Bull. Pharm. Sci., Assiut University,
Vol. 13, Part 1, PP 9-24

MACRO- AND MICROMORPHOLOGY OF THE STEMS AND LEAVES OF *FICUS INFECTORIA* (ROXB.)

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ABSTRACT

The macro and micromorphology of the stem and leaves of Ficus infectoria (Roxb.) are presented with the aim of finding their characters by which they could be identified and differentiated, both in the entire and powdered forms.

INTRODUCTION

Ficus infectoria (Roxb.) broad-leaf fig (Family Moraceae) is a large spreading deciduous, fast growing tree [1] indigenous to South Africa and cultivated in Egypt for its shade.

Some *Ficus* species are used medicinally for treatment of leprosy, ulcers, scrofula, chest conditions and cough [2,3]. The latex of various species has been used as laxative, emolient, diuretic, anthelmintic and in treatment of warts [2]. From the genus Ficus, coumarins and flavonoids were isolated and studied [4,5]. In the present work, the macro- and micromorphological features of the stems and leaves of *ficus infectoria* (Roxb.) are illustrated. The phytochemistry of the plant is currently under investigation.

Material:

Collections were made from trees cultivated in Experimental Station of Faculty of Agriculture, Assiut University and identified by Prof. Dr. I. Hassan, Professor of floriculture and Horticulture, Faculty of Agriculture, Assiut University.

Fresh stems and leaves, as well as, preserved samples in a mixture of alcohol - glycerin - water (1:1:1) were used.

Habitat:

Ficus infectoria (Roxb.) is a large evergreen tree attaining up to 15 meters in height. The tree bears simple coriaceous, ovate to oblong-ovate leaves. The flowers are minute yellowish-green and appear during summer season. Fruits are succulent, enlarged hollow, cup-shaped closed receptacles, enclosing achene-like bodies (syconus). They are yellowish-brown when ripe.

MACROMORPHOLOGY

1-The Stem : (Fig. 1)

the main trunk of the plant is erect, cylindrical, woody, monopodially-branched, reaching about 5-12 meters in height and 50-80 cm in diameter. The outer surface is pale-brown and rough, wrinkled and sometimes shows lenticels. The terminal and lateral branches are thinner and have short internodes (about 2-5 cm in length). They are green, glabrous to naked eye and faintly longitudinally striated, the older lower parts are brownish, with rough, longitudinally wrinkled surface and bear scars of fallen leaves. The stem is odourless and with a characteristic acrid taste.

The bark is hardly separated from the wood. The outer surface is greenish to reddish-brown with longitudinal wrinkles, transvers fissures and lenticells.

2-The Leaves: (Fig. 1)

The plant carries alternate, exstipulate, simple leaves. The leaf is ovate or oblong-ovate with entire or subundulate margin and acuminate apex, coriaceous texture and symmetric cordate base. The leaves measure about 9-14 cm in width at its widest part. Both surfaces are glabrous; the upper surface is dark green in colour while the lower one is lighter. Secondary veins are 8-10 pairs joined by arching intramarginal veins and distinct reticulate venation in between. The leaf possesses a faint characteristic odour and bitter acrid taste.

MICROMORPHOLOGY

1-The stem:

A transverse section through the young stem (Fig. 2A) is nearly circular in outline. It shows an epidermis accompanied by a layer of 3-4 rows of paranchymatous cells. The cortex is parenchymatous and traversed at its outer third by a complete ring of about 3-4 rows of sclereides which is accompanied at its anterior by collenchyma arranged in 2-3 rows. Parenchyma cells of the cortex contain prismatic and cluster crystals of calcium oxalate. The endodermis is indistinct.

The pericycle consists of groups of lignified fibres alternating with parenchyma and surrounded by crystal sheath. The vascular tissue is formed of a number of collateral continuous radiating bundles. Each bundle consists of an outer phloem and inner radiating xylem. The phloem and xylem are traversed by bi- and triseriate medullary rays. Patches of intraxylary phloem are present at the periphery of the wide parenchymatous pith.

The Epidermis: (Fig. 3A, B)

In transverse section appears as one row of square to subrectangular cells, covered with thick smooth cuticle. In surface view (Fig. 2B), the cells are polygonal, somewhat axially elongated with straight anticlinal walls and measure 38-50-63 μ in length, 20-23-25 μ in width and 17-20-23 μ in height. The epidermal cells are covered with thick smooth cuticle and stomata are not observed. Few unicellular non-glandular trichomes covered with thick smooth cuticle, measure from

75-160-175 μ in length and 15-18-23 μ in width are observed.

The Cortex: (Fig. 3A, B)

Is parenchymatous and traversed at its outer third by a complete ring of about 3-4 rows of lignified stone cells with thick walled and moderately wide lumina and measure about 60-75-88 μ in length and 27-35-40 μ in width. The parenchyma cells of the cortex contain prismatic and cluster crystals of calcium oxalate measuring 23-25-33 μ in length and 25-34-38 μ in diameter respectively. The endodermis is indistinct.

The Pericycle: (Fig. 4)

The fibres are elongated, straight and have thick lignified walls, moderately wide lumina and blunt to rounded apices, they measure from 20-23-25 μ in diameter and 500-600-650 μ in length. Sometimes the surrounding parenchyma cells contain prismatic crystals of calcium oxalate, forming a crystal sheath.

The Vascular system: (Fig. 3A, B)

The phloem is formed of sieve tubes, campanion cells and phloem parenchyma. The latter contain few prismatic and cluster crystals of calcium oxalate. Some laticiferous tubes, which are non-branched and with contents that stain yellowish-brown with iodine (T.S.) are observed in the phloem. It is separated from the xylem by a narrow cambial ring. The xylem consists of lignified scalariform, spiral and pitted vessels accompanied by lignified pitted wood parenchyma. Wood fibres have lignified walls, moderately wide to narrow lumina and acute ends. The vessels measure 25-28-30 μ in diameter. Elongated tracheids with lignified pitted walls are observed. The medullary rays are mainly biseriate of subrectangular cells with lignified walls.

The Pith:

Is formed of somewhat large, rounded isodiametric, thin-walled parenchyma with wide intercellular spaces. The cells contain prismatic and cluster crystals of calcium oxalate. The prisms measure from 20-22-25 μ in length and the clusters from 25-30-33 μ in diameter.

The Powder: (Fig. 4)

Powdered stem of *Ficus infectoria* (Roxb.) is dark green in colour having a faint odour and bitter acrid taste. It is characterised microscopically by the following:

1-Fragments of ploygonal, mainly axially elongated epidermal cells with straight anticlinal walls and covered with thick cuticle, stomata are not observed.

2-Unicellular, non-glandular trichomes covered with thick cuticle and acute apices are observed.

2-Fragments of thin-walled parenchyma cells either from the cortex or the pith, containing prismatic and cluster crystals of calcium oxalate. The cells from the pith are larger in size.

4-Fragments showing pericyclic fibres with straight, thick lignified walls, moderately wide lumina and blunt to rounded apices and the fragments are surrounded by crystal sheath.

5-Fragments of lignified xylem vessels with spiral, scalariform and pitted thickenings.

6-Wood fibres with straight, moderately wide to narrow lumina, acute ends and lignified walls.

7-Fragments showing lignified and pitted parenchyma cells of the xylem in addition to pitted and lignified fragments of medullary ray cells.

8-Fragments of tracheids, with rounded tips and lignified pitted walls.

9-Laticiferous tubes which are simple, non-branched and containing granular contents, staining yellowish-brown with iodine (T.S.).

10-Fragments of lignified stone cells with thick walls and mostly branched narrow lumina.

11-Starch is absent.

2-The Leaves:

A-The Lamina:

A transverse section through the lamina (Fig. 5A, D) is somewhat biconvex in outline. It shows an upper and lower epidermises, a mesophyll consisting entirely of palisade cells, no spongy parenchyma. The palisade is formed entirely of elongated columnar cells. The palisade is interrupted by vascular bundles containing slightly lignified xylem and phloem, showing upper and lower layers of parenchyma. It is interrupted in the midrib region by mass of hypodermal collenchyma. The vascular system in the midrib region is represented by a large crescent-shaped vascular bundle accompanied by sveral additives and inverted smaller ones oriented to form a dissected ring enclosing central parenchyma. The latter contains groups of intraxylary phloem. Two lateral vascular bundles are also observed. All the system is surrounded by a pericycle formed of a ring of groups of fibres interrupted by parenchyma.

The Epidermis:

The upper epidermal cells (Fig. 5C) are polygonal, isodiametric with straight anticlinal walls and covered with thin smooth cuticle. They measure from 60-75-90 μ in height. Hairs and stomata are not observed.

The lower epidermal cells (Fig. 5B) are polygonal, nearly isodiametric to elongated with slightly wavy anticlinal walls and covered with thin smooth cuticle. They measure 25-38-50 μ in length, 13-23-30 μ in width and 10-13-15 μ in height.

Stomata of anomocytic type surrounded by 4-6 cells are noticed. The cells carry few glandular structure consisting of about 10 radiating cells, containing wax (dissolved by warming with petroleum ether). Sometimes described as wax gland [6] with no stalk.

The Cortical Tissue: (Fig. 6A, B)

the upper and lower collenchyma are formed of 4-5 rows of rounded collenchyma cells. The parenchyma is rounded and those adjacent to the vascular bundles contain cluster and few prismatic crystals of calcium oxalate, measuring 18-20-25 μ in diameter and 20-25-28 μ in length respectively. Few cells contain fixed oil globules which stain red with sudan III (T.S.).

The Mesophyll: (Fig. 5D)

The uppermost row of the palisade shows longer columnar cells than the others.

The Vascular system: (Fig. 6A, B)

The pericyclic fibres are straight elongated and have lignified moderately thick walls, narrow lumina, acute apices and measure 570-650-700 μ in length and 20-25-28 μ in diameter. The phloem is formed of soft cellulosic elements showing sieve tubes, companion cells and phloem parenchyma. Laticiferous tubes are observed which have granular contents, staining yellowish-brown with iodine (T.S.). The xylem shows spiral, scalariform and pitted, lignified vessels, measuring 25-27-30 μ in diameter. Medullary rays are bi- and triseriate and show quadrangular to rectangular pitted, lignified cells in the xylem region.

B-The petiole:

A transverse section through the petiole (Fig. 7A) is nearly similar to that of the stem. The cortex contain a ring of 1-2 rows of lignified thick walls and moderately wide lumina stone cells, 3-4 rows of collenchymatous cells and 2-3 rows of rounded parenchyma cells.

The Epidermis: (Fig, 7B)

It consists of polygonal mostly isodiametric cells with straight anticlinal walls and covered with smooth cuticle, they measure 15-35-40 μ in length, 10-15-18 μ in width and 14-16-19 μ in height.

The Cortex: (Fig. 8)

Consists of a ring of 1-2 rows of lignified thick walled and moderately wide lumina stone cells followed by 3-4 rows of rounded collenchymatous cells and 5-7 rows of nearly rounded parenchyma cells containing prismatic and cluster crystals of calcium oxalate measuring 20-22-25 μ in length and 30-32-35 μ in diameter respectively.

The Pericycle: (Fig 8)

The fibres are similar to that of the stem and measure 25-27-30 μ in diameter and 580-620-650 μ in length.

The vascular system: (Fig. 8)

There is no difference in vascular system from that of the stem, the cambium is indistinct, xylem vessels measure 22-25-30 μ in diameter. The pith is formed of somewhat rounded to isodiametric thin walled parenchyma with wide intercellular spaces. The cells contain prismatic and cluster crystals of calcium oxalate which measure 22-25-27 μ in length and 28-30-32 μ in diameter respectively.

The Powder: (Fig. 9)

The powdered leaves are dark-green in colour with characteristic odour and bitter acrid taste. It is characterised microscopically by the following:

1-Fragments of the upper epidermis of the leaves showing polygonal, nearly isodiametric cells with straight anticlinal walls and covered with thin smooth cuticle.

2-Fragments of lower epidermis of the leaves showing polygonal, nearly isodiametric cell with slightly wavy anticlinal walls bearing ranunculaceous stom-

ata and sometimes showing glandular structure consisting of 10 radiating cells.

3-Fragments of epidermal cells of the petiole consisting of polygonal, small, isodiametric cells covered with smooth cuticle.

4-Fragments of the cortical parenchyma cells containing fixed oil globules, in addition, other containing prismatic and cluster crystals of calcium oxalate.

5-Fragments of pericyclic fibres with straight, slightly lignified walls, narrow lumina and acute apices and the fragments are surrounded by crystal sheath.

6-Fragments of spiral, scalariform and pitted lignified xylem vessels.

7-Fragments of phloem tissue showing laticiferous tubes.

8-Fragments of wood fibres with straight, slightly thick, lignified walls and acute to acuminate apices.

9-Fragments of lignified and pitted parenchyma cells of xylem and pitted lignified fragments of tracheids.

10-No starch granules were observed.

Some Numerical values:

Stomatal number : 23

Stomatal index : 20.3

Vein islet number: 6

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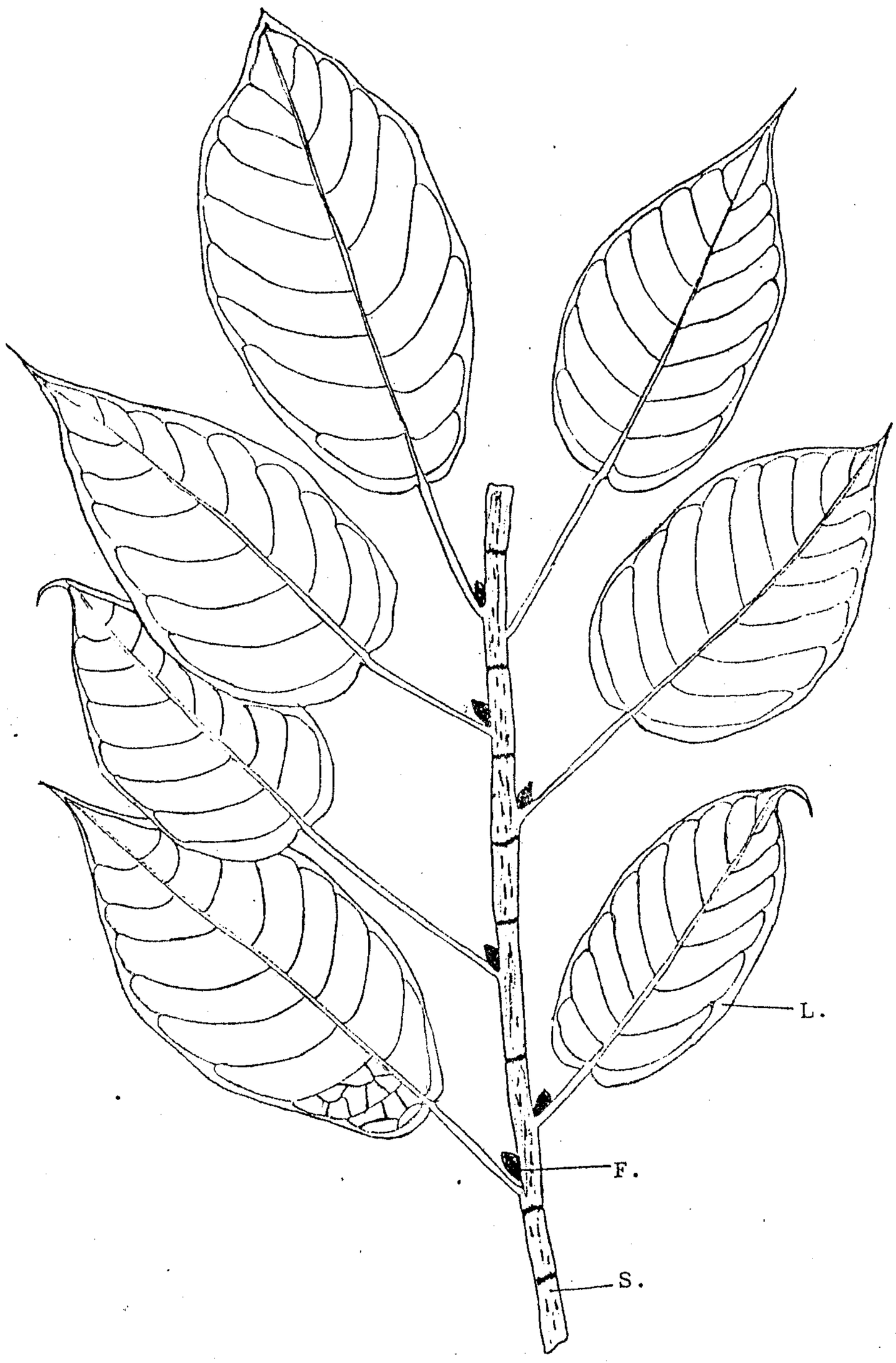
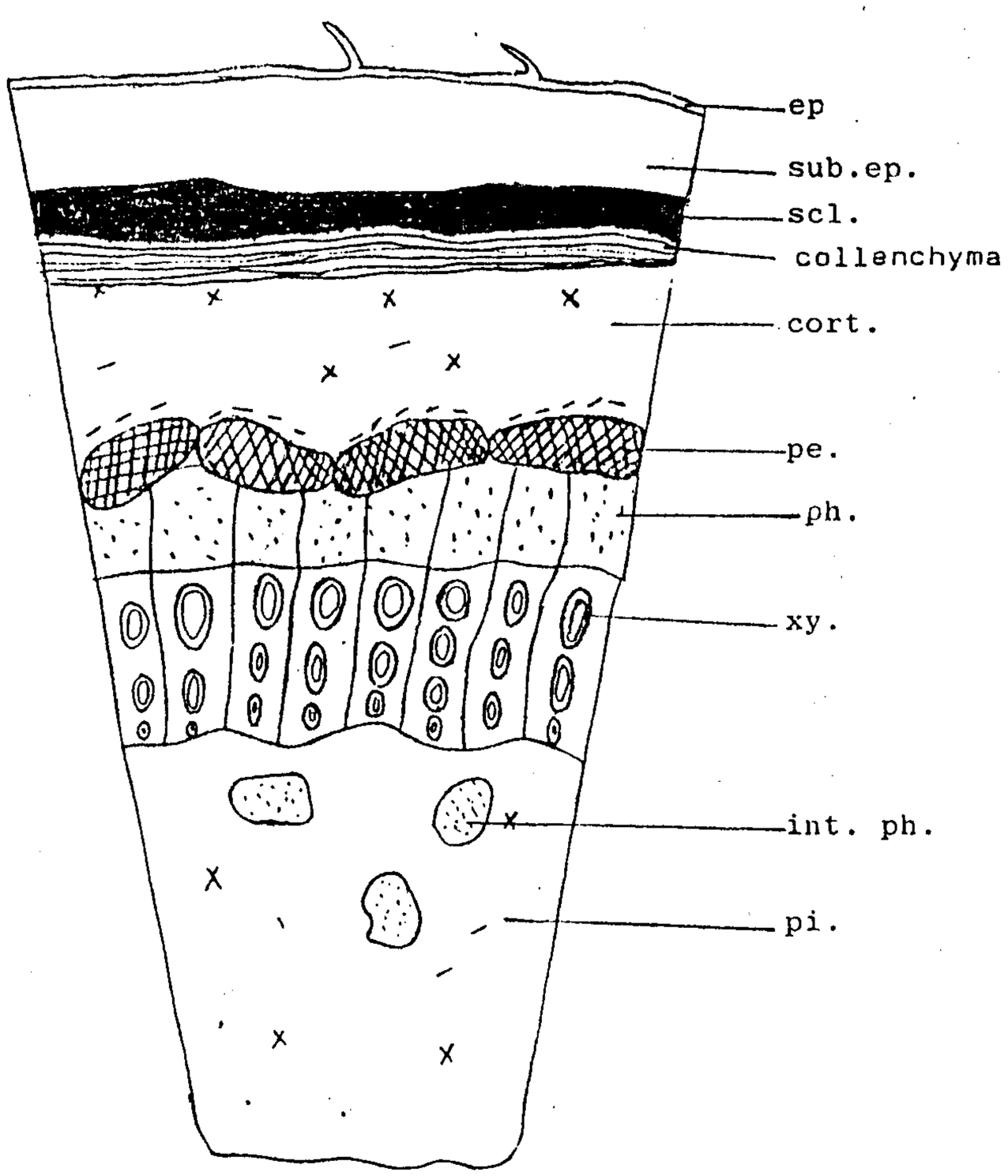


Fig. 1: Sketch of a branch.
F., fruit; L., leaf; S., stem.

x 0.4

A



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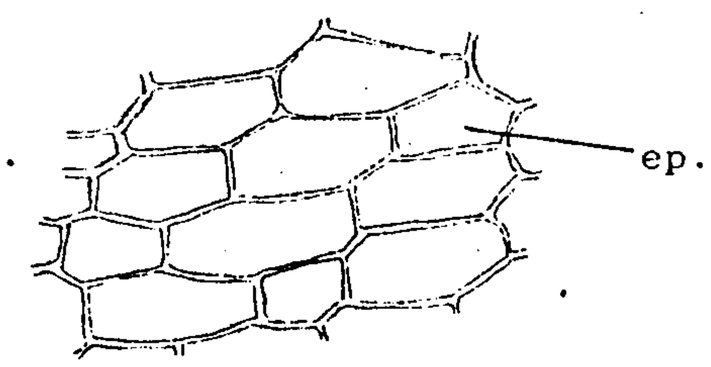

Fig. 2: A. Diagrammatic T.S. of Young stem. x 286

B. Surface preparation of young stem. x 286

cor., cortex; ep., epidermis; int. ph., intraxylary phloem; pe., pericycle; ph., phloem; pi., pith; scl., sclereid, sub. ep., subepidermis; xy., xylem.

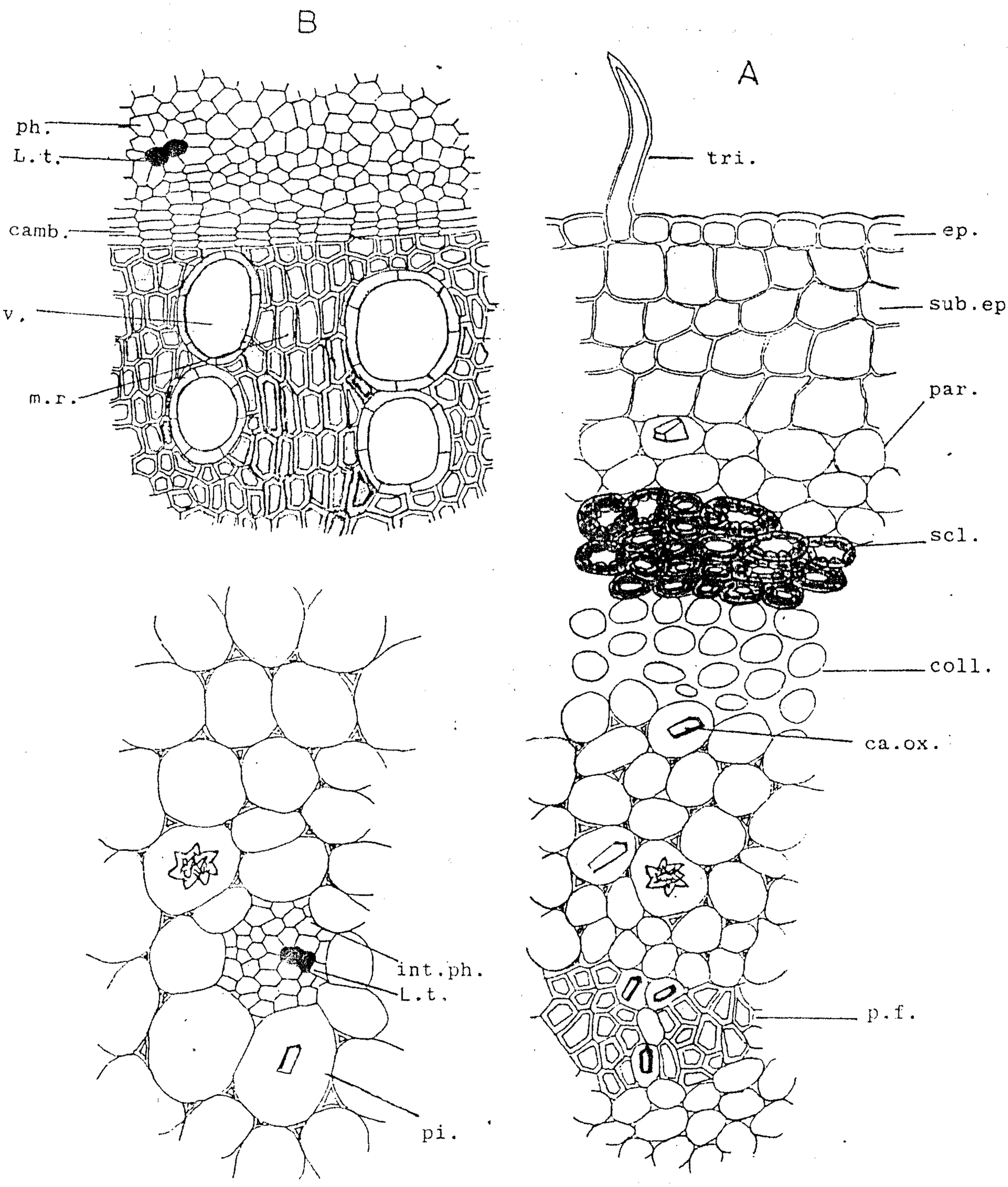

Fig. 3: Detailed T.S. of Young stem. x 232

camb., cambium; coll., collenchyma; ep., epidermis; par., parenchyma; per., pericycle; p.f., pericyclic fibre; ph., phloem; pi., pith; int. ph., intraxylary phloem; L.t., laticiferous tube; m.r., medullary ray; ph., phloem; sub. ep., subepidermis; tri., trichome; v., vessel.

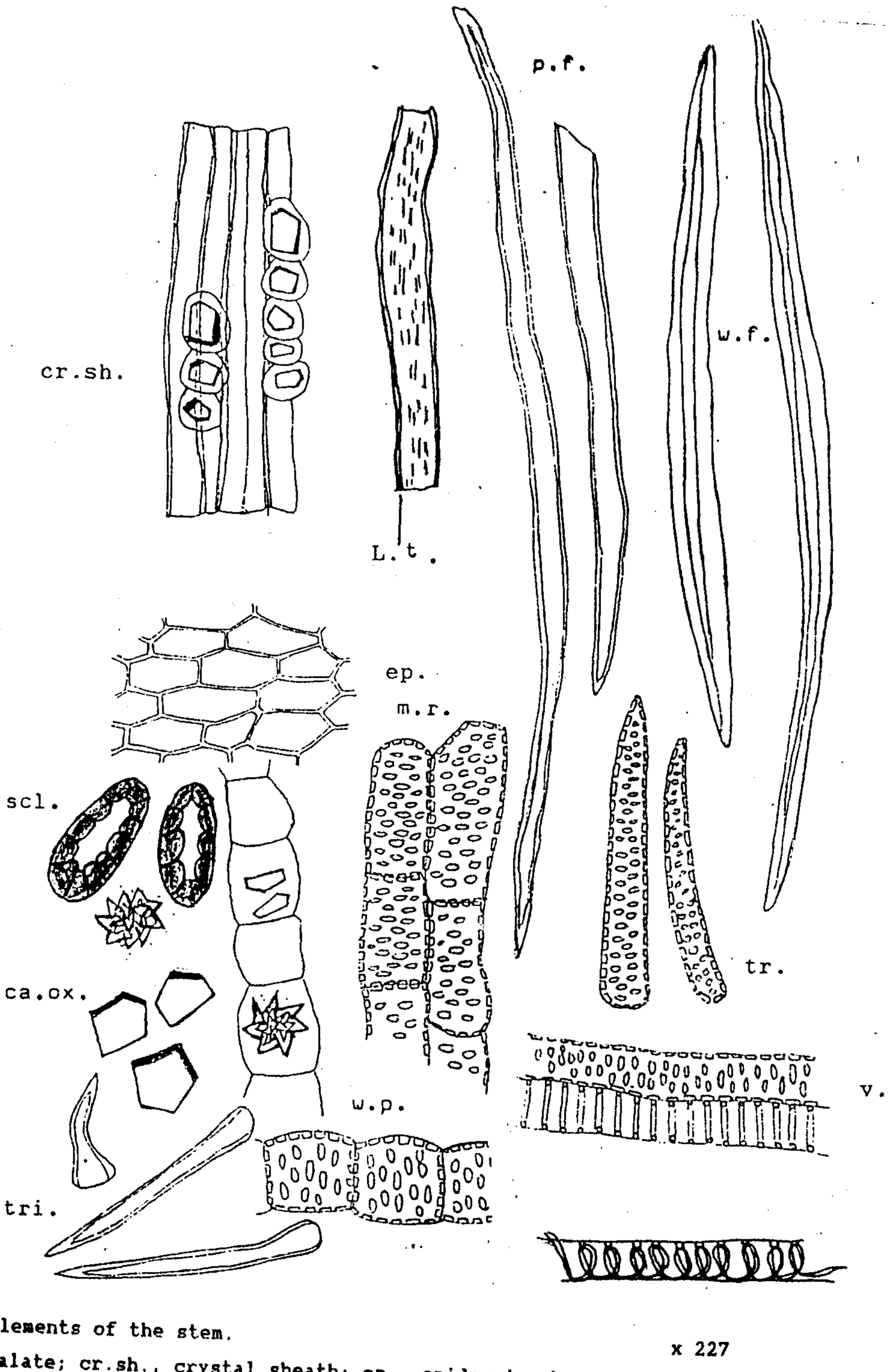

Fig. 4: Isolated elements of the stem. x 227

ca.ox., calcium oxalate; cr.sh., crystal sheath; ep., epidermis; h., hair; L.t., laticiferous tube; m.r., medullary ray; p.f., pericyclic fibre; scl., sclereid; st., stomata; tr., tracheid; tri., trichomes; v., vessel; w.f., wood fibre; w.p., wood parenchyma.

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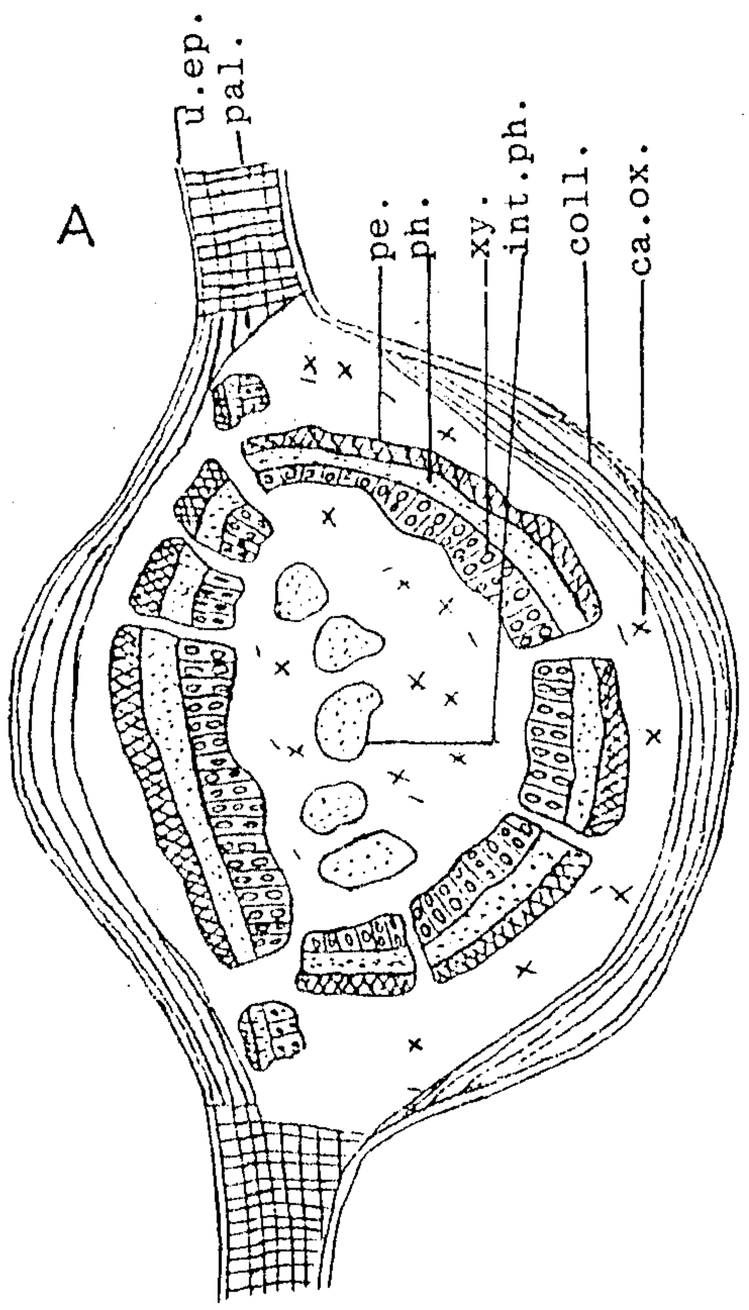

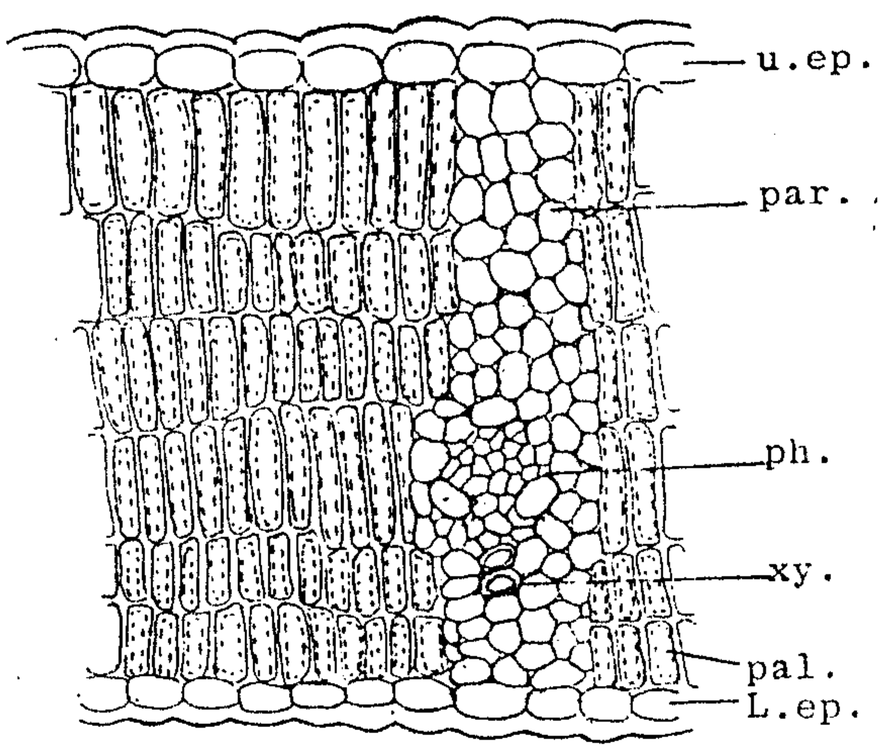

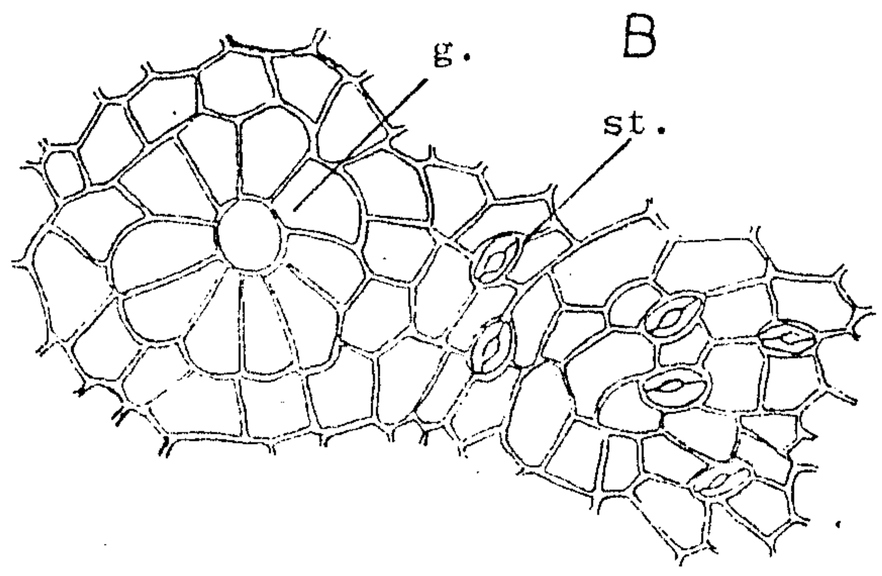

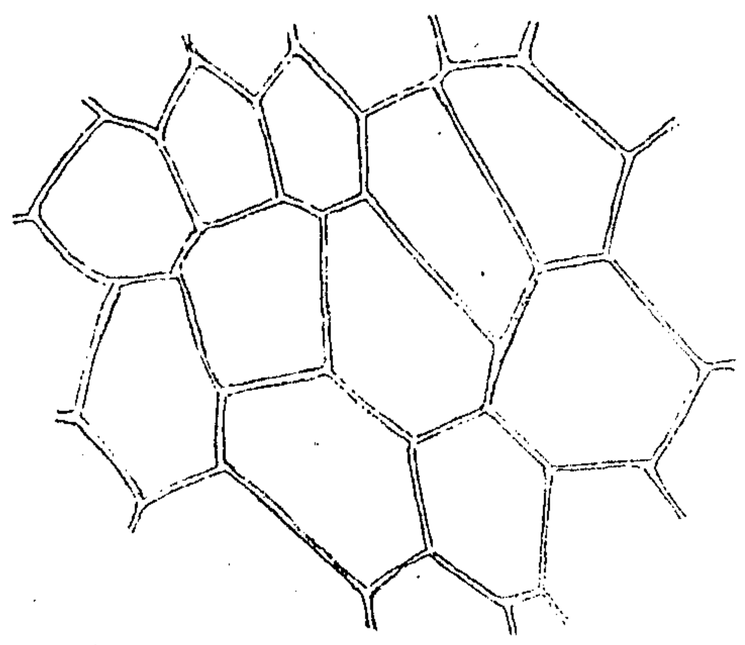

Fig. 5: A. Diagrammatic T.S. of the leaf. x 29
B. Surface preparation of the leaf (lower epidermis). x 228
C. Surface preparation of the leaf (upper epidermis). x 223
D. Detailed T.S. of the lamina. x 23

ca. ox., calcium oxalate; coll., collenchyma; g., gland; int. ph., intraxylary phloem; l.ep., lower epidermis; par., parenchyma; pal., palisade; per., pericycle; ph., phloem; st., stomata; u.ep. upper epidermis; xy., xylem.

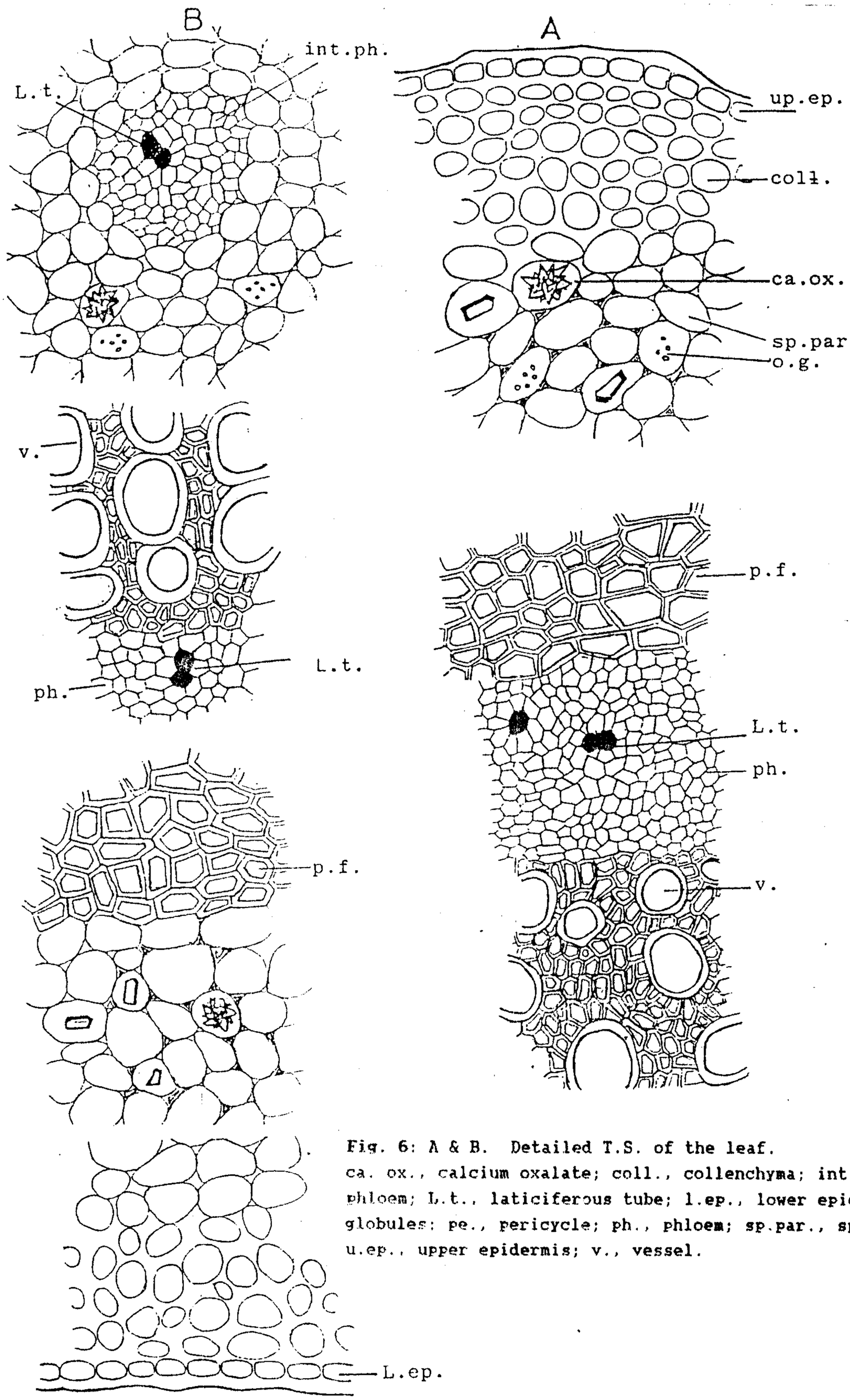

Fig. 6: A & B. Detailed T.S. of the leaf. x 234
ca. ox., calcium oxalate; coll., collenchyma; int. ph., intraxylary phloem; L.t., laticiferous tube; l.ep., lower epidermis; o.g., oil globules; pe., pericycle; ph., phloem; sp.par., spongy parenchyma; u.ep., upper epidermis; v., vessel.

Macro- and Micromorphology of the Stems and Leaves of Ficus infectoria (ROXB.)

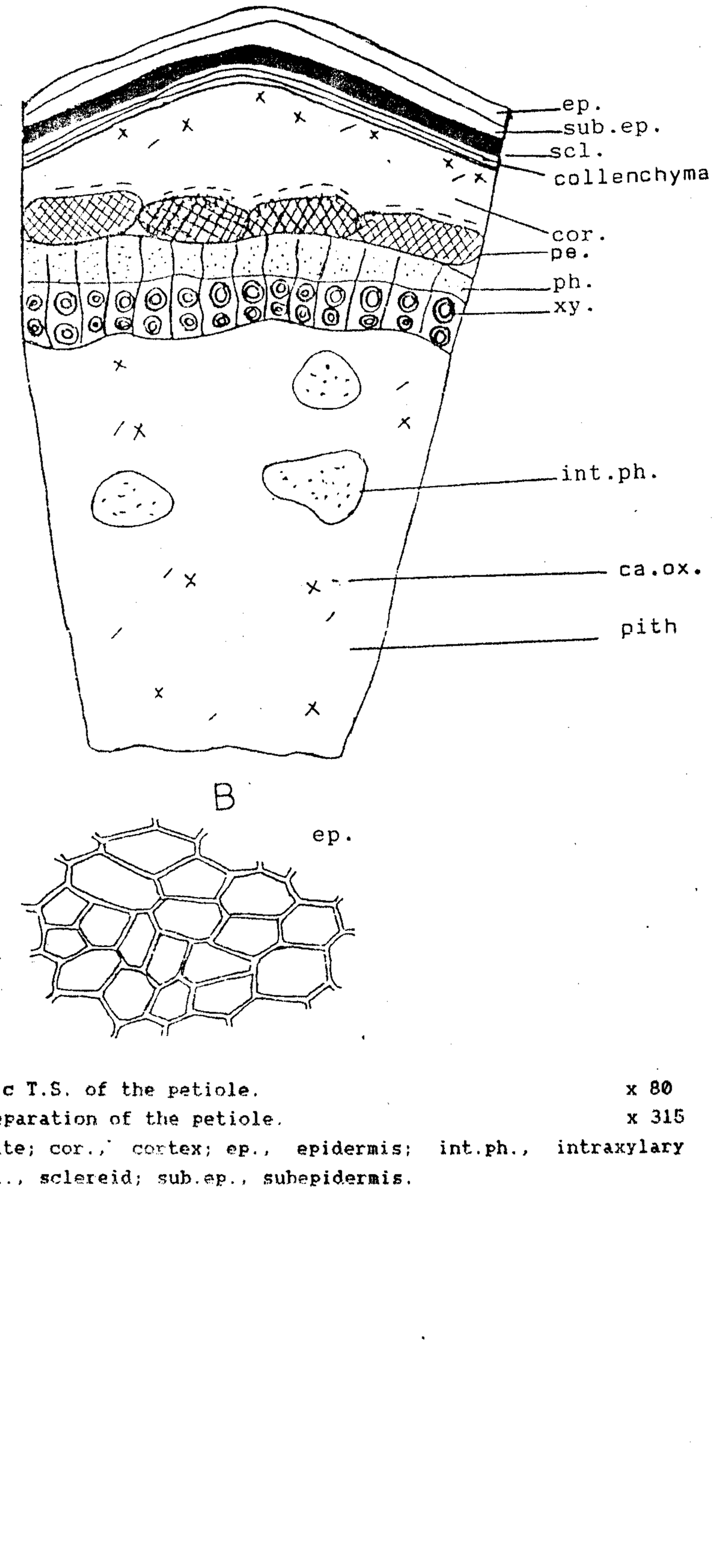

Fig. 7: A. Diagrammatic T.S. of the petiole. x 80
B. Surface preparation of the petiole. x 315

ca.ox., calcium oxalate; cor., cortex; ep., epidermis; int.ph., intraxylary phloem; pi., pith; scl., sclereid; sub.ep., subepidermis.

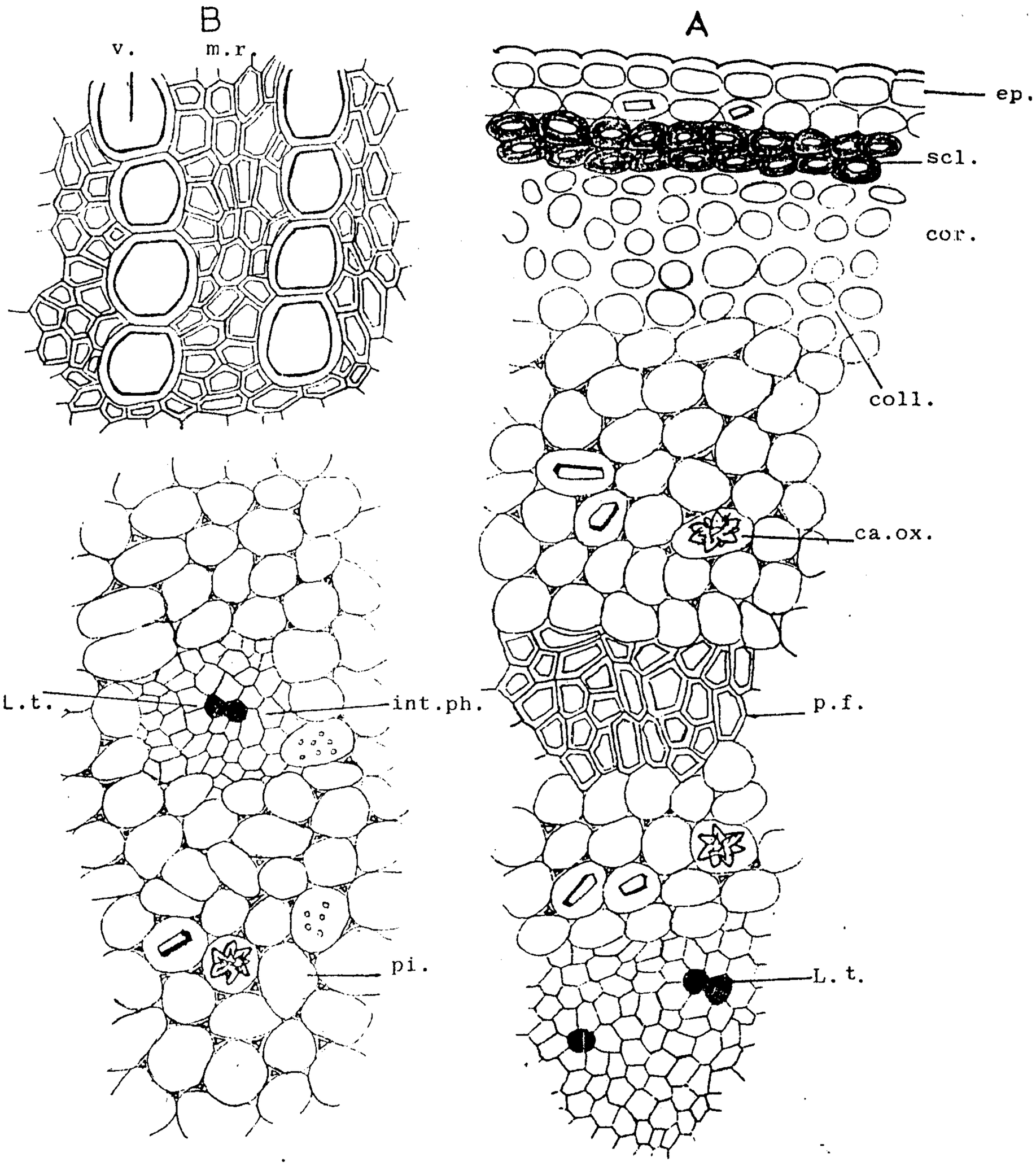

Fig. 8: Detailed T.S. of the petiole. x 274

ca.ox., calcium oxalate; cor., cortex; coll., collenchyma; ep., epidermis; int. ph., intraxylary phloem; L.t., laticiferous tube; pe., pericycle; ph., phloem; pi., pith; scl., sclereid, v., vessel.

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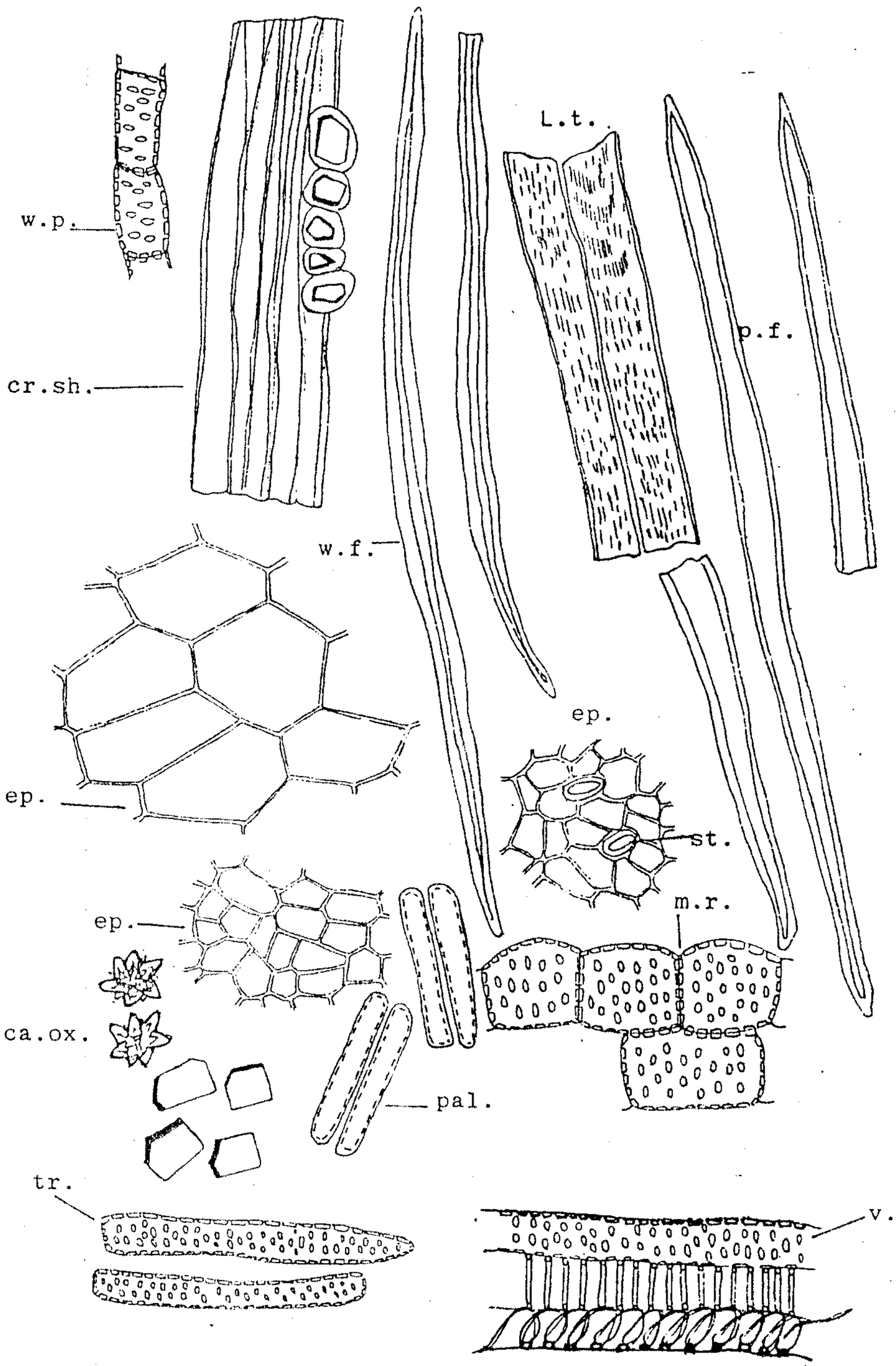

Fig. 9: Isolated elements of the leaf. x 227
ca.ox., calcium oxalate; cr.sh., crystal sheath; ep., epidermis; L.t., laticiferous tube; m.r., medullary ray; pal., palisade; p.f., pericyclic fibre; st., stomata; tr., tracheid; v., vessel; w.f., wood fibre; w.p. wood parenchyma.

الصفات العيانيه والمجهريه لسيقان وأوراق نبات الفيكس انفيكتوريا روكسب

أنعام يونس بخيت

قسم العقاقير - كليه الصيدله - جامعه أسيوط

تزرع أشجار الفيكس انفيكتوريا "روكسب" في الحدائق العامه والطرق وذلك لاغراض الظل.

وقد تبين لنا من المراجع المختلفه أن أنواع كثيره من جنس الفيكس لها استعمالات طبيه شعبيه عديده ولوحظ أن الناس يستعملون ثماره في علاج بعض القرح الجلديه ويجرى الان عمل دراسه للمكونات الكيميائيه لهذا النبات ويشتمل هذا البحث على دراسه تفصيليه للصفات العيانيه والمجهريه لسيقان وأوراق نبات الفيكس انفيكتوريا "روكسب" بهدف التعرف على اجزائه سواء كامله أو على هيئه مسحوق.

Received in 25/1/1990 & accepted in 2/4/1990.