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SEED MORPHOLOGICAL STUDIES IN *PHASEOLUS*, *VIGNA* AND *MACROPTILIUM*[1]

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ABSTRACT

In 33 species of *Vigna*, *Phaseolus* and *Macroptilium* seed morphological studies have been made. The present study confirms the combination of *Phaseolus* species to *Vigna* by Verdcourt (1970) and combi nation of *Phaseolus semierectus L.* and *P. atropurpureus* Urb. to a new genus *Macroptilium*by Urban (1925). It is proposed here that *Phaseolus adenanthus* Mey. may be treated as a species of *Vigna*.

INTRODUCTION

Seed morphological studies, nature of germination and first pair of leaves were considered as important tools to assess the affiinities among the species of *Vigna* and *Phaseolus* by Tourneur, 1958 and Mackawa, 1955 (cf. Verdcourt, 1970). But their works were concerned only with a few species of either *Vigna* or *Phaseolus* and they are, therefore, not reliable. In this present attempt, as many species of *Phaseolus*, *Vigna* and *Macroptilium* were taken into consideration as to satisfy the purpose of assessment of inter- relationship among the species of the three genera.

MATERIALS AND METHODS

The length and breadth of the seeds, 100 seed weight, nature and colour of hilum, shape, colour and ornamentations of the seeds were presented in the form of tabulation, from the available varieties of each species. Ten readings were taken for the length and breadth in each variety and species, and their Mean ± standard error was calculated and the results given in Table. I.

OBSERVATIONS

The seeds of *Macroptilium lathyroides* var. *semierectum* and *M. atropurpureus* were smaller in size, flat and rectangular (in the former species) and rectangular with spherical ends (in the latter species). They are cement or brown or black coloured with dots in both species. The 100 seeds weight was not significant when compared to the species of *Vigna* and *Phaseolus* herein studied (Table I).

Among the species of 'Mungbean group', the seeds are the smallest in *Vigna trilobata*. In the cultivated and wild monsoon varieties, the seeds were brown

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TABLE I

S.No.	Species studied	Plant Introduction number of variety	Seed size in cm		100 seeds weight in grams	Nature and colour of hilum	Shape, colour and Ornamentation of seeds
			Length Mean±S. E.	Breadth Mean±S. E.			
1	2	3	4	5	6	7	8
1.	*Macroptilium lathyroides* var. *seminerectum* Urb.	Local cultivated	0.28±0.001	0.18±0.001	0.866	White, concave and centric	Rectangular and latterally compcompressed; Cement coloured with black streaks.
2.	*M. atropurpurus* Urb.	Local cultivated	0.35±0.006	00.24±0.004	1.500	—do—	Light brown, brown and cement cement coloured with black streaks; laterally compressed.
3.	*Vigna trilobata* Verdc.	Cultivated	0.28±0.010	0.22±0.003	1.090	—do—	Brown to black with black and brown dots; globular.
4.	*V. trilobata* Verdc.	Wild, monsoon	0.22±0.001	0.17±0.006	0.770	—do—	Reddish brown or brownish black with black dots and streaks; globular.
5.	*V. trilobata* Verdc.	Wild, dryland	0.35±0.003	0.19±0.010	1.360	Brown, convex and centric.	Brown with dark brown patches; elongated and slightly laterally compressed.
6.	*V. aconitifolia* Verdc.	Local cultivated	0-37±0.001	0.24±0.006	2.330	White, concave and centric	Browaish yellow; elongated.
7.	*V. dalzellii* Verdc.	'Punalur' wild	0.31+0.001	0.20±0.003	1.950	Brownish-black, convex.	Browaish black; globular.
8.	*V. radiata* Wilczek.	Violet-dotted	0.37±0.005	0.38±0.008	2.750	White concave, centric.	Violet coloured with green dots; globular to slightly elongated.
9.	*V. radiata* Wilczek	Local yellow-seeded, cultivated	0.36±0.001	0.28±0.003	2.310	—do—	Yellow; globular.
10.	*V. radita* var. *sublobatus* Verdc.	Wild, local	0.26±0.008	0.21±0.006	2.258	—do—	Brownish black; globular.

TABLE 1 (*Contd.*)

1	2	3	4	5	6	7	8
11.	*V. mungo* Hepper	Local, black seeded, cultivated	0.36±0.010	0.29±0.001	3.340	White, convex and and centric	Brownish black with Black patches an dots; slightly elongated and laterally compressed.
12.	*V. mungo* Hepper	Local, green seeded, cultivated	0.43±0.001	0.32±0.003	4.200	Light green, convex and centric.	Green; slightly elongated.
13.	*V. umbellata* Ohwi and Ohashi.	Wild, 'Dehradun'	0.54±0.010	0.26±0.010	3.510	White, convex acentric to wards one side of the seed	Elongated and cylindrical; Red, Brown, Yellow, Black.
14.	*V. umbellata* ohwi and Ohashi.	Commercial, cultivated	0.57±0.010	0.39+0.051	9.440	White, convex acentic, towards one side of the seed	Elongated and cylindrical; Red, Borwn, Yellow, Black.
15.	*V. angularis* ohwi and Ohashi	'Okla', cultivated	0.55±0.010	0.36±0.001	7.060	White, half concave, acentric	Brown with black streaks and dots.; slightly elongated.
16.	*V. angularis* ohwi and ohashi	'Korea', cultivated	0.67±0.006	0.43±.006	10.890	—do—	Black and slightly elongated.
17.	*Phaseolus acutifolius* A Gray	'Britain', cultivated	0.66±0.003	0.42±0.001	9.570	White, concave and almost centric.	White globular and slightly laterally compressed.
18.	*P. acutifolius* A. Gray	'El. sal', cultivated	0.63±0.001	0.40±0.003	12.120	White, concave and centric	White and globular.
19.	*P. acutifolius* A. Gray	'Nebraska', cultivated	0.82±0.006	0.46±0.001	20.630	—do—	Light brown with grey streaks; almost rectangularis slightly laterally compressed.
20.	*P. polystachyus* Linn	'Florida', wild.	0.56±0.001	0.44±0.003	13.480	White concave and toward one side.	Cement coloured with black dots; more or less kidney shaped.
21.	*P. lunastachyus* Lorz.	Amphidiploid hybrid.	1.10±0.027	0.80±0.003	31.300	White concave and centric.	Light brown to dark brown; more or less kidney shaped and slightly laterally compressed.

TABLE I (*Contd.*)

1	2	3	4	5	6	7	8
22.	*P. lunatus* Linn.	var. 'Fordhook'	1.66±0.001	1.32±0.003	100.410	White, concave and centric.	White and kidney shaped.
23.	*P. limensis* Macf.	var. 'Red speckled'	2.21±0.008	1.31±0.004	153.480	—do—	Flate and broad; red with white patches towards hilum
24.	*P. vulgaris* Linn.	var. 'Acclamatised boundiful'	1.21±0.003	0.68±0.002	31.930	—do—	Dull red with brown streaks; elongated Kidney shaped.
25.	*P. multiflorus* Willd.	'Ooty', cultivated	2.02±0.003	1.24±0.004	106.300	—do—	Red with black patches; Elongated Kidney shaped.
26.	*P. aborigeneus* Burkart	'Florida' wild. P. I. No. 266910	0.80±0.007	0.42±0.005	10.850	Light brown, concave and centric.	Elongated kidney shaped and laterally compressed.
27.	*P. adenanthus* Mey.	'Mexico', wild	0.36±0.006	0.32±0.003	1.800	Brown, concave and centric.	Rectangular-spherical laterally compressed; Brownish black.
28.	*P. adenanthus* Mey.	'Argentina', wild.	0.50±0.027	0.45±0.010	2.60	—do—	—do—
29.	*Vigna unguiculata* subsp. *Cylindrica.* Verdc.	Local, cultivated	0.61±0.020	0.49±0.010	11.30	Brown, convex and centric.	Rectangular and slightly laterally compressed; cement dotted.
30.	*V. unguiculata* subsp. *unguiculata* Verdc.	Local, cultivated	0.69±0.010	0.46±0.003	10.55	—do—	Elongated, slightly bent and kidney shaped.
31.	*V. unguiculata* subsp. *sesquipedalis* Verdc.	Local, cultivated	0.71±0.004	0.51±0.003	12.60	—do—	Elongated and Kidney shaped.
32.	*V. membranacea* A. Rich	P. I. No. 292867 India.	0.199±0.002	0.111±0.002	0.60	Brown, centric and concave	Cement dotted; elongated spherical.
33.	*V. luteola* Benth.	P. I. No. 322304 Brazil	0.414±0.001	0.317±0.044	2.20	Light brown, convex, centric	Brown; slightly elongated-spherical.
34.	*V. repens.* Bak.	P. I. No. 26406 Brazil	0.500±0.010	0.37±0.004	2.29	—do—	Brown; slightly elongated-spherical.

TABLE I (*Contd.*)

1	2	3	4	5	6	7	8
35.	*V. vexillata* A. rich	P. I. No. 225934	0.39±0.002	0.24±0.006	3.40	—do—	—do—
36.	*V. dawyi* Bolus	P. I. No. 292862 India	0.26±0.006	0.20±0.002	1.50	—do—	Brown and spherical
37.	*V. oblong ifolia* A Rich	P. I. No. 276474 Australia	0.51±0.012	0.29±0.003	2.85	Light brown, concave; towards one side.	Light brown; with unequal ends.
38.	*V. parviflora* A. Rich	P. I. No. 292868 India	0.41±0.001	0.28±0.010	2.75	—do—	—do—
39.	*V. lancifolia* A. Rich	P. I. No. 292872 Nigeria.	0.50±0.010	0.28±0.003	4.00	—do—	—do—
40.	*V. wilmsii* Burt Davy	P. I. No. 300176	0.46±0.007	0.33±0.033	3.25	—do—	—do—
41.	*V. wightii* Benth	'Punalur', wild.	0.56±0.006	0.45±0.004	5.80	Brown, centric and convex	Cement coloured; slightly rectangular and laterally compressed.
42.	*V. pilosa* Bak.	'Kerala', wild	0.55±0.009	0.26±0.010	4.78	—do—	Reddish brown; elongated and cylindrical.
43.	*V. grahamianus* Verdc.	'Coimbatore' wild.	0.61±0.011	0.16±0.005	4.15	—do—	Brown; more elongated and laterally compressed.

or black with black dots and globular whereas in the case of the wild dryland variety of this species, the seeds are elongated with spherical ends and slightly laterally compressed and grey in colour with brown streaks over it. In the former varieties, the hilum is dot-like, whereas in the latter variety, it is somewhat elongated. So, here exist some doubts whether the latter variety may be raised to a species level.

In *V. aconitifolia*, the seeds were slightly elongated with spherical ends. The two varieties of this species, namely local variety and Salem variety differ only in size and 100 seeds weight. The seeds of *V. dalzellii* resemble more or less to those of *V. trilobata*, cultivated variety in most of the characters.

The seeds of *V. radiata* var. *sublobatus* and *V. radiata* resemble closely to each other. But in a few cases of *V. radiata* var. *sublobatus*, the ends were blunt instead of spherical as we find in the varieties of *V. radiata*. The seeds of *V. mungo* completely differ from the above species in being elongated and laterally compressed with raised hilum.

The seeds of *V. umbellata* and *V. angularis* are of the same type. In both the cases the hilum is towards one side but the seeds of the former species are more elongated than those of the latter species.

The seeds of *Phaseolus acutifolius* especially the 'Britain' and 'Nebraska' varieties are completely differeing from those of all other species of '*Phaseolus*' herein studied, as they are more or less Quadrangular and laterally compressd, whereas the 'El Sal' variety is globular.

The seeds of (1) *P. polystachyus*, (2) *P. lunatus*, (3) *P. lunastachyus* and (4) *P. limensis* are almost similar. They are more or less kidney shaped and laterally compressed. The 100 seeds weight of *P. limensis* var 'Red speckled' is the highest of all the species of *Phaseolus*, *Vigna* and related genera herein studied.

The seeds of (1) *P. aborigeneus*, (2) *P. vulgaris* (both bush and pole beans) and (3) *P. multiflorus* are kidney shaped. The seeds of *P. aborigeneus* are laterally compressed; whereas those of *P. vulgaris* and *P. multiflorus* are not laterally compressed.

The seeds of *P. adenanthus* are rather small with centric hilum. We get the smallest seeds in this species of *Phaseolus*. The seeds were also to some extent, but not completely, kidney shaped.

The three subspecies of *Vigna unguiculata* namely (1) *Cylindrica*, (2) *Unguiculata* and (3) *Sesquipedalis* have larger seeds than those of other species of *Vigna* studied. The seeds of *V. repens*, *V. luteola*, *V. davyi* and *V. vexillata* are more or less alike and they resemble the seeds of Blackgram and Greengram whereas those of *V. wilmsii*, *V. lancifolia*, *V. parviflora* and *V. oblongifolia* are having acentric hilum with unequal ends of the seeds, *V. membranacea* has the smallest of all the seeds of various species studied.

The seeds of *V. wightii* resemble to those of *V. unguiculata* subsp. *cylindrica*. The seeds of *V. pilosa* has shining reddish brown seeds and *V. grahamianus* elongated, laterally compressed brown seeds.

DISCUSSION

Seed morphological studies have helped the taxonomists to a considerable extent in solving the problems of interrelationship in a large number of plants like members of Fabaceae (Lhotska and Chritkova-Zertova, 1975). Therefore, it is hoped that the seed morphological studies in *Vigna*, *Phaseolus* and *Macroptilium* will be useful to interpret their relationship among them.

Verdcourt (1969 and 1970) has transferred sixteen species of *Phaseolus* like *P. mungo*, *P. aureus*, *P. trilobus*, etc., to

Vigna based on the nature of keel petals, pods and pollen characters. These sixteen species are called 'Mungbean group'. Urban (1925) (cf. Verdcourt, 1970) has transferred two species of *Phaseolus*, namely, *P. semierectus* and *P. atropurpureus* to another new genus *Macroptilium*. Verdcourt (1970) again added 14 more species of *Phaseolus* like *P. erythroloma*, *P. gracile*, *P. longipedunculatum* *P. prostratum* etc., to *Macroptilium*. He also transferred *Phaseolus grahamianus* and *P. praecox* to *Vigna*. Therefore, the larger genus *Phaseolus* has been now reduced into a smal genus with a few species like *P. vulgaris*, *P. limensis*, *P. lunatus*, *P. multiflorus*, *P. polystachyus* and *P. aborigeneus*.

Subramanian (1976) has suggested the removal of *P. adenanths* from *Phaseolus* to *Vigna* on the basis of cytotaxonomical, chemotaxonomical- morphological, palynological and gentical evidences.

The first point is that the seeds of *Macroptilium lathyroides* var. *semcerectum* and *M. atropurpureus* are resembling, to some extent, the seeds of the species of *Vigna* and not resembling the seeds of species of *Phaseolus*. Therefore, their separation from *Phaseolus* and trearment in *Macroptilium* is justified. The second point is that the seeds of 'Mungbean group' studied here (14 varieties of 7 species) resemble the seeds of species of 'Vigna proper' in the shape, size of the seeds, 100 seed weight and the position and nature of hilum. Therefore the separation of 'Mungebean group' from *Phaseolus* and addition of them to '*Vigna*' is justified. Thirdly, the seeds of *Phaseolus adenanthus* are not at all resembling the seeds of species of *Phaseolus* and they resemble the seeds of species of 'Vigna prper'. Therefore, it is suggested that *P. adenanthus* may be treafed as a species of *Vigna*. Fourthly, the seeds of wild dryland variety resemble more or less the seeds of *V. aconitifolia* and do not resemble the seeds of the other two varieties of *V. trilobata*. Therefore it is again suggested here that the wild dryland variety may be treated as a separate species of *Vigna*. Finally, the seeds of *V. grahamianus* is more related to these of other *Vigna* species. Therefor its separation from *Phaseolus* and their treatment under 'Vigna proper' by Verdcourt (1970) is justified.

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