Genetic Resources Communication

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ISSN 0159-6-71
ISBN 0 643 05339 5

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A characterisation study of the genus *Vigna* with regard to potential as forage

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Abstract

The collection of the genus *Vigna*, conserved by the Australian Tropical Forages Genetic Resource Centre, was grown in an unreplicated characterisation study with the objective of evaluating potential as forage on clay soils. The trial included 225 entries and was located on a prairie soil at Lawes, Southeast Queensland. It was conducted over the period January 1980 to July 1981.

The 225 entries were allocated to 22 groups, based on morphological characteristics and days to flowering. Some species were comparatively uniform, whereas others (*e.g. V. vexillata*) showed a high level of heterogeneity, with different entries falling into several groups. Based in part on grouping from this study, accessions of *V. decipiens, V. oblongifolia, V. trilobata* and *V. vexillata* were selected for further field evaluation.

Introduction

The genus *Vigna* includes about 150 species and is largely tropical in its distribution, occurring in the African, Asian and Australian tropics and, to a lesser degree, in tropical America. It includes a number of important grain crops, including *V. aconitifolia, V. angularis, V. mungo, V. radiata, V. trilobata* and *V. umbellata.* Also, several species are sown as forage crops. *V. unguiculata* (cowpea) is a commonly grown annual ley legume in south-east Queensland. The perennial species *V. parkeri* (cv. Shaw) is also grown in coastal districts of the State, as a component of grass-legume pastures. *V. luteola* (cv. Dalrymple), also a perennial, was released as a cultivar but is rarely grown.

A number of other species are listed as having potential as forages (Bogdan 1977), but none is widely used. A large collection of the genus is conserved at the Australian Tropical Forages Genetic Resource Centre but the forage potential of the collection was unknown. For many collections, the taxonomic identity was uncertain. The present paper provides characterisation data on the collection and taxonomic identity, as determined by R.J. Williams. Based in part on this study, selections were made for inclusion of *Vigna* spp. in evaluation trials aimed at developing ley legumes for clay soils in south-east Queensland (*e.g.* Rees *et al.* 1995).

Few forage legume species are as yet available for use on clay soils, and this has been identified as a major limitation to cattle production in parts of Central Queensland. Useful species might either be perennial or self-regenerating species able to co-exist with grasses, or vigorous, high-yielding species suitable for growing as leys in a monoculture. Perennial ley species may offer an advantage over the currently used *Lablab purpureus* which, being an annual, needs to be resown each year.

MATERIALS AND METHODS

Seed of all accessions was sown in a potting mix in peat cups on 14 January 1980. The plants, together with their peat pots, were then planted at Lawes, south-east Queensland, on 11 February 1980. The soil at the experimental site was a prairie soil developed on alluvium. Plants were grown in single unreplicated rows 4 m long, with 3 m between rows, with 20 cm between plants within the row; thus, there were 20 plants planted in each row. The trial was irrigated strategically during periods of severe moisture stress. Maximum spread permitted was 3 m, to prevent plants intermingling.

Yield was rated monthly from May 1980 to July 1981 inclusive (17 ratings), and plant height and spread measured and leaf:stem ratio estimated at peak growth.. Monthly yield rating was based on a value of 10 for the "control" entry *V. luteola* cv. Dalrymple. Leaf:stem ratio estimates were verified against hand-sorted samples. For those entries which failed to survive for the full period, yield ratings were averaged over the period for which the entry survived. Date of first flowering and flower colour were recorded. Perenniality (over an 18 month period) and tuber development were also recorded. Seed was harvested from all accessions as it became available. Flower colour was noted as plants came to flower.

Accessions were subjectively classified into groups according to the following attributes:

- spread
- erectness
- leaf:stem ratio
- stem thickness
- leaf texture
- flowering time
- seed pod presentation
- indumentum

Each accession was identified as to species using appropriate available recent floras. The main reference sources for identification were Verdcourt (1970) and Gillett *et al.* (1971).

For those accessions with little available seed or where the seed germinated poorly, the few plants available were retained in a glasshouse and identified and grouped as far as possible.

Results

Twenty five species were identified and verified in the collection. Species evaluated, together with authorities and number of entries, are as follows:

V. aconitifolia (Jacq.) Marechal	8
V. ambacensis Bak.	4
V. angularis (Willd.) Ohwi & Ohashi	8
V. angustifoliolata Verdc.	2
V. decipiens Harv.	2
V. frutescens A. Rich.	2
V. heterophylla A. Rich.	4

V. hosei (Craib) Backer	1
V. lanceolata Benth.	2
V. lasiocarpa (Benth.) Verdc.	15
V. luteola (Jacq.) Benth.	17
V. marina (Burm.) Merrill	7
V. membranacea A. Rich.	2
V. monophylla Taub.	1
V. oblongifolia A. Rich.	17
V. parkeri Bak.	11
V. pubescens Wilczek	2
V. racemosa (G. Don) Hutch & Dalz.)	3
V. radiata var. *sublobata* (Roxb.) Verdc.	1
V. reticulata Hook.	3
V. schimperi Bak.	9
V. trilobata (L.) Verdc.	8
V. umbellata (Thunb.) Ohwi & Ohashi	28
V. unguiculata (L.) Walp.	14
V. unguiculata var. *dekindtiana* (Harms) Verdc.	2
V. vexillata (L.) A. Rich.	31
V. vexillata var. *angustifolia* (Schumach. & Thonn.) Bak.	6

A further 16 accessions were not identified to species level or showed affinities with other species but were not identified with certainty.

Available passport data and plant characteristics for all accessions are shown in Tables 1-23. The first five columns include species, accession and latitude and longitude and mean annual rainfall. Accession number is CPI (Commonwealth Plant Introduction number, unless otherwise stated). Country of origin indicates the country where the accession was collected in the wild , or, rarely, where it was collected as a cultivated crop or pasture. Where country of origin is in parentheses, the accession was introduced from an institution and would often not have been native to that country. Column 6 is the number of plants (of the 20 planted) which successfully established. Column 7 gives the date of first flowering, for accessions planted in the field; GH in this column indicates any data were derived from glasshouse-grown plants. Columns 8, 9 and 10 give canopy height, spread (maximum 3 m) and leaf:stem ratio at peak growth.

Many accessions did not survive through to the 17th yield rating, and mean rating over the period ratings were made is presented in column 11, together with total number of ratings (column 12, maximum = 17) and last month of last rating (column 13). Entries with a yield rating of >10 were, on average, more productive than the control cultivar Dalrymple. Seed yield is given in grams (column 14), with number of harvests taken. Seed yield was clearly related to the number of plants surviving.

Not all accessions were characterised to groups; some accessions which survived for only a short period could not be adequately classified, and others were in doubt for other reasons.

Groups were characterised as follows:

Group A (17 accessions)
Group A included all *V. luteola* accessions and CQ773, which was not identified to species level (Table 1). Plants characteristically had densely piled leafy and succulent growth, but frosts during June and July 1980 restricted growth. Jassids and other insects caused some damage.

Some variation was evident in this group, with P1448, P12165 and 40324 having larger, more rounded and darker leaflets than 33038, 40735, 51365 and 64066, which had smaller, lanceolate leaflets. Establishment was variable, and for several entries, fewer than 5 of the 20 plants which were planted successfully established. Mean yield ratings were generally high compared to those of other groups; most entries persisted for the entire experimental period and spread was generally 2-3 m. Weight of harvested seed was variable. No entry was markedly superior to cv. Dalrymple, in terms of estimated total yield, although the amount of seed harvested from CPI 46383 was higher than that from other accessions, including Dalrymple from which no seed was harvested.

60428 differed from other Group A accessions in that in appeared to be more hardy and was jassid resistant. Although it flowered prolifically, it set no seed.

Group B (7 accessions)
This group included *V. marina* accessions (Table 2). They were perennial, with dark green, orbicular leaves and succulent growth. The species was evidently poorly adapted to the environment at the trial site and plants failed to flower, although all entries survived for the term of the trial. Mean yield rating of 4.7 was lower than that of Group A, although spread was comparable. Leaf: stem ratio was consistently lower than that of Group A.

Group C (18 accessions)
Group C included *V. lasiocarpa*, *V. racemosa* CPI 60436 and two accessions of *V. vexillata.* Plants were densely leafy with soft, hairy leaves and dense ground cover (Table 3). They were all annual or biennial, late maturing and frost sensitive. Spread was mostly 1.5-3 m and mean yield rating was variable. The highest-yielding entry was *V. lasiocarpa* CPI 34436 (mean yield of 11.8) and this accession also had good survival and seed yield. Most entries failed to survive for the full period of the trial.

Group D (3 accessions)
Three similar accessions of *V. vexillata* were included in Group D (Table 4). They were perennials, with tuberous roots, robust, leafy and compact. Pods were stout, borne in clusters above the foliage, covered with stiff, brown hairs, and with seeds plump and rounded. Plants were frost-sensitive. Although all three entries had a spread of 3 m, mean yield ratings were low. All three seeded prolifically. This group appeared to have more of the attributes of a crop than a forage.

Group E (6 accessions)
The six Group E accessions were all *V. vexillata* (Table 5). Plants were decumbent, vining, generally with tuberous roots, and with lavender or blue flowers with a curled keel and pods borne above the foliage. Plants were late-flowering and frost-sensitive and in consequence set little seed; the highest seed yield was obtained from CPI 52967, and this entry also had the highest mean yield rating, although still low by comparison with some other groups. This group was apparently poorly adapted to the Lawes environment.

Group F (12 accessions)
Group F accessions included 11 *V. vexillata* accessions, and one accession of *V. ambacensis* (Table 6). Plants were very small, and stunted in appearence, with dark green, leathery leaves. At the experimental site they tended to behave as annuals, although some entries persisted for 16 ratings. Seed yields tended to be low.

Group G (13 accessions)
These accessions included *V. hosei*, *V. parkeri* and an accession similar to *V. parkeri*. They had yellow or violet flowers (Table 7). Plants spread up to 1 m but rarely exceeded 20 cm in height. In most entries, a high proportion of plants failed to establish. Leaf:stem ratio was consistently high. Several of this group failed to flower at the experimental site and no seed was harvested.

Mean yield rating was low (<3) in comparison to some other groups.

Group H (9 accessions)
Group H plants were all *V. schimperi* and exhibited little variation within the group (Table 8). They were perennials with densely piled, leafy growth and cylindrical pods covered with short, golden-brown hairs. Spread was 2-3 m and mean yield rating comparatively high, the most productive being CPI 28766. Pods were generally hidden within the canopy, and variable quantities of seed were harvested, which may reflect differences between entries. Plants were free of jassid damage and were cold-tolerant.

Group I (24 accessions)
This large group included accessions identified as *V. decipiens*, *V. oblongifolia*, *V. reticulata* and *Vigna* sp. CPI 77000 (Table 9). Plants were small annuals, not persisting for more than 4-6 ratings. Mean yield ratings over their brief lifespan were low, rarely as high as 2.5. They had decumbent trailing stems, were moderately leafy and were prolific seeders.

Group J (26 accessions)
Group J included the majority of *V. umbellata* entries, and 5 of *V. angularis* (Table J). Plants were erect, leafy, with stems terminally twining, the immature pods grey-green in colour and cylindrical. Mean yield ratings were consistently low and few entries survived for more than six ratings, although CPIs 17033 and 29650 survived almost until the end of the experiment. Seeds were plump and several entries provided comparatively heavy yields of harvested seed.

Group K (7 accessions)
These accessions, also *V. umbellata* (6) and *V. angularis* (1), were similar to Group J, but later maturing (Table 11). Three entries (CPIs 30731, 30873 and 32962) survived for the entire duration of the trial. Although late maturing, seed was harvested from three entries in reasonable quantities, especially *V. angularis* CPI 32962. This accession showed affinities with Group J.

Group L (8 accessions)
V. trilobata accessions were all in this group, with plants characterised by having decumbent growth, reddish stems, succulent leaves, small pods, ripening unevenly, becoming black when mature (Table 12). Plants behaved as annuals. Spread and height were modest and yield, low. The highest-yielding entry was CPI 13671, which also yielded the most harvested seed.

Group M (8 accessions)
This group included all of the *V. aconitifolia* accessions (Table 13). They were annuals, with slender, creeping stems, lobed leaflets, small yellow flowers and cylindrical pods. Yield ratings were low but seed yield was generally high.

Group N (6 accessions)
Some *V. racemosa* (4) and *V. unguiculata* (2) were included in Group N (Table 14). Yield was comparatively good, especially for *V. racemosa* CPI 51603, which also had good seed yield. Plants behaved as annuals or perennials.

Group O (9 accessions)
These accessions, all in *V. unguiculata*, had decumbent growth and pods borne above the foliage (Table 15). They overwintered but failed to survive for the full course of the experiment. Spread was moderate and mean yield rating generally low.

Group P (4 accessions)
Group P included a *V. decipiens* entry, a similar species, *V. unguiculata* CPI 43795 and an unidentified species (Table 16). Stems were reddish where exposed to light and pods were borne above the foliage. Yield ratings were low, although the first two entries persisted for most of the duration of the trial.

Group Q (7 accessions)
This group included three entries of *V. ambacensis* and four of *V. heterophylla* (Table 17) Growth was fairly dense, soft and leafy, the vining stems forming a low canopy. One accession of each species (CPI 60422, 28764) persisted for the whole, or almost the whole, trial. CPI 28764 was clearly the most productive entry in this group.

Group R (3 accessions)
Three accessions similar to *V. parkeri* comprised Group R (Table 18). Plants were slender twining vines, with lanceolate leaflets, forming a dense cover but yield ratings were low. Two of the three yielded a reasonable amount of harvested seed. CPI 60433 showed affinities with Group G.

Group S (2 accessions)
This group comprised two *V. vexillata* entries - CPI 60457 and CQ502 (Table 19). Plants were vigorous and leafy, the leaves dark green but with leaf markings. Growth was piled and pods were thin and cylindrical, borne above the foliage. Little or no seed was harvested. Plants persisted through the winter and until mid-summer but died before the end of the trial.

Group T (1 accession)
This was a single entry of this group, *V. membranacea* CPI 28762 (Table 20). Leaves were leathery, hairy, and stems squarish in section. Growth at the site was very poor and the accession did not survive the winter.

Group U (2 accessions)
The two accessions in this group were both unidentified species (Table 21). They were extremely hairy and had rather thick leaves and cylindrical pods c.7 mm in diameter, borne above the foliage. They were quite leafy and persisted for most of the duration of the experiment.

Group V (5 accessions)
Group V included accessions of *V. lanceolata*, *V. vexillata* and three unidentified accessions (Table 22). Leaflets were lanceolate, long and narrow, deeply veined, giving a crinkled appearence. Yield ratings were low and most entries failed to surviv the winter. *V. vexillata* CPI 25379 showed affinities with Group I.

Unclassified entries (28 accessions)
Unclassified entries included a considerable number of different species. They were not classified for various reasons - in some instances because of difficulties in assigning them to particular classes, and in others, because the particular group was considered to be of minor interest (*e.g. V. vexillata* var. *angustifolia*, a native Australian taxon, but also occurring in Central Africa). Three entries were variously classed in different groups. *V. pubescens* CPI 60435, the only accession of this species,

apparently showed affinities with Groups F and I. Similarly, *V. angustifoliolata* CPI 73601, again the only representative of this species, was classified in Groups G, J and I, and *V. vexillata* var. *angustifolia* CPI 60421 was classified either in I or J. None of the unclassified group had a mean yield rating greater than 3.6.

DISCUSSION

High yield ratings together with survival for most or all of the trial were generally characteristic of Groups A,B and H. These included the species *V. luteola, V. marina* and *V. schimperi.* However, high yielding and persistent accessions were also evident in groups C, K, N, Q and S. The extensive variation in this collection offers good opportunity for selection of elite accessions.

The purpose of the trial was to select accessions adapted to clay soils. Many of the entries failed to survive for the duration of the trial, and it is possible that they would have survived longer on lighter soils. The morphological/agronomic groups derived in this trial provide a basis for selecting entries for evaluation on other soil types.

The various species characterised differed in their intraspecific variability. Some species, such as *V. marina, V. luteola* and *V. schimperi*, were classified into single, reasonably uniform groups, although still with sufficient variation to allow the opportunity for selecting superior accessions. In contrast, *V. vexillata* exhibited a high level of heterogeneity, with accessions in Groups C,D,E,F,I,S and V, most accessions being in E and F.

A number of accessions were introduced as *V. gracilis* (*e.g.* CPI 28760, 32956). This name has been used for *V. parkeri* in the past (L. Pedley, pers. comm. to BG Cook, 24/10/1984). This species did not show any particular attributes which would favour selection for further evaluation in this study, but the cultivar Shaw is noted as a particularly useful legume in the humid subtropics. This cultivar was not released following a systematic selection procedure, but its potential became apparent when it was observed as persisting and spreading some years after a trial had been abandoned (Oram 1992). Selection simply on the basis of high yield can result in rejection of potentially useful cultivars. The variation apparent in *V. parkeri* in this trial suggests that there could be further opportunities for selection. However, at the trial site this species failed to set seed, so the species is likely to be better adapted to districts with a longer growing season.

Accessions selected from this trial for evaluation for potential on clay soils were:

Species	Accession	Group	Site
V. decipiens	CPI 52839	(Group P)	- - - N Th E - -
	CPI 73602	(Group I)	- - - N Th E Ta W
V. sp. aff. *decipiens*	CPI 52835B	(Group P)	- - - N Th E - -
V. luteola	cv. Dalrymple	(Group A)	P T D - - - Ta W
	CPI 40735	(Group A)	- - - - - - Ta W
V. oblongifolia	CPI 28763	(Group I)	P T D N Th E Ta W
	CPI 57524	(Group E)	- - - N Th E Ta W
	CPI 60430	(Group I)	- - - N Th E Ta W
V. sp. aff. *parkeri*	CPI 60433	(Group R)	- - - N Th E - -
V. trilobata	CPI 13671	(Group L)	P T D N Th E Ta W
V. vexillata	CPI 15463	(Group I)	P - - N Th E Ta W
	CPI 43799	(Group E)	P - - N Th E Ta W
	CPI 60455	(Group C)	P - - - - - - -
	CPI 69030	(Group D)	P - - N Th E Ta W

The sites where they were sown were Pittsworth (P) and Tobeah (T) (Rees *et al.* 1995), Dalby (D), Tara (Ta), Wandoan (W) (R.M. Jones pers. comm.) and Narayen Research Station (N), Brigalow Research Station (Th) near Theodore and Emerald Research Station (E) (N.J. Brandon pers. comm.).

Further *Vigna* accessions were included in a co-ordinated series of trials across a wide environmental and latitudinal range in Queensland (B.C .Pengelly and I.B. Staples undated). These, together with their group letters, were *V. ambacensis* CPIs 29869 (F) and 47188 (Q), *V. decipiens* CPI 73602 (I) and 73602 (I), *V. oblongifolia* CPIs 28763, 37953, 57524, 60430 (all I), *Vigna* sp. aff. *decipiens* (CPI 52835B (P), *V. parkeri* cv. Shaw, *Vigna* sp. aff. *parkeri* CPI 60433 and *V. heterophylla* CPIs 28761 and 28764 (both Q).

Rees *et al.* (1995) and Jones and Rees (1996) have reported on some of these trials. In summary, these authors found that no *Vigna* accessions outyielded *Lablab purpureus* cv. Rongai or Highworth in the year of sowing. However, Rongai and Highworth failed to persist into the second year, whereas *V. oblongifolia* CPI 28763,*V. luteola* cv. Dalrymple, *V. aconitifolia* CPI 106160 (not included in the present trial) and some accessions of *V. vexillata* yielded 2-6 tonnes/ha dry matter in the second year when adequate moisture was available. They also state there was little variation in the five *V. trilobata* accessions they evaluated (only one of which was included in the present trial). In our study, *V. trilobata* were all assigned to Group K, and the only noteworthy variation was the apparent superiority of CPI 13671, which was included in the Rees *et al.* trials. These authors considered this species has little potential as a forage in Southeast Queensland as it becomes reproductive with the onset of soil moisture stress. Rees *et al.* also comment on the variability in *V. vexillata*, supporting the separation of this species into seven groups, in our study.

Group H, all *V. schimperi*, is a group which perhaps deserves more recognition than it has received. Yield ratings were high compared to those of some other groups, and the freedom from jassid damage and some cold tolerance are attributes which would be useful in a forage.

Acknowledgements

We are indebted to Mr A.E. Wynn for conducting the trial and assembling and interpreting data. We are also grateful to Mr E. Gieseman and the field staff of the CSIRO Cooper Laboratory, Lawes, for maintaining the experiment.

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Table 1 Passport data and chararacteristics of *Vigna* accessions in Group A (for explanation, see paragraph 2, Results section)

Species	Accn number	Country	Lat., long	An. Rain (mm)	Plants	Site, Fl. date	Ht. (cm)	Spd (cm)	L/S	Mean yld	No rtgs	Fin. yld rtg	seed yld (g)	Flower colour
V. luteola (cv. Dalrymple)	21347	(Costa Rica)					90	300	8	10.0	17	7/81		yellow
V. luteola	21518	(Puerto Rico)			20	11/4	100	300	8	10.0	17	7/81	36/1	yellow
	28451	(Costa Rica)			18	11/4	90	300	8	10.6	17	7/81	3/1	yellow
	33038	USA	27°28'N 80°20'W		4	GH								yellow
	36213	Guyana			19	11/4	80	300	8	8.1	17	7/81	2/1	yellow
	39128	Brazil			17		60	200	8	8.2	17	7/81	6/3	yellow
	40324	Brazil			3	20/5	60	300	6	5.9	17	7/81	2/1	yellow
	40735	Guyana			18	17/4	80	300	8	6.6	17	7/81	T/3	yellow
	46383	(Cuba)			14	11/4	90	300	8	9.9	17	7/81	65/4	yellow
	51365	Brazil			18	11/4	60	300	8	8.8	17	7/81	T/1	yellow
	60428	Uganda	0°14'S 31°61'E	1050	5	23/4	60	300	8	6.4	17	7/81		bright yellow
	64066	Ecuador	2°13'S 79°54'W			GH								yellow
	CQ773	Australia	27°08'S 153°03'E			GH								
	P1448	unknown			18	11/4	60	200	8	6.5	17	7/81	4/3	yellow
(cv. Dalrymple)	P1469	unknown			18	11/4	90	300	8	10.0	17	7/81		yellow
	P6918	Brazil			19	22/4	100	300	8	9.9	17	7/81	2/1	yellow
	P12165	unknown			18	24/9	50	150	8	4.1	12	2/81	3/4	yellow

Table 2 Passport data and chararacteristics of *Vigna* accessions in Group B (for explanation, see paragraph 2, Results section)

V. marina	39610	(PNG)			19		80	300	6	4.9	17	7/81	T/1	
	40618	PNG	9°30'S 147°07'E		19		60	300	6	4.2	17	7/81		
	41162	Fr.Polynesia	16°50'S 151°30'W		17		60	300	6	4.1	17	7/81		
	43350	Fr.Polynesia			13		90	300	6	5.4	17	7/81		
	43351	Fr.Polynesia			8		90	300	6	5.5	17	7/81		
	43455	PNG	9°30'S 148°10'E		13		50	200	6	3.9	17	7/81		
	43584	PNG	9°30'S 148°10'E		12		90	300	6	4.9	17	7/81	12/1	

Table 3 Passport data and chararacteristics of *Vigna* accessions in Group C (for explanation, see paragraph 2, Results section)

Species	Accn number	Country	Lat., long	An. Rain (mm)	Plants	Site, Fl. date	Ht. (cm)	Spd (cm)	L/S	Mean yld	No rtgs	Fin. yld rtg	seed yld (g)	Flower colour
V. lasiocarpa	33970	Costa Rica			3		30	100	5	2.0	15	5/81		
	33971	Costa Rica	10°15'N 83°46'W		18	11/4	90	200	8	6.1	16	6/81	T	lilac
	34436	Honduras			19	11/4	100	300	8	11.8	17	7/81	74/2	yellow
	38630	(Mexico)					80	200	8	7.4	16	6/81	T/2	pale cream
	46540	Guatamala	16°012N 89°25'W		18	10/4	100	200	8	5.4	16	6/81		blue/yellow
	46584	Guatamala	16°012N 89°25'W		16	22/4	80	200	7	3.7	16	6/81	2/1	blue
	81727	Ecuador	2°13'S 79°54'W		10		50	100	6	3.0	15	5/81	T/1	
	Q8328	Costa Rica			10		30	100	6	3.1	13	3/81		
	Q8329	Costa Rica			15	30/5	40	100	6	3.6	12	2/81	33/2	pale blue
	Q8330	Costa Rica			13	30/5	30	150	5	3.7	9	11/80		pale blue
	Q8331	Costa Rica			17	30/5	80	200	8	6.4	16	6/81	25/2	pale blue
	Q8346	Guatamala			19	10/6	50	250	6	5.0	15	5/81		pale blue
	Q8496	Mexico			16	11/4	50	200	6	5.0	15	5/81	15/3	pale yel. std (pale lilac)
	Q8499	Mexico			18	17/4	50	150	6	5.1	12	2/81	1/2	blue yel.std (?)
	Q8508	Mexico			17	1/4	50	200	6	6.4	16	6/81	35/6	pale blue
V. racemosa	60436	Uganda	2°19'N 31°61'E	1025	16	13/4	80	300	8	6.2	16	6/81	1/1	pale lilac
V. vexillata	29141	Kenya			19	11/7	80	300	8	6.7	16	6/81		purple
	60455	Kenya		1200	17	11/7	60	200	8	6.1	16	6/81	15/2	purple

Table 4 Passport data and chararacteristics of *Vigna* accessions in Group D (for explanation, see paragraph 2, Results section)

V. vexillata	15452	(Sudan)			16	4/4	80	300	7	4.6	16	6/81	1199/12	
	17457	(Sudan)			17	11/4	80	300	7	4.9	15	5/81	553/10	creamy yellow std
	69030	Nigeria			14	1/4	30	200	6	2.3	16	6/81	662/12	pale blue

Table 5 Passport data and chararacteristics of *Vigna* accessions in Group E (for explanation, see paragraph 2, Results section)

Species	Accn number	Country	Lat., long	An. Rain mm	Plants	Site, Fl.	Ht. (cm)	Spd (cm)	L/S	Mean yld	No rtgs	Fin. yld	seed yld	Flower colour
V. vexillata	43799	Zambia			18	23/4	80	200	6	2.8	16	6/81	5/5	pale lav
	52905	Tanzania		750	14	30/5	60	100	5	2.9	16	6/81	4/1	lavender
	52967	Zambia		850	17	10/5	90	200	7	3.9	14	4/81	27/7	pale mauve
	60453	Kenya		1150	4	11/4	30	80	5	1.5	12	2/81	T/1	pale blue
	60458	Malawi		700	?	11/4	60	200	7	3.5	16	6/81	1/7	blue
	77012	Zambia	15°39'S 28°19'E		18	20/4	60	150	6	2.7	16	6/81		lav/blue

Table 6 Passport data and chararacteristics of *Vigna* accessions in Group F (for explanation, see paragraph 2, Results section)

V. ambacensis	29869	India			19	4/4	40	200	6	2.2	14	5/81	85/8	creamy yellow
V. vexillata	52907 = P12745	Zimbabwe		850	17	11/4	10	50	4	1.2	12	2/81	22	blue yel std
	57516	South Africa			17	11/4	40	150	6	1.9	15	5/81		pale pink
	57517	South Africa			9	1/5	20	100	6	1.1	14	4/81	1/2	blue yel.std
	57518	South Africa			19	11/4	40	100	5	1.5	16	6/81	22/11	blue yel.std
	57519	South Africa			18	5/4	20	100	5	1.2	13	3/81	54/8	lavender
	57520	South Africa			16	11/4	20	80	5	1.0	12	2/81	10/7	blue yel.std
	57527	South Africa			19	11/4	20	60	5	1.3	12	2/81	31/10	lavender
	57529	(South Africa)			19	11/4	20	150	6	1.2	16	6/81	2/3	lavender
	69512	Zimbabwe	19°31'S 28°17'E		18	10/3/ 81	50	200	5	1.4	16	6/81		pale blue
	69513	Zimbabwe	19°31'S 28°17'E		17	11/4	40	100	6	1.7	12	2/81	3/5	lavender
	69514	Zimbabwe	19°31'S 28°17'E		19	5/4	10	40	3	1.0	11	1/81	10/6	pale blue

Table 7 Passport data and chararacteristics of *Vigna* accessions in Group G (for explanation, see paragraph 2, Results section)

Species	Accn number	Country	Lat., long	An. Rain (mm)	Plants	Site, Fl. date	Ht. (cm)	Spd (cm)	L/S	Mean yld	No rtgs	Fin. yld rtg	seed yld (g)	Flower colour
V. hosei	Q5398	Costa Rica			8		20	100	7	2.3	16	6/81		
V. parkeri	25378	Uganda	0°04'S 37°27'E		19		10	50	8	1.9	8	10/80	nil	
	28281	Uganda			9	17/4	30	100	8	1.5	16	6/81	nil	yellow
	28703	(Kenya)			19	4/7	30	100	8	2.8	11	1/81	nil	violet
	28760	(Kenya)			11	6/8	20	60	8	1.7	7	9/80	nil	violet
	32956	Kenya			4	4/7	20	80	8	1.1	17	7/81	nil	violet
	37950	Kenya	1°01'N 36°01'E		18	22/7	20	60	8	2.8	8	10/80	nil	violet
	37952	Uganda	0°04'N 37°27'E										nil	violet
	60432	Kenya	0°22'S 35°19'E	1200	15	11/7	20	80	8	2.4	8	10/80		violet
	60434	Tanzania	3°23'S 36°40'E	1200	4		20	80	8	1.8	10	12/80		
	CQ948	(Australia)			3		5	40	5	1.0	10	12/80	nil	
	CQ1374	(Australia)			15		10	80	8	1.4	7	9/80		violet
V. parkeri aff.	33081	PNG	9°05'S 32°35'E		2	GH								

Table 8 Passport data and chararacteristics of *Vigna* accessions in Group H (for explanation, see paragraph 2, Results section)

V. schimperi	16007	(Kenya)			16	11/4	90	200	8	6.9	17	7/81	59/2	yellow
	28705	(Kenya)			18	11/4	80	200	8	5.5	17	7/81	15/3	yellow
	28706= P6922	Kenya			20	17/4	80	200	8	7.1	17	7/81	171/6	yellow
	28766	Kenya			19	15/7	100	300	8	7.8	17	7/81	7/3	pale yellow
	28767	Kenya	0°04'S 36°22'E		19	7/8	80	300	8	7.4	17	7/81	7/3	yellow
	33454	(Kenya)			5	7/8	80	300	8	7.4	17	7/81	7/4	lemon
	37954	Zimbabwe			14	17/4	80	300	8	5.1	17	7/81	135/5	pale yellow
	37955	Kenya	1°01'N 36°01'E		3	23/4	60	200	8	3.5	17	7/81	29/2	yellow
	37956	Kenya	0°04'S 36°22'E		17	20/4	80	200	8	5.7	17	7/81	93/4	yellow

Table 9 Passport data and chararacteristics of *Vigna* accessions in Group I (for explanation, see paragraph 2, Results section)

Species	Accn number	Country	Lat., long	An. Rain (mm)	Plants	Site, Fl. date	Ht. (cm)	Spd (cm)	L/S	Mean yld	No rtgs	Fin. yld rtg	seed yld (g)	Flower colour
V. decipiens	73602	(South Africa)			14	4/4	8	20	6	1.6	5	7/80	215/14	yellow
V. oblongifolia	16682	(Zimbabwe)			8	1/4	20	60	6	1.8	4	6/80	140/11	yellow
	17855	Kenya					40	80	5	1.6	5	7/80	51/10	yellow
	28763	Kenya			11	25/4	30	60	5	2.4	5	7/80	143/14	bright yellow
	29142	South Africa			19	14/3	30	30	6	1.2	5	7/80	172/16	small yellow
	29868	India			19	1/4	20	40	6	1.8	4	6/80	114/13	yellow
	37953	Zimbabwe			19	14/3	20	50	5	1.7	3	6/80	197/10	yellow
	43796	Zimbabwe			10	11/4	15	40	3	1.3	3	6/80	28/5	yellow
	57521	South Africa			19	1/4	30	40	6	1.5	4	6/80	459/18	lemon
	57522	South Africa	26°30'S 29°30'E		18	20/3	20	50	5	1.6	5	7/80	268/18	yellow
	57523	South Africa	26°32'S 29°59'E		12	1/4	30	40	6	1.8	5	7/80	119/14	yellow
	57524	South Africa	26°32'S 29°59'E		16	1/4	30	30	4	2.4	5	7/80	454/12	yellow
	57525	South Africa	26°30'S 29°30'E		13	4/4	30	40	5	1.8	6	8/80	331/17	yellow
	57526	South Africa	27°45'S 29°55'E		4	1/4	15	30	4	1.6	5	7/80	49/14	
	60430	South Africa	29°00'S 29°53'E	750	14	28/3	30	50	6	3.0	5	7/80	371/15	yellow
	65483	Zimbabwe	19°31'S 28°17'E		15	4/4	30	30	4	1.2	5	7/80	147/16	yellow
	77009	Zimbabwe	15°39'S 28°19'E		15	11/4	20	30	3	1.4	5	7/80	9/6	yellow
Vigna oblongifolia aff	57530	South Africa			7	11/4	20	20	6	1.3	3	6/80	7/10	yellow
Vigna oblongifolia var. *parviflora* ?	16682	(Zimbabwe)			8	1/4	20	60	6	1.8	4	6/80	140/11	yellow
V. reticulata	17856	(Kenya)			14	S23/4	30	80	6	2.8	5	7/80	187/11	small lemon
	60440	Kenya		1175	4	22/4	10	30	6	1.6	5	7/80		cerise
	60441	Zambia		800	13	11/4	10	30	5	1.0	3	5/80	46/8	purple, pale std
V. vexillata	15463	(Sudan)			18	14/3	30	30	6	1.2	5	7/80	175/15	lemon
Vigna sp.	77000	(Zimbabwe)			14	4/4	20	40	4	1.3	3	6/80	128/16	yellow

Table 10 Passport data and chararacteristics of *Vigna* accessions in Group J (for explanation, see paragraph 2, Results section)

Species	Accn number	Country	Lat., long	An. Rain (mm)	Plants	Site, Fl. date	Ht. (cm)	Spd (cm)	L/S	Mean yld	No rtgs	Fin. yld rtg	seed yld (g)	Flower colour
V. angularis	29638	(Thailand)				GH								
	36029	(Hungary)				GH								
	49743	Brazil			16	10/4	80	100	6	2.3	12	2/81	483/15	yellow
	56672	Japan			pot									
	67773	China			7	11/4	40	30	6	1.3	4	6/80	109/11	yellow
V. umbellata	2779	(Bangladesh)			12	6/5	50	50	7	1.8	5	7/80	257/3	yellow
	12143	Cuba			10	11/4	80	200	6	2.3	12	2/81	665/16	yellow
	17033	(PNG)			7	10/4	80	200	6	2.6	16	6/81	12/4	yellow
	28111	(Venezuela)			10	6/5	60	80	7	2.8	4	6/80	250/3	yellow
	29405	(Indonesia)			13	6/5	60	60	7	2.4	5	7/80	225/5	yellow
	29406	(Indonesia)			10	17/4	30	40	6	2.0	3	6/80	314/8	yellow
	29407	(Indonesia)			7	25/5	50	30	6	1.0	3	6/80	2/1	yellow
	29648	(Thailand)				GH								yellow
	29649	(Thailand)			2	1/6	50	60	6	2.3	6	8/80	99/1	yellow
	29650	Myanmar			6	20/5	90	200	6	3.2	16	6/81		yellow
	29826	(India)			15	10/4	60	80	6	4.3	3	6/80	471/5	yellow
	29827	(India)			13	21/4	40	40	6	2.7	3	6/80	344/5	yellow
	29829	(India)			1	30/5								yellow
	29830	(India)			12	6/5	50	60	6	1.7	6	7/80	147/6	yellow
	29831	(India)			6	7/4	50	60	5	1.0	14	4/81	163/10	yellow
	29832	(India)			8	11/4	30	40	5	1.0	5	7/80	86/12	yellow
	29833	(India)				GH								
	56673	(India)			4	1/4	30	30	6	1.0	5	7/80	42/10	yellow
	56674	(India)			8	17/4							8/5	yellow
	56675	(Russia)			3	17/4							9/5	yellow
	79869	(Thailand)			12	15/5	60	80	7	3.2	5	7/80	182/2	yellow

Table 11 Passport data and chararacteristics of *Vigna* accessions in Group K (for explanation, see paragraph 2, Results section)

Species	Accn number	Country	Lat., long	An. Rain (mm)	Plants	Site, Fl. date	Ht. (cm)	Spd (cm)	L/S	Mean yld	No rtgs	Fin. yld rtg	seed yld (g)	Flower colour
V. angularis	32962	(Colombia)			14	30/5	100	200	8	6.4	17	7/81	135/1	yellow
V. umbellata	30731	(Myanmar)			5	30/5	90	100	6	5.4	17	7/81		yellow
	30873	(Philippines)			15	6/5	100	300	7	5.8	17	7/81	91/4	yellow
	40210	(Brazil)			5	11/7	80	200	8	4.2	15	5/81		yellow
	45426	Thailand			15	20/6	30	40	5	2.0	5	7/80	43/4	yellow
	75927	Thailand		1200	1	20/6	50	40	7	1.4	5	7/80		yellow
	83026	Myanmar			12	30/5	90	200	7	4.3	16	6/81	3/1	yellow

Table 12 Passport data and chararacteristics of *Vigna* accessions in Group L (for explanation, see paragraph 2, Results section)

V. trilobata	13671	(India)			18	1/4	40	80	6	3.7	6	8/80	440/17	small yellow
	24264	Senegal			3	GH								
	29841	India			6	1/4	5	20	6	1.0	3	6/80	18/6	yellow
	29842	India			12	11/4	10	40	6	1.0	4	6/80	68/8	yellow
	29843	India			14	1/4	10	40	6	1.0	4	6/80	30/6	small yellow
	30070	India			6	1/4	10	50	6	1.0	5	6/80	10/7	small yellow
	30101	(Italy)			3									yellow
	30726	Myanmar			14	1/4	15	30	6	1.4	5	7/80	59/12	bright yellow

Table 13 Passport data and chararacteristics of *Vigna* accessions in Group M (for explanation, see paragraph 2, Results section)

V. aconitifolia	28263	(India)			8		10	30	6	1.0	4	6/80	48/14	yellow
	50748	(India)			16		30	40	5	1.8	4	6/80	178/13	small yellow
	50749	(India)			8	11/4	30	50	5	2.5	4	6/80	189/11	small yellow
	50750	(India)			?	4/4	20	30	6	2.0	4	6/80	324/11	small yellow
	50751	(India)			14	11/4	30	50	6	4.0	4	6/80	186/10	small yellow
	50752	(India)			18	25/3	20	50	5	1.0	1	3/80	210/1	small yellow
	50753	(India)			16	1/4	15	50	5	1.4	5	7/80	130/3	small yellow
	50754	(India)			?	11/4	30	50	4	2.0	4	6/80	439/11	small yellow

Table 14 Passport data and chararacteristics of *Vigna* accessions in Group N (for explanation, see paragraph 2, Results section)

Species	Accn number	Country	Lat., long	An. Rain (mm)	Plants	Site, Fl. date	Ht. (cm)	Spd (cm)	L/S	Mean yld	No rtgs	Fin. yld rtg	seed yld (g)	Flower colour
V. racemosa	51603	Ghana			16	1/4	60	150	7	8.0	4	6/80	149/12	pale blue, yellow std
	53597	(Ghana)				11/4	60	120	6	6.2	6	8/80		blue
V. unguiculata	28924	(Malaysia)			3	1/4	40	50	8	2.0	4	7/80	3/2	
	28928	(Malaysia)			19	11/4	100	200	8	6.4	16	6/81		lge pinkish
	50984	(Senegal)			17	26/3	6	100	6	5.0	6	8/80	108/13	blue
	77011	Zambia		1400	18	17/4	30	100	6	4.5	11	1/81	46/11	blue yel std

Table 15 Passport data and chararacteristics of *Vigna* accessions in Group O (for explanation, see paragraph 2, Results section)

V. unguiculata	25380	Uganda			11	11/4	40	150	6	4.0	12	2/81	15/4	mauve
	43794	Zambia				GH								blue
	52836 = P12743	Zambia		1400			20	100	6	3.6	11	1/81	2	
	52837= P12744	Zambia		1400			10	100	6	2.3	11	1/81	96	
	72862	(Zambia)			18	4/4	15	50	5	1.4	12	2/81	62/14	mauve
	74878	S. Africa			16	1/4	15	100	6	2.3	12	2/81	42/13	lilac
	77007	Zambia			19	1/6	20	100	6	3.2	11	1/81	67/4	blue
V. unguiculata var. *dekindtiana* (2 entries)	72529	PNG			17	4/4	20 15	200 100	6 5	5.6 2.4	9 12	11/80 2/81	37/3 35/17	blue
	72734	(PNG)			17	1/4	20	200	6	4.3	11	1/81	12/8	blue

Table 15 Passport data and chararacteristics of *Vigna* accessions in Group P (for explanation, see paragraph 2, Results section)

V. decipiens	52839	South Africa	25°25'S 31°55'E				30	150	5	1.6	16	8/81	140/10	
V. decipiens aff	52835B	Zambia	15°26'S 28°20'E		19	4/4	40	200	5	3.0	16	6/81	36/14	mauve
V. unguiculata	43795	Zambia				GH								
Vigna sp.	30254	(Zambia)			20	4/4	10	60	6	1.4	10	1/81	64/9	pale blue yel std

Table 17 Passport data and chararacteristics of *Vigna* accessions in Group Q (for explanation, see paragraph 2, Results section)

Species	Accn number	Country	Lat., long	An. Rain (mm)	Plants	Site, Fl. date	Ht. (cm)	Spd (cm)	L/S	Mean yld	No rtgs	Fin. yld rtg	seed yld (g)	Flower colour
V. ambacensis	47188	Sudan			17	1/4	50	60	2	2.3	4	6/80	183/13	lavender
	60422	Uganda	0°19'N 32°35'E	1000	3	11/7	40	100	6	2.4	16	6/81	nil	blue
	60423	Uganda	2°19'N 31°37'E	667	6									
V. heterophylla	28761	(Kenya)					40	100	6	3.1	7	9/80	nil	
	28764	(Kenya)			5	10/6	80	200	8	6.9	17	7/81		lavender
	60426	Kenya	1°N	1000			20	60	6	2.2	5	7/80	nil	
	60427	Uganda	0°	1400	12	10/6	60	200	7	5.6	12	2/81	nil	lavender

Table 18 Passport data and chararacteristics of *Vigna* accessions in Group R (for explanation, see paragraph 2, Results section)

V. parkeri aff	17817	(Kenya)			11	20/4	40	100	6	2.1	11	1/81	3/3	yellow
	49184	Uganda	0°20'N 32°35'E		18	20/4	50	100	6	2.9	12	2/81	103/11	small yellow
	60433	Uganda			18	11/4	20	80	8	3.0	12	2/81	117/6	yellow

Table 19 Passport data and chararacteristics of *Vigna* accessions in Group S (for explanation, see paragraph 2, Results section)

V. vexillata	60457	Tanzania		1750	6	11/7	30	200	6	3.8	9	11/80		blue
	CQ502	(Australia)			17	17/4	60	150	6	5.8	12	2/81	T/1	blue

Table 20 Passport data and chararacteristics of *Vigna* accessions in Group T (for explanation, see paragraph 2, Results section)

V. membranacea	28762	Kenya			4	15/5	30	80	1	1.8	4	6/80	T/1	pink

Table 21 Passport data and chararacteristics of *Vigna* accessions in Group U (for explanation, see paragraph 2, Results section)

Vigna sp.	17859	(Kenya)			18	4/4	60	200	8	5.6	14	5/81	22/11	pale blue
	37957	(Kenya)			17	28/3	40	150	6	2.9	16	6/81	151/25	pale mauve

Table 22 Passport data and chararacteristics of *Vigna* accessions in Group V (for explanation, see paragraph 2, Results section)

Species	Accn number	Country	Lat., long	An. Rain	Plants	Site, Fl. date	Ht.	Spd	L/S	Mean yld	No rtgs	Fin. yld rtg	seed yld (g)	Flower colour
V. lanceolata	P8181	Australia			?	11/4	10	40	4	1.0	11	1/81	2	yellow
V. vexillata	25379	Uganda	0°04'N 37°27'E		20	30/5	40	100	6	3.0	5	7/80		cerise
Vigna sp.	57982	Brazil			18	11/4	30	40	4	2.0	3	6/80	7/5	cerise
	Q8653	Mexico			18		40	80	6	2.6	7	9/80	nil	
	Q10818 A	Guatamala			18		30	40	6	1.7	7	9/80	nil	

Table 23 Passport data and chararacteristics ofunclassified entries of *Vigna* accessions in Group V (for explanation, see paragraph 2, Results section)

Species	Accn number	Country	Lat., long	An. Rain (mm)	Plants	Site, Fl. date	Ht. (cm)	Spd (cm)	L/S	Mean yld	No rtgs	Fin. yld rtg	seed yld (g)	Flower colour
V. angularis	36087	(Russia)			6	1/4	15	20	5	1.0	3	6/80	2/4	yellow
	56670	Japan			5		15	?	5	1.0	3	6/80		
V. angustifoliolata	73601	South Africa	28°42'S 26°06'E		3		10	?	4	1.0	8	11/80	nil	
V. frutescens	43479	Zambia			19	24/9	80	100	6	2.4	16	6/81	nil	lavender
	60424	Zimbabwe	19°31'S 28°17'E	550			40	50	6	3.3	4	6/80	220/12	blue
V. membranacea	60429	Kenya	4°04'S 39°40'E	1250	17	14/3	40	60	6	2.4	7	9/80	20/7	dk blue
V. monophylla	70158	Zimbabwe	19°31'S 28°17'E		3	10/6	10		5	1.0	5	7/80		blue
V. pubescens	52867	Zambia	10°10'S 31°11'E	1200	14	11/4	10	60	6	2.5	4	6/80	14/6	small blue
	60435	Kenya		1250	14	4/4	40	100	6	4.8	5	7/80	9/5	yellow
V. sublobata	P11826	Brazil					20	60	6	1.8	5	7/80	11	
V. umbellata	29828	(India)				H								
V. unguiculata	52838B	Zambia			18	4/4	50	200	6	2.8	16	6/81	72/11	mauve (pale blue?)
	57515	S. Africa			0									
V. vexillata	16683	(Zimbabwe)			11	11/4	80	200	7	3.0	16	6/81	T/3	purple
	66514	(India)			16	11/4	10		4	1.0	3	6/80	3/6	blue
	77010	Zambia	15°39'S 28°19'E		15	1/4	30	60	6	2.3	4	6/80	117/8	creamy yel.std
	CQ395	Australia			19	1/4	10	80	4	1.1	11	1/81	16/12	blue yel/std
	CQ1456	unknown			17	1/4	30	60	3	1.2	12	2/81	68/8	blue
V. vexillata var. *angustifolia*	60421	Zimbabwe		600	18		20	80	8	2.7	3	6/80	143/14	small yellow
	P8177	Australia			18	1/4	30	80	7	1.3	12	2/81	13	dirty blue
	P8180	Australia			16	1/4	10	50	4	1.5	11	1/81	2	lav blue
	P11829	unknown			18	4/4	10	50	4	1.2	12	2/81	28	blue yel std
	P11934	unknown			13	17/4	10	30	4	1.0	5	7/80	4	blue
	P12157	unknown			4	10/4	10	50	4	1.0	14	4/81	8	blue
Vigna sp.	65486	Zimbabwe	19°31'S 28°17'E		13	4/4	10	50	3	0.8	12	2/81	6/3	pale blue
	70160	Botswana			17	14/3	30	100	6	1.8	12	2/81	96/10	blue
	Q8495	Mexico			15	1/4	40	150	6	3.6	12	2/81	11/6	pale blue