

MACRO-AND MICROMORPHOLOGY OF THE STEMS AND
LEAVES OF *FICUS PLATYPHYLLA* (DEL.)

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ABSTRACT

The macro and micromorphology of the stems and leaves of *Ficus platyphylla* (Del.) 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 platyphylla (Del.) broad-leaf fig (family, Moraceae) is a tree indigenous to South Africa¹ and cultivated in Egypt for its shade in public and private gardens. In a previous publication² the chemical constituents and preliminary anthelmintic activity of the plant were reported.

Some *Ficus* species are used medicinally for treatment of leprosy ulcers, scrofula, chest conditions and cough^{3,4}. The latex of various species has been used as laxative, emolient, diuretic, anthelmintic and in treatment of warts³. In the present work, the macro as well as micromorphological features of the stems and leaves of *Ficus platyphylla* (Del.) are illustrated.

Material :

Collections were made from trees cultivated in Assiut University campus and identified by Prof. Dr.N.El-Keltawi, Professor of Floriculture, 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 platyphylla (Del.) is a small, at times a large, evergreen tree attaining up to 12 meters in height. The tree bears simple, ovate leaves and flowers. 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.

MACROMORPHOLGY1-The Stems : (Fig. 1)

The main trunk of the plant is erect, cylindrical, woody, monopodially-branched, reaching about 3-10 meters in height and 50-70 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 4-10 cm in length), they are green, glabrous and faintly longitudinally striated. The older lower parts are brownish, with rough, longitudinally wrinkled surface and bear scars of fallen leaves. The stems are 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, transverse fissures and lenticells.

Macro-and Micromorphology of the Stems and Leaves of Ficus Platyphylla (Del.).

2- The Leaves : (Fig. 1)

The plant carries alternate, exstipulate, simple leaves. The leaf is ovate to orbicular-ovate or elliptic in shape with entire margin, more or less acute apex, coriaceous texture and symmetric cordate base. The leaves measure about 15-35 cm in length and 13-18 cm in width at the widest part. Both surfaces are glabrous, the upper surface is dark green in colour while the lower one is lighter. Secondary veins are 5-8 pairs, joined by arching intramarginal veins and distinct reticulate venation between. The leaf possesses a faint characteristic odour and bitter acrid taste.

MICROMORPHOLOGY

1- The Stem :

A transverse section through the young stem (Fig. 2,A) is nearly circular in outline. It shows a glabrous outer epidermis accompanied by one row of subepidermal cells. The cortex shows an outer collenchymatous hypodermis and inner parenchymatous layer. The endodermis is indistinct.

The pericycle consists of groups of fibres abutting the vascular bundles and interrupted by parenchyma, surrounding the central cylinder. The vascular tissue is formed of a number of collateral, separated bundles. Each bundle consists of an outer phloem and inner radiating xylem. The phloem and xylem are traversed by uni-or biseriate medullary rays. Patches of intraxillary phloem are present at the periphery of the parenchymatous pith.

The Epidermis : of the young stem (Fig. 2,C), appears in transverse section as one row of square to subrectangular cells, covered with moderately thick cuticle. In surface

view (Fig. 2,B) the cells appear polygonal, somewhat axially elongated with straight anticlinal walls and measure from 48 to 90 μ in length, 22 to 36 μ in width and 15-20 μ in height. The epidermal cells are covered with thick smooth cuticle. Stomata and trichomes are not observed. The epidermal cells are followed by one row of tabular subepidermal cells.

The Cortex : (Fig. 2,C) The outer collenchyma is represented by 7-13 rows of more or less rounded to oval collenchymatous cells. These are followed by 12-15 rows of nearly rounded parenchymatous cells, containing prismatic and cluster crystals of calcium oxalate measuring 20-36 μ in length and 20-60 μ in diameter respectively.

The Pericycle : (Fig. 2,C & 3) The fibres have thick lignified walls, moderately wide lumina and blunt to rounded apices. They measure from 10 to 30 μ in diameter and 800 to 1500 μ in length. Sometimes the neighbouring parenchyma cells contain prismatic crystals of calcium oxalate forming a crystal sheath.

The Vascular System (Fig. 2,C) : The phloem is formed of sieve tubes, companion cells and phloem parenchyma. The phloem shows some laticiferous tubes which stain yellowish-brown with iodine (T.S.). The xylem consists of lignified scalariform, reticulate, spiral and pitted vessels accompanied by lignified, pitted wood parenchyma. Wood fibres are sometimes septated with straight, lignified walls, moderately wide to narrow lumina and acute ends. The vessels measure from 20 -36 μ in diameter. Elongated tracheids with lignified pitted walls are observed. The medullary rays are mainly biseriate, of subrectangular cells with non-lignified walls in the phloem region but lignified and pitted in the xylem region.

Macro-and Micromorphology of the Stems and Leaves of Ficus Platyphylla (Del.).

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 to 40 μ in length and the clusters from 48 to 60 μ in diameter. Several groups of intraxillary phloem consisting of soft cellulosic elements are scattered at the periphery of the pith.

The Powder : (Fig. 3)

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

- 1- Fragments of polygonal, mainly axially elongated epidermal cells with straight anticlinal walls and covered with thick, smooth cuticle. Stomata and trichomes are not 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.
- 3- Fragments showing pericyclic fibres with straight, thick, lignified walls, moderately wide lumina and blunt to rounded apices.
- 4- Fragments of lignified vessels with spiral, reticulate scalariform and pitted thickenings.
- 5- Wood fibres with straight, moderately wide to narrow lumina, acute ends and sometimes septated lignified walls.

- 6- Fragments showing lignified and pitted parenchyma cells of the xylem in addition to pitted and lignified fragments of medullary ray cells.
- 7- Fragments of tracheids, with rounded tips and lignified, pitted walls.
- 8- Laticiferous tubes which are simple, non-branched and containing granular contents, stain yellowish-brown with iodine (T.S.).
- 9- Few fragments of pericyclic fibres showing crystal sheath containing prisms of calcium oxalate.
- 10- Absence of sclerieds and hairs.

2- The Leaves :

A- The Lamina :

A transverse section through the lamina (Fig. 4, A) is somewhat planoconvex in outline. It shows an upper and lower epidermises, the former is accompanied by subepidermal layer of tabular cells.

The upper and lower epidermises enclose a dorsiventral structure with upper palisade of 2 to 3 rows which is separated from the upper epidermis by parenchymatous hypodermis. The palisade is interrupted in the midrib region by a mass of hypodermal collenchyma. The vascular system in the midrib region is represented by a large crescent-shaped main dissected vascular bundle accompanied by several additives and inverted smaller ones oriented to form a dissected ring enclosing central parenchyma. The latter contains groups of intraxylary phloem. All the system, is surrounded by a pericycle formed of a ring of groups of fibres interrupted by parenchyma. The lower epidermis, carries few glandular

Macro-and Micromorphology of the Stems and Leaves of Ficus Platyphylla (Del.).

hairs specially near the midrib, while the upper one shows some wax glands.

The Epidermis : consists of a single layer of epidermal cells, while small proportion of the upper ones are horizontally divided⁵.

The upper epidermal cells (Fig. 4,C) are polygonal isodiametric with straight anticlinal walls and covered with thin smooth cuticle. They measure 22 to 45 μ in length, 12 to 36 μ in width and 16 to 22 μ in height. The cells carry few glandular structures consisting of 6 radiating cells, containing wax (dissolved by warming with petroleum ether), sometimes described as wax glands⁵. Hairs and stomata are not observed. Cystolith are observed in the upper epidermis which are increased inside and intruded into the hypodermal tissue and mesophyll (Fig. 4,D), containing calcium carbonate which effervesce with dil. acids.

The lower epidermal cells (Fig. 4,B) are polygonal nearly isodiametric to slightly elongated with wavy anticlinal walls and covered with thin smooth cuticle. They measure 30 to 80 μ in length, 30 to 48 μ in width and 20 to 28 μ in height. Stomata of ranunculaceous type surrounded by 4-6 cells are noticed. The cells carry few glandular hairs specially near the midrib and veins. These hairs have unicellular stalks and bicellular heads, divided vertically. The stalk measures 30 to 44 μ in length, while the head measures 30 to 45 μ in length and 34 to 50 μ in width.

The Cortical Tissue : (Fig. 5, A,B) the upper and lower collenchyma are formed of 4-9 rows of rounded collenchyma cells, which are preceded by one row of subepidermal cells below the upper epidermis only. The parenchyma is rounded

and those adjacent to the vascular bundles contain cluster and few prismatic crystals of calcium oxalate, measuring 16 to 60 μ in diameter and 13 to 17 μ in length respectively. Few cells contain fixed oil globules which stain red with Sudan III T.S.

The Mesophyll : (Fig. 4,D) The uppermost row of the palisade shows longer cells than the others.

The spongy mesophyll shows somewhat irregular wide parenchymatous cells containing cluster and prismatic crystals of calcium oxalate.

The Vascular System : (Fig. 5,A & B). The pericyclic fibres are straight with lignified moderately thick walls, narrow lumina, acute apices and measure 440 to 560 μ in length and 22 to 45 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, that stain yellowish-brown with iodine T.S. The xylem shows spiral, reticulate, scalariform and pitted, lignified vessels, measuring 15 to 28 μ in diameter. Medullary rays are uni-to biseriate and show quadrangular to rectangular, pitted, lignified cells in the xylem region.

B- The Petiole :

A transverse section through the petiole (Fig. 6,A) is nearly circular in outline. It shows an outer epidermis accompanied by one row of subepidermal cells, surrounding a comparatively wide cortex. The pericycle consists of groups of fibres alternated with parenchyma and surrounding the central vascular cylinder. The vascular system consists of a radiating xylem and outer phloem surrounding the nearly wide parenchymatous pith. Groups of intraxylary

*Macro-and Micromorphology of the Stems and
Leaves of Ficus Platyphylla (Del.).*

phloem are scattered at the periphery of the pith.

The Epidermis : (Fig. 6, B & C).

It consists of polygonal mostly isodiametric cells with straight anticlinal walls and covered with smooth cuticle. They measure 13 to 40 u in length, 18 to 20 u in width and 4 to 17 u in height. Stomata and hairs are not observed. The epidermal cells are followed by one row of tabular-shaped subepidermal cells.

The Cortex : (Fig. 6,C) Consists of an outer zone of 8-10 rows of more or less rounded to oval collenchyma cells. The inner zone is represented by 12-15 rows of nearly rounded parenchyma cells containing prismatic and cluster crystals of calcium oxalate measuring 5 to 9 u in length and 22 to 35 u in diameter respectively. Some cells contain fixed oil globules which stain red with Sudan III.

The Pericycle : (Fig. 6,C) The fibres have moderately thick lignified walls and narrow lumina with blunt to rounded apices. They measure from 14 to 32 u in diameter and 450 to 700 u in length. Sometimes the surrounding parenchyma cells of the cortex contain prismatic crystals of calcium oxalate and forming a crystal sheath.

The Vascular System : (fig. 6, C) The phloem consists of sieve tubes, companion cells and phloem parenchyma. The phloem shows some laticiferous tubes with granular contents, which stain yellowish-brown with iodine T.S. The cambium is indistinct. The xylem consists of lignified scalariform, reticulate, spiral and pitted lignified vessels accompanied by lignified pitted wood parenchyma. Wood fibres are fusiform in shape with straight, lignified walls, narrow lumina

and acute ends. The vessels measure 45 to 90 μ in diameter. Elongated lignified and pitted tracheids are present. The medullary rays are mainly biseriate, of subrectangular cells pitted and lignified in the xylem region but non-lignified in the phloem region.

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 5 to 9 μ in length and 22 to 35 μ in diameter respectively. Several groups of intraxylary phloem consisting of soft cellulosic elements are scattered at the periphery of the pith.

The Powder (Fig 7) :

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. Sometimes showing glandular structures, consisting of 6 radiating cells.
- 2- Fragments of the lower epidermis of the leaves showing polygonal, nearly isodiametric cells with wavy anticlinal walls, bearing ranunculaceous stomata and few glandular hairs of unicellular stalk and bicellular vertically divided heads.
- 3- Fragments of the epidermal cells of the petiole consisting of polygonal, small, isodiametric cells covered with smooth cuticle.

*Macro-and Micromorphology of the Stems and
Leaves of Ficus Platyphylla (Del.).*

- 4- Fragments of the cortical parenchyma cells containing fixed oil globules, in addition, others containing prismatic and cluster crystals of calcium oxalate.
- 5- Fragments of pericyclic fibres with straight, slightly lignified walls, narrow lumina and acute apices.
- 6- Fragments of spiral, reticulate, scalariform and pitted lignified xylem vessels.
- 7- Fragments of phloem tissue showing laticiferous tubes.
- 8- Fragments of wood fibres sometimes septated, with straight, slightly thick, lignified, walls and acute to acuminate apices.
- 9- Fragments of lignified and pitted parenchyma cells of the xylem, pitted lignified fragments of tracheids and medullary rays.

Some Numerical Values :

Stomatal number : 24

Stomatal index : 23.07

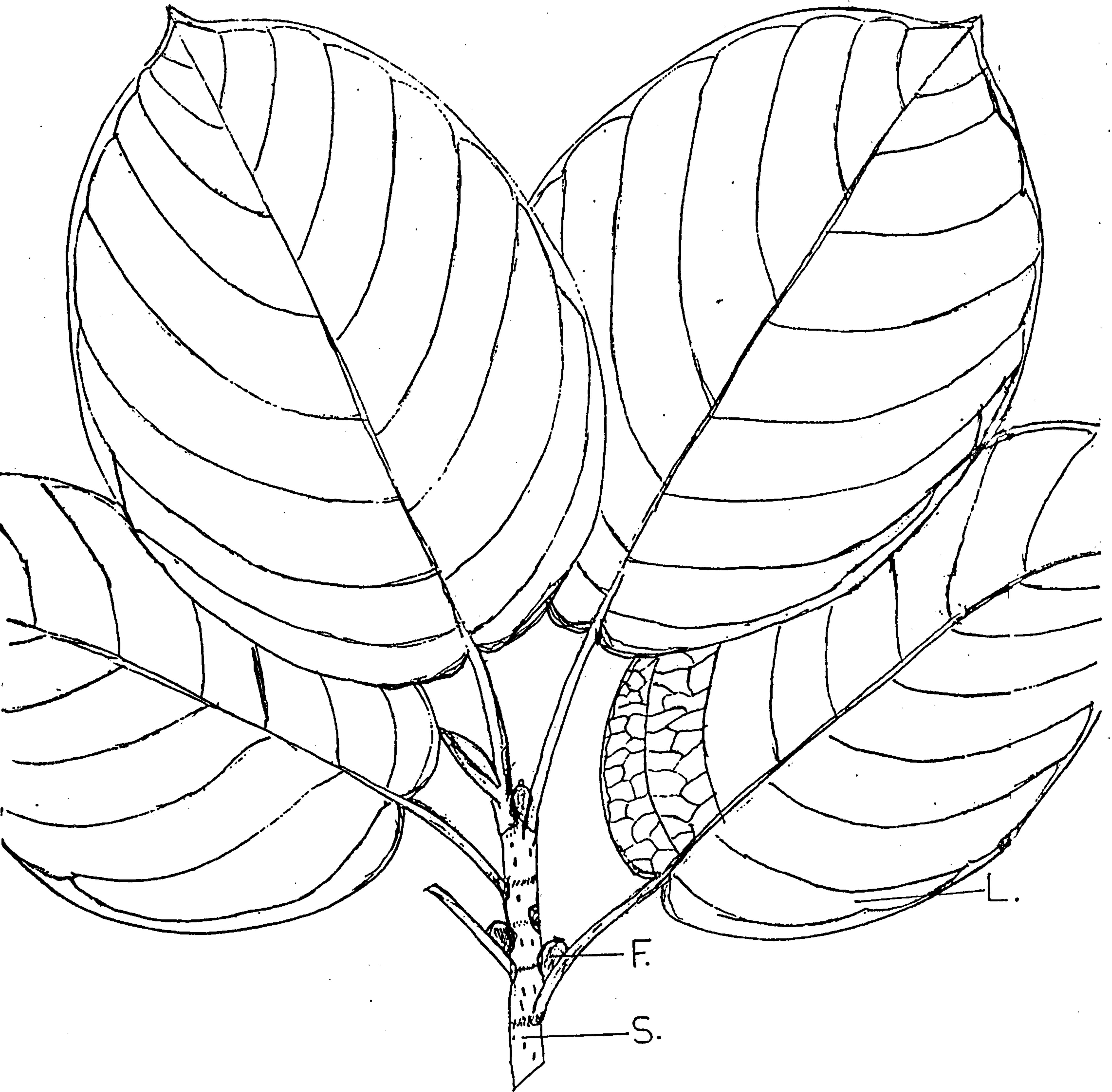


Fig. 1: Sketch of A Branch

X $\frac{1}{2}$

F., fruit; L., leaf; S., stem.

Macro-and Micromorphology of the Stems and Leaves of *Ficus Platyphylla* (Del.).

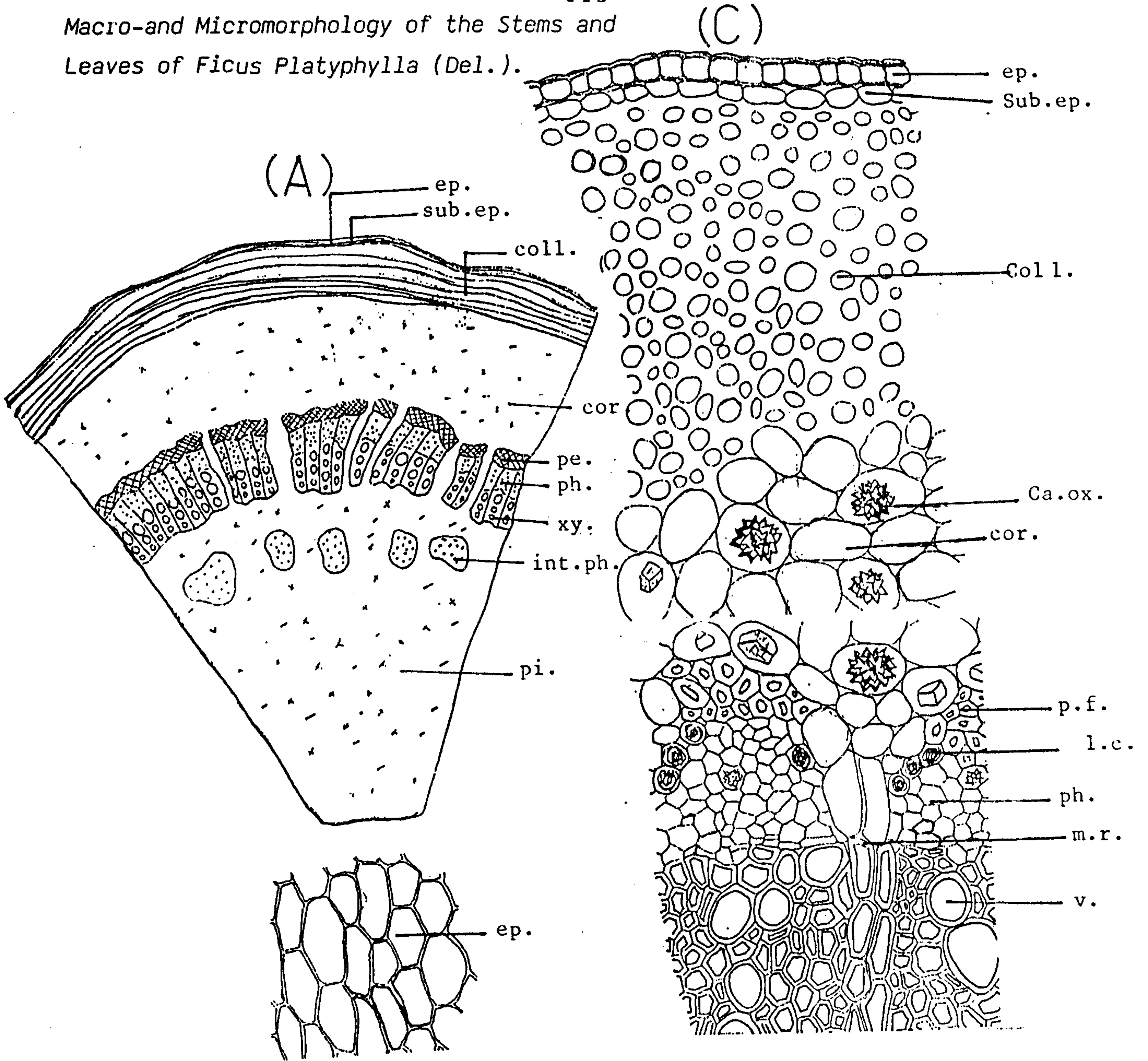
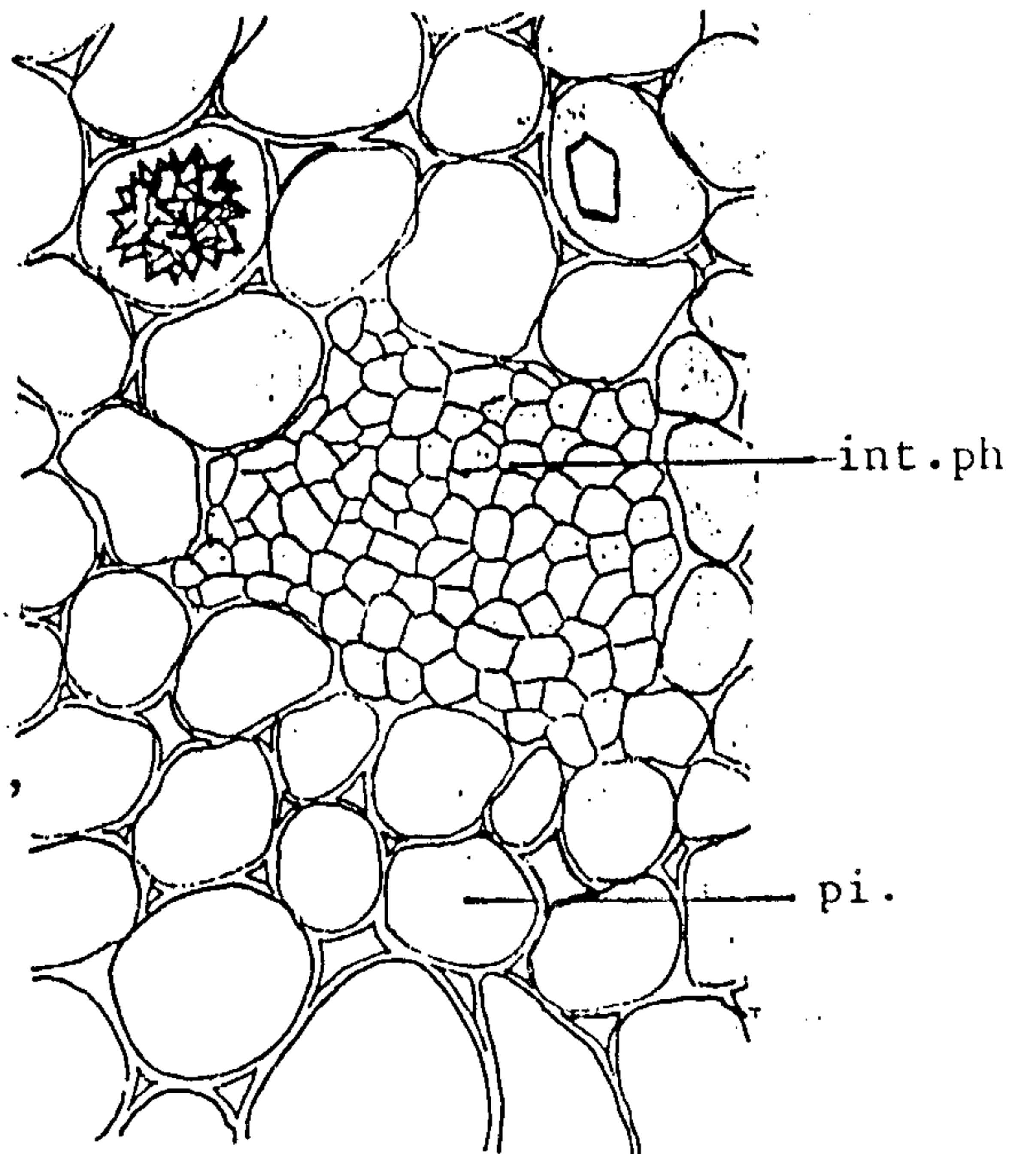


Fig. 2: A. Diagrammatic T.S. of young stem X 25
 B. Surface preparation of young stem. X 225
 C. Detailed T.S. of young stem X 225

ca.ox., calcium oxalate; coll., collenchyma; cor., cortex; ep., epidermis; l.c., laticiferous cell; int.ph., intraxylary phloem; m.r., medullary ray; ph., phloem; pe., pericycle; p.f., pericyclic fibre; pi., pith; sub.ep., subepidermis; v., vessel; xy., xylem.



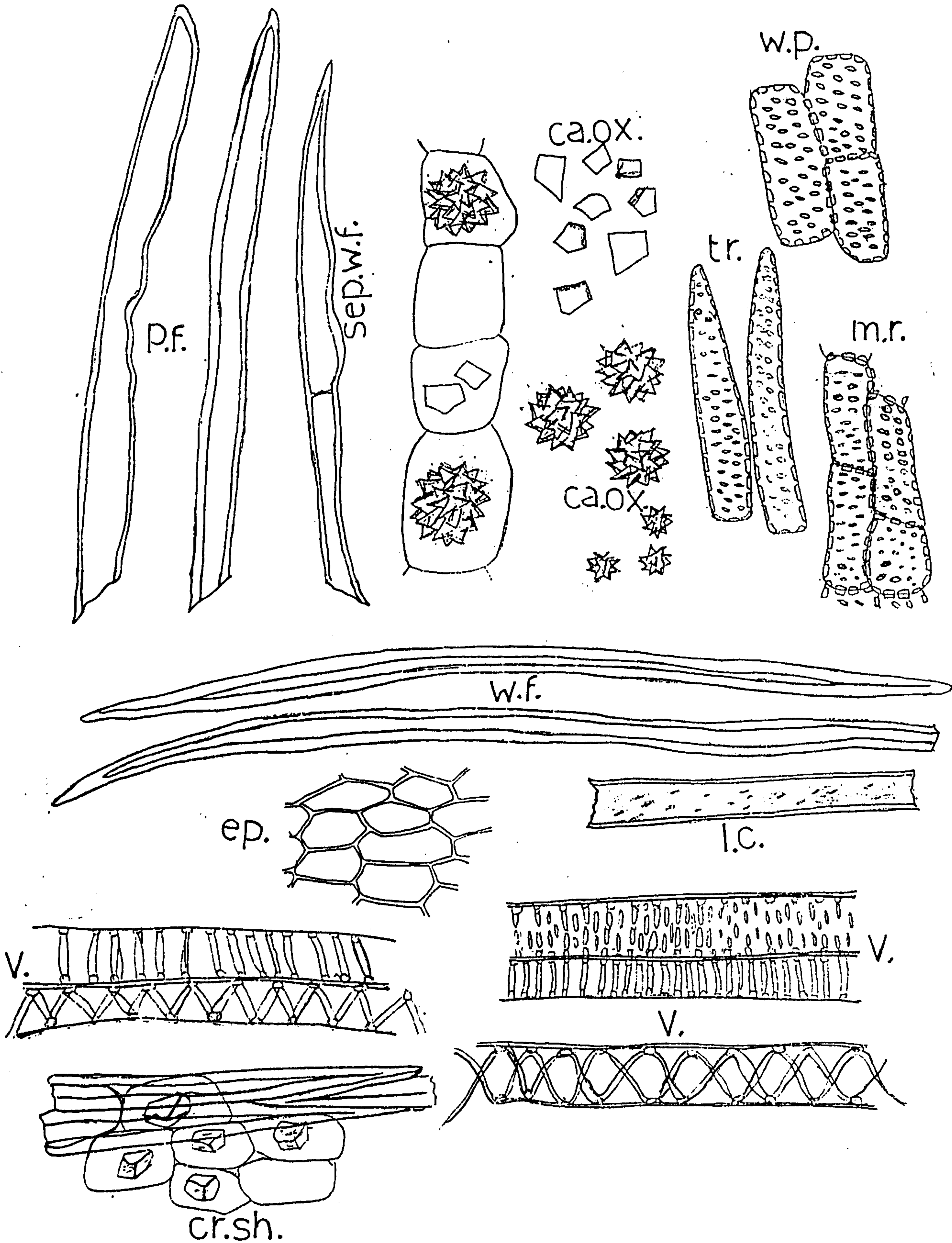


Fig. 3: Isolated elements of the stem

X 225

ca.ox., calcium oxalate; cr., sh., crystal sheath; ep., epidermis; l.c., laticiferous cell; m.r., medullary ray; p.f. pericyclic fibre; sep.w.p., septated wood fibre; tr., tracheid; v., vessel; w.f., wood fibre; w.p., wood parenchyma.

Macro-and Micromorphology of the Stems and Leaves of *Ficus Platyphylla* (Del.).

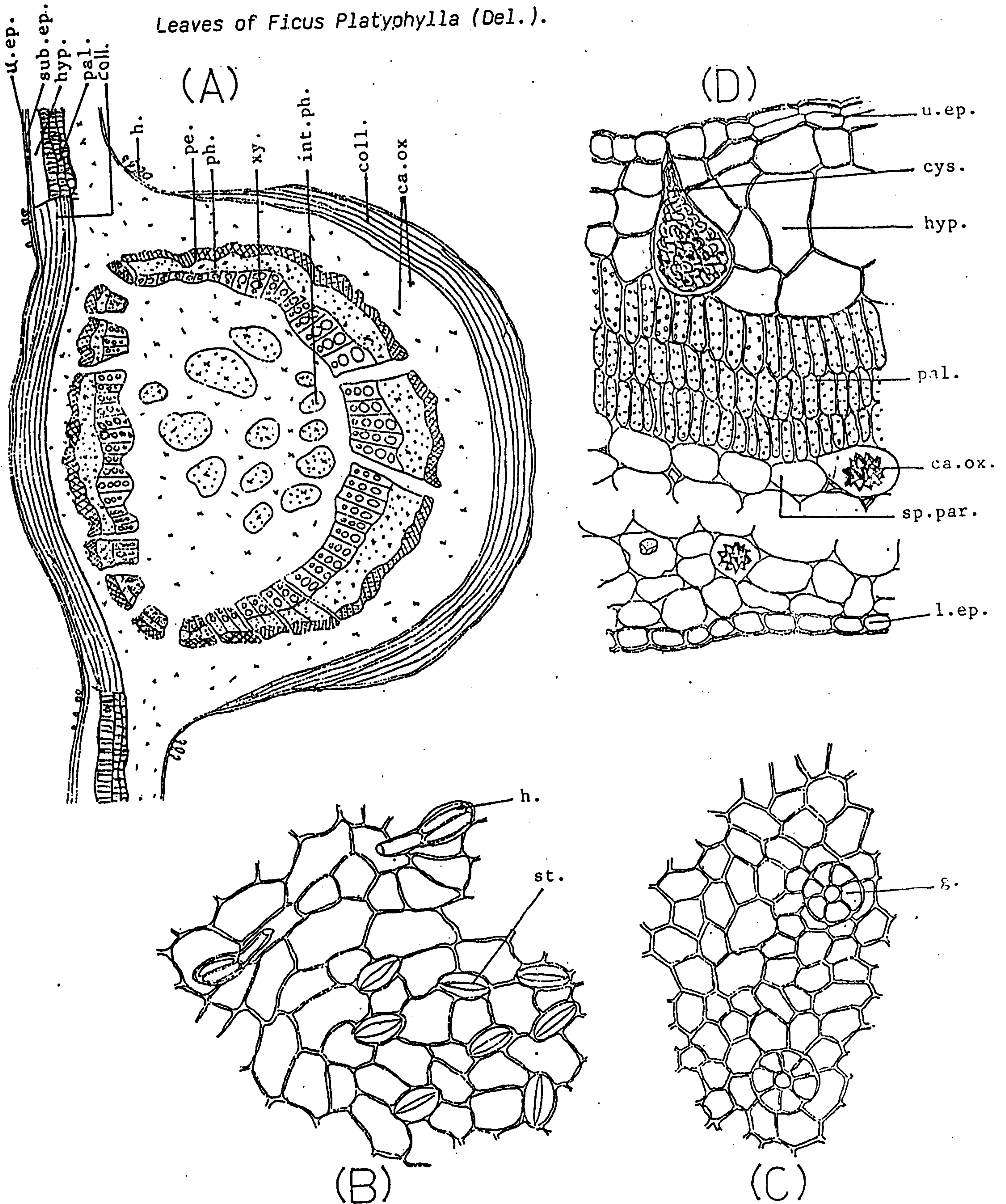


Fig. 4: A-Diagrammatic T.S. of the leaf X 25
 B-Surface preparation of the leaf(lower epidermis X 225
 C-Surface preparation of the leaf(upper epidermis) X 225
 D-Detailed T.S. of the leaf X 225

ca.ox. calcium oxalate; coll., collenchyma; cys., cystolith; g., gland; h., hair; hyp., hypodermis; int.ph., intraaxillary ph; l.c., latiferous cell; l.ep., lower epidermis; pal., palisade; per., pericycle; ph., phloem; st., stomata; sub.ep., subepidermis; u.ep., upper epidermis; xy., xylem; sp.par., spongy parenchyma.

(B)

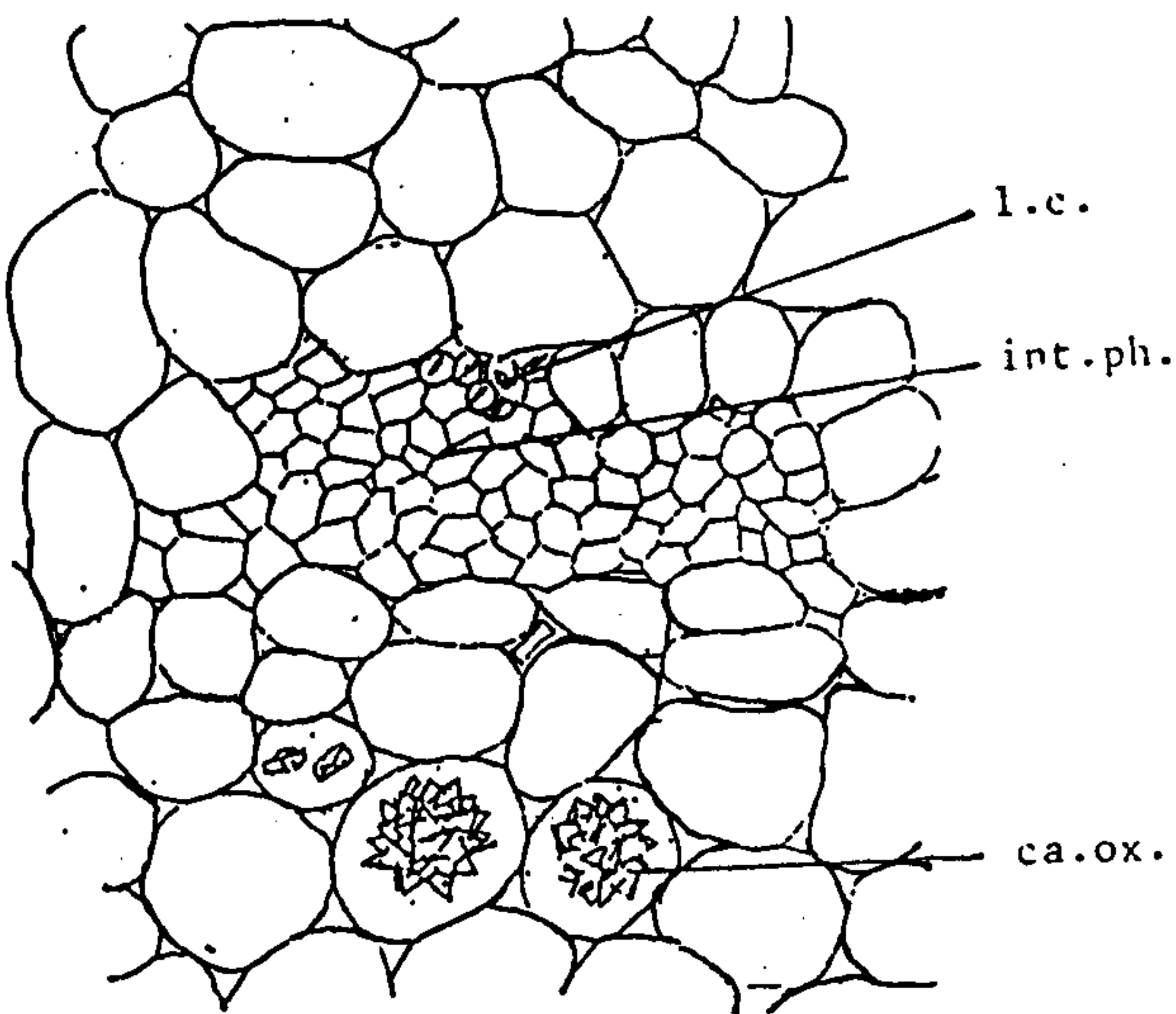
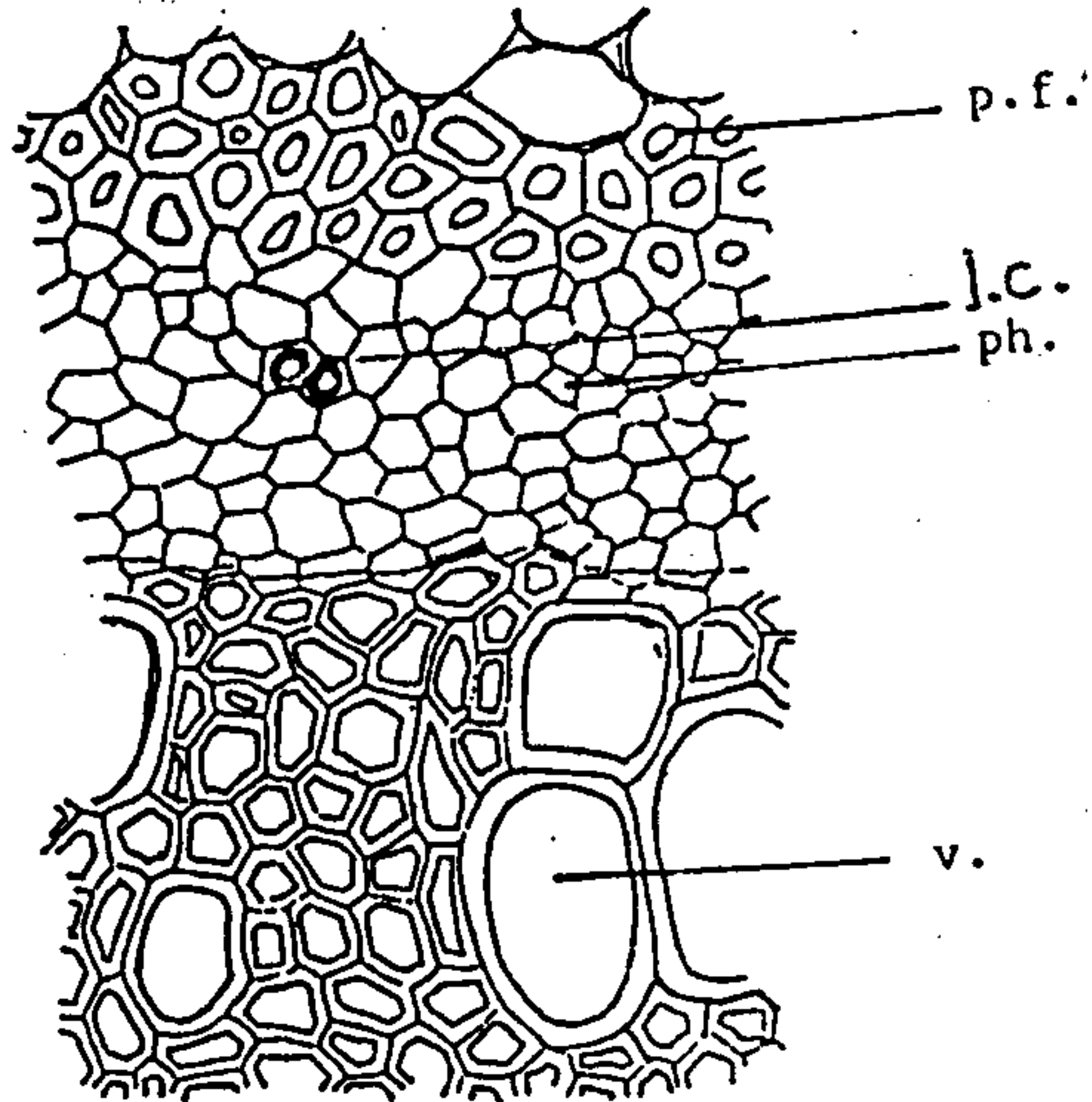
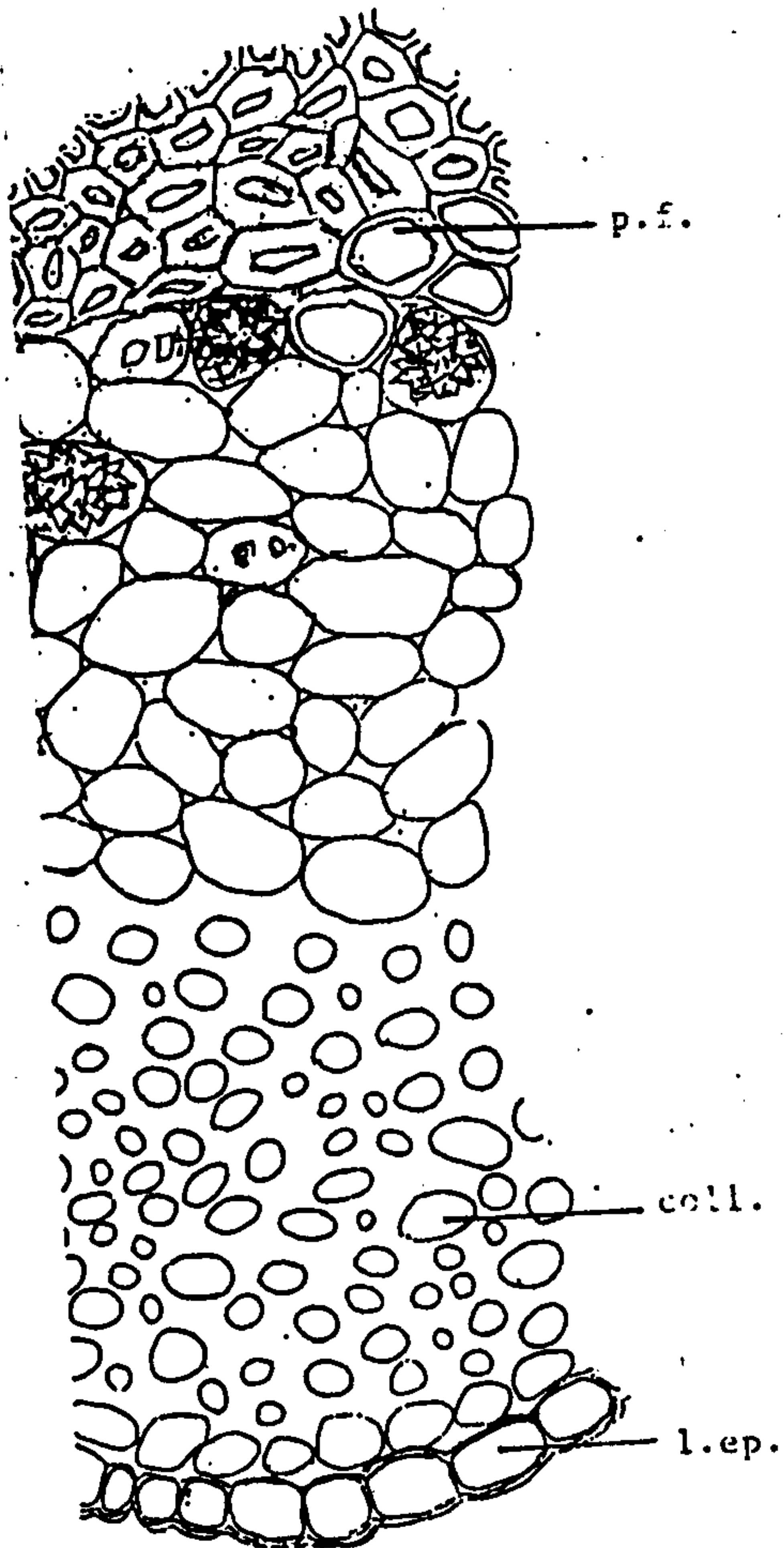
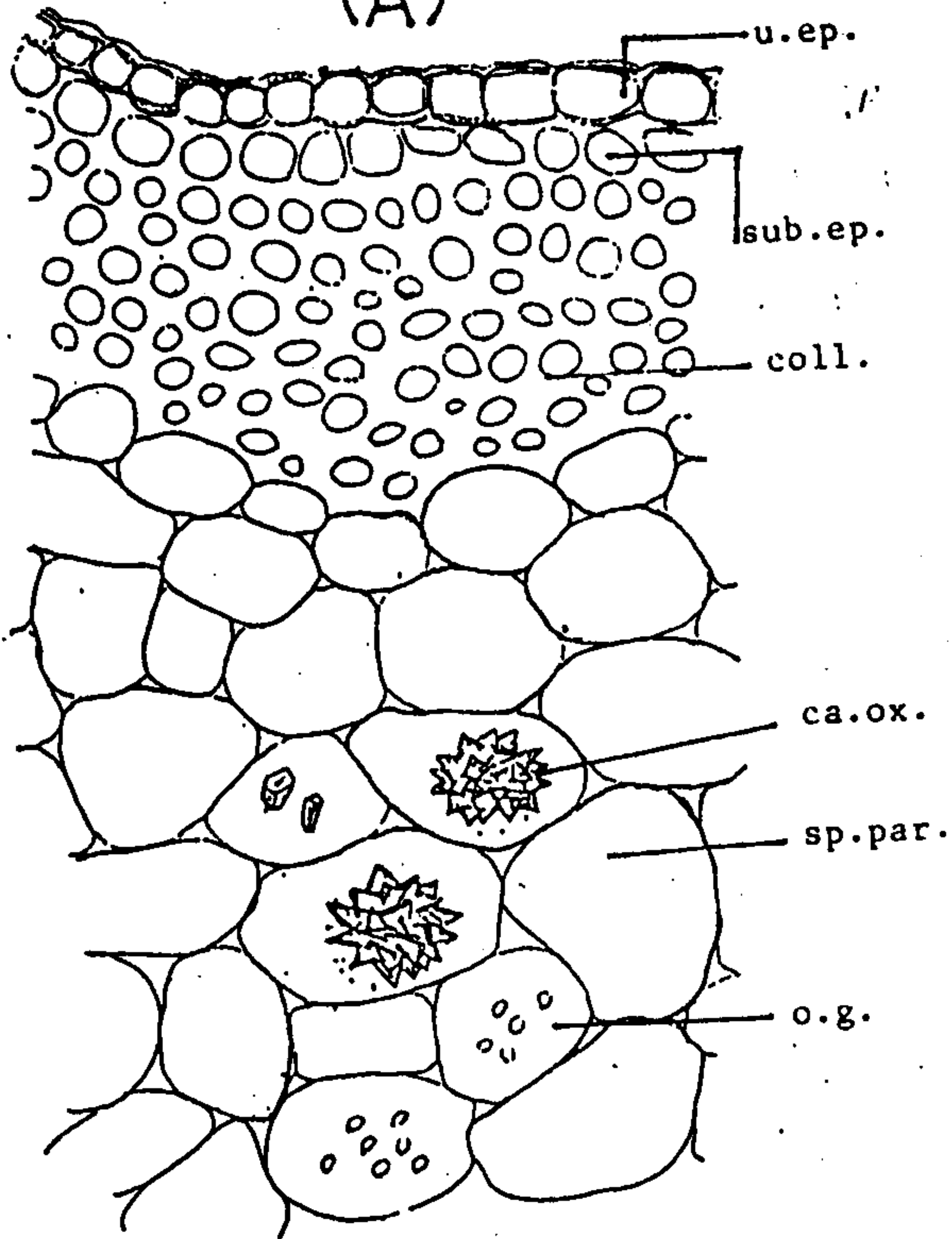
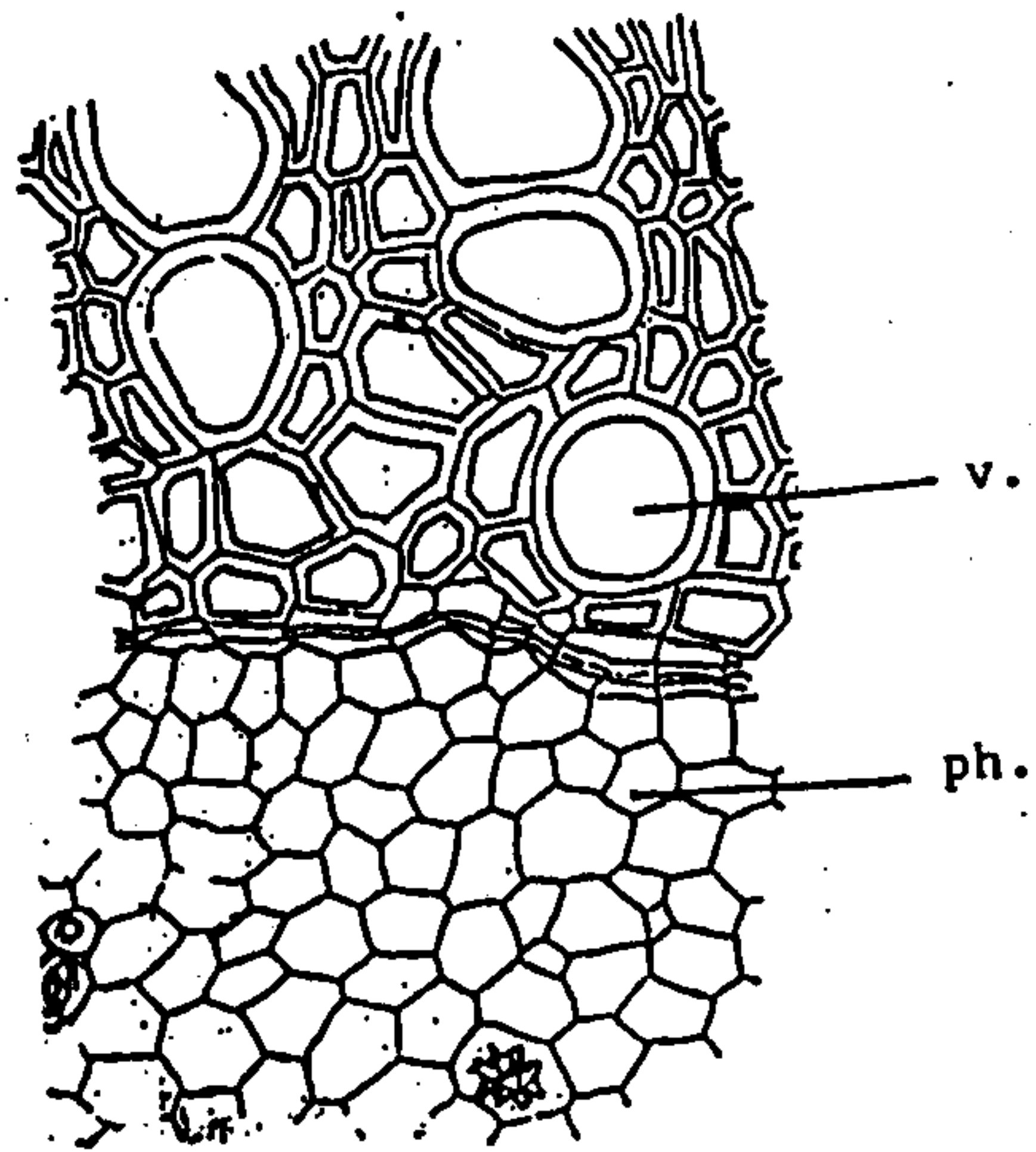


Fig. 5: A&B. Detailed T.S. of the leaf

(x' 200)

ca.ox., calcium oxalate; coll., collenchyma; int.ph., intraxylary phloem; l.e., laticiferous cell; l.ep., lower epidermis; o.g., oil globules; p.e., pericycle; ph., phloem; sub.ep., sub epidermis; sp.par., spongy parenchyma; u.ep., upper epidermis; v., vessel;

Macro-and Micromorphology of the Stems and Leaves of *Ficus Platyphylla* (Del.).

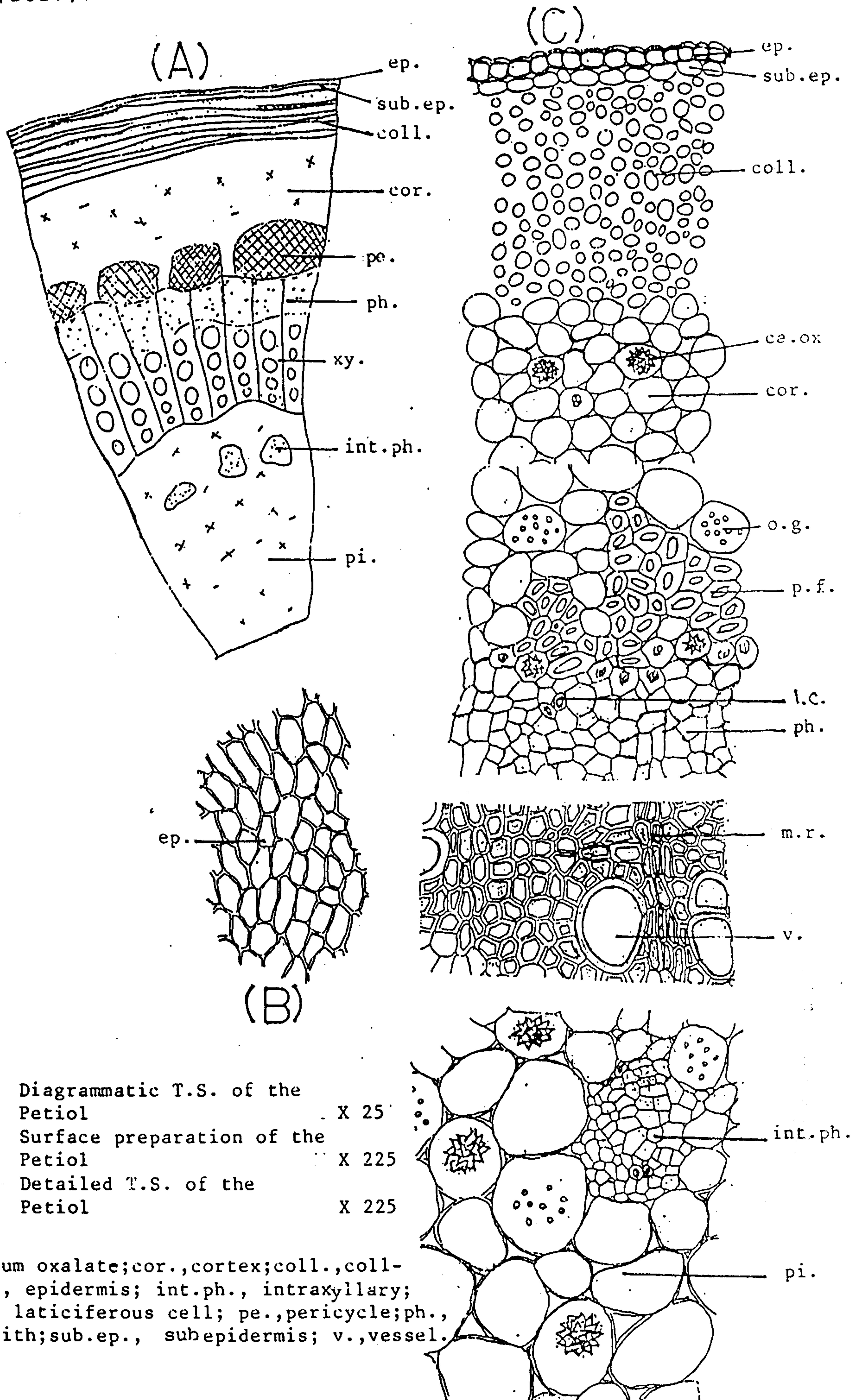


Fig. 6: A. Diagrammatic T.S. of the Petiol X 25
 B. Surface preparation of the Petiol X 225
 C. Detailed T.S. of the Petiol X 225

ca.ox., calcium oxalate; cor., cortex; coll., collenchyma; ep., epidermis; int.ph., intraxylary; phloem; l.c.; laticiferous cell; pe., pericycle; ph., phloem; pi., pith; sub.ep., subepidermis; v., vessel.

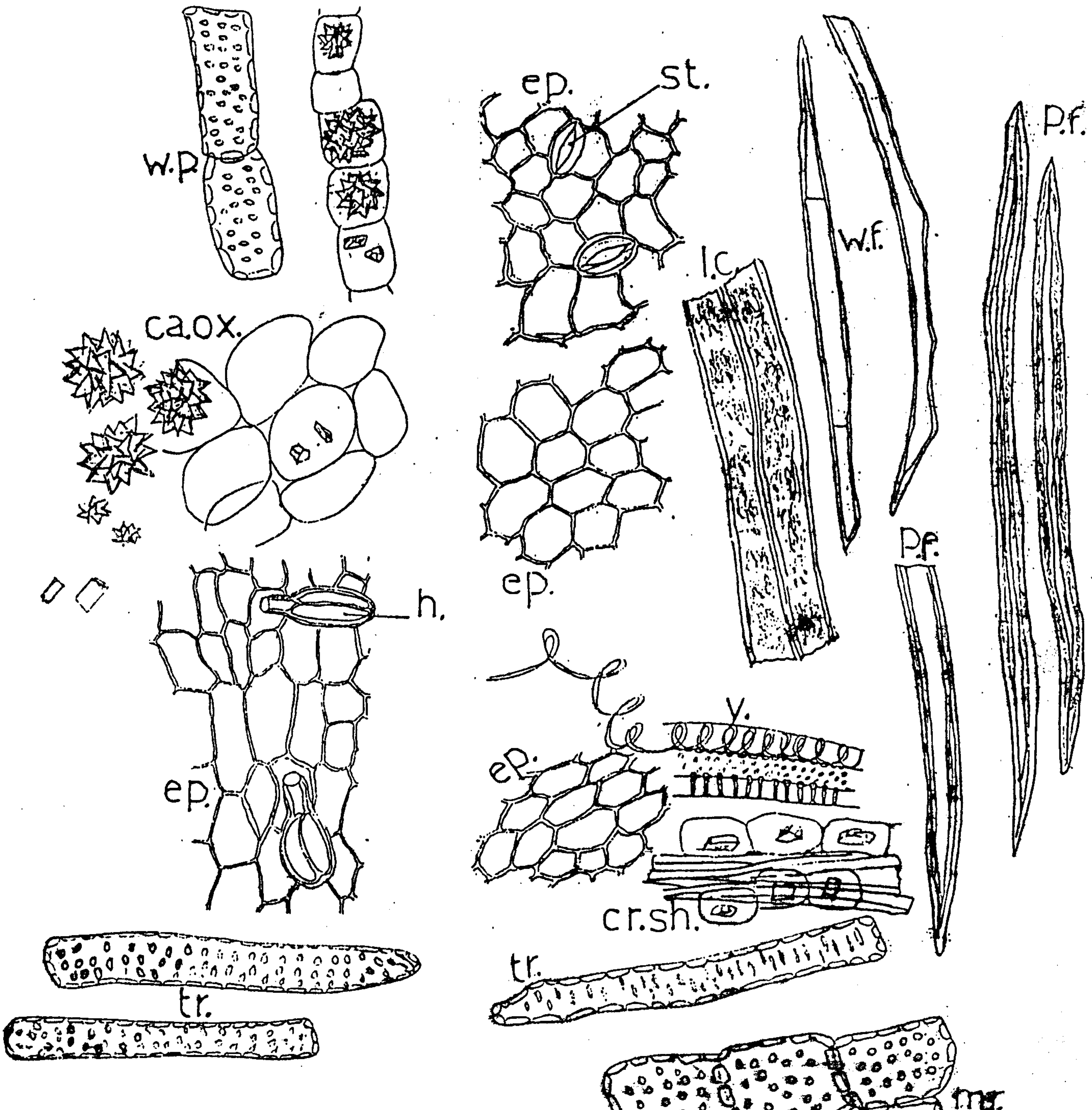


Fig. 7: Isolated elements of the leaf X225

ca.ox., calcium oxalate; cr.sh., crystal sheath; ep., epidermis; h., hair; l.c., laticiferous cell; m.r., medullary ray; p.f., pericyclic fibre; sep.w.f., septated wood fibre; st., stomata, tr., tracheid; v., vessel; w.f., wood fibre; w.p., wood parenchyma.

Macro-and Micromorphology of the Stems and
Leaves of *Ficus Platyphylla* (Del),

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الصفات العيانية والمجهرية لسيقان وأوراق

نبات الفيكس بلاتيفلا (ديل)

سامية محمد الصياد - هناء محمد سيد - أحمد عابدين محمد عطية

قسم العقاقير - كلية الصيدلة - جامعة أسيوط

تزرع أشجار الفيكس بلاتيفلا (ديل) فى الحدائق العامة والطرق وذلك

لاغراض الظل .

وقد تبين لنا من المراجع المختلفة أن أنواع كثيرة من جنس الفيكس لها

استعمالات طبية شعبية عديدة ولوحظ أن بعض المواطنين يستعملون ثمار هذا الجنس

بالذات فى علاج بعض القرص الجلدية .

ولقد سبق لنا عمل دراسة المكونات الكيميائية لهذا النبات وأجريت عليه

بعض الدراسات البيولوجية واثبت أن له تأثير فعال كمضاد للديدان مما استرعى

الانتباه لدراسته تفصيلىا فهذا البحث يشتمل على دراسة تفصيلية للصفات العيانية

والمجهرية لسيقان وأوراق نبات الفيكس بلاتيفلا (ديل) بهدف التعرف على أجزائه

سواء كانت كاملة أو على هيئة مسحوق .