Systematic revision of Leguminosae in Egypt
1. Tephrosia Pers.

by

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Abstract:
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A revision of the genus *Tephrosia* in Egypt is presented. Basic characters of the groups are given as well as an identification key and an enumeration of the studies specimens.

Introduction

The genus *Tephrosia* Pers. comprises about 300 species occurring throughout the tropics and in many warm temperate regions of the world, especially Africa.

According to TÄCKHOLM (1956: 300-301), seven species were known to occur in Egypt viz.: *T. apollinea, T. purpurea, T. ehrenbergiana, T. uniflora, T. quartiniana, T. arabica* and *T. nubica.* BOULOS (1966: 205) described *T. kassasii* which is characterized by its 1-foliolate leaves and is believed to be endemic to the Nubian Desert of Egypt. TÄCKHOLM (1974: 257-258) followed GILLETT (1958: 123) and treated both *T. nubica* and *T. arabica* as two subspecies of *T. nubica.* On the other hand, she (1974, op. cit.) regarded the characters of leaf and flower grouping as the main features for the distinction of the Egyptian species of *Tephrosia.*

The aim of this work is to revise systematically the native taxa of *Tephrosia* with special reference to the earlier applied characters as well as other macro- and micromorphological characters, which are hoped to be more reliable for the distinction of these taxa.

This work is based on ample collections kept in the Herbaria: BM, CAI, CAIM and K as well as intensive field studies.

The upper and lower surface of the leaf as well as the seed coat have been studied by means of light microscope and a JEOL JSM scanning electron microscope, which is operated at accelerated voltage of 15 KV at the Scanning Electron Microscope centre of Assiut University.

Characters of systematic value

Leaf Characters

Leaves are generally imparipinnate, except in *Tephrosia kassasii* which is 1-foliate. Leaflet shape varies from obovate-cordate in *T. uniflora* and *T. quartiniana* to oblong-lanceolate in the other taxa.

The indumentum is apparently denser on lower surfaces than the upper ones. In *T. uniflora* the leaflets are glabrous on the upper surface. It ranges from hirtellous in *T. purpurea* and *T. kassasii* to hispid in *T. uniflora, T. desertorum* and *T. purpurea* subsp. *dunensis* or tomentose in *T. nubica, T. quartiniana* and *T. villosa.* SEM examination of the indumentum showed that all the taxa possess unicellular, granulate hairs with slightly enlarged bases. In *T. purpurea* (subsp. *purpurea* & subsp. *dunensis*), *T. quartiniana, T. desertorum* and *T. nubica* the hairs are short, spreading with bulbous, slightly raised bases (Pl. I, Fig. A-D & Pl. II, Fig. A). In *T. purpurea* subsp. *apollina, T. kassasii, T. uniflora* and *T. villosa* the hairs are long, appressed with sunken non-bulbous base (Pl. II, Fig. B-D).

Pod and Seed Characters

With the exception of *Tephrosia nubia*, the other species have linear, compressed, several seeded (5-10) pods, with tomentose (*T. villosa*) or strigose-hirtellous hairs. In *T. nubica*, pods are ovoid, tomentose and one-seeded.

Most of seeds are reniform-subcylindrical, however they are subglobose in *T. quartiniana.* The seeds are small (2-2,2 x 1,5-2 mm) in *T. nubica.*

The seed coat in all species of *Tephrosia* is glossy, smooth, usually brown or grey mottled with dark spots. In *T. nubica, T. uniflora* and *T. villosa* the seeds are dark-brown, wrinkled. The hilum is ± central, circular-elliptical surrounded by a thick hilar rim of epidermal cells which differ from those of the surrounding testa. The epidermal cell pattern of the hilar rim varies from rugose in *T. villosa* to colliculate in *T. uniflora*, finely rugose in *T. nubica* and *T. quartiniana* or finely scalariform colliculate in the rest of species (Pl. III, Fig. A-D).

SEM examination of seed testa showed that the epidermal cell pattern varies from colliculate in *T. uniflora* (Pl. IV, Fig. A) to reticulate in *T. quartiniana* and *T. villosa* (Pl. IV. Fig. B, C) or reticulate-foveate in *T. purpurea* subsp. *purpurea* (Pl. V, Fig. A) to reticulate-papillate in *T. kassasii, T. purpurea* subsp. *apollinea* (Pl. V. Fig. B), subsp. *dunensis* and *T. nubica* (Pl. IV, Fig. D). The anticlinal cell wall boundaries are either indicated by channels in *T. uniflora*, or raised in the other examined test, The boundaries are either straight in *T. purpurea, T. kassasii, T. desertorum* (Pl. V, Fig. C) and *T. uniflora* or folded in *T. nubica, T. villosa* and *T. quartiniana.*

Key for the investigated taxa

1 Pod ovate, 1-seeded; seeds 5-5.5 x 3.5 mm *T. nubica*
- Pod linear, (3) 5-10-seeded; seeds 2-4.5 x 1.5-2.5 mm 2
2 Flowers clustered (2-3 flowers each) in leaf axils; leaf rachis short 1-2.5 cm long 3
- Flowers in racemes, terminal and axillary; leaf rachis long (3)4-6(-9) cm long 4
3 Leaflets 5-7; main lateral veins 4; leaflets tomentose on both surfaces; style glabrous. Seeds brown mottled with dark spots, subgloboid; epidermal cell pattern of seed coat reticulate *T. quartiniana*
- Leaflets 3(-5); main lateral veins 7. upper surface of leaflets glabrous, the lower surface tomentose; style penicillate. Seeds brown, subcylindrical; epidermal cell pattern of seed coat colliculate *T. uniflora*
4 Leaf 1-foliate *T. kassassii*
- Leaf 3-11 (-13)-foliate, imparipinnate 5
5 Pod 3-4 x 0.4-0.5 cm, strongly curved, densely tomentose; sepals filiform, more than half of the standard length, hispid; style penicillate. Epidermal cell pattern of seed coat reticulate *T. villosa*
- Pod 3.5-5 (-6) x 0.2-0.4 cm, slightly curved, subglabrous-strigose; sepals triangular, less than half of the standard length, pubescent; style glabrous. Epidermal cell pattern

otherwise 6
Leaflets small (0.5-1 x 0.2-0.3 cm); pods short (2.5-4 x 0.2-0.3 cm); seed small (2-2.5 x 1.5 mm) *T. desertorum*
- Leaflets larger ((1)2-5 x (0.2) 0.6-1.2 cm)); pods longer (3-6 x 0.3-0.5); seeds larger (3.5-4 x 1.5-2.5 mm) *T. purpurea*

Systematic Treatment

1. Tephrosia purpurea (L.) Pers., Syn. Pl. 2: 329. 1807 ≡ *Cracca purpurea* L., Sp. pl.: 752 1753. **Type:** Ceylon, *Hermann* (BM, Holotype).

A polymorphic species in the number and size of leaflets, indumentum; as well as the size of pod and the number of seeds in each pod. Several subspecies are recognized (Brummitt, 1968: 241) of which two were known earlier from Egypt; in addition subsp. *dunensis* is a new record.

Key to subspecies:

1 Young stems, inflorescence, leaves densely pubescent (Pl. I, Fig. A) subsp. *dunensis*
- Young stems, inflorescence subglabrous-pubescent (Plate 1, e,f) 2
2 Pod 3-4 cm long, 5-6(-7) seeded, curved downwards; leaflets with 7 lateral veins, indumentum with short spreading slightly raised hairs with bulbous base; epidermal cell pattern of testa reticulate-foveolate (Pl. I, Fig. B) subsp. *purpurea*
- Pod 3.5-5 (-5.5) cm long, (3)7-9 seeded, curved upwards; leaflets with 9 lateral veins, indumentum with long appressed sunken hairs with non bulbous base; epidermal cell pattern of testa reticulate-papillate (Pl. II, Fig. B) subsp. *apollinea*

1.1 Tephrosia purpurea subsp. **purpurea**
= *Tephrosia purpurea* (L.) Pers. var. *gracilis* Täckh. & Boulos in Publ. Cairo Univ. Herb. 5: 75 (1972). **Holotype:** Gebel Um Gurdi, Gebel Elba, 11.2.1962, *V. Täckholm et al. 889* (CAI!).

Specimens seen from Egypt are with smaller number of leaflets ranging from (3)5-11(-13). Common in moist habitats and wadi beds of Gebel Elba district; very rare in Southern Sinai.

Distribution:
Known from Pakistan throughout India, Sri Lanka, China, Indonesia. Recently introduced in Africa; recorded from Kenya, Ghana, Cote d'Ivoire and Zimbabwe.

Representative specimens:

Wadi Nasib, 9.5.1982, *Bot. Dept. Excursion* s.n. (CAI); Nuweiba-Dahab road, 8.8.1988, *H. Hosni s.n.* (CAI); Wadi Aideib, Gebel Elba, 20.1.1962, *V. Täckholm et al. s.n.* (CAI); Gebel Mekerba, 23.1.1962, *V. Täckholm et al. 377* (CAI); Wadi Haikwal, 23.10.1956, *Boulos s.n.* (CAI); Wadi Mirikwan, 5.3.1963, *Abdallah 1330* (CAIM); Bir Kansisrob, 3.2.1962, *V. Täckholm et al. 1256* (CAI); Wadi Haiteem, 27.1.1962, *V. Täckholm et al. 761* (CAI).

1.2 Tephrosia purpurea subsp. **dunensis** Brummit in Bol. Soc. Brot. sér. 2, 41: 251 (1968).
Holotype: Tanganyka, 16 miles N. of Dar es Salam, sand dunes, 2.7.1960, *Leach & Brunton 10164* (K!).

Very rare in wadi beds and oases of Southern Sinai.

Distribution:
Eastern coasts of Africa, Somali Republic, Mozambique, Lake Malawi, Kenya, Tanzanya and the islands of the Indian Ocean.

Representative specimens:

Southern Sinai, Sharm El Sheikh, 18.8.1982, *Bot. Dept. Excursion* s.n. (CAI); Um Maru, 24.10.1926, *Kaiser 929* (CAIM); Wadi Feiran, Mzeriq, 22.11.1926, *Kaiser 919* (CAIM); Wadi Nasb, 5.4.1982, *Bot. Dept. Excursion* s.n. (CAI); Wadi Isla, April 1940, *Hassib* s.n. (CAI); Kharga Oasis, 4.11.1966, *Hadidi* s.n. (CAI); sandy waste near Qalamum, Dakhla, 14.4.1928, *Simpson 6083* (CAIM).

1.3 Tephrosia purpurea subsp. **apollinea** (Del.) H. Hosni & El-Karemy comb. et stat. nova
Basionym: *Galega apollinea* Del., Descr. Egypt., Hist. nat.: 70 no. 688 et 288-289 pl. 53, fig. 5 (1813) ≡ *Tephrosia apollinea* (Del.) Link, Enum. Hort. Berol. Alt. 2: 252 (1822).
Type: Egypt, Edfu, *Delile* s.n. (P).

Common in dry and moist habitats of the Nile Nubian territory, Nubian and Arabian deserts, the coastal plains along the Red Sea in Southern Sinai, Gebel Elba massive; rare in the oases of Western Desert.

Distribution:
Known from the Sudan, Ethiopia, Somalia Republic, Djibuti, eastward to Arabia, Iran and Pakistan.

Representative specimens:

Abu Simbel, 4.2.1963, *V. Täckholm et al. 188* (CAI); Aniba, 14.-18.11.1963, *V.Täckholm et. al.* s.n. (CAI); Aswan, 7.1.1909, *Schweinfurth* s.n. (CAI); Wadi Seyal, N. Galala, 15.2.1956, *Imam* s.n. (CAI); Wadi Aber, near Suez, 15.2.1956, *Hadidi* s.n. (CAI); El Allaqi, 17.3.1963, *Abdallah 1701* (CAIM); Kharga Oasis, 12.3.1928, *Simpson 2134* (CAIM); Dakhla Oasis, 14.9.1928, *Simpson 6088* (CAIM); Wadi Madsus, 17 km from Sharm El Sheikh, 17.8.1982, *Bot. Dept. Excursion* s.n. (CAI); Ain Sokhna, Red Sea coast, 8.2.1952, *Hadidi* s.n. (CAI); Wadi Aideib, 26.2.1938, *Shabetai 5109* (CAIM); Syene, Silsilis, s.d., *Sieber* s.n. (K); Aegypto-inferiore, 1836, *Kotschy 941* (K).

Note:
Galega apollinea Del. is a North African taxon which was treated by Link (1822) as *Tephrosia apollinea*. It is closely related to *T. purpurea* which was described from Sri Lanka. Both species agree in most of their characters and the distinction between typical forms is rather difficult; which justifies the treatment of both taxa as conspecific.

The plants which grow in the Eastern Desert of Egypt may produce smaller pods (2,5-4 x 0,3-0,4 cm) and even smaller leaves and leaflets (1,5-2,5 x 0,5-0,8 cm), appearing therefore different (Suez, in desert, 4.1875, *Hildebrandt* s.n. (BM); Wadi Harunis, S. Galala, 10.2.1956, *Imam & Abdel Fadeel* s.n. (CAI). Plants from oases (Kharga Oasis, Hibis, 7.2.1952,

V. Täckholm & Kassas s.n. (CAI); Dakhla Oasis, 16.8.1967, *Hadidi* s.n. (CAI) differ from the typical form in having rather densely pubescent spreading hairs.

2. Tephrosia desertorum Scheele in Linnaea XVII: 383 (1843). **Holotype:** In planitie deserti prope Dscheddam, 20.12.1835, *Schimper 770* (BM!)

This species is best distinguished from *T. purpurea* by its smaller leaflets (0.5-1 x 0.2-0.3 cm); its pods which are generally narrow (2.5-4 x 0.2-0.3 cm); by its smaller seeds (2-2.5 x 1.5 mm).

Very rare in wadi beds of Arabian Desert of Egypt.

Distribution:
Known from Arabian Peninsula.

Representative specimens:

Wadi Um Lassaf, S. Qosseir, 2.2.1933, *Drar* s.n. (CAIM); Wadi Ararat, 11.2.1932, *Drar* s.n. (CAIM).

3. Tephrosia kassasii Boulos in, Feddes Repert. 73: 205 (1966). **Holotype:** Egypt, Aniba, 18.1. 1963, *V. Täckholm et al.* (CAI!).

Rather distinct by its 1-foliate leaves, although some intermediate forms exist. Only known from the type locality.

Distribution:
Believed to be endemic to the Nubian Desert of Egypt.

4. Tephrosia villosa (L.) Pers., Syn. Pl. 2: 329 (1807) ≡ *Cracca villosa* L., Sp. Pl.: 752 (1753).

4.1. Tephrosia villosa subsp. **ehrenbergiana** (Schweinf.) Brummit in Bol. Soc. Brot. ser. 2, 41: 225 (1968) ≡ *Tephrosia ehrenbergiana* Schweinf., Beitr. Fl. Aethiop.: 18 (1867). **Type:** Eritrea, *Ehrenberg s.n.* (B, Lectotype).

Very rare in Egypt, recorded from Kharga Oasis.

Distribution:
Known from Angola, Kenya, Eritrea, Somalia, Sudan, Tanzania, Zimbawi, Uganda, Mozambique and Namibia; also from the islands of the Indian Ocean.

Representative specimens:

Ein Serag, Kharga, 23.1.1924, *Simpson 2373* (CAIM, K).

5. Tephrosia uniflora Pers., Syn. Pl. 2: 329 (1807).

5.1. Tephrosia uniflora subsp. **petrosa** (Blatt & Hall.) Gillet & Ali in Bull. 13 (1): 114 (1958) ≡ *Tephrosia petrosa* Blatt & Hall. Journ. Bombay N.H.S. 26: 239 (1918). **Type:** India, Rajasthan, Taisalmer, *Blatter 6970* (K, Lectotype, Photo !).

Differs from the type subspecies by its 3-5 leaflets; pods which are about 4 cm long with 8-9 seeds in each.

Confined in Egypt to moist habitats of Gebel Elba massive. Known from the Sudan, Ethiopia and Somalia, eastwards in Arabia, Pakistan and India.

Representative specimens:

Gebel Karam Elba, 7.2.1962, *V. Täckholm et al. 1722* (CAI); Wadi Yahameib, 22.1.1962, *V. Täckholm et al. 259* (CAI); Gebel Alafoot, 7.2.1962, *V. Täckholm et al. 1626* (CAI); Wadi Rabdeit, 21.1.1933, *Shabetai 2655* (CAIM); N. Wadi Laham, 29.10.1956, *Khattab 107* (CAIM).

6. Tephrosia quartiniana Cuf. ex Greuter & Burdet in Willdenowia 16 (2): 446 (1987). **Type:** Ethiopia, Djeladjekanne ad flumen Taccazze, *Quartin-Dillon s.n.* (P, Holotype).
= *Tephrosia vicioides* A. Rich., Tent. Fl. Abyss. 1: 188 (1847), nom. illegit. non Schlecht. (1838).

Confined in Egypt to moist habitats of Gebel Elba massive.

Distribution:
Known from Ethiopia, Eritrea, Sudan, Mali and Mauritania, eastwards to Southern Arabia.

Representative specimens:

Gebel Alafoot, 7.2.1962, *V. Täckholm et al. 1659* (CAI); Wadi Ararat, 11.2.1933, *Drar s.n.* (CAIM); Wadi Mera Kwan near Halaib, 1933, *Drar s.n.* (CAIM); Wadi Rabdeit, 21.1.1933, *Shabetai 2656* (CAIM).

7. Tephrosia nubica (Boiss.) Baker in Fl. Trop. Africa 2: 125 (1871).

7.1. Tephrosia nubica subsp. **nubica**
Basionym: *Pogonostigma nubicum* Boiss., Diagn. Pl. Or. ser. 1,2: 39 (1843)
= *Pogonostigma abyssinicum* Jaub. & Spach, Ill. P. Orient. 5: 88. 1856 ≡ *Tephrosia nubica* var. *abyssinica* (Jaub. & Spach) Schweinf. in Bull. Herb. Boiss. 4, app. 2: 247 (1896).

Leaflets (3) 5-9, oblanceolate, (2) 3-4 x 0,2-0,6 cm, villous to densely tomentose; lateral veins 4-5, usually red; pod wooly, ovate, 1,1 x 0,7 cm with a 2 mm stipe, sed solitary, brown, 5-5,5 x 3,5 mm.

Confined in Egypt to moist habitats and wadi beds of the Arabian Desert and Gebel Elba massive.

Distribution:

Known from Djibuti, Ethiopia, Kenya, Mauritania, Niger, Sudan and Chad.

Representative specimens:

Gebel Elba, 23.-27.1.1929, *G. Täckholm* s.n. (CAI); Gebel Elba, 14.1.-6.2.1933, *Fahmy & Hassib* s.n. (CAI, K); Wadi Khasher, 1924-25, *Murray 3349* (K); Gebel Karam Elba, 1925-26, *Murray 3882* (K); Wadi Kansisrob, 28.1.1933, *Shabetai 2654* (CAIM); Wadi Haikwal, 27.1.1933, *Drar 222* (CAIM); Wadi Ehmeit, 20.1.1933, *Shabetai 2661* (CAIM); Upstream of Wadi Seramatai, 29.1.1962, *V. Täckholm et al. 1998* (CAI).

Note:

TÄCKHOLM (1974: 257) reported the occurrence of subsp. *nubica* and *arabica* (Boiss.)Gillet, which vary in regards of the shape, number of leaflets and the pod size. The examined material from the Arabian Desert and Gebel Elba district of Egypt apparently belongs to subsp. *nubica*. This agree with the fact that subsp. *arabica* is a S.W. Asiatic taxon which is not known from Africa.

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Explanations to plates I-V

Plate I
SEM micrographs of leaf epidermis
Fig. A - *T. purpurea* subsp. *dunensis*, x 500; B - *T. purpurea* subsp. *purpurea*, x 650; C - *T. nubica*, x 650; D - *T. desertorum*, x 400.

Plate II
SEM micrographs of leaf epidermis
Fig. A - *T. quartiniana*, x 500; B - *T. purpurea* subsp. *apollinea*, x 650; C - *T. kassasii*, x 650; D - *T. uniflora*, x 180.

Plate III
SEM micrographs of hilar rim and hilar cavity of seeds
Fig. A - *T. purpurea* subsp. *apollinea*, x 90; B - *T. villosa* subsp. *ehrenbergiana*, x 180; C - *T. uniflora* subsp. *petrosa*, x 300; D - *T. purpurea* subsp. *purpurea*, x 90; E - *T. nubica*, x 190; F - *T. quartiniana*, x 150.

Plate IV
SEM micrographs of seed coat
Fig. A - *T. uniflora* subsp. *petrosa*, x 1800; B - *T. quartiniana*, x 500; C - *T. villosa* subsp. *ehrenbergiana*, x 1800; D - *T. nubica*, x 1500.

Plate V
SEM micrographs of seed coat
Fig. A - *T. purpurea* subsp. *purpurea*, x 650; B - *T. purpurea* subsp. *apollinea*, x 1800; C - *T. desertorum*, x 1200.

Plate I

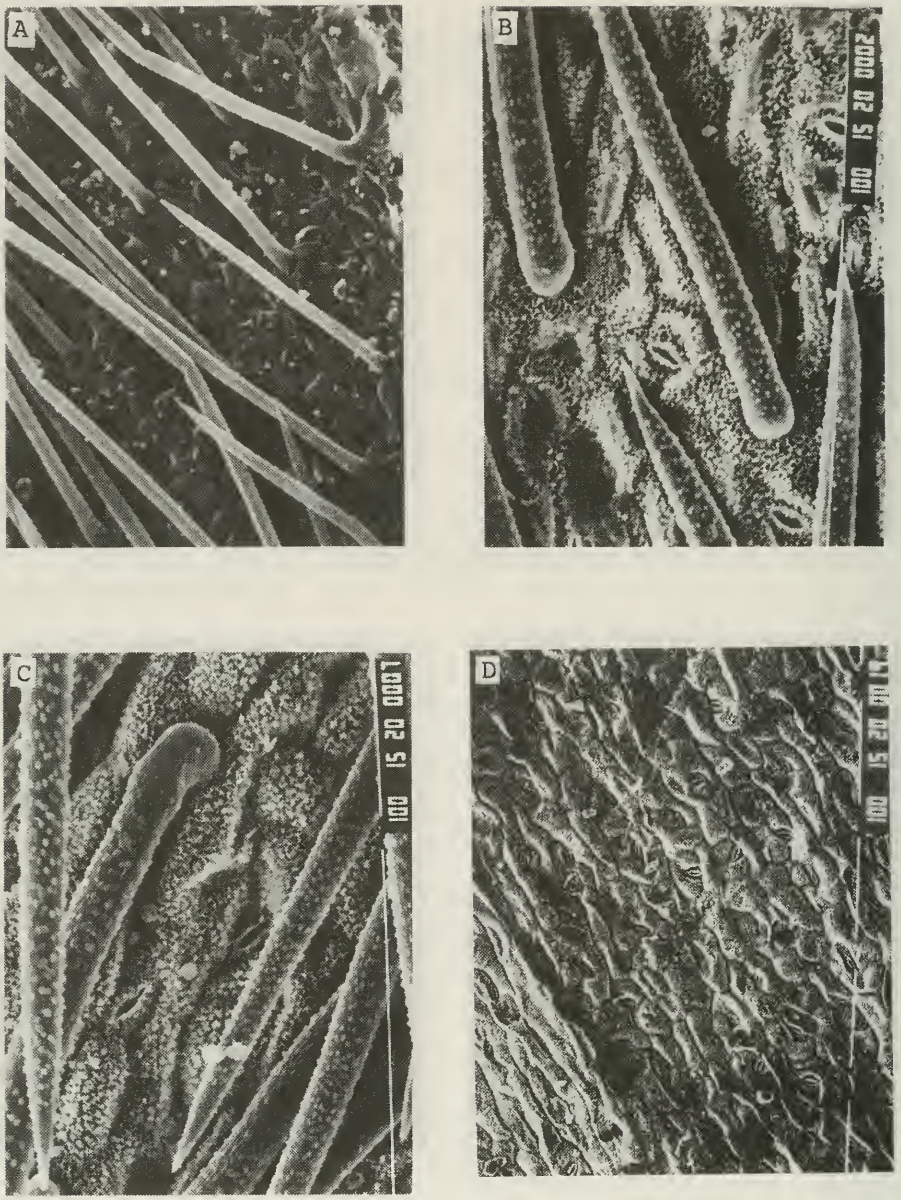
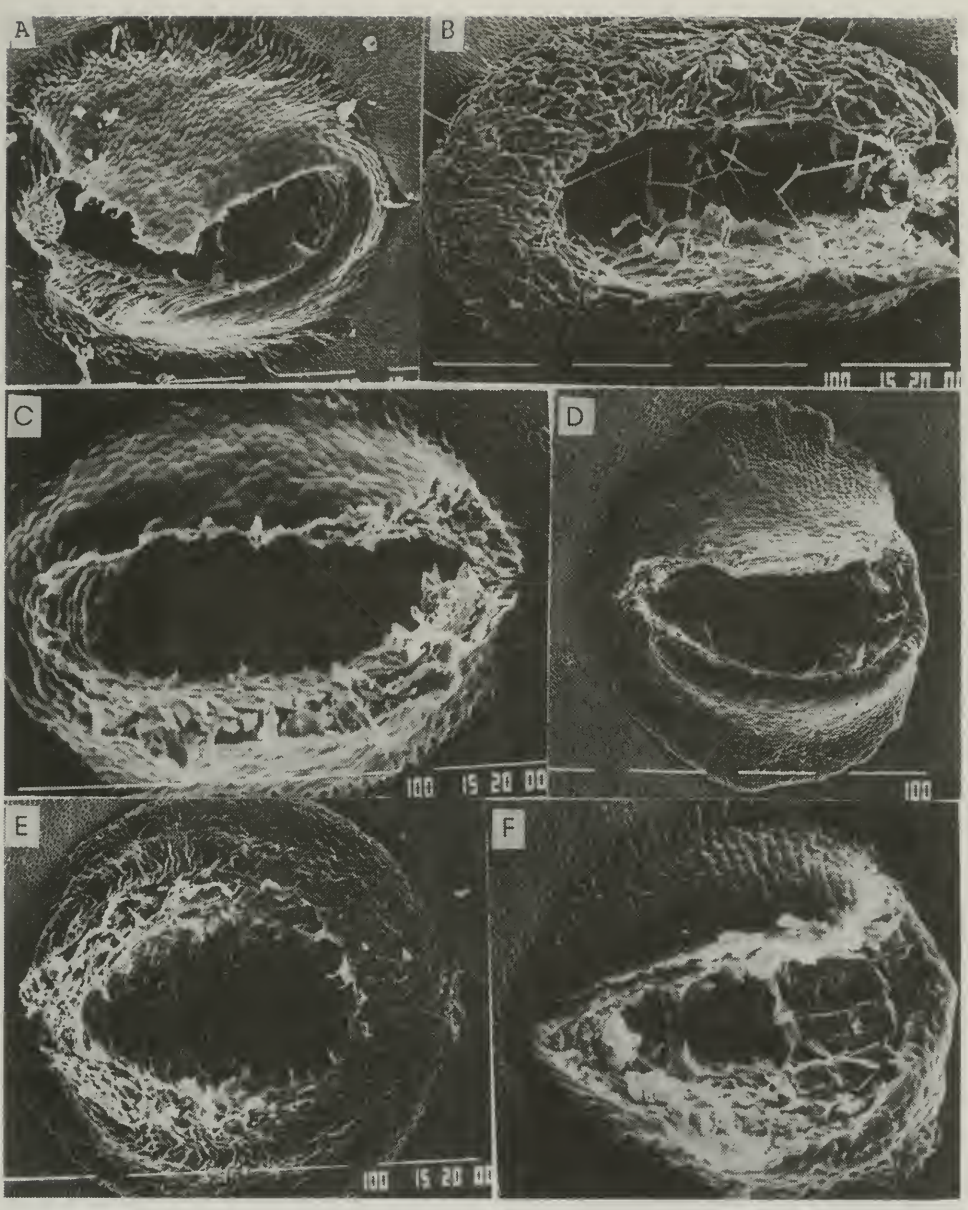


Plate II



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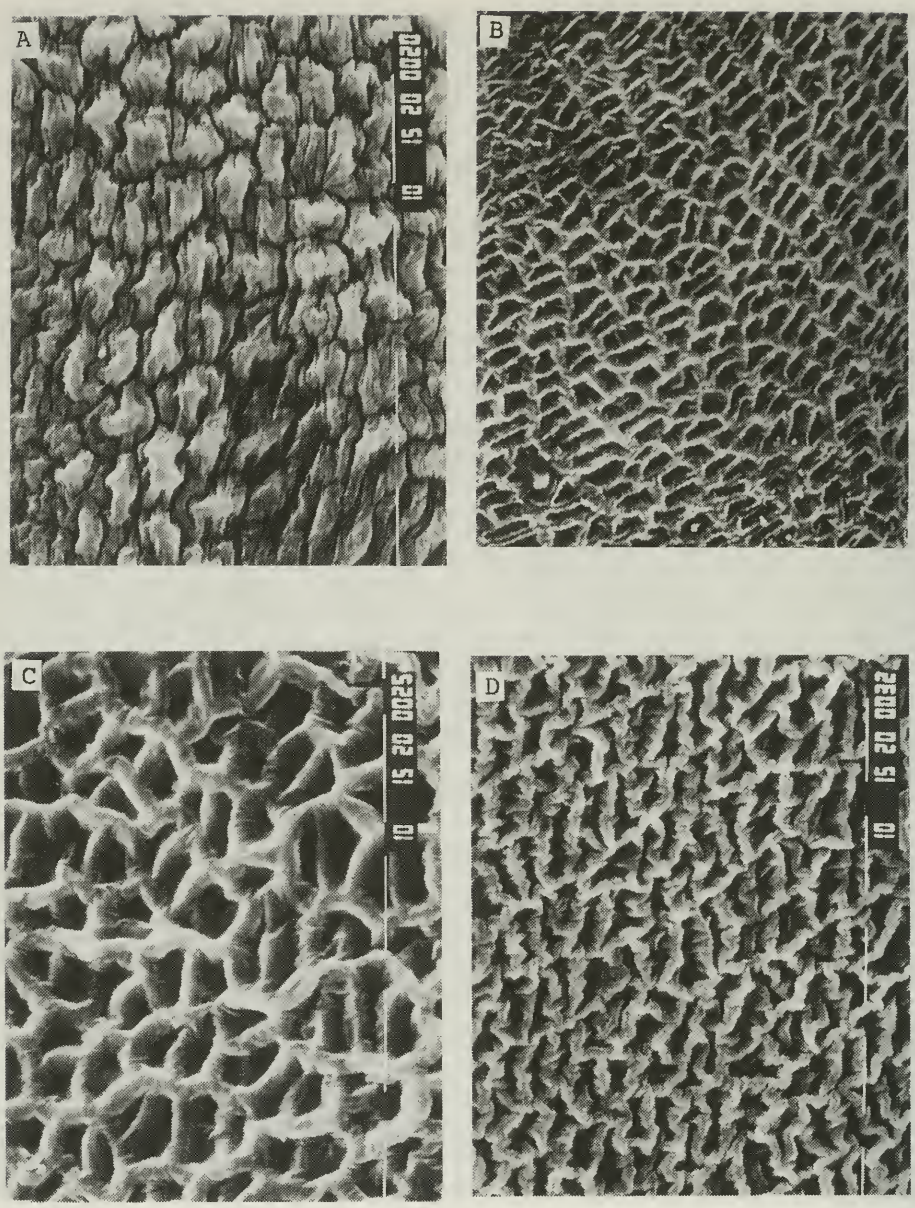
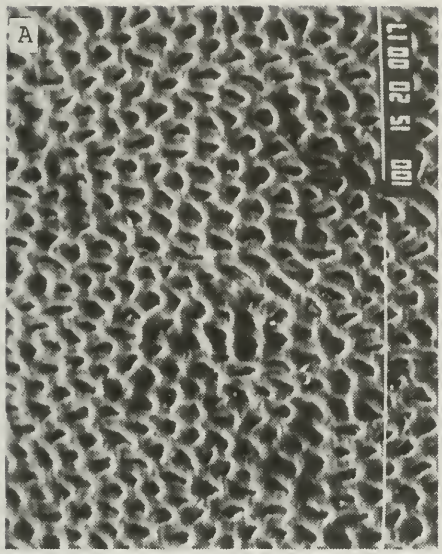
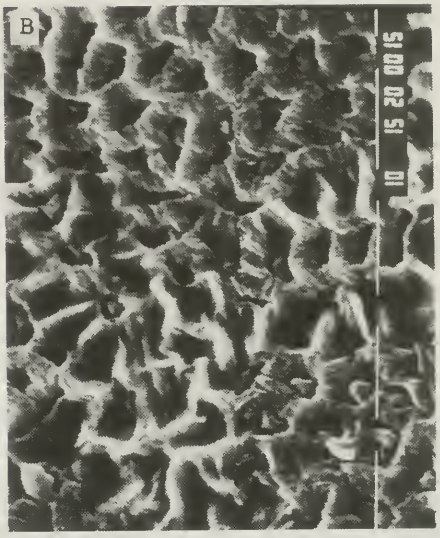


Plate IV





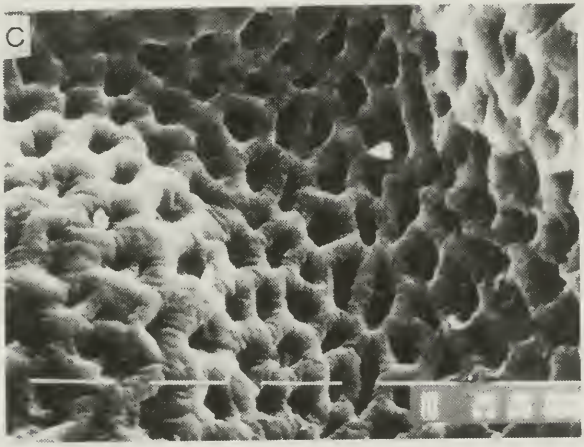


Plate V