

# Characterization and preliminary evaluation of some accessions of local germplasm of velvet bean (*Mucuna pruriens* DC var. *utilis* Wall) of Ghana

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## SUMMARY

Velvet bean is a vigorously growing leguminous plant used for food, cover crop, and for soil improvement. Eight accessions of velvet beans, namely: 1739, 1740, 1741, 1742, 1743, 1744, 1745, and 1746 were collected from the Ashanti, Eastern, and Upper West Regions between 1982 and 1983. They were planted for characterization and preliminary evaluation in a replicated trial at the Plant Genetic Resources Centre at Bunso in the Eastern Region of Ghana. Qualitative characters like flower colour, plant pigmentation, and seed colour showed variability. Quantitative characters included both vegetative and reproductive characters. Characters like hypocotyl length, days to 50 per cent flowering and maturity, pods per plant, pod length, and 100-seed weight all showed variability. Accessions 1739, 1740, 1741, 1742, 1743, 1744, and 1745 had medium to large canopies and flowered (74-154 days) and matured (142-189 days) late, attributes which will make them good cover crops due to their vigorous vegetative growth. Accession 1746 had a light canopy, flowered early (49 days), set pod and matured early (118 days), and had high pods per plant (50.0).

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## Introduction

Velvet bean, *Mucuna pruriens* DC var. *utilis* Wall, known in Akan as "Aduapea", is a minor legume found mostly in the forest regions of Ghana (Bennett-Lartey, 1987), though it is also found in

## RÉSUMÉ

BENNETT-LARTEY, S. O.: *La caractérisation et l'évaluation préliminaire de quelques accessions du germoplasme local d'haricot du velours (Mucuna pruriens DC var. utilis Wall) du Ghana.* L'haricot du velours est une plante légumineuse de croissance vigoureuse qui se sert pour la nourriture, la plante de couverture et l'amélioration du sol. Huit (8) accessions d'haricot du velours, à savoir, 1739, 1740, 1741, 1742, 1743, 1744, 1745 et 1746 étaient prises de la Région d'Ashanti, la Région de l'Est et la Haute Région de l'Ouest, entre 1982 et 1983. Ils étaient plantés pour la caractérisation et l'évaluation préliminaire dans un essai répliqué au Centre des Ressources Génétiques de Plante à Bunso dans la Région de l'Est du Ghana. Les caractéristiques quantitatives comme la couleur de fleur, la pigmentation de plante et la couleur de graine montraient de variabilité. Les caractéristiques quantitatives comprenaient les caractéristiques végétales et reproductives à la fois. Les caractéristiques comme la longueur de hypocotyle, 50 pour cent des jours de floraison et de maturité, les cosses par plante, la longueur de cosse, et le poids de 100-graines, tous montraient de variabilité. Les accessions 1739, 1740, 1741, 1742, 1743, 1744 et 1745 avaient des voûtes de moyenne en large et fleurissaient (74-154 jours) et mûrissaient (142-189 jour) tard. Des attributs qui pourraient les rendre des bonnes plantes de couverture dû à des croissance végétatives vigoureuses qu'elles exposaient. L'accession 1746 avait une voûte légère, fleurissait tôt (49 jours), établissait la cosse et mûrissait tôt (118 jours) et avait tant de cosse par plante (50.0)

the savanna regions. It belongs to the family leguminosae and sub-family papilionaceae, the cowpea family.

Cultivated in Ghana on a subsistence level with virtually no commercial importance, "Aduapea"

is related to the wild "apea" (*Mucuna pruriens* var. *pruriens*). The former is eaten as a soup thickener whereas the latter is inedible. Short hairs on the pods of the latter cause intense itching when they come into contact with the skin. Hairs on the pods of velvet bean may also cause slight itching of the skin.

Velvet bean is a vigorously growing plant (Tracy & Coe, 1918) which climbs by twining in the anticlockwise direction when provided a stake or spreads profusely on the ground when there is no stake.

This bean has many uses which merit detailed study. The young seeds are used in soup as a source of protein in some parts of Ghana, namely: Ashanti, Eastern, and Brong Ahafo Regions, and some areas of the Upper East and Upper West Regions. Rajaram & Janardhanan (1993) have observed that *Mucuna pruriens* has a high crude protein value. Its growth habit of spreading profusely makes it a good cover crop and a useful weed control agent. Being a legume, it provides the soil with nitrogen through nodulation, and its leaves and other parts also serve as green manure (Tracy & Coe, 1918; NAS, 1979).

In this study, velvet bean germplasm collected from three regions of Ghana were characterized both qualitatively and quantitatively to facilitate its use for agronomic purposes.

## Materials and methods

### Germplasm collecting

Germplasm was collected in the Ashanti, Eastern and Upper West Regions of Ghana in 1982 and 1983, together with passport data. Five accessions were collected in the Ashanti Region, two in the Eastern Region, and one in the Upper West Region, amounting to eight accessions. The germplasm was collected in home gardens, farm stores, farmers' fields, and in the market in the form of pods and seeds. Seed colour ranged between light grey, brown with white mottlings, and black with brown mottlings. Table 1 shows a list of velvet bean accessions and some passport data collected in Ghana in 1982 and 1983.

### Characterization and preliminary evaluation

Accessions 1739, 1740, 1741, 1742, 1743, 1744, 1745, and 1746 were planted in May 1993 in a randomized complete block design with three replications for characterization and preliminary evaluation. Three seeds of each accession were planted per hill and were thinned to one seedling per hill after emergence. There were 10 plants per accession at a between accession and within row spacing of 1 m. Each plant was staked with a 3-m bamboo stick to facilitate record taking.

Both qualitative and quantitative characters were recorded from five randomly selected plants per accessions. For the qualitative characters,

TABLE 1

*Accessions of Velvet Bean Collected in Ghana in 1982 and 1983 Showing Some Passport Data*

Accession number	Locality	Longitude	Latitude	Region of collection	Date of collection	Source of collection	Local name
1739	Akumadan	01° 57' W	07° 25' N	Ashanti	10/11/82	Market	Adua-apea
1740	Mpraeso	00° 44' W	06° 37' N	Eastern	30/11/82	Garden	Adua-apea
1741	Kwahu Tafo	00° 41' W	06° 40' N	Eastern	30/11/82	Field	Adua-apea
1742	Tumu	01° 59' W	10° 52' N	Upper West	13/12/82	Field	Kankiese
1743	Huntado	01° 40' W	06° 28' N	Ashanti	28/1/83	Farm Store	Adua-apea
1744	Kwapia-Obuasi	02° 04' W	06° 10' N	Ashanti	28/1/83	Farm Store	Adua-apea
1745	Odumasi	01° 12' W	06° 36' N	Ashanti	28/1/83	Field	Adua-apea
1746	Odumasi	01° 12' W	06° 36' N	Ashanti	28/1/83	Field	Adua-apea

the following descriptors were used: canopy size, growth habit, growth pattern, twining tendency, presence or absence of plant pigmentation, pod hairiness, immature pod pigmentation, flower colour, seed colour, and mature pod colour. The descriptors used for the quantitative characters were as follows: hypocotyl length, terminal leaflet width and length, nodes per stem, branches per stem, days to 50 per cent flowering and maturity, pods per plant, pod width and length, seeds per pod, and 100-seed weight. The descriptors for cowpea (IBPGR, 1983) were adapted for these studies. The data were analysed statistically using analysis of variance.

## Results and discussion

### Qualitative characterization

Table 2 shows the qualitative data collected from

the characterization studies. The following five qualitative characters did not show any variability: growth habit, growth pattern, twining tendency, pod hairiness, and immature pod pigmentation. All the accessions studied had the following characteristics: the capacity to climb the stakes provided, indeterminate growth, pronounced twining tendency, green immature pods, and hairy mature pods.

The velvet bean was very important as a grazing crop for cattle and hogs, and was also the best annual legume crop for soil improvement in the United States (Tracy & Coe, 1918), due to its profuse growth habit.

*Canopy.* Three categories of canopies were observed in the velvet beans. These were light, medium, and large canopies. Only accession 1746 had a light canopy. Accessions 1742 and 1744

TABLE 2

Summary of Variability in Quantitative Characters Among Velvet Bean Accessions

Acc. no.	Canopy	Growth habit	Growth pattern	Twining tendency	Plant pigmentation	Pod hairiness	Flower colour	Immature pod pigmentation	Seed colour	Mature pod colour
1744	Medium	Climbing/trailing	Indeterminate	Pronounced	(Purple) slight	Present	Purple	Green	Black with brown mottling	Dark brown
1746	Light	Climbing/trailing	Indeterminate	Pronounced	(Purple) slight	Present	Purple	Green	Brown with white mottling	Dark brown
1739	Large	Climbing/trailing	Indeterminate	Pronounced	None	Present	White	Green	Light grey	Dark purple
1745	Large	Climbing/trailing	Indeterminate	Pronounced	slight	Present	White	Green	Light grey	Dark purple
1740	Large	Climbing/trailing	Indeterminate	Pronounced	slight	Present	White	Green	Light grey	Dark purple
1743	Large	Climbing/trailing	Indeterminate	Pronounced	None	Present	White	Green	Light grey	Dark purple
1742	Medium	Climbing/trailing	Indeterminate	Pronounced	None	Present	White	Green	Light grey	Dark
1741	Large	Climbing/trailing	Indeterminate	Pronounced	Slight	Present	White	Green	Light grey	Dark

had medium canopies whilst accessions 1739, 1740, 1741, 1743, and 1745 had large canopies. This implies that most of the accessions under study would be suitable for use as cover crop on account of their canopies.

*Plant pigmentation and flower colour.* In accessions 1739, 1742 and 1743, the stem was not pigmented, that is, it was green. Accessions 1740, 1741, 1744, 1745, and 1746 had slightly purple stems. Two types of flower colour observed in the accessions studied were white and purple. Accessions 1744 and 1746 had purple flower colour whereas accessions 1739, 1740, 1741, 1742, 1743, and 1745 had white flowers.

#### *Quantitative characterization*

Table 3 shows quantitative data of velvet bean accessions.

*Hypocotyl length.* There was variability in the hypocotyl length of the seedlings of the various accessions studied. The range of hypocotyl length was from 3.4 to 5.5 mm with a mean of 4.1 mm and coefficient of variation (cv) of 6.0 per cent.

*Days to 50 per cent flowering and maturity.* Variability was observed in the days to 50 per cent flowering which ranged from 49 to 154 days with a

mean of 105 days and cv of 14.2 per cent. Days to 50 per cent maturity also ranged from 118 to 189 days with a mean of 163 days and cv of 4.0 per cent. Accession 1746 from Odumasi in the Ashanti Region flowered and set pods earliest. The other seven accessions remained vegetative for long periods (74-154 days) and formed medium to large canopies at the expense of flowering and pod setting. The accessions which had late flowering and maturity periods were 1739, 1740, 1741, 1742, 1743, 1744, and 1745.

*Number of pods per plant.* The number of pods per plant of the velvet bean accessions ranged from 29.3 to 50.0 with a mean of 37.9 and cv of 18.9 per cent. The accessions showed variability with respect to this character. Accession 1746 which had the lightest canopy, flowered and set pods earliest, also had the highest number of pods per plant (50.0). This accession used more energy in the production of pods whereas the other accessions produced more vegetative growth.

*Pod length.* There were significant differences among the velvet bean accessions with respect to pod length. Pod length ranged from 6.8 to 9.0 cm with a mean of 8.1 cm and cv of 4.8 per cent. Accession 1743 from Huntado in the Ashanti

TABLE 3

*Summary of Variability in Quantitative Characters Among Velvet Bean Accessions*

Acc. no.	Hypocotyl length (mm)	Terminal leaflet length (cm)	Terminal leaflet width (cm)	No. of nodes per stem	Branches per stem	Days to 50 % flowering	Days to 50 % maturity	Pods per plant	Pod length (cm)	Pod width (cm)	Seeds per pod	100-seed weight (g)
1744	5.5	13.2	7.5	17.7	2.0	74	148	43.7	6.8	1.9	5.1	104.8
1745	4.0	11.5	7.7	14.7	3.0	146	189	34.3	8.9	2.1	4.4	85.6
1739	3.7	12.3	7.5	16.0	3.0	154	183	40.7	8.3	1.4	5.1	79.8
1746	4.0	11.1	7.2	17.0	3.0	49	118	50.0	6.9	1.5	4.4	62.2
1740	3.6	11.1	7.2	16.0	3.0	86	158	31.0	8.8	1.5	4.8	82.1
1743	3.4	12.2	8.0	20.0	3.0	112	180	29.3	9.0	1.9	5.7	83.1
1742	4.2	11.7	7.7	12.3	4.0	90	142	34.3	7.6	1.2	4.8	76.2
1741	4.4	11.1	7.8	16.7	3.0	129	183	38.7	8.2	1.9	5.2	79.0
Trial Mean	4.1	11.8	7.6	16.3	2.8	105	163	37.9	8.1	1.7	5.1	81.6
LSD (5 %)	0.4	1.2	0.8	2.8	0.9	14.2	4.0	11.9	0.7	0.4	0.9	5.5
CV (%)	6.0	6.2	6.1	9.8	18.9	7.7	1.4	18.9	4.8	11.8	9.8	6.7

Region had the longest pod of 9.0 cm.

*Hundred-seed weight.* The seeds of velvet bean are fairly large. The 100-seed weight ranged from 62.2 to 104.8 g with a mean of 81.6 g and cv of 6.7 per cent. For comparison, the 100-seed weight of cowpea germplasm collected in Ghana ranged from 6.7 to 21.4 g with a mean of 11.0 g and cv of 3.5 per cent (Bennett-Lartey, 1992). The young seeds of velvet beans are used for thickening soup in Ghana and also provide protein in the diet.

### Conclusion

The study has shown that there is a great variability in the germplasm of velvet bean assembled at the Plant Genetic Resources Centre at Bunso based on the morphological and phenological characters used.

Most accessions grow so profusely, flower, set pods and mature late, that they will be suitable for use as cover crop. These accessions are 1739, 1740, 1741, 1742, 1743, 1744, and 1745 from the Ashanti, Eastern, and Upper West Regions. Accession 1746, from Odumasi in the Ashanti

Region, flowers, sets pods and matures early, and has a very light canopy so that it will be suitable for seed production for home consumption.

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