DEDICATION

The authors dedicate this conservation monograph to Professor J.T. Williams who originally commissioned the research and provided encouragement towards its fruition.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dedication</td>
<td>iii</td>
</tr>
<tr>
<td>Acknowledgements</td>
<td>iv</td>
</tr>
<tr>
<td>SUMMARY</td>
<td>ix</td>
</tr>
<tr>
<td>PROJECT BACKGROUND</td>
<td>xi</td>
</tr>
<tr>
<td>1. INTRODUCTION</td>
<td></td>
</tr>
<tr>
<td>1.1 General introduction</td>
<td>1</td>
</tr>
<tr>
<td>1.2 Project commission</td>
<td>2</td>
</tr>
<tr>
<td>1.3 Aims</td>
<td>2</td>
</tr>
<tr>
<td>1.4 Ecogeographic investigations</td>
<td>2</td>
</tr>
<tr>
<td>1.5 Utilization of <em>Vigna</em></td>
<td></td>
</tr>
<tr>
<td>1.5.1 Cowpea</td>
<td>4</td>
</tr>
<tr>
<td>1.5.2 Bambara groundnut (<em>V. subterranea</em>)</td>
<td>11</td>
</tr>
<tr>
<td>1.5.3 Medicinal uses</td>
<td>15</td>
</tr>
<tr>
<td>1.6 The phytogeographic context</td>
<td>17</td>
</tr>
<tr>
<td>1.6.1 Geology</td>
<td>17</td>
</tr>
<tr>
<td>1.6.2 Climate</td>
<td>17</td>
</tr>
<tr>
<td>1.6.3 Vegetation</td>
<td>21</td>
</tr>
<tr>
<td>2. BIOSYSTEMATIC BACKGROUND</td>
<td></td>
</tr>
<tr>
<td>2.1 Leguminosae (<em>Fabaceae</em>)</td>
<td>27</td>
</tr>
<tr>
<td>2.2 Phaseoleae</td>
<td>27</td>
</tr>
<tr>
<td>2.3 The genus <em>Vigna</em></td>
<td>28</td>
</tr>
<tr>
<td>2.4 Infrageneric classification of <em>Vigna</em></td>
<td>35</td>
</tr>
<tr>
<td>2.5 Morphology of <em>Vigna</em> taxa</td>
<td>41</td>
</tr>
<tr>
<td>2.6 Classifications of cultivated <em>Vigna</em></td>
<td>47</td>
</tr>
<tr>
<td>2.7 Breeding systems of <em>Vigna</em></td>
<td>51</td>
</tr>
<tr>
<td>2.8 The <em>Vigna</em> genepool</td>
<td>52</td>
</tr>
<tr>
<td>3. CURRENT CONSERVATION STATUS AND THREATS</td>
<td></td>
</tr>
<tr>
<td>3.1 Herbarium collections of African <em>Vigna</em></td>
<td>55</td>
</tr>
<tr>
<td>3.2 Genebank accessions of African <em>Vigna</em></td>
<td>55</td>
</tr>
<tr>
<td>3.3 Review of <em>Vigna</em> germplasm conserved <em>ex situ</em></td>
<td>59</td>
</tr>
<tr>
<td>3.4 Review of <em>Vigna</em> germplasm conserved <em>in situ</em></td>
<td>60</td>
</tr>
<tr>
<td>3.4.1 On-farm conservation of <em>Vigna</em> species</td>
<td>62</td>
</tr>
<tr>
<td>3.4.2 Genetic reserve conservation of <em>Vigna</em> species</td>
<td>62</td>
</tr>
<tr>
<td>3.5 Ecological conservation of <em>Vigna</em> species</td>
<td>63</td>
</tr>
<tr>
<td>3.6 Threats to <em>Vigna</em> and African plant diversity</td>
<td>68</td>
</tr>
<tr>
<td>3.7 Current Red List data on threatened African <em>Vigna</em></td>
<td>70</td>
</tr>
<tr>
<td>4. ECOGEOGRAPHIC DATA</td>
<td></td>
</tr>
<tr>
<td>4.1 Delimitation of the target area</td>
<td>73</td>
</tr>
<tr>
<td>4.2 Collation of ecogeographic data</td>
<td>75</td>
</tr>
<tr>
<td>4.2.1 Taxon data collation</td>
<td>75</td>
</tr>
<tr>
<td>4.2.2 Genebank accession and</td>
<td></td>
</tr>
<tr>
<td>herbarium specimen data collation</td>
<td>75</td>
</tr>
<tr>
<td>4.2.3 Selection of representative specimens</td>
<td>77</td>
</tr>
</tbody>
</table>
4.2.4 Specimen determination 78
4.2.5 Ecogeographic database 78
4.3 Ecogeographic conspectus format 80
  4.3.1 Conspectus structure 80
  4.3.2 Taxon vulnerability assessment 82

5. ECOGEOGRAPHIC CONSPECTUS
  5.1 Introduction 89
  5.2 Subgenus Vigna 90
  5.3 Subgenus Haydonia 226
  5.4 Subgenus Plectotropis 244
  5.5 Subgenus Ceratotropis 268
  5.6 Subgenus Lasiospron 277
  5.7 Subgenus Sigmoidotropis 278
  5.8 Subgenus Macrorhyncha 282

6. ECOGEOGRAPHIC ANALYSIS
  6.1 Introduction 291
  6.2 Ecogeographic database content 291
  6.3 Evenness of sampling 292
  6.4 Taxon vulnerability assessment analysis 292
    6.4.1 Rarity 292
    6.4.2 Distribution 298
    6.4.3 Representation in ex situ collections 301
    6.4.4 Geographic coverage of ex situ collections 302
    6.4.5 Taxon coverage of ex situ collections 302
    6.4.6 Use 303
    6.4.7 Taxon extinction assessment 303

7. BIOGEOGRAPHIC ANALYSIS
  7.1 Spatial analysis of existing collections 305
  7.2 Analysis strategy 306
  7.3 Methodology 306
    7.3.1 Geographic coordinates in the specimen database 306
    7.3.2 Basic species distribution statistics 307
    7.3.3 Analysis of known hotspots of richness 307
    7.3.4 Complementarity analysis 307
    7.3.5 FloraMap distribution modelling 307
    7.3.6 Predicted richness 309
  7.4 Results and discussion 309
    7.4.1 Spatial distribution of collection density 309
    7.4.2 Range size statistics 309
    7.4.3 Patterns of species richness 313
    7.4.4 Complementarity 315
    7.4.5 Predicting species richness 316
  7.5 Climatic characterization of Vigna species 323
    7.5.1 Methodology 323
    7.5.2 Results and discussion 323
8. ECOGEOGRAPHIC DISCUSSION

8.1 Introduction 326
8.2 Ecogeography of *Vigna* in Africa 326
  8.2.1 Taxonomy 326
  8.2.2 Phytogeography 327
  8.2.3 Centres of diversity, endemism and complementarity 329
  8.2.4 Ecology 331
8.3 The exploitable genepool 332
  8.3.1 *Vigna* species crop potential 332
  8.3.2 Relationship between cultivated species and their wild relatives 333
8.4 Threat assessment 336
  8.4.1 Genetic erosion and extinction of African *Vigna* 336
  8.4.2 Red List data on threatened African *Vigna* 337
  8.4.3 Taxon vulnerability assessment for *Vigna* species 341
8.5 Gap analysis 341
  8.5.1 Identification and circumscription of African *Vigna* taxa 341
  8.5.2 Location of areas of African *Vigna* diversity 341
  8.5.3 Reviewing current *in situ* conservation activities 342
  8.5.4 Reviewing current *ex situ* conservation activities 343
8.6 Conservation strategy recommendations 343
  8.6.1 *Ex situ* conservation priorities 344
  8.6.2 *In situ* genetic reserve conservation priorities 347
  8.6.3 *In situ* on-farm conservation priorities 347
  8.6.4 Complementarity and sustainability 349
8.7 Future research requirements 350

9. REFERENCES 352

10. APPENDIXES

  Appendix I Classification of the genus *Vigna* 371
  Appendix II Morphological descriptions of African *Vigna* taxa 378
  Appendix III Keys to African *Vigna* species and subspecific taxa 414
  Appendix IV Genebanks and herbarium with major African *Vigna* collections 424
  Appendix V *African ex situ Vigna* collection holdings 426
  Appendix VI *African Vigna* distributional ranges 428
  Appendix VII Geographic coverage of *ex situ* collections 430
  Appendix VIII Subspecific taxon coverage of *ex situ* collections 432
  Appendix IX *African Vigna* species utility 433
  Appendix X *African Vigna* extinction assessment 435
  Appendix XI Taxon vulnerability assessment for *Vigna* species scores 437
  Appendix XII Climatic envelopes for African *Vigna* species 439
  Appendix XIII Listing of priority countries with native priority *Vigna* taxa 442

11. INDEX TO TAXA 444

12. *AFRICAN VIGNA* RESOURCE CD 449
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SUMMARY

An ecogeographic study of cowpea and Bambara groundnut and their wild relatives (Vigna Savi) in Africa is presented; as circumscribed, the African taxa comprise 61 species and 63 subspecific taxa. The taxonomy, genetic diversity and use of wild and cultivated African Vigna, as well as the African phytogeographic context and threats to plant diversity, are reviewed. Ecogeographic data were recorded for each taxon throughout its geographical range within Africa. Representative herbarium specimens and genebank accessions were each identified and passport data collated into the ecogeographic database from thirty herbaria and four genebanks in Africa, Europe and North America. These specimen passport data were supplemented by field observation and taxon-based information from the literature. An assessment of current ex situ and in situ conservation status of wild and cultivated Vigna species in Africa is made.

The African Vigna ecogeographic database contains the “raw” phytogeographic, ecological, genetic and taxonomic data for 7289 herbarium specimens and 1802 genebank accessions representing the 61 species sampled between 1762 and 1997. These data are summarized for each taxon in the ecogeographic conspectus. The conspectus includes: accepted names of taxa, author(s), date of publication, where published; reference to full description and iconography; botanical illustrations; vernacular names; habit and lifespan; flower colour; habitat; associated species; altitude range; geographical distribution, actual distribution and predicted distribution maps; phenology and uses; as well as individual taxon vulnerability assessment; conservation notes; IUCN Red List Category; taxonomic notes and other additional notes.

General patterns of taxonomy, phytogeography and ecology for African Vigna are discussed following detailed ecogeographic and spatial biogeographic analyses using geographic information systems (GIS). The climatic characteristics underlying the distribution and species richness of Vigna in Africa is reported. Patterns of actual distribution, based on herbarium specimens and genebank accessions passport data, and predicted distribution, using climatic models, are presented and reviewed. The evenness of current sampling, the vulnerability of taxa to genetic erosion and extinction and the major threats to diversity and potential exploitation are assessed.

Conservation gap analysis was undertaken. Many taxa have not been or are poorly represented in ex situ collections. Analysis of species distribution patterns showed a high correlation (=0.748) between levels of species richness and rarity. Vigna is shown to have a broad distributional range across the African continent south of the Sahara and north of 30° south, being most rich in subtropical latitudes around 10° north and south. Three hotspots of Vigna diversity were found: around the Great Lakes, the southern tip of Lake Tanganyika and the Cameroon Highlands. Models that predict species richness have highlighted other areas with potentially higher species richness that are undersampled in the Democratic Republic of the Congo, south of Lake Victoria in Tanzania, and
in central Togo. Based on an analysis of complementary areas, just three grid cells contain 37 species.

Specific conservation actions are recommended. It is suggested that: *in situ* genetic reserves are established within existing protected areas at the southern tip of Lake Tanganyika, in the coastal area of Sierra Leone and between Lake Victoria and the other Great Lakes; there is a need to establish patterns of genetic diversity in landraces of *V. subterranea* and *V. unguiculata* before *in situ* on-farm conservation can be proposed; and further germplasm collection and *ex situ* conservation are particularly required in Cameroon, the Democratic Republic of the Congo, Guinea Bissau, Nigeria and Zambia and *V. dolomitica*, *V. haumaniana* var. *pedunculata*, *V. monantha*, *V. nuda*, *V. richardsiae*, *V. somaliensis*, *V. stenophylla*, *V. subterranea* var. *spontanea*, *V. unguiculata* subsp. *unguiculata* var. *spontanea*, *V. unguiculata* subsp. *aduensis*, *V. unguiculata* subsp. *baoulensis*, *V. unguiculata* subsp. *burundiensis*, *V. vexillata* var. *dolichonema* and *V. virescens* are the highest priority species. Future research requirements to ensure sustainable conservation and use of African *Vigna* gene pools are discussed. As an aid to field conservation descriptions and dichotomous keys, an interactive identification system for species and subspecies is presented.
PROJECT BACKGROUND

Jan Engels (IPGRI)

Subsistence agriculture is dependent on diversity — both diversity of cropping and intra-crop diversity, as can be found in particular in landraces — to ensure that farmers can feed their families, irrespective of the season. There is still a much higher proportion of subsistence farming in Africa than in any other continent. Cowpea (*Vigna unguiculata* [L.] Walp.) and other cultivated *Vigna* species play an important role in existing cropping systems throughout Africa.

It is widely accepted that cowpea breeding and *Vigna* germplasm utilization in general have been hampered by lack of knowledge of both the diversity within the cultivated cowpea and the broader inter- and intra-specific genetic diversity in the genus in Africa, which is the major centre of diversity. Therefore, IBPGR (and later its successor, the International Plant Genetic Resources Institute, IPGRI), based in Rome, Italy, in close collaboration with the International Institute of Tropical Agriculture (IITA), based in Ibadan, Nigeria, supported a series of *Vigna* germplasm exploration and collecting missions starting in 1974 (see Table A) that resulted in a total of 7447 samples of *Vigna* species. In 1984 IBPGR commissioned an ecogeographic study of *Vigna* in sub-Saharan Africa. However, the completion of this commission was held back by serious lack of knowledge of the genus in Africa; there was a need for a fresh collecting initiative and a review of the taxonomy of the genus. It should be noted that the latter is still only partially complete.

The collecting efforts initiated by the ecogeographic commission were conducted through general or genus-specific IBPGR/IPGRI-funded collecting missions. A total of 168 such missions were carried out between 1974 and 1996 in 73 different countries across the world (Table B and Figure A). A total of 66 different *Vigna* taxa have been collected (Table C). The duration of these missions varied from one month to several years. This significant collecting effort resulted in a much clearer picture of the ecogeography of the cultivated cowpea, and of the genus as a whole, as this publication shows. However, the precise picture is still unclear in certain regions where collecting has been more limited.

This publication aims to describe the distribution and ecology of *Vigna* species, review current ex situ and in situ conservation activities and define priorities for future *Vigna* conservation and use. However, the authors realize that its content will not resolve all problems related to the genetic diversity distribution patterns and the taxonomy of the cowpea genepool and that further research will be needed. The text and accompanying data set are intended to facilitate updating as fresh information becomes available and also to provide an exemplar ecogeographic study, the model for which could be applied to other taxa. The text will form a natural companion to sister ecogeographic volumes on *Vigna* in Asia (Tomooka et al., 2002b) and the closely related *Phaseolus* worldwide (Freytag and Debouck, 2002). Each has focused at the taxon, largely species, level and there is now a need to focus more specifically on intra-specific diversity within the crop species. Not only do we need a definitive answer to the
Table A. Number of samples collected per year and region.

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<thead>
<tr>
<th>Start year</th>
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<tbody>
<tr>
<td>74</td>
<td>–</td>
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<td>2</td>
<td>–</td>
<td>–</td>
<td>34</td>
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<tr>
<td>94</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
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<td>1</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>95</td>
<td>–</td>
<td>–</td>
<td>5</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>72</td>
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<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>77</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Grand totals 121 56 182 16 2780 125 1432 117 1050 950 441 12 99 49 20 14 7447
question of how many subspecies and botanical varieties of *V. unguiculata* exist but, if the farmer and the breeder are to improve utilization, we need to know what the landrace groups are and how the genetic diversity is distributed within them.

**Figure A.** Numbers of collection missions initiated per year.

![Graph showing the number of collection missions initiated per year.](image)

**Table B.** Number of species, samples and collecting missions per region.

<table>
<thead>
<tr>
<th>No. of samples</th>
<th>No. of species</th>
<th>No. of missions</th>
<th>Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>2780</td>
<td>20</td>
<td>26</td>
<td>West Africa</td>
</tr>
<tr>
<td>56</td>
<td>12</td>
<td>5</td>
<td>East Africa</td>
</tr>
<tr>
<td>1050</td>
<td>7</td>
<td>26</td>
<td>Southwest Asia</td>
</tr>
<tr>
<td>950</td>
<td>9</td>
<td>9</td>
<td>South Asia</td>
</tr>
<tr>
<td>441</td>
<td>17</td>
<td>13</td>
<td>Southeast Asia</td>
</tr>
<tr>
<td>100</td>
<td>6</td>
<td>17</td>
<td>Mediterranean</td>
</tr>
<tr>
<td>99</td>
<td>14</td>
<td>15</td>
<td>Meso-America</td>
</tr>
<tr>
<td>49</td>
<td>4</td>
<td>6</td>
<td>Andean Zone</td>
</tr>
<tr>
<td>20</td>
<td>3</td>
<td>3</td>
<td>Tropical America</td>
</tr>
<tr>
<td>14</td>
<td>3</td>
<td>2</td>
<td>Southern South America</td>
</tr>
<tr>
<td>12</td>
<td>3</td>
<td>2</td>
<td>East Asia</td>
</tr>
<tr>
<td>182</td>
<td>7</td>
<td>7</td>
<td>Northeast Africa</td>
</tr>
<tr>
<td>121</td>
<td>16</td>
<td>11</td>
<td>Central Africa</td>
</tr>
<tr>
<td>16</td>
<td>8</td>
<td>3</td>
<td>Southern Africa</td>
</tr>
<tr>
<td>125</td>
<td>13</td>
<td>5</td>
<td>West Indian Ocean</td>
</tr>
<tr>
<td>1432</td>
<td>24</td>
<td>15</td>
<td>Zambesiaca</td>
</tr>
</tbody>
</table>
Table C. Species, number of accessions and number of countries where collected.

<table>
<thead>
<tr>
<th>No. of samples</th>
<th>No. of countries</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>3030</td>
<td>46</td>
<td>V. unguiculata</td>
</tr>
<tr>
<td>1450</td>
<td>19</td>
<td>V. subterranea</td>
</tr>
<tr>
<td>805</td>
<td>36</td>
<td>Vigna species</td>
</tr>
<tr>
<td>548</td>
<td>18</td>
<td>V. radiata</td>
</tr>
<tr>
<td>426</td>
<td>7</td>
<td>V. mungo</td>
</tr>
<tr>
<td>365</td>
<td>14</td>
<td>V. unguiculata subsp. unguiculata</td>
</tr>
<tr>
<td>283</td>
<td>7</td>
<td>V. unguiculata subsp. unguiculata var. unguiculata cultivar group Sesquipedalis</td>
</tr>
<tr>
<td>87</td>
<td>6</td>
<td>V. umbellate</td>
</tr>
<tr>
<td>60</td>
<td>11</td>
<td>V. unguiculata subsp. dekindtiana</td>
</tr>
<tr>
<td>30</td>
<td>1</td>
<td>V. luteola</td>
</tr>
<tr>
<td>30</td>
<td>11</td>
<td>V. aconitifolia</td>
</tr>
<tr>
<td>27</td>
<td>9</td>
<td>V. vexillata</td>
</tr>
<tr>
<td>20</td>
<td>4</td>
<td>V. reticulate</td>
</tr>
<tr>
<td>19</td>
<td>1</td>
<td>V. sp. (poss. Voandzeia)</td>
</tr>
<tr>
<td>18</td>
<td>2</td>
<td>V. umbellata var. umbellata</td>
</tr>
<tr>
<td>18</td>
<td>3</td>
<td>V. subterranea var. spontanea</td>
</tr>
<tr>
<td>17</td>
<td>2</td>
<td>V. radiata var. radiata</td>
</tr>
<tr>
<td>16</td>
<td>1</td>
<td>V. umbellata var. gracilis</td>
</tr>
<tr>
<td>15</td>
<td>2</td>
<td>V. vexillata var. vexillata</td>
</tr>
<tr>
<td>13</td>
<td>2</td>
<td>V. adenantha</td>
</tr>
<tr>
<td>12</td>
<td>2</td>
<td>V. schlechteri</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>V. oblongifolia</td>
</tr>
<tr>
<td>11</td>
<td>3</td>
<td>V. marina</td>
</tr>
<tr>
<td>10</td>
<td>3</td>
<td>V. vexillata var. angustifolia</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>V. angularis var. nipponensis</td>
</tr>
<tr>
<td>8</td>
<td>3</td>
<td>V. radiata var. sublobata</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>V. oblongifolia var. oblongifolia</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>V. hosei</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>V. mungo</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>V. membranacea</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>V. elegans</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>V. ambacensis</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>V. multinervis</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>V. frutescens</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>V. filicaulis</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>V. subterranea var. subterranea</td>
</tr>
<tr>
<td>No. of samples</td>
<td>No. of countries</td>
<td>Species</td>
</tr>
<tr>
<td>----------------</td>
<td>-----------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>V. oblongifolia var. parviflora</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>V. minima</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>V. longifolia</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>V. candida</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>V. sp.cf frutescens</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>V. parkeri</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>V. unguiculata subsp. pubescens</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>V. heterophylla</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>V. gentryi</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>V. caracalla</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>V. angularis</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>V. unguiculata subsp. stenophylla</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>V. unguiculata subsp. nov.</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>V. trilobata</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>V. subgenus Haydonia</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>V. stenophylla</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>V. spectabilis</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>V. speciosa</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>V. sp.cf V. gracilis</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>V. sp.cf V. vexillata var. lobatifolia</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>V. sp.cf V. frutescens</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>V. sp.cf V. laurantii</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>V. sp.cf V. ambacensis</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>V. schimperi</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>V. racemosa</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>V. monophylla</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>V. linearis</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>V. gazensis</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>V. vexillata var. davyi</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>V. comosa</td>
</tr>
</tbody>
</table>
It could be argued that this publication, even after 20 years of work, is still premature, in that further Vigna collecting is still required and there remains a need to resolve important taxonomic questions (e.g. how many African Vigna species are there, where are they found and how do we recognize them?). However, although farmers have maintained diversity for millennia, African agriculture is now changing dramatically and replacement of landrace diversity and loss of weedy and wild Vigna species are increasingly likely. There is a need for action now! We have sufficient knowledge to help Vigna breeders and conservationists make better informed decisions even with the incomplete data we currently have. This publication does not have all the necessary answers but is a significant step forward for African conservationists and breeders and will provide a framework for more informed policy decisions that will ultimately benefit African farmers.

ACKNOWLEDGEMENT

The author thanks Nigel Maxted, Luigi Guarino and Imke Thorshalm for their contributions. In particular the data searches that Imke conducted are most appreciated.
1. INTRODUCTION

1.1 General introduction

Cultivation of beans, predominantly from the closely related genera of *Phaseolus* L. and *Vigna* Savi, is increasing (Ehlers and Hall, 1997; FAOSTAT, http://apps.fao.org/faostat), and contributes widely to subsistence agriculture in the Americas, sub-Saharan Africa and Asia. Yet we have remained until recently largely ignorant of their exploitation potential or how these important genetic resources might be most effectively conserved for use by future generations. Although plant breeders have striven to enhance and improve production, for example cowpea production has increased 10 fold in the last 20 years (IITA, http://www.iita.org/); exploitation has been hampered by a lack of:

- Taxonomic, genetic and ecogeographic knowledge.
- *In situ* and *ex situ* conserved material that is easily exploitable by breeders.
- Characterization and evaluation of existing conserved germplasm.
- Coordination of national, regional or international coordinated conservation strategies for *Phaseolus* and *Vigna* diversity.

Species of the genera *Phaseolus* and *Vigna* predominate in subsistence agriculture worldwide, with *Phaseolus* being grown largely in the Americas and *Vigna* in Africa and Asia, reflecting the natural distribution of the genera. However, as noted by Maréchal et al. (1978) the extreme paucity of both “good” taxonomic characters to distinguish the two genera and discrete natural groupings has led to much debate over the generic distinction between the two genera and an abundant synonymy. Recent ecogeographic studies, including conservation gap analysis, of *Phaseolus* worldwide and *Vigna* in Asia and the five species of *Vigna* in Australia have recently been published by Freytag and Debouck (2002), Tomooka et al. (2002b) and Lawn and Watkinson (2002) respectively. The ecogeographic study presented here attempts to contribute to information available for wild African *Vigna* by reviewing African *Vigna* diversity, their conservation status and discussing how the *Vigna* genepool might be more efficiently sustained and exploited to benefit African agriculture. It also will provide a complementary volume for *Vigna* in Africa to the Freytag and Debouck (2002) and Tomooka et al. (2002b) studies of the remainder of the *Phaseolus* and *Vigna* genepool.

The study is based on an extensive literature and other media survey of African *Vigna*, combined with detailed reviews of herbarium specimen and germplasm accession passport (or provenance) data. The work builds on the traditional taxonomic work of Verdcourt (1970), a subsequent phenetic study by Maréchal et al. (1978) and various more recent taxonomic studies by Pasquet (1993a,b, 1994, 1998, 1999, 2001) and Tomooka et al. (2002). This work is not taxonomic in nature and therefore does not extend previous taxonomic studies of African *Vigna*, Verdcourt’s taxonomic system, as modified by Maréchal et al. (1978), is largely adhered to, except for the necessary addition of subsequently described taxa. The focus is rather to collate, synthesize and analyze ecological, geographic, taxonomic and genetic data for African *Vigna* taxa as a means of
enhancing the efficiency of their conservation and sustainable use. The ultimate aim of the study is to formulate an effective conservation strategy for *Vigna* diversity in Africa and establish conservation priorities for the genus.

### 1.2 Project commission

The first step in any form of conservation is often the project commission statement, which outlines the main objectives of the work, the breadth of the target taxon and the target area to be investigated. The project commission statement originally provided by the International Board for Plant Genetic Resources (subsequently the International Plant Genetic Resources Institute) in 1985 to the senior author was as follows (Maxted *et al*., 2000):

“An ecogeographic study is commissioned for the genus *Vigna* Savi in sub-Saharan Africa by the International Board for Plant Genetic Resources. The study has the objective of identifying areas that contain novel genetic diversity not already conserved that could be utilized in selection or breeding programmes for the benefit of African agriculture. The conclusions should contain a detailed complementary conservation strategy for the genus, including the application of both *ex situ* (including target taxa, collecting routes, collection timing) and *in situ* (including target taxa, genetic reserve locations, management regimes) techniques as well as suitable local contacts to enact these policies. It should also attempt to identify those *Vigna* species of immediate and medium-term potential value to African agriculture.”

### 1.3 Aims

Following on from the commission statement, the broad aim of the project was to undertake an ecogeographic study of African *Vigna* species in order to facilitate their conservation and use, and this had several specific project objectives, which can be identified as follows:

- Determine the distribution and ecology of wild *Vigna* species on the African continent.
- Assess the current *ex situ* and *in situ* conservation status of wild species of *Vigna* in Africa.
- Investigate environmental factors underlying the distribution and species richness of *Vigna* in Africa.
- Prioritize *Vigna* taxa for *ex situ* germplasm conservation.
- Prioritize *Vigna* taxa for *in situ* conservation action; specifically identify potential sites for the establishment of genetic reserves to conserve *Vigna* diversity.
- Define future research priorities with respect to *Vigna* genepools.
- As an aid to field conservation, produce keys and descriptions for African *Vigna* species.

### 1.4 Ecogeographic investigations

Ecogeographic data collation, synthesis and analysis are a necessary prerequisite of any conservation activity (IBPGR, 1985; Maxted *et al*., 1995), because the financial and human resources available for conservation of genetic
diversity will always be limited, it is essential to make full use of whatever information is available, especially ecogeographic information. The locations inhabited or niches occupied by plant species are defined by differing sets of environmental and geographical constraints. The analysis of ecological, geographic, taxonomic and genetic information combined with the analysis of herbarium specimens and germplasm accessions passport data can be used to define these constraints and so establish priorities for conservation and sustainable exploitation. For instance, if such data for a particular species or phenotype indicate that previously it had only been found growing in deciduous woodland at lower altitude on sand or limestone in West Madagascar, then all other factors being equal it would be in this area that a genetic reserve to conserve the species in situ should be sited. The financial and practical resources available for conservation of genetic diversity will always be limited; therefore the application of ecogeographic techniques to identify conservation priorities, optimize locations of genetic reserves or clarify collection routes is essential to make the best use of available resources.

This need for increased efficiency of conservation effort is underlined in the Convention on Biological Diversity (CBD, 1992), particularly in the field of in situ conservation, where the CBD calls on nations to:

“Develop, where necessary, guidelines for the selection, establishment and management of protected areas or areas where special measures need to be taken to conserve biological diversity.” Article 8 (CBD, 1992)

Ecogeographic techniques provide an essential tool that enables the objective of this CBD article to be met (Maxted et al., 1997a). An ecogeographic survey can be defined thus:

“An ecogeographic survey is an ecological, geographical and taxonomic information gathering and synthesis process. The results are predictive and can be used to assist in the formulation of collection and conservation priorities.” Maxted et al. (1995)

In practice, some form of ecogeographic data collection and analysis necessarily precedes all conservation activities. One procedure for undertaking an ecogeographic survey is outlined in the model proposed by Maxted et al. (1995), see Figure 1.1. The model is divided into three phases:

- Project design—during which the scope of the project is established and information sources are identified.
- Data collection and analysis—during which the raw ecological, geographic, taxonomic and genetic data from the published and grey literature, and passport data are collated, verified and analyzed to identify ecogeographic patterns.
- Production—during which the data are synthesized to produce three basic products:
  - Database—contains the raw data for each taxon and specimen.
  - Conspectus—summarizes the data for each taxon.
  - Report—discusses the contents of the database and conspectus, as well as proposing future collection and conservation strategies.
Ecogeographic studies provide the basic biodiversity information that is required by the conservationist to prioritize taxa for conservation, locate target populations, monitor *in situ* population levels and plan effective complementary conservation. Examples of some recent ecogeographic surveys include: Edmonds (1990) for African *Corchorus* L. species, Ehrman and Cocks (1990) for annual legumes in Syria, Hughes (1998) for the genus *Leucaena* worldwide and Hijmans and Spooner (2001) and Hijmans *et al.* (2002b) for wild potatoes.

1.5 Utilization of *Vigna*


The highest number of cultivated taxa is found in the closely related complex of *Phaseolus/Vigna* species. *Vigna* contains numerous cultivated species (see Table 1.1) which constitute an important source of protein worldwide especially among lower income groups in developing countries. However, the majority of these species are restricted to Asian cultivation and have only recently been introduced to Africa, largely via Madagascar. In Africa cultivation remains primarily restricted to two native cultivated species, cowpea (*V. unguiculata* [L.] Walp.) and Bambara groundnut (*V. subterranea* [L.] Verdc.), which are widely grown by subsistence farmers and are discussed below. Use of other African *Vigna* species is summarized in Table 1.2.
Figure 1.1. An ecogeographic paradigm (Maxted et al., 1995).

PHASE 1

PROJECT DESIGN

Project commissioning
- Identification of taxon expertise
- Selection of target taxon taxonomy
- Delimitation of the target area
- Identification of taxon collections

Designing and building the ecogeographic database structure

PHASE 2

DATA COLLECTION AND ANALYSIS

2.1 Listing of germplasm conserved
- 2.2 Media survey of geographical, ecological and taxonomic data
- 2.3 Collection of ecogeographic data
- 2.4 Selection of representative specimens
- 2.5 Data verification
- 2.6 Analysis of geographic, ecological and taxonomic data

PHASE 3

PRODUCTION

3.1 Data synthesis
- 3.2.1 Ecogeographic Database
- 3.2.2 Ecogeographic Conspectus
- 3.2.3 Ecogeographic Report

3.3 Identification of conservation priorities
<table>
<thead>
<tr>
<th>Botanical name</th>
<th>Common name</th>
<th>Section</th>
<th>Native</th>
<th>Cultivation</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. aconitifolia (Jacq.) Maréchal, Mascherpa &amp; Stainier</td>
<td>Moth bean, mat bean</td>
<td>Aconitifoliae</td>
<td>South Asia</td>
<td>Minor pulse (mainly India), green pods eaten as vegetable, forage, cover crop and green manure.</td>
</tr>
<tr>
<td>V. adenantha (G.Mey.) Maréchal, Mascherpa &amp; Stainier</td>
<td>–</td>
<td>Leptosprone</td>
<td>Pan-tropical, native to Americas</td>
<td>Folk medicine, tuberous roots edible.</td>
</tr>
<tr>
<td>V. angularis (Willd.) Ohwi &amp; Ohashi</td>
<td>Adzuki beans</td>
<td>Angulares</td>
<td>East Asia</td>
<td>Pulse, ripe seeds cooked, milled for soup, sprouting beans are popular vegetable, flour used in cosmetics, medicinal plant (Korea, China), forage and green manure.</td>
</tr>
<tr>
<td>V. antillana (Urb.) Fawc. &amp; Rendle</td>
<td>–</td>
<td>Sigmoidotropis</td>
<td>Caribbean</td>
<td>Pulse and soil improver (Cuba).</td>
</tr>
<tr>
<td>V. caracalla (L.) Verdc.</td>
<td>Snail flower</td>
<td>Caracallae</td>
<td>South &amp; Central America</td>
<td>Ornamental climber, minor pulse (Cuba).</td>
</tr>
<tr>
<td>V. hosei (Craib) Backer in Backer &amp; Slooten</td>
<td>Sarawak bean</td>
<td>Vigna</td>
<td>South &amp; Southeast Asia, East Africa</td>
<td>Cover and green manure (India, Malaysia &amp; Sri Lanka) auxiliary crop (East Africa, Surinam &amp; Southeast Asia).</td>
</tr>
<tr>
<td>V. luteola (Jacq.) Benth. in Mart.</td>
<td>Dalrymple vigna</td>
<td>Vigna</td>
<td>South America</td>
<td>Fodder and forage (Argentina), soil improvement (Cuba).</td>
</tr>
<tr>
<td>V. marina (Burm.) Merr.</td>
<td>Dune bean</td>
<td>Vigna</td>
<td>Pan-tropical, native to Africa</td>
<td>Human food and cover crop (Southeast Asia), and as a forage (Cuba).</td>
</tr>
<tr>
<td>V. mungo (L.) Hepper</td>
<td>Black gram, urd bean</td>
<td>Ceratotropis</td>
<td>South Asia</td>
<td>Pulse (South Asia), young pods eaten as vegetable, forage and green manure.</td>
</tr>
<tr>
<td>V. parkeri Baker</td>
<td>Creeping vigna</td>
<td>Vigna</td>
<td>Central &amp; East Africa</td>
<td>Pasture legume (Australia and USA), cover and green manure (New Guinea).</td>
</tr>
<tr>
<td>V. radiata (L.) R. Wilczek</td>
<td>Mung bean, green or golden gram, Jerusalem pea</td>
<td>Ceratotropis</td>
<td>South Asia</td>
<td>Dry seeds milled and made into soup, porridge and noodles, raw or cooked bean sprouts in oriental cooking, rarely forage and green manure.</td>
</tr>
<tr>
<td>Botanical name</td>
<td>Common name</td>
<td>Section</td>
<td>Native</td>
<td>Cultivation</td>
</tr>
<tr>
<td>----------------</td>
<td>-------------</td>
<td>---------</td>
<td>--------</td>
<td>-------------</td>
</tr>
<tr>
<td><em>V. reflexo-pilosa</em> var. <em>gliabra</em> (Maréchal, Mascherpa &amp; Stainier) Tomooka &amp; Maxted</td>
<td>Creole bean</td>
<td><em>Angulares</em></td>
<td>Southeast Asia</td>
<td>Minor pulse (Philippines, Thailand).</td>
</tr>
<tr>
<td><em>V. subterranea</em> (L.) Verdc.</td>
<td>Bambara groundnut</td>
<td><em>Vigna</em></td>
<td>Sub-Saharan Africa</td>
<td>Largely pulse, mature seeds roasted, boiled or ground for porridge, green seeds (and pods) also eaten fresh or roasted, boiled in soup (throughout Africa).</td>
</tr>
<tr>
<td><em>V. trilobata</em>¹ (L.) Verdc.</td>
<td>Jungli bean</td>
<td><em>Aconitifoliae</em></td>
<td>South Asia</td>
<td>Forage and cover crop (India, Pakistan, Indonesia &amp; Sudan).</td>
</tr>
<tr>
<td><em>V. trinervia</em> (Heyne ex Wall.) Tateishi &amp; Maxted</td>
<td>Tooapée</td>
<td><em>Angulares</em></td>
<td>South &amp; Southeast Asia</td>
<td>Cover crop to suppress weed growth in rubber plantations.</td>
</tr>
<tr>
<td><em>V. umbellata</em> (Thunb.) Ohwi &amp; Ohashi</td>
<td>Rice bean</td>
<td><em>Angulares</em></td>
<td>Southeast Asia</td>
<td>Pulse, dry seeds boiled and eaten with rice, young pods, leaves and seedlings eaten as vegetable, sown as fodder and green manure. Grown in rotation with rice.</td>
</tr>
<tr>
<td><em>V. unguiculata</em> (L.) Walp. cultivar group <em>Biflora</em> (L.) Westphal</td>
<td>Catjang bean</td>
<td><em>Catiang</em></td>
<td>South &amp; Southeast Asia</td>
<td>Pulse or green vegetable, forage crop (hay or silage), green manure.</td>
</tr>
<tr>
<td><em>Vigna unguiculata</em> (L.) Walp. cultivar group <em>Melanophthalmus</em> (DC.) Pasquet</td>
<td>–</td>
<td><em>Catiang</em></td>
<td>Sub-Saharan Africa</td>
<td>Pulse cooked ground and made as fried or steamed cakes.</td>
</tr>
<tr>
<td><em>V. unguiculata</em> (L.) Walp. cultivar group <em>Sesquipedalis</em> (L.) Westphal</td>
<td>Yard-long bean, asparagus bean</td>
<td><em>Catiang</em></td>
<td>South &amp; Southeast Asia (&amp; Africa?)</td>
<td>Pods used as vegetable, forage crop, green manure.</td>
</tr>
<tr>
<td><em>V. unguiculata</em> (L.) Walp. cultivar group <em>Unguiculata</em></td>
<td>Cowpea, black-eye bean</td>
<td><em>Catiang</em></td>
<td>Sub-Saharan Africa</td>
<td>Pulse cooked ground and made as fried or steamed cakes (throughout Africa).</td>
</tr>
<tr>
<td><em>V. vexillata</em></td>
<td>Zombi pea, Aka sausage</td>
<td><em>Plectotropis</em></td>
<td>Pan-tropical, native to Africa</td>
<td>Pasture, green manure, cover crop, edible tubers.</td>
</tr>
</tbody>
</table>

¹ *V. trilobata* is frequently mentioned as used for forage or seeds collected in times of food shortage (Hanelt, 2001). Tomooka *et al.* (2002b) believe, however, that the correct identity for the species that is cultivated and harvested should be *V. stipulacea* (Lam.) Kuntze.
### Table 1.2. Summary African wild *Vigna* use (adapted from Peters *et al.*, 1992; Burkill, 1995).

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Plant organ</th>
<th>Use</th>
<th>Reference or specimen</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>V. adenantha</em></td>
<td>Tubers</td>
<td>Eaten by humans</td>
<td>Padulosi and Ng (1990)</td>
</tr>
<tr>
<td><em>V. ambacensis</em></td>
<td>Leaves, shoot, flower, fruit and seed</td>
<td>Eaten by chimpanzees</td>
<td>Nishida and Uehara (1983)</td>
</tr>
<tr>
<td></td>
<td>Leaves</td>
<td>Dried and smoked as a cough remedy</td>
<td>Wilczek (1954)</td>
</tr>
<tr>
<td></td>
<td>Leaves</td>
<td>Grazed by animals and used as fodder</td>
<td>Padulosi and Ng (1990)</td>
</tr>
<tr>
<td><em>V. angivensis</em></td>
<td>Roots, pods and seeds</td>
<td>Eaten by domesticated and wild animals</td>
<td>Du Puy and Labat (2002)</td>
</tr>
<tr>
<td><em>V. fischeri</em></td>
<td>Flower and root</td>
<td>Eaten by humans, the raw root has a sweet juice</td>
<td>Williamson (1972, 1975)</td>
</tr>
<tr>
<td></td>
<td>Leaves and shoot</td>
<td>Used to make rope</td>
<td>Wilczek (1954)</td>
</tr>
<tr>
<td></td>
<td>Tubers</td>
<td>Eaten by humans</td>
<td>Padulosi and Ng (1990)</td>
</tr>
<tr>
<td><em>V. friesiorum</em></td>
<td>Flower and flower bud, fruit, pod, green seed and tuber</td>
<td>Eaten by baboons</td>
<td>Norton <em>et al.</em> (1987)</td>
</tr>
<tr>
<td><em>V. frutescens</em></td>
<td>Flower and flower bud, fruit, pod, green seed and tuber</td>
<td>Eaten by baboons and grazing animals</td>
<td>Norton <em>et al.</em> (1987), Glover <em>et al.</em> (1969)</td>
</tr>
<tr>
<td></td>
<td>Stem</td>
<td>Made into rope and used in hut construction</td>
<td>Richards 2312 (K)</td>
</tr>
<tr>
<td></td>
<td>Flower</td>
<td>Fragrant and floriferous so may have potential as an ornamental</td>
<td>Burkill (1995)</td>
</tr>
<tr>
<td><em>V. gracilis</em></td>
<td>Leaves, shoot, flower, fruit and seed</td>
<td>Grazed by animals and used as fodder</td>
<td>Adam (1966), Dalziel (1937)</td>
</tr>
<tr>
<td></td>
<td>Seed-pods</td>
<td>Eaten by humans once grilled</td>
<td>Vergiat (1970)</td>
</tr>
<tr>
<td></td>
<td>Roots</td>
<td>Used as a vermifuge</td>
<td>Wilczek (1954)</td>
</tr>
<tr>
<td><em>V. juncea</em></td>
<td>Fruit and seed</td>
<td>Eaten by humans</td>
<td>Anon (1981)</td>
</tr>
<tr>
<td><em>V. luteola</em></td>
<td>Leaves, shoot, flower, fruit and seed</td>
<td>Grazed by animals as forage</td>
<td>Burkill (1995)</td>
</tr>
<tr>
<td><em>V. macrorhyncha</em></td>
<td>Root</td>
<td>Eaten by humans as raw root</td>
<td>Anon (1981)</td>
</tr>
<tr>
<td>Taxon</td>
<td>Plant organ</td>
<td>Use</td>
<td>Reference or specimen</td>
</tr>
<tr>
<td>--------------</td>
<td>------------------------------</td>
<td>----------------------------------------------</td>
<td>-------------------------------------------</td>
</tr>
<tr>
<td><em>V. marina</em></td>
<td>Leaves, shoot, flower, fruit and seed</td>
<td>Grazed by animals and used as fodder</td>
<td>Walker and Sillans (1961)</td>
</tr>
<tr>
<td>–</td>
<td>Seed</td>
<td>Used as a coffee substitute in Gabon</td>
<td>Burkill (1995)</td>
</tr>
<tr>
<td>–</td>
<td>Tubers</td>
<td>Eaten by humans</td>
<td>Padulosi and Ng (1990)</td>
</tr>
<tr>
<td><em>V. membranacea</em></td>
<td>Flower, fruit, seed and root</td>
<td>Eaten by humans</td>
<td>Anon (1981)</td>
</tr>
<tr>
<td><em>V. monophylla</em></td>
<td>Root</td>
<td>Eaten by humans</td>
<td>Verdcourt (1971)</td>
</tr>
<tr>
<td><em>V. multiflora</em></td>
<td>Root</td>
<td>Used as a vermifuge</td>
<td>Wilczek (1954)</td>
</tr>
<tr>
<td><em>V. multinervis</em></td>
<td>Root</td>
<td>Root decoction is taken on an empty stomach at daybreak for <em>Ascaris</em> infection</td>
<td>Fay 4695 (K)</td>
</tr>
<tr>
<td><em>V. nuda</em></td>
<td>Root</td>
<td>Flavouring in beer</td>
<td>Pauwels <em>et al.</em> (1992)</td>
</tr>
<tr>
<td><em>V. oblongifolia</em></td>
<td>Root</td>
<td>Eaten by humans as raw root</td>
<td>Tanaka (1980)</td>
</tr>
<tr>
<td><em>V. parkeri</em></td>
<td>Leaves, shoot, flower, fruit and seed</td>
<td>Grazed by animals as forage</td>
<td>Wilczek (1954)</td>
</tr>
<tr>
<td>–</td>
<td>Whole plant</td>
<td>Used as a cover crop under coconuts in Madagascar</td>
<td>Wild and Pedro 5886 (K)</td>
</tr>
<tr>
<td><em>V. racemosa</em></td>
<td>Leaves and shoot</td>
<td>Eaten by chimpanzees and all animals</td>
<td>Van Lawick-Goodall (1968), Adam (1966), Berhaut (1976)</td>
</tr>
<tr>
<td>–</td>
<td>Leaf</td>
<td>Mashed-up leaf is drunk for cataracts</td>
<td>Thomas NWT 1840 (K)</td>
</tr>
<tr>
<td>–</td>
<td>Leaf</td>
<td>Mashed-up leaf is drunk for catarrh</td>
<td>Burkill (1995)</td>
</tr>
<tr>
<td>–</td>
<td>Leaf</td>
<td>Poulte for testicles</td>
<td>Burkill (1995)</td>
</tr>
<tr>
<td><em>V. reticulata</em></td>
<td>Leaves, shoot, flower, fruit and seed</td>
<td>Grazed by animals as forage</td>
<td>Wilczek (1954), Adam (1966), Berhaut (1976)</td>
</tr>
<tr>
<td>–</td>
<td>Leaf</td>
<td>Eaten by humans</td>
<td>Williamson (1972, 1975)</td>
</tr>
<tr>
<td>–</td>
<td>Leaf and root</td>
<td>Sap decoction taken by mouth for ear-ache and diarrhoea in Tanzania</td>
<td>Haerd (1964)</td>
</tr>
<tr>
<td>–</td>
<td>Root</td>
<td>Eaten by humans</td>
<td>Wilczek (1954)</td>
</tr>
<tr>
<td><em>V. stenophylla</em></td>
<td>Tubers</td>
<td>Eaten by humans</td>
<td>Padulosi and Ng (1990)</td>
</tr>
<tr>
<td>Taxon</td>
<td>Plant organ</td>
<td>Use</td>
<td>Reference or specimen</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td><em>V. subterranea</em></td>
<td>Fruit and seed</td>
<td>Eaten by humans, fruit and seed eaten green and raw, cultivated as Bambara groundnut</td>
<td>Dalziel (1937), Wild (1975)</td>
</tr>
<tr>
<td><em>V. umbellata</em></td>
<td>Seed</td>
<td>Eaten by humans as a vegetable</td>
<td>Anon (1981)</td>
</tr>
<tr>
<td><em>V. unguiculata</em></td>
<td>Leaf, young shoot, fruit, young pod, seed, tuberous root</td>
<td>Eaten by humans; the tuberous root may be poisonous when roasted</td>
<td>Dalziel (1937), Busson (1965), Williamson (1972, 1975) Maguire (1978), Anon (1981), Rodin (1985)</td>
</tr>
<tr>
<td>–</td>
<td>Flower and flower bud, fruit, pod, green seed and tuber</td>
<td>Eaten by baboons</td>
<td>Norton et al. (1987)</td>
</tr>
<tr>
<td>–</td>
<td>Root</td>
<td>Used as a dye</td>
<td>Dalziel (1937)</td>
</tr>
<tr>
<td><em>V. vexillata</em></td>
<td>Leaf, pod, tuber</td>
<td>Eaten by humans, the tuber may be used as a water source</td>
<td>Dalziel (1937), Adam (1966), Glover et al. (1969), Anon (1981)</td>
</tr>
<tr>
<td>–</td>
<td>Flower and bud, fruit, pod, green seed and tuber</td>
<td>Eaten by baboons</td>
<td>Norton et al. (1987)</td>
</tr>
<tr>
<td>–</td>
<td>Leaf</td>
<td>Leaf decoction is used as a wash against itch</td>
<td>Wilczek (1954)</td>
</tr>
<tr>
<td>–</td>
<td>Root</td>
<td>Root is ground into a paste for tropical ulcers and sores in Mozambique and for schistosomiasis in Tanzania</td>
<td>Wilczek (1954), Tanner 1498 (K)</td>
</tr>
</tbody>
</table>
1.5.1 Cowpea

Cowpea (*Vigna unguiculata* [L.] Walp.) is one of the main world pulses, domesticated in Northeast Africa (Pasquet, 1999) with a secondary centre of domestication in West Africa (Pasquet, 1996b; Garba and Pasquet, 1998a) and the Indian sub-continent (Steele et al., 1985), it is now cultivated in all tropical and some temperate areas. The crop is a widely adapted, stress tolerant grain legume, vegetable and fodder crop grown in the warm to hot regions of Africa, Asia and the Americas (Ehlers and Hall, 1997). The species is morphologically and genetically variable including wild perennial, wild annual and annual cultivated forms that are mainly used for their edible seeds, young leaves and pods (Pasquet, 1999), see Chapter 2 for a summary of *Vigna* systematics. Cultivated cowpea originated in Africa, the only continent where wild relatives are encountered (Marèchal et al., 1978). Wild and cultivated forms cross readily. Sauer (1952) argues a solely Ethiopian centre of origin, followed by subsequent evolution predominantly in the ancient farming systems of the African savannah.

Two approaches have been taken to the taxonomy of the cultivated forms; Piper (1912) took the three groups recognized on the basis of seed and pod characters by Linnaeus (1763) and raised them to specific rank. However, the second approach, suggested by Westphal (1974), of using cultivar-group rank is now accepted and cv. gr. *Unguiculata*, *Biflora* and *Sesquipedalis* is now widely used. However Pasquet (1998) noted that it is not easy to distinguish cv. gr. *Unguiculata* from *Biflora* and undertook a phenetic analysis of the genepool using 29 characters. He concluded a fourth cultivar-group, cv. gr. *Melanophthalmus*, should be added, the four cultivar-groups are distinguished:

- **Cultivar-group* Unguiculata* (Westphal, 1974)—Cowpea, black-eye bean. The most widespread and economically most important group of the species, cultivated in many (sub)-tropical and warmer temperate countries. Main production regions are in the Sahel belt in Africa, Brazil and Venezuela, but it is also frequently grown in other Africa, Asia, Australia and America countries. It is mostly used as a pulse, especially in Africa, consumed in various preparations (cooked, ground and made into fried or steamed cakes etc). Less often young pods and leaves are used as vegetable. In the United States of America it is often cultivated as forage or green manure crop. Originally domesticated in Africa in Neolithic times and remains the dominant African grain legume.

- **Cultivar-group* Melanophthalmus* (Pasquet, 1998)—The most recently recognized cultivar-group, it is based on the taxon proposed by Chevalier (1944) with a thin testa and often wrinkled, and is cultivated mainly in West Africa.

- **Cultivar-group* Biflora* (Westphal, 1974)—Catjang (bean). Mainly cultivated in South Asia (India, Sri Lanka), less often in Southeast or East Asia, rarely in Africa or elsewhere in (sub)-tropical regions. It is grown as a pulse, as vegetable for the green pods, as forage crop, especially for hay and silage, and as a green manure crop. Much less variable than the true cowpea.
• Cultivar-group *Sesquipedalis* (Westphal, 1974)—Yard-long bean, asparagus bean. Cultivated mainly in South and Southeast Asia, from India to Indonesia and the Pacific islands, also in East Asia and as a minor garden crop widely grown in many (sub-)tropical countries of Africa (especially West Africa) and America (e.g. Caribbean). The very long young pods (to 90 cm) are used as a vegetable (sometimes also the leaves or seedlings), dry seeds are less often consumed and also more infrequently the yard-long bean is grown as forage or green manure plant. Breeding programmes have produced many cultivars in India, Nigeria, United States of America, Cuba and the Philippines, some of them originating from hybridizations between cowpea and yard-long bean.

There are two centres of diversity for this variable crop species: Tropical Africa (*Unguiculata* group and wild forms) and India/Southeast Asia (the other cultivar-groups). Domestication took place in Africa in Neolithic times (Hanelt, 2001), the crop spread in the second millennium BC via the Near East to India and in the first millennium BC to the Mediterranean countries and to Southeast and East Asia. Here the cultivar-groups *Biflora* and *Sesquipedalis* were developed as results of selection for grain. Where exactly the crop was domesticated in Africa is still a matter of debate, Ethiopia, West Africa or a diffuse origin in the sub-Saharan belt having been proposed. The crop was subsequently taken to the Americas along with the slave trade.

The crop’s value lies in the high protein content of the seeds, vitamins and minerals in the young plants, its ability to tolerate droughts and to fix atmospheric nitrogen, which allows it to improve poor soils (IITA, www.iita.org). Cowpea is now considered an underutilized crop in areas of Africa where the formal sector has promoted cereal monocultures to replace the pre-existing mixed cropping systems. In Zimbabwe, for example, when maize monoculture was widely imposed in the 1930s, there was a decrease in production of cowpea along with other important food crops such as pigeon pea, pumpkin and melon, which were grown in mixed cropping system with sorghum and millet (SAFAIDS News, /www.safaids.org.zw/).

Cowpea is one of the most important pulse crops globally. FAO estimates that cowpea is now cultivated on at least 12.5 million hectares, and an annual production of over 3.3 million tonnes of cowpea dry grains were produced worldwide in 2000. Nigeria produced 2.1 million tonnes of this, making it the world’s largest producer, followed by Niger (650 000 tonnes) and Mali (110 000 tonnes). Total area grown to cowpea was 9.8 million hectares, about 9.3 million hectares of these in West Africa. World average yield was 337 kg per hectare; average yield in Nigeria was 417 kg per hectare, and in Niger was 171 kg per hectare (IITA, www.iita.org). More than half of the cultivated area is in Central and Southern Africa. Production is characterized by limited use of purchased inputs and the crop is traditionally intercropped with cereals such as maize, millets, sorghum and cassava (Singh et al., 1997; Rao and Mathuva, 2000). The cowpea is harvested at a different time to the cereal, spreading labour demand and providing a quick source of cash. The fast growth and spreading habit of traditional cowpea varieties suppresses weeds and the increased soil nitrogen...
due to nitrogen fixation improves cereal growth (Singh et al., 1997; Fulton et al., 1999). It has been suggested that such intercropping systems have the advantage of minimizing the destructive effects of insect pests on cowpea. A recent study, however, reports that mixed cropping with pearl millet had no effect on major pests (Bottenburg, 1995; Bottenburg and Singh, 1997).

Cowpea is widely cultivated in many African countries including Nigeria, Niger, Egypt, Benin, Burkina Faso, Mali, Mauritania, Malawi, Senegal, South Africa, Swaziland, Tanzania, Uganda and Madagascar. It is also grown in eastern Europe including Bosnia and Herzegovina, Croatia, Macedonia and Slovenia; in Australia; the United States; in the Mediterranean including Cyprus, Italy and Portugal; in Asia including India, Myanmar and Sri Lanka; and in the Caribbean (Ehlers and Hall, 1997; FAOSTAT, http://apps.fao.org/faostat/). Cowpea does best in the savannah regions of the tropics and subtropics, where the climate is characterized by wet summer seasons and dry winter seasons, and where droughts and poor soils restrict other crops. Nigeria is the largest producer of cowpea, followed by Niger. In Southern African, Mozambique is the main producer followed by Zambia and Zimbabwe (Fulton et al., 1999). As shown in Figure 1.2, the area under cultivation has increased markedly from just over 4 million hectares in 1987 to more than 8 million hectares. It has recently been suggested that this figure is an underestimation and 12.5 million hectares is a more realistic figure (Singh et al., 1997).

A wide range of nutritional value exists between cultivars of cowpea (Breassani, 1985). Cowpea grain contains about 25% protein, making it extremely valuable where people cannot afford protein foods such as meat and fish. A recent study on six Brazilian cultivars reports protein, carbohydrate and oil content ranging from 195 to 261, 678 to 761 and 12 to 36 g/kg of dry matter respectively. The study also reports differences in amino acid content between varieties (Maia et al., 2000). EneObong (1995) reports a protein content of 24–28%, which is significantly higher than values reported for African yam beans (Sphenostylis stenocarpa) and pigeon pea (Cajanus cajan) in the same study.

Cowpea is mainly used for human and livestock consumption. When fresh, the young leaves, immature pods and peas are used as vegetables, while snacks and main meal dishes are prepared from the dried grain. Cowpea grain matures earlier than cereals, hence becomes a quick source of cash before the maize, millets and cassava are harvested. Cowpea residue after harvest is used for feeding cattle, goats, pigs, sheep and other farm animals (IITA, http://www.iita.org/)

Cowpea can be prepared in different ways. In Cameroon, cowpea paste is prepared by soaking the seeds, followed by removal of the testa (Steele et al., 1985) and whipping with palm oil and spices then cooking by steaming to make “koki” (Mbofung et al., 1999). In Nigeria, the seeds are processed into “akara” or cooked as porridge (Uguru, 1996). In Ethiopia, cowpeas, locally called “ohota”, “okala” or “neeqayta” are boiled or eaten raw (Engels and Goettsch, 1991). In Nigeria, cowpea is the main source of protein used in weaning supplements by low-income groups. Concern about possible linkages to flatulence and diarrhoea may limit use following weaning (Akinyele and Akinlosotu, 1987). Many older cultivars have a tendency to ripen over an extended time period, which makes
them amenable to subsistence rather than commercial farming. More recently cultivars have been developed for monocultural systems.

The crop is also grown in the derived savannah and rainforest belt of Nigeria for use as a vegetable. The fresh immature pods are boiled with the young shoot and served with yam and palm oil (Uguru, 1996). Steele et al. (1985) also report the use of some cowpea varieties as leafy vegetables in East Africa where *P. vulgaris* is the predominant pulse species. Cowpeas are sacred to Hausa and Yoruba of West Africa, and are used as a folk medicine to abate evil and to pacify the spirits of sickly children. The Hausa and Edo tribes also grind one or two seeds and mix them with soil or oil to treat stubborn boils (Duke, 1981).

The haulms of cowpea are harvested and used as fodder (Singh et al., 1997; Tarawali et al., 1997) while the decaying root residues provide manure for cultivated fields (Singh et al., 1997). The nutritive value of cowpea haulms is comparable to that of other forage legumes (Tarawali et al., 1997). In many regions cowpea is intercropped with cereals such as sorghum, maize or pearl millet (Singh et al., 1997; Rao and Mathuva, 2000). In such systems, the indeterminate or semi-determinate growth has the added advantage of preventing soil erosion and suppressing growth of weeds (Singh et al., 1997).

The major limitation to the production of cowpea in many parts of Africa is attack by insect pests (Jackai and Adalla, 1997), notably storage weevil (*Callosobruchus maculatus*) is a serious problem, especially as pesticides are not accessible and/or affordable for subsistence farmers. Some of these are more important in the field while others are a problem during storage. Important pests of cowpea include thrips (*Megalurothrips sjostedti*), pod borers (*Maruca vitrata* Fabricius, formerly *M. testulalis* Geyer), aphids (*Aphis craccivora*) and pod-sucking bugs (*Clavigralla tomentosicollis*) among others (Bottenburg and Singh, 1997; Jackai and Adalla, 1997; Tamò et al., 1997). Therefore for subsistence farmers, on-farm storage often involves the mixing of infested cowpea grain

![Figure 1.2](image.png)
with wood ash from cooking fires to discourage insects. Triple bagging of stored seed is also a cheap storage technology, which involves storing cowpea grain in plastic bags, one within the other, or "solar disinfection" of seed in dark plastic, which uses the sun to heat the cowpea grain to a temperature high enough to kill the eggs, larvae, pupae and adults in the grain (Gómez, 1999). Parasitic weeds, such as *Striga gesnerioides* are also an important limitation to cowpea production (Toure *et al*., 1997). In a recent experiment, Karungi *et al.* (2000) found that insect damage alone accounts for 24–69% of the total variation in grain yield.

Early maturing cultivars have been developed with good grain quality and resistance to some important diseases and pests including bacterial blight (*Xanthomonas campestris*), cowpea aphid-borne mosaic virus, cowpea aphid (*Aphis craccivora*), cowpea curculio (*Chalcodermus aeneus*), root-knot nematodes (*Meloidogyne incognita* and *M. javanica*), cowpea weevil (*Callosobruchus maculatus*) and the parasitic weeds, such as *Striga gesnerioides* and *Alectra vogelii* (Ehlers and Hall, 1997). These authors note that earliness is particularly important in Africa as these early cultivars can escape drought and some insect infestations, while providing the first food and marketable product from the new growing season, and that they can be grown in a diverse array of cropping systems. Also, new early maturing cultivars with indeterminate growth habits have been very effective in the extremely dry and hot environment of the Sahel. Ehlers and Hall (1997) note that future breeding objectives include breeding high levels of resistance to pests such as flower thrips (*Megalurothrips sjostedti*), pod borer (*Maruca testulalis*), lygus (*Lygus hesperus*), and pod bugs (*Clavigralla tomentosicollis* and others). While Uguru (1998) notes that genes from wild cowpeas or related *Vigna* species are likely to be necessary to the development of future cultivars and that the conservation and maintenance of this useful legume amid the new varieties released yearly from research stations and seed companies have been accomplished through indigenous traditional methods.

### 1.5.2 Bambara groundnut (*V. subterranea*)

Named after the Bambara tribe from Mali (Goli, 1997), Bambara groundnuts, also called “nyimo” (Shona), “indlubu” (Ndebele/Siswati) or “ditloo” (SeTswana), are widely grown throughout most of Africa. The wild form (*Vigna subterranea* var. *spontanea* (Harms) Hepper) is found in an arc including northern Nigeria, northern Cameroon, Chad and the Central African Republic (Hanelt, 2001). While Bambara groundnut is traditionally cultivated in drier parts of sub-Saharan Africa, more recently it has spread to India, Southeast Asia, Fiji and South America. The main producer countries are Nigeria, Niger, Ghana, Côte d’Ivoire and Burkina Faso, elsewhere it is more locally grown. It is cultivated as a field or garden crop, often in mixture with millets, yam, cassava or other legumes such as *Arachis*. Within sub-Saharan Africa this species is primarily cultivated in traditional farming systems, where it is intercropped with other root and cereal crops (Pillay, 2003). The bulk of consumption is as a pulse. Mature seed is roasted, boiled or ground for porridge, green seeds (and pods) are also eaten fresh or roasted or boiled in soups. Beans can occasionally be used as a coffee substitute.
Domestication occurred within the area of the wild forms (Hanelt, 2001) and the crop was brought very early to East Africa and Madagascar, then later to South and Southeast Asia, and with the slave trade to Suriname and then Brazil and later also to other places in the New World. More recently in Africa some of its production area was replaced by *Arachis* and the area cultivated has decreased. There is large variation, especially in seed and pod characters within the crop, many landraces exist and in West Africa spontaneous hybridizations with the wild forms can be observed. The seeds contain, on average, 6.3% oil, 63% carbohydrate and 19% protein. The gross energy has been reported to be higher than that of other pulses including cowpea, lentils and pigeon pea (FAO/WHO, 1987). Fresh pods are commonly boiled with salt or grilled and eaten as a snack (Goli, 1997; Tanimu and Aliyu, 1997). In Côte d’Ivoire, the dry seeds are ground into flour, which is reported to make digestion easier. In Nigeria Bambara groundnut is used to prepare such foods as “akara” in the same way as cowpea (Goli, 1997).

In a recent trial to evaluate the acceptance of milks prepared from soya bean, cowpea, pigeonpea and Bambara groundnut, the latter was reportedly found to be the most acceptable owing to its lighter colour compared with the others (Brough et al., 1993; Goli, 1997). Burkill (1966) cited in Linnemann (1992) reported that Bambara groundnuts were used in the preparation of coffee substitutes during the Second World War. As with cowpea, the haulms of Bambara groundnut are fed to livestock (Goli, 1997; Tanimu and Aliyu, 1997). Within Africa it is third in area grown after cowpea and *Arachis*.

Some of the insect pests of cowpea have also been reported to be important pests of Bambara groundnut (Doku, 1996; Tainamu and Aliya, 1997). However, many wild species of *Vigna* show high levels of resistance to these pests. Wild species that show marked levels of resistance to pod-sucking bugs include *V. vexillata*, (Padulosi and Ng, 1990) as well as *V. luteola*, *V. oblongifolia* and *V. reticulata* (Laghetti et al., 1998), in addition *V. kirkii* (Baker) Gillett and *V. vexillata* show high levels of resistance to bruchid pests (Laghetti et al., 1998; Padulosi and Ng, 1990). The resistance of *V. vexillata* to many insect pests is thought to be owing to its pubescent leaves, stems and pods. Oghiakhe et al. (1992) found that it is the density and not so much the length of trichomes that is important in conferring resistance. The trichomes are believed to interfere with the ovipositor attachment of eggs and feeding of insects.

### 1.5.3 Medicinal uses

Medicinal applications of members of this genus include the use of *V. gracilis* var. *multiflora* (Hook.f.) Maréchal, Mascherpa & Stainier roots as a vermifuge and smoking of leaves of *V. ambacensis* as a cough remedy in the Democratic Republic of the Congo, use of leaves of *V. racemosa* (G.Don) Hutch. & Dalziel in the treatment of cataract in Nigeria, and the use of the leaf sap and roots in the treatment of diarrhoea in Tanzania. In the Central African Republic, a decoction prepared from the roots of *V. multinervis* Hutch. & Dalziel is taken on an empty stomach to treat roundworm infections (Burkill, 1995).
1.6 The phytogeographic context
This section briefly outlines the ecogeographic context for African Vigna, the major factors governing the distribution of the species: geology and climate, which together have a marked effect on the vegetation types.

1.6.1 Geology
Africa, with the exception of the Atlas Mountains and the Southern Cape ranges, is composed of a crystalline shield of Precambrian age, overlain in part along the eastern coast by Precambrian and Jurassic/Cretaceous sediments, Jurassic basalts in southern Central Africa, Miocene-Pleistocene volcanic rocks along the Rift Valleys in East Africa and Aeolian sands in the Saharan and Kalahari regions. The oldest rocks form the rugged massifs of Air and Ahaggar, the dissected plateaux of the Guinea highlands, the escarpments flanking the Niger basin, the Jos Plateau in Nigeria and the western rim of the continent from the Cristal Mountains to the Orange River.

Following the break-up of Pangaea (ca. 200 million years ago), Africa was part of the southern land-mass of Gondwanaland that proceeded to drift north. Around the continent's margins, sandstones, shales, limestones and dolomites were deposited in the Maghreb, Western Sahara, Tanzania, Mozambique and the Cape. Subsequent earth movements formed the parallel mountain ranges found today along the south coast of Africa, south of the Great Karoo.

Madagascar is believed to have separated from the African mainland about 160 million years ago (Rabinowitz et al., 1983), before Africa separated from the other components of Gondwanaland about 135 million years ago. Both Madagascar and Africa drifted north towards the equator. So between 135 and 25 million years ago, when Africa collided with Eurasia creating the Alps and Atlas Mountains, the flora and fauna of Africa evolved in relative isolation. Then, about 15 million years ago, Africa again became isolated, as the rifting apart of Africa and Arabia resulting in the Great Rift Valley extending from Turkey to Zimbabwe. At the same time, the climate became much drier, resulting in the expansion of grasslands at the expense of forests. This region is still volcanically active and includes the highest mountains on the continent—Mt Kilimanjaro (5895 m) and Mt Kenya (5199 m). Meanwhile, successive uplifting created the Great African Plateau, stretching from South Africa to Tanzania and Zaire, the largest plateau on earth. Most of the plateau is more than 900 m above sea level, the highest parts being the Drakensberg in Southern Africa (Thabana-Ntlenyana, 3482 m), Mt Rungwe (2691 m) in southern Tanzania, Mt Mulanje (3002 m) in southern Malawi and Mt Moco (2620 m) in Angola.

1.6.2 Climate
Climate is one of the factors governing the distribution of plants throughout the world. Africa's climatic zones are largely controlled by the continent's location astride the equator with almost symmetrical extensions into the northern and southern hemispheres. Africa can be divided into 12 general climatic regions
Areas near the equator and on the windward shores of southeast Madagascar have a tropical rainforest climate, with heavy rain and high temperatures throughout the year. The north and south of the rainforest are belts of tropical savannah climate, with high temperatures all year and a seasonal distribution of rain during the summer season. The equatorial savannah grades pole-ward in both hemispheres into a region of semiarid steppe (with limited summer rain) and then into the arid conditions of the extensive Sahara (north) and the Kalahari (south). Belts of semiarid steppe with limited winter rain occur on the pole-ward sides of the desert regions. At the northern and southern extremities of the continent are narrow belts of Mediterranean-type climate with subtropical temperatures and a concentration of rainfall mostly in the autumn and winter months.

Overall climatic zonality is determined by the relative positions of the earth and sun throughout the year, which in turn give rise to a general pattern of atmospheric circulation, although local factors such as topography, ocean currents and continental mass alter the general circulation pattern and bring about local variations, which produce a specific climate in a particular region. Figure 1.3 presents the climatic regions of Africa according to the system of Papadakis (1966).

- **Mediterranean**—This region is indicated by the figure (6°) on Figure 1.3. Rain falls only in the winter (400 to 700 mm) and the summer is very hot and dry. The summer climate of the Atlantic coast of Morocco is influenced by the cold sea current from the Canary Islands. The plateaux of the “chotts” rise to an altitude of about 1000 m, have cold winters and receive less rainfall (150 to 200 mm). These conditions have produced a treeless steppe. The decrease in precipitation is due to lower latitude and to the coastal ranges which block the cold, moist winds from the north. The Atlas chain receives much more rainfall, but is also colder. In Egypt and Libya the Mediterranean climate is reduced to a narrow coastal strip by the lower latitude and by the advancing desert, which here is not contained by the Atlas mountain system, as is the Maghreb.

- **Sahara**—The Sahara has a desert climate (3); four fifths of it receives precipitation of <20 mm a year, which comes often as fine rain, but the Mauritanian Sahara (3.1) receives more. Flow in the wadis is linked to subtropical anticyclone and lack of associated storms means that they do not flow every year. Violent winds are frequent and cold sea currents produce fog and an ocean desert climate (3.3) on the coast of Mauritania, the Spanish Sahara and Morocco. In the northern part there is frost in the winter. In the summer temperatures can exceed 43°C. Higher altitude areas such us the Ahaggar and Tibesti ranges have semi-desert climates, i.e. a rainfall of about 100 mm and more moderate temperatures with regular frosts in the winter.

*Figure 1.3. Climatic zones of Africa (Papadakis, 1966).*

Note: in this account, numbers in brackets correspond to the Papadakis (1966) classification system as shown in Figure 1.3.
• **Western Africa**—South of the 15th parallel are east-west climatic regions that become increasingly humid toward the Gulf of Guinea. The semi-arid tropical zones (1.5 and 1.9) correspond to the Sahelo-Sudanese climate. The average annual temperature is between 26 and 31°C and precipitation is between 400 and 1000 mm. The rainy season is short to very short (two to four months) and the dry season, when the dry winds blow, is extremely severe. Another semi-arid tropical zone (1.4) corresponds approximately to the Sudano-Guinean climate. Here the temperatures are lower (24 to 28°C) and rainfall heavier (950 to 1750 mm). The dry season lasts four to five months and the rainy season five to seven months, with precipitation mainly in the summer. Another zone (1.1) is humid equatorial and tropical. The rainfall curve often shows two maxima and two minima, always exceeds 1000 mm a year and may reach 2000 mm in Liberia. The dry season is very short, temperatures range from 25 to 27°C and the fluctuation of the temperature is very modest in comparison with the first two zones. The abnormal drier climate of the coasts of Togo and Ghana (1.3) and the “Baoulé ‘V’” formed
by an incursion of climate (1.4) in Côte d’Ivoire are reflected in the vegetation and soil distribution.

- **Horn of Africa**—The Somali-Ethiopian region is characterized both by very dry desert climates with a yearly precipitation of less than 100 mm (Danakil plain—3.1 and 3.5) and semi-desert climates with 250 to 500 mm (Somalia—1.5). However, the Ethiopian highlands, with altitudes of 3000 to 5000 m, receive plentiful rainfall in the summer and have a maximum of 1200 to 1300 mm (1.7) on the western scarp of the high plateau and less on the plateau itself (2.3). The eastern scarp of the plateau receives 500 to 1000 mm (1.8). The temperature is much lower on the plateau (2.3) than in the neighbouring plains (1.5 and 1.7).

- **Sudanese Region**—The zonality of western Africa is somewhat disturbed by the Jebel Marra mountains and the large swampy depression of the Sudd. The jagged relief causes cooler winters (1.9 and 4.3). On the other hand, the Sahelo-Sudanese climate reaches further south along the White Nile depression following the 1000 mm isohyet southward. Northern Sudan is arid. The Red Sea coast and the coastal hills receive about 100 mm of rain in the winter (3.1).

- **Eastern Africa**—The climate is extremely varied and is associated with altitudinal zoning, being in general drier than the remainder of the continent at the same latitude. The desert climate (3.1) reaches as far as the equator in northern Kenya. Only the high altitude regions, e.g. the Kenyan highlands, volcanoes and crests on either side of the Great Rift Valley (1.7) are relatively well watered, receiving 1200 to 1500 mm of precipitation. On the other hand, the Rift valley (1.3) and the plateau south of Lake Victoria (1.8) are rather dry. The heights to the east of Lake Victoria are cooler (2.3), with dryness increasing towards the coast (1.3 and 1.5) because of lower relief and, perhaps, the influence of a cold sea current. However, the coast of Tanzania in front of Zanzibar Island has an abnormally high rainfall of approximately 2000 mm (1.1).

- **Central Congo Basin**—This basin is humid (precipitation over 1500 mm) and has a hot equatorial climate (1.1 and 1.2) with two rainfall maxima. There is no distinct dry season around the equator, but there are two dry seasons at higher latitudes. The average temperature is around 25°C and the daily ranges increase with distance from the equator (11 to 20°C). The highlands have a climate with cooler nights (1.7).

- **High Plateaus of Southern Africa**—These regions cover southern Angola, Zambia, Zimbabwe and part of South Africa. The predominant climate is (2). Because of the altitude, which often exceeds 1000 m, average temperatures are appreciably lower. The average July minima are below 0°C. Winter seasons are dry and long. Some lower regions are subtropical and therefore hotter (4).

- **Plains of Mozambique**—These plains have a low rainfall of 200 to 600 mm with cool winters (1.9), while the coastal strip has higher rainfall (1.3) and the northern plains are appreciably more humid (1.2).

- **Namib and Kalahari Deserts**—The deserts were formed as a result of the persistence of the subtropical anticyclone and the influence of the cold
Benguela current (3.3, 3.4, 3.2, 2.1 and 2.2). The effects of both these factors diminish towards the interior. The Kalahari is less dry than the Sahara, having an average summer rainfall of over 150 mm, which reaches a maximum of 500 mm in the northern and eastern parts. The Namib receives little rainfall, but has higher air humidity (3.4).

- **Coastal strip of South Africa**—A Mediterranean climate (6) prevails at the foot of the Great Escarpment. Temperatures are lower during the summer than in northern Africa. Rainfall and temperature increase towards the east, forming a semi-tropical climate (4.4). Pampean climates (5) with hot summers and some frosts occur between these two climates.

- **Madagascar**—The east coast and a small area in the northwest (Sambirano) have an equatorial-type climate (1.1 and 1.2). Rainfall is between 1500 and 3500 mm; the dry season is very short as the coast blocks the trade winds. The high plateaus have milder temperatures (2.1 and 2.2). The hot west coast has a distinct rainy season of four to six months (1.3 and 1.4). The southwest is sheltered from the trade winds, has a semi-arid climate (1.5) and a rainfall of <500 mm.

### 1.6.3 Vegetation

Africa has an enormous range of vegetation types, ranging from true desert to dry bushland, wooded grassland, rainforest and alpine desert. The continent is predominantly open woodland and grassland. Erratic climatic variation has generally resulted in increasing aridity. Climatic change has affected the survival and distribution of individual species and whole vegetation types (Beentje et al., 1994). In particular, moist forests have decreased considerably during the 21 or so ice ages during the last 2–3 million years, whereas grassland and open woodland have expanded of these periods. Increasing aridity has resulted in several forest areas in Central Africa becoming isolated forest refugia, many extinctions, fragmentation of populations and divergent evolution within the isolated forests. It is unclear when the isolated and endemic-rich forests near the East African coast were connected with the main Guineo-Congolian forests further west, but high levels of endemism in the East African coastal forests (including forest patches from Somalia to Mozambique and the Eastern Arc Mountains of Kenya and Tanzania) indicate a long period of isolation. For example, 40% of forest tree species on the East Usambara Mountains are not found in the main Guineo-Congolian forests (Hamilton and Bensted Smith, 1989). The richness of the flora of African savannahs indicates the existence of extensive savannah throughout the recent geological past; however, human activities have extended its distribution. Present day African vegetation has been classified by several authors, most notably by White (1983) whose concept is summarized below by Beentje et al. (1994) (see also Figure 1.4):

- **Forest**—Continuous stands of trees 10 m to more than 50 m tall, with interlocking crowns; shrub layer normally present. Nearly all the forests of Africa are evergreen or semi-evergreen. Tropical rainforest now covers only about 7% of the land area of Africa, representing slightly less than one-fifth
of the total remaining global resource. Evergreen rainforest tends to be found in the wettest areas, especially if dry seasons are not too severe, such as in the central pans of the Zaire basin (which receives between 2000 and 2500 mm per annum), in wetter places near the Atlantic coast (including on the seaward side of Mt Cameroon which has an excess of 4000 mm per annum) and at higher altitudes on mountains. More than 80% of Africa’s rainforest occurs in a central belt, which stretches from Cameroon and Gabon on the Atlantic coast to western parts of Kenya and Tanzania. In West Africa, large-scale deforestation and fragmentation have left important relict blocks of rainforest at Gola (Sierra Leone), Sapo (Liberia) and Tai’ (Côte d’Ivoire), all of which are identified below as centres of plant diversity and endemism. Dry forest occurs locally in the Zambesian and Sudanian regions, on the dry coastal plain of Ghana and in Madagascar.

- **Woodland**—Open stands of trees at least 8 m tall, with a canopy cover of 40% or more, with a field layer usually dominated by grasses. Nearly all types are deciduous or semi-deciduous, but most contain at least some evergreen species. Woodlands are widespread in tropical Africa and are especially characteristic of the Sudanian and Zambesian regions, which have continental climates and moderate precipitation falling in the summer.

- **Bushland and thicket**—Bushland includes open stands of bushes, usually between 3 and 7 m tall and with a canopy cover of 40% or more; in thicket the stands of bushes are closed. Both types are found under a wide range of climatic and edaphic conditions that are unfavourable for tree growth. They are most frequent in areas where annual rainfall is 250–500 mm and of irregular occurrence, or where there are two pronounced dry seasons. Deciduous bushland and thicket is extensively developed in the Somali-Masai region; evergreen and semi-evergreen bushland and thicket is found in the Cape, coastal east and southeast Africa and associated with the drier types of montane forest. Bushland and thicket, dominated by Ericaceae, forms a distinct zone on many African mountains and crowns the peaks in the Guineo-Congolian region.

- **Shrubland**—Open or closed stands of shrubs up to 2 m tall. The most extensive shrublands are in the Karoo-Namib region and in the Cape (fynbos). Shrublands also occur in montane and Afroalpine regions. In the latter they are typically dwarf and form but one component of a diverse range of communities.

- **Grassland**—Land covered with grasses and other herbs, either without woody plants or the latter not covering more than 10% of the ground. Edaphic grasslands are widespread throughout Africa and include vast areas in the Serengeti (developed on volcanic deposits and maintained as grassland by grazing); grasslands associated with seasonally or permanently waterlogged soils and also secondary grassland, which has replaced forest or woodland after human intervention (such as burning and cultivation).

- **Wooded grassland**—Land covered with grasses and other herbs, with woody plants covering between 10 and 40% of ground. Most widespread vegetation
in the Sahel and in the Kalahari part of the Kalahari-Highveld zone. It is also common in the Sudanian and the Zambesian regions.

- **Deserts and semi-deserts**—Arid landscapes with a sparse plant cover, except in depressions where water accumulates. Semi-desert vegetation begins to occur when the mean annual rainfall drops below c. 250 mm, e.g. in parts of the Karoo-Namib, Somali-Masai and the Sahel and on the margins of the Sahara Desert. True deserts include the Sahara, the historically richer Namib Desert and parts of northern Kenya.

- **Afroalpine vegetation**—Physiognomically mixed vegetation confined to the highest mountains in Africa where night frosts are liable to occur throughout the year. Nearly half the flowering plant species present exhibit specialized growth forms, including giant rosette plants such as *Dendrosenecio* and *Lobelia*.

- **Mangroves**—Open or closed stands of trees or bushes occurring on shores between the high- and low-water marks. Extensive tracts of mangroves occur on the west coast, the tallest being found in the Niger Delta (Nigeria), with trees up to 45 m tall and covering an area of 5400 km², while on the east coast, Tanzania has 1155 km² of mangroves. Other formations include: herbaceous freshwater swamp and aquatic vegetation, and halophytic vegetation (saline and brackish swamp).

- **Bamboo**—Only four species of bamboo are native to Africa. Of these, *Arundinaria tesselata*, *Oreobambos buchwaldii* and *Sinarundinaria alpina* are part of Afromontane communities, while *Oxytenanthera abyssinica* is widespread in the Sudanian and Zambesian regions.

There are also several transitional formations of local extent, these include:

- **Scrub forest**—Intermediate between forest and bushland and thicket and often dominated by tree-like species of *Aloe* and *Euphorbia*.

- **Transition woodland**—Intermediate between forest and woodland.

- **Scrub woodland**—Stunted woodland less than 8 m tall or vegetation intermediate between woodland and bushland.

A general picture of African plant species richness and endemism is provided in Table 1.3 (Davis et al., 1994). By far the highest numbers of native and endemic species are located in South Africa, with Cameroon, Ethiopia, Gabon, Kenya, Tanzania and Zaire having lesser numbers. However, due to the size of the continent and the large proportion of endemic species, especially in Madagascar and South Africa, a crude numeric analysis is unhelpful in defining conservation priorities.
Table 1.3. African plant species richness and endemism (Davis et al., 1994).

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<tr>
<th>Country</th>
<th>Native vascular plant species</th>
<th>Endemic species</th>
<th>% Endemic species</th>
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<td>74</td>
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<td>500</td>
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<td>23,420</td>
<td>&gt;16,500</td>
<td>&gt;70.0</td>
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<tr>
<td>Sudan</td>
<td>&gt;3132</td>
<td>50</td>
<td>1.6</td>
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<td>4</td>
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<tr>
<td>Tanzania</td>
<td>&gt;10,000</td>
<td>1122</td>
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<tr>
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<td>?</td>
<td>?</td>
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<tr>
<td>Uganda</td>
<td>5406</td>
<td>30</td>
<td>0.6</td>
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<tr>
<td>Western Sahara</td>
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<td>?</td>
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<tr>
<td>Zaire</td>
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<td>1100</td>
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Figure 1.4. African Centres of Plant Diversity and Endemism (from Beentje et al., 1994).

Key:
Af2  Tai National Park (Côte d’Ivoire)          Af39  Zambezi source area (Zambia)
Af4  Mont Nimba (Guinea, Liberia, Côte d’Ivoire) Af42  Cal Madow (Somalia)
Af7  Sapo National Park (Liberia)               Af44  Hobyo (Somalia)
Af11 Forest zone River Dja region (Cameroon)    Af49  Garamba National Park (Zaire)
Af12 Korup National Park (Cameroon)             Af50  The Kaokoveld (Angola, Namibia)
Af13 Mount Cameroon (Cameroon)                  Af51  Western Cape Domain (Succulent Karoo)
Af16 Mayombe (Congo, Cabinda, Zaire)           Af57  Rondo Plateau (Tanzania)
Af18 Cristal Mountains (Gabon)                  Af59  Maputaland-Pondoland Region (South Africa, Swaziland, Mozambique)
Af24 Cross River National Park (Nigeria)        Af62  Mount Kenya (Kenya)
Af25 Bwindi (Impenetrable) Forest (Uganda)      Af64  Mount Mulanje (Malawi)
Af29 Maiko National Park (Zaire)                Af71  East Usambara Mountains (Tanzania)
Af30 Salonga National Park (Zaire)              Af81  Afroalpine Region (East and North-east Africa)
Af33 Mahale-Karobwa Hills (Tanzania)            Af82  Drakensberg Alpine Region (Lesotho, South Africa)
Af35 Kundelungu (Zaire)                        Af84  High Atlas (Morocco)
Af37 UpeMBa National Park (Zaire)               Af85  Lake Victoria regional mosaic

2. BIOSYSTEMATIC BACKGROUND

2.1 Leguminosae (Fabaceae)
The genus *Vigna* Savi is a member of the family Leguminosae (=Fabaceae), subfamily Papilionoideae, tribe Phaseoleae, subtribe Phaseolinae. The Leguminosae are a morphologically diverse family, ranging from trees to aquatics to xerophytes, and rank second only to the Gramineae in economic importance (Heywood, 1985). The family contains approximately 650 genera and 18 000 species, and is the largest family of plants after the Compositae and Orchidaceae (Polhill *et al*., 1981). The family is normally divided by taxonomists into three subfamilies, Mimosoideae, Caesalpinioideae and Papilionoideae, of which the latter is the largest and contains largely herbs and shrubs with a few trees. The 400–500 genera and 10 000 Papilionoid legume species are distributed through temperate, subtropical and tropical regions of the world (Polhill *et al*., 1981). The leaves are usually pinnate; the flowers are irregular with lateral petals enclosed by the standard in the bud; there are usually 10 stamens, commonly diadelphous but sometimes monadelphous or free. The Papilionoideae were traditionally divided into 10 or 11 tribes, based on habit, vegetative and floral characters. More recently, legume taxonomists have tended to increase the number of tribes; Gillett *et al*. (1971) detail 17 tribes but Polhill (in Lackey, 1977) suggests a complete break with prior tribal delimitations to form 31 tribes. Polhill and Raven (1981) divide the subfamily into 32 tribes. Recent phylogenetic analysis of the Leguminosae using the 319 \(rbcL\) sequence has highlighted the monophyly of the Papilionoideae. Although a few major clades were well supported, the overall topology for the subfamily was unresolved (Kajita *et al*., 2001). One of the strongest clades was that containing the Phaseoleae subtribes Erythrininae, Glycininae, Phaseolinae, Kennediinae and Cajaninae.

2.2 Phaseoleae
The tribe Phaseoleae (*sensu* Polhill and Raven, 1981) is the largest Papilionoideae tribe, with about 84 genera and 1500 species, and is economically the most important, containing the genera *Phaseolus*, *Vigna*, *Glycine*, *Cajanus*, *Clitoria*, *Macrotyloma*, *Lablab*, *Pachyrhizus*, *Pueraria* and *Psophocarpus*. The group is generally recognized by its twining habit and trifoliolate leaves with asymmetrical lateral leaflet margins, although not all taxa have all three characters. In addition to the trifoliolate leaves and climbing habit, some members of Phaseoleae share with members of other tribes a number of derived features, such as inflorescences in pseudoracemes (Tucker, 1987), pollen with a thickened endexine (Ferguson and Skvarla, 1981), seedlings with opposite and simple eophylls (Baudet, 1974), the presence of stipels, and chromosome base numbers of 10 or 11 (Lackey, 1981). For these reasons it has been difficult, Bruneau *et al*. (1995) believe, to delimit the Phaseoleae clearly from other tribes of the derived Old World tropical lineage (e.g. Millettieae, Desmodieae, Indigofereae and Psoraleeae). Lackey (1981) provides the following description of the Phaseoleae:
“Phaseoleae DC (1825)—Dextrorotatory twining, prostrate, or erect herbs, occasionally subshrubs or rarely trees; leaves usually pinnately 3-foliate, less commonly 1–9 foliolate or palmate; leaflets sometimes lobed; stipels and stipules present; foliar and foliolar pulvini present; inflorescence consisting of fascicles of flowers scattered along an axis, sometimes reduced to solitary flowers or expanded into panicles; calyx with (4–5) teeth; corolla papilionaceous; stamens in 9+1 arrangement, the vexillary stamen free or partially or completely united to the others; pods 2-valved. Seedlings with opposite first leaves. 2n usually = 20, 22, 84 genera worldwide, primarily in tropical and subtropical regions.”

In subdividing the Phaseoleae, Lackey recognizes eight subtribes. He discriminates subtribal limits using largely floral characters, though including some leaf and seed traits as well. Bruneau et al. (1995) studied the infra-tribal relationships of the Phaseoleae using chloroplast DNA restriction site characters and found the Phaseolinae Benth., which contains Vigna, to be a monophyletic group. However, they question the most appropriate rank for the subtribes: should they be given tribal rank? This question remains unresolved. Lackey (1981) provides a key to the Phaseoleae subtribes (Figure 2.1) and genera (Figure 2.2) which help distinguish and define current concepts of the eight subtribes and genera included.

Lackey (1981) places Vigna in the seventh subtribe, the Phaseolinae Benth. Doyle et al. (2000) comment that the core Phaseolinae genera (including the Phaseolus-Vigna complex of taxa) share a 78 kb cpDNA inversion, and show similar patterns of chloroplast RFLP and rbcL data (Bruneau et al., 1990, 1995; Doyle and Doyle, 1993; Kajita et al., 2001), thus forming a natural, monophyletic group. Lackey (1981) provides a generic key to the Phaseolinae and provides an introduction to current concepts of the subtribe.

Lackey’s (1977, 1981) approach was essentially phenetic, while Baudet (1977), adopting a phylogenetic approach, proposed a radical reclassification of the Phaseoleae, originally suggested by Baudet and Maréchal (1976), using subtribes and superfamilies; the groupings are defined on the basis of major evolutionary trends, such as pollen aperture type, presence of hairs with hooked apices and less specific ecogeographical characters. Baudet split the traditional Phaseolinae genera into two superfamilies: Phaseolastrae centred on the Phaseolus-Vigna complex of genera and the Dolichastrae centred on Dolichos and its close allies. The two superfamilies were distinguished by the presence of a beard below the stigma in the Phaseolastrae and its absence in the Dolichastrae. Although the use of superfamilies has not been widely adopted, the existence of two distinct groups of genera with Phaseolinae is accepted and Vigna is an obvious member of the Phaseolastrae.

2.3 The genus Vigna
At first sight the genus Vigna seems relatively heterogeneous (Baudoin and Maréchal, 1988) and therefore it is not surprising that there have been
so many infrageneric and infraspecific classifications proposed. However, certain infrageneric groupings have persisted and these are recognized in the classification of Verdcourt (1970), modified by Maréchal et al. (1978), which is now generally regarded as the accepted classification for the *Phaseolus-Vigna* complex. However, the genus *Vigna* was originally published in 1824 by Savi, who named it after Domenico Vigna, professor of botany in Pisa (Baudoin and Maréchal, 1988). However, as noted by Pasquet (2002) the name *Vigna* is predated by *Cadelium* Medik. (1787) but Pasquet formally proposed the conservation of the name *Vigna* to avoid numerous, unnecessary name changes.

One of the major problems surrounding the taxonomy of *Vigna* has been the generic delimitation between it and closely related genera, particularly *Phaseolus* L. and *Dolichos* L. Several *Vigna* species, notably *V. unguiculata* and *V. vexillata*, were recognized as *Dolichos* by Linnaeus (1753). Savi (1824) split *Vigna* from the true *Phaseolus* using the following characters (detailed in Savi, 1826):

- Upper calyx tooth entire.
- Appendages on the standard that converge towards the apex.
- Presence of a disc nectary at the base of the ovary.
- Presence of a curved cylindrical pod.
- Seeds with a caruncle and hilum ventrally positioned.

He transferred several *Dolichos* species to *Vigna*, including *V. luteola* (Jacq).

**Figure 2.1.** Key to subtribes of Phaseoleae (Lackey, 1981).

1 Leaflets and calyx generally with yellowish gland-dots; bracteoles 0 (except *Adenodolichos*); style slender below, hardened and a little thickened distally, glabrous except *Adenodolichos*; inflorescences not nodose ...............................................................Cajaninae

Leaflets and calyx eglandular ...........................................................................................................2

2 Style complicated by expansion, flattening, coiling or specialized hairs, or if rarely both unbearded and terete then petals elaborate with appendages on standard and keel-petals adaxially joined; hila usually covered with spongy tissue ..........................................................Phaseolinae

Style generally terete and unbearded (sometimes a few hairs below the stigma), occasionally coiled in *Erythrininae*, sometimes bearded or flattened in *Clitoriinae* but then petals less complex; hila rarely (some *Erythrina*) covered with tissue ..................................................3

3 Flowers generally resupinate; calyx naked inside; style narrowed or expanded to naked, penicillate or bearded distal part; petals often hairy; leaflets 3, 1 or 5–9, with minute hooked hairs .....................................................................................................................Clitoriinae

Flowers not resupinate or if so differing in other respects ..............................................................4

4 Standard silky hairy outside, rather small, without appendages inside; seeds smooth, with a prominent aril; inflorescences not or only slightly nodose .................................Ophrestiinae

Standard glabrous or if hairy then inflorescence generally nodose or flowers much modified5

5 Bracteoles absent; seeds with a prominent horse-collar-like aril and thick endosperm–Australia, New Guinea .....................................................................................................................Kennediinae

Bracteoles generally present ............................................................................................................6

6 Flowers mostly adapted to birds or bats, the petals generally unequal in length, the fertile parts loosely housed or exerted, sometimes with small bee-type flowers but then either style coiled (*Apios*, *Cochlianthus*) or flowers in extensive panicles and pod samaroid (*Spatholobus*) ......... 

**Erythrininae**

Flowers mostly adapted to bees or if bird-flowers then petals subequal in length .......................7

Inflorescence generally nodose, occasionally paniculate or axillary and few-flowered; seeds diverse, with short to long hilum ....................................................................................Diocteinae

Inflorescence not or scarcely nodose (sometimes branches in *Pueraria*); seeds smooth, granular or shagreened, with short hilum ...........................................................................Glycininae
Figure 2.2. Key to genera of Phaseolinae (Lackey, 1981).

1. Plants native to America .................................................................................................................................................................................. 2
   Plants native to the Old World .................................................................................................................................................................................. 11

2. Uncinate hairs always present (≥25 magnification); style coiled 2±3 revolutions, with a lateral flattened stigma; bracts usually persistent to mid flower, or at least to anthesis; bracteoles, if present, equally or slightly less persistent ............................................................... Phaseolus
   Uncinate hairs absent; style erect, curved, or sigmoid, rarely coiled through 3±5 or more revolutions Vigna subgen. Cochlianthus with bracteoles never persisting past open flower, and usually falling earlier); bracts and bracteoles variously persistent ........................................ 3

3. Stipules peltate, or at least with a portion above the point of attachment and a generally smaller often bifid, portion below ............................................................................................................................... Vigna
   Stipules with only 1 lobe above point of attachment, although often reflexed on mature stems ........................................................................................................................................................................................................................................................................ 4

4. Style ± erect (perhaps slightly sigmoid in Strophostyles) ......................................................................................................................... 5
   Style coiled, or inrolled and becoming clearly sigmoid at maturity ............................................................................................................................... 8

5. Inflorescence subumbellate; bracts and bracteoles persistent past seed set; upper calyx-lobes completely united; seeds frequently pubescent ............................................................................................................................... Strophostyles
   Inflorescences elongate; bracts rarely remaining on open flowers, bracteoles rarely remaining at pod set; upper calyx-lobes separated by a distinct notch; seeds not pubescent ............................................................................... 6

6. Style constricted in the middle and with a distinct bulge above; flowers 22±25 mm; minute hairs on inside of the standard and wings ................................................................................................................................. Vigna
   Style rarely with even the suggestion of a construction, not bulged; flowers 6±15 mm; petals glabrous ........................................................................................................................................................................................................................................................................ 7

7. Hilum 50% or more of seed circumference - Central America and vicinity ....................................................................................................................... Oxyrynchus
   Hilum less than 50% of seed circumference - southern South America ............................................................................................................................. Dolichopsis

8. Style coiled 3±5 or more ........................................................................................................................................................................................................................................................................................................................................ 9
   Style inrolled, becoming sigmoid ............................................................................................................................................................................................................................................................................................................................................. 9

9. Style bent sharply to form a squarish hook calyx-teeth all distinct to the same depth on the tube; petals glabrous; leaflets sometimes lobed; keel with a transverse fold; wings longer than other petals; inflorescence-nodes slightly swollen at most; flowers (excluding wings) 3.5±16 mm ........................................................................................................................................................................................................................................................................................................................................ 10
   Style bent gradually; upper calyx-teeth partially or completely united; standard and wings often with minute hairs; leaflets never lobed; keel with a longitudinal fold (only rarely approaching transverse); wings not conspicuously larger than other petals; inflorescence-nodes usually conspicuously swollen; flowers (6±) 15±38 mm long ........................................................................................................................................................................................................................................................................................................................................ 10

10. Flowers often clustered into strobilus-like inflorescences; inflorescence-nodes not swollen; pedicels usually longer than the calyx at late flower or fruit stage ............................................................................................................................. Ramirezzella
    Flowers usually not in strobilus-like inflorescences; inflorescence-nodes swollen; pedicels short, even in late flower and fruit stages rarely exceeding the calyx length ............................................................................................................................. Vigna

11. Style flattened .......................................................................................................................................................................................................................................................................................................................... 12
    Style terete .......................................................................................................................................................................................................................................................................................................................... 16

12. Standard face with a single large appendage ............................................................................................................................................................................................ 13
    Standard face with 2 small appendages, or no appendages ............................................................................................................................................................................................ 14

13. Style without flattened margins, a line of hairs along the inner margin ............................................................................................ Lablab
    Style with a flattened blade along each margin, glabrous ................................................................................................................................. Alistilus

14. Stamen-filaments filiform; vexillary stamen lacking hooks; calyx naked inside ........................................................................ Sphenostylis
   Stamen-filaments dilated above; vexillary stamen with a hook at the base; calyx pubescent inside .......................................................................................................................................................................................................................................................................................................................... 15

15. Style expanded at tip .......................................................................................................................................................................................................................................................................................................................... 15
    Style not expanded at tip .......................................................................................................................................................................................................................................................................................................................... 15

16. Style with a flap behind the stigma ............................................................................................................................................................................................ 17
    Style with at most a short projection beyond the stigma .......................................................................................................................................................................................................................................................................................................................... 18

17. Basal corner of keel with erect spur ± 1 cm long (fig 4.7a); standard appendages absent; style coiled 1±1.25 turns .......................................................................................................................................................................................................................................................................................................................... Physostigma
   Basal corner of keel not spurred; standard appendages present; style curved 0.5 turn ........................................................................................................................................................................................................................................................................................................................................ 17
   Vatovaea
AFRICAN VIGNA

18 Tip of style expanded into a horizontal spoon-like cover, from which is suspended a spherical stigma upper wing spurs huge ± S. Africa ...................................................... Otoptera
Style not so expanded into a cover; upper wing spurs not particularly large ± worldwide...19
19 Standard appendages present ..................................................................................20
Standard appendages absent or in Psophocarpus or Decorsea small ..................24
20 Stigma lateral, oblique or rarely ± terminal.........................................................Vigna
Stigma terminal ........................................................................................................21
21 Standard appendage 1 large bilobed structure; style bent in (thickest at the bend), bent out
and then in again, tapering, hardened with 2-line beard on upper half .................. Dipogon
Standard appendages 2±4 separate ........................................................................22
22 Style bearded; alternate filaments expanded below the anthers ...................... Spathionema
Style glabrous or hairs only around the stigma; filaments uniform .......................23
23 Pollen not spinulose; standard appendages short flowers mostly red to blue ....... Dolichos
Pollen grains tuberculate or spinulose; standard appendages long and narrow flowers usually
yellow or orange ...........................................................................................................24
24 Style with an excentric bulging calleus at the base, whole style less than half as long as the
ovary; bracteoles absent ..............................................................................................Neorautanenia
Style without such a calleus..........................................................................................25
25 Style not bearded, but with a ring of branched hairs around the stigma............ Decorsea
Style bearded, without branched hairs. ......................................................................26
26 Style curved ±180, distinctly hardened, tapered but slightly thickened just below lateral
stigma, so apex rather like a snake's head, bearded on upper third, pods oblong to elliptic,
with thick valves; seeds 2±3 with a hilum 1/2±2/3 circumference ......................... Oxrhythynus
Style bearded only a little below the stigma; pods winged or more seeded; seeds with
a shorter hilum ..................................................................................................................27
27 Stipules not produced; lower calyx-lobes prominently upturned ...................... Dysolobium
Stipules produced; lower calyx-lobes not prominently upturned ....................... Psophocarpus

Bentham (=D. luteolus Jacq.), V. marina (Burman) Merrill (=D. luteus Sw.), and V.
unguiculata (L.) Walpers (=D. unguiculatus L.), V. unguiculata subsp. unguiculata
cv-gr. Biflora (=D. biflorus L. and D. catjang Burman fil.) and V. unguiculata
subsp. unguiculata cv-gr. Sesquipedalis (=Syn: D. sesquipedalis L.). As originally
conceived by Savi, Vigna contained a small number of species characterized
by a bent keel and the presence of a beard on the inner surface of the style just
below the stigma. Conversely, Phaseolus L. was a much larger genus containing
all species with spiral or curved styles (Baudoin and Maréchal, 1988). However,
opinions on the most appropriate rank varied. For example, both Richard (1847)
and Gagnepain (1916) grouped Vigna, Phaseolus and Dolichos species as
sections of a single broadly conceived genus, while Bentham (1865) attempted
to distinguish them on the basis of the extent of incurving of the beak of the keel,
placing all species with spiral keels in Phaseolus and all species with strongly
incurved beaks in Vigna. Using the dichotomy shown below, Wilczek (1954)
transferred two species, P. radiatus L. and P. campestris Mart., to Vigna, but
retained P. schimperi Taub. in Phaseolus.

“Stipule not prolonged below point of insertion; keel in spiral of 1–5 complete
turns, stigma elongated, internal, or sometimes very short and terminal or
subterminal; style without an apical appendage............................................ Phaseolus
Stipule prolonged below point of insertion, keel erect-incurved, rarely making
almost a complete spiral turn; style ending beyond the stigma in a more or
less distinct beak .............................................................................................................Vigna”
On the basis of its medifixed stipules and narrow, septate pods, following Wilczek’s work, Hepper (1956) transferred \textit{P. mungo} L. to \textit{Vigna} but retained \textit{P. calcaratus} Roxb. in \textit{Phaseolus} despite its medifixed stipules. Transfer of \textit{P. mungo} and \textit{P. radiatus} to \textit{Vigna} was supported by Tourneur (1958), who suggested that in \textit{Vigna} the first pair of leaves to emerge (after the cotyledons) are sessile, while they are petiolate in \textit{Phaseolus}. However, Verdcourt (1970) noted that this conclusion was based on a limited number of species, and as such its reliability was questionable.

In an attempt to resolve the problem of the boundaries between \textit{Phaseolus} and \textit{Vigna}, Verdcourt (1970) took a monographic approach and considered merging \textit{Vigna} with \textit{Phaseolus}, or subdividing one or both genera into smaller genera to remove the difficult groups. However, he considered the former unsatisfactory as the type species of the two genera are so different, clearly representing distinct natural groups, while the latter answer, on the other hand, would result in too many small new genera. Therefore, Verdcourt’s solution was to restrict \textit{Phaseolus} to \textit{P. vulgaris} and its close relatives and to transfer all other species to \textit{Vigna}. He considered the in-rolled keel insufficient to distinguish between the two genera, suggesting this character should only be considered in conjunction with the free part of the stamens and the basal part of the style. Other characters that he considered important for distinguishing \textit{Phaseolus} and \textit{Vigna} included the wide, open pollen reticulation observed in the majority of species of African \textit{Vigna}, as opposed to the sculptured walls found in members of \textit{Phaseolus}, and electrophoretic patterns of seed proteins that are quite different between the two genera. Fawcett and Rendle (1920) had earlier used pollen grain reticulation as a basis for transferring \textit{P. peduncularis} H.B.K. and \textit{P. antillanus} Urb. to \textit{Vigna}.

Thus, based on a combination of characters, including floral morphology, pollen grain sculpture and biochemical evidence, Verdcourt (1970) restricted \textit{Phaseolus} to those American species with a tightly coiled style (as originally suggested by Bentham, 1865) and whose pollen grains lacked wide reticulation. Yeh \textit{et al.} (1987) studied 37 agriculturally important members of the \textit{Phaseolus-Vigna} complex and, using such characters as primary leaf morphology (simple or three-foliolate), texture, shape, petiole length, stipule number and hypogeal or epigeal germination, produced a seedling key to the main taxa. Both \textit{Phaseolus} and \textit{Vigna} have either hypogeal or epigeal cotyledons and have two stipules but the other characters differ from each other and clearly divide seedlings plants into two genera.

The distinction of \textit{Phaseolus} and \textit{Vigna} meant that \textit{Phaseolus} taxa were isolated but \textit{Vigna} was composed of a series of taxon clusters of subgeneric and sectional rank containing about 150 \textit{Vigna} species, which are widely distributed in the tropics of both hemispheres. The link between the two genera was subgenus \textit{Sigmoidotropis}, a large and apparently primitive subgenus that probably evolved in the neotropics and includes most of the American \textit{Vigna} species (Baudoin and Maréchal, 1988). Subgenus \textit{Lasiospron} is also confined to the Neotropical regions and presents most of the \textit{Vigna} generic characters. All these characters are present in the subgenus \textit{Plectrotropis}, which seems to have
originated in the Old World. There appear to have been two distinct evolutionary paths: a differentiation towards a specialized floral morphology as seen in the homogeneous subgenus *Ceratotropis* taxa of Asia, and a relative simplification of the floral morphology which retains bilateral symmetry found in the species-rich subgenus *Vigna* of Africa. Relatively closely related to Verdcourt’s main African grouping, subgenus *Haydonia* seems to represent a recent evolutionary trend expressed by the loss of some typical *Vigna* characters with acquisition of others. The remaining subgenus *Macrorhynchus*, appears remote from the other *Vigna* supra-specific taxa but is retained in the genus for convenience (Baudoin and Maréchal, 1988), although Maréchal et al. (1978) suggest that more information may necessitate the raising of its status to genus. Verdcourt (1971) describes *Vigna* as:

“Climbing, prostrate or erect herbs or subshrubs, rarely small shrubs, mostly from woody or tuberous rootstocks. Leaves pinnately, more rarely subdigitately, 3-foliolate or 1-foliolate; stipules truncate, bilobed or spurred at the base or sometimes quite peltate; stipels ± persistent, rarely absent. Inflorescences axillary or terminal, falsely racemose or flowers in dense 1-many-flowered subumbellate clusters or fasciculate; rhachis usually thickened and glandular at the point of insertion of the pedicels; bracts and bracteoles ± deciduous. Calyx 5-lobed, 2-lipped; lower lip 3-lobed, the middle lobe usually the longest; upper lip of 2 lobes completely or partly united. Corolla small or medium-sized, yellow, blue or purple; standard with inﬁxed auricles and 2–4 appendages or sometimes a single structure on the internal face, less often without appendages; keel truncate, obtuse or conspicuously beaked, sometimes the beak incurred through up to 360° (in some species the keel is twisted and untidy-looking and in others there is a distinct conical pocket on the left-hand petal). Vexillary stamen free; 5 shorter filaments (including the vexillary one) sometimes (in subgen. *Haydonia*) with a pair of joined glands below each anther; anthers uniform. Ovary 3-many-ovuled; style with tenuous lower part obsolete to quite long, filiform or ﬂattened, upper part thickened and cartilaginous, straight or curved, upper portion barbate or hirsute on the internal face, sometimes produced beyond the stigma to form a short to long subulate or rarely ﬂattened or capitate beak; stigma completely lateral, oblique or rarely ± terminal. Pods linear or linear-oblong, cylindrical or ﬂattened, straight or ± curved, usually ± septic. Seeds mostly reniform or quadrat; hilum small or elongate; aril obsolete to well developed, usually eccentric, often 3-pronged.”

Verdcourt (1970) subdivided the genus into 8 subgenera and 9 sections as indicated in his key to the infrageneric taxa of *Vigna*, see Figure 2.3.

Subsequent to this, Verdcourt (1978) transferred the anomalous geocarpic genus *Voandzeia* to *Vigna* on the grounds that, apart from the one species with geocarpic habit, it was inseparable from *Vigna* using morphological characters. This, however, created a new dilemma, as *Voandzeia*, having been named by Du Petit-Thouars (1806) had priority over *Vigna*. Verdcourt, however, proposed that
the name *Vigna* be retained on the grounds that mass transfer of more than 100 species with a large volume in publications to a monospecific genus with limited literature would create unnecessary confusion (Verdcourt, 1978).

Following Verdcourt’s work, Maréchal *et al.* (1978, 1981) undertook a numerical analysis of the supergenus *Phaseolastrae*, a grouping within the *Phaseolinae* characterized by the presence of a beard of hairs on the inner surface of the stigma (Baudoin and Maréchal, 1988). This group included the *Vigna-Phaseolus* complex as well as several smaller related genera, namely *Alepidocalyx, Condylostylis, Dipogon, Dolichopsis, Dysolobium, Lablab, Macroptilium, Minkelersia, Oxyrhynchus, Physostigma, Ramirezella, Spathionema, Strophostyles, Vatovaea and Voandzeia*. The study was based on a mixture of live and herbarium material representing 177 taxa, for which they scored 161 morphological, cytological, floral and pollen characters. The conclusions of their study broadly supported Verdcourt’s classification and species groupings, although the names used for some groupings changed. They added several additional characters, including the presence of hooked hairs, the persistence of bracts and the absence of floral nectarines on the inflorescence rachis that could be used to distinguish the groupings. They also observed differences in the ultra-structure of the exine, which was columellar in *Phaseolus* and granular in *Vigna* (Maréchal *et al.*, 1978, 1981). The genus *Vigna* thus defined is characterized by the following features:

- Stipules produced below the point of insertion.
- Internodes of the inflorescence rachis contracted.
- Style prolonged beyond the stigma.
- Triporate pollen.
- Large, reticulation of the pollen exine with granular infratectum.

These characters are all expressed in the more advanced and specialized groups, such as the subgenus *Ceratotropis* (Baudoin and Maréchal, 1988). *Alepidocalyx* and *Minkelersia* were defined as sections in *Phaseolus*, while *Leptosprion* was transferred to *Vigna*. *Dolichovigna* was removed from *Vigna* and placed as a subgenus in *Dysolobium*. The remaining groups were left as satellite genera around the *Vigna-Phaseolus* complex. Following extensive study, Pasquet (2001) concludes that the genus currently includes approximately 80 species which are found throughout the tropics. However he notes that recent cpDNA studies suggest that the New World species (mostly representatives of subgenus *Plectotropis* and *Lasiosprion*) and possibly *V. macrorhyncha* should be removed from *Vigna*, leaving between 50 and 60 true *Vigna*, but these suggestions have yet to gain sufficient support to warrant the changes.
2.4 Infrageneric classification of *Vigna*

One of the unfortunate problems with infrageneric taxonomy of *Vigna* is that the majority of authors have produced a classification based on too narrow a species sample, which has resulted in much confusion and unnecessary synonymy. The generally accepted classification of Verdcourt (1970) based on a worldwide and species-comprehensive study has supplied necessary stability. As modified by Maréchal *et al.* (1978), it contains 82 species distributed among 7 subgenera:

**Subgenus *Vigna***: This is by far the most species-rich subgenus, with a total of 39 species, most of which are endemic to Africa. This group is characterized by a bilateral floral morphology with a keel curved through no more than 180°. Flower colour ranges from yellow to violet, lilac or purple. Both *V. unguiculata* and *V. subterranea* are classified under this subgenus (Baudoin and Maréchal, 1988). Subgenus *Vigna* is found throughout sub-Saharan Africa, with representatives present in tropical Asia and the Americas.

**Subgenus *Haydonia* (Wilczek) Verdc.**: This group is thought to be the result of a recent evolutionary trend arising directly from subgenus *Vigna*. It is characterized by loss of typical *Vigna* characters, including the coarse exine reticulation, prolongation of stipules beyond the point of attachment and prolongation of the style beyond the stigma, and acquisition of new ones, i.e. presence of glands below the anthers of the inner circle of stamens, reduced seed size, and strongly ribbed stems (Maréchal *et al.*, 1978; Maréchal, 1982). The extent of loss of typical *Vigna* characters and acquisition of new ones varies among species. Subgenus *Haydonia* is endemic to Africa and Madagascar (Baudoin and Maréchal, 1988).

**Subgenus *Plectotropis* (Schum.) Bak.**: This subgenus is believed to form the link between African and Asian species of *Vigna* (Maréchal *et al.*, 1978; Maréchal, 1982; Baudoin and Maréchal, 1988). In addition to the typical *Vigna* characters, this subgenus is characterized by asymmetric flowers with a keel curved to the left and a unilateral pocket facing the tip of the style. Apart from *V. vexillata*, which is pantropical, all species in this group are African (Baudoin and Maréchal, 1988).

**Subgenus *Ceratotropis* (Piper) Verdc.**: This is a homogeneous group of species of Asian origin recently studies by Tomooka *et al.* (2002b). Floral morphology is similar to that of members of subgenus *Plectotropis*, but the two can be distinguished on flower colour, which is always yellow in *Ceratotropis* while violet, blue and lilac are the predominant colours in *Plectotropis*. This subgenus is strictly of Asian origin. *V. radiata* var. *sublobata* has, however, been recorded in Tigray and Gondar, Ethiopia, where it grows wild (Edwards, 1991), and Madagascar (Du Puy and Labat, 2002).
Key to infrageneric taxa of *Vigna* Savi and *Phaseolus* L. (Amended from Verdcourt, 1970).

1. Vexillar stamen and 4 other short stamens with a pair of fused glands below the anthers; leaves unifoliolate or trifoliolate; division of style into tenuous and thickened portions obscure, upper part densely barbate; stigma obliquely subterminal; pollen-grains without evident sculpture ................................................................. *Vigna* subgen. *Haydonia* (Wilczek) Verdc.
   Vexillar stamen and others without glands below the anthers .................................................. 2

2. Leaves digitation-trifoliolate or rarely unifoliolate; the rhachis suppressed; leaflets narrowly linear-elliptic or linear, 3-nerved from the base; keel with a very minute barely noticeable pocket-style thickened and expanded into a circular membrane at the apex; indumentum mostly ferruginous; standard without appendages; pollen-grains widely reticulate .................. *Vigna* longissima Hutch.
   Leaves not digitate-trifoliolate ...................................................................................................... 3

3. Keel bearing a distinct upwardly directed pocket on left side; pollen-grains with a wide open reticulation (*Vigna*) .................................................................................................................. 4
   Keel not bearing a distinct pocket on left side (there may be small pockets present on both sides near the claw, or a larger downwardly directed pocket, e.g. in *V. lanceolata*); pollen-grains smooth or reticulate .................................................................................................................. 7

4. Stipules distinctly peltate or at least very conspicuously spurred; style with thickened part very strongly curved, prominently and slenderly beaked beyond the stigma................................. *Vigna* subgen. *Ceratotropis* (Piper) Verdc.
   Stipules not distinctly peltate but shortly appressed or distinctly to slightly bilobed at the base; style with short lobe-like appendage and appearing subcapitate or if the lobe is folded then very shortly beaked .................................................................................................................. 5

5. Plant flowering when leaves are fully developed; the flowering shoots mostly erect .......................................................................................................................... *Vigna* subgen. *Plectrotropis* (Schumach.) Bak. sect. *Pseudoliebrechtsia* Verdc.
   Plant flowering when leaves are scarcely developed; the flowering shoots mostly erect .................. *Vigna* subgen. *Plectrotropis* (Schumach.) Bak. sect. *Plectrotropis*

   Keel-pocket small; stems without ferruginous hairs ...... *Vigna* kirkii (*Vigna* subgen. *Vigna*)

7. Style with thickened part, together with the keel, twisted through more than 360° (rarely much reduced and not twined); stipules not produced below the point of insertion; pollen-grains with no obvious sculpture or with a very fine reticulation; standard typically with a transverse groove at the top of the claw and no appendages but in some species 2 appendages are present .............................................................................................................................. *Phaseolus* L.
   Style with thickened part twisted through no more than 360°, usually up to 180°, but the keel itself and thread like part of the style are sometimes twisted through several 100°................................. 8

8. Keel much elongated, the lip coiled through 5±7 turns but actual thickened part of the style twisted through only 180±360°; pollen-grains coarsely reticulate ................................................................. *Vigna* subgen. *Cochliasanthus* (Trew) Verdc.
   Keel never coiled through more than 3 turns, usually through less than one .............................. 9

9. Thickened part of style scarcely curved, obliquely hoof-shaped at the apex, the stigma obliquely terminal; a conspicuous tuft of hairs about ±0.5 mm from the tip of the style; standard without appendages; wings very characteristic in shape, transversely oblong, long clawed with a tooth at both proximal corners; pollen-grains coarsely reticulate ......................... *Vigna* subgen. *Dolichovigna* (Hayata) Verdc.
   Thickened part of style not hoof-shaped or, if so, then wings differently shaped and standard with X-shaped callus within; thickened part of style mostly longitudinally densely bearded but without a discrete tuft ................................................................. 10

10. Thickened part of style hoof-shaped at the apex; stipules not produced; keel with narrow produced beak curved back through 180°; standard with X-shaped callus; pollen-grains smooth or coarsely reticulate ................................................................. *Vigna* subgen. *Macrorhynchus* Verdc.
   Thickened part of style not hoof-shaped at the apex and without other characters combined
11. Stipules very distinctly produced at the base or peltate, the spur elliptic, entire, often acute, mostly narrower than the upper part of the stipule; pollen-grains coarsely reticulate..............................


Stipules not so distinctly produced at the base but often shortly produced or subcordate or bilobed .................................................................12

12. Style very prominently produced beyond the lateral stigma ........................................13

Style not so prominently beaked, never with a tongue-like appendage .........................14

13. Beak stiffly conical; bearding hairs pale and soft; flowers mostly appearing before the leaves; pollen-grains coarsely reticulate ......Vigna subgen. Vigna sect. Liebrechtsia (De Wild.) Bak. f.

Beak tongue-like, narrowly linear-oblong, soft and flattened; bearding hairs blackish and bristly; flowers and leaves always contemporary; pollen-grains smooth ........................................

14. Style beak characteristic, cylindrical, enlarged at the apex; leaflets linear-oblong with numerous lateral nerves at right angles to the mid-rib; pollen-grains coarsely reticulate ........

Style beak not cylindrical .................................................................15

15. Tertiary venation of leaflets characteristically closely transversely parallel or subparallel; style with venose projection beyond the stigma; pollen-grains widely..........................

Tertiary venation more open and not so obviously transverse and parallel ..............................16

16. Pollen-grains smooth; erect, prostrate or twining herbs; stipules not or scarcely bilobed; keel beaked, slightly curved; thick part of style slightly curved, scarcely beaked but stigma lateral Vigna subgen. Haydonia (Wilczek) Verdc.

Pollen-grains widely reticulate (or rarely in V. schimperi with reticulation degraded and represented by rounded raised areas); plants mostly true climbers or prostrate, rarely truly erect .............................................................17

17. Keel loosely curved and misted to resemble the letter S but never forming a complete circle; thickened part of the style curved through 180°, very similar to the top of the letter S, not beaked beyond the lateral or subterminal stigma; stipules not produced; standard typically with a single square indentation pointing inwards; tropical America ........................................
.............................................................................................................................................Vigna subgen. Sigmoidotropis (Piper) Verdc.

Keel curved through up to 180° or scarcely recurved at all but not resembling the letter S; thickened part ± straight or curved; stipules mostly bilobed or distinctly produced, more rarely without any production, below point of attachment; standard mostly with 2±4 appendages inside.................................................................18

18. Stipules rather distinctly produced; tenuous part of style long and thread-like; thick part of style curved through 180°±270°, not beaked, the stigma more or less terminal or with a small apical recurved flap and stigma more or less lateral; standard deeply bilobed at apex or at least deeply emarginate with no or 2 faint to definite appendages; tropical American species, two of which are naturalized in W. and Central Africa.................................................................
.............................................................................................................................................Vigna subgen. Vigna sect. Lasiospron (Benth.) Verdc.

Without these characters combined; stipules slightly produced, bilobed at base or more rarely not produced; tenuous part of style often shorter and ribbon-like; thick part of style straight or curved, mostly slightly beaked beyond the lateral stigma; standard often emarginated but not so deeply bilobed, mostly with 2±4 appendages inside.........................................................19

19. Pods long, very narrowly cylindrical, up to 25-seeded; seeds small, mostly with small central hilum; leaflets often 3-lobed, finely characteristically silky pilose when young; stipules bilobed; keel beak canoe-shaped, not markedly incurved; style with thickened part almost straight, scarcely beaked ...........................................Vigna subgen. Vigna sect. Macrodonatæ Harms

Pods mostly shorter and fewer-seeded; seeds sometimes arillate; stipules mostly bilobed; keel usually curved through 180°; style with thickened part slightly curved, not or shortly beaked...
.............................................................................................................................................Vigna subgen. Vigna sect. Vigna
Subgenus *Lasiospron* (Bentham emend. Piper) Maréchal, Mascherpa and Stainier: This group is of Neotropical origin and forms a link between Old World and New World *Vigna*. Members of this subgenus show most of the typical *Vigna* characters, i.e. stipules produced beyond the point of insertion, a contracted inflorescence, short pedicels, triporate pollen with wide, open reticulation and a beaked style (Maréchal *et al*., 1978). However, both *V. juruana* and *V. longifolia* lack stylar extensions and their infratectum is intermediate. In *V. juruana*, on the other hand, the infratectum is granular, as is typical of *Vigna*, but the style is coiled a complete turn (Baudoin and Maréchal, 1988).

Subgenus *Sigmoidotropis* (Piper) Verdc.: Subgenus *Sigmoidotropis* is of Neotropical origin and is considered primitive, as members have accumulated, to varying extents, only a few typical *Vigna* characters. In this subgenus, the stipules are never produced (Baudoin and Maréchal, 1988), although in sections *Condylostylis* and *Peduncularis* styles are extended beyond the stigma. The style varies from simple curved in sections *Condylostylis*, *Sigmoidotropis* and *Peduncularis* to tightly coiled in section *Leptospron*, and loosely spiral through 2–5 turns in *Caracallae*. In members of sections *Caracallae* and *Sigmoidotropis*, the infratectum consists of granules, which are neatly arranged into columellar (Baudoin and Maréchal, 1988). This is intermediate between the granular structure that is typical of *Vigna* and the columellar structure that is found among members of *Phaseolus*.

Subgenus *Macrorhyncha* Verdc.: This subgenus is more distantly related to *Vigna*, but it was retained in this genus for convenience (Maréchal, 1982; Baudoin and Maréchal, 1988). Maréchal *et al*.’s (1978) classification of *Vigna* is summarized in Figure 2.4 and, with minor amendments, is the most widely used contemporary classification of the genus.

Although generally accepted as a good scheme, Maréchal *et al*.’s (1978) classification has been criticized on two grounds. First, it encompasses too wide a range of morphological variation and, second, too many genepools representing both ancient and more recent lineages are included within its confines. Modifications that have been proposed include raising subgenus *Ceratotropis* to generic rank (Smartt, 1980, 1981, 1985). Maréchal (1982), however, argues for a global conceptualization of the genus on the grounds of continuity of the group, as well as close phylogenetic affinities linking members. The need for additional work in this area, especially as regards delimitation of species boundaries, is accepted by Baudoin and Maréchal (1991). Smartt (1990), on the other hand, maintains that palynological evidence has been given much more significance than is warranted in the Leguminosae.
Table 2.1. Summary of *Vigna* classification.

<table>
<thead>
<tr>
<th>Subgenus</th>
<th>Section</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comosae</td>
<td></td>
<td>V. comosa*, V. haumaniana*</td>
</tr>
<tr>
<td>Macrodonatae</td>
<td></td>
<td>V. membranacea*, V. fiesiorum*, V. somaliensis*#</td>
</tr>
<tr>
<td>Reticulatae</td>
<td></td>
<td>V. reticulata*, V. radicans*, V. dolomitica*, V. pygmaea*, V. phoenix*, V. platyloba*</td>
</tr>
<tr>
<td>Liebrechtsia</td>
<td></td>
<td>V. antunessii*, V. frutescens*, V. bosseri*#</td>
</tr>
<tr>
<td>Catiang</td>
<td></td>
<td>V. unguiculata*, V. schlechteri*, V. keraudrenii*#, V. monantha*#</td>
</tr>
<tr>
<td>Haydonia</td>
<td>Haydonia</td>
<td>V. monophylla*, V. triphylla*, V. juncea*, V. nyangensis*#</td>
</tr>
<tr>
<td>Microspermae</td>
<td></td>
<td>V. microsperma*, V. richardsiae*, V. schimperi*, V. mudenia*#, V. kokii*#</td>
</tr>
<tr>
<td>Glossostylus</td>
<td></td>
<td>V. nigritia*, V. venulosa*</td>
</tr>
<tr>
<td>Plectotropis</td>
<td>Plectotropis</td>
<td>V. vexillata*, V. kirkii*</td>
</tr>
<tr>
<td>Pseudoliebrechtsia</td>
<td></td>
<td>V. nuda*, V. longissima*</td>
</tr>
<tr>
<td>Ceratotropis</td>
<td>Ceratotropis</td>
<td>V. grandiflora, V. mungo, V. radiata I, V. trifolata, V. subramaniana</td>
</tr>
<tr>
<td>–</td>
<td>Aconitifoliae</td>
<td>V. aconitifolia, V. aridicola #, V. khandalensis #, V. stipulacea, V. trifolata</td>
</tr>
<tr>
<td>–</td>
<td>Angulares</td>
<td>V. angularis, V. dalzelliana, V. exilis #, V. hirtella, V. minima, V. nakashimae, V. nepalensis #, V. reflexopilosa, V. riukiensis, V. tenuicaulis #, V. trinervia, V. umbellata</td>
</tr>
<tr>
<td>Lasiospron</td>
<td>Lasiospron</td>
<td>V. lasiocarpa, V. longifolia, V. trichocarpa, V. juruana I, V. gentry</td>
</tr>
<tr>
<td>Sigmoidotropis</td>
<td>Sigmoidotropis</td>
<td>V. speciosa, V. appendiculata, V. candida, V. halophila, V. elegans, V. antillana, V. latidenticulata, V. megatyta</td>
</tr>
<tr>
<td>Pedunculares</td>
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<td>V. spectabilis, V. peduncularis, V. subhastata, V. firmula</td>
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<td>Caracallae</td>
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<td>V. caracalla, V. hookeri, V. linearis, V. vignoides</td>
</tr>
<tr>
<td>Condylostylis</td>
<td></td>
<td>V. venusta</td>
</tr>
<tr>
<td>Leptospron</td>
<td></td>
<td>V. adenantha I</td>
</tr>
<tr>
<td>Macrorhyncha</td>
<td></td>
<td>V. macrorhyncha*, V. grahamiana, V. praecox*, V. virescens*#</td>
</tr>
</tbody>
</table>

* = native African species, I = introduced African species, # = species not known to Maréchal et al. (1978).
The classification used in this study is an amended version of that proposed by Maréchal et al. (1978), which includes subsequently described taxa, and incorporates Pasquet’s (2001) conception of *V. unguiculata* and Tomooka et al.’s (2002b) conception of subgenus *Ceratotropis*. Table 2.1 lists all accepted *Vigna* species with their subgeneric and sectional position, while Appendix I presents a classification of *Vigna* taxa with their publication details. The selection of the most adequate target taxon classification and a good taxonomic understanding of the target group are essential prior to undertaking an ecogeographic study (IBPGR, 1985; Maxted et al., 1995). The classification detailed in Appendix I lists the taxa currently considered members of *Vigna* and so delimits the taxonomic scope of the study. Although this study is primarily concerned with conservation and is not taxonomic in nature, morphological descriptions and keys to African *Vigna* species are provided in Appendices II and III respectively. There is also an interactive key to African *Vigna* taxa contained on the accompanying CD to this text. It is tempting to provide a summary of the common synonyms associated with the accepted African *Vigna* taxon names but, as this work is not primarily taxonomic in nature and the classification of *Vigna*, particularly for the West African taxa, remains unresolved, those requiring this information are referred to the primary taxonomic sources used in preparation of this text, Pasquet (2001) and Verdcourt (1971).

Within *Vigna* there have recently been many research projects focused on investigating patterns of genetic variation, for example, Spinosa et al. (1998) assessed genetic variation in *Vigna vexillata* A. Rich. using isozyme and RAPD analyses, Xu et al. (2000) studied the *Vigna angularis* complex using RAPD analysis and drew conclusions about the complexes in situ conservation and

Figure 2.4. Summary of *Vigna* classification (Maréchal et al., 1978).
possible domestication, Negri et al. (2000) characterized 13 cowpea landraces from Umbria (Italy) as a means of developing a strategy for the conservation and promotion of landrace material, Tosti and Negri (2002) looked at the relative effectiveness of different marker systems for characterizing *Vigna unguiculata* subsp. *unguiculata* landraces, Massawe et al. (2002a) studied Bambara groundnut landraces using AFLP markers as an aid to breeding, and Nkongolo (2003) undertook RAPD analysis of Malawian cowpea landraces to assess diversity and gene flow among accessions, and found very high levels of intra-accession variability possibly resulting from uncontrolled gene flow between accessions. These intra-specific studies have been focused largely on specific crop species and so would be useful when planning conservation activities for that taxon, but have little broader usage.

However, Jaaska (1999), using isoenzymes, undertook an investigation of 23 African and 3 Asian *Vigna* species. Cladistic and phenetic analysis of the allozyme data identified for the African *Vigna* five major monophyletic groups. The subgenus *Haydonia* species are directly linked to the Asian outgroup species of the subgenus *Ceratotropis* and appear basally paraphyletic to other African species which form two clades each with two subclades. One major clade comprises species of subgenus *Vigna* section *Vigna*, with blue- and yellow-flowered species forming two separate subclades. The second major clade comprises species of the sections *Reticulatae* and *Plectrotropis* in one subclade, with the subgenus *Catiang* species, including *V. unguiculata*, most basal. The other subclade includes species of sections *Macrodontae* and *Liebrechtsia* of subgenus *Vigna*, together with *V. kirkii* of the subgenus *Plectrotropis* as basally sister to them. The phylogeny is largely congruent with current delimitation of species into sections and subgenera on the basis of morphology, but there are some important exceptions regarding the position of *V. unguiculata*, *V. angivensis*, *V. kirkii* and *V. frutescens*. A molecular phylogeny study by Goel et al. (2002) using internal transcribed spacer (ITS) sequences looked at diversity patterns in 29 *Vigna* species representing five subgenera. The ITS phylogeny is generally congruent with existing classification, except that the Asian subgenus *Plectrotropis* appeared closely related to subgenus *Vigna* rather than forming the bridge between the African subgenera and the Asiatic subgenus *Ceratotropis*. The ITS sequences were also useful in suggesting wild progenitors for *V. mungo*, *V. radiata*, *V. umbellata*, and *V. unguiculata*.

### 2.5 Morphology of *Vigna* taxa

Throughout the taxonomic history of *Vigna*, certain characters have repeatedly been used to define and distinguish subgeneric, specific and supra-specific groupings. The following synopsis of African *Vigna* taxon morphology that highlights these characters draws on discussion provided in Verdcourt (1970, 1971), Maréchal et al. (1978, 1981), Pienaar (1992) and Pasquet (2001), along with personal observation of herbarium specimens and field observation.

**Root.** The root system is most commonly either shallow adventitious or swollen taproots becoming woody with age, but perpendicular, dauciform, fusiform,
turbinate or bearing fusiform-moniliform tubers are also seen, and spindle-shaped, moniliform root tubers are diagnostic of \textit{V. vexillata} var. \textit{lobatifolia} (Baker) Pasquet. They always bear nodules, particularly when immature.

**Stem.** Stems are climbing, prostrate or erect, normally cylindrical to ridged or grooved, with winged stems diagnostic for subgenus \textit{Haydonia}. They may be thick and almost woody to thin, soft or wiry. Stem hairs are broad-based, with ferruginous hairs, whether aculeate or patent, typical of \textit{V. vexillata}, and a combination of bristle-like, ferruginous and colourless hairs indicates \textit{V. pygmaea}. Totally glabrous stems are rare, only occurring occasionally in \textit{V. unguiculata} subsp. \textit{dekindtiana} var. \textit{dekindtiana} or \textit{V. unguiculata} subsp. \textit{tenuis}, when they often are red at the base. The concentration of hairs varies within species and even on single specimens. Some species stems never twine but remain prostrate or scramble only (e.g. \textit{V. unguiculata} subsp. \textit{protracta}) or remain erect as in \textit{V. friesiorum} var. \textit{friesiorum}, \textit{V. pygmaea} and \textit{V. monophylla} (all three taxa are reported to be pyrophytic—Pienaar, 1992).

**Leaves.** Leaves are pinnate, more rarely subdigitately, and most commonly trifoliate with a few unifoliolate species \textit{V. tisserantiana}, \textit{V. venulosa}, \textit{V. vexillata} var. \textit{lobatifolia} and \textit{V. monophylla}, while \textit{V. angivensis}, \textit{V. reticulata} \textit{V. davyi} have unifoliolate, bifoliolate and trifoliolate leaves on the same stem – a character Maréchal \textit{et al.} (1978) believe is associated with granite rocks. Leaves are always petiolate, stipulate. Leaflet shape is variable but can be taken to indicate broad infra-generic grouping. In almost all cases the lower two leaflets of the leaf are asymmetrical, whatever the general shape of the leaflets. There are three predominant leaflet shapes, ovate, rhomboid and ovate-lobulate. The ovate and related shapes, i.e. narrowly or broadly ovate with apices acute, obtuse or emarginate and bases cuneate or obtuse, to circular or lanceolate, are the most common in subgenus \textit{Vigna}, e.g. \textit{V. luteola}, \textit{V. marina}, \textit{V. oblongifolia}, \textit{V. comosa}, \textit{V. friesiorum} var. \textit{friesiorum}, \textit{V. unguiculata} subsp. \textit{tenuis} and subsp. \textit{stenophylla}, \textit{V. nervosa}, \textit{V. mudenia}, \textit{V. vexillata}, \textit{V. pygmaea} and \textit{V. monophylla} (which is unifoliolate). Species may have rhomboid and ovate leaflets as in \textit{V. unguiculata} subsp. \textit{dekindtiana} var. \textit{dekindtiana} and \textit{V. davyi}. Lobed leaflets are most common in \textit{V. unguiculata} taxa, \textit{V. frutescens} subsp. \textit{frutescens} var. \textit{frutescens} and \textit{V. vexillata} var. \textit{lobatifolia}. However, leaflet shape is seldom consistent per species, more often variable. Leaflets more or less appressed, strigose, trinerved from the base with lateral nerves variously reticulated, subparallel in section \textit{Reticulatae}, often with herbaceous or papyaceous to coriaceous and brittle lamina. Petioles are glabrescent to variously pubescent, petiololes patently pubescent to setose.

**Stipule.** Stipules are important diagnostic characters for \textit{Vigna}, varying from ovate to lanceolate or almost linear to filiform, apex obtuse to acuminate, elongated at the point of attachment, often cordate, lateral elongations form auricles or are elongated into a spur. The cordate stipules in \textit{Vigna} are generally small, widest at the base and variously produced upwards to an acute, acuminate or obtuse apex in subgenus \textit{Vigna} (particularly in sections \textit{Vigna}, \textit{Macrodontae} and \textit{Liebrechtsia}) and to a lesser extent in subgenus \textit{Plectrotropis} and \textit{Haydonia}. 
In subgenus *Vigna* section *Comosae* the stipule are scarcely prolonged, but the base is attached to the stem by a distinctive pad-like structure. Otherwise, the stipules are commonly filiform and uni-nerved. Stipules in the subgenus *Vigna* section *Catjang* have accentuated spurs which vary in shape from short, broad spurs, straight or oblique and often split, to slender, narrow ones, the point of attachment not always being noticeably constricted. Degree of hairiness and their position on the stipules varies, from abundant to few, over the whole surface, restricted to nerves or glabrous in *V. unguiculata* subsp. *protracta*. Stipule margins are coarsely ciliate in *V. unguiculata* subsp. *protracta* and at the extremities only in most other species. Stipels are commonly persistent.

**Inflorescence.** All *Vigna* inflorescences (except *V. schlechteri* which is uniflorate) are terminal or axillary racemes with long peduncles carrying the flowers and legumes above the level of the leaves. Some species, e.g. *V. luteola*, *V. marina*, *V. oblongifolia* and *V. unguiculata* subsp. *protracta* have 7–15(–20), flowers placed at the thicker apex of the peduncle. The majority of species have more or less contracted racemes with only two or three flowers of which all buds may not mature. Extra-floral nectaries represent abortive flower buds replaced by glands containing vertical rows of orifices that are always present in inflorescence rachis, between two pedicels or alternatively. The positioning of the extra-floral nectaries is characteristic of the species and they are persistent. They are noticeably alternate in the long-rachis, multiflowered racemes but appear to occur between flowers on contracted inflorescences.

**Bracteoles.** Bracts and bracteoles are very variable in size with a range from minute to 1 cm. Both bracts and bracteoles tend to be the same shape and are often ovate to linear lanceolate with similar nervation. Both are commonly deciduous.

**Flower.** The papilionate floral structure provides a number of diagnostic characters. Flower colour shades from white flushed with mauve to cream flushed with green or yellow; or shading from blue, lilac, mauve, purple or magenta or even apricot. The colour and size of the flower divides the species into two groups; first, the relatively smaller yellow to greenish flowered species (e.g. *V. luteola*, *V. oblongifolia*, *V. comosa* and *V. mudenia*), while all remaining species have relatively large flowers, excluding *V. schlechteri*, ranging from pink, magenta, mauve to purple and blue. There is usually a relatively bright tint of the dominant colour of the flower, with one or two contrasting spots or nectar guides at the base. The outer surface, which shows once the flower has closed, may be greenish or fawn-yellow.

The pedicels are short, never exceeding the length of the calyx, bracts and bracteoles are usually caducous, linear, unnerved, apex obtuse, base truncate or obtuse, appearing spurred, ciliate.

The calyx is campanulate, with five free lobes varying from triangular to acuminate and subulate, shorter than or equal to or longer than tube, upper pair variously connate, lower lobe longer than others, rugose to strigose or setose. Excessively long calyx lobes are typical of *V. davyi*, *V. vexillata* var. *dolicohonema* and *V. unguiculata* subsp. *pawekiae*. *V. unguiculata* subsp. *dekindtiana* is
recognized by the horizontally, rugose calyx tube at maturity, the length of the lobes varying from shorter than to the same length as the tube.

The standard is initially erect, reflexed, often closing over inner floral parts after a few hours (after tripping), causing confusion in flower colour due to buff to yellow external colouring. Standard shape varies from reniform to oblate, usually with an emarginate apex. The standard varies in size depending on the species, sometimes repand, the spur may be curved or straight and is sometimes alate. Species are often characterized by callosities on the inner face of the standard petal. These often consist of two symmetrical calluses formed by fleshy folds of the upper limb or by the median vein, occasionally a second upper pair may occur in the centre of the standard, varying from a vestigial, thick ridge to relatively broad, flat appendages, either lying parallel to each other or divergent to the base or to the apex. Nerves radiating from spur are sometimes markedly darker in colour.

Wing petals are narrowly oval to ovate, apex obtuse, spur varying from long and narrow to alate, auricle varying from a scarcely rounded bulge in *V. unguiculata* to a narrow appendage, surface smooth to papillate in *V. luteola* to a rugose, falcate spurs with folds in the tissue in *V. vexillata*. The outer wing wraps round the keel, inner wing shorter, assisting pump action at pollination, the auricles may be attached to the lower callosites of the standard and by lateral depressions to the keel. Wings are usually paler than standard.

Keel shape is characteristic and it is always a paler, colour than the other petals. The keel may be straight, curved or twisted up to 180° with erect conical pocket on left side, which causes a deflection of the rostrum, the apex obtuse or acute, straight or upturned, free only at base and at apex where pistil extrudes at pollination, usually palest part of corolla. This character is always associated with a bonnet-shaped style elongation in subgenus *Plectrotropis* (e.g. *V. vexillata*). The result is an irregular flower whereas other subgenera have bilaterally regular flowers. The rostrum in the remaining species varies from obtuse to slightly incurved. All upper pairs of lobes are adnate to varying degrees. Pubescence is variable.

Androecium diadelphous with nine filaments forming an open tube, the vexillary, anterior filament is free, usually incassate and geniculate, while the remaining nine free filaments are of two alternate lengths, alate, sometimes markedly broader immediately below anthers wrapped around pistil before pollination so that pollen lies in close proximity to the ripe stigma, which is shielded by style brush; anthers oblong to oblate with or without basal glands. In subgenus *Haydonia* the shorter stamen filaments have a pair of joined glands below each anther which is regarded as another advanced feature. All anthers are uniform.

The gynoecium is superior, pubescent, and unilocular with marginal ovules. The style is initially tenuous, variously thickened or broadened and compressed, curving upwards only or twisted up to 180°; barbate on adaxial face (i.e. style brush), twisted to the right from below stigma at maturity, variously extended beyond stigma into shapes and lengths typical of species. Style prolongation
past the lateral stigma is the most important diagnostic character for *Vigna*. Three main morphological categories are distinguished: (a) Style prolongations referred to as beaks with either, thin, obtuse and even nerved flaps of tissue, as in *V. pygmaea*, or thick obtuse tissue, tongue-shaped, as in *V. luteola* and *V. marina*, or accentuated thick, subulate and spathulate as in *V. oblongifolia* and *V. frutescens* subsp. *frutescens* var. *frutescens*. (b) Style prolongation with rugose flap bent over the lateral stigmatic papillae to form a bonnet, as in subgenus *Plectrotropis* (e.g. *V. vexillata*). (c) Style protuberance developing from the style tissue to form various shapes, either as a horizontal or oblique protuberance produced opposite to the stigmatic papillae thereby causing the whole to appear hammer-shaped, as in *V. unguiculata* subsp. *stenophylla*, or an erect or oblique thimble at the apex of the style, as in *V. mudenia*. In subgenus *Haydonia*, regarded as an evolutionary advanced group (Maréchal *et al*., 1978), the stilar beak has been lost leaving a horizontal, obliquely terminal stigma, as in *V. monophylla*. The stigma is lateral or oblique to almost terminal, usually globular when ripe, fringed basally by short hairs protecting stigma from selfing, or receptive papillae within bonnet of the style.

**Legume.** The pods are linear to linear-oblong, terete, rectangular, cylindrical or flattened (in *V. macrorhyncha*), straight or slightly curved. Pods are geocarpic in *V. subterranea*. Seeds are commonly separated by internal septa of spongy tissue.

**Seed.** Seeds are mostly reniform or quadrate with the thickness slightly less than the width. The testa is usually cream coloured, possibly with grey mottling or black, smooth or pitted reticulate. The hilum is small or slightly elongate. The aril may either be obsolete to well developed, usually eccentric to almost central, and is often covered by soft, spongy, white tissue and is often three pronged. Unfortunately seed characteristics have not been recorded for many species.

**Pollen.** The genus *Vigna* has particularly large triporate pollen grains. Sometimes coarse granules cover the pores, as in *V. frutescens* subsp. *frutescens* var. *frutescens*. The exine sculpturing of the pollen grains in *Vigna* consists generally of definite wide reticulations with relatively high muri, especially noted in *V. unguiculata*, lower, flattened and rounded in *V. luteola*, *V. marina* and *V. mudenia*, and in *V. juncea*, *V. macrorhyncha*, *V. schimperi* and *V. monophylla* the muri have virtually completely disappeared, the completion of an evolutionary trend towards psilate grains (Maréchal *et al*., 1978).

**Chromosomes.** Most species have a diploid number of $2n=22$, with a few $2n=20$ species.

There are a few characters that are commonly used to distinguish the major subgeneric groupings within *Vigna* and these have been used consistently. These major diagnostic characters are: rootstock presence; leaf foliation and whether petiolate, sub-sessile or sessile, lobed or entire leaflet venation; stipules insertion, whether basifixied or medifixied; flowers number per inflorescence, rachis gland presence; bracteoles persistence; calyx relative length of teeth, upper teeth shape; standard pubescence and sculpturing; keel beak curvature and lateral pouching; anther gland presence; pollen exine sculpturing; style curvature and bipartic form; stigma extension and position; legume pubescence;
legume protrusion; relative legume size; relative legume shape; legume suture curvature; legume hairs type; seed shape; relative hilum length; relative position of the seed hilum and lens; seed surface type and aril presence.

The characters used to distinguish major and minor groupings are illustrated in the generalized diagram of vetch vegetative, floral, fruit and seed characters drawn in Figure 2.5.
2.6 Classifications of cultivated Vigna

Linnaeus (1753, 1763) did not recognize the species we now consider members of Vigna as a distinct entity, splitting them between Phaseolus and Dolichos. He recognized three of the cultivated forms of V. unguiculata as distinct species within Dolichos, namely Dolichos unguiculatus, D. biflorus and D. sinensis. The new genus Vigna was erected by Savi (1824) to contain cowpea (V. unguiculata (L.) Walp.) and related species. Although the transfer was universally accepted, there has remained some debate about classification and nomenclature at the infra-specific level (Ng and Maréchal, 1985). Pasquet (1998) noted that several approaches have been taken to the taxonomy of the cultivated forms, and although the number of taxa has been generally agreed, their rank has been much debated.

Piper (1912) took the three groups recognized on the basis of seed and pod characters by Linnaeus (1753) and raised them to specific rank. Verdcourt (1970) took a broader conception of V. unguiculata, recognizing five subspecies, namely: subsp. unguiculata (cowpea), subsp. cylindrica (the Catiang bean, mostly grown for forage in Asia) and subsp. sesquipedalis (yard-long bean or asparagus bean, also predominantly grown in Asia), as well as two wild taxa, V. unguiculata subsp. dekindtiana and subsp. mensensis (formerly V. mensensis Schweinfr.). Westphal (1974) proposed that all cultivated forms be lumped into subsp. unguiculata and subordinate cultigen groups recognized, namely cv. gr. Unguiculata, Biflora and Sesquipedalis. Ng and Maréchal (1985) recognized four cultigen groups, i.e. Unguiculata, Biflora, Sesquipedalis and Textilis, adding the latter group, which is grown in Nigeria for its strong fibres obtained from the peduncles. Maréchal et al. (1978) and Ng and Maréchal (1985) recognized three wild forms of V. unguiculata: subsp. dekindtiana, stenophylla and tenuis, the former includes both wild subspecies recognized by Verdcourt (dekindtiana and mensensis) as varieties along with var. pubescens (=V. pubescens Wilczek) and var. protracta (=V. unguiculata var. protracta [E. Mey.]).

In their revision of the taxonomy of V. unguiculata, Mithen and Kibblewhite (1993) placed heavy emphasis on separating the wild and cultivated forms, placing them in separate subspecies, with all wild taxa being assigned varietal rank. Padulosi (1993) recognized four wild subspecies of V. unguiculata, namely, subsp. dekindtiana (with varieties dekindtiana, ciliolata, congolensis and grandiflora), pubescens, protracta (with varieties protracta, kgalagadiensis and rhomboidea), tenuis (with varieties tenuis and parviflora) and stenophylla. Subsequent karyotypic analysis revealed very low levels of variation (Venora and Padulosi, 1997), which led them to suggest that the varieties may only represent isolated ecological variants and the varietal status may be unwarranted. Vaillancourt and Weeden (1996) reviewed the existing data sets for intra- and interspecific relationships of V. unguiculata and found that genetic diversity in cultivated cowpea was comparatively low, but high in wild cowpea taxa. Also that the closest genetic relatives to cowpea are in subgenus Plectotropis (=V. vexillata), a finding later corroborated by Jaaska (1999), and subgenus Vigna section Reticulatae (V. reticulata).
In a series of studies based on ecogeography, morphology, physiology and molecular evidence, Pasquet has refined his views on the classification of *V. unguiculata*. Pasquet (1996b, 1998) recognized four cultigen groups, namely *Unguiculata*, *Sesquipedalis*, *Biflora* and *Melanophthalmus*, distinguished on the basis of photosensitivity, ovule number and other characters. They can be distinguished as follows:

1. Fleshy pod, wrinkled when ripe, longer than 30 cm, reniform seeds spaced within the pod, ovule number higher than 17 .............. cv. gr. *Sesquipedalis*
   Unfleshy pod, shorter than 30 cm, seed not spaced within the pod ........... 2

2. Seed testa thin and often wrinkled, flower and seed partly white, ovule number lower than 17 (plant able to flower quickly from the first nodes under inductive conditions) .............................................. cv. gr. *Melanophthalmus*
   Seed testa thick and shiny, flower and seed most often coloured............. 3

3. Ovule number lower than 17 (plant able to flower quickly from the first nodes under inductive conditions) .............................................. cv. gr. *Biflora*
   Ovule number higher than 16 (plant flowering late, even under inductive conditions) ........................................................................ cv. gr. *Unguiculata*

The wild taxa within the species were subdivided into 10 subspecies and 1 variety (Pasquet, 1993a,b, 1996a), and can be broadly subdivided into three groups. The first group consists of perennial out-breeders, which can be distinguished from each other on the basis of floral characters. These include subspecies *baoulensis*, *burundiensis*, *letouzey* and *pawekiae*. The second group is the perennial out/inbreeds associated with mostly drier, coastal environments, this group includes subspecies *alba*, *pubescens*, *tenuis*, *stenophylla* and *dekindtiana*. The last group consists of wild or weedy annuals, which are all classified under subspecies *spontanea*. The distribution of these taxa in Africa is shown in Figure 2.6. Subsequently, Pasquet described a new subspecies *aduensis* (Pasquet, 1997); and this is included with the other subspecies recognized by Pasquet in the tabular key for *V. unguiculata* subspecies in Table 2.2. Allozyme analysis of the *V. unguiculata* species complex showed that the cowpea genepool is highly structured. Pasquet (1993c) had previously reported similar results, but these

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**Figure 2.6.** Geographical distribution of subspecies of *V. unguiculata* (Pasquet, 1996a).
Table 2.2. Tabular key for *V. unguiculata* subspecies (Adapted from Pasquet, 1996a, 1997).

<table>
<thead>
<tr>
<th><em>V. unguiculata</em> subspecies</th>
<th>Root</th>
<th>Rachis Internodes</th>
<th>Flower</th>
<th>Calyx-lobe</th>
<th>Keel twisting</th>
<th>Ovule number</th>
<th>Seed</th>
</tr>
</thead>
<tbody>
<tr>
<td>aduensis</td>
<td>No rootstock</td>
<td>Short, numerous</td>
<td>Medium</td>
<td>Long</td>
<td>Left</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>baoulensis</td>
<td>No rootstock</td>
<td>Short, numerous</td>
<td>Very large</td>
<td>Short</td>
<td>Left</td>
<td>High</td>
<td>Long/medium</td>
</tr>
<tr>
<td>letouzeyi</td>
<td>No rootstock</td>
<td>Short, numerous</td>
<td>Large</td>
<td>Long</td>
<td>Right</td>
<td>High</td>
<td>Long/medium</td>
</tr>
<tr>
<td>burundiensis</td>
<td>No rootstock</td>
<td>Short, numerous</td>
<td>Large</td>
<td>Very long</td>
<td>Right</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>pawekiae</td>
<td>No rootstock/rootstock</td>
<td>Short, numerous</td>
<td>Medium/large</td>
<td>Long</td>
<td>Left</td>
<td>High</td>
<td>Long/medium</td>
</tr>
<tr>
<td>dekindtiana</td>
<td>Rootstock</td>
<td>Short, numerous</td>
<td>Large</td>
<td>Short/medium</td>
<td>Beaked</td>
<td>Low</td>
<td>Long</td>
</tr>
<tr>
<td>stenophylla</td>
<td>Rootstock</td>
<td>Short, numerous</td>
<td>Small/medium</td>
<td>Medium</td>
<td>Left</td>
<td>Low</td>
<td>Long</td>
</tr>
<tr>
<td>tenuis</td>
<td>Rootstock</td>
<td>Short, few</td>
<td>Small/medium</td>
<td>Short</td>
<td>Right</td>
<td>Low/medium</td>
<td>Short/medium</td>
</tr>
<tr>
<td>alba</td>
<td>Rootstock</td>
<td>Short, numerous</td>
<td>Medium</td>
<td>Short/medium</td>
<td>Right</td>
<td>Very high</td>
<td>Very short</td>
</tr>
<tr>
<td>pubescens</td>
<td>No rootstock</td>
<td>Long, numerous</td>
<td>Medium</td>
<td>Medium/long</td>
<td>Right</td>
<td>Low/medium</td>
<td>Medium</td>
</tr>
<tr>
<td>subsp. <em>unguiculata</em> var. spontanea</td>
<td>No rootstock</td>
<td>Short, numerous/few</td>
<td>Medium</td>
<td>Short/medium</td>
<td>Right</td>
<td>Low/high</td>
<td>Medium</td>
</tr>
</tbody>
</table>
Table 2.3. Summary of *V. unguiculata* classification proposed by various authors.

<table>
<thead>
<tr>
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<td>var. <em>tenuis</em></td>
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<td>var. <em>kgalagadiensis</em></td>
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<td>var. <em>tenuis</em></td>
<td>var. <em>ovata</em></td>
<td>var. <em>protracta</em></td>
<td>var. <em>mensensis</em></td>
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<td>subsp. <em>ktalagadiensis</em></td>
<td>var. <em>tenuis</em></td>
<td>var. <em>tenuis</em></td>
<td>var. <em>protracta</em></td>
<td>subsp. <em>ungsiculata</em></td>
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<td>subsp. <em>rhomboidea</em></td>
<td>var. <em>tenuis</em></td>
<td>var. <em>tenuis</em></td>
<td>var. <em>protracta</em></td>
<td>subsp. <em>ungsiculata</em></td>
</tr>
<tr>
<td>subsp. <em>pubescens</em></td>
<td>subsp. <em>pubescens</em></td>
<td>var. <em>tenuis</em></td>
<td>var. <em>tenuis</em></td>
<td>var. <em>protracta</em></td>
<td>subsp. <em>ungsiculata</em></td>
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<tr>
<td>subsp. <em>stenophylla</em></td>
<td>subsp. <em>stenophylla</em></td>
<td>var. <em>tenuis</em></td>
<td>var. <em>tenuis</em></td>
<td>var. <em>protracta</em></td>
<td>subsp. <em>ungsiculata</em></td>
</tr>
<tr>
<td>subsp. <em>tenuis</em></td>
<td>subsp. <em>tenuis</em></td>
<td>var. <em>oblonga</em></td>
<td>var. <em>tenuis</em></td>
<td>var. <em>protracta</em></td>
<td>subsp. <em>ungsiculata</em></td>
</tr>
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<td>var. <em>oblonga</em></td>
<td>var. <em>tenuis</em></td>
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<td>subsp. <em>advenis</em></td>
<td>var. <em>oblonga</em></td>
<td>var. <em>parviflora</em></td>
<td>var. <em>protracta</em></td>
<td>subsp. <em>ungsiculata</em></td>
</tr>
</tbody>
</table>

Wild

| subsp. *dekindtiana* | subsp. *dekindtiana*     | var. *dekindtiana*       | var. *huillensis*      | var. *kgalagadiensis*          | subsp. *ungsiculata*             |
| var. *dekindtiana* | subsp. *dekindtiana*     | subsp. *dekindtiana*     | var. *congolensis*     | var. *kgalagadiensis*          | subsp. *ungsiculata*             |
| var. *mensensis* | subsp. *dekindtiana*     | subsp. *mensensis*       | var. *congolensis*     | var. *kgalagadiensis*          | subsp. *ungsiculata*             |
| var. *pubescens*  | subsp. *dekindtiana*     | subsp. *protracta*       | var. *grandiflora*     | var. *kgalagadiensis*          | subsp. *ungsiculata*             |
| var. *protracta*  | subsp. *dekindtiana*     | subsp. *pubescens*       | var. *ciliolata*       | var. *kgalagadiensis*          | subsp. *ungsiculata*             |
| subsp. *tenuis*   | subsp. *dekindtiana*     | subsp. *stenophylla*     | subsp. *protracta*     | var. *kgalagadiensis*          | subsp. *ungsiculata*             |
| subsp. *strenophylla* | subsp. *strenophylla*   | subsp. *tenuis*          | var. *protracta*       | var. *kgalagadiensis*          | subsp. *ungsiculata*             |
| var. *ovata*      | subsp. *tenuis*          | var. *tenuis*            | var. *protracta*       | var. *kgalagadiensis*          | subsp. *ungsiculata*             |
| subsp. *kgalagadiensis* | subsp. *kgalagadiensis* | var. *tenuis*            | var. *tenuis*          | var. *kgalagadiensis*          | subsp. *ungsiculata*             |
were based on a smaller number of accessions and not all subspecies were used in the analysis. The perennial outbreeders appear primitive and are somewhat separated from each other and from the perennial out/inbreeds. Although distinct morphologically, two subspecies of *V. unguiculata*, subsp. *pubescens* and subsp. *unguiculata*, appeared closest in this analysis (Pasquet, 1999).

Table 2.3 shows a summary of the classification of *V. unguiculata* recently proposed by various authors (Pasquet [1993a,b, 1994]; Pienaar [1992]; Pienaar and van Wyk [1992]; Mithen and Kibblewhite [1993]; Padulosi [1993]) against those of Verdcourt (1970) and Maréchal *et al.* (1978).

The second cultivated species, *V. subterranea*, was first described by Linnaeus (1763) as *Glycine subterranea* L. Following his study of the Madagascan flora, Du Petit-Thouars (1806) transferred the species, known locally as Voanjou, written “Voandzou” in French, to the monospecific genus *Voandzeia* as *V. subterranea* (L.) Thouars. The placement in a monospecific genus indicates its lack of a close relative. The wild form of the species, first reported by Dalziel (1901) in North Yola, Nigeria, was subsequently published by Harms (1912) as *Voandzeia subterranea* forma *spontanea*, and then raised to varietal rank by Hepper (1963). The distinction of this species was originally maintained by Verdcourt (1971) and Maréchal *et al.* (1978), although the latter comment that the species has some affinity with *Vigna* section *Plectrotropis*. However, it was Verdcourt (1978, 1980) who also recognized the similarity and sank *Voandzeia* in *Vigna*, where it has remained as an isolated species.

### 2.7 Breeding systems of *Vigna*

There have been very few and no complete studies of the breeding system for all species of *Vigna*. The importance of an appreciation of breeding systems is critical to understanding natural crossing rates, gene flow, patterns of genetic diversity and minimum population size, all of which are vital key components in formulating conservation actions. In general, Lush (1979) reported that the breeding mechanism can be predicted from the floral morphology. Outbreeders generally have large, scented flowers which remain open throughout the day, the stigma are oriented away from the anthers. While in inbreeding species on the other hand, flowers tend to be small and pale, usually unscented with stigmas pointing towards the anthers (Lush and Evans, 1980; Mithen and Kibblewhite, 1993).

Within the cultivated species that have been studied there appears to be for each species a combination of facultative xenogamous and facultative autogamous, and bees are the main pollen vectors. Duke (1981) reported that out-crossing rates in *V. unguiculata* are between 10 and 15% and that ants, flies and bees act as the main pollen vectors. However, Pursglove (1968) previously reported that out-crossing is uncommon, but Pasquet (1996a) has shown that within *V. unguiculata* there are both predominantly outbreeding and subspecies that show a mix of pollination mechanisms. Lush (1979) noted that out-crossing subspecies are characterized by the arrangement of their anthers and stigma preventing selfing. In a study of *V. vexillata* in Costa Rica, the main pollinator was found to be carpenter bees (Hymenoptera—Anthophoridae—Xylocarpa
gualanensis) that foraged mainly in the early mornings, visiting each flower for about 7–8 seconds, the weight of the bee causing the style to project from the keel beak and “hug” the dorsal surface of the bee’s head and thorax thus initiating pollination (Hedström and Thulin, 1986). Carpenter bees have also been observed on flowers of V. monophylla (Specimen Ash 2138). Ants have also been observed on flowers of V. frutescens and V. macrorhyncha.

Another study in Argentina found that two species of Lepidoptera and one bee (Megachile sp.) visited the flowers of V. longifolia, but it was only the latter that triggered pollination (Hoc et al., 1993). It also found that ants (Camponotus sp.) visited the extra-floral nectaries continually and tended to deter other flower visitors. Experiments in the development of the flower ovaries isolated for 24 and 48 hours and pollen tube growth in those isolated for 48 hours, suggest the species is both self and cross fertile. Although seed production rates indicate that an incompatibility system exists and a fecundation efficiency of 51% was observed. It is obviously unsafe to extrapolate from these few studies to the whole genus. There is clearly a need for a much broader pollination study.

2.8 The Vigna genepool

The majority of Vigna species have been described and classified using a combination of morphological characteristics. Traditional taxonomists have less often considered the degree of genetic differentiation among species. Such studies tend to be restricted to well-known crop plants and their allies, where the genetic relationships among the taxa have been extensively studied and the make-up of the genepool is relatively well understood. For the majority of Vigna species this information is unavailable, and traditionally defined morphological species concepts have been applied.

Harlan and de Wet (1971) suggested that cultivated plants and their wild relatives be grouped into primary, secondary and tertiary genepools based on the ease with which inter-breeding is possible. The primary genepool includes the cultigen and the closest wild infraspecific forms, and corresponds to an application of the biological species concept. Hybridization occurs easily within this group, resulting in fertile hybrids with normal chromosome pairing and gene segregation. The secondary genepool includes those species with which hybridization is possible but the resulting hybrid may be sterile, often showing poor chromosome pairing etc. The tertiary genepool includes species with which crossing may result in a hybrid, but this may be completely sterile or even non-viable, making gene transfer by conventional methods difficult.

Unlike the Asian species of Vigna, there have only been a limited number of hybridization studies using African material, and as such the genepool of African Vigna remains poorly understood, with the exception of cowpea (Vigna unguiculata), which as the major cultivated species has been widely studied (Ng and Padulosi, 1991).

The cowpea genepool is unusually large, with 11 subspecies plus several varieties recognized by Pasquet (1993a,b, 1997), i.e. 10 perennial and one annual subspecies (unguiculata). The latter is split into var. unguiculata, which
is the cultivated cowpea and contains four cultivar groups, and var. spontanea, which is the annual wild cowpea found in Senegal to Eritrea and south to Namibia and South Africa. Coulibaly *et al.* (2002) found that the wild annual cowpea was more diverse than the domesticated cowpea for AFLP markers, based on 117 accessions with a mixture of wild and weedy annuals, domesticated types and perennial subspecies. This study corroborates an earlier study using allozymes on the cultivar groups that showed low levels of variation in the cultivated cowpeas. Pasquet (1999) suggests that while domestication of cowpea occurred in West Africa, considerable genetic and biochemical diversity of *V. unguiculata* is also found in southern Africa, providing a potentially valuable, but so far relatively unexploited, resource for cowpea breeding programmes. The wild conspecific forms of *V. unguiculata* have all been reported to hybridize easily with the cultigen and have thus been placed in the primary genepool (Smartt, 1979, 1981; Mithen, 1987), although reduction in seed weight has been reported in F₁ progeny of crosses between the wild forms and cultivated forms (Rawal *et al.*, 1976). Fatokun and Singh (1987) report that in a cross between IT84S-2246-4, an improved cowpea variety, and *V. unguiculata* subsp. dekindtiana var. pubescens, pods collapsed within 12 days and embryo rescue was required. Similarly, F₁ hybrids of a cross between cultivated cowpea and *V. unguiculata* subsp. rhomboidea (=stenophylla) were only partially fertile (Fatokun *et al.*, 1997).

Since no adequate levels of resistance to major pests and diseases have been identified in accessions of any taxon of *V. unguiculata* (Barone and Ng, 1990), it is necessary to identify genotypes and species which can be used as bridge parents in wide crosses. The only species with which concerted efforts have been made to hybridize *V. unguiculata* is *V. vexillata*, due to its resistance to major insect pests. These studies have shown that these two species cannot easily hybridize, as any pods obtained from crosses have been observed to shrivel within a few days (Barone and Ng, 1990, Fatokun, 1991; Barone *et al.*, 1992; Fatokun *et al.*, 1993). However, it has been confirmed that pollen tube germination and subsequent fertilization occur normally (Fatokun, 1991), which implies that embryo rescue remains a possibility. Gomathinayagam *et al.* (1998) have recently reported success in growing immature embryos (10–12 days old) resulting from a cross between *V. unguiculata* and *V. vexillata* in Murashige and Skoog (MS) medium supplemented with BAP to produce callus. Cytological studies of the resulting plantlets showed a high rate of univalent formation in hybrids, suggesting genetic differentiation between the two parental species. *V. marina* and *V. luteola* have also been hybridized with *V. unguiculata* (Smartt, 1979), but both attempts have been unsuccessful. In a hybridization experiment involving *V. nervosa* and *V. unguiculata*, it has been reported that developing pods aborted within 5 days of pollination (Mithen, 1987), which seems to indicate that these two species cannot hybridize successfully. Although *V. unguiculata* is morphologically similar to species in sections *Macrodontae* and *Liebrechtsia*, it is unlikely that hybridization with these species would be successful because of the different chromosome numbers, 2n=20, as opposed to 2n=22 in *V. unguiculata* (Baudoin and Maréchal, 1991).
Until recently, *V. subterranea* has not been used in hybridization studies and was believed to represent a relatively isolated gene pool (Smartt, 1981). *V. subterranea* is most similar to *V. hosei*, which is believed to be in its secondary gene pool, but this has not been confirmed (Baudoin and Maréchal, 1991). The results of an experiment to cross *V. subterranea* with cowpea have given some indication that hybridization may be possible between these two species if *V. unguiculata* is used as the female parent (Begemann, 1995). In the experiment, hand pollination was carried out using IITA-TVu-13677 (cowpea) as the female parent and TVSU-501 (Bambara groundnut) as the pollen donor, resulting in a single pod bearing only one seed. If the findings are confirmed by subsequent experiments, this will improve prospects of using wide crosses in the improvement of Bambara groundnut. Following the Harlan and de Wet (1971) gene pool concept, the *Vigna* gene pools may be summarized as shown in Table 2.4. However, it must be admitted that crossing experiments between *Vigna* species have by no means been exhaustive and further crossing experiments and molecular studies will be necessary to clarify further gene pool delimitations and relationships between cultivated and wild species.

### Table 2.4 Genepools of African *Vigna* cultigens.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>1st Gene pool</th>
<th>2nd Gene pool</th>
<th>3rd Gene pool</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>V. unguiculata</em></td>
<td>A. <em>V. unguiculata</em> subsp. <em>unguiculata</em> cv. gr. <em>Unguiculata, Biflora, Sesquipedalis, Melanophthaulmus</em></td>
<td><em>V. nervosa</em></td>
<td>Other <em>Vigna</em> species</td>
</tr>
<tr>
<td></td>
<td>B. All wild and weedy infra-specific <em>V. unguiculata</em> taxa</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>V. subterranea</em></td>
<td>A. <em>V. subterranea</em> subsp. <em>subterranea</em></td>
<td><em>V. hosei?</em></td>
<td>Other <em>Vigna</em> species</td>
</tr>
<tr>
<td></td>
<td>B. <em>V. subterranea</em> subsp. <em>spontanea</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. CURRENT CONSERVATION STATUS AND THREATS

3.1 Herbarium collections of African Vigna

The researcher undertaking an ecogeographic study will want to compare the “real” ecogeographic distribution of a target taxon with the sample of the genepool that is conserved either ex situ or in situ (Maxted et al., 1995). It is on the basis of this comparison that conservation “gaps” can be identified and conservation priorities formulated. Some approximation of the “real” ecogeographic distribution of a taxon can be reached by collating the passport data associated with herbarium specimen and germplasm accession collections. Information may also be obtained from the literature review, but this is rarely sufficiently detailed to provide a comprehensive ecogeographic overview of the target taxon. Thus, at an early stage in an ecogeographic study, both herbarium and genebank collections of the target taxon must be located, then either visited to obtain passport data directly from the specimens or the data requested. The broader the sampling of ecogeographic data associated with herbarium specimens or germplasm, the more likely the analysis will prove ecologically and geographically predictive.

Index Herbariorum (Holmgren et al., 1990) records the location of major herbarium collections and indicates the regions covered by historic collections. Discussion with taxon specialists will also enable the researcher to decide which herbaria and libraries should be visited. For the ecogeographic survey of Vigna in Africa, ideally the researcher would need to visit the major international herbaria e.g. the Royal Botanical Gardens, Kew, the Natural History Museum, London, the Museum National d’Histoire Naturelle, Paris and the Jardin Botanique National de Belgique, Brussels, Belgium. These herbaria have large collections of specimens from Africa collected during the colonial period and also have specimens that have been used in writing the floras of various parts of Africa. The researcher would also need to visit African herbaria, such as the East African Herbarium located in the National Museums of Kenya, Nairobi, which contains 500 000 specimens from Central and East Africa, the National Botanical Institute, Pretoria, South Africa, which contains 900 000 specimens from southern Africa, and the National Forestry Research Institute, Ibadan, Nigeria, which contains 100 000 specimens from West Africa.

During the ecogeographic study of African Vigna 30 international and African herbaria were visited and herbarium passport data for Vigna species recorded. A full list of herbaria visited is provided with their contact details in Appendix IV.

3.2 Genebank accessions of African Vigna

The researcher should also collect the available passport data from germplasm accessions conserved ex situ in genebanks. Information on genebanks is available in IPGRI’s Germplasm Holdings Database (www.ipgri.cgiar.org/germplasm/dbintro.htm) and associated directories, though these can go out
Table 3.1. *Vigna* accessions held by CGIAR Centres for African countries (SINGER, 2003).^1^  

<table>
<thead>
<tr>
<th>Country</th>
<th>Accessions of cowpea</th>
<th>Accessions of bambara groundnut</th>
<th>Accessions of wild <em>Vigna</em></th>
<th>Wild species represented</th>
<th>Total no. accessions</th>
</tr>
</thead>
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<td>4</td>
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<td>3</td>
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<td>26</td>
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<td>409</td>
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<td>718</td>
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<td>236</td>
<td>90</td>
<td>9</td>
<td>444</td>
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<td><strong>Totals</strong></td>
<td><strong>9860</strong></td>
<td><strong>1579</strong></td>
<td><strong>1415</strong></td>
<td><strong>–</strong></td>
<td><strong>13 290</strong></td>
</tr>
</tbody>
</table>

^1^ Note: numbers of accessions are constantly changing and accurate information can only be obtained by directly querying the respective databases, listings are included for indicative purposes only.
of date fairly quickly (Bettencourt et al., 1989; www.ipgri.cgiar.org/publications/pubfile+.asp?ID_PUB=434). The largest germplasm collection of African Vigna is held at the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria, which holds the CGIAR world mandate for cowpea, Bambara groundnut and their wild relatives. Until 1983, IITA held only 200 accessions of wild species of Vigna (Laghetto et al., 1998). Over the past 10 years, there have been a total of 20 collecting missions in several countries including Botswana, Cameroon, Central African Republic, Chad, Congo, Ethiopia, Lesotho, Equatorial Guinea, Malawi, Mali, Niger, Nigeria, Senegal, Somalia, Swaziland, South Africa, Tanzania, Zambia and Zimbabwe, resulting in acquisition of more than 750 additional accessions (Ng, 1990; Padulosi and Ng, 1990, Laghetto et al., 1994, 1998). The total number of Vigna accessions held here is 18,686, of which 14,887 are cultivated V. unguiculata subsp. unguiculata and 553 are wild V. unguiculata, and 2032 are V. subterranea accessions. Other genebanks that hold accessions of Vigna within the CGIAR system include ILRI and CIAT, with 276 and 842 Vigna accessions respectively (for details, connect to www.singer2.cgiar.org). Table 3.1 shows the number of accessions originating from each country held by genebanks within the CGIAR system.

The largest collection of Vigna outside the CGIAR system is held by the Phaseolinae genebank at The National Botanical Gardens of Belgium (Jardin Botanique National de Belgique) at Meise, Brussels with 507 predominantly wild species. Other genebanks, such as the National PGR Laboratory in the Philippines, the Asian Vegetable Research and Development Centre in Taiwan and the National Bureau of PGR, India also have large collections of cultivated material (FAO, 1998). Table 3.2 shows the number of accessions of each species held by major genebanks. Both V. adenantha and V. hosei have a wider distribution outside Africa and are represented by more accessions originating outside Africa than within the continent. V. adenantha has been collected widely from Argentina, Brazil, Colombia, Panama and Venezuela, and V. hosei from Malaysia, Indonesia and Colombia.

While the international and national herbaria contain large collections of Vigna specimens, few have databases of the passport data for their collections. The larger genebanks, however, commonly have on-line databases of their germplasm collection passport data, thus in the present study these data were obtained via the web without visiting the actual genebank. Notably, the holdings of the CGIAR centres are collated in the SINGER database (www.cgiar.org/singer/index.htm), the United States Department of Agriculture Vigna holdings are available via the Genetic Resources Information Network (GRIN) (www.ars-grin.gov) and additional data are also available via the World Information and Early Warning System (WIEWS) of the Food and Agriculture Organization of the United Nations (apps.fao.org:8080/wiews.new). The importance generally given to recording detailed passport data by germplasm collectors means that the data associated with germplasm will often be of a higher quality than those associated with herbarium specimens, sometimes collected one or two hundred years ago. Systematic germplasm acquisition programmes have only
Table 3.2. Number of accessions for African *Vigna* species held in major genebanks (cultivated taxa excluded; numbers in brackets indicate additional accessions of non-African origin.

<table>
<thead>
<tr>
<th>Species</th>
<th>IITA</th>
<th>NBGB</th>
<th>USDA</th>
<th>Other genebanks</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>V. adenantha</em></td>
<td>4 (155)</td>
<td>1</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td><em>V. ambacensis</em></td>
<td>128</td>
<td>34</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><em>V. angievensis</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. antunesii</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. benuensis</em></td>
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<td>4</td>
<td>0</td>
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</tr>
<tr>
<td><em>V. bequaertii</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. bosseri</em></td>
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<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. comosa</em></td>
<td>9</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. desmodioides</em></td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. dolomitica</em></td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. filicaulis</em></td>
<td>4</td>
<td>9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. fischeri</em></td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. friesiorum</em></td>
<td>4 (2)</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><em>V. frutescens</em></td>
<td>9</td>
<td>10</td>
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<td>4</td>
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<td><em>V. gazensis</em></td>
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<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td><em>V. gracilis</em></td>
<td>22</td>
<td>14</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td><em>V. haumaniana</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. heterophylla</em></td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. hosei</em></td>
<td>1 (11)</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. juncea</em></td>
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<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. juruana</em></td>
<td>2 (1)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. keraudrenii</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. kirkii</em></td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. kokii</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. lanceolata</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. laurantii</em></td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. longissima</em></td>
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<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. luteola</em></td>
<td>54 (70)</td>
<td>8</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td><em>V. macrorhyncha</em></td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td><em>V. marina</em></td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. membranacea</em></td>
<td>7</td>
<td>16</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td><em>V. microsperma</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. monantha</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. monophylla</em></td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><em>V. mudenia</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. multinervis</em></td>
<td>18</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. nigritia</em></td>
<td>21</td>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. nuda</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. nyangensis</em></td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. oblongifolia</em></td>
<td>55 (3)</td>
<td>26</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td><em>V. parkeri</em></td>
<td>1 (3)</td>
<td>4</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td><em>V. phoenix</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
been established relatively recently and, as is shown in Table 3.2, few rare *Vigna* species have germplasm conserved *ex situ*, therefore herbarium specimens remain an invaluable source of passport data. A full list of genebanks supplying passport data is provided with their contact details in Appendix IV. It is worth noting that there is also a database of European *Vigna* germplasm holdings (Schachl and Kainz, 2002) that is available at www.agrobio.bmlf.gv.at/Vigna/, this duplicates the data for the National Botanical Gardens of Belgium, along with the N.I. Vavilov (St. Petersburg, Russia) and INIA (Madrid, Spain) holdings.

### 3.3 Review of *Vigna* germplasm conserved *ex situ*

Maxted *et al.* (1995) stress that prior to initiating new conservation activities, current activities should be reviewed; if sufficient genetic material of the target taxon from the target area is already safely conserved *in situ* and/or *ex situ*, there may be little justification for further conservation activities. Details of what material is currently being conserved can be obtained from botanic gardens, genebanks and *in situ* conservation areas, as well as from national and international catalogues, databases and web sites. Taxon experts may also be able to guide the researcher to the appropriate catalogues or databases. Although IITA, the National Botanical Gardens of Belgium and USDA hold large seed collections of cultivated and wild *V. unguiculata* and *V. subterranea* taxa (Table 3.3), there are 25 wild African *Vigna* species that have no *ex situ* conserved germplasm and the majority of the remaining species are represented by few collections in a single genebank (IITA). Also, the USDA collection is primarily a duplicate of the material

<table>
<thead>
<tr>
<th>Species</th>
<th>IITA</th>
<th>NBGB</th>
<th>USDA</th>
<th>Other genebanks</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>V. platyloba</em></td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. praecox</em></td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. procera</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. pygmaea</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. racemosa</em></td>
<td>107</td>
<td>39</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><em>V. radiata</em></td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td><em>V. radicans</em></td>
<td>24</td>
<td>4</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><em>V. reticulata</em></td>
<td>108</td>
<td>25</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. richardssiae</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. schimperi</em></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><em>V. schlechteri</em></td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. somaliensis</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. stenophylla</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. subterranea</em></td>
<td>36</td>
<td>0</td>
<td>64</td>
<td>0</td>
</tr>
<tr>
<td><em>V. triphylla</em></td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. unguiculata</em> (wild)</td>
<td>489</td>
<td>188</td>
<td>244</td>
<td>51</td>
</tr>
<tr>
<td><em>V. venulosa</em></td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>V. vexillata</em></td>
<td>154 (144)</td>
<td>68</td>
<td>13</td>
<td>67</td>
</tr>
<tr>
<td><em>V. virescens</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
held at IITA and NBGB. The SADC Regional Genetic Resource Centre, Lusaka has a small number of accessions of wild \textit{Vigna} species.

Maxted \textit{et al.} (1995) point out that for those species that do have \textit{ex situ} conserved germplasm, care must be taken when interpreting information on genebank holdings, because:

- It may be incorrectly identified (although if voucher material or living material is available the identification can be checked).
- It may not contain a representative sample of the genetic diversity of the sampled population.
- It may represent a duplicate of material held by another genebank or botanic garden, thus providing a false impression of the actual genetic diversity conserved.
- It may for various reasons be unavailable to potential users.
- The collections databases may not be efficiently managed and therefore records may not be current or may contain errors.

We can conclude that the broad African \textit{Vigna} genepool is not adequately conserved in \textit{ex situ} genebanks.

\subsection*{3.4 Review of \textit{Vigna} germplasm conserved \textit{in situ}}

Much historic and current effort to conserve African \textit{Vigna} genetic resources has been focused on \textit{ex situ} seed conservation in genebanks, because this method is generally regarded as technically straightforward (the species having orthodox seed storage behaviour), the cost of genebank storage is relatively low, and material held in genebanks is considered more easily utilizable. However, these efforts can be criticized because they have not been systematic in terms of taxonomic (species) representation, focusing largely on the two main crop species, and even for these the material conserved is not thought to reflect accurately the genetic diversity in the entire genepool. As well as the lack of systematic sampling for \textit{Vigna}, \textit{ex situ} techniques do have several inherent disadvantages (Maxted \textit{et al.}, 1997a):

- \textit{Ex situ} techniques freeze evolutionary development, especially that which is related to pest and disease resistance.
- Genetic diversity is likely to be lost with each regeneration cycle (though individual cycles in legume species can be extended to periods of 20–50 years or more).
- Conservation is restricted to a single target taxon per accession (no conservation of associated species, habitat or ecosystem found in the same location along with the target taxon is possible).
- There are problems with storing seeds of “recalcitrant” seeded species in genebanks (however, all \textit{Vigna} species have orthodox seed storage behaviour).

These criticisms do not apply to \textit{in situ} conservation, where genetic diversity is conserved at the location where it is currently found. The Convention on
Biological Diversity (for details, connect to www.biodiv.org), the FAO Global Plan of Action for Plant Genetic Resources for Food and Agriculture (FAO, 1996), the International Treaty on Plant Genetic Resources for Food and Agriculture (FAO, 2002) and the Global Strategy for Plant Conservation (for details, connect to www.biodiv.org/programmes/cross-cutting/plant/) all place particular emphasis on in situ conservation. However, it must also be recognized that no in situ conserved genetic diversity is totally secure, political priorities change and any amount of protection may be negated if there is insufficient political will. Therefore, the wise conservationist, for Vigna as for other genepools, will employ ex situ techniques as a complement to in situ conservation. The definition of in situ conservation provided by CBD (for details, connect to www.biodiv.org) includes two distinct conservation concepts (=techniques) for conserving wild and cultivated species. The definitions provided by Maxted et al. (1997b) are:

- Genetic reserve conservation—the location, management and monitoring of genetic diversity in natural wild populations within defined areas designated for active, long-term conservation.

- On-farm conservation—the sustainable management of genetic diversity of locally developed traditional crop varieties with associated wild and weedy species or forms by farmers within traditional agricultural, horticultural or agri-silvicultural cultivation systems.

Although much scientific research has been focused on ex situ conservation techniques (Hawkes, 1991; Maxted et al., 1997a), in situ protocols are only just beginning to be formulated (Jain, 1975; Gadgil et al., 1996; Safriel, 1997; Safriel et al., 1997; Maxted et al., 1997c; Maxted and Kell, 1998; Maxted et al., 2002). However, there are few examples of in situ techniques being specifically applied for Vigna species and for that matter any plant group. As Hoyt (1988) points out, the majority of existing nature reserves, protected areas and natural parks

<table>
<thead>
<tr>
<th>Taxon</th>
<th>IITA</th>
<th>NBGB</th>
<th>USDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. unguiculata subsp. unguiculata var. unguiculata</td>
<td>14 887</td>
<td>15</td>
<td>4399</td>
</tr>
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<td>V. unguiculata subsp. unguiculata var. spontanea</td>
<td>4</td>
<td>111</td>
<td>0</td>
</tr>
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<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>V. unguiculata subsp. burundiensis</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>V. unguiculata subsp. pubescens</td>
<td>8</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>V. unguiculata subsp. dekindtiana</td>
<td>380</td>
<td>0</td>
<td>37</td>
</tr>
<tr>
<td>V. unguiculata subsp. tenuis</td>
<td>45</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
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<td>37</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>V. unguiculata subsp. alba</td>
<td>0</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>V. unguiculata subsp. pawekiae</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>V. unguiculata subsp. aduensis</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V. subterranea var. subterranea</td>
<td>2032</td>
<td>0</td>
<td>64</td>
</tr>
<tr>
<td>V. subterranea var. spontanea</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
were established to conserve large animals or protect aesthetically beautiful landscapes rather than for plant conservation, and the number of conservation projects that focus in situ genetic conservation of plants are very few.

3.4.1 On-farm conservation of *Vigna* species

In recent years there have been on-farm conservation projects that include *Vigna* species, although on-farm techniques have not been systematically applied to the cultivated species of *Vigna*. However, African farmers have been conserving *Vigna* species for millennia via annual cycles of planting, cultivating, harvesting, and selecting seed. It is the recognition of this as a conservation technique and the initiation of collaboration between the farmer and the conservationist that is the recent innovation.

In 1995, IPGRI (Jarvis and Ndungú-Skilton, 2000) together with national programmes in nine countries, including Burkina Faso in West Africa, formulated a global project to strengthen the scientific basis of in situ conservation of agrobiodiversity, and cowpea was one of the targeted crop species. Within Burkina Faso, three agro-ecological zones were selected for establishment of the on-farm project: the Sahelian zone in the centre and centre-north, the Sudano-Sahelian zone to the west, and the Sudanian zone to the southeast. These zones are distinguished by annual precipitation and characterized as arid and semi-arid tropical. The project is implemented by the national PGR programme, involving national agricultural research institutions, as well as non-governmental organizations and the extension branch of the Ministry of Agriculture at the local level. More information on the Burkina Faso component of the project and the IPGRI In Situ Project as a whole can be found at www.cgiar.org/ipgri/.

This is the only project of its kind studying on-farm methodologies at a global scale, but there have been several more localized projects focused on various research topics associated with on-farm conservation of *Vigna* in sub-Saharan Africa, including: the Shea project in Uganda, studying the cultivation of *Vigna subterranea* (www.pnumen.com/covaol/onfarm.html); and the Community Technology Development Trust project in Zimbabwe looking at the relationship between socio-economic factors and on-farm crop diversity of several crops, including *V. subterranea* and *V. unguiculata* (Odero, 2001—www.cbdcprogram.org). It should be noted that these projects either address specific research questions or are purely descriptive, and are funded on short-term grants. Projects that have the long-term objective of conserving *V. subterranea* and *V. unguiculata* genetic diversity implemented by farmers and conservationists working together have yet to be established. The establishment of such on-farm projects is particularly important for the conservation of a grain legume species where landraces are under immediate threat of replacement with higher yielding varieties.

3.4.2 Genetic reserve conservation of *Vigna* species

There are currently no genetic reserves specifically established to conserve African *Vigna* species or where they are priority taxa for management and monitoring.
Having made this point, the majority of the species are widely distributed along roadsides, in scrubland, field margins and primary forest, and therefore existing national parks and other protected areas will contain *Vigna* species. However, their existence in these protected areas is coincidental, which means their conservation is regarded as being passive and insecure. Unless *Vigna* species are targeted for active management and conservation within a protected area, any deleterious environmental trends that would negatively impact on the *Vigna* populations are likely to be missed and so counter-measures are not adopted. Also, although African protected areas undoubtedly passively conserve *Vigna* species diversity, the absence of detailed check lists for all protected areas makes it impossible to assess or utilize in situ conserved *Vigna* species held in protected areas. With the level of genetic erosion and habitat destruction or degradation that is occurring at present in Africa (see section 3.6 below), more active in situ conservation is urgently required to promote the long-term survival of *Vigna* taxa and the maintenance of the natural or artificial (i.e. agricultural) ecosystems which contain them.

In reality, the number and ecogeographic diversity of African *Vigna* species make in situ conservation the only practical conservation option for adequate conservation of the broadest genepool. There is therefore a need for more systematic funding of in situ conservation projects throughout Africa, and for more regionally based or national agencies to take the lead in the development of future projects. Our emphasis as genetic conservationists is always to link conservation to use. Therefore, if the diversity conserved in this way is ever to be of potential use, we need to encourage protected area managers to produce inventories of the *Vigna* species contained in their reserves, characterize the populations contained therein and so promote the use of the *Vigna* germplasm.

### 3.5 Ecological conservation of *Vigna* species

In the absence of specific genetic reserves for *Vigna* it is worth reviewing where *Vigna* species may be being passively conserved in African protected areas. In fact, this will be an essential first step in establishing genetic reserves for African *Vigna*.

There are extensive ecological conservation activities in Africa, where the focus is habitat or ecosystem conservation. The existing legally protected areas system has evolved largely with a focus on large game animals, with hunting and, later, potential for ecotourism in mind, or else through the setting aside of forest in reserves, principally for timber harvesting (Davis *et al.*, 1994). As a result, large areas of savannah and woodland have been conserved, while some of the most biologically rich habitats, with fewer “flagship” species, have received little or no legal protection. Thus there are major gaps in the network of African protected areas.

A review of the Afrotropical protected areas system by MacKinnon and MacKinnon (1986) concludes that there is need for considerable extension of the protected area network throughout tropical Africa, in particular in the Guineo-Congolian, East Malagasy and montane areas. Many areas of high plant
diversity and endemism remain legally unprotected (Davis et al., 1994). Although some gaps in the existing protected area network have recently been plugged, for example in Gabon, Congo and Cameroon (Gartlan, 1989; IUCN, 1990), the rich Cape and Karoo-Namib floras remain seriously underprotected (Davis et al., 1994). Over the continent as a whole, there are tremendous differences in the levels of conservation activity and awareness. The area or percentage of land legally protected and the level of protection vary widely from country to country, particularly in western and Central Africa.

The uneven coverage of protected areas in Africa is illustrated by considering the 1997 UN List of National Parks and Protected Areas (IUCN, 1998) for African countries, summarized in Table 3.4. IUCN (1994) defines the six Protected Area Categories used in the 1997 UN List of National Parks and Protected Areas as follows:

**Category I: Strict nature reserve/wilderness area.** To protect nature and maintain natural processes in an undisturbed state in order to have ecologically representative examples of the natural environment for scientific study, environmental monitoring, education and maintenance of genetic resources in a dynamic and evolutionary state.

**Category II: National park.** To protect outstanding natural and scenic areas of national or international significance for scientific, educational and recreational use. These are relatively large areas not materially altered by human activity and where extractive resource uses are not allowed.

**Category III: National monument/natural landmark.** To protect and preserve nationally significant natural features because of their special interest or unique characteristics. These are relatively small areas focussed on the protection of specific features.

**Category IV: Habitat/species management area.** To assure the natural conditions necessary to protect nationally significant species, groups of species, biotic communities or physical features of the environment where these may require specific human manipulation for their perpetuation. Controlled harvesting of some resources may be permitted.

**Category V: Protected landscapes and seascapes.** To maintain nationally significant natural landscapes that permit harmonious interaction of human and land while providing opportunities for public enjoyment through recreation and tourism. These are mixed cultural/natural landscapes of high scenic value where traditional land uses are maintained.

**Category VI: Managed resource protected area.** Areas ensuring long-term protection and maintenance of biodiversity while permitting sustainable natural production to meet community needs. They are intended to be relatively large and predominantly unmodified natural systems where traditional and sustainable resource uses are encouraged.

Table 3.4 indicates that some countries, such as Libya and Somalia, have few or no protected areas and the level of protection is minimal, but on the other hand some countries, such as Zambia and Zimbabwe, have extensive areas
Figure 3.1. African MAB Biosphere Reserves (for details, connect to www.unesco.org/mab).

covered by reserves, at least some of which are very well managed (Davis et al., 1994). However, even in such a conservation-minded country as South Africa, the coverage of different vegetation types is very uneven and the extremely species-rich and endemic-rich lowland fynbos and succulent karoo are still very inadequately protected. Of the six Protected Area Categories, the closest to a genetic reserve would be the categories IV and VI. Specific recommendation for establishing genetic reserves in these protected areas are made in Chapter 6, following the ecogeographic analysis of the collated African Vigna data. Figure 3.1 shows the location of the 35 UNESCO Man and Biosphere reserves (for details, connect to www.unesco.org/mab/) found in Africa. As with the network of National Parks and Protected Areas, countries vary in their commitment to biosphere reserves. Some like Kenya and Guinea have been active, but apart from South Africa there is a significant lack of biosphere reserves in southern Africa.
Table 3.4. UN List of National Parks and Protected Areas summary data for African countries (IUCN, 1998).

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<td>33 162 832 21.6</td>
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<td>27 019</td>
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<td>197</td>
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<td>15</td>
<td>3460 0.1</td>
</tr>
<tr>
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<td><strong>38 773 259</strong></td>
<td><strong>52</strong></td>
<td><strong>27 888</strong></td>
<td><strong>0.09</strong></td>
<td><strong>258 840 273.5</strong></td>
<td><strong>3.15</strong></td>
<td><strong>35</strong></td>
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<td><strong>649 513 349</strong></td>
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<td><strong>29 13 481 0.03</strong></td>
<td><strong>253 605 347</strong></td>
<td><strong>1.78</strong></td>
<td><strong>1276 2 013 523 7.08</strong></td>
</tr>
</tbody>
</table>
Along with the need to expand the protected areas network, Davis et al. (1994) conclude that there is a need for considerable improvement in the management of many existing reserves. Designation of a protected area does not mean that there is a species check list, that it is well managed and that the target species are routinely monitored. Many protected areas exist largely on paper. Appropriate management will require additional funding and it is understandably difficult in many African countries to persuade politicians to earmark additional sums for conservation.

3.6 Threats to *Vigna* and African plant diversity

Ideally this section should discuss the specific, current threat to African *Vigna* diversity, but there have been no specific studies of this kind, therefore the more general threats facing African plant diversity will be introduced here and further reviewed in Chapter 8 in light of the results of this study. It is worth noting initially that only 20% of the remaining forest in West Africa is legally protected and only 7% in Central Africa (Sayer et al., 1992). A vast area of forest has already been cleared in West Africa, in fact only about 11–12% of the original moist forest cover of West Africa has escaped deforestation as compared with about 59% in Central Africa (Sayer et al., 1992). As is recognized by Stuart et al. (1990) biodiversity in Africa is under exactly the same threat as elsewhere in the world: the fundamental conflict between supply and demand, in terms of there being a limited supply of the earth’s resources and an increasing demand on them to meet the needs of a growing population and the growing aspirations of that population. The problem for biodiversity is when the demand placed upon species and ecosystems outstrips natural rates of regeneration. Therefore, the main factors causing loss of biodiversity are associated with anthropogenic influences; substantial increases in Africa’s human population have a direct and inverse relationship to plant diversity. Humans have dramatically changed the natural vegetation throughout Africa, particularly since the age of European exploration and colonialization (see Richardson et al., 1996). In recent years even apparently remote areas have been influenced by settlement or collection of forest products. The impact is humans and the threats they place on African plant diversity have been categorized by Beentje et al. (1994) as follows:

- **Deforestation**—Clearance for agriculture and repeated burning for hunting have resulted in severe degradation of natural forest communities, species and their component genetic diversity. FAO/UNEP (1981) estimate that annual deforestation of African closed canopy forests between 1976 and 1980 was about 0.61%, and moist forest loss was likely to be about 1% per year during the 1990s (FAO, 1990). Only one-third of Africa’s original rainforests remain (Sayer et al., 1992) and West Africa’s forests are being lost at a rate of 2.1% per annum. Traditional forms of shifting cultivation which provides 2–4 years of cultivation, followed by fallow for 10–20 years promoted diversity (Beentje et al., 1994). However, cash crop production has shortened the traditional farming cycle, even eliminating the fallow period altogether, and depleted the land available for subsistence agriculture, reducing soil fertility and crop yields.
• **Logging**—Commercial logging continues on a large scale for about 15–20 species. Nearly all of the moist forest in West Africa has been logged over at least once (Rietbergen, 1992). The extraction methods employed have resulted in the extinction and genetic erosion of noncommercial tree and other plant species, along with rapid decline in soil nutrients and, often, soil erosion.

• **Plantation agriculture and forestry**—Recent extensive land clearance for cash crops or exotic trees has exterminated species. For example, in Liberia, Ghana and Nigeria, vast areas of species-rich native forest have been replaced by monoculture plantations of rubber, cocoa and oil-palm (Campbell, 1990), resulting in significant loss of species diversity.

• **Dryland destruction**—Changes in pastoralism in the Sahel and other semi-arid regions have resulted in the exhaustion of local vegetation by domestic stock in some areas. A situation exacerbated by increased stocking rates, prolonged droughts resulting in overgrazing and resultant erosion, especially around permanent waterholes and wells.

• **Fire**—Fire is a natural element of African woodland and grassland ecosystems. In many biomes, occasional fires can enhance species diversity; however, the incidence of fire has increased along with the human population and results in restriction of the natural regrowth of vegetation.

• **Urbanization**—Although Africa remains a largely rural continent, there is an ongoing mass migration to the cities, placing a heavy demand on fuelwood, charcoal, building materials, medicinal resources and easily eliminated taxa of restricted distribution. For example, at least five plant species formerly occurred only in the area now occupied by the suburbs of Cape Town (Beentje et al., 1994). Feeding the tourist craft market is an increasing demand on suitable species, such as African Blackwood (*Dalbergia melanoxylon*) for woodcarving and grasses for making baskets and mats. Cunningham (1993) notes that in the vicinity of large urban centres scarce or slow growing medicinal species are rapidly being exhausted.

• **Mining and quarrying**—The association of rare plant diversity with enclaves of extreme or otherwise distinct soils is well established; soils rich in heavy metals and certain minerals often support unique floras. The endemic vegetation found on these soils is easily threatened by mining, particularly opencast mining that removes the entire vegetation cover.

• **Invasive species**—The problems of invasive alien species are severe and well documented particularly in South Africa, where monospecific stands in the absence of natural pests, diseases or herbivores are replacing native plant diversity. For example, some 8000 km² of the coastal lowlands of Natal have been invaded by *Chromolaena odorata* (Macdonald, 1989).

• **Other factors**—There are also more nebulous but equally detrimental threats to plant diversity, such as the loss of traditional values or indigenous knowledge leading to lower valuation of diversity and resultant careless destruction. Other locally important factors include the impact of increasing tourism (as on Table Mountain or Mt Kilimanjaro), the commercial harvesting
of wild flowers in South Africa and wars. Civil unrest and human displacement undoubtedly stress natural diversity, refugee camps are almost by definition established in areas of low human population and the often pristine vegetation is sacrificed to necessary expediency but, where the environment is fragile, recovery may take time if it is possible at all.

When attempting a continental review it must be understood that within such a large area threats to plant diversity will vary greatly from region to region, country to country and even within countries, see Table 3.5. Threats can be very specific; opencast mining and wild collecting are, for example, a major threat to species diversity in certain parts of Namibia but they are not recorded as a problem in Botswana or Lesotho. The Cape Peninsula of South Africa is notable as an extreme example of vulnerability to anthropomorphic change associated with urbanization, agricultural transformation and invasive species introduction (Richardson et al., 1996).

Having summarized the various factors that threaten African plant diversity, the fact that many *Vigna* species are adventive species of disturbed habitats suggests they may face less severe threats than many species associated with more specific abiotic conditions or restricted habitats. Specifically for *Vigna* the most deleterious factors are likely to be urban expansion, overgrazing, fire, habitat degradation, salination and industrial agricultural practices.

### 3.7 Current Red List data on threatened African *Vigna*

There has been no comprehensive review of the conservation and threat status of African plant species. However, within Africa some regionally based assessment has been made, first South Africa (Hall and Veldhuis, 1985) and later extended to southern Africa (Hilton-Taylor, 1996; Golding, 2002). Both the Hall and Veldhuis (1985) and Hilton-Taylor (1996) studies do not include any *Vigna* taxa. Within the Golding (2002) review of the Red List Threat Status for southern African plant species, the chapter on Zambia, written by Bingham and Smith (2002) categorizes *Vigna comosa* subsp. *abercomensis* as being Vulnerable D2. This means that the species is located in a very restricted area (typically less than 20 km) or that the number of locations (typically five or fewer) is such that it is prone to the effects of human activities or stochastic events within a very short time period in an uncertain future, and is thus capable of becoming Critically Endangered or even Extinct in a very short time.

The 1997 IUCN Red List of Threatened Plants (Walters and Gillett, 1998), which uses the pre-1994 IUCN Red List categories, includes two African species, as indicated in Table 3.6. Subsequent to publication of the 1997 IUCN Red List, the revised Red List Categories were applied, necessitating the need to reassess the Red List Status for all species. Later revisions of the Red List Categories (IUCN, 1994, 2000) were much less subjective than the pre-1994 categories, they therefore required a more detailed knowledge of population levels over a time period. As many of these data are currently unavailable it has had the effect of reducing the numbers of plant species on the list. Thus the 2000 IUCN Red List of Threatened Species...
<table>
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<tr>
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<th>Malawi</th>
<th>Mozambique</th>
<th>Namibia</th>
<th>South Africa</th>
<th>Swaziland</th>
<th>Zambia</th>
<th>Zimbabwe</th>
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<td>7</td>
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<td>48</td>
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<td>57</td>
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<td>1</td>
<td>1</td>
<td>–</td>
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<td>4</td>
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</tr>
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</tr>
<tr>
<td><strong>Total</strong></td>
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<td><strong>164</strong></td>
<td><strong>72</strong></td>
<td><strong>624</strong></td>
<td><strong>503</strong></td>
<td><strong>105</strong></td>
<td><strong>42</strong></td>
<td><strong>174</strong></td>
<td><strong>1755</strong></td>
</tr>
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</table>
(Hilton-Taylor, 2000) includes no Vigna species as threatened. However, this should not be taken to imply that previously threatened species are now safe, it is the case that we currently do not have the necessary data to make the objective assessment. This remains the case for the current IUCN Red List of Threatened Species (for details, connect to www.iucn.org/themes/ssc/red-lists.htm), which currently applies the IUCN Red List Categories and Criteria version 3.1.

The Red List Threat Status of African Vigna taxa is summarized in Table 3.6. It should be understood that this assessment is unlikely to reflect the “real” situation and that the number of taxa included in a future Africa Red List of Threatened Plant Species is likely to include many more African Vigna once adequate population levels over a time period become available.

The Red List Threat Status of African Vigna is discussed further and broader Red List categorization provided in Chapter 8.

Table 3.6. Comparison of Red List Threatened Vigna of Africa.

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Category</td>
<td>Country</td>
<td>Category</td>
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<tr>
<td>Vigna comosa subsp. abercornensis</td>
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<td>–</td>
</tr>
<tr>
<td>V. debanensis¹</td>
<td>Vulnerable</td>
<td>Ethiopia</td>
<td>–</td>
</tr>
<tr>
<td>V. dolomitica</td>
<td>Rare</td>
<td>Zaire</td>
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</tr>
</tbody>
</table>

¹ V. debanensis is considered a synonym of V. frutescens within the classification used for this text and the question over its acceptance as a distinct taxon is likely to have contributed to its Red List assessment status; V. frutescens itself is not threatened in Ethiopia.
4. ECOGEOGRAPHIC DATA

4.1 Delimitation of the target area

Ideally when undertaking an ecogeographic study the target taxon should be studied throughout its range to obtain an accurate and unbiased overall picture of the genepool (Maxted et al., 1995). However, in the case of Vigna, which is a pan-tropical genus found in the Americas, Africa, Asia, Australasia and Oceania, its breadth of distribution and the number of taxa involved make this impractical. Also, much work has already been undertaken in some regions. American Vigna and Phaseolus taxa have been reviewed by Delgado-Salinas (1985), Delgado-Salinas et al. (1993) and Freytag and Debouck (2002), Asian Vigna by Tomooka et al. (2002b) and Australian Vigna by Lawn and Watkinson (2002). There have also been studies of East African Vigna by Verdcourt (1970) and of the Phaseolus-Vigna complex by Maréchal et al. (1978), which together laid the foundations for the subsequent studies. However, even though the centre of diversity for Vigna is in Africa (with a secondary centre in Asia), African Vigna have not been comprehensively studied. Therefore, the commission statement for the current ecogeographic study (see section 1.2) restricted the study to Africa, to complement the recently published works thus enabling a more complete global overview of Vigna ecogeography and assisting in efficient conservation planning.

In practice, Vigna species are not found distributed evenly throughout the African continent, as can be seen from Table 4.1. They are primarily tropical in distribution, with very few being found to the north of the Sahara, and species richness dwindles rapidly towards the temperate regions of southern Africa. Thus, the ecogeographic study was based primarily on tropical mainland Africa, along with the islands of Pemba, Zanzibar, Sao Tome and Principe, and Madagascar.

Having established the target area, taxonomic and ecogeographic information on local geographical distribution and ecological preferences for African Vigna was obtained from local floras and monographs, identified using Davis et al. (1986) and Frodin (2001). These included:

- Catalogue des plantes vasculaires du Tchad méridional – Lebrun et al. (1972)
- Flora of Tropical East Africa – Verdcourt (1971).
Table 4.1. Regional distribution of *Vigna* species in Africa.

<table>
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<th>Species</th>
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<th>EAF</th>
<th>NEAF</th>
<th>SAF</th>
<th>WAF</th>
<th>WIO</th>
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</table>
4.2 Collation of ecogeographic data

The collection of ecogeographic information followed the model proposed by Maxted et al. (1995), as discussed in Chapter 1. Ecogeographic data were collated for Vigna taxa from existing published and grey literature sources, as well as from the passport data associated with genebank accessions and herbarium specimens.

4.2.1 Taxon data collation

Ecogeographic information was gathered from books, journal articles, CD-ROMs and the Internet, as well as from the “grey” literature, most notably Moss (1986). An example of the kinds of data that were obtained from the printed literature, databases and the web is given in Table 4.2 for Vigna schimperi Bak. The collation of much of this information was done while visiting major herbaria, which are usually associated with good botanical libraries.

4.2.2 Genebank accession and herbarium specimen data collation

As noted by Davis and Heywood (1963) and Maxted et al. (1995), the broader the sampling of ecogeographic data associated with germplasm accessions and herbarium specimens, the more likely the data will prove ecologically and geographically predictive. Therefore, passport data were obtained from international herbaria and regional and national herbaria in Africa as well as from genebanks. In all, passport data were obtained for herbarium specimens held by 30 herbaria (AAU, B, BOL, BM, BR, C, COI, EA, FT, G, GENT, K, L, LISC, LISU, MAL, MO, MOG, NBG, NH, P, PRE, PRU, SAM, SRGH, TAN, UPS, W, WAG and WU) and four genebanks (CIAT, IITA, ILRI and NBGB). For full details of herbaria and genebanks, see Appendix IV. Owing to the number of specimens

<table>
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<th>Species</th>
<th>CAF</th>
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<th>NEAF</th>
<th>SAF</th>
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<tr>
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<td>–</td>
<td>√</td>
<td>–</td>
<td>–</td>
<td>–</td>
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</tr>
</tbody>
</table>

involved including a full citation of specimens in the text was not possible, but a Specimen Citation database is included, with the full African Vigna database on the accompanying African Vigna Data CD. Specimens or accessions are listed in the Specimen Citation database with the following data where available: taxon identification, country, locality, town, habitat, whether flowering or fruiting, day/month/year of collection, latitude/longitude, elevation (m), collector and collection number, herbarium or genebank where deposited. The imbalance between the number of herbaria and genebanks sampled reflects the time period botanists have been collecting in Africa and the relatively recent advent of germplasm collection and ex situ conservation in genebanks. It is, however, worth stressing that the quality of the passport data associated with genebank accessions is significantly better than herbarium specimens.

Where possible, the following data were collected from herbarium labels and genebank documentation systems: collector’s name, collector’s number, date of collection, presence/absence of flowers, presence/absence of seeds, country of collection, nearest town, exact locality, habitat, description of collecting site including soil colour, soil texture, associated species, biotic and abiotic factors observed at the collecting site, and any ethnobotanical data recorded for the specimen. An example of the kinds of information it was possible to collate for African Vigna from passport data associated with herbarium specimens and germplasm accessions is given in Table 4.3. This listing of categories of ecogeographic data is extensive and it was not possible to record this amount

<table>
<thead>
<tr>
<th>Ecogeographic data type</th>
<th>Example data for a Vigna species</th>
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<tbody>
<tr>
<td>Accepted taxon name</td>
<td>Vigna schimperi Bak.</td>
</tr>
<tr>
<td>Locally used taxon name(s)</td>
<td>None known</td>
</tr>
<tr>
<td>Distribution</td>
<td>Congo, Ethiopia, Kenya, Sudan, Tanzania and Uganda</td>
</tr>
<tr>
<td>Timing of local flowering and fruiting</td>
<td>October–January in Central Africa and April–August in East Africa</td>
</tr>
<tr>
<td>Habitat preference</td>
<td>Coarse grassland</td>
</tr>
<tr>
<td>Altitude</td>
<td>0–2250 m</td>
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<tr>
<td>Soil preference</td>
<td>Unknown</td>
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<tr>
<td>Geological preference</td>
<td>None observed</td>
</tr>
<tr>
<td>Climatic and micro-climatic preference</td>
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</tr>
<tr>
<td>Breeding system</td>
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</tr>
<tr>
<td>Genotypic and phenotypic variation</td>
<td>None observed</td>
</tr>
<tr>
<td>Biotic interactions (pests, pathogens, herbivores)</td>
<td>None observed</td>
</tr>
<tr>
<td>Archaeological information</td>
<td>None available</td>
</tr>
<tr>
<td>Ethnobotanical information</td>
<td>Also known as Emaret, Mangwia, or Njazi in Kenya, Urubore or Omaharakuku in UGA, Adjuru or Okworokworo in ZAR</td>
</tr>
<tr>
<td>Conservation status (e.g. IUCN Red List Category)</td>
<td>Not threatened</td>
</tr>
</tbody>
</table>
of information from every specimen. As with any ecogeographic survey there are, however, certain data that must be recorded for the study to yield predictive results, and these are the first seven fields in Table 4.3. The other data types listed would normally be recorded at the collection site by the germplasm conservationist these days, but many of the herbarium specimens seen were collected by botanists several decades ago, when the need for such detailed passport data was not fully appreciated. Databases of large international genebanks were searched over the web to determine the number and origin of germplasm accession of each species of *Vigna* held. Where latitude and longitude were not given, or if errors were suspected, gazetteers were used to determine correct coordinates.

It is also worth noting here that the final database inevitably contained numerous gaps, where passport data were missing for particular specimens. In general, it is much easier to record curatorial or geographic data from herbarium specimens than it is to record ecological data. This will have an obvious effect on the analysis and must be considered when interpreting the results.

### 4.2.3 Selection of representative specimens

The scope of any ecogeographic investigations is always limited by the available time, facilities and materials (Maxted et al., 1995). The herbaria of the world contain thousands of *Vigna* specimens. This necessitated the selection of representative specimens for inclusion in the survey. During the course of the ecogeographic project several thousand specimens were seen; each was identified and a proportion of these were selected to have their passport data recorded in the database. Specimens were selected primarily on the basis of the quality of their associated passport data or if they showed features of particular taxonomic, ecological or geographic interest, i.e. the specimens represented

<table>
<thead>
<tr>
<th>Specimens or accessions data</th>
<th>Example data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample identification</td>
<td><em>Vigna vexillata</em> var. <em>angustifolia</em></td>
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<tr>
<td>Herbarium or genebank where deposited</td>
<td>K</td>
</tr>
<tr>
<td>Collector’s name and number</td>
<td>Wilson, 1776</td>
</tr>
<tr>
<td>Collection date (to derive flower and fruiting time)</td>
<td>August, 1972</td>
</tr>
<tr>
<td>Phenological data (does specimen have flowers or fruit?)</td>
<td>Flower—yes, Fruit—yes</td>
</tr>
<tr>
<td>Particular area of provenance</td>
<td>Country—Uganda, Province—U1-Karamoja, Location—Bokota, County—Nakisumet, Latitude 29°54’, Longitude 30°23’</td>
</tr>
<tr>
<td>Altitude</td>
<td>750 m</td>
</tr>
<tr>
<td>Habitat</td>
<td>Dry, rocky veldt in full sun</td>
</tr>
<tr>
<td>Soil colour</td>
<td>Black</td>
</tr>
<tr>
<td>Soil type</td>
<td>Clay</td>
</tr>
<tr>
<td>Associated species</td>
<td><em>Acacia</em></td>
</tr>
<tr>
<td>Vernacular names</td>
<td>“Echorekileng”</td>
</tr>
<tr>
<td>Plant uses</td>
<td>Tap root edible</td>
</tr>
</tbody>
</table>
odd forms or rare taxa, came from unusual environments or were found on the periphery of their natural distribution.

Ideally, only specimens that either had latitude and longitude data available, or for which these data could be established, were selected for inclusion in the database. In practice, however, it was necessary to include specimens with two levels of detail; those for which full latitude and longitude details could be obtained, and those for which only the major country subunit (i.e. province or state) was known. Latitude and longitude of collecting localities were determined, where possible, using gazetteers, including Cohen (1998), Polhill (1998), Pope and Pope (1995) and the Microsoft Encarta World Atlas (1998). Following the recommendation of Rhoads and Thompson (1992), coordinates that were inferred from gazetteers or other sources were coded depending on the accuracy of the inference to distinguish them from data derived directly from herbarium labels. Where locality had been given to the nearest village which could be located on a map or gazetteer, the specimen was given a “1”. The code “2” indicated areas mapped to nearest town and a “3” indicated areas that could only be mapped to nearest district.

It is desirable to collect detailed passport data from as broad a geographic range as possible. Entering data from multiple specimens sampled from the same or nearby populations is likely to add little to the predictive value of the data set as a whole. Specimens were thus selected to represent the breadth of geographic and ecological conditions under which the target taxon is to be found.

Recently collected specimens were found to have higher quality passport data that was more frequently typewritten and so easier to read. These specimens are also likely to have data that are still current, representing populations that are still extant. Extensive use of specimens collected several decades ago may provide details about historical distributions, but is likely to yield less useful information about contemporary populations (Maxted et al., 1995).

4.2.4 Specimen determination
As Maxted et al. (1995) stress, care must be taken in accepting scientific names written on herbarium sheets. Inaccurate identification will obviously have a detrimental impact on the validity of the results generated. In this study, the identification was always confirmed to ensure the taxonomic concept used was consistently applied using the keys provided in the taxonomic works listed in section 4.1 above. The majority of the herbarium specimen data included were taken from herbarium material seen, determined and used in recent studies by Verdcourt (1971) and Maréchal et al. (1978).

4.2.5 Ecogeographic database
The herbarium specimen and genebank accession data were collated directly into a database to facilitate data checking and analysis and also to avoid transcription errors. The basic structure of the database file is shown in Table 4.4 with an explanation of the content of the fields.
### Table 4.4. Field structure and content of the ecogeographic database.

<table>
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<tr>
<th>Field</th>
<th>Data type</th>
<th>Field name</th>
<th>Field description</th>
</tr>
</thead>
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<td>1</td>
<td>Taxonomic</td>
<td>SUBGENUS</td>
<td>Vigna subgenus to which species belongs</td>
</tr>
<tr>
<td>2</td>
<td>Taxonomic</td>
<td>SECTION</td>
<td>Vigna section to which species belongs</td>
</tr>
<tr>
<td>3</td>
<td>Taxonomic</td>
<td>SPECIES</td>
<td>Accepted Vigna species name</td>
</tr>
<tr>
<td>4</td>
<td>Taxonomic</td>
<td>SUBSPECIES</td>
<td>Subspecies name, if appropriate</td>
</tr>
<tr>
<td>5</td>
<td>Taxonomic</td>
<td>VARIETY</td>
<td>Varietal name, if appropriate</td>
</tr>
<tr>
<td>6</td>
<td>Curatorial</td>
<td>H_OR_G</td>
<td>Whether herbarium specimen or genebank accession was located, herbarium codes follow</td>
</tr>
<tr>
<td>7</td>
<td>Curatorial</td>
<td>COLLECTION</td>
<td>Collection where herbarium specimen or genebank accession was located, herbarium codes follow</td>
</tr>
<tr>
<td>8</td>
<td>Curatorial</td>
<td>COLLECTOR</td>
<td>Name of collector(s)</td>
</tr>
<tr>
<td>9</td>
<td>Curatorial</td>
<td>COLL_NOS</td>
<td>Number given by collector to specimen</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>DAY_OF_C</td>
<td>Day of collection</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>MONTH_OF_C</td>
<td>Month of collection</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>YEAR_OF_CO</td>
<td>Year of collection</td>
</tr>
<tr>
<td>13</td>
<td>Descriptive</td>
<td>FLOWERS</td>
<td>Flower present/absent</td>
</tr>
<tr>
<td>14</td>
<td>Descriptive</td>
<td>FLOWER_COL</td>
<td>Colour of flower</td>
</tr>
<tr>
<td>15</td>
<td>Descriptive</td>
<td>FRUIT</td>
<td>Fruit present/absent</td>
</tr>
<tr>
<td>16</td>
<td>Geographic</td>
<td>FLORCODE</td>
<td>Kew Floristic Region Code</td>
</tr>
<tr>
<td>17</td>
<td>Geographic</td>
<td>COUNTRYCOD</td>
<td>BRU country code</td>
</tr>
<tr>
<td>18</td>
<td>Geographic</td>
<td>PROVINCE</td>
<td>BRU province code</td>
</tr>
<tr>
<td>19</td>
<td></td>
<td>TOWN</td>
<td>Name of nearest town</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>LOCALITY</td>
<td>Name of nearest settlement</td>
</tr>
<tr>
<td>21</td>
<td></td>
<td>DISTANCE</td>
<td>Distance from nearest town</td>
</tr>
<tr>
<td>22</td>
<td></td>
<td>DIRECTION</td>
<td>Direction from nearest town</td>
</tr>
<tr>
<td>23</td>
<td></td>
<td>LATITUDE</td>
<td>N=+; S=–</td>
</tr>
<tr>
<td>24</td>
<td></td>
<td>LONGITUDE</td>
<td>E=+; W=–</td>
</tr>
<tr>
<td>25</td>
<td>Ecological</td>
<td>ELEVATION</td>
<td>Height in metres</td>
</tr>
<tr>
<td>26</td>
<td></td>
<td>HABITAT</td>
<td>Ecological habitat where specimen found</td>
</tr>
<tr>
<td>27</td>
<td></td>
<td>VEGETATION</td>
<td>Vegetation type at site of collection</td>
</tr>
<tr>
<td>28</td>
<td></td>
<td>SOIL_COLOU</td>
<td>Colour of soil where specimen found</td>
</tr>
<tr>
<td>29</td>
<td></td>
<td>SOIL_TEXTU</td>
<td>Texture of soil where specimen found</td>
</tr>
<tr>
<td>30</td>
<td></td>
<td>SITE_STONI</td>
<td>Stoniness/rockiness where specimen found</td>
</tr>
<tr>
<td>31</td>
<td></td>
<td>PARENT_ROC</td>
<td>Type of parent rock</td>
</tr>
<tr>
<td>32</td>
<td></td>
<td>SLOPE</td>
<td>Slope of ground</td>
</tr>
<tr>
<td>33</td>
<td></td>
<td>ASPECT</td>
<td>Aspect of collection site</td>
</tr>
<tr>
<td>34</td>
<td></td>
<td>EXPOSURE_T</td>
<td>Degree of openness of site</td>
</tr>
<tr>
<td>35</td>
<td></td>
<td>DRAINAGE</td>
<td>E (excessive) / G (Good) / M (Moderate) / P (Poor)</td>
</tr>
<tr>
<td>36</td>
<td></td>
<td>LAND_USE</td>
<td>Principle use of land</td>
</tr>
<tr>
<td>37</td>
<td></td>
<td>BIOTIC_FAC</td>
<td>Any noted biotic interaction with site where the specimen was found</td>
</tr>
<tr>
<td>38</td>
<td></td>
<td>ABIOTIC_FA</td>
<td>Any noted abiotic interaction with site where the specimen was found</td>
</tr>
<tr>
<td>39</td>
<td></td>
<td>FREQUENCY</td>
<td>Estimation of population size at site where the specimen was found</td>
</tr>
</tbody>
</table>
The database was indexed (i.e. the records were rearranged in alphabetical or numerical order) on each field in turn to highlight typing errors or invalid entries. Exploratory mapping using the latitude and longitude fields also revealed location errors, specimens collected from the sea or from a different geographical unit, these errors were corrected whenever possible. A copy of the database is provided on the accompanying African Vigna Data CD.

4.3 Ecogeographic conspectus format

The following account gives a summary of the available taxonomic, geographic, ecological, ethnobotanical and conservation information for each species of Vigna in Africa.

4.3.1 Conspectus structure

The ecogeographic conspectus is organized systematically, using the updated classification of Vigna listed in Appendix 1. An index to taxa is provided in Section 7. The following information is summarized for each taxon:

- **Accepted name**—Including the authority and publication details.
- **Reference to a published description**—Citation is made to the major regional Floras of Africa and illustrations; abbreviations used are as follows:

• **Botanical drawing**—All botanical illustrations included were drawn by Stefano Padulosi.

• **Vernacular names**—Taken from herbarium specimens, genebank accessions and the literature.

• **Habit and lifespan**—Taken from observations of herbarium specimens and the literature.

• **Flower colour**—Taken from observations of herbarium specimens and the literature.

• **Habitat**—Taken from herbarium specimen labels and genebank accession passport data.

• **Associated species**—Taken from herbarium specimen labels and genebank accession passport data.

• **Altitude**—Taken from herbarium specimen labels and genebank accession passport data.

• **Distribution**—Taken from herbarium specimen labels and genebank accession passport data, with distributional information from the literature. Where distribution is only known from the literature the country code has an exclamation mark added, e.g. ZAM(!). The country codes of the International Working Group on Taxonomic Databases for Plant Sciences Standards were used (Hollis and Brummitt, 1992). The African geographical subregions follow the classification used the Royal Botanic Gardens, Kew. The subregions, countries and country codes are listed in Table 4.5.

• **Actual distribution and predicted distribution maps**—A dot distribution map was made for all taxa based on the herbarium specimen labels and genebank accession passport data. For each taxon with 10 or more herbarium specimens or germplasm accessions, an additional map was made showing its predicted distribution based on climate data from known localities. The FloraMap software was used to make the predicted distribution maps (Jones et al., 1997; Jones and Gladkov, 1999).

• **Phenology**—Taken from herbarium specimens, genebank accessions and the literature.

• **Uses**—Taken from herbarium specimens, genebank accessions and the literature.

• **Taxon Vulnerability Assessment**—Provides a comparative score of the taxon’s propensity for genetic erosion or extinction. See the following section for a detailed explanation of the methodology applied.

• **Conservation notes**—Summary of the conservation status of each species based on its distribution, representation in ex situ collections as well as observations by collectors at collecting sites.

• **IUCN Red List Category**—An attempt has been made using the data collated by the project to assess the IUCN Red List Category for each Vigna taxon using the 2001 IUCN Red List Category and Criteria (version 3.1) [www.redlist.org/info/category_criteria2001](http://www.redlist.org/info/category_criteria2001).

• **Taxonomic notes**—Brief comments on taxonomy.

• **Additional notes**—Any additional remarks.
Table 4.5. African regional and country codes.

<table>
<thead>
<tr>
<th>Region</th>
<th>Countries</th>
<th>Country code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Africa (CEAF)</td>
<td>Burundi</td>
<td>BUR</td>
</tr>
<tr>
<td></td>
<td>Central African Republic</td>
<td>CAF</td>
</tr>
<tr>
<td></td>
<td>Chad</td>
<td>CHA</td>
</tr>
<tr>
<td></td>
<td>Democratic Republic of the Congo</td>
<td>ZAI</td>
</tr>
<tr>
<td></td>
<td>Congo</td>
<td>CON</td>
</tr>
<tr>
<td></td>
<td>Gabon</td>
<td>GAB</td>
</tr>
<tr>
<td></td>
<td>Equatorial Guinea</td>
<td>EQG</td>
</tr>
<tr>
<td></td>
<td>Sao Tome &amp; Principe</td>
<td>GGI</td>
</tr>
<tr>
<td></td>
<td>Rwanda</td>
<td>RWA</td>
</tr>
<tr>
<td>East Africa (EAF)</td>
<td>Kenya</td>
<td>KEN</td>
</tr>
<tr>
<td></td>
<td>Tanzania</td>
<td>TAN</td>
</tr>
<tr>
<td></td>
<td>Uganda</td>
<td>UGA</td>
</tr>
<tr>
<td>North East Africa (NEAF)</td>
<td>Djibouti</td>
<td>DJI</td>
</tr>
<tr>
<td></td>
<td>Egypt</td>
<td>EGY</td>
</tr>
<tr>
<td></td>
<td>Eritrea</td>
<td>ERI</td>
</tr>
<tr>
<td></td>
<td>Ethiopia</td>
<td>ETH</td>
</tr>
<tr>
<td></td>
<td>Socotra</td>
<td>SOC</td>
</tr>
<tr>
<td></td>
<td>Somalia</td>
<td>SOM</td>
</tr>
<tr>
<td></td>
<td>Sudan</td>
<td>SUD</td>
</tr>
<tr>
<td>Southern Africa (SAF)</td>
<td>Lesotho</td>
<td>LES</td>
</tr>
<tr>
<td></td>
<td>Namibia</td>
<td>NAM</td>
</tr>
<tr>
<td></td>
<td>South Africa</td>
<td>ZAF</td>
</tr>
<tr>
<td></td>
<td>Swaziland</td>
<td>SWZ</td>
</tr>
<tr>
<td>West Africa (WAF)</td>
<td>Benin</td>
<td>BEN</td>
</tr>
<tr>
<td></td>
<td>Burkina Faso</td>
<td>BKN</td>
</tr>
<tr>
<td></td>
<td>Cameroon</td>
<td>CMN</td>
</tr>
<tr>
<td></td>
<td>Côte d’Ivoire</td>
<td>IVO</td>
</tr>
<tr>
<td></td>
<td>Gambia</td>
<td>GAM</td>
</tr>
<tr>
<td></td>
<td>Ghana</td>
<td>GHA</td>
</tr>
<tr>
<td></td>
<td>Guinea</td>
<td>GUI</td>
</tr>
<tr>
<td></td>
<td>Guinea Bissau</td>
<td>GNB</td>
</tr>
<tr>
<td></td>
<td>Liberia</td>
<td>LBR</td>
</tr>
<tr>
<td></td>
<td>Mali</td>
<td>MLI</td>
</tr>
<tr>
<td></td>
<td>Niger</td>
<td>NGR</td>
</tr>
<tr>
<td></td>
<td>Nigeria</td>
<td>NGA</td>
</tr>
<tr>
<td></td>
<td>Senegal</td>
<td>SEN</td>
</tr>
<tr>
<td></td>
<td>Sierra Leone</td>
<td>SIE</td>
</tr>
<tr>
<td></td>
<td>Togo</td>
<td>TOG</td>
</tr>
<tr>
<td>West Indian Ocean (WIO)</td>
<td>Madagascar</td>
<td>MDG</td>
</tr>
<tr>
<td>Zambesiaca (ZAMB)</td>
<td>Angola</td>
<td>ANG</td>
</tr>
<tr>
<td></td>
<td>Botswana</td>
<td>BOT</td>
</tr>
<tr>
<td></td>
<td>Malawi</td>
<td>MLW</td>
</tr>
<tr>
<td></td>
<td>Mozambique</td>
<td>MOZ</td>
</tr>
<tr>
<td></td>
<td>Zambia</td>
<td>ZAM</td>
</tr>
<tr>
<td></td>
<td>Zimbabwe</td>
<td>ZIM</td>
</tr>
</tbody>
</table>

4.3.2 Taxon vulnerability assessment

Ideally, it would have been useful to determine the IUCN Red List Category for each African Vigna taxon, as a means of helping formulate conservation priorities. However, using the current definitions of Red List Categories
(for details, connect to [www.iucn.org/themes/ssc/red-lists.html](http://www.iucn.org/themes/ssc/red-lists.html), there were insufficient data available for even the more common *Vigna* species to permit a formal IUCN Red List assessment to be made. Therefore, to provide a basic assessment of genetic vulnerability using the limited data for each species, seven criteria were scored for each taxon in the conspectus. The seven scores were then combined to provide an overall Taxon Vulnerability Assessment, a number between 0 and 10, the higher the number the more vulnerable the taxon to generic erosion and extinction.

### a. Rarity

Rarity is measured as the total number of herbarium specimens and genebank accessions of each species contained in the database, a numeric listing is provided in Appendix V. This was used as a crude indicator of the true rarity of the species. Scores were assigned as follows:

<table>
<thead>
<tr>
<th>Number of specimens or accessions</th>
<th>Category</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1–9</td>
<td>Very rare</td>
<td>10</td>
</tr>
<tr>
<td>10–29</td>
<td>Rare</td>
<td>7</td>
</tr>
<tr>
<td>30–69</td>
<td>Scarce</td>
<td>5</td>
</tr>
<tr>
<td>70–99</td>
<td>Occasional</td>
<td>3</td>
</tr>
<tr>
<td>100–499</td>
<td>Frequent</td>
<td>2</td>
</tr>
<tr>
<td>500–999</td>
<td>Common</td>
<td>1</td>
</tr>
<tr>
<td>1000+</td>
<td>Abundant</td>
<td>0</td>
</tr>
</tbody>
</table>

### b. Distributional range

The distributional analysis takes the point observations for each species, and draws a circle of radius \(x\) around each point. Then, the CA\(x\) value is calculated as the total area of these circles, counting overlapping regions only once (see Appendix VI). The assumption with a calculation like this is that each observation represents an area where the species exists, and within a certain radius around the sampled plant there are likely to be others. The radius used here was 50 km. The result is a number useful in representing the approximate total area of distribution of the species. The taxa were ordered into classes from the largest CA50 to the smallest, and quintiles fitted. The top 15 species with the widest distributional area are in class 5 and receive a score of 0. The second highest 15 species are in class 4 with a score of 2.5 etc., to the lowest 15 in class 1, which receive a score of 10.

<table>
<thead>
<tr>
<th>Category</th>
<th>Class</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most restricted 15 species</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Next restricted 15 species</td>
<td>2</td>
<td>7.5</td>
</tr>
<tr>
<td>Next restricted 15 species</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Next restricted 15 species</td>
<td>4</td>
<td>2.5</td>
</tr>
<tr>
<td>Most widespread 15 species</td>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>
c. *Gross representation in ex situ collections*

The score is based on the number of germplasm accessions held in *ex situ* collections (see Appendix V). Scores were assigned as follows:

<table>
<thead>
<tr>
<th>Number of accessions</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not represented</td>
<td>10</td>
</tr>
<tr>
<td>1–9</td>
<td>9</td>
</tr>
<tr>
<td>10–19</td>
<td>8</td>
</tr>
<tr>
<td>20–29</td>
<td>7</td>
</tr>
<tr>
<td>30–39</td>
<td>6</td>
</tr>
<tr>
<td>40–79</td>
<td>5</td>
</tr>
<tr>
<td>80–119</td>
<td>4</td>
</tr>
<tr>
<td>120–149</td>
<td>3</td>
</tr>
<tr>
<td>150–199</td>
<td>2</td>
</tr>
<tr>
<td>200–499</td>
<td>1</td>
</tr>
<tr>
<td>500+</td>
<td>0</td>
</tr>
</tbody>
</table>

*Geographic coverage of ex situ collections*

The score is based on the distributional range of the germplasm accessions held in *ex situ* collections; from what proportion of the potential range has germplasm been sampled and conserved *ex situ*, see Appendix VII for scoring. Scores were assigned as follows:

<table>
<thead>
<tr>
<th>Category</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not represented</td>
<td>10</td>
</tr>
<tr>
<td>Represented by accessions from 1 to 25% of distribution range</td>
<td>8</td>
</tr>
<tr>
<td>Represented by accessions from 26 to 50% of distribution range</td>
<td>6</td>
</tr>
<tr>
<td>Represented by accessions from 51 to 75% of distribution range</td>
<td>4</td>
</tr>
<tr>
<td>Represented by accessions from 76 to 100% of distribution range</td>
<td>2</td>
</tr>
</tbody>
</table>

e. *Taxon coverage of ex situ collections*

The score is given to all *Vigna* species and is based on the infraspecific representation of germplasm accessions held in *ex situ* collections. All species that either had infraspecific taxa that were well sampled or where there were no infraspecific taxa present were given a score of 0, those with underrepresented infraspecific taxa were given a score of 10, and those species with some infraspecific taxa well represented and others not well represented in *ex situ* collections were given an intermediate score, see Appendix VIII for scoring. Scores were assigned as follows:
### Category | Score
--- | ---
All infraspecific taxa undersampled | 10
Some infraspecific taxa well sampled other infraspecific taxa undersampled | 5
All infraspecific taxa well sampled or species without infraspecific taxa | 0

f. **Taxon utility**
There are numerous criteria for assessing the “value” of plant species (Maxted *et al.*, 1997c), including ecological, genetic, aesthetic, cultural and economic considerations. All use of *Vigna* taxa was considered; however, as the most economically significant use is as a food crop their use as human food receives double the score of other uses. Each species could potentially have more than one use (e.g. animal food and environmental), therefore scores were accumulative, see Appendix IX for scoring. Scores were assigned as follows:

<table>
<thead>
<tr>
<th>Category</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>4</td>
</tr>
<tr>
<td>Animal food</td>
<td>2</td>
</tr>
<tr>
<td>Materials</td>
<td>2</td>
</tr>
<tr>
<td>Social use</td>
<td>2</td>
</tr>
<tr>
<td>Poison</td>
<td>2</td>
</tr>
<tr>
<td>Medicine</td>
<td>2</td>
</tr>
<tr>
<td>Environmental</td>
<td>2</td>
</tr>
<tr>
<td>Gene source</td>
<td>2</td>
</tr>
</tbody>
</table>

g. **Taxon extinction assessment**
A modified form of Solow’s equation (Solow, 1993), as proposed by Burgman *et al.* (1995), was applied to specimen collection data to determine the risk of extinction based on collection frequency per region since commencement of collection to the present time. The collecting period was subdivided into intervals as follows:

|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-------|

The total number of specimens/accessions collected for these time periods is shown in Figure 4.1.
The probability $p$ of each species still being extant was calculated as

$$p = (C_e/C_t)^N$$

Where:
- $C_e$ is the number of time intervals between the start of sampling to the last collection.
- $C_t$ is the total number of intervals.
- $N$ is the number of observations.

The probability was then scored as follows:

<table>
<thead>
<tr>
<th>Probability that species is extant</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–0.49</td>
<td>0</td>
</tr>
<tr>
<td>0.5–1.49</td>
<td>1</td>
</tr>
<tr>
<td>1.5–2.49</td>
<td>2</td>
</tr>
<tr>
<td>2.5–3.49</td>
<td>3</td>
</tr>
<tr>
<td>3.5–4.49</td>
<td>4</td>
</tr>
<tr>
<td>4.5–5.49</td>
<td>5</td>
</tr>
<tr>
<td>5.5–6.49</td>
<td>6</td>
</tr>
<tr>
<td>6.5–7.49</td>
<td>7</td>
</tr>
<tr>
<td>7.5–8.49</td>
<td>8</td>
</tr>
<tr>
<td>8.5–9.49</td>
<td>9</td>
</tr>
<tr>
<td>9.5–10</td>
<td>10</td>
</tr>
</tbody>
</table>

See Appendix X for extinction assessment scoring.
Each individual assessment score for a Vigna taxon together with the combined overall Taxon Vulnerability Assessment score is provided in Table 4.6, the latter is also entered in the taxon conspectus.

Table 4.6. Summary of taxon vulnerability assessment scores.

<table>
<thead>
<tr>
<th>Species</th>
<th>Rarity</th>
<th>Distribution</th>
<th>Ex situ holdings</th>
<th>Ex situ coverage</th>
<th>Infraspecific coverage</th>
<th>Use</th>
<th>Extinction</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. adenantha</td>
<td>5</td>
<td>2.5</td>
<td>9</td>
<td>8</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>4.6</td>
</tr>
<tr>
<td>V. ambacensis</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>10</td>
<td>1</td>
<td>2.6</td>
</tr>
<tr>
<td>V. angensis</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>10</td>
<td>0</td>
<td>6</td>
<td>4</td>
<td>5.3</td>
</tr>
<tr>
<td>V. antunesii</td>
<td>3</td>
<td>2.5</td>
<td>10</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>4.1</td>
</tr>
<tr>
<td>V. benuensis</td>
<td>7</td>
<td>7.5</td>
<td>9</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>5.1</td>
</tr>
<tr>
<td>V. bequaertii</td>
<td>7</td>
<td>7.5</td>
<td>10</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>5.1</td>
</tr>
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5. ECOGEOGRAPHIC CONSPECTUS

5.1 Introduction


Climbing, twining, prostrate or erect herbs or subshrubs, rarely small shrubs, mostly from woody or tuberous rootstocks, without hooked hairs (as in Phaseolus). Leaves pinnately, more rarely subdigitately, 3-foliolate, 1-foliolate or simple; leaflets entire, venation usually reticulate, rarely with secondary nerves parallel (V. multinervis) or tertiary nerves parallel; stipules usually bilobed or spurred at the base, sometimes peltate, rarely truncate; stipels persistent, rarely absent. Inflorescence axillary, falsely racemose or flowers in dense 1 to-many-flowered subumbellate clusters or fasciculate; rhachis thickened and glandular at the point of insertion of the pedicels, flowers paired at each node; bracts and bracteoles deciduous, usually similar in shape and nervation; pedicel shorter than or as long as the calyx, extending or not as the pod matures. Calyx 5-lobed, 2-lipped; lower lip 3-lobed, the middle lobe usually the longest; upper lip of two lobes completely or partly united. Corolla small or medium-sized, yellow, blue or purple inside (internal face of standard, external face of wings), greenish outside (external face of standard), all petals of subequal length; standard glabrous (except in V. ambacensis), emarginate, usually slightly wider than long and symmetrical, with inflexed auricles and appendages on the internal face, less often without appendages; appendages of the standard are based on a U-shaped pattern with one on each half of the standard, but the pattern is rarely complete; it can be reduced to the central part of the U with the appendages appearing parallel and very close together (central position), or sometimes joined and appearing V- or X-shaped (V. luteola or V. monophylla for example); it can be reduced to the lateral part of the U with the appendages appearing parallel but spaced apart (lateral position) (as in V. unguiculata); it can be reduced to the basal part of the U with the appendages appearing perpendicular to the standard axis (V. comosa); keel whitish except for the beak (if there is a beak), usually fused on the upper side, truncate, obtuse or conspicuously beaked, sometimes the beak incurved through up to 180° (V. radiata), sometimes with a distinct conical pocket on the left-hand petal (V. vexillata for example). Vexillary stamen free; five shorter filaments (including the vexillary one) sometimes with a pair of joined glands below each anther (in subgenus Haydoria); anthers uniform. Pollen triporate, exine coarsely reticulate (except in subgenus Haydoria). Ovary 1-many-ovuled; style with tenuous lower part obsolete to quite long, filiform or flattened, upper part thickened and cartilaginous, straight or curved, upper portion barbate or hirsute on the internal face, produced beyond the stigma to form a short to long subulate beak (except in subgenus Haydoria); stigma
completely lateral or oblique. Pods linear or linear-oblong, usually terete, rarely flattened (*V. macrorhyncha*), with sutures not raised (except *V. macrorhyncha*), straight or curved, not septate (seeds are separated by a spongy tissue, not as woody as in *Dysolobium* and *Pachyrhizus*); style caducous. Seeds mostly reniform or quadrate, thickness usually slightly less than width, usually cream-coloured, cream-coloured in combination with grey, mottled and speckled patterns, or black; hilum small or elongate; aril obsolete to well developed, usually excentric, often 3-pronged. Chromosome count usually 2\(n=22\), rarely 2\(n=20\). (Generic description taken from Pasquet, 2001).

5.2 Subgenus *Vigna*


**Reference to a published description:** CPV 165; FCBR 363; FE 172; FTEA 625; FWTA 569; FZ 125; LM 578.

**Vernacular names:**

ZAI: Gilibande, Goko, Masheke, Mugulula, Kavuhivuhi, Umurakuku, Toshimbo-shimbo, Indola a kwakwa, Ka vuhivahi

MDG: Antaka, Famehifary, Telouravy, Vahipoko, Vahisanjy.

NGR: Mare

SUD: Akwari, Lubiya taiyib

TAN: Kisukuna, Kashilika

**Habit and lifespan:** Creeping or prostrate, perennial.

**Flower colour:** Yellow

**Habitat:** Grasslands, lake edges, riverbanks, swamp edges, sclerophyllous forests, around cultivated fields and other disturbed areas, often associated with wet environments.

**Associated species:** *Andropogon, Cyperus, Papyrus, Phragmites, Thelypteris* and *Typha*.

**Altitude:** 1–2800 m.

**Distribution:** This is pantropical and is one of the most widely distributed species in the genus occurring in:

CEAF: BUR, CAF, CHA, CON, GAB, RWA, SEN, SIE, ZAI.

EAF: KEN, TAN, UGA.

NEAF: EGY, ETH, SOM, SUD

SAF: NAM, ZAF.

WAF: BEN, CMN, GHA, GNB, GUI, LBR, NGA, NGR, SEN, SIE, TOG.

WIO: MDG.

ZAMB: ANG, BOT, MLW, MOZ, ZAM, ZIM.

This species appears to be the only member of the genus *Vigna*, which occurs north of the Sahara as a few records from Egypt were found.

**Phenology:** There is a wide variation in flowering both within and between regions as can be seen from Figure 5.1.

**Uses:** Reported to be palatable to cattle and elephants on some herbarium specimens from Zambia (Burkill, 1995).
**Taxon Vulnerability Assessment:** $=2.0$

**Conservation Notes:** *V. luteola* is relatively well represented in *ex situ* collections although further collection in NEAF and SAF may be justified. Seasonal flooding and overgrazing are quoted as a restrictive factor at collecting sites, on herbarium specimens. Populations in such areas may need to be monitored. The species has however been collected at least once throughout the collecting period in every region apart from North Africa. There is no obvious evidence of decline in frequency from the data contained in the database, suggesting that this species in not under immediate threat. However, the fact that it is eaten by cattle and elephants justifies more systematic *ex situ* representation.

**IUCN Red List Category:** Least Concern.

**Taxonomic notes:** *V. luteola*, *V. marina* and *V. oblongifolia* are considered by Pasquet (2001) to be very closely related and possibly to be conspecific owing to the low genetic distances observed between them. However he concludes that they are morphologically distinct and do not seem to hybridize very easily.

**Additional notes:** Some accessions of *V. luteola* show high levels of resistance to major cowpea pests including *Maruca* pod borers and pod sucking bugs (Fatokun *et al.*, 1997). This may be owing to the high levels of anti-nutritional factors including trypsin inhibitors, tannins and lectins all of which are believed to confer resistance to major pests of cowpeas that have been reported in this species (Marconi *et al.*, 1997). This implies that the species has some potential for improvement of cowpea. In addition, because of its rapid growth rate, the species has a high potential for use in preventing soil erosion. It is also a good source of hay and silage (Padulosi and Ng, 1990). Plants of this species have been reported to be easy to inoculate showing rapid and vigorous production of herbage, which is palatable to livestock although its grazing must be lenient for

![Figure 5.1. Phenology of *V. luteola* African regions.](image-url)
Figure 5.2. *Vigna luteola*: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×3); 4, inflorescence nectaries, details (×2.5); 5, flower, front and lateral view (×1); 6, standard, details (×3); 7, standard, (×2); 8 and 9, keel, lateral and front view (×3); 10, diadelphous stamens, spread out (×3); 11, style (×3); 12, stigma (×12), 13, wing (×3); 14, calyx, spread out (×2.5); 15, seed, lateral and front view (×2.5); all drawings by S. Padulosi.
Figure 5.3. Distribution of *V. luteola* based on herbarium specimen passport data.

Figure 5.4. FloraMap predicted distribution for *V. luteola*.
it to persist (Bogdan, 1977). In addition, V. luteola has been demonstrated to be more tolerant to saline environments than V. vexillata (Okusanya and Oyesiku, 1994). However, the species has the disadvantage of having poor tolerance to drought (Skerman et al., 1988) making it unsuitable for use as a forage crop in drought susceptible areas.


**Reference to a published description:** CPV 166; FTEA 626; FWTA 569; FZ 126; LM 579.

**Vernacular names:** None known

**Habit and lifespan:** Perennial, scrambling or trailing herb.

**Flower colour:** Yellow.

**Habitat:** Associated with seashores where it may occur from immediately above watermark to low coastal dunes and scrub, as well as along river mouths and particularly over recent sandstone; sandy soils.

**Associated species:** Grewia, Ipomoea and Sporobolus.

**Altitude:** 1–1030 m. However, the bulk of the specimens were collected at sea level and low altitude.

**Distribution:** Not native to Africa.

CEAF: CON, EQG, GAB, GGI, ZAI.

EAF: TAN.

SAF: ZAF.

WAF: BEN, CMN, GHA, GNB, GUI, LBR, NGA, SEN(!).

WIO: MDG.

ZAMB: MOZ.

**Phenology:** Variable throughout area of distribution.

**Uses:** The species is reportedly used by some African farmers as a cover crop and green manure and has a potential as a sand binding agent (Padulosi, 1993). It also produces edible tubers (Padulosi and Ng, 1990). The seeds are used as a coffee substitute in GAB (Burkill, 1995).

**Taxon Vulnerability Assessment:** = 6.5

**Conservation Notes:** *V. marina* is inadequately represented in *ex situ* collections, because although widely distributed in Africa, the *ex situ* conserved germplasm does not represent the full geographic range. There is need for further systematic collection of both subspecies, particularly from most of West Africa, Tanzania, Mozambique and South Africa. Collection of the species in CEAF, EAF and SAF appear to have been sporadic, and both the number of specimens collected over time and the area from which the species has been collected are in decline. There are, for example, no records of it being collected in South Africa in the twentieth century. *V. marina* is used in numerous ways so it is surprising that it is currently so poorly conserved. There is potential for further exploitation in Africa and as such there is a need for conservation priority even though the species is thought to have been introduced to Africa.

**IUCN Red List Category:** Vulnerable.

**Additional notes:** This species closely resembles *V. luteola* from which it differs...
mainly by habitat with *V. marina* being restricted to seashores. Padulosi (1993) distinguishes two subspecies of this species namely *V. marina* subsp. *marina* distributed in MOZ, ZAF, TAN, along the Indian Ocean littorals and *V. marina* subsp. *oblonga* which occurs on the Atlantic ocean coasts of BEN, CMN, ZAI, CON, EQG, GAB, LBR and NGA. The two subspecies are distinguished by their leaf shape and inflorescence size. Subdivision of this species into two subspecies was confirmed by Sonnante *et al.* (1997) who used isozymes and RAPD analysis to study genetic diversity between *V. marina* and *V. luteola*. Interestingly, their findings suggested that subspecies *oblonga* is more closely related to *V. luteola* than it is to subspecies *marina*.

Being adapted to seashores, this species shows high levels of resistance to salty environments, a trait which may be introduced into cowpea. The species is also highly nodulated (Padulosi and Ng, 1990) and is thus important for improving the soil nitrogen status in areas where it grows. In a trial involving *V. marina*, *V. unguiculata* and *Lablab purpureus* carried out in Turkmenistan (former USSR), *V. marina* out-yielded both *V. unguiculata* and *Lablab purpureus* producing 65–68 tonnes fresh fodder/ha (Bogdan, 1977).

Verdcourt (1971) distinguishes the subspecies as follows:

1. Leaflets rounded-ovate, often mucronate at apex, with slightly raised reticulate venation; linear-oblong inflated pod, 35–60×8–9 mm, glabrous; seeds 6–7×5–6 mm ................................................................. subsp. *marina*

Leaflets ovate-elliptic or oblong-lanceolate, often retuse at apex with raised reticulate venation; narrow less inflated pod, 55×6 mm, close but rather oppressed hairs; smaller seeds....................................................... subsp. *oblonga*

**Vigna marina** (Burm.) Merrill subsp. *marina*.

Reference to a published description: CPV 166; FTEA 626; FZ 126; LM 579.

Vernacular names: None known.

Habit and lifespan: climbing or scrambling perennial herb.

Flower colour: Yellow.

Habitat: Coastal bushland and just above high tide mark on sandy shores.

Associated species: Unknown.

Altitude: Sea level.

Distribution: Not native to Africa.

EAF: TAN(!).

SAF: ZAF(!).

WIO: MDG(!).

ZAMB: MOZ(!).

Phenology: Unknown.

Uses: None known.

Conservation Notes: There are significant numbers of accessions available for this species throughout its range but few have been identified to subspecies, this suggests the subspecies is not a conservation priority but in terms of IUCN Red Listing should be regarded as Data Deficient.

**Reference to a published description:** CPV 166; FWTA 569.

**Vernacular names:** None known.

**Habit and lifespan:** Climbing or scrambling perennial herb.

**Flower colour:** Yellow.

**Habitat:** Sea shore.

**Associated species:** Unknown.

**Altitude:** Sea level.

**Distribution:** Not native to Africa.

CEAF: CON, EQG(!), GAB(!), GGI(!), ZAI(!).

WAF: BEN(!), CMN(!), GHA(!), LBR(!), NGA(!), SEN(!).

**Phenology:** Unknown.

**Uses:** None known.

**Conservation Notes:** There are significant numbers of accessions available for this species throughout its range but few have been identified to subspecies, this suggests the subspecies is not a conservation priority but in terms of IUCN Red Listing should be regarded as Data Defficient.


**Reference to a published description:** FCBR 378; FE 172; FTEA 627.

**Vernacular names:**

ZAI: Umhara-kuku, Bakasukui, Ngaraorwe, Legishyimbo emuhasam

TAN: Muchari (KEN); Kuzimbi/Lukusimbi.

**Habit and lifespan:** Climbing or trailing perennial.

**Flower colour:** Yellow.

**Habitat:** Roadsides, forest edges, woodland, thickets, grasslands, old cultivation areas, stream edges, swamp and marshes; and sandy loam.

**Associated species:** *Combretum*, *Commiphora*, *Cussonia*, *Hyparrhenia*, *Newtonia*, *Pennisetum*, *Phragmites*, *Podocarpus*, *Scleria* and *Scirpus*.

**Altitude:** 293–2500 m. Most specimens were collected at altitudes of 1000–2250 m.

**Distribution:**

CEAF: BUR, RWA, ZAI.

EAF: KEN, TAN.

NEAF: ETH.

WAF: CMN.

ZAMB: BOT, MLW, MOZ, ZAM, ZIM(!).

**Phenology:** Highly variable in East Africa. Material in flower has been collected from March–December. Appears to flower July–September in ZAMB although this is again variable.

**Uses:** The fruit are eaten in TAN. In ZAI, the plant is used as a source of fibre (part not stated). The tubers produced by the plant are eaten in MLW (Padulosi and Ng, 1990).

**Taxon Vulnerability Assessment:** = 4.6
Figure 5.5. Distribution of *V. marina* based on specimen and accession passport data.

Figure 5.6. FloraMap predicted distribution for *V. marina*.
Figure 5.7. *Vigna marina* (Burm.) Merrill subsp. *marina*: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×3); 4, inflorescence rachis, front view (×2.5); 5, inflorescence (×3); 6, flower, front and lateral view (×1); 7, standard, (×2); 8, standard, details (×3); 9, keel, lateral view (×3); 10, wing (×2.5); 11, diadelphous stamens, spread out (×3); 12, style (×3); 13, stigma (×12), 14, calyx bracts (×12); 15, seed, lateral and front view (×2.5).
Figure 5.8. *Vigna marina* (Burm.) Merrill subsp. *oblonga* (Benth.) Padulosi: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×3); 4, inflorescence (×5); 5, inflorescence rachis, front view (×2.5); 6, flower, front and lateral view (×1); 7, standard, (×2); 8, standard, details (×3); 9 and 10, keel, front and lateral view (×3); 11, wing (×2.5); 12, diadelphous stamens, spread out (×3); 13, style (×3); 14, stigma (×12), 15, calyx bracts (×12); 16, calyx, spread out (×2.5); 17, seed, lateral and front view (×2.5).
Figure 5.9. Frequency of altitude classes from which specimens of *V. fischeri* have been collected.
Figure 5.10. Distribution of *V. fischeri* based on specimen and accession passport data.

Figure 5.11. FloraMap predicted distribution for *V. fischeri*. 
Conservation Notes: *V. fischeri* is inadequately represented in *ex situ* collections with much of its range unrepresented; particularly from NEAF, CEAF and EAF. The species is cultivated for its flowers and tubers, which are used as human food. Therefore, additional collecting is needed throughout its range; however, the pattern of *ex situ* collecting is similar to the average for all *Vigna* species.

**IUCN Red List Category:** Near Threatened.

Additional notes: A recent study by Pasquet and Vanderborght (1999) based on isozyme analyses has suggested that this species may be conspecific with *V. luteola*, *V. marina* and possibly *V. bequaertii* although no accessions of the latter were available for use in that study. All three accessions of *V. fischeri* they analyzed fell into the same cluster as *V. luteola*, but as *V. fischeri* is morphologically distinct we have retained the specific distinction until further evidence supports the sinking.


**Reference to a published description:** CPV 167; FCBR 364.

**Vernacular names:** ZAI: Baharakuhuge, Kindandi.

**Habit and lifespan:** Climbing or twining perennial, with or without a large, woody rootstock.

**Flower colour:** Yellow.

**Habitat:** Roadsides, fallows, savannah, riversides, swamps.

**Associated species:** *Acanthus, Hyparrhenia, Pennisetum*.

**Altitude:** 450–1830 m.

**Distribution:** CEAF: BUR, RWA(!), ZAI.

**Phenology:** Mostly October–December.

**Uses:** None known.

**Taxon Vulnerability Assessment:** = 5.1

Conservation Notes: *V. bequaertii* is not represented by *ex situ* collections, therefore the collection of accessions should be treated as a priority. The species has a limited distribution which means it is more likely to be vulnerable to extinction. Although the total number of specimens collected is very limited, the peak was between 1950 and 1959, with only a single specimen collected subsequently. The species is obviously rare and appears to be in decline.

**IUCN Red List Category:** Endangered.

Additional notes: Distinguished from *V. fischeri*, to which it is similar, by unusually large flowers and fruits. Verdcourt (1970) suggested that this species may represent a geographical variant of *V. fischeri* but Maréchal et al. (1978) maintained it as a distinct species.


**Reference to a published description:** CPV 167; FCBR 360; FE 172; FTEA 629; FWTA 568; FZ 127; LM 580.

**Vernacular names:** None known.
Figure 5.12. Distribution of *V. bequaertii* based on specimen and accession passport data.

Figure 5.13. FloraMap predicted distribution for *V. bequaertii*. 
Habit and lifespan: Prostrate or climbing annual, rarely perennial.

Flower colour: Yellow or greenish yellow.

Habitat: Grassland, fallow, weed of cultivation, dambo, lake shore, open woodland, roadside, often associated with periodic inundation; clay or sandy loam.

Associated species: Acacia, Bothriochloa, Cynodon, Digitaria, Echinochloa pyramidalis, Hyparrhenia, Sporobolus and Themeda.

Altitude: 1–3000 m.

Distribution:
CEAF: BUR, CAF, CHA, CON, RWA, ZAI.
EAF: KEN, TAN, UGA.
NEAF: ERI, ETH, SUD.
SAF: NAM, ZAF.
WIO: MDG.
WAF: CMN, GHA, IVO, NGA.
ZAMB: ANG, BOT, MLW, ZAM(!), ZIM.

Phenology: See varieties.

Uses: None known.

Taxon Vulnerability Assessment: = 1.3

Conservation Notes: V. oblongifolia is one of the few Vigna species to have been systematically collected, and both varieties are adequately represented by ex situ collections. Therefore, further collection has a low priority, except for West Africa where the species has been less well sampled. The species has a relatively wide distribution but the two varieties have been sampled throughout their range and they do not appear to be vulnerable to extinction. However, the species may be prone to localized genetic erosion, because of its weedy nature it is susceptible to current changes in agricultural practice. Factors cited on herbarium specimens that may cause some populations to be vulnerable are: heavy grazing, flooding and fire. The pattern of collection sampling follows the general pattern for Vigna species, and population levels appear to be stable.

IUCN Red List Category: Least Concern.

Taxonomic notes: Two varieties of this species are recognized, varieties oblongifolia and parvilora distinguished by leaf, flower and pod characters as follows (Verdcourt, 1971):

1. Leaflets ovate, oblong to lanceolate, up to 120×22 mm; standard 10–11 mm; calyx tube 1.5–2.5 mm, teeth 1.5–2.5 mm; pods 40–45 mm; seed c. 4.0×3.0–3.5 mm..................................................var. oblongifolia

   Leaflets ovate to linear-lanceolate, 15–80×2–25 mm; standard 6–8 mm; calyx tube 1.0–1.5 mm, teeth 1.0–1.5 mm; pods 23–40 mm; seed 2.5–3.0×2.0–2.5 mm .................................................................var. parvilora

Both varieties are fairly widely distributed.

Vigna oblongifolia var. oblongifolia.

Reference to a published description: CPV 167; FE 172; FTEA 629; FZ 127.

Vernacular names:
ZAI: Lotomba.
Figure 5.14. Distribution map of *V. oblongifolia* based on herbarium specimen passport data.

Figure 5.15. FloraMap predicted distribution for *V. oblongifolia*. 
NGA: Waken Kada.
TAN: Kalalalonde.

**Habit and lifespan:** Annual (rarely perennial), prostrate or climbing herb.

**Flower colour:** Yellow or greenish yellow.

**Habitat:** Damp grassland and swamp, aquatic on *Echinochloa* swamps, sandy riverbanks, cultivated fields, roadsides, seasonal marshes, thickets and secondary woodlands, red sandy loam from mica schist, damp black clay soil, black basaltic soil, and as a weed of cultivation.

**Associated species:** *Echinochloa, Acacia.*

**Altitude:** 1–3000 m.

**Distribution:**
CEAF: BUR, CHA, CON, ZAI.
EAF: KEN, TAN.
NEAF: ERI, ETH, SUD,
SAF: NAM, ZAF.
WAF: CMN, GHA, NGA, NGR.
ZAMB: BOT, MLW, ZAM, ZIM.

**Phenology:** April to June.

**Uses:** None known.

**Conservation Notes:** This variety does not appear to be threatened, see discussion for species above.

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**Reference to a published description:** CPV 168; FCBR 361; FE 172; FTEA 629; FZ 128; LM 580.

**Vernacular names:**
TAN: Kashilishili.
ZAM: Siboyani (Lozi).

**Habit and lifespan:** Annual, prostrate or climbing herb.

**Flower colour:** Yellow or brown yellow.

**Habitat:** Floodplains, anthill bases, marsh edges, grasslands, field edges, open woodlands, savannahs, swamp edges, lake shores and stream banks.

**Associated species:** Unknown.

**Altitude:** 10–2900 m.

**Distribution:**
CEAF: BUR, RWA, ZAI.
EAF: KEN, TAN, UGA.
NEAF: ETH, SUD.
SAF: NAM, ZAF.
WAF: CMN, NGA.
WIO: MDG.
ZAMB: ANG, BOT, MLW, ZAM, ZIM.

**Phenology:** Mostly December–April in SAF and ZAMB. Material in flower has been collected throughout most of the year in EAF although this appears to be interrupted in March as well as November–December.
Figure 5.16. *Vigna oblongifolia* A.Rich. var. *oblongifolia*: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×2.5); 4, inflorescence nectaries (×3); 5, flower, front and lateral view (×1); 6, standard (×3); 7, standard, details (×6); 8 and 9, keel, lateral and front view (×3); 10, wing (×2.5); 11, diadelphous stamens, spread out (×3); 12, style (×3); 13, stigma (×12); 14, calyx, spread out (×2.5); 15, seed, lateral and front view (×2.5).
Figure 5.17. *Vigna oblongifolia* var. *parviflora* (Baker) Verdc.: 1, habit (×1); 2, stipule (×2.5); 3, flower, front and lateral view (×1); 4, standard (×4); 5, standard, details (×6); 6 and 7, keel, front and lateral view (×3); 9, diadelphous stamens, spread out (×6); 10, style (×6); 11, stigma (×12); 12, calyx, spread out (×4); 14, details of leaf nervation, lower surface (×6); 15, seed, lateral and front view (×2.5).
Uses: None known.

Conservation Notes: This variety does not appear to be threatened, see discussion for species above.

Additional notes: Of three accessions of this taxon used in a study on isozyme variation among species of subgenus *Vigna*, one fell into the same cluster as accessions of *V. luteola*. This led the authors to suggest that this species may be conspecific with *V. luteola* (Pasquet and Vanderborght, 1999). This is further strengthened by reports of successful hybridization between the two species (Murdock, 1992; Ng, 1990; Pasquet and Vanderborght, 1999).

Some accessions of this species show resistance to important insect pests of cowpea (Jackai and Singh, 1991). Together with *V. vexillata*, this species showed high levels of resistance to *Callosobruchus maculatus*, the cowpea pod weevil (Kitch and Shade, 1993). The species is also palatable to livestock and has been observed to form a dense growth (Bogdan, 1977; Skerman *et al.*, 1988) although it has been reported to show low levels of regrowth following cutting (Skerman *et al.*, 1988). Levels of crude protein ranging from 17.2–23.7% have been reported (Bogdan, 1977).


Reference to a published description: CPV 169; FWTA 568.

Vernacular names: None known.

Habit and lifespan: Prostrate or climbing annual.

Flower colour: Mainly yellow, rarely orange or purple.

Habitat: Damp grasslands, dry savannah forest mosaics, seasonal marshes, rock fissure and inundated plains; and sandy loam.

Associated species: *Andropogon*, *Loudetia*, *Schizachyrium* and Spermacaeae.

Altitude: 1–1200 m.

Distribution:

CEAF: CAF, CHA.

WAF: BKN, CMN, GHA, GNB, GUI, IVO, MLI, SEN, TOG.

No specimens seen from CHA and IVO, where the species has also been reported (Lock, 1989).

Phenology: July–December.

Uses: None known.

Taxon Vulnerability Assessment: = 5.1

Conservation Notes: *V. filicaulis* has relatively wide distribution within West Africa but appears to have been poorly sampled for both herbarium specimens and *ex situ* germplasm. It is difficult from the available data to assess whether this species is in fact widespread but locally rare throughout its range or more common but undercollected. Whichever is true, there are insufficient *ex situ* samples available and there is a need for further collecting throughout its range. The number of previous collections is relatively low, so it is difficult to make any valid assessment of the pattern of collections over time. As a priority, this species needs to be systematically studied to provide sufficient data for the IUCN Red List assessment to be made and to help clarify the most immediate conservation priorities.
IUCN Red List Category: Data Deficient.
Additional notes: *V. filicaulis* is often confused with *V. venulosa*. The similarity between the two species is however superficial and they can be distinguished on the basis of flower colour, pollen reticulation and floral morphology. Pasquet and Vanderborgh (1999) report that the two varieties of *V. filicaulis* are separated by a large genetic distance and suggest that this may be grounds for raising both to species level.

**Taxonomic notes:** Two varieties of this species are recognized. These are *V. filicaulis* var. *filicaulis* and var. *pseudovenulosa* separated on the basis of flower, pod and seed size as well as the degree of leaf and stem pubescence (Maréchal et al., 1978):
1. Flowers 8–10 mm; pod 20–30×4–6 mm; 2–4 seeded, each 6×3 mm; stems and leaves more or less pubescent ............................................ var. *filicaulis*
   Flowers 6–8 mm; pod 18–22×3–4 mm; 2–5 seeded each 3×1.5 mm; stems and leaves more or less glabrescent.............................. var. *pseudovenulosa*

**Vigna filicaulis var. filicaulis**
Reference to a published description: CPV 169.
Vernacular names: None known.
Habit and lifespan: Slender annual.
Flower colour: Yellow.
Habitat: Grassland.
Associated species: Unknown.
Altitude: 30–40 m.
Distribution: WAF: GHA(!), IVO(!), NGA(!), NGR(!), SEN.
Phenology: Unknown.
Uses: None known.
Conservation Notes: So little information is available on this variety it is impossible to suggest any coherent conservation strategy, see conservation notes for the species for discussion.

**Vigna filicaulis var. pseudovenulosa** Maréchal, Mascherpa and Stainier, Taxon 27:200 (1978).
Reference to a published description: CPV 170.
Vernacular names: None known.
Habit and lifespan: Slender annual.
Flower colour: Yellow.
Habitat: Grassland
Associated species: Unknown
Altitude: 40–50 m.
Distribution: WAF: CMN(!), MLI(!), SIE(!), SEN.
Phenology: Unknown.
Uses: None known.
Figure 5.18. Distribution of *V. filicaulis* based on specimen and accession passport data.

Figure 5.19. FloraMap predicted distribution for *V. filicaulis*. 
Figure 5.20. *Vigna filicaulis* Hepper: 1., habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×3); 4, inflorescence (×3); 5, flower, front and lateral view (×1); 6, standard (×3); 7 and 8, keel, front and lateral view (×3); 9, wing (×3); 10, diadelphous stamens, spread out (×3); 11, style (×3); 12, stigma (×12); 13, calyx, spread out (×3); 14, seed, lateral and front view (×2.5).
Conservation Notes: So little information is available on this variety it is impossible to suggest any coherent conservation strategy, see conservation notes for the species for discussion.

_Vigna multinervis_ Hutch. and Dalziel, Kew Bull.: 17 (1929).

*Reference to a published description:* FCBR 357; FE 173; FTEA 637; FWTA 568; FZ 128.

**Vernacular names:**
ZAI: Katoya.
GAM: Fula-pulaar.

**Habit and lifespan:** Climbing or trailing, slender perennial.

**Flower colour:** Mostly yellow but orange and pink have also been noted.

**Habitat:** Grasslands, herbaceous savannahs, woody savannahs, dambos, permanently wet dunes, waste grounds, fallow fields and rarely in bogs, often on stony, sandy soil.

**Associated species:** Afromaniastrum, Crossopteryx, Hyparrhenia, Loudetia, Piliostigma and Urelytrum.

**Altitude:** 1–1850 m.

**Distribution:**
CEAF: BUR, CAF, CHA(!), CON, GAB, RWA(!), ZAI.
EAF: TAN, UGA.
NEAF: ETH(!), SUD.
WAF: CMN, GHA, GNB, GUI, IVO, NGA, SIE, TOG.
ZAMB: ANG, ZAM.

**Phenology:**
CEAF: highly variable.
WAF: August–December.
ZAMB: March–May in ZAMB.

**Uses:** In CAF, a soup made of the roots is taken before breakfast to treat *Ascaris* infections. The leaf is believed to hasten learning to walk when rubbed on babies’ legs (Burkill, 1995).

**Taxon Vulnerability Assessment:** = 2.9

*Conservation Notes:* _V. multinervis_ is not well represented by *ex situ* collections, therefore the collection of accessions should be treated as a priority. There is a need to collect additional germplasm accessions from CEAF (Burundi, Central African Republic and Democratic Republic of the Congo) and UGA to ensure full geographic coverage. Herbarium specimens of the species have been collected consistently from CEAF, but less so in WAF and ZAMB. In NEAF records are sporadic, indicating that the species is either rare in this region or that populations are declining.

**IUCN Red List Category:** Endangered.


*Reference to a published description:* CPV 170; FCBR 361.

**Vernacular names:**
BUR: Umukaloko.
Figure 5.21. *Vigna multinervis* Hutch. and Dalziel: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×2.5); 4, flower, front and lateral view (×1); 5, inflorescence (×2.5); 6, standard (×3); 7, standard, details (×6); 8 and 9, keel, lateral and front view (×4); 10, diadelphous stamens, spread out (×4); 11, style (×4); 12, stigma (×12); 13, calyx, spread out (×3); 14, wing (×4); 15, seed, lateral and front view (×2.5).
Figure 5.22. Distribution of *V. multinervis* based on specimen and accession passport data.

Figure 5.23. FloraMap predicted distribution for *V. multinervis*.
Habit and lifespan: Climbing, perennial.

Flower colour: Blue or violet.

Habitat: Savannah, riverbanks and on poor marshy soils.

Associated species: Loudetia, Phragmites.

Altitude: 340–1850 m.

Distribution:
CEAF: BUR, ZAI.
WAF: CMN.

Phenology: September–December.

Uses: None known.

Taxon Vulnerability Assessment: = 5.4

Conservation Notes: V. laurentii is rare and restricted in terms of distribution, but it should be noted that it is restricted to countries that have in general been undercollected. The predicted distribution indicates a much wider distribution that has yet to be validated. It is inadequately represented in ex situ collections with only two germplasm samples from Burundi, which cannot hope to represent the full geographic range or genetic diversity of the species. The number of collections made over time is sporadic, and since the 1970s only one population has been sampled, which may indicate decline. There is need for further systematic collection throughout Burundi, Democratic Republic of the Congo and Cameroon.

IUCN Red List Category: Endangered.


Reference to a published description: CPV 171; FCBR 355; FE 173; FTEA 632; FWTA 568.

Vernacular names:
ANG: Fuca n’ Lepo.
ZAI: Mondo, Kasali.
ETH: Aragora Baratha.
NGA: Tsarkiyan zomo, Waken Wangi, Yaryadi dagi, Zagaya rafi.
SEN: Tere.
SUD: Erg el Kheil, Emdere, Lubia el Ghazal, Luia Tartag, Lufute Lemeri, Shireyik, Tutu Waru.

Habit and lifespan: Climbing or suberect annual or perennial herb.

Flower colour: Flower colour in WAF is predominantly yellow while blue is more common in EAF (Verdcourt, 1970).

Habitat: Herbaceous (mainly grassland) and tree savannahs, roadside, weed of cultivation, swamps and fallows (CEAF); grasslands, forest edges and swamps (EAF); grasslands and roadsides (NEAF); parent rock commonly laterite, and clay loam or sandy soils, associates with burnt or inundated soils.

Associated species: Acacia, Andropogon, Boswellia, Euphorbia, Hyparrhenia, Lannea, Loudetia, Mirragyna, Parkia, Terminalia.

Altitude: 1–4000 m.
Figure 5.24. *Vigna laurentii* De Wild.: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×3); 4, inflorescence nectaries (×2.5); 5, flower, front and lateral view (×1); 6, standard (×4); 7, standard, details (×8); 8 and 9, keel, front and lateral view (×6); 10, wing (×6); 11, diadelphous stamens, spread out (×6); 12, style (×6); 13, stigma (×12); 14, calyx, spread out (×6); 15, seed, lateral and front view (×2.5).
Figure 5.25. Distribution of *V. laurentii* based on specimen and accession passport data.

Figure 5.26. FloraMap predicted distribution for *V. laurentii*. 
**Distribution:**
CEAF: BUR, CAF, CHA, CON, ZAI.
EAF: KEN, TAN, UGA.
NEAF: ETH, SUD.
WAF: BEN, BKN, CMN, GHA, GNB, GUI, IVO, MLI, NGA, NGR, SEN, SIE, TOG.
SAF: ZAF.
ZAMB: ANG, BOT, MLW, ZAM.

**Phenology:** Mostly September–December in NEAF and WAF, highly variable in CEAF with two peaks of flowering in October–December and April–July.

**Uses:** The fruits are eaten and the leaves used as a dressing for wounds in SUD. The leaves are dried and smoked as a cough remedy and used for food and drink in ZAI, tubers are reported to be eaten in ZAI (Robyns, 1954; Burkill, 1995). In CHA, the species is reportedly used for forage (Padulosi and Ng, 1990).

**Taxon Vulnerability Assessment:** = 2.6

**Conservation Notes:** *V. ambacensis* is widely distributed in Africa but is generally well represented in *ex situ* collections. Even the two varieties are fairly adequately conserved *ex situ*; however, additional sampling from northeastern Democratic Republic of the Congo, Angola, Burundi, Rwanda and Sudan is required for complete representation. Herbarium specimens have been collected regularly throughout its geographic range with the exception of the Zambesiaca region, where the species appears to be rarer. This would seem to suggest that the species is not in danger in the other regions.

**IUCN Red List Category:** Least Concern.

**Additional notes:** Flower colour in WAF is predominantly yellow while blue is more common in EAF (Verdcourt, 1971) although isozyme analysis failed to confirm the existence of this cline (Pasquet and Vanderborght, 1999); the single accession of *V. heterophylla* studied fell within the *V. ambacensis* var. *ambacensis* cluster. The species is closely related to *V. heterophylla* and intermediates between the two occur in SUD and UGA (Verdcourt, 1970; Thulin, 1983, 1989a).

Two varieties, *V. ambacensis* var. *ambacensis* and var. *pubigera*, are recognized within this species. The latter occurs in BUR, ZAI, NGA, RWA, TAN and UGA while var. *ambacensis* occurs in CMN, ZAI and CHA. Distinction between the two is however difficult and, apart from two records, identification was not carried out to varietal level. *V. benuensis*, previously described as a new species from northern Cameroon (Pasquet and Maréchal, 1989) has been reduced to a variety within this species because it could not be distinguished from *V. ambacensis* var. *pubigera* by isozyme analysis (Pasquet and Vanderborght, 1999). The main characters which separated the two were the amphicarpic nature of *V. benuensis* as well as differences in the number of ovules per ovary (3 in *V. benuensis*, 6 or more in *V. ambacensis*) and other morphological characters (Pasquet and Maréchal, 1989). Such characters have additionally not been found to be useful; instead the number of nodes in the inflorescence is suggested as a more useful character (Pasquet and Vanderborght, 1999). Thulin (1989) notes that *V. ambacensis* is very closely related to *V. heterophylla* from which it may not be specifically distinct. He adds that Verdcourt (1970, 1971) treats *V. micrantha* and *V. chiovendae* as synonyms of *V. heterophylla* but that they would be better
assigned as synonyms of *V. ambacensis*. Pasquet (2001) goes further and has recently sunk *V. ambacensis* var. *ambacensis* into *V. heterophylla*, although he comments that the status of var. *pubigera* remains unclear.

The two varieties are identified by Maréchal et al. (1978) as follows:

1. Leaflets lanceolate-elliptic (rarely oval), flowers mauve fading white, inflorescence and rachis relatively short, bearing 4 to 6 flowers

   .............................................................. var. *ambacensis*

   Leaflets oblqng-elliptic, flowers yellow (rarely blue or reddish), inflorescence and rachis longer, bearing 6 to 12 flowers

   .............................................................. var. *pubigera*

**Vigna ambacensis** var. *ambacensis*

Reference to a published description: CPV 171; FWTA 568.

Vernacular names: None known.

Habit and lifespan: Twining, herb.

Flower colour: Bright yellow.

Habitat: Grassland and bush.

Associated species: As for species.

Altitude: 100–2510 m.

Distribution:

CEAF: BUR, CAF, CON, RWA, ZAI.

EAF: TAN, UGA.

NEAF: SUD.

WAF: CMN, GHA, GUI, NGA, NGR.

ZAMB: ANG(!), BOT, MLW, ZAM.

Phenology: Unknown.

Uses: None known.

Conservation Notes: This variety is well represented in ex situ collections and does not appear threatened, so is not a conservation priority.


Reference to a published description: CPV 171; FWTA 568.

Vernacular names: None known.

Habit and lifespan: Prostrate or climber.

Flower colour: Yellow, rarely blue or reddish.

Habitat: Fallow field and bush not far from cultivation.

Associated species: As for species.

Altitude: 70–1650 m.

Distribution:

CEAF: CAF, CHA, CON, GAB, ZAI.

SAF: ZAF.

WAF: BEN, BKN, CMN, GHA, IVO, MIL, NGA, NGR, TOG(!).

ZAMB: BOT.

Phenology: August–November.
Figure 5.27. *Vigna ambacensis* Welw. ex Baker in Oliv.: 1, habit (x1); 2, details of leaf nervation, lower surface (x6); 3, stipule (x3); 4, inflorescence nectaries, details (x2.5); 5, flower, front and lateral view (x1); 6, standard, details of external surface (x3); 7, standard, (x2); 8, wing, front view (x2.5); 9, standard, details (x3); 10, keel, lateral view (x2.5); 11, diadelphous stamens, spread out (x3); 12, wing (x3); 13, style (x3); 14, stigma (x12), 15, calyx, spread out (x2.5); 16, seed, lateral and front view (x2.5).
Figure 5.28. Distribution of *V. ambacensis* based on specimen and accession passport data.

Figure 5.29. FloraMap predicted distribution for *V. ambacensis*.
**Uses:** None known.

**Conservation Notes:** This variety is well represented in *ex situ* collections and does not appear threatened, so is not a conservation priority.


**Reference to a published description:** Refer to protologue.

**Vernacular names:** None known.

**Habit and lifespan:** Annual herb.

**Flower colour:** White with pale yellow beak.

**Habitat:** Roadside and disturbed habitats.

**Associated species:** Unknown.

**Altitude:** 200–1250 m.

**Distribution:**

CEAF: BUR.

WAF: CMN, NGA.

**Phenology:** Unknown.

**Uses:** None known.

**Taxon Vulnerability Assessment:** = 5.1

**Conservation Notes:** *V. benuensis* is only relatively recently described therefore there are few historical data upon which to base a conservation assessment. However, the geographical range of the species from Cameroon to Burundi, with no species having yet been recorded from the Central African Republic or Democratic Republic of the Congo, suggests it is too early to formulate a conservation strategy. Pasquet and Maréchal (1989) suggest the species is most closely related to *V. ambacensis* var. *pubigera*, which is native to the Central African Republic or Democratic Republic of the Congo; therefore, material of the latter should be re-examined to check whether it is in fact *V. ambacensis* var. *pubigera* or should now be reidentified as *V. benuensis*. Therefore, as a priority this species needs to be systematically studied to provide sufficient data for IUCN Red List assessment and to help clarify the most appropriate conservation strategy.

**IUCN Red List Category:** Data Deficient.


**Reference to a published description:** CPV 172; FZ 129.

**Vernacular names:** None known.

**Habit and lifespan:** Prostrate perennial.

**Flower colour:** Yellow.

**Habitat:** Disturbed areas and roadsides, damp ground; sandy loam.

**Associated species:** Unknown.

**Altitude:** 21–200 m (–1348 m in Kenya).

**Distribution:**

CEAF: RWA.

EAF: KEN(!), TAN(!).
Figure 5.30. *Vigna benuensis* Pasquet and Maréchal: 1, habit (×1); 2, stipule (×3); 3, details of leaf nervation, lower surface (×6); 4, inflorescence nectaries (×2.5); 5, flower, front and lateral view (×1); 6, standard (×2); 7, standard, details (×3); 8 and 9, keel, lateral and front view (×2.5); 10, wing (×3); 11, diadelphous stamens, spread out (×3); 12, style (×3); 13, stigma (×12); 14, calyx, spread out (×2.5); 15, pods (×2); 16, seed, lateral and front view (×2.5).
Figure 5.31. Distribution of V. benuensis based on specimen and accession passport data.

Figure 5.32. FloraMap predicted distribution for V. benuensis.
WAF: CMN.
WIO: MDG.
ZAMB: MOZ.

An Asian species used as a cover crop that has been naturalized in the coastal plains of Mozambique and Tanzania (Maréchal et al., 1978), and Kenya (Pasquet, 2001).

**Phenology**: Unknown.

**Uses**: None known.

**Taxon Vulnerability Assessment**: = 6.6

**Conservation Notes**: *V. hosei* is rare, as indicated by the small number of herbarium specimens and accessions collected, but it is found across a large area of Africa, indicating that individual populations are likely to be isolated. The fact that Asian material has been introduced along the eastern seaboard of Africa complicates development of a conservation strategy. If the eastern seaboard populations are Asian introductions then should they be actively conserved? As the species is cultivated, most probably they should be actively conserved, especially as Verdcourt (1971) suggests an African origin for the species. Whatever the truth of its manner of distribution and origin, it is inadequately represented in *ex situ* collections, with only two germplasm samples from Rwanda, which cannot hope to represent the full geographic range or genetic diversity of the species. The number of collections made over time is sporadic; and since the 1960s no population has been sampled, indicating a decline.

**IUCN Red List Category**: Endangered.

**Additional notes**: Two varieties, primarily var. *hosei* occurring in Tanzania (as well as parts of Asia) and var. *pubescens* in Mozambique, Rwanda and Tanzania, are recognized in this species (Maréchal et al., 1978). Only eight records of this species occur in the database. *V. hosei* is closely related to *V. parkeri* and was originally thought to be a variant of that species (Verdcourt, 1970). However, the two species have different chromosome numbers (2n=22 in *V. parkeri*) and a similarity coefficient of 82% (Maréchal et al., 1978).

The two varieties are identified by Maréchal et al. (1978) as follows:

1. Stem and leaves glabrescent, seed aril not developed ........................................
   .................................................................................................................... *Vigna hosei* var. *hosei*

   Stem and leaves pubescent, seed aril developed ........................................
   .................................................................................................................... *Vigna hosei* var. *pubescens*

*V. hosei* is thought to be the closest relative of *V. subterranea*, although this has not been confirmed (Baudoin and Maréchal, 1991). The species has been reported to have some potential as a green manure under coconuts where it gives good growth and suppresses weed growth. Once established, it is tolerant to heavy grazing but is seriously affected by drought and fire (Skerman et al., 1988).

**Vigna hosei** var. *hosei*

**Reference to a published description**: CPV 174.

**Vernacular names**: None known.

**Habit and lifespan**: Annual or perennial, creeping herb.
Figure 5.33. Distribution of *V. hosei* based on herbarium specimen passport data.
Figure 5.34. *Vigna hosei* (Craib) Backer: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule, front view (×2.5); 4, stipule, lateral view (×2.5); 5, inflorescence nectaries (×3); 6, inflorescence (×2.5); 7, flower, front and lateral view (×1); 8, standard (×2.5); 9, standard, details (×6); 10 and 11, keel, front and lateral view (×3); 12, wing (×3); 13, diadelphous stamens, spread out (×6); 14, style (×6); 15, stigma (×12), 16, calyx, spread out (×3); 17, seed, lateral and front view (×2.5).
Flower colour: Yellow.
Habitat: Disturbed areas and roadsides.
Associated species: Unknown.
Altitude: 0–1200 m.

**Distribution:**
EAF: KEN(!), TAN(!).
ZAMB: MOZ.

**Phenology:** Unknown.

**Uses:** None known.

**Conservation Notes:** An Asian species used as a cover crop and naturalized along the eastern seaboard of Africa, it requires systematic collection and conservation.

**Vigna hosei var. pubescens** Maréchal, Mascherpa and Stainier, Taxon 27: 200 (1978).

**Reference to a published description:** CPV 174.

**Vernacular names:** None known.

**Habit and lifespan:** Annual or perennial, creeping herb.

**Flower colour:** Unknown.

**Habitat:** Unknown.

**Associated species:** Unknown.

**Altitude:** 1350 m.

**Distribution:**
CEAF: RWA.

**Phenology:** Unknown.

**Uses:** None known.

**Conservation Notes:** Although this variety has a wider distribution in Africa, its full distribution is unclear, it requires systematic collection and conservation.

**Taxonomic notes:** Pasquet (2001) suggest this variety is quite distinct from var. hosei and could deserve specific rank in its own right.

**Vigna parkeri** Baker, J. Bot. 20:69 (1882).

**Reference to a published description:** CPV 174; FE 173; FTEA 635; FZ 130; LM 581.

**Vernacular names:** None known.

**Habit and lifespan:** Annual or perennial, creeping prostrate, scrambling or climbing, herb, sometimes forming mats as it may root from nodes.

**Flower colour:** Blue turning purple blue or yellow or white.

**Habitat:** Grassland, savannah, thicket, forest, fallow and weed of cultivation, path and roadsides; predominantly on sandy loam.

**Associated species:** Acacia, Andropogon, Eragrostis, Hyparrhenia and Sporobolus.

**Altitude:** 1–3900 m.

**Distribution:**
CEAF: BUR, RWA, ZAI.
EAF: KEN, TAN, UGA.
NEAF: ETH.
WAF: CMN.
WIO: MDG(!).
ZAMB: ANG, MOZ, ZAM.

**Phenology:** Unknown.

**Uses:** *V. parkeri* has been noted to be excellent for grazing (Bogdan, 1977; Skerman *et al.*, 1988), it has been found to be very susceptible to waterlogging showing low levels of transpiration and low levels of manganese concentration in shoots as well as reduced plant weights under waterlogged conditions (Shiferaw *et al.*, 1992).

**Taxon Vulnerability Assessment:** = 4.1

**Conservation Notes:** *V. parkeri*, although widely distributed in Africa, is poorly represented in *ex situ* collections. Additional germplasm collection is required from throughout its geographic range. The trend in collection of herbarium specimens suggests that this species is not threatened in East or Northeast Africa, where its distribution is concentrated. However, collection has been sporadic in West Africa and the Zambesiaca region, probably because the species is rarer in these regions. Overall the species does not appear to be in danger of genetic erosion or extinction, but should be collected further in West Africa and the Zambesiaca region.

**IUCN Red List Category:** Least Concern.

**Taxonomic notes:** Three *V. parkeri* subspecies are recognized, subsp. *parkeri* (endemic to Madagascar), *maranguënsis* and *acutifolia*, they can be identified as follows:

1. Leaflets mostly large, elliptic or ovate, acute or acuminate at the apex ..... 2.
   Leaflets mostly small, usually round with a rounded apex; flowers predominantly blue, purple or white, with yellow forms frequent in Uganda. .......................................................... subsp. *maranguënsis*

2. Flowers predominantly purple/pink fading bluish; endemic to Madagascar . .......................................................... subsp. *parkeri*
   Flowers predominantly yellow (sometimes blue); present on mainland Africa .................................................................................................. subsp. *acutifolia*

*Vigna parkeri* subsp. *parkeri*

**Reference to a published description:** CPV 174; LM 581.

**Vernacular names:** None known.

**Habit and lifespan:** Annual, creeping, scrambling or climbing herb.

**Flower colour:** Purple pink, fading blue.

**Habitat:** Grasslands, roadsides, damp ground, in undergrowth in forests and swamp edges.

**Associated species:** Unknown.

**Altitude:** 0–1500 m.

**Distribution:**

WIO: MDG(!) (endemic to area around Ankaratra massif, including Antananarivo and Ambositra).
Figure 5.35. Distribution of *V. parkeri* based on specimen and accession passport data.

Figure 5.36. FloraMap predicted distribution for *V. parkeri*.
Phenology: January – May (–August).
Uses: None known.
Conservation Notes: Although the detailed conservation assessment in the conspectus is primarily focused at the species level, the fact that subsp. parkeri is so restricted can be taken to indicate that it deserves a high level of conservation priority. There are no ex situ conserved accessions of this subspecies. The available evidence suggests this subspecies warrants an IUCN Red List Category of Endangered.

Reference to a published description: CPV 175; FCBR 369; FE 173; FTEA 636; FWTA 568; FZ 130.
Vernacular names: Kutuikumu (BUR), Kajingo, Kafolobia, Kwakwa lokirere, Malula, Umniyaye, Toshimbo-shimbo (ZAI), Ih’r’idi, Lutumah (KEN), Umhuharokoto, Umutshasuka (RWA), Kahewa nyakake (UGA), Yundo Fundo (TAN).
Habit and lifespan: Perennial, climbing or prostrate herb.
Flower colour: Blue turning purple pink or yellow or white.
Habitat: In degraded grassland, fallow fields, grasslands, dambos, herbaceous savannahs, roadsides, montane forests, seasonal swamps, thickets etc.
Associated species: Andropogon, Eleusine, Eragrostis, Hyparrhenia, Pennisetum etc.
Altitude: 45–3857 m.
Distribution:
CEAF: BUR, RWA, ZAI.
EAF: KEN, TAN, UGA.
NEAF: ETH.
WAF: CMN.
ZAMB: ANG, ZAM.
Phenology: Flowers throughout the year in EAF, but is restricted to August–January in NEAF.
Uses: Eaten by livestock.
Conservation Notes: There are significant numbers of accessions available for this subspecies throughout its range and therefore the subspecies does not have conservation priority.
Taxonomic Notes: Pasquet (2001) comments that subsp. maranguënsis is shown by genetic diversity studies to contain two infra-subspecific taxa with some accessions from Cameroon and Central Africa being genetically very distinct, although this genetic distinction is not correlated with easily observable morphological characteristics.

Reference to a published description: FTEA 636.
Vernacular names: None known.
Habit and lifespan: Annual, creeping, scrambling or climbing, herb.

Flower colour: Predominantly yellow, blue.

Habitat: Grasslands, roadsides and bushlands.

Associated species: Unknown.

Altitude: 1–1955 m.

Distribution:
- EAF: KEN, TAN, UGA(!).
- ZAMB: MOZ, ZAM.

Phenology: January – May (–August).

Uses: None known.

Conservation Notes: There are significant numbers of accessions available for this subspecies throughout its range and therefore the subspecies does not have conservation priority.

Vigna gracilis (Guill. and Perr.) Hook.f. in Hook., Niger Fl.: 311 (1849).

Reference to a published description: CPV 175; FCBR 368; FWTA 569; FZ 131.

Vernacular names: None known.

Habit and lifespan: Slender, twining herb.

Flower colour: Pink or blue.

Habitat: Grassland and forest openings, dambo, field and forest margin, along streams, montane scrub and roadside; clay and sandy loam over granite and laterite.

Associated species: Daniellia olivieri, Euphorbia, Hyparrhenia, Loudetia and Lophira.

Altitude: 1–4059 m.

Distribution:
- CEAF: CON, GAB, GGI, RWA, ZAI.
- EAF: UGA.
- NEAF: ETH.
- WAF: BEN, CNM, GAM, GHA, GNB, GUI, IVO, LBR, MLI, NGA, NGR, SEN, SIE.
- ZAMB: ANG, MLW, MOZ, ZIM.

Phenology: Unknown.

Uses: See information for var. multiflora.

Taxon Vulnerability Assessment: = 5.9

Conservation Notes: V. gracilis is widely distributed in Africa and the species as a whole, as well as its two varieties, is well represented in ex situ collections from throughout their range, with the possible exception of West Africa and the Democratic Republic of the Congo. As indicated by the number of herbarium specimens collected, the species has a centre of diversity in West and Central Africa, while collection in East Africa and the Zambesiaca region has been more sporadic, indicating a requirement for more focused collection efforts. The trend in numbers of herbarium specimens collected over time follows the general pattern for Vigna species, which suggests that the species does not appear to be in danger of genetic erosion or extinction.

IUCN Red List Category: Least Concern.
Taxonomic notes: Two varieties of *V. gracilis* are recognized by Maréchal et al. (1978), var. *gracilis* and var. *multiflora*, they can be identified as follows:

1. Leaflets usually <50 mm, variable shape; flowers usually <10 mm; plant delicate appearance; rachis frequently elongated; seed 1.5–2.5 mm, aril present........................................................................................... var. *gracilis*

   Leaflets usually >50 mm; flowers usually >10 mm; plant robust appearance; rachis not usually elongated; seed 3.0–3.5 mm, aril absent or not well developed ................................................................. var. *multiflora*


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**Vigna gracilis** var. *gracilis*

Reference to a published description: CPV 175; FCBR 368; FWTA 569.

Vernacular names:

ZAI: Madezo manseke, Yonde wa Wokombo.

GAM: Endinga, Petego, Tireh and Jirundingo.

SIE: Burangoi, Digbingi Irsa (“Leopard’s Bean”), Kjori-Lowei and Ndogbolwek.

Habit and lifespan: Climbing perennial.

Flower colour: Mostly blue, but violet, white and lilac have also been recorded.

Habitat: Grasslands, forest edges, thickets, marshes, wastelands etc.

Associated species: *Hyparrhenia, Imperata, Themeda*.

Altitude: 1–1712 m.

Distribution:

CEAF: CAF, CON, GAB, GGI, ZAI.

EAF: UGA(!).

WAF: CMN, GAM, GHA, GNB, GUI, IVO, LBR, MLI, NGA, SEN, SIE.

ZAMB: ANG, ZAM.

Phenology: Unknown.

Uses: None known.

Conservation Notes: There are significant numbers of accessions available for this variety throughout its range and therefore it does not have conservation priority.

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Reference to a published description: CPV 176; FCBR 367; FWTA 569.

Vernacular names:

ZAI: Kantumbatumba, Tandanda, Kahukoro, Kwakwa lo lowe, Mangasi wa mai, Nzilo, Imbiri.

Habit and lifespan: Climbing perennial.

Flower colour: Blue, bluish white, rarely yellow, purple, white or mauve.

Habitat: Gallery forest and forest clearings, grasslands, herbaceous savannahs, lakesides, riverine forests, swamp and marsh edges.

Associated species: *Hyparrhenia, Imperata, Themeda*.

Altitude: 1–1768 m.

Distribution:

CEAF: CON, EQG, GAB, ZAI.
Figure 5.37. *Vigna gracilis* (Guill. and Perr.) Hook.f. in Hook.: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×3); 4, inflorescence nectaries (×3); 5, inflorescence (×1.5); 6, flower, front and lateral view (×1); 7, standard (×2); 8, standard, details (×3); 9, wing (×3); 10 and 11, keel, lateral and front view (×3); 12, diadelphous stamens, spread out (×3); 13, style (×3); 14, stigma (×12); 15, calyx, spread out (×3); 16, seed, lateral and front view (×2.5).
Figure 5.38. Distribution of *V. gracilis* based on specimen and accession passport data.

Figure 5.39. FloraMap predicted distribution for *V. gracilis*. 
Vigna racemosa (G. Don) Hutch. and Dalziel, Kew Bull.:18 (1929).

Reference to a published description: CPV 176; FCBR 370; FTEA 633; FWTA 569; FZ 131.

Vernacular names:
Catandasa (ANG), Ngase, Kafulule, Kahunde-bakishi, Kolulu/Wandu nsinga (ZAI), Harshen damo, Kafan gouraka, Mamangieva, Okokonu, adiya hankaka, Yaryyadin gono, (NGA), Urubebia (RWA), Litina (SIE), Dove beans/“beans not eaten”—(GAM).

Habit and lifespan: Climbing perennial.

Flower colour: Blue, bluish white, rarely yellow, purple, white or mauve.

Habitat: Fallows, disturbed areas, gallery forests, grasslands, hill miombos, roadsides, marshy savannas, tree savannas, often associated with occasional waterlogging; sandy loam over quartzite.

Associated species: Andropogon, Hyparrhenia, Imperata, Isoberlinia, Loudetia, Pennisetum, and Uapaca.

Altitude: 0–2500 m.

Distribution:
CEAF: BUR, CAF, CHA, CON, GAB, GGI, RWA, ZAI.
EAF: KEN, TAN, UGA.
NEAF: SUD.
SAF: ZAF.
WAF: BEN, BKN, CMN, GAM, GHA, GNB, GUI, IVO, LBR, MLI, NGA, NGR, SEN, SIE, TOG.
ZAMB: ANG, MLW, ZAM.

Phenology:
September–December and February–July (CEAF).
September–December (mostly)—WAF.
March–May (ZAMB).

Uses: Used as poultice for testicles (ANG). In NGA, the leaves are mashed up and taken as a drink for catarrh (Burkill, 1995).

Taxon Vulnerability Assessment: = 3.3

Conservation Notes: V. racemosa is widely distributed in Africa and the species is reasonably well represented in ex situ collections from throughout its range, with the possible exception of the Democratic Republic of the Congo and West Africa, particularly Guinea, Guinea Bissau, Liberia and Sierra Leone, where further collection is required. The trend in numbers of herbarium specimens
collected over time follows the pattern for all Vigna species, which suggests the species does not appear to be in danger of genetic erosion or extinction.

**IUCN Red List Category:** Least Concern.


**Reference to a published description:** CPV 176; FCBR 366; FTEA 634; FWTA 569.

**Vernacular names:**
Ilenabulere (NGA).

**Habit and lifespan:** Perennial, climber.

**Flower colour:** Pink, blue, violet or white.

**Habitat:** Primary and secondary forest, riverine valley forest.

**Associated species:** Unknown.

**Altitude:** 48–1200 m.

**Distribution:**
CEAF: CAF, ZAI.
EAF: UGA.
WAF: CMN, NGA, SIE.

**Phenology:** September–January (CEAF).

**Uses:** None known.

**Taxon Vulnerability Assessment:** = 5.1

**Conservation Notes:** *V. desmodioides* has a relatively wide but disjunct distribution. The species is not represented in *ex situ* collections, therefore is of conservation priority, with further collection required. The trend in numbers of herbarium specimens collected over time indicates that only four specimens have been collected since the 1930s, which suggests the species is in decline and is in danger of genetic erosion and extinction.

**IUCN Red List Category:** Endangered.

**Additional notes:** This species closely resembles *V. racemosa*. Distinguishing features include shorter and broader stipules; long, prominent bracts and large, multilobed rhachis glands which are lacking in *V. racemosa*. The fact that so few specimens have been collected in recent years would tend to indicate species decline, as concluded above, but there is another interpretation, possibly the species has been confused in recent years with *V. racemosa*. Therefore, there is a need to clarify the taxonomic relationship between *V. desmodioides* and *V. racemosa* as a matter of urgency as it may impact on the conservation strategy.


**Reference to a published description:** CPV 177; FCBR 343; FE 173; FTEA 666, illust. 667; FWTA 572; FZ 124; LM 583.

**Vernacular names:** None known.

**Habit and lifespan:** Annual herb with short creeping stem.

**Flower colour:** Yellow.

**Habitat:** Cultivated.
Figure 5.40. *Vigna racemosa* (G.Don) Hutch. and Dalziel: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×2.5); 4, flower, front and lateral view (×1); 5, standard (×3); 6, standard, details (×6); 7 and 8, keel, lateral and front view (×2.5); 9, calyx, spread out (×3); 10, wing (×2.5); 11, diadelphous stamens, spread out (×3); 12, style (×3); 13, stigma (×12), 14, inflorescence nectaries (×2.5); 15, seed, lateral and front view (×2.5).
Figure 5.41. Distribution of *V. racemosa* based on specimen and accession passport data.

Figure 5.42. FloraMap predicted distribution for *V. racemosa*.
Figure 5.43. Distribution of *V. desmodioides* based on herbarium specimen passport data.

Figure 5.44. FloraMap predicted distribution for *V. desmodioides*.
**Associated species:** *Andropogon, Boswellia dalzielii, Combretum, Isoberlinia* and *Indigofera*.

**Altitude:** 10–1650 m, though dependent on cultivation for var. *subterranea*.

**Distribution:**
- CEAF: CAF(!), CHA(!), CON(!).
- EAF: KEN(!), TAN(!).
- NEAF: ETH(!), SUD(!).
- SAF: SWZ(!), ZAF(!).
- WAF: BEN(!), BKN, CMN, GAM(!), GHA(!), IVO(!), MLI(!), NGA, NGR(!), SEN(!), SIE(!), TOG(!).
- WIO: MDG(!).
- ZAMB: ANG, BOT(!), MOZ, ZAM(!), ZIM(!).

**Phenology:** Dependent on cultivation.

**Uses:** Locally grown for edible seeds, native to West Africa but now cultivated throughout the tropics.

**Taxon Vulnerability Assessment:** 6.8

**Conservation Notes:** *V. subterranea* has a distribution that spans continental Africa and Madagascar, although possibly the distribution has been extended by its wide cultivation. However, it is surprising that for a major human food species so few *ex situ* accessions have been conserved, and particularly that there are no *ex situ* accessions of *V. subterranea* var. *spontanea*, the wild progenitor of Bambara groundnut. The systematic collection of both *V. subterranea* var. *subterranea* and *V. subterranea* var. *spontanea* needs to be given the highest priority. There is, however, no evidence to suggest that the species as a whole is in danger of genetic erosion or extinction.

**IUCN Red List Category:** Least Concern.

**Taxonomic notes:** Originally described by Linnaeus (1763) as *Glycine subterranea* and subsequently transferred to the monospecific genus *Voandzeia* by DeCandolle (1825). The similarity between *Voandzeia subterranea* and *Vigna* subgenus *Plectotropis* was noted by Maréchal et al. (1978), but it was Verdcourt (1980) who transferred the species to *Vigna*. Two varieties are recognized within this species, *V. subterranea* var. *subterranea* and *V. subterranea* var. *spontanea*, the latter was originally described by Harms (1912) and formally transferred to *Vigna* by Pasquet (2001). The latter is distinguished from the cultivated form by its more diffuse growth habit and smaller seeds and is known only from northern NGA, CMN and doubtfully from CAF (Verdcourt, 1971).

1. Plant cultivated; stem erect; leaves borne at short intervals along stem and tightly clustered together; pods tightly clustered together beneath compact plant; found throughout Africa ........................................ var. *subterranea*

   Plant wild; distinctly spreading in appearance with prostrate stems, reaching 2 m; bearing leaves at wide intervals; pods are found over an equally wide area, usually one beneath each stem node; apparently endemic to northwestern Cameroon and northeastern Nigeria....................var. *spontanea*
Vigna subterranea var. subterranea

Reference to a published description: CPV 177; FTEA 668; FWTA 572; FZ 124; LM 583.

Vernacular names:
BOT: “ditloo”.
KEN: “njugo mawe”—Swahili; “bande” (Luo); “tsimbande”, chimbande or simbade (Luhya); “nzugu mawe” (Giriama); tandegwa (Kambe) (Ngugi, 1995).
MDG: Voanjabory, Voanjobory.
SWZ: Tindlubu.

Habit and lifespan: Perennial, herb with short creeping stem.

Flower colour: Yellow.

Habitat: Cultivated, usually on sandy soils.

Associated species: Unknown.

Altitude: 10–1650 m.

Distribution:
CEAF: CAF(!), CHA(!), CON(!).
EAF: KEN(!), TAN(!).
NEAF: ETH(!), SUD(!).
SAF: SWZ(!), ZAF(!).
WAF: BEN(!), BKN, CMN(!), GAM(!), GHA(!), IVO(!), MLI(!), NGA, NGR(!), SEN(!), SIE(!), TOG(!).
WIO: MDG(!).
ZAMB: ANG, BOT(!), MOZ, ZAM(!), ZIM(!).

Bambara groundnut is also grown in Madagascar. Outside Africa, it has been reported to be cultivated in Thailand (Benjakul et al., 2000).

Phenology: Unknown.

Uses: This is the cultivated form of the species. It was discovered by Du Petit-Thouars (1806) in Madagascar, where it was commonly known as “Voanjo”, who then named the species Voandzeia (Goli, 1995). Commonly called Bambara groundnut (derived from the Bambara ethnic group of Mali), V. subterranea is widely cultivated as a pulse crop, mainly for subsistence in many parts of Africa. Bambara groundnut may be prepared in various ways and used as a snack or main meal. The most common method of preparation for use as a snack is to boil the immature seeds with salt in the pod as reportedly done in BOT (Karikari et al., 1995) KEN (Ngugi, 1995), NGA (Tanimu and Aliyu, 1997), ZAF (Swanevelder, 1995). The mature, dry seeds may be ground into flour and used to make cakes or mixed with cereals to make porridge (Karikari et al., 1995). Along with its use as a pulse, the leaves are used as fodder in BKN (Drabo et al., 1995).

Conservation Notes: There are significant numbers of accessions available from Nigeria and Burkina Faso, but there is an urgent need to collect the variety from the remainder of its distributional range; as an important cultivated species this action should have the highest priority.

Additional notes: Begemann (1995) reports that hybridization may be possible between this species and V. unguiculata. However, more experiments are needed to verify this.

Reference to a published description: CPV 178; FZ 125.

Vernacular names: None known.

Habit and lifespan: Perennial, herb with short creeping stem.

Flower colour: Yellow.

Habitat: Unknown.

Associated species: Unknown.

Altitude: 250–1200 m.

Distribution:
- CEAF: CAF(!).
- WAF: CMN, NGA.

Phenology: Unknown.

Uses: None known.

Conservation Notes: As discussed above, there are no accessions of var. *spontanea* conserved *ex situ*; as this is the wild progenitor of var. *subterranea* the situation must be rectified urgently. The variety is also primarily restricted to a limited area of northern Cameroon and Nigeria, which indicates that it deserves a high level of conservation priority. The geographic restriction indicates an IUCN Red List Category of Endangered is appropriate.

Taxonomic notes: This taxon has been suggested as the wild progenitor of *V. subterranea*, and recent isozyme analysis has provided some evidence (Pasquet *et al*., 1999).

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Reference to a published description: CPV 178; LM 573, illust. 575.

Vernacular names:

Habit and lifespan: Perennial, climbing or creeping herb.

Flower colour: Purple pink fading to bluish purple or violet.

Habitat: Grassland, open woodland and disturbed areas, forest and forest margins, also along roadsides, resistant to grazing and tires, prefers laterite and basaltic rock.

Associated species: *Eucalyptus* and Ericaceous shrubs.

Altitude: 30–2180 m.

Distribution:
- CEAF: BUR.
- WIO: MDG (widespread in and endemic to the uplands of Central Madagascar).

Phenology: (September–) November to April (–June).

Uses: The swollen roots, pods and seeds are edible; a good animal fodder.

Taxon Vulnerability Assessment: = 5.3

Conservation Notes: *V. angivensis* is a common species of the central plateaux of Madagascar that shows high phenotypic variation associated with different habitat conditions. However, it is not represented in *ex situ* collections, and further collection is required. The trend in numbers of herbarium specimens collected over time follows the pattern for all *Vigna* species, which suggests the species does not appear to be in danger of genetic erosion or extinction.
Figure 5.45. Distribution of *V. subterranea* based on specimen and accession passport data.

Figure 5.46. FloraMap predicted distribution for *V. subterranea*.
IUCN Red List Category: Least Concern.

Taxonomic notes: A common species distinguished from the other native species with mauve flowers, *V. parkeri* and *V. microsperma* by its usually solitary and relatively larger flowers, and from *V. keraudrenii* by the distinctly medifixed stipules of the latter. *V. angivensis* is very variable in its vegetative morphology. The habit varies from a delicate, prostrate herb to more robust and climbing. The leaves are unifoliolate or 3-foliolate; some plants have only unifoliolate leaves, and others have the basal leaves unifoliolate and those higher up trifoliolate, but the majority of plants have all the leaves trifoliolate. The leaflets are also very polymorphic in size and shape; those of the upper leaves are often much narrower. This phenotypic variation appears to be in response to the habitat and amount of shade in which the plant is growing rather than corresponding to different infraspecific taxa (Du Puy et al., 2002).

Reference to a published description: CPV 178; FWTA 568.
Vernacular names: None known.
Habit and lifespan: A perennial creeping or climbing herb with a fibrous rootstock.
Flower colour: Bluish purple.
Habitat: Moist areas, scrub, bush and grasslands.
Associated species: Unknown.
Altitude: 1–1000 m.
Distribution:
WAF: BEN, BKN, CMN, GAM, GHA, GUI, IVO(!), MLI, SEN, SIE, TOG(!).
ZAMB: MOZ (a doubtful record).
Phenology: Unknown.
Uses: The tubers are reported to be edible (Padulosi and Ng, 1990).
Taxon Vulnerability Assessment: = 6.3

Conservation Notes: *V. stenophylla* is a West African species that is not well known and is not represented by *ex situ* collections, therefore the collection of accessions should be treated as the highest priority. There is a need to collect systematically throughout its geographic range. Herbarium specimens of the species were collected consistently until the 1940s, since when only three specimens have been collected, which tends to indicate the species is in serious decline.

IUCN Red List Category: Critically Endangered.

Reference to a published description: CPV 179; FZ 131; LM 576.
Vernacular names: None known.
Habit and lifespan: Annual or perhaps perennial, climbing herb.
Flower colour: Blue, mauve or purple, rarely yellow or white.
Habitat: Disturbed or open forests, forest edges, montane grassland or scrub, roadsides and river or stream banks.
Figure 5.47. Distribution of *V. angivenis* based on specimen and accession passport data.

Figure 5.48. FloraMap predicted distribution for *V. angivenis*.
Figure 5.49. Distribution of *V. stenophylla* based on herbarium specimen passport data.

Figure 5.50. FloraMap predicted distribution for *V. stenophylla*. 
Figure 5.51. *Vigna gazensis* Baker f. 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×3); 4, calyx bracts (×3); 5, flower, front and lateral view (×1); 6, standard (×2); 7, standard, details (×3); 8 and 9, keel, front and lateral view (×2.5); 10, wing (×2.5); 11, diadelphous stamens, spread out (×3); 12, style (×3); 13, stigma (×12); 14, calyx, spread out (×3); 15, seed, lateral and front view (×2.5).
Figure 5.52. Distribution of *V. gazensis* based on specimen and accession passport data.

Figure 5.53. FloraMap predicted distribution for *V. gazensis*. 
**Associated species:** *Brachystegia, Podocarpus, Rhynchosia, Strelitzia* and *Uapaca.* 
**Altitude:** 50–2800 m. 
**Distribution:**
- WIO: MDG.
- ZAMB: ANG(!), MLW, MOZ, ZAM, ZIM.
**Phenology:** August to September.
**Uses:** None known.
**Taxon Vulnerability Assessment:** = 4.0
**Conservation Notes:** *V. gazensis* is found widely in Southeast Africa and Madagascar but only has a single *ex situ* collection from Zambia; thus, further systematic collection is required. The trend in numbers of herbarium specimens collected over time follows the pattern for all *Vigna* species, which suggests the species does not appear to be in danger of genetic erosion or extinction. **IUCN Red List Category:** Least Concern.

**Section Comosae** Maréchal, Mascherpa and Stainier, Taxon 27: 200 (1978).


**Reference to a published description:** CPV 180; FTEA 630; FZ 132.

**Vernacular names:**
- ZAI: Bangassu, Kilulu, Yonde.

**Habit and lifespan:** Perennial, prostrate or climbing, herb.

**Flower colour:** Yellow or mauve-yellow.

**Habitat:** Rocky places, hillsides, savannah, primary and secondary woodlands, grasslands, roadsides, lake shore, fallows and seasonally inundated areas; sandy soils.

**Associated species:** *Brachystegia, Combretum, Entada, Eragrostis, Erythrina, Hyparrhenia, Protea* and *Loudetia.*

**Altitude:** 1–2200 m.

**Distribution:**
- CEAF: BUR, CAF, CON, GAB, GGI, RWA, ZAI.
- EAF: KEN, UGA.
- NEAF: SUD.
- SAF: ZAF.
- WAF: CMN, GUI, LBR, NGA, SEN, SIE.
- ZAMB: ANG, MLW, MOZ, ZAM.
**Phenology:** Unknown.
**Uses:** None known.
**Taxon Vulnerability Assessment:** = 3.9
**Conservation Notes:** *V. comosa* is widely distributed in Africa; however, the species, the two subspecies and two varieties are poorly represented in *ex situ* collections. There is a need for further collections from throughout their range, but particularly from Angola, Democratic Republic of the Congo, Cameroon, Liberia and Sierra Leone. The trend in numbers of herbarium specimens collected over time follows the general pattern for *Vigna* species, which suggests the species does not appear to be in danger of genetic erosion or extinction. However, it...
should be noted that, as will be seen below, this assessment does not hold true for subsp. abercornensis and var. lebrunii.

**IUCN Red List Category:** Least Concern.

**Taxonomic notes:** Two subspecies, namely *V. comosa* subsp. *comosa*, with varieties *comosa* and *lebrunii*, and subsp. *abercornensis*, can be distinguished as follows:

1. Leaflet triangular or tri-lobed; standard (5-)8–10(-14)×10–14 mm; pod 10–25 mm.
   
   ...................................................................... *V. comosa* subsp. *comosa* 2
   
   Leaflet elliptic or oblong; standard 13×18 mm; pod approx. 40 mm.


2. Stem graceful; leaflet hastate, up to 35×20 mm; standard ± 10 mm long.
   
   .............................................................................................................. var. *comosa*
   
   Stem robust; leaflet usually oblong or rhombic, larger; standard larger.


**Vigna comosa** subsp. **comosa** var. **comosa**

**Reference to a published description:** CPV 180; FTEA 630; FZ 132.

**Vernacular names:**

ZAI: Bangassu, Kilulu, Yonde.

**Habit and lifespan:** Prostrate, climbing or twining perennial, occasionally annual.

**Flower colour:** Mainly yellow, but orange, mauve and purple have also been reported.

**Habitat:** Rocky places (laterite rock in dry dambos), hillsides, woodlands, grasslands, roadsides, fallows and seasonally inundated areas.

**Associated species:** As for species.

**Altitude:** 1–1750 m.

**Distribution:**

CEAF: BUR(!), CAF(!), CON(!), GAB, GGI(!), RWA(!), ZAI(!).

EAF: KEN, UGA.

NEAF: SUD(!).

SAF: ZAF.

WAF: CMN(!), GUI, LBR(!), NGA(!), SIE(!).

ZAMB: ANG, MLW, MOZ, ZAM.

**Phenology:** Mainly November in NEAF and mostly April–June in CEAF and ZAMB.

**Uses:** None known.

**Conservation Notes:** This variety in comparison with the other subspecific taxa is well represented in ex situ collections from throughout its range; therefore further collection is not a priority.


**Reference to a published description:** CPV 180.

**Vernacular names:**

ZAI: Bangassu, Kilulu, Yonde.
Figure 5.54. Distribution of *V. comosa* based on specimen and accession passport data.

Figure 5.55. FloraMap predicted distribution for *V. comosa*. 
Habit and lifespan: Perennial, prostrate or climbing, herb.
Flower colour: Yellow or mauve-yellow.
Habitat: Insufficiently known (only a single record seen).
Associated species: As for species.
Altitude: 380–400 m.
Distribution: CEAF: GAB, ZAI(!).
Phenology: Unknown.
Uses: None known.

Conservation Notes: *V. comosa* subsp. *comosa* var. *lebrunii* has a very restricted distribution within Gabon (it is also reported from the Democratic Republic of the Congo), which indicates that it deserves a high level of conservation priority; the geographic restriction indicates an IUCN Red List Category of Endangered is appropriate.

Reference to a published description: CPV 180; FZ 132.
Vernacular names: ZAM: Kalalalonde.
Habit and lifespan: Perennial, prostrate or climbing, herb.
Flower colour: Yellow to yellow-green.
Habitat: Roadsides, rocky hillsides, secondary woodlands, bushlands.
Associated species: As for species.
Altitude: 1200–1700 m.
Distribution: ZAMB: ZAM (endemic to northeast of the country).
Phenology: April–July
Uses: None known.

Conservation Notes: *V. comosa* subsp. *abercornensis* has a very restricted distribution within Zambia, it deserves a high level of conservation priority; the geographic restriction indicates an IUCN Red List Category of Vulnerable is appropriate (see Bingham and Smith, 2002).

Reference to a published description: CPV 181; FCBR 350, illust. 351; FTEA 631; FZ 132.
Vernacular names: None known.
Habit and lifespan: Erect subshrub.
Flower colour: Yellow outside, brown yellow inside.
Habitat: Rocky hillside, dry sandy soil, granite kopje, rock face, miombo woodland.
Associated species: Unknown.
Altitude: 450–1650 m.
Distribution: CEAF: ZAI.
EAF: TAN.
ZAMB: ZAM.

**Phenology:** May–July.

**Uses:** None known.

**Taxon Vulnerability Assessment:** 6.6

**Conservation Notes:** *V. haumaniana* is restricted to Central-east Africa, where it is locally rare. As there are no *ex situ* collections for the species or the two varieties, there is a need for urgent germplasm collection in the Democratic Republic of the Congo, Tanzania and Zambia. The trend in numbers of herbarium specimens collected over time follows the general pattern for *Vigna* species, but the numbers of populations sampled is so low that there must be concern that the species is vulnerable to genetic erosion and extinction.

**IUCN Red List Category:** Endangered.

**Taxonomic notes:** Very closely related to *V. comosa*. This species contains two varieties namely var. *haumaniana* and var. *pedunculata*, distinguished as follows:

1. Peduncles ±2 mm; stems and leaves velvety pubescent.....var. *haumaniana*

   Peduncles 6–25 mm; stems and leaves scarcely pubescent............................var. *pedunculata*

**Vigna haumaniana** var. *haumaniana*

**Reference to a published description:** CPV 181; FTEA 631.

**Vernacular names:** None known.

**Habit and lifespan:** Erect subshrub.

**Flower colour:** Yellow outside, brown yellow inside.

**Habitat:** Rocky hillsides, rough grasslands, herbaceous plateaus, woodlands. It has also been recorded on granite koppies.

**Associated species:** Unknown.

**Altitude:** 450–1560 m.

**Distribution:**

CEAF: ZAI.

EAF: TAN.

ZAMB: ZAM.

**Phenology:** May–July.

**Uses:** None known.

**Conservation Notes:** *V. haumaniana* var. *haumaniana* has a restricted distribution to Central-east Africa, which indicates that it deserves a high level of conservation priority; the geographic restriction indicates an IUCN Red List Category of Endangered is appropriate.

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**Reference to a published description:** CPV 181.

**Vernacular names:** None known.
Figure 5.56. Distribution of *V. haumaniana* based on herbarium specimen passport data.

Figure 5.57. FloraMap predicted distribution for *V. haumaniana*. 
Figure 5.58. *Vigna haumaniana* R.Wilczek: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, leaflet nervation, details (×2); 4, stipule (×3); 5, inflorescence nectaries (×3); 6, flower, front and lateral view (×1); 7, standard (×2.5); 8, keel, lateral and front view (×3); 9, diadelphous stamens, spread out (×3); 10, standard, details (×3); 11, wing (×3); 12, style (×3); 13, calyx, spread out (×3); 14, stigma (×12).
Habit and lifespan: Erect subshrub.

Flower colour: Yellow.

Habitat: Grassland or open woodland.

Associated species: Unknown.

Altitude: 600–620 m.

Distribution:
CEAF: ZAI.
ZAMB: ZAM.

Phenology: February to September (CEAF).

Uses: None known.

Conservation Notes: *V. haumaniana* var. *pedunculata* has a very restricted distribution within southern Democratic Republic of the Congo and northern Zambia, which indicates that it deserves a high level of conservation priority; the geographic restriction indicates an IUCN Red List Category of Critically Endangered is appropriate.


Reference to a published description: CPV 182; FCBR 385; FE 173; FS 434; FTEA 638.

Vernacular names: None known.

Habit and lifespan: Annual or perennial, climbing or trailing herb.

Flower colour: Mauve, pink-magenta or blue.

Habitat: Grassland, fallow, coastal woodland, open bushland, dry evergreen forest, roadside; gneiss or limestone; clay and sandy loams.

Associated species: *Acacia, Adansonia, Combretum, Commiphora, Euphorbia, Ficus, Juniperus*, and *Tephrosia*.

Altitude: 1–4280 m.

Distribution:
CEAF: BUR, RWA(!), ZAI.
EAF: KEN, TAN, UGA.
NEAF: ERI, ETH, SOM, SUD.
WAF: GHA, NGA.

Phenology: April–November (CEAF); September–February (NEAF); November–January and April–September (EAF).

Uses: None known.

Taxon Vulnerability Assessment: = 3.1

Conservation Notes: *V. membranacea* is widely distributed in Africa. As a whole the species is well represented in ex situ collections, however, subsp. *macrodon* has no ex situ germplasm accessions. Overgrazing and genetic erosion are noted on some herbarium specimens from Kenya and Tanzania indicating populations from East Africa are vulnerable and require further collection. However, the overall trend in numbers of herbarium specimens collected over time follows the general pattern for all *Vigna* species.
IUCN Red List Category: Vulnerable.

Taxonomic notes: This species is highly variable, with four subspecies, namely subsp. *membranacea*, *macrodon*, *caesia* and *hapalantha*, being recognized (Verdcourt, 1971).

1. Calyx teeth longer than the tube; usually growing above 1000 m ................. 2
   Calyx teeth usually shorter than tube, if longer then plants of the coastal area or lowland dry deciduous bushland ................................................................. 3
2. Calyx lobes (4-)5–9 mm long; standard mostly 1–1.5 cm.................................
   ...................................................................................... subsp. *membranacea*
   Calyx lobes 8–17 mm long; standard 1.5–2.5 cm................subsp. *macrodon*
3. Standard 20–23 mm long and wide...........................................subsp. *caesia*
   Standard 12–13(–16) mm long and wide ......................... subsp. *hapalantha*

Additional notes: *V. membranacea* is listed as a summer weed in farmlands of Egypt (El Hadidi *et al*., 1996), however, no herbarium specimens of this species of Egyptian origin were located. The species is notable for its disjunct distribution and provides a good example of undercollecting in Central Africa.

**Vigna membranacea** subsp. *membranacea*

Reference to a published description: CPV 182; FE 174; FTEA 639.

Vernacular names:
ZAI: Muraramba, Mushibanyuma, Kikuluwe/Kindandi, Igishimboeha or Kiaraome.
ETH: Turina and Oldakaka.
UGA: Bukalasa.

Habit and lifespan: Usually annual.

Flower colour: Mauve, pink-magenta or blue.

Habitat: Open, grassy slopes and roadsides, rice paddies, fallow fields, secondary thickets, stunted woodlands, upland rainforests.

Associated species: *Acacia, Albizia, Euphorbia, Ficus*.

Altitude: 90–2800 m.

Distribution:
CEAF: BUR, RWA(!), ZAI.
EAF: KEN, TAN, UGA(!).
NEAF: ERI, ETH, SUD.
WAF: NGA.

Phenology: Mostly September to December.

Uses: None known.

Conservation Notes: This subspecies in comparison with the other subspecies is well represented in *ex situ* collections, but further collecting to ensure it is sampled from throughout its range is required.


Reference to a published description: CPV 183; FE 174; FS 435; FTEA 639.

Vernacular names:
SOM: Bidawi, Dimbulgar.
Figure 5.59. Distribution of *V. membranacea* based on specimen and accession passport data.

Figure 5.60. FloraMap predicted distribution for *V. membranacea*. 
**Habit and lifespan:** Annual or perennial, climbing or trailing herb.

**Flower colour:** Mauve, pink-magenta or blue.

**Habitat:** Open, grassy places, thorn woodlands, open woodlands and dry bushlands.

**Associated species:** *Acacia, Commiphora, Diospyros, Terminalia.*

**Altitude:** 12–2800 m.

**Distribution:**
- EAF: KEN, TAN(!).
- NEAF: ETH, SOM, SUD.

**Phenology:** Unknown.

**Uses:** None known.

**Conservation Notes:** This subspecies represented in *ex situ* collections solely by Kenya material and therefore further collecting to ensure it is sampled from throughout its range is required.

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**Reference to a published description:** CPV 183; FS 435; FTEA 640.

**Vernacular names:**
- KEN: Kikunde-mbala, Kikunde-wazimu, Mkunde-MLWtu.
- HABITAT: Coastal grassland, deciduous or semi-evergreen bushland and thicket.

**Associated species:** Unknown.

**Altitude:** 1–1200 m.

**Distribution:**
- EAF: KEN.
- NEAF: SOM.
- WAF: GHA.

**Phenology:** November–January and April–September.

**Uses:** None known.

**Conservation Notes:** This subspecies in comparison with the other subspecies is well represented in *ex situ* collections from throughout its range so further collection is not a priority.

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**Reference to a published description:** CPV 182; FCBR 384; FTEA 640.

**Vernacular names:**
- TAN: Kimbamba.

**Habit and lifespan:** Annual or perennial, climbing or trailing herb.

**Flower colour:** Mauve, pink-magenta or blue.

**Habitat:** Evergreen forest and derived scrub.

**Associated species:** Unknown.

**Altitude:** 450–2260 m.
Distribution:
CEAF: BUR, ZAI.
EAF: KEN, TAN(!), UGA(!).

Phenology:
Uses: None known.

Conservation Notes: V. membranacea subsp. macrodon is poorly sampled from throughout its range and further collecting from throughout its range is required.

Reference to a published description: CPV 183; FE 174; FTEA 641.

Vernacular names: None known.

Habit and lifespan: Prostrate or erect perennial herb, usually with an elongated tuber which may be fleshy or woody.

Flower colour: Pale creamy-yellow, green with or without mauve basal stripes or entirely mauve.

Habitat: Grassland, savannah, open woodland, deciduous thicket, roadside, weed of cultivation; clay over basaltic rocks.

Associated species: Albizia, Combretum, Dadonea, Hyparrhenia, Juniperus, Stachys and Themeda.

Altitude: 140–3900 m.

Distribution:
CEAF RWA ZAI.
EAF: KEN, TAN, UGA.
NEAF: ETH.
SAF: ZAF.

Phenology: Throughout year.

Uses: See var. \textit{angustifolia}.

Taxon Vulnerability Assessment: = 6.7

Conservation Notes: \textit{V. friesiorum} is widely distributed in Central and East Africa, however, there is insufficient representation in \textit{ex situ} collections of the species as a whole and of the three varieties. There is a need for further collections from throughout their range, but particularly from Ethiopia and the Democratic Republic of the Congo. The trend in numbers of herbarium specimens collected over time follows the general pattern for \textit{Vigna} species, which suggests the species does not appear to be in danger of genetic erosion or extinction.

IUCN Red List Category: Least Concern.

Taxonomic notes: Three varieties, which can be distinguished on the basis of leaflet shape and habit, are recognized (Verdcourt, 1971).

1. Leaflets linear-lanceolate, up to 70 mm long; stems erect or procumbent ................................................................. var. \textit{angustifolia}
   Leaflets rounded to oblong ............................................................................................................................... 2

2. Leaflets round to oblong, up to 25 mm long; stems procumbent; pods minutely pubescent to yellowish pubescent ......................... var. \textit{friesiorum}
   Leaflets round to elliptic-oblong, 10–40 mm long; stems mostly erect; pods minutely pubescent ......................................................................................... var. \textit{ulugurensis}
Vigna friesiorum var. friesiorum
Reference to a published description: CPV 183; FTEA 641.
Vernacular names: None known.
Habit and lifespan: Prostrate or erect perennial, usually with an elongated tuber which may be fleshy or woody.
Flower colour: Pink, purple or mauve.
Habitat: Open glades and thickets, cultivated fields, grasslands.
Associated species: Crotalaria, Stachys, Trifolium.
Altitude: 1210–2150 m.
Distribution: EAF: KEN, TAN(!).
Phenology: Unknown.
Uses: None known.
Conservation Notes: This variety is inadequately represented in *ex situ* collections and further collection from throughout its range is a priority.

Reference to a published description: CPV 184; FTEA 641.
Vernacular names:
UGA: Maruet.
Habit and lifespan: Prostrate or erect perennial, usually with an elongated tuber which may be fleshy or woody.
Flower colour: Green, yellowish or purple to red.
Habitat: Grassland; dry thorn bushland; open, stony ground.
Associated species: Albizia, Combretum, Dadonea, Juniper, Pennisetum, Themeda.
Altitude: 190–2000 m (with two records occurring at less than 500 m).
Distribution: EAF: KEN, TAN, UGA.
Phenology: Unknown.
Uses: The plant has a swollen root which is eaten in UGA. A note on a specimen reads “like a stringy turnip”.
Conservation Notes: This variety is inadequately represented in *ex situ* collections and further collection from throughout its range is a priority.

Reference to a published description: CPV 184; FCBR 375; FE 174; FTEA 642.
Vernacular names: None known.
Habit and lifespan: Prostrate or erect perennial, usually with an elongated tuber which may be fleshy or woody.
Flower colour: Green, yellowish or purple to red.
Habitat: Grasslands, savannahs, rocky ground in deciduous thicket.
Figure 5.61. *Vigna friesiorum* Harms: 1., habit (x1); 2, root (x1); 3, details of leaf nervation, lower surface (x6); 4, stipule (x3); 5, inflorescence nectaries (x3); 6, flower, front and lateral view (x1); 7, inflorescence (x1.5); 8, standard (x2); 9, standard, details (x3); 10 and 11, keel, front and lateral view (x3); 12, diadelphous stamens, spread out (x3); 13, calyx, spread out (x3); 14, style (x3); 15, stigma (x12); 16, seed, lateral and front view (x2.5).
Figure 5.62. Distribution of *V. friesiorum* based on specimen and accession passport data.

Figure 5.63. FloraMap predicted distribution for *V. friesiorum*. 
**Associated species**: Albizia, Combretum, Hyparrhenia, Diospyros.
**Altitude**: 140–3900 m (with only three records from below 1000 m).
**Distribution**:
CEAF RWA ZAI.
EAF: KEN, TAN, UGA.
NEAF: ETH(!).
**Phenology**: October–February (CEAF); variable (EAF).
**Uses**: None known.
**Conservation Notes**: This variety is the most widely distributed and yet it is not represented in *ex situ* collections; therefore further collection from throughout its range is a priority.

**Reference to a published description**: FS 435.
**Vernacular names**: None known.
**Habit and lifespan**: Annual, trailing herb.
**Flower colour**: Unknown.
**Habitat**: Unknown.
**Associated species**: Unknown.
**Altitude**: 900–1000.
**Distribution**:
NEAF: SOM.
**Phenology**: Unknown.
**Uses**: None known.
**Taxon Vulnerability Assessment**: 7.0

**Conservation Notes**: *V. somaliensis* is a Somali endemic and probably, along with the other Somali endemics *V. monantha* and *V. virescens*, is the most highly threatened African *Vigna* taxon. There is only one herbarium specimens available and no *ex situ* collections. The species appears to be in terminal decline. Clarification of whether the species is still extant is required as no populations of the species where seen after 1900. There is a need for a critical review of this species and a search for extant populations should be given the highest priority.

**IUCN Red List Category**: Critically Endangered.

**Taxonomic Notes**: Thulin (1993) comments that no material matching the type has been seen, but the specimens collected by Drake-Brockman 1149 and 1150 (K) from the Golis Range represent a closely related species. They differ from *V. somaliensis* in being relatively short (c. 10 cm high) and erect with a c. 7 mm long calyx with spreading hairs and narrowly triangular lobes up to 4 mm long. The corolla of the plants from the Golis Range is only 1.2—1.3 cm long.

**Reference to a published description**: CPV 184; FCBR 382; FE 176; FTEA 650;
Figure 5.64. Distribution of *V. somaliensis* based on herbarium specimen passport data.
Figure 5.65. *Vigna reticulata* Hook. F. Hook.: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×2.5); 4, inflorescence nectaries (×2.5); 5, flower, front and lateral view (×1); 6, standard (×2); 7, standard, details (×3); 8 and 9, keel, lateral and front view (×2.5); 10, wing (×2.5); 11, style (×3); 12, stigma (×12); 13, diadelphous stamens, spread out (×3); 14, calyx, spread out (×2.5); 15, seed, lateral and front view (×2.5).
Figure 5.66. Distribution of *V. reticulata* based on specimen and accession passport data.

Figure 5.67. FloraMap predicted distribution for *V. reticulata*. 
FWTA 568; FZ 133; LM 582.

**Vernacular names:**
CAF: Guadjja, Ay jod/Kani.
KEN: Kunde-mbala, Kikunde-wazimu, Ih’ridi.
MDG: Kadakliky.
TAN: Nakalandala.
UGA: Agaba.
ZAI: Akwamu, Singa-nthou.

**Habit and lifespan:** Annual or more commonly perennial, trailing or climbing herb.

**Flower colour:** Pink, purple or deep mauve.

**Habitat:** Fallow fields, grasslands, forest edges, roadsides, savannah, forest edges and open wooded areas, miombo woodlands, boggy ground, fallow and as a weed of cultivation; basaltic or laterite with sand, sandy loam or clay loam soils.

**Associated species:** *Acacia, Brachystegia, Combretum, Daniellia, Digitaria, Eragrostis, Eucalyptus, Hyparrhenia, Imperata, Piliostigma* and *Uapaca*.

**Altitude:** 1–2800 m.

**Distribution:**
CEAF: BUR, CAF, CHA, CON, GAB, RWA, ZAI.
EAF: KEN, TAN, UGA.
NEAF: ETH (not collected since 1840s), SUD.
WAF: BKN, CMN, GHA, GNB, GUI, IVO, MIL, NGA, NGR, SEN, SIE, TOG.
WIO: MDG.
ZAMB: ANG, MLW, MOZ, ZAM, ZIM.

**Phenology:** All year round.
September–December and April–July (CEAF).
Mostly April–September (EAF).
August–December (WAF).
February–July (ZAMB).

**Uses:** Treatment of earache (ANG), occasionally used as food by the Panas tribe (CAF). The tubers are reported to be eaten in MLW and ZAI (Burkill, 1995; Padulosi and Ng, 1990). The leaf-sap and a decoction prepared from the roots are taken orally for diarrhoea in TAN. Marconi *et al.* (1997) report that this species is resistant to important pests of cowpea and thus represents another potential source of resistance genes.

**Taxon Vulnerability Assessment:** = 2.6

**Conservation Notes:** *V. reticulata* is widely distributed in Africa and the species is generally well represented in *ex situ* collections from throughout its range, with the possible exception of West Africa and the Democratic Republic of the Congo. Further collecting is required in Angola, Ghana, Guinea Bissau and Côte d’Ivoire, as well as the Democratic Republic of the Congo. The trend in numbers of herbarium specimens collected over time follows the general pattern for *Vigna* species, which suggests the species does not appear to be in danger of genetic erosion or extinction.

**IUCN Red List Category:** Least Concern.
Figure 5.68. *Vigna radicans* Welw. ex Baker in Oliv.: 1, habit (×1); 2, flower, front and lateral view (×1).
Figure 5.69. Distribution of *V. radicans* based on specimen and accession passport data.

Figure 5.70. FloraMap predicted distribution for *V. radicans*. 

**Reference to a published description:** CPV 186; FZ 134.

**Vernacular names:** None known.

**Habit and lifespan:** Perennial, trailing or prostrate herb.

**Flower colour:** Mauve to purple.

**Habitat:** Damp places, dambos, floodplains, grassland, roadsides and woodland; sandy soils.

**Associated species:** *Brachystegia*, *Hymenocardia* and *Hypteregon*.

**Altitude:** 1–1950 m.

**Distribution:**
- CEAF: BUR(!), CAF, CON, GAB, ZAI.
- EAF: KEN, TAN.
- NEAF: ETH.
- WAF: CMN, EQG, NGA.
- ZAMB: ANG, MLW, ZAM, ZIM(!).

**Phenology:** March to May.

**Uses:** None known.

**Taxon Vulnerability Assessment:** = 2.5

**Conservation Notes:** *V. radicans* is widely distributed in Africa and the species is well represented in *ex situ* collections from throughout its range with the possible exception of Ethiopia, where further collecting is required. The trend in numbers of herbarium specimens collected over time follows the general pattern for *Vigna* species, which suggests the species does not appear to be in danger of genetic erosion or extinction.

**IUCN Red List Category:** Least Concern.

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**Reference to a published description:** CPV 186; FCBR 379.

**Vernacular names:** None known.

**Habit and lifespan:** Robust, creeping herb.

**Flower colour:** Unknown.

**Habitat:** Dolomite rocky areas.

**Associated species:** Unknown.

**Altitude:** 450–1250 m.

**Distribution:**
- CEAF: ZAI.
- EAF: KEN(!).
- ZAMB: ANG.

**Phenology:** January–May.

**Uses:** None known.

**Taxon Vulnerability Assessment:** = 5.4

**Conservation Notes:** *V. dolomitica* is restricted to adjacent regions of Angola and the Democratic Republic of the Congo (the Kenyan record seems doubtful) and is represented in *ex situ* collections by one accession from the Democratic
Figure 5.71. Distribution of *V. dolomitica* based on specimen and accession passport data.

Figure 5.72. FloraMap predicted distribution for *V. dolomitica*. 
Figure 5.73. *Vigna dolomitica* R.Wilczek: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×3); 4, flower, front and lateral view (×1); 5, standard, details (×3); 6, standard (×2); 7, keel, lateral view (×3); 8, wing (×3); 9, keel, front view (×3); 10, diadelphous stamens, spread out (×2); 11, style (×3); 12, stigma (×12); 13, calyx spread out (×3).
Figure 5.74. Distribution of *V. pygmaea* based on herbarium specimen passport data.

Figure 5.75. FloraMap predicted distribution for *V. pygmaea*. 
Figure 5.76. *Vigna pygmaea* R.E.Fr.: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×2.5); 4, inflorescence (×2); 5, flower, front and lateral view (×1); 6, standard (×2.5); 7, standard, details (×3); 8 and 9, keel, lateral and front view (×3); 10, wing (×3); 11, diadelphous stamens, spread out (×3); 12, style (×3); 13, stigma (×12), 14, calyx, spread out (×2.5).
Republic of the Congo. However, there is doubt over the delimitation between *V. dolomitica* and *V. reticulata*, it would seem appropriate to delay proposing a conservation strategy until the taxonomy is clarified. However, an assessment of rare for Democratic Republic of the Congo using the 1994 criteria already stands in the IUCN Red Data Book (Walters and Gillett, 1998).

**IUCN Red List Category:** Data Deficient.

**Taxonomic notes:** *V. dolomitica* may be an ecotype of *V. reticulata* (Maréchal et al., 1978).

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**Reference to a published description:** CPV 187; FCBR 374; FTEA 651; FZ 135.

**Vernacular names:** Katukwe (ZAI).

**Habit and lifespan:** Short, erect herb growing from a rootstock which consists of one to several woody fusiform or carrot-like tubers.

**Flower colour:** Pale to deep mauve or violet.

**Habitat:** Herbaceous savannahs, tree (miombo) savannahs, grassland and miombo woodlands, often associated with recent burning.

**Associated species:** *Brachystegia*, *Combretum*, *Hyparrhenia*, *Loudetia*, *Trichopteryx*, *Uapaca*.

**Altitude:** 450–2500 m.

**CEAF:** BUR, ZAI.

**EAF:** TAN.

**SAF:** NAM.

**WAF:** CMN.

**ZAM:** ANG, BOT(!), MLW, MOZ, ZAM, ZIM.

**Phenology:** August to November.

**Uses:** None known.

**Taxon Vulnerability Assessment:** = 4.2

**Conservation Notes:** *V. pygmaea* is found widely in continental Africa but appears to be uncommon throughout. There are no ex situ collections from throughout its range, thus further systematic collection is required. The trend in numbers of herbarium specimens collected over time follows the pattern for all *Vigna* species, which suggests the species does not appear to be in danger of immediate extinction. However, the fact that the species is uncommon throughout its range suggests individual populations are relatively isolated and therefore vulnerable to genetic erosion.

**IUCN Red List Category:** Vulnerable.

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**Reference to a published description:** CPV 187; FZ 136.

**Vernacular names:** None known.
Figure 5.77. *Vigna phoenix* Brummitt: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×2.5); 4, flower, front and lateral view (×1); 5, standard (×2.5); 6, wing (×3); 7, calyx, spread out (×3).
Figure 5.78. Distribution of *V. phoenix* based on herbarium specimen passport data.
Habit and lifespan: An erect, multistemmed pyrophyte with a woody rootstock.
Flower colour: Pink to purple.
Habitat: Fire-swept grasslands and woodlands often associated with rocky areas.
Associated species: Unknown.
Altitude: 600–1700 m (more common at higher altitude).
Distribution: EAF: TAN.
ZAMB: MLW, ZAM(!).
Phenology: August–November (ZAMB).
Uses: None known.
Taxon Vulnerability Assessment: = 5.6
Conservation Notes: *V. phoenix* is restricted to southern-central-east Africa, where it is locally rare. As there are no ex situ collections and only four herbarium specimens representing the species, there is a need for urgent germplasm collection in Tanzania, Malawi and Zambia. The trend in numbers of herbarium specimens collected over time cannot be assessed as there are too few collections. However, the fact that only five populations have been sampled suggests the species is seriously vulnerable to genetic erosion and extinction.
IUCN Red List Category: Endangered.
Taxonomic notes: This species may represent a large-flowered variant of *V. pygmaea*. Intermediates are known to occur between the two species.

Reference to a published description: Refer to protologue.
Vernacular names: None known.
Habit and lifespan: Perennial herb with several annual erect stems arising from woody rootstock.
Flower colour: Pink to purple.
Habitat: Moist areas near lakes, grassland, seasonal rivers and dambos, often associated with recent burning; sandy or clay loam.
Associated species: Unknown.
Altitude: approx. 1400 m (descending to 60 m in Angola; Pasquet, 2001).
Distribution: ZAMB: ANG, ZAM(!).
Phenology: 1000–2000 m.
Uses: None known.
Taxon Vulnerability Assessment: = 5.9
Conservation Notes: *V. procera* is restricted to southern-central-west Africa, where it is uncommon. As there are no ex situ collections for the species there is a need for urgent germplasm collection in Angola and western Zambia. The trend in numbers of herbarium specimens collected over time does not follow the general pattern for *Vigna* species: there was a peak before 1900, then four
Figure 5.79. Distribution of *V. procera* based on herbarium specimen passport data.

Figure 5.80. FloraMap predicted distribution for *V. procera*. 
Figure 5.81. Distribution of *V. platyloba* based on specimen and accession passport data.

Figure 5.82. FloraMap predicted distribution for *V. platyloba*. 
Figure 5.83. *Vigna platyloba* Welw. ex Hiern: 1, habit (×1); 2, stipule (×2.5); 3, details of leaf nervation, lower surface (×6); 4, inflorescence nectaries (×3); 5, flower, front and lateral view (×1); 6, standard (×1); 7, standard, details (×3); 8 and 9, keel, front and lateral view (×2.5); 10, calyx, spread out (×2.5); 11, diadelphous stamens, spread out (×2.5); 12, stigma (×12); 13, seed, lateral and front view (×2.5).
specimens were collected by a single collector in 1955, and nothing since. The pattern of collections indicates we should be concerned over the vulnerability of this species to genetic erosion and extinction.

**IUCN Red List Category:** Endangered.


**Reference to a published description:** CPV 188; FTEA 649; FZ 134.

**Vernacular names:** None known.

**Habit and lifespan:** Climbing or trailing, perennial herb.

**Flower colour:** Bluish purple outside and pale violet or magenta inside.

**Habitat:** Riparian, thickets, dambo edges, bushland and miombo woodlands, weed, often associated with dry habitats; sandy loam.

**Associated species:** *Brachystegia, Isoberlinia, Julbernardia* and *Uapaca*.

**Altitude:** 1–1750 m.

**Distribution:**

CEAF: ZAI(!).

EAF: TAN.

ZAMB: ANG, MLW, MOZ, ZAM.

**Phenology:** Flowers mostly between April and June in Zambesiaca region, where the majority of records originate.

**Uses:** None known.

**Taxon Vulnerability Assessment:** = 3.6

**Conservation Notes:** *V. platyloba* is widely distributed in Central-southern Africa. The species is represented in *ex situ* collections by six accessions from part of its range. Further collecting is required in Zambia, Tanzania and the Democratic Republic of the Congo. The trend in numbers of herbarium specimens collected over time follows the general pattern for *Vigna* species, which suggests overall the species does not appear to be in danger of genetic erosion or extinction.

**IUCN Red List Category:** Least Concern.


**Reference to a published description:** FZ 147.

**Vernacular names:** None known.

**Habit and lifespan:** Perennial, herb with woody rootstock.

**Flower colour:** Unknown.

**Habitat:** Seasonally burnt grassland, dry miombo woodland and riverside; and sandy loam and clay.

**Associated species:** *Brachystegia, Combretum, Entada, Parinari* and *Terminalia*.

**Altitude:** 450–2000 m.

**Distribution:**

CEAF: BUR, ZAI.
Figure 5.84. Distribution of V. antunesii based on specimen and accession passport data.

Figure 5.85. FloraMap predicted distribution for V. antunesii.
**EAF:** TAN(!).
**ZAMB:** ANG, MLW, MOZ, ZAM, ZIM.
**Phenology:** July to October.
**Uses:** None known.
**Taxon Vulnerability Assessment:** = 4.1

**Conservation Notes:** *V. antunesii* is found widely in southern-central Africa, however, there are no *ex situ* collections; thus, further systematic collection is required throughout its range. The trend in collection over time follows the general pattern for all *Vigna* species, which suggests the species does not appear to be in danger of immediate extinction or genetic erosion.

**IUCN Red List Category:** Least Concern.

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**Reference to a published description:** CPV 188; FE 174; FTEA 647; FZ 136.

**Vernacular names:** None known.

**Habit and lifespan:** Erect or rarely climbing or prostrate perennial herb.

**Flower colour:** Mauve-lilac or greyish white.

**Habitat:** Grassland, bushland, woodland or in cultivation, recently burnt areas; sandy loam over granite, quartzite and gneiss.

**Associated species:** *Acacia*, *Albizia*, *Brachystegia*, *Combretum*, *Erythrina*, *Hyparrhenia*, *Loudetia*, *Pterocarpus*, *Rhynchosia*, *Stachys*, *Terminalia*, and *Themeda*.

**Altitude:** 1–3900 m.

**Distribution:**
- **CEAF:** BUR, CAF, RWA, ZAI.
- **EAF:** KEN, TAN, UGA.
- **NEAF:** DJI, ERI, ETH, SUD.
- **SAF:** NAM, SWZ, ZAF.
- **WAF:** CMN, NGA.
- **ZAMB:** ANG, BOT, MLW, MOZ, ZAM, ZIM.

**Phenology:** Not known.

**Uses:** None known.

**Taxon Vulnerability Assessment:** = 4.3

**Conservation Notes:** *V. frutescens* is widely distributed in continental Africa, however it is inadequately represented in current *ex situ* collections, which do not represent the full geographic range. As *V. frutescens* is used for human and animal feed, and in rope making, it is somewhat surprising it is so poorly sampled for *ex situ* conservation. There is need for further systematic collection of the three subspecies and two varieties, particularly from Northeast Africa. The trend in numbers of herbarium specimens collected over time follows the general pattern for all *Vigna* species, which suggests overall the species does not appear to be in danger of extinction or genetic erosion. However, this assessment does not hold true for subsp. *kotschyi*, see below.

**IUCN Red List Category:** Least Concern.
Figure 5.86. *Vigna frutescens* A.Rich.: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×3); 4, flower, front and lateral view (×1); 5, standard (×2); 6, standard, details (×3); 7 and 8, keel, front and lateral view (×2.5); 9, wing (×2.5); 10, diadelphous stamens, spread out (×3); 11, style (×3); 12, stigma (×12); 13, calyx, spread out (×3); 14, seed, lateral and front view (×2.5).
Figure 5.87. Distribution of *V. frutescens* based on specimen and accession passport data.

Figure 5.88. FloraMap predicted distribution for *V. frutescens*. 
**Taxonomic notes:** Lower genetic distances are reported between *V. frutescens*, *V. friesisorum* and *V. membranacea* var. *caesia* than have been found among taxa of *V. vexillata* using isozyme markers. This has prompted Pasquet and Vanderborght (2000) to suggest merging of these three taxa into a single species. Thulin (1989) notes that *V. debanensis* is very close to *V. frutescens* and might better be regarded as a subspecies. Verdcourt (1970) included *V. spartioides* and *Liebrechtsia schweinfurthii* as synonyms of *V. frutescens* var. *buchneri* (Harms) Verde., a taxon otherwise not known north of Tanzania, while keeping *V. debanensis* separate. However, Pienaar (1992) sank *V. decipiens* Harv. into *V. frutescens* and Pasquet (2001) sank *V. debanensis* into *V. frutescens* and this nomenclature is followed here.

**Key to infraspecific variants** (Verdcourt, 1970):
1. Calyx lobes much longer than the tube, 5–10 mm long .......... subspp. *incana*
   Calyx lobes ± equalling the tube, 3–5.5 mm long ..................................................... 2
2. Standard glabrous outside ........................................ subspp. *frutescens* 3
   Standard velvety pubescent outside ........................................ subspp. *kotschyi*
3. Stem, calyx and most of plant pubescent or velvety .......... var. *frutescens*
   Stem, calyx and most of plant glabrous .................................. var. *buchneri*

**Vigna frutescens** subsp. *frutescens* var. *frutescens*

**Reference to a published description:** CPV 189; FE 174; FTEA 648; FZ 136.

**Vernacular names:**
ZAI: Umucasuka, Poko, Kimpunu, Iyichuya, Ikichuku, Bazubuvu.
KEN: Othoe, Murdjei.
UGA: Niahenge, Boayan.

**Habit and lifespan:** Erect or rarely climbing perennial herb.

**Flower colour:** Mauve-lilac or greyish white.

**Habitat:** Recently burnt grasslands, bushlands, dry savannahs, herbaceous savannahs, open woodlands, roadsides, rocky hillsides, mountain slopes, waste ground. Heavy grazing by domestic animals is noted on some records.

**Associated species:** Acacia, Bauhinia, Brachystegia, Combretum, Erythrina, Hyparrhenia, Protea, Rhynchosia, Terminalia.

**Altitude:** 1–3900 m.

**Distribution:** This is by far the most common and widely distributed member of this species.

CEAF: BUR, CAF, RWA, ZAI.
EAF: KEN, TAN, UGA.
NEAF: DJI, ETH, SUD.
SAF: NAM, SWZ, ZAF.
WAF: CMN, NGA.
ZAMB: ANG, BOT, MLW, MOZ, ZAM, ZIM.

**Phenology:** Variable.

**Uses:** None known.
Conservation Notes: This variety in comparison with the other subspecific taxa is well represented in ex situ collections from throughout its range; therefore further collection is not a priority.

Reference to a published description: CPV 189; FCBR 373; FTEA 648; FZ 138.
Vernacular names:
ZAI: Kankunda.
Habit and lifespan: Erect or rarely climbing perennial herbs.
Flower colour: Blue or mauve, rarely purple, violet or yellow.
Habitat: Recent burning is the most commonly noted abiotic factor at collecting sites.
Associated species: *Andropogon, Brachystegia, Isoberlinia, Heliotropium, Indigofera, Loudetia*.
Altitude: 450–2400 m.
Distribution:
CEAF: BUR, CAF, RWA, ZAI.
EAF: TAN.
NEAF: ERI.
ZAMB: ANG, BOT(!), MLW, ZAM, ZIM.
Phenology: None known.
Uses: None known.
Conservation Notes: This variety in comparison with the other subspecific taxa is well represented in ex situ collections from throughout its range; therefore further collection is not a priority.

Reference to a published description: CPV 190; FTEA 649.
Vernacular names:
KEN: Olmongwoiya, Osugumerialongop, Mangweaget, Mangunganget, Ol’kalei/Olmangwea.
Habit and lifespan: Erect or rarely climbing perennial herb.
Flower colour: Mauve-lilac or greyish white.
Habitat: Forest and thicket edges, grasslands and open bushlands.
Associated species: *Acacia, Combretum, Commiphora, Dichrostachys, Themeda, Sporobolus*.
Altitude: 1300–1800 m.
Distribution:
EAF: KEN, TAN.
WAF: CMN.
Phenology: Unknown.
Uses: Grazed by domestic animals and used to make ropes in Kenya.
Conservation Notes: This variety in comparison with the other subspecific taxa is well represented in ex situ collections from throughout its range; therefore further collection is not a priority.

Reference to a published description: CPV 190; FE 174.
Vernacular names: None known.
Habit and lifespan: Erect or rarely climbing perennial herb.
Flower colour: Mauve-lilac or greyish white.
Habitat: Tree savannahs, woodland and grasslands.
Associated species: _Combretum, Loudetia, Pterocarpus, Terminalia_.
Altitude: 1000–2300 m.
Distribution: CEAF: CAF.
NEAF: ETH, SUD.
Phenology: Unknown.
Uses: The seeds are eaten in Uganda. In Kenya the haulms are used to make ropes used in construction and tethering goats.
Conservation Notes: This variety in comparison with the other subspecific taxa is more geographically restricted, less well known and not represented in ex situ collections; therefore further collection is a priority. The lack of material and restricted distribution indicate that this subspecies deserves a higher conservation priority; an IUCN Red List Category of Vulnerable is appropriate.

Reference to a published description: LM 574, illust. 577.
Vernacular names: None known.
Habit and lifespan: Annual or perhaps perennial climbing herb.
Flower colour: White and violet.
Habitat: Deciduous woodland at lower altitudes; sandy soil over limestone.
Associated species: Unknown.
Altitude: 80–650 m.
Distribution: WIO: MDG (west of island, only known from Sakaraha, Bermaraha and Namoroka).
Phenology: February to March.
Uses: None known.
Taxon Vulnerability Assessment: = 7.0
Conservation Notes: _V. bosseri_ is a rare Madagascan endemic that is not represented in _ex situ_ collections; thus, further collection is a priority. The trend in numbers of herbarium specimens collected over time cannot be assessed as there are so few populations that have been sampled, which suggests the species could be vulnerable to genetic erosion and extinction.
Figure 5.89. Distribution of *V. bosseri* based on herbarium specimen passport data.
IUCN Red List Category: Vulnerable.

**Taxonomic notes:** This species can be distinguished by its distinctive 3-lobed leaflets, basifixed stipules, flowers white tinged violet and 12–15 mm long, and keel with a long and incurved beak but lacking a lateral pocket.


**Reference to a published description:** CPV 191; FCBR 387, illust. 389; FE 174; FS 436; FTEA 642; FZ 138; LM 584.

**Vernacular names:** None known.

**Habit and lifespan:** Annual or perennial, erect, trailing or climbing herb.

**Flower colour:** White, greenish, yellow or lilac-purple.

**Habitat:** Both cultivated and wild forms are found in diverse habitats, soils and rock types.

**Associated species:** Numerous but primarily *Acacia, Brachystegia, Combretum, Eragrostis, Hyparrhenia, Terminalia* and *Urochloa*.

**Altitude:** 1–3650.

**Distribution:** Widespread throughout Africa.

**Phenology:** Various.

**Uses:** Widely cultivated for its edible seeds and leaves which are eaten as a green vegetable.

**Taxon Vulnerability Assessment:** = 2.6

**Conservation Notes:** *V. unguiculata* is the most widely distributed *Vigna* species in Africa and there are very significant *ex situ* collections from throughout Africa. As *V. unguiculata* is such an important source of human and animal feed it is not surprising that so much effort has been devoted to ensuring the gene-pool is systematically conserved. In terms of gene-pool conservation, with 600 conserved accessions there is little need for further collection of the cultivated material; although with a focus on infra-taxonomic diversity there may be a need for further landrace sampling of material not already held *ex situ*. The trend in numbers of herbarium specimens collected over time follows the general pattern for all *Vigna* species, which suggests overall the species does not appear to be in danger of extinction or genetic erosion; however, this assessment does not hold true for all subspecies, for subsp. *aduensis*, *baoulensis* and *berundiensis* see below.

IUCN Red List Category: Least Concern.

**Taxonomic notes:** The plant is warm-season adapted, annual and an herbaceous legume. Plant types are often categorized as erect, semi-erect, prostrate (trailing) or climbing. Growth habits range from indeterminate to fairly determinate with the nonvining types tending to be more determinate. Cowpea seed ranges in size from the very small wild types up to nearly 14 inches long and the number of seeds per pound ranges from 1600 to 4300 seeds. Seed shape is a major characteristic correlated with seed development in the pod. Seeds develop a kidney shape if not restricted within the pod. When seed
growth is restricted by the pod the seed becomes progressively more globular. The seed coat can be either smooth or wrinkled and of various colours including white, cream, green, buff, red, brown and black. Seed may also be speckled, mottled or blotchy. Many are also referred to as “eyed” (blackeye, pinkeye, purple hull, etc.) where the white coloured hilum is surrounded by another colour (Coulibaly et al., 2002).

Maréchal et al. (1978) and Pasquet (1998, 2001) recognize four cultivar-groups within this species. These are

(i) **Biflora**: common name Catjang bean, used mainly for forage; flower and seed most often coloured; ovules fewer than 17 per ovary, pod not fleshy, less than 30 cm long, seeds not spaced within the pod, testa thick and shiny, and plant able to flower quickly from the first nodes under short-day conditions.

(ii) **Sesquipedalis**: common name yard-long bean or asparagus bean, grown for its fresh green pods which can grow up to 1 m long and are used as a vegetable, mainly in Asia; ovules more than 17 per ovary; pod fleshy, wrinkled when ripe, more than 30 cm long; seeds reniform, spaced within the pod.

(iii) **Melanophthalmus**: grown for the tough fibres obtained from its peduncles in parts of NGA; flower and seed partly white; ovules fewer than 17 per ovary, pod not fleshy, less than 30 cm long, seeds not spaced within the pod, testa thin and often wrinkled, plant able to flower quickly from the first nodes under short-day conditions.

(iv) **Unguiculata**: common name cowpea/black-eye bean; flower and seed often coloured, ovules more than 16 per ovary, pod not fleshy, <30 cm long, seeds not spaced within the pod, testa thick and shiny, plant flowering late, even under short-day conditions.

This account will only be restricted to the wild forms of this species. A full treatment of the cultivated forms is given by Pasquet (1998). Revisions have been proposed by various authors including Pienaar and van Wyk (1992), Pienaar (1992), Mithen and Kibblewhite (1993), Padulosi (1993), Pasquet (1993a,b,c, 1994) as previously discussed. The following key is derived from Pasquet (1993a, 2001):

1. Cultivated plant; pod >100×5 mm ........ subsp. unguiculata var. unguiculata 2
   Plant wild or weedy; pod <100×5 mm ........................................... .3
2. Flower and seed most often coloured; <17 ovules per ovary; pods not fleshy, unwrinkled, <30 cm, seeds not spaced within the pod; seed testa thick and shiny ...................................................... cv Biflora
   Flower and seed often coloured; >17 ovules per ovary; pods fleshy, wrinkled when ripe, up to 1 m, seeds spaced within the pod; seeds reniform ................. ................................................................. cv Sesquipedalis
   Flower and seed partly white; <17 ovules per ovary, pod not fleshy, unwrinkled, <30 cm, seeds not spaced within the pod; seed testa thin and often wrinkled .......................................................... cv Melanophthalmus
Flower and seed often coloured; >17 ovules per ovary, pod not fleshy, <30 cm, seeds not spaced within the pod, testa thick and shiny
......................................................................................................................................................... cv Unguiculata

3. Keel with a marked beak, 6–8 mm................................................................. 4
Keel without a beak or with a short beak <3 mm................................. 5

4. Leaflet thick, obtuse at apex, inflorescence 2–5-noded, internode 2–4 mm, flowers 24–33 mm...................................................... subsp. dekindtiana

Leaflet small, acute at apex, inflorescence multinoded, short internode, flowers (16-)18–23(-25) mm ................................................................. subsp. alba

5. Keel twisted towards the left, without a beak........................................ 6
Keel twisted towards the right, with a short beak up to 3 mm long.......... 9

6. Calyx teeth 0.5–6 mm ........................................................................... 7
Calyx teeth 5–15 mm................................................................................. 8

7. Calyx teeth 2.0–6.0 mm; flower 16–21 mm; ovary 10–14-ovuled..........
...................................................................................................................... subsp. stenophylla
Calyx teeth 0.5–2.0 mm; flower (21-)26–38 mm; ovary ± 17-ovuled..........
...................................................................................................................... subsp. baoulensis

8. Stipules 12–27 mm; rachis 5–25 mm, 3–10-noded; ovary 18–20 ovules......
...................................................................................................................... subsp. aduensis
Stipules 6–20 mm; rachis 5 mm, 3–4-noded; ovary 15–18 ovules........
...................................................................................................................... subsp. pawekiae

9. Plant pubescent; rachis internodes long.............................................. subsp. pubescens
Plant scabrous or glabrous; rachis internodes short.............................. 10

10. Inflorescence rachis 1–2-noded; plant with a rootstock; leaflets rhombic....
...................................................................................................................... subsp. tenuis
Inflorescence rachis multinoded; plant without a rootstock; leaflets variable
...................................................................................................................... 11

11. Annual; petiole 20–40 mm; flower 15–23 mm........................................ subsp. unguiculata var. spontanea
Perennial; petiole 50–60 mm; flower 25–31 mm ................................. 12

12. Peduncle 4–15-noded, calyx teeth 5–9 mm ....................................... subsp. letouzeyi
Peduncle 4–8-noded, calyx teeth 8–14 mm ................................... subsp. burundiensis

Pasquet (2001) notes that although the different perennial subspecies are morphologically, geographically and ecologically distinct they are interfertile and numerous intermediate specimens are found.

_Vigna unguiculata_ subsp. _unguiculata_ var. _unguiculata_

**Reference to a published description:** CPV 191; FE 174; FTEA 643; FZ 139; LM 584, illust. 575.

**Vernacular names:** For the four most important cultigens there are numerous vernacular names but these include for cv. gr. _unguiculata_ (L.) Westphal (cowpea, African bean, black-eye bean, black-eye pea, southern pea, China pea, kaffir pea,
Figure 5.90. Distribution of *V. unguiculata* based on specimen and accession passport data.

Figure 5.91. FloraMap predicted distribution for *V. unguiculata*.
marble pea [English], kafferboontjie [Afrikaans], haricot dolique and dolique de Chine [French] and many more local names), cv. gr. *biflora* (L.) Westphal (catjang, catjang cowpea and many local names), cv. gr. *sesquipedalis* (L.) Westphal (yard-long bean, asparagus bean, snake bean [English], dolique asperge [French]). In Somalia it is known as Salbuko, salbuko-deghell as well as catjang. It is also known in Madagascar as Antaka, Avokondrana, Lozy, Mahalaindolo, Voahimba, Voanemba and Voatsirokonangatra.

**Habit and lifespan:** Annual or perennial, climbing or trailing herb.

**Flower colour:** White to purple.

**Habitat:** Cultivated.

**Altitude:** Depending on cultivation.

**Distribution:** Cowpea is widely cultivated throughout the tropical and semi-tropical regions of Africa, America and Asia (Ehlers and Hall, 1997, for details, connect to www.apps.fao.org/notes).

**Phenology:** Throughout the year.


**Conservation notes:** This variety in comparison with the other subspecific taxa is well represented in *ex situ* collections from throughout its range; therefore further collection is not a priority.

**Taxonomic notes:** Pasquet (2001) notes that Mithen 55 is intermediate with subsp. *tenuis*.


**Reference to a published description:** FZ 140.

**Vernacular names:** None known.

**Habit and lifespan:** Annual or rarely perennial.

**Flower colour:** White, greenish, yellow or lilac-purple.

**Habitat:** Savannah, especially disturbed areas, often as a weed.

**Associated species:** Unknown.

**Altitude:** 0–1850 m.

**Distribution:**

CEAF: BUR, CHA(!), CON, ZAI.

EAF: KEN, TAN.

NEAF: ERI, SUD.

SAF: NAM, ZAF.
Figure 5.92. Distribution of *V. unguiculata* subsp. *unguiculata* based on specimen and accession passport data.

Figure 5.93. FloraMap predicted distribution for *V. unguiculata* subsp. *unguiculata*. 
Figure 5.94. Distribution of *V. unguiculata* subsp. *unguiculata* var. *spontanea* based on specimen and accession passport data.

Figure 5.95. FloraMap predicted distribution for *V. unguiculata* subsp. *unguiculata* var. *spontanea*. 
Figure 5.96. Distribution of *V. unguiculata* subsp. *aduensis*, subsp. *baoulensis*, subsp. *burundiensis* and subsp. *letouzeyi* based on specimen and accession passport data.
WAF: CMN, NGA, NGR, SEN.
ZAMB: ANG, BOT, MLW, MOZ, ZAM, ZIM.

**Phenology**: Depends on floristic region.

**Uses**: None known.

**Conservation Notes**: This variety in comparison with the other subspecific taxa is well represented in *ex situ* collections from throughout its range; therefore further collection is not a priority.


**Reference to a published description**: Refer to protologue.

**Vernacular names**: None known.

**Habit and lifespan**: Perennial.

**Flower colour**: Purple.

**Habitat**: Disturbed areas.

**Associated species**: Unknown.

**Altitude**: 80–1250 m.

**Distribution**:
- WAF: CMN, GHA, IVO, LBR, NGA, SIE(!), TOG.
- ZAMB: ZAM.

**Phenology**: Unknown.

**Uses**: None known.

**Conservation Notes**: *V. unguiculata* subsp. *baoulensis* is restricted to West Africa (with one Zambian collection), it is relatively well represented in *ex situ* collections; however, further collection is required but it is not such a high priority as for subsp. *aduensis* and *burundiensis*.


**Reference to a published description**: Refer to protologue.

**Vernacular names**: None known.

**Habit and lifespan**: Perennial.

**Flower colour**: Purple.

**Habitat**: Disturbed areas.

**Associated species**: Unknown.

**Altitude**: 320–800 m.

**Distribution**:
- CEAF: CAF, GAB(!), ZAI.
- WAF: CMN.

**Phenology**: Unknown.

**Uses**: None known.

**Conservation Notes**: This subspecies in comparison with the other subspecific taxa is well represented in *ex situ* collections from throughout its range; therefore further collection is not a priority.
**Figure 5.97.** Distribution of *V. unguiculata* subsp. *pubescens* based on specimen and accession passport data.

**Figure 5.98.** FloraMap predicted distribution for *V. unguiculata* subsp. *pubescens*. 
Figure 5.99. *Vigna unguiculata* subsp. *pubescens* (R. Wilczek) Padulosi.

**Reference to a published description:** Refer to protologue.

**Vernacular names:** None known.

**Habit and lifespan:** Perennial.

**Flower colour:** Purple.

**Habitat:** Disturbed areas.

**Associated species:** Unknown.

**Altitude:** 1800–1900 m.

**Distribution:**
- CEAF: BUR, RWA(!), ZAI(!).
- EAF: KEN(!), UGA(!).

**Phenology:** Unknown.

**Uses:** None known.

**Conservation Notes:** *V. unguiculata* subsp. *burundiensis* is recently described thus less well known, in comparison with the other subspecific taxa it is geographically restricted and represented by a single *ex situ* collection; therefore further collection is a priority from throughout the range given by Pasquet (1993b). The lack of material and restricted distribution indicate that this subspecies deserves a higher conservation priority; an IUCN Red List Category of Vulnerable is appropriate.

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**Reference to a published description:** FCBR 386; FTEA 646; FZ 141.

**Vernacular names:**
- SUD: Najok.
- MOZ: Niembaoda.
- TAN: Lukundembala, Kundimbala.

**Habit and lifespan:** Perennial, climbing herb.

**Flower colour:** White, greenish, yellow or lilac-purple.

**Habitat:** Grasslands, coastal thickets, rocky outcrops, roadsides, savannahs and fallow fields, usually near water.

**Associated species:** Unknown.

**Altitude:** 0–1550 m.

**Distribution:**
- CEAF: BUR, ZAI.
- EAF: KEN, TAN, UGA.
- NEAF: SUD.
- SAF: NAM, ZAF.
- WAF: GHA, NGA.
- ZAMB: MLW, MOZ, ZIM.

**Phenology:** October to December.

**Uses:** None known.
Figure 5.100. Distribution of *V. unguiculata* subsp. *dekindtiana* based on specimen and accession passport data.

Figure 5.101. FloraMap predicted distribution for *V. unguiculata* subsp. *dekindtiana*. 
Figure 5.102. *Vigna unguiculata* subsp. *dekindtiana* (Harms) Verdc.
Figure 5.103. Distribution of *V. unguiculata* subsp. *tenuis* based on specimen and accession passport data.

Figure 5.104. FloraMap predicted distribution for *V. unguiculata* subsp. *tenuis*. 
Figure 5.105. Vigna unguiculata subsp. tenuis (E. Mey) Maréchal, Mascherpa and Stainier.
Conservation Notes: This subspecies in comparison with the other subspecific taxa is well represented in ex situ collections from throughout its range; therefore further collection is not a priority.

Reference to a published description: FE 174; FS 436; FTEA 644, illust. 645; FZ 141, illust. 142.

Vernacular names:
ANG: Kakundi-Kombambi.
CMN: Mebbiladdi.
ZAI: Kasema Pori, Yarkame, Abakpanvua, Manyasa na Nzamba.
GHA: Benet, Kusasi, Goya Kusasi.
KEN: Chani, Chesuwaucha, MkundeMLWta, Mkundembala.
MOZ: Nchanchin nhyemba.
NAM: Gani.
NGA: Akadi; Akedi aja, Akedi nkulunku, Gayan gayan, Kgbamaje, Wake and Wakengizo.
TAN: Enandala, Kibenda benda, Shilishashiliwa.
UGA: Amaret, Kindiru, Omugambe, Karimojoij bean.

Habit and lifespan: Wild or cultivated, prostrate or climbing.

Flower colour: White, greenish, yellow or lilac-purple.

Habitat: Roadside, open woodlands, grasslands (especially if burnt seasonally), various savannahs, swamps, cultivated fields, riversides, riverine forests, littoral zones, etc.

Associated species: *Acacia, Adansonia, Brachystegia, Combretum, Digitaria, Eragrostis, Euphorbia, Imperata, Terminalia, Sporobolus*, etc.

Altitude: 1–2800 m.

Distribution:
CEAF: BUR(!), CAF, CHA, CON, GAB(!), GGI, ZAI.
EAF: KEN, TAN, UGA.
NEAF: ERI, ETH, SEN, SIE, SOM(!), SUD.
SAF: NAM, SWZ, ZAF.
WAF: BEN, BKN, CMN, GAM, GHA, GNB, GUI, IVO, ML, NGA, NGR, SEN, SIE.
ZAMB: ANG, BOT, MLW, MOZ, ZAM, ZIM.

Phenology: Depends on floristic region.
Uses: The roots are roasted and eaten by the Kung of Namibia and used to dye leather in Nigeria (Dalziel, 1937). In Ghana the leaves are eaten in stews and the seeds are used to make Goya Kusasi. The leaves are also eaten as a vegetable in Tanzania and Kenya, more so in times of famine. The seeds are collected and used as food in Uganda.

Taxonomic Notes: Pasquet (2001) notes that lowland specimens from eastern Angola and Zambia, although pyrophytic, show more nodes per inflorescence, smaller flowers, with a shorter keel beak and higher ovule number than are typical,
Figure 5.106. *Vigna unguiculata* subsp. *stenophylla* (Harvey) Maréchal, Mascherpa and Stainier.
Figure 5.107. Distribution of *V. unguiculata* subsp. *stenophylla* based on specimen and accession passport data.

Figure 5.108. FloraMap predicted distribution for *V. unguiculata* subsp. *stenophylla*. 
Figure 5.109. Distribution of *V. unguiculata* subsp. *alba* based on specimen and accession passport data.

Figure 5.110. FloraMap predicted distribution for *V. unguiculata* subsp. *alba*.
which may indicate that they are intermediates between subsp. *dekindtiana* and subsp. *unguiculata* var. *spontanea*.

**Conservation Notes:** This subspecies, in comparison with the other subspecific taxa, is well represented in *ex situ* collections from throughout its range; therefore further collection is not a priority.


**Reference to a published description:** CPV 195; FZ 143.

**Vernacular names:** None known.

**Habit and lifespan:** Perennial with rootstock.

**Flower colour:** Pink to purple.

**Habitat:** Miombo woodland, grassland, and sandy places near coast.

**Associated species:** Unknown.

**Altitude:** 1–1550 m.

**Distribution:**
- EAF: KEN.
- SAF: ZAF.
- ZAMB: MLW, MOZ, ZAM, ZIM.

**Phenology:** Year-round.

**Uses:** None known.

**Taxonomic Notes:** Pasquet (2001) notes that Mozambique specimens, especially coastal specimens, are quite different and could be intermediates with subsp. *unguiculata*. The inflorescence is often up to 3-noded, flowers are larger and ovule numbers are markedly higher, (13–)14–17-ovuled as compared with 12–15(–16)-ovuled in other Flora Zambesiaca countries.

**Conservation Notes:** This subspecies, in comparison with other subspecific taxa, is well represented in *ex situ* collections from throughout its range; therefore further collection is not a priority.


**Reference to a published description:** CPV 196; FZ 144.

**Vernacular names:** None known.

**Habit and lifespan:** Perennial with rootstock.

**Flower colour:** Pink to purple.

**Habitat:** Kalahari sands in FZ region.

**Associated species:** *Terminalia sericea*.

**Altitude:** 1–2350 m.

**Distribution:**
- CEAF: BUR.
- SAF: NAM, SWZ, ZAF.
- ZAMB: BOT, MOZ, ZAM, ZIM(!).
Figure 5.111. Distribution of *V. unguiculata* subsp. *pawekiae* based on specimen and accession passport data.

Figure 5.112. FloraMap predicted distribution for *V. unguiculata* subsp. *pawekiae*. 
Figure 5.113. Stipules of wild Vigna unguiculata taxa: 1, subsp. dekindtiana (×4); 2, subsp. pubescens (×3); 3, subsp. stenophylla (×4); 4, subsp. alba; 5, subsp. protracta (×3); 6, var. tenuis (×3);

Figure 5.114. Calyces of Vigna unguiculata taxa: 1, subsp. pawekiae (×1.5); 2, subsp. stenophylla (×1.5); 3, subsp. protracta (×1.5); 4, subsp. tenuis (×1.5); 5, subsp. pubescens (×1.5); 6, subsp. alba (×1.5).
Figure 5.115. Inflorescence rachis of wild Vigna unguiculata taxa: 1, subsp. stenophylla (×6); 2, subsp. pawekiae (×3); 3, subsp. dekindtiana (×6); 4, subsp. pubescens (×6).

Figure 5.116. Stigmas of wild Vigna unguiculata taxa (all ×16): 1, subsp. protracta; 2, subsp. pubescens; 3, subsp. dekindtiana, 4, subsp. tenuis; 5, subsp. stenophylla; 6, subsp. alba; 7, subsp. pawekiae.
**Phenology:** Unknown.

**Uses:** None known.

**Conservation Notes:** This subspecies in comparison with other subspecific taxa is well represented in *ex situ* collections from throughout its range; therefore further collection is not a priority.

**Taxonomic Notes:** Pasquet (2001) suggests that three groups might be distinguished within subspecies *stenophylla* with intermediate specimens between them in the areas where their distributions overlap. The first group would include stout specimens from dry areas of Namibia, Botswana and western parts of the former Transvaal, in which the plants are scabrous or poorly pubescent with scabrous pods. The second group would include specimens from eastern parts of the former Transvaal and Cape Province of South Africa with stout and pubescent plants often with pubescent pods. The third group would include specimens from the Transvaal where the plants are more slender and possess linear leaflets and scabrous pods.


**Reference to a published description:** FCBR; FTEA; FZ.

**Vernacular names:** None known.

**Habit and lifespan:** Perennial.

**Flower colour:** White?

**Habitat:** Disturbed grassland and forest margin.

**Associated species:** Unknown.

**Altitude:** 1–1700 m.

**Distribution:**
- CEAF: CON, GAB(!), GGI, ZAI.
- EAF: TAN.
- ZAMB: ANG, ZIM.

**Phenology:** Unknown.

**Uses:** None known.

**Conservation Notes:** This subspecies in comparison with the other subspecific taxa is well represented in *ex situ* collections from throughout its range; therefore further collection is not a priority.


**Reference to a published description:** FCBR 387; FTEA 646; FZ 141.

**Vernacular names:**
- ZAI: Kulu, Ndekona mongasa.
- ETH: Turina.

**Habit and lifespan:** Wild, climbing perennial.

**Flower colour:** White, greenish, yellow or lilac-purple.

**Habitat:** Tree and palm savannahs, swampy areas, roadsides, gallery forests, grasslands and fallow fields.
**Associated species:** Unknown.
**Altitude:** 1–2700 m (–3650 m in Kenya).

**Distribution:**
- CEAF: BUR, GGI, ZAI.
- EAF: KEN, TAN(!), UGA.
- NEAF: ERI, ETH.
- WAF: CMN, NGA, SIE.
- ZAMB: ANG, BOT, MLW, MOZ, ZAM, ZIM.

**Phenology:** Unknown.

**Uses:** None known.

**Conservation Notes:** This subspecies in comparison with the other subspecific taxa is well represented in ex situ collections from throughout its range; therefore further collection is not a priority.


**Reference to a published description:** FCBR; FTEA; FZ.

**Vernacular names:** Unknown.

**Habit and lifespan:** Wild, climbing perennial.

**Flower colour:** Purple.

**Habitat:** Disturbed areas.

**Associated species:** Unknown.

**Altitude:** 1200–2900 m.

**Distribution:** Obvious.

**NEAF:** ETH.

**Phenology:** Unknown.

**Uses:** None known.

**Conservation Notes:** *V. unguiculata* subsp. *aduensis* is the most recently described subspecies and as an Ethiopian endemic is the most geographically restricted subspecies. There are no ex situ collections, and only a few herbarium specimens are known; therefore further collection is a priority to help establish the true range of the taxon and provide conservation of an important crop wild relative. The lack of material and restricted distribution indicate that this subspecies deserves a higher conservation priority; an IUCN Red List Category of Endangered is appropriate.


**Reference to a published description:** FZ 149.

**Vernacular names:** None known.

**Habit and lifespan:** Perennial with rootstock

**Flower colour:** Pink, purple, yellow or mauve.

**Habitat:** Mostly montane grasslands, Ngongoni veld, roadsides, among rocks and disturbed areas; loams.

**Associated species:** *Zornia.*
Figure 5.117. *Vigna schlechteri* Harms in Engler: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×2.5); 4, flower, front and lateral view (×1); 5, flower bud (×2); 6, standard (×3); 7, standard, details (×6); 8 and 9, keel, lateral and front view (×2.5); 10, wing (×3); 11, diadelphous stamens, spread out (×3); 12, style (×3); 13, stigma (×12); 14, calyx, spread out (×2.5); 15, seed, lateral and front view (×2.5).
Figure 5.118. Distribution of *V. schlechteri* based on herbarium specimen passport data.

Figure 5.119. FloraMap predicted distribution for *V. schlechteri*.
Figure 5.120. Distribution of *V. keraudrenii* based on herbarium specimen passport data.

Figure 5.121. FloraMap predicted distribution for *V. keraudrenii*.
Figure 5.122. Distribution of *V. monantha* based on herbarium specimen passport data.
Altitude: 650–2290 m.

Distribution:
SAF: SWZ, ZAF.
ZAMB: MOZ, ZAM(!), ZIM.

Phenology: Flowering occurs between November and April.

Uses: None known.

Taxon Vulnerability Assessment: = 3.4

Conservation Notes: *V. schlechteri* is found widely in southern Africa and there are 10 ex situ collections, although all of these are from South Africa and Swaziland. Therefore, there is a need for further systematic collection from throughout Zimbabwe and Mozambique. The trend in collection over time follows the general pattern for all *Vigna* species, which suggests the species does not appear to be in danger of immediate extinction or genetic erosion.

IUCN Red List Category: Least Concern.

Additional notes: This species is endemic to the montane grasslands of southern Africa (Mithen and Kibblewhite, 1993). It is thought to be the closest relative of *V. unguiculata* and has been placed in the secondary genepool (Mithen 1987, Baudoin and Maréchal, 1991) although hybridization has so far proved unsuccessful between the two species (Mithen, 1987).


Reference to a published description: LM 567, illust. 577.

Vernacular names: None known.

Habit and lifespan: Perennial, climbing, delicate herb.

Flower colour: Deep pink to purple.

Habitat: Rocky hillsides and high altitude woodland with mosses and lichens.

Associated species: Unknown.

Altitude: 1420–1940 m.

Distribution:
WIO: MDG (Central Madagascar: Ambositra to north of Antananarivo).
ZAMB: MOZ.

Phenology: December to March.

Uses: None known.

Taxon Vulnerability Assessment: = 5.1

Conservation Notes: *V. keraudrenii* is found on the central plateaux of Madagascar, but it is not currently represented in ex situ collections and thus collection is a priority. The trend in numbers of herbarium specimens collected over time cannot be assessed as so few specimens have been collected. The small number of populations seen, the lack of ex situ collections and the restricted distribution suggest that the species is vulnerable to genetic erosion and possible extinction.

IUCN Red List Category: Vulnerable.
Taxonomic notes: This species closely resembles some forms of *V. angivensis* in its delicate habit, very narrow leaflets and inflorescences with solitary purplish flowers, but can easily be distinguished by its characteristic stipules with a distinct lower lobe extending below the point of attachment and its almost glabrous stems, leaves and calyces. It is also more remotely related to *V. schlechteri* from which it differs in its narrow leaflets, less pubescent stems, and narrower and smaller stipules with triangular lobes.

Reference to a published description: FS 436.
Vernacular names: None known.
Habit and lifespan: Perennial herb with radiating trailing stems.
Flower colour: Blue or mauve.
Habitat: Sandy plains of ancient dunes.
Associated species: Grasses, sedges, *Indigofera sparteola*, *Chamaecrisa dunensis*.
Altitude: 20–230 m.
Distribution:
NEAF: SOM (northeastern coast and central).
Phenology: Unknown.
Uses: None known.
Taxon Vulnerability Assessment: = 6.4
Conservation Notes: *V. monantha* is a recently described Somali endemic and probably, alongside *V. somaliensis* and *V. virescens*, is one of the most highly threatened African *Vigna* taxa. There are few herbarium specimens available and no ex situ collections. The species appears to be very restricted but the fact that it was only described in 1991 means that the species full range may not be fully appreciated. The need for systematic surveying of this species and collection for ex situ conservation should be given the highest priority.
IUCN Red List Category: Critically Endangered.
Taxonomic notes: Like *V. schlechteri*, this species has a one-flowered inflorescence. It is distinguished from *V. schlechteri* by its longer flowers (17–20 mm c.f. 10 mm in *V. schlechteri*) and its calyx teeth, which are clearly shorter than the tube while in *V. schlechteri* they are about as long as the tube. Thulin (1993) notes that Thulin and Abdi Dahir 6546 collected from North Central Somalia at 300 m (4°29' N, 47°23' E) is close to *V. monantha*, but differs in its flower number and inflorescence length as well as the shallowly lobed leaflets with a distinct silvery line above. He also notes that Gillett, Hemming and Watson 22603 from North Central Somalia (4°10' N, 46°28' E) is also similar to *V. monantha* but differs in its glabrous calyx and almost unlobed leaflets. He suggests both these collections represent new taxa, but more material is required before they can be described formally.
5.3 Subgenus *Haydonia*


**Section *Haydonia***


**Reference to a published description:** CPV 197; FE 177; FTEA 661, illust. 662; FZ 149, illust. 150.

**Vernacular names:**
KEN: Mbendi.
UGA: Emisinoye mpunga, Omutsinoya mpunga.

**Habit and lifespan:** Erect, climbing or trailing, perennial herb.

**Flower colour:** Blue, mauve, pink or violet.

**Habitat:** Grasslands, floodplains, savannah, deciduous woodlands, open woodlands, roadside, wet woodlands, cultivated fields (weedy), often associated with seasonal waterlogging or burning; clay or sandy loam.

**Associated species:** *Acacia*, *Adansonia*, *Berlinia*, *Brachystegia*, *Commiphora* and *Hyparrhenia*.

**Altitude:** 20–3900 m.

**Distribution:**
CEAF: BUR, RWA, ZAI(!).
EAF: KEN, TAN, UGA.
NEAF: ETH.
WAF: CMN.
ZAMB: BOT, MLW, ZAM, ZIM.

**Phenology:** In CEAF, the species flowers between December and February. In EAF, flowering appears to occur throughout the year, while in NEAF it occurs between December and April.

**Uses:** The root is considered a delicacy in Kenya (Verdcourt, 1971)

**Taxon Vulnerability Assessment:** = 4.2

**Conservation Notes:** *V. monophylla* is widely distributed in Central-southern-east Africa. The species is represented in *ex situ* collections by a few accessions from part of its range; therefore further collecting from throughout its range is required. The trend in numbers of herbarium specimens collected over time follows the general pattern for *Vigna* species, which suggests overall the species does not appear to be in danger of genetic erosion or extinction.

**IUCN Red List Category:** Least Concern.

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**Reference to a published description:** CPV 198; FE 177; FTEA 663; FZ 151.

**Vernacular names:** None known.

**Habit and lifespan:** Prostrate, creeping or climbing herb.

**Flower colour:** Yellow tinged with mauve.

**Habitat:** Mountain slopes, tree savannahs, miombo woodland, forest fringes and moist, open grasslands, edge of riverine forest.

**Associated species:** *Brachystegia*, *Hymenocardia*, *Daniellia*, *Syzigium* and *Uapaca*. 
Altitude: 30–2800 m.
Distribution:
CEAF: BUR, CAF, ZAI.
EAF: KEN, TAN(!).
NEAF: ETH.
WAF: CMN(!), NGA.
ZAMB: ANG, ZAM.
Phenology: March–April (ZAMB).
Uses: None known.
Taxon Vulnerability Assessment: = 4.3
Conservation Notes: *V. triphylla* is widely distributed in Central-west and East Africa, however, the species is rare throughout its range and is represented in *ex situ* collections by only two accessions, therefore further collecting from throughout its range is required. The trend in numbers of herbarium specimens collected over time roughly follows the general pattern for *Vigna* species, but recent collections are rarer. The breadth of distribution of this species combined with its rarity make it vulnerable to genetic erosion and extinction.
IUCN Red List Category: Vulnerable.
Taxonomic notes: Closely related to *V. monophylla* from which it can be distinguished by its trifoliate leaves and more prominently winged peduncles.

Reference to a published description: CPV 198; FCBR 354; FTEA 660; FZ 152.
Vernacular names: None known.
Habit and lifespan: Climbing or trailing perennial growing from a narrow wood-stock.
Flower colour: Yellow or flesh colour to mauve.
Habitat: Woodlands, herbaceous savannah, grasslands, streambeds on alluvium and anthills, burnt ground.
Associated species: *Brachystegia, Isoberlinia, Parinari* and *Uapaca*.
Altitude: 700–1750 m.
Distribution:
CEAF: ZAI.
EAF: TAN.
ZAMB: MLW, MOZ, ZAM, ZIM.
Phenology: Flowers between August and November throughout its distribution.
Uses: None known.
Taxon Vulnerability Assessment: = 7.3
Conservation Notes: *V. juncea* is most widely distributed in the Zambesiaca region, but there are no *ex situ* collections from here or throughout its range. Three varieties are recognized but none is common. The trend in numbers of herbarium specimens collected over time follows the general pattern for all *Vigna* species, though with fewer populations sampled in more recent years.
Figure 5.123. Distribution of *V. monophylla* based on specimen and accession passport data.

Figure 5.124. FloraMap predicted distribution for *V. monophylla*. 
Figure 5.125. Distribution of *V. triphylla* based on specimen and accession passport data.

Figure 5.126. FloraMap predicted distribution for *V. triphylla*. 
This suggests overall that the species may be in decline, is likely to be suffering genetic erosion, and may in the longer term face extinction

**IUCN Red List Category:** Vulnerable.

**Taxonomic notes:** Verdcourt (1970) notes that this species is aberrant in that its smooth pollen is typical of subgenus *Phaseolus*, but he retained it within *Vigna* because its seed amino acid distribution is typical of *Vigna*. Pasquet (2001) comments that the flowers of var. *juncea* and var. *corbyi* are very similar, while those of var. *major* show marked differences and this may justify specific distinction. However, the lack of living material of *V. juncea* precludes such a distinction at this time.

Three varieties, *V. juncea* var. *juncea*, var. *major* and var. *corbyi* are recognized (Pasquet, 2001):

1. Flowers 16–18 mm; keel with short straight beak; distal part of style almost straight; pod 6–7.5 cm. ................................................................. var. *major*
   Flowers 9–13 mm long; keel with short incurved beak; distal part of style curved in a semicircle; pod 4–5.5 cm long ............................................. 2
2. Inflorescence rachis 8–20 cm, 10–30-noded, internodes (except the lowest) 6–20 mm........................................................................................................... var. *juncea*
   Inflorescence rachis 0.5–7 cm long, 4–16-noded, internodes (except the lowest) 2–5 mm long ................................................................................ var. *corbyi*

*Vigna juncea* var. *juncea*

**Reference to a published description:** CPV 198; FTEA 661; FZ 152.

**Vernacular names:** None known.

**Habit and lifespan:** Climbing or trailing perennial growing from a narrow wood-stock.

**Flower colour:** Yellow or flesh colour to mauve.

**Habitat:** Miombo woodlands, herbaceous savannah, grasslands, streambeds on alluvium and anthills.

**Associated species:** *Brachystegia*, *Uapaca* and *Parinari* woodland.

**Altitude:** 920–1200 m.

**Distribution:**
- CEAF: ZAI(!).
- EAF: TAN.
- ZAMB: MOZ, ZAM(!).

**Phenology:** October to November.

**Uses:** None known.

**Conservation Notes:** This variety is not represented in *ex situ* collections and collection is required from throughout its range.


**Reference to a published description:** FZ 152.

**Vernacular names:** None known.
Figure 5.127. *Vigna juncea* Milne-Redh.: 1, habit (×1); 2, stipule (×2.5); 3, details of leaf nervation, upper surface (×1); 4, details of leaf nervation, lower surface (×2); 5, flower, front and lateral view (×1); 6, standard (×2); 7, standard, details (×3); 8 and 9, keel, lateral and front view (×2); 10, wing (×2.5); 11, diadelphous stamens, spread out (×3); 12, style (×3); 13, stigma, lateral and front view (×12); 14, calyx, spread out (×2.5); 15, seed, lateral and front view (×2.5).
Figure 5.128. Distribution of *V. juncea* based on herbarium specimen passport data.

Figure 5.129. FloraMap predicted distribution for *V. juncea*. 

**Habit and lifespan**: Climbing or trailing perennial growing from a narrow wood-stock.

**Flower colour**: Yellow or flesh colour to mauve.

**Habitat**: Woodlands, herbaceous savannah, grasslands subject to fire.

**Associated species**: Unknown.

**Altitude**: 900–1800 m.

**Distribution**: ZAMB: MLW, ZIM.

**Phenology**: October to November.

**Uses**: None known.

**Conservation Notes**: *V. juncea var. corbyi* is not represented in *ex situ* collections and collection is therefore required from throughout its range. It also has a restricted distribution, which, along with the lack of material available, suggests this variety deserves a higher conservation priority. An IUCN Red List Category of Vulnerable is appropriate.

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**Vigna juncea var. major** Milne-Redh., Kew Bull.: 302 (1934).

**Reference to a published description**: CPV 198; FZ 153.

**Vernacular names**: None known.

**Habit and lifespan**: Climbing or trailing perennial growing from a narrow wood-stock.

**Flower colour**: Yellow or flesh colour to mauve.

**Habitat**: Miombo woodlands, herbaceous savannah, grasslands.

**Associated species**: Unknown.

**Altitude**: 1300–500 m.

**Distribution**: CEAF: ZAI(!). EAF: TAN(!). ZAMB: MOZ, ZAM, ZIM.

**Phenology**: October to November.

**Uses**: None known.

**Conservation Notes**: This variety is not represented in *ex situ* collections and collection is required from throughout its range.

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**Reference to a published description**: FZ 151.

**Vernacular names**: None known.

**Habit and lifespan**: Perennial, climber with rootstock.

**Flower colour**: Unknown.

**Habitat**: Grassland roadsides and streamsides.

**Associated species**: *Hyparrhenia filipendula* and *Heteropogon contortus*.

**Altitude**: 1600–2300 m.

**Distribution**: WAF: CMN(?).
Figure 5.130. Distribution of *V. nyangensis* based on herbarium specimen passport data.
ZAMB: ANG, ZIM (Nyanga region).

**Phenology:** March.

**Uses:** None known.

**Taxon Vulnerability Assessment:** = 5.9

**Conservation Notes:** *V. nyangensis* is a recently described Zambesiaca endemic (there is a record from Cameroon but this seems likely to have been misidentified). There are few herbarium specimens available and only one *ex situ* collection. The species appears to be very restricted but the fact that it was only described in 1989 means that its full range may not yet be fully appreciated. The need for systematic surveying of this species and collection for *ex situ* conservation should be given the highest priority.

**IUCN Red List Category:** Vulnerable.

**Taxonomic notes:** Closely related to *V. triphylla*. This species is grouped under section *Haydonia* of subgenus *Haydonia*.

**Section Microspermae** Maréchal, Mascherpa and Stainier, in Taxon, 27: 200 (1978).


**Reference to a published description:** CPV 199; LM 580, illust. 575.

**Vernacular names:** None known.

**Habit and lifespan:** Perennial, climbing or prostrate, delicate herb.

**Flower colour:** Purple pink.

**Habitat:** Associated with disturbance, around settlements and cultivated land.

**Associated species:** Unknown.

**Altitude:** 1200–1750 m.

**Distribution:**

WIO: MDG (mainly around Ankaratra massif but also south to Itremo and Andringitra massifs).

**Phenology:** November to April.

**Uses:** None known.

**Taxon Vulnerability Assessment:** = 4.6

**Conservation Notes:** *V. microsperma* has a restricted distribution in Central Madagascar; the species is not represented in *ex situ* collections, therefore further collecting is required. The trend in numbers of herbarium specimens collected over time follows the general pattern for *Vigna* species, which suggests overall the species does not appear to be in imminent threat of genetic erosion or extinction. However, the limited distribution indicates population levels should be monitored.

**IUCN Red List Category:** Near Threatened.

**Taxonomic notes:** Most closely resembles *V. parkeri*. It is somewhat resistant to grassland fires, owing to its fleshy root.


**Reference to a published description:** CPV 199; FTEA 660; FZ 153.

**Vernacular names:** None known.
Habit and lifespan: Twining or procumbent herb.
Flower colour: Yellow or mauve.
Habitat: Woodlands, savannah and open bushes.
Associated species: Bamboo.
Altitude: 1000–1700 m.
Distribution:
WAF: SEN(!).
EAF: TAN.
ZAMB: ZAM.
Phenology: April.
Uses: None known.
Taxon Vulnerability Assessment: = 6.0
Conservation Notes: *V. richardsiae* has a restricted distribution on the Tanzanian–Zambian border. There is also a record from Senegal, but this would be so isolated from the other populations it may have been misidentified and should be checked. Four specimens have been collected from the Tanzanian–Zambian border since the 1930s but there are no *ex situ* conserved accessions; further collection is therefore a priority. The fact that so few specimens have been sampled from populations suggests the species is in decline and is in danger of genetic erosion and extinction.
IUCN Red List Category: Critically Endangered.
Taxonomic notes: This species is closely related to *V. juncea* (Verd court, 1970), which it resembles in stipules, calyx, pods and pollen grain characters. Pasquet (2001) notes that this species may be close to *V. mudenia* and *V. kokii* but the lack of living material has hampered the clarification of their relationships.

Reference to a published description: CPV 199; FCBR 365; FE 172, illust. 175; FTEA 628; FZ 153.
 Vernacular names: Emaret, Mangwia, Njazi (KEN).
Aubole, Orubore, Omaharakuku (UGA).
Adjuru, Okworokworo (ZAR).
Habit and lifespan: Perennial twining or climbing from a woody rootstock.
Flower colour: Not recorded.
Habitat: Grasslands, forest margin, thicket, degraded forests, savannah, roadsides, hills and mountain slopes.
Associated species: *Acacia, Acanthus, Commiphora, Dombeya, Hyparrhenia, Lannea and Protea*.
Altitude: 70–4800 m.
Distribution:
CEAF: BUR, CON, RWA, ZAI.
EAF: KEN, TAN, UGA.
NEAF: ETH, SUD.
Figure 5.131. Distribution of *V. microsperma* based on herbarium specimen passport data.

Figure 5.132. FloraMap predicted distribution for *V. microsperma*. 
WAF: IVO.
ZAMB: MLW.

**Phenology**: October–January as well as April–July in EAF.

**Uses**: None known.

**Taxon Vulnerability Assessment**: $= 3.4$

**Conservation Notes**: *V. schimperi* has a relatively wide and disjunct distribution. The single specimen from Côte d’Ivoire needs to be checked as it is so remote from the main distribution centre in North and East Africa. The species is inadequately represented in *ex situ* collections, with only two germplasm samples from Central Africa. There is an urgent need for collection from its full geographic range; particularly from Ethiopia and East Africa. The trend in numbers of herbarium specimens collected over time follows the general pattern for *Vigna* species, which suggests overall the species does not appear to be in imminent threat of genetic erosion or extinction.

**IUCN Red List Category**: Least Concern.

**Taxonomic notes**: Resembles *V. luteola* but has been shown to have a different pollen sculpture and is thus placed in section *Haydonia*. Pasquet (2001) notes that the Malawi specimens have smaller flowers than those found further north and specific distinction may be warranted when more specimens become available.

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**Reference to a published description**: Refer to protologue.

**Vernacular names**: None known.

**Habit and lifespan**: Perennial twining or recumbent herb.

**Flower colour**: Cream.

**Habitat**: Rocky soil in thorn-veldt and savannah.

**Associated species**: *Acacia*.

**Altitude**: 520–1290 m.

**Distribution**: ZAMB: ZAF (Northwest of Muden and Eshowe Kwazulu-Natal, Baberton).

**Phenology**: Unknown.

**Uses**: None known.

**Taxon Vulnerability Assessment**: $= 6.9$

**Conservation Notes**: *V. mudenia* has a restricted distribution in eastern South Africa. Five herbarium specimens have been collected and there are no *ex situ* conserved accessions; further collection is a priority. *V. mudenia* was relatively recently described in 1991, therefore its full range may not yet be fully appreciated. The need for systematic surveying of this species and collection for *ex situ* conservation should be given the highest priority. The IUCN Red List Category is therefore tentative.

**IUCN Red List Category**: Vulnerable.
Figure 5.133. Distribution of *V. richardsiae* based on herbarium specimen passport data.
Figure 5.134. Distribution of \textit{V. schimperi} based on specimen and accession passport data.

Figure 5.135. FloraMap predicted distribution for \textit{V. schimperi}. 
Figure 5.136. Distribution of *V. mudenia* based on herbarium specimen passport data.

Reference to a published description: Refer to protologue.

Vernacular names: None known.

Habit and lifespan: Perennial twining herb with carrot-shaped rootstock.

Flower colour: Yellowish green.

Habitat: Woodland, grassland and riverside; sand and stony gravel.

Associated species: Unknown.

Altitude: 180–1700 m.

Distribution: SAF: NAM, ZAF.

Phenology: Unknown.

Uses: None known.

Taxon Vulnerability Assessment: = 5.5

Conservation Notes: V. kokii has a distribution limited to Namibia and South Africa. Nine herbarium specimens have been collected and there are no ex situ conserved accessions; therefore further collection is a priority. V. kokii was relatively recently described in 1993, which means that its full range may not yet be fully appreciated. The need for systematic surveying of this species and collection for ex situ conservation should be given the highest priority. The assessment of IUCN Red List Category is therefore tentative.

IUCN Red List Category: Near Threatened.


Vigna nigritia Hook.f. in Hook., Niger Fl.: 310 (1849).

Reference to a published description: CPV 200; FCBR 358; FWTA 568.

Vernacular names: Bambe (SEN).

Habit and lifespan: Climbing herb.

Flower colour: Blue, mauve, pink, red or violet.

Habitat: Grasslands, fallows, roadsides, various types of savannahs and rarely in marshes.

Associated species: Andropogon, Daniellia olivieri, Hyparrhenia, Lophira lanceolata and Pennisetum.

Altitude: 1–1800 m.

Distribution: CEAF: CAF, CON, GAB, ZAI.

WAF: CMN, GHA, GNB, GUI, IVO, LBR, MLI, NGA, SEN, SIE, TOG.

ZAMB: ANG.


Uses: None known.

Taxon Vulnerability Assessment: = 2.2

Conservation Notes: V. nigritia is widely distributed in West and Central Africa. The species is reasonably well represented in ex situ collections, though not by
Figure 5.137. Distribution of *V. kokii* based on herbarium specimen passport data.
accessions from throughout its range; therefore further collecting from throughout its range is required; particularly from Guinea, Sierra Leone, Côte d’Ivoire, Central African Republic and Angola. The trend in numbers of herbarium specimens collected over time follows the general pattern for *Vigna* species, which suggests overall the species does not appear to be in danger of genetic erosion or extinction.

**IUCN Red List Category:** Least Concern.


**Reference to a published description:** CPV 201; FWTA 568.

**Vernacular names:** None known.

**Habit and lifespan:** Slender, climbing or creeping annual.

**Flower colour:** Purple or yellow.

**Habitat:** Inundated areas, savannahs, roadsides, laterite plateaux, coastal areas, primary and secondary grasslands, riverbanks, with a preference for moist and seasonally inundated sandy grasslands; sandy loam over laterite.

**Associated species:** *Ctenium* and *Loudetia*.

**Altitude:** 1–1200 m.

**Distribution:**

CEAF: CAF, ZAI.

EAF: TAN.

NEAF: SUD.

WAF: BKN, CMN, GHA(!), GNB, GUI, IVO, LBR, MLI, NGA, SEN, SIE, TOG.

ZAMB: ANG.

**Phenology:** Flowers between October and December in WAF.

**Uses:** None known.

**Taxon Vulnerability Assessment:** = 3.4

**Conservation Notes:** *V. venulosa* is widely distributed in West and Central Africa; however, the species is not well represented in *ex situ* collections, therefore further collecting from throughout its range is required. The trend in numbers of herbarium specimens collected over time follows the general pattern for *Vigna* species, which suggests overall the species does not appear to be in danger of genetic erosion or extinction.

**IUCN Red List Category:** Least Concern.

**Taxonomic notes:** Closely related to *V. nigritia*. The two species also have similar distribution patterns but *V. venulosa* is more common.

### 5.4 Subgenus *Plectotropis*

(Schumach.) Baker in Fl. Br. India 2:206 (1876).

**Section Plectotropis**


**Reference to a published description:** CPV 202; FCBR 379, illust. 381; FE 176; FS 436; FTEA 652; FWTA 567; FZ 145; LM 585.

**Vernacular names:** None known.
Figure 5.138. Vigna nigritia Hook. f.: 1, habit (x1); 2, stipule (x2.5); 3, inflorescence nectaries, front view (x2.5); 4, inflorescence nectaries, lateral view (x2.5); 5, stem, horizontal section (2.5); 6, flower, front and lateral view (x1); 7, flower bud (x2); 8, standard (x2.5); 9, standard, details (x6); 10 and 11, keel, front and lateral view (x3); 12 and 13, wing (x3); 14, diadelphous stamens, spread out (x3); 15, style (x3); 16, stigma (x12); 17, seed, lateral and front view (x2.5); 18, details of leaf nervation, lower surface (x6).
Figure 5.139. Distribution of *V. nigritia* based on specimen and accession passport data.

Figure 5.140. FloraMap predicted distribution for *V. nigritia*.
Figure 5.141. Vigna venulosa Baker in Oliv.: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×2.5); 4, flower, front and lateral view (×1); 5, standard (×2); 6, standard, details (×3); 7 and 8, keel, front and lateral view (×2.5); 9 and 10, wing (×2.5); 11, diadelphous stamens, spread out (×3); 12, style (×3); 13, stigma (×12); 14, calyx, spread out (×2.5); 15, stem, horizontal section (×6); 16, inflorescence nectaries, details (×6); 17, seed, lateral and front view (×2.5).
Figure 5.142. Distribution of *V. venulosa* based on specimen and accession passport data.

Figure 5.143. FloraMap predicted distribution for *V. venulosa*.
**Habit and lifespan:** Climbing or trailing perennial herb, growing from a long, narrow rootstock.

**Flower colour:** Pink, purple or yellowish.

**Habitat:** Grassland, savannah, swamp, lake shore, open bush, forest margin, woodland, river and roadsides, fallow and weed in cultivation; clay or sandy loam over sandstone or granite.

**Associated species:** Acacia, Albizia, Brachystegia, Combretum, Commiphora, Hyparrhenia, Pteridium and Themeda.

**Altitude:** 1–3900 m.

**Distribution:**
- CEA: BUR, CAF, CHA, CON, EQG, GAB, RWA, ZAI.
- EAF: KEN, TAN, UGA.
- NEAF: ERI, ETH, SOM, SUD.
- SAF: SWZ, ZAF.
- WAF: BEN, BKN, CMN, GHA, GNB, IVO, LBR, MLI, NGA, NGR, SEN, SIE, TOG.
- WIO: MDG(!).
- ZAMB: ANG, BOT, MLW, MOZ, ZAM, ZIM.

**Phenology:** Variable depending on location.

**Uses:** See var. vexillata, var. angustifolia and var. lobatifolia for notes on use.

**Taxon Vulnerability Assessment:** = 2.4

**Conservation Notes:** V. vexillata is widely distributed throughout Africa and there are significant *ex situ* collections from throughout its range. It is an important source of human and animal feed therefore it is not surprising that so much effort has been devoted to ensuring the genepool is well conserved. However, there are still gaps in the conserved material. Additional collecting is required from Ghana, Liberia, Sudan, Sierra Leone and Chad. As with V. unguiculata, there may be a need for further landrace sampling of material not already held *ex situ*. The trend in numbers of herbarium specimens collected over time follows the general pattern for all *Vigna* species, which suggests overall the species does not appear to be in danger of extinction or genetic erosion; however, this assessment does not hold true for all subspecies, for subsp. dolichonema and microsperma see below.

**IUCN Red List Category:** Least Concern.

**Taxonomic notes:** Several varieties of this species are recognized: var. vexillata, var. angustifolia, var. davyi, var. dolichonema, var. lobatifolia, var. macrosperma and var. ovata. These are distinguished on the basis of leaflet size and shape. The species shows a wide range of variation across its distribution which makes varietal separation difficult. Further, intermediate forms are common. Southern African material shows more marked levels of variation. Pasquet (2001) interestingly notes that numerous intermediate specimens between var. vexillata and var. angustifolia are found in ZAMB.

1. Leaflets sometimes all unifoliate, or one-, two- or three-foliolate on the same stem, more or less rhombic to broadly ovate with base cuneate; stems densely ferruginous, setaceous, hairs sometimes light-coloured; calyx lobes much longer than tube. .......................................................... var. davyi
Leaflets always trifoliolate, shape varying, almost round to ovate, base essentially cuneate to more or less obtuse, or more or less lanceolate (much longer than broad), base essentially truncate to obtuse; stems ferruginous, villous to subglabrous; calyx lobes longer or shorter than tube

2. Leaflets lobed, glabrous or nearly so, 2–4 cm wide; calyx pubescent, with teeth 4.5–11 mm............................... var. lobatifolia

Leaflets entire or if slightly lobed then densely hairy. .................................................. 3

3. Calyx teeth 2.0–2.2 mm var. dolichonema Calyx teeth 0.2–2.0 mm. .................. 4

4. Pod 12–15 cm; seed subspherical 3.5–5 mm. ...................... var. macrospemma

Pod <12 cm; seed 2.5–4 mm. .............................................................. 5

5. Terminal leaflets ovate, base cuneate to obtuse; apex obtuse or acute, size variable; stems densely ferruginous, villous to puberulent; calyx lobes usually longer than tube .......................................................... 6

Terminal leaflets essentially lanceolate to linear, base truncate to more or less obtuse, apex acuminated, up to approx. 100–150×8–18 mm; stems often glabrescent or aculeate; calyx lobes often shorter than tube.......................... var. angustifolia

6. Plant usually densely ferruginous; terminal leaflets broadly or narrowly ovate to elliptic or rhombic-ovate, base cuneate to more or less obtuse, up to 120×55 mm; peduncles as thick or thinner than twinning stems; legumes up to approx. 100 mm long.............................. var. vexillata

Plant sparsely pubescent, ferruginous; terminal leaflets rotund, elliptic, ovate to narrowly ovate or more or less lanceolate to linear, base usually obtuse, seldom longer than 25 mm when rotund, up to 40 mm when lanceolate; peduncles much thickened than low-creeping stem; legumes approx. 55 mm long............................. var. ovata

Additional notes: The pubescence on the leaves, stems and pods of V. vexillata and the high content of para-aminophenylalanine are reported to be repulsive to major insect pests of cowpea including pod borers (Maruca testulalis) (Padulosi and Ng, 1990; Baudoin and Maréchal, 1991; Fatokun, 1991; Jackai and Singh, 1991) and Clavigralla tomentosicollis (Oghiakhe et al., 1992). The species has also been reported to have high levels of bruchid-resistance conferring anti-metabolites including trypsin inhibitors, tannins and lectins (Marconi et al., 1997). This furthermore implies a great potential for improvement of cowpea. Although many attempts to hybridize V. vexillata with V. unguiculata have been unsuccessful, a recent study has reported some success with embryo rescue (Gomathinayagam et al., 1998).

In addition to being tasty boiled or raw, the tubers are easy to peel and contain about 15% protein and are reported to be eaten in Africa during times of severe hunger (Stephens, 1994), although the seeds contain low levels of sulphur-amino acids (Siddhuraju et al., 1994). In view of its ability to grow in harsh conditions, and considering that many African countries are plagued with seasonal droughts, V. vexillata holds great promise as a potential new crop.

Apart from the potential use in cowpea improvement, this species has great potential as a crop. Its edible tubers are often roasted like sweet potatoes and
contain a higher protein content than other root crops such as cassava and sweet potato (Padulosi and Ng, 1990.)

**Vigna vexillata var. vexillata**

**Reference to a published description:** CPV 202; FE 176; FS 436; FZ 145.

**Vernacular names:**
Akanyayua, Umuyambi or Ngole (BUR).
Areg, Yacta doungari, Zohot orthi (ETH).
Shi’hibi (KEN).
Inganiga, Muharaku, Umucusuka (RWA).
Lubiya el ghazal (SUD).
Kisukuma, Lufundufundu, Kisumbumbi, Mninahandala (TAN).
Ekihuru (BOT).
Kokole (UGA).
Adjolo, Kansimba-simba, Kwakwa, Madezo masiolo, Njoro (ZAI).

**Habit and lifespan:** Perennial, climbing, herb.

**Flower colour:** Pink, purple or yellowish.

**Habitat:** Fallows, disturbed areas, coastal bushes, grasslands, lake edges, various grasslands, roadsides, riverbanks, thicket and cultivated fields where it grows as a weed.

**Associated species:** Unknown.

**Altitude:** 1–3860 m.

**Distribution:**
CEAF: BUR, CAF, CHA, CON, GAB, RWA, ZAI.
EAF: KEN, TAN, UGA.
NEAF: ERI, ETH, SOM, SUD.
SAF: SWZ, ZAF.
WAF: BEN, BKN, CMN, GHA, GNB, IVO, LBR, NGA, NGR, SEN, SIE, TOG.
ZAMB: ANG, BOT, MLW, MOZ, ZIM.

**Phenology:** Variable depending on location.

**Uses:** The leaves are eaten as a salad in hot weather in Kenya and are also eaten in Tanzania and Zaire. When fed to goats, the leaves are believed to increase milk flow (Tanzania). The plant is also used in the treatment of bilharzia in Tanzania.

**Conservation Notes:** This variety in comparison with the others is well represented in ex situ collections from throughout its range; therefore further collection is not a priority.


**Reference to a published description:** Refer to protologue.

**Vernacular names:** None known.

**Habit and lifespan:** Perennial, climbing herb.

**Flower colour:** Pink or purple.
**Habitat:** Disturbed areas.

**Associated species:** Unknown.

**Altitude:** 220–1700 m.

**Distribution:**
CEAF: CAF, ZAI.
SAF: ZAF.
ZAMB: BOT.

**Phenology:** Unknown.

**Uses:** None known.

**Conservation Notes:** *V. vexillata* var. *macrosperma* was relatively recently described, is less well known but has several *ex situ* collections, but further collection is a priority.


**Reference to a published description:** CPV 204; FS 436; FTEA 654; FZ 146; LM 585, illust. 575.

**Vernacular names:**
GHA: Wate.
MDG: Tokambahatsy, Tsiroko.
MOZ: Chiteji, Tembu.
SUD: Abapu muno.

**Habit and lifespan:** Perennial, climbing or prostrate herb.

**Flower colour:** Violet or purple pink fading bluish.

**Habitat:** Floodplains, disturbed grass veldts, thicket edges, freshwater marshes, grasslands, roadsides, herbaceous savannahs, swamp and lake edges, thickets and woodlands.

**Associated species:** Unknown.

**Altitude:** 1–2300 m.

**Distribution:**
CEAF: BUR, CAF, CHA, CON, RWA, ZAI.
EAF: KEN, TAN, UGA.
NEAF: ETH, SOM, SUD.
SAF: SWZ, ZAF.
WAF: BEN, BKN, CMN, GAM, GHA, IVO, MLI, NGA, NGR, SEN, TOG.
WIO: MDG(!).
ZAMB: ANG, MLW, MOZ, ZAM, ZIM.

**Phenology:** Throughout the year.

**Uses:** The tubers are ground and used as a remedy for sores and ulcers. The pods are also used to cure skin irritation thus the local name “itch bean”.

**Conservation Notes:** This variety in comparison with the others is well represented in *ex situ* collections from throughout its range; therefore further collection is not a priority.

**Taxonomic Notes:** Pasquet (2001) notes that there are numerous intermediates between var. *vexillata* and var. *angustifolia*.
Figure 5.144. *Vigna vexillata* (L.) A. Rich. var. *vexillata*: 1, habit (×1); 2, stipule (×2.5); 3, details of leaf nervation, lower surface (×6); 4, inflorescence nectaries (×3); 5, flower, front and lateral view (×1); 6, standard (×1); 7, standard, details (×2.5); 8 and 9, keel, lateral and front view (×2); 10 and 11, wing (×2.5); 12, diadelphous stamens, spread out (×3); 13, style (×3); 14, stigma (×12); 15, calyx, spread out (×2.5); 16, seed, lateral and front view (×2.5); 17, flower nectaries (×3).
Figure 5.145. Distribution of *V. vexillata* based on specimen and accession passport data.

Figure 5.146. FloraMap predicted distribution for *V. vexillata*. 
Figure 5.147. Distribution of *V. vexillata* var. *vexillata* based on specimen and accession passport data.

Figure 5.148. FloraMap predicted distribution for *V. vexillata* var. *vexillata*. 

Reference to a published description: CPV 205; FTEA 654.

Vernacular names: None known.

Habit and lifespan: Perennial, climbing or prostrate herb.

Flower colour: Violet or purple pink fading bluish.

Habitat: Known only from type location.

Associated species: Unknown.

Altitude: 1300–1400 m.

Distribution: EAF: TAN (Matengo Hills).

Phenology: March.

Uses: None known.

Conservation Notes: *V. vexillata* var. *dolichonema* was relatively recently described and is the most geographically restricted variety, being a Tanzanian endemic. Only a single specimen was seen and no ex situ collections exist; therefore further collection is a priority to help establish the true range of the taxon. The lack of material and restricted distribution indicate that this variety deserves a higher conservation priority; an IUCN Red List Category of Critically Endangered is appropriate.

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Reference to a published description: Refer to protologue.

Vernacular names: None known.

Habit and lifespan: Perennial, climbing or prostrate herb.

Flower colour: Violet or purple.

Habitat: Coastal areas.

Associated species: Unknown.

Altitude: 1–1900 m.

Distribution: SAF: SWZ, ZAF.

Phenology: Not known.

Uses: None known.

Conservation Notes: This variety in comparison with the others is well represented in ex situ collections from throughout its range; therefore further collection is not a priority.

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Reference to a published description: CPV 207; FZ 146.

Vernacular names: NAM: Idi, Kwanyama, Muimbo, Okupunde or Sha.

Habit and lifespan: Perennial, climbing or prostrate herb.
Figure 5.149. Distribution of *V. vexillata* var. *angustifolia* based on specimen and accession passport data.

Figure 5.150. FloraMap predicted distribution for *V. vexillata* var. *angustifolia*.
Flower colour: Violet or purple pink.
Habitat: Regenerating woodland, riverbanks, riverbeds, sandy flats and scattered bushes.
Associated species: Bakiaea, Combretum, Lonchocarpus.
Altitude: 900–1750 m (though only one record with altitude in the database).
Distribution:
SAF: NAM, ZAF.
ZAMB: ANG, BOT(!), ZAM.
Phenology: Mainly January–April, but flowering in August and September has been recorded.
Uses: The fleshy tubers are eaten raw or cooked by the Kung in Namibia.
Conservation Notes: This variety in comparison with the others is well represented in ex situ collections from throughout its range; therefore further collection is not a priority.

Reference to a published description: CPV 205.
Vernacular names: None known.
Habit and lifespan: Herbaceous, climbing perennial.
Flower colour: Lilac, mauve, purple or violet.
Habitat: Mainly in grasslands but also recorded in open woodlands and cleared forests. Pienaar and Kok (1991) note that this species is adapted to the acidity of igneous, granite outcrops.
Associated species: Unknown.
Altitude: 1–1950 m.
Distribution:
SAF: SWZ, ZAF (Mpumalanga and Kwazulu-Natal Provinces).
ZAMB: MOZ.
Phenology: Mainly September–March.
Uses: None known.
Conservation Notes: This variety in comparison with the others is well represented in ex situ collections from throughout its range; therefore further collection is not a priority.
Additional notes: It has recently been suggested that this species is no more than a unique variant of V. vexillata (Pienaar and Kok, 1991; Pienaar, 1992). No evidence of gene flow between this species and the closely related V. vexillata was observed even where they grew in close proximity (Pienaar and Kok, 1992). Fatokun et al. (1997), using RFLP markers, reported 73% similarity between the two species and that hybridization is possible between the two species resulting in a partially fertile F_1 hybrid.

Reference to a published description: CPV 205; FTEA 637; FZ 148.
Figure 5.151. Distribution of *V. vexillata* var. *ovata* based on specimen and accession passport data.

Figure 5.152. FloraMap predicted distribution for *V. vexillata* var. *ovata*. 
Figure 5.153. Distribution of *V. vexillata* var. *lobatifolia* based on specimen and accession passport data.

Figure 5.154. FloraMap predicted distribution for *V. vexillata* var. *lobatifolia*.
Figure 5.155. Vigna vexillata var. lobatifolia (Baker) Pasquet: 1., habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×3); 4, inflorescence nectaries (×3); 5, flower, front and lateral view (×1); 6, keel, front view (×3); 7, keel, front view (×3); 8, standard (×1.5); 9, standard, details (×3); 10 and 11, wing (×2.5); 12, diadelphous stamens, spread out (×3); 13, stigma (×12); 14, style (×2.5); 15, calyx, spread out (×2.5); 16, seed, lateral and front view (×2.5).
Vernacular names:
ZAI: Inaola Kwaka.
KEN: Muchaihi.
Habit and lifespan: Perennial, climbing herb.
Flower colour: Mauve, yellow or white with a yellow patch or very pale blue tinged yellow.
Habitat: Alluvial plains, grasslands, forest undergrowth, disturbed ground, inundated areas, stream- and riverbanks, roadsides, savannahs; sandy or clay loam, alluvial.
Associated species: Barringtonia racemosa, Brachystegia, Hyparrhenia and Syzygium.
Altitude: 1–1712 m.
Distribution:
CEAF: BUR, ZAI.
EAF: KEN, TAN, UGA.
NEAF: SUD.
WAF: CMN, GAM(!), GNB.
ZAMB: MLW, MOZ, ZAM.
Phenology: February to May.
Uses: None known.
Taxon Vulnerability Assessment: = 3.2
Conservation Notes: V. kirkii is widely distributed in Central Africa. The species is poorly represented in ex situ collections, therefore further collecting from throughout its range is required, particularly from the Democratic Republic of the Congo and northeast Tanzania. The trend in numbers of herbarium specimens collected over time follows the general pattern for Vigna species, which suggests overall the species does not appear to be in danger of genetic erosion or extinction.
IUCN Red List Category: Least Concern.
Additional notes: The species shows high levels of resistance to bruchid beetles and thus represents a potential source of resistance genes (Padulosi and Ng, 1990).

Vigna nuda N.E. Br., Kew Bull.:121 (1901).
Reference to a published description: CPV 206; FCBR 372; FTEA 655.
Vernacular names:
ZAI: Lusashi.
Habit and lifespan: Initially erect, later prostrate or rarely climbing, perennial. Flowers almost always appear before leaves.
Flower colour: Greenish or yellow-brown.
Habitat: Open woodlands, grassy thickets, grasslands, savannahs, riversides and rarely in swamps. Recent burning is the most commonly noted abiotic factor at collecting sites. Sand, sandy loam and clay have been cited as substrates.
Associated species: Brachystegia, Combretum, Entada, Parinari, Sphenostylis, Terminalia.
Figure 5.156. *Vigna vexillata* var. *davyi* (Bolus) Pienaar: 1, habit (x1); 2, stipule (x3); 3, details of leaf nervation, lower surface (x6); 4, inflorescence nectaries (x2.5); 5, flower, front and lateral view (x1); 6, standard (x1.5); 7, standard, details (x3); 8 and 9, keel, front and lateral view (x2); 10 and 11, wing (x2.5); 12, diadelphous stamens, spread out (x2); 13, style (x2); 14, stigma (x12), 15, calyx, spread out (x2); 16, calyx bract (x3); 17, seed, lateral and front view (x2.5).
Figure 5.157. Distribution of *V. vexillata* var. *davyi* based on specimen and accession passport data.

Figure 5.158. FloraMap predicted distribution for *V. vexillata* var. *davyi*. 
Altitude: (0–30) 450–2300 m.

Distribution:
CEAF: BUR(!), ZAI(!).
EAF: TAN(!).
ZAMB: ANG, MLW(!), MOZ(!), ZAM(!), ZIM(!).

Phenology: May–October in both CEAF and ZAMB.

Uses: The roots are reported to be used in the brewing of Munkoyo beer in Zambia and the Shaba region of the Democratic of the Congo (Pauwels et al., 1992).

Taxon Vulnerability Assessment: = 6.4

Conservation Notes: *V. nuda* is widely distributed in southern-central and West Africa, but it is rare throughout its range. As only two specimens were seen and there are no *ex situ* collections for the species, there is a need for urgent germplasm collection throughout its range. Recent burning is associated with many of the specimens seen. Although burning is important for flowering of this species, if inappropriate burning regimes are used, the population is threatened. The trend in numbers of herbarium specimens collected over time cannot be assessed as so few populations have been sampled; only a few specimens were collected in the last century. It appears the species is in decline and vulnerable to genetic erosion and extinction.

IUCN Red List Category: Critically Endangered.

Additional notes: This species resembles *V. frutescens* morphologically as well as in the tendency to flower before the appearance of leaves. Recently Pasquet (2001) has sunk the species in *V. antunesii*, which may explain the relatively small number of specimens seen compared with its reported breadth of distributional range.


Reference to a published description: CPV 207; FCBR 377; FWTA 567; FZ 148.

Vernacular names: None known.

Habit and lifespan: Perennial, erect herb.

Flower colour: Mauve to purple.

Habitat: Wet pasture, marsh, bush, open ground, woodlands, forests and dambos on sand and clay.

Associated species: *Brachystegia, Cyperaceae, Protea* and *Uapaca*.

Altitude: 166–1602 m. Most records 1400–1700 m.

Distribution:
CEAF: ZAI.
EAF: TAN(!).
WAF: CMN, NGA.
ZAMB: ZAM.

Phenology: December to February in CEAF and ZAMB; June to August in WAF.

Uses: None known.

Taxon Vulnerability Assessment: = 4.9
Figure 5.159. Distribution of *V. kirkii* based on specimen and accession passport data.

Figure 5.160. FloraMap predicted distribution for *V. kirkii*. 
Figure 5.161. *Vigna kirkii* (Baker) Gillett: 1, habit (x1); 2, details of leaf nervation, lower surface (x6); 3, stipule (x2.5); 4, inflorescence nectaries (x2.5); 5, flower, front and lateral view (x1); 6, standard (x2); 7, standard, details (x3); 8 and 9, keel, lateral and front view (x2); 10 and 11, wing (x2.5); 12, diadelphous stamens, spread out (x2.5); 13, style (x2.5); 14, stigma (x12); 15, calyx, spread out (x2.5); 16, seed, lateral and front view (x2.5).
Conservation Notes: *V. longissima* has a relatively wide but disjunct distribution and the species is not represented in *ex situ* collections; therefore, further collection across its range of distribution is clearly a priority. The trend in numbers of herbarium specimens collected over time indicates that few specimens have been collected since the 1940s, which suggests the species is in decline and is in danger of genetic erosion and extinction.

IUCN Red List Category: Vulnerable.

5.5 Subgenus Ceratotropis


Section Ceratotropis


Reference to a published description: CPV 209; FE 177; FS 436; FTEA 655; FZ 154; LM 581.

Vernacular names: Mung bean or green gam in English, mung in Hindi and salbuko-cagaar in Somali.

Habit and lifespan: Annual, climbing or suberect herb.

Flower colour: Yellow green.

Habitat: Cultivated or escape, primarily in the Indian subcontinent but throughout the tropics.

Associated species: Unknown.

Altitude: 1–2200 m.

Distribution: Not native to Africa.

CEAF: CON.

EAF: KEN(!), TAN(!), UGA(!).

NEAF: ETH, SOM(!), SUD.

WAF: CMN, GHA.

WIO: MDG(!) (mainly west and north).

ZAMB: ANG, MOZ(!), ZAM(!), ZIM.

Phenology: Throughout the year.

Uses: Ancient Indian crop cultivated for its edible seeds at fairly low altitudes throughout the tropics and subtropics.

Taxon Vulnerability Assessment: = 6.1

Conservation Notes: Introduced from Asia and now widely distributed as an escape.

IUCN Red List Category: Least Concern.

Taxonomic notes: Two varieties are recognized from Africa, they can be distinguished as follows:

1. Plant cultivated; stems robust, often woody, multistemmed and erect; pods more or less indehiscent; leaflets usually entire; pods 70–90 mm long; seeds 4 mm.................................................................................................................................

   var. radiata

   Plant wild or weedy; stems twining or prostrate, less robust; pods dehiscent; leaflets frequently lobed; pods and seeds usually smaller ...........................

   var. sublobata
Figure 5.162. Distribution of *V. nuda* based on herbarium specimen passport data.
Figure 5.163. *Vigna nuda* N.E. Br.: 1, habit (×1); 2, stipule (×2.5); 3, details of leaf nervation, lower surface (×1); 4, flower, front and lateral view (×1); 5, standard (×2); 6, standard, details (×3); 7 and 8, keel, lateral and front view (×3); 9 and 10, wing (×2.5); 11, diadelphous stamens, spread out (×3); 12, style (×3); 13, stigma (×12); 14, calyx (×3); 15, seed, lateral and front view (×2.5).
Figure 5.164. *Vigna longissima* Hutch.: 1., habit (×1); 2, stipule (×3); 3, leaflet attachment details (×1).
**Figure 5.165.** Distribution of *V. longissima* based on herbarium specimen passport data.

**Figure 5.166.** FloraMap predicted distribution for *V. longissima*. 
**Vigna radiata var. radiata**

Reference to a published description: CPV 209; FE 177; FTEA 656; LM 582.

Vernacular names: None known.

Habit and lifespan: Annual, climbing or suberect herb.

Flower colour: Yellow green.

Habitat: Seasonally wet secondary grassland, bushland, cultivated.

Associated species: Unknown.

Altitude: Wherever cultivated.

Distribution: Not native to Africa.

EAF: KEN(!), TAN(!), UGA(!).

NEAF: ETH(!).

WIO: MDG(!).

Phenology: Throughout the year.

Uses: Used mainly by the Indian ethnic population as green gram or mung bean.

Conservation Notes: Introduced from Asia and now widely distributed as an escape.

IUCN Red List Category: Least Concern.

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Reference to a published description: FE 177; FTEA 656; FWTA 656; FZ 145; LM 582, illust. 575.

Vernacular names:

MDG: Antandro, Sarimahalay, Voango.

Habit and lifespan: Annual, climbing or suberect herb.

Flower colour: Yellow green.

Habitat: Naturalized in grassland, disturbed and cultivated areas, especially in seasonally marshy areas.

Associated species: Unknown.

Altitude: 0–1000 m.

Distribution: Not native to Africa.

EAF: TAN(!).

NEAF: ETH(!), SUD(!).

WAF: CMN, GHA, NGA(!).

WIO: MDG(!) (mainly west and north).

ZAMB: MOZ(!), ZAM(!), ZIM(!).

Phenology: Throughout the year but mainly February to April.

Uses: Common food crop, originally native to Asia.

Conservation Notes: Introduced from Asia and now widely distributed as an escape.

IUCN Red List Category: Least Concern.

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Reference to a published description: CPV 212; LM 583.
Vernacular names: None known.
Habit and lifespan: Scrambling herb.
Flower colour: Yellow green.
Habitat: Roadsides and secondary vegetation.
Associated species: Unknown.
Altitude: 0–2800 m.
Distribution: Not native to Africa.
NEAF: ETH, SUD.
SAF: ZAF(!).
WIO: MDG(!).
Phenology: March to April.
Uses: None known.
Taxon Vulnerability Assessment: = 6.9
Conservation Notes: A recent introduction to Madagascar and East Africa from Southeast Asia.
IUCN Red List Category: Least Concern.

Reference to a published description: CPV 213; FE 177; LM 584.
Vernacular names: Moth or rice bean in English.
Habit and lifespan: Annual, slender, climbing herb.
Flower colour: Yellow.
Habitat: Cultivated for its edible pods and seeds and also used as fodder, particularly in hot dry areas.
Associated species: Unknown.
Altitude: Wherever cultivated.
Distribution:
NEAF: ETH(!), SOM(!).
WIO: MDG(!).
Phenology: Throughout year.
Uses: Cultivated for edible pods and seeds.
Conservation Notes: Introduced from Asia and now widely distributed as an escape.
IUCN Red List Category: Least Concern.

Reference to a published description: CPV 214; LM 584.
Vernacular names:
MDG: Anatsamby, Mahalay, Tseisa, Tsiasisa.
Habit and lifespan: Annual, climbing herb.
Flower colour: Bright yellow.
Habitat: Cultivated.
Associated species: Unknown.
Figure 5.167. Distribution of *V. radiata* based on specimen and accession passport data.

Figure 5.168. FloraMap predicted distribution for *V. radiata*. 
Figure 5.169. Distribution of *V. trilobata* based on herbarium specimen passport data.
**Altitude**: Wherever cultivated up to 1000 m.

**Distribution**:
- WAF: IVO.
- WIO: MDG(!).

**Phenology**: Throughout year.

**Uses**: Cultivated for edible beans (rice bean).

**Conservation Notes**: Introduced to Madagascar and now widely cultivated.

**IUCN Red List Category**: Least Concern.


No African species.

### 5.6 Subgenus *Lasiospron*


**Reference to a published description**: CPV 219; LM 578.

**Vernacular names**:
- SIE: Yawe.

**Habit and lifespan**: Annual or perhaps perennial, climbing herb.

**Flower colour**: Orange yellow.

**Habitat**: Marshes, swamps, riverbanks, coastal sand, rice fields and moist areas.

**Associated species**: Unknown.

**Altitude**: 1–1660 m. However, only one specimen was found over 286 m.

**Distribution**: Not native to Africa.

- CEAF: ZAI.
- WAF: BEN, GHA, GNB, IVO, SEN, SIE.
- WIO: MDG.

**Phenology**: January.

**Uses**: None known.

**Taxon Vulnerability Assessment**: = 5.4

**Conservation Notes**: *V. longifolia* has a disjunct distribution from Senegal to Madagascar and appears to be uncommon throughout its range, possibly indicating individual population isolation and vulnerability. There is only a single *ex situ* collection and further systematic collection is required. The trend in numbers of herbarium specimens collected over time follows the pattern for all *Vigna* species, but the last specimen to be collected was in 1968 and this may indicate decline and genetic erosion. However, the fact that the species is uncommon throughout its range suggests individual populations are relatively isolated and vulnerable to extinction.

**IUCN Red List Category**: Vulnerable.

**Additional notes**: This species is not native to Africa but is thought to have been introduced from the Americas (Verdcourt, 1970; Maréchal *et al.*, 1978).


**Reference to a published description**: CPV 219.
Vernacular names: None known.
Habit and lifespan: Annual or perhaps perennial, climbing herb.
Flower colour: Yellow.
Habitat: Riverine forests, swamps and riverbanks.
Associated species: Chrysophyllum, Raphia hookeri and Rhynchospora corymbosa.
Altitude: 40–1300 m.
Distribution: Not native to Africa.
CEAF: CAF, CON, GAB, ZAI.
EAF: KEN, TAN, UGA.
WAF: CMN, GHA, GUI, IVO, NGA, SIE.
Phenology:
Uses: None known.
Taxon Vulnerability Assessment: = 4.5
Conservation Notes: V. juruana, although not believed to be native to Africa, is widely distributed in a band across the centre of the continent, but is rare throughout. The species is represented by two ex situ collections from Cameroon and the Central African Republic, and therefore further systematic collecting is required. The trend in numbers of herbarium specimens collected over time follows the general pattern for Vigna species, which suggests overall the species does not appear to be in imminent threat of genetic erosion or extinction, but the rarity indicates population levels should be monitored.
IUCN Red List Category: Near Threatened.
Additional notes: This species is thought to be an introduction from the New World.

5.7 Subgenus Sigmoidotropis
Section Sigmoidotropis
No African species.
Section Pedunculares Maréchal, Mascherpa and Stainier, Taxon 27:201 (1978).
No African species.
Section Caracallae (DC.) Maréchal, Mascherpa and Stainier, Taxon 27:201 (1978).
No African species.
No African species.

Section Leptospron (Benth.) Maréchal, Mascherpa and Stainier, in Taxon 27: 201 (1978).
Reference to a published description: CPV 229; FS 437; LM 573.
Vernacular names:
SIE: Stuxe/Kungsuturu.
Figure 5.170. *Vigna longifolia* (Benth.) Verdc.: 1., habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×3); 4, flower, front and lateral view (×1); 5, inflorescence with pod (×3); 6, standard, details (×3); 7, standard (×2); 8, keel, front view (×3); 9, keel, lateral view (×3); 10, diadelphous stamens, spread out (×3); 11, diadelphous stamens and style (×3); 12 and 13, wing (×2.5); 14, style (×2.5); 15, stigma (×12); 16, inflorescence nectaries, details (×3); 17, seed, lateral and front view (×2.5); 18, calyx, spread out (×2.5).
Figure 5.171. Distribution of *V. longifolia* based on specimen and accession passport data.

Figure 5.172. FloraMap predicted distribution for *V. longifolia*.
Figure 5.173. Distribution of *V. juruana* based on specimen and accession passport data.

Figure 5.174. FloraMap predicted distribution for *V. juruana*.
Habit and lifespan: Climbing, creeping or twining perennial.
Flower colour: Cream, white, yellow, greenish yellow or purple.
Habitat: Beaches, roadsides, riversides, coastal thickets and rarely swamps and marshes, and forest fringe on sandy soils.
Associated species: *Mimosa* sp.
Altitude: 1–1660 m. Widely cultivated but most commonly a littoral species.
Distribution: Not native to Africa.
CEAF: CHA, GAB, ZAI.
EAF: TAN.
NEAF: SOM.
WAF: CMN, GAM, GHA, GUI, LBR, NGA, SIE, TOG.
WIO: MDG.
ZAMB: ANG, ZAM.
The species has been recorded as being cultivated in ANG, GNB, MLI, GGI and SEN (Hiern, 1896).
Phenology: Flowers in September to April (CEAF); September to March (WAF); July (EAF).
Uses: The species produces edible tubers (Padulosi and Ng, 1990).
Taxon Vulnerability Assessment: $= 4.6$
Conservation Notes: *V. adenantha*, although not believed to be native to Africa, is widely distributed in a band across the centre of the continent, there are only five *ex situ* collections so further systematic collecting is required, particularly in Sierra Leone, Liberia and Cameroon. The trend in numbers of herbarium specimens collected over time follows the general pattern for *Vigna* species, which suggests overall the species does not appear to be in imminent threat of genetic erosion or extinction.
IUCN Red List Category: Least Concern.
Additional notes: This is believed to have been introduced into Africa from the Americas but has now become naturalized into most of Africa. The species has some potential for use as a forage crop although it requires a period of recovery as it has been shown not to persist under continuous grazing (Muir and Pitman, 1991).

5.8 Subgenus *Macrorhyncha*


Reference to a published description: CPV 231; FE 177; FS 437; FTEA 658, illust. 659; FWTA 568; FZ 156, illust. 155.

Vernacular names:
MOZ: Cahemba nhemba.
TAN: Hla’akeko, Kikuzikwima, Penzepembe.
UGA: Onyumabasalea.

Habit and lifespan: Trailing or twining perennial herb, which grows from a woody rootstock.
Flower colour: Mauve or purple, rarely red, blue or lilac.
Figure 5.175. Distribution of *V. adenantha* based on specimen and accession passport data.

Figure 5.176. FloraMap predicted distribution for *V. adenantha*.
Habitat: Coastal bushes, grassland subjected to seasonal burning, bushland, roadside, herbaceous savannahs, often associated with dry environments that have been recently burnt; clay or sandy loam over laterite, limestone or quartz.

Associated species: *Acacia, Brachystegia, Colophospermum, Combretum, Commiphora, Euphorbia, Gardenia, Omacarpum* and *Protea*.

Altitude: 1–3857 m.

Distribution:
- CEAF: BUR, RWA, ZAI.
- EAF: KEN, TAN, UGA.
- NEAF: ETH, SOM, SUD.
- WAF: CMN, NGA.
- ZAMB: MLW, MOZ, ZAM, ZIM.

Phenology: June to November.

Uses: The tubers are eaten, raw or cooked by the Hadza (Tanzania). In Uganda boys eat the tubers whilst herding livestock.

Taxon Vulnerability Assessment: 4.3

Conservation Notes: *V. macrorhyncha* has a north–south distribution from Sudan and Ethiopia to Mozambique. There are only three *ex situ* collections and further systematic collection is required from throughout its range. West African populations should be given higher priority because they are isolated from the main range of population and no populations are conserved *ex situ*. Overgrazing and burning are noted as a cause of genetic erosion on some of the herbarium specimens. Populations growing in such areas may be threatened by both factors and may require specific monitoring. However, overall the trend in numbers of herbarium specimens collected over time follows the pattern for all *Vigna* species, indicating nonparticular threat from genetic erosion or extinction.

IUCN Red List Category: Near Threatened.

Taxonomic notes: This species shows close affinity to *V. grahamiana*, an Indian species. Although floral morphology of both species is typical of *Vigna*, the unsculptured pollen resembles that of *Phaseolus*. The two species may need to be placed in a separate genus (Verdcourt, 1970). However, Maréchal et al. (1978) retained both in *Vigna* mainly for convenience (Maréchal, 1982). Pasquet (2001) notes that this species is quite distinct from other *Vigna sensu stricto* and may warrant generic distinction in the future.


Reference to a published description: CPV 231; FTEA 657.

Vernacular names: None known

Habit and lifespan: Robust, climbing perennial whose flowers appear before leaves.

Flower colour: Green outside, mauve and white inside or veined with dull purple.

Habitat: Dry scrub, savannah bushland, deciduous woodlands, dense scrublands, especially in areas that are prone to burning; sandy loam.

Associated species: *Acacia, Combretum, Commiphora, Terminalia* and *Thylachia*.

Altitude: 200–1100 m.
Figure 5.177. *Vigna macrorhyncha* (Harms) Milne-Redh.: 1., habit (×1); 2, stipule (×3); 3, flower, front and later view (×1); 4, standard, details (×3); 5, standard (×2); 6, keel, lateral view (×3); 7, keel, front view (×3); 8, wing (×2.5); 9, diadelphous stamens, spread out (×3); 10, style (×3); stigma (×12); 12, calyx (×2.5); 13, seed, lateral and front view (×2.5).
Figure 5.178. Distribution of *V. macrorhyncha* based on specimen and accession passport data.

Figure 5.179. FloraMap predicted distribution for *V. macrorhyncha*.
AFRICAN VIGNA

Distribution:
EAF: KEN, TAN(!).
NEAF: SOM(!).
WAF: NGR.

Phenology: Flowers throughout the year.
Uses: None known.

Taxon Vulnerability Assessment: = 4.9

Conservation Notes: V. praecox is basically an East African species, however, the one ex situ collection is from Niger, this accession should be checked as it is very isolated from other populations. As this is the only ex situ collection of what is an uncommon species, the species is likely to be vulnerable. Further systematic collection is required. The trend in numbers of herbarium specimens collected over time roughly follows the pattern for all Vigna species, although the species was only relatively recently described, therefore its true distribution may not yet be known, further study is required before an appropriate conservation strategy can be clarified.

IUCN Red List Category: Data Deficient.

Taxonomic notes: Its floral morphology resembles that of V. macrorhyncha. Pollen reticulation in this species resembles that of members of subgenus Vigna (Maréchal et al., 1978) and may thus represent a link between subgenera Vigna and Macrorhyncha.

Reference to a published description: FS 437, illust. 437.
Vernacular names: None known.
Habit and lifespan: Robust, perennial climber.
Flower colour: Dull greenish.
Habitat: Limestone bushland on sandstone escarpments or granite outcrops.
Associated species: Grasses, sedges, Indigofera sparteola, Cassia dunensis.
Altitude: 190–350 m.

Distribution:
NEAF: SOM (southern and central).

Phenology: Unknown.
Uses: None known.

Taxon Vulnerability Assessment: = 6.7

Conservation Notes: V. virescens is a Somali endemic and probably, along with the other Somali endemics, V. monantha and V. somaliensis, one of the most highly threatened African Vigna taxon. There are few herbarium specimens available and no ex situ collections. There is a need for a critical review of this species and a search for extant populations should be given the highest priority.

IUCN Red List Category: Critically Endangered.

Taxonomic notes: The species most closely resembles V. praecox, from which it differs by having the leaves produced with the flowers as well as its fully incurved beak of keel, which only curves through 270° in V. praecox. It also shares some characteristics with the monotypic genus Wajira.
Figure 5.180. Distribution of *V. praecox* based on specimen and accession passport data.

Figure 5.181. FloraMap predicted distribution for *V. praecox*. 

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288

SYSTEMATIC AND ECOGEOGRAPHIC STUDIES ON CROP GENEPOOLS 11
Figure 5.182. Vigna praecox Verdc.: 1, habit (×1); 2, stipule (×2.5); 3, flower, front and lateral view (×1); 4, standard (×3); 5, details of close standard, lateral view (×3); 6, standard, details (×6); 7 and 8, keel, lateral and front view (×3); 9 and 10, wing (×3); 11, diadelphous stamens, spread out (×3); 12, style (×3); 13, stigma (×12), 14, calyx, spread out (×3).
Figure 5.183. Distribution of V. virescens based on herbarium specimen passport data.
5. ECOGEOGRAPHIC CONSPECTUS

5.1 Introduction


Climbing, twining, prostrate or erect herbs or subshrubs, rarely small shrubs, mostly from woody or tuberous rootstocks, without hooked hairs (as in *Phaseolus*). Leaves pinnately, more rarely subdigitately, 3-foliolate, 1-foliolate or simple; leaflets entire, venation usually reticulate, rarely with secondary nerves parallel (*V. multinervis*) or tertiary nerves parallel; stipules usually bilobed or spurred at the base, sometimes peltate, rarely truncate; stipels persistent, rarely absent. Inflorescence axillary, falsely racemose or flowers in dense 1 to-many-flowered subumbellate clusters or fasciculate; rhachis thickened and glandular at the point of insertion of the pedicels, flowers paired at each node; bracts and bracteoles deciduous, usually similar in shape and nervation; pedicel shorter than or as long as the calyx, extending or not as the pod matures. Calyx 5-lobed, 2-lipped; lower lip 3-lobed, the middle lobe usually the longest; upper lip of two lobes completely or partly united. Corolla small or medium-sized, yellow, blue or purple inside (internal face of standard, external face of wings), greenish outside (external face of standard), all petals of subequal length; standard glabrous (except in *V. ambacensis*), emarginate, usually slightly wider than long and symmetrical, with inflexed auricles and appendages on the internal face, less often without appendages; appendages of the standard are based on a U-shaped pattern with one on each half of the standard, but the pattern is rarely complete; it can be reduced to the central part of the U with the appendages appearing parallel and very close together (central position), or sometimes joined and appearing V- or X-shaped (*V. luteola* or *V. monophylla* for example); it can be reduced to the lateral part of the U with the appendages appearing parallel but spaced apart (lateral position) (as in *V. unguiculata*); it can be reduced to the basal part of the U with the appendages appearing perpendicular to the standard axis (*V. comosa*); keel whitish except for the beak (if there is a beak), usually fused on the upper side, truncate, obtuse or conspicuously beaked, sometimes the beak incurved through up to 180° (*V. radiata*), sometimes with a distinct conical pocket on the left-hand petal (*V. vexillata* for example). Vexillary stamen free; five shorter filaments (including the vexillary one) sometimes with a pair of joined glands below each anther (in subgenus *Haydonia*); anthers uniform. Pollen triporate, exine coarsely reticulate (except in subgenus *Haydonia*). Ovary 1-many-ovuled; style with tenuous lower part obsolete to quite long, filiform or flattened, upper part thickened and cartilaginous, straight or curved, upper portion barbate or hirsute on the internal face, produced beyond the stigma to form a short to long subulate beak (except in subgenus *Haydonia*); stigma
completely lateral or oblique. Pods linear or linear-oblong, usually terete, rarely flattened (V. macrorhyncha), with sutures not raised (except V. macrorhyncha), straight or curved, not septate (seeds are separated by a spongy tissue, not as woody as in Dysolobium and Pachyrhizus); style caducous. Seeds mostly reniform or quadrate, thickness usually slightly less than width, usually cream-coloured, cream-coloured in combination with grey, mottled and speckled patterns, or black; hilum small or elongate; aril obsolete to well developed, usually excentric, often 3-pronged. Chromosome count usually 2n=22, rarely 2n=20. (Generic description taken from Pasquet, 2001).

5.2 Subgenus Vigna

Section Vigna


Reference to a published description: CPV 165; FCBR 363; FE 172; FTEA 625; FWTA 569; FZ 125; LM 578.

Vernacular names:
ZAI: Gilibande, Goko, Masheke, Mugulula, Kavuhivuh, Umurakuku, Toshimbo-shimbo, Indola a kwakwa, Ka vuhihahi
MDG: Antaka, Famehifary, Telouravy, Vahipoko, Vahisanjy.
NGR: Mare
SUD: Akwari, Lubiya taiyib
TAN: Kisukuna, Kashilika

Habit and lifespan: Creeping or prostrate, perennial.

Flower colour: Yellow

Habitat: Grasslands, lake edges, riverbanks, swamp edges, sclerophyllous forests, around cultivated fields and other disturbed areas, often associated with wet environments.

Associated species: Andropogon, Cyperus, Papyrus, Phragmites, Thelypteris and Typha.

Altitude: 1–2800 m.

Distribution: This is pantropical and is one of the most widely distributed species in the genus occurring in:
CEAF: BUR, CAF, CHA, CON, GAB, RWA, SEN, SIE, ZAI.
EAF: KEN, TAN, UGA.
NEAF: EGY, ETH, SOM, SUD
SAF: NAM, ZAF.
WAF: BEN, CMN, GHA, GNB, GUI, IVO, LBR, NGA, NGR, SEN, SIE, TOG.
WIO: MDG.
ZAMB: ANG, BOT, MLW, MOZ, ZAM, ZIM.

This species appears to be the only member of the genus Vigna, which occurs north of the Sahara as a few records from Egypt were found.

Phenology: There is a wide variation in flowering both within and between regions as can be seen from Figure 5.1.

Uses: Reported to be palatable to cattle and elephants on some herbarium specimens from Zambia (Burkill, 1995).
Taxon Vulnerability Assessment: $\geq 2.0$

Conservation Notes: *V. luteola* is relatively well represented in *ex situ* collections although further collection in NEAF and SAF may be justified. Seasonal flooding and overgrazing are quoted as a restrictive factor at collecting sites, on herbarium specimens. Populations in such areas may need to be monitored. The species has however been collected at least once throughout the collecting period in every region apart from North Africa. There is no obvious evidence of decline in frequency from the data contained in the database, suggesting that this species in not under immediate threat. However, the fact that it is eaten by cattle and elephants justifies more systematic *ex situ* representation.

IUCN Red List Category: Least Concern.

Taxonomic notes: *V. luteola*, *V. marina* and *V. oblongifolia* are considered by Pasquet (2001) to be very closely related and possibly to be conspecific owing to the low genetic distances observed between them. However he concludes that they are morphologically distinct and do not seem to hybridize very easily.

Additional notes: Some accessions of *V. luteola* show high levels of resistance to major cowpea pests including *Maruca* pod borers and pod sucking bugs (Fatokun *et al*., 1997). This may be owing to the high levels of anti-nutritional factors including trypsin inhibitors, tannins and lectins all of which are believed to confer resistance to major pests of cowpeas that have been reported in this species (Marconi *et al*., 1997). This implies that the species has some potential for improvement of cowpea. In addition, because of its rapid growth rate, the species has a high potential for use in preventing soil erosion. It is also a good source of hay and silage (Padulosi and Ng, 1990). Plants of this species have been reported to be easy to inoculate showing rapid and vigorous production of herbage, which is palatable to livestock although its grazing must be lenient for...
Figure 5.2. *Vigna luteola*: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×3); 4, inflorescence nectaries, details (×2.5); 5, flower, front and lateral view (×1); 6, standard, details (×3); 7, standard, (×2); 8 and 9, keel, lateral and front view (×3); 10, diadelphous stamens, spread out (×3); 11, style (×3); 12, stigma (×12), 13, wing (×3); 14, calyx, spread out (×2.5); 15, seed, lateral and front view (×2.5); all drawings by S. Padulosi.
Figure 5.3. Distribution of *V. luteola* based on herbarium specimen passport data.

Figure 5.4. FloraMap predicted distribution for *V. luteola*. 
it to persist (Bogdan, 1977). In addition, *V. luteola* has been demonstrated to be more tolerant to saline environments than *V. vexillata* (Okusanya and Oyesiku, 1994). However, the species has the disadvantage of having poor tolerance to drought (Skerman *et al*., 1988) making it unsuitable for use as a forage crop in drought susceptible areas.


**Reference to a published description:** CPV 166; FTEA 626; FWTA 569; FZ 126; LM 579.

**Vernacular names:** None known

**Habit and lifespan:** Perennial, scrambling or trailing herb.

**Flower colour:** Yellow.

**Habitat:** Associated with seashores where it may occur from immediately above watermark to low coastal dunes and scrub, as well as along river mouths and particularly over recent sandstone; sandy soils.

**Associated species:** *Grewia*, *Ipomoea* and *Sporobolus*.

**Altitude:** 1–1030 m. However, the bulk of the specimens were collected at sea level and low altitude.

**Distribution:** Not native to Africa.

CEAF: CON, EQG, GAB, GGI, ZAI.

EAF: TAN.

SAF: ZAF.

WAF: BEN, CMN, GHA, GNB, GUI, LBR, NGA, SEN(!).

WIO: MDG.

ZAMB: MOZ.

**Phenology:** Variable throughout area of distribution.

**Uses:** The species is reportedly used by some African farmers as a cover crop and green manure and has a potential as a sand binding agent (Padulosi, 1993). It also produces edible tubers (Padulosi and Ng, 1990). The seeds are used as a coffee substitute in GAB (Burkhill, 1995).

**Taxon Vulnerability Assessment:** = 6.5

**Conservation Notes:** *V. marina* is inadequately represented in *ex situ* collections, because although widely distributed in Africa, the *ex situ* conserved germplasm does not represent the full geographic range. There is need for further systematic collection of both subspecies, particularly from most of West Africa, Tanzania, Mozambique and South Africa. Collection of the species in CEAF, EAF and SAF appear to have been sporadic, and both the number of specimens collected over time and the area from which the species has been collected are in decline. There are, for example, no records of it being collected in South Africa in the twentieth century. *V. marina* is used in numerous ways so it is surprising that it is currently so poorly conserved. There is potential for further exploitation in Africa and as such there is a need for conservation priority even though the species is thought to have been introduced to Africa.

**IUCN Red List Category:** Vulnerable.

**Additional notes:** This species closely resembles *V. luteola* from which it differs...
mainly by habitat with \textit{V. marina} being restricted to seashores. Padulosi (1993) distinguishes two subspecies of this species namely \textit{V. marina} subsp. \textit{marina} distributed in MOZ, ZAF, TAN, along the Indian Ocean littorals and \textit{V. marina} subsp. \textit{oblonga} which occurs on the Atlantic ocean coasts of BEN, CMN, ZAI, CON, EQG, GAB, LBR and NGA. The two subspecies are distinguished by their leaf shape and inflorescence size. Subdivision of this species into two subspecies was confirmed by Sonnante \textit{et al.} (1997) who used isozymes and RAPD analysis to study genetic diversity between \textit{V. marina} and \textit{V. luteola}. Interestingly, their findings suggested that subspecies \textit{oblonga} is more closely related to \textit{V. luteola} than it is to subspecies \textit{marina}.

Being adapted to seashores, this species shows high levels of resistance to salty environments, a trait which may be introduced into cowpea. The species is also highly nodulated (Padulosi and Ng, 1990) and is thus important for improving the soil nitrogen status in areas where it grows. In a trial involving \textit{V. marina}, \textit{V. unguiculata} and \textit{Lablab purpureus} carried out in Turkmenistan (former USSR), \textit{V. marina} out-yielded both \textit{V. unguiculata} and \textit{Lablab purpureus} producing 65–68 tonnes fresh fodder/ha (Bogdan, 1977).

Verdcourt (1971) distinguishes the subspecies as follows:

1. Leaflets rounded-ovate, often mucronate at apex, with slightly raised reticulate venation; linear-oblong inflated pod, 35–60×8–9 mm, glabrous; seeds 6–7×5–6 mm ................................................................. subsp. \textit{marina}

Leaflets ovate-elliptic or oblong-lanceolate, often retuse at apex with raised reticulate venation; narrow less inflated pod, 55×6 mm, close but rather oppressed hairs; smaller seeds........................................ subsp. \textit{oblonga}

\textbf{\textit{Vigna marina} (Burm.) Merrill subsp. \textit{marina}.}

\textbf{Reference to a published description:} CPV 166; FTEA 626; FZ 126; LM 579.

\textbf{Vernacular names:} None known.

\textbf{Habit and lifespan:} climbing or scrambling perennial herb.

\textbf{Flower colour:} Yellow.

\textbf{Habitat:} Coastal bushland and just above high tide mark on sandy shores.

\textbf{Associated species:} Unknown.

\textbf{Altitude:} Sea level.

\textbf{Distribution:} Not native to Africa.

EAF: TAN(!).

SAF: ZAF(!).

WIO: MDG(!).

ZAMB: MOZ(!).

\textbf{Phenology:} Unknown.

\textbf{Uses:} None known.

\textbf{Conservation Notes:} There are significant numbers of accessions available for this species throughout its range but few have been identified to subspecies, this suggests the subspecies is not a conservation priority but in terms of IUCN Red Listing should be regarded as Data Deficient.

**Reference to a published description:** CPV 166; FWTA 569.

**Vernacular names:** None known.

**Habit and lifespan:** Climbing or scrambling perennial herb.

**Flower colour:** Yellow.

**Habitat:** Sea shore.

**Associated species:** Unknown.

**Altitude:** Sea level.

**Distribution:** Not native to Africa.

**CEAF:** CON, EQG(!), GAB(!), GGI(!), ZAI(!).

**WAF:** BEN(!), CMN(!), GHA(!), LBR(!), NGA(!), SEN(!).

**Phenology:** Unknown.

**Uses:** None known.

**Conservation Notes:** There are significant numbers of accessions available for this species throughout its range but few have been identified to subspecies, this suggests the subspecies is not a conservation priority but in terms of IUCN Red Listing should be regarded as Data Deficient.


**Reference to a published description:** FCBR 378; FE 172; FTEA 627.

**Vernacular names:**

**ZAI:** Umhara-kuku, Bakasukui, Ngaraorwe, Legishyimbo emuhasam

**TAN:** Muchari (KEN); Kuzimbi/Lukusimbi.

**Habit and lifespan:** Climbing or trailing perennial.

**Flower colour:** Yellow.

**Habitat:** Roadsides, forest edges, woodland, thickets, grasslands, old cultivation areas, stream edges, swamp and marshes; and sandy loam.

**Associated species:** *Combretum, Commiphora, Cussonia, Hyparrhenia, Newtonia, Pennisetum, Phragmites, Podocarpus, Scleria* and *Scirpus*.

**Altitude:** 293–2500 m. Most specimens were collected at altitudes of 1000–2250 m.

**Distribution:**

**CEAF:** BUR, RWA, ZAI.

**EAF:** KEN, TAN.

**NEAF:** ETH.

**WAF:** CMN.

**ZAMB:** BOT, MLW, MOZ, ZAM, ZIM(!).

**Phenology:** Highly variable in East Africa. Material in flower has been collected from March–December. Appears to flower July–September in ZAMB although this is again variable.

**Uses:** The fruit are eaten in TAN. In ZAI, the plant is used as a source of fibre (part not stated). The tubers produced by the plant are eaten in MLW (Padulosi and Ng, 1990).

**Taxon Vulnerability Assessment:** = 4.6
Figure 5.5. Distribution of V. marina based on specimen and accession passport data.

Figure 5.6. FloraMap predicted distribution for V. marina.
Figure 5.7. *Vigna marina* (Burm.) Merrill subsp. *marina*: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×3); 4, inflorescence rachis, front view (×2.5); 5, inflorescence (×3); 6, flower, front and lateral view (×1); 7, standard, (×2); 8, standard, details (×3); 9, keel, lateral view (×3); 10, wing (×2.5); 11, diadelphous stamens, spread out (×3); 12, style (×3); 13, stigma (×12); 14, calyx bracts (×12); 15, seed, lateral and front view (×2.5).
Figure 5.8. *Vigna marina* (Burm.) Merrill subsp. *oblonga* (Benth.) Padulosi: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×3); 4, inflorescence (×5); 5, inflorescence rachis, front view (×2.5); 6, flower, front and lateral view (×1); 7, standard, (×2); 8, standard, details (×3); 9 and 10, keel, front and lateral view (×3); 11, wing (×2.5); 12, diadelphous stamens, spread out (×3); 13, style (×3); 14, stigma (×12); 15, calyx bracts (×12); 16, calyx, spread out (×2.5); 17, seed, lateral and front view (×2.5).
Figure 5.9. Frequency of altitude classes from which specimens of *V. fischeri* have been collected.
Figure 5.10. Distribution of *V. fischeri* based on specimen and accession passport data.

Figure 5.11. FloraMap predicted distribution for *V. fischeri*. 
Conservation Notes: *V. fischeri* is inadequately represented in *ex situ* collections with much of its range unrepresented; particularly from NEAF, CEAF and EAF. The species is cultivated for its flowers and tubers, which are used as human food. Therefore, additional collecting is needed throughout its range; however, the pattern of *ex situ* collecting is similar to the average for all *Vigna* species.

**IUCN Red List Category:** Near Threatened.

**Additional notes:** A recent study by Pasquet and Vanderborght (1999) based on isozyme analyses has suggested that this species may be conspecific with *V. luteola*, *V. marina* and possibly *V. bequaertii* although no accessions of the latter were available for use in that study. All three accessions of *V. fischeri* they analyzed fell into the same cluster as *V. luteola*, but as *V. fischeri* is morphologically distinct we have retained the specific distinction until further evidence supports the sinking.


**Reference to a published description:** CPV 167; FCBR 364.

**Vernacular names:** ZAI: Baharakuhuge, Kindandi.

**Habit and lifespan:** Climbing or twining perennial, with or without a large, woody rootstock.

**Flower colour:** Yellow.

**Habitat:** Roadsides, fallows, savannah, riversides, swamps.

**Associated species:** *Acanthus, Hyparrhenia, Pennisetum*.

**Altitude:** 450–1830 m.

**Distribution:** CEAF: BUR, RWA(!), ZAI.

**Phenology:** Mostly October–December.

**Uses:** None known.

**Taxon Vulnerability Assessment:** = 5.1

**Conservation Notes:** *V. bequaertii* is not represented by *ex situ* collections, therefore the collection of accessions should be treated as a priority. The species has a limited distribution which means it is more likely to be vulnerable to extinction. Although the total number of specimens collected is very limited, the peak was between 1950 and 1959, with only a single specimen collected subsequently. The species is obviously rare and appears to be in decline.

**IUCN Red List Category:** Endangered.

**Additional notes:** Distinguished from *V. fischeri*, to which it is similar, by unusually large flowers and fruits. Verdcourt (1970) suggested that this species may represent a geographical variant of *V. fischeri* but Maréchal et al. (1978) maintained it as a distinct species.


**Reference to a published description:** CPV 167; FCBR 360; FE 172; FTEA 629; FWTA 568; FZ 127; LM 580.

**Vernacular names:** None known.
Figure 5.12. Distribution of *V. bequaertii* based on specimen and accession passport data.

Figure 5.13. FloraMap predicted distribution for *V. bequaertii*. 
Habit and lifespan: Prostrate or climbing annual, rarely perennial.

Flower colour: Yellow or greenish yellow.

Habitat: Grassland, fallow, weed of cultivation, dambo, lake shore, open woodland, roadside, often associated with periodic inundation; clay or sandy loam.

Associated species: *Acacia*, *Bothriochloa*, *Cynodon*, *Digitaria*, *Echinochloa pyramidalis*, *Hyparrhenia*, *Sporobolus* and *Themeda*.

Altitude: 1–3000 m.

Distribution:
CEAF: BUR, CAF, CHA, CON, RWA, ZAI.
EAF: KEN, TAN, UGA.
NEAF: ERI, ETH, SUD.
SAF: NAM, ZAF.
WIO: MDG.
WAF: CMN, GHA, IVO, NGA.
ZAMB: ANG, BOT, MLW, ZAM(!), ZIM.

Phenology: See varieties.

Uses: None known.

Taxon Vulnerability Assessment: = 1.3

Conservation Notes: *V. oblongifolia* is one of the few *Vigna* species to have been systematically collected, and both varieties are adequately represented by *ex situ* collections. Therefore, further collection has a low priority, except for West Africa where the species has been less well sampled. The species has a relatively wide distribution but the two varieties have been sampled throughout their range and they do not appear to be vulnerable to extinction. However, the species may be prone to localized genetic erosion, because of its weedy nature it is susceptible to current changes in agricultural practice. Factors cited on herbarium specimens that may cause some populations to be vulnerable are: heavy grazing, flooding and fire. The pattern of collection sampling follows the general pattern for *Vigna* species, and population levels appear to be stable.

IUCN Red List Category: Least Concern.

Taxonomic notes: Two varieties of this species are recognized, varieties *oblongifolia* and *parviflora* distinguished by leaf, flower and pod characters as follows (Verdcourt, 1971):

1. Leaflets ovate, oblong to lanceolate, up to 120×22 mm; standard 10–11 mm; calyx tube 1.5–2.5 mm, teeth 1.5–2.5 mm; pods 40–45 mm; seed c. 4.0×3.0–3.5 mm.................................................................var. *oblongifolia*

Leaflets ovate to linear-lanceolate, 15–80×2–25 mm; standard 6–8 mm; calyx tube 1.0–1.5 mm, teeth 1.0–1.5 mm; pods 23–40 mm; seed 2.5–3.0×2.0–2.5 mm .................................................................var. *parviflora*

Both varieties are fairly widely distributed.

*Vigna oblongifolia* var. *oblongifolia*.

Reference to a published description: CPV 167; FE 172; FTEA 629; FZ 127.

Vernacular names:
ZAI: Lotomba.
Figure 5.14. Distribution map of *V. oblongifolia* based on herbarium specimen passport data.

Figure 5.15. FloraMap predicted distribution for *V. oblongifolia*.
NGA: Waken Kada.
TAN: Kalalalonde.

**Habit and lifespan:** Annual (rarely perennial), prostrate or climbing herb.

**Flower colour:** Yellow or greenish yellow.

**Habitat:** Damp grassland and swamp, aquatic on *Echinochloa* swamps, sandy riverbanks, cultivated fields, roadsides, seasonal marshes, thickets and secondary woodlands, red sandy loam from mica schist, damp black clay soil, black basaltic soil, and as a weed of cultivation.

**Associated species:** *Echinochloa, Acacia*.

**Altitude:** 1–3000 m.

**Distribution:**
CEAF: BUR, CHA, CON, ZAI.
EAF: KEN, TAN.
NEAF: ERI, ETH, SUD,
SAF: NAM, ZAF.
WAF: CMN, GHA, NGA, NGR.
ZAMB: BOT, MLW, ZAM, ZIM.

**Phenology:** April to June.

**Uses:** None known.

**Conservation Notes:** This variety does not appear to be threatened, see discussion for species above.

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**Reference to a published description:** CPV 168; FCBR 361; FE 172; FTEA 629; FZ 128; LM 580.

**Vernacular names:**
TAN: Kashilishili.
ZAM: Siboyani (Lozi).

**Habit and lifespan:** Annual, prostrate or climbing herb.

**Flower colour:** Yellow or brown yellow.

**Habitat:** Floodplains, anthill bases, marsh edges, grasslands, field edges, open woodlands, savannahs, swamp edges, lake shores and stream banks.

**Associated species:** Unknown.

**Altitude:** 10–2900 m.

**Distribution:**
CEAF: BUR, RWA, ZAI.
EAF: KEN, TAN, UGA.
NEAF: ETH, SUD.
SAF: NAM, ZAF.
WAF: CMN, NGA.
WIO: MDG.
ZAMB: ANG, BOT, MLW, ZAM, ZIM.

**Phenology:** Mostly December–April in SAF and ZAMB. Material in flower has been collected throughout most of the year in EAF although this appears to be interrupted in March as well as November–December.
Figure 5.16. *Vigna oblongifolia* A.Rich. var. *oblongifolia*: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×2.5); 4, inflorescence nectaries (×3); 5, flower, front and lateral view (×1); 6, standard (×3); 7, standard, details (×6); 8 and 9, keel, lateral and front view (×3); 10, wing (×2.5); 11, diadelphous stamens, spread out (×3); 12, style (×3); 13, stigma (×12); 14, calyx, spread out (×2.5); 15, seed, lateral and front view (×2.5).
Figure 5.17. *Vigna oblongifolia* var. *parviflora* (Baker) Verdc.: 1, habit (×1); 2, stipule (×2.5); 3, flower, front and lateral view (×1); 4, standard (×4); 5, standard, details (×6); 6 and 7, keel, front and lateral view (×3); 9, diadelphous stamens, spread out (×6); 10, style (×6); 11, stigma (×12); 12, calyx, spread out (×4); 14, details of leaf nervation, lower surface (×6); 15, seed, lateral and front view (×2.5).
**Uses:** None known.

**Conservation Notes:** This variety does not appear to be threatened, see discussion for species above.

**Additional notes:** Of three accessions of this taxon used in a study on isozyme variation among species of subgenus *Vigna*, one fell into the same cluster as accessions of *V. luteola*. This led the authors to suggest that this species may be conspecific with *V. luteola* (Pasquet and Vanderborght, 1999). This is further strengthened by reports of successful hybridization between the two species (Murdock, 1992; Ng, 1990; Pasquet and Vanderborght, 1999).

Some accessions of this species show resistance to important insect pests of cowpea (Jackai and Singh, 1991). Together with *V. vexillata*, this species showed high levels of resistance to *Callosobruchus maculatus*, the cowpea pod weevil (Kitch and Shade, 1993). The species is also palatable to livestock and has been observed to form a dense growth (Bogdan, 1977; Skerman et al., 1988) although it has been reported to show low levels of regrowth following cutting (Skerman et al., 1988). Levels of crude protein ranging from 17.2–23.7% have been reported (Bogdan, 1977).

**Vigna filicaulis** Hepper, Kew Bull. 11:128 (1956).

**Reference to a published description:** CPV 169; FWTA 568.

**Vernacular names:** None known.

**Habit and lifespan:** Prostrate or climbing annual.

**Flower colour:** Mainly yellow, rarely orange or purple.

**Habitat:** Damp grasslands, dry savannah forest mosaics, seasonal marshes, rock fissure and inundated plains; and sandy loam.

**Associated species:** *Andropogon, Loudetia, Schizachyrium* and Spermaceae.

**Altitude:** 1–1200 m.

**Distribution:**
CEAF: CAF, CHA.
WAF: BKN, CMN, GHA, GNB, GUI, IVO, MLI, SEN, TOG.

No specimens seen from CHA and IVO, where the species has also been reported (Lock, 1989).

**Phenology:** July–December.

**Uses:** None known.

**Taxon Vulnerability Assessment:** = 5.1

**Conservation Notes:** *V. filicaulis* has relatively wide distribution within West Africa but appears to have been poorly sampled for both herbarium specimens and *ex situ* germplasm. It is difficult from the available data to assess whether this species is in fact widespread but locally rare throughout its range or more common but undercollected. Whichever is true, there are insufficient *ex situ* samples available and there is a need for further collecting throughout its range. The number of previous collections is relatively low, so it is difficult to make any valid assessment of the pattern of collections over time. As a priority, this species needs to be systematically studied to provide sufficient data for the IUCN Red List assessment to be made and to help clarify the most immediate conservation priorities.
IUCN Red List Category: Data Deficient.

Additional notes: *V. filicaulis* is often confused with *V. venulosa*. The similarity between the two species is however superficial and they can be distinguished on the basis of flower colour, pollen reticulation and floral morphology. Pasquet and Vanderborght (1999) report that the two varieties of *V. filicaulis* are separated by a large genetic distance and suggest that this may be grounds for raising both to species level.

Taxonomic notes: Two varieties of this species are recognized. These are *V. filicaulis* var. *filicaulis* and var. *pseudovenulosa* separated on the basis of flower, pod and seed size as well as the degree of leaf and stem pubescence (Maréchal et al., 1978):
1. Flowers 8–10 mm; pod 20–30×4–6 mm; 2–4 seeded, each 6×3 mm; stems and leaves more or less pubescent ........................................ var. *filicaulis*
   Flowers 6–8 mm; pod 18–22×3–4 mm; 2–5 seeded each 3×1.5 mm; stems and leaves more or less glabrescent........................... var. *pseudovenulosa*

*Vigna filicaulis* var. *filicaulis*

Reference to a published description: CPV 169.

Vernacular names: None known.

Habit and lifespan: Slender annual.

Flower colour: Yellow.

Habitat: Grassland.

Associated species: Unknown.

Altitude: 30–40 m.

Distribution: WAF: GHA(!), IVO(!), NGA(!), NGR(!), SEN.

Phenology: Unknown.

Uses: None known.

Conservation Notes: So little information is available on this variety it is impossible to suggest any coherent conservation strategy, see conservation notes for the species for discussion.


Reference to a published description: CPV 170.

Vernacular names: None known.

Habit and lifespan: Slender annual.

Flower colour: Yellow.

Habitat: Grassland

Associated species: Unknown

Altitude: 40–50 m.

Distribution: WAF: CMN(!), MLI(!), SIE(!), SEN.

Phenology: Unknown.

Uses: None known.
Figure 5.18. Distribution of *V. filicaulis* based on specimen and accession passport data.

Figure 5.19. FloraMap predicted distribution for *V. filicaulis*. 
Figure 5.20. *Vigna filicaulis* Hepper: 1., habit (×1); 2, details of leaf nervation, lower surface (×5); 3, stipule (×3); 4, inflorescence (×3); 5, flower, front and lateral view (×1); 6, standard (×3); 7 and 8, keel, front and lateral view (×3); 9, wing (×3); 10, diadelphous stamens, spread out (×3); 11, style (×3); 12, stigma (×12); 13, calyx, spread out (×3); 14, seed, lateral and front view (×2.5).
Conservation Notes: So little information is available on this variety it is impossible to suggest any coherent conservation strategy, see conservation notes for the species for discussion.

*Vigna multinervis* Hutch. and Dalziel, Kew Bull.: 17 (1929).

**Reference to a published description:** FCBR 357; FE 173; FTEA 637; FWTA 568; FZ 128.

**Vernacular names:**
ZAI: Katoya.
GAM: Fula-pulaar.

**Habit and lifespan:** Climbing or trailing, slender perennial.

**Flower colour:** Mostly yellow but orange and pink have also been noted.

**Habitat:** Grasslands, herbaceous savannahs, woody savannahs, dambos, permanently wet dunes, waste grounds, fallow fields and rarely in bogs, often on stony, sandy soil.

**Associated species:** *Afromaniastrum*, *Crossopteryx*, *Hyparrhenia*, *Loudetia*, *Piliostigma* and *Urelytrum*.

**Altitude:** 1–1850 m.

**Distribution:**
CEAF: BUR, CAF, CHA(!), CON, GAB, RWA(!), ZAI.
EAF: TAN, UGA.
NEAF: ETH(!), SUD.
WAF: CMN, GHA, GNB, GUI, IVO, NGA, SIE, TOG.
ZAMB: ANG, ZAM.

**Phenology:**
CEAF: highly variable.
WAF: August–December.
ZAMB: March–May in ZAMB.

**Uses:** In CAF, a soup made of the roots is taken before breakfast to treat *Ascaris* infections. The leaf is believed to hasten learning to walk when rubbed on babies’ legs (Burkill, 1995).

**Taxon Vulnerability Assessment:** = 2.9

**Conservation Notes:** *V. multinervis* is not well represented by *ex situ* collections, therefore the collection of accessions should be treated as a priority. There is a need to collect additional germplasm accessions from CEAF (Burundi, Central African Republic and Democratic Republic of the Congo) and UGA to ensure full geographic coverage. Herbarium specimens of the species have been collected consistently from CEAF, but less so in WAF and ZAMB. In NEAF records are sporadic, indicating that the species is either rare in this region or that populations are declining.

**IUCN Red List Category:** Endangered.

*Vigna laurentii* De Wild., Mission Laurent: 122 (1905).

**Reference to a published description:** CPV 170; FCBR 361.

**Vernacular names:**
BUR: Umukaloko.
Figure 5.21. *Vigna multinervis* Hutch. and Dalziel: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×2.5); 4, flower, front and lateral view (×1); 5, inflorescence (×2.5); 6, standard (×3); 7, standard, details (×6); 8 and 9, keel, lateral and front view (×4); 10, diadelphous stamens, spread out (×4); 11, style (×4); 12, stigma (×12); 13, calyx, spread out (×3); 14, wing (×4); 15, seed, lateral and front view (×2.5).
Figure 5.22. Distribution of *V. multinervis* based on specimen and accession passport data.

Figure 5.23. FloraMap predicted distribution for *V. multinervis*. 
Habit and lifespan: Climbing, perennial.
Flower colour: Blue or violet.
Habitat: Savannah, riverbanks and on poor marshy soils.
Associated species: Loudetia, Phragmites.
Altitude: 340–1850 m.
Distribution:
CEAF: BUR, ZAI.
WAF: CMN.
Phenology: September–December.
Uses: None known.
Taxon Vulnerability Assessment: = 5.4
Conservation Notes: V. laurentii is rare and restricted in terms of distribution, but it should be noted that it is restricted to countries that have in general been undercollected. The predicted distribution indicates a much wider distribution that has yet to be validated. It is inadequately represented in ex situ collections with only two germplasm samples from Burundi, which cannot hope to represent the full geographic range or genetic diversity of the species. The number of collections made over time is sporadic, and since the 1970s only one population has been sampled, which may indicate decline. There is need for further systematic collection throughout Burundi, Democratic Republic of the Congo and Cameroon.
IUCN Red List Category: Endangered.

Reference to a published description: CPV 171; FCBR 355; FE 173; FTEA 632; FWTA 568.
Vernacular names:
ANG: Fuca n’ Lepo.
ZAI: Mondo, Kasali.
ETH: Aragora Baratha.
NGA: Tsarkiyan zomo, Waken Wangi, Yaryadi dagi, Zagaya rafi.
SEN: Tere.
SUD: Erg el Kheil, Emdere, Lubia el Ghazal, Luia Tartag, Lufute Lemer, Shireyik, Tutu Waru.
Habit and lifespan: Climbing or suberect annual or perennial herb.
Flower colour: Flower colour in WAF is predominantly yellow while blue is more common in EAF (Verdcourt, 1970).
Habitat: Herbaceous (mainly grassland) and tree savannahs, roadside, weed of cultivation, swamps and fallows (CEAF); grasslands, forest edges and swamps (EAF); grasslands and roadsides (NEAF); parent rock commonly laterite, and clay loam or sandy soils, associates with burnt or inundated soils.
Associated species: Acacia, Andropogon, Boswellia, Euphorbia, Hyparrhenia, Lannea, Loudetia, Mirragyna, Parkia, Terminalia.
Altitude: 1–4000 m.
Figure 5.24. *Vigna laurentii* De Wild.: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×3); 4, inflorescence nectaries (×2.5); 5, flower, front and lateral view (×1); 6, standard (×4); 7, standard, details (×8); 8 and 9, keel, front and lateral view (×6); 10, wing (×6); 11, diadelphous stamens, spread out (×6); 12, style (×6); 13, stigma (×12); 14, calyx, spread out (×6); 15, seed, lateral and front view (×2.5).
Figure 5.25. Distribution of *V. laurentii* based on specimen and accession passport data.

Figure 5.26. FloraMap predicted distribution for *V. laurentii*.
Distribution:
CEAF: BUR, CAF, CHA, CON, ZAI.
EAF: KEN, TAN, UGA.
NEAF: ETH, SUD.
WAF: BEN, BKN, CMN, GHA, GNB, GUI, IVO, MLI, NGA, NGR, SEN, SIE, TOG.
SAF: ZAF.
ZAMB: ANG, BOT, MLW, ZAM.

Phenology: Mostly September–December in NEAF and WAF, highly variable in CEAF with two peaks of flowering in October–December and April–July.

Uses: The fruits are eaten and the leaves used as a dressing for wounds in SUD. The leaves are dried and smoked as a cough remedy and used for food and drink in ZAI, tubers are reportedly to be eaten in ZAI (Robyns, 1954; Burkill, 1995). In CHA, the species is reportedly used for forage (Padulosi and Ng, 1990).

Taxon Vulnerability Assessment: = 2.6

Conservation Notes: *V. ambacensis* is widely distributed in Africa but is generally well represented in ex situ collections. Even the two varieties are fairly adequately conserved ex situ; however, additional sampling from northeastern Democratic Republic of the Congo, Angola, Burundi, Rwanda and Sudan is required for complete representation. Herbarium specimens have been collected regularly throughout its geographic range with the exception of the Zambesiaca region, where the species appears to be rarer. This would seem to suggest that the species is not in danger in the other regions.

IUCN Red List Category: Least Concern.

Additional notes: Flower colour in WAF is predominantly yellow while blue is more common in EAF (Verdcourt, 1971) although isozyme analysis failed to confirm the existence of this cline (Pasquet and Vanderborght, 1999); the single accession of *V. heterophylla* studied fell within the *V. ambacensis* var. *ambacensis* cluster. The species is closely related to *V. heterophylla* and intermediates between the two occur in SUD and UGA (Verdcourt, 1970; Thulin, 1983, 1989a).

Two varieties, *V. ambacensis* var. *ambacensis* and var. *pubigera*, are recognized within this species. The latter occurs in BUR, ZAI, NGA, RWA, TAN and UGA while var. *ambacensis* occurs in CMN, ZAI and CHA. Distinction between the two is however difficult and, apart from two records, identification was not carried out to varietal level. *V. benuensis*, previously described as a new species from northern Cameroon (Pasquet and Maréchal, 1989) has been reduced to a variety within this species because it could not be distinguished from *V. ambacensis* var. *pubigera* by isozyme analysis (Pasquet and Vanderborght, 1999). The main characters which separated the two were the amplicarpic nature of *V. benuensis* as well as differences in the number of ovules per ovary (3 in *V. benuensis*, 6 or more in *V. ambacensis*) and other morphological characters (Pasquet and Maréchal, 1989). Such characters have additionally not been found to be useful; instead the number of nodes in the inflorescence is suggested as a more useful character (Pasquet and Vanderborght, 1999). Thulin (1989) notes that *V. ambacensis* is very closely related to *V. heterophylla* from which it may not be specifically distinct. He adds that Verdcourt (1970, 1971) treats *V. micrantha* and *V. chiovendae* as synonyms of *V. heterophylla* but that they would be better
assigned as synonyms of *V. ambacensis*. Pasquet (2001) goes further and has recently sunk *V. ambacensis* var. *ambacensis* into *V. heterophylla*, although he comments that the status of var. *pubigera* remains unclear.

The two varieties are identified by Maréchal *et al.* (1978) as follows:

1. Leaflets lanceolate-elliptic (rarely oval), flowers mauve fading white, inflorescence and rachis relatively short, bearing 4 to 6 flowers..........................

   .................................................................................................................... var. *ambacensis*

   Leaflets oblong-elliptic, flowers yellow (rarely blue or reddish), inflorescence and rachis longer, bearing 6 to 12 flowers............................................ var. *pubigera*

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**Vigna ambacensis** var. *ambacensis*

Reference to a published description: CPV 171; FWTA 568.

Vernacular names: None known.

Habit and lifespan: Twining, herb.

Flower colour: Bright yellow.

Habitat: Grassland and bush.

Associated species: As for species.

Altitude: 100–2510 m.

Distribution:

CEAF: BUR, CAF, CON, RWA, ZAI.

EAF: TAN, UGA.

NEAF: SUD.

WAF: CMN, GHA, GUI, NGA, NGR.

ZAMB: ANG(!), BOT, MLW, ZAM.

Phenology: Unknown.

Uses: None known.

Conservation Notes: This variety is well represented in *ex situ* collections and does not appear threatened, so is not a conservation priority.

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Reference to a published description: CPV 171; FWTA 568.

Vernacular names: None known.

Habit and lifespan: Prostrate or climber.

Flower colour: Yellow, rarely blue or reddish.

Habitat: Fallow field and bush not far from cultivation.

Associated species: As for species.

Altitude: 70–1650 m.

Distribution:

CEAF: CAF, CHA, CON, GAB, ZAI.

SAF: ZAF.

WAF: BEN, BKN, CMN, GHA, IVO, MLI, NGA, NGR, TOG(!).

ZAMB: BOT.

Phenology: August–November.
Figure 5.27. *Vigna ambacensis* Welw. ex Baker in Oliv.: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×3); 4, inflorescence nectaries, details (×2.5); 5, flower, front and lateral view (×1); 6, standard, details of external surface (×3); 7, standard, (×2); 8, wing, front view (×2.5); 9, standard, details (×3); 10, keel, lateral view (×2.5); 11, diadelphous stamens, spread out (×3); 12, wing (×3); 13, style (×3); 14, stigma (×12); 15, calyx, spread out (×2.5); 16, seed, lateral and front view (×2.5).
Figure 5.28. Distribution of *V. ambacensis* based on specimen and accession passport data.

Figure 5.29. FloraMap predicted distribution for *V. ambacensis*. 
Uses: None known.
Conservation Notes: This variety is well represented in ex situ collections and does not appear threatened, so is not a conservation priority.

Reference to a published description: Refer to protologue.
Vernacular names: None known.
Habit and lifespan: Annual herb.
Flower colour: White with pale yellow beak.
Habitat: Roadside and disturbed habitats.
Associated species: Unknown.
Altitude: 200–1250 m.
Distribution: CEAF: BUR.
WAF: CMN, NGA.
Phenology: Unknown.
Uses: None known.
Taxon Vulnerability Assessment: 5.1
Conservation Notes: *V. benuensis* is only relatively recently described therefore there are few historical data upon which to base a conservation assessment. However, the geographical range of the species from Cameroon to Burundi, with no species having yet been recorded from the Central African Republic or Democratic Republic of the Congo, suggests it is too early to formulate a conservation strategy. Pasquet and Maréchal (1989) suggest the species is most closely related to *V. ambacensis* var. *pubigera*, which is native to the Central African Republic or Democratic Republic of the Congo; therefore, material of the latter should be re-examined to check whether it is in fact *V. ambacensis* var. *pubigera* or should now be reidentified as *V. benuensis*. Therefore, as a priority this species needs to be systematically studied to provide sufficient data for IUCN Red List assessment and to help clarify the most appropriate conservation strategy.
IUCN Red List Category: Data Deficient.

Reference to a published description: CPV 172; FZ 129.
Vernacular names: None known.
Habit and lifespan: Prostrate perennial.
Flower colour: Yellow.
Habitat: Disturbed areas and roadsides, damp ground; sandy loam.
Associated species: Unknown.
Altitude: 21–200 m (–1348 m in Kenya).
Distribution: CEAF: RWA.
EAF: KEN(!), TAN(!).
Figure 5.30. *Vigna benuensis* Pasquet and Maréchal: 1, habit (×1); 2, stipule (×3); 3, details of leaf nervation, lower surface (×6); 4, inflorescence nectaries (×2.5); 5, flower, front and lateral view (×1); 6, standard (×2); 7, standard, details (×3); 8 and 9, keel, lateral and front view (×2.5); 10, wing (×3); 11, diadelphous stamens, spread out (×3); 12, style (×3); 13, stigma (×12); 14, calyx, spread out (×2.5); 15, pods (×2); 16, seed, lateral and front view (×2.5).
Figure 5.31. Distribution of *V. benuensis* based on specimen and accession passport data.

Figure 5.32. FloraMap predicted distribution for *V. benuensis*.
An Asian species used as a cover crop that has been naturalized in the coastal plains of Mozambique and Tanzania (Maréchal et al., 1978), and Kenya (Pasquet, 2001).

**Phenology:** Unknown.

**Uses:** None known.

**Taxon Vulnerability Assessment:** = 6.6

**Conservation Notes:** *V. hosei* is rare, as indicated by the small number of herbarium specimens and accessions collected, but it is found across a large area of Africa, indicating that individual populations are likely to be isolated. The fact that Asian material has been introduced along the eastern seaboard of Africa complicates development of a conservation strategy. If the eastern seaboard populations are Asian introductions then should they be actively conserved? As the species is cultivated, most probably they should be actively conserved, especially as Verdcourt (1971) suggests an African origin for the species. Whatever the truth of its manner of distribution and origin, it is inadequately represented in *ex situ* collections, with only two germplasm samples from Rwanda, which cannot hope to represent the full geographic range or genetic diversity of the species. The number of collections made over time is sporadic; and since the 1960s no population has been sampled, indicating a decline.

**IUCN Red List Category:** Endangered.

**Additional notes:** Two varieties, primarily var. *hosei* occurring in Tanzania (as well as parts of Asia) and var. *pubescens* in Mozambique, Rwanda and Tanzania, are recognized in this species (Maréchal et al., 1978). Only eight records of this species occur in the database. *V. hosei* is closely related to *V. parkeri* and was originally thought to be a variant of that species (Verdcourt, 1970). However, the two species have different chromosome numbers (*2n* = 22 in *V. parkeri*) and a similarity coefficient of 82% (Maréchal et al., 1978).

The two varieties are identified by Maréchal et al. (1978) as follows:

1. Stem and leaves glabrescent, seed aril not developed
   
   .......................... ................................................................. *Vigna hosei* var. *hosei*

2. Stem and leaves pubescent, seed aril developed
   
   .......................... ................................................................. *Vigna hosei* var. *pubescens*

*V. hosei* is thought to be the closest relative of *V. subterranea*, although this has not been confirmed (Baudoin and Maréchal, 1991). The species has been reported to have some potential as a green manure under coconuts where it gives good growth and suppresses weed growth. Once established, it is tolerant to heavy grazing but is seriously affected by drought and fire (Skerman et al., 1988).

**Vigna hosei var. hosei**

**Reference to a published description:** CPV 174.

**Vernacular names:** None known.

**Habit and lifespan:** Annual or perennial, creeping herb.
Figure 5.33. Distribution of *V. hosei* based on herbarium specimen passport data.
Figure 5.34. *Vigna hosei* (Craib) Backer: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule, front view (×2.5); 4, stipule, lateral view (×2.5); 5, inflorescence nectaries (×3); 6, inflorescence (×2.5); 7, flower, front and lateral view (×1); 8, standard (×2.5); 9, standard, details (×6); 10 and 11, keel, front and lateral view (×3); 12, wing (×3); 13, diadelphous stamens, spread out (×6); 14, style (×6); 15, stigma (×12), 16, calyx, spread out (×3); 17, seed, lateral and front view (×2.5).
**Flower colour:** Yellow.

**Habitat:** Disturbed areas and roadsides.

**Associated species:** Unknown.

**Altitude:** 0–1200 m.

**Distribution:**
- EAF: KEN(!), TAN(!).
- ZAMB: MOZ.

**Phenology:** Unknown.

**Uses:** None known.

**Conservation Notes:** An Asian species used as a cover crop and naturalized along the eastern seaboard of Africa, it requires systematic collection and conservation.

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**Vigna hosei var. pubescens** Maréchal, Mascherpa and Stainier, Taxon 27: 200 (1978).

**Reference to a published description:** CPV 174.

**Vernacular names:** None known.

**Habit and lifespan:** Annual or perennial, creeping herb.

**Flower colour:** Unknown.

**Habitat:** Unknown.

**Associated species:** Unknown.

**Altitude:** 1350 m.

**Distribution:**
- CEAF: RWA.

**Phenology:** Unknown.

**Uses:** None known.

**Conservation Notes:** Although this variety has a wider distribution in Africa, its full distribution is unclear, it requires systematic collection and conservation.

**Taxonomic notes:** Pasquet (2001) suggest this variety is quite distinct from var. hosei and could deserve specific rank in its own right.

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**Vigna parkeri** Baker, J. Bot. 20:69 (1882).

**Reference to a published description:** CPV 174; FE 173; FTEA 635; FZ 130; LM 581.

**Vernacular names:** None known.

**Habit and lifespan:** Annual or perennial, creeping prostrate, scrambling or climbing, herb, sometimes forming mats as it may root from nodes.

**Flower colour:** Blue turning purple blue or yellow or white.

**Habitat:** Grassland, savannah, thicket, forest, fallow and weed of cultivation, path and roadsides; predominantly on sandy loam.

**Associated species:** Acacia, Andropogon, Eragrostis, Hyparrhenia and Sporobolus.

**Altitude:** 1–3900 m.

**Distribution:**
- CEAF: BUR, RWA, ZAI.
EAF: KEN, TAN, UGA.
NEAF: ETH.
WAF: CMN.
WIO: MDG(!).
ZAMB: ANG, MOZ, ZAM.

Phenology: Unknown.

Uses: *V. parkeri* has been noted to be excellent for grazing (Bogdan, 1977; Skerman *et al.*, 1988), it has been found to be very susceptible to waterlogging showing low levels of transpiration and low levels of manganese concentration in shoots as well as reduced plant weights under waterlogged conditions (Shiferaw *et al.*, 1992).

**Taxon Vulnerability Assessment:** = 4.1

Conservation Notes: *V. parkeri*, although widely distributed in Africa, is poorly represented in *ex situ* collections. Additional germplasm collection is required from throughout its geographic range. The trend in collection of herbarium specimens suggests that this species is not threatened in East or Northeast Africa, where its distribution is concentrated. However, collection has been sporadic in West Africa and the Zambesiaca region, probably because the species is rarer in these regions. Overall the species does not appear to be in danger of genetic erosion or extinction, but should be collected further in West Africa and the Zambesiaca region.

IUCN Red List Category: Least Concern.

Taxonomic notes: Three *V. parkeri* subspecies are recognized, subsp. *parkeri* (endemic to Madagascar), *maranguensis* and *acutifolia*, they can be identified as follows:

1. Leaflets mostly large, elliptic or ovate, acute or acuminate at the apex ..... 2.
   Leaflets mostly small, usually round with a rounded apex; flowers predominantly blue, purple or white, with yellow forms frequent in Uganda.

2. Flowers predominantly purple/pink fading bluish; endemic to Madagascar .
   Flowers predominantly yellow (sometimes blue); present on mainland Africa

**Vigna parkeri subsp. parkeri**
Reference to a published description: CPV 174; LM 581.

Vernacular names: None known.

Habit and lifespan: Annual, creeping, scrambling or climbing herb.

Flower colour: Purple pink, fading blue.

Habitat: Grasslands, roadsides, damp ground, in undergrowth in forests and swamp edges.

Associated species: Unknown.

Altitude: 0–1500 m.

Distribution:
WIO: MDG(!) (endemic to area around Ankaratra massif, including Antananarivo and Ambositra).
Figure 5.35. Distribution of *V. parkeri* based on specimen and accession passport data.

Figure 5.36. FloraMap predicted distribution for *V. parkeri*. 
**Phenology:** January – May (–August).

**Uses:** None known.

**Conservation Notes:** Although the detailed conservation assessment in the conspectus is primarily focused at the species level, the fact that subsp. *parkeri* is so restricted can be taken to indicate that it deserves a high level of conservation priority. There are no *ex situ* conserved accessions of this subspecies. The available evidence suggests this subspecies warrants an IUCN Red List Category of Endangered.


**Reference to a published description:** CPV 175; FCBR 369; FE 173; FTEA 636; FWTA 568; FZ 130.

**Vernacular names:**
Kutuilumkum (BUR), Kajingo, Kafolobia, Kwakwa lokirere, Malula, Umniyaye, Toshimbo-shimbo (ZAI), Ih’r’i, Lutumah (KEN), Umhuarokoto, Umutshasuka (RWA), Kahewa nyakake (UGA), Yundo Fundo (TAN).

**Habit and lifespan:** Perennial, climbing or prostrate herb.

**Flower colour:** Blue turning purple pink or yellow or white.

**Habitat:** In degraded grassland, fallow fields, grasslands, dambos, herbaceous savannahs, roadsides, montane forests, seasonal swamps, thickets etc.

**Associated species:** Andropogon, Eleusine, Eragrostis, Hyparrhenia, Pennisetum etc.

**Altitude:** 45–3857 m.

**Distribution:**
CEAF: BUR, RWA, ZAI.
EAF: KEN, TAN, UGA.
NEAF: ETH.
WAF: CMN.
ZAMB: ANG, ZAM.

**Phenology:** Flowers throughout the year in EAF, but is restricted to August–January in NEAF.

**Uses:** Eaten by livestock.

**Conservation Notes:** There are significant numbers of accessions available for this subspecies throughout its range and therefore the subspecies does not have conservation priority.

**Taxonomic Notes:** Pasquet (2001) comments that subsp. *maranguënsis* is shown by genetic diversity studies to contain two infra-subspecific taxa with some accessions from Cameroon and Central Africa being genetically very distinct, although this genetic distinction is not correlated with easily observable morphological characteristics.


**Reference to a published description:** FTEA 636.

**Vernacular names:** None known.
Habit and lifespan: Annual, creeping, scrambling or climbing, herb.
Flower colour: Predominantly yellow, blue.
Habitat: Grasslands, roadides and bushlands.
Associated species: Unknown.
Altitude: 1–1955 m.
Distribution:
EAF: KEN, TAN, UGA(!).
ZAMB: MOZ, ZAM.
Phenology: January – May (–August).
Uses: None known.
Conservation Notes: There are significant numbers of accessions available for this subspecies throughout its range and therefore the subspecies does not have conservation priority.

Vigna gracilis (Guill. and Perr.) Hook.f. in Hook., Niger Fl.: 311 (1849).
Reference to a published description: CPV 175; FCBR 368; FWTA 569; FZ 131.
Vernacular names: None known.
Habit and lifespan: Slender, twining herb.
Flower colour: Pink or blue.
Habitat: Grassland and forest openings, dambo, field and forest margin, along streams, montane scrub and roadside; clay and sandy loam over granite and laterite.
Associated species: Daniellia olivieri, Euphorbia, Hyparrhenia, Loudetia and Lophira.
Altitude: 1–4059 m.
Distribution:
CEAF: CON, GAB, GGI, RWA, ZAI.
EAF: UGA.
NEAF: ETH.
WAF: BEN, CMN, GAM, GHA, GNB, GUI, IVO, LBR, MLI, NGA, NGR, SEN, SIE.
ZAMB: ANG, MLW, MOZ, ZIM.
Phenology: Unknown.
Uses: See information for var. multiflora.
Taxon Vulnerability Assessment: = 5.9
Conservation Notes: V. gracilis is widely distributed in Africa and the species as a whole, as well as its two varieties, is well represented in ex situ collections from throughout their range, with the possible exception of West Africa and the Democratic Republic of the Congo. As indicated by the number of herbarium specimens collected, the species has a centre of diversity in West and Central Africa, while collection in East Africa and the Zambesiaca region has been more sporadic, indicating a requirement for more focused collection efforts. The trend in numbers of herbarium specimens collected over time follows the general pattern for Vigna species, which suggests that the species does not appear to be in danger of genetic erosion or extinction.
IUCN Red List Category: Least Concern.
Taxonomic notes: Two varieties of *V. gracilis* are recognized by Maréchal *et al.* (1978), var. *gracilis* and var. *multiflora*, they can be identified as follows:

1. Leaflets usually <50 mm, variable shape; flowers usually <10 mm; plant delicate appearance; rachis frequently elongated; seed 1.5–2.5 mm, aril present.................................................................var. *gracilis*

   Leaflets usually >50 mm; flowers usually >10 mm; plant robust appearance; rachis not usually elongated; seed 3.0–3.5 mm, aril absent or not well developed .................................................................var. *multiflora*

**Vigna gracilis** var. *gracilis*

Reference to a published description: CPV 175; FCBR 368; FWTA 569.

Vernacular names:

ZAI: Madezo manseke, Yonde wa Wokombo.

GAM: Endinga, Petego, Tireh and Jirundoinga.

SIE: Burangoi, Digbingi Irsa (“Leopard’s Bean”), Kjori-Lowei and Ndogbolwek.

Habit and lifespan: Climbing perennial.

Flower colour: Mostly blue, but violet, white and lilac have also been recorded.

Habitat: Grasslands, forest edges, thickets, marshes, wastelands etc.

Associated species: *Hyparrhenia, Imperata, Themeda*.

Altitude: 1–1712 m.

Distribution:

CEAF: CAF, CON, GAB, GGI, ZAI.

EAF: UGA(1).

WAF: CMN, GAM, GHA, GNB, GUI, IVO, LBR, MLI, NGA, SEN, SIE.

ZAMB: ANG, ZAM.

Phenology: Unknown.

Uses: None known.

Conservation Notes: There are significant numbers of accessions available for this variety throughout its range and therefore it does not have conservation priority.


Reference to a published description: CPV 176; FCBR 367; FWTA 569.

Vernacular names:

ZAI: Kantumbatumba, Tandanda, Kahukoro, Kwakwa lo lowe, Mangasi wa mai, Nzilo, Imbiri.

Habit and lifespan: Climbing perennial.

Flower colour: Blue, bluish white, rarely yellow, purple, white or mauve.

Habitat: Gallery forest and forest clearings, grasslands, herbaceous savannahs, lakesides, riverine forests, swamp and marsh edges.

Associated species: *Hyparrhenia, Imperata, Themeda*.

Altitude: 1–1768 m.

Distribution:

CEAF: CON, EQG, GAB, ZAI.
Figure 5.37. *Vigna gracilis* (Guill. and Perr.) Hook.f. in Hook.: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×3); 4, inflorescence nectaries (×3); 5, inflorescence (×1.5); 6, flower, front and lateral view (×1); 7, standard (×2); 8, standard, details (×3); 9, wing (×3); 10 and 11, keel, lateral and front view (×3); 12, diadelphous stamens, spread out (×3); 13, style (×3); 14, stigma (×12); 15, calyx, spread out (×3); 16, seed, lateral and front view (×2.5).
Figure 5.38. Distribution of *V. gracilis* based on specimen and accession passport data.

Figure 5.39. FloraMap predicted distribution for *V. gracilis*.
Vigna racemosa (G. Don) Hutch. and Dalziel, Kew Bull.:18 (1929).

Reference to a published description: CPV 176; FCBR 370; FTEA 633; FWTA 569; FZ 131.

Vernacular names:
Catandasa (ANG), Ngase, Kafulule, Kahunde-bakishi, Kolulu/Wandu nsinga (ZAI), Harshen damo, Kafan gouraka, Mamangieva, Okokonu, adiya hankaka, Yaryyadin gono, (NGA), Urubebia (RWA), Litina (SIE), Dove beans/"beans not eaten"—(GAM).

Habit and lifespan: Climbing perennial.

Flower colour: Blue, bluish white, rarely yellow, purple, white or mauve.

Habitat: Fallows, disturbed areas, gallery forests, grasslands, hill miombo, roadsides, marshy savannahs, tree savannahs, often associated with occasional waterlogging; sandy loam over quartzite.

Associated species: Andropogon, Hyparrhenia, Imperata, Isoberlinia, Loudetia, Pennisetum, and Uapaca.

Altitude: 0–2500 m.

Distribution:
CEAF: BUR, CAF, CHA, CON, GAB, GGI, RWA, ZAI.
EAF: KEN, TAN, UGA.
NEAF: SUD.
SAF: ZAF.
WAF: BEN, BKN, CMN, GAM, GHA, GNB, GUI, IVO, LBR, MLI, NGA, NGR, SEN, SIE, TOG.
ZAMB: ANG, MLW, ZAM.

Phenology:
September–December and February–July (CEAF).
September–December (mostly)—WAF.
March–May (ZAMB).

Uses: Used as poultice for testicles (ANG). In NGA, the leaves are mashed up and taken as a drink for catarrh (Burkill, 1995).

Taxon Vulnerability Assessment: = 3.3

Conservation Notes: V. racemosa is widely distributed in Africa and the species is reasonably well represented in ex situ collections from throughout its range, with the possible exception of the Democratic Republic of the Congo and West Africa, particularly Guinea, Guinea Bissau, Liberia and Sierra Leone, where further collection is required. The trend in numbers of herbarium specimens
collected over time follows the pattern for all Vigna species, which suggests the species does not appear to be in danger of genetic erosion or extinction.

**IUCN Red List Category:** Least Concern.


**Reference to a published description:** CPV 176; FCBR 366; FTEA 634; FWTA 569.

**Vernacular names:**
Ilenabulere (NGA).

**Habit and lifespan:** Perennial, climber.

**Flower colour:** Pink, blue, violet or white.

**Habitat:** Primary and secondary forest, riverine valley forest.

**Associated species:** Unknown.

**Altitude:** 48–1200 m.

**Distribution:**
CEAF: CAF, ZAI.
EAF: UGA.
WAF: CMN, NGA, SIE.

**Phenology:** September–January (CEAF).

**Uses:** None known.

**Taxon Vulnerability Assessment:** = 5.1

**Conservation Notes:** V. desmodioides has a relatively wide but disjunct distribution. The species is not represented in ex situ collections, therefore is of conservation priority, with further collection required. The trend in numbers of herbarium specimens collected over time indicates that only four specimens have been collected since the 1930s, which suggests the species is in decline and is in danger of genetic erosion and extinction.

**IUCN Red List Category:** Endangered.

**Additional notes:** This species closely resembles V. racemosa. Distinguishing features include shorter and broader stipules; long, prominent bracts and large, multilobed rhachis glands which are lacking in V. racemosa. The fact that so few specimens have been collected in recent years would tend to indicate species decline, as concluded above, but there is another interpretation, possibly the species has been confused in recent years with V. racemosa. Therefore, there is a need to clarify the taxonomic relationship between V. desmodioides and V. racemosa as a matter of urgency as it may impact on the conservation strategy.


**Reference to a published description:** CPV 177; FCBR 343; FE 173; FTEA 666, illust. 667; FWTA 572; FZ 124; LM 583.

**Vernacular names:** None known.

**Habit and lifespan:** Annual herb with short creeping stem.

**Flower colour:** Yellow.

**Habitat:** Cultivated.
Figure 5.40. *Vigna racemosa* (G.Don) Hutch. and Dalziel: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×2.5); 4, flower, front and lateral view (×1); 5, standard (×3); 6, standard, details (×6); 7 and 8, keel, lateral and front view (×2.5); 9, calyx, spread out (×3); 10, wing (×2.5); 11, diadelphous stamens, spread out (×3); 12, style (×3); 13, stigma (×12); 14, inflorescence nectaries (×2.5); 15, seed, lateral and front view (×2.5).
Figure 5.41. Distribution of *V. racemosa* based on specimen and accession passport data.

Figure 5.42. FloraMap predicted distribution for *V. racemosa*.
Figure 5.43. Distribution of *V. desmodioides* based on herbarium specimen passport data.

Figure 5.44. FloraMap predicted distribution for *V. desmodioides*. 
Associated species: Andropogon, Boswellia dalzielii, Combretum, Isoberlinia and Indigofera.

Altitude: 10–1650 m, though dependent on cultivation for var. subterranea.

Distribution:
CEAF: CAF(!), CHA(!), CON(!).
EAF: KEN(!), TAN(!).
NEAF: ETH(!), SUD(!).
SAF: SWZ(!), ZAF(!).
WAF: BEN(!), BKN, CMN, GAM(!), GHA(!), IVO(!), MLI(!), NGA, NGR(!), SEN(!), SIE(!), TOG(!).
WIO: MDG(!).
ZAMB: ANG, BOT(!), MOZ, ZAM(!), ZIM(!).

Phenology: Dependent on cultivation.

Uses: Locally grown for edible seeds, native to West Africa but now cultivated throughout the tropics.

Taxon Vulnerability Assessment: = 6.8

Conservation Notes: V. subterranea has a distribution that spans continental Africa and Madagascar, although possibly the distribution has been extended by its wide cultivation. However, it is surprising that for a major human food species so few ex situ accessions have been conserved, and particularly that there are no ex situ accessions of V. subterranea var. spontanea, the wild progenitor of Bambara groundnut. The systematic collection of both V. subterranea var. subterranea and V. subterranea var. spontanea needs to be given the highest priority. There is, however, no evidence to suggest that the species as a whole is in danger of genetic erosion or extinction.

IUCN Red List Category: Least Concern.

Taxonomic notes: Originally described by Linnaeus (1763) as Glycine subterranea and subsequently transferred to the monospecific genus Voandzeia by DeCandolle (1825). The similarity between Voandzeia subterranea and Vigna subgenus Plectotropis was noted by Maréchal et al. (1978), but it was Verdcourt (1980) who transferred the species to Vigna. Two varieties are recognized within this species, V. subterranea var. subterranea and V. subterranea var. spontanea, the latter was originally described by Harms (1912) and formally transferred to Vigna by Pasquet (2001). The latter is distinguished from the cultivated form by its more diffuse growth habit and smaller seeds and is known only from northern NGA, CMN and doubtfully from CAF (Verdcourt, 1971).

1. Plant cultivated; stem erect; leaves borne at short intervals along stem and tightly clustered together; pods tightly clustered together beneath compact plant; found throughout Africa ........................................ var. subterranea

Plant wild; distinctly spreading in appearance with prostrate stems, reaching 2 m; bearing leaves at wide intervals; pods are found over an equally wide area, usually one beneath each stem node; apparently endemic to northwestern Cameroon and northeastern Nigeria.................. var. spontanea
**Vigna subterranea var. subterranea**

**Reference to a published description:** CPV 177; FTEA 668; FWTA 572; FZ 124; LM 583.

**Vernacular names:**
- BOT: “ditloo”.
- KEN: “njugo mawe”—Swahili; “bande” (Luo); “tsimbande”, chimbande or simbade (Luhya); “nzugu mawe” (Giriama); tandegwa (Kambe) (Ngugi, 1995).
- MDG: Voanjabory, Voanjabory.
- SWZ: Tindlubu.

**Habit and lifespan:** Perennial, herb with short creeping stem.

**Flower colour:** Yellow.

**Habitat:** Cultivated, usually on sandy soils.

**Associated species:** Unknown.

**Altitude:** 10–1650 m.

**Distribution:**
- CEA: CAF(!), CHA(!), CON(!).
- EAF: KEN(!), TAN(!).
- NEAF: ETH(!), SUD(!).
- SAF: SWZ(!), ZAF(!).
- WAF: BEN(!), BKN, CMN(!), GAM(!), GHA(!), IVO(!), MLI(!), NGA, NGR(!), SEN(!), SIE(!), TOG(!).
- WIO: MDG(!).
- ZAMB: ANG, BOT(!), MOZ, ZAM(!), ZIM(!).

Bambara groundnut is also grown in Madagascar. Outside Africa, it has been reported to be cultivated in Thailand (Benjakul et al., 2000).

**Phenology:** Unknown.

**Uses:** This is the cultivated form of the species. It was discovered by Du Petit-Thouars (1806) in Madagascar, where it was commonly known as “Voanjo”, who then named the species *Voandzeia* (Goli, 1995). Commonly called Bambara groundnut (derived from the Bambara ethnic group of Mali), *V. subterranea* is widely cultivated as a pulse crop, mainly for subsistence in many parts of Africa. Bambara groundnut may be prepared in various ways and used as a snack or main meal. The most common method of preparation for use as a snack is to boil the immature seeds with salt in the pod as reportedly done in BOT (Karikari et al., 1995) KEN (Ngugi, 1995), NGA (Tanimu and Aliyu, 1997), ZAF (Swanevelder, 1995). The mature, dry seeds may be ground into flour and used to make cakes or mixed with cereals to make porridge (Karikari et al., 1995). Along with its use as a pulse, the leaves are used as fodder in BKN (Drabo et al., 1995).

**Conservation Notes:** There are significant numbers of accessions available from Nigeria and Burkina Faso, but there is an urgent need to collect the variety from the remainder of its distributional range; as an important cultivated species this action should have the highest priority.

**Additional notes:** Begemann (1995) reports that hybridization may be possible between this species and *V. unguiculata*. However, more experiments are needed to verify this.
Reference to a published description: CPV 178; FZ 125.

**Vernacular names:** None known.

**Habit and lifespan:** Perennial, herb with short creeping stem.

**Flower colour:** Yellow.

**Habitat:** Unknown.

**Associated species:** Unknown.

**Altitude:** 250–1200 m.

**Distribution:**
CEAF: CAF(!).
WAF: CMN, NGA.

**Phenology:** Unknown.

**Uses:** None known.

**Conservation Notes:** As discussed above, there are no accessions of var. *spontanea* conserved *ex situ*; as this is the wild progenitor of var. *subterranea* the situation must be rectified urgently. The variety is also primarily restricted to a limited area of northern Cameroon and Nigeria, which indicates that it deserves a high level of conservation priority. The geographic restriction indicates an IUCN Red List Category of Endangered is appropriate.

**Taxonomic notes:** This taxon has been suggested as the wild progenitor of *V. subterranea*, and recent isozyme analysis has provided some evidence (Pasquet *et al.*, 1999).

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Reference to a published description: CPV 178; LM 573, illust. 575.

**Vernacular names:**
MDG: Avoko, Avokombiby, Havoko, Kismaotsa, Vahizato, Voanimban’dzaza (Central Madagascar).

**Habit and lifespan:** Perennial, climbing or creeping herb.

**Flower colour:** Purple pink fading to bluish purple or violet.

**Habitat:** Grassland, open woodland and disturbed areas, forest and forest margins, also along roadsides, resistant to grazing and tires, prefers laterite and basaltic rock.

**Associated species:** *Eucalyptus* and Ericaceous shrubs.

**Altitude:** 30–2180 m.

**Distribution:**
CEAF: BUR.
WIO: MDG (widespread in and endemic to the uplands of Central Madagascar).

**Phenology:** (September–) November to April (–June).

**Uses:** The swollen roots, pods and seeds are edible; a good animal fodder.

**Taxon Vulnerability Assessment:** = 5.3

**Conservation Notes:** *V. angivensis* is a common species of the central plateaux of Madagascar that shows high phenotypic variation associated with different habitat conditions. However, it is not represented in *ex situ* collections, and further collection is required. The trend in numbers of herbarium specimens collected over time follows the pattern for all *Vigna* species, which suggests the species does not appear to be in danger of genetic erosion or extinction.
Figure 5.45. Distribution of *V. subterranea* based on specimen and accession passport data.

Figure 5.46. FloraMap predicted distribution for *V. subterranea*. 
IUCN Red List Category: Least Concern.

**Taxonomic notes:** A common species distinguished from the other native species with mauve flowers, *V. parkeri* and *V. microsperma* by its usually solitary and relatively larger flowers, and from *V. keraudrenii* by the distinctly medifixed stipules of the latter. *V. angivensis* is very variable in its vegetative morphology. The habit varies from a delicate, prostrate herb to more robust and climbing. The leaves are unifoliolate or 3-foliolate; some plants have only unifoliolate leaves, and others have the basal leaves unifoliolate and those higher up trifoliolate, but the majority of plants have all the leaves trifoliolate. The leaflets are also very polymorphic in size and shape; those of the upper leaves are often much narrower. This phenotypic variation appears to be in response to the habitat and amount of shade in which the plant is growing rather than corresponding to different infraspecific taxa (Du Puy et al., 2002).


Reference to a published description: CPV 178; FWTA 568.

Vernacular names: None known.

**Habit and lifespan:** A perennial creeping or climbing herb with a fibrous rootstock.

**Flower colour:** Bluish purple.

**Habitat:** Moist areas, scrub, bush and grasslands.

**Associated species:** Unknown.

**Altitude:** 1–1000 m.

**Distribution:**
- WAF: BEN, BKN, CMN, GAM, GHA, GUI, IVO(!), MLI, SEN, SIE, TOG(!).
- ZAMB: MOZ (a doubtful record).

**Phenology:** Unknown.

**Uses:** The tubers are reported to be edible (Padulosi and Ng, 1990).

**Taxon Vulnerability Assessment:** = 6.3

**Conservation Notes:** *V. stenophylla* is a West African species that is not well known and is not represented by ex situ collections, therefore the collection of accessions should be treated as the highest priority. There is a need to collect systematically throughout its geographic range. Herbarium specimens of the species were collected consistently until the 1940s, since when only three specimens have been collected, which tends to indicate the species is in serious decline.

**IUCN Red List Category:** Critically Endangered.


Reference to a published description: CPV 179; FZ 131; LM 576.

Vernacular names: None known.

**Habit and lifespan:** Annual or perhaps perennial, climbing herb.

**Flower colour:** Blue, mauve or purple, rarely yellow or white.

**Habitat:** Disturbed or open forests, forest edges, montane grassland or scrub, roadsides and river or stream banks.
Figure 5.47. Distribution of *V. angivensis* based on specimen and accession passport data.

Figure 5.48. FloraMap predicted distribution for *V. angivensis*.
Figure 5.49. Distribution of *V. stenophylla* based on herbarium specimen passport data.

Figure 5.50. FloraMap predicted distribution for *V. stenophylla*. 
Figure 5.51. *Vigna gazensis* Baker f. 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×3); 4, calyx bracts (×3); 5, flower, front and lateral view (×1); 6, standard (×2); 7, standard, details (×3); 8 and 9, keel, front and lateral view (×2.5); 10, wing (×2.5); 11, diadelphous stamens, spread out (×3); 12, style (×3); 13, stigma (×12); 14, calyx, spread out (×3); 15, seed, lateral and front view (×2.5).
Figure 5.52. Distribution of *V. gazensis* based on specimen and accession passport data.

Figure 5.53. FloraMap predicted distribution for *V. gazensis*.
Associated species: *Brachystegia, Podocarpus, Rhynchosia, Strelitizia* and *Uapaca*.  
**Altitude:** 50–2800 m.  
**Distribution:**  
WIO: MDG.  
ZAMB: ANG(!), MLW, MOZ, ZAM, ZIM.  
**Phenology:** August to September.  
**Uses:** None known.  
**Taxon Vulnerability Assessment:** = 4.0  
**Conservation Notes:** *V. gazensis* is found widely in Southeast Africa and Madagascar but only has a single *ex situ* collection from Zambia; thus, further systematic collection is required. The trend in numbers of herbarium specimens collected over time follows the pattern for all *Vigna* species, which suggests the species does not appear to be in danger of genetic erosion or extinction.  
**IUCN Red List Category:** Least Concern.

**Reference to a published description:** CPV 180; FTEA 630; FZ 132.  
**Vernacular names:**  
ZAI: Bangassu, Kilulu, Yonde.  
**Habit and lifespan:** Perennial, prostrate or climbing, herb.  
**Flower colour:** Yellow or mauve-yellow.  
**Habitat:** Rocky places, hillsides, savannah, primary and secondary woodlands, grasslands, roadsides, lake shore, fallows and seasonally inundated areas; sandy soils.  
**Associated species:** *Brachystegia, Combretum, Entada, Eragrostis, Erythrina, Hyparrhenia, Protea* and *Loudetia*.  
**Altitude:** 1–2200 m.  
**Distribution:**  
CEAF: BUR, CAF, CON, GAB, GGI, RWA, ZAI.  
EAF: KEN, UGA.  
NEAF: SUD.  
SAF: ZAF.  
WAF: CMN, GUI, LBR, NGA, SEN, SIE.  
ZAMB: ANG, MLW, MOZ, ZAM.  
**Phenology:** Unknown.  
**Uses:** None known.  
**Taxon Vulnerability Assessment:** = 3.9  
**Conservation Notes:** *V. comosa* is widely distributed in Africa; however, the species, the two subspecies and two varieties are poorly represented in *ex situ* collections. There is a need for further collections from throughout their range, but particularly from Angola, Democratic Republic of the Congo, Cameroon, Liberia and Sierra Leone. The trend in numbers of herbarium specimens collected over time follows the general pattern for *Vigna* species, which suggests the species does not appear to be in danger of genetic erosion or extinction. However, it
should be noted that, as will be seen below, this assessment does not hold true for subsp. abercomensis and var. lebrunii.

**IUCN Red List Category:** Least Concern.

**Taxonomic notes:** Two subspecies, namely *V. comosa* subsp. comosa, with varieties *comosa* and *lebrunii*, and subsp. abercomensis, can be distinguished as follows:

1. Leaflet triangular or tri-lobed; standard (5-)8–10×14 mm; pod 10–25 mm. ................................................................. *V. comosa* subsp. *comosa* 2
   Leaflet elliptic or oblong; standard 13×18 mm; pod approx. 40 mm ............ ................................................................. *V. comosa* subsp. *abercornensis*

2. Stem graceful; leaflet hastate, up to 35×20 mm; standard ± 10 mm long..... ................................................................. var. *comosa*
   Stem robust; leaflet usually oblong or rhombic, larger; standard larger........ ................................................................. var. *lebrunii*

**Vigna comosa** subsp. *comosa* var. *comosa*

**Reference to a published description:** CPV 180; FTEA 630; FZ 132.

**Vernacular names:**

ZAI: Bangassu, Kilulu, Yonde.

**Habit and lifespan:** Prostrate, climbing or twining perennial, occasionally annual.

**Flower colour:** Mainly yellow, but orange, mauve and purple have also been reported.

**Habitat:** Rocky places (laterite rock in dry dambos), hillsides, woodlands, grasslands, roadsides, fallows and seasonally inundated areas.

**Associated species:** As for species.

**Altitude:** 1–1750 m.

**Distribution:**

CEAF: BUR(!), CAF(!), CON(!), GAB, GGI(!), RWA(!), ZAI(!).

EAF: KEN, UGA.

NEAF: SUD(!).

SAF: ZAF.

WAF: CMN(!), GUI, LBR(!), NGA(!), SIE(!).

ZAMB: ANG, MLW, MOZ, ZAM.

**Phenology:** Mainly November in NEAF and mostly April–June in CEAF and ZAMB.

**Uses:** None known.

**Conservation Notes:** This variety in comparison with the other subspecific taxa is well represented in ex situ collections from throughout its range; therefore further collection is not a priority.


**Reference to a published description:** CPV 180.

**Vernacular names:**

ZAI: Bangassu, Kilulu, Yonde.
Figure 5.54. Distribution of *V. comosa* based on specimen and accession passport data.

Figure 5.55. FloraMap predicted distribution for *V. comosa*. 
Habit and lifespan: Perennial, prostrate or climbing, herb.

Flower colour: Yellow or mauve-yellow.

Habitat: Insufficiently known (only a single record seen).

Associated species: As for species.

Altitude: 380–400 m.

Distribution:

CEAF: GAB, ZAI(!).

Phenology: Unknown.

Uses: None known.

Conservation Notes: V. comosa subsp. comosa var. lebrunii has a very restricted distribution within Gabon (it is also reported from the Democratic Republic of the Congo), which indicates that it deserves a high level of conservation priority; the geographic restriction indicates an IUCN Red List Category of Endangered is appropriate.

\*\*\*\*\*\*


Reference to a published description: CPV 180; FZ 132.

Vernacular names: ZAM: Kalalalonde.

Habit and lifespan: Perennial, prostrate or climbing, herb.

Flower colour: Yellow to yellow-green.

Habitat: Roadsides, rocky hillsides, secondary woodlands, bushlands.

Associated species: As for species.

Altitude: 1200–1700 m.

Distribution:

ZAMB: ZAM (endemic to northeast of the country).

Phenology: April–July

Uses: None known.

Conservation Notes: V. comosa subsp. abercornensis has a very restricted distribution within Zambia, it deserves a high level of conservation priority; the geographic restriction indicates an IUCN Red List Category of Vulnerable is appropriate (see Bingham and Smith, 2002).

\*\*\*\*\*\*


Reference to a published description: CPV 181; FCBR 350, illust. 351; FTEA 631; FZ 132.

Vernacular names: None known.

Habit and lifespan: Erect subshrub.

Flower colour: Yellow outside, brown yellow inside.

Habitat: Rocky hillsides, dry sandy soil, granite kopje, rock face, miombo woodland.

Associated species: Unknown.

Altitude: 450–1650 m.

Distribution:

CEAF: ZAI.
EAF: TAN.
ZAMB: ZAM.

Phenology: May–July.

Uses: None known.

Taxon Vulnerability Assessment: $= 6.6$

Conservation Notes: *V. haumaniana* is restricted to Central-east Africa, where it is locally rare. As there are no *ex situ* collections for the species or the two varieties, there is a need for urgent germplasm collection in the Democratic Republic of the Congo, Tanzania and Zambia. The trend in numbers of herbarium specimens collected over time follows the general pattern for *Vigna* species, but the numbers of populations sampled is so low that there must be concern that the species is vulnerable to genetic erosion and extinction.

IUCN Red List Category: Endangered.

Taxonomic notes: Very closely related to *V. comosa*. This species contains two varieties namely var. *haumaniana* and var. *pedunculata*, distinguished as follows:

1. Peduncles ±2 mm; stems and leaves velvety pubescent

   Peduncles 6–25 mm; stems and leaves scarcely pubescent

   .................................................................

   var. *pedunculata*

*Vigna haumaniana* var. *haumaniana*

Reference to a published description: CPV 181; FTEA 631.

Vernacular names: None known.

Habit and lifespan: Erect subshrub.

Flower colour: Yellow outside, brown yellow inside.

Habitat: Rocky hillsides, rough grasslands, herbaceous plateaus, woodlands. It has also been recorded on granite koppies.

Associated species: Unknown.

Altitude: 450–1560 m.

Distribution:

CEAF: ZAI.
EAF: TAN.
ZAMB: ZAM.

Phenology: May–July.

Uses: None known.

Conservation Notes: *V. haumaniana* var. *haumaniana* has a restricted distribution to Central-east Africa, which indicates that it deserves a high level of conservation priority; the geographic restriction indicates an IUCN Red List Category of Endangered is appropriate.


Reference to a published description: CPV 181.

Vernacular names: None known.
Figure 5.56. Distribution of *V. haumaniana* based on herbarium specimen passport data.

Figure 5.57. FloraMap predicted distribution for *V. haumaniana*.
Figure 5.58. *Vigna haumaniana* R.Wilczek: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, leaflet nervation, details (×2); 4, stipule (×3); 5, inflorescence nectaries (×3); 6, flower, front and lateral view (×1); 7, standard (×2.5); 8, keel, lateral and front view (×3); 9, diadelphous stamens, spread out (×3); 10, standard, details (×3); 11, wing (×3); 12, style (×3); 13, calyx, spread out (×3); 14, stigma (×12).
**Habit and lifespan:** Erect subshrub.

**Flower colour:** Yellow.

**Habitat:** Grassland or open woodland.

**Associated species:** Unknown.

**Altitude:** 600–620 m.

**Distribution:**
- CEAF: ZAI.
- ZAMB: ZAM.

**Phenology:** February to September (CEAF).

**Uses:** None known.

**Conservation Notes:** *V. haumaniana* var. *pedunculata* has a very restricted distribution within southern Democratic Republic of the Congo and northern Zambia, which indicates that it deserves a high level of conservation priority; the geographic restriction indicates an IUCN Red List Category of Critically Endangered is appropriate.

**Section Macrodontae** Harms in Engler, Pflanzenw. Afr. 3(1):688 (1915).


**Reference to a published description:** CPV 182; FCBR 385; FE 173; FS 434; FTEA 638.

**Vernacular names:** None known.

**Habit and lifespan:** Annual or perennial, climbing or trailing herb.

**Flower colour:** Mauve, pink-magenta or blue.

**Habitat:** Grassland, fallow, coastal woodland, open bushland, dry evergreen forest, roadside; gneiss or limestone; clay and sandy loams.

**Associated species:** *Acacia, Adansonia, Combretum, Commiphora, Euphorbia, Ficus, Juniperus*, and *Tephrosia*.

**Altitude:** 1–4280 m.

**Distribution:**
- CEAF: BUR, RWA(!), ZAI.
- EAF: KEN, TAN, UGA.
- NEAF: ERI, ETH, SOM, SUD.
- WAF: GHA, NGA.

**Phenology:** April–November (CEAF); September–February (NEAF); November–January and April–September (EAF).

**Uses:** None known.

**Taxon Vulnerability Assessment:** = 3.1

**Conservation Notes:** *V. membranacea* is widely distributed in Africa. As a whole the species is well represented in ex situ collections, however, subsp. *macrodon* has no ex situ germplasm accessions. Overgrazing and genetic erosion are noted on some herbarium specimens from Kenya and Tanzania indicating populations from East Africa are vulnerable and require further collection. However, the overall trend in numbers of herbarium specimens collected over time follows the general pattern for all *Vigna* species.
IUCN Red List Category: Vulnerable.

Taxonomic notes: This species is highly variable, with four subspecies, namely subsp. membranacea, macrodon, caesia and hapalantha, being recognized (Verdcourt, 1971).

1. Calyx teeth longer than the tube; usually growing above 1000 m ............... 2
   Calyx teeth usually shorter than tube, if longer then plants of the coastal area or lowland dry deciduous bushland................................................................. 3

2. Calyx lobes (4-)5–9 mm long; standard mostly 1–1.5 cm.....................
   ...................................................................................... subsp. membranacea
   Calyx lobes 8–17 mm long; standard 1.5–2.5 cm.................... subsp. macrodon

3. Standard 20–23 mm long and wide........................................... subsp. caesia
   Standard 12–13(–16) mm long and wide ....................... subsp. hapalantha

Additional notes: V. membranacea is listed as a summer weed in farmlands of Egypt (El Hadidi et al., 1996), however, no herbarium specimens of this species of Egyptian origin were located. The species is notable for its disjunct distribution and provides a good example of undercollecting in Central Africa.

Vigna membranacea subsp. membranacea
Reference to a published description: CPV 182; FE 174; FTEA 639.

Vernacular names:
ZAI: Muraramba, Mushibanyuma, Kikuluwe/Kindandi, Igishimboeha or Kiaraome.
ETH: Turina and Oldakaka.
UGA: Bukalasa.

Habit and lifespan: Usually annual.

Flower colour: Mauve, pink-magenta or blue.

Habitat: Open, grassy slopes and roadsides, rice paddies, fallow fields, secondary thickets, stunted woodlands, upland rainforests.

Associated species: Acacia, Albizia, Euphorbia, Ficus.

Altitude: 90–2800 m.

Distribution:
CEAF: BUR, RWA(!), ZAI.
EAF: KEN, TAN, UGA(!).
NEAF: ERI, ETH, SUD.
WAF: NGA.

Phenology: Mostly September to December.

Uses: None known.

Conservation Notes: This subspecies in comparison with the other subspecies is well represented in ex situ collections, but further collecting to ensure it is sampled from throughout its range is required.

Reference to a published description: CPV 183; FE 174; FS 435; FTEA 639.

Vernacular names:
SOM: Bidawi, Dimbulgar.
Figure 5.59. Distribution of *V. membranacea* based on specimen and accession passport data.

Figure 5.60. FloraMap predicted distribution for *V. membranacea*. 
Habit and lifespan: Annual or perennial, climbing or trailing herb.
Flower colour: Mauve, pink-magenta or blue.
Habitat: Open, grassy places, thorn woodlands, open woodlands and dry bushlands.
Associated species: Acacia, Commiphora, Diospyros, Terminalia.
Altitude: 12–2800 m.
Distribution: EAF: KEN, TAN(!).
NEAF: ETH, SOM, SUD.
Phenology: Unknown.
Uses: None known.
Conservation Notes: This subspecies represented in ex situ collections solely by Kenya material and therefore further collecting to ensure it is sampled from throughout its range is required.

Reference to a published description: CPV 183; FS 435; FTEA 640.
Vernacular names:
KEN: Kikunde-mbala, Kikunde-wazimu, Mkunde-MLWtu.
Habit and lifespan: Annual or perennial, climbing or trailing herb.
Flower colour: Mauve, pink-magenta or blue.
Habitat: Coastal grassland, deciduous or semi-evergreen bushland and thicket.
Associated species: Unknown.
Altitude: 1–1200 m.
Distribution: EAF: KEN.
NEAF: SOM.
WAF: GHA.
Phenology: November–January and April–September.
Uses: None known.
Conservation Notes: This subspecies in comparison with the other subspecies is well represented in ex situ collections from throughout its range so further collection is not a priority.

Reference to a published description: CPV 182; FCBR 384; FTEA 640.
Vernacular names:
TAN: Kimbamba.
Habit and lifespan: Annual or perennial, climbing or trailing herb.
Flower colour: Mauve, pink-magenta or blue.
Habitat: Evergreen forest and derived scrub.
Associated species: Unknown.
Altitude: 450–2260 m.
Distribution:
CEAF: BUR, ZAI.
EAF: KEN, TAN(!), UGA(!).
Phenology:
Uses: None known.
Conservation Notes: *V. membranacea* subsp. *macrodon* is poorly sampled from throughout its range and further collecting from throughout its range is required.

Reference to a published description: CPV 183; FE 174; FTEA 641.
Vernacular names: None known.
Habit and lifespan: Prostrate or erect perennial herb, usually with an elongated tuber which may be fleshy or woody.
Flower colour: Pale creamy-yellow, green with or without mauve basal stripes or entirely mauve.
Habitat: Grassland, savannah, open woodland, deciduous thicket, roadside, weed of cultivation; clay over basaltic rocks.
Associated species: *Albizia*, *Combretum*, *Dadonea*, *Hyparrhenia*, *Juniperus*, *Stachys* and *Themeda*.
Altitude: 140–3900 m.
Distribution:
CEAF RWA ZAI.
EAF: KEN, TAN, UGA.
NEAF: ETH.
SAF: ZAF.
Phenology: Throughout year.
Uses: See var. *angustifolia*.
Taxon Vulnerability Assessment: 6.7
Conservation Notes: *V. friesiorum* is widely distributed in Central and East Africa, however, there is insufficient representation in *ex situ* collections of the species as a whole and of the three varieties. There is a need for further collections from throughout their range, but particularly from Ethiopia and the Democratic Republic of the Congo. The trend in numbers of herbarium specimens collected over time follows the general pattern for *Vigna* species, which suggests the species does not appear to be in danger of genetic erosion or extinction.
IUCN Red List Category: Least Concern.
Taxonomic notes: Three varieties, which can be distinguished on the basis of leaflet shape and habit, are recognized (Verdcourt, 1971).
1. Leaflets linear-lanceolate, up to 70 mm long; stems erect or procumbent..............................var. *angustifolia*
   Leaflets rounded to oblong .................................................................2
2. Leaflets round to oblong, up to 25 mm long; stems procumbent; pods minutely pubescent to yellowish pubescent......................var. *friesiorum*
   Leaflets round to elliptic-oblong, 10–40 mm long; stems mostly erect; pods minutely pubescent .................................................................var. *ulugurensis*
**Vigna friesiorum var. friesiorum**

Reference to a published description: CPV 183; FTEA 641.

Vernacular names: None known.

Habit and lifespan: Prostrate or erect perennial, usually with an elongated tuber which may be fleshy or woody.

Flower colour: Pink, purple or mauve.

Habitat: Open glades and thickets, cultivated fields, grasslands.

Associated species: Crotalaria, Stachys, Trifolium.

Altitude: 1210–2150 m.

Distribution: EAF: KEN, TAN(!).

Phenology: Unknown.

Uses: None known.

Conservation Notes: This variety is inadequately represented in ex situ collections and further collection from throughout its range is a priority.

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Reference to a published description: CPV 184; FTEA 641.

Vernacular names:

UGA: Maruet.

Habit and lifespan: Prostrate or erect perennial, usually with an elongated tuber which may be fleshy or woody.

Flower colour: Green, yellowish or purple to red.

Habitat: Grassland; dry thorn bushland; open, stony ground.

Associated species: Albizia, Combretum, Dadonea, Juniper, Pennisetum, Themeda.

Altitude: 190–2000 m (with two records occurring at less than 500 m).

Distribution: EAF: KEN, TAN, UGA.

Phenology: Unknown.

Uses: The plant has a swollen root which is eaten in UGA. A note on a specimen reads “like a stringy turnip”.

Conservation Notes: This variety is inadequately represented in ex situ collections and further collection from throughout its range is a priority.

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Reference to a published description: CPV 184; FCBR 375; FE 174; FTEA 642.

Vernacular names: None known.

Habit and lifespan: Prostrate or erect perennial, usually with an elongated tuber which may be fleshy or woody.

Flower colour: Green, yellowish or purple to red.

Habitat: Grasslands, savannahs, rocky ground in deciduous thicket.
Figure 5.61. *Vigna friesorum* Harms: 1., habit (×1); 2, root (×1); 3, details of leaf nervation, lower surface (×6); 4, stipule (×3); 5, inflorescence nectaries (×3); 6, flower, front and lateral view (×1); 7, inflorescence (×1.5); 8, standard (×2); 9, standard, details (×3); 10 and 11, keel, front and lateral view (×3); 12, diadelphous stamens, spread out (×3); 13, calyx, spread out (×3); 14, style (×3); 15, stigma (×12); 16, seed, lateral and front view (×2.5).
Figure 5.62. Distribution of *V. friesiorum* based on specimen and accession passport data.

Figure 5.63. FloraMap predicted distribution for *V. friesiorum*. 
**Associated species:** *Albizia*, *Combretum*, *Hyparrhenia*, *Diospyros*.

**Altitude:** 140–3900 m (with only three records from below 1000 m).

**Distribution:**
- CEAF RWA ZAI.
- EAF: KEN, TAN, UGA.
- NEAF: ETH(!).

**Phenology:** October–February (CEAF); variable (EAF).

**Uses:** None known.

**Conservation Notes:** This variety is the most widely distributed and yet it is not represented in *ex situ* collections; therefore further collection from throughout its range is a priority.

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**Reference to a published description:** FS 435.

**Vernacular names:** None known.

**Habit and lifespan:** Annual, trailing herb.

**Flower colour:** Unknown.

**Habitat:** Unknown.

**Associated species:** Unknown.

**Altitude:** 900–1000.

**Distribution:**
- NEAF: SOM.

**Phenology:** Unknown.

**Uses:** None known.

**Taxon Vulnerability Assessment:** = 7.0

**Conservation Notes:** *V. somaliensis* is a Somali endemic and probably, along with the other Somali endemics *V. monantha* and *V. virescens*, is the most highly threatened African *Vigna* taxon. There is only one herbarium specimens available and no *ex situ* collections. The species appears to be in terminal decline. Clarification of whether the species is still extant is required as no populations of the species where seen after 1900. There is a need for a critical review of this species and a search for extant populations should be given the highest priority.

**IUCN Red List Category:** Critically Endangered.

**Taxonomic Notes:** Thulin (1993) comments that no material matching the type has been seen, but the specimens collected by Drake-Brockman 1149 and 1150 (K) from the Golis Range represent a closely related species. They differ from *V. somaliensis* in being relatively short (c. 10 cm high) and erect with a c. 7 mm long calyx with spreading hairs and narrowly triangular lobes up to 4 mm long. The corolla of the plants from the Golis Range is only 1.2—1.3 cm long.


**Vigna reticulata** Hook.f. in Hook., Niger Fl.: 310 (1849).

**Reference to a published description:** CPV 184; FCBR 382; FE 176; FTEA 650;
Figure 5.64. Distribution of *V. somaliensis* based on herbarium specimen passport data.
Figure 5.65. *Vigna reticulata* Hook. F. Hook.: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×2.5); 4, inflorescence nectaries (×2.5); 5, flower, front and lateral view (×1); 6, standard (×2); 7, standard, details (×3); 8 and 9, keel, lateral and front view (×2.5); 10, wing (×2.5); 11, style (×3); 12, stigma (×12); 13, diadelphous stamens, spread out (×3); 14, calyx, spread out (×2.5); 15, seed, lateral and front view (×2.5).
Figure 5.66. Distribution of *V. reticulata* based on specimen and accession passport data.

Figure 5.67. FloraMap predicted distribution for *V. reticulata*. 
FWTA 568; FZ 133; LM 582.

**Vernacular names:**
CAF: Guadja, Ay jod/Kani.
KEN: Kunde-mbala, Kikunde-wazimu, Ih’ridi.
MDG: Kadaliky.
TAN: Nakalandala.
UGA: Agaba.
ZAI: Akwamu, Singa-nthou.

**Habit and lifespan:** Annual or more commonly perennial, trailing or climbing herb.

**Flower colour:** Pink, purple or deep mauve.

**Habitat:** Fallow fields, grasslands, forest edges, roadsides, savannah, forest edges and open wooded areas, miombo woodlands, boggy ground, fallow and as a weed of cultivation; basaltic or laterite with sand, sandy loam or clay loam soils.

**Associated species:** *Acacia, Brachystegia, Combretum, Daniellia, Digitaria, Eragrostis, Eucalyptus, Hyparrhenia, Imperata, Piliostigma* and *Uapaca.*

**Altitude:** 1–2800 m.

**Distribution:**
CEAF: BUR, CAF, CHA, CON, GAB, RWA, ZAI.
EAF: KEN, TAN, UGA.
NEAF: ETH (not collected since 1840s), SUD.
WAF: BKN, CMN, GHA, GNB, GUI, IVO, MLI, NGA, NGR, SEN, SIE, TOG.
WIO: MDG.
ZAMB: ANG, MLW, MOZ, ZAM, ZIM.

**Phenology:** All year round.
September–December and April–July (CEAF).
Mostly April–September (EAF).
August–December (WAF).
February–July (ZAMB).

**Uses:** Treatment of earache (ANG), occasionally used as food by the Panas tribe (CAF). The tubers are reported to be eaten in MLW and ZAI (Burkill, 1995; Padulosi and Ng, 1990). The leaf-sap and a decoction prepared from the roots are taken orally for diarrhoea in TAN. Marconi *et al.* (1997) report that this species is resistant to important pests of cowpea and thus represents another potential source of resistance genes.

**Taxon Vulnerability Assessment:** = 2.6

**Conservation Notes:** *V. reticulata* is widely distributed in Africa and the species is generally well represented in *ex situ* collections from throughout its range, with the possible exception of West Africa and the Democratic Republic of the Congo. Further collecting is required in Angola, Ghana, Guinea Bissau and Côte d’Ivoire, as well as the Democratic Republic of the Congo. The trend in numbers of herbarium specimens collected over time follows the general pattern for *Vigna* species, which suggests the species does not appear to be in danger of genetic erosion or extinction.

**IUCN Red List Category:** Least Concern.
Figure 5.68. *Vigna radicans* Welw. ex Baker in Oliv.: 1, habit (×1); 2, flower, front and lateral view (×1).
Figure 5.69. Distribution of *V. radicans* based on specimen and accession passport data.

Figure 5.70. FloraMap predicted distribution for *V. radicans*. 
Reference to a published description: CPV 186; FZ 134.
Vernacular names: None known.
Habit and lifespan: Perennial, trailing or prostrate herb.
Flower colour: Mauve to purple.
Habitat: Damp places, dambos, floodplains, grassland, roadsides and woodland; sandy soils.
Associated species: Brachystegia, Hymenocardia and Hypteregon.
Altitude: 1–1950 m.
Distribution:
CEAF: BUR(!), CAF, CON, GAB, ZAI.
EAF: KEN, TAN.
NEAF: ETH.
WAF: CMN, EQG, NGA.
ZAMB: ANG, MLW, ZAM, ZIM(!).
Phenology: March to May.
Uses: None known.
Taxon Vulnerability Assessment: = 2.5
Conservation Notes: V. radicans is widely distributed in Africa and the species is well represented in ex situ collections from throughout its range with the possible exception of Ethiopia, where further collecting is required. The trend in numbers of herbarium specimens collected over time follows the general pattern for Vigna species, which suggests the species does not appear to be in danger of genetic erosion or extinction.
IUCN Red List Category: Least Concern.

Reference to a published description: CPV 186; FCBR 379.
Vernacular names: None known.
Habit and lifespan: Robust, creeping herb.
Flower colour: Unknown.
Habitat: Dolomite rocky areas.
Associated species: Unknown.
Altitude: 450–1250 m.
Distribution:
CEAF: ZAI.
EAF: KEN(!).
ZAMB: ANG.
Phenology: January–May.
Uses: None known.
Taxon Vulnerability Assessment: = 5.4
Conservation Notes: V. dolomitica is restricted to adjacent regions of Angola and the Democratic Republic of the Congo (the Kenyan record seems doubtful) and is represented in ex situ collections by one accession from the Democratic
Figure 5.71. Distribution of *V. dolomitica* based on specimen and accession passport data.

Figure 5.72. FloraMap predicted distribution for *V. dolomitica*. 
Figure 5.73. *Vigna dolomitica* R.Wilczek: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×3); 4, flower, front and lateral view (×1); 5, standard, details (×3); 6 standard (×2); 7, keel, lateral view (×3); 8, wing (×3); 9, keel, front view (×3); 10, diadelphous stamens, spread out (×2); 11, style (×3); 12, stigma (×12); 13 calyx spread out (×3).
Figure 5.74. Distribution of *V. pygmaea* based on herbarium specimen passport data.

Figure 5.75. FloraMap predicted distribution for *V. pygmaea*.
Figure 5.76. *Vigna pygmaea* R.E.Fr.: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×2.5); 4, inflorescence (×2); 5, flower, front and lateral view (×1); 6, standard (×2.5); 7, standard, details (×3); 8 and 9, keel, lateral and front view (×3); 10, wing (×3); 11, diadelphous stamens, spread out (×3); 12, style (×3); 13, stigma (×12); 14, calyx, spread out (×2.5).
Republic of the Congo. However, there is doubt over the delimitation between *V. dolomitica* and *V. reticulata*, it would seem appropriate to delay proposing a conservation strategy until the taxonomy is clarified. However, an assessment of rare for Democratic Republic of the Congo using the 1994 criteria already stands in the IUCN Red Data Book (Walters and Gillett, 1998).

**IUCN Red List Category**: Data Deficient.

**Taxonomic notes**: *V. dolomitica* may be an ecotype of *V. reticulata* (Maréchal et al., 1978).


**Reference to a published description**: CPV 187; FCBR 374; FTEA 651; FZ 135.

**Vernacular names**: Katukwe (ZAI).

**Habit and lifespan**: Short, erect herb growing from a rootstock which consists of one to several woody fusiform or carrot-like tubers.

**Flower colour**: Pale to deep mauve or violet.

**Habitat**: Herbaceous savannahs, tree (miombo) savannahs, grassland and miombo woodlands, often associated with recent burning.

**Associated species**: *Brachystegia*, *Combretum*, *Hyparrhenia*, *Loudetia*, *Trichopteryx Uapaca*.

**Altitude**: 450–2500 m.

CEAF: BUR, ZAI.

EAF: TAN.

SAF: NAM.

WAF: CMN.

ZAM: ANG, BOT(!), MLW, MOZ, ZAM, ZIM.

**Phenology**: August to November.

**Uses**: None known.

**Taxon Vulnerability Assessment**: = 4.2

**Conservation Notes**: *V. pygmaea* is found widely in continental Africa but appears to be uncommon throughout. There are no *ex situ* collections from throughout its range, thus further systematic collection is required. The trend in numbers of herbarium specimens collected over time follows the pattern for all *Vigna* species, which suggests the species does not appear to be in danger of immediate extinction. However, the fact that the species is uncommon throughout its range suggests individual populations are relatively isolated and therefore vulnerable to genetic erosion.

**IUCN Red List Category**: Vulnerable.


**Reference to a published description**: CPV 187; FZ 136.

**Vernacular names**: None known.
Figure 5.77. *Vigna phoenix* Brummitt: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×2.5); 4, flower, front and lateral view (×1); 5, standard (×2.5); 6, wing (×3); 7, calyx, spread out (×3).
Figure 5.78. Distribution of *V. phoenix* based on herbarium specimen passport data.
Habit and lifespan: An erect, multistemmed pyrophyte with a woody rootstock.

Flower colour: Pink to purple.

Habitat: Fire-swept grasslands and woodlands often associated with rocky areas.

Associated species: Unknown.

Altitude: 600–1700 m (more common at higher altitude).

Distribution: 
EAF: TAN.
ZAMB: MLW, ZAM(!).

Phenology: August–November (ZAMB).

Uses: None known.

Taxon Vulnerability Assessment: = 5.6

Conservation Notes: *V. phoenix* is restricted to southern-central-east Africa, where it is locally rare. As there are no *ex situ* collections and only four herbarium specimens representing the species, there is a need for urgent germplasm collection in Tanzania, Malawi and Zambia. The trend in numbers of herbarium specimens collected over time cannot be assessed as there are too few collections. However, the fact that only five populations have been sampled suggests the species is seriously vulnerable to genetic erosion and extinction.

IUCN Red List Category: Endangered.

Taxonomic notes: This species may represent a large-flowered variant of *V. pygmaea*. Intermediates are known to occur between the two species.


Reference to a published description: Refer to protologue.

Vernacular names: None known.

Habit and lifespan: Perennial herb with several annual erect stems arising from woody rootstock.

Flower colour: Pink to purple.

Habitat: Moist areas near lakes, grassland, seasonal rivers and dambos, often associated with recent burning; sandy or clay loam.

Associated species: Unknown.

Altitude: approx. 1400 m (descending to 60 m in Angola; Pasquet, 2001).

Distribution: 
ZAMB: ANG, ZAM(!).

Phenology: 1000–2000 m.

Uses: None known.

Taxon Vulnerability Assessment: = 5.9

Conservation Notes: *V. procera* is restricted to southern-central-west Africa, where it is uncommon. As there are no *ex situ* collections for the species there is a need for urgent germplasm collection in Angola and western Zambia. The trend in numbers of herbarium specimens collected over time does not follow the general pattern for *Vigna* species: there was a peak before 1900, then four
Figure 5.79. Distribution of *V. procera* based on herbarium specimen passport data.

Figure 5.80. FloraMap predicted distribution for *V. procera*.
Figure 5.81. Distribution of *V. platyloba* based on specimen and accession passport data.

Figure 5.82. FloraMap predicted distribution for *V. platyloba*. 
Figure 5.83. *Vigna platyloba* Welw. ex Hiern: 1, habit (×1); 2, stipule (×2.5); 3, details of leaf nervation, lower surface (×6); 4, inflorescence nectaries (×3); 5, flower, front and lateral view (×1); 6, standard (×1); 7, standard, details (×3); 8 and 9, keel, front and lateral view (×2.5); 10, calyx, spread out (×2.5); 11, diadelphous stamens, spread out (×2.5); 12, stigma (×12); 13, seed, lateral and front view (×2.5).
specimens were collected by a single collector in 1955, and nothing since. The pattern of collections indicates we should be concerned over the vulnerability of this species to genetic erosion and extinction.  
**IUCN Red List Category**: Endangered.

**Reference to a published description**: CPV 188; FTEA 649; FZ 134.  
**Vernacular names**: None known.  
**Habit and lifespan**: Climbing or trailing, perennial herb.  
**Flower colour**: Bluish purple outside and pale violet or magenta inside.  
**Habitat**: Riparian, thickets, dambo edges, bushland and miombo woodlands, weed, often associated with dry habitats; sandy loam.  
**Associated species**: *Brachystegia, Isoberlinia, Julbernardia* and *Uapaca*.  
**Altitude**: 1–1750 m.  
**Distribution**:  
CEAF: ZAI(!).  
EAF: TAN.  
ZAMB: ANG, MLW, MOZ, ZAM.  
**Phenology**: Flowers mostly between April and June in Zambesiaca region, where the majority of records originate.  
**Uses**: None known.  
**Taxon Vulnerability Assessment**: = 3.6  
**Conservation Notes**: *V. platyloba* is widely distributed in Central-southern Africa. The species is represented in *ex situ* collections by six accessions from part of its range. Further collecting is required in Zambia, Tanzania and the Democratic Republic of the Congo. The trend in numbers of herbarium specimens collected over time follows the general pattern for *Vigna* species, which suggests overall the species does not appear to be in danger of genetic erosion or extinction.  
**IUCN Red List Category**: Least Concern.

**Reference to a published description**: FZ 147.  
**Vernacular names**: None known.  
**Habit and lifespan**: Perennial, herb with woody rootstock.  
**Flower colour**: Unknown.  
**Habitat**: Seasonally burnt grassland, dry miombo woodland and riverside; and sandy loam and clay.  
**Associated species**: *Brachystegia, Combretum, Entada, Parinari* and *Terminalia*.  
**Altitude**: 450–2000 m.  
**Distribution**:  
CEAF: BUR, ZAI.
Figure 5.84. Distribution of *V. antunesii* based on specimen and accession passport data.

Figure 5.85. FloraMap predicted distribution for *V. antunesii*.
**Vigna antunesii**

Reference: [PCP 188; FE 174; FTEA 647; FZ 136]

**Vernacular names**: None known.

**Habit and lifespan**: Erect or rarely climbing or prostrate perennial herb.

**Flower colour**: Mauve-lilac or greyish white.

**Habitat**: Grassland, bushland, woodland or in cultivation, recently burnt areas; sandy loam over granite, quartzite and gneiss.

**Associated species**: *Acacia*, *Albizia*, *Brachystegia*, *Combretum*, *Erythrina*, *Hyparrhenia*, *Loudetia*, *Pterocarpus*, *Rhynchosia*, *Stachys*, *Terminalia*, and *Themeda*.

**Altitude**: 1–3900 m.

**Distriution**:
- CEAF: BUR, CAF, RWA, ZAI.
- EAF: KEN, TAN, UGA.
- NEAF: DJI, ERI, ETH, SUD.
- SAF: NAM, SWZ, ZAF.
- WAF: CMN, NGA.
- ZAMB: ANG, BOT, MLW, MOZ, ZAM, ZIM.

**Phenology**: Not known.

**Uses**: None known.

**Taxon Vulnerability Assessment**: = 4.1

**Conservation Notes**: *V. antunesii* is found widely in southern-central Africa, however, there are no *ex situ* collections; thus, further systematic collection is required throughout its range. The trend in collection over time follows the general pattern for all *Vigna* species, which suggests the species does not appear to be in danger of immediate extinction or genetic erosion.

**IUCN Red List Category**: Least Concern.

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**Reference to a published description**: CPV 188; FE 174; FTEA 647; FZ 136.

**Vernacular names**: None known.

**Habit and lifespan**: Erect or rarely climbing or prostrate perennial herb.

**Flower colour**: Mauve-lilac or greyish white.

**Habitat**: Grassland, bushland, woodland or in cultivation, recently burnt areas; sandy loam over granite, quartzite and gneiss.

**Associated species**: *Acacia*, *Albizia*, *Brachystegia*, *Combretum*, *Erythrina*, *Hyparrhenia*, *Loudetia*, *Pterocarpus*, *Rhynchosia*, *Stachys*, *Terminalia*, and *Themeda*.

**Altitude**: 1–3900 m.

**Distribution**:
- CEAF: BUR, CAF, RWA, ZAI.
- EAF: KEN, TAN, UGA.
- NEAF: DJI, ERI, ETH, SUD.
- SAF: NAM, SWZ, ZAF.
- WAF: CMN, NGA.
- ZAMB: ANG, BOT, MLW, MOZ, ZAM, ZIM.

**Phenology**: Not known.

**Uses**: None known.

**Taxon Vulnerability Assessment**: = 4.3

**Conservation Notes**: *V. frutescens* is widely distributed in continental Africa, however it is inadequately represented in current *ex situ* collections, which do not represent the full geographic range. As *V. frutescens* is used for human and animal feed, and in rope making, it is somewhat surprising it is so poorly sampled for *ex situ* conservation. There is need for further systematic collection of the three subspecies and two varieties, particularly from Northeast Africa. The trend in numbers of herbarium specimens collected over time follows the general pattern for all *Vigna* species, which suggests overall the species does not appear to be in danger of extinction or genetic erosion. However, this assessment does not hold true for subsp. *kotschyi*, see below.

**IUCN Red List Category**: Least Concern.
Figure 5.86. *Vigna frutescens* A.Rich.: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×3); 4, flower, front and lateral view (×1); 5, standard (×2); 6, standard, details (×3); 7 and 8, keel, front and lateral view (×2.5); 9, wing (×2.5); 10, diadelphous stamens, spread out (×3); 11, style (×3); 12, stigma (×12); 13, calyx, spread out (×3); 14, seed, lateral and front view (×2.5).
Figure 5.87. Distribution of *V. frutescens* based on specimen and accession passport data.

Figure 5.88. FloraMap predicted distribution for *V. frutescens*. 
**Taxonomic notes:** Lower genetic distances are reported between *V. frutescens*, *V. friesiorum* and *V. membranacea* var. *caesia* than have been found among taxa of *V. vexillata* using isozyme markers. This has prompted Pasquet and Vanderborght (2000) to suggest merging of these three taxa into a single species. Thulin (1989) notes that *V. debanensis* is very close to *V. frutescens* and might better be regarded as a subspecies. Verdcourt (1970) included *V. spartioides* and *Liebrechtsia schweinfurthii* as synonyms of *V. frutescens* var. *buchneri* (Harms) Verde., a taxon otherwise not known north of Tanzania, while keeping *V. debanensis* separate. However, Pienaar (1992) sank *V. decipiens* Harv. into *V. frutescens* and Pasquet (2001) sank *V. debanensis* into *V. frutescens* and this nomenclature is followed here.

Key to infraspecific variants (Verdcourt, 1970):

1. Calyx lobes much longer than the tube, 5–10 mm long...........subsp. *incana*
   Calyx lobes ± equalling the tube, 3–5.5 mm long.........................................2
2. Standard glabrous outside ...........................................subsp. *frutescens* 3
   Standard velvety pubescent outside..................................................subsp. *kotschyi*
3. Stem, calyx and most of plant pubescent or velvety..............var. *frutescens*
   Stem, calyx and most of plant glabrous ......................................var. *buchneri*

**Vigna frutescens** subsp. *frutescens* var. *frutescens*

**Reference to a published description:** CPV 189; FE 174; FTEA 648; FZ 136.

**Vernacular names:**
ZAI: Umucasuka, Poko, Kimpunu, lyichuya, Ikichuku, Bazubuvu.
KEN: Othoe, Murdjei.
UGA: Niahenge, Boayan.

**Habit and lifespan:** Erect or rarely climbing perennial herb.

**Flower colour:** Mauve-lilac or greyish white.

**Habitat:** Recently burnt grasslands, bushlands, dry savannahs, herbaceous savannahs, open woodlands, roadsides, rocky hillsides, mountain slopes, waste ground. Heavy grazing by domestic animals is noted on some records.

**Associated species:** Acacia, Bauhinia, Brachystegia, Combretum, Erythrina, Hyparrhenia, Protea, Rhynchosia, Terminalia.

**Altitude:** 1–3900 m.

**Distribution:** This is by far the most common and widely distributed member of this species.

CEAF: BUR, CAF, RWA, ZAI.
EAF: KEN, TAN, UGA.
NEAF: DJI, ETH, SUD.
SAF: NAM, SWZ, ZAF.
WAF: CMN, NGA.
ZAMB: ANG, BOT, MLW, MOZ, ZAM, ZIM.

**Phenology:** Variable.

**Uses:** None known.
**Conservation Notes:** This variety in comparison with the other subspecific taxa is well represented in *ex situ* collections from throughout its range; therefore further collection is not a priority.


**Reference to a published description:** CPV 189; FCBR 373; FTEA 648; FZ 138.

**Vernacular names:**
- ZAI: Kankunda.

**Habit and lifespan:** Erect or rarely climbing perennial herbs.

**Flower colour:** Blue or mauve, rarely purple, violet or yellow.

**Habitat:** Recent burning is the most commonly noted abiotic factor at collecting sites.

**Associated species:** *Andropogon, Brachystegia, Isoberlinia, Heliotropium, Indigofera, Loudetia*.

**Altitude:** 450–2400 m.

**Distribution:**
- CEAF: BUR, CAF, RWA, ZAI.
- EAF: TAN.
- NEAF: ERI.
- ZAMB: ANG, BOT(!), MLW, ZAM, ZIM.

**Phenology:** None known.

**Uses:** None known.

**Conservation Notes:** This variety in comparison with the other subspecific taxa is well represented in *ex situ* collections from throughout its range; therefore further collection is not a priority.


**Reference to a published description:** CPV 190; FTEA 649.

**Vernacular names:**
- KEN: Olmongwoiya, Osugumerialongop, Mangweaget, Mangunganget, Ol’kalei/Olmangwea.

**Habit and lifespan:** Erect or rarely climbing perennial herb.

**Flower colour:** Mauve-lilac or greyish white.

**Habitat:** Forest and thicket edges, grasslands and open bushlands.

**Associated species:** *Acacia, Combretum, Commiphora, Dichrostachys, Themeda, Sporobolus*.

**Altitude:** 1300–1800 m.

**Distribution:**
- EAF: KEN, TAN.
- WAF: CMN.

**Phenology:** Unknown.

**Uses:** Grazed by domestic animals and used to make ropes in Kenya.
**Conservation Notes**: This variety in comparison with the other subspecific taxa is well represented in *ex situ* collections from throughout its range; therefore further collection is not a priority.

Reference to a published description: CPV 190; FE 174.

**Vernacular names**: None known.

**Habit and lifespan**: Erect or rarely climbing perennial herb.

**Flower colour**: Mauve-lilac or greyish white.

**Habitat**: Tree savannahs, woodland and grasslands.

**Associated species**: Combretum, Loudetia, Pterocarpus, Terminalia.

**Altitude**: 1000–2300 m.

**Distribution**: CEAF: CAF.

**Phenology**: Unknown.

**Uses**: The seeds are eaten in Uganda. In Kenya the haulms are used to make ropes used in construction and tethering goats.

**Conservation Notes**: This variety in comparison with the other subspecific taxa is more geographically restricted, less well known and not represented in *ex situ* collections; therefore further collection is a priority. The lack of material and restricted distribution indicate that this subspecies deserves a higher conservation priority; an IUCN Red List Category of Vulnerable is appropriate.

Reference to a published description: LM 574, illust. 577.

**Vernacular names**: None known.

**Habit and lifespan**: Annual or perhaps perennial climbing herb.

**Flower colour**: White and violet.

**Habitat**: Deciduous woodland at lower altitudes; sandy soil over limestone.

**Associated species**: Unknown.

**Altitude**: 80–650 m.

**Distribution**: WIO: MDG (west of island, only known from Sakaraha, Bermaraha and Namoroka).

**Phenology**: February to March.

**Uses**: None known.

**Taxon Vulnerability Assessment**: = 7.0

**Conservation Notes**: *V. bosseri* is a rare Madagascan endemic that is not represented in *ex situ* collections; thus, further collection is a priority. The trend in numbers of herbarium specimens collected over time cannot be assessed as there are so few populations that have been sampled, which suggests the species could be vulnerable to genetic erosion and extinction.
Figure 5.89. Distribution of *V. bosseri* based on herbarium specimen passport data.
IUCN Red List Category: Vulnerable.

**Taxonomic notes:** This species can be distinguished by its distinctive 3-lobed leaflets, basifixed stipules, flowers white tinged violet and 12–15 mm long, and keel with a long and incurved beak but lacking a lateral pocket.


**Reference to a published description:** CPV 191; FCBR 387, illust. 389; FE 174; FS 436; FTEA 642; FZ 138; LM 584.

**Vernacular names:** None known.

**Habit and lifespan:** Annual or perennial, erect, trailing or climbing herb.

**Flower colour:** White, greenish, yellow or lilac-purple.

**Habitat:** Both cultivated and wild forms are found in diverse habitats, soils and rock types.

**Associated species:** Numerous but primarily *Acacia*, *Brachystegia*, *Combretum*, *Eragrostis*, *Hyparrhenia*, *Terminalia* and *Urochloa*.

**Altitude:** 1–3650.

**Distribution:** Widespread throughout Africa.

**Phenology:** Various.

**Uses:** Widely cultivated for its edible seeds and leaves which are eaten as a green vegetable.

**Taxon Vulnerability Assessment:** = 2.6

**Conservation Notes:** *V. unguiculata* is the most widely distributed *Vigna* species in Africa and there are very significant *ex situ* collections from throughout Africa. As *V. unguiculata* is such an important source of human and animal feed it is not surprising that so much effort has been devoted to ensuring the genepool is systematically conserved. In terms of genepool conservation, with 600 conserved accessions there is little need for further collection of the cultivated material; although with a focus on infra-taxonomic diversity there may be a need for further landrace sampling of material not already held *ex situ*. The trend in numbers of herbarium specimens collected over time follows the general pattern for all *Vigna* species, which suggests overall the species does not appear to be in danger of extinction or genetic erosion; however, this assessment does not hold true for all subspecies, for subsp. *aduensis*, *baoulensis* and *berundiensis* see below.

IUCN Red List Category: Least Concern.

**Taxonomic notes:** The plant is warm-season adapted, annual and an herbaceous legume. Plant types are often categorized as erect, semi-erect, prostrate (trailing) or climbing. Growth habits range from indeterminate to fairly determinate with the nonvining types tending to be more determinate. Cowpea seed ranges in size from the very small wild types up to nearly 14 inches long and the number of seeds per pound ranges from 1600 to 4300 seeds. Seed shape is a major characteristic correlated with seed development in the pod. Seeds develop a kidney shape if not restricted within the pod. When seed
growth is restricted by the pod the seed becomes progressively more globular. The seed coat can be either smooth or wrinkled and of various colours including white, cream, green, buff, red, brown and black. Seed may also be speckled, mottled or blotchy. Many are also referred to as “eyed” (blackeye, pinkeye, purple hull, etc.) where the white coloured hilum is surrounded by another colour (Coulibaly et al., 2002).

Maréchal et al. (1978) and Pasquet (1998, 2001) recognize four cultivar-groups within this species. These are

(i) *Biflora*: common name Catjang bean, used mainly for forage; flower and seed most often coloured; ovules fewer than 17 per ovary, pod not fleshy, less than 30 cm long, seeds not spaced within the pod, testa thick and shiny, and plant able to flower quickly from the first nodes under short-day conditions.

(ii) *Sesquipedalis*: common name yard-long bean or asparagus bean, grown for its fresh green pods which can grow up to 1 m long and are used as a vegetable, mainly in Asia; ovules more than 17 per ovary; pod fleshy, wrinkled when ripe, more than 30 cm long; seeds reniform, spaced within the pod.

(iii) *Melanophthalmus*: grown for the tough fibres obtained from its peduncles in parts of NGA; flower and seed partly white; ovules fewer than 17 per ovary, pod not fleshy, less than 30 cm long, seeds not spaced within the pod, testa thin and often wrinkled, plant able to flower quickly from the first nodes under short-day conditions.

(iv) *Unguiculata*: common name cowpea/black-eye bean; flower and seed often coloured, ovules more than 16 per ovary, pod not fleshy, <30 cm long, seeds not spaced within the pod, testa thick and shiny, plant flowering late, even under short-day conditions.

This account will only be restricted to the wild forms of this species. A full treatment of the cultivated forms is given by Pasquet (1998). Revisions have been proposed by various authors including Pienaar and van Wyk (1992), Pienaar (1992), Mithen and Kibblewhite (1993), Padulosi (1993), Pasquet (1993a,b,c, 1994) as previously discussed. The following key is derived from Pasquet (1993a, 2001):

1. Cultivated plant; pod >100×5 mm ...... subsp. *unguiculata* var. *unguiculata* 2
   Plant wild or weedy; pod <100×5 mm .............................................3
2. Flower and seed most often coloured; <17 ovules per ovary; pods not fleshy, unwrinkled, <30 cm, seeds not spaced within the pod; seed testa thick and shiny .................................................................cv *Biflora*
   Flower and seed often coloured; >17 ovules per ovary; pods fleshy, wrinkled when ripe, up to 1 m, seeds spaced within the pod; seeds reniform ...........
   ..........................................................................................................cv *Sesquipedalis*
   Flower and seed partly white; <17 ovules per ovary, pod not fleshy, unwrinkled, <30 cm, seeds not spaced within the pod; seed testa thin and often wrinkled ........................................cv *Melanophthalmus*
Flower and seed often coloured; >17 ovules per ovary, pod not fleshy, <30 cm, seeds not spaced within the pod, testa thick and shiny
................................. cv Unguiculata

3. Keel with a marked beak, 6–8 mm. .................................................. 4
Keel without a beak or with a short beak <3 mm. .............................. 5

4. Leaflet thick, obtuse at apex, inflorescence 2–5-noded, internode 2–4 mm, flowers 24–33 mm ................................................... subsp. dekindtiana
Leaflet small, acute at apex, inflorescence multinoded, short internode, flowers (16-)18–23(-25) mm ........................................ subsp. alba

5. Keel twisted towards the left, without a beak. .............................. 6
Keel twisted towards the right, with a short beak up to 3 mm long. .... 9

6. Calyx teeth 0.5–6 mm ................................................................. 7
Calyx teeth 5–15 mm. ............................................................... 8

7. Calyx teeth 2.0–6.0 mm; flower 16–21 mm; ovary 10–14-ovuled. ....
................................................................. subsp. stenophylla
Calyx teeth 0.5–2.0 mm; flower (21-)26–38 mm; ovary ± 17-ovuled. ...
................................................................. subsp. baoulensis

8. Stipules 12–27 mm; rachis 5–25 mm, 3–10-noded; ovary 18–20 ovules...
................................................................. subsp. aduensis
Stipules 6–20 mm; rachis 5 mm, 3–4-noded; ovary 15–18 ovules........
................................................................. subsp. pawekiae

9. Plant pubescent; rachis internodes long. .................................. subsp. pubescens
Plant scabrous or glabrous; rachis internodes short ........................ 10

10. Inflorescence rachis 1–2-noded; plant with a rootstock; leaflets rhombic...
................................................................. subsp. tenuis
Inflorescence rachis multinoded; plant without a rootstock; leaflets variable
................................................................. 11

11. Annual; petiole 20–40 mm; flower 15–23 mm ............................ subsp. unguiculata var. spontanea
Perennial; petiole 50–60 mm; flower 25–31 mm .............................. 12

12. Peduncle 4–15-noded, calyx teeth 5–9 mm ................................. subsp. le touzeyi
Peduncle 4–8-noded, calyx teeth 8–14 mm ................................. subsp. burundiensis

Pasquet (2001) notes that although the different perennial subspecies are morphologically, geographically and ecologically distinct they are interfertile and numerous intermediate specimens are found.

**Vigna unguiculata subsp. unguiculata var. unguiculata**

**Reference to a published description:** CPV 191; FE 174; FTEA 643; FZ 139; LM 584, illus. 575.

**Vernacular names:** For the four most important cultigens there are numerous vernacular names but these include for cv. gr. unguiculata (L.) Westphal (cowpea, African bean, black-eye bean, black-eye pea, southern pea, China pea, kaffir pea,
**Figure 5.90.** Distribution of *V. unguiculata* based on specimen and accession passport data.

**Figure 5.91.** FloraMap predicted distribution for *V. unguiculata*.
marble pea [English], kafferboontjie [Afrikaans], haricot dolique and dolique de Chine [French] and many more local names), cv. gr. *biflora* (L.) Westphal (catjang, catjang cowpea and many local names), cv. gr. *sesquipedalis* (L.) Westphal (yard-long bean, asparagus bean, snake bean [English], dolique asperge [French]). In Somalia it is known as Salbuko, salbuko-deghell as well as catjang. It is also known in Madagascar as Antaka, Avokondrana, Lozy, Mahalaindolo, Voahimba, Voanemba and Voatsirokonangatra.

**Habit and lifespan:** Annual or perennial, climbing or trailing herb.

**Flower colour:** White to purple.

**Habitat:** Cultivated.

**Altitude:** Depending on cultivation.

**Distribution:** Cowpea is widely cultivated throughout the tropical and semi-tropical regions of Africa, America and Asia (Ehlers and Hall, 1997, for details, connect to www.apps.fao.org/notes).

**Phenology:** Throughout the year.

**Uses:** Cultivated for edible beans cowpea. The cultivated forms are:


** Conservation notes:** This variety in comparison with the other subspecific taxa is well represented in *ex situ* collections from throughout its range; therefore further collection is not a priority.

**Taxonomic notes:** Pasquet (2001) notes that Mithen 55 is intermediate with subsp. *tenuis*.

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**Reference to a published description:** FZ 140.

**Vernacular names:** None known.

**Habit and lifespan:** Annual or rarely perennial.

**Flower colour:** White, greenish, yellow or lilac-purple.

**Habitat:** Savannah, especially disturbed areas, often as a weed.

**Associated species:** Unknown.

**Altitude:** 0–1850 m.

**Distribution:**

CEAF: BUR, CHA(!), CON, ZAI.

EAF: KEN, TAN.

NEAF: ERI, SUD.

SAF: NAM, ZAF.
Figure 5.92. Distribution of *V. unguiculata* subsp. *unguiculata* based on specimen and accession passport data.

Figure 5.93. FloraMap predicted distribution for *V. unguiculata* subsp. *unguiculata*. 
Figure 5.94. Distribution of *V. unguiculata* subsp. *unguiculata var. spontanea* based on specimen and accession passport data.

Figure 5.95. FloraMap predicted distribution for *V. unguiculata* subsp. *unguiculata var. spontanea*. 
Figure 5.96. Distribution of *V. unguiculata* subsp. *aduensis*, subsp. *baoulensis*, subsp. *burundiensis* and subsp. *letouzeyi* based on specimen and accession passport data.
WAF: CMN, NGA, NGR, SEN.
ZAMB: ANG, BOT, MLW, MOZ, ZAM, ZIM.

**Phenology:** Depends on floristic region.

**Uses:** None known.

**Conservation Notes:** This variety in comparison with the other subspecific taxa is well represented in *ex situ* collections from throughout its range; therefore further collection is not a priority.


**Reference to a published description:** Refer to protologue.

**Vernacular names:** None known.

**Habit and lifespan:** Perennial.

**Flower colour:** Purple.

**Habitat:** Disturbed areas.

**Associated species:** Unknown.

**Altitude:** 80–1250 m.

**Distribution:**
- WAF: CMN, GHA, IVO, LBR, NGA, SIE(!), TOG.
- ZAMB: ZAM.

**Phenology:** Unknown.

**Uses:** None known.

**Conservation Notes:** *V. unguiculata* subsp. *baoulensis* is restricted to West Africa (with one Zambian collection), it is relatively well represented in *ex situ* collections; however, further collection is required but it is not such a high priority as for subsp. *aduensis* and *burundiensis*.


**Reference to a published description:** Refer to protologue.

**Vernacular names:** None known.

**Habit and lifespan:** Perennial.

**Flower colour:** Purple.

**Habitat:** Disturbed areas.

**Associated species:** Unknown.

**Altitude:** 320–800 m.

**Distribution:**
- CEAF: CAF, GAB(!), ZAI.
- WAF: CMN.

**Phenology:** Unknown.

**Uses:** None known.

**Conservation Notes:** This subspecies in comparison with the other subspecific taxa is well represented in *ex situ* collections from throughout its range; therefore further collection is not a priority.
Figure 5.97. Distribution of *V. unguiculata* subsp. *pubescens* based on specimen and accession passport data.

Figure 5.98. FloraMap predicted distribution for *V. unguiculata* subsp. *pubescens*. 
Figure 5.99. *Vigna unguiculata* subsp. *pubescens* (R. Wilczek) Padulosi.

**Reference to a published description:** Refer to protologue.

**Vernacular names:** None known.

**Habit and lifespan:** Perennial.

**Flower colour:** Purple.

**Habitat:** Disturbed areas.

**Associated species:** Unknown.

**Altitude:** 1800–1900 m.

**Distribution:**
- CEAf: BUR, RWA(!), ZAI(!).
- EAF: KEN(!), UGA(!).

**Phenology:** Unknown.

**Uses:** None known.

**Conservation Notes:** *V. unguiculata* subsp. *burundiensis* is recently described thus less well known, in comparison with the other subspecific taxa it is geographically restricted and represented by a single *ex situ* collection; therefore further collection is a priority from throughout the range given by Pasquet (1993b). The lack of material and restricted distribution indicate that this subspecies deserves a higher conservation priority; an IUCN Red List Category of Vulnerable is appropriate.


**Reference to a published description:** FCBR 386; FTEA 646; FZ 141.

**Vernacular names:**
- SUD: Najok.
- MOZ: Niembaoda.
- TAN: Lukundembala, Kundimbala.

**Habit and lifespan:** Perennial, climbing herb.

**Flower colour:** White, greenish, yellow or lilac-purple.

**Habitat:** Grasslands, coastal thickets, rocky outcrops, roadsides, savannahs and fallow fields, usually near water.

**Associated species:** Unknown.

**Altitude:** 0–1550 m.

**Distribution:**
- CEAf: BUR, ZAI.
- EAF: KEN, TAN, UGA.
- NEAF: SUD.
- SAF: NAM, ZAF.
- WAF: GHA, NGA.
- ZAMB: MLW, MOZ, ZIM.

**Phenology:** October to December.

**Uses:** None known.
Figure 5.100. Distribution of *V. unguiculata* subsp. *dekindtiana* based on specimen and accession passport data.

Figure 5.101. FloraMap predicted distribution for *V. unguiculata* subsp. *dekindtiana*. 
Figure 5.102. *Vigna unguiculata* subsp. *dekindtiana* (Harms) Verdc.
Figure 5.103. Distribution of *V. unguiculata* subsp. *tenuis* based on specimen and accession passport data.

Figure 5.104. FloraMap predicted distribution for *V. unguiculata* subsp. *tenuis*.
Figure 5.105. *Vigna unguiculata* subsp. *tenuis* (E. Mey) Maréchal, Mascherpa and Stainier.
Conservation Notes: This subspecies in comparison with the other subspecific taxa is well represented in ex situ collections from throughout its range; therefore further collection is not a priority.

Reference to a published description: FE 174; FS 436; FTEA 644, illust. 645; FZ 141, illust. 142.

Vernacular names:
ANG: Kakundi-Kombambi.
CMN: Mebbiladdi.
ZAI: Kasema Pori, Yarkame, Abakpanvua, Manyasa na Nzamba.
GHA: Benet, Kusasi, Goya Kusasi.
KEN: Chani, Chesuwaucha, MkundeMLWta, Mkundembala.
MOZ: Nchanchin nhyemba.
NAM: Gani.
NGA: Akadi; Akedi aja, Akedi nkulunku, Gayan gayan, Kgabamaje, Wake and Wakengizo.
TAN: Enandala, Kibenda benda, Shilishashiliwa.
UGA: Amaret, Kindiru, Omugambe, Karimojoj bean.

**Habit and lifespan:** Wild or cultivated, prostrate or climbing.
**Flower colour:** White, greenish, yellow or lilac-purple.
**Habitat:** Roadsides, open woodlands, grasslands (especially if burnt seasonally), various savannahs, swamps, cultivated fields, riversides, riverine forests, littoral zones, etc.
**Associated species:** _Acacia, Adansonia, Brachystegia, Combretum, Digitaria, Eragrostis, Euphorbia, Imperata, Terminalia, Sporobolus_, etc.
**Altitude:** 1–2800 m.

**Distribution:**
CEAF: BUR(!), CAF, CHA, CON, GAB(!), GGI, ZAI.
EAF: KEN, TAN, UGA.
NEAF: ERI, ETH, SEN, SIE, SOM(!), SUD.
SAF: NAM, SWZ, ZAF.
WAF: BEN, BKN, CMN, GAM, GHA, GNB, GUI, IVO, MLW, NGA, NGR, SEN, SIE.
ZAMB: ANG, BOT, MLW, MOZ, ZAM, ZIM.

**Phenology:** Depends on floristic region.

**Uses:** The roots are roasted and eaten by the Kung of Namibia and used to dye leather in Nigeria (Dalziel, 1937). In Ghana the leaves are eaten in stews and the seeds are used to make Goya Kusasi. The leaves are also eaten as a vegetable in Tanzania and Kenya, more so in times of famine. The seeds are collected and used as food in Uganda.

**Taxonomic Notes:** Pasquet (2001) notes that lowland specimens from eastern Angola and Zambia, although pyrophytic, show more nodes per inflorescence, smaller flowers, with a shorter keel beak and higher ovule number than are typical,
Figure 5.106. *Vigna unguiculata* subsp. *stenophylla* (Harvey) Maréchal, Mascherpa and Stainier.
Figure 5.107. Distribution of *V. unguiculata* subsp. *stenophylla* based on specimen and accession passport data.

Figure 5.108. FloraMap predicted distribution for *V. unguiculata* subsp. *stenophylla*. 
Figure 5.109. Distribution of *V. unguiculata* subsp. *alba* based on specimen and accession passport data.

Figure 5.110. FloraMap predicted distribution for *V. unguiculata* subsp. *alba*. 
which may indicate that they are intermediates between subsp. *dekindtiana* and subsp. *unguiculata* var. *spontanea*.

**Conservation Notes:** This subspecies, in comparison with the other subspecific taxa, is well represented in ex situ collections from throughout its range; therefore further collection is not a priority.


**Reference to a published description:** CPV 195; FZ 143.

**Vernacular names:** None known.

**Habit and lifespan:** Perennial with rootstock.

**Flower colour:** Pink to purple.

**Habitat:** Miombo woodland, grassland, and sandy places near coast.

**Associated species:** Unknown.

**Altitude:** 1–1550 m.

**Distribution:**
- EAF: KEN.
- SAF: ZAF.
- ZAMB: MLW, MOZ, ZAM, ZIM.

**Phenology:** Year-round.

**Uses:** None known.

**Taxonomic Notes:** Pasquet (2001) notes that Mozambique specimens, especially coastal specimens, are quite different and could be intermediates with subsp. *unguiculata*. The inflorescence is often up to 3-noded, flowers are larger and ovule numbers are markedly higher, (13–)14–17-ovuled as compared with 12–15(–16)-ovuled in other Flora Zambesiaca countries.

**Conservation Notes:** This subspecies, in comparison with other subspecific taxa, is well represented in ex situ collections from throughout its range; therefore further collection is not a priority.


**Reference to a published description:** CPV 196; FZ 144.

**Vernacular names:** None known.

**Habit and lifespan:** Perennial with rootstock.

**Flower colour:** Pink to purple.

**Habitat:** Kalahari sands in FZ region.

**Associated species:** *Terminalia sericea*.

**Altitude:** 1–2350 m.

**Distribution:**
- CEAF: BUR.
- SAF: NAM, SWZ, ZAF.
- ZAMB: BOT, MOZ, ZAM, ZIM(!).
Figure 5.111. Distribution of *V. unguiculata* subsp. *pawekiae* based on specimen and accession passport data.

Figure 5.112. FloraMap predicted distribution for *V. unguiculata* subsp. *pawekiae*. 
Figure 5.114. Calyces of *Vigna unguiculata* taxa: 1, subsp. *pawekiae* (×1.5); 2, subsp. *stenophylla* (×1.5); 3, subsp. *protracta* (×1.5); 4, subsp. *tenuis* (×1.5); 5, subsp. *pubescens* (×1.5); 6, subsp. *alba* (×1.5).

Figure 5.113. Stipules of wild *Vigna unguiculata* taxa: 1, subsp. *dekindtiana* (×4); 2, subsp. *pubescens* (×3); 3, subsp. *stenophylla* (×4); 4, subsp. *alba*; 5, subsp. *protracta* (×3); 6, var. *tenuis* (×3);
Figure 5.115. Inflorescence rachis of wild *Vigna unguiculata* taxa: 1, subsp. *stenophylla* (×6); 2, subsp. *pawekiae* (×3); 3, subsp. *dekindtiana* (×6); 4, subsp. *pubescens* (×6).

Figure 5.116. Stigmas of wild *Vigna unguiculata* taxa (all ×16): 1, subsp. *protracta*; 2, subsp. *pubescens*; 3, subsp. *dekindtiana*; 4, subsp. *tenuis*; 5, subsp. *stenophylla*; 6, subsp. *alba*; 7, subsp. *pawekiae*. 
Phenology: Unknown.
Uses: None known.
Conservation Notes: This subspecies in comparison with other subspecific taxa is well represented in ex situ collections from throughout its range; therefore further collection is not a priority.
Taxonomic Notes: Pasquet (2001) suggests that three groups might be distinguished within subspecies stenophylla with intermediate specimens between them in the areas where their distributions overlap. The first group would include stout specimens from dry areas of Namibia, Botswana and western parts of the former Transvaal, in which the plants are scabrous or poorly pubescent with scabrous pods. The second group would include specimens from eastern parts of the former Transvaal and Cape Province of South Africa with stout and pubescent plants often with pubescent pods. The third group would include specimens from the Transvaal where the plants are more slender and possess linear leaflets and scabrous pods.

Reference to a published description: FCBR; FTEA; FZ.
Vernacular names: None known.
Habit and lifespan: Perennial.
Flower colour: White?
Habitat: Disturbed grassland and forest margin.
Associated species: Unknown.
Altitude: 1–1700 m.
Distribution:
CEAF: CON, GAB(!), GGI, ZAI.
EAF: TAN.
ZAMB: ANG, ZIM.
Phenology: Unknown.
Uses: None known.
Conservation Notes: This subspecies in comparison with the other subspecific taxa is well represented in ex situ collections from throughout its range; therefore further collection is not a priority.

Reference to a published description: FCBR 387; FTEA 646; FZ 141.
Vernacular names:
ZAI: Kulu, Ndekona mongasa.
ETH: Turina.
Habit and lifespan: Wild, climbing perennial.
Flower colour: White, greenish, yellow or lilac-purple.
Habitat: Tree and palm savannahs, swampy areas, roadsides, gallery forests, grasslands and fallow fields.
Associated species: Unknown.
Altitude: 1–2700 m (–3650 m in Kenya).

Distribution:
CEAF: BUR, GGI, ZAI.
EAF: KEN, TAN(!), UGA.
NEAF: ERI, ETH.
WAF: CMN, NGA, SIE.
ZAMB: ANG, BOT, MLW, MOZ, ZAM, ZIM.

Phenology: Unknown.

Uses: None known.

Conservation Notes: This subspecies in comparison with the other subspecific taxa is well represented in ex situ collections from throughout its range; therefore further collection is not a priority.

Reference to a published description: FCBR; FTEA; FZ.

Vernacular names: None known.
Habit and lifespan: Wild, climbing perennial.

Flower colour: Purple.

Habitat: Disturbed areas.

Associated species: Unknown.

Altitude: 1200–2900 m.

Distribution: Obvious.

Phenology: Unknown.

Uses: None known.

Conservation Notes: V. unguiculata subsp. aduensis is the most recently described subspecies and as an Ethiopian endemic is the most geographically restricted subspecies. There are no ex situ collections, and only a few herbarium specimens are known; therefore further collection is a priority to help establish the true range of the taxon and provide conservation of an important crop wild relative. The lack of material and restricted distribution indicate that this subspecies deserves a higher conservation priority; an IUCN Red List Category of Endangered is appropriate.

Reference to a published description: FZ 149.

Vernacular names: None known.
Habit and lifespan: Perennial with rootstock

Flower colour: Pink, purple, yellow or mauve.

Habitat: Mostly montane grasslands, Ngongoni veld, roadsides, among rocks and disturbed areas; loams.

Associated species: Zornia.
Figure 5.117. *Vigna schlechteri* Harms in Engler: 1, habit (x1); 2, details of leaf nervation, lower surface (x6); 3, stipule (x2.5); 4, flower, front and lateral view (x1); 5, flower bud (x2); 6, standard (x3); 7, standard, details (x6); 8 and 9, keel, lateral and front view (x2.5); 10, wing (x3); 11, diadelphous stamens, spread out (x3); 12, style (x3); 13, stigma (x12); 14, calyx, spread out (x2.5); 15, seed, lateral and front view (x2.5).
**Figure 5.118.** Distribution of *V. schlechteri* based on herbarium specimen passport data.

**Figure 5.119.** FloraMap predicted distribution for *V. schlechteri*.
Figure 5.120. Distribution of *V. keraudrenii* based on herbarium specimen passport data.

Figure 5.121. FloraMap predicted distribution for *V. keraudrenii*. 
Figure 5.122. Distribution of *V. monantha* based on herbarium specimen passport data.
**Altitude:** 650–2290 m.

**Distribution:**
SAF: SWZ, ZAF.
ZAMB: MOZ, ZAM(!), ZIM.

**Phenology:** Flowering occurs between November and April.

**Uses:** None known.

**Taxon Vulnerability Assessment:** = 3.4

**Conservation Notes:** *V. schlechteri* is found widely in southern Africa and there are 10 *ex situ* collections, although all of these are from South Africa and Swaziland. Therefore, there is a need for further systematic collection from throughout Zimbabwe and Mozambique. The trend in collection over time follows the general pattern for all *Vigna* species, which suggests the species does not appear to be in danger of immediate extinction or genetic erosion.

**IUCN Red List Category:** Least Concern.

**Additional notes:** This species is endemic to the montane grasslands of southern Africa (Mithen and Kibblewhite, 1993). It is thought to be the closest relative of *V. unguiculata* and has been placed in the secondary genepool (Mithen 1987, Baudoin and Maréchal, 1991) although hybridization has so far proved unsuccessful between the two species (Mithen, 1987).

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**Reference to a published description:** LM 567, illust. 577.

**Vernacular names:** None known.

**Habit and lifespan:** Perennial, climbing, delicate herb.

**Flower colour:** Deep pink to purple.

**Habitat:** Rocky hillsides and high altitude woodland with mosses and lichens.

**Associated species:** Unknown.

**Altitude:** 1420–1940 m.

**Distribution:**
WIO: MDG (Central Madagascar: Ambositra to north of Antananarivo).
ZAMB: MOZ.

**Phenology:** December to March.

**Uses:** None known.

**Taxon Vulnerability Assessment:** = 5.1

**Conservation Notes:** *V. keraudrenii* is found on the central plateaux of Madagascar, but it is not currently represented in *ex situ* collections and thus collection is a priority. The trend in numbers of herbarium specimens collected over time cannot be assessed as so few specimens have been collected. The small number of populations seen, the lack of *ex situ* collections and the restricted distribution suggest that the species is vulnerable to genetic erosion and possible extinction.

**IUCN Red List Category:** Vulnerable.
Taxonomic notes: This species closely resembles some forms of *V. angivenensis* in its delicate habit, very narrow leaflets and inflorescences with solitary purplish flowers, but can easily be distinguished by its characteristic stipules with a distinct lower lobe extending below the point of attachment and its almost glabrous stems, leaves and calyces. It is also more remotely related to *V. schlechteri* from which it differs in its narrow leaflets, less pubescent stems, and narrower and smaller stipules with triangular lobes.


Reference to a published description: FS 436.

Vernacular names: None known.

Habit and lifespan: Perennial herb with radiating trailing stems.

Flower colour: Blue or mauve.

Habitat: Sandy plains of ancient dunes.

Associated species: Grasses, sedges, *Indigofera sparteola*, *Chamaecrisa dunensis*.

Altitude: 20–230 m.

Distribution:

NEAF: SOM (northeastern coast and central).

Phenology: Unknown.

Uses: None known.

Taxon Vulnerability Assessment: = 6.4

Conservation Notes: *V. monantha* is a recently described Somali endemic and probably, alongside *V. somaliensis* and *V. virescens*, is one of the most highly threatened African *Vigna* taxa. There are few herbarium specimens available and no ex situ collections. The species appears to be very restricted but the fact that it was only described in 1991 means that the species full range may not be fully appreciated. The need for systematic surveying of this species and collection for ex situ conservation should be given the highest priority.

IUCN Red List Category: Critically Endangered.

Taxonomic notes: Like *V. schlechteri*, this species has a one-flowered inflorescence. It is distinguished from *V. schlechteri* by its longer flowers (17–20 mm c.f. 10 mm in *V. schlechteri*) and its calyx teeth, which are clearly shorter than the tube while in *V. schlechteri* they are about as long as the tube. Thulin (1993) notes that Thulin and Abdi Dahir 6546 collected from North Central Somalia at 300 m (4°29' N, 47°23' E) is close to *V. monantha*, but differs in its flower number and inflorescence length as well as the shallowly lobed leaflets with a distinct silvery line above. He also notes that Gillett, Hemming and Watson 22603 from North Central Somalia (4°10' N, 46°28' E) is also similar to *V. monantha* but differs in its glabrous calyx and almost unlobed leaflets. He suggests both these collections represent new taxa, but more material is required before they can be described formally.
5.3 Subgenus *Haydonia*


**Section *Haydonia***


**Reference to a published description:** CPV 197; FE 177; FTEA 661, illus. 662; FZ 149, illus. 150.

**Vernacular names:**

KEN: Mbendi.
UGA: Emisinoye mpunga, Omutsinoya mpunga.

**Habit and lifespan:** Erect, climbing or trailing, perennial herb.

**Flower colour:** Blue, mauve, pink or violet.

**Habitat:** Grasslands, floodplains, savannah, deciduous woodlands, open woodlands, roadside, wet woodlands, cultivated fields (weedy), often associated with seasonal waterlogging or burning; clay or sandy loam.

**Associated species:** *Acacia*, *Adansonia*, *Berlinia*, *Brachystegia*, *Commiphora* and *Hyparrhenia*.

**Altitude:** 20–3900 m.

**Distribution:**

CEAF: BUR, RWA, ZAI(!).
EAF: KEN, TAN, UGA.
NEAF: ETH.
WAF: CMN.
ZAMB: BOT, MLW, ZAM, ZIM.

**Phenology:** In CEAF, the species flowers between December and February. In EAF, flowering appears to occur throughout the year, while in NEAF it occurs between December and April.

**Uses:** The root is considered a delicacy in Kenya (Verdcourt, 1971)

**Taxon Vulnerability Assessment:** = 4.2

**Conservation Notes:** *V. monophylla* is widely distributed in Central-southern-east Africa. The species is represented in ex situ collections by a few accessions from part of its range; therefore further collecting from throughout its range is required. The trend in numbers of herbarium specimens collected over time follows the general pattern for *Vigna* species, which suggests overall the species does not appear to be in danger of genetic erosion or extinction.

**IUCN Red List Category:** Least Concern.

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**Reference to a published description:** CPV 198; FE 177; FTEA 663; FZ 151.

**Vernacular names:** None known.

**Habit and lifespan:** Prostrate, creeping or climbing herb.

**Flower colour:** Yellow tinged with mauve.

**Habitat:** Mountain slopes, tree savannahs, miombo woodland, forest fringes and moist, open grasslands, edge of riverine forest.

**Associated species:** *Brachystegia, Hymenocardia, Daniellia, Syzigium* and *Uapaca.*
Altitude: 30–2800 m.
Distribution:
CEAF: BUR, CAF, ZAI.
EAF: KEN, TAN(!).
NEAF: ETH.
WAF: CMN(!), NGA.
ZAMB: ANG, ZAM.
Phenology: March–April (ZAMB).
Uses: None known.
Taxon Vulnerability Assessment: = 4.3
Conservation Notes: V. triphylla is widely distributed in Central-west and East Africa, however, the species is rare throughout its range and is represented in ex situ collections by only two accessions, therefore further collecting from throughout its range is required. The trend in numbers of herbarium specimens collected over time roughly follows the general pattern for Vigna species, but recent collections are rarer. The breadth of distribution of this species combined with its rarity make it vulnerable to genetic erosion and extinction.
IUCN Red List Category: Vulnerable.
Taxonomic notes: Closely related to V. monophylla from which it can be distinguished by its trifoliate leaves and more prominently winged peduncles.

Vigna juncea Milne-Redh., Kew Bull.: 301 (1934).
Reference to a published description: CPV 198; FCBR 354; FTEA 660; FZ 152.
Vernacular names: None known.
Habit and lifespan: Climbing or trailing perennial growing from a narrow wood-stock.
Flower colour: Yellow or flesh colour to mauve.
Habitat: Woodlands, herbaceous savannah, grasslands, streambeds on alluvium and anthills, burnt ground.
Associated species: Brachystegia, Isoberlinia, Parinari and Uapaca.
Altitude: 700–1750 m.
Distribution:
CEAF: ZAI.
EAF: TAN.
ZAMB: MLW, MOZ, ZAM, ZIM.
Phenology: Flowers between August and November throughout its distribution.
Uses: None known.
Taxon Vulnerability Assessment: = 7.3
Conservation Notes: V. juncea is most widely distributed in the Zambesiaca region, but there are no ex situ collections from here or throughout its range. Three varieties are recognized but none is common. The trend in numbers of herbarium specimens collected over time follows the general pattern for all Vigna species, though with fewer populations sampled in more recent years.
Figure 5.123. Distribution of *V. monophylla* based on specimen and accession passport data.

Figure 5.124. FloraMap predicted distribution for *V. monophylla*. 
Figure 5.125. Distribution of *V. triphylla* based on specimen and accession passport data.

Figure 5.126. FloraMap predicted distribution for *V. triphylla*. 
This suggests overall that the species may be in decline, is likely to be suffering genetic erosion, and may in the longer term face extinction.

**IUCN Red List Category:** Vulnerable.

**Taxonomic notes:** Verdcourt (1970) notes that this species is aberrant in that its smooth pollen is typical of subgenus *Phaseolus*, but he retained it within *Vigna* because its seed amino acid distribution is typical of *Vigna*. Pasquet (2001) comments that the flowers of var. *juncea* and var. *corbyi* are very similar, while those of var. *major* show marked differences and this may justify specific distinction. However, the lack of living material of *V. juncea* precludes such a distinction at this time.

Three varieties, *V. juncea* var. *juncea*, var. *major* and var. *corbyi* are recognized (Pasquet, 2001):

1. Flowers 16–18 mm; keel with short straight beak; distal part of style almost straight; pod 6–7.5 cm. ............................................................... var. *major*
   Flowers 9–13 mm long; keel with short incurved beak; distal part of style curved in a semicircle; pod 4–5.5 cm long ........................................2

2. Inflorescence rachis 8–20 cm, 10–30-noded, internodes (except the lowest) 6–20 mm ........................................................................ var. *juncea*
   Inflorescence rachis 0.5–7 cm long, 4–16-noded, internodes (except the lowest) 2–5 mm long ............................................................ var. *corbyi*

**Vigna juncea var. *juncea***

**Reference to a published description:** CPV 198; FTEA 661; FZ 152.

**Vernacular names:** None known.

**Habit and lifespan:** Climbing or trailing perennial growing from a narrow woodstock.

**Flower colour:** Yellow or flesh colour to mauve.

**Habitat:** Miombo woodlands, herbaceous savannah, grasslands, streambeds on alluvium and anthills.

**Associated species:** *Brachystegia*, *Uapaca* and *Parinari* woodland.

**Altitude:** 920–1200 m.

**Distribution:**
- CEAF: ZAI(!).
- EAF: TAN.
- ZAMB: MOZ, ZAM(!).

**Phenology:** October to November.

**Uses:** None known.

**Conservation Notes:** This variety is not represented in *ex situ* collections and collection is required from throughout its range.


**Reference to a published description:** FZ 152.

**Vernacular names:** None known.
Figure 5.127. *Vigna juncea* Milne-Redh.: 1, habit (×1); 2, stipule (×2.5); 3, details of leaf nervation, upper surface (×1); 4, details of leaf nervation, lower surface (×2); 5, flower, front and lateral view (×1); 6, standard (×2); 7, standard, details (×3); 8 and 9, keel, lateral and front view (×2); 10, wing (×2.5); 11, diadelphous stamens, spread out (×3); 12, style (×3); 13, stigma, lateral and front view (×12); 14, calyx, spread out (×2.5); 15, seed, lateral and front view (×2.5).
Figure 5.128. Distribution of *V. juncea* based on herbarium specimen passport data.

Figure 5.129. FloraMap predicted distribution for *V. juncea*. 
Habit and lifespan: Climbing or trailing perennial growing from a narrow wood-stock.
Flower colour: Yellow or flesh colour to mauve.
Habitat: Woodlands, herbaceous savannah, grasslands subject to fire.
Associated species: Unknown.
Altitude: 900–1800 m.
Distribution:
ZAMB: MLW, ZIM.
Phenology: October to November.
Uses: None known.
Conservation Notes: V. juncea var. corbyi is not represented in ex situ collections and collection is therefore required from throughout its range. It also has a restricted distribution, which, along with the lack of material available, suggests this variety deserves a higher conservation priority. An IUCN Red List Category of Vulnerable is appropriate.

Reference to a published description: CPV 198; FZ 153.
Vernacular names: None known.
Habit and lifespan: Climbing or trailing perennial growing from a narrow wood-stock.
Flower colour: Yellow or flesh colour to mauve.
Habitat: Miombo woodlands, herbaceous savannah, grasslands.
Associated species: Unknown.
Altitude: 1300–500 m.
Distribution:
CEAF: ZAI(!).
EAF: TAN(!).
ZAMB: MOZ, ZAM, ZIM.
Phenology: October to November.
Uses: None known.
Conservation Notes: This variety is not represented in ex situ collections and collection is required from throughout its range.

Reference to a published description: FZ 151.
Vernacular names: None known.
Habit and lifespan: Perennial, climber with rootstock.
Flower colour: Unknown.
Habitat: Grassland roadsides and streamsides.
Associated species: *Hyparrhenia filipendula* and *Heteropogon contortus*.
Altitude: 1600–2300 m.
Distribution:
WAF: CMN(?).
Figure 5.130. Distribution of *V. nyangensis* based on herbarium specimen passport data.
ZAMB: ANG, ZIM (Nyanga region).

Phenology: March.

Uses: None known.

Taxon Vulnerability Assessment: = 5.9

Conservation Notes: *V. nyangensis* is a recently described Zambesiaca endemic (there is a record from Cameroon but this seems likely to have been misidentified). There are few herbarium specimens available and only one *ex situ* collection. The species appears to be very restricted but the fact that it was only described in 1989 means that its full range may not yet be fully appreciated. The need for systematic surveying of this species and collection for *ex situ* conservation should be given the highest priority.

IUCN Red List Category: Vulnerable.

Taxonomic notes: Closely related to *V. triphylla*. This species is grouped under section *Haydonia* of subgenus *Haydonia*.


Reference to a published description: CPV 199; LM 580, illust. 575.

Vernacular names: None known.

Habit and lifespan: Perennial, climbing or prostrate, delicate herb.

Flower colour: Purple pink.

Habitat: Associated with disturbance, around settlements and cultivated land.

Associated species: Unknown.

Altitude: 1200–1750 m.

Distribution:

WIO: MDG (mainly around Ankaratra massif but also south to Icremo and Andringitra massifs).

Phenology: November to April.

Uses: None known.

Taxon Vulnerability Assessment: = 4.6

Conservation Notes: *V. microsperma* has a restricted distribution in Central Madagascar; the species is not represented in *ex situ* collections, therefore further collecting is required. The trend in numbers of herbarium specimens collected over time follows the general pattern for *Vigna* species, which suggests overall the species does not appear to be in imminent threat of genetic erosion or extinction. However, the limited distribution indicates population levels should be monitored.

IUCN Red List Category: Near Threatened.

Taxonomic notes: Most closely resembles *V. parkeri*. It is somewhat resistant to grassland fires, owing to its fleshy root.


Reference to a published description: CPV 199; FTEA 660; FZ 153.

Vernacular names: None known.
**Habit and lifespan:** Twining or procumbent herb.

**Flower colour:** Yellow or mauve.

**Habitat:** Woodlands, savannah and open bushes.

**Associated species:** Bamboo.

**Altitude:** 1000–1700 m.

**Distribution:**
- WAF: SEN(!).
- EAF: TAN.
- ZAMB: ZAM.

**Phenology:** April.

**Uses:** None known.

**Taxon Vulnerability Assessment:** = 6.0

**Conservation Notes:** *V. richardsiae* has a restricted distribution on the Tanzanian–Zambian border. There is also a record from Senegal, but this would be so isolated from the other populations it may have been misidentified and should be checked. Four specimens have been collected from the Tanzanian–Zambian border since the 1930s but there are no *ex situ* conserved accessions; further collection is therefore a priority. The fact that so few specimens have been sampled from populations suggests the species is in decline and is in danger of genetic erosion and extinction.

**IUCN Red List Category:** Critically Endangered.

**Taxonomic notes:** This species is closely related to *V. juncea* (Verdcourt, 1970), which it resembles in stipules, calyx, pods and pollen grain characters. Pasquet (2001) notes that this species may be close to *V. mudenia* and *V. kokii* but the lack of living material has hampered the clarification of their relationships.

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**Reference to a published description:** CPV 199; FCBR 365; FE 172, illust. 175; FTEA 628; FZ 153.

**Vernacular names:**
- Emaret, Mangwia, Njazi (KEN).
- Aubole, Orubore, Omaharakuku (UGA).
- Adjuru, Okworokworo (ZAR).

**Habit and lifespan:** Perennial twining or climbing from a woody rootstock.

**Flower colour:** Not recorded.

**Habitat:** Grasslands, forest margin, thicket, degraded forests, savannah, roadsides, hills and mountain slopes.

**Associated species:** *Acacia, Acanthus, Commiphora, Dombeya, Hyparrhenia, Lannea and Protea*.

**Altitude:** 70–4800 m.

**Distribution:**
- CEAF: BUR, CON, RWA, ZAI.
- EAF: KEN, TAN, UGA.
- NEAF: ETH, SUD.
Figure 5.131. Distribution of *V. microsperma* based on herbarium specimen passport data.

Figure 5.132. FloraMap predicted distribution for *V. microsperma*.
WAF: IVO.
ZAMB: MLW.

Phenology: October–January as well as April–July in EAF.

Uses: None known.

Taxon Vulnerability Assessment: = 3.4

Conservation Notes: *V. schimperi* has a relatively wide and disjunct distribution. The single specimen from Côte d’Ivoire needs to be checked as it is so remote from the main distribution centre in North and East Africa. The species is inadequately represented in *ex situ* collections, with only two germplasm samples from Central Africa. There is an urgent need for collection from its full geographic range; particularly from Ethiopia and East Africa. The trend in numbers of herbarium specimens collected over time follows the general pattern for *Vigna* species, which suggests overall the species does not appear to be in imminent threat of genetic erosion or extinction.

IUCN Red List Category: Least Concern.

Taxonomic notes: Resembles *V. luteola* but has been shown to have a different pollen sculpture and is thus placed in section *Haydonia*. Pasquet (2001) notes that the Malawi specimens have smaller flowers than those found further north and specific distinction may be warranted when more specimens become available.

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Reference to a published description: Refer to protologue.

Vernacular names: None known.

Habit and lifespan: Perennial twining or recumbent herb.

Flower colour: Cream.

Habitat: Rocky soil in thorn-veldt and savannah.

Associated species: *Acacia*.

Altitude: 520–1290 m.

Distribution:


Phenology: Unknown.

Uses: None known.

Taxon Vulnerability Assessment: = 6.9

Conservation Notes: *V. mudenia* has a restricted distribution in eastern South Africa. Five herbarium specimens have been collected and there are no *ex situ* conserved accessions; further collection is a priority. *V. mudenia* was relatively recently described in 1991, therefore its full range may not yet be fully appreciated. The need for systematic surveying of this species and collection for *ex situ* conservation should be given the highest priority. The IUCN Red List Category is therefore tentative.

IUCN Red List Category: Vulnerable.
Figure 5.133. Distribution of *V. richardsiae* based on herbarium specimen passport data.
Figure 5.134. Distribution of *V. schimperi* based on specimen and accession passport data.

Figure 5.135. FloraMap predicted distribution for *V. schimperi*.
Figure 5.136. Distribution of *V. mudenia* based on herbarium specimen passport data.

**Reference to a published description:** Refer to protologue.

**Vernacular names:** None known.

**Habit and lifespan:** Perennial twining herb with carrot-shaped rootstock.

**Flower colour:** Yellowish green.

**Habitat:** Woodland, grassland and riverside; sand and stony gravel.

**Associated species:** Unknown.

**Altitude:** 180–1700 m.

**Distribution:** SAF: NAM, ZAF.

**Phenology:** Unknown.

**Uses:** None known.

**Taxon Vulnerability Assessment:** = 5.5

**Conservation Notes:** *V. kokii* has a distribution limited to Namibia and South Africa. Nine herbarium specimens have been collected and there are no ex situ conserved accessions; therefore further collection is a priority. *V. kokii* was relatively recently described in 1993, which means that its full range may not yet be fully appreciated. The need for systematic surveying of this species and collection for ex situ conservation should be given the highest priority. The assessment of IUCN Red List Category is therefore tentative.

**IUCN Red List Category:** Near Threatened.

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**Vigna nigritia** Hook.f. in Hook., Niger Fl.: 310 (1849).

**Reference to a published description:** CPV 200; FCBR 358; FWTA 568.

**Vernacular names:** Bambe (SEN).

**Habit and lifespan:** Climbing herb.

**Flower colour:** Blue, mauve, pink, red or violet.

**Habitat:** Grasslands, fallows, roadsides, various types of savannahs and rarely in marshes.

**Associated species:** *Andropogon, Daniellia olivieri, Hyparrhenia, Lophira lanceolata* and *Pennisetum*.

**Altitude:** 1–1800 m.

**Distribution:**

CEAF: CAF, CON, GAB, ZAI.

WAF: CMN, GHA, GNB, GUI, IVO, LBR, MIL, NGA, SEN, SIE, TOG.

ZAMB: ANG.

**Phenology:** CEAF: March–June and September–December, WAF: September–February.

**Uses:** None known.

**Taxon Vulnerability Assessment:** = 2.2

**Conservation Notes:** *V. nigritia* is widely distributed in West and Central Africa. The species is reasonably well represented in ex situ collections, though not by
Figure 5.137. Distribution of *V. kokii* based on herbarium specimen passport data.
accessions from throughout its range; therefore further collecting from throughout its range is required; particularly from Guinea, Sierra Leone, Côte d’Ivoire, Central African Republic and Angola. The trend in numbers of herbarium specimens collected over time follows the general pattern for *Vigna* species, which suggests overall the species does not appear to be in danger of genetic erosion or extinction.

**IUCN Red List Category:** Least Concern.


**Reference to a published description:** CPV 201; FWTA 568.

**Vernacular names:** None known.

**Habit and lifespan:** Slender, climbing or creeping annual.

**Flower colour:** Purple or yellow.

**Habitat:** Inundated areas, savannahs, roadsides, laterite plateaux, coastal areas, primary and secondary grasslands, riverbanks, with a preference for moist and seasonally inundated sandy grasslands; sandy loam over laterite.

**Associated species:** *Ctenium* and *Loudetia*.

**Altitude:** 1–1200 m.

**Distribution:**

CEAF: CAF, ZAI.
EAF: TAN.
NEAF: SUD.
WAF: BKN, CMN, GHA(!), GNB, GUI, IVO, LBR, MLI, NGA, SEN, SIE, TOG.
ZAMB: ANG.

**Phenology:** Flowers between October and December in WAF.

**Uses:** None known.

**Taxon Vulnerability Assessment:** = 3.4

**Conservation Notes:** *V. venulosa* is widely distributed in West and Central Africa; however, the species is not well represented in *ex situ* collections, therefore further collecting from throughout its range is required. The trend in numbers of herbarium specimens collected over time follows the general pattern for *Vigna* species, which suggests overall the species does not appear to be in danger of genetic erosion or extinction.

**IUCN Red List Category:** Least Concern.

**Taxonomic notes:** Closely related to *V. nigritia*. The two species also have similar distribution patterns but *V. venulosa* is more common.

### 5.4 Subgenus *Plectotropis*

(Schumach.) Baker in Fl. Br. India 2:206 (1876).

**Section *Plectotropis***


**Reference to a published description:** CPV 202; FCBR 379, illust. 381; FE 176; FS 436; FTEA 652; FWTA 567; FZ 145; LM 585.

**Vernacular names:** None known.
Figure 5.138. *Vigna nigritia* Hook. f.: 1, habit (×1); 2, stipule (×2.5); 3, inflorescence nectaries, front view (×2.5); 4, inflorescence nectaries, lateral view (×2.5); 5, stem, horizontal section (2.5); 6, flower, front and lateral view (×1); 7, flower bud (×2); 8, standard (×2.5); 9, standard, details (×6); 10 and 11, keel, front and lateral view (×3); 12 and 13, wing (×3); 14, diadelphous stamens, spread out (×3); 15, style (×3); 16, stigma (×12); 17, seed, lateral and front view (×2.5); 18, details of leaf nervation, lower surface (×6).
Figure 5.139. Distribution of *V. nigrizia* based on specimen and accession passport data.

Figure 5.140. FloraMap predicted distribution for *V. nigrizia*. 
Figure 5.141. *Vigna venulosa* Baker in Oliv.: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×2.5); 4, flower, front and lateral view (×1); 5, standard (×2); 6, standard, details (×3); 7 and 8, keel, front and lateral view (×2.5); 9 and 10, wing (×2.5); 11, diadelphous stamens, spread out (×3); 12, style (×3); 13, stigma (×12), 14, calyx, spread out (×2.5); 15, stem, horizontal section (×6); 16, inflorescence nectaries, details (×6); 17, seed, lateral and front view (×2.5).
Figure 5.142. Distribution of *V. venulosa* based on specimen and accession passport data.

Figure 5.143. FloraMap predicted distribution for *V. venulosa*. 
**Habit and lifespan:** Climbing or trailing perennial herb, growing from a long, narrow rootstock.  
**Flower colour:** Pink, purple or yellowish.  
**Habitat:** Grassland, savannah, swamp, lake shore, open bush, forest margin, woodland, river and roadsides, fallow and weed in cultivation; clay or sandy loam over sandstone or granite.  
**Associated species:** *Acacia*, *Albizia*, *Brachystegia*, *Combretum*, *Commiphora*, *Hyparrhenia*, *Pteridium* and *Themeda*.  
**Altitude:** 1–3900 m.  
**Distribution:**  
CEAF: BUR, CAF, CHA, CON, EQG, GAB, RWA, ZAI.  
EAF: KEN, TAN, UGA.  
NEAF: ERI, ETH, SOM, SUD.  
SAF: SWZ, ZAF.  
WAF: BEN, BKN, CMN, GHA, GNB, IVO, LBR, MLI, NGA, NGR, SEN, SIE, TOG.  
WIO: MDG(!).  
ZAMB: ANG, BOT, MLW, MOZ, ZAM, ZIM.  
**Phenology:** Variable depending on location.  
**Uses:** See var. *vexillata*, var. *angustifolia* and var. *lobatolia* for notes on use.  
**Taxon Vulnerability Assessment:** = 2.4  
**Conservation Notes:** *V. vexillata* is widely distributed throughout Africa and there are significant *ex situ* collections from throughout its range. It is an important source of human and animal feed therefore it is not surprising that so much effort has been devoted to ensuring the genepool is well conserved. However, there are still gaps in the conserved material. Additional collecting is required from Ghana, Liberia, Sudan, Sierra Leone and Chad. As with *V. unguiculata*, there may be a need for further landrace sampling of material not already held *ex situ*. The trend in numbers of herbarium specimens collected over time follows the general pattern for all *Vigna* species, which suggests overall the species does not appear to be in danger of extinction or genetic erosion; however, this assessment does not hold true for all subspecies, for subsp. *dolichonema* and *microsperma* see below.  
**IUCN Red List Category:** Least Concern.  
**Taxonomic notes:** Several varieties of this species are recognized: var. *vexillata*, var. *angustifolia*, var. *davyi*, var. *dolichonema*, var. *lobatolia*, var. *macrosperma* and var. *ovata*. These are distinguished on the basis of leaflet size and shape. The species shows a wide range of variation across its distribution which makes varietal separation difficult. Further, intermediate forms are common. Southern African material shows more marked levels of variation. Pasquet (2001) interestingly notes that numerous intermediate specimens between var. *vexillata* and var. *angustifolia* are found in ZAMB.  
1. Leaflets sometimes all unifoliate, or one--, two- or three-foliolate on the same stem, more or less rhombic to broadly ovate with base cuneate; stems densely ferruginous, setaceous, hairs sometimes light-coloured; calyx lobes much longer than tube. ........................................................................................................................................ var. *davyi*
Leaflets always trifoliolate, shape varying, almost round to ovate, base essentially cuneate to more or less obtuse, or more or less lanceolate (much longer than broad), base essentially truncate to obtuse; stems ferruginous, villous to subglabrous; calyx lobes longer or shorter than tube..................2

2. Leaflets lobed, glabrous or nearly so, 2–4 cm wide; calyx pubescent, with teeth 4.5–11 mm.......................................................... var. lobatifolia
   Leaflets entire or if slightly lobed then densely hairy...........................3

3. Calyx teeth 2.0–2.2 mm; var. dolichonema Calyx teeth 0.2–2.0 mm..........4

4. Pod 12–15 cm; seed subspherical 3.5–5 mm.................................. var. macro sperma
   Pod <12 cm; seed 2.5–4 mm................................................................5

5. Terminal leaflets ovate, base cuneate to obtuse; apex obtuse or acute, size variable; stems densely ferruginous, villous to puberulent; calyx lobes usually longer than tube .................................................................6
   Terminal leaflets essentially lanceolate to linear, base truncate to more or less obtuse, apex acuminate, up to approx. 100–150×8–18 mm; stems often glabrescent or aculeate; calyx lobes often shorter than tube..........................
   ................................................................................................... var. angustifolia

6. Plant usually densely ferruginous; terminal leaflets broadly or narrowly ovate to elliptic or rhombic-ovate, base cuneate to more or less obtuse, up to 120×55 mm; peduncles as thick or thinner than twinning stems; legumes up to approx. 100 mm long......................................................... var. vexillata
   Plant sparsely pubescent, ferruginous; terminal leaflets rotund, elliptic, ovate to narrowly ovate or more or less lanceolate to linear, base usually obtuse, seldom longer than 25 mm when rotund, up to 40 mm when lanceolate; peduncles much thickened than low-creeping stem; legumes approx. 55 mm long................................................................. var. ovata

**Additional notes:** The pubescence on the leaves, stems and pods of *V. vexillata* and the high content of para-aminophenylalanine are reported to be repulsive to major insect pests of cowpea including pod borers (*Maruca testulalis*) (Padulosi and Ng, 1990; Baudoin and Maréchal, 1991; Fatokun, 1991; Jackai and Singh, 1991) and *Clavigralla tomentosicollis* (Oghiakhe et al., 1992). The species has also been reported to have high levels of bruchid-resistance conferring anti-metabolites including trypsin inhibitors, tannins and lectins (Marconi et al., 1997). This furthermore implies a great potential for improvement of cowpea. Although many attempts to hybridize *V. vexillata* with *V. unguiculata* have been unsuccessful, a recent study has reported some success with embryo rescue (Gomathinayagam et al., 1998).

In addition to being tasty boiled or raw, the tubers are easy to peel and contain about 15% protein and are reported to be eaten in Africa during times of severe hunger (Stephens, 1994), although the seeds contain low levels of sulphur-amino acids (Siddhuraju et al., 1994). In view of its ability to grow in harsh conditions, and considering that many African countries are plagued with seasonal droughts, *V. vexillata* holds great promise as a potential new crop.

Apart from the potential use in cowpea improvement, this species has great potential as a crop. Its edible tubers are often roasted like sweet potatoes and
contain a higher protein content than other root crops such as cassava and sweet potato (Padulosi and Ng, 1990.)

**Vigna vexillata var. vexillata**

**Reference to a published description:** CPV 202; FE 176; FS 436; FZ 145.

**Vernacular names:**
Akanyayua, Umuyambi or Ngole (BUR).
Areg, Yacta doungari, Zohot orthi (ETH).
Shi’hobi (KEN).
Inganiga, Muharaku, Umucasuka (RWA).
Lubiya el ghazal (SUD).
Kisukuma, Lufundufundu, Kisumbumbi, Mninahandala (TAN).
Ekihuru (BOT).
Kokole (UGA).
Adjolo, Kansimba-simba, Kwakwa, Madezo masiolo, Njoro (ZAI).

**Habit and lifespan:** Perennial, climbing, herb.

**Flower colour:** Pink, purple or yellowish.

**Habitat:** Fallows, disturbed areas, coastal bushes, grasslands, lake edges, various grasslands, roadsides, riverbanks, thicket and cultivated fields where it grows as a weed.

**Associated species:** Unknown.

**Altitude:** 1–3860 m.

**Distribution:**
CEAF: BUR, CAF, CHA, CON, GAB, RWA, ZAI.
EAF: KEN, TAN, UGA.
NEAF: ERI, ETH, SOM, SUD.
SAF: SWZ, ZAF.
WAF: BEN, BKN, CMN, GHA, GNB, IVO, LBR, NGA, NGR, SEN, SIE, TOG.
ZAMB: ANG, BOT, MLW, MOZ, ZIM.

**Phenology:** Variable depending on location.

**Uses:** The leaves are eaten as a salad in hot weather in Kenya and are also eaten in Tanzania and Zaire. When fed to goats, the leaves are believed to increase milk flow (Tanzania). The plant is also used in the treatment of bilharzia in Tanzania.

**Conservation Notes:** This variety in comparison with the others is well represented in ex situ collections from throughout its range; therefore further collection is not a priority.


**Reference to a published description:** Refer to protologue.

**Vernacular names:** None known.

**Habit and lifespan:** Perennial, climbing herb.

**Flower colour:** Pink or purple.
**Habitat:** Disturbed areas.

**Associated species:** Unknown.

**Altitude:** 220–1700 m.

**Distribution:**
- CEAF: CAF, ZAI.
- SAF: ZAF.
- ZAMB: BOT.

**Phenology:** Unknown.

**Uses:** None known.

**Conservation Notes:** *V. vexillata* var. *macrosperma* was relatively recently described, is less well known but has several *ex situ* collections, but further collection is a priority.

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**Reference to a published description:** CPV 204; FS 436; FTEA 654; FZ 146; LM 585, illust. 575.

**Vernacular names:**
- GHA: Wate.
- MDG: Tokambahatsy, Tsiroko.
- MOZ: Chiteji, Tembu.
- SUD: Abapu muno.

**Habit and lifespan:** Perennial, climbing or prostrate herb.

**Flower colour:** Violet or purple pink fading bluish.

**Habitat:** Floodplains, disturbed grass veldts, thicket edges, freshwater marshes, grasslands, roadsides, herbaceous savannahs, swamp and lake edges, thickets and woodlands.

**Associated species:** Unknown.

**Altitude:** 1–2300 m.

**Distribution:**
- CEAF: BUR, CAF, CHA, CON, RWA, ZAI.
- EAF: KEN, TAN, UGA.
- NEAF: ETH, SOM, SUD.
- SAF: SWZ, ZAF.
- WAF: BEN, BKN, CMN, GAM, GHA, IVO, MIL, NGA, NGR, SEN, TOG.
- WIO: MDG(!).
- ZAMB: ANG, MLW, MOZ, ZAM, ZIM.

**Phenology:** Throughout the year.

**Uses:** The tubers are ground and used as a remedy for sores and ulcers. The pods are also used to cure skin irritation thus the local name “itch bean”.

**Conservation Notes:** This variety in comparison with the others is well represented in *ex situ* collections from throughout its range; therefore further collection is not a priority.

**Taxonomic Notes:** Pasquet (2001) notes that there are numerous intermediates between var. *vexillata* and var. *angustifolia*. 
Figure 5.144. *Vigna vexillata* (L.) A. Rich. var. *vexillata*: 1, habit (×1); 2, stipule (×2.5); 3, details of leaf nervation, lower surface (×6); 4, inflorescence nectaries (×3); 5, flower, front and lateral view (×1); 6, standard (×1); 7, standard, details (×2.5); 8 and 9, keel, lateral and front view (×2); 10 and 11, wing (×2.5); 12, diadelphous stamens, spread out (×3); 13, style (×3); 14, stigma (×12); 15, calyx, spread out (×2.5); 16, seed, lateral and front view (×2.5); 17, flower nectaries (×3).
Figure 5.145. Distribution of *V. vexillata* based on specimen and accession passport data.

Figure 5.146. FloraMap predicted distribution for *V. vexillata*.
Figure 5.147. Distribution of *V. vexillata* var. *vexillata* based on specimen and accession passport data.

Figure 5.148. FloraMap predicted distribution for *V. vexillata* var. *vexillata*. 

Reference to a published description: CPV 205; FTEA 654.

Vernacular names: None known.

Habit and lifespan: Perennial, climbing or prostrate herb.

Flower colour: Violet or purple pink fading bluish.

Habitat: Known only from type location.

Associated species: Unknown.

Altitude: 1300–1400 m.

Distribution: EAF: TAN (Matengo Hills).

Phenology: March.

Uses: None known.

**Conservation Notes:** *V. vexillata* var. *dolichonema* was relatively recently described and is the most geographically restricted variety, being a Tanzanian endemic. Only a single specimen was seen and no *ex situ* collections exist; therefore further collection is a priority to help establish the true range of the taxon. The lack of material and restricted distribution indicate that this variety deserves a higher conservation priority; an IUCN Red List Category of Critically Endangered is appropriate.

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Reference to a published description: Refer to protologue.

Vernacular names: None known.

Habit and lifespan: Perennial, climbing or prostrate herb.

Flower colour: Violet or purple.

Habitat: Coastal areas.

Associated species: Unknown.

Altitude: 1–1900 m.

Distribution: SAF: SWZ, ZAF.

Phenology: Not known.

Uses: None known.

**Conservation Notes:** This variety in comparison with the others is well represented in *ex situ* collections from throughout its range; therefore further collection is not a priority.

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Reference to a published description: CPV 207; FZ 146.

Vernacular names:

NAM: Idi, Kwanyama, Muimbo, Okupunde or Sha.

Habit and lifespan: Perennial, climbing or prostrate herb.
Figure 5.149. Distribution of *V. vexillata* var. *angustifolia* based on specimen and accession passport data.

Figure 5.150. FloraMap predicted distribution for *V. vexillata* var. *angustifolia*.
Flower colour: Violet or purple pink.
Habit: Regenerating woodland, riverbanks, riverbeds, sandy flats and scattered bushes.
Associated species: Bakiaea, Combretum, Lonchocarpus.
Altitude: 900–1750 m (though only one record with altitude in the database).
Distribution: SAF: NAM, ZAF. ZAMB: ANG, BOT(!), ZAM.
Phenology: Mainly January–April, but flowering in August and September has been recorded.
Uses: The fleshy tubers are eaten raw or cooked by the Kung in Namibia.
Conservation Notes: This variety in comparison with the others is well represented in ex situ collections from throughout its range; therefore further collection is not a priority.

Reference to a published description: CPV 205.
Vernacular names: None known.
Habit and lifespan: Herbaceous, climbing perennial.
Flower colour: Lilac, mauve, purple or violet.
Habitat: Mainly in grasslands but also recorded in open woodlands and cleared forests. Pienaar and Kok (1991) note that this species is adapted to the acidity of igneous, granite outcrops.
Associated species: Unknown.
Altitude: 1–1950 m.
Phenology: Mainly September–March.
Uses: None known.
Conservation Notes: This variety in comparison with the others is well represented in ex situ collections from throughout its range; therefore further collection is not a priority.
Additional notes: It has recently been suggested that this species is no more than a unique variant of V. vexillata (Pienaar and Kok, 1991; Pienaar, 1992). No evidence of gene flow between this species and the closely related V. vexillata was observed even where they grew in close proximity (Pienaar and Kok, 1992). Fatokun et al. (1997), using RFLP markers, reported 73% similarity between the two species and that hybridization is possible between the two species resulting in a partially fertile F₁ hybrid.

Reference to a published description: CPV 205; FTEA 637; FZ 148.
Figure 5.151. Distribution of *V. vexillata* var. *ovata* based on specimen and accession passport data.

Figure 5.152. FloraMap predicted distribution for *V. vexillata* var. *ovata*. 
Figure 5.153. Distribution of *V. vexillata* var. *lobatifolia* based on specimen and accession passport data.

Figure 5.154. FloraMap predicted distribution for *V. vexillata* var. *lobatifolia*. 
Figure 5.155. *Vigna vexillata* var. *lobatifolia* (Baker) Pasquet: 1., habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×3); 4, inflorescence nectaries (×3); 5, flower, front and lateral view (×1); 6, keel, front view (×3); 7, keel, front view (×3); 8, standard (×1.5); 9, standard, details (×3); 10 and 11, wing (×2.5); 12, diadelphous stamens, spread out (×3); 13, stigma (×12); 14, style (×2.5); 15, calyx, spread out (×2.5); 16, seed, lateral and front view (×2.5).
**Vernacular names:**
ZAI: Inaola Kwaka.
KEN: Muchaihi.

**Habit and lifespan:** Perennial, climbing herb.

**Flower colour:** Mauve, yellow or white with a yellow patch or very pale blue tinged yellow.

**Habitat:** Alluvial plains, grasslands, forest undergrowth, disturbed ground, inundated areas, stream- and riverbanks, roadsides, savannahs; sandy or clay loam, alluvial.

**Associated species:** *Barringtonia racemosa, Brachystegia, Hyparrhenia* and *Syzygium.*

**Altitude:** 1–1712 m.

**Distribution:**
CEAF: BUR, ZAI.
EAF: KEN, TAN, UGA.
NEAF: SUD.
WAF: CMN, GAM(!), GNB.
ZAMB: MLW, MOZ, ZAM.

**Phenology:** February to May.

**Uses:** None known.

**Taxon Vulnerability Assessment:** = 3.2

**Conservation Notes:** *V. kirkii* is widely distributed in Central Africa. The species is poorly represented in *ex situ* collections, therefore further collecting from throughout its range is required, particularly from the Democratic Republic of the Congo and northeast Tanzania. The trend in numbers of herbarium specimens collected over time follows the general pattern for *Vigna* species, which suggests overall the species does not appear to be in danger of genetic erosion or extinction.

**IUCN Red List Category:** Least Concern.

**Additional notes:** The species shows high levels of resistance to bruchid beetles and thus represents a potential source of resistance genes (Padulosi and Ng, 1990).

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**Vigna nuda** N.E. Br., Kew Bull.:121 (1901).

**Reference to a published description:** CPV 206; FCBR 372; FTEA 655.

**Vernacular names:**
ZAI: Lusashi.

**Habit and lifespan:** Initially erect, later prostrate or rarely climbing, perennial. Flowers almost always appear before leaves.

**Flower colour:** Greenish or yellow-brown.

**Habitat:** Open woodlands, grassy thickets, grasslands, savannahs, riversides and rarely in swamps. Recent burning is the most commonly noted abiotic factor at collecting sites. Sand, sandy loam and clay have been cited as substrates.

**Associated species:** *Brachystegia, Combretum, Entada, Parinari, Sphenostylis, Terminalia.*
Figure 5.156. *Vigna vexillata* var. *davyi* (Bolus) Pienaar: 1, habit (×1); 2, stipule (×3); 3, details of leaf nervation, lower surface (×6); 4, inflorescence nectaries (×2.5); 5, flower, front and lateral view (×1); 6, standard (×1.5); 7, standard, details (×3); 8 and 9, keel, front and lateral view (×2); 10 and 11, wing (×2.5); 12, diadelphous stamens, spread out (×2); 13, style (×2); 14, stigma (×12); 15, calyx, spread out (×2); 16, calyx bract (×3); 17, seed, lateral and front view (×2.5).
Figure 5.157. Distribution of *V. vexillum* var. *davyi* based on specimen and accession passport data.

Figure 5.158. FloraMap predicted distribution for *V. vexillum* var. *davyi*. 
Altitude: (0–30) 450–2300 m.

Distribution:
CEAF: BUR(!), ZAI().
EAF: TAN().
ZAMB: ANG, MLW(!), MOZ(!), ZAM(!), ZIM().

Phenology: May–October in both CEAF and ZAMB.

Uses: The roots are reported to be used in the brewing of Munkoyo beer in Zambia and the Shaba region of the Democratic of the Congo (Pauwels et al., 1992).

Taxon Vulnerability Assessment: = 6.4

Conservation Notes: V. nuda is widely distributed in southern-central and West Africa, but it is rare throughout its range. As only two specimens were seen and there are no ex situ collections for the species, there is a need for urgent germplasm collection throughout its range. Recent burning is associated with many of the specimens seen. Although burning is important for flowering of this species, if inappropriate burning regimes are used, the population is threatened. The trend in numbers of herbarium specimens collected over time cannot be assessed as so few populations have been sampled; only a few specimens were collected in the last century. It appears the species is in decline and vulnerable to genetic erosion and extinction.

IUCN Red List Category: Critically Endangered.

Additional notes: This species resembles V. frutescens morphologically as well as in the tendency to flower before the appearance of leaves. Recently Pasquet (2001) has sunk the species in V. antunesii, which may explain the relatively small number of specimens seen compared with its reported breadth of distributional range.


Reference to a published description: CPV 207; FCBR 377; FWTA 567; FZ 148.

Vernacular names: None known.

Habit and lifespan: Perennial, erect herb.

Flower colour: Mauve to purple.

Habitat: Wet pasture, marsh, bush, open ground, woodlands, forests and dambos on sand and clay.

Associated species: Brachystegia, Cyperaceae, Protea and Uapaca.

Altitude: 166–1602 m. Most records 1400–1700 m.

Distribution:
CEAF: ZAI.
EAF: TAN().
WAF: CMN, NGA.
ZAMB: ZAM.

Phenology: December to February in CEAF and ZAMB; June to August in WAF.

Uses: None known.

Taxon Vulnerability Assessment: = 4.9
Figure 5.159. Distribution of *V. kirkii* based on specimen and accession passport data.

Figure 5.160. FloraMap predicted distribution for *V. kirkii*.
Figure 5.161. *Vigna kirkii* (Baker) Gillett: 1, habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×2.5); 4, inflorescence nectaries (×2.5); 5, flower, front and lateral view (×1); 6, standard (×2); 7, standard, details (×3); 8 and 9, keel, lateral and front view (×2); 10 and 11, wing (×2.5); 12, diadelphous stamens, spread out (×2.5); 13, style (×2.5); 14, stigma (×12); 15, calyx, spread out (×2.5); 16, seed, lateral and front view (×2.5).
Conservation Notes: *V. longissima* has a relatively wide but disjunct distribution and the species is not represented in *ex situ* collections; therefore, further collection across its range of distribution is clearly a priority. The trend in numbers of herbarium specimens collected over time indicates that few specimens have been collected since the 1940s, which suggests the species is in decline and is in danger of genetic erosion and extinction.

**IUCN Red List Category:** Vulnerable.

### 5.5 Subgenus *Ceratotropis*

**Section *Ceratotropis***


**Reference to a published description:** CPV 209; FE 177; FS 436; FTEA 655; FZ 154; LM 581.

**Vernacular names:** Mung bean or green gam in English, mung in Hindi and salbuko-cagaar in Somali.

**Habit and lifespan:** Annual, climbing or suberect herb.

**Flower colour:** Yellow green.

**Habitat:** Cultivated or escape, primarily in the Indian subcontinent but throughout the tropics.

**Associated species:** Unknown.

**Altitude:** 1–2200 m.

**Distribution:** Not native to Africa.

**EAF:** KEN(!), TAN(!), UGA(!).

**NEAF:** ETH, SOM(!), SUD.

**WAF:** CMN, GHA.

**WIO:** MDG(!) (mainly west and north).

**ZAMB:** ANG, MOZ(!), ZAM(!), ZIM.

**Phenology:** Throughout the year.

**Uses:** Ancient Indian crop cultivated for its edible seeds at fairly low altitudes throughout the tropics and subtropics.

**Taxon Vulnerability Assessment:** = 6.1

**Conservation Notes:** Introduced from Asia and now widely distributed as an escape.

**IUCN Red List Category:** Least Concern.

**Taxonomic notes:** Two varieties are recognized from Africa, they can be distinguished as follows:

1. Plant cultivated; stems robust, often woody, multistemmed and erect; pods more or less indehiscent; leaflets usually entire; pods 70–90 mm long; seeds 4 mm.............................................................................................................................................

   **var. radiata**

   Plant wild or weedy; stems twining or prostrate, less robust; pods dehiscent; leaflets frequently lobed; pods and seeds usually smaller ......................

   **var. sublobata**
Figure 5.162. Distribution of *V. nuda* based on herbarium specimen passport data.
Figure 5.163. *Vigna nuda* N.E. Br.: 1, habit (×1); 2, stipule (×2.5); 3, details of leaf nervation, lower surface (×1); 4, flower, front and lateral view (×1); 5, standard (×2); 6, standard, details (×3); 7 and 8, keel, lateral and front view (×3); 9 and 10, wing (×2.5); 11, diadelphous stamens, spread out (×3); 12, style (×3); 13, stigma (×12); 14, calyx (×3); 15, seed, lateral and front view (×2.5).
Figure 5.164. *Vigna longissima* Hutch.: 1., habit (x1); 2, stipule (x3); 3, leaflet attachment details (x1).
Figure 5.165. Distribution of *V. longissima* based on herbarium specimen passport data.

Figure 5.166. FloraMap predicted distribution for *V. longissima*. 
**Vigna radiata var. radiata**

Reference to a published description: CPV 209; FE 177; FTEA 656; LM 582.

Vernacular names: None known.

Habit and lifespan: Annual, climbing or suberect herb.

Flower colour: Yellow green.

Habitat: Seasonally wet secondary grassland, bushland, cultivated.

Associated species: Unknown.

Altitude: Wherever cultivated.

Distribution: Not native to Africa.

EAF: KEN(!), TAN(!), UGA(!).

NEAF: ETH(!).

WIO: MDG(!).

Phenology: Throughout the year.

Uses: Used mainly by the Indian ethnic population as green gram or mung bean.

Conservation Notes: Introduced from Asia and now widely distributed as an escape.

IUCN Red List Category: Least Concern.

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Reference to a published description: FE 177; FTEA 656; FWTA 656; FZ 145; LM 582, illust. 575.

Vernacular names:

MDG: Antandro, Sarimahalay, Voango.

Habit and lifespan: Annual, climbing or suberect herb.

Flower colour: Yellow green.

Habitat: Naturalized in grassland, disturbed and cultivated areas, especially in seasonally marshy areas.

Associated species: Unknown.

Altitude: 0–1000 m.

Distribution: Not native to Africa.

EAF: TAN(!).

NEAF: ETH(!), SUD(!).

WAF: CMN, GHA, NGA(!).

WIO: MDG(!) (mainly west and north).

ZAMB: MOZ(!), ZAM(!), ZIM(!).

Phenology: Throughout the year but mainly February to April.

Uses: Common food crop, originally native to Asia.

Conservation Notes: Introduced from Asia and now widely distributed as an escape.

IUCN Red List Category: Least Concern.

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Reference to a published description: CPV 212; LM 583.
Vernacular names: None known.
Habit and lifespan: Scrambling herb.
Flower colour: Yellow green.
Habitat: Roadsides and secondary vegetation.
Associated species: Unknown.
Altitude: 0–2800 m.
Distribution: Not native to Africa.
NEAF: ETH, SUD.
SAF: ZAF(!).
WIO: MDG(!).
Phenology: March to April.
Uses: None known.
Taxon Vulnerability Assessment: = 6.9
Conservation Notes: A recent introduction to Madagascar and East Africa from Southeast Asia.
IUCN Red List Category: Least Concern.

Reference to a published description: CPV 213; FE 177; LM 584.
Vernacular names: Moth or rice bean in English.
Habit and lifespan: Annual, slender, climbing herb.
Flower colour: Yellow.
Habitat: Cultivated for its edible pods and seeds and also used as fodder, particularly in hot dry areas.
Associated species: Unknown.
Altitude: Wherever cultivated.
Distribution:
NEAF: ETH(!), SOM(!).
WIO: MDG(!).
Phenology: Throughout year.
Uses: Cultivated for edible pods and seeds.
Conservation Notes: Introduced from Asia and now widely distributed as an escape.
IUCN Red List Category: Least Concern.

Reference to a published description: CPV 214; LM 584.
Vernacular names:
MDG: Anatsamby, Mahalay, Tseisa, Tsiasisa.
Habit and lifespan: Annual, climbing herb.
Flower colour: Bright yellow.
Habitat: Cultivated.
Associated species: Unknown.
Figure 5.167. Distribution of *V. radiata* based on specimen and accession passport data.

Figure 5.168. FloraMap predicted distribution for *V. radiata*.
Figure 5.169. Distribution of *V. trilobata* based on herbarium specimen passport data.
Altitude: Wherever cultivated up to 1000 m.

Distribution:
WAF: IVO.
WIO: MDG(!).

Phenology: Throughout year.

Uses: Cultivated for edible beans (rice bean).

Conservation Notes: Introduced to Madagascar and now widely cultivated.

IUCN Red List Category: Least Concern.


No African species.

5.6 Subgenus Lasiospron


Reference to a published description: CPV 219; LM 578.

Vernacular names:
SIE: Yawe.

Habit and lifespan: Annual or perhaps perennial, climbing herb.

Flower colour: Orange yellow.

Habitat: Marshes, swamps, riverbanks, coastal sand, rice fields and moist areas.

Associated species: Unknown.

Altitude: 1–1660 m. However, only one specimen was found over 286 m.

Distribution: Not native to Africa.

CEAF: ZAI.
WAF: BEN, GHA, GNB, IVO, SEN, SIE.
WIO: MDG.

Phenology: January.

Uses: None known.

Taxon Vulnerability Assessment: = 5.4

Conservation Notes: V. longifolia has a disjunct distribution from Senegal to Madagascar and appears to be uncommon throughout its range, possibly indicating individual population isolation and vulnerability. There is only a single ex situ collection and further systematic collection is required. The trend in numbers of herbarium specimens collected over time follows the pattern for all Vigna species, but the last specimen to be collected was in 1968 and this may indicate decline and genetic erosion. However, the fact that the species is uncommon throughout its range suggests individual populations are relatively isolated and vulnerable to extinction.

IUCN Red List Category: Vulnerable.

Additional notes: This species is not native to Africa but is thought to have been introduced from the Americas (Verdcourt, 1970; Maréchal et al., 1978).


Reference to a published description: CPV 219.
Vernacular names: None known.
Habit and lifespan: Annual or perhaps perennial, climbing herb.
Flower colour: Yellow.
Habitat: Riverine forests, swamps and riverbanks.
Associated species: Chrysophyllum, Raphia hookeri and Rhynchospora corymbosa.
Altitude: 40–1300 m.
Distribution: Not native to Africa.
CEAF: CAF, CON, GAB, ZAI.
EAF: KEN, TAN, UGA.
WAF: CMN, GHA, GUI, IVO, NGA, SIE.
Phenology:
Uses: None known.
Taxon Vulnerability Assessment: = 4.5
Conservation Notes: *V. juruana*, although not believed to be native to Africa, is widely distributed in a band across the centre of the continent, but is rare throughout. The species is represented by two *ex situ* collections from Cameroon and the Central African Republic, and therefore further systematic collecting is required. The trend in numbers of herbarium specimens collected over time follows the general pattern for *Vigna* species, which suggests overall the species does not appear to be in imminent threat of genetic erosion or extinction, but the rarity indicates population levels should be monitored.
IUCN Red List Category: Near Threatened.
Additional notes: This species is thought to be an introduction from the New World.

### 5.7 Subgenus *Sigmoidotropis*

**Section Sigmoidotropis**
No African species.
**Section Pedunculares** Maréchal, Mascherpa and Stainier, Taxon 27:201 (1978).
No African species.
**Section Caracallae** (DC.) Maréchal, Mascherpa and Stainier, Taxon 27:201 (1978).
No African species.
**Section Condylostylis** (Piper) Maréchal, Mascherpa and Stainier, Taxon, 27:202 (1978).
No African species.

**Section Leptospron** (Benth.) Maréchal, Mascherpa and Stainier, in Taxon 27: 201 (1978).
Reference to a published description: CPV 229; FS 437; LM 573.

Vernacular names:
SIE: Stuxé/Kungsutsuru.
Figure 5.170. *Vigna longifolia* (Benth.) Verdc.: 1., habit (×1); 2, details of leaf nervation, lower surface (×6); 3, stipule (×3); 4, flower, front and lateral view (×1); 5, inflorescence with pod (×3); 6, standard, details (×3); 7, standard (×2); 8, keel, front view (×3); 9, keel, lateral view (×3); 10, diadelphous stamens, spread out (×3); 11, diadelphous stamens and style (×3); 12 and 13, wing (×2.5); 14, style (×2.5); 15, stigma (×12); 16, inflorescence nectaries, details (×3); 17, seed, lateral and front view (×2.5), 18, calyx, spread out (×2.5).
Figure 5.171. Distribution of *V. longifolia* based on specimen and accession passport data.

Figure 5.172. FloraMap predicted distribution for *V. longifolia*. 
Figure 5.173. Distribution of *V. juruana* based on specimen and accession passport data.

Figure 5.174. FloraMap predicted distribution for *V. juruana*. 
Habit and lifespan: Climbing, creeping or twining perennial.

Flower colour: Cream, white, yellow, greenish yellow or purple.

Habitat: Beaches, roadsides, riversides, coastal thickets and rarely swamps and marshes, and forest fringe on sandy soils.

Associated species: Mimosa sp.

Altitude: 1–1660 m. Widely cultivated but most commonly a littoral species.

Distribution: Not native to Africa.

CEAF: CHA, GAB, ZAI.
EAF: TAN.
NEAF: SOM.
WAF: CMN, GAM, GHA, GUI, LBR, NGA, SIE, TOG.
WIO: MDG.
ZAMB: ANG, ZAM.

The species has been recorded as being cultivated in ANG, GNB, MLI, GGI and SEN (Hiern, 1896).

Phenology: Flowers in September to April (CEAF); September to March (WAF); July (EAF).

Uses: The species produces edible tubers (Padulosi and Ng, 1990).

Taxon Vulnerability Assessment: = 4.6

Conservation Notes: V. adenantha, although not believed to be native to Africa, is widely distributed in a band across the centre of the continent, there are only five ex situ collections so further systematic collecting is required, particularly in Sierra Leone, Liberia and Cameroon. The trend in numbers of herbarium specimens collected over time follows the general pattern for Vigna species, which suggests overall the species does not appear to be in imminent threat of genetic erosion or extinction.

IUCN Red List Category: Least Concern.

Additional notes: This is believed to have been introduced into Africa from the Americas but has now become naturalized into most of Africa. The species has some potential for use as a forage crop although it requires a period of recovery as it has been shown not to persist under continuous grazing (Muir and Pitman, 1991).

5.8 Subgenus Macrorhyncha


Reference to a published description: CPV 231; FE 177; FS 437; FTEA 658, illust. 659; FWTA 568; FZ 156, illust. 155.

Vernacular names:

MOZ: Cahemba nhemba.
TAN: Hla’akeko, Kikuzikwima, Penzepembe.
UGA: Onyumabasalea.

Habit and lifespan: Trailing or twining perennial herb, which grows from a woody rootstock.

Flower colour: Mauve or purple, rarely red, blue or lilac.
Figure 5.175. Distribution of *V. adenantha* based on specimen and accession passport data.

Figure 5.176. FloraMap predicted distribution for *V. adenantha*. 
**Habitat:** Coastal bushes, grassland subjected to seasonal burning, bushland, roadside, herbaceous savannahs, often associated with dry environments that have been recently burnt; clay or sandy loam over laterite, limestone or quartz.

**Associated species:** *Acacia, Brachystegia, Colophospermum, Combretum, Commiphora, Euphorbia, Gardenia, Omacarpum and Protea.*

**Altitude:** 1–3857 m.

**Distribution:**
CEAF: BUR, RWA, ZAI.
EAF: KEN, TAN, UGA.
NEAF: ETH, SOM, SUD.
WAF: CMN, NGA.
ZAMB: MLW, MOZ, ZAM, ZIM.

**Phenology:** June to November.

**Uses:** The tubers are eaten, raw or cooked by the Hadza (Tanzania). In Uganda boys eat the tubers whilst herding livestock.

**Taxon Vulnerability Assessment:** = 4.3

**Conservation Notes:** *V. macrorhyncha* has a north–south distribution from Sudan and Ethiopia to Mozambique. There are only three *ex situ* collections and further systematic collection is required from throughout its range. West African populations should be given higher priority because they are isolated from the main range of population and no populations are conserved *ex situ*. Overgrazing and burning are noted as a cause of genetic erosion on some of the herbarium specimens. Populations growing in such areas may be threatened by both factors and may require specific monitoring. However, overall the trend in numbers of herbarium specimens collected over time follows the pattern for all *Vigna* species, indicating nonparticular threat from genetic erosion or extinction.

**IUCN Red List Category:** Near Threatened.

**Taxonomic notes:** This species shows close affinity to *V. grahamiana*, an Indian species. Although floral morphology of both species is typical of *Vigna*, the unsculptured pollen resembles that of *Phaseolus*. The two species may need to be placed in a separate genus (Verdcourt, 1970). However, Maréchal et al. (1978) retained both in *Vigna* mainly for convenience (Maréchal, 1982). Pasquet (2001) notes that this species is quite distinct from other *Vigna sensu stricto* and may warrant generic distinction in the future.


**Reference to a published description:** CPV 231; FTEA 657.

**Vernacular names:** None known

**Habit and lifespan:** Robust, climbing perennial whose flowers appear before leaves.

**Flower colour:** Green outside, mauve and white inside or veined with dull purple.

**Habitat:** Dry scrub, savannah bushland, deciduous woodlands, dense scrublands, especially in areas that are prone to burning; sandy loam.

**Associated species:** *Acacia, Combretum, Commiphora, Terminalia* and *Thylacia*.

**Altitude:** 200–1100 m.
Figure 5.177. Vigna macrorhyncha (Harms) Milne-Redh.: 1., habit (×1); 2, stipule (×3); 3, flower, front and later view (×1); 4, standard, details (×3); 5, standard (×2); 6, keel, lateral view (×3); 7, keel, front view (×3); 8, wing (×2.5); 9, diadelphous stamens, spread out (×3); 10, style (×3); stigma (×12); 12, calyx (×2.5); 13, seed, lateral and front view (×2.5).
Figure 5.178. Distribution of *V. macrorhyncha* based on specimen and accession passport data.

Figure 5.179. FloraMap predicted distribution for *V. macrorhyncha*. 
**Distribution:**
EAF: KEN, TAN(!).
NEAF: SOM(!).
WAF: NGR.

**Phenology:** Flowers throughout the year.

**Uses:** None known.

**Taxon Vulnerability Assessment:** = 4.9

**Conservation Notes:** *V. praecox* is basically an East African species, however, the one *ex situ* collection is from Niger, this accession should be checked as it is very isolated from other populations. As this is the only *ex situ* collection of what is an uncommon species, the species is likely to be vulnerable. Further systematic collection is required. The trend in numbers of herbarium specimens collected over time roughly follows the pattern for all *Vigna* species, although the species was only relatively recently described, therefore its true distribution may not yet be known, further study is required before an appropriate conservation strategy can be clarified.

**IUCN Red List Category:** Data Deficient.

**Taxonomic notes:** Its floral morphology resembles that of *V. macrorhyncha*. Pollen reticulation in this species resembles that of members of subgenus *Vigna* (Maréchal *et al*., 1978) and may thus represent a link between subgenera *Vigna* and *Macrorhyncha*.

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**Reference to a published description:** FS 437, illust. 437.

**Vernacular names:** None known.

**Habit and lifespan:** Robust, perennial climber.

**Flower colour:** Dull greenish.

**Habitat:** Limestone bushland on sandstone escarpments or granite outcrops.

**Associated species:** Grasses, sedges, *Indigofera sparteola*, *Cassia dunensis*.

**Altitude:** 190–350 m.

**Distribution:**
NEAF: SOM (southern and central).

**Phenology:** Unknown.

**Uses:** None known.

**Taxon Vulnerability Assessment:** = 6.7

**Conservation Notes:** *V. virescens* is a Somali endemic and probably, along with the other Somali endemics, *V. monantha* and *V. somaliensis*, one of the most highly threatened African *Vigna* taxon. There are few herbarium specimens available and no *ex situ* collections. There is a need for a critical review of this species and a search for extant populations should be given the highest priority.

**IUCN Red List Category:** Critically Endangered.

**Taxonomic notes:** The species most closely resembles *V. praecox*, from which it differs by having the leaves produced with the flowers as well as its fully incurved beak of keel, which only curves through 270° in *V. praecox*. It also shares some characteristics with the monotypic genus *Wajira*. 
**Figure 5.180.** Distribution of *V. praecox* based on specimen and accession passport data.

**Figure 5.181.** FloraMap predicted distribution for *V. praecox*.
Figure 5.182. Vigna praecox Verdc.: 1, habit (×1); 2, stipule (×2.5); 3, flower, front and lateral view (×1); 4, standard (×3); 5, details of close standard, lateral view (×3); 6, standard, details (×6); 7 and 8, keel, lateral and front view (×3); 9 and 10, wing (×3); 11, diadelphous stamens, spread out (×3); 12, style (×3); 13, stigma (×12), 14, calyx, spread out (×3).
Figure 5.183. Distribution of \( V. \) virescens based on herbarium specimen passport data.
6. ECOGEOGRAPHIC ANALYSIS

6.1 Introduction
The *Vigna* conspectus presented in the previous chapter includes significant data analysis and interpretation for individual African *Vigna* taxa. The following two chapters focus on the genus as a whole; general ecogeographic analysis in this chapter and spatial biogeographic analysis using geographic information systems (GIS) and multivariate analysis in Chapter 7. The final chapter summarizes the specific conservation actions recommended on the basis of these analyses.

6.2 Ecogeographic database content
The African *Vigna* database contains ecogeographic data on 7289 herbarium specimens from 30 herbaria and 1802 genebank accessions from four genebanks. In total, 9091 populations representing 61 species were sampled between 1762 and 1997 (see Appendix V). The database also contains 113 records (3 herbarium specimens and 110 genebank accessions) that could not be identified. These were not included in the analysis.

There can be few comparable comprehensive ecogeographic data sets for a tropical crop genepool, but some species are represented by large numbers of specimens, while others are only represented by a few (Figure 6.1). Also, not all fields in the database were filled for each record. Table 6.1 summarizes the percentage completion for some selected data types.

<table>
<thead>
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<th>Data type</th>
<th>Percentage complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species identification</td>
<td>98.8</td>
</tr>
<tr>
<td>Herbarium or genebank location</td>
<td>95.2</td>
</tr>
<tr>
<td>Month of collection</td>
<td>67.7</td>
</tr>
<tr>
<td>Country of collection</td>
<td>100.0</td>
</tr>
<tr>
<td>Exact locality</td>
<td>100.0</td>
</tr>
<tr>
<td>Altitude</td>
<td>100.0</td>
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<td>Abiotic factors at site</td>
<td>1.7</td>
</tr>
<tr>
<td>Frequency</td>
<td>5.0</td>
</tr>
</tbody>
</table>

The quality and scope of the ecogeographic analysis will be dictated by the data collated during the survey or study. The more complete the data, the more detailed and reliable the analysis. Although the *Vigna* data set is relatively large, no specimens have complete ecological data and the data set follows the observations of Maxted *et al.* (1995) that it is easier to record taxonomic and descriptive data, followed by curatorial data, then geographic data and finally ecological data. Interpretation of data should be carried out with these constraints in mind.
6.3 Evenness of sampling
The number of populations sampled from each country where *Vigna* is found ranged from 1 (Djibouti) to 974 (South Africa), see Table 6.2. The highest number of species was recorded in South Africa, followed by the Democratic Republic of the Congo and Tanzania. The main problem with unequal sampling effort is that it can result in an underestimation of the species richness of undersampled areas. To determine if the number of species recorded in each country is a true reflection of the actual number of species or merely a sampling artefact, the number of *Vigna* species recorded in each country was plotted against the number of herbarium specimens and genebank accessions originating from that country. The regression line, together with 95% confidence intervals, fitted following Nabhan (1990), is shown in Figure 6.2. Species below the lower confidence interval are likely to be oversampled while those above are undersampled, as such, Botswana, Namibia, South Africa and Swaziland appear overcollected, while Angola, Burundi, Cameroon, Democratic Republic of the Congo, Djibouti, Nigeria, Tanzania and Zambia appear undercollected and more species than currently recorded may occur in these countries.

Species accumulation curves for each country are shown in Figures 6.3–6.6. As sampling effort increases (measured as the cumulative number of herbarium specimens) the number of species recorded in each country is expected to increase until it reaches the true species richness. At this point, further collections will not result in any additional species (Fagan and Kareiva, 1997). Any countries for which the species accumulation curve has not reached a plateau can be concluded to have been undersampled.

The species accumulation curves indicate that Benin, Central African Republic, Côte d’Ivoire, Cameroon, Ethiopia, Guinea, Equatorial Guinea, Malawi, Namibia, Nigeria, Sudan, Senegal, Sierra Leone, Somalia, Zimbabwe and Zambia are likely to have been undercollected i.e. they may contain more species of *Vigna* than have been currently recorded.

6.4 Taxon vulnerability assessment analysis
In the conspectus presented in Chapters 4 and 5, each species is given a Taxon Vulnerability Assessment, i.e. a score out of 10 with the higher numbers indicating greater vulnerability to genetic erosion and extinction. This estimate of vulnerability is based on seven criteria: rarity, distributional range, gross representation in ex situ collections, geographic coverage of ex situ collections, coverage of ex situ collections, utility and extinction assessment. The following discussion draws attention to the individual factors as they relate to the most threatened species.

6.4.1 Rarity
Rarity is estimated from the total number of herbarium specimens and genebank accessions of each species contained in the database (see Appendix V). It is assumed that this is likely to be a true indicator of actual occurrence, because
Figure 6.1. Number of herbarium specimens and germplasm accessions for each *Vigna* species.
### Table 6.2. Number of populations sampled per country.

<table>
<thead>
<tr>
<th>Country</th>
<th>Area of country</th>
<th>Number of herbarium specimens (B)</th>
<th>Number of genebank accessions (C)</th>
<th>Total populations sampled (B+C=D)</th>
<th>Unit area per Vigna population (A/D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td>2 381 745</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Absent</td>
</tr>
<tr>
<td>Angola</td>
<td>12 467 000</td>
<td>353</td>
<td>3</td>
<td>356</td>
<td>35 020</td>
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<tr>
<td>Benin</td>
<td>112 620</td>
<td>13</td>
<td>28</td>
<td>41</td>
<td>2747</td>
</tr>
<tr>
<td>Botswana</td>
<td>575 000</td>
<td>109</td>
<td>113</td>
<td>222</td>
<td>2590</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>274 122</td>
<td>21</td>
<td>23</td>
<td>44</td>
<td>6230</td>
</tr>
<tr>
<td>Burundi</td>
<td>27 835</td>
<td>154</td>
<td>18</td>
<td>172</td>
<td>162</td>
</tr>
<tr>
<td>Cameroon</td>
<td>475 500</td>
<td>252</td>
<td>176</td>
<td>428</td>
<td>1111</td>
</tr>
<tr>
<td>Central African Rep.</td>
<td>624 975</td>
<td>98</td>
<td>44</td>
<td>142</td>
<td>4401</td>
</tr>
<tr>
<td>Chad</td>
<td>1 284 000</td>
<td>25</td>
<td>27</td>
<td>52</td>
<td>24 692</td>
</tr>
<tr>
<td>Congo</td>
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<td>117</td>
<td>104</td>
<td>221</td>
<td>1548</td>
</tr>
<tr>
<td>Congo (DRC)</td>
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<td>866</td>
<td>84</td>
<td>950</td>
<td>2469</td>
</tr>
<tr>
<td>Côte d’Ivoire</td>
<td>322 465</td>
<td>86</td>
<td>12</td>
<td>98</td>
<td>3290</td>
</tr>
<tr>
<td>Djibouti</td>
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<td>1</td>
<td>0</td>
<td>1</td>
<td>23 000</td>
</tr>
<tr>
<td>Egypt</td>
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<td>17</td>
<td>17</td>
<td>35</td>
<td>58 838</td>
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<td>0</td>
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<td>3506</td>
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<td>7350</td>
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<td>256</td>
<td>4314</td>
</tr>
<tr>
<td>Gabon</td>
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<td>24</td>
<td>74</td>
<td>98</td>
<td>2823</td>
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<tr>
<td>Gambia</td>
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<td>10</td>
<td>0</td>
<td>10</td>
<td>1069</td>
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<tr>
<td>Ghana</td>
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<td>119</td>
<td>99</td>
<td>218</td>
<td>1093</td>
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<tr>
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<td>45</td>
<td>8</td>
<td>53</td>
<td>4639</td>
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<tr>
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<td>55</td>
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</tr>
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<td>432</td>
<td>82</td>
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<td>1134</td>
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<td>0</td>
<td>0</td>
<td>Absent</td>
</tr>
<tr>
<td>Liberia</td>
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<td>48</td>
<td>4</td>
<td>52</td>
<td>2142</td>
</tr>
<tr>
<td>Libya</td>
<td>1 759 540</td>
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<td>0</td>
<td>0</td>
<td>Absent</td>
</tr>
<tr>
<td>Madagascar</td>
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<td>0</td>
<td>213</td>
<td>2790</td>
</tr>
<tr>
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<td>281</td>
</tr>
<tr>
<td>Mali</td>
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<td>30</td>
<td>5</td>
<td>35</td>
<td>35 433</td>
</tr>
<tr>
<td>Morocco</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>Absent</td>
</tr>
<tr>
<td>Mozambique</td>
<td>784 755</td>
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<td>12</td>
<td>238</td>
<td>3297</td>
</tr>
<tr>
<td>Namibia</td>
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<td>107</td>
<td>26</td>
<td>133</td>
<td>6198</td>
</tr>
<tr>
<td>Niger</td>
<td>1 186 410</td>
<td>27</td>
<td>68</td>
<td>95</td>
<td>12 489</td>
</tr>
<tr>
<td>Nigeria</td>
<td>923 850</td>
<td>224</td>
<td>179</td>
<td>403</td>
<td>2292</td>
</tr>
<tr>
<td>Rwanda</td>
<td>26 328</td>
<td>105</td>
<td>21</td>
<td>126</td>
<td>209</td>
</tr>
<tr>
<td>Sao Tome</td>
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<td>20</td>
<td>0</td>
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<td>48</td>
</tr>
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<td>Senegal</td>
<td>196 720</td>
<td>109</td>
<td>10</td>
<td>119</td>
<td>1653</td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>72 325</td>
<td>136</td>
<td>1</td>
<td>137</td>
<td>528</td>
</tr>
</tbody>
</table>
Table 6.2. Regression of species against herbarium specimens and genebank accessions from each country.

<table>
<thead>
<tr>
<th>Country</th>
<th>Area of country (A)</th>
<th>Number of herbarium specimens (B)</th>
<th>Number of genebank accessions (C)</th>
<th>Total populations sampled (B+C=D)</th>
<th>Unit area per Vigna population (A/D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somalia</td>
<td>630 000</td>
<td>28</td>
<td>5</td>
<td>33</td>
<td>19 091</td>
</tr>
<tr>
<td>South Africa</td>
<td>1 184 825</td>
<td>802</td>
<td>172</td>
<td>974</td>
<td>1216</td>
</tr>
<tr>
<td>Sudan</td>
<td>2 505 815</td>
<td>113</td>
<td>4</td>
<td>117</td>
<td>21 417</td>
</tr>
<tr>
<td>Swaziland</td>
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<td>56</td>
<td>46</td>
<td>102</td>
<td>170</td>
</tr>
<tr>
<td>Tanzania</td>
<td>939 760</td>
<td>625</td>
<td>106</td>
<td>731</td>
<td>1286</td>
</tr>
<tr>
<td>Togo</td>
<td>56 785</td>
<td>42</td>
<td>6</td>
<td>48</td>
<td>1183</td>
</tr>
<tr>
<td>Tunisia</td>
<td>164 150</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Absent</td>
</tr>
<tr>
<td>Uganda</td>
<td>236 580</td>
<td>311</td>
<td>4</td>
<td>315</td>
<td>751</td>
</tr>
<tr>
<td>Zambia</td>
<td>752 615</td>
<td>470</td>
<td>96</td>
<td>566</td>
<td>1330</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>390 310</td>
<td>301</td>
<td>111</td>
<td>412</td>
<td>947</td>
</tr>
</tbody>
</table>
Figure 6.3. Species accumulation curves for countries with >200 herbarium specimens represented in the African Vigna database.

Figure 6.4. Species accumulation curves for countries with 101–200 herbarium specimens represented in the African Vigna database.
Figure 6.5. Species accumulation curves for countries with 51–100 herbarium specimens represented in the African Vigna database.

Figure 6.6. Species accumulation curves for countries with <50 herbarium specimens represented in the African Vigna database.
There is no reason to suspect, apart from the cultivated or very rare taxa, that any particular taxon would have been disproportionately oversampled compared with its true frequency in the wild occurrence. It is likely that cultivated taxa will be overrepresented because of their utilitarian importance, while rare taxa may possibly be oversampled because botanists receive kudos from finding rare taxa and so will tend to collect more samples and place duplicates in multiple herbaria.

Within these constraints, *V. somaliensis*, *V. nuda*, *V. trilobata*, *V. phoenix*, *V. virescens*, *V. mudenia*, *V. richardsiae*, *V. bosseri*, *V. nyangensis*, *V. monantha*, *V. hosei*, *V. kokii*, *V. dolomitica* and *V. benuensis*, all with fewer than ten herbarium specimens seen and three or fewer genebank accessions collected may be considered rare. The common taxa, estimated using the top 15 percentile, are *V. parkeri*, *V. gracilis*, *V. oblongifolia*, *V. racemosa*, *V. luteola*, *V. reticulata*, *V. ambacensis*, *V. frutescens*, *V. vexillata* and *V. unguiculata*, with over 272 populations sampled, as can be seen in Table 6.3.

### 6.4.2 Distribution

The distributional analysis used here takes a radius around each collecting locality and then by merging the resulting circles calculates the total distributional area, providing an approximation of a species range (see Appendix VI). Thus it provides a good approximation of endemicity, which is based on neither political units or same size grid squares. Thus, the most restricted endemics and most widely distributed species were identified. The most geographically restricted *Vigna* species, in order of rarity, beginning with the rarest species, were *V. somaliensis*, *V. trilobata*, *V. dolomitica*, *V. nuda*, *V. richardsiae*, *V. bosseri*, *V. nyangensis*, *V. mudenia* and *V. virescens* (see Table 6.4). It should be noted that *V. mudenia*, *V. richardsiae*, *V. bosseri*, *V. nyangensis* and *V. virescens* are each relatively recently described species and, as such, their full distributional ranges may not yet have been identified because collectors previously surveying the area of occurrence would by definition not have noted the presence of the species. This would suggest that a more intense survey of their area of occurrence and adjacent regions – or even a review of previously collected specimens from this area – is required before conclusions can be drawn about the true range of these species. This appears particularly true for *V. richardsiae* and *V. dolomitica*, which have very disjunct distributions. *V. trilobata* is not native to Africa and is a recent introduction to Madagascar and East Africa from southeast Asia, hence the low number of specimens seen and their disjunct distribution. *V. somaliensis* is a well established, but very restricted species, endemic, as might be expected from the name, to Somalia. Recently, Pasquet (2001) has sunk *V. nuda* in *V. antunesii*, which may explain the relatively small number of specimens seen compared with its reported breadth of distributional range.

The most geographically extensive *Vigna* species were *V. unguiculata*, *V. vexillata*, *V. ambacensis*, *V. reticulata*, *V. frutescens*, *V. racemosa*, *V. luteola*, *V. oblongifolia*, *V. gracilis*, *V. membranacea*, *V. comosa*, *V. parker*, *V. macrorhyncha*
and V. multinervis in order of breadth of distribution, beginning with the most common species. It is not surprising that the most widely distributed species, V. unguiculata and V. vexillata, are cultivated. For any cultivated species it is difficult to distinguish natural range from the human mediated distribution. It is worth noting, however, that the wild progenitor of cowpea, V. unguiculata subsp. spontanea also has a relatively wide distribution, it is found in Angola, Botswana, Cameroon, Congo, Democratic Republic of the Congo, Eritrea, Kenya, Malawi, Mozambique, Niger, Nigeria, Senegal, Sudan, Tanzania, Zambia and Zimbabwe.

Table 6.3. Rare and common African Vigna species.

<table>
<thead>
<tr>
<th>Species</th>
<th>Rare species</th>
<th>Germplasm accessions</th>
<th>Species</th>
<th>Germplasm accessions</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. somaliensis</td>
<td>1</td>
<td>0</td>
<td>V. multinervis</td>
<td>107</td>
</tr>
<tr>
<td>V. nuda</td>
<td>2</td>
<td>0</td>
<td>V. macrorhyncha</td>
<td>155</td>
</tr>
<tr>
<td>V. trilobata</td>
<td>1</td>
<td>2</td>
<td>V. comosa</td>
<td>177</td>
</tr>
<tr>
<td>V. phoenic</td>
<td>4</td>
<td>0</td>
<td>V. membranacea</td>
<td>163</td>
</tr>
<tr>
<td>V. virescens</td>
<td>4</td>
<td>0</td>
<td>V. parkeri</td>
<td>264</td>
</tr>
<tr>
<td>V. mudenia</td>
<td>5</td>
<td>0</td>
<td>V. gracilis</td>
<td>293</td>
</tr>
<tr>
<td>V. richardiae</td>
<td>5</td>
<td>0</td>
<td>V. oblongifolia</td>
<td>277</td>
</tr>
<tr>
<td>V. bosseri</td>
<td>6</td>
<td>0</td>
<td>V. racemosa</td>
<td>344</td>
</tr>
<tr>
<td>V. nyangensis</td>
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<td>1</td>
<td>V. luteola</td>
<td>409</td>
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<td>V. monantha</td>
<td>7</td>
<td>0</td>
<td>V. reticulata</td>
<td>360</td>
</tr>
<tr>
<td>V. hosei</td>
<td>6</td>
<td>2</td>
<td>V. ambacensis</td>
<td>361</td>
</tr>
<tr>
<td>V. kokii</td>
<td>9</td>
<td>0</td>
<td>V. frutescens</td>
<td>512</td>
</tr>
<tr>
<td>V. dolomitica</td>
<td>9</td>
<td>1</td>
<td>V. vexillata</td>
<td>1223</td>
</tr>
<tr>
<td>V. benuensis</td>
<td>8</td>
<td>3</td>
<td>V. unguiculata</td>
<td>1152</td>
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</table>

Table 6.4. Distributional range of most geographically restricted Vigna species.

<table>
<thead>
<tr>
<th>Species</th>
<th>Year of description</th>
<th>km² ( x 10³)</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. somaliensis</td>
<td>1929</td>
<td>7.81</td>
<td>Somalia</td>
</tr>
<tr>
<td>V. trilobata</td>
<td>1968</td>
<td>7.81</td>
<td>Ethiopia, Madagascar, Sudan</td>
</tr>
<tr>
<td>V. mudenia</td>
<td>1991</td>
<td>24.52</td>
<td>South Africa</td>
</tr>
<tr>
<td>V. richardiae</td>
<td>1970</td>
<td>23.54</td>
<td>Senegal, Tanzania, Zambia</td>
</tr>
<tr>
<td>V. bosseri</td>
<td>2002</td>
<td>23.94</td>
<td>Madagascar</td>
</tr>
<tr>
<td>V. nyangensis</td>
<td>1989</td>
<td>24.21</td>
<td>Angola, Cameroon (?), Zimbabwe</td>
</tr>
<tr>
<td>V. virescens</td>
<td>1991</td>
<td>24.71</td>
<td>Somalia</td>
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</table>
Table 6.5. African Vigna species underrepresented in genebanks.

<table>
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<tr>
<th>Species</th>
<th>Herbarium specimens</th>
<th>Germplasm accessions</th>
<th>Ratio of number of germplasm accessions to herbarium specimens</th>
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<td>V. somaliensis</td>
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<td>0.0</td>
</tr>
<tr>
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<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>V. phoenix</td>
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<td>0.0</td>
</tr>
<tr>
<td>V. virescens</td>
<td>4</td>
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<td>0.0</td>
</tr>
<tr>
<td>V. mudenia</td>
<td>5</td>
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<tr>
<td>V. richardsiae</td>
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<td>V. bosseri</td>
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<td>V. monantha</td>
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<td>0.0</td>
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<tr>
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<tr>
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<tr>
<td>V. juncea</td>
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<td>0</td>
<td>0.0</td>
</tr>
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<td>V. pygmaea</td>
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<tr>
<td>V. angivensis</td>
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<td>0.0</td>
</tr>
<tr>
<td>V. gazensis</td>
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<td>1.7</td>
</tr>
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<td>V. schimperi</td>
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<td>V. fischeri</td>
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<tr>
<td>V. juruana</td>
<td>37</td>
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<tr>
<td>V. venulosa</td>
<td>66</td>
<td>5</td>
<td>7.6</td>
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<td>V. kirkii</td>
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<td>V. platyloba</td>
<td>44</td>
<td>6</td>
<td>13.6</td>
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</tbody>
</table>
6.4.3 Representation in ex situ collections

A crude estimate of whether a sufficient proportion of the species’ gene pools is conserved ex situ can be gained from the absolute numbers of genebank holdings, but this estimate does not take into consideration the comparative rarity of the species. Thus, a common species is more likely to be sampled and have ex situ representation than a rare species. In an attempt to relate adequacy of ex situ representation to comparative rarity, it may be considered appropriate for the numbers of genebank accessions to be approximately 10% of the number of herbarium specimens. Table 6.5 shows the ratio of germplasm accessions to herbarium specimens for each species. Over a third of African wild Vigna, 21 species, have no germplasm conserved ex situ (V. somaliensis, V. nuda, V. phoenic, V. virescens, V. mudenia, V. richardsiae, V. bosseri, V. monantha, V. kokii, V. procera, V. haumaniana, V. bequaertii, V. keraudrenii, V. stenophylla, V. desmodioides, V. longissima, V. microsperma, V. juncea, V. pygmaea, V. antunesii
and *V. angivensis*), which is striking when it is considered that *Vigna* provides a major exploitable genepool for African agriculture. A further 14 species have a ratio of germplasm accessions to herbarium specimens of less than 10.0, indicating undercollection. However, the converse is true for the major crop species; *V. subterranea* has more genebank accessions than herbarium specimens collected and *V. unguiculata* has 645 *ex situ* accessions, about half of the number of herbarium specimens collected.

### 6.4.4 Geographic coverage of *ex situ* collections

Whereas the previous analysis focused on the gross numbers of *ex situ* conserved accessions, this analysis focuses on the distributional range of the germplasm accessions held in *ex situ* collections for those taxa regarded as sufficiently well conserved *ex situ*. In other words, the analysis attempts to address whether the entire range of geographic distribution is represented in *ex situ* collections (see Appendix VII). *V. adenantha*, *V. dolomitica*, *V. fischeri*, *V. friesiorum*, *V. frutescens*, *V. gazensis*, *V. hosei*, *V. juruana*, *V. laurentii*, *V. longifolia*, *V. macrorhyncha*, *V. marina*, *V. parkeri*, *V. schimperi*, *V. triphylla* and *V. venulosa* were found to have been sampled from less than 25% of their geographical range and therefore the current *ex situ* collections are inadequate. Thus further sampling of these species from the remainder of their distribution should be a priority, along with those species for which no current *ex situ* collections exist.

### 6.4.5 Taxon coverage of *ex situ* collections

It was also necessary to test whether for *Vigna* species that have multiple infraspecific categories, each infraspecific taxon was adequately represented in *ex situ* collections (see Appendix VIII). *V. comosa*, *V. filicaulis*, *V. friesiorum*, *V. gracilis*, *V. haumaniana*, *V. hosei*, *V. juncea*, *V. marina*, *V. radiata* and *V. subterranea* were each found to have been unevenly sampled for their infraspecific taxa. While the infraspecific taxa of *V. ambacensis*, *V. frutescens*, *V. membranacea*, *V. oblongifolia*, *V. parkeri*, *V. radiata* and *V. vexillata* are more evenly sampled.

So, although the species may have significant numbers of *ex situ* conserved accessions as a whole, these accessions do not adequately represent each subordinate taxon and therefore further collecting of these undercollected infraspecific taxa is required. Even some infraspecific taxa within *V. unguiculata* (notably subsp. *aduensis*, subsp. *baoulensis*, subsp. *burundiensis* and subsp. *letouzeyi*) were not well represented in *ex situ* collections and this gap in conserved material for the most important cultivated African legume should be addressed as a matter of urgency. Although there are 41 accessions of *V. unguiculata* subsp. *unguiculata* var. *spontanea* already conserved *ex situ*, as this is the wild progenitor of cowpea it would also be advisable to undertake further collecting, linked to genetic analysis, to ensure the extent of this taxa is fully understood and the genepool is well sampled.
### Table 6.6. Usage of Vigna species.

<table>
<thead>
<tr>
<th>Species</th>
<th>Human food</th>
<th>Animal food</th>
<th>Materials</th>
<th>Plant uses</th>
<th>Social use</th>
<th>Poison</th>
<th>Medicine</th>
<th>Environmental</th>
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<tbody>
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<tr>
<td>V. ambacensis</td>
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<td>V. fischeri</td>
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<td>–</td>
<td>√</td>
<td>–</td>
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</tr>
</tbody>
</table>

**6.4.6 Use**

The usefulness of Vigna species will be a particular incentive for establishing conservation programmes. Vigna species are listed with their uses in Appendix IX and these data are summarized in Table 6.6. Generally, those species most directly associated with human food, particularly in regions where subsistence agriculture predominates, will be given highest conservation priority.

**6.4.7 Taxon extinction assessment**

The risk of species extinction was estimated by applying Solow’s equation (Solow, 1993) as proposed by Burgman et al. (1995), which uses a combination of collection timing, frequency and specimen numbers (see Appendix X). The species most at risk were V. racemosa, V. bosseri, V. gracilis, V. longifolia, V. somaliensis, V. trilobata, V. mudenia, V. stenophylla, V. juruana, V. macrorhyncha, V. monantha, V. procera, V. virescens and V. benuensis, in order of increasing threat. Of these, V. longifolia, V. trilobata and V. juruana are not species native to...
Africa and their disjunct distribution indicates multiple introductions, therefore their active conservation is likely to be of low priority, but resources should be focused on further systematic collecting of *V. racemosa*, *V. bosseri*, *V. gracilis*, *V. somaliensis*, *V. mudenia*, *V. stenophylla*, *V. macrobrachya*, *V. monantha*, *V. procera*, *V. virescens* and *V. benuensis*, as well as consideration of the establishment of *in situ* genetic reserves for these species.

The Taxon Vulnerability Assessment score is included in the conspectus but the individual component scores that contribute to the Taxon Vulnerability Assessment, along with the overall score, are provided in Appendix XI.
7. BIOGEOGRAPHIC ANALYSIS

7.1 Spatial analysis of existing collections

Each geographic area is ecogeographically unique; the combination of geology, edaphic, latitude, climate (and affect of climate change), biota, ecological history and anthropomorphic factors provides a unique range of constraints that define that locality, these constraints then act on a species genepool giving rise to unique patterns of genetic diversity associated with particular geographic locations (Maxted et al., 1995). With finite conservation funding there is an imperative to maximize efficiency and the accurate spatial mapping of genetic diversity is an essential prerequisite for effectively prioritizing conservation interventions. The task of measuring genetic diversity at a location presents many difficulties, and the subsequent extrapolation from areas that are studied to other, less well-studied, regions is a problem central to biodiversity research (Colwell and Coddington, 1994; Guarino et al., 1999). A germplasm collection in a genebank aims to contain the maximum amount of genetic variation in order to be able to respond to both current and anticipated future uses (Allard, 1970; Brown and Marshall, 1995). However, Hijmans et al. (2000) analyzed wild potato genebank collections for bias in their geographic representativeness and detected strong overcollecting along roads and within areas previously identified as species-level hotspots for the genepool. Herbarium collections likewise have strong biases, reflecting the specialization of botanists. These biases must be acknowledged in any analysis of such point data.

Maxted et al. (1995) and Anderson et al. (2002) both state that shaded enclosed outline maps of species ranging between and beyond known localities are likely to be misread in terms of density and to overestimate species distribution, while dot maps of known localities portray species distribution conservatively. Geographic bias in collecting efforts creates further error in approximating species range. Species distribution modelling presents a means of extrapolating species range from point localities to a wider region while minimizing the risk of over- or underestimation (Franklin, 1995). Guisan and Zimmerman (2000) discuss some of the applications of species distribution modelling, and the various algorithms that have been applied to the problem. Many of these methods use climatic variables as the presumed principal drivers of geographic distribution (Walker and Cocks, 1991; Franklin, 1995; Guisan and Zimmerman, 2000). Jones et al. (1997), for example, used the computer program FloraMap to predict the geographic distribution of wild bean (*Phaseolus vulgaris* L.) based on the distribution of germplasm and herbarium specimens. The results correctly predicted areas where the species had not been collected, but was reported to occur in the literature. Segura et al. (2003) used the same software to map the geographic distribution of five species of *Passiflora*, and successfully guided germplasm collecting in Ecuador. Jarvis et al. (2004) used a similar process to collect germplasm of *Capsicum flexuosum* Sendtn. in Paraguay, finding six previously undiscovered populations based on *a priori* predictions of potential species range. Guarino et al. (2001) provide a general discussion on the application of GIS in the conservation and use of plant genetic resources.
7.2 Analysis strategy
Using the extensive herbarium and germplasm Vigna collection data spatial analysis has been performed with the following objectives:

a. Quantify basic statistics of geographic distribution for each Vigna species.
b. Locate the hotspots in Africa where most Vigna species have been found.
c. Assess the potential distribution of each Vigna species using predictive distribution models.
d. Locate conservation gaps, where Vigna species are likely to occur, but have not yet been found.

The strategy combines two different analyses of species distribution, one that locates the actual hotspots of Vigna richness (i.e. areas where numerous species are known to occur) and another that attempts to predict hotspots of species richness based on the potential distribution of each species, and that therefore may include areas until now unexplored for Vigna. Combining these two results allows conservation gaps to be identified, and permits an analysis of the current status of in situ and ex situ conservation of the Vigna gene pool.

7.3 Methodology
7.3.1 Geographic coordinates in the specimen database
Some 2065 specimens in the original database (or 22% of the 9179 total specimens) lacked geographic coordinates. These were manually examined one by one, and where possible geographic coordinates were assigned using gazetteers of populated places for Africa (available within DIVA-GIS at diva-gis.org), which include the coordinates of some 547 490 villages/towns/cities across the whole continent. If the collection was made at a documented distance from a populated place, this information was included in the calculation of the geographic coordinates.

All geographic coordinates in the Vigna database of existing collections were then subjected to an error checking exercise using various methods and tools. The first process involved the identification of erroneous coordinates. These included entries with the following errors:

- The specimen fell in a body of water (sea or lake).
- The specimen was located in a country other than that stated in the passport data.
- The specimen was located in the wrong department/state/province, assuming information on the administrative district was available in the passport data.

Some 2587 entries were found to have one or more of these errors. Each of these entries was then manually revised, and the true coordinates assigned using the locality information in the passport data and using the same method as for those collections without geographic coordinates. In the absence of any descriptive locality information, collections with geographic errors were excluded from any spatial analysis. The final data set used in this analysis contained 7733 accurately geo-referenced entries.
7.3.2 Basic species distribution statistics
To quantify the area over which each species is distributed, given the available data, the maximum distance (MaxD) and the circular area (CA) over which observations were distributed were calculated following the methods of Hijmans et al. (2001). MaxD is the longest distance between any pair of observations of one species. CA is calculated by assigning a circle of radius r (in this case r=50 km) to each observation. The area over which the species is distributed is then calculated with overlapping areas being included only once. Area is expressed relative to the area of one circle. The CA statistic was plotted against the number of observations of a species to explore differences in abundance among species. This was quantified using a relative CA (R CA) calculated as CA/number of observations. The number of observations recorded in protected areas was also determined using the Global Protected Areas Dataset held by the World Conservation Monitoring Centre (UNEP-WCMC, 2002).

7.3.3 Analysis of known hotspots of richness
Areas of high species richness were located by determining and displaying the number of species occurring in each cell of a 50×50 km grid using DIVA-GIS (Hijmans et al., 2001). DIVA-GIS is available at no cost from diva-gis.org, and the reader will find further information about its use in a plant genetic resources context in Hijmans et al. (2002a). Species richness is used as a measure of taxonomic diversity because it is a simple, useful, widely used and easily understood parameter (Gaston, 1996). It is also less sensitive to the problems of unsystematic sampling intensities and procedures than other diversity indices (Hijmans et al., 2000). Species richness was calculated for the Vigna genus at the section and species level, and also calculated for V. unguiculata at the subspecies level.

7.3.4 Complementarity analysis
To determine optimal locations for in situ reserves to conserve maximum species diversity, a study of complementarity was undertaken using the DIVA-GIS software (Hijmans et al., 2001, 2002a). The complementarity procedure is based on the algorithm described by Rebelo (1994) and Rebelo and Sigfried (1992). The aim is to identify grid cells of a defined size that complement each other in terms of species composition. The process is iterative, whereby the first cell is the most species rich. The second iteration locates a grid cell that is richest in species not already represented in the first iteration. This iterative process continues until all species have been represented. We computed the minimum number of grid cells needed to capture all 69 species in the Vigna genus. The grid cell size was defined as 100×100 km.

7.3.5 FloraMap distribution modelling
FloraMap (Jones and Gladkov, 1999) was used to develop climatic models for predicting the diversity of Vigna species in the study area. This software was developed at the International Center for Tropical Agriculture (CIAT) for predicting the distribution of organisms in the wild when little or nothing is known of the
physiology of the species involved. It is assumed that the climate at the points of observation and/or collection of a species is representative of the environmental range of the organism. The climate at these points is used as a calibration set to compute a climate probability model.

FloraMap uses climatic data from a 10-minute grid (corresponding to 18×18 km at the equator) derived from observations from over 7400 meteorological stations across Africa. A simple interpolation algorithm based on the inverse square of the distance between stations and the interpolated point is used. For each interpolated pixel, the five nearest stations are used in the inverse distance equation. The climatic variables included are the monthly averages for temperature, rainfall, and diurnal temperature range. Mean temperature is standardized with elevation using the NOAA TGP-006 (NOAA, 1984) digital elevation model and a lapse rate model (Jones, 1991). Rainfall and diurnal temperature range remain independent of elevation. A 12-point Fourier transform is applied to each variable to adjust for geographic differences in the timing of major seasons. For further information the reader is referred to Jones et al. (1997, 2002).

For each accession the 36 climate variables (12 monthly means for temperature, rainfall and diurnal temperature range) are extracted for the pixel in which the accession is located, and a principal components analysis (PCA) is applied to identify a smaller number of variables that account for the bulk of the variance in climate among the accession locations. The PCA is performed on the variance-covariance matrix since the Fourier analysis has transformed the variables to comparable scales. A multivariate-Normal distribution is fitted to the principal component scores so that the probability of belonging to the distribution can then be calculated for all pixels. The result is a probability surface for all of Africa.

FloraMap was used to map a probability distribution for 51 species in the genus *Vigna* across a geographical range spanning all of Africa. 14 species with fewer than 10 observations were omitted from the analysis, as the number of points was deemed too low for the results to be reliable. The excluded species were *V. bosseri*, *V. hosei*, *V. kokii*, *V. microsperma*, *V. monantha*, *V. mudenia*, *V. nuda*, *V. nyangensis*, *V. phoenix*, *V. richardsiae*, *V. somaliensis*, *V. trilobata*, *V. umbellata* and *V. virescens*. FloraMap was also used to map the potential distribution of subspecies of *V. unguiculata*. This was only possible for 7 of the subspecies, given that the remaining 4 have fewer than 10 observations.

While the climatic potential for a species may be geographically very large, in many cases the distribution is in reality much more limited (e.g. Madagascar is climatically suitable for many *Vigna* species unlikely to be present owing to the island’s long geological isolation). Historical and biological factors such as environmental change, anthropogenic habitat modification, dispersal mechanisms and edaphic requirements may be responsible for confining a species distribution to a smaller range than its climatic potential. FloraMap merely maps the potential climatic envelope where an organism could exist, and does not account for such factors. Expert opinion was used to limit the distribution for some species. It should be noted, however, that the results are likely to overestimate species range for some species.
7.3.6 Predicted richness
Potential species richness was predicted using the individual species distribution predictions. If the probability of finding a species in an individual grid square was 0.5 or greater, then the species was assumed to be present. Richness was then predicted by calculating the number of species potentially present in each grid square. This was performed both for species richness of the *Vigna* genus, and subspecies richness for *V. unguiculata*.

7.4 Results and discussion
7.4.1 Spatial distribution of collection density
Botanists have not and do not sample diversity randomly. For various reasons certain areas have been more intensively sampled than others, resulting in biased observation representativeness which will impact on the analysis. However, awareness of bias can aid interpretation of analysis results. Species-area and species-individuals curves in ecology to a certain extent show trends of increasing number of species encountered given greater collection effort (in terms of area or number of individuals sampled), and this is especially important in germplasm and herbarium collections. Collections are often made in areas most accessible by road (or river in Amazonia), regions/countries that are safe, and areas where experts feel the greatest number of interesting populations or species may be found. This typically creates a nonrandom spatial distribution of species observations points. Therefore, it is important to keep this in mind when interpreting maps of species richness generated using specimen data alone. This is certainly the case for *Vigna*; Figure 7.1 indicates the density of herbarium and germplasm collections for all African *Vigna* taxa. The areas most sampled are in Swaziland and surrounding regions in South Africa (199 specimens in a 200×200 km area) and around the southern tip of Lake Tanganyika (177 specimens). Other heavily sampled areas include the area around the Great Lakes, along the border between Tanzania and Kenya, northern Ghana, southern Malawi and northwestern parts of Zimbabwe. While, Central Democratic Republic of the Congo and southeast Angola remain undersampled and significantly large areas have yet to be sampled at all.

7.4.2 Range size statistics
Spatial analysis of the points of observation for each species produced basic information on the extent of the geographic distribution of each species (Figure 7.2). As can be seen, *V. unguiculata* and *V. vexillata* both of which are cultivated are the most widely distributed species, with distribution areas of nearly 4 million km² and 3.3 million km², respectively, using the 50 km circular area statistic. All other species have a distribution area of under 2 million km², with 31 species distributed over less than 100 000 km².

The maximum distance statistic presents a different measure of species geographic range by measuring the maximum distance between observations (Figure 7.3). Once again, *V. unguiculata* is highlighted as having an extensive range, with over 8000 km between the two most distant observations. Plotting
the maximum distance statistic against the CA\textsubscript{50} statistic provides information as to the shape of the geographic range (Figure 7.4). Species with a uniform, rounded and even distribution are likely to have a high CA\textsubscript{50} relative to their MaxD (\textit{V. unguiculata}, \textit{V. vexillata}, \textit{V. ambacensis} and \textit{V. luteola}), while species with a disjunct or fragmented distribution will have a high MaxD relative to the CA\textsubscript{50} statistic. These include \textit{V. adenantha} (Madagascar, East Africa and West Africa), \textit{V. longifolia} (Madagascar and West Africa) and \textit{V. stenophylla} (West Africa and Mozambique).

The CA\textsubscript{50} statistic was plotted against the number of observations to explore differences in abundance among species (Figure 7.5). A species with a high number of observations per CA\textsubscript{50} would be abundant within its area of distribution (or densely collected), whereas a low number would indicate that a species has a more scattered distribution within the range in which it occurs (or is less densely collected).

On average \textit{Vigna} spp. had an RCA\textsubscript{50} of 0.37 times the number of observations. This figure is higher than statistics previously calculated for collections of wild potato species (0.15) (Hijmans and \textit{et al.}, 2002b) and wild peanut species (0.26) (Ferguson, personal communication), indicating that \textit{Vigna} species are either lower in abundance in the wild, or have been less densely collected. There is little variation in abundance/densities among species. \textit{V. ambacensis} is the most significant outlier, having a RCA\textsubscript{50} of 0.62 times the number of observations,

\textbf{Figure 7.1.} Density of collections in 200×200 km grid cells for the genus \textit{Vigna}. 
Figure 7.2. Observed geographic area of distribution calculated using the Circular Area statistic with a 50 km radius ($\text{CA}_{50}$).

Figure 7.3. The maximum distance statistic (MaxD) for each species.
Figure 7.4. $\text{MaxD}$ plotted against $\text{CA}_{25}$ for each species, highlighting some species with elongated/disjunct geographical ranges (e.g. *V. adenantha*, *V. longifolia*), and others with more rounded distributions (*V. unguiculata*, *V. vexillata*).

Figure 7.5. Relative circular area ($\text{RCA}_{25}$) plotted against the number of observations for *Vigna* species. Each dot refers to one species, more interesting species and outliers are labelled.
indicating low abundance or density of collecting. *V. vexillata* and *V. unguiculata* have high collection densities (0.35 and 0.34 respectively), indicating that they have been more exhaustively searched for and found.

### 7.4.3 Patterns of species richness

In a preliminary exploration of the actual spatial patterns of richness, the average number of species in each degree of latitude from the southern tip of Africa to the most northern point was calculated (Figure 7.6). The pattern is bimodal, with peaks of species richness around $10^\circ$ N and $10^\circ$ S (34 and 33 species respectively). Along the equator, between these peaks, there are about 25 species per degree of latitude. On the whole, there is greater species richness in the southern hemisphere, where various species continue to be found as far south as $35^\circ$ S. In contrast, the northern hemisphere rapidly loses species between $10^\circ$ N and $20^\circ$ N. Further north of $20^\circ$ N, only three observations of *Vigna* occur, from three different species (*V. ambacensis*, *V. luteola* and *V. trilobata*), indicating the Sahara desert has been an important barrier to *Vigna* distribution. Analyzing patterns of species richness in 50 m altitudinal bands (Figure 7.7), the greatest richness occurs in mid-elevations around 1300 m, with some 42 species. Species richness remains fairly stable from sea level to 1700 m, fluctuating between 25 and 30 species, but then takes a sharp drop, with just one or two species found above 2700 m.

Figure 7.8 indicates the proportion of *Vigna* specimens collected at various altitudes on the African continent (based on the 2500 specimens with altitude data) and it can be seen that the highest proportion of specimens have been collected between an altitude of 1001 and 1500 m.

![Figure 7.6. Species richness per degree latitude across the full latitudinal gradient where *Vigna* taxa are found.](image)
Examining spatial patterns of species richness in more detail, mapping species richness in 200×200 km grids highlights three main hotspots (Figures 7.9 and 7.10). These are around the southern tip of Lake Tanganyika (24 species), the Great Lakes (23 species) and the Cameroon Highlands (19 species). The hotspot at the southern tip of Lake Tanganyika also extends south along the west coast of Lake Malawi, containing areas with 17 species. The Great Lakes hotspot includes the northern tip of Lake Tanganyika, Lake Kivu, Lake Edward and the northern and western sides of Lake Victoria (including eight grid cells with 14–23 species, average of 18 species). Four grid cells in Cameroon have high species richness (15–19 species, average 17 species), stretching north–northeast from the coastal city of Douala up along the border with Nigeria. Central Angola (18 species) and the southern border between the Democratic Republic of the Congo and Zambia around Lubumbashi (16 species) are two other areas with notably
high species richness. While, on average, a 200×200 km grid cell in Africa south of the 17° N parallel contains six species of *Vigna*.

The richness of botanical sections in the genus *Vigna* (Figures 7.11 and 7.12) has a similar pattern to that of species richness (Great Lakes—8–11 sections, southern tip of Lake Tanganyika—10 sections, Cameroon highlands—10 sections), but with more pronounced richness along the border between Kenya and Tanzania (7–8 sections). Northern Zimbabwe also has a relatively high richness in sections (6–7 sections).

From a conservation standpoint, it is important that the germplasm collections of *Vigna* represent the full ecogeographic range of the genus. Figures 7.13 and 7.14 show separately the species richness in 200 km grid cells derived for the herbarium collections (6311 unique records) and for the germplasm collections (1422 unique records), respectively.

There are stark differences in the geographic pattern of species richness between herbarium collections and germplasm collections. The pattern of species richness in herbarium collections reflects more closely the species richness found in analyzing the entire collection (Figure 7.8), but this is expected owing to the larger sample size. In general, the germplasm collection contains many geographic holes, as well as underrepresenting the species richness of many already sampled regions. In order to conserve the genetic resources of the *Vigna* genus, there are many areas where *ex situ* collections should be made, including the Democratic Republic of the Congo, Angola, Kenya, Uganda, Madagascar, and some western African countries including Guinea and Sierra Leone.

Looking in more detail at patterns of subspecies richness in *V. unguiculata* (Figures 7.15 and 7.16), different geographic areas are identified as hotspots. The greatest subspecies richness occurs in a 200 ×200 km grid cells between Zimbabwe and Mozambique, around the city of Mutare, where five different subspecies have been found. Eleven other 200×200 km grid cells contain four subspecies, including southern Malawi, the southern tip of Mozambique and its border with Swaziland and South Africa.

### 7.4.4 Complementarity

Twenty-three 100×100 km grid cells were required to include all 69 species of the genus *Vigna* (Figure 7.17), though just three of these grid cells contain 37 species (54% of all species in the genus). Figure 7.18 shows the 23 grid cells ordered in order of complementarity and marked on a map of Africa, and the most important grid cell (iteration 1) includes the hotspot of species richness at the southern tip of Lake Tanganyika, where 23 species are found. However, the second iteration is not in any of the other previously outlined hotspots, but in the coastal area of Sierra Leone, where eight further species can be found. This indicates that the three hotspots (the Great Lakes, southern tip of Lake Tanganyika and the Cameroon Highlands) are in fact fairly similar in species composition. The third grid cell, within the Great Lakes hotspot contains just three species different to those already found in the previous two iterations.
The remaining 20 grid cells pick up just 1–3 species each, and are fairly evenly spread around the African continent. Many of the species captured in the final iterations are endemic species with highly restricted ranges.

### 7.4.5 Predicting species richness

Many of the hotspots identified in Figure 7.18 correspond to areas where collection has been particularly intense (Figure 7.1). It is difficult to identify whether this is because the hotspots are genuinely the most species rich areas on the African continent, or whether these regions have been identified as hotspots partly *because* they have been more completely sampled than other regions. Predicting the distributions of species using independent variables (in this case climate), and then calculating potential species richness goes some way in separating these two possibilities. Figure 7.19 shows the result of this analysis, highlighting some areas with potentially very high species richness that have not been identified previously. The region identified as most species rich in Figure 7.9, the southern tip of Lake Tanganyika, is predicted to have 19–28 species using FloraMap. This is comparable with what has already been found in this region. The Great Lakes region also has comparable predicted species richness to observed species richness, with 15–24 species predicted to occur compared with the 14–23 already found in the region. Interestingly, the finer detail of the predicted species richness map shows a complex pattern of areas of both low and high richness in this hotspot. The Cameroon highlands are predicted to harbour 12–24 species, compared with the 15–19 already found. This indicates that the three primary hotspots highlighted in Figure 7.9 have been collected sufficiently to represent their potential species richness. However, some areas have potentially much higher species richness than has currently been found or collected. Most of the Democratic Republic of the Congo has potentially very high species richness, with 21–31 species potentially found in the northern and east-central regions of the country. The Congolese shores of Lake Mweru are predicted to have the highest species richness, with 34 species potentially being found there. Yet to date there are no known collections of *Vigna* in this region. The area to the south of Lake Victoria, through much of western Tanzania, is also predicted to have high species richness, with 17–31 species. There have only been 42 collections made in this area, but these include 12 different species, which suggests that more collecting should be made in this region.
Figure 7.9. Species richness of *Vigna* in 200×200 km grid cells.

Figure 7.10. Species richness of *Vigna* in 20×20 km grid cells smoothed using inverse distance weighting and a window of 200 km radius.
Figure 7.11. Section richness of *Vigna* in 200×200 km grid cells.

Figure 7.12. Section richness of *Vigna* in 20×20 km grid cells smoothed using inverse distance weighting and a window of 200 km radius.
Figure 7.13. Species richness of herbarium collections only in 200×200 km grid cells.

Figure 7.14. Species richness of germplasm collections only in 200×200 km grid cells.
Figure 7.15. Subspecies richness of *V. unguiculata* in 200×200 km grid cells.

Figure 7.16. Subspecies richness of *V. unguiculata* in 20×20 km grid cells smoothed using inverse distance weighting and a window of 200 km radius.
Figure 7.17. Accumulation of species for each iterative addition of a 100 km grid cell in the complementarity analysis. Note three grid cells contain 50% of all 70 species of Vigna.

Figure 7.18. Complementarity analysis of grid cells in order of priority for in situ conservation.
In West Africa, Central Togo potentially has the highest species richness, with 16–29 species predicted to exist. There have been only 17 specimens collected in this region, representing eight species. Once again, this region could potentially harbour more species than have been documented, and should be a priority for *ex situ* exploration. Also worthy of note in West Africa is the central region of Côte d’Ivoire, where 16–24 species are predicted to be present, just five specimens, representing four species, are included in the database.

Predicting the distribution of subspecies richness in *V. unguiculata* also identifies some areas worthy of further exploration (Figure 7.20). The highest predicted species richness (five subspecies) is found at the southern tip of Mozambique and the region directly over the border in South Africa, where *V. unguiculata* appears to be comprehensively collected. Some areas in eastern Tanzania are also predicted to have high species richness (five subspecies), which is also reflected in the specimen collections. Once again, the area of most importance to note is Central Angola, where four subspecies are predicted to be found, but where few collections have been made.
7.5 Climatic characterization of Vigna species
To characterize the environments preferred by different species, highlight the factors that may influence their geographic distribution and provide an indication of tolerances to abiotic stress, climate data were extracted for each collection point and generalized for individual species.

7.5.1 Methodology
The species means for each of 36 climate variables (monthly means for minimum temperature, maximum temperature and rainfall) were subjected to Principal Components Analysis (PCA) and cluster analysis (Euclidian distances, Ward’s method) using the STATISTICA software. Appendix XII reports species statistics for mean, maximum and minimum annual temperatures, and mean annual rainfall for each Vigna species.

7.5.2 Results and discussion
The analysis reveals clear differences among species in their climatic requirements, which could potentially be exploited by plant breeding and introduction programmes. To illustrate this point better, the species are arranged in order of increasing mean annual temperature and mean annual rainfall in
Figures 7.21 and 7.22 respectively. Mean annual temperature at collection points has an overall mean of 22°C (s.d.=3.3), ranging from a mean of 17°C (s.d.=2.05, n=62) for *V. schlechteri* to 29°C for *V. trilobata* (note the latter is only represented by a single specimen in the database). Mean annual rainfall ranges from 44 mm (*V. trilobata* again) to 655 mm (s.d.=216.4, n=23) for *V. longifolia* (overall mean 380 mm, s.d.=147.1).

The PCA analysis resulted in the first two principal components accounting for over three-quarters of the overall variability in the data. The resulting PCA plot is shown in Figure 7.23. The first component essentially reflects decreasing temperature, and separates out a group of six species, including *V. schlechteri*, adapted to relatively cool conditions (red circle). The second principal component is positively correlated with rainfall and separates out two species (*V. trilobata* and *V. somaliensis*), which seem to be adapted to relatively arid conditions (blue circle).

The bulk of species not belonging to the two small groups mentioned above seem to divide into two about equally sized groups with regard to temperature, with *V. unguiculata* falling almost exactly in the middle, see Figure 7.24. The mean temperature and rainfall values for *V. unguiculata* (n=1460) are in fact 23°C (s.d.=3.2) and 319 mm (s.d.=131.4), which means that its adaptation is very similar to that of the genus on the whole, though perhaps with a tendency towards somewhat more arid environments than is typical.
Figure 7.23. Principal components plot of multivariate analysis of climatic adaptations for each species. In general terms principal component 1 represents the temperature gradient (descending) and principal component 2 represents the rainfall gradient (ascending).

Figure 7.24. Dendrogram of results from the multivariate cluster analysis (Ward’s method) for climate variables per species.
8  ECOGEOGRAPHIC DISCUSSION

8.1 Introduction
This chapter discusses the results of the ecogeographic survey, highlighting which *Vigna* taxa and which regions of Africa are underconserved and, just as importantly, which are overconserved. It makes specific recommendations for an overall conservation strategy for African *Vigna*, as well as recommending specific collecting activities, potential sites for genetic reserves and associated actions that will enhance conservation and utilization. As the focus is native African *Vigna* conservation, several species that are found in Africa but that are not native to the continent (*V. adenantha*, *V. juruana*, *V. longifolia*, *V. marina*, *V. radiata* and *V. marina*) will not be given priority for conservation action.

The results of an ecogeographic survey, at least as defined by Maxted *et al.* (1995), are contained in the ecogeographic database, conspectus and report. The ecogeographic database contains the raw data of the project, and is provided in .txt (tab delimited) format on the accompanying CD. The conspectus, which summarizes the available ecological, geographic and taxonomic information for each taxon throughout its range in Africa, forms a major part of Chapter 4. Finally, the report should discuss and interpret the collated data and present a clear summary of conservation priorities. That is what follows here.

8.2 Ecogeography of *Vigna* in Africa

8.2.1 Taxonomy
As discussed in Chapter 2, the classification used in this study is an amended version of that proposed by Maréchal *et al.* (1978), which was in turn derived from Verdcourt (1970, 1971), and has subsequently been revised at least in part by Pasquet (1993b, 2001). An attempt has also been made to incorporate the many recently described *Vigna* taxa. However, the classification of *Vigna* presented in Appendix I should not be taken as a classification in the taxonomic sense—a listing of *Vigna* taxa into subgenera, sections, species, subspecies and varieties on the basis of their relationships. It is simply a systematic listing of what the authors see as the currently accepted *Vigna* taxa, without having undertaken any novel taxonomic studies. It is important to describe in detail the classification used to clarify the circumspection and delimitation of the taxa included in the ecogeographic study. Having stressed this point, it is clear that one of the urgent actions required to facilitate the conservation of African *Vigna* is the preparation of a continental taxonomic revision of African *Vigna*. This will involve clarifying the relationship between the various New World taxa recently transferred to *Vigna* from *Phaseolus* by Delgado-Salinas *et al.* (1993), and their African and Asian counterparts. Remy Pasquet, with his generic account for Flora Zambesiaca (Pasquet, 2001) has established an excellent foundation, but this work needs to be extended to the whole continent. There is a particular problem with the West African species, which have not been studied in detail since Hepper (1958), and it seems likely that several current species may not
warrant specific status. Are, for example, *V. luteola*, *V. marina* and *V. oblongifolia* conspecific (Pasquet, 2001)? Is *V. hosei* var. *pubescens* sufficiently distinct from var. *hosei* to warrant specific status (Pasquet, 2001)? Does *V. dolomitica* only represent an ecotype of *V. reticulata* (Maréchal et al., 1978)? Is *V. phoenix* merely a large-flowered variant of *V. pygmaea*? And, does *V. somaliensis* actually exist? Thulin (1993) could not locate material matching the type.

As well as a revision, conservationists need identification aids for African *Vigna* taxa. How can the African conservationist hope to conserve the breadth of *Vigna* species diversity if the keys that are available each covers only part of the continent and they are spread through numerous, sometimes obscure publications? Historically, the available keys were produced for localized floras and so are both geographically and taxonomically restricted, necessitating the use of multiple keys to identify the full breadth of *Vigna* taxa. The existing keys also show a heavy reliance on complex floral characters, which means they have remained largely unused by all but a few taxonomists, and even fewer germplasm collectors. Descriptions and a key to African *Vigna* species are provided in Appendixes II and III respectively, as well as an interactive key to African *Vigna* species on the accompanying CD. The main objective of these new aids is to facilitate identification for conservationists, not professional taxonomists, therefore the descriptions and keys use easily recognized gross morphological features, they avoid complex descriptive jargon, incorporate images and also permit multiaccess identification, meaning that if some characters are absent identification can still be made on the remaining characters.

The fact that this discussion of the urgent need for identification aids follows a call for a full revision of African *Vigna* taxa may seem to imply that the production of new descriptions and keys is premature. However, conservationists need the descriptions and keys now, if they are to attempt to stop genetic erosion and effectively manage *Vigna* diversity in Africa. There appears to be no other initiative to produce identification aids for *Vigna* on a continental basis and the publication of a full revision of African *Vigna* is not imminent, so the new descriptions and keys are a stopgap until such a revision eventually becomes available. To assist the taxonomist undertaking the revision, the full DELTA (Dallwitz, 1980; Dallwitz et al., 1996) and Lucid (Lucid, 2003) data sets are included on the accompanying CD in the hope that they will be useful in helping to generate local regional keys and ultimately the new descriptions and keys that will be required once the full revision of African *Vigna* taxa has been achieved.

### 8.2.2 Phytogeography

The distribution of each taxon is discussed, and the actual and predicted distributions, based on herbarium specimen and genebank accession passport data, are shown graphically in the conspectus (Chapter 4). More detailed distribution data are available from the African *Vigna* database available on the accompanying CD. The reliability of extrapolating detailed distribution data from passport data, where the latitude and longitude are often inferred from the nearest known location and a gazetteer, is certainly open to question. The precision of
the distribution predictions is highly dependent on the frequency of collections, which in turn is a reflection of the particular interests of collectors, the accessibility of areas of occurrence, and the rarity, “visibility” and weediness of the species. The inferences drawn from this information are also dependant on the degree of specimen or accession exchange between herbaria or genebanks; rarer taxa are often duplicated more extensively than common species. However, as conservationists, unless we know of any specific instances of bias in sampling, we must assume that the sampling of herbarium specimens and genebank accessions provides a “rough” indication of both the distribution pattern and frequency of a taxon. Certainly, in general, this assumption appears to hold true for African Vigna, except for the countries that are thought to be particularly undercollected (notably Angola, Burundi, Cameroon, Central African Republic, Democratic Republic of the Congo, Malawi and Nigeria). Bearing these caveats in mind we can draw general conclusions about the phytogeography of African Vigna.

Of the seven subgenera recognized by Maréchal et al. (1978), four are native to Africa and the majority of species in these are endemic to the continent. With the exception of V. luteola and perhaps V. membranacea, which is reported to be a summer weed in fields in Egypt (El Hadidi et al., 1996), most species of Vigna in Africa occur south of the Sahara. Similarly, no species of Vigna has been recorded from the western Cape of South Africa, western Namibia and Lesotho. It appears that the limiting factor in North Africa, the western Cape and western Namibia is low rainfall, most of these areas receiving <125 mm rainfall annually. In Lesotho, the likely limiting factor is low winter temperature, and frequent frosts. The mean annual temperature at collection points for Vigna is 22°C (s.d.=3.3), ranging from a mean of 17°C (s.d.=2.05, n=62) for V. schlechteri to 29°C for V. trilobata (note the latter is only represented by a single specimen in the database), while mean annual rainfall ranges from 44 mm (V. trilobata again) to 655 mm (s.d.=216.4, n=23) for V. longifolia (overall mean 380 mm, s.d.=147.1).

Based on their distribution patterns, African species of Vigna can be divided into several subgroups, on the basis of their distribution patterns as revealed by the ecogeographic analysis:

A. Widespread species—This group contains species whose distribution covers most of sub-Saharan Africa and includes V. luteola, V. oblongifolia, V. comosa, V. frutescens, V. unguiculata (subsp. dekindtiana) and V. vexillata. Apart from V. luteola, which shows a preference for papyraceous swamps and other aquatic vegetation, this group is found in a wide range of habitats, including grasslands, woodlands, bushland etc., all of which are common in many parts of the continent. V. adenantha, V. ambacensis and V. reticulata can also be included in this group, although their distribution is slightly narrower, as they do not occur in southern Africa (sensu Royal Botanic Gardens, Kew’s geographic classification.

B. Narrow endemics—These are very geographically restricted species, which fall into two categories: (1) those that have been relatively recently described, such as V. bossieri, V. benuensis, V. kokii, V. microsperma, V. monantha, V. mudenia, V. nyangensis, V. phoenix, V. richardsiae and V. virescens; and (2)
those that were described less recently and not often subsequently, such as
V. gazensis, V. laurentii, V. nuda, V. procera and V. somaliensis.

C. Northeast African species—V. monantha and V. somaliensis are probably
the only species in this group. This region also has one specific taxa of V.
unguiculata, V. unguiculata subsp. aduensis.

D. West African species—Included in this group are those species whose
distribution extends from the Zambesia towards West Africa, such as: V.
multinervis, V. gracilis, V. racemosa, V. comosa (with some southern African
records), V. pygmaea, V. filicaulis, V. stenophylla, V. venulosa (with a few
records from Central Africa and Zambeicia) and V. longifolia, V. kirkii, V.
longissima, V. juruana and V. adenantha. Species that are found from Central
Africa to West Africa include V. desmodioides and V. nigritia. There are no
endemics to this region. This region also has a number of infraspecific
taxa of V. unguiculata, notably V. unguiculata subsp. baoulensis and subsp.
letouzeyi.

E. Central East African species—This group is largely endemic to Central Africa
and includes V. bequaertii, V. laurentii, V. haumaniana (with records from
Tanzania and Zambia) and V. dolomitica. This region also has one taxon of V.
unguiculata, V. unguiculata subsp. burundiensis.

F. East African species—These include V. antunesii, V. dolomitica and V. praecox
(which also occurs in Northeast Africa). There are no endemics to this region,
but there is one taxa of V. unguiculata, V. unguiculata subsp. pubescens.

G. Zambezian species—This group includes V. radicans and V. phoenix, and
more northeasterly towards the Horn of Africa V. fischeri, V. parkeri (with a
few records from West Africa), V. membranacea, V. monophylla, V. nuda, V.
platyloba, V. schimperi and V. macrorhyncha. Most species in this group have
been recorded at altitudes above 1000 m (Verdcourt, 1970). There are no
endemics to this region.

H. Southern African species—This group includes V. kokii, V. mudenia and
V. schlechteri. This region also has a number of infraspecific taxa of V.
unguiculata, notably V. unguiculata subsp. stenophylla and subsp. tenuis.

I. Malagasy species—These are the species endemic to Madagascar: V.
angivensis V. benuensis V. bosseri V. gazensis, V. keraudrenii V. microsperma
and V. virescens.

8.2.3 Centres of diversity, endemism and complementarity
The highest concentration of Vigna species occurs in the Zambezian centre of
endemism (White, 1983), with 80% of all African Vigna species present there.
The Guinea-Congolian and Sudanian centres of endemism have the next highest
level with 59% of all species of Vigna in both, while the Guinea-Congolian/
Sudanian transition region contains 55% of all species. Other regions of high
species richness include the Lake Victoria Mosaic, the Guinea-Congolian/
Zambebian regional transition zone, each with 45% of all Vigna species, as well
as the Somalia-Masai centre of endemism, with 43% of all species. Conversely,
the Sahara regional transition zone, the Cape regional centre of endemism,
Karoo-Namib and the Tongaland-Pondoland regional mosaics are the most species poor, with 3.5–12.5% of *Vigna* species.

The highest concentration of *Vigna* species, i.e. the hotspots for *Vigna* diversity, occurs between 10° N and 20° N in the Zambezi River basin and Central African regions, mainly within the Democratic Republic of the Congo. There are three particular hotspots (shown in Figures 7.9 and 7.10) at the southern tip of Lake Tanganyika (24 species), around the Great Lakes (23 species) and in the Cameroon Highlands (19 species). The cell 8–9° S, 31–32° E, at the southern tip of Lake Tanganyika within the Zambezian centre of endemism, contains the highest number of species (24 species). The Great Lakes hotspot at 2–3° S, 29–30° E includes the northern tip of Lake Kivu and Lake Edward (with 23 species). Four grid cells in Cameroon have high species richness (15–19 species, average 17 species), stretching north–northeast from the coastal city of Douala along the border with Nigeria. Central Angola (18 species) and the southern border between the Democratic Republic of the Congo and Zambia around Lubumbashi (16 species) are two other areas with notably high species richness. However, it is important to reiterate that this diversity may not be owing to these grid cells being inherently rich in *Vigna* species, but to particularly intense sampling in these areas. The highest ranking grid cell for species with small ranges is 20–21° S, 47–48° E in Central Madagascar; it is home to the following rare *Vigna* taxa: *V. parkeri* subsp. *parkeri*, *V. angivensis*, *V. bossertii*, *V. keraudrenii* and *V. microsperma*. The highest ranking grid cell on mainland Africa is 11–12° S, 27–28° E in Southwest Democratic Republic of the Congo, which includes *V. dolomitica* and *V. laurentii*.

In terms of complementarity, the most important grid cell is the hotspot of species richness at the southern tip of Lake Tanganyika, where 23 species were found, as discussed above. The area with the highest number of species not included in the first area is the coastal area of Sierra Leone, where eight further species can be found, and a third grid cell, within the Great Lakes hotspot contains just three species different from those already found in the previous two areas. The 34 species found in these three grid cells represent 56% of the total number of *Vigna* species in Africa. The area of highest predicted species richness is located on the Congolese shores of Lake Mweru, where 34 species could be potentially found, but to date there are no known collections of *Vigna* in this region! The second highest area is the Cameroon highlands, with 12–24 species predicted to be present, while the northern and east-central region of the Democratic Republic of the Congo has potentially 21–31 species. In West Africa, Central Togo potentially has the highest species richness, with 16–29 species predicted to exist. For infraspecific diversity within *V. unguiculata*, the highest predicted species richness (5 subspecies) is found at the southern tip of Mozambique and the region directly over the border in South Africa, but *V. unguiculata* already appears to have been comprehensively collected in this area. Other potentially interesting areas for *V. unguiculata* are eastern Tanzania (with five subspecies) and Central Angola (with four subspecies), in both of which fewer collections have been made.
8.2.4 Ecology

Interpretation of the full distribution and ecological requirements of each species depends to a large extent on the quality and quantity of data recorded on the herbarium specimens and genebank accessions on which the survey is based. Maxted et al. (1995) draw attention to the fact that collectors in the past have been remiss in recording detailed ecological data. For the genus *Vicia*, Maxted (1995) found soil type was recorded from 25% of collections, altitude from 55% and habitat from 65%, while Rihan (1988) for *Medicago* species found 15% for soil type, 26% for altitude and 52% for habitat. For the current data set, the figures are much lower for soil type (6.3%) and habitat (41.3), but the altitude has been estimated for all sites using DIVA-GIS (diva-gis.org). The accuracy of the inference of environmental variables (latitude and longitude, geology, soil, altitude, etc.) of collection sites from location data by reference to maps or GIS layers will depend on the precision of the location data available, the topography of the collection area and the precision of the environmental data being used. For example, if the collection site is situated on a gently undulating plain, then a crude estimate of altitude may be gained from the location data, as the altitude is unlikely to vary significantly in the vicinity of the collecting site. However, if the collection site is situated in a mountainous area, then the altitude is likely to vary markedly within relatively short distances, and so estimates of site altitude based on location may be misleading unless this is extremely precisely specified. Therefore caution must be exercised when discussing ecological patterns from such inferred data rather than from detailed field observations. However, the following section attempts to summarize the ecological patterns observed for *Vigna* in Africa.

Members of the genus are predominantly herbaceous plants which occur in a wide range of habitats, but particularly grasslands, open woodlands, bushlands and thickets. Perennial species generally possess large, woody rootstocks, which usually die back in the colder months, growing again from the rootstocks in warm weather or following burning. There are several pyrophytic species (see Table 8.1), which flower directly from the rootstocks following burning, although in some cases, e.g. *V. frutescens*, the pyrophytic tendency is not always apparent. A few species, including *V. luteola* and *V. longifolia*, show a preference for wetter habitats, including marshes, swamps and moist vegetation, while others are often associated with seasonal flooding (see Table 8.1). *V. marina* is exclusively associated with coastal areas, where it may occur on beaches as well as river estuaries. A number of species appear to be resistant to intensive grazing, including *V. frieisiorum*, *V. frutescans*, *V. luteola*, *V. parkeri*, *V. macrorhyncha*, *V. oblongifolia* and *V. vexillata*. *Vigna* species are most commonly associated with sandy soils, and less commonly clay loam soils, over laterite or granite rocks.
Table 8.1. *Vigna* species associations with ecogeographic characteristics.

<table>
<thead>
<tr>
<th>Ecogeographic characteristics</th>
<th>Recently burnt sites</th>
<th>Moisture level</th>
<th>Soil type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry sites</td>
<td>Seasonally inundated</td>
<td>Sandy loam</td>
<td>Clay loam</td>
</tr>
<tr>
<td>&quot;V. ambacensis&quot;</td>
<td>&quot;V. aconitifolia&quot;</td>
<td>&quot;V. adenantha&quot;</td>
<td>&quot;V. friesorum&quot;</td>
</tr>
<tr>
<td>&quot;V. antunesii&quot;</td>
<td>&quot;V. antunesii&quot;</td>
<td>&quot;V. ambacensis&quot;</td>
<td>&quot;V. frutescens&quot;</td>
</tr>
<tr>
<td>&quot;V. frutescens&quot;</td>
<td>&quot;V. frutescens&quot;</td>
<td>&quot;V. comosa&quot;</td>
<td>&quot;V. luteola&quot;</td>
</tr>
<tr>
<td>&quot;V. juncea&quot;</td>
<td>&quot;V. haumaniana&quot;</td>
<td>&quot;V. filicaulis&quot;</td>
<td>&quot;V. marina&quot;</td>
</tr>
<tr>
<td>&quot;V. macrorhyncha&quot;</td>
<td>&quot;V. macrorhyncha&quot;</td>
<td>&quot;V. gracilis&quot;</td>
<td>&quot;V. monophylla&quot;</td>
</tr>
<tr>
<td>&quot;V. monophylla&quot;</td>
<td>&quot;V. membranacea&quot;</td>
<td>&quot;V. kirkii&quot;</td>
<td>&quot;V. multinervis&quot;</td>
</tr>
<tr>
<td>&quot;V. nuda&quot;</td>
<td>&quot;V. praecox&quot;</td>
<td>&quot;V. longifolia&quot;</td>
<td>&quot;V. reticulata&quot;</td>
</tr>
<tr>
<td>&quot;V. procera&quot;</td>
<td>&quot;V. platyloba&quot;</td>
<td>&quot;V. luteola&quot;</td>
<td>&quot;V. unguiculata&quot;</td>
</tr>
<tr>
<td>&quot;V. pygmaea&quot;</td>
<td>&quot;V. monophylla&quot;</td>
<td>&quot;V. nigritia&quot;</td>
<td>&quot;V. vexillata&quot;</td>
</tr>
<tr>
<td>&quot;V. praecox&quot;</td>
<td>&quot;V. oblongifolia&quot;</td>
<td>&quot;V. parkeri&quot;</td>
<td></td>
</tr>
<tr>
<td>&quot;V. vexillata&quot;</td>
<td>&quot;V. parkeri&quot;</td>
<td>&quot;V. racemosa&quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot;V. venulosa&quot;</td>
<td></td>
</tr>
</tbody>
</table>

Although *Vigna* taxa are associated with numerous other species, collection records indicate that there are certain species commonly found at localities alongside *Vigna*, including taxa from the following genera: *Acacia, Andropogon, Brachystegia, Combretum, Commiphora, Cynodon, Digitaria, Echinochloa, Entada, Eragrostis, Erythrina, Lannea, Loudetia, Pennisetum, Phragmites, Protea, Strelitzia, Thelypteris, Themeda, Typha* and *Uapaca*. However, these are common species of the open grassland habitats *Vigna* species prefer, and no specific obligate associations have been noted between particular *Vigna* taxa and other plants.

The phenological or flowering and fruiting time data can be used to indicate when a collecting team should visit the target area. If seed is to be collected there may be a narrow “collecting window”, as with many legume species: if the collecting team arrives too early the seed will not be ripe, too late and the pods will have shattered and the seed shed. However, it is difficult to identify precise flowering periods for individual *Vigna* taxa, first because this is likely to vary across subregions of the African continent, second because so few collectors recorded date of collection (only 3.9% of collectors recorded the day and 67.6% the month of collection), and third, because the data that are available indicate that for many *Vigna* species flowering occurs throughout the year.

### 8.3 The exploitable genepool

#### 8.3.1 *Vigna* species crop potential

Several species in the genus *Vigna* are known to be used as foods or at least to have potential for use as vegetables, root or pulse crops. Several species produce large, swollen tubers, which are eaten in various parts of the continent,
the best-known being *V. vexillata*. Its root has been shown to be rich in calcium, iron, zinc, manganese and magnesium as well as proteins (Sidduraju *et al.*, 1994) and the species is now being cultivated as a tuber crop in parts of Asia (Garba and Pasquet, 1998). Other species with potential as root crops include: *V. adenantha*, *V. ambacensis*, *V. fischeri*, *V. marina* and *V. reticulata* (Pellegrin, 1948; Burkill, 1995; Padulosi and Ng, 1990). The root protein content of *V. lobatifolia* and *V. vexillata* is much higher than that of many established root crops, such as potato and cassava (Padulosi and Ng, 1990). Other species known to have edible seeds and/or pods include *V. adenantha* (Pellegrin, 1948; Padulosi and Ng, 1990), *V. gracilis* (Burkill, 1995) and *V. unguiculata* subsp. *dekindingiana* (Padulosi and Ng, 1990). A number of species in the genus have potential as forage crops and a few are already being cultivated in different parts of the world for this purpose. These include *V. luteola*, *V. parkeri*, *V. oblongifolia* and *V. vexillata* (Skerman *et al.*, 1988). Other species of *Vigna* that have some potential as forages include *V. frutescens*, *V. marina* and *V. schimperi* (Bogdan, 1977).

8.3.2 Relationship between cultivated species and their wild relatives

It is not surprising, with so few genetic diversity studies of *Vigna* taxa, that so little is known about the subdivisions of the *Vigna* genepool. Morphological characters alone have been used to describe taxa and the degree of genetic differentiation among species has been studied only in the crop taxa. Harlan and de Wet’s (1971) primary, secondary and tertiary genepools can only be applied to *V. unguiculata* and *V. subterranea* (Chapter 2). In order to apply further genepool concepts to *Vigna*, much more detailed genetic diversity knowledge is required, but realistically this is unlikely to be available in the near future. But how do we then prioritize taxa for conservation in relation to utilization potential? What are the closest wild relatives of crop species?

There is no generally accepted way of measuring the distance between a crop and its wild relatives. It would seem logical that a taxon within the same species as the crop is a very close relative, while those outside the genus are so remote as to not be considered wild relatives. Therefore, without genetic information, the taxonomic hierarchy can be used to define taxon group and thus the degree of relatedness of a crop wild relative to the crop as follows (Maxted *et al.*, [in prep.]):

- Taxon Group 1a—crop.
- Taxon Group 1b—same species as crop.
- Taxon Group 2—same series or section as crop.
- Taxon Group 3—same subgenus as crop.
- Taxon Group 4—same genus as crop.
- Taxon Group 5—same tribe but different genus to the crop.

Therefore, we can prioritize taxa even for those species for which we have few or no genetic diversity data. See Table 8.2 for the genepool (which is based on Harlan and de Wet’s definition) and taxon group priority ratings for the *Vigna* grain legume species.
Table 8.2. Gene pools and taxon groups of African Vigna grain legume species.

<table>
<thead>
<tr>
<th>Crop</th>
<th>1st Genepool</th>
<th>2nd Genepool</th>
<th>3rd Genepool</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. unguiculata</td>
<td>A. <em>V. unguiculata</em> subsp. unguiculata cv. gr. <em>Unguiculata, Biflora, Sesquipedalis, Melanopthalmus</em></td>
<td><em>V. nervosa</em></td>
<td>Other <em>Vigna</em> species</td>
</tr>
<tr>
<td></td>
<td>B. All wild and weedy infra-specific <em>V. unguiculata</em> taxa</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V. subterranea</td>
<td>A. <em>V. subterranea</em> subsp. <em>subterranea</em></td>
<td><em>V. hosei?</em></td>
<td>Other <em>Vigna</em> species</td>
</tr>
<tr>
<td></td>
<td>B. <em>V. subterranea</em> subsp. <em>spontanea</em></td>
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</table>

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<th>TG2</th>
<th>TG3</th>
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<td>var. <em>pubigera</em></td>
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<td><em>V. comosa, V. haumaniana, V. membranacea,</em></td>
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<td></td>
<td></td>
<td><em>V. oblongifolia, V. filicaulis, V. multineris,</em></td>
<td><em>V. friesiorum, V. somaliensis, V. reticulata,</em></td>
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<td><em>V. laurentii, V. benuensis, V. hosei, V. parkeri,</em></td>
<td><em>V. radicans, V. dolomitica, V. pygmaea,</em></td>
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<td><em>V. gracilis, V. racemosa, V. desmodioides,</em></td>
<td><em>V. phoenix, V. platyloba, V. antunesii,</em></td>
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<td><em>V. subterranea, V. angivensis, V. stenophylla,</em></td>
<td><em>V. frutescens, V. bosseri, V. unguiculata,</em></td>
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<td><em>V. gazensis</em></td>
<td><em>V. schlechteri, V. keraudreni, V. monantha</em></td>
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<td>V. angivensis</td>
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<td>var. <em>ulugurensis</em></td>
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</table>
8.4 Threat assessment

The ecogeographic study needs to conclude with a clear, concise statement of the conservation priorities and proposed conservation strategy for the target taxon. The data presented thus far are a start, but a final factor that needs to be assessed before this statement can be formulated is the degree of threat, of either genetic erosion or extinction, facing the taxon. The quantification of genetic erosion is still in its infancy (Guarino, 1995; for details, connect to apps3.fao.org/wiews/Prague/tabcont.html), and remains primarily subjective and anecdotal or based on inference, because of the lack of genetic studies over time to provide the objective comparative basis for assessment. This is likely to be especially true for a group of predominantly wild species largely endemic to sub-Saharan Africa because of the comparatively poor knowledge of the African flora. Even assessment of potential species extinction is more difficult in Africa because of the lack of the necessary population level data, although the systematic work required has begun in southern Africa (Golding, 2002). A general introduction to the threats facing all African plants was presented in Chapter 3, and an assessment of the threats specifically faced by African *Vigna* is presented in Chapter 6. The following attempts to summarize the conclusions and tie them more closely to *Vigna* taxa using information from the literature and that obtained during the study.

8.4.1 Genetic erosion and extinction of African *Vigna*

As discussed in Chapter 3, African plant diversity is threatened by a number of factors, many of which are socioeconomic. Much of the African savannah has been greatly modified by the direct action of humans (e.g. logging, burning, desertification, climate change) and indirectly by overgrazing of cattle, sheep and goats. Overgrazing has left many areas of savannah that are susceptible to erosion by wind and rain (Stuart and Stuart, 1995), radically changing habitats and affecting plant populations. Other factors that pose a threat to the survival of biodiversity include unsustainable harvesting, human population pressures, modification of land use, introduction of alien species, unviable population sizes and climatic changes, with reduced rainfall being the most important factor in this category (Stuart *et al*., 1990).

Laghetto *et al.* (1998) have cited the destabilizing action of humans as the single most important factor threatening survival of wild species of *Vigna* in Africa. In Ethiopia, drastic changes in land use have been cited as the most important factor (Engels and Hawkes, 1991) while afforestation, mainly by conifer plantations, is the most important factor in Zimbabwe (Mithen, 1987). Pienaar (1992), in relation to southern African *Vigna*, cites habitat destruction for development and settlement schemes as the main threats. Although few plant collectors have recorded threats to populations of wild species of *Vigna*, a few specimens or accessions often cite grazing pressure as an important factor, while less often flooding or drought was thought to be threatening populations.

In the case of the major crop species, marginalization of traditional African crops, such as cowpea and Bambara groundnut, by improved exotic varieties
of recently introduced crops, such as Phaseolus beans and Arachis hypogea, has been and will continue to be an important factor in the genetic erosion of landraces. Even for the traditional African Vigna crops, the fact that there is increasing formal breeding activity is in time likely to result in the loss of localized native diversity. As has happened in other parts of the world, the relatively high level of landrace diversity in African crops is surely a result of the historic neglect by breeders rather than concerted conservation action.

**8.4.2 Red List data on threatened African Vigna**

There has been no comprehensive review of the threat status for African Vigna. It is difficult to obtain sufficiently accurate data to be able to assess Vigna taxa in individual countries, let alone across a whole continent. However, within Golding’s (2002) review for southern Africa, Bingham and Smith (2002) categorize Vigna comosa subsp. abercornensis as being Vulnerable D2 in Zambia. They used the 1994 Red List Categories (IUCN, 1994), which means that the subspecies is located in a very restricted area (typically less than 20 km) or that the number of locations (typically five or fewer) is such that it is prone to the effects of human activities or stochastic events within a very short time period, and is thus capable of becoming Critically Endangered or even Extinct. However, the fact that this is the only African Vigna taxon that has been ascribed a threat category should not be taken to indicate that there are no other threatened taxa.

The general lack of population data for African Vigna taxa remains a limitation in applying an IUCN Red List assessment, but it would be remiss to have collated such a relatively large ecogeographic data set without attempting at least a tentative assessment. Therefore, the authors have attempted to use the IUCN Red List Categories and Criteria version 3.1 [www.redlist.org/info/category_criteria2001] to produce an assessment for each taxon. It must be stressed that this assessment is preliminary and will need revision as more population data become available, but this is the best assessment possible with the information available. The most important data used for the IUCN Red List Category assessment are summarized in Table 8.3 and the IUCN Red List Categories assigned are provided in Table 8.4.

The IUCN Red List Categories assigned to the African Vigna indicate that approximately 50% of species fall into one of the four threat categories and, of those most threatened, i.e. given Critically Endangered status, three are endemics of Somalia (V. monantha, V. somaliensis and V. virescens). As the legume volume for the Flora of Somalia (Thulin, 1993) has only recently been published and as this involved extensive field work, it would appear that the rarity of these three species is not just an artefact of undercollecting and they should truly be classified as Critically Endangered. The situation regarding V. nuda, V. richardsiae and V. stenophylla is less clear-cut. Recently, Pasquet (2001) sank V. nuda into V. antunesii, which may explain the relatively small number of specimens seen compared with its reported breadth of distributional range. If this is accepted, then the combined taxon would not warrant a high-level threat assessment. Although recently described by Verdcourt (1970) as a restricted endemic of the
<table>
<thead>
<tr>
<th>Vigna species</th>
<th>Ex situ collections</th>
<th>Estimated distributional range (km² × 10³)</th>
<th>Ex situ sampled range score</th>
<th>Ex situ sampling over time</th>
<th>IUCN ¹ Red List category</th>
</tr>
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<td>14</td>
</tr>
</tbody>
</table>

1. IUCN Red List categories: LC = Least Concern, VU = Vulnerable, DD = Data Deficient, NT = Near Threatened, EN = Endangered.
| Genus           | Species | Total | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 |
|----------------|---------|-------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| membranacea   | 163     | 34    | 719.7 | 4 | 10 | 2 | 2 | 7 | 28 | 4 | 23 | 31 | 31 | 4 | 0  | NT |
| microspersma  | 28      | 0     | 43.4  | 10 | 0  | 0 | 8  | 3 | 2  | 1  | 2  | 8  | 1  | 1  | 0  | NT |
| monantha      | 7       | 0     | 28.6  | 10 | 0  | 0 | 0  | 0  | 0 | 0  | 0  | 0  | 4  | 3  | 0  | CR |
| monophylla    | 78      | 4     | 350.6 | 6  | 0  | 2 | 0  | 2 | 11 | 6  | 22 | 16 | 10 | 3  | 0  | LC |
| mudenia       | 5       | 0     | 24.5  | 10 | 0  | 0 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 2  | 0  | VU |
| multinervis   | 107     | 22    | 597.9 | 4  | 6  | 2 | 8  | 4  | 16 | 10 | 28 | 17 | 9  | 3  | 0  | EN |
| nigritia      | 76      | 26    | 481.0 | 2  | 3  | 7 | 5  | 6  | 13 | 2  | 14 | 10 | 6  | 0  | 0  | LC |
| nuda          | 2       | 0     | 15.6  | 10 | 0  | 0 | 1  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | CR |
| nyangensis    | 5       | 1     | 24.2  | 6  | 0  | 0 | 0  | 0  | 0  | 0  | 2  | 1  | 1  | 0  | VU |
| oblongifolia  | 277     | 90    | 1259.8| 2  | 15 | 7 | 9  | 10 | 27 | 9  | 49 | 72 | 31 | 14 | 2  | LC |
| parkeri       | 264     | 8     | 674.5 | 8  | 8  | 2 | 17 | 8  | 57 | 14 | 44 | 61 | 31 | 12 | 2  | LC |
| phoenix       | 4       | 0     | 31.3  | 10 | 0  | 0 | 0  | 0  | 0  | 1  | 0  | 2  | 1  | 0  | EN |
| platyloba     | 44      | 6     | 231.7 | 6  | 2  | 1 | 2  | 4  | 4  | 1  | 9  | 5  | 13 | 0  | 0  | LC |
| praecox       | 12      | 1     | 71.0  | 6  | 0  | 0 | 0  | 0  | 0  | 2  | 5  | 3  | 2  | 0  | DD |
| procera       | 12      | 0     | 38.9  | 10 | 4  | 1 | 2  | 0  | 0  | 4  | 0  | 0  | 0  | 0  | EN |
| pygmaea       | 66      | 0     | 262.9 | 10 | 2  | 2 | 3  | 2 | 4  | 9  | 16 | 15 | 10 | 1  | 0  | VU |
| racemosa      | 344     | 123   | 1541.4| 4  | 24 | 23 | 30 | 24 | 40 | 16 | 64 | 33 | 22 | 14 | 0  | LC |
| radiata       | 16      | 7     | 93.8  | 6  | 1  | 0 | 1  | 0  | 0  | 1  | 1  | 0  | 0  | 0  | 0  | LC |
| racidans      | 67      | 29    | 396.2 | 2  | 4  | 0 | 2  | 1  | 8  | 1  | 26 | 17 | 4  | 0  | 0  | LC |
| reticulata    | 360     | 129   | 1742.9| 4  | 16 | 9 | 13 | 20 | 51 | 26 | 75 | 79 | 37 | 10 | 0  | LC |
| richardiaeae  | 5       | 0     | 23.5  | 10 | 0  | 0 | 0  | 0  | 0  | 1  | 0  | 3  | 3  | 0  | 0  | CR |
| schimperi     | 95      | 2     | 358.5 | 8  | 1  | 4 | 2  | 3  | 24 | 11 | 17 | 19 | 8  | 2  | 1  | LC |
| schlechteri   | 68      | 10    | 190.8 | 6  | 7  | 1 | 4  | 2  | 7  | 6  | 5  | 8  | 8  | 18 | 2  | LC |
| somalinesis   | 1       | 0     | 7.8   | 10 | 1  | 0 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | CR |
| sternophylla  | 16      | 0     | 99.4  | 10 | 2  | 2 | 3  | 2 | 3  | 0  | 1  | 2  | 0  | 0  | 0  | CR |
| subterranea   | 10      | 36    | 59.3  | 6  | 0  | 0 | 0  | 0  | 1  | 1  | 1  | 6  | 0  | 0  | 0  | LC |
| trilobata     | 1       | 2     | 7.8   | 10 | 0  | 0 | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | LC |
| triphylla     | 23      | 2     | 146.4 | 8  | 6  | 1 | 1  | 2  | 2  | 2  | 1  | 5  | 1  | 2  | 0  | VU |
| unguiculata   | 1152    | 645   | 3914.3| 2  | 74 | 42 | 48 | 41 | 78 | 48 | 161 | 158 | 139 | 134 | 37 | LC |
| venulosa      | 66      | 5     | 309.9 | 8  | 4  | 5 | 4  | 7  | 7  | 8  | 18 | 14 | 1  | 1  | 2  | LC |
| vexillata     | 1223    | 278   | 3350.3| 2  | 87 | 41 | 55 | 57 | 118 | 75 | 194 | 180 | 154 | 101 | 20 | LC |
| virescens     | 4       | 0     | 24.7  | 10 | 0  | 0 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 4  | 0  | CR |

1 IUCN Red List Categories: EX – Extinct; EW – Extinct in the wild; CR – Critically endangered; EN – Endangered; VU – Vulnerable; NT – Near threatened; LC – Least concern; DD – Data deficient; NE – Not evaluated. Note: The numbers of specimens associated with decades does not equal the total specimens collected because not all specimens have a collection date.
Tanzanian–Zambian border, there are so few specimens available it would be difficult to make an objective assessment. Also, although *V. richardsiae* has a characteristic combination of stipule, calyx, pod and pollen grain characters, Verdcourt (1970) says that it is close to *V. juncea* and Pasquet (2001) notes that this species may be close to *V. mudenia* and *V. kokii*. Further living material is required to clarify the relationship between it and its close allies. There appears to be no doubt over the taxonomic status of *V. stenophylla*, and the increasing rarity of the species, as indicated by the fall-off of specimen collections since the 1940s, does suggest that the species is in serious decline and deserves a high level of threat assessment.

Table 8.4. IUCN Red List categories for African *Vigna* species.¹

<table>
<thead>
<tr>
<th>Critically endangered</th>
<th>Endangered</th>
<th>Vulnerable</th>
<th>Near threatened</th>
<th>Least concern</th>
<th>Data deficient</th>
</tr>
</thead>
</table>
| *V. monantha*         | *V. bequaertii* | *V. bossieri* | *V. fischeri* | *V. adenantha* | *V. benuensis*
| *V. nuda*             | *V. desmodioides* | *V. juncea* | *V. juruana* | *V. ambacensis* | *V. dolomitica*
| *V. richardsiae*      | *V. haumaniana* | *V. keraudrenii* | *V. kokii* | *V. angivenis* | *V. filicaulis*
| *V. somaliensis*      | *V. hosei* | *V. longifolia* | *V. membranacea* | *V. antunesii* | *V. praecox*
| *V. stenophylla*      | *V. laurantii* | *V. longissima* | *V. microsperma* | *V. comosa* |
| *V. virescens*        | *V. multinervis* | *V. marina* | *V. friesiour* | *V. frutescens* |
| *V. phoenix*          | *V. mudenia* | *V. nyangensis* | *V. gazensis* | *V. gracilis* |
| *V. procera*          | *V. pygmaea* | *V. triphylla* | *V. kirkii* | *V. luteola* |
|                       |             |             |             | *V. macrorhyncha* |
|                       |             |             |             | *V. monophylla* |
|                       |             |             |             | *V. nigritia* |
|                       |             |             |             | *V. oblongifolia* |
|                       |             |             |             | *V. parkeri* |
|                       |             |             |             | *V. platyloba* |
|                       |             |             |             | *V. racemosa* |
|                       |             |             |             | *V. radiata* |
|                       |             |             |             | *V. radicans* |
|                       |             |             |             | *V. reticulata* |
|                       |             |             |             | *V. schimperi* |
|                       |             |             |             | *V. schlechteri* |
|                       |             |             |             | *V. subterranea* |
|                       |             |             |             | *V. trifolata* |
|                       |             |             |             | *V. unguiculata* |
|                       |             |             |             | *V. venulosa* |
|                       |             |             |             | *V. vexillata* |

¹ Note IUCN Red List categories for subspecific taxa of African *Vigna* are provided in the ecogeographic conspectus.
8.4.3 Taxon vulnerability assessment for Vigna species

The vulnerability of *Vigna* species to genetic erosion and extinction was also assessed using seven criteria: rarity, distributional range, gross representation in *ex situ* collections, geographic coverage of *ex situ* collections, coverage of *ex situ* collections, utility and extinction assessment, as discussed in Chapter 6, and the results are given in Appendix XI. The species most vulnerable, with a TVA score over 6.0, were (excluding the non-native *V. radiata* and *V. trilobata*): *V. bosseri*, *V. friesiorum*, *V. haumaniana*, *V. hosei*, *V. juncea*, *V. marina*, *V. monantha*, *V. mudenia*, *V. nuda*, *V. richardiae*, *V. somaliensis*, *V. stenophylla*, *V. subterranea* and *V. virescens*. It should be noted that the taxon vulnerability assessment scores show a high correlation with IUCN Red List assessments.

8.5 Gap analysis

Gap analysis is a useful tool in the formulation of conservation priorities, especially when resources are limited. Within the African *Vigna* context, this has involved five steps:

1. Identify and circumscribe African *Vigna* taxa.
2. Locate areas of African *Vigna* diversity.
3. Review current *in situ* conservation activities.
4. Review current *ex situ* conservation activities.
5. Set priorities for conservation action.

The full results are presented in earlier chapters, but the conclusions are summarized below to indicate how the final conservation strategy was formulated.

8.5.1 Identification and circumscription of African *Vigna* taxa

The overall objective of this study is to enhance the conservation and therefore use of African *Vigna* and has included no original taxonomic work. However, as there is currently no single accepted classification of African *Vigna* it has necessarily involved making taxonomic decisions. The most widely accepted classification for all *Vigna* is that proposed by Maréchal *et al.* (1978), which is in turn a modification of the concept of Verdcourt (1970). However, the classification of Maréchal *et al.* (1978) needs modification, first, owing to the several recently described taxa published since 1978 and, second, because of the extensive taxonomic work on African *Vigna* taxa by Padulosi (1993), Pasquet (1993a,b, 1994, 1996a,b, 1997, 1998, 1999, 2002), Pasquet and Maréchal (1989), Pasquet and Vanderborght (1999), Pienaar (1992), Pienaar and Kok (1991), Pienaar and van Wyk (1992) and Thulin (1983, 1989a,b, 1991, 1993). Therefore, the classification used in this study (see Appendix I) is an attempt to produce a unified system using the Maréchal *et al.* (1978) framework that incorporates the recent proposals suggested by the authors listed above.

8.5.2 Location of areas of African *Vigna* diversity

The genus *Vigna* has a broad distributional range across the African continent south of the Sahara and north of 30° S. *Vigna* is most species rich in subtropical
latitudes around 10° N and S. Observations have been found from sea level to nearly 5000 m, though 99% are below 3000 m. The greatest species richness is found at elevations below 1500 m. Three hotspots of high species richness have been observed, notably around the Great Lakes, the southern tip of Lake Tanganyika and the Cameroon Highlands. Models that predict species richness have highlighted other areas with potentially higher species richness in areas up to now not sampled or undersampled for the genus *Vigna*. These are located in many parts of the Democratic Republic of the Congo, south of Lake Victoria in Tanzania and in Central Togo.

Based on an analysis of complementary areas, just 23 areas of 100 km² are required to capture all 69 species in the *Vigna* genus. Just three of these grid cells contain 37 species (54% of all species in the genus), and these are (in order of importance) the southern tip of Lake Tanganyika (23 species), the coastal area of Sierra Leone (eight new species), and between Lake Victoria and the other Great Lakes (three new species).

A more detailed analysis of *V. unguiculata* showed the currently observed hotspots to lie at the southern tip of Mozambique and the region directly over the border in South Africa (five subspecies), where *V. unguiculata* appears to be comprehensively collected. Predictive modelling of subspecies richness also highlights Central Angola as the priority for conservation, where four subspecies are predicted to be found, but where few collections have been made.

An assessment of efficiency of population sampling, which using regression compared numbers of *Vigna* species recorded in each country with numbers of herbarium specimens and genebank accessions originating from that country, indicated that Botswana, Namibia, South Africa and Swaziland were overcollected for *Vigna*, while Angola, Burundi, Cameroon, Democratic Republic of the Congo, Djibouti, Nigeria, Tanzania and Zambia remain undercollected.

### 8.5.3 Reviewing current *in situ* conservation activities

**On-farm**—African farmers have been conserving *Vigna* species for millennia via annual cycles of planting, cultivating, harvesting and selecting seed, a contribution that should be emphasized. However, there are no on-farm projects in Africa that focus on *Vigna* species, although there are several projects that include *Vigna* species along with other native crops. Cowpea (*V. unguiculata*) is included in IPGRI’s current on-farm conservation project in Burkina Faso (Jarvis and Ndungu-Skitton, 2000), the Shea project in Uganda includes Bambara groundnut (*Vigna subterranea*) [www.pnumen.com/covaol/onfarm.htm](http://www.pnumen.com/covaol/onfarm.htm) and the Community Technology Development Trust project in Zimbabwe, which is looking at the relationship between socioeconomic factors and on-farm crop diversity of several crops, includes *V. subterranea* and *V. unguiculata* (Odero, 2001—[www.cbdcpprogram.org](http://www.cbdcpprogram.org)).

**Genetic reserve**—There are currently no reserves specifically established to conserve African *Vigna* species or where they are priority taxa within the management plan and monitoring objectives. Having made this point, the majority of the species are widely distributed in grassland, along roadsides, field
margins and open primary forest, and therefore existing national parks and other protected area networks will contain many of them. A comparison of the location data for herbarium specimens or genebank accessions with the boundaries of existing African protected areas found that 54% of wild Vigna species have populations present in at least one protected area. The real figure for population presence in protected areas is likely to be higher because the data set only refers to those populations that have been sampled for herbarium specimens or germplasm and obviously not all populations would have been sampled.

Bearing in mind the genetic erosion from habitat destruction and degradation that is current in many parts of Africa, as well as the fact that most protected areas in Africa were established to conserve animals or ecosystems, the size and well-being of populations of Vigna they contain are uncertain, and any management or monitoring of the reserve will be targeted at the animals or ecosystems the reserve has been set up to conserve not taking Vigna into account. This “passive” conservation of Vigna populations in existing protected areas is better than nothing, but there is a need for more active in situ genetic reserve conservation of priority Vigna taxa. The point was made in Chapter 3 that the sheer number of African Vigna taxa, and their genetic and ecogeographic diversity make in situ conservation the only practical conservation option for adequately maintaining the broadest gene pool of these socioeconomically important species. This study has identified where the hotspots of Vigna taxonomic diversity are located in Africa. Existing protected areas in these regions need to be identified and the possibility of establishing genetic reserves in them assessed. Those existing protected areas where the management plan can be amended to permit the establishment and monitoring of a Vigna genetic reserve must be identified.

8.5.4 Reviewing current ex situ conservation activities
Genebank holdings for Vigna taxa are reviewed in detail in Chapters 3 and 6. The review found that more than a third of African wild Vigna, 21 species in all, have no germplasm conserved ex situ: V. angivensis, V. antunesii, V. bequaertii, V. bosseri, V. desmodioides, V. haumaniana, V. juncea, V. keraudrenii, V. kokii, V. longissima, V. microesperma, V. monantha, V. mudenia, V. nuda, V. phoenic, V. procera, V. pygmaea, V. richardsiae, V. somaliensis, V. stenophylla and V. virescens. A further 14 species are regarded as undercollected: V. adenantha, V. comosa, V. fischeri, V. frutescens, V. gazensis, V. jruana, V. longifolia, V. macrorhyncha, V. monophylla, V. parkeri, V. praecox, V. schimperi, V. triphylla and V. venulosa. Of the two major crop species, V. subterranea has more genebank accessions than herbarium specimens collected and V. unguiculata has 645 ex situ accessions, about half of the number of herbarium specimens collected.

8.6 Conservation strategy recommendations
The ecogeographic study needs to conclude with a clear, concise statement of the conservation priorities and proposed conservation strategy for the target taxon.
8.6.1 Ex situ conservation priorities

Country based priorities—as defined by number of Vigna taxa included and current ex situ representation, there is a need for further collecting and conservation of germplasm ex situ in the following countries: Angola, Benin, Burundi, Cameroon, Côte d’Ivoire, the Democratic Republic of the Congo, Djibouti, Eritrea, Gambia, Guinea, Guinea Bissau, Liberia, Madagascar, Mozambique, Nigeria, Rwanda, Sierra Leone, Somalia, Tanzania and Zambia, see Figures 8.1 and 8.2. Of these, Cameroon, the Democratic Republic of the Congo, Guinea Bissau, Nigeria and Zambia are the highest priority.

Taxon based priorities—Vigna taxa are prioritized for conservation in Table 8.5. Although the cultivated forms of V. unguiculata and V. vexillata appear well conserved ex situ, it is suggested that their collection continue in order to ensure full representation of all infraspecific taxa and ecological variants. Furthermore, in the light of failure of interspecific crosses involving V. unguiculata, it is of paramount importance that as wide a range of accessions of wild forms of the species as possible is collected and evaluated in order to identify material that may be useful for cowpea improvement.

Table 8.5. Priority ranking of African Vigna taxa for conservation.

<table>
<thead>
<tr>
<th>Priority rating</th>
<th>Vigna taxa</th>
</tr>
</thead>
<tbody>
<tr>
<td>High priority</td>
<td>V. dolomitica, V. haumaniana var. pedunculata, V. monantha, V. nuda, V. richardiae, V. somaliensis, V. stenophylla, V. subterranea var. spontanea, V. unguiculata subsp. unguiculata var. spontanea, V. unguiculata subsp. aduensis, V. unguiculata subsp. baoulenensis, V. unguiculata subsp. burundiensis, V. vexillata var. dolichonema and V. virescens.</td>
</tr>
<tr>
<td>Medium priority</td>
<td>V. bequaertii, V. comosa subsp. comosa var. lebrunii, V. desmodioides, V. haumaniana, V. haumaniana var. haumaniana, V. hosei, V. laurentii, V. multinervis, V. parkeri subsp. parkeri, V. phoenix, V. procera.</td>
</tr>
<tr>
<td>Low priority</td>
<td>V. adenantha, V. angivensis, V. antunesii, V. bosseri, V. comosa, V. comosa subsp. abercornensis, V. fischeri, V. frutescens, V. frutescens subsp. kotschyi, V. gazensis, V. juncea, V. juncea var. corbyi, V. juruana, V. keraudrenii, V. kokii, V. longifolia, V. longissima, V. macrorhyncha, V. membranacea subsp. macrodon, V. microsperma, V. monophylla, V. mudenia, V. parkeri, V. praecox, V. pygmaea, V. schimperi, V. triphylla and V. venulosa.</td>
</tr>
</tbody>
</table>

The combination of high priority Vigna taxa with high priority countries is made in Appendix XIII and summarized in Table 8.6, to highlight within the priority countries which taxa require germplasm collection most urgently.
Figure 8.1. Areas of Africa where *Vigna* conservation action is currently required.

Figure 8.2. Areas of Central Africa where *Vigna* conservation action is required.
Table 8.6. Combination of high priority *Vigna* taxa with high priority countries.

<table>
<thead>
<tr>
<th>Priority countries</th>
<th>Priority <em>Vigna</em> taxa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angola</td>
<td><em>V. adenantha</em>, <em>V. antunescii</em>, <em>V. comosa</em>, <em>V. dolomitica</em>, <em>V. frutescens</em>, <em>V. gazensis</em>, <em>V. multinervis</em>, <em>V. nuda</em>, <em>V. parkeri</em>, <em>V. procera</em>, <em>V. pygmaea</em>, <em>V. triphylla</em>, <em>V. unguiculata</em> subsp. <em>unguiculata</em> var. <em>spontanea</em>, <em>V. venulosa</em></td>
</tr>
<tr>
<td>Benin</td>
<td><em>V. longifolia</em>, <em>V. stenophylla</em></td>
</tr>
<tr>
<td>Burundi</td>
<td><em>V. angivensis</em>, <em>V. antunescii</em>, <em>V. bequaertii</em>, <em>V. comosa</em>, <em>V. fischeri</em>, <em>V. frutescens</em>, <em>V. laurentii</em>, <em>V. macrorhyncha</em>, <em>V. membranacea</em> subsp. <em>macronod</em>, <em>V. monophylla</em>, <em>V. multinervis</em>, <em>V. nuda</em>, <em>V. parkeri</em>, <em>V. pygmaea</em>, <em>V. schimperi</em>, <em>V. triphylla</em>, <em>V. unguiculata</em> subsp. <em>burundiensis</em>, <em>V. unguiculata</em> subsp. <em>unguiculata</em> var. <em>spontanea</em></td>
</tr>
<tr>
<td>Cameroon</td>
<td><em>V. adenantha</em>, <em>V. comosa</em>, <em>V. desmodioides</em>, <em>V. fischeri</em>, <em>V. frutescens</em>, <em>V. juruana</em>, <em>V. laurentii</em>, <em>V. longissima</em>, <em>V. macrorhyncha</em>, <em>V. monophylla</em>, <em>V. multinervis</em>, <em>V. parkeri</em>, <em>V. pygmaea</em>, <em>V. stenophylla</em>, <em>V. subterranae</em> var. <em>spontanea</em>, <em>V. triphylla</em>, <em>V. unguiculata</em> subsp. <em>baouelensis</em>, <em>V. unguiculata</em> subsp. <em>unguiculata</em> var. <em>spontanea</em>, <em>V. venulosa</em></td>
</tr>
<tr>
<td>Côte d’Ivoire</td>
<td><em>V. juruana</em>, <em>V. longifolia</em>, <em>V. multinervis</em>, <em>V. schimperi</em>, <em>V. stenophylla</em>, <em>V. unguiculata</em> subsp. <em>baouelensis</em>, <em>V. venulosa</em></td>
</tr>
<tr>
<td>D.R. Congo</td>
<td><em>V. adenantha</em>, <em>V. antunescii</em>, <em>V. bequaertii</em>, <em>V. comosa</em> subsp. <em>comosa</em> var. <em>lebrunii</em>, <em>V. comosa</em>, <em>V. desmodioides</em>, <em>V. dolomitica</em>, <em>V. fischeri</em>, <em>V. frutescens</em>, <em>V. haumaniana</em> var. <em>haumaniana</em>, <em>V. haumaniana</em> var. <em>pedunculata</em>, <em>V. juncea</em>, <em>V. juruana</em>, <em>V. laurentii</em>, <em>V. longifolia</em>, <em>V. longissima</em>, <em>V. macrorhyncha</em>, <em>V. membranacea</em> subsp. <em>macronod</em>, <em>V. monophylla</em>, <em>V. multinervis</em>, <em>V. nuda</em>, <em>V. parkeri</em>, <em>V. pygmaea</em>, <em>V. schimperi</em>, <em>V. triphylla</em>, <em>V. unguiculata</em> subsp. <em>burundiensis</em>, <em>V. unguiculata</em> subsp. <em>unguiculata</em> var. <em>spontanea</em>, <em>V. venulosa</em></td>
</tr>
<tr>
<td>Djibouti</td>
<td><em>V. frutescens</em></td>
</tr>
<tr>
<td>Eritrea</td>
<td><em>V. frutescens</em>, <em>V. membranacea</em> subsp. <em>macronod</em></td>
</tr>
<tr>
<td>Gambia</td>
<td><em>V. adenantha</em></td>
</tr>
<tr>
<td>Guinea</td>
<td><em>V. adenantha</em>, <em>V. comosa</em>, <em>V. juruana</em>, <em>V. multinervis</em>, <em>V. stenophylla</em>, <em>V. venulosa</em></td>
</tr>
<tr>
<td>Guinea Bissau</td>
<td><em>V. longifolia</em>, <em>V. multinervis</em>, <em>V. venulosa</em></td>
</tr>
<tr>
<td>Liberia</td>
<td><em>V. adenantha</em>, <em>V. comosa</em>, <em>V. unguiculata</em> subsp. <em>baouelensis</em></td>
</tr>
<tr>
<td>Madagascar</td>
<td><em>V. adenantha</em>, <em>V. angivensis</em>, <em>V. bosseri</em>, <em>V. gazensis</em>, <em>V. hosei</em>, <em>V. keraudrenii</em>, <em>V. longifolia</em>, <em>V. microsperma</em>, <em>V. parkeri</em> subsp. <em>parkeri</em>, <em>V. parkeri</em></td>
</tr>
<tr>
<td>Mozambique</td>
<td>No priority taxa</td>
</tr>
<tr>
<td>Nigeria</td>
<td><em>V. adenantha</em>, <em>V. comosa</em>, <em>V. desmodioides</em>, <em>V. frutescens</em>, <em>V. juruana</em>, <em>V. longissima</em>, <em>V. macrorhyncha</em>, <em>V. multinervis</em>, <em>V. praecox</em>, <em>V. subterranae</em> var. <em>spontanea</em>, <em>V. triphylla</em>, <em>V. unguiculata</em> subsp. <em>baouelensis</em>, <em>V. unguiculata</em> subsp. <em>unguiculata</em> var. <em>spontanea</em>, <em>V. venulosa</em></td>
</tr>
<tr>
<td>Rwanda</td>
<td><em>V. bequaertii</em>, <em>V. comosa</em>, <em>V. fischeri</em>, <em>V. frutescens</em>, <em>V. hosei</em>, <em>V. macrorhyncha</em>, <em>V. multinervis</em>, <em>V. praecox</em>, <em>V. subterranae</em> var. <em>spontanea</em>, <em>V. triphylla</em>, <em>V. unguiculata</em> subsp. <em>baouelensis</em>, <em>V. unguiculata</em> subsp. <em>unguiculata</em> var. <em>spontanea</em></td>
</tr>
<tr>
<td>Sierra Leone</td>
<td><em>V. adenantha</em>, <em>V. comosa</em>, <em>V. desmodioides</em>, <em>V. juruana</em>, <em>V. longifolia</em>, <em>V. monophylla</em>, <em>V. multinervis</em>, <em>V. nuda</em>, <em>V. parkeri</em>, <em>V. schimperi</em>, <em>V. unguiculata</em> subsp. <em>burundiensis</em>, <em>V. venulosa</em></td>
</tr>
<tr>
<td>Somalia</td>
<td><em>V. adenantha</em>, <em>V. macrorhyncha</em>, <em>V. monantha</em>, <em>V. praecox</em>, <em>V. somaliensis</em>, <em>V. virescens</em></td>
</tr>
</tbody>
</table>
Zambia
V. adenantha, V. antunesii, V. comosa, V. fischeri, V. frutescens, V. gazensis, V. haumaniana var. haumaniana, V. haumaniana var. pedunculata, V. juncea, V. longissima, V. macrorhyncha, V. monophylla, V. multinervis, V. nuda, V. parkeri, V. phoenix, V. procera, V. pygmaea, V. richardsiae, V. triphylla, V. unguiculata subsp. baoulensis, V. unguiculata subsp. unguiculata var. spontanea

Taxon colour indicates priority: red=high priority, brown=medium priority, and blue=lower priority. Those countries and taxa not listed have no specific conservation priority.

8.6.2 In situ genetic reserve conservation priorities
This study identified complementary areas at the southern tip of Lake Tanganyika, the coastal area of Sierra Leone and between Lake Victoria and the other Great Lakes. The nearby protected areas are listed in Table 8.7 and coloured green in Figure 8.2. Without surveying them it is impossible to say within which of these it is most appropriate to establish the reserves, and they need to be studied for recommendations to be made for the most appropriate areas for the establishment of genetic reserves, these protected areas need to be surveyed for Vigna species. One genetic reserve within each priority area would be appropriate to conserve a significant proportion of Vigna genetic diversity.

8.6.3 In situ on-farm conservation priorities
With 23 of the 61 African Vigna species being utilized in some form or other in Africa, combined with the fact that many of the species have multiple uses, there is an urgent need to establish on-farm conservation projects for Vigna. Perhaps the most immediate priority is for the two most widely cultivated grain legume species, V. subterranea and V. unguiculata, to be better conserved. But Africa is a large continent, where should such a project be established exactly? It is currently impossible to answer this question because we do not have sufficient information on the geographical patterns of genetic diversity in either V. subterranea or V. unguiculata in Africa. It is perhaps surprising that for V. subterranea there are insufficient ex situ samples to be able to undertake the necessary molecular analysis, thus for V. subterranea further systematic germplasm collections is required before this question can begin to be addressed; however, the necessary genetic studies have commenced (Massawe et al., 2002a,b) on a limited scale. The situation with V. unguiculata is better as
Table 8.7. Locations suggested for potential establishment of genetic reserves.

<table>
<thead>
<tr>
<th>Country</th>
<th>Protected area name</th>
<th>Type of protected area</th>
<th>IUCN protected area categories</th>
<th>Location</th>
<th>Area (km²)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Southern tip of Lake Tanganyika</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zambia</td>
<td>Lusenga Plain</td>
<td>National Park</td>
<td>II</td>
<td>9°23' S/ 29°13' E</td>
<td>88 000</td>
</tr>
<tr>
<td></td>
<td>Mweru-Wantipa</td>
<td>National Park</td>
<td>II</td>
<td>8°44' S/ 29°38' E</td>
<td>313 400</td>
</tr>
<tr>
<td></td>
<td>Nsumbu</td>
<td>National Park</td>
<td>II</td>
<td>8°47' S/ 30°30' E</td>
<td>206 300</td>
</tr>
<tr>
<td>Tanzania</td>
<td>Uwanda</td>
<td>Game Reserve</td>
<td>IV</td>
<td>8°32' S/ 32°08' E</td>
<td>500 000</td>
</tr>
<tr>
<td></td>
<td>Katavi</td>
<td>National Park</td>
<td>II</td>
<td>6°53' S/ 31°10' E</td>
<td>225 300</td>
</tr>
<tr>
<td></td>
<td>Mahale Mountain</td>
<td>National Park</td>
<td>II</td>
<td>6°10' S/ 29°50' E</td>
<td>157 700</td>
</tr>
<tr>
<td><strong>Coastal area of Sierra Leone</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>Outamba-Kiliimi</td>
<td>National Park</td>
<td>IV</td>
<td>9°45' N/ 12°13' E</td>
<td>80 813</td>
</tr>
<tr>
<td><strong>Between Lake Victoria and the other Great Lakes:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uganda</td>
<td>Bwindi Impenetrable Forest</td>
<td>National Park</td>
<td>II</td>
<td>1°02' S/ 29°42' E</td>
<td>32 092</td>
</tr>
<tr>
<td></td>
<td>Gorilla (Mgahinga)</td>
<td>National Park</td>
<td>II</td>
<td>1°22' S/ 29°38' E</td>
<td>2899</td>
</tr>
<tr>
<td></td>
<td>Lake Mburo</td>
<td>National Park</td>
<td>II</td>
<td>0°35' S/ 31°00' E</td>
<td>25 594</td>
</tr>
<tr>
<td></td>
<td>Queen Elizabeth</td>
<td>National Park</td>
<td>II</td>
<td>0°04' S/ 30°00' E</td>
<td>197 752</td>
</tr>
<tr>
<td></td>
<td>Rwenzori Mountains</td>
<td>National Park</td>
<td>II</td>
<td>0°15' N/ 29°57' E</td>
<td>99 576</td>
</tr>
<tr>
<td>Tanzania</td>
<td>Biharamulo</td>
<td>Game Reserve</td>
<td>IV</td>
<td>2°30' S/ 31°30' E</td>
<td>500 000</td>
</tr>
<tr>
<td></td>
<td>Burigi</td>
<td>Game Reserve</td>
<td>IV</td>
<td>2°05' S/ 31°20' E</td>
<td>130 000</td>
</tr>
<tr>
<td></td>
<td>Ibanda</td>
<td>Game Reserve</td>
<td>IV</td>
<td>1°09' S/ 30°35' E</td>
<td>20 000</td>
</tr>
<tr>
<td></td>
<td>Kigosi</td>
<td>Game Reserve</td>
<td>IV</td>
<td>3°42' S/ 31°34' E</td>
<td>700 000</td>
</tr>
<tr>
<td></td>
<td>Moyowosi</td>
<td>Game Reserve</td>
<td>IV</td>
<td>4°08' S/ 31°00' E</td>
<td>600 000</td>
</tr>
<tr>
<td></td>
<td>Ugalla</td>
<td>Game Reserve</td>
<td>IV</td>
<td>5°53' S/ 31°50' E</td>
<td>500 000</td>
</tr>
<tr>
<td></td>
<td>River</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gombe</td>
<td>National Park</td>
<td>II</td>
<td>4°40' S/ 29°35' E</td>
<td>5200</td>
</tr>
<tr>
<td></td>
<td>Katavi</td>
<td>National Park</td>
<td>II</td>
<td>6°53' S/ 31°10' E</td>
<td>225 300</td>
</tr>
<tr>
<td></td>
<td>Mahale Mountain</td>
<td>National Park</td>
<td>II</td>
<td>6°10' S/ 29°50' E</td>
<td>157 700</td>
</tr>
<tr>
<td></td>
<td>Rubondo</td>
<td>National Park</td>
<td>II</td>
<td>2°25' S/ 31°50' E</td>
<td>45 700</td>
</tr>
<tr>
<td><strong>Burundi</strong></td>
<td>Kibira</td>
<td>National Park</td>
<td>V</td>
<td>3°00' S / 29°22' E</td>
<td>40 000</td>
</tr>
<tr>
<td></td>
<td>Rusizi</td>
<td>National Park</td>
<td>V</td>
<td>3°15' S / 29°15' E</td>
<td>5235</td>
</tr>
<tr>
<td></td>
<td>Ruvubu</td>
<td>National Park</td>
<td>V</td>
<td>3°00' S / 30°23' E</td>
<td>43 630</td>
</tr>
<tr>
<td><strong>Rwanda</strong></td>
<td>Akagera</td>
<td>National Park</td>
<td>II</td>
<td>1°32' S/ 30°38' E</td>
<td>312 000</td>
</tr>
<tr>
<td></td>
<td>Volcans</td>
<td>National Park</td>
<td>II</td>
<td>1°28' S/ 29°33' E</td>
<td>15 000</td>
</tr>
<tr>
<td><strong>Democratic Republic of the Congo</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Garamba</td>
<td>National Park</td>
<td>II</td>
<td></td>
<td>4°13' N/ 29°24' E</td>
<td>492 000</td>
</tr>
<tr>
<td>Kahunzi-Biega</td>
<td>National Park</td>
<td>II</td>
<td></td>
<td>2°31' S/ 28°45' E</td>
<td>600 000</td>
</tr>
<tr>
<td>Kundelungu</td>
<td>National Park</td>
<td>II</td>
<td></td>
<td>10°35' S/ 28°56' E</td>
<td>760 000</td>
</tr>
<tr>
<td>Virunga</td>
<td>National Park</td>
<td>II</td>
<td></td>
<td>0°20' S/ 29°35' E</td>
<td>780 000</td>
</tr>
</tbody>
</table>
systematically sampled germplasm collections from throughout Africa already exist, these should be geographically sampled and used to clarify patterns of genetic diversity. Then to answer the question where to site the on-farm project, the purely scientific answer would be in the locations with the highest landrace diversity, which need not be the same as the hotspots for *V. unguiculata* taxon diversity identified above, as here the focus would be infrataxon genetic diversity within *V. unguiculata* subspecies *unguiculata* variety *unguiculata*. It should also be recognized that initiating an on-farm conservation project involves many other factors than the precise identification of hotspots of taxon and genetic diversity; national support for the project is required, macro- and micro-economic compatibility in the region, country, locale with the establishment of the project is needed, lack of a local development project that would promote the replacement of local landraces with higher yielding varieties is advisable and, most important, collaborative local farmers would be essential.

**8.6.4 Complementarity and sustainability**

The priorities detailed above should be seen as a whole in that they are intended to provide complementarity of conservation, few now believe that even systematically collected germplasm in the genebank alone is sufficient to ensure the long-term security of a species. Thus, if the analysis of herbarium and genebank material indicates that there is a rare relative of the cowpea, *Vigna monantha*, growing on coastal dunes of Mudug and Galguduud in Somalia and even if a review of current conservation activities indicates that there is a large *ex situ* collection of this species held in the national genebank with a duplicate at IITA, then further collection would not be justified. However, if the species is not conserved using *in situ* techniques, there is a need for complementary conservation and the establishment of a genetic reserve at that location may be appropriate. Therefore there is a need to employ a range of techniques, germplasm collection and *ex situ* storage, genetic reserves establishment and on-farm conservation to conserve the genepool.

For plants, in particular, the necessary political will to set aside land for genetic reserves is often lacking in the face of pressures for other types of land utilization. Conservation efforts are also often hindered by problems with the surveying and demarcation of proposed protected areas. Even some long-established African protected areas still lack properly defined boundaries. Not only do such activities cost money but, owing to inadequate inventories in some areas (such as in Gabon), it is difficult to identify the best areas to site reserves.

Conservation is made even more difficult if there is opposition from the local population. Conservation experience has repeatedly shown that unless governments and the local populace see direct benefits from conserving biodiversity a project is unlikely to succeed. It is vital that land use plans address the needs of conserving biodiversity while also being acceptable to national and local communities’ interests. Such land use plans may contain areas open to harvesting of specific products. Scientists can work together with land managers and local people to devise methods of harvesting that are sustainable in the
long run so that resources are not depleted and other environmental values lost. Increasingly, the emergence of local wildlife clubs, such as those in East Africa, is a very encouraging sign of a new appreciation of conservation and valuation of biodiversity, with large numbers of young people taking an interest in native animals and plants.

Pressure for land is increasing in all regions of Africa, to such an extent that, if additional areas are not legally protected within the next decade, many areas of botanically interesting vegetation will no longer be available or will be so degraded as to be not worth saving for this purpose. However, the protected areas themselves will not survive unless the needs and aspirations of the people who live in and around them are taken into account. Active local involvement in planning and management of wildlife resources is essential if protected areas are to continue to provide a refuge for biological diversity and to provide long-term economic benefits to the local people. Several projects exist in Africa which attempt to protect critical forest sites while using development assistance to help local communities meet their needs in a sustainable manner.

8.7 Future research requirements

The perhaps naïve objective when this project started was to resolve the many questions associated with Vigna conservation, leading to the sustainable use of its diversity in Africa. Although progress has been made towards achieving this aim, the project has also highlighted the extent to which research remains to be undertaken. The following research priorities have been identified:

- **Taxonomic clarification**—Much work has been undertaken in recent years on the taxonomy of African Vigna, initially associated with African regional floras and more recently focusing on crop complexes, and much progress has been made. But there remains a critical need for a taxonomic study that draws these numerous studies together and provides a practical resolution to some outstanding problems. As identified above, there is a need for further systematic collecting in the undercollected areas of Africa, i.e. Cameroon, the Democratic Republic of the Congo, Guinea Bissau, Nigeria and Zambia, and this is likely to locate new Vigna taxa. Second, there is confusion over the taxonomic delimitation of taxa in the regions of Africa with the oldest flora: clarification of taxonomic delimitation of the West and Central African taxa is a priority. For instance, is the specific distinction of *V. laurentii*, *V. desmodioides* and *V. richardsiae* warranted?

- **Population surveys**—It is perhaps suspicious when three apparently "good" species are located in relative close vicinity and yet each is only known from a few specimens. *V. monantha*, *V. somaliensis* and *V. virescens* are all known from a limited number of collections and they are all endemic to Somalia. Thulin (1993) makes no comment in this regard, but the coincidence of three of the rarest African Vigna species all being endemic to Somalia means that detailed surveys for Vigna in Somalia would be advisable.

- **Reproductive biology**—As discussed in Chapter 2, relatively little is currently known about out-crossing rates, gene flow patterns etc. The fact that Vigna
species have large, often scented, flowers is thought to indicate out-breeding and the need to attract pollinators (Lush, 1979). However, Duke (1981) reported an out-crossing rate of only 10–15% in *V. unguiculata*. Clarification would facilitate the effectiveness of any conservation strategy.

- **Spatial distribution of genetic diversity**—Virtually nothing is known of the geographical distribution of genetic diversity for *Vigna*, even for the cultivated species. Is the magnitude of genetic diversity related to ecogeographic diversity or is there as much diversity within a single population as across the geographic range of the species? We currently have no idea of the answer, but an understanding of these issues would greatly facilitate identification of sites where to sample and where to establish genetic reserves. To be realistic, this is unlikely to happen for all African *Vigna* species in the near future, therefore, the highest priority will be focused on those species of most direct utility to humanity. However, work in the UK has shown that for each species there is a unique relationship between genetic diversity and ecogeographic diversity and there is no means of generalizing from one species to another, even for closely related species.
9. REFERENCES


DeCandolle, A.P. 1825. Prodromus Systematis Naturalis Regni Vegetabilis.
Treuttel et Wurtz, Paris.


FAO. 1996. Global Plan of Action for Plant Genetic Resources for Food and Agriculture. FAO, Rome, Italy.


Gomathinayagam, P., S. Ganeshram, R. Rathnaswany and N.M. Ramaswamy. 1998. Interspecific hybridisation between V. unguiculata (L.) Walp. and


Savi, G. 1826. Troisieme memoire sur les genres Phaseolus et Dolichos par le Dr Gaetano Savi. Linnean 1:331.


10. APPENDIXES

APPENDIX I. Classification of the genus *Vigna*

The classification used in this survey is an amended version of the classification of Maréchal et al. (1978) which includes subsequently described taxa (African species are marked with asterisks, introductions to Africa are marked with † and non-Maréchal et al. (1978) with #). Pasquet’s (2001) conception of *V. unguiculata* and Tomooka et al.’s (2002a) conception of subgenus *Ceratotropis*.


I. Subgenus *Vigna*

A. Section *Vigna*

*V. luteola* (Jacq.) Benth. in Mart., Fl. Brasil. 15(1):194, t. 50/2 (1859) *.


*V. marina* subsp. *marina* †.


*V. o-wahuensis* Vogel, Linnaea 10:585 (1836). #.


*V. oblongifolia* A. Rich., Tent. Fl. Abyss. 1:220 (1847) *.

*V. oblongifolia* var. *oblongifolia* *.


*V. filicaulis* Hepper, Kew Bull. 11:128 (1956) *.

*V. filicaulis* var. *filicaulis* *.

*V. filicaulis* var. *pseudovenulosa* Maréchal, Mascherpa and Stainier, Taxon 27:200 (1978) *.

*V. multinervis* Hutch. & Dalziel, Kew Bull.: 17 (1929) *.

*V. laurentii* De Wild., Mission Laurent: 122 (1905) *.


*V. ambacensis* var. *ambacensis* *.


*V. hosei* (Craib) Backer in Backer & Slooten, Geïllustreerd Handbook voor de Thee-onkruiden: 153 (1924) *.

*V. hosei* var. *hosei* 

*V. hosei* var. *pubescens* Maréchal, Mascherpa and Stainier, Taxon 27:200 (1978) *.

*V. parkeri* Baker, J. Bot. 20:69 (1882) *

*V. parkeri* subsp. *parkeri* *


*V. gracilis* (Guill. & Perr.) Hook.f. in Hook., Niger Fl.: 311 (1849) *.

*V. gracilis* var. *gracilis* *
V. gracilis var. multiforma (Hook.f.) Maréchal, Mascherpa and Stainier, Taxon 27:200 (1978) *
V. racemosa (G. Don) Hutch. & Dalziel, Kew Bull.: 18 (1929) *
V. subterranea (L.) Verdc., Kew Bull. 35-3:474 (1980) *
V. subterranea var. subterranea *
V. subterranea var. spontanea (Harms) Hepper, Kew Bull. 16:400 (1963) *
V. angivensis Baker, J. Bot. 20:69 (1882) *
V. stenophylla Harms, Notizbl. Bot. Gart. Berl. 5:210 (1911) *

B. Section Comosae Maréchal, Mascherpa and Stainier, Taxon 27:200 (1978).
V. comosa Baker in Oliv., Fl. Trop. Afr. 2:202 (1871) *
V. comosa subsp. comosa comosa *
V. comosa subsp. comosa var. lebrunii (Baker f.) Verdc., Kew Bull. 24-3: 528 (1970) *.
V. comosa subsp. abercornensis Verdc., Kew Bull. 24-3:528 (1970) *
V. haumaniana var. haumaniana *

V. membranacea A. Rich., Tent. Fl. Abyss. 1:219 (1847) *
V. membranacea subsp. membranacea *
V. membranacea subsp. caesia (Chiov.) Verdc., Kew Bull. 24:536 (1970) *
V. membranacea subsp. hapalantha (Harms) Verdc., Kew Bull. 24:536 (1970) *
V. friesiorum var. friesiorum *
V. friesiorum var. angustifolia Verdc., Kew Bull. 24:538 (1970) *
V. friesiorum var. ulugurenensis (Harms) Verdc., Kew Bull. 24:538 (1970) *
V. somaliensis Bak. f., Legum. Top. Afr.: 411 (1929) *#.

V. reticulata Hook.f. in Hook., Niger Fl.:310 (1849) *
V. radicans Welw. ex Baker in Oliv., Fl. Trop. Afr. 2:198 (1871) *
V. phoenix Brummitt, Kew Bull. 31:168 (1976) *
V. platyloba Welw. ex Hiern, Cat. Afr. Pl. Welw. 1:257 (1896) *

**F. Section Catiang (DC.) Verdc., in Kew Bull. 24:548 (1970).**


*V. unguiculata* subsp. *unguiculata* *

*V. unguiculata* subsp. *unguiculata* var. *unguiculata* *

*V. unguiculata* subsp. *unguiculata* var. *unguiculata* cultivar group


*V. unguiculata* subsp. *unguiculata* var. *unguiculata* cultivar group


*V. unguiculata* subsp. *unguiculata* var. *unguiculata* cultivar group


*V. unguiculata* subsp. *unguiculata* var. *unguiculata* cultivar group


*V. unguiculata* subsp. *unguiculata* var. *unguiculata* cultivar group

*Stenophylla* (Harv.) Maréchal, Mascherpa & Stainier, Taxon 27:200 (1978) *.

*V. unguiculata* subsp. *unguiculata* cultivar group

*B. alba* (G. Don.) Pasquet, Kew Bull. 48:805 (1993) *#.

*V. unguiculata* subsp. *pawekiae* Pasquet, Kew Bull. 48:806 (1993) *#.

*V. unguiculata* subsp. *aduensis* Pasquet, Kew Bull. 52:840 (1997) *#.


*V. frutescens* A. Rich., in Tent. Fl. Abyss. 1:218 (1847) *.

*V. frutescens* subsp. *frutescens* *

*V. frutescens* subsp. *frutescens* var. *frutescens* *


*F.  Section Catiang (DC.) Verdc., in Kew Bull. 24:548 (1970).*


*V. unguiculata* subsp. *unguiculata* *

*V. unguiculata* subsp. *unguiculata* var. *unguiculata* *

*V. unguiculata* subsp. *unguiculata* var. *unguiculata* cultivar group


*V. unguiculata* subsp. *unguiculata* var. *unguiculata* cultivar group


*V. unguiculata* subsp. *unguiculata* var. *unguiculata* cultivar group


*V. unguiculata* subsp. *unguiculata* var. *unguiculata* cultivar group


*V. unguiculata* subsp. *unguiculata* var. *unguiculata* cultivar group

*Stenophylla* (Harv.) Maréchal, Mascherpa & Stainier, Taxon 27:200 (1978) *.

*V. unguiculata* subsp. *unguiculata* cultivar group

*B. alba* (G. Don.) Pasquet, Kew Bull. 48:805 (1993) *#.

*V. unguiculata* subsp. *pawekiae* Pasquet, Kew Bull. 48:806 (1993) *#.

*V. unguiculata* subsp. *aduensis* Pasquet, Kew Bull. 52:840 (1997) *#.


G. Section Haydonia


*V. juncea* Milne-Redh., Kew Bull.: 301 (1934) *.

*V. juncea* var. *juncea*


*V. juncea* var. *major* Milne-Redh., Kew Bull.:302 (1934) *.

*V. nyangensis* Mithen, Kew Bull. 44-1:175 (1989) #.


*V. microsperma* R. Vig., Not. Syst. 14:178 (1952) *.


*V. koki* Pienaar, Bothalia 23:68–70 (1993) #.


*V. nigritia* Hook.f. in Hook., Niger Fl.:310 (1849) *.


J. Section Plectotropis


*V. vexillata* var. *vexillata* *


*V. kirkii* (Baker) Gillett, Kew Bull. 20:103 (1966) *.


*V. nuda* N.E. Br., Kew Bull. 1901:121 (1901) *.


L. Section Ceratotropis


*V. mungo* (L.) Hepper, Kew Bull.:128 (1956).


*V. radiata* var. *radiata*


V. stipulacea (Lam.) Kuntze Rev. Gen. 212 (1891).
V. trilobata (L.) Verdc., Taxon 17:172 (1968) †.

V. angularis var. angularis
V. reflexo-pilosa var. reflexo-pilosa
V. trinervia var. trinervia
V. trinervia var. bourneae (Gamble) Tateishi and Maxted, Kew Bull. 57:633 (2002).
V. umbellata var. umbellata
V. longifolia (Benth.) Verdc., Kew Bull. 24(3):541 (1970) †.


O. Section Sigmoidotropis
V. candida (Vell.) Maréchal, Mascherpa and Stainier, Taxon 27:201 (1978).
V. antillana (Urb.) Fawc. and Rendle, Fl. Jam. 4:69 (1920).
V. peduncularis Fawc. and Rendle, Fl. Jam. 4:68 (1920).
V. peduncularis var. peduncularis
V. peduncularis var. clitorioides (Benth.) Maréchal, Mascherpa and Stainier, Taxon 27:201 (1978).
V. peduncularis var. pusilla (Hassler) Maréchal, Mascherpa and Stainier, Taxon 27:201 (1978).
V. firmula (Benth.) Maréchal, Mascherpa and Stainier, Taxon 27:201 (1978).
V. linearis var. linearis
V. linearis var. latifolia (Benth.) Maréchal, Mascherpa and Stainier, Taxon 27:202 (1978).
S. Section *Leptospron* (Benth.) Maréchal, Mascherpa and Stainier, in *Taxon* 27:201 (1978).

APPENDIX II. Morphological descriptions of African Vigna taxa

*V. luteola* (Jacq.) Benth.

**Habit and Stem:** Perennial, climbing or scrambling, herb, 1.2–6 m, rootstock absent. Stem terete, glabrous or pubescent, glabrescent or dense, shorter than 1 mm, ferruginous.

**Leaf:** Trifoliolate, petiolate, leaflets oblong or elliptic or ovate, apex acuminate or acute or obtuse, base cuneate or rounded or truncate, not lobed, venation reticulate, 15–100(–110)×4–50 mm, glabrous or pubescent, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules:** Lanceolate or ovate or deltoid, erect, basifixed, base produced, and cordate or bilobed, 2–5×1.5–2 mm, lower extension 0.5 to 1.0 mm.

**Inflorescence:** Auxiliary, flowers few, lax, flowering with leaves or after leaves. Peduncle 50–400 mm, rachis 15–55 mm, flower 11–25 mm, pedicel 3–9 mm. Rachis glands absent.

**Flower:** Bracteoles deciduous, lanceolate or ovate or broadly-oblong, shorter than calyx, glabrous. Calyx tube 3–4 mm, teeth 1.5–4 mm, teeth all equal length, teeth shorter than tube, teeth broad, ribs absent, upper teeth fused, tube sparsely hairy, hairs pale yellow-brown. Corolla yellow, standard glabrous. Wings yellow. Keel beaked, slightly curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style slightly curved, with distinct tenuous and thickened portions, beak absent or present, stigma subterminal.

**Legume:** Pods borne above ground, deflexed, linear, 30–80×4–7 mm, valves twisted at dehiscence, constricted at maturity, glabrous or bristly, hairs glabrescent or dense, shorter than 1 mm or longer than 1 mm, pale yellow-brown.

**Seed:** (3–)6–9(–12) seeds per pod, colour reddish brown or grey-brown, oblong, 3–6×3–4 mm. Testa mottled, smooth. Hilum central, less than 3.0 mm. Aril absent.

**Distribution:** Central-east, East, Northeast, South, West, Madagascar and Zambesiaca.

*V. marina* (Burm.) Merr.

**Habit and Stem:** Perennial, climbing or scrambling or procumbent or prostrate, herb, 2–4 m, rootstock absent. Stem terete, glabrous or pubescent, glabrescent, shorter than 1 mm, pale yellow-brown.

**Leaf:** Trifoliolate, petiolate, leaflets elliptic or ovate, apex rounded or obtuse, base cuneate or rounded or obtuse, not lobed, venation reticulate, 35–95×25–80 mm, bristly, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules:** Ovate or deltoid, erect, basifixed or medifixed, base produced, and cordate, 2–3×1.5 mm, lower extension 0.5 to 1.0 mm.

**Inflorescence:** Auxiliary, flowers few, lax, flowering with leaves or after leaves. Peduncle 30–120 mm, rachis 20–30 mm, flower 9–14 mm, pedicel 2–6 mm. Rachis glands absent.
**Flower:** Bracteoles deciduous, lanceolate or broadly-oblong, shorter than calyx, glabrous. Calyx tube 2–2.5 mm, teeth 0.5–1.5 mm, lower tooth longer, teeth shorter than tube, teeth broad, ribs absent, upper teeth fused, tube glabrous, hairs pale yellow-brown. Corolla yellow, standard glabrous. Wings yellow. Keel beaked, slightly curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style slightly curved, with distinct tenuous and thickened portions, beak absent or present, stigma subterminal.

**Legume:** Pods borne above ground, deflexed, linear-oblong, 35–75×6–9 mm, valves not twisted at dehiscence, constricted at maturity or not constricted at maturity, glabrous or bristly, hairs glabrescent, shorter than 1 mm, pale yellow-brown.

**Seed:** 2–6 seeds per pod, colour reddish brown or brown or yellow, oblong or globose, 5.5–7×4.5–6 mm. Testa unmottled, smooth. Hilum not central, less than 3.0 mm. Aril absent.

**Distribution:** Central-east, East, South, West, Madagascar and Zambesiaca.

*V. fischeri* Harms in Engl.

**Habit and Stem:** Perennial, climbing or scrambling or procumbent or prostrate, herb, 1.8–6 m, rootstock absent. Stem terete, pubescent, dense, 1 mm or longer, pale yellow-brown.

**Leaf:** Trifoliolate, petiolate, leaflets linear-lanceolate or oblong or elliptic, apex acuminate, base cuneate or cordate or truncate, not lobed or prominent, venation reticulate, 28–100×7.5–43 mm, bristly, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules:** Linear-lanceolate or ovate, erect, basifixed, base produced, and bilobed, 3–8×1–3 mm, lower extension 0.5 to 1.0 mm.

**Inflorescence:** Auxiliary, flowers many, dense, flowering with leaves or after leaves. Peduncle 60–270 mm, rachis 20–30 mm, flower 15–22 mm, pedicel 2–7 mm. Rachis glands absent.

**Flower:** Bracteoles deciduous, lanceolate, shorter than calyx, densely hairy. Calyx tube 2.5–5 mm, teeth 2.5–5 mm, lower tooth longer, tube and teeth approximately equal, teeth broad, ribs absent, upper teeth fused, tube sparsely hairy or densely hairy, hairs pale yellow-brown. Corolla yellow, standard glabrous. Wings yellow. Keel not beaked, not curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style slightly curved, with distinct tenuous and thickened portions, beak absent or present, stigma subterminal.

**Legume:** Pods borne above ground, deflexed, linear, 30–55×4–5.5 mm, valves twisted at dehiscence, constricted at maturity or not constricted at maturity, softly pubescent or bristly, hairs dense, shorter than 1 mm or longer than 1 mm, distinctly grey.

**Seed:** 10–11 seeds per pod, colour reddish brown, oblong or ellipsoid, 3.3–4.2×3–3.5 mm. Testa mottled or unmottled, smooth. Hilum not central, less than 3.0 mm. Aril present, eccentric, cream.

**Distribution:** Central-east, East, Northeast, West and Zambesiaca.
V. bequaertii R. Wilczek

**Habit and Stem:** Perennial, climbing or scrambling, herb, rootstock absent. Stem terete, pubescent, dense, 1 mm or longer, pale yellow-brown.

**Leaf:** Trifoliolate, petiolate, leaflets oblong, apex acuminate, base rounded, slightly lobed, venation reticulate, 30–100×15–45 mm, pubescent, hairs dense, longer than 1 mm, pale yellow-brown.

**Stipules:** Lanceolate, erect, basifixed, base produced, and bilobed, 4–6×1–2 mm, lower extension 1.1 to 2.0 mm.

**Inflorescence:** Auxiliary, flowers few, dense, flowering with leaves or after leaves. Peduncle 60–200 mm, rachis 10–30 mm, flower 22–35 mm, pedicel 5–10 mm. Rachis glands absent.

**Flower:** Bracteoles deciduous, lanceolate, shorter than calyx, sparsely hairy. Calyx tube 3–4 mm, teeth 2–4 mm, lower tooth longer, tube and teeth approximately equal, teeth narrow and lanceolate, ribs absent, upper teeth fused, tube sparsely hairy, hairs pale yellow-brown. Corolla yellow or purple, standard glabrous. Wings yellow or purple. Keel beaked, slightly curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style slightly curved, with distinct tenuous and thickened portions, beak present, stigma subterminal.

**Legume:** Pods borne above ground, pendent, linear, 70–100×5–6 mm, valves twisted at dehiscence, not constricted at maturity, bristly, hairs glabrescent, longer than 1 mm, pale yellow-brown.

**Seed:** 6–9 seeds per pod, colour red or brown, oblong, 5–6×3–3.5 mm. Testa unmottled, smooth. Hilum central, less than 3.0 mm or 3.0 mm or longer. Aril absent.

**Distribution:** Central-east.

V. oblongifolia A. Rich.

**Habit and Stem:** Annual, climbing or scrambling or procumbent or prostrate, herb, 0.2–4.8 m, rootstock absent or present. Stem terete, bristly, glabrescent, 1 mm or longer, dark brown.

**Leaf:** Trifoliolate, petiolate, leaflets linear-lanceolate or ovate, apex acute or rounded, base cuneate or rounded, not lobed, venation reticulate, 15–120×2–35 mm, pubescent, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules:** Linear-lanceolate or ovate, erect, basifixed, base produced, and cordate, 2–4×0.8–1.5 mm, lower extension 0.5 to 1.0 mm.

**Inflorescence:** Auxiliary, flowers few or many, dense, flowering with leaves or after leaves. Peduncle 20–350 mm, rachis 5–25 mm, flower 6–12 mm, pedicel 2–5 mm. Rachis glands present, large.

**Flower:** Bracteoles deciduous, lanceolate, shorter than calyx, densely hairy. Calyx tube 1–2.5 mm, teeth 1–4 mm, lower tooth longer, tube and teeth approximately equal, teeth broad or narrow and lanceolate, ribs absent, upper teeth fused, tube sparsely hairy or densely hairy, hairs pale yellow-brown. Corolla yellow, standard glabrous. Wings yellow. Keel beaked, not curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation.
Style not curved, with distinct tenuous and thickened portions, beak absent, stigma subterminal.

**Legume:** Pods borne above ground, deflexed, linear-cylindrical, 17–70×2.5–5 mm, valves twisted at dehiscence, constricted at maturity, bristly or ferruginous, hairs glabrescent or dense, longer than 1 mm, pale yellow-brown or dark brown.

**Seed:** 3–9 seeds per pod, colour greenish or reddish brown or brown, globose, 2–4.5×2–3.2 mm. Testa mottled, smooth. Hilum not central, less than 3.0 mm or 3.0 mm or longer. Aril present, eccentric.

**Distribution:** Central-east, East, Northeast, South, West, Madagascar and Zambesiaca.

*V. filicaulis* Hepper

**Habit and Stem:** Perennial, climbing or scrambling, herb, rootstock present. Stem terete, pubescent, glabrescent, shorter than 1 mm or 1 mm or longer, pale yellow-brown.

**Leaf:** Trifoliolate, petiolate, leaflets linear-lanceolate or oblong, apex rounded or obtuse, base rounded, not lobed, venation reticulate, 10–50×5–10 mm, pubescent, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules:** Deltoid, erect, medi-fixed, base produced, and cordate, 2–3×1–2 mm, lower extension 0.5 to 1.0 mm.

**Inflorescence:** Auxiliary, flowers solitary or few, lax, flowering with leaves or after leaves. Peduncle 20–30 mm, flower 6–10 mm. Rachis glands present, large.

**Flower:** Bracteoles deciduous, broadly-oblong, shorter than calyx, glabrous. Calyx teeth all equal length, teeth shorter than tube, teeth broad, ribs absent, upper teeth fused, tube sparsely hairy, hairs pale yellow-brown. Corolla yellow, standard glabrous. Wings yellow. Keel beaked, not curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style not curved, with same proportions along length, beak absent, stigma subterminal.

**Legume:** Pods borne above ground, deflexed, linear, 35–39×3–5 mm, valves not twisted at dehiscence, not constricted at maturity, glabrous.

**Seed:** 3–7 seeds per pod, colour black, oblong. Testa unmottled, smooth. Hilum not central. Aril present, eccentric.

**Distribution:** Central-east, West and Zambesiaca.

*V. multinervis* Hutch. & Dalziel

**Habit and Stem:** Perennial, climbing or scrambling, herb, 0.3–2 m, rootstock absent. Stem terete, glabrous, glabrescent, shorter than 1 mm, pale yellow-brown.

**Leaf:** Trifoliolate, petiolate, leaflets linear-lanceolate or oblong, apex acuminate or rounded, base rounded or cordate or truncate, not lobed, venation parallel, 28–150×2–13 mm, glabrous, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules:** Linear-lanceolate or ovate or deltoid, erect, medi-fixed, base produced, and cordate, 2–4×1–2 mm, lower extension 0.5 to 1.0 mm.
Inflorescence: Auxiliary, flowers solitary or few, lax, flowering with leaves. Peduncle 5–100 mm, rachis 2–15 mm, flower 8–10 mm, pedicel 1.5–3 mm. Rachis glands present, small or large.

Flower: Bracteoles deciduous, lanceolate or ovate, shorter than calyx, glabrous. Calyx tube 2 mm, teeth 0.7–2 mm, teeth all equal length, teeth shorter than tube, teeth broad, ribs present, upper teeth fused, tube glabrous or sparsely hairy, hairs pale yellow-brown. Corolla yellow or pink, standard glabrous. Wings yellow. Keel beaked, slightly curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style slightly curved, with distinct tenuous and thickened portions, beak absent, stigma subterminal.

Legume: Pods borne above ground, deflexed, linear-cylindrical, 30–60×3.5–5 mm, valves twisted at dehiscence, not constricted at maturity, glabrous, hairs glabrescent, shorter than 1 mm, pale yellow-brown.

Seed: 4–10 seeds per pod, colour black, ellipsoid or globose, 2.8–3×1.5–2 mm. Testa unmottled, smooth. Hilum not central, less than 3.0 mm. Aril present, eccentric, yellow.

Distribution: Central-east, East, Northeast, West and Zambesiac. 

V. laurentii De Wild.

Habit and Stem: Perennial, climbing or scrambling, herb, 0.6–0.8 m, rootstock absent. Stem terete, pubescent, glabrescent, 1 mm or longer, pale yellow-brown.

Leaf: Trifoliolate, petiolate, leaflets linear-lanceolate or oblong, apex acute or rounded or obtuse, base rounded, not lobed, venation reticulate, 15–60×5–16 mm, pubescent, hairs sparse, shorter than 1 mm, pale yellow-brown.

Stipules: Linear-lanceolate, erect, medifixed, base produced, and bilobed, 2.5–4×0.6 mm, lower extension 0.5 to 1.0 mm.

Inflorescence: Auxiliary, flowers few or many, lax, flowering with leaves or after leaves. Peduncle 20–150 mm, rachis 10 mm, flower 7–9 mm, pedicel 2 mm. Rachis glands present, large.

Flower: Bracteoles deciduous, lanceolate or ovate, shorter than calyx, glabrous. Calyx tube 2 mm, teeth 0.7–1.2 mm, teeth all equal length, teeth shorter than tube, teeth broad, ribs absent, upper teeth fused, tube sparsely hairy, hairs pale yellow-brown. Corolla yellow or white or blue or purple, standard glabrous. Wings yellow or white or blue or purple. Keel beaked, slightly curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style slightly curved, with distinct tenuous and thickened portions, beak absent, stigma subterminal.

Legume: Pods borne above ground, pendent, linear, 12–20×4 mm, valves not twisted at dehiscence, not constricted at maturity, glabrous.

Seed: 4–5 seeds per pod, colour black, oblong, 2×1 mm. Testa unmottled, smooth. Hilum not central, less than 3.0 mm. Aril present, eccentric.

Distribution: Central-east.

V. ambacensis Welw. ex Baker in Oliv.

Habit and Stem: Annual or perennial, climbing or scrambling, herb, 0.9–7 m,
rootstock absent. Stem terete, pubescent, glabrescent or dense, shorter than 1 mm or 1 mm or longer, pale yellow-brown or hyaline.

**Leaf:** Trifoliolate, petiolate, leaflets linear-lanceolate or oblong or elliptic, apex acuminate or rounded, base rounded or coriaceous, not lobed, venation reticulate, 25–150×3–50 mm, pubescent, hairs dense, shorter than 1 mm, pale yellow-brown or grey.

**Stipules:** Linear-lanceolate or ovate, erect, medifixed, base produced, and coriaceous or bilobed, 2–5×1–2 mm, lower extension 0.5 to 1.0 mm.

**Inflorescence:** Auxiliary, flowers few or many, dense, flowering with leaves or after leaves. Peduncle 15–150 mm, rachis 10–40 (–80) mm, flower 11–20 mm, pedicel 3–5 mm. Rachis glands present, large.

**Flower:** Bracteoles deciduous, lanceolate or broadly-oblong, shorter than calyx, sparsely hairy. Calyx tube 2–3 mm, teeth 0.6–2 mm, teeth all equal length, teeth shorter than tube, teeth broad, ribs absent, upper teeth fused, tube densely hairy, hairs distinctly grey. Corolla yellow or pink or blue, standard hairy. Wings yellow or white. Keel beaked, not curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style slightly curved, with distinct tenuous and thickened portions, beak absent, stigma subterminal.

**Legume:** Pods borne above ground, deflexed, linear, 27–60×4–7 mm, valves twisted at dehiscence, not constricted at maturity, glabrous or softly pubescent, hairs glabrescent or dense, shorter than 1 mm or longer than 1 mm, distinctly grey or dark brown.

**Seed:** 4–8 seeds per pod, colour greenish or reddish brown, oblong, 4–5.5×2–3.5 mm. Testa mottled, smooth. Hilum not central, less than 3.0 mm. Aril present, eccentric, yellow.

**Distribution:** Central-east, East, Northeast, West and Zambesiaca.

*V. benuensis* Pasquet & Maréchal

**Habit and Stem:** Annual, climbing or scrambling, herb, 0.2–0.4 m, rootstock absent. Stem terete, scabrous, glabrescent, shorter than 1 mm, pale yellow-brown.

**Leaf:** Trifoliolate, petiolate, leaflets elliptic or ovate, apex emarginated, base cuneate or rounded, not lobed, venation reticulate, 23–53×8–23 mm, glabrous, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules:** Lanceolate, erect, basifixed, base produced, and coriaceous, 2–3×1.5 mm, lower extension 0.5 to 1.0 mm.

**Inflorescence:** Auxiliary, flowers few, lax, flowering with leaves or after leaves. Peduncle 120 mm, rachis 20 mm, flower 10–14 mm, pedicel 2.5–3.5 mm. Rachis glands absent.

**Flower:** Bracteoles deciduous, ovate, shorter than calyx, glabrous. Calyx tube 2–2.5 mm, teeth 1–1.5 mm, lower tooth longer, teeth shorter than tube, teeth triangular, ribs absent, upper teeth fused, tube glabrous, hairs pale yellow-brown. Corolla green, standard glabrous. Wings yellow. Keel beaked, not curved or slightly curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style slightly curved, with distinct tenuous and thickened portions, beak absent, stigma subterminal.
Legume: Pods borne above ground, pendent, linear, 8–27×5–7 mm, valves twisted at dehiscence, constricted at maturity, softly pubescent, hairs glabrescent, shorter than 1 mm, pale yellow-brown.

**Seed:** 1–3 seeds per pod, colour black, oblong, 6×4–5 mm. Testa mottled, smooth. Hilum central, less than 3.0 mm. Aril present, central, white.

**Distribution:** Central-east and West.

*V. hosei* (Craib) Backer in Backer & Slooten

**Habit and Stem:** Annual or perennial, procumbent or prostrate, herb, 2–3 m, rootstock present. Stem terete, glabrous or pubescent, glabrescent or dense, 1 mm or longer, pale yellow-brown.

**Leaf:** Trifoliolate, petiolate, leaflets oblong or ovate, apex acute or rounded or obtuse, base obtuse or rounded, not lobed, venation reticulate, 15–90×15–25 mm, pubescent, hairs sparse, longer than 1 mm, pale yellow-brown.

**Stipules:** Linear-lanceolate or oblong, erect, medifixed, base truncate or produced, and bilobed or single spurred, 2.5–3×0.8 mm, lower extension 1.1 to 2.0 mm.

**Inflorescence:** Auxiliary, flowers solitary or few, lax, flowering with leaves or after leaves. Peduncle 20–80 mm, rachis 0.1–20 mm, flower 7–8 mm, pedicel 1–3 mm. Rachis glands present, large.

**Flower:** Bracteoles deciduous, lanceolate, shorter than calyx, glabrous. Calyx tube 1 mm, teeth 0.8–1 mm, teeth all equal length, teeth shorter than tube, teeth broad or narrow and lanceolate, ribs absent, upper teeth fused, tube sparsely hairy or densely hairy, hairs pale yellow-brown. Corolla yellow, standard glabrous. Wings yellow. Keel not beaked, slightly curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style not curved, with distinct tenuous and thickened portions, beak absent, stigma subterminal.

**Legume:** Pods borne above ground, deflexed, linear-cylindrical, 20–30×4 mm, valves twisted at dehiscence or not twisted at dehiscence, constricted at maturity or not constricted at maturity, glabrous or softly pubescent, hairs glabrescent, shorter than 1 mm, pale yellow-brown.

**Seed:** 3–4 seeds per pod, colour black, cubic, 5×3 mm. Testa unmottled, smooth. Hilum central, less than 3.0 mm. Aril present, along rim.

**Distribution:** Central-east and West.

*V. parkeri* Baker

**Habit and Stem:** Annual or perennial, climbing or scrambling or procumbent or prostrate, herb, 0.1–2 m, rootstock present. Stem terete, pubescent, glabrescent or dense, 1 mm or longer, pale yellow-brown.

**Leaf:** Trifoliolate, petiolate, leaflets linear-lanceolate or ovate, apex acute or rounded or obtuse, base acute or rounded, not lobed, venation reticulate, 10–88×8–54 mm, pubescent, hairs sparse, longer than 1 mm, pale yellow-brown.

**Stipules:** Lanceolate or oblong, erect, basifixed, base truncate or produced, and bilobed or single spurred, 2.5–5×0.8–1 mm, lower extension 1.1 to 2.0 mm.
Inflorescence: Auxiliary, flowers solitary or few, lax, flowering with leaves or after leaves. Peduncle 20–130 mm, rachis 5–25 mm, flower 5–8.5 mm, pedicel 1–3 mm. Rachis glands present, large.

Flower: Bracteoles persistent, lanceolate or ovate, shorter than calyx, glabrous. Calyx tube 1.5–2 mm, teeth 1–1.5 mm, teeth all equal length, teeth shorter than tube, teeth broad or narrow and lanceolate or ovate or deltoid, ribs absent, upper teeth fused, tube sparsely hairy or densely hairy, hairs pale yellow-brown. Corolla yellow or pink or white or blue, standard glabrous. Wings blue. Keel beaked, not curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style not curved, with distinct tenuous and thickened portions, beak present, stigma subterminal.

Legume: Pods borne above ground, deflexed, linear-oblong, 9–30×4.5–5.5 mm, valves twisted at dehiscence or not twisted at dehiscence, constricted at maturity or not constricted at maturity, glabrous or softly pubescent, hairs glabrescent, shorter than 1 mm, pale yellow-brown.

Seed: 2–5 seeds per pod, colour brown or grey, oblong or cubic, 2.2–4×2–3 mm. Testa mottled, smooth. Hilum not central, less than 3.0 mm. Aril present, eccentric, white.

Distribution: Central-east, East, Northeast, West, Madagascar and Zambesiaca.

V. gracilis (Guill. & Perr.) Hook.f.

Habit and Stem: Annual or perennial, climbing or scrambling, herb, 1 m, rootstock present. Stem terete, pubescent, glabrescent, shorter than 1 mm, pale yellow-brown.

Leaf: Trifoliolate, petiolate, leaflets oblong or elliptic or ovate, apex acute or rounded, base rounded, not lobed, venation reticulate, 15–50×10–30 mm, pubescent, hairs sparse or dense, shorter than 1 mm, pale yellow-brown.

Stipules: Lanceolate, erect, medifixed, base produced, and cordate or bilobed, 2.5–3×0.8–1 mm, lower extension 0.5 to 1.0 mm.

Inflorescence: Auxiliary, flowers few or many, lax, flowering with leaves or after leaves. Peduncle 10–150 mm, rachis 5–50 mm, flower 8–14 mm, pedicel 1.5–4 mm. Rachis glands present, large.

Flower: Bracteoles subpersistent, lanceolate or ovate or broadly-oblong, shorter than calyx, glabrous. Calyx tube 2 mm, teeth 1.5 mm, teeth all equal length, teeth shorter than tube, teeth broad, ribs absent, upper teeth fused, tube glabrous or sparsely hairy, hairs pale yellow-brown. Corolla pink or blue, standard glabrous. Wings yellow or pink or blue. Keel beaked, not curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style not curved, with distinct tenuous and thickened portions, beak present, stigma subterminal.

Legume: Pods borne above ground, deflexed, linear, 20×2.5 mm, valves not twisted at dehiscence, not constricted at maturity, glabrous or bristly, hairs dense, shorter than 1 mm, pale yellow-brown.

Seed: 4–6 seeds per pod, colour black, cubic, 1.5–2.5×1.5–2.5 mm. Testa unmottled, smooth. Hilum not central, less than 3.0 mm. Aril present, along rim or eccentric, yellow.
**Distribution**: Central-east, East, West and Zambesiaca.

*V. racemosa* (G. Don.) Hutch. & Dalziel

**Habit and Stem**: Perennial, climbing or scrambling, herb, 0.5–7 m, rootstock absent. Stem terete, bristly, glabrescent or dense, shorter than 1 mm, dark brown.

**Leaf**: Trifoliolate, petiolate, leaflets oblong or ovate, apex acuminate or acute, base rounded or truncate, not lobed, venation reticulate, 30–130×7–80 mm, bristly, hairs sparse or dense, longer than 1 mm, pale yellow-brown.

**Stipules**: Lanceolate, erect, medifixed, base produced, and bilobed, 5–9×2–4 mm, lower extension greater than 2.0 mm.

**Inflorescence**: Auxiliary, flowers many, lax, flowering with leaves or after leaves. Peduncle 50–230 mm, rachis 15–120 mm, flower 6–14 mm, pedicel 2–5 mm. Rachis glands present, large.

**Flower**: Bracteoles persistent, lanceolate or ovate, shorter than calyx, glabrous or densely hairy. Calyx tube 1.5–2 mm, teeth 1.2–2 mm, teeth all equal length, teeth shorter than tube, teeth broad, ribs absent, upper teeth fused, tube glabrous or sparsely hairy, hairs pale yellow-brown. Corolla pink or blue, standard glabrous. Keel beaked, not curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style not curved, with distinct tenuous and thickened portions, beak absent, stigma subterminal.

**Legume**: Pods borne above ground, deflexed, linear or curved or straight, 20–45×2.8–4 mm, valves twisted at dehiscence, constricted at maturity or not constricted at maturity, glabrous or scabrous, hairs glabrescent, shorter than 1 mm, pale yellow-brown.

**Seed**: 6–8 seeds per pod, colour red or reddish brown, oblong or ellipsoid or globose, 3–4.5×2.5–3 mm. Testa mottled, smooth. Hilum not central, less than 3.0 mm. Aril present, eccentric, yellow.

**Distribution**: Central-east, East, Northeast, West and Zambesiaca.

*V. desmodioides* R. Wilczek

**Habit and Stem**: Perennial, climbing or scrambling, herb, 1.2–2.4 m, rootstock present. Stem terete, bristly, dense, 1 mm or longer, pale yellow-brown.

**Leaf**: Trifoliolate, petiolate, leaflets ovate, apex acuminate, base rounded or cordate, not lobed, venation reticulate, 40–120×25–100 mm, pubescent or bristly, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules**: Lanceolate or oblong, erect, medifixed, base produced, and bilobed, 3–6×2 mm, lower extension 0.5 to 1.0 mm.

**Inflorescence**: Auxiliary, flowers many, lax, flowering with leaves or after leaves. Peduncle 30–60 mm, rachis 20–40 mm, flower 8–12 mm, pedicel 2–4 mm. Rachis glands present, large.

**Flower**: Bracteoles persistent, lanceolate or ovate, longer than calyx, densely hairy. Calyx tube 2–2.5 mm, teeth 1–1.5 mm, teeth all equal length, teeth shorter than tube, teeth broad, ribs absent, upper teeth fused, tube sparsely hairy, hairs pale yellow-brown. Corolla pink or blue, standard glabrous. Wings pink or blue.
Keel beaked, not curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style not curved, with distinct tenuous and thickened portions, beak absent, stigma subterminal.

**Legume**: Pods borne above ground, deflexed, linear, 30–50×3–4 mm, valves not twisted at dehiscence, constricted at maturity, softly pubescent, hairs glabrescent, shorter than 1 mm, pale yellow-brown.

**Seed**: 3–7 seeds per pod, colour red or brown, oblong or reniform, 3.5–4×3 mm. Testa mottled, smooth. Hilum central, less than 3.0 mm. Aril absent or present, vestigial.

**Distribution**: East, Northeast and West.

*V. subterranea* (L.) Verdc.

**Habit and Stem**: Annual, procumbent or prostrate, herb, 0.05–0.5 m, rootstock absent. Stem terete, glabrous or pubescent, glabrescent, shorter than 1 mm, pale yellow-brown.

**Leaf**: Trifoliolate, petiolate or subsessile, leaflets oblong or elliptic, apex rounded or emarginated, base acute or cuneate, not lobed, venation reticulate, 30–110×10–50 mm, glabrous or pubescent, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules**: Lanceolate or ovate, erect, basifixed, base truncate or produced, and bilobed, 3×1 mm, lower extension 0.5 to 1.0 mm.

**Inflorescence**: Flowers solitary or few, lax, flowering with leaves or after leaves. Peduncle 5–30 mm, rachis 1–2.5 mm, flower 9.5–12 mm, pedicel 1–5 mm. Rachis glands present, large.

**Flower**: Bracteoles lanceolate, shorter than calyx, densely hairy. Calyx tube 1 mm, teeth 1 mm, lower tooth longer, teeth shorter than tube, teeth broad, ribs absent, upper teeth fused, tube sparsely hairy, hairs pale yellow-brown. Corolla yellow, standard glabrous. Wings yellow. Keel not beaked, slightly curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style not curved, with same proportions along length, beak absent, stigma subterminal.

**Legume**: Pods borne below ground, oblong-falcate, 10–35×10–18 mm, valves not twisted at dehiscence, not constricted at maturity, glabrous.

**Seed**: 1–4 seeds per pod, colour various, globose, 8.5–15×6.5–10 mm. Testa mottled, smooth. Hilum not central, 3.0 mm or longer. Aril absent.

**Distribution**: Central-east, East, Northeast, South, West, Madagascar and Zambesiaca.

*V. angivensis* Baker

**Habit and Stem**: Perennial, climbing or scrambling, herb, 0.2–1 m, rootstock present. Stem terete, pubescent or bristly, glabrescent or dense, shorter than 1 mm or 1 mm or longer, dark brown.

**Leaf**: Trifoliolate or Unifoliolate, petiolate or subsessile, leaflets elliptic or ovate, apex obtuse, base obtuse or rounded or cordate, not lobed, venation reticulate, 11–69(–90)×2–42 mm, bristly, hairs sparse or dense, shorter than 1 mm or longer than 1 mm, pale yellow-brown.
Stipules: Ovate, erect, medifixed, base truncate or produced, and bilobed, 2–4×1–2 mm, lower extension 0.5 to 1.0 mm.

Inflorescence: Auxiliary, flowers solitary, lax, flowering with leaves or after leaves. Peduncle 30–260 mm, rachis 3–4 mm, flower 10–15 mm, pedicel 2–3 mm. Rachis glands present, large.

Flower: Bracteoles persistent, ovate or broadly-oblung, shorter than calyx, sparsely hairy or densely hairy. Calyx tube 3–4 mm, teeth 2–3 mm, teeth all equal length, teeth shorter than tube, teeth narrow and lanceolate, ribs absent, upper teeth free, tube sparsely hairy, hairs pale yellow-brown. Corolla pink, standard glabrous. Wings pink. Keel beaked, not curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style not curved, with same proportions along length, beak absent, stigma terminal.

Legume: Pods borne above ground, erect, linear-cylindrical, 35–65×3 mm, valves twisted at dehiscence, not constricted at maturity, bristly, hairs dense, shorter than 1 mm, dark brown.

Seed: 9–12 seeds per pod, colour brown or black, oblong or reniform, 2–3×1.8–2.5 mm. Testa unmottled, smooth. Hilum central, less than 3.0 mm. Aril absent.

Distribution: Madagascar.

V. stenophylla Harms

Habit and Stem: Perennial, erect or climbing or scrambling, herb, 0.5–3 m, rootstock present. Stem terete, glabrous or pubescent, glabrescent.

Leaf: Petiolate, leaflets linear-lanceolate, apex acuminate, base attenuate, slightly lobed or prominent, venation reticulate, 15–165×10–125 mm, glabrous, hairs sparse, shorter than 1 mm, pale yellow-brown.

Stipules: Deltoid, erect, basifixed or medifixed, base produced, and cordate, 6–20×1–2 mm, lower extension 0.5 to 1.0 mm.

Inflorescence: Flowers solitary or few, lax, flowering with leaves or after leaves. Peduncle 20–360 mm, rachis 5–30 mm, flower 16–21 mm, pedicel 1–3 mm. Rachis glands absent.

Flower: Bracteoles lanceolate or spatulate, absent. Calyx tube 2–5.5 mm, teeth 3–5 mm, teeth all equal length, teeth shorter than tube, teeth narrow and lanceolate, ribs absent, upper teeth free, tube glabrous. Corolla pink or purple, standard glabrous. Keel not beaked, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style not curved, with same proportions along length, beak absent, stigma terminal.

Legume: Pods borne above ground, linear-cylindrical, 8–10×2–5 mm, valves twisted at dehiscence, not constricted at maturity, glabrous or scabrous.

Seed: 7–10 seeds per pod, globose, 4–6.5×2–4.5 mm. Hilum not central, less than 3.0 mm. Aril present, eccentric.

Distribution: West and Zambesiaca.

V. gazensis Baker f.

Habit and Stem: Annual or perennial, climbing or scrambling, herb, rootstock absent. Stem terete, pubescent, dense, shorter than 1 mm, pale yellow-brown.
Leaf: Trifoliolate, petiolate or subsessile, leaflets oblong or ovate, apex acuminate or acute, base obtuse or rounded or truncate, not lobed, venation reticulate, 40–70×21–36 mm, pubescent, hairs sparse, shorter than 1 mm, pale yellow-brown.

Stipules: Lanceolate or deltoid, erect, basifixed, base produced, and bilobed or single spurred, 5–15×1–1.5 mm, lower extension greater than 2.0 mm.

Inflorescence: Auxiliary, flowers few, dense, flowering with leaves or after leaves. Peduncle 50–230 mm, rachis 15–70 mm, flower 9–16 mm, pedicel 2–5 mm. Rachis glands absent.

Flower: Bracteoles persistent, lanceolate, longer than calyx, densely hairy. Calyx tube 1.5–2 mm, teeth 1.2–2 mm, teeth all equal length, teeth longer than tube, teeth narrow and lanceolate, ribs absent, upper teeth fused, tube sparsely hairy or densely hairy, hairs pale yellow-brown or dark brown. Corolla blue, standard glabrous. Wings pink or blue. Keel beaked, slightly curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style slightly curved, with same proportions along length, beak present, stigma subterminal.

Legume: Pods borne above ground, linear-cylindrical, 20–45×2.8–5 mm, softly pubescent or bristly, hairs dense, longer than 1 mm, dark brown.

Seed: 5–6 seeds per pod, colour reddish brown or brown, oblong, 3–4.5×2.5–3.3 mm. Smooth. Hilum not central, less than 3.0 mm. Aril present, eccentric, cream.

Distribution: Madagascar and Zambesiaca.

_V. comosa_ Baker in Oliv.

Habit and Stem: Perennial, climbing or scrambling or procumbent or prostrate, herb, 0.4–1.2 m, rootstock present. Stem terete, pubescent, dense, shorter than 1 mm, hyaline.

Leaf: Trifoliolate, petiolate, leaflets linear-lanceolate or ovate, apex rounded or obtuse, base cuneate or rounded, not lobed, venation reticulate, 8–60×4–35 mm, glabrous or pubescent, hairs dense, shorter than 1 mm, pale yellow-brown or dark brown.

Stipules: Linear-lanceolate, erect, basifixed, base truncate, 1.5–3×1 mm.

Inflorescence: Auxiliary, flowers few or many, lax or dense, flowering with leaves or after leaves. Peduncle 20–250 mm, rachis 4–65 mm, flower 6–13 mm, pedicel 0.5–2 mm. Rachis glands present, large.

Flower: Bracteoles persistent, lanceolate, longer than calyx, densely hairy. Calyx tube 1.5–2 mm, teeth 0.6–1.5 mm, teeth all equal length, teeth shorter than tube, teeth broad, ribs absent, upper teeth fused, tube sparsely hairy, hairs pale yellow-brown. Corolla yellow, standard glabrous. Wings yellow (rarely mauve-purple). Keel beaked, slightly curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style slightly curved, with same proportions along length, beak present, stigma terminal.

Legume: Pods borne above ground, deflexed, oblong-falcate, 10–40×4–5 mm, valves not twisted at dehiscence, not constricted at maturity, softly pubescent, hairs glabrescent, shorter than 1 mm, pale yellow-brown.
**Seed:** 1–3 seeds per pod, colour reddish brown, oblong, 3–5×2–3.5 mm. Testa mottled, smooth. Hilum not central, less than 3.0 mm. Aril present, eccentric.

**Distribution:** Central-east, East, Northeast, South, West and Zambesiaca.

*V. haumaniana* R. Wilczek

**Habit and Stem:** Perennial, erect, small shrub, 0.7–1.2 m, rootstock present. Stem terete, pubescent, dense, shorter than 1 mm, pale yellow-brown or hyaline.

**Leaf:** Trifoliolate, petiolate, leaflets elliptic or ovate, apex rounded or emarginated, base rounded, not lobed, venation reticulate, 9–30×7–30 mm, pubescent, hairs dense, shorter than 1 mm, pale yellow-brown or grey.

**Stipules:** Linear-lanceolate, erect, basifixed, base truncate, 1.5–3×1 mm.

**Inflorescence:** Auxiliary, flowers solitary or few, lax, flowering with leaves or after leaves. Peduncle 5–30 mm, rachis 5–10 mm, flower 10–16 mm, pedicel 0.5–3 mm. Rachis glands present, large.

**Flower:** Bracteoles lanceolate or ovate, shorter than calyx, densely hairy. Calyx tube 2–3 mm, teeth 1.5–3 mm, teeth all equal length, teeth shorter than tube, teeth broad, ribs absent, upper teeth fused, tube densely hairy, hairs distinctly grey. Corolla yellow, standard glabrous. Wings yellow. Keel beaked, slightly curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style slightly curved, with same proportions along length, beak present, stigma terminal.

**Legume:** Pods borne above ground, deflexed, linear or linear-cylindrical, 28–45×4–6 mm, valves twisted at dehiscence, not constricted at maturity, softly pubescent, hairs glabrescent, shorter than 1 mm, distinctly grey.

**Seed:** (1–)3–4 seeds per pod, oblong or globose, 5–7.5×3–5 mm. Smooth. Hilum not central, 3.0 mm or longer. Aril present, eccentric.

**Distribution:** Central-east, East and Zambesiaca.

*V. membranacea* A. Rich.

**Habit and Stem:** Annual or perennial, climbing or scrambling, herb or suffrutex, 0.2–1.8 m, rootstock present. Stem striated, pubescent or bristly, glabrescent or dense, shorter than 1 mm, pale yellow-brown.

**Leaf:** Trifoliolate, petiolate, leaflets ovate or rhombic, apex acuminate or rounded, base rounded or truncate, not lobed or prominent, venation reticulate, 12–100×11–65 mm, pubescent or bristly, hairs sparse or dense, shorter than 1 mm or longer than 1 mm, pale yellow-brown.

**Stipules:** Lanceolate, erect, medifixed, base produced, and bilobed, 3–12×2–3 mm, lower extension 1.1 to 2.0 mm.

**Inflorescence:** Auxiliary, flowers solitary or few, dense, flowering with leaves or after leaves. Peduncle 10–450 mm, rachis 3–20 mm, flower 10–25 mm, pedicel 2–4 mm. Rachis glands present, large.

**Flower:** Bracteoles deciduous, lanceolate, shorter than calyx, densely hairy. Calyx tube 2–3 mm, teeth 1.5–17 mm, teeth all equal length, teeth longer than tube, teeth narrow and lanceolate, ribs present, upper teeth free, tube sparsely hairy or densely hairy, hairs dark brown. Corolla pink to blue, standard glabrous.
Wings pink or blue or mauve. Keel beaked, slightly curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style slightly curved, with same proportions along length, beak present, stigma subterminal.

**Legume**: Pods borne above ground, erect, linear-cylindrical, 30–95×2–3 mm, valves twisted at dehiscence, not constricted at maturity, scabrous, hairs dense, shorter than 1 mm, pale yellow-brown.

**Seed**: 14–25 seeds per pod, colour red or grey, oblong, 2.5–4.5×1.5–2.8 mm. Testa mottled, distinct median ridge. Hilum central, less than 3.0 mm. Aril absent.

**Distribution**: Central-east, East and Northeast.

*V. friesiorum* Harms

**Habit and Stem**: Perennial, erect or procumbent or prostrate, herb, 0.076–0.3 m, rootstock present. Stem terete, pubescent, glabrescent or dense, shorter than 1 mm or 1 mm or longer, pale yellow-brown.

**Leaf**: Trifoliolate, petiolate, leaflets linear-lanceolate or oblong or elliptic, apex acute or rounded, base rounded, not lobed, venation reticulate, 8–70×3–32 mm, pubescent, hairs sparse or dense, shorter than 1 mm or longer than 1 mm, pale yellow-brown.

**Stipules**: Linear-lanceolate or oblong, erect, medifixed, base produced, and bilobed, 4–7×1–3 mm, lower extension 1.1 to 2.0 mm.

**Inflorescence**: Auxiliary, flowers solitary or few, lax, flowering with leaves or after leaves. Peduncle 35–200 mm, rachis 2.5–9 mm, flower 10–14 mm, pedicel 1–2 mm. Rachis glands present, large.

**Flower**: Bracteoles persistent, lanceolate, shorter than calyx, glabrous. Calyx tube 2–3.5 mm, teeth 2–3.5 mm, teeth all equal length, tube and teeth approximately equal, teeth narrow and lanceolate, ribs present, upper teeth bifid, tube sparsely hairy or densely hairy, hairs pale yellow-brown. Corolla yellow or mauve or green, standard glabrous. Wings yellow or green. Keel beaked, slightly curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style slightly curved, with same proportions along length, beak present, stigma subterminal.

**Legume**: Pods borne above ground, erect, linear-cylindrical, 40–60×2–3 mm, valves twisted at dehiscence, not constricted at maturity, softly pubescent or scabrous, hairs glabrescent or dense, shorter than 1 mm, pale yellow-brown.

**Seed**: 17–20 seeds per pod, colour brown, oblong or reniform, 1.8–2.5×1.5–2 mm. Testa mottled, smooth. Hilum central, less than 3.0 mm. Aril absent.

**Distribution**: Central-east, East and Northeast.

*V. somaliensis* Bak. f.

**Habit and Stem**: Annual, procumbent or prostrate, herb, rootstock absent. Stem terete, pubescent, glabrescent, shorter than 1 mm, pale yellow-brown.

**Leaf**: Trifoliolate, petiolate, leaflets linear-lanceolate, apex acuminate, base acute, not lobed, venation reticulate, 40–55×4–6 mm, pubescent, hairs sparse, shorter than 1 mm, pale yellow-brown.
Stipules: Lanceolate, erect, medifixed, base produced, and bilobed, 3–4×1–2 mm.

Inflorescence: Auxiliary, flowers few, dense, flowering with leaves. Peduncle 200–250 mm, flower 22 mm.

Flower: Calyx tube 3–4 mm, teeth 6–8 mm, teeth all equal length, longer than tube, teeth narrow and lanceolate, upper teeth free, tube sparsely hairy, hairs pale yellow-brown. Standard glabrous. Keel beaked, slightly curved, pocket absent. Pollen exine with coarse reticulation. Style slightly curved, with same proportions along length, beak present, stigma subterminal.

Distribution: Northeast.

V. reticulata Hook.f. in Hook.

Habit and Stem: Annual or perennial, climbing or scrambling or procumbent or prostrate, herb, 0.6–1.5 m, rootstock absent. Stem terete, bristly, dense, 1 mm or longer, pale yellow-brown or dark brown or mixed.

Leaf: Trifoliolate or unifoliolate, petiolate, leaflets linear-lanceolate or elliptic or ovate, apex acuminate or rounded, base rounded or cordate, not lobed, venation subparallel, 15–220×3–75 mm, bristly, hairs sparse or dense, longer than 1 mm, pale yellow-brown.

Stipules: Linear-lanceolate or oblong or ovate, erect, basifixed, base produced, and cordate or bilobed, 5–15×2–4 mm, lower extension 1.1 to 2.0 mm.

Inflorescence: Auxiliary, flowers few, dense, flowering with leaves or after leaves. Peduncle 40–250 mm, rachis 5–25 mm, flower 13–23 mm, pedicel 0.5–1.5 mm. Rachis glands present, small.

Flower: Bracteoles deciduous, lanceolate or broadly-oblong, shorter than calyx, densely hairy. Calyx tube 3–6 mm, teeth 6–20 mm, teeth all equal length, teeth longer than tube, teeth narrow and lanceolate, ribs present, upper teeth free, tube densely hairy, hairs dark brown. Corolla pink or purple, standard glabrous. Wings pink or purple. Keel not beaked, not curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style not curved, with same proportions along length, beak absent, stigma subterminal.

Legume: Pods borne above ground, erect, linear-cylindrical, (27–)38–70×3–5 mm, valves twisted at dehiscence or not twisted at dehiscence, not constricted at maturity, bristly, hairs dense, longer than 1 mm, dark brown.

Seed: 8–14 seeds per pod, colour reddish brown or grey-brown, oblong or cubic, 2.5–5×2–3.5 mm. Testa mottled, smooth. Hilum not central, less than 3.0 mm. Aril present, along rim, greenish.

Distribution: Central-east, East, Northeast, West, Madagascar and Zambesiaca.

V. radicans Welw. ex Baker in Oliv.

Habit and Stem: Annual or perennial, climbing or scrambling or procumbent or prostrate, herb, 1–1.8 m, rootstock present. Stem terete, bristly, dense, 1 mm or longer, pale yellow-brown or dark brown or mixed.

Leaf: Trifoliolate, petiolate, leaflets linear-lanceolate or ovate, apex acute or obtuse, base cuneate or rounded, not lobed, venation subparallel, 30–100×10–
70 mm, bristly, hairs sparse, longer than 1 mm, pale yellow-brown.

**Stipules**: Linear-lanceolate or oblong or ovate, erect, medifixed, base produced, and cordate, unevenly lobed, 4–10×1.5–3 mm, lower extension 0.5 to 1.0 mm.

**Inflorescence**: Auxiliary, flowers few, dense, flowering with leaves or after leaves. Peduncle 40–250 mm, rachis 4–6 mm, flower 11–18 mm, pedicel 1 mm. Rachis glands present, small.

**Flower**: Bracteoles lanceolate or broadly-oblong, shorter than calyx, densely hairy. Calyx tube 3–4 mm, teeth 5–9 mm, teeth all equal length, teeth longer than tube, teeth narrow and lanceolate, ribs present, upper teeth bifid, tube densely hairy, hairs distinctly grey or dark brown. Corolla pink or blue, standard glabrous. Wings pink or blue. Keel not beaked, not curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style not curved, with same proportions along length, beak absent, stigma subterminal.

**Legume**: Pods borne above ground, erect, linear-cylindrical, 40–50×4–5 mm, valves not twisted at dehiscence, not constricted at maturity, bristly, hairs glabrescent, shorter than 1 mm, pale yellow-brown or dark brown.

**Seed**: 5–9 seeds per pod, cubic, 3.5–6.5×2.5–3.5 mm. Testa unmottled, smooth. Hilum central, 3.0 mm or longer. Aril present, along rim, white.

**Distribution**: Central-east, East, West and Zambesiaca.

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**V. dolomitica** R. Wilczek

**Habit and Stem**: Annual or perennial, climbing or scrambling or procumbent or prostrate, herb, 1.8 m, rootstock present. Stem terete, pubescent, dense, shorter than 1 mm or 1 mm or longer, hyaline.

**Leaf**: Trifoliolate, petiolate or subsessile, leaflets elliptic or ovate, apex acute or rounded, base acute, not lobed, venation subparallel, 15–35×9–25 mm, pubescent, hairs dense, longer than 1 mm, grey.

**Stipules**: Linear-lanceolate or ovate, erect, medifixed, base produced, and cordate, 4–7×2 mm, lower extension 0.5 to 1.0 mm.

**Inflorescence**: Auxiliary, flowers few, dense, flowering with leaves or after leaves. Peduncle 15–55 mm, rachis 4–10 mm, flower 10–14 mm, pedicel 1 mm. Rachis glands present, large.

**Flower**: Bracteoles persistent, lanceolate or broadly-oblong, shorter than calyx. Calyx tube 3 mm, teeth 4–5 mm, teeth all equal length, teeth longer than tube, teeth narrow and lanceolate, ribs present, upper teeth bifid, tube densely hairy, hairs dark brown or mixed dark and pale brown. Corolla pink or blue, standard glabrous. Wings pink or blue. Keel beaked, not curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style not curved, with same proportions along length, beak absent, stigma subterminal.

**Legume**: Pods borne above ground, softly pubescent or bristly, distinctly grey.

**Seed**: 6–7 seeds per pod.

**Distribution**: Central-east, East and Zambesiaca.

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**V. pygmaea** R.E. Fr.

**Habit and Stem**: Perennial, erect, herb, 0.03–0.3 m, rootstock present. Stem
terete, bristly, glabrescent, shorter than 1 mm, pale yellow-brown or dark brown.

**Leaf:** Trifoliolate, petiolate, leaflets linear-lanceolate or elliptic, apex acute, base rounded or cordate, not lobed, venation subparallel, 10–80×5–30 mm, bristly, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules:** Linear-lanceolate, erect, medifixed, base produced, and cordate or bilobed, 2–11×1–1.8 mm, lower extension 0.5 to 1.0 mm.

**Inflorescence:** Terminal or auxiliary, flowers solitary or few, lax, flowering before leaves. Peduncle 0–170 mm, rachis 1–6 mm, flower 9–12 mm, pedicel 1–3 mm. Rachis glands present, small or large.

**Flower:** Bracteoles persistent, lanceolate or ovate or broadly-oblong, shorter than calyx, densely hairy. Calyx tube 2–3 mm, teeth 1–6 mm, teeth all equal length, teeth shorter than tube or tube and teeth approximately equal, teeth broad, ribs present, upper teeth free, tube sparsely hairy or densely hairy, hairs pale yellow-brown or dark brown or mixed dark and pale brown. Corolla pink or blue or mauve, standard glabrous. Wings mauve. Keel beaked, not curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style slightly curved, with same proportions along length, beak present, stigma subterminal.

**Legume:** Pods borne above ground, pendent, linear-cylindrical, 30–43×2.5–4 mm, valves not twisted at dehiscence, constricted at maturity or not constricted at maturity, softly pubescent or bristly, hairs dense, shorter than 1 mm, pale yellow-brown or dark brown.

**Seed:** 3–7 seeds per pod, colour reddish brown, globose, 2–2.8×2–2.5 mm. Testa mottled. Hilum central, less than 3.0 mm. Aril absent.

**Distribution:** Central-east, East and Zambesiaca.

*V. phoenix* Brummitt

**Habit and Stem:** Perennial, climbing or scrambling, herb, 0.3 m, rootstock present. Stem terete, bristly, dense, shorter than 1 mm, dark brown or hyaline.

**Leaf:** Trifoliolate, petiolate, leaflets linear-lanceolate or elliptic, apex acute, base cuneate or rounded, not lobed, venation subparallel, 30–70×20–25 mm, bristly, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules:** Linear-lanceolate or oblong or ovate, erect, medifixed, base produced, and cordate or bilobed, 7–18×2.5–5.5 mm, lower extension 0.5 to 1.0 mm.

**Inflorescence:** Auxiliary, flowers solitary or few, dense, flowering before leaves. Peduncle 40–130 mm, rachis 5–15 mm, flower 13–18 mm, pedicel 0.5–2.5 mm. Rachis glands present, large.

**Flower:** Bracteoles persistent, ovate, shorter than calyx, densely hairy. Calyx tube 3 mm, teeth 2.5–5 mm, teeth all equal length, teeth longer than tube, teeth narrow and lanceolate, ribs present, upper teeth free, tube densely hairy, hairs pale yellow-brown or distinctly grey or dark brown. Corolla pink or purple, standard glabrous. Wings pink or purple. Keel not beaked, not curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style slightly curved, with same proportions along length, beak present, stigma subterminal.
**Legume**: Pods borne above ground, linear-cylindrical, 20–40×2–3 mm, valves not twisted at dehiscence, not constricted at maturity, softly pubescent or bristly, hairs dense, longer than 1 mm, pale yellow-brown or dark brown.

**Seed**: 12–15 seeds per pod, globose, 2×1.5–2 mm. Hilum central, less than 3.0 mm. Aril absent.

**Distribution**: East and Zambesiaca.

*V. procera* Welw. Ex Hiern

**Habit and Stem**: Perennial, erect, herb, 0.6 m, rootstock present. Stem terete, pubescent, dense, 1 mm or longer, pale yellow-brown.

**Leaf**: Trifoliolate or unifoliolate, sessile, leaflets ovate, apex rounded or obtuse, base truncate, not lobed, venation subparallel, 45–120×20–55 mm, pubescent, hairs dense, longer than 1 mm, pale yellow-brown.

**Stipules**: Oblong, erect, medifixed, base produced, and cordate, 8–11×3.5–4 mm, lower extension 0.5 to 1.0 mm.

**Inflorescence**: Auxiliary, flowers few, dense, flowering with leaves. Peduncle 95–230 mm, rachis 2–25 mm, flower 17–22 mm, pedicel 0.5–2 mm. Rachis glands absent.

**Flower**: Bracteoles persistent, ovate, shorter than calyx, densely hairy. Calyx tube 4 mm, teeth 9–18 mm, teeth all equal length, teeth longer than tube, teeth narrow and lanceolate, ribs absent, upper teeth bifid, tube densely hairy, hairs pale yellow-brown. Corolla pink or purple, standard glabrous. Wings pink or purple. Keel not beaked, not curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style not curved, with same proportions along length, beak absent, stigma subterminal.

**Legume**: Pods borne above ground, pendent, linear, 50–65×8 mm, valves twisted at dehiscence, not constricted at maturity, densely pubescent, hairs dense, longer than 1 mm, pale yellow-brown.

**Seed**: 6–8 seeds per pod, oblong, 4–5×3–4 mm. Testa unmottled, smooth. Hilum central, less than 3.0 mm. Aril present, along rim, white.

**Distribution**: Zambesiaca.

*V. platyloba* Welw. ex Hiern

**Habit and Stem**: Perennial, climbing or scrambling or procumbent or prostrate, herb, 0.4–2 m, rootstock present. Stem terete, pubescent, dense, shorter than 1 mm, pale yellow-brown.

**Leaf**: Trifoliolate, petiolate, leaflets ovate or rhombic, apex rounded or obtuse, base cuneate or rounded, not lobed or prominent, venation subparallel, 30–150×15–90 mm, pubescent, hairs dense, shorter than 1 mm, pale yellow-brown.

**Stipules**: Linear-lanceolate or deltoid, erect, medifixed, base produced, and cordate or bilobed, 5–10×3–4 mm, lower extension 0.5 to 1.0 mm or 1.1 to 2.0 mm.

**Inflorescence**: Auxiliary, flowers few or many, lax or dense, flowering with leaves or after leaves. Peduncle 30–210 mm, rachis 6–30 mm, flower 17–27 mm, pedicel 0.5–1 mm. Rachis glands present, large.
Flower: Bracteoles deciduous, lanceolate or broadly-oblong, shorter than calyx or absent, densely hairy. Calyx tube 4 mm, teeth 1.5–7 mm, lower tooth longer, teeth longer than tube, teeth narrow and lanceolate, ribs absent, upper teeth bifid, tube densely hairy, hairs distinctly grey or dark brown or mixed dark and pale brown. Corolla pink or purple, standard glabrous. Wings mauve. Keel beaked, not curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style not curved, with same proportions along length, beak absent, stigma subterminal.

Legume: Pods borne above ground, pendent, linear-cylindrical, 40–90×6–7 mm, valves not twisted at dehiscence, not constricted at maturity, softly pubescent or bristly, hairs dense, shorter than 1 mm, distinctly grey or dark brown.

Seed: 12 seeds per pod, colour reddish brown, oblong, 4.5–6×3–4.5 mm. Testa mottled, smooth. Hilum not central, less than 3.0 mm. Aril present, along rim, white.

Distribution: Central-east, East and Zambesiaca.

V. antunesii Harms in Engl.

Habit and Stem: Perennial, erect or climbing or scrambling or procumbent or prostrate, herb, 0.06–1.8 m, rootstock present. Stem terete, glabrous or pubescent, glabrescent, shorter than 1 mm, pale yellow-brown.

Leaf: Trifoliolate, petiolate, leaflets linear-lanceolate or ovate or rhombic, apex obtuse, base cuneate or rounded or cordate, not lobed, venation reticulate, 35–95×4–65 mm, glabrous, hairs sparse, shorter than 1 mm, pale yellow-brown.

Stipules: Linear-lanceolate or ovate, erect, basifixed, base truncate, and bilobed, 4–10×1–3 mm, lower extension 0.5 to 1.0 mm.

Inflorescence: Terminal or auxiliary, flowers solitary or few, dense, flowering before leaves or with leaves. Peduncle 40–200 mm, rachis 20–50 mm, flower 13–25 mm, pedicel 1–3 mm. Rachis glands present, small.

Flower: Bracteoles persistent, lanceolate or broadly-oblong, shorter than calyx, densely hairy. Calyx tube 4 mm, teeth 2–9 mm, teeth all equal length, teeth shorter than tube, teeth broad or narrow and lanceolate, ribs present, upper teeth bifid or free, tube sparsely hairy or densely hairy, hairs pale yellow-brown or distinctly grey. Corolla pink or blue, standard glabrous or hairy. Wings pink or blue. Keel beaked, slightly curved, pocket present. Anther glands absent, pollen exine with coarse reticulation. Style slightly curved, with distinct tenuous and thickened portions, beak present, stigma lateral.

Legume: Pods borne above ground, pendent, linear-cylindrical, 70–110×4–7 mm, valves not twisted at dehiscence, constricted at maturity, softly pubescent, hairs glabrescent, shorter than 1 mm, pale yellow-brown.

Seed: 3–4 seeds per pod, oblong, 3. Testa unmottled, smooth. Hilum central, less than 3.0 mm. Aril present, vestigial, white.

Distribution: Central-east, East and Zambesiaca.

V. frutescens A. Rich.

Habit and Stem: Perennial, climbing or scrambling or procumbent or prostrate,
herb, 0.5–1.5 m, rootstock present. Stem terete, glabrous or pubescent, glabrescent or dense, shorter than 1 mm, pale yellow-brown or dark brown or hyaline.

**Leaf:** Trifoliolate, petiolate, leaflets oblong or elliptic or rhombic, apex acute or emarginated, base cuneate or rounded, not lobed or prominent, venation reticulate or parallel, 15–95×10–47 mm, glabrous or pubescent, hairs sparse or dense, shorter than 1 mm, pale yellow-brown or grey.

**Stipules:** Lanceolate or oblong, erect, medifixed, base produced, and bilobed, 4.5–8×1–2 mm, lower extension 0.5 to 1.0 mm.

**Inflorescence:** Terminal or auxiliary, flowers solitary or few, dense, flowering before leaves. Peduncle 12–190 mm, rachis 6–15 mm, flower 13–26 mm, pedicel 1–4 mm. Rachis glands present, small.

**Flower:** Bracteoles persistent, ovate or broadly-oblong, shorter than calyx or absent, densely hairy. Calyx tube 2.5–5 mm, teeth 1.5–10 mm, teeth all equal length, teeth shorter than tube or longer than tube, teeth broad or narrow and lanceolate, ribs present, upper teeth free, tube sparsely hairy or densely hairy, hairs pale yellow-brown or distinctly grey. Corolla pink or white or blue or mauve, standard glabrous or hairy. Wings mauve. Keel beaked, slightly curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style slightly curved, with distinct tenuous and thickened portions, beak present, stigma lateral.

**Legume:** Pods borne above ground, erect, linear-cylindrical, 60–110×3.5–5 mm, valves twisted at dehiscence, not constricted at maturity, softly pubescent, hairs glabrescent or dense, shorter than 1 mm, pale yellow-brown or distinctly grey.

**Seed:** 12–16 seeds per pod, colour reddish brown, oblong or ellipsoid, 3–5×2–3 mm. Testa mottled, smooth. Hilum central, less than 3.0 mm. Aril absent.

**Distribution:** Central-east, East, Northeast, South, West and Zambesiaca.


**Habit and Stem:** Annual or perennial, climbing or scrambling, herb, rootstock absent. Stem terete, glabrous, glabrescent, shorter than 1 mm, pale yellow-brown or hyaline.

**Leaf:** Trifoliolate, petiolate, leaflets ovate, apex obtuse, base truncate, not lobed, venation reticulate, 25–43×18–28 mm, glabrous, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules:** Ovate, erect, basifixed, base produced, and bilobed, 1.5–2.5×1–2 mm, lower extension 0.5 to 1.0 mm.

**Inflorescence:** Auxiliary, flowers solitary or few, lax, flowering before leaves. Peduncle 5–50 mm, rachis 1–8 mm, flower 12–15 mm, pedicel 2–4 mm. Rachis glands absent.

**Flower:** Bracteoles deciduous, ovate, shorter than calyx, glabrous. Calyx tube 4 mm, teeth 1.5 mm, lower tooth shorter, teeth shorter than tube, teeth broad or triangular, ribs absent, upper teeth fused, tube glabrous. Corolla yellow or purple, standard glabrous. Wings white or purple. Keel beaked, slightly curved,
pocket absent. Anther glands present, pollen exine with coarse reticulation. Style slightly curved, with distinct tenuous and thickened portions, beak present, stigma lateral.

**Legume**: Pods borne above ground, erect, linear-oblong.

**Seed**: 11–16 seeds per pod.

**Distribution**: Madagascar.

*V. unguiculata* (L.) Walp.

**Habit and Stem**: Annual or perennial, erect or climbing or scrambling or procumbent or prostrate, herb, 0.5–3 m, rootstock absent. Stem striated, glabrous or pubescent or scabrous, glabrescent or dense, shorter than 1 mm, pale yellow-brown.

**Leaf**: Trifoliolate, petiolate, leaflets linear-lanceolate or ovate or rhombic, apex acuminate or acute, base acute or rounded, not lobed or prominent, venation reticulate, 15–165×8–90 mm, glabrous or pubescent or scabrous, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules**: Oblong or ovate, erect, medifixed, base produced, and single spurred, 6–20×1–2 mm, lower extension 1.1 to 2.0 mm or greater than 2.0 mm.

**Inflorescence**: Auxiliary, flowers solitary or few, lax, flowering with leaves or after leaves. Peduncle 20–360 mm, rachis 5–50 mm, flower 15–33 mm, pedicel 1–4 mm. Rachis glands present, small or large.

**Flower**: Bracteoles deciduous, lanceolate or broadly-oblong or spatulate, shorter than calyx or absent, glabrous. Calyx tube 2–5.5 mm, teeth 2–14 mm, teeth all equal length, teeth shorter than tube or longer than tube, teeth broad or narrow and lanceolate, ribs absent, upper teeth free, tube glabrous or densely hairy, hairs pale yellow-brown. Corolla pink or white or purple, standard glabrous. Wings blue or purple. Keel beaked, slightly curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style slightly curved, with distinct tenuous and thickened portions, beak present, stigma subterminal.

**Legume**: Pods borne above ground, erect or pendent, linear-cylindrical or linear-oblong, (40–)70–150×2.5–11 mm, valves not twisted at dehiscence, not constricted at maturity, glabrous or scabrous, hairs glabrescent, shorter than 1 mm, pale yellow-brown.

**Seed**: 11–18 seeds per pod, colour reddish brown or black or white, oblong or reniform, 3.5–5(–12)×2–3.5(–7) mm. Testa mottled, distinct median ridge. Hilum not central, less than 3.0 mm. Aril present, along rim, white.

**Distribution**: Central-east, East, Northeast, South, West, Madagascar and Zambesiaca.

*V. schlechteri* Harms in Engler

**Habit and Stem**: Perennial, erect, herb, rootstock present. Stem terete, glabrous or pubescent, glabrescent, 1 mm or longer, pale yellow-brown.

**Leaf**: Trifoliolate, petiolate, leaflets elliptic, apex acute or rounded, not lobed, venation reticulate, 20–30×10–12 mm, glabrous, hairs sparse, shorter than 1 mm, pale yellow-brown.
**Stipules**: Lanceolate, erect, medifixed, base produced, and cordate, 5–11×1–3.5 mm, lower extension 1.1 to 2.0 mm.

**Inflorescence**: Auxiliary, flowers solitary, flowering with leaves. Peduncle 7–12 mm, flower 8–9 mm, pedicel 0.5–1 mm. Rachis glands absent.

**Flower**: Bracteoles persistent, ovate, shorter than calyx, glabrous. Calyx tube 2–4 mm, teeth 1.5–3 mm, lower tooth longer, teeth shorter than tube, teeth narrow and lanceolate, ribs absent, upper teeth free, tube glabrous or sparsely hairy, hairs pale yellow-brown. Standard glabrous. Keel not beaked, slightly curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style slightly curved, with distinct tenuous and thickened portions, beak present, stigma subterminal.

**Legume**: Pods borne above ground, pendent, linear-cylindrical, 35×2.5 mm, valves twisted at dehiscence, not constricted at maturity, glabrous.

**Seed**: 7–8 seeds per pod, oblong, 2–3×1.5–2 mm. Testa unmottled, smooth. Hilum not central, less than 3.0 mm. Aril present, eccentric, white.

**Distribution**: South and Zambesiaca.


**Habit and Stem**: Perennial, climbing or scrambling, herb, 0.1–1 m, rootstock present. Stem terete, glabrous or pubescent, glabrescent, shorter than 1 mm, pale yellow-brown.

**Leaf**: Trifoliolate, sessile, leaflets linear-lanceolate or oblong or ovate, apex obtuse, base obtuse or rounded, not lobed, venation reticulate, 10–45×1.5–5(–8) mm, glabrous or pubescent, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules**: Ovate, erect, medifixed, base produced, and single spurred, 2–4×1–2.5 mm, lower extension 1.1 to 2.0 mm.

**Inflorescence**: Auxiliary, flowers solitary, lax, flowering with leaves. Peduncle 15–75 mm, rachis 0 mm, flower 8–14 mm, pedicel 5 mm. Rachis glands absent.

**Flower**: Bracteoles persistent, ovate or triangular, shorter than calyx, glabrous. Calyx tube 1.5–2 mm, teeth 1–2 mm, lower tooth longer, teeth shorter than tube, teeth triangular, ribs absent, upper teeth bifid, tube glabrous, hairs pale yellow-brown. Corolla pink or purple, standard glabrous. Wings pink or purple. Keel not beaked, slightly curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style slightly curved, with distinct tenuous and thickened portions, beak present, stigma subterminal.

**Legume**: Pods borne above ground, erect, linear-oblong, 28–35×2.5 mm, valves twisted at dehiscence, not constricted at maturity, glabrous, hairs glabrescent, shorter than 1 mm, pale yellow-brown.

**Seed**: 7 seeds per pod, colour reddish brown, oblong, 2×1.4 mm. Testa mottled, smooth. Hilum central, less than 3.0 mm. Aril absent.

**Distribution**: Madagascar.
**V. monantha** Thulin

**Habit and Stem:** Perennial, climbing or scrambling, herb, 0.5 m, rootstock absent. Stem terete, bristly, dense, 1 mm or longer, pale yellow-brown.

**Leaf:** Trifoliolate, petiolate, leaflets ovate or rhombic, apex acute or rounded, base cuneate, prominently lobed, venation reticulate, 12–35×8–16 mm, pubescent, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules:** Lanceolate, erect, medifixed, base produced, and rounded, 3–4×1.5 mm.

**Inflorescence:** Auxiliary, flowers solitary. Peduncle 20–80 mm, rachis 0 mm, flower 17 mm, pedicel 1 mm. Rachis glands absent.

**Flower:** Bracteoles deciduous, ovate, shorter than calyx, sparsely hairy. Calyx tube 4 mm, teeth 2.4–3.2 mm, lower tooth longer, teeth shorter than tube, teeth deltoid, ribs absent, upper teeth bifid, tube glabrous, hairs pale yellow-brown. Corolla blue or mauve, standard glabrous. Wings blue or mauve. Keel beaked, slightly curved, pocket absent. Anther glands absent, pollen exine with coarse reticulation. Style slightly curved, with distinct tenuous and thickened portions, beak present, stigma subterminal.

**Legume:** Pods borne above ground, erect, linear-cylindrical, 55×3 mm, valves twisted at dehiscence, not constricted at maturity, softly pubescent, hairs dense, shorter than 1 mm, pale yellow-brown.

**Seed:** 6–10 seeds per pod, colour brown, oblong. Testa mottled, smooth. Hilum subcentral, less than 3.0 mm. Aril absent.

**Distribution:** Northeast.

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**V. monophylla** Taub. in Engl.

**Habit and Stem:** Perennial, erect or climbing or scrambling or procumbent or prostrate, herb, 0.14–0.6 m, rootstock present. Stem terete, glabrous, shorter than 1 mm, pale yellow-brown.

**Leaf:** Unifoliolate, subsessile, leaflets linear-lanceolate or elliptic or ovate, apex rounded or obtuse, base rounded or cordate, not lobed, venation reticulate, 18–115×5–30 mm, glabrous or pubescent, hairs dense, shorter than 1 mm, pale yellow-brown.

**Stipules:** Linear-lanceolate or deltoid, erect, basifixed or medifixed, base produced, and bilobed, 1.5–4×1.5 mm, lower extension 0.5 to 1.0 mm.

**Inflorescence:** Flowers many, dense, flowering with leaves or after leaves. Peduncle 70–350 mm, rachis 3–15 mm, flower 10–14 mm, pedicel 1 mm. Rachis glands present, large.

**Flower:** Bracteoles deciduous, ovate or broadly-oblong, shorter than calyx, glabrous. Calyx tube 2 mm, teeth 1.5–2.5 mm, teeth all equal length, teeth shorter than tube, teeth broad, ribs absent, upper teeth fused, tube glabrous or sparsely hairy, hairs dark brown. Corolla yellow or pink or purple, standard glabrous. Wings purple. Keel beaked, slightly curved, pocket absent. Anther glands present, pollen exine smooth. Style slightly curved, with same proportions along length, beak absent, stigma subterminal.

**Legume:** Pods borne above ground, erect, linear-cylindrical, 38–50×3–4 mm, valves not twisted at dehiscence, not constricted at maturity, briskly, hairs dense, shorter than 1 mm, dark brown.
**Seed:** 12–14 seeds per pod, colour reddish brown, globose or cubic, 1.5–2.5×1.5–2.5 mm. Testa mottled. Hilum central, less than 3.0 mm. Aril absent, vestigial.

**Distribution:** Central-east, East, Northeast and Zambesiaca.

*V. triphylla* (R. Wilczek) Verdc.

**Habit and Stem:** Perennial, climbing or scrambling or procumbent or prostrate, herb, 0.6–1.8 m, rootstock present. Stem distinctly winged, glabrous or pubescent, glabrescent, shorter than 1 mm, pale yellow-brown or dark brown.

**Leaf:** Trifoliolate, petiolate, leaflets linear-lanceolate or oblong or ovate, apex acute or rounded, base rounded or cordate, not lobed, venation reticulate, 28–70×3–30 mm, glabrous or pubescent, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules:** Lanceolate, erect, basifixed or medifixed, base produced, and bilobed, 3–6×1–2 mm, lower extension 0.5 to 1.0 mm.

**Inflorescence:** Flowers few, dense, flowering with leaves or after leaves. Peduncle 15–90 mm, rachis 3–25 mm, flower 10–13 mm, pedicel 0.5–2 mm. Rachis glands present, large.

**Flower:** Bracteoles ovate or broadly-oblong, shorter than calyx, glabrous or densely hairy. Calyx tube 1.5–2 mm, teeth 1–2.5 mm, lower tooth longer, teeth shorter than tube, teeth broad, ribs absent, upper teeth fused, tube glabrous or sparsely hairy, hairs pale yellow-brown. Corolla yellow or pink or mauve, standard glabrous. Wings yellow or pink or blue. Keel beaked, slightly curved, pocket absent. Anther glands present, pollen exine smooth. Style slightly curved, with same proportions along length, beak absent, stigma subterminal.

**Legume:** Pods borne above ground, erect, linear-cylindrical, 40–50×3–4 mm, valves twisted at dehiscence, not constricted at maturity, glabrous or scabrous, hairs glabrescent, shorter than 1 mm, pale yellow-brown.

**Seed:** 13–18 seeds per pod, globose or cubic, 1.5–2.5×1.5 mm. Hilum not central, less than 3.0 mm. Aril absent or present, vestigial.

**Distribution:** Central-east, East, Northeast, West and Zambesiaca.

*V. juncea* Milne-Redh.

**Habit and Stem:** Perennial, erect or climbing or scrambling, herb, 0.15–0.5 m, rootstock present. Stem terete, glabrous or pubescent, glabrescent, shorter than 1 mm, pale yellow-brown.

**Leaf:** Trifoliolate, petiolate, leaflets oblong or ovate, apex acuminate or acute, base rounded, not lobed, venation reticulate, 20–43×5–22 mm, glabrous or pubescent, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules:** Lanceolate, erect, basifixed or medifixed, base produced, and bilobed, 3–10×2–7 mm.

**Inflorescence:** Flowers solitary or few, lax, flowering with leaves or after leaves. Peduncle 120–250 mm, rachis 50–200 mm, flower 9–18 mm, pedicel 2–3 mm. Rachis glands present, small.
Flower: Bracteoles deciduous, broadly-oblong, shorter than calyx or absent, glabrous. Calyx tube 2.5–3 mm, teeth 1–2 mm, teeth all equal length, teeth shorter than tube, teeth broad, ribs absent, upper teeth fused, tube glabrous, hairs pale yellow-brown. Corolla yellow or purple, standard glabrous. Wings pink or white. Keel beaked, slightly curved, pocket absent. Anther glands present, pollen exine smooth. Style slightly curved, with same proportions along length, beak absent, stigma subterminal.

Legume: Pods borne above ground, erect, linear-cylindrical, 30–75×2–5 mm, valves twisted at dehiscence, glabrous or scabrous, hairs glabrescent, shorter than 1 mm, pale yellow-brown.

Seed: 12–16 seeds per pod, colour brown, globose, 2.5–3×1.8–2.5 mm. Testa mottled. Less than 3.0 mm. Aril absent.

Distribution: Central-east, East and Zambesiaca.

V. nyangensis Mithen

Habit and Stem: Perennial, climbing or scrambling or procumbent or prostrate, herb, rootstock present. Stem terete, glabrous, glabrescent, shorter than 1 mm, pale yellow-brown.

Leaf: Trifoliolate, petiolate, leaflets linear-lanceolate or oblong or elliptic, apex acute, base rounded, not lobed, venation reticulate, 30–40×5–20 mm, glabrous or pubescent, hairs sparse, shorter than 1 mm, pale yellow-brown.

Stipules: Lanceolate, erect, basifixed or medifixed, base produced, and bilobed, 3–4×1–1.5 mm, lower extension 0.5 to 1.0 mm.

Inflorescence: Auxiliary, flowers many, dense, flowering with leaves or after leaves. Peduncle 30–100 mm, rachis 20–40 mm, flower 10–17 mm, pedicel 1.5–4 mm. Rachis glands absent.

Flower: Bracteoles deciduous, broadly-oblong, shorter than calyx, glabrous. Calyx tube 2–3 mm, teeth 1.5–3 mm, lower tooth longer, tube and teeth approximately equal, teeth broad, ribs absent, upper teeth fused, tube glabrous. Corolla blue, standard glabrous. Wings blue. Keel beaked, slightly curved, pocket absent. Anther glands present, pollen exine smooth. Style slightly curved, with same proportions along length, beak absent, stigma subterminal.

Legume: Pods borne above ground, erect, linear-cylindrical, 50–65×3–5 mm, valves twisted at dehiscence, not constricted at maturity, glabrous.

Seed: 12–14 seeds per pod, oblong, 2–4×1.5–2 mm. Testa unmottled. Hilum central, less than 3.0 mm. Aril absent.

Distribution: Zambesiaca.

V. microsperma R. Vig.

Habit and Stem: Perennial, climbing or scrambling or procumbent or prostrate, herb, 0.1–0.5 m, rootstock present. Stem striated, glabrous, glabrescent, shorter than 1 mm, hyaline.

Leaf: Trifoliolate, sessile, leaflets oblong or elliptic or ovate, apex acute or rounded, base rounded or truncate, not lobed, venation reticulate, 5–22(–35)×1.5–13(–18) mm, glabrous.
**Stipules**: Ovate, erect, basifixed, base truncate, and rounded, 1–3×1 mm.

**Inflorescence**: Auxiliary, flowers few, dense, flowering with leaves. Peduncle 20–190 mm, rachis 1 mm, flower 6–8 mm, pedicel 1 mm. Rachis glands absent.

**Flower**: Bracteoles deciduous, triangular, shorter than calyx, densely hairy. Calyx tube 2 mm, teeth 1 mm, lower tooth longer, teeth shorter than tube, teeth ovate or triangular, ribs absent, upper teeth bifid, tube glabrous, hairs pale yellow-brown. Corolla pink or purple, standard glabrous. Wings pink or purple. Keel beaked, not curved, pocket absent. Anther glands absent, pollen exine smooth. Style not curved, with same proportions along length, beak absent, stigma terminal.

**Legume**: Pods borne above ground, erect, linear-cylindrical, 18–35×2–3 mm, valves twisted at dehiscence, not constricted at maturity, glabrous, hairs glabrescent, shorter than 1 mm, dark brown.

**Seed**: (6–)8–10 seeds per pod, colour greenish or grey, oblong, 1.5–2×1.5 mm. Testa mottled, smooth. Hilum central, less than 3.0 mm. Aril absent or present, vestigial.

**Distribution**: Madagascar.

*V. richardsiae* Verdc.

**Habit and Stem**: Annual, climbing or scrambling or procumbent or prostrate, herb, 1.5 m, rootstock absent. Stem terete, glabrous, glabrescent, shorter than 1 mm, pale yellow-brown.

**Leaf**: Trifoliolate, petiolate, leaflets linear-lanceolate or ovate, apex acuminate or acute, base rounded, not lobed, venation reticulate, 15–50×4–28 mm, glabrous, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules**: Linear-lanceolate, erect, medifixed, base truncate, and rounded, 2–4×1 mm, lower extension 1.1 to 2.0 mm or greater than 2.0 mm.

**Inflorescence**: Auxiliary, flowers few, dense, flowering with leaves. Peduncle 10–65 mm, rachis 5–10 mm, flower 11–12 mm, pedicel 2–4 mm. Rachis glands absent.

**Flower**: Bracteoles deciduous, broadly-oblong, shorter than calyx, glabrous. Calyx tube 2.5 mm, teeth 1–1.5 mm, teeth all equal length, teeth shorter than tube, teeth deltoid, ribs absent, upper teeth fused, tube glabrous, hairs pale yellow-brown. Corolla yellow or mauve, standard glabrous. Wings yellow or mauve. Keel beaked, not curved, pocket absent. Anther glands present, pollen exine smooth. Style not curved, with same proportions along length, beak absent, stigma terminal.

**Legume**: Pods borne above ground, deflexed, linear, 40×3–4.5 mm, valves twisted at dehiscence, not constricted at maturity, glabrous or softly pubescent, hairs glabrescent, shorter than 1 mm, pale yellow-brown.

**Seed**: 6–10 seeds per pod.

**Distribution**: East and Zambesiaca.

*V. schimperi* Baker in Oliv.

**Habit and Stem**: Perennial, climbing or scrambling, herb, 2 m, rootstock
present. Stem terete, pubescent, glabrescent or dense, shorter than 1 mm, pale yellow-brown.

**Leaf:** Trifoliolate, petiolate, leaflets oblong or elliptic or ovate, apex acute, base rounded, not lobed, venation reticulate, (12–)30–70×(6–)13–48 mm, pubescent, hairs sparse or dense, shorter than 1 mm, pale yellow-brown.

**Stipules:** Linear-lanceolate or ovate, erect, medifixed, base produced, and bilobed, 3–5×1.5 mm.

**Inflorescence:** Auxiliary, flowers few, dense, flowering with leaves or after leaves. Peduncle 30–180 mm, rachis 1–17 mm, flower 13–25 mm, pedicel 2–8 mm. Rachis glands absent.

**Flower:** Bracteoles deciduous, lanceolate or ovate, shorter than calyx, densely hairy. Calyx tube 3–6 mm, teeth 1.5–5 mm, lower tooth longer, teeth shorter than tube, teeth broad, ribs absent, upper teeth bifid, tube sparsely hairy or densely hairy, hairs distinctly grey. Corolla yellow or green, standard glabrous. Wings yellow or green. Keel beaked, slightly curved, pocket absent. Anther glands absent, pollen exine with rounded reticulation. Style not curved, with same proportions along length, beak absent, stigma terminal.

**Legume:** Pods borne above ground, erect, linear-cylindrical, 40–95×3.5–4 mm, valves twisted at dehiscence, constricted at maturity or not constricted at maturity, softly pubescent, hairs dense, longer than 1 mm, pale yellow-brown.

**Seed:** 16 seeds per pod, colour reddish brown, oblong or ellipsoid or cubic, 2.5–4×1.5–3 mm. Testa mottled, smooth. Hilum not central, less than 3.0 mm. Aril absent or present, vestigial or along rim, white.

**Distribution:** Central-east, East, Northeast and Zambesiaca.

*V. mudenia* Pienaar

**Habit and Stem:** Perennial, climbing or scrambling, herb, rootstock present. Stem distinctly winged or striated, pubescent, dense, 1 mm or longer, hyaline.

**Leaf:** Trifoliolate, petiolate, leaflets elliptic, apex acute, base cuneate or asymmetrical, not lobed, venation reticulate, 40×20 mm, pubescent, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules:** Lanceolate, reflexed, medifixed, base produced, and cordate, 5–6×3 mm, lower extension 1.1 to 2.0 mm.

**Inflorescence:** Auxiliary, flowers few, lax. Peduncle 100 mm, rachis 8 mm, flower 10–14 mm, pedicel 2 mm. Rachis glands absent.

**Flower:** Bracteoles deciduous, ovate, shorter than calyx, glabrous. Calyx tube 2 mm, teeth 2 mm, lower tooth longer, tube and teeth approximately equal, teeth narrow or triangular, ribs absent, upper teeth fused, tube densely hairy, hairs pale yellow-brown. Corolla yellow, standard glabrous. Wings yellow. Keel not beaked, slightly curved, pocket absent. Anther glands absent, pollen exine smooth. Style not curved, with same proportions along length, beak present, stigma subterminal.

**Legume:** Pods borne above ground, erect, linear, 60×3 mm, valves twisted at dehiscence, constricted at maturity, softly pubescent, hairs dense, longer than 1 mm, distinctly grey.
Seed: 12–14 seeds per pod, colour grey, oblong, 3×2 mm. Testa mottled, smooth. Hilum central, less than 3.0 mm. Aril present, vestigial, white.

**Distribution:** South.

*V. kokii* Pienaar

**Habit and Stem:** Perennial, climbing or scrambling, suffrutex, rootstock present. Stem distinctly winged or striated, pubescent or bristly, glabrescent, 1 mm or longer, pale yellow-brown.

**Leaf:** Trifoliolate, petiolate, leaflets oblong, apex rounded, base rounded, not lobed, venation reticulate, 25–58×0.8–30 mm, pubescent, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules:** Lanceolate, erect, medifixed, base produced, and cordate, 6×1.5 mm, lower extension 0.5 to 1.0 mm.

**Inflorescence:** Terminal, flowers few, lax, flowering with leaves or after leaves. Flower 10–14 mm. Rachis glands present, small.

**Flower:** Bracteoles deciduous. Calyx tube 3.5 mm, teeth 2 mm, lower tooth longer, teeth shorter than tube or longer than tube, teeth broad, ribs absent, upper teeth fused, tube sparsely hairy, hairs pale yellow-brown. Corolla yellow or green, standard glabrous. Wings yellow. Keel beaked, not curved, pocket absent. Anther glands present, pollen exine smooth. Style not curved, with same proportions along length, beak present, stigma subterminal.

**Legume:** Pods borne above ground, erect, linear-cylindrical, 68×3–4 mm, valves twisted at dehiscence, not constricted at maturity, softly pubescent, hairs glabrescent, longer than 1 mm, pale yellow-brown.

**Seed:** 18 seeds per pod, colour brown or grey, oblong, 3–4 mm. Testa mottled, smooth. Hilum central, less than 3.0 mm. Aril absent or present, vestigial, white.

**Distribution:** South.

*V. nigritia* Hook.f. in Hook.

**Habit and Stem:** Perennial, climbing or scrambling, herb, 2–7 m, rootstock present. Stem terete, glabrous or bristly, glabrescent, 1 mm or longer, pale yellow-brown.

**Leaf:** Trifoliolate, petiolate, leaflets linear-lanceolate or ovate, apex acute, base acute or rounded, not lobed, venation reticulate, 40–75×5–35 mm, bristly, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules:** Lanceolate, erect, medifixed, base produced, and bilobed, 5–9×1.5–2 mm, lower extension 0.5 to 1.0 mm.

**Inflorescence:** Auxiliary, flowers many, lax, flowering with leaves or after leaves. Peduncle 30–220 mm, rachis 5–50 mm, flower 10–13 mm, pedicel 1.5 mm. Rachis glands present, small.

**Flower:** Bracteoles deciduous, lanceolate or broadly-oblong, approximately equalling calyx, densely hairy. Calyx tube 2 mm, teeth 0.6–1.2 mm, teeth all equal length, teeth shorter than tube, teeth broad, ribs absent or present, upper teeth fused, tube glabrous or sparsely hairy, hairs pale yellow-brown.
Corolla pink or purple, standard glabrous. Wings pink or purple. Keel beaked, slightly curved, pocket absent. Anther glands absent, pollen exine smooth. Style slightly curved, with same proportions along length, beak present, stigma subterminal.

**Legume**: Pods borne above ground, deflexed, linear-oblong, 30–40×3 mm, valves twisted at dehiscence, not constricted at maturity, glabrous or scabrous, hairs glabrescent, shorter than 1 mm, pale yellow-brown.

**Seed**: 6–9 seeds per pod, cubic, 2–3×1.5–2 mm. Testa unmottled, smooth. Hilum central, less than 3.0 mm. Aril present, along rim, white.

**Distribution**: Central-east, West and Zambesiaca.

V. venulosa Baker in Oliv.

**Habit and Stem**: Climbing or scrambling, herb, rootstock present. Stem terete, pubescent, glabrescent, shorter than 1 mm, pale yellow-brown.

**Leaf**: Unifoliolate, petiolate, leaflets linear-lanceolate or elliptic, apex mucronate, base rounded, not lobed, venation reticulate, 30–45×5–10(–20) mm, glabrous or pubescent, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules**: Linear-lanceolate or oblong, erect, medifixed, base produced, and cordate, 4–7.5×0.5–3.5 mm.

**Inflorescence**: Flowers few, lax, flowering with leaves or after leaves. Peduncle 25–38 mm, rachis 5–10 mm, flower 8–10 mm, pedicel 1–2 mm. Rachis glands present, large.

**Flower**: Bracteoles deciduous, broadly-oblong, shorter than calyx, glabrous. Calyx tube 4–5 mm, teeth 2–3 mm, teeth all equal length, teeth shorter than tube, teeth broad, ribs absent or present, upper teeth fused, tube glabrous. Corolla pink or blue, standard glabrous. Wings pink or blue. Keel beaked, slightly curved, pocket present. Anther glands absent, pollen exine smooth. Style slightly curved, with same proportions along length, beak present, stigma subterminal.

**Legume**: Pods borne above ground, linear, 30–40×3 mm, valves twisted at dehiscence, constricted at maturity or not constricted at maturity, hairs glabrescent, shorter than 1 mm, pale yellow-brown.

**Seed**: 5 seeds per pod, oblong. Smooth. Hilum not central, less than 3.0 mm. Aril present, along rim.

**Distribution**: Central-east, Northeast, West and Zambesiaca.

V. vexillata (L.) A. Rich.

**Habit and Stem**: Perennial, climbing or scrambling or procumbent or prostrate, herb, 0.1–6 m, rootstock present. Stem terete, bristly, glabrescent or dense, 1 mm or longer, pale yellow-brown or dark brown or mixed.

**Leaf**: Trifoliolate, petiolate, leaflets linear-lanceolate or oblong or ovate, apex acuminate or acute, base rounded or truncate, not lobed, venation reticulate, 25–165×4–83 mm, glabrous or pubescent or bristly, hairs sparse or dense, shorter than 1 mm, pale yellow-brown or dark brown.

**Stipules**: Lanceolate or ovate, erect, medifixed, base produced, and cordate or bilobed, 5–13×2.5–3.5 mm, lower extension 0.5 to 1.0 mm.
Inflorescence: Auxiliary, flowers few, dense, flowering with leaves or after leaves. Peduncle 45–360 mm, rachis 0–1.5 mm, flower 17–26 mm, pedicel 0.5–3 mm. Rachis glands present, large.

Flower: Bracteoles deciduous, lanceolate, shorter than calyx, densely hairy. Calyx tube 4–7 mm, teeth 2–20 mm, teeth all equal length, teeth longer than tube, teeth narrow and lanceolate, ribs present, upper teeth free, tube densely hairy, hairs pale yellow-brown or dark brown. Corolla pink or purple, standard glabrous. Wings purple. Keel beaked, curving through more than 180 degrees, pocket present. Anther glands absent, pollen exine with coarse reticulation. Style curving through more than 180 degrees, with distinct tenuous and thickened portions, beak present, stigma subterminal.

Legume: Pods borne above ground, erect, linear-cylindrical, 40–140×2.5–5 mm, valves twisted at dehiscence, not constricted at maturity, bristly, hairs glabrescent, shorter than 1 mm or longer than 1 mm, dark brown.

Seed: 10–18 seeds per pod, colour reddish brown or black or white, oblong or reniform, 2.5—4.5×2—2.5 mm. Testa unmottled, smooth. Hilum central, less than 3.0 mm. Aril absent or present, vestigial.

Distribution: Central-east, East, Northeast, South, West, Madagascar and Zambesiaca.

V. kirkii (Baker) Gillett

Habit and Stem: Annual or perennial, climbing or scrambling, herb, 1.8–4 m, rootstock present. Stem terete, glabrous or pubescent, glabrescent, shorter than 1 mm, pale yellow-brown.

Leaf: Trifoliolate, petiolate, leaflets oblong or ovate, apex acute or rounded, base rounded or truncate, not lobed, venation reticulate, 13–100×5–55 mm, glabrous or pubescent, hairs sparse, shorter than 1 mm, pale yellow-brown.

Stipules: Lanceolate or deltoid, erect, medifixed, base truncate or produced, and bilobed, 2–6×1 mm, lower extension 0.5 to 1.0 mm.

Inflorescence: Auxiliary, flowers few, lax, flowering with leaves or after leaves. Peduncle 20–150 mm, rachis 0.1–2 mm, flower 11–15 mm, pedicel 1–3 mm. Rachis glands present, large.

Flower: Bracteoles deciduous, lanceolate or ovate, shorter than calyx, glabrous or sparsely hairy. Calyx tube 2–4 mm, teeth 1–4 mm, lower tooth longer, teeth shorter than tube, teeth narrow and lanceolate, ribs absent, upper teeth fused, tube glabrous or sparsely hairy, hairs pale yellow-brown. Corolla pink or white, standard glabrous. Wings yellow or white. Keel beaked, curving through more than 260 degrees, pocket present. Anther glands absent, pollen exine with coarse reticulation. Style curving through more than 180 degrees, with distinct tenuous and thickened portions, beak present, stigma subterminal.

Legume: Pods borne above ground, erect, linear, 50–95×3–4.5 mm, valves twisted at dehiscence, not constricted at maturity, glabrous or scabrous, hairs glabrescent, shorter than 1 mm, pale yellow-brown.
**Seed**: 15 seeds per pod, colour brown or black or blackish red, oblong, 4–5×2–2.5 mm. Testa mottled, smooth. Hilum not central, less than 3.0 mm. Aril present, eccentric, white.

**Distribution**: Central-east, East, Northeast, West and Zambesiaca.

*V. nuda* N.E. Br.

**Habit and Stem**: Perennial, erect or procumbent or prostrate, herb, 0.06–1.8 m, rootstock present. Stem terete, glabrous or pubescent or scabrous, glabrescent or dense, shorter than 1 mm, pale yellow-brown.

**Leaf**: Trifoliolate, petiolar, leaflets ovate or rhombic, apex obtuse, base cuneate or rounded or cordate, not lobed, venation reticulate, 39–95×4–65 mm, glabrous or scabrous, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules**: Lanceolate or ovate, erect, medifixed, base truncate or produced, and bilobed, 4–10×1–3 mm, lower extension 1.1 to 2.0 mm.

**Inflorescence**: Auxiliary, flowers few, dense, flowering before leaves. Peduncle 40–200 mm, rachis 20–30 mm, flower 15–23 mm, pedicel 1–3 mm. Rachis glands present, large.

**Flower**: Bracteoles deciduous, lanceolate or broadly-oblong, shorter than calyx, densely hairy. Calyx tube 4 mm, teeth 2–5 mm, teeth all equal length, teeth shorter than tube, teeth broad, ribs present, upper teeth free, tube sparsely hairy, hairs pale yellow-brown. Corolla yellow or purple or green, standard glabrous. Wings mauve. Keel beaked, slightly curved, pocket present. Anther glands absent, pollen exine with coarse reticulation. Style curving through more than 180 degrees, with distinct tenuous and thickened portions, beak present, stigma subterminal.

**Legume**: Pods borne above ground, erect, linear-cylindrical, 70–110×4–7 mm, valves twisted at dehiscence, constricted at maturity or not constricted at maturity, scabrous, hairs glabrescent, shorter than 1 mm, pale yellow-brown.

**Seed**: 12–14 seeds per pod, colour yellow or purple, oblong or ellipsoid or reniform, 5.5–8×3–4 mm. Testa unmottled, smooth. Hilum central, less than 3.0 mm. Aril present, along rim, greenish-black.

**Distribution**: Central-east, East and Zambesiaca.

*V. longissima* Hutch.

**Habit and Stem**: Perennial, erect or procumbent or prostrate, herb, 0.2–0.5 m, rootstock present. Stem terete, glabrous or bristly, glabrescent, shorter than 1 mm or 1 mm or longer, pale yellow-brown.

**Leaf**: Trifoliolate, subsessile, leaflets linear-lanceolate, apex acuminate, base cuneate, not lobed, venation reticulate, 130–250×5–12 mm, bristly, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules**: Oblong, erect, medifixed, base produced, and bilobed, 7×1.5–2 mm, lower extension greater than 2.0 mm.

**Inflorescence**: Auxiliary, flowers solitary or few, lax, flowering before leaves. Peduncle 20–30 mm, rachis 0–4 mm, flower 12–19 mm, pedicel 1 mm. Rachis glands absent.
**Flower:** Bracteoles deciduous, filiform, shorter than calyx, densely hairy. Calyx tube 3 mm, teeth 5–8 mm, lower tooth longer, teeth shorter than tube, teeth narrow and lanceolate, ribs present, upper teeth free, tube sparsely hairy, hairs pale yellow-brown. Corolla pink or purple, standard glabrous. Wings purple. Keel beaked, slightly curved, pocket present. Anther glands absent, pollen exine with coarse reticulation. Style curving through more than 180 degrees, with distinct tenuous and thickened portions, beak present, stigma subterminal.

**Legume:** Pods borne above ground, deflexed, linear-cylindrical, 50×3 mm, valves not twisted at dehiscence, constricted at maturity, bristly, hairs dense, shorter than 1 mm, dark brown.

**Seed:** 15–20 seeds per pod, cubic, 2×2 mm. Hilum central, less than 3.0 mm. Aril present, along rim, white.

**Distribution:** Central-east, East, West and Zambesiaca.

*V. radiata* (L.) R. Wilczek

**Habit and Stem:** Annual, erect or climbing or scrambling, herb, 0.2–0.6 m, rootstock absent. Stem terete, pubescent or bristly, glabrescent or dense, 1 mm or longer, dark brown.

**Leaf:** Trifoliolate, subsessile, leaflets elliptic or ovate, apex acuminate or acute, base cuneate or rounded, prominent lobed, venation reticulate, 50–160×30–120 mm, bristly, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules:** Oblong, erect, medifixed, base produced, and bilobed, 7–15×3–6 mm, lower extension greater than 2.0 mm.

**Inflorescence:** Auxiliary, flowers many, dense, flowering before leaves. Peduncle 25–150(–300) mm, rachis 10–20 mm, flower 10–12 mm, pedicel 2 mm. Rachis glands present, large.

**Flower:** Bracteoles deciduous, lanceolate or ovate, shorter than calyx, densely hairy. Calyx tube 3 mm, teeth 3 mm, teeth all equal length, tube and teeth approximately equal, teeth narrow and lanceolate, ribs present, upper teeth bifid, tube sparsely hairy, hairs pale yellow-brown. Corolla yellow or green, standard glabrous. Wings yellow or green. Keel beaked, curving through more than 260 degrees, pocket present. Anther glands absent, pollen exine with coarse reticulation. Style curving through more than 260 degrees, with distinct tenuous and thickened portions, beak present, stigma subterminal.

**Legume:** Pods borne above ground, erect or deflexed, linear-cylindrical, 40–90×5–9 mm, valves twisted at dehiscence, constricted at maturity, bristly, hairs dense, shorter than 1 mm, dark brown.

**Seed:** 8–14 seeds per pod, colour greenish or brown, oblong or cubic, 2.5–4×2.5–3 mm. Testa mottled, sculptured. Hilum central, less than 3.0 mm. Aril absent or present, vestigial, white.

**Distribution:** East, Northeast, West, Madagascar and Zambesiaca.
V. trilobata (L.) Verdc.

**Habit and Stem:** Annual or perennial, climbing or scrambling, herb, rootstock absent. Stem terete, glabrous or pubescent, glabrescent, shorter than 1 mm, pale yellow-brown.

**Leaf:** Trifoliolate, subsessile, leaflets oblong, apex rounded or obtuse, base obtuse, lobing prominent, venation reticulate, 10–30×5–20 mm, pubescent, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules:** Oblong or ovate, erect, basifixed, base produced, and bilobed, 5–8×2–4 mm, lower extension greater than 2.0 mm.

**Inflorescence:** Auxiliary, flowers few, dense, flowering before leaves. Peduncle 10–15 mm, rachis 0–4 mm, flower 5–6 mm, pedicel 1.5 mm. Rachis glands absent.

**Flower:** Bracteoles deciduous, ovate, shorter than calyx, glabrous or sparsely hairy. Calyx tube 1.5 mm, teeth 1 mm, teeth all equal length, teeth shorter than tube, teeth broad or triangular, ribs absent, upper teeth free, tube glabrous. Corolla yellow or green, standard glabrous. Wings yellow or green. Keel beaked, curving through more than 260 degrees, pocket present. Anther glands absent, pollen exine with coarse reticulation. Style curving through more than 260 degrees, with distinct tenuous and thickened portions, beak present, stigma subterminal.

**Legume:** Pods borne above ground, deflexed, linear-cylindrical, 15–35×3 mm, valves twisted at dehiscence, constricted at maturity, scabrous, hairs glabrescent, shorter than 1 mm, dark brown.

**Seed:** Globose, 1.5×1.5 mm. Hilum central, less than 3.0 mm. Aril absent.

**Distribution:** South and Madagascar.

V. longifolia (Benth.) Verdc.

**Habit and Stem:** Annual or perennial, climbing or scrambling, herb, rootstock absent. Stem terete, glabrous or pubescent, glabrescent, 1 mm or longer, pale yellow-brown.

**Leaf:** Trifoliolate, subsessile, leaflets oblong or ovate, apex acute or obtuse, base rounded or cordate, not lobed, venation reticulate, 22–45×8–14 mm, glabrous or pubescent, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules:** Ovate or deltoid, erect, basifixed, base produced, and bilobed, 4–6×1.5–2 mm, lower extension 1.1 to 2.0 mm.

**Inflorescence:** Auxiliary, flowers solitary or few, dense. Peduncle 30–65 (–110) mm, rachis 5 mm, flower 10–12 mm, pedicel 1–2 mm. Rachis glands absent.

**Flower:** Bracteoles persistent, ovate, shorter than calyx, glabrous or sparsely hairy. Calyx tube 3–4 mm, teeth 2–3 mm, teeth all equal length, teeth shorter than tube, teeth ovate or triangular, ribs absent, upper teeth bifid, tube glabrous or sparsely hairy, hairs pale yellow-brown. Corolla yellow or orange, standard glabrous. Wings purple. Keel beaked, curving through more than 260 degrees, pocket present. Anther glands absent, pollen exine with coarse reticulation. Style curving through more than 260 degrees, with distinct tenuous and thickened portions, beak present, stigma subterminal.
**Legume**: Pods borne above ground, deflexed, linear-cylindrical, 45–50×6–7 mm, valves twisted at dehiscence, constricted at maturity, softly pubescent, hairs dense, longer than 1 mm, pale yellow-brown.

**Seed**: 5–6 seeds per pod, globose. Hilum central, less than 3.0 mm. Aril absent.

**Distribution**: West and Madagascar.

*V. adenantha* (G. Mey.) Maréchal, Mascherpa & Stainier

**Habit and Stem**: Perennial, erect or climbing or scrambling, herb, 0.5–4 m, rootstock absent. Stem terete, glabrous or pubescent, glabrescent, shorter than 1 mm or 1 mm or longer, pale yellow-brown.

**Leaf**: Trifoliolate, subsessile, leaflets elliptic or ovate, apex acute or obtuse, base rounded or truncate, not lobed, venation reticulate, (25–)50–100(–140)×(16–)25–65(–80) mm, pubescent, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules**: Oblong or ovate, erect, basifixed, base produced, and cordate, 3–6×1.5–2 mm, lower extension 1.1 to 2.0 mm.

**Inflorescence**: Auxiliary, flowers many, dense, flowering before leaves. Peduncle 50–270 mm, rachis 20–70 mm, flower 15–23 mm, pedicel 2–3 mm. Rachis glands present, large.

**Flower**: Bracteoles deciduous, ovate or broadly-oblong, shorter than calyx, sparsely hairy. Calyx tube 3–4 mm, teeth 3–5 mm, lower tooth longer, teeth longer than tube, teeth narrow and lanceolate, ribs absent, upper teeth bifid, tube sparsely hairy, hairs pale yellow-brown. Standard glabrous. Keel beaked, curving through more than 260 degrees, pocket present. Anther glands absent, pollen exine with coarse reticulation. Style curving through more than 260 degrees, with distinct tenuous and thickened portions, beak present, stigma subterminal.

**Legume**: Pods borne above ground, erect, oblong-falcate, 70–150×9–12 mm, valves twisted at dehiscence, constricted at maturity, glabrous or softly pubescent, hairs glabrescent, shorter than 1 mm, dark brown.

**Seed**: 9–15 seeds per pod, colour reddish brown, reniform, 5.5–7.5×4.5–6 mm. Testa mottled, smooth. Hilum central, less than 3.0 mm. Aril present, along rim, cream.

**Distribution**: Central-east, East, West, Madagascar and Zambesiaca.

*V. macrorhyncha* (Harms) Milne-Redh.

**Habit and Stem**: Perennial, climbing or scrambling, herb, 0.5–3 m, rootstock present. Stem terete, glabrous or pubescent, glabrescent, shorter than 1 mm, pale yellow-brown.

**Leaf**: Trifoliolate, petiolate, leaflets linear-lanceolate or oblong or ovate or rhombic, apex acute or rounded, base cuneate or rounded, not lobed, venation reticulate, 15–90×3–65 mm, glabrous or pubescent, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules**: Ovate or deltoid, erect, basifixed, base truncate, and rounded, 2–3×1.5–2 mm.

**Inflorescence**: Terminal, flowers solitary or many, lax, flowering with leaves or after leaves. Peduncle 35–140 mm, rachis 15–120 mm, flower 11–17 mm, pedicel 2–5 mm. Rachis glands present, small.
**Flower:** Bracteoles persistent, lanceolate or ovate, shorter than calyx, glabrous. Calyx tube 2–3 mm, teeth 2–3 mm, lower tooth longer, teeth longer than tube, teeth broad, ribs absent or present, upper teeth fused, tube glabrous. Corolla pink or blue, standard glabrous. Wings vinaceous. Keel beaked, curving through more than 260 degrees, pocket present. Anther glands absent, pollen exine smooth. Style curving through more than 260 degrees, with distinct tenuous and thickened portions, beak present, stigma subterminal.

**Legume:** Pods borne above ground, linear, 48–140×2–4 mm, valves not twisted at dehiscence, not constricted at maturity, glabrous.

**Seed:** 8–15 seeds per pod, colour reddish brown, oblong, 3–6.5×2–2.5 mm. Testa mottled, smooth. Hilum central, less than 3.0 mm. Aril absent.

**Distribution:** Central-east, East, Northeast, West and Zambesiaca.

*V. praecox* Verdc.

**Habit and Stem:** Perennial, climbing or scrambling, herb, 0.5–3 m, rootstock present. Stem terete, glabrous or pubescent, glabrescent, shorter than 1 mm, pale yellow-brown.

**Leaf:** Trifoliolate, petiolate, leaflets elliptic or ovate or rhombic, apex acuminate or obtuse, base rounded, not lobed, venation reticulate, 24–58×16–48 mm, pubescent, hairs sparse, shorter than 1 mm, pale yellow-brown.

**Stipules:** Linear-lanceolate or ovate, erect, basifixed, base truncate, and rounded, 3–4×1 mm.

**Inflorescence:** Auxiliary, flowers many, dense, flowering before leaves. Peduncle 5–15 mm, rachis 20–50 mm, flower 9 mm, pedicel 5 mm. Rachis glands present, small.

**Flower:** Bracteoles deciduous, ovate, shorter than calyx or absent, glabrous. Calyx tube 2.5 mm, teeth 0.5–1.5 mm, teeth all equal length, teeth shorter than tube, teeth broad, ribs absent, upper teeth fused, tube glabrous. Corolla yellow or white or mauve or green, standard glabrous. Wings yellow or mauve or green. Keel beaked, curving through more than 260 degrees, pocket present. Anther glands absent, pollen exine smooth. Style curving through more than 260 degrees, with distinct tenuous and thickened portions, beak present, stigma subterminal.

**Legume:** Pods borne above ground, deflexed, linear, 60–100×5.5–6.5 mm, valves not twisted at dehiscence, not constricted at maturity, glabrous.

**Seed:** 4–7 seeds per pod, colour reddish brown, oblong or reniform, 8×4.5 mm. Testa mottled, smooth. Hilum central, less than 3.0 mm. Aril absent.

**Distribution:** East and Northeast.

*V. virescens* Thulin

**Habit and Stem:** Perennial, climbing or scrambling, herb, 2.5 m, rootstock absent. Stem distinctly winged, glabrous or pubescent, dense, shorter than 1 mm, pale yellow-brown.

**Leaf:** Trifoliolate, petiolate, leaflets ovate or rhombic, apex acute or rounded, base cuneate or truncate, not lobed, venation reticulate, 12–65×12–45 mm, glabrous, hairs sparse, shorter than 1 mm, pale yellow-brown.
Stipules: Ovate or deltoid, erect, basifixed, base truncate, and rounded, 2–4×1 mm.

Inflorescence: Auxiliary, flowers many, dense. Peduncle 50 mm, rachis 25–150 mm, flower 10–13 mm, pedicel 2.5 mm. Rachis glands present, large.

Flower: Bracteoles deciduous, broadly-oblone, shorter than calyx, glabrous. Calyx tube 2.4–2.8 mm, teeth 2 mm, teeth all equal length, teeth shorter than tube, teeth broad, ribs absent, upper teeth fused, tube glabrous, hairs pale yellow-brown. Corolla green, standard glabrous. Wings purple. Keel beaked, curving through more than 260 degrees, pocket present. Anther glands absent, pollen exine smooth. Style curving through more than 260 degrees, with distinct tenuous and thickened portions, beak present, stigma subterminal.

Legume: Pods borne above ground, pendent, linear, 70×5 mm, valves twisted at dehiscence, not constricted at maturity, softly pubescent, hairs glabrescent, shorter than 1 mm.

Seed: 8 seeds per pod, oblong or globose.

Distribution: Northeast.
APPENDIX III. Keys to African Vigna species and subspecific taxa

IIIA Keys to African Vigna species

1(0). Flowering before leaves appear ................................................................. 2
Flowering when leaves appear ........................................................................... 7

2(1). Keel apex not curved .................................................................................. 3
Keel apex slightly curved .................................................................................. 4
Keel apex curving through more than 260 degrees .......................... V. praecox

3(2). Keel not beaked; inflorescence dense; calyx teeth narrow and lanceolate;
plant climbing or scrambling .............................................................. V. phoenix
Keel beaked; inflorescence lax; calyx teeth broad; plant erect ......................
.................................................................................................................. V. pygmaea

4(2). Aril absent; keel pocket absent; seed testa mottled ......................... 5
Aril present; keel pocket present; seed testa unmottled ......................... 6

5(4). Calyx upper teeth fused; anther glands present; pollen exine smooth;
bracteoles deciduous .................................................................................. V. juncea
Calyx upper teeth free; anther glands absent; pollen exine with coarse
reticulation; bracteoles persistent .......................................................... V. frutescens

6(4). Stipules basifixed; rachis glands small; bracteoles persistent; stipules 0.5
to 1.0 mm long .................................................................................. V. antunesii
Stipules medifixed; rachis glands large; bracteoles deciduous; stipules
1.1 to 2.0 mm ............................................................................................. V. nuda

7(1). Rootstock absent ...................................................................................... 8
Rootstock present ............................................................................................ 24

8(7). Calyx lower tooth longer .............................................................................. 9
Calyx teeth all equal length ........................................................................... 14
Calyx lower tooth shorter ........................................................................... V. bosseri

9(8). Stipules rounded .......................................................................................... V. monantha
Stipules cordate .............................................................................................. 10
Stipules bilobed ............................................................................................... 12

10(9). Calyx tube and teeth approximately equal; style not curved; bracteoles
densely hairy ............................................................................................... V. oblongifolia
Calyx teeth longer than tube; style curving through more than 260
degrees; bracteoles sparsely hairy ................................................ V. adenantha
Calyx teeth shorter than tube; style slightly curved; bracteoles glabrous
.................................................................................................................. 11

11(10). Aril absent; corolla yellow; seed testa unmottled; pod linear-oblong ....
................................................................................................................................. V. marina
Aril present; corolla green; seed testa mottled; pod linear ... V. benuensis

12(9). Aril absent; keel beak curvature slightly curved............................... 13
Aril present; keel beak curvature not curved................................. V. fischeri

13(12). Leaflet lobing absent; pods borne below ground; rachis glands present;
calyx teeth shorter than tube......................................................... V. subterranea
Leaflet lobing slightly lobed; pods borne above ground; rachis glands
absent; calyx tube and teeth approximately equal ............ V. bequaertii

14(8). Keel beak curvature not curved.................................................. 15
Keel beak curvature slightly curved................................................ 18
Keel beak curvature curving through more than 260 degrees........ 22

15(14). Stipules basifixed; calyx free; keel not beaked; calyx teeth longer than
tube................................................................. V. reticulata
Stipules medifixed; calyx fused; keel beaked; calyx teeth shorter than
tube......................................................................................... 16

16(15). Stipule base truncate; rachis glands absent; anther glands present;
pollen exine smooth.............................................................. V. richardsiae
Stipule base produced; rachis glands present; anther glands absent;
pollen exine coarse reticulation...................................................... 17

17(16). Standard glabrous; stipule lower extension longer than 2.0 mm;
bracteoles persistent; leaflet hairs longer than 1 mm ........ V. racemosa
Standard hairy; stipule lower extension 0.5 to 1.0 mm; bracteoles
subpersistent; leaflet hairs shorter than 1 mm ........ V. ambacensis

18(14). Stipules basifixed............................................................ 19
Stipules medifixed ........................................................................... 20

19(18). Aril absent; calyx teeth shorter than tube; corolla yellow; stipule lower
extension 0.5 to 1.0 mm......................................................... V. luteola
Aril present; calyx teeth longer than tube; corolla blue; stipule lower
extension greater than 2.0 mm.................................................. V. gazensis

20(18). Stipules cordate.......................................................... V. multinervis
Stipules single spurred ......................................................... V. unguiculata
Stipules bilobed ........................................................................... 21
21(20). Distribution in Central Africa; calyx teeth shorter than tube; calyx upper teeth fused; stipules linear-lanceolate .................................. *V. laurentii*
Distribution in Somalia only; calyx teeth longer than tube; calyx free; stipules lanceolate ......................................................... *somaliensis*

22(14). Calyx upper teeth fused .......................................................... *V. virescens*
Calyx upper teeth free .................................................................. *V. trilobata*
Calyx upper teeth bifid ....................................................................

23(22). Stipules basifixed; leaflet lobing absent; calyx teeth shorter than tube; rachis glands absent.............................................. *V. longifolia*
Stipules medifixed; leaflet lobing prominently; calyx tube and teeth approximately equal; rachis glands present.................... *V. radiata*

24(7). Calyx fused .............................................................................. 25
Calyx bifid ....................................................................................... 40
Calyx free ....................................................................................... 44

25(24). Keel beak not curved............................................................... 26
Keel beak slightly curved............................................................... 31
Keel beak curving through more than 260 degrees ...................... 39

26(25). Stipules basifixed ................................................................. 27
Stipules medifixed ........................................................................... 28

27(26). Calyx lower tooth longer; calyx tube and teeth approximately equal length; wing yellow; stipule lower extension 0.5 to 1.0 mm .................
......................................................................................... *V. oblongifolia*
Calyx teeth all equal length; calyx teeth shorter than tube; wing blue; stipule lower extension 1.1 to 2.0 mm ............................... *V. parkeri*

28(26). Calyx lower tooth longer; rachis glands small; anther glands present; pollen exine smooth................................................................. *V. kokii*
Calyx teeth all equal length; rachis glands large; anther glands absent; pollen exine with coarse reticulation .............................. 28

29(28). Aril absent; seed testa mottled; hilum central; bracteoles longer than calyx................................................................. *V. desmodioides*
Aril present; seed testa unmottled; hilum not central; bracteoles shorter than calyx................................................................. 30

30(29). Seed oblong; stipules deltoid; bracteoles deciduous; style beak absent ................................................................. *V. filicaulis*
Seed cubic; stipules lanceolate; bracteoles subpersistent; style beak present ................................................................. *V. gracilis*
31(25). Calyx lower tooth longer ........................................................................ 32
Calyx teeth all equal length .................................................................... 34

32(31). Stipules cordate; aril present; keel not beaked; anther glands absent.....
.................................................................................................................. V. mudenia
Stipules bilobed; aril absent; keel beaked; anther glands present ...... 33

33(32). Rachis glands absent; calyx tube and teeth approximately equal; flowers
many. ........................................................................................................ V. nyangensis
Rachis glands present and large; calyx teeth shorter than tube; flowers
few ........................................................................................................ V. triphylla

34(31). Leaves trifoliolate ............................................................................ 35
Leaves unifoliolate .................................................................................. 38

35(34). Stipules basifixed; hilum not central; stigma terminal; leaflet hairs dense
.............................................................................................................. 36
Stipules medifixed; hilum central; stigma subterminal; leaflet hairs
sparse ....................................................................................................... 37

36(35). Hilum less than 3.0 mm; bracteoles longer than calyx; plant herb; calyx
sparsely hairy ........................................................................................ V. comosa
Hilum 3.0 mm or longer; bracteoles shorter than calyx; plant small shrub;
calyx densely hairy .............................................................................. V. haumaniana

37(35). Rachis glands small; keel beaked; pollen exine smooth; stipule lower
extension 0.5 to 1.0 mm ....................................................................... V. nigritia
Rachis glands large; keel not beaked; pollen exine with coarse reticulation;
stipule lower extension 1.1 to 2.0 mm ................................................. V. hosei

38(34). Stipules cordate; aril present; leaflet petiolate; keel pocket present ......
.............................................................................................................. V. venulosa
Stipules bilobed; aril absent; leaflet subsessile; keel pocket absent..........
.............................................................................................................. V. monophylla

39(25). Stipules basifixed, lower extension rounded; aril absent; calyx teeth
longer than tube.................................................................................. V. macrorhyncha
Stipules medifixed, lower extension bilobed; aril present; calyx teeth
shorter than tube ................................................................................ V. kirkii

40(24). Stipule lower extension cordate with unevenly lobed ............ V. radicans
Stipule lower extension single spurred ............................................. V. keraudrenii
Stipule lower extension rounded ...................................................... V. microsperma
Stipule lower extension cordate ......................................................... 41
Stipule lower extension bilobed.......................................................... 43
41(40). Calyx lower tooth longer; bracteoles deciduous; leaflet hairs shorter than 1 mm ........................................ V. platyloba
Calyx teeth all equal length; bracteoles persistent; leaflet hairs longer than 1 mm ........................................ 42

42(41). Plant height up to 1 m.; rachis glands absent; keel not beaked; leaflet base truncate ........................................ V. procera
Plant height 1 to 2 m.; rachis glands present; keel beaked; leaflet base acute ...................................................................... V. dolomitica

43(40). Calyx teeth shorter than tube ........................................ V. schimperi
Calyx tube and teeth approximately equal ...................... V. friesiorum
Calyx teeth longer than tube ........................................ V. platyloba

44(24). Calyx lower tooth longer ........................................ 45
Calyx teeth all equal length ........................................ 46

45(44). Stipules cordate; keel not beaked, pocket absent; leaflet petiolate ........
........................................................................................................ V. schlechteri
Stipules bilobed; keel beaked, pocket present; leaflet subsessile........
........................................................................................................ V. longissima

46(44). Calyx teeth shorter than tube; inflorescence lax; style beak absent; stigma terminal ........................................ 47
Calyx teeth longer than tube; inflorescence dense; style beak present; stigma subterminal ........................................ 48

47(46). Stipules cordate; aril present; rachis glands absent; keel not beaked ..... ........................................................................................................ V. stenophylla
Stipules bilobed; aril absent; rachis glands present; keel beaked
........................................................................................................ V. angivensis

48(46). Keel beak slightly curved; keel pocket absent; seed testa mottled and with distinct median ridge ........................................ V. membranacea
Keel beak curving through more than 180 degrees; keel pocket present; seed testa unmottled and smooth........................................ V. vexillata

III B Keys to African Vigna subspecific taxa

A. V. ambacensis
The two varieties are identified as follows:

1. Leaflets lanceolate-elliptic (rarely oval); flowers mauve, fading white; inflorescence and rachis relatively short, bearing four to six flowers ......
........................................................................................................ var. ambacensis
Leaflets oblong-elliptic; flowers yellow (rarely blue or reddish); inflorescence and rachis longer, bearing 6 to 12 flowers .... var. pubigera
B. **V. comosa**
Two subspecies, namely *V. comosa* subsp. *comosa*, with varieties *comosa* and *lebrunii*, and subsp. *abercornensis*, they can be distinguished as follows:

1. Leaflet triangular or tri-lobed; standard (5–)8–10(–14)×10–14 mm; pod 10–25 mm .................................................. *V. comosa* subsp. *comosa* 2
   Leaflet elliptic or oblong; standard 13×18 mm; pod approx. 40 mm ...... ........................................ *V. comosa* subsp. *abercornensis*

2. Stem graceful; leaflet hastate, up to 35×20 mm; standard ± 10 mm long ........................................................................................................... var. *comosa*
   Stem robust; leaflet usually oblong or rhombic, larger; standard larger ... ........................................................................................................ var. *lebrunii*

C. **V. filicaulis**
Two varieties are separated on the basis of flower, pod and seed size as well as the degree of leaf and stem pubescence (*Maréchal et al.,* 1978):

1. Flowers 8–10 mm; pod 20–30×4–6 mm; 2–4 seeded, each 6×3 mm; stems and leaves more or less pubescent............................... var. *filicaulis*
   Flowers 6–8 mm; pod 18–22×3–4 mm; 2–5 seeded, each 3×1.5 mm; stems and leaves more or less glabrescent........... var. *pseudovenulosa*

D. **V. friesiorum**
Three varieties are distinguished on the basis of leaflet shape and habit (*Verdcourt, 1971*):

1. Leaflets linear-lanceolate, up to 70 mm long; stems erect or procumbent. .......................................................... var. *angustifolia*
   Leaflets rounded to oblong............................................................................... 2

2. Leaflets round to oblong, up to 25 mm long; stems procumbent; pods minutely pubescent to yellowish pubescent .................... var. *friesiorum*
   Leaflets round to elliptic-oblong, 10–40 mm long; stems mostly erect; pods minutely pubescent ............................................ var. *ulugurensis*

E. **V. frutescens**
Three subspecies, namely *V. frutescens* subsp. *frutescens*, with varieties *frutescens* and *buchneri*, and subsp. *incana* and *kotschyi*, they can be distinguished as follows:

1. Calyx lobes much longer than the tube, 5–10 mm long ....subsp. *incana*
   Calyx lobes ± equalling the tube, 3–5.5 mm long............................... 2

2. Standard glabrous outside ............................................................ subsp. *frutescens* 3
   Standard velvety pubescent outside .................................................... subsp. *kotschyi*

3. Stem, calyx and most of plant pubescent or velvety........ var. *frutescens*
   Stem, calyx and most of plant glabrous................................. var. *buchneri*

F. **V. gracilis**
Two varieties of *V. gracilis* are recognized by *Maréchal et al.* (1978), var. *gracilis* and var. *multiflora*, they can be identified as follows:
1. Leaflets usually <50 mm, variable shape; flowers usually <10 mm; plant
delicate appearance; rachis frequently elongated; seed 1.5–2.5 mm, aril
present ................................................................. var. gracilis
Leaflets usually >50 mm; flowers usually >10 mm; plant robust
appearance; rachis not usually elongated; seed 3.0–3.5 mm, aril absent
or not well developed ........................................ var. multiflora

G. V. haumaniana
This species contains two varieties, var. haumaniana and var. pedunculata,
distinguished as follows (Verdcourt, 1970; Maréchal et al., 1978):
1. Peduncles ± 2 mm; stems and leaves velvety pubescent ..............
.................................................................................................. var. haumaniana
Peduncles 6–25 mm; stems and leaves scarcely pubescent ..............
.................................................................................................. var. pedunculata

H. V. hosei
This species contains two varieties, var. hosei and var. pubescens,
distinguished as follows (Maréchal et al., 1978):
1. Stem and leaflets glabrescent, seed with undeveloped aril, distributed in
Asia and Tanzania ......................................................... var. hosei
Stem and leaflets pubescent, seed with developed aril, distributed in Asia
and Tanzania, Zanzibar and Mozambique .......................... var. pubescens

I. V. juncea
Three varieties, V. juncea var. juncea, var. major and var. corbyi, are
recognized (Pasquet, 2001):
1. Flowers 16–18 mm; keel with short straight beak; distal part of style
almost straight; pod 6–7.5 cm ........................................... var. major
Flowers 9–13 mm; keel with short incurved beak; distal part of style
curved in a semicircle; pod 4–5.5 cm long .............................. 2
2. Inflorescence rachis 8–20 cm, 10–30-noded, internodes (except the
lowest) 6–20 mm .......................................................... var. juncea
Inflorescence rachis 0.5–7 cm long, 4–16-noded, internodes (except the
lowest) 2–5 mm ...................................................... var. corbyi

J. V. marina
Verdcourt (1971) distinguishes the subspecies as follows:
1. Leaflets rounded-obovate, often mucronate at apex, with slightly raised
reticulate venation; linear-oblong inflated pod, 35–60×8–9 mm, glabrous;
seeds 6–7×5–6 mm .................................................. subsp. marina
Leaflets ovate-elliptic or oblong-lanceolate, often retuse at apex with
raised reticulate venation; narrow less inflated pod, 55×6 mm, close but
rather oppressed hairs; smaller seeds ................................ subsp. oblonga

K. V. membranacea
This species is highly variable, with four subspecies, namely subsp.
membranacea, macrodon, caesia and hapalantha, being recognized (Verdcourt, 1971).

1. Calyx teeth longer than the tube; usually growing above 1000 m...........2
   Calyx teeth usually shorter than tube, if longer then plants of the coastal area or lowland dry deciduous bushland ..........................................................3

2. Calyx lobes (4–)5–9 mm long; standard mostly 1–1.5 cm ..................
    ................................................................................ subsp. membranacea
   Calyx lobes 8–17 mm long; standard 1.5–2.5 cm........subsp. macrodon

3. Standard 20–23 mm long and wide ..................................subsp. caesia
   Standard 12–13(–16) mm long and wide..................subsp. hapalantha

L.  \textit{V. oblongifolia}

These are varieties oblongifolia and parviflora, distinguished by leaf, flower and pod characters as follows (Verdcourt, 1971):

1. Leaflets ovate, oblong to lanceolate, up to 120×22 mm; standard 10–11 mm; calyx tube 1.5–2.5 mm, teeth 1.5–2.5 mm; pods 40–45 mm; seed c. 4.0×3.0–3.5 mm...............................................var. oblongifolia
   Leaflets ovate to linear-lanceolate, 15–80×2–25 mm; standard 6–8 mm; calyx tube 1.0–1.5 mm, teeth 1.0–1.5 mm; pods 23–40 mm; seed 2.5–3.0×2.0–2.5 mm...................................var. parviflora

M.  \textit{V. parkeri}

Three subspecies are recognized, subsp. parkeri (endemic to Madagascar), maranguënsis and acutifolia, they can be identified as follows:

1. Leaflets mostly large, elliptic or ovate, acute or acuminate at the apex...
   ..........................................................2
   Leaflets mostly small, usually round with a rounded apex; flowers predominantly blue, purple or white, with yellow forms frequent in Uganda........................................subsp. maranguënsis

2. Flowers predominantly purple/pink fading bluish; endemic to Madagascar
   ..........................................................subsp. parkeri
   Flowers predominantly yellow (sometimes blue); present on mainland Africa...........................................subsp. acutifolia

N.  \textit{V. radiata}

Two varieties are recognized from Africa, they can be distinguished as follows:

1. Plant cultivated; stems robust, often woody, multistemmed and erect; pods more or less indehiscent; leaflets usually entire; pods 70–90 mm long; seeds 4 mm ............................................. var. radiata
   Plant wild or weedy; stems twining or prostrate, less robust; pods dehiscent; leaflets frequently lobed; pods and seeds usually smaller......
   ................................................................................ var. sublobata

O.  \textit{V. subterranea}

Two varieties are recognized and can be distinguished as follows:
1. Plant cultivated; stem erect; leaves borne at short intervals along stem and tightly clustered together; pods tightly clustered together beneath compact plant; found throughout Africa ................. var. *subterranea*
Plant wild; distinctly spreading in appearance with prostrate stems, reaching 2 m; bearing leaves at wide intervals; pods are found over an equally wide area, usually one beneath each stem node; apparently endemic to northwestern Cameroon and northeastern Nigeria .................. var. *spontanea*

P. *V. unguiculata*

The following key is derived from Pasquet (1993a, 2001):

1. Cultivated plant; pod >100×5 mm. subsp. *unguiculata* var. *unguiculata* 2
   2. Flower and seed most often coloured; <17 ovules per ovary; pods not fleshy, unwrinkled, <30 cm, seeds not spaced within the pod; seed testa thick and shiny ................................................................. cv *Biflora*
   Flower and seed often coloured; >17 ovules per ovary; pods fleshy, wrinkled when ripe, up to 1 m, seeds spaced within the pod; seeds reniform ................................................................. cv *Sesquipedalis*
   Flower and seed partly white; <17 ovules per ovary, pod not fleshy, unwrinkled, <30 cm, seeds not spaced within the pod; seed testa thin and often wrinkled ................................................................. cv *Melanophthalmus*
   Flower and seed often coloured; >17 ovules per ovary, pod not fleshy, <30 cm, seeds not spaced within the pod; testa thick and shiny ..........
   ...................................................................................................... cv *Unguiculata* 3
2. Plant wild or weedy; pod <100×5 mm .......................... 3
3. Keel with a marked beak, 6–8 mm .......................................................... 4
   Keel without a beak or with a short beak <3 mm .......................... 5
4. Leaflet thick, obtuse at apex, inflorescence 2–5-noded, internode 2–4 mm, flowers 24–33 mm ............................................................. subsp. *dekindtiana*
   Leaflet small, acute at apex, inflorescence multinoded, short internode, flowers (16–)18–23(–25) mm .................................................. subsp. *alba*
5. Keel twisted towards the left, without a beak ............................. 6
   Keel twisted towards the right, with a short beak up to 3 mm long ....... 9
6. Calyx teeth 0.5–6 mm .................................................................. 7
   Calyx teeth 5–15 mm .................................................................. 8
7. Calyx teeth 2.0–6.0 mm; flower 16–21 mm; ovary 10–14-ovuled ........
   ................................................................................................. subsp. *stenophylla*
   Calyx teeth 0.5–2.0 mm; flower (21–)26–38 mm; ovary ± 17-ovuled ....
   ................................................................................................. subsp. *bouleensis*
8. Stipules 12–27 mm; rachis 5–25 mm, 3–10-noded; ovary 18–20 ovules .
   ................................................................................................. subsp. *aduensis*
   Stipules 6–20 mm; rachis 5 mm, 3–4-noded; ovary 15–18 ovules .........
   ................................................................................................. subsp. *pawekiae*
9. Plant pubescent; rachis internodes long .................. subsp. *pubescens*
   Plant scabrous or glabrous; rachis internodes short .................... 10
10. Inflorescence rachis 1–2-noded; plant with a rootstock; leaflets rhombic

Inflorescence rachis multinoded; plant without a rootstock; leaflets

variable.......................... subsp. *tenuis*

11. Annual; petiole 20–40 mm; flower 15–23 mm

Perennial; petiole 50–60 mm; flower 25–31 mm

12. Peduncle 4–15-noded, calyx teeth 5–9 mm

Peduncle 4–8-noded, calyx teeth 8–14 mm

Q. *V. vexillata*

Seven varieties are recognized and can be distinguished as follows:

1. Leaflets sometimes all unifoliate, or one-, two- or three-foliolate on the

same stem, more or less rhombic to broadly ovate with base cuneate;

Leaflets always trifoliolate, shape varying, almost round to ovate, base

essentially cuneate to more or less obtuse, or more or less lanceolate

(much longer than broad), base essentially truncate to obtuse; stems

ferruginous, villous to subglabrous; calyx lobes longer or shorter than

tube.................................................. var. *davyi*

Leaflets entire or if slightly lobed then densely hairy ......................... 3

2. Calyx teeth 2.0–2.2 mm........................................... var. *dolichonema*

Calyx teeth 0.2–2.0 mm ............................................ 4

3. Pod 12–15 cm; seed subspherical 3.5–5 mm ............ var. *macrospersma*

Pod <12 cm; seed 2.5–4 mm ........................................... 5

4. Terminal leaflets ovate, base cuneate to obtuse; apex obtuse or acute,

size variable; stems densely ferruginous, villous to puberulent; calyx

lobes usually longer than tube.......................................... 6

Terminal leaflets essentially lanceolate to linear, base truncate to more or

less obtuse, apex acuminate, up to approx. 100–150 × 8–18 mm; stems

often glabrescent or aculeate; calyx lobes often shorter than tube..........

.......................................................... var. *angustifolia*

5. Plant usually densely ferruginous; terminal leaflets broadly or narrowly

ovate to elliptic or rhombic-ovate, base cuneate to more or less obtuse,

up to 120 × 55 mm; peduncles as thick or thinner than twinning stems;

legumes up to approx. 100 mm long ......................... var. *vexillata*

Plant sparsely pubescent, ferruginous; terminal leaflets rotund, elliptic,

ovate to narrowly ovate or more or less lanceolate to linear, base usually

obtuse, seldom longer than 25 mm when rotund, up to 40 mm when

lanceolate; peduncles much thickened than low-creeping stem; legumes

approx. 55 mm long........................................ var. *ovata*
**APPENDIX IV. Genebanks and herbarium with major African *Vigna* collections**

Herbaria visited or that provided voucher specimens' passport data

Herbaria addresses are preceded by their standard codes (Holmgren *et al.*, 1990).

<table>
<thead>
<tr>
<th>Herbarium code</th>
<th>Full name and address</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAU</td>
<td>Herbarium Jutlandicum, Botanical Institute, University of Aarhus, Bygn. 137, Universitetsparken, DK-8000 Aarhus C, Denmark</td>
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<tr>
<td>B</td>
<td>Botanischer Garten und Botanisches Museum Berlin-Dahlem, Königin-Luise-Strasse 6-8, D-1000, Berlin 33, Germany</td>
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<tr>
<td>BOL</td>
<td>Bolus Herbarium, Botany Department, University of Cape Town, Private Bag, Rondebosch 7700, Cape Province, South Africa</td>
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<tr>
<td>BM</td>
<td>British Museum (Natural History), Cromwell Rd, London, SW7 5BD, UK</td>
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<tr>
<td>BR</td>
<td>Herbarium, Nationale Plantentuin van België, Jardin Botanique Nationale de Belgique, Domein van Bouchout, B-1860 Meise, Belgium</td>
</tr>
<tr>
<td>C</td>
<td>Botanical Museum, University of Copenhagen, Gothersgade 130, DK-1123, Copenhagen K, Denmark</td>
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<tr>
<td>COI</td>
<td>Herbarium, Botanical Institute, University of Coimbra, Apartado 3011, P-3049, Coimbra, Portugal</td>
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<td>EA</td>
<td>Herbarium, National Museums of Kenya, PO Box 45166, Nairobi, Kenya</td>
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<tr>
<td>FT</td>
<td>Erbario Tropicale di Firenze, Via La Pira 4, I-50121 Firenze, Italy</td>
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<td>G</td>
<td>Herbarium, Conservatoire et Jardin Botaniques de la Ville de Geneve, Case postale 60, CH-1292 Chambesy/GE, Switzerland</td>
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<td>Herbarium, Laboratory Of Plant Systematics, State University of Gent, K.L. Ledeganckstraat 35, B-9000, Gent, Belgium</td>
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<td>K</td>
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<td>L</td>
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<td>Herbário, Centro de Botânica, Instituto de Investigação Científicas Tropical, Rua da Junqueira 86, P-1300 Lisboa, Portugal</td>
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<td>LISU</td>
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<td>MAL</td>
<td>National Herbarium and Botanic Gardens of Malawi, PO Box 528, Zomba, Malawi</td>
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<td>MO</td>
<td>Herbarium, Missouri Botanical Garden, PO Box 299, St. Louis, Missouri 63166, USA</td>
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<td>MOG</td>
<td>National Herbarium, National Range Agency, PO Box 1759, Mogadishu, Somalia</td>
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<td>NH</td>
<td>Natal Herbarium, Botanical Research Unit, Botanic Garden Road, Durban 4001, Natal Province, South Africa</td>
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Herbarium code | Full name and address
---|---
P | Herbier, Laboratoire de Phanérogame, Muséum National d'Histoire Naturelle, 16 rue Buffon, F-75005 Paris, France
PRE | National Herbarium, Botanic Research Institute, 2 Cussonia Avenue, Private Bag X101, Pretoria 0001, Transvaal Province, South Africa
PRU | Herbarium, Agriculture Department, National Collection of Fungi, Private Bag X134, Pretoria 0001, Transvaal Province, South Africa
SAM | South African Museum Herbarium, Private Bag X7, Claremont 7735, Cape Province, South Africa
SRGH | National Herbarium and Botanic Garden, PO Box 8100, Causeway, Harare, Zimbabwe
TAN | Herbier, Département Botanique, Parc de Tsimbazaza, BP 4096, Antananarivo 101, Madagascar
UPS | Botanical Museum (Fytoteket), Uppsala University, PO Box 541, S-751 21 Uppsala, Sweden
W | Department of Botany, Naturhistorisches Museum Wein, Burgring 7, Postfach 417, A-1014, Wein, Austria
WAG | Herbarium Vadense, Department of Plant Taxonomy, Agricultural University, Postbus 8010, 6700 ED, Wageningen, Netherlands
WU | Herbarium, Institut für Botanik, Universität Wien, Rennweg 14, A-1030 Wien, Austria

IVB Genebanks visited or that provided accession passport data¹

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<td>Jardin Botanique Nationale de Belgique, Domein van Bouchout, B-1860 Meise, Belgium</td>
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<td>CIAT</td>
<td>Centro Internacional de Agricultura Tropical, Recta Cali-Palmira, km 17 A.A. 6713, Cali, Colombia</td>
<td><a href="http://www.ciat.cgiar.org/">www.ciat.cgiar.org/</a></td>
</tr>
<tr>
<td>IITA</td>
<td>International Institute of Tropical Agriculture Oyo Road, PMB 5320 Ibadan, Oyo State Nigeria</td>
<td><a href="http://www.iita.cgiar.org/">www.iita.cgiar.org/</a></td>
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<tr>
<td>ILRI</td>
<td>International Livestock Research Institute PO Box 5689, Addis Ababa, Ethiopia</td>
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¹CGIAR Centre Vigna accessions were obtained via the CGIAR System-wide Information Network for Genetic Resources (SINGER) at [www.singer.cgiar.org](http://www.singer.cgiar.org)
### APPENDIX V. African ex situ Vigna collection holdings

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<th>Germplasm accessions</th>
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### APPENDIX VI. African *Vigna* distributional ranges

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<th>Species</th>
<th>No. observations</th>
<th>CA$_{50}$ (m)</th>
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Scores per utility category are given in parentheses.

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Mean temperature, Mean minimum temperature, Mean maximum temperature, Mean annual rainfall.
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APPENDIX XIII. Listing of priority countries with native priority *Vigna* taxa

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11. INDEX OF TAXA

Page numbers of text citations are indicated in plain text, and those of botanical diagrams and maps in italic.

Vigna

Subgenus Ceratotropis 268
Section Aconitifoliae 274
  Vigna aconitifolia 274
  Vigna umbellata 274

Section Ceratotropis 268
  Vigna radiata 268
  Vigna radiata var. radiata 273, 275
  Vigna radiata var. sublobata 273, 275

Subgenus Haydonia 226
Section Glossostylus 242
  Vigna nigritia 242, 245, 246
  Vigna venulosa 244, 247, 248

Section Haydonia 226
  Vigna juncea 227, 231, 232
  Vigna juncea var. corbyi 230
  Vigna juncea var. juncea 230
  Vigna juncea var. major 233
  Vigna monophylla 226, 228
  Vigna nyangensis 233, 234
  Vigna triphylla 226, 229

Section Microspermae 235
  Vigna kokii 238, 243
  Vigna microsperma 235, 237
  Vigna mudenia 238, 241
  Vigna richardsiae 235, 240
  Vigna schimperi 236, 240
  Vigna trilobata 273, 276

Subgenus Lasiospron 277
  Vigna juruana 277, 281
  Vigna longifolia 277, 279, 280
Subgenus *Sigmoidotropis* 278
   Section *Leptosprona* 278
      Vigna adenantha 278, 283

Subgenus *Macrorhyncha* 282
   Vigna macrorhyncha 282, 285, 286
   Vigna praecox 284, 288, 289
   Vigna virescens 287, 290

Subgenus *Plectotropis* 244
   Section *Plectotropis* 244
      Vigna kirkii 258, 266, 267
      Vigna vexillata 244, 254
      Vigna vexillata var. angustifolia 252, 257
      Vigna vexillata var. davyi 258, 263, 264
      Vigna vexillata var. dolichonema 252
      Vigna vexillata var. lobatifolia 256, 260, 261
      Vigna vexillata var. macroperma 251
      Vigna vexillata var. ovata 256, 259
      Vigna vexillata var. vexillata 251, 253, 255

   Section *Pseudoliebrechtsia* 262
      Vigna longissima 265, 271, 272
      Vigna nuda 262, 269, 270

Subgenus *Vigna* 90
   Section *Catung* 194
      Vigna kerandrenii 222, 224
      Vigna monantha 223, 225
      Vigna schlechteri 219, 220, 221
      Vigna unguiculata 194, 197, 201, 216, 217
      Vigna unguiculata subsp. aduensis 219
      Vigna unguiculata subsp. alba 213, 218
      Vigna unguiculata subsp. baoulensis 202
      Vigna unguiculata subsp. burundiensis 205
      Vigna unguiculata subsp. dekindtiana 206, 207, 210
      Vigna unguiculata subsp. letouzeyi 202
      Vigna unguiculata subsp. pawekiae 215, 218
      Vigna unguiculata subsp. pubescens 203, 204, 205
      Vigna unguiculata subsp. stenophylla 211, 212, 214
      Vigna unguiculata subsp. tennis 208, 209, 214
Vigna unguiculata subsp. unguiculata var. spontanea 198, 200
Vigna unguiculata subsp. unguiculata var. unguiculata 196, 199

Section Comosae 151
Vigna comosa 151, 153
Vigna comosa subsp. abercornensis 154
Vigna comosa subsp. comosa var. comosa 152
Vigna comosa subsp. comosa var. lebrunii 152
Vigna haumaniana 154, 156, 157
Vigna haumaniana var. haumaniana 155
Vigna haumaniana var. pedunculata 155

Section Liebrechtsia 185
Vigna antunesii 185, 186
Vigna bosseri 192, 193
Vigna frutescens 187, 188, 189
Vigna frutescens subsp. frutescens var. buchneri 191
Vigna frutescens subsp. frutescens var. frutescens 190
Vigna frutescens subsp. incana 191
Vigna frutescens subsp. kotschyi 192

Section Macrodontae 158
Vigna friesiorum 162, 164, 165
Vigna friesiorum var. angustifolia 163
Vigna friesiorum var. friesiorum 163
Vigna friesiorum var. ulugurensis 163
Vigna membranacea 158, 160
Vigna membranacea subsp. caesia 159
Vigna membranacea subsp. hapalantha 161
Vigna membranacea subsp. macrodon 161
Vigna membranacea subsp. membranacea 159
Vigna somaliensis 166, 167

Section Reticulatae 166
Vigna dolomitica 173, 174, 175
Vigna phoenix 178, 179, 180
Vigna platyloba 183, 184, 185
Vigna procera 181, 182
Vigna pygmaea 176, 177, 178
Vigna radicans 171, 172, 173
Vigna reticulata 166, 168, 169

Section Vigna 90
Vigna ambacensis 116, 121, 122
Vigna ambacensis var. ambacensis 120
Vigna ambacensis var. pubigera 120
Vigna angivensis 144, 147
Vigna benuensis 123, 124, 125
Vigna bequaertii 102, 103
Vigna desmodioides 138, 141
Vigna filicaulis 109, 111, 112
Vigna filicaulis var. filicaulis 110
Vigna filicaulis var. pseudovenulosa 110
Vigna fischeri 96, 100, 101
Vigna gazensis 146, 149, 150
Vigna gracilis 133, 135, 136
Vigna gracilis var. gracilis 134
Vigna gracilis var. multiflora 134
Vigna hosei 123, 127, 128
Vigna hosei var. hosei 126
Vigna hosei var. pubesceno 129
Vigna laurentii 113, 117, 118
Vigna luteola 90, 92, 93
Vigna marina 94, 97
Vigna marina subsp. marina 95, 98
Vigna marina subsp. oblonga 96, 99
Vigna multinervis 113, 114, 115
Vigna oblongifolia 102, 105
Vigna oblongifolia var. oblongifolia 104, 107
Vigna oblongifolia var. parviflora 106, 108
Vigna parkeri 129, 131
Vigna parkeri subsp. acutifolia 132
Vigna parkeri subsp. maranguënsis 132
Vigna parkeri subsp. parkeri 130
Vigna racemosa 137, 139, 140
Vigna stenophylla 146, 148
Vigna subterranea 138, 145
Vigna subterranea var. spontanea 144
Vigna subterranea var. subterranea 143
12. AFRICAN VIGNA: RESOURCE CD

The CD that accompanies the Ecogeographic Study contains the following folders and files:

**African Vigna: Accompanying CD**

- **Database Files**
  - African Vigna Database text and Excel files
  - Specimen Citation txt file text and Excel files

- **DELTA Descriptive files**
  - CHARS text file
  - ITEMS text file
  - SPECS text file

- **Install Lucid Player**
  - Setup.exe

- **Interactive Key**
  - Lucid Player Plus application file
  - Various Lucid key files
  - Various Lucid folders and subordinate files

- **Line drawings**
  - Various line drawing bitmap images

- **Maps**
  - Various black and white, and colour map jpeg files

- **Interactive**
  - Various photograph image files

**African Vigna: an Interactive Key**

The CD that accompanies the Ecogeographic Study contains the Lucid interactive key for African Vigna species and subspecific taxa. The various files
required to run the key are contained in the subdirectory named Interactive Key as indicated below:

**African Vigna: Accompanying CD**
- Interactive
  - Lucid Player Plus application file
  - Various Lucid key files
  - Various Lucid folders and subordinate files

**Install Lucid Player**
Open the folder ‘Install Lucid Player’, double-click on the file ‘setup.exe’ and follow the installation instructions.

**Installing the Vigna Interactive Key**
The key may be installed in three ways:
- a. It can either be run direct from the CD itself.
- b. The various files in the Interactive Key directory on the CD can be copied into a directory on a hard drive and run from there.
- c. The key can be downloaded from the following Web address: http://www.lucidcentral.com/keys/African_Vigna/default.htm

**How to identify Vigna Specimens (text is adapted from Maslin¹, 2001)**

**To start the key:**
1. Go to the directory that contains the interactive key.
2. Double-click on the ‘A key to African Vigna’ icon and the front page of the key will appear.
3. Click on the Start key at the top left of the window, you will see a screen divided into four windows, with a menu bar and tool bar.

African Vigna: accompanying CD
Interactive Key
Lucid Player Plus application file
Various Lucid key files
Various Lucid folders and subordinate files

The four windows display four lists:
- **Characters Available** lists the characters that you may use to describe your specimen to the key; when you first start the key this will show a list of 90 characters.
- **Character States Chosen** will list the characters and their states as you select them; when you first start the key this window will be empty.
- **Taxa Remaining** lists the names of the taxa that ‘match’ your description; when you first start the key this window shows a list of the entire 60 species that are included in African Vigna data set.
- **Taxa Discarded** will list all those taxa that do not ‘match your description; when you first start the key this window will be empty.

**To identify a specimen (i.e. name a Vigna specimen):**
Your aim is to match your unidentified specimen against the species descriptions held in the data set. As your description becomes more and more complete the key will progressively narrow down the list in Taxa Remaining until, hopefully, only one taxon remains – you have identified (in other words, named) the taxon to which your specimen belongs.

**Characters and states**
To select a character that you have chosen to score click on the name of the character in the Characters Available window and it will open to display its states. A character is any attribute referring to form, structure or behaviour which the taxonomist separates from the whole organism for a particular purpose such as comparison or interpretation. These are distinguished from character states which are the actual representation of that character found in a particular specimen. Thus a character, for example, “Corolla colour”, has multiple character states, yellow, pink, white, blue, purple, etc. Within the context of the interactive key there are two basic sorts of characters, multistate and numeric:

**To select states of a character:**
**Multistate character**
Click on the character name, which will ‘open’ the character to show the states, then either double-click the text of the state (e.g. ‘Corolla colour’ in the above example) or drag it with the mouse into the Character States Chosen window; one or more character-states can be chosen in this way. You will now notice that some taxa – those with character-states that do not match your answer – will be moved from Taxa Remaining into Taxa Discarded.

As you answer more and more questions the list in Taxa Remaining will get shorter and shorter until, perhaps, only one remains.
**Numeric characters**

Click on the character name, which will ‘open’ the character to show the states, then double-click the hash (#) symbol to the right of the orange information button (or drag it into Character States Chosen) and a box will pop up into which you can type the measurement: you can enter either a single number or a numeric range (with the two numbers separated by a hyphen [-]). To view other syntax options click on the blue hyperlink at the bottom of the dialogue box.

Apart from plant height, which is measured in metres, all other numeric measurements for the African Vigna data set are recorded in millimetres (but you do not have to type ‘mm’ into the box when you record your measurements). It will increase the likelihood of retaining the correct answer in Taxa Remaining if you enter a range of values (e.g. 3—6).

**Which characters should you use?**

When you first start the key, all 90 characters will be listed in the Characters Available window. You can answer questions in any order you wish, so you should be able to make an identification of your specimen based on the characters that are available. Use of dichotomous keys often fails because of the need to assess character states for characters that it is not possible to score on your specimen, e.g. seed characters are difficult to score as they are seldom present with a specimen. However, you can also ask the key itself to help by suggesting what is the appropriate character to use next (see Best and Bingo below) or compare descriptive information of the remaining taxa to see if you can match your specimen that way (see Similarities and Differences below) or scroll through the illustrations or photographs of the taxa remaining and see if your specimen matches any of them (see Slide show below).

The key opens with the full set of 90 characters that are available, but it is also possible to select a particular subset of characters, for example, if you only have vegetative material you may wish to use the vegetative characters alone and this may be achieved by selecting the vegetative character set. To select a particular character set click on characters, then click sets and check the small box to the left of the set name; you can load two or more sets simultaneously by checking more than one box. Now click anywhere outside the sets window and the characters contained in the set(s) you have selected will appear in the Characters Available window. The following sets of characters are available:

- **All**—This set contains the entire 90 characters which are available for use. This is the default set and when starting a new identification it is generally good practice to load this set and run Best (see below).
- **Fast Find**—This character set comprises the 29 characters that are generally easy to score and which have strong discriminating power.
- **Vegetative**—31 characters relating to the vegetative characteristics of the plant.
- **Inflorescence** - 8 characters relating to the inflorescences.
- **Flower** - 27 characters relating to flowers.
- **Fruit / legume** - 12 characters relating to the fruit.
• **Seed** - 11 characters specific to seeds (including the hilum and aril).
• **Distribution** – This character set is composed of one character with seven states for the seven sub-regions of Africa:
  o Central-east Africa – Burundi, Central African Republic, Chad, Democratic Republic of the Congo, Congo, Gabon, Equatorial Guinea, Sao Tome & Principe and Rwanda.
  o East Africa – Kenya, Tanzania and Uganda.
  o North-east Africa – Djibouti, Egypt, Eritrea, Ethiopia, Socotra, Somalia and Sudan.
  o Southern Africa – Lesotho, Namibia, South Africa and Swaziland.
  o West Africa – Benin, Burkina Faso, Cameroon, Gambia, Ghana, Guinea, Guinea Bissau, Côte d’Ivoire, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo.
  o West Indian Ocean – Madagascar.
  o Zambesiaca – Angola, Botswana, Malawi, Mozambique, Zambia and Zimbabwe.

It is advisable not to use geographic characters too early in your identification because of the possibility that yours is a new record for that region (which means that the correct answer will be eliminated from Taxa Remaining).

**Using Best**
If you have a potential choice over which character to score next and are unsure which to choose you can ask for assistance. You do this by invoking the *Best* or *Bingo* options. Click on the Best button located on the toolbar and all characters in Characters Available will be checked to find those that, on average, will give you the shortest list in Taxa Remaining if you choose one of their states. If you can, answer one of these next. When you use the Best option the programme will either sort the characters, placing those with the strongest discriminating power at the top of the list, or find (and highlight) the next best character to use; you can decide which of these options you require by clicking on Characters then Best Options located on the menu bar.

**Using Bingo**
The Bingo command also helps you to choose which character is appropriate to use next. Click on the Bingo button located on the toolbar and a window will appear showing various characters and their states (these will vary depending upon what taxa are left in Taxa Remaining). If your specimens possess any of the character states which are displayed then you will be left with just a single taxon in Taxa Remaining if you double-click that state.

**Using Similarities and Differences**
Click on the Similarities and Differences button located on the toolbar and you will see a Similarities and Differences tab. Each tab is divided into two panels: the upper one listing the characters and the lower one showing the taxa listed in Taxa Remaining with their character-state scores. Click on a character in the
upper panel and the lower panel will display the states scored for that character for each of the remaining taxa. You can then compare the features of your specimen with the character-states for each taxon. Further options available under Similarities and Differences can be accessed at any time via the Lucid Help menu.

Using Slide Show
When you have reduced the number of taxa in Taxa Remaining to a few you can scroll through illustrations of them to see if any match your specimen. To do this click on the Taxa button located on the menu bar, then click on Slide Show and then All Remaining Taxa. Drawings of the remaining taxa will then automatically scroll on-screen (with a 4-second delay between images). You can control the slide show with the buttons located at the upper right-hand corner of the screen.

Starting a new identification
If you wish to restart the key after having identification a specimen then click the Restart button on the menu bar and this will clear both the Character States Chosen and Taxa Discarded windows. When you click this button a small window will appear, and by opening the drop-down list you will see that there are three options available concerning character sets for your new identification session: select one of these options then click on Restart. The characters that then appear in Characters Available will depend upon your selection.

About Lucid
Lucid is an easy to use knowledge management tool that can be used in the production of interactive identification systems. Lucid was developed by the Centre for Biological Information Technology (CBIT) at the University of Queensland. The Lucid system consists of a number of inter-related products that assist with the creation and use of keys (in any language) for any group of organisms. The software has standard system requirements and is available to either download or purchase. You can learn more about Lucid and the software available from the Lucid website: http://www.lucidcentral.com/.