MORPHOLOGY, ANATOMY AND SPERMODERM PATTERN IN SOME *LENS* SPECIES (PAPILIONOIDEAE)[1]

ARUNA PAL, R. P. SINGH & HARBANS KAUR

National Botanical Research Institute, Rana Pratap Marg, Lucknow 226 001, India

Abstract

Morphology, anatomy and spermoderm pattern in some *Lens* species are described. Seeds are lenticular in all the three species studied; namely, *L. culinaris* (14 varieties), *L. ervoides* and *L. orientalis*. Seed coat consists of an outermost malpighian layer of palisade-like cells followed by a layer of I-shaped Hour-glass cells. Underlying this layer is seen mesophyll tissue in a crushed state. In the hilar region there is an additional layer of counter-palisade and tracheid bar. Spermoderm pattern of the general seed surface is tuberculate in all the species and varieties studied; in the hilar region the pattern is mostly faveolate or irregular tubercles; however, adjacent to hilar region the pattern varies from tuberculate to faveolate to low mounds.

Introduction

The genus *Lens* Mill. is estimated to have five species (Cubero, 1980). In India, *L. culinaris* Medikus is a widely grown rabi season pulse crop of considerable economic value. Trivedi and Gupta (1988) studied only the spermoderm pattern in 12 varieties of *L. culinaris;* their study, however, did not include any other species of *Lens*. In view of the importance of seed anatomy and spermoderm pattern as supplementary aids in taxonomy and identification, the present communication deals with two more species of *Lens*, namely, *L. ervoides* (Brign.) Grande. and *L. orientalis* (Boiss.) Handel-Mazzeti, besides 14 other varieties of *L. culinaris* not studied by Trivedi and Gupta (1988) to throw some more light on the subject.

Material and method

Mature seeds of *L. ervoides*, *L. orientalis* and 14 varieties of *Lens culinaris* were very kindly supplied by Dr R. S. Misra of D. A. V. College, Kanpur and we are thankful to him. For anatomical studies, slightly trimmed seeds were passed through tertiary-butyl alcohol series and embedded in paraffin wax. Microtome sections were cut at 10μm thickness and stained with safranin-fast green combination. For SEM studies, seeds of *L. culinaris* varieties and other two species were mounted on brass stubs and coated with gold-palladium in a sputter coater. For the sake of uniformity and comparison, the seeds were scanned at three different regions, namely : (a) hilum, (b) adjacent to hilum, and (c) general surface. Scanning was done under JEOL-JSM 35C Model Scanning Electron Microscope operated at 15 KV.

Observations

Morphology-Seeds of all the species and varieties studied presently are lenticular and show smooth surface under low magnification of a stereoscopic binocular. Hilum is oblong-elliptical in *L. orientalis* and linear in *L. ervoides*, whereas both these shapes occur in varieties of *L. culinaris* (Pl. 1, figs. 1, 6). Colour of the hilum is yellow, creamy or light brown in varieties of *L. culinaris;* it is almond-coloured in *L. ervoides* and yellow-creamy in *L. orientalis*. Colour and size of the hilum and seed characters are given in Table 1. Seeds of *L. ervoides* measure 2-3 × 1.5-2 mm; and of *L. orientalis* 3-4 × 1.5-2 mm and of *L. culinaris* 2-7 × 2-5 mm (length × height).

---

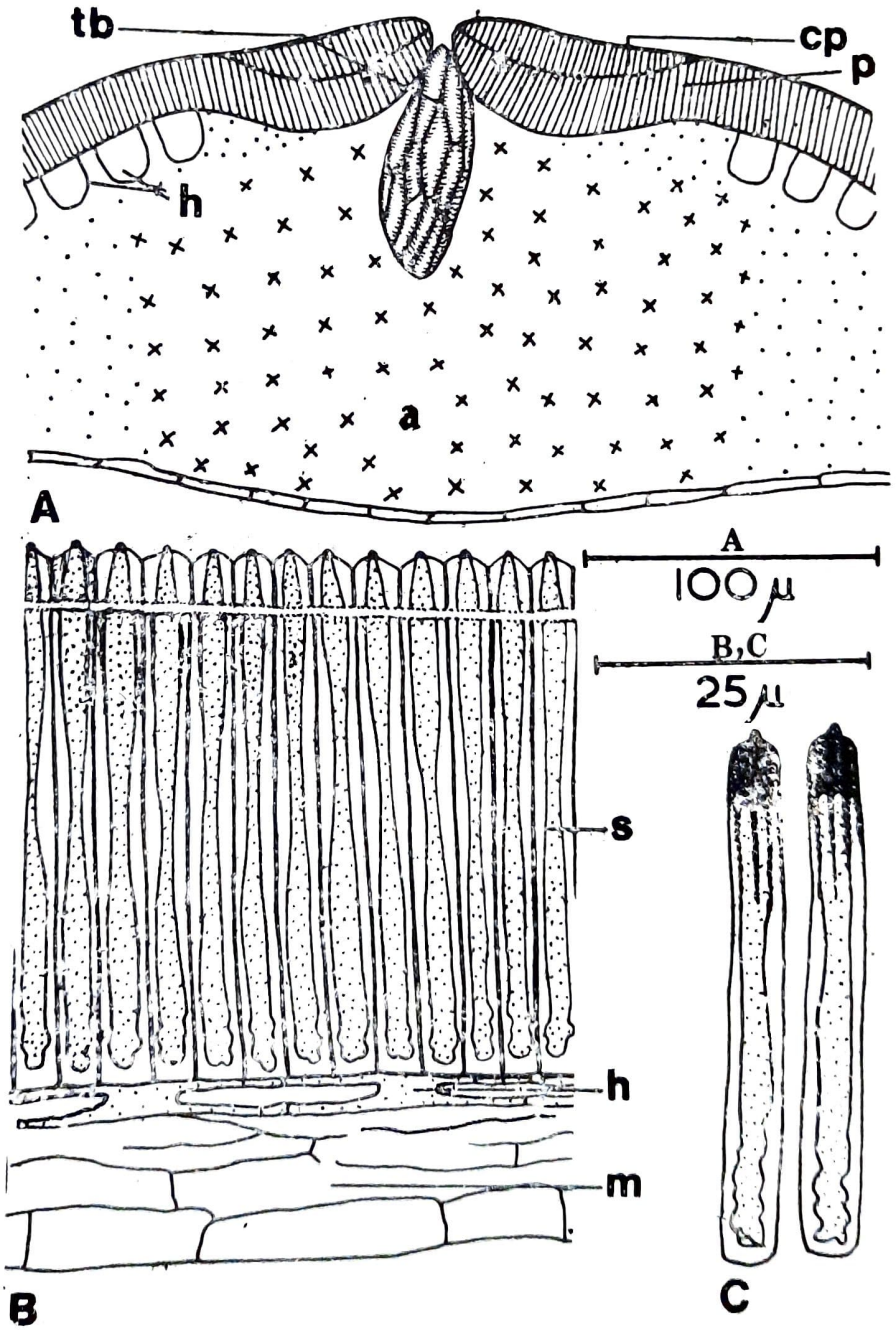
1. NBRI Publication No. 362

Geophytology, **19**(2) : 162-166, 1989. Issued : September 1990.

Micropyle is clearly visible as a small pore or slit near the hilum (Pl. 1, figs. 1,6).

Anatomy—Cross-section of mature seed shows that seed coat consists of an outermost palisade-like layer (Malpighian layer) whose cells show distinct 'light line' close to the outer tangential wall (Text-fig. 1B). The palisade-like cells are thick-walled; the thickenings being more pronounced in the middle portion leaving the cell-lumen narrow in this region. The inner basal region of these cells is corrugated due to uneven thickenings (Text-fig. 1 B, C). On maceration the Malpighian cells show thickened fibrous strands extending from the outer tangential side towards the inner side (Text-fig. 1 C). The Malpighian layer is followed throughout by a layer of I-shaped, thick-walled cells termed as 'Osteosclereids' or 'hour-glass cells', except in the region of the hilum where they are absent; the thickenings in these cells are uniform (Text-fig. 1 B). Below this layer is present mesophyll tissue which persists in a compressed state (Text-fig. 1 B).

In the hilar region there is an additio-



Text-figure 1—*Lens culinaris* : A, T. S. of seed coat through hilum; B, T. S. of seed coat general; C, macerated Malpighian cells (a, aerenchyma; cp, counter palisade; h, hour-glass cells; p, palisade; tb, tracheid bar).

Table 1—Seed characters in *Lens* species and varieties

	Seed Morphology			Spermoderm Pattern		
Name	Size in mm (l × h)	Colour	Hilum	Hilum	Adjacent to hilum	General seed surface
Lens culinaris var. LL-30	2—4 × 1.5—2	Light brown with black mottlings	Off-white, oblong-elliptical, slightly broader on one side, 1 mm × 20 μm	Broad, dissimilar, mounds with fissured cuticle	Faveolate with radiating cuticle	Tuberculate, tubercles have clefts
L. culinaris var. 75KT 36627/ ILL 1169	4.5—5 × 2.5—3	Dark tan	Cream coloured, linear, 1 mm × 15 μm	Faveolate	Irregular low tubercles, fissured cuticle	Tuberculate with fissured cuticle in between tubercles
L. culinaris var. PG—9	3—4 × 2—2.5	Brown with black mottlings	Cream coloured, elliptical, 1mm × 18 μm	Faveolate	Faveolate with radiating cuticle	Tuberculate, tubercles with clefts
L. culinaris var. K—75	3—5 × 2—2.5	Dull brown with black mottlings	Cream coloured, elliptical, 1mm × 20 μm	Faveolate	Faveolate	Tuberculate
L. culinaris var. WYR 1720	3.5—5 × 2—2.5	Brown(dark tan)	Cream coloured, linear, 1 mm × 18 μm	Faveolate	Irregular, low tubercles with cuticular reticulum	Tuberculate, tubercles like rose flowers
L. culinaris var. WYR 244	3.5—5 × 2—2.5	Brown (tan) with black mottlings	Light brown, linear 1 mm × 18 μm	Broad low mounds	Low mounds	Tuberculate
L. culinaris var. WYR 1811	4.5—6 × 2—2.5	Light brown	Cream coloured, linear, 2 mm × 20 μm	Faveolate	Irregular low tubercules with folded cuticle	Tuberculate
L. culinaris L. 127	3—4 × 2—3	Dull brown with black mottlings	Light brown like the colour of the seed, oblong elliptical, 1 mm × 18 μm	Faveolate	Faveolate	Tuberculate, irregular tubercles
L. culinaris car.LC 5	3—5 × 2.5—3	Dull brown with black mottlings	Cream coloured, linear, 1 mm × 20 μm	Faveolate	Low broad tubercles with radiating cuticular folds.	Tuberculate
L. culinaris var. WYR 2327	5—7 × 2.5—3	Buff colour like bamboo paper	Cream-coloured, linear, 1.2mm × 20 μm	Faveolate	Faveolate	Tuberculate, tubercles joined with each other with cuticular connection

L. culinaris var. L—312	3—4×2—2.5	Dull brown with black mottlings	Light-yellow, oblong elliptical, 1 mm× 15 μm	Unusual tuberculate with irregular tuberculate	Faveolate	Tuberculate, tubercles joined with each other by cuticular connection
L. culinaris var. LG 60	2.5—4×2—2.5	Dull brown with black mottlings	Cream colured (light yellow), 1 mm ×15 μm	Faveolate	Faveolate with radiating cuticle	Tuberculate, tubercles not smooth but have clefts
L. culinaris var. ILL—467	3.5—5×2—3	Brown (tan)	Light brown, linear 1 mm×13 μm	Tuberculate, low mounds with radiating cuticle	Faveolate with radiating cuticle	Tuberculate, irregular tubercles with fissured cuticle
L. culinaris var WYR—16	3—4×2.2—5	Dark brown (dull) with black mottlings	Light brown (yellow), linear, 1.2 mm ×15 μm	Faveolate	Irregular low tubercles with cuticular reticulum in between	Tuberculate, tubercles with fissured cuticle
L. orientalis No. 26	3—4×1.5—2	Dark brown (dull) with dense mottlings	Yellow-creamy, oblong elliptic, 1 mm× 15 μm	No definite pattern	Broad low irregular tubercles	Tuberculate
L. ervoides (1) w²seeds	2.5×1.5	Dark brown with black mottlings	Almond, oblong-elliptical, 0.7 mm×10 μm	Faveolate	Faveolate	Irregular tubercles

l—length, h—thickness

nal layer of palisade-like cells, known as counter palisade (Text-fig. 1A), below which is found well-developed aerenchyma of stellate cells. In this region just below the groove are present tracheidal cells known as 'tracheid bar', which in cross-section of the seed appears pear-shaped (Text-fig. 1 A).

Spermoderm pattern—The spermoderm pattern in hilar region (frontal view) is of the faveolate type in all the 14 varieties of *L. culinaris* and *L. ervoides* (Pl. 1, figs. 2, 3, 4), except in *L. orientalis* where the pattern shows low irregular tubercles (Pl. 1, fig. 5). The region adjacent to hilum shows three types of pattern; Type I—tuberculate, found in *L. culinaris* varieties 75 KT 36627, ILL-1169, WYR 1720, WYR-1811, LC-5, WYR-16 and *L. orientalis* var. No. 26 (Pl. 2 A,B,C.). Type II—Faveolate found in *L. culinaris* varieties LL-30, PG-9, K-75, WYR 2327, L-312, LG-60, ILL-467 and *L. ervoides* (Pl. 2, fig. 6); Type III-Low mounds occur in *L. culinaris* var. WYR 244 (Pl. 2, figs. 4,5). The general seed surface invariably shows tuberculate pattern in all the 14 varieties of *L. culinaris*, *L. ervoides* and *L. orientalis* with slight variations (Pl. 3 figs. 1-6). Tubercles of adjacent cells may or may not be joined by finger or thread-like projections.

Conclusions

Seed morphology of *Lens* species and varieties of *L. culinaris* shows variations to some extent as far as seed size, hilar structure and colour are concerned. These features can be used for identification purposes along with other vegetative characters.

The spermoderm pattern for the major part of the seed is of the Tuberculate type (Papillose type of Lersent, 1981) in all the species and varieties of *Lens* studied presently and as also reported in other varieties of *Lens* studied by Trivedi and Gupta (1988). From the present study it appears that tuberculate pattern, in general, is a constant feature at the generic level in *Lens*. Tuberculate pattern of spermoderm is also reported in *Vicia* and *Lathyrus* (Lersten, 1981). Cubero's (1980) suggestion that the '*Vicia-Lens* continuum' is a reality, finds support from the present investigations based on spermoderm pattern.

The seed coat anatomy in *Lens*, in general, follows similar anatomical pattern as reported in most papilionoideae (Corner, 1976), and no distinct characteristic feature is observed to use the anatomical pattern as a basis for taxonomy below the rank of subfamily, especially in cases where dehiscent fruits occur.

References

Corner, E. J. H. (1976). *The Seeds of Dicotyledons.* **2** vol., Cambridge Univ. Press, Cambridge,

Cubero, J. (1980). Origin, taxonomy and domestication. *In: (eds) Webb, C. & Hawtan, G. Lentils.*, pp. 15-38. Commonwealth Agricultural Bureaux, England.

Lersten, N. R. (1981). Testa topography in Leguminosae, sub-family Papilionoideae. *Proc. Iowa Acad. Sci.*, **88:** 180-191.

Trivedi, B. S. & Gupta, M. (1988). SEM studies on seed coat of some varieties of *Lens culinaris* Medikus (Lentil). *Phytomorphology*, **38:** 179-186.

Explanation of Plates

Plate 1

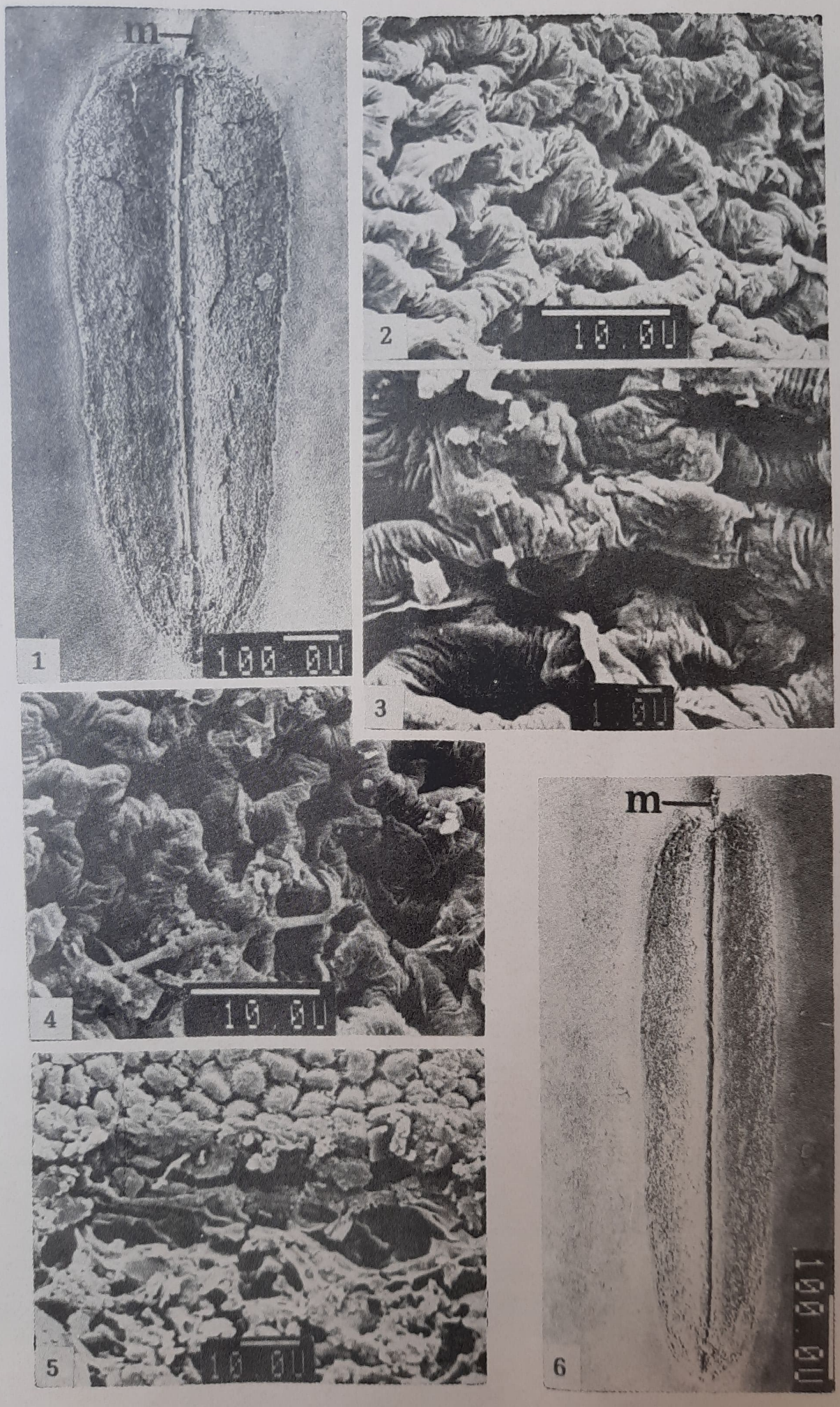
1,6. Hilum of *Lens culinaris* var. K-75 and var. WYR-244, respectively.
2-5. Hilar portion of *L. culinaris* var. WYR-16, *L. ervoides*, *L. orientalis* and *L. culinaris* var. WYR-2327 respectively (m, micropyle)

Plate 2

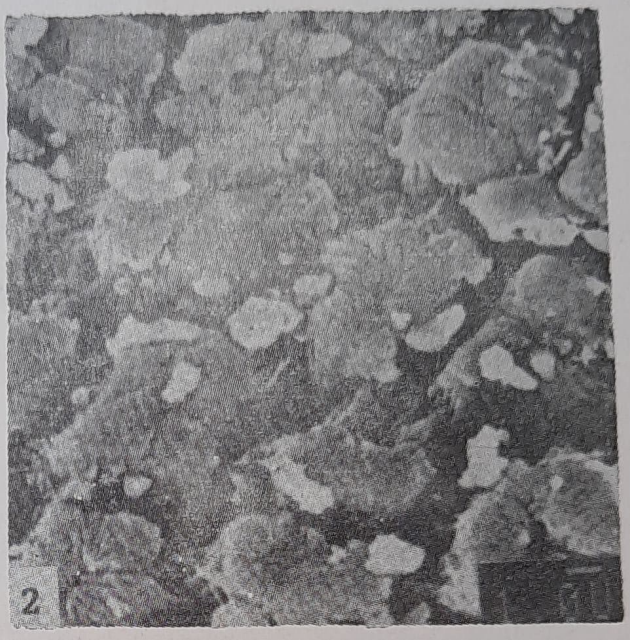
Spermoderm pattern adjacent to hilum in *Lens*.
1-5. *Lens culinaris*.
L. ervoides.
6. *L. orientalis*.

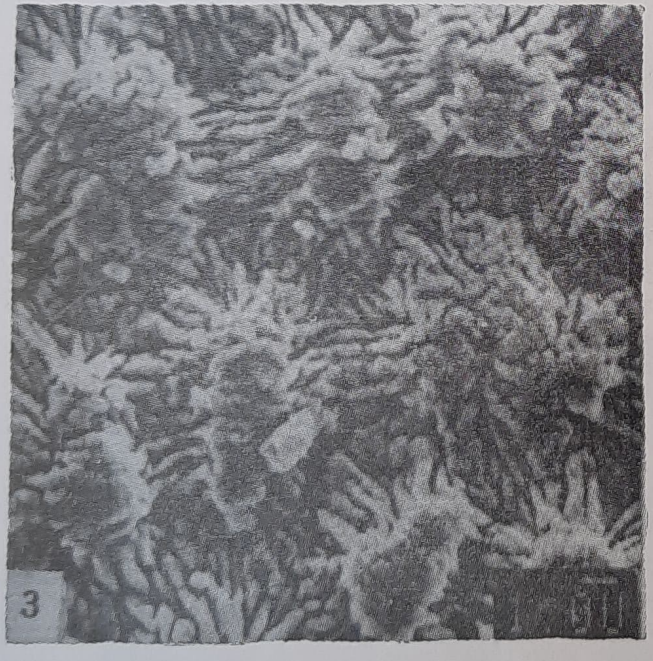
Plate 3

Spermodem pattern on the general seed surface in *Lens*.
1-4. *Lens culinaris*.
5. *L. ervoides*.
6. *L. orientalis*.

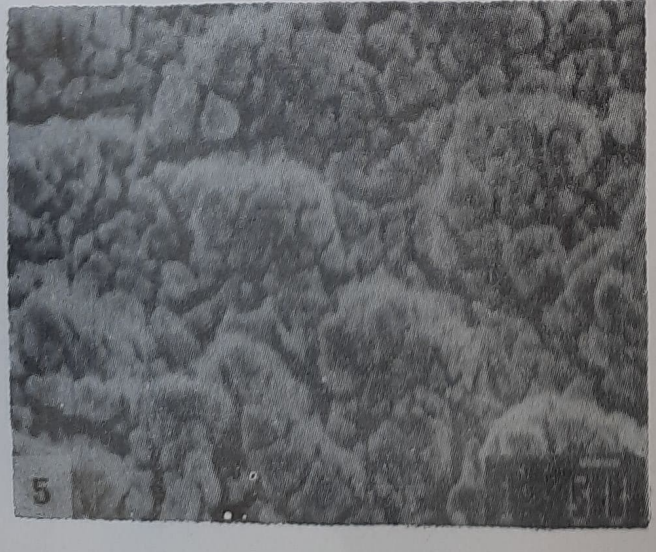

m
1
2
3
4
5
m
6


1


2

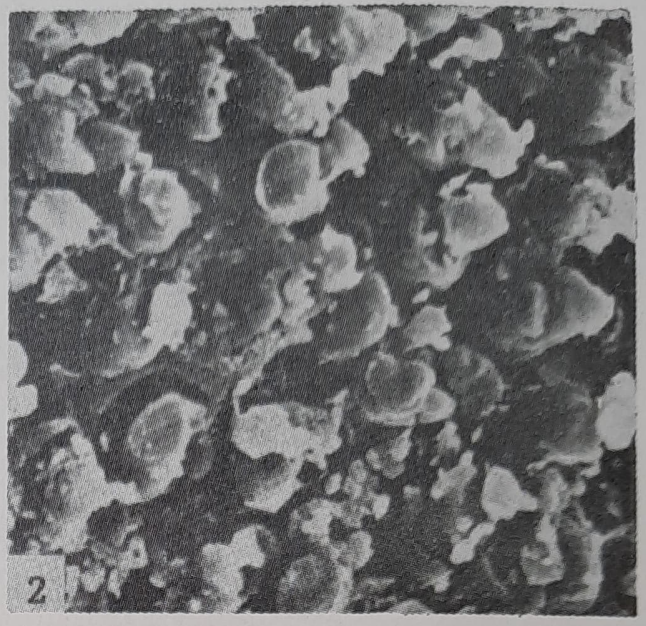

3


4

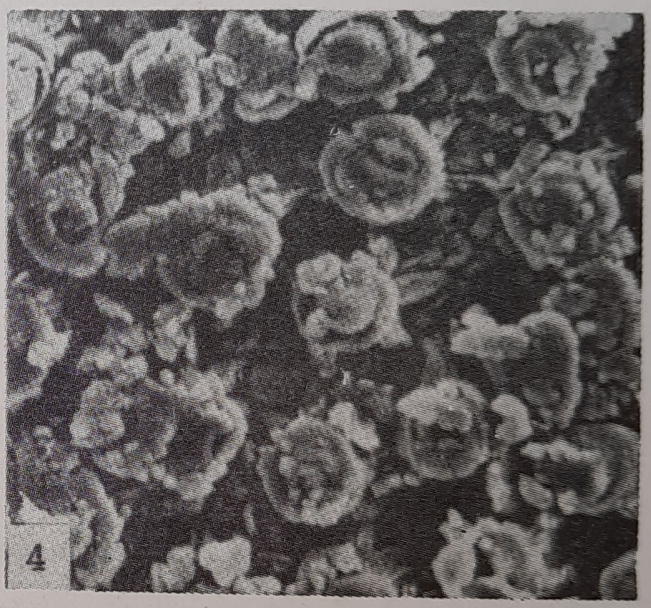

5

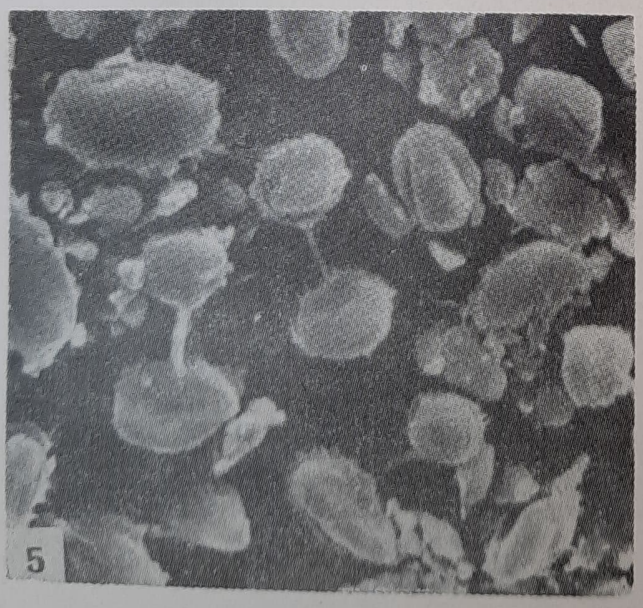

6

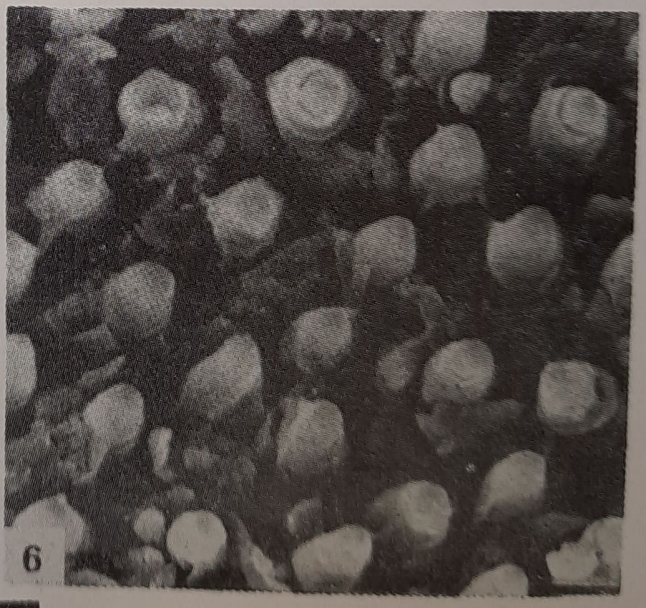

1


2


3


4


5


6