

# Morphology and spermoderm pattern in some varieties of *Lupinus* species

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Kaur, Harbans, Singh, R.P. & Pal, Aruna 1994. Morphology and spermoderm pattern in some varieties of some *Lupinus* species. *Geophytology* **23**(2):265-271.

Morphology of twenty one varieties grouped in six species of *Lupinus* L. was studied under light and scanning electron microscope. Seeds are generally compressed and are commonly mottled or streaked with light and dark markings. Colour of the seed varies from greyish green, to fawn (light yellowish brown). Spermoderm pattern is of three types (i.e. rugulate, lophate and tuberculate) in ten varieties of *L. angustifolius*; rugulate in *L. albus* (seven varieties); foveolate in *L. hispanicus* (two varieties) and tuberculate in *L. cosentini* (two varieties), *L. digitatus* and *L. linifolius*.

**Key-words**—Seed, morphology, Spermoderm pattern, *Lupinus*, Fabaceae.

## INTRODUCTION

THE genus *Lupinus* L., placed in the tribe Genisteeae, subfamily Papilionoideae of Fabaceae, has 200 species distributed in temperate regions of North America, Europe, Africa and West Asia (Bisby, 1981). Heyn and Herrnstadt (1977) described spermoderm pattern in a few species of *Lupinus* of the old world and compared this feature with six species from new world. Bragg (1983) studied the seed coat structure in three most common species of *Lupinus* occurring in Texas. The present study reports the spermoderm pattern in six species of *Lupinus*, viz., *L. digitatus*, *L. hispanicus* (two varieties), *L. linifolius*, *L. albus* (seven varieties), *L. angustifolius* (ten varieties) and *L. cosentini* (two varieties). The first three species have not been studied by the above authors. The present observations are focused to find out the uniformity/dissimilarity in the surface pattern in the investigated species and varieties.

## MATERIAL AND METHOD

Seeds of *Lupinus* species and varieties (see Table 1) were brought by one of us (RPS) from the Botanic Gardens of the Polish Academy of Sciences, Warsaw, Poland. For SEM studies, seeds of each species and their varieties were selected and mounted on brass stubs and coated with gold-palladium in sputter coating unit. Scanning was done on Jeol-JSM-35C model at an accelerating voltage of 15 KV. The photomicrographs were taken

from the central region of the seed to maintain uniformity. The outline of the hilum was also photographed. Seed size was measured with the help of a scale.

## OBSERVATIONS

Seeds are generally compressed and mottled or streaked with light and dark marking. They vary in shape from orbicular to quadrangular and their sizes range from 4.5 x 4.0 mm to 12.0 x 11.0 mm. The hilar groove is present in all taxa studied, the groove is narrow and elongated in most and broad in some (Table 1).

### Spermoderm pattern

*Lupinus albus*— In all seven varieties of *L. albus* the spermoderm pattern, in general, is rugulate; the rugae are thickened and interwoven in var. *hetman* (Pl. 2, fig. 1). In var. *lotos* the pattern is nearly similar but the cells are larger and somewhat loosely arranged (Pl. 2, fig. 2). In varieties *lup* 256/83 and *kreta* the pattern at places appear substriate type (see Lersten, 1981) and waxy deposition usually masks the detailed structure (Pl. 2, figs 3,4). In varieties *wat*, *kalina* and *tremoco*, the pattern shows a close reticulum (Pl. 2, figs 5,6).

*L. hispanicus*— The var. B-486/79 presents a simple foveolate pattern with variable width of grooves. The var. *vidigudino* - 3 also shows a foveolate pattern having more distinct cells. Rugae are found inside the foveolae (Pl. 2, figs 7,8).

*L. digitatus*— Spermoderm shows tuberculate pat-

Table 1. Seed characters in *Lupinus* species and varieties

Name	Seed				Hilum	
	Colour	Shape	Size mm	Spermoderm pattern	Colour	Shape
1	2	3	4	5	6	7
<i>L. albus</i> var. <i>hetman</i>	Fawn without mottlings, rarely some seeds with brown spots, light streak is visible on one side of hilum.	Nearly quadrangular to orbicular, compressed, micropylar side protruding.	10.0x9.0- 12.0x10.5	Rugulate	Light brown surrounded by white rim	Elliptical, groove narrow and elongated
<i>L. albus</i> var. <i>lotos</i>	Fawn without mottlings, a faint light brown streak is visible on one side of hilum	Orbicular, compressed, micropylar side slightly protruding	10.0x10.0- 11.0x11.0	Rugulate	Light brown surrounded by white rim	Elliptical, groove narrow and elongated
<i>L. albus</i> var. <i>lup</i> 256/83	Fawn without mottlings, with a faint brown streak is visible on one side of hilum.	Quadrangular, compressed micropylar side slightly protruding.	11.5x9.5- 13.0x11.0	Rugulate (±substrate)	Light brown surrounded by white rim	Broadly elliptical, groove narrow and elongated
<i>L. albus</i> var. <i>wat</i>	Fawn without mottlings, with a faint brown streak is visible on one side of hilum	Quadrangular to orbicular, compressed, micropylar side slightly protruding	10.0x9.0- 11.0x10.0	Rugulate	Light brown surrounded by white rim	Broadly elliptical, groove narrow and elongated
<i>L. albus</i> var. <i>kalina</i>	Fawn without mottlings with a faint streak on one side of hilum	Rectangular with micropylar end protruding	8.0x7.0- 10.0x9.0	Rugulate	Light brown surrounded by white rim	Broadly elliptical, groove narrow and elongated
<i>L. albus</i> var. <i>tremoco</i>	Fawn without mottlings	Quadrangular	11.0x11.0- 12.0x12.0, 12.0x10.5	Rugulate	Light brown	Broadly elliptical, groove narrow and elongated
<i>L. albus</i> var. <i>kreta</i>	Fawn without mottlings	Quadrangular	11.5x10.5- 12.0x10.5	Rugulate	Light brown surrounded by white rim	Elliptical, groove narrow and elongated
<i>L. hispanicus</i> var. B-486/79	Greenish fawn without mottlings with marking on one side	Nearly spherical	5.0x4.5- 6.5x6.0	Simple foveolate	Light brown	Narrowly elliptical, groove broad
<i>L. hispanicus</i> var. <i>vitigudino</i> - 3	Fawn with light dark brown mottlings and crescent-shaped band on both sides of seed.	Orbicular	4.5x4.0- 5.0x4.0	Simple foveolate	Light brown	Broadly elliptical, groove broad
<i>L. digitatus</i>	Fawn with dark brown mottlings, dark brown crescent-shaped band on both sides of seed.	Nearly spherical, compressed	6.5x6.0- 7.0x6.0	Tuberculate	Light brown	Elliptical, groove not distinct
<i>L. angustifolius</i> var. <i>turkus</i>	Greyish green with light and dark mottlings, dark brown marking on both sides of hilum	Orbicular	7.0x6.0- 8.0x7.0, 8.0x6.0	Rugulate	Light brown surrounded by white area	Elliptical, groove narrow and elongated

## Plate 1



- Hilum
- Lupinus albus* var. *hetman*;
  - L. albus* var. *lup* 256/83;
  - L. albus* var. *wat* (3-3, x 40).
  - L. hispanicus* var. *vitigudino*- 3 & B 486/79, x 100.
  - L. digitatus*, x 40.
  - L. angustifolius* var. *mirela*, x 40.
  - L. angustifolius* var. *kazan*
  - L. angustifolius* var. *anatolia*.
  - L. angustifolius* var. *ignis*.
  - L. angustifolius* var. *niemczynowski*.
  - L. consentini* var. *lup* 93/93 (8-12, x 60).

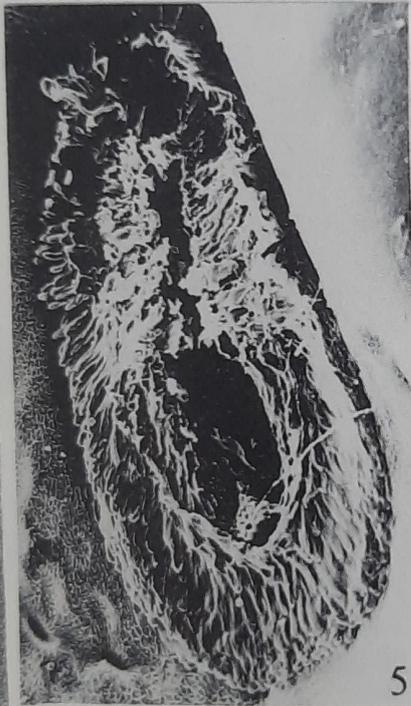
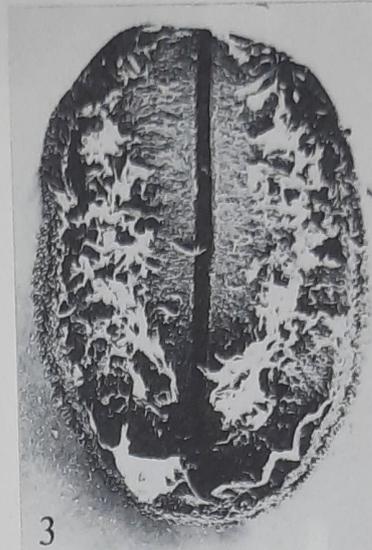


Plate 1

**Table 1.**  
contd.

1	2	3	4	5	6	7
<i>L. angustifolius</i> var. <i>remik</i>	Fawn without mottlings with faint light brown marking	Orbicular, micropylar side slightly protruding	4.0x4.0- 6.0x5.0	Tuberculate	Light brown	Elliptical, groove narrow and elongated
<i>L. angustifolius</i> var. <i>anatolia</i>	Greyish green with light and dark mottlings	Orbicular with micropylar end protruding	7.0x6.0- 8.0x6.0	Lophate	Light brown	Elliptical, groove narrow and elongated
<i>L. angustifolius</i> var. <i>mirela</i>	Fawn with dark brown mottlings, dark brown marking on both sides of hilum	Nearly squarish round to oval, micropylar side slightly protruding	6.0x5.0- 7.0x6.0, 8.0x6.0	Lophate	Light brown	Elliptical, groove narrow and elongated
<i>L. angustifolius</i> var. <i>niemzynowski</i>	Fawn without mottlings thin streak, faintly brown on one side of hilum.	Orbicular with micropylar end protruding	6.0x5.0- 7.0x6.0	Rugulate	Light brown with insignificant rim	Elliptical, groove narrow and elongated
<i>L. angustifolius</i> var. <i>merkel</i>	Greenish grey with light and dark mottlings, brown markings on both sides of hilum.	Orbicular	7.5x6.0	Tuberculate	Light brown with insignificant rim	Elliptical, groove narrow and elongated
<i>L. angustifolius</i> var. <i>lup117/73</i>	Fawn with faint brown mottlings, light marking on both sides of hilum	Orbicular with micropylar end protruding	7.0x6.0	Rugulate	Light brown with insignificant rim	Elliptical, groove narrow and elongated
<i>L. angustifolius</i> var. <i>kazan</i>	Greenish grey with white and brown mottlings, dark markings on both sides of hilum	Orbicular with micropylar end protruding	5.0x4.0- 6.0x5.0	Rugulate	Light brown with insignificant rim	Ovate, groove narrow and elongated
<i>L. angustifolius</i> var. <i>ignis</i>	Fawn with brown mottlings, dark marking on both sides of hilum.	Orbicular	5.5x5.0- 6.0x5.0	Rugulate	Light brown with rim.	Narrowly elliptical, groove narrow and elongated
<i>L. angustifolius</i> var. <i>emir</i>	Greenish grey with white and brown mottlings	Orbicular with micropylar end slightly protruding	5.5x5.5	Tuberculate	Light brown with rim	Elliptical, groove narrow and elongated
<i>L. cosentini</i> var. C B-19	Fawn with light and dark markings, dark brown crescent-shaped band on both sides of hilum	Orbicular	8.0x7.5- 9.0x8.0	Tuberculate	Light brown	Elliptical, groove not distinct
<i>L. cosentini</i> var. <i>lup 93/93</i>	Fawn with light and dark dense mottlings, dark brown crescent-shaped band on both sides of seed	Orbicular (nearly)	7.0x6.0- 9.5x8.5	Tuberculate	Light brown	Elliptical, groove not distinct
<i>L. linifolius</i>	Fawn with brown mottlings, dark brown markings on both sides of the hilum	Elliptical	7.0x5.0	Tuberculate	Light brown	Narrowly elliptical, groove elongated

**Plate 2**Spermoderm pattern on the general seed surface. 

1. *Lupinus albus* var. *hetman* x 3000.
2. *L. albus* var. *lotos*, x 2000.
3. *L. albus* var. *lup 256/83* x 1500.
4. *L. albus* var. *kreta*, x 2000.

5. *L. albus* var. *wat.*, x 3000.
6. *L. albus* var. *kalina*, x 3000.
- 7-8. *L. hispanicus* var. *B. 486/79* & *vitigudino* - 3, x 2000.
9. *L. digitatus*, x 200.

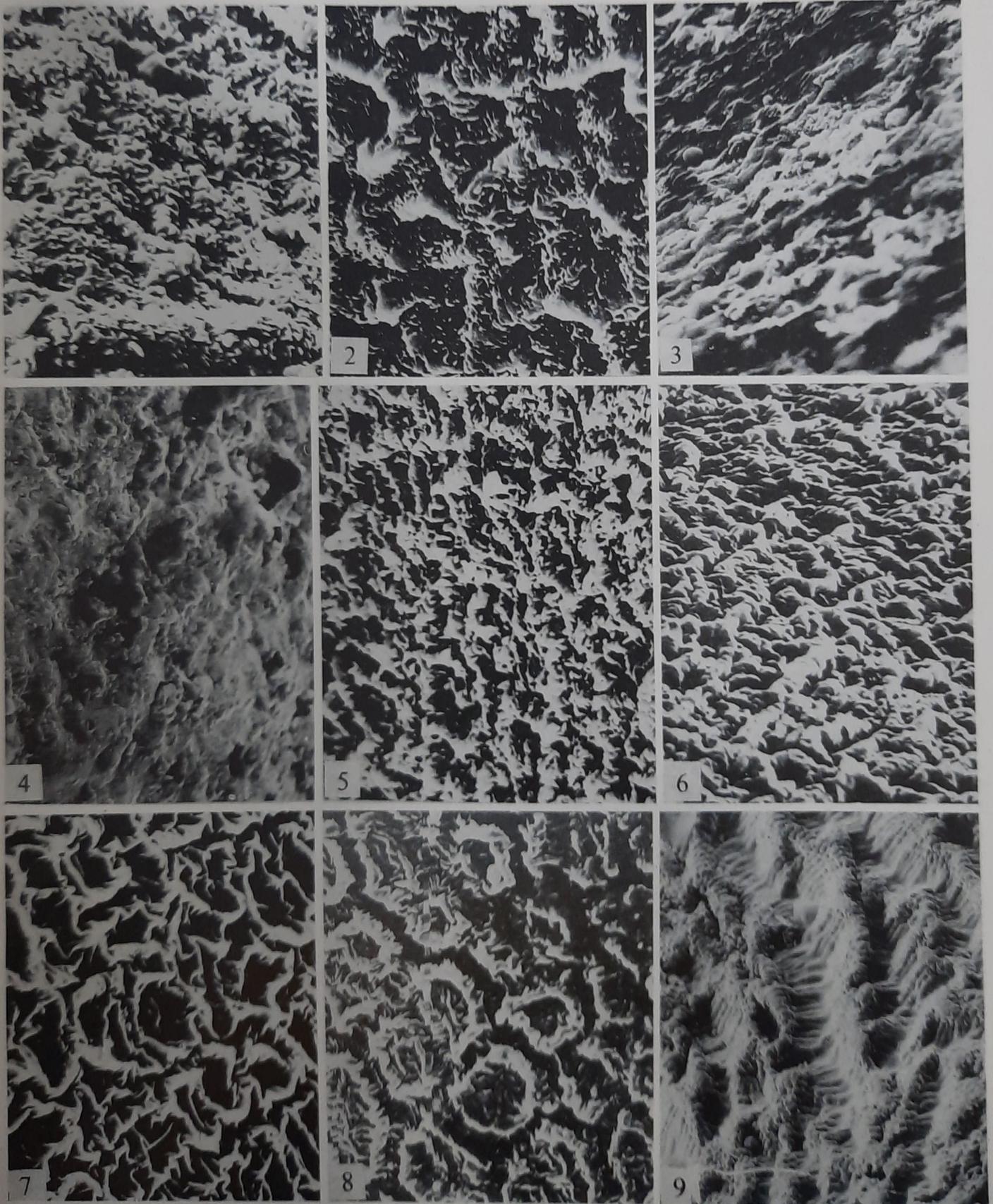


Plate 2

tern (Papillose of Lersten (1981). The tubercles are interconnected with striations (Pl. 2, fig. 9).

*L. angustifolius* (10 varieties)— Spermoderm pattern is found to be of three distinct types: tuberculate, lophate and rugulate. In varieties *turkus*, *remik*, *merkel* and *Emir* (Pl. 3, figs, 1, 2, 6, 10) the pattern is basically tuberculate with minor distinctions. In varieties *merkel* and *emir* the major area of the tubercles is raised more. In varieties *anatolia* and *mirela* the pattern is nearly lophate type (Pl. 3, figs 3,4) (see Lersten, 1981). In vars. *niemczynowski* and *lup 117/73*, *kazan* and *ignis* the pattern follows the rugulate type. In varieties *niemczynowski* and *lup 117/73* raised rugae are observed (Pl. 3, figs 5,7). Waxy substances are seen on the entire surface of the seed in latter variety. In variety *kazan*, the rugae are arranged in more compact manner (Pl. 3, fig. 8). In *ignis*, on the other hand, spermoderm shows very thin rugae and at places these rugae are found to form reticulum (pl. 3, fig. 9).

*L. cosentini*— The pattern is tuberculate in both the varieties *lup 93/93* and *CB-19*. The tubercles are raised and show interconnecting striations (Pl. 3, figs 11, 12).

*L. linifolius*— Show tuberculate pattern. The tubercles are arranged in more regular fashion and are connected with thick striations. The pattern is similar to that seen in *L. angustifolius* var. *emir*. (Pl. 3, fig. 10).

## DISCUSSION

Heyn and Herrnstadt (1977) studied the spermoderm pattern of eight old world *Lupinus* species and found four different patterns. They grouped the species accordingly and suggested that species like *L. albus* and *L. graecus* which have close relationship have a similar seed coat. They, however, further pointed out that species which are not closely related, viz., *L. angustifolius* and *L. micranthus* have similar seed coat structure. Likewise, intraspecific variation has been reported by them in native

and introduced *L. angustifolius* and wild and cultivated *L. luteus*. Heyn and Herrnstadt (1977) also compared the spermoderm pattern of six new world species and suggested uniformity in surface structure. The photomicrographs of *L. montanus* and *L. albicaulis* however, do show definite variation.

Bragg (1983) found that the three species of the new world, viz., *L. texensis*, *L. subcarnosus* and *L. hawardii* have some variation of simple foveolate type. During the present study it has been found that three types of spermoderm pattern are present in 10 varieties of *L. angustifolius*, and little variation also occur in varieties of *L. albus*, *L. hispanicus* and *L. cosentini*.

From the present study it appears that variations which are found may be due to varietal differences as well as due to environmental adaptation where they were originally located. More work is needed regarding hybridization experiments to correlate the variations in spermoderm patterns.

## ACKNOWLEDGEMENTS

The authors are thankful to the Director, National Botanical Research Institute for providing facilities. They are also grateful to Dr M. Niedziński, In-charge of the Seed Bank Botanic Gardens, Polish Academy of Sciences, Warsaw, Poland for providing the material.

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## Plate 3



Spermoderm pattern on the general seed surface

1. *Lupinus angustifolius* var. *turkus*, x 200.
2. *L. angustifolius* var. *remik*, x 2000.
3. *L. angustifolius* var. *anatolia*, x 1500.
4. *L. angustifolius* var. *mirela*.
5. *L. angustifolius* var. *niemczynowski*.
6. *L. angustifolius* var. *merkel*.
7. *L. angustifolius* var. *lup 117/73*.
8. *L. angustifolius* var. *kazan*.
9. *L. angustifolius* var. *ignis* (4-9, x 2000).
10. *L. angustifolius* var. *emir*, x 3000.
11. *L. angustifolius* var. *C-B 19*, x 200.
12. *L. angustifolius* var. *lup 93/93*, x 300.

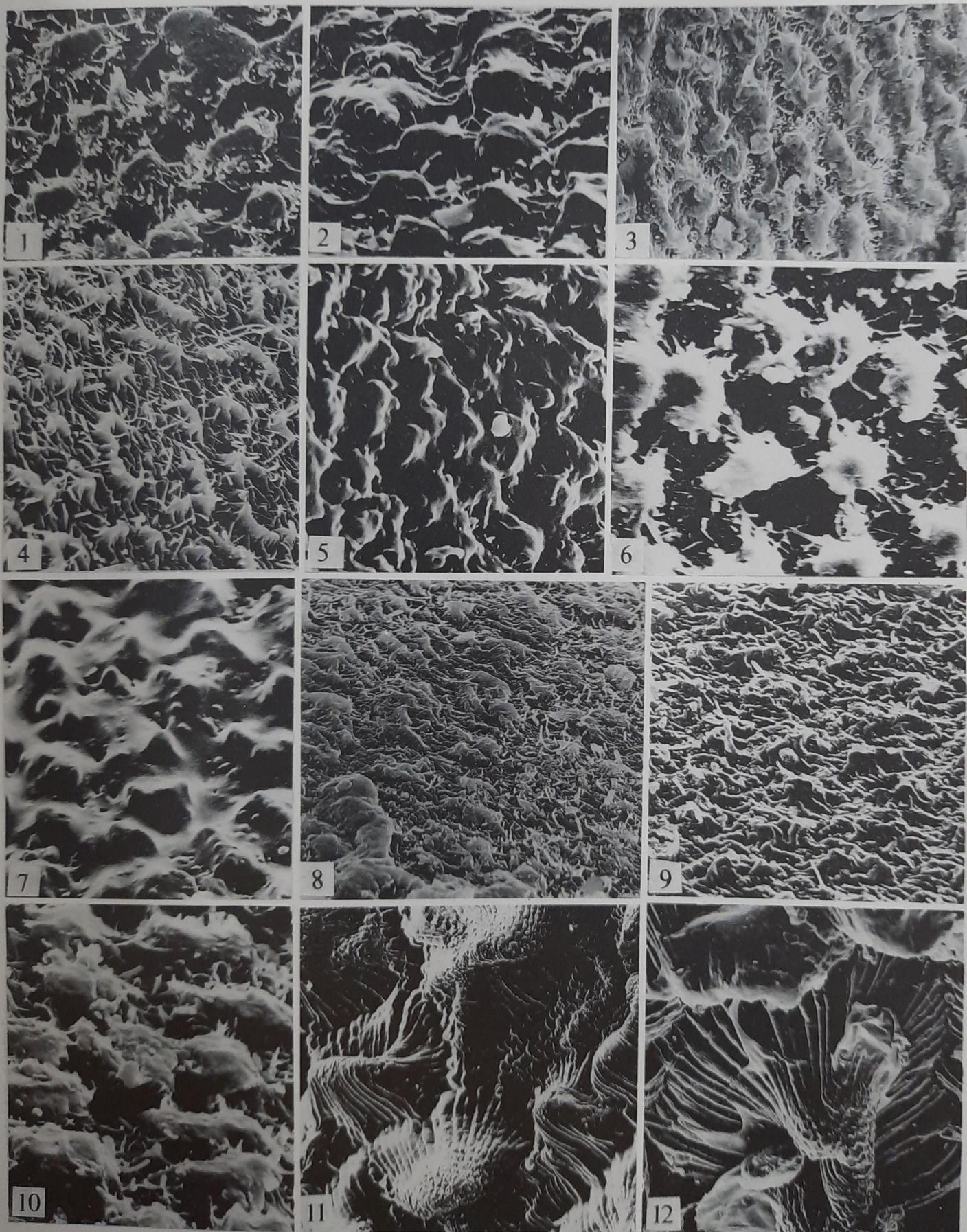


Plate 3