

MACRO- AND MICROMORPHOLOGY OF *AEGIALOPHILA CRETICA* BOISS & HELDER

1: THE LEAF AND STEM

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ABSTRACT

The macro- micromorphological characters of the leaf and stem of *Aegialophila cretica* Boiss & Helder are presented with the aim of finding out their diagnostic characters by which the plant can be easily identified either in the entire or in powdered forms.

INTRODUCTION

Aegialophila cretica Boiss and Helder is an erect perennial herb belongs to family Astraceae, close to *Centaurea* (1). It is a wild plant, growing in the Egyptian desert. Recently, aegialophilin, a cytotoxic sesquiterpene lactone of the germacranolide type (2) and seven flavonoid compounds (3) were isolated from *Aegialophila pumila* (Jusl.) Boiss. Meanwhile, there is no reports on the botanical study of the genus *Aegialophila* except *Aegialophila pumila* (4,5) and a brief taxonomic descriptions in some flora (1).

Concerning *Aegialophila cretica* neither the chemical nor the botanical study were previously carried out. In this investigation, the botanical study of the leaf and stem of *Aegialophila cretica* are presented also, the chemical study is under investigation.

EXPERIMENTAL

Material:

Wild flowering plants were collected in March 1994 from Borg El-Arab, 50 Kilometers west of Alexandria. The authenticity of the plant was kindly verified by Professor Dr. N. El Hadidi, Department of Botany, Faculty of Science, Cairo University.

A voucher specimen is kept at the Pharmacognosy Department, Faculty of Pharmacy, Zagazig University.

Fresh plant material, as well as material preserved in alcohol 70% containing 5% glycerol were used. In case of powder examination, the plant organs were air dried and powdered (No. 36), prior to examination.

A. Macromorphology:

Aegialophila cretica Boiss & Helder (Fig. 1) is an erect, perennial herb 5-15 cm high with few short, branches and rosette leaves. The branches arise near the

base and terminate in a moderately large reddish ovate capitulae carried on short pubescent peduncles.

The stem is short, erect, cylindrical. It is rarely branched and bears a limited number of leaves. It is brownish green in colour being covered by long wooly hairs, measuring about 0.5-1.5 cm long and 0.3-0.5 cm in diameter. It is flexible slender when young, brown hard when old breaks with a fibrous fracture exposing a yellowish-white solid interior.

The plant bears numerous cauline, and few radical leaves (Fig. 1). They are simple petiolate, exstipulate usually arranged in whorls. Both surfaces of the leaves are pale-green and covered with long whitish hairs. The lamina has an obtuse apex and an asymmetric base. The venation is pinnate reticulate.

The lamina of the cauline leaves is ovate oblong undivided or with few minute side lobes having blunt apices and undulate margins. The lamina measures 3-9 cm in length and 1-3 cm in width. The petiole is whitish-green in colour, wooly with a straight upper side and a rounded lower one; it measures 2-8 cm long and 0.3- 0.6 cm in diameter.

The leaves have papery texture, slight bitter taste and a faint characteristic odour.

B. Micromorphology:

1. The leaf

A transverse section in the lamina (Fig. 2A) shows an isobilateral structure; and the palisade is discontinuous in the midrib region. The midrib is strongly prominent on the lower surface and is slightly depressed on the upper one. The epidermis of the leaf bears numerous covering trichomes and multicellular projections (IFig. 3B & 4A).

The epidermis:

The epidermal cells of both surfaces (Fig. 3B & C) are polygonal tabular with straight or slightly wavy

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Fig. 1:
Flowering branch of *Aegialophila cretica* x 1/2
Fl., Flower, lf., Leaf; st., stem

anticlinal walls, covered with thick smooth cuticle. Dimensions of the epidermal cells are listed in Table (1). Stomata are of anomocytic type and are oval in shape. They are nearly equally distributed on both surfaces of the lamina. Occasional stomata are present in the neural regions.

The epidermis of the leaf bears numerous non-glandular trichomes. They are uniseriate, multicellular with 4-6 short basal cells and one long whip like terminal cell (Fig. 3B). Trichomes are scattered on both epidermises.

Numerous group of cells of both upper and lower epidermises protrude in the form of multi cellular dome like projections (Fig. 4):

The mesophyll (Fig. 3 A) is isobilateral. The palisade consists of 2 rows abutting both the upper and lower epidermises. The palisade cells are cylindrical,

with more or less straight anticlinal walls and contain greenish chloroplasts; they measure L. 35-55-75 u and D. 10-15-20u. The spongy tissue is formed of 2-3 layers of rounded or irregular parenchyma showing wide intercellular spaces; they measure 17-24-32 u in diameter.

The cortex:

The cortical tissue (Fig. 2A &B) is parenchymatous formed of large rounded or polygonal, thin-walled parenchyma, except the peripheral layers where the upper and lower epidermises are underlined with 3-5 rows of collenchyma. Epidermises of the peripheral sides and lateral projections of the midrib is underlined with 3-5 rows of collenchyma cells.

The pericycle:

The pericycle of the leaf (Fig. 2B) consists of

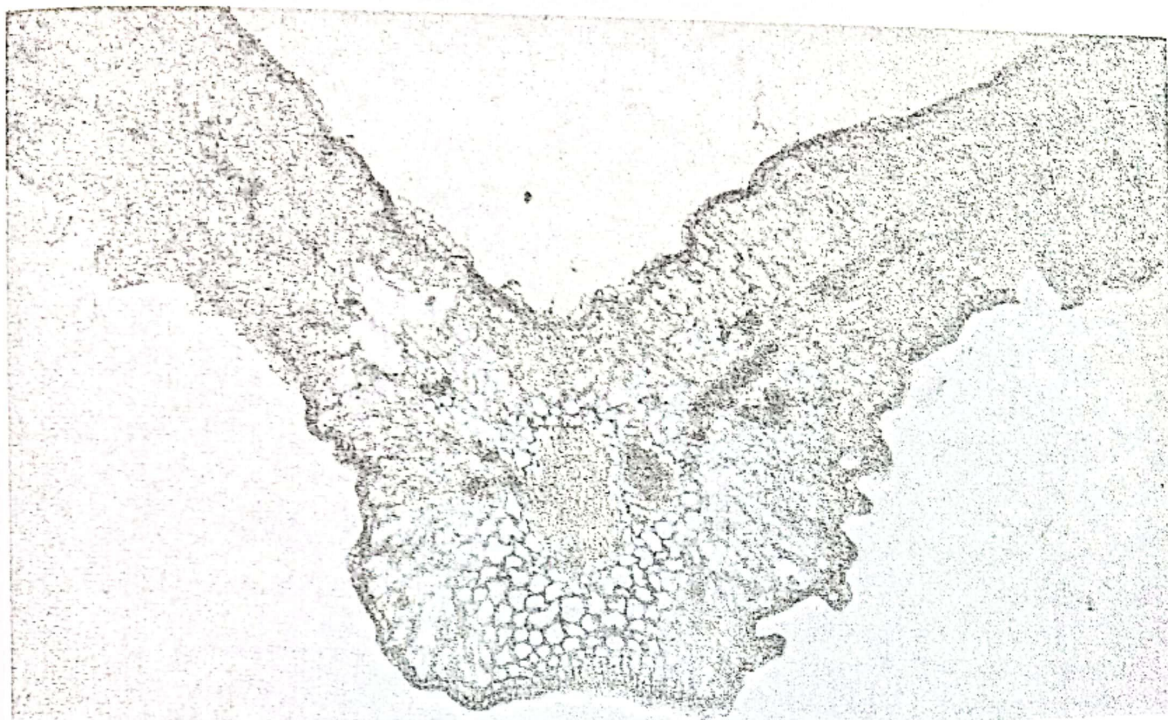
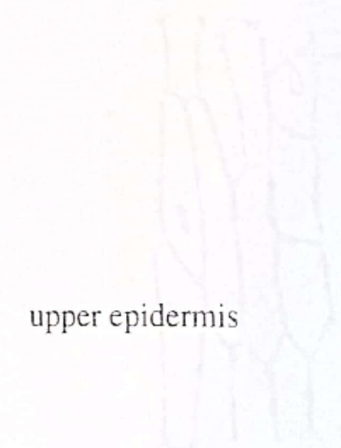


Fig. 2A x 31.25
Transverse section of the lamina.



upper epidermis

cortical parenchyma

pericycle

xylem

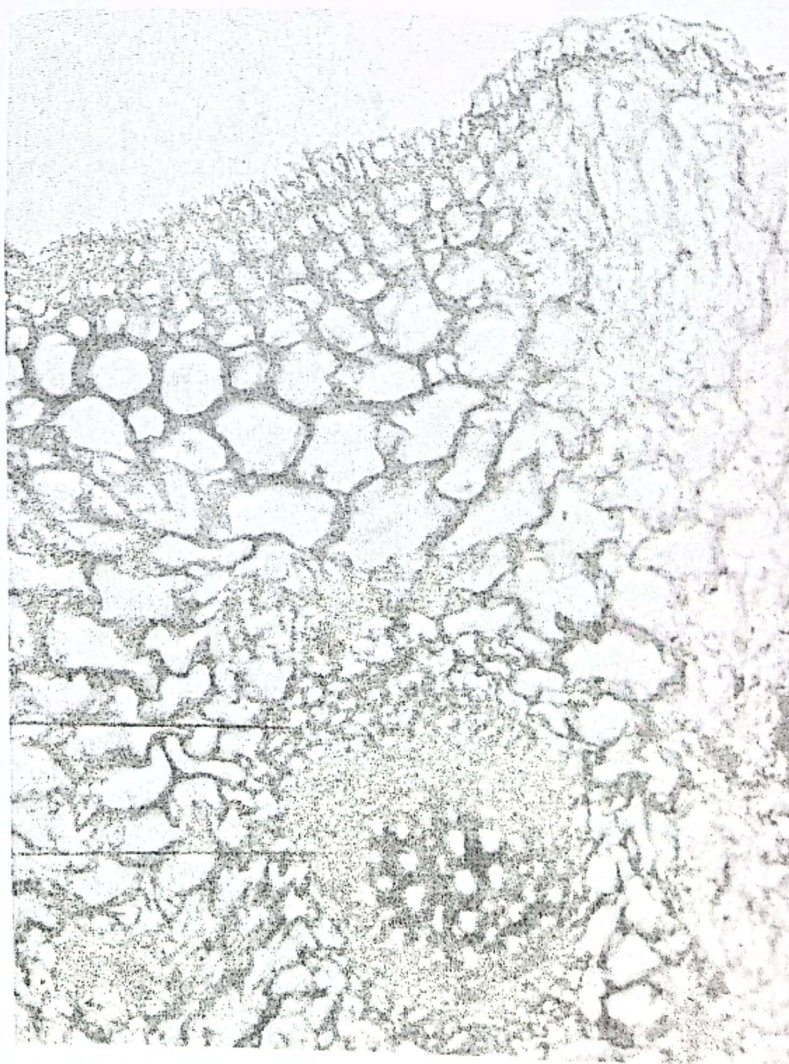


Fig. 2B x 126
The cortical tissue and the midrib.

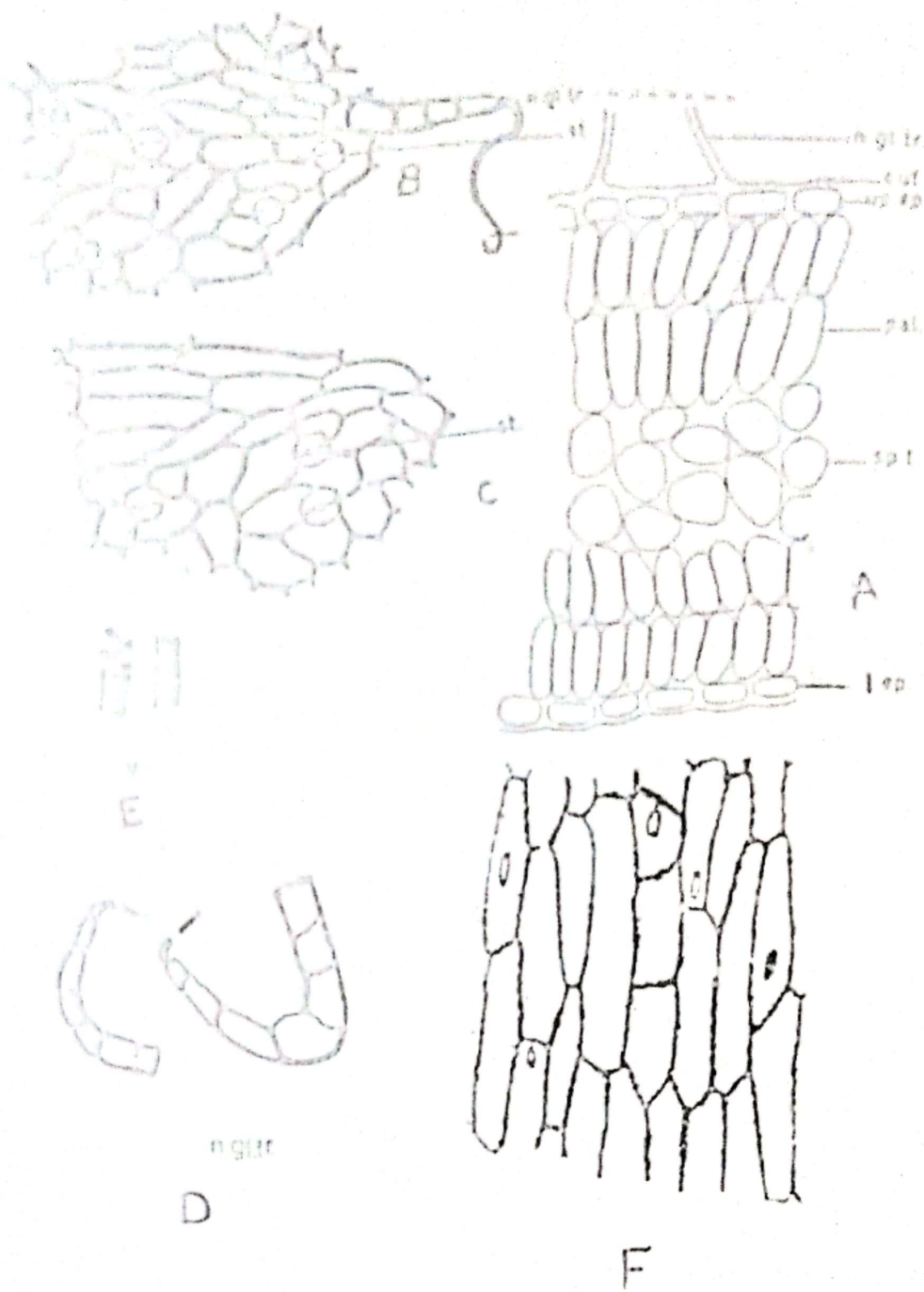


Fig. 3: (B-Fx125)

A- Detailed mesophyll x 200
 B- Lower epidermis of the lamina
 C- Upper epidermis of the lamina

E- Isolated Elements
 F- Epidermis of the petiole
 D- Trichomes

Cut., cuticle; lep., lower epidermis; n. gl.t., non glandular trichomes; st., stomata; up. ep., upper epidermis; v., vessels; w.f., wood fiber.

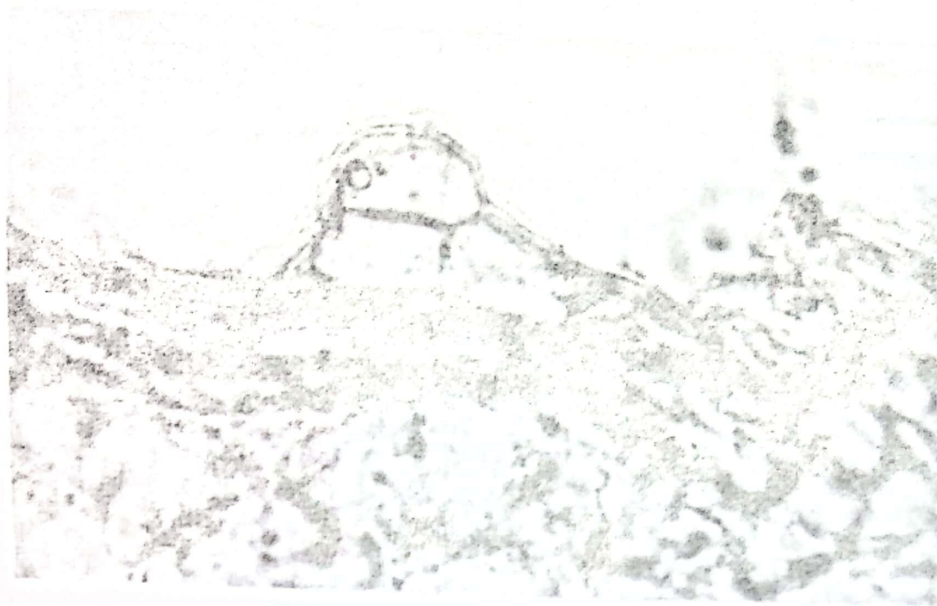


Fig. 4A x 320
Dome Projection.

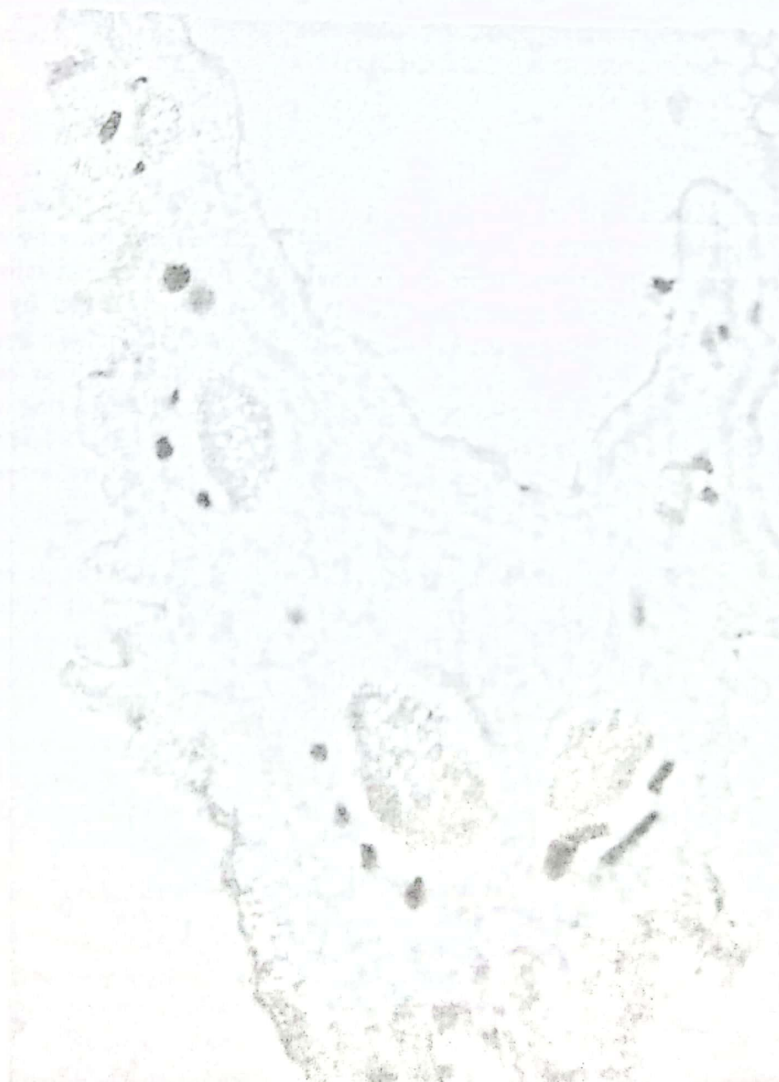


Fig. 4B x 50
T.S. of the petiole of the leaf.

Table 1: Leaf and Stem Epidermal Cells Size (in microns)

Epidermis	Length	Width	Height
Upper epidermis of lamina	25- 85	9- 40	15- 25
Lower epidermis of lamina	25-55	9- 30	10- 25
Upper epidermis of the midrib	57- 192	10- 35	19-23
Lower epidermis of the midrib	45- 190	9- 27	6-14
Epidermis of petiole	20- 140	10- 40	9-19
Stomata	15- 28	20- 30	-
non glandular Hair	935- 1355	39- 48	-

small collenchymatous cells forming an arc below the vascular bundle and a compact mass above.

The vascular tissue:

The vascular tissue of the leaf (Fig. 2A, 2B & 3E) consists of radiate lignified xylem with an arc of phloem below it. The xylem is formed of annular, spiral, and pitted vessels measuring 9-20-30u in diameter and lignified wood parenchyma measuring L. 120-230-350 u and D-7-10-12. The phloem consists of somewhat thin-walled cellulosic elements. Calcium oxalate crystals are completely absent.

The petiole:-

A transverse section of the petiole (Fig. 4 A) is more or less planoconvex which is distinctly prominent on the lower surface. It shows lateral projections towards the upper flat slightly grooved surface. The vascular system consists of a large vascular strand and 4-6 smaller one.

The epidermis:-

The epidermal cells of the petiole are polygonal (Fig. 3F) with more or less straight anticlinal, slightly beaded walls.

Trichomes:

Covering trichomes similar to those of the leaf are present (Fig.3D).

The cortex:

The cortical tissue of the petiole (Fig. 4B) is formed of large more or less round parenchyma cells except the peripheral layers where the upper and lower epidermises are underlined with 3-5 rows of collenchyma. The epidermis of the peripheral sides and lateral projections of the midrib is underlined by 3-5 rows of chlorenchyma. It shows 2-4 yellow to orange schizogenous ducts below each vascular bundle (Fig. 4B and C).

The pericycle:

The pericycle of the petiole (Fig.4B & 5) is collenchymatous similar to that of the lamina.

The vascular tissue:-

The vascular tissue (Fig. 5) of the petiole is similar to those of the leaf except in that, the xylem vessels measure 20-32-45 u in diameter and few

tracheids are present measuring 130-160-185 u in length and 15-23-30 u. in diameter. Calcium oxalate crystals are completely absent.

The powdered leaf:

The powdered leaf is whitish-green in colour having a slight odour and no particular taste. The diagnostic microscopical characters of the powdered leaf are:-

- 1) Fragments of the epidermal cells with polygonal slightly wavy anticlinal walls and covered with thick smooth cuticle. They show anomocytic stomata.
- 2) Uniseriate, multicellular non-glandular trichomes with 4-6 short basal cells and one long whip-like terminal cell.
- 3) Fragments of vascular tissue showing annular, spiral and pitted lignified vessels in addition to few tracheids from the leaf petiole.
- 4) Fragments showing isobilateral mesophyll with 3-4 rows of upper and lower palisade cells.
- 5) Fragments from the cortex showing large rounded or polygonal thin walled parenchyma.
- 6) Fragments of numerous branching and anastomosing laticiferous ducts.

The stem:

A transverse section of the stem (Fig. 6A & B) is somewhat circular in outline. It shows an interrupted metaderm followed by a parenchymatous cortical tissue lined internally by a single layer of endoderms. The pericycle is parenchymatous and shows few laticiferous ducts followed by the secondary phloem which is parenchymatous interrupted with groups of lignified fibres as well as laticiferous ducts. The meristele is composed of a ring of 10-12 separate unequal collateral vascular bundles surrounding a parenchymatous pith. 4-6 bundles are distinctly larger.

The metaderm:

The metaderm (Fig. 6A & B) is present in old stem. It consists of an interrupted layer of 4-6 rows of irregular suberised compressed cells.

The cortex:

The cortex of the stem (Fig. 6 A) is formed of large round compressed parenchymatous cells. The innermost layer is differentiated as a single row of tangentially elongated, narrow cellulosic cells.

The pericycle:

The pericycle of the stem (Fig. 7) is parenchymatous and consists of 5-7 rows of cellulosic parenchyma cells. The pericycle shows few schizogenous yellow ducts.

The vascular tissue:

The vascular tissue of the stem (Fig. 7A&B) is composed of a ring of 10-12 collateral vascular bundles separated by wide medullary rays. Each vascular bundle



Fig. 4C x 50
T.S. of the petiole.

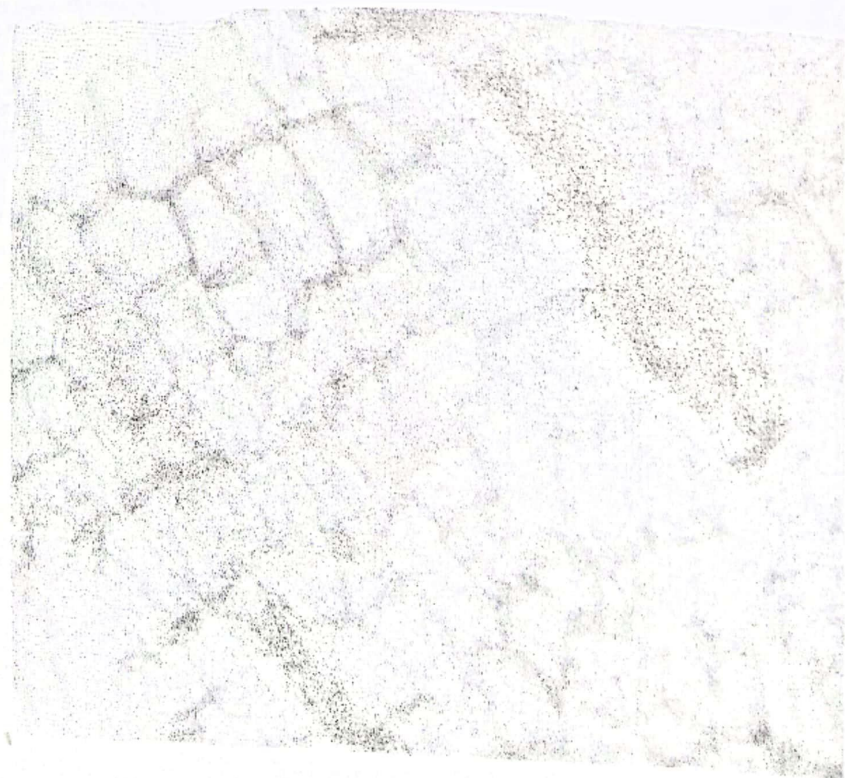


Fig. 4D x 126
Laticiferous ducts



Fig. 4E x 126
Non glandular trichomes.

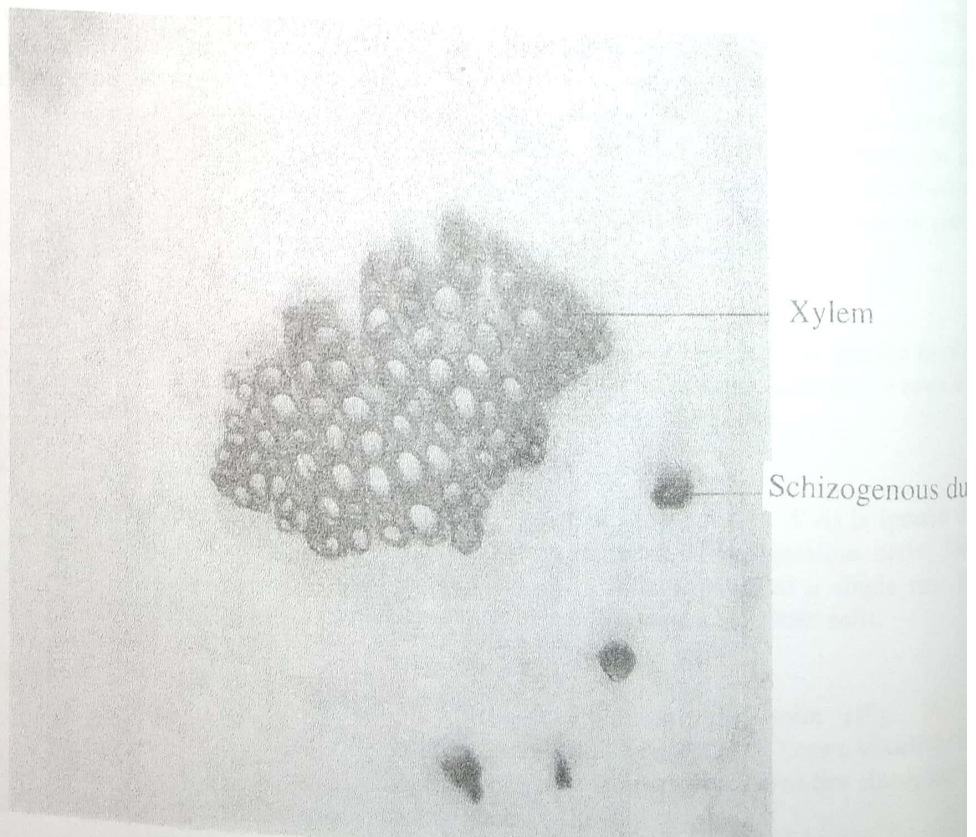


Fig. 5 x 126
T.S. of the petiole (the vascular bundle).

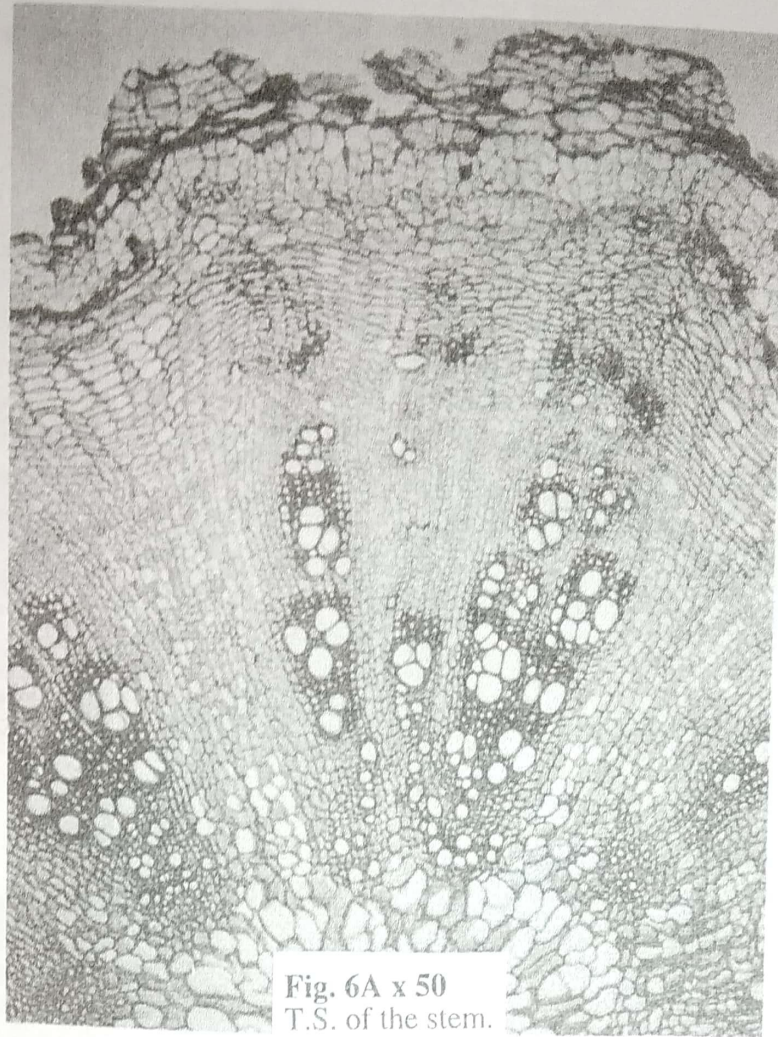
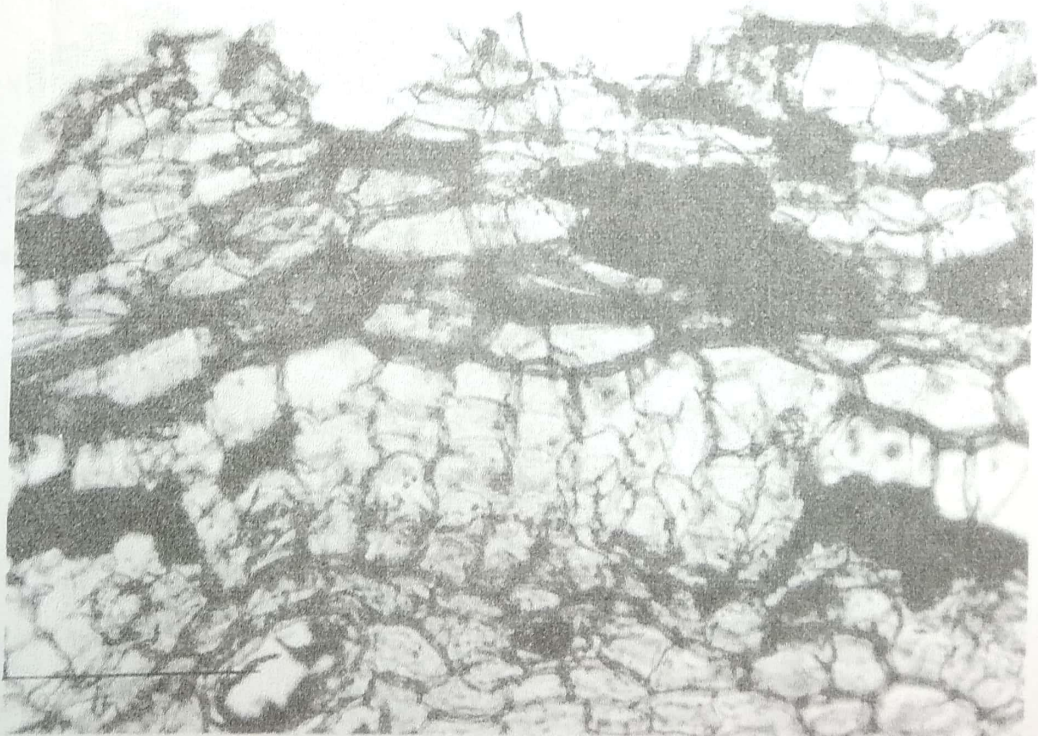


Fig. 6A x 50
T.S. of the stem.



Rhytidoma

Shisogenous duct

Fig. 6B x 126
The metaderm

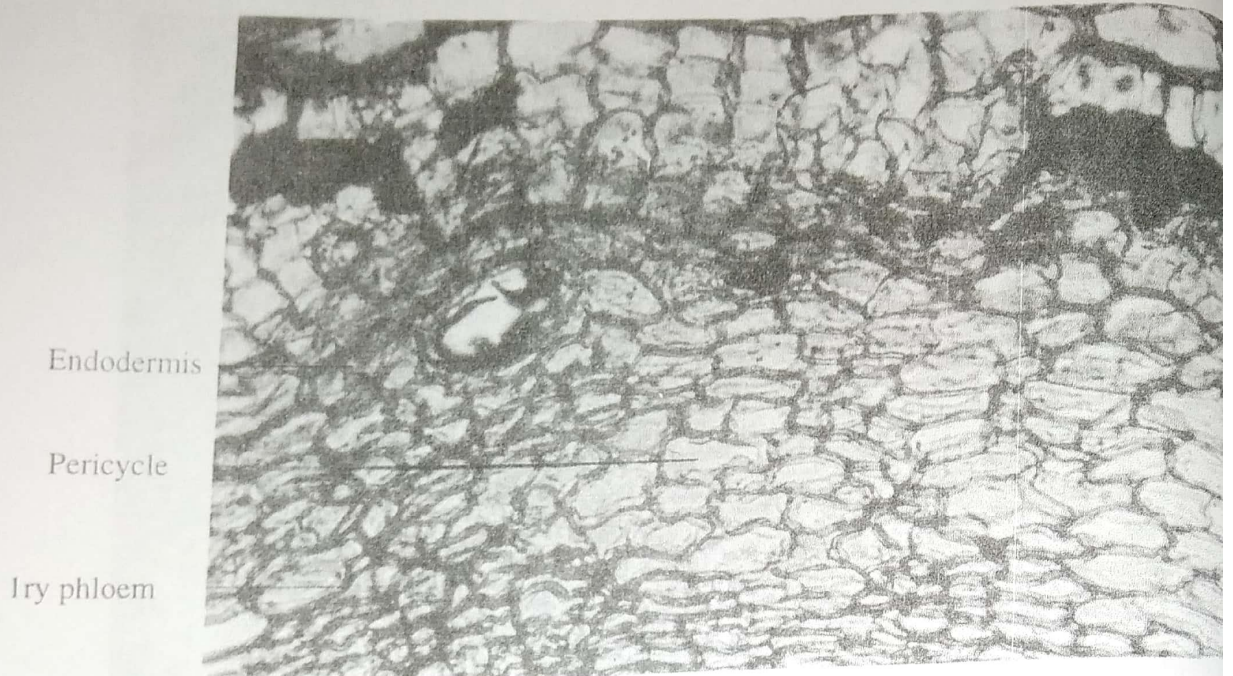


Fig. 6C x 126
T.S. of the stem in the pericycle region.

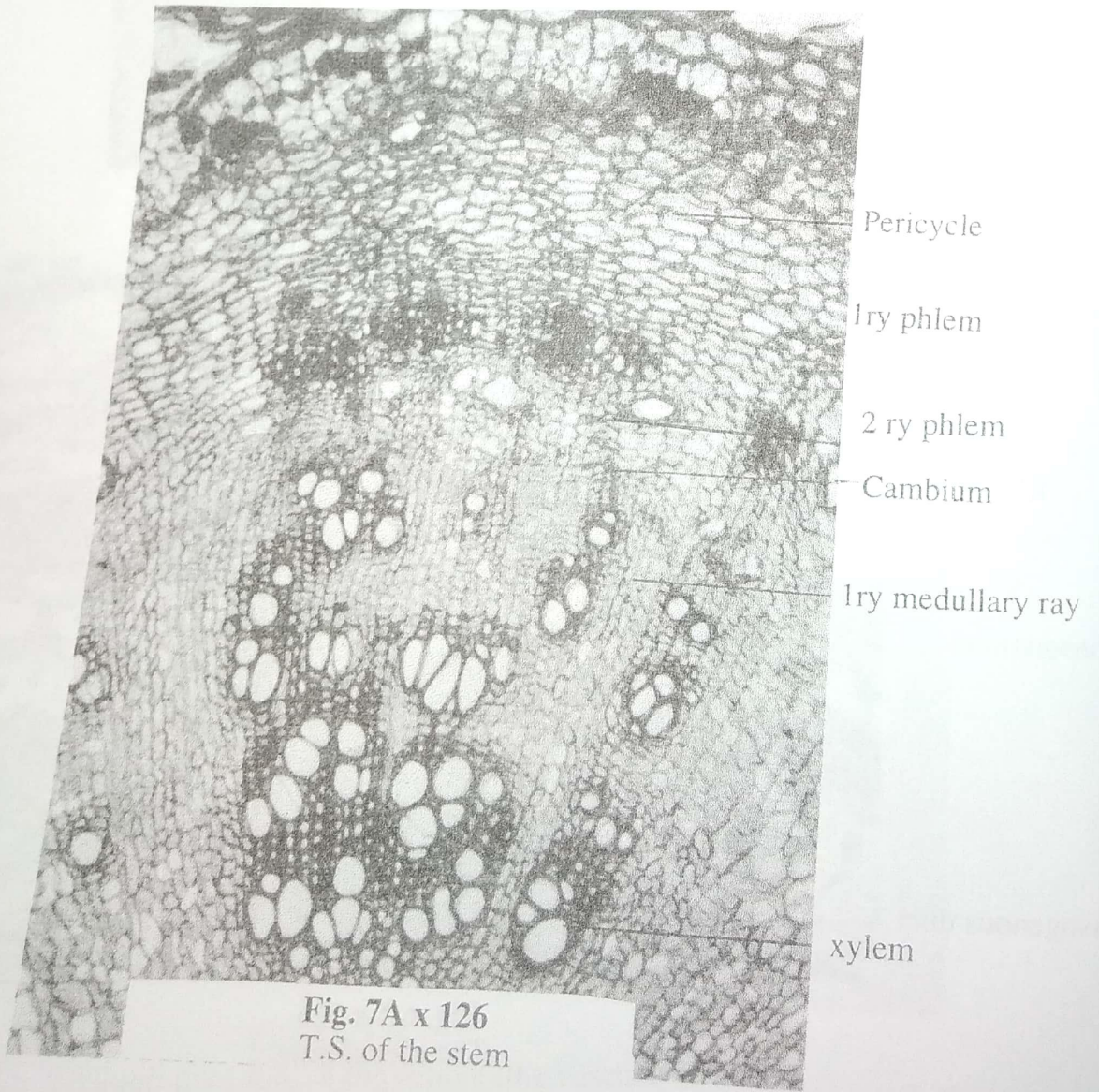


Fig. 7A x 126
T.S. of the stem

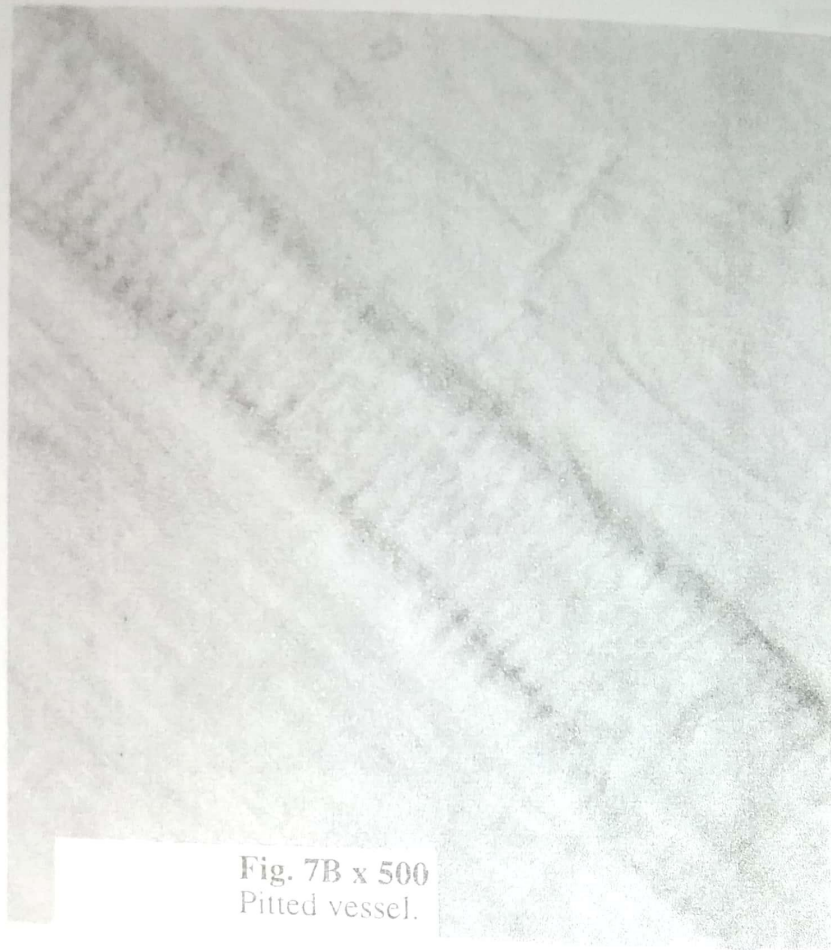


Fig. 7B x 500
Pitted vessel.



Fig. 7C x 500
Wood fiber.

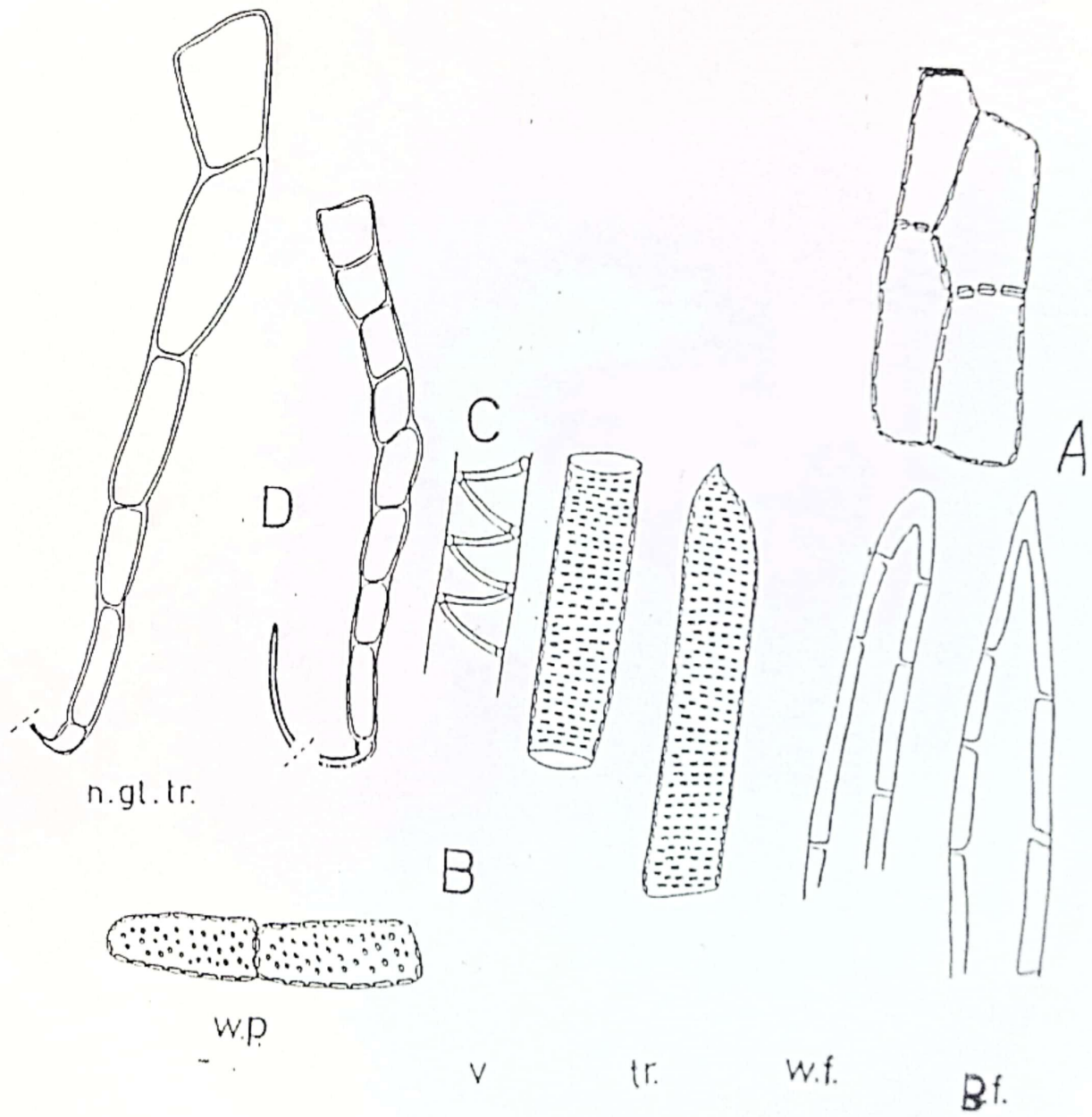


Fig. 8:
Isolated elements of stem (All x 200).
b.f. bast fiber; n. gl. t., non glandular trichomes; tr., tracheid; v., vessel; w.p., wood parenchyma.

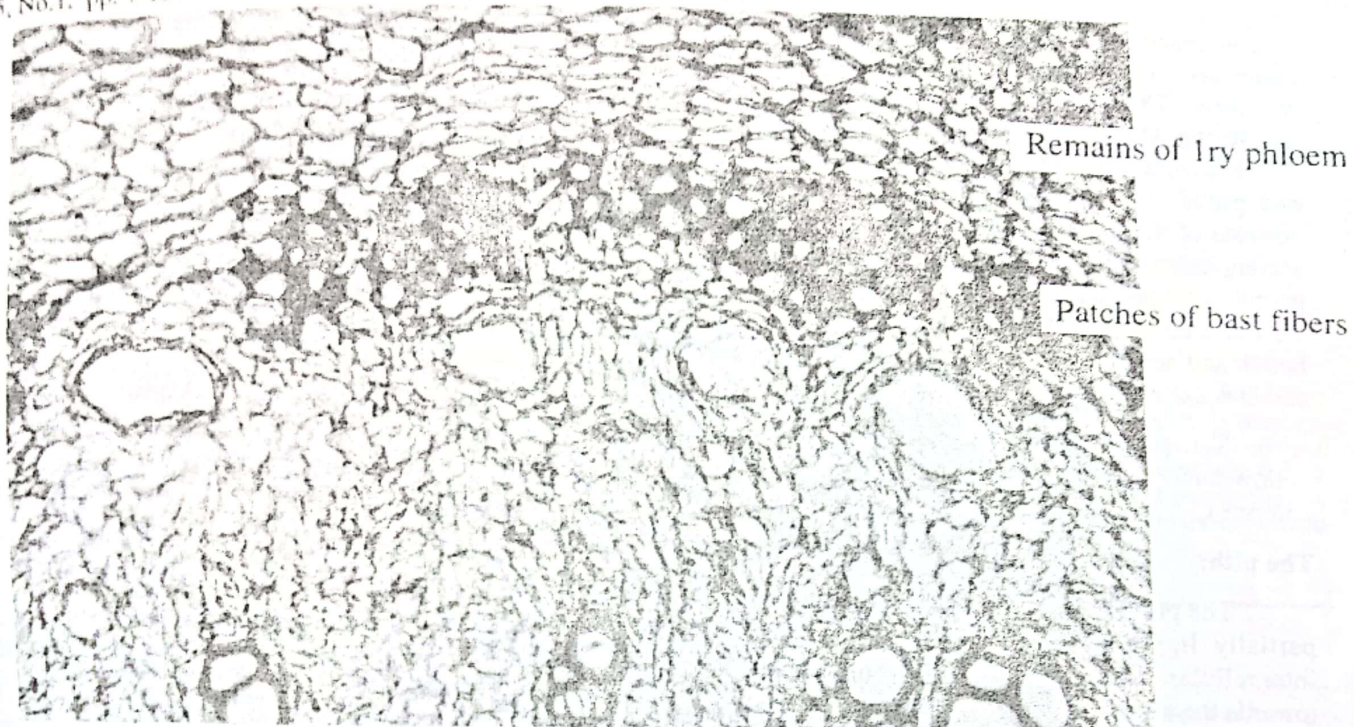


Fig. 9 x 31.25
The bast fiber

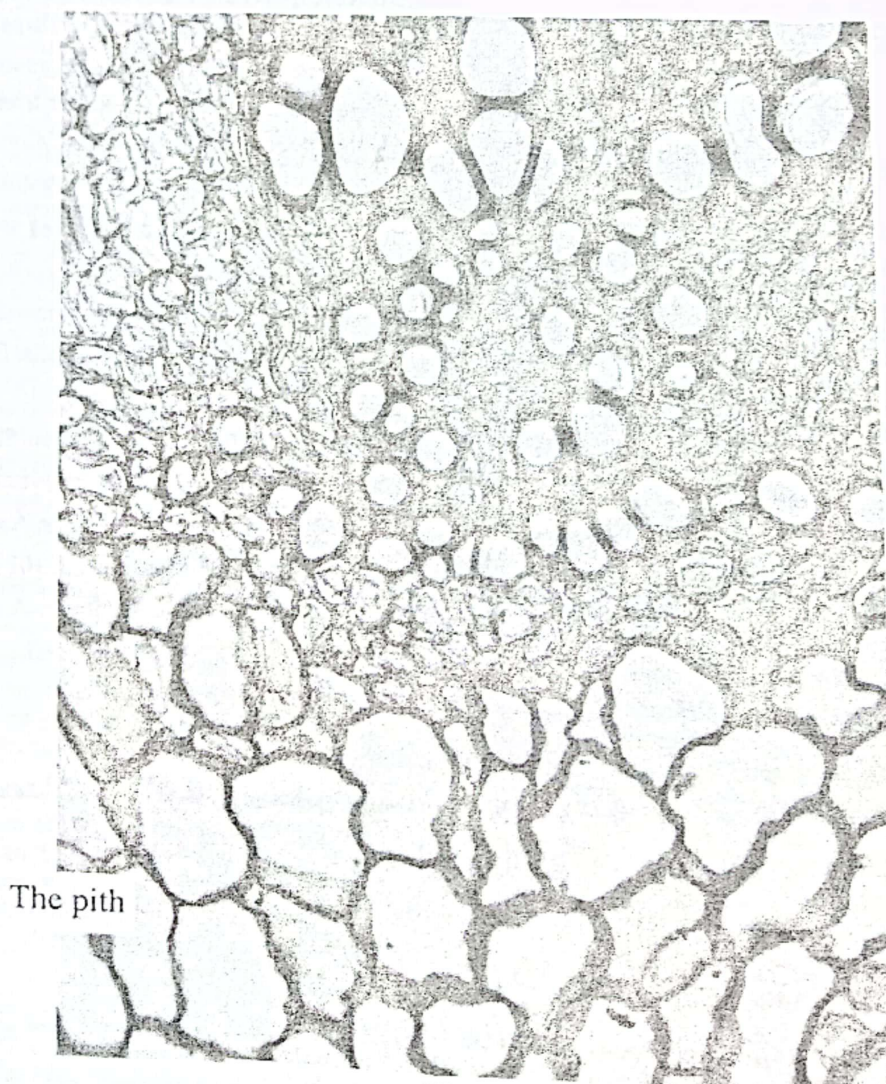


Fig. 10 x 126
The pith

is composed of a radiate lignified xylem, which is composed of spiral, annular and pitted vessels (Fig. 8) measuring D6- 35-55 u fusiform, pitted wood fibres measuring D10- 15-20 u and L 110- 180- 255 u; tracheids measuring D10-20-30 u and L 110-130-150 u and pitted lignified wood parenchyma. The phloem consists of thin walled cellulosic elements, sieve tubes accompanied by narrow companion cells, thin cellulosic parenchyma and bast fibres (Fig. 9). The fibres (Fig. 8) are lignified thickened with slightly pitted walls narrow lumen and acute apices. They measure L270-320-380 u and D 4-2-20u.

The phloem (Fig. 9) shows 1-3 schizogenous yellow ducts (not stained by Sudan III, iodine or ferric chloride).

The pith:

The pith is composed of moderately thick walled partially lignified parenchyma (Fig. 10) with wide intercellular spaces and the cells increased in size towards the center, they measure D15-32-50 u.

The cells of the primary medullary rays, are lignified pitted in the old stem and united by the pericyclic fibres.

Calcium oxalate crystals are completely absent.

The powdered stem:

The powdered stem (Fig. 7B, C & D) is brownish-green in colour with a slight odour and slightly bitter tast. It is characterized microscopically by the following:

- 1- Fragments of polygonal, suberised, thin-walled cells of the metaderm.
- 2- Fragments of lignified wood fibres isolated or in groups, the fibres with moderately thick walls and acute or blunt apices.
- 3- Fragments of lignified, spiral, annular and pitted vessels.
- 4- Fragments of lignified, pitted tracheids with blunt apices.
- 5- Fragments of polygonal, slightly thick-walled lignified parenchyma of the pith.
- 6- Fragments of branching laticiferous ducts showing yellowish brown contents.

CONCLUSION

From the previously mentioned study, one can conclude that the characteristic feature of *Aegialophila cretica* leaf and stem are the following:

- 1- The plant is stemless or having a short-stem, somewhat fleshy, perennial. Leaves are undivided or with few minute side-lobes below the blade.
- 2- The epidermis of the leaf is formed of polygonal cells with straight or slightly wavy anticlinal walls and covered with thick smooth cuticle.
- 3- The pericycle of the leaf is collenchymatous and shows numerous branching and anastomosing laticiferous ducts which are also present to lesser extent in the phloem of the stem.
- 4- The metaderm of the stem consists of suberized walls.
- 5- The xylem of the stem is lignified showing spiral, and pitted vessels, tracheids, wood fibres and pitted wood parenchyma.
- 6- The leaf and stem are completely free from calcium oxalate crystals.
- 7- The pith is composed of moderately thick-walled cellulosic parenchyma with wide intracellular spaces and no sclerenchymatous fibres are present c.f. *Aegialophila pumila*
- 8- Complete absence of glandular trichomes both in the leaf and stem c.f. *Aegialophila pumila*. (4).

REFERENCES

1. Tackholm, V., "Students Flora of Egypt." 2nd Edition, Cairo University, p. 541 (1974).
2. Abou Shoer, M.I., "A pharmacognostical Study of *Aegialophila Pumila*" M. Ph Thesis, Faculty of Pharmacy, Alexandria University (1980).
3. El-Masry, S., "Omar, A.A.; Abou Shoer, M. and Saleh, M.R.; *Planta Medica*, 42, 199 (1981).
4. Saleh, M.R.; El-Masry, S.; Omar, A.A. and Abou-Shoer, M.I., *Egypt. J. Pharm. Sci.*, 23, 101 (1982).
5. Saleh, M.R.; El-Masry, S.; Omar, A.A. and Abou-Shoer, M.I., *Egypt. J. Pharm. Sci.*, 23, 283 (1982).

الصفات العيانية والمجهريّة لنبات "ايجياالوفيليا كريتিকা" بواس وهلدن

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