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Observations on the Vegetative and Floral Morphology of Some *Vigna* Species (Leguminosae-Papilionoideae)

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Abstract: Observations on the vegetative and floral morphology of eight species of *Vigna* namely *V. ambacensis*, *V. gracillis*, *V. racemosa*, *V. reticulata*, *V. subterranea*, *V. triloba*, *V. unguiculata* and *V. vexillata* are presented. The results of the vegetative characters showed that *V. ambacensis* and *V. gracillis* are creeping herbs while others are climbing herbs. The leaf texture of all the taxa are rough except in *V. racemosa* with smooth leaf texture and the leaf shape of *V. reticulata* and *V. vexillata* are lanceolate, linear in *V. racemosa* but ovate in others. *V. reticulata* has the longest leaf while *V. unguiculata* has the widest leaf. The floral symmetry is zygomorphic in *V. ambacensis* and *V. triloba* but actinomorphic in others. *V. vexillata* has the longest pod while *V. subterranea* has the widest pod. The seed number per pod is numerous in *V. reticulata*, *V. triloba* and *V. vexillata* but ranges from 4-10 in others. The significance of these characters in the taxonomy of these taxa was discussed in view of the perceived similarities in structural and reproductive biology of these taxa.

Key words: Morphology, *Vigna*, Taxa, Leguminosae-Papilionoideae, taxonomy

INTRODUCTION

The genus *Vigna* belongs to the family Leguminosae-Papilionoideae. The Leguminosae-Papilionoideae are mostly herbs but include also shrubs and trees found in both temperate and tropical areas (Isely, 1982). They comprise one of the largest families of flowering plants, numbering some 400 genera and 10,000 species (Smartt, 1980). They are dicotyledonous plants bearing pods with one or more seeds whose pods dehisce along both dorsal and ventral sutures (Rachie and Roberts, 1974).

Morphologically, *Vigna* species are mostly shrubs, herbs or lianes; They may be resinous or not resinous. Majority of them are normal plants while others are switch-plants with the principal photosynthesizing functions transferred to stems and leaves (Tindall, 1968). The leaves are well developed or much reduced. The herbs are annual, biennial or perennial with neither basal nor terminal aggregations of leaves. They are self-supporting, epiphytic or climbing. The climbers are stem twiners or tendrill climbers via stem or leaf tendrils or scrambling via hooks. The twiners are twining clockwise or anticlockwise as in *Phaseolus* and *Wisteria* G. Don. (Rachie and Roberts, 1974). Some are hydrophytic, mesophytic or xerophytic. Others are heterophyllous

with bipinnate juvenile and phyllogineous mature foliage leaves. The leaves are usually evergreen to deciduous, minute to large, alternate, opposite to whorled, spiral to distichous, petiolate to sessile; and aromatic to non-aromatic (Daniel, 1960). They can also be herbaceous, leathery, membranous or modified into spines, non-sheathing, gland-dotted, aromatic or not, with normal orientation. The leaves can be compound, simple pulvinate, epulvinate, unifoliolate, ternate, pinnate (commonly, either pari- or imparipinnate), palmate (commonly bipinnate or bifoliolate). The leaves are nearly always stipulate but few are exstipulate. The stipules could be intrapetiolar, scaly, leafy, spiny, caducous, persistent and represented by glands. The leaves also lack persistent basal meristem (Skerman *et al.*, 1988; Daniel, 1960; Aziz and Shah, 1966). The calyx has two upper teeth which are free or connate. The base of the calyx is appendicular with inflexed auricles. The wings are falcate-obovate and shorter than the standard. The keel is truncate or beaked at the tip. The upper stamen is free while others are connate. The anthers are uniform. The ovary is sessile and multiovulate. The style is filiform, dilated upwards and longitudinally bearded on the inner side upwards. The stigma is very oblique. The pod can be linear, straight, recurved, subterete with two valves filled within the seeds. (Daniel, 1960; Burkill, 1995).

The use of vegetative and floral morphology in the systematic grouping, characterization and classification of different taxa is no more a rare event. For example, Edeoga *et al.* (1998) used vegetative and floral characters to classify eight species of *Dioscorea*. According to them, the variation in the floral morphology seen in flowers, fruits, seeds and floral formulae of the investigated *Dioscorea* species, is in agreement with the earlier research findings that emphasized that the inflorescence are very variable in form and that the flower construction is equally variable (Dahlgren *et al.*, 1985; Rudall *et al.*, 1995).

Despite the numerous economic and agronomic importance of the *Vigna* species, there is absence of clear taxonomic criteria especially in vegetative and floral morphology to delineate these taxa. The objective of this study therefore is to present the vegetative and floral characters of the eight *Vigna* species that could be used for the systematic characterization of these species.

MATERIALS AND METHODS

The studies were made on living and herbarium materials (*Vigna* species) identified with standard herbarium specimens collected from Forest Herbarium, Ibadan (FHI), University of Ibadan Herbarium (UIH), International Institute for Tropical Agriculture (IITA) Onne Station Port Harcourt, Rivers State and National Root Crop Research Institute (NRCRI) Umudike, Abia State. The living species were collected from some parts of Eastern Nigeria such as Imo, Rivers, Abia, Ebonyi,

Enugu, Anambra, Bayelsa, Akwa Ibom and Cross River states (Table 1). This study was conducted at the Science Laboratory of Michael Okpara University of Agriculture, Umudike Umuahia, Abia State Nigeria in October, 2005.

Morphological studies: Morphological studies were carried out on the mature living and herbarium specimens. Thirty mature leaves from the middle portion of the plant were collected for this study. These leaves were collected from different *Vigna* species from different locations such as Amakaohia, Omaogwa, Ndioro, Abakaliki, Nsukka, Awka, Ishielu, Uyo and Ikot Ekpene (Table 1). The length and width of the leaves were measured using a 30 cm rule. This was done by spreading the middle leaflet on a flat surface of a laboratory bench. For the width, the same median leaflet was chosen to avoid being biased. Altogether 30 mature leaves were measured for each of the taxa. Data collected were analysed statistically and bar charts drawn using a computer. The seed number per pod was obtained by counting the number of seeds in the longest pod so as to ensure consistency. Photographs of the herbarium specimens were taken using ordinary camera (Fig. 1 and 2).

RESULTS

Hutchinson and Dalziel (1958) and Burkill (1995) have described the morphology (vegetative and floral) of these taxa to some extent. However, a more detailed description of the structures of these plants based largely on fresh specimens, that are of taxonomic interest is presented in this section.

Table 1: List of *Vigna* species from which fresh material was used

Collection number	Taxa	Locality	Collector(s)	Voucher specimen*
009	<i>V. ambacensis</i> Welrv. ex. Bak.	Umudike Umuahia Omagwa Port Harcourt Atta Ikeduru	Mr. Ariwodo J. O. Onyeachusim H.D Okeke S.E	MOUAUH 121
10 11	<i>V. gracillia</i> Hook. f. Ndioro	Umuahia, Ibele Umuaka and Omagwa Port Harcourt, Enugu	Mr. Ariwodo J. O. Okeke S. E. and Onyeachusim H. D	MOUAUH 122
011	<i>V. racemosa</i> (G. Don) Hut. and Dalz.	Umudike Umuahia Atta Ikeduru Choba Port Harcourt Ikoti Ekpene.	Mr. Ariwodo J. O. Okeke S. E Onyeachusim H.D	MOUAUH 123
012 013	<i>V. reticulata</i> Hook f. <i>V. subterranea</i>	Omagwa, Port Harcourt. Umudike Umuahia Isielu, Enugu, Abakaliki	Onyeachusim H.D Mr. Ariwodo J. O.	MOUAUH 124 MOUAUH 125
014	Thouars; DC. <i>V. triloba</i> walf, Harv.	Amakaohia Owerri Rumuokoro Port Harcourt Rumuokoro Port Harcourt, Umuahia, Uyo.	Mbagwu F. N Onyeachusim H.D Olokoro Onyeachusim H.D and Mr. Ariwodo J. O.	MOUAUH 126
015	<i>V. unguiculata</i> (L) Walp.	Amakaohia Owerri, Olokoro Umuahia, Omagwa Port Harcourt, Enugu, Ezaa, Ikot Ekpene, Awka, Uyo, Yenegoa.	Mbagwu F. N. Mr. Ariwodo J. O. Onyeachusim H.D	MOUAUH 127
016	<i>V. vexillata</i> Benth	Choba Port Harcourt, Yenegoa.	Onyeachusim H.D	MOUAUH 128

*MOUAUH = Michael Okpara University of Agriculture Umudike, Herbarium

Table 2: Vegetative characters of the eight vigna species studied

Characters	<i>V. ambacensis</i>	<i>V. gracillis</i>	<i>V. racemosa</i>	<i>V. reticulata</i>	<i>V. subterranea</i>	<i>V. triloba</i>	<i>V. unguiculata</i>	<i>V. vexillata</i>
STEM								
Habit	Creeping herb	Creeping herb	Climbing herb	Climbing herb	Climbing herb	Climbing herb	Climbing herb	Climbing herb
Type	Creoper	Creoper	Climber	Climber	Climber	Climber	Climber	Climber
Colour	Green	Brown	Brown	Green	Green	Green	Green	Dark green
Bark	Hairy	Glabrous	Glabrous	Pubescent	Smooth	Smooth	Smooth	Pubescent
LEAF								
Texture	Rough	Rough	Smooth	Rough	Rough	Rough	Rough	Rough
Shape	Ovate	Ovate	Linear	Lanceolate	Ovate	Ovate	Ovate	Lanceolate
Apex	Acute	Acute	Acute	Attenuate	Acute	Acute	Acute	Attenuate
Base	Obovate	Obovate	Round	Attenuate	Round	Round	Obtuse	Attenuate
Length (cm)	10.20±1.02	4.73±0.07	9.39±0.37	10.92±1.63	6.93±0.83	5.93±0.93	10.51±1.10	10.43±0.98
Width (cm)	1.34±0.12	2.31±0.29	2.08±0.23	2.21±0.30	1.30±0.21	3.92±0.71	5.97±0.41	0.45±0.13

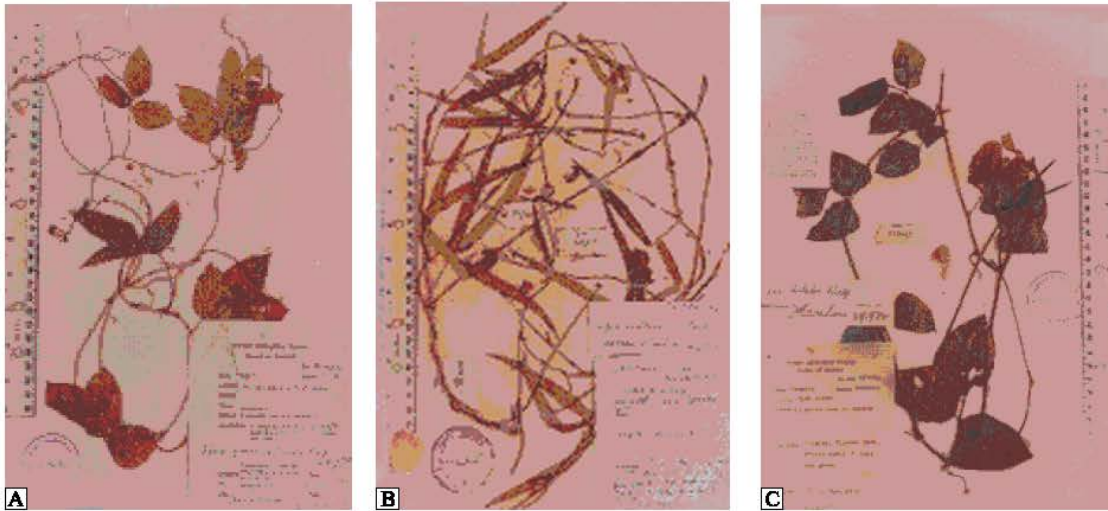


Fig. 1: (A-C) Habit of the *Vigna* species studied. (A) *V. gracillis*, (B) *V. reticulata*, (C) *V. vexillata*
 Note: The differences in shapes of leaves of these taxa

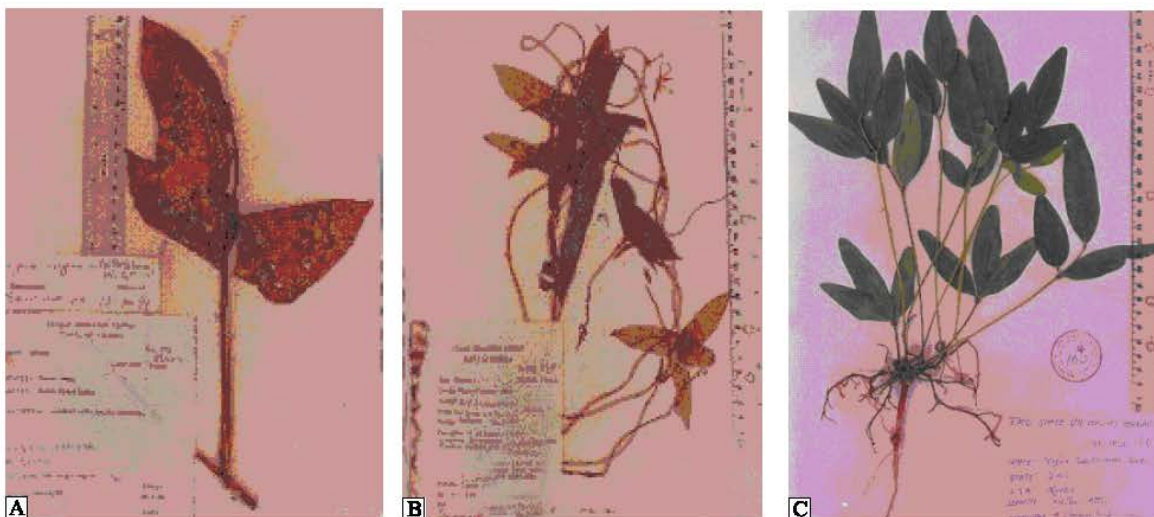


Fig. 2: (A-C) Habit of the *Vigna* species studied. (A) *V. unguiculata*, (B) *V. ambacensis*, (C) *V. racemosa*,
 Note: The differences in shapes of leaves of these taxa

Table 3: Floral morphology of the eight *Vigna* species studied

Characters	<i>V. ambacensis</i>	<i>V. gracillis</i>	<i>V. racemosa</i>	<i>V. reticulata</i>	<i>V. subterranea</i>	<i>V. triloba</i>	<i>V. unguiculata</i>	<i>V. vexillata</i>
INFLORESCENCE								
Peduncle length (cm)	2.5-6.2 cm	1.2-2.5 cm	2.5-6.2 cm	5.0-6.2 cm	2.5-7.5 cm	2.5-7.5 cm	2.5-6.2 cm	1.6-1.8 cm
	Long	Long	long	long	long	long	long	long
Pedicle	short	short	Very short	short	short	short	short	very short
Floral Symmetry	Zygomorphic	Actinomorphic	Actinomorphic	Actinomorphic	Actinomorphic	Zygomorphic	Actinomorphic	Actinomorphic
Arrangement	Sessile	Opposite	Nearly Sessile	Alternate	Alternate	Nearly	Alternate	Sessile
Type	Solitary	Raceme	Raceme	Axillary Raceme	Raceme	Sessile Receme	Axillary receme	Raceme
SEPAL								
Colour	Green	Light green	Light green	Green	Green	Light green	Green	Green
Free/Fused	Free	Free	Fused	Free	Free	Free	Free	Fused
PETAL								
Colour	Yellow/pink	Pink or Blue	Bright blue	Red	Yellow	Bright red Yellow	White/pink/	Red/purple
Free/Fused	Free	Free	Fused	Free	Free	Free	Free	Fused
FRUIT								
Shape	Oblong	Ovoid	Linear	Linear	Ovoid	Linear	Ovoid	Linear
Seed								
Number	4-8	6-8	4-10	Numerous	4-10	Numerous	4-8	Numerous
Per pod								
Pod length (cm)	4.18±0.51	4.82±0.87	6.33±0.41	5.55±0.29	2.69±0.61	6.30±0.46	7.84±1.93	8.38±0.17
Pod width (cm)	0.39±0.12	0.38±0.41	0.41±0.51	0.44±0.17	0.79±0.16	0.36±0.10	0.61±0.13	0.64±0.11

The results of the vegetative features of the eight *Vigna* species studied showed that *V. gracillis* and *V. ambacensis* are creepers while *V. vexillata*, *V. reticulata*, *V. triloba*, *V. unguiculata*, *V. racemosa* and *V. subterranea* are climbers (Table 2, Fig. 1 and 2).

The stem bark of *V. triloba*, *V. unguiculata* and *V. subterranea* are smooth while those of *V. reticulata*, *V. vexillata* and *V. ambacensis* are hairy. The leaf texture of *V. racemosa* is smooth and differs from other seven species that are rough. *V. racemosa* has linear leaf shape, while *V. gracillis*, *V. triloba*, *V. unguiculata*, *V. ambacensis* and *V. vexillata* have lanceolate leaf-shape. The leaf apex is attenuate in *V. racemosa* and *V. vexillata* but acute in the other six species. The leaf base is obovate in *V. gracillis* and *V. ambacensis*, round in *V. triloba*, *V. racemosa* and *V. subterranea*, obtuse in *V. unguiculata* and attenuate in *V. reticulata* and *V. vexillata*. *V. reticulata* has the longest leaf while *V. unguiculata* has the widest leaf. Also, *V. ambacensis*, *V. unguiculata* and *V. vexillata* have leaf lengths that are approximately the same (Table 2, Fig. 1 and 2).

The floral morphology (Table 3) showed that the pedicel of *V. vexillata* and *V. racemosa* are very short compared to those of other six species that are short. The floral symmetry of *V. triloba* and *V. ambacensis* are zygomorphic whereas the other six species are actinomorphic. *V. ambacensis* is distinct with solitary type of inflorescence compared to axillary raceme in *V. reticulata* and *V. unguiculata*, raceme in *V. gracillis*, *V. vexillata*, *V. triloba*, *V. racemosa* but *V. subterranea*. The sepals and petals are fused in *V. vexillata* and *V. racemosa* and free in the other six species studied.

V. ambacensis is distinct with oblong fruit shape, compared to linear fruit shape that characterized *V. reticulata*, *V. vexillata*, *V. triloba* and *V. racemosa*, ovoid fruit shape in *V. gracillis*, *V. unguiculata* and *V. subterranea*. The pod length of *V. racemosa* and *V. triloba* are approximately the same (Table 2) and that of *V. unguiculata* and *V. vexillata* are approximately the same indicating that these species can be distinguished from others using this character. *V. unguiculata* is distinct having the widest pod compared to others (Table 2).

DISCUSSION

The characteristics vegetative and floral features of the eight *Vigna* species are summarised in Table 2 and 3. The outcome of this investigation separated the species into climbing and creeping herbs and established zygomorphic and actinomorphic types of symmetry among the taxa. The longest and the widest pod lengths of *V. vexillata* and *V. subterranea* is reported for the first time in these species. The variation in the vegetative and floral morphology as seen in the flowers, fruits, seeds, leaves, pods and other vegetative and floral characters of the investigated *Vigna* species is in agreement with some of the earlier research findings of Daniel (1960) and Hutchinson and Dalziel (1958) whereas others are added data for easy identification and characterization of these taxa. These data from the floral and vegetative morphology of the *Vigna* species investigated, however, present some important characters that could be exploited in improving the characterization of the *Vigna* species.

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