SEED MORPHOLOGY IN SOME *PHASEOLUS* SPECIES

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ABSTRACT

Exomorphic seed characters and spermoderm patterns under SEM of seven *Phaseolus* species are described. Seeds vary in shape, size, colour, texture, hilum shape and its position. Rugose, reticulate, faveolate and tuberculate pattern of spermoderm provide some basis for identification.

INTRODUCTION

Phaseolus Linn. is placed in the subtribe Phaseolinae, tribe Phaseoleae, subfamily Papilionoideae and family Fabaceae (LACKEY, 1981). Seed structure and embryology of *Phaseolus aconitifolius* have been studied by CHOWDHURY AND BUTH (1970) and DESHPANDE AND BHASIN (1974), respectively. The spermodermal pattern of seed in *Phaseolus mungo-radiatus-sublobatus* complex has been described by SHARMA *et al.* (1977) and that of *Phaseolus vulgaris* by LERSTEN (1981). Since studies on seed morphology and spermodermal ornamentation in *Phaseolus* are meagre, the present paper aims to describe these aspects in seven species of this genus.

MATERIAL AND METHOD

Seeds of *Phaseolus aconitifolius* Jacq. Obs., *P. acutifolius* A. Grey, *P. atropurpureus* (Moc. & Sosse) ex DC., *P. calcaratus* Roxb., *P. lathyroides* Linn., *P. ricciardianus* Tenor and *P. trilobus* Ait. were very kindly supplied to us by Dr. R. K. Sarbhoy of Botany Department, Agra College, Agra. Seeds were examined under a stereoscopic binocular and their measurements were taken with a scale. The spermodermal pattern of seed was examined with a Jeol JSM-35C Model Scanning Electron Microscope operated at 10 kv. To maintain uniformity of spermodermal pattern, lateral sides near the middle of seeds were photographed.

OBSERVATION

SEED

Shape of the seeds is nearly reniform in *P. acutifolius*, reniform-oval in *P. atropurpureus*, nearly cylindrical with more or less flat ends in *P. trilobus*, nearly rectangular in *P. calcaratus* and *P. lathyroides* and rod-like with tendency towards reniform in *P. aconitifolius* and *P. ricciardianus*. The lateral sides of seeds are convex which, however, is less in *P. acutifolius*.

The seed colour is creamish in *P. acutifolius*, mustard-brown in *P. aconitifolius* and *P. ricciardianus*, light brown mottled with black patches in *P. trilobus* and light brown to brown mottled with dark patches in *P. atropurpureus*, *P. calcaratus* and *P. lathyroides*. The seed surface is smooth and shiny under a binocular in all the species except in *P. acutifolius* where it is somewhat wrinkled and dull in appearance.

Table 1—Seed Morphology in *Phaseolus* species

Name of species	Seed shape	Seed colour	Seed surface		Hilum shape	Hilum colour	Seed size (mm)
			BM	SEM			L×B×T
P. aconitifolius	Rod-like with tendency towards renifrom	Mustard-brown	Bright shiny smooth	Faveolate	Long elliptical-linear, more towards chalazal side	Obscured 'rim-aril' present.	3.5×2.0×2.0
P. acutifolius	Nearly reniform	Cream	Wrinkled dull	Tuberculate	Small, elongated oval, central	,, ,,	7.0×5.0×2.0
P. atropurpureus	Reniform oval	Light to dark brown mottled with dark patches	Smooth, shiny	Reticulate	Nearly oval, mostly central	,, ,,	3.75×2.5×1.5
P. calcaratus	Nearly rectangular	,, ,,	,, ,,	Rugose	Long, elongated oval, extending up to chalazal end	,, ,,	6.0×9.25×3.75
P. latyroides	Rectangular	,, ,,	,, ,,	Reticulate	Small oval, usually central	,, ,,	2.75×2.0×1.25
P. riciardianus	Rod-like	Mustard-brown	,, ,,	Rugose	Long, linear-oval	,, ,,	6.0×3.5×2.5
P. trilobus	Nearly cylindrical with more or less flat ends	Brown, mottled with black patches	Nearly smooth and shiny	Reticulate	Long, oval almost central in most cases	,, ,, ,, ,,	2.75×1.75×1.5

BM=Binocular, SEM=Scanning electron microscope.
L=Length, B=Breadth, T=Thickness.

Nearly oval-shaped hilum located approximately in the centre of the seed is found in *P. acutifolius*, *P. atropurpureus* *P. lathyroides* and *P. trilobus*. In *P. aconitifolius*, *P. calcaratus* and *P. ricciardianus*, the hilum extends more on the chalazal side. It is elliptical-linear and small in proportion to seed length in *P. aconitifolius* but long and elongated oval in *P. calcaratus* and *P. ricciardianus*. The hilum shows a white tissue on its periphery referred to as 'rim-aril'. This structure is much pronounced in *P. calcaratus*, *P. ricciardianus* and *P. trilobus*.

The seed size and seed characters are recorded in table 1 and from the data it is evident that largest seeds are in *P. calcaratus* and smallest in *P. trilobus*.

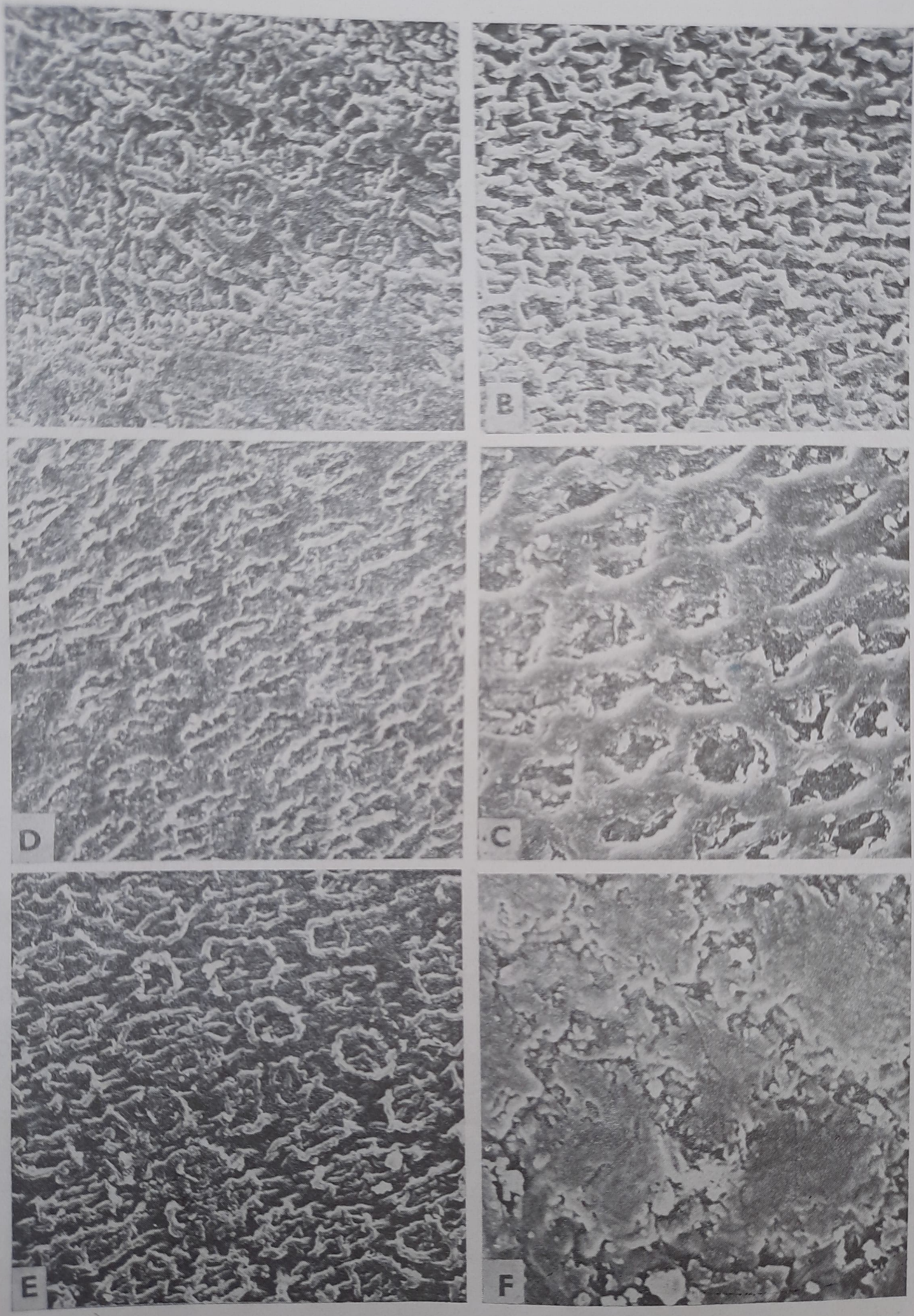
Spermoderm Pattern

The scanning electron microscopical study (SEM) shows the following four types of ornamentation of spermoderm: (a) Rugose—the haphazardly interwoven rugae are distinct in *P. calcaratus* and *P. ricciardianus* (Fig. 1 A, B), (b) Reticulate- the reticulate ornamentation shows a simple polygonal network in *P. atropurpureus* and *P. trilobus* (Fig. 1 C), but interwoven nearly polygons in *P. lathyroides* (Fig. 1 D), (c) Faveolate-in this pattern the ridges form nearly annular structures separated by distinct wide grooves. Each ring further encloses many smaller ridges, e. g. *P. aconitifolius* (Fig. 1 E), (d) Tuberculate—*P. acutifolius* shows this pattern where compactly arranged low tubercles have almost smooth surface (Fig. 1 F).

DISCUSSION

The position of hilum on the seed shows two basic patterns in the *Phaseolus* species presently studied. In one pattern it is placed in the central region whereas in the other it extends more on the chalazal side. The former condition is found in *P. acutifolius*, *P. atropurpureus*, *P. lathyroides* and *P. trilobus* and the latter situation exists in *P. aconitifolius*, *P. calcaratus* and *P. ricciardianus*. In cases where the hilum is in the central region, the growth in the developing seed is nearly equal both on micropylar and chalazal sides, but in cases where its position is more on chalazal side, the growth is more on the micropylar side. Growth at the hilar level in addition to growth elewhere results in a long hilum as is seen in *P. calcarats* and *P. ricciardianus*. The 'rim-aril' is fairly well-developed in *P. calcaratus*, *P. ricciardianus* and *P. trilobus* and this parenchymatous tissue is undoubtedly useful in absorbing and retaining moisture in earlier stages of imbibition and seed germination.

Four types of spermoderm patterns found in the species presently studied are: (a) Rugose (Rugulate of Lersten, 1981), (b) Reticulate, (c) Faveolate and (d) Tuberculate (Papillose of Lersten, 1981). Sharma *et al.* (1977) reported two major types of spermoderm pattern in *Phaseolus mungo-radiatus-sublobatus* complex. Their pattern I conforms to the reticulate pattern of Lersten (1981) and their pattern II, the tuberculate ones, nearly on lines of tuberculate pattern described presently with the difference that in *P. acutifolius* the cell boundries are more distinct and elevation of tubercles is low. Lersten (1981) opines that pattern on a mature seed reflects epidermal configuration and cuticular deposition as influenced by seed expansion. He further points out that simple patterns involving one cell such as simple reticulate, simple faveolate and papillose conform to underlying cell patterns. In contrast, some regulate patterns are entirely of cuticular origin. The present study supports Lersten for these suggestions.


B
D
C
E
F

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EXPLANATION OF FIG. 1

1 A-F. Spermoderm patterns in *Phaseolus* species.

A. *Phaseolus calcaratus* Rugose type ×2000, B. *P. ricciaridanus* Rugose type ×1500, C. *atropurpureus* Reticulate type × 2000, D. *P. lathyroides* Reticulate type with interwoven strands × 1500, E. *P. aconitifolius* Faveolate type × 1500, F. *P. acutifolius* Tuberculate type × 3000.