

PHARMACOGNOSTICAL STUDY OF DURANTA PLUMIERI
JACQ. GROWN IN EGYPT

PART I: Morphology and Histology of THE LEAVES
AND STEMS.

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The morphological, histological characters of the leaf and stem of Duranta plumieri Jacq. growing in Egypt are presented to show the diagnostic characters of these organs by which each of them can be identified both in the entire and powdered forms.

Material:

Collection was made from plants cultivated in experimental station of Medicinal Plants, Faculty of Pharmacy, Assiut Univ. The plant was identified by Prof. Dr. Foad Y. Amin, Prof. of Floriculture, Faculty of Agriculture, Assiut University. Fresh stems and leaves as well as preserved in a mixture of : alcohol: glycerin : water(1 : 1 : 1) were used.

Habitat:

Duranta plumieri Jacq. belonging to the Verbenaceae^{1,2}. growing as ornamental plant in Egypt^{3,4,5}. The extracts of the leaf and juice of the fruit were used as diuretics⁶.

Duranta plumieri Jacq. (Fig. 1) is an evergreen, woody, shrub or small tree attaining 2-3 meters in height and carrying numerous branches. It bears simple petiolate exstipulate leaves arranged in opposite decussate, and numerous violate terminal simple racemose inflorescence, the plant gives its flowers in March and June.

The stem:

The stem (Fig. 2) is erect, cylindrically to subcylindrical in outline and solid. It carries more or less long internodes, the younger parts of the stem are yellowish green in colour, while the older parts are rough, light brown to greyish-green, it shows monopodial

branching. It has a faint odour and slightly bitter taste.

Histology:

A transverse section in the stem (Fig. 3) is circular to slightly irregular in outline, showing an epidermis, followed by a cortex formed of 2-3 rows of collenchymatous then 2-3 rows of parenchymatous cells. The innermost layer of the cortex, the endodermis, is distinguishable and starchy.

The pericycle is formed of groups of thick-walled lignified pericyclic fibres which are interrupted by thin-walled parenchyma. The pericycle surrounds the central cylinder, and is formed of a complete ring of vascular elements, enclosing a wide pith. The phloem region is narrow while the xylem ring is comparatively wide, with the primary xylem projecting in the medulla and being separated from the phloem by a zone of the cambiform cells.

The phloem and the xylem are radially traversed by numerous medullary rays. Small starch granules, and minute prismatic crystals of calcium oxalate are also present in the parenchyma of the cortex, and pith.

The epidermis:

The epidermis (Fig. 3) consists of one layer of cells which appear square or subrectangular in T.S. In surface view, the cells are mainly axially elongated subrectangular with more or less straight or slightly curved anticlinal walls and measure from 40-48-64 μ in length and from 20-22-30 μ in width. The epidermal cells are covered with thin smooth cuticle. Stomata are of the anomocytic type, surrounded by 4-6 epidermal cells being of common occurrence. They are oval to rounded in shape and measure from 48-56-64 μ in length and from 32-40-43 μ in width. Long unicellular nonglandular hairs with broad bases and acuminate apices are abundant especially on young stems. They are covered with warty cuticle, measuring from 120-140-160 μ in length, and from 24-32-40 μ in width. Also uniseriate multicellular non-glandular hairs are present measuring from 200-350-550 μ in length and from 40-56-64 μ in width at the base,

Each hair consists of 3-4 short basal cells and one very long terminal cell covered with warty cuticle. Glandular hairs with unicellular stalk and unicellular head are present.

The cortex:

It is composed of several rows (from 3-5 rows) of more or less rounded collenchyma followed by parenchymatous cells with intercellular spaces. The cells contain rosettes and few minute prismatic crystals of calcium oxalate. Minute starch grains are also present. The innermost layer of the cortex, the endodermis is formed of one layer of tangentially elongated cells containing starch grains.

The pericycle:

It consists of groups of lignified fibres, these fibres have usually thin refractive walls and comparatively narrow lumens. Their ends are sometime blunt to rounded. The fibres measure from 40-50-60 μ in diameter.

Vascular system:

It is represented by a wide continuous ring formed mainly of secondary elements and is traversed by narrow medullary rays.

The phloem:

It is formed of a narrow ring, consisting of shining thin-walled soft, cellulosic elements of sieve tubes with companion cells and phloem parenchyma. The phloem parenchyma is thin-walled, somewhat rounded in T.S. measuring from 32-40-56 μ in width. The cambium zone is formed of about 2-3 rows of cellulosic thin-walled cambiform cells, which are subrectangular, tangentially and radially elongated.

The xylem is formed of lignified, pitted, and thick walled radially arranged elements. The vessels measure from 50-60-80 μ in diameter. Spiral, scalariform and reticulate vessels are also encountered. They are accompanied by nume-

rous lignified tracheids, fibrous tracheids and few tracheidal vessels.

The wood parenchyma occurs usually in vertical rows and the cells are subrectangular, and axially elongated. The medullary rays are usually biseriate.

The pith is wide, consisting usually of large polyhedral to rounded, isodiametric cells with thick and pitted walls. It contains minute starch grains and crystals of calcium oxalate.

The powder:

Powdered young stem is greenish yellow in colour with slight odour and slightly bitter taste. The important diagnostic microscopic features of the powder are:

- 1- Fragments of polygonal axially elongated epidermal cells with nearly straight anticlinal walls and covered with smooth cuticle. Long unicellular non-glandular hairs are present, consisting of 2-3 short basal cells and one very long terminal cell covered with warty cuticle. Glandular hairs with unicellular stalk and unicellular head are also observed. Fragments of epidermal cells showing anomocytic stomata.
- 2- Fragments of lignified pericyclic and phloem fibres with refractive walls, narrow lumens and usually with pointed to acuminate, sometimes blunt or rounded ends.
- 3- Fragments showing lignified wood parenchyma and medullary rays cells.
- 4- Few small rounded to oval simple starch grains as well as rosettes and minute prismatic crystals of calcium oxalate.

The leaf:

Macromorphology:

The leaves of *Duranta plumieri* are simple, petiolate and exstipulate. The leaf has whitish green spots on both surfaces. The lamina is ovate to ovate lanceolate with an acute sometimes acuminate apex. The margin is entire or

rarely crenate to serrate in the lower third of the leaf.

The leaf is decurrent at the base and has a papery in texture. Venation is reticulate. The leaf has a faint odour and a bitter taste.

Micromorphology:

The transverse section in the lamina (Fig. 4) exhibits upper and lower epidermises enclosing inbetween the mesophyll tissue which is replaced in the midrib and big viens by the vascular strands and the cortical tissue. The leaf shows a dorsiventral structure with an upper palisade consisting of 3 rows; the outer row is longer than the inner one. The palisade is not continous in the region of the midrib where it is replaced by a sub-epidermal mass of collenchyma.

Another mass of collenchyma is present abutting on the lower epidermis. In between the upper epidermis and the upper palisade there is a hypodermal layer of somewhat larger subepidermal collenchymatous cells. The midrib region shows a larger main vascular bundle accompanied with 1-5 smaller ones on its upper side . The pericycle is usually parenchymatous, becoming collenchymatous with isolated groups of fibres in the petiole. Both the upper and lower epidermis are covered with glandular and non-glandular hairs which increase in number in the midrib region.

The epidermis:

The upper epidermis (Fig.5) consists of a single row of tangentially elongated cells as seen in a transverse section

In surface view the cells appear polygonal, isodiametric with wavy anticlinal walls and measuring from 40-50-60 μ in height, 80-120-150 μ in length and 60-80-90 μ in width.

The surface is covered with a thin smooth cuticle.

Anomocytic stomata are distributed on both surface but are more frequent on the lower one.

Trichomes of the glandular type are present on both surfaces but more comon on the lower one. They consist of a unicellular stalk and multicellular head of 8 radiating cells and measuring from 100-110-120 μ in diameter. Nonglandular

trichomes are also observed, they are usually unicellular, occasionally bicellular and rarely tricellular, uniseriate covered with warty cuticle. They measure 90-100-110 μ in height and 40-50-60 μ in width at the base.

The lower epidermis formed of one row of square or subrectangular cells as seen in transverse section. In surface view the cells are polygonal, mostly isodiametric with wavy anticlinal walls. They measure from 30-40-50 μ in height, from 40-50-80 μ in width. The cells are covered with smooth cuticle. Stomata and trichomes are exactly similar to those of the upper epidermis in all respect except that they are more abundant.

Mesophyll:

It is a wide heterogenous region showing a hypodermis below the upper epidermis consisting of usually one sometimes two rows of large collenchymatous cells. The palisade is interrupted by a mass of collenchyma in the midrib region. The palisade is mainly formed of three rows of columnar cells, those of the upper row are longer than those of the middle and the inner ones. The cells measure from 100-120-160 μ in length and from 40-48-56 μ in diameter.

The rest of the mesophyll is formed of more or less rounded to irregular spongy parenchyma with wide intercellular spaces. It contains few starch granules, which are mainly simple, circular to oval in shape. Few rosettes and minute prismatic crystals of calcium oxalate are present in the mesophyll cells.

The cortical tissue:

The cortical tissue shows an upper and lower subepidermal collenchymatous masses; the upper being formed of 4-6 rows and the lower of 2-4 rows of cells. The rest of the cortical tissue is occupied by rounded or polyhedral parenchymatous cells with rather wide intercellular spaces and contain few starch granules and prisms of calcium oxalate.

The vascular tissue:

It is represented by a large central crescent-shaped

vascular bundle and from 2-5 smaller ones situated on its upper side. Generally the bundles are collateral, formed of an upper xylem and a lower phloem, but some of the smaller bundles are concentric with an outer xylem, partly surrounding a phloem zone and a narrow central parenchymatous zone representing a pith. The xylem consists mainly of pitted, spiral and scalariform lignified vessels measuring from 30-40-50 μ in diameter. The phloem is narrow and consists of thin walled shining soft cellulosic elements.

The pericycle is formed of 2-3 rows of thin-walled parenchymatous cells, which is partially replaced by collenchyma with isolated fibres in the petiole. The pericyclic fibres are usually non-lignified with a moderately wide lumen, thick walls and tapering acute to acuminate apices.

Few starch grains are present in the parenchyma surrounding the vascular strands.

The powder:

Powdered leaf of *Duranta plumieri* is yellowish green in colour, with characteristic odour and bitter taste. It is characterised by.

- 1- Fragments of the epidermis from lamina showing polygonal isodiametric subrectangular cells, with straight or wavy sometimes sinuated anticlinal walls, and covered with numerous anomocytic stomata as well as glandular hairs. The glandular hairs have multicellular head and usually unicellular stalk. The non-glandular hairs are two types, one uniseriate multicellular, with 3-4 short basal cells and one long terminal cell covered with warty cuticle and the other unicellular with swollen base.
- 2- Fragments of epidermis from petiole with polygonal axially elongated cells having straight anticlinal walls and covered with faintly striated cuticle. The cells contain rosettes and minute prismatic crystals of calcium oxalate. Stomata and trichomes are present.

- 3- Fragments of the glandular and non-glandular hairs
- 4- Fragments showing pitted or occasionally spiral, lignified vessels.
- 5- Fragments of mesophyll tissue with columnar palisade cells and spongy parenchyma.
- 6- Fragments of thin-walled wide-lumen fibres with usually pointed, sometimes rounded ends.



Fig. 1- Photograph Of *Duranta Plumieri* Jacq. XI/30

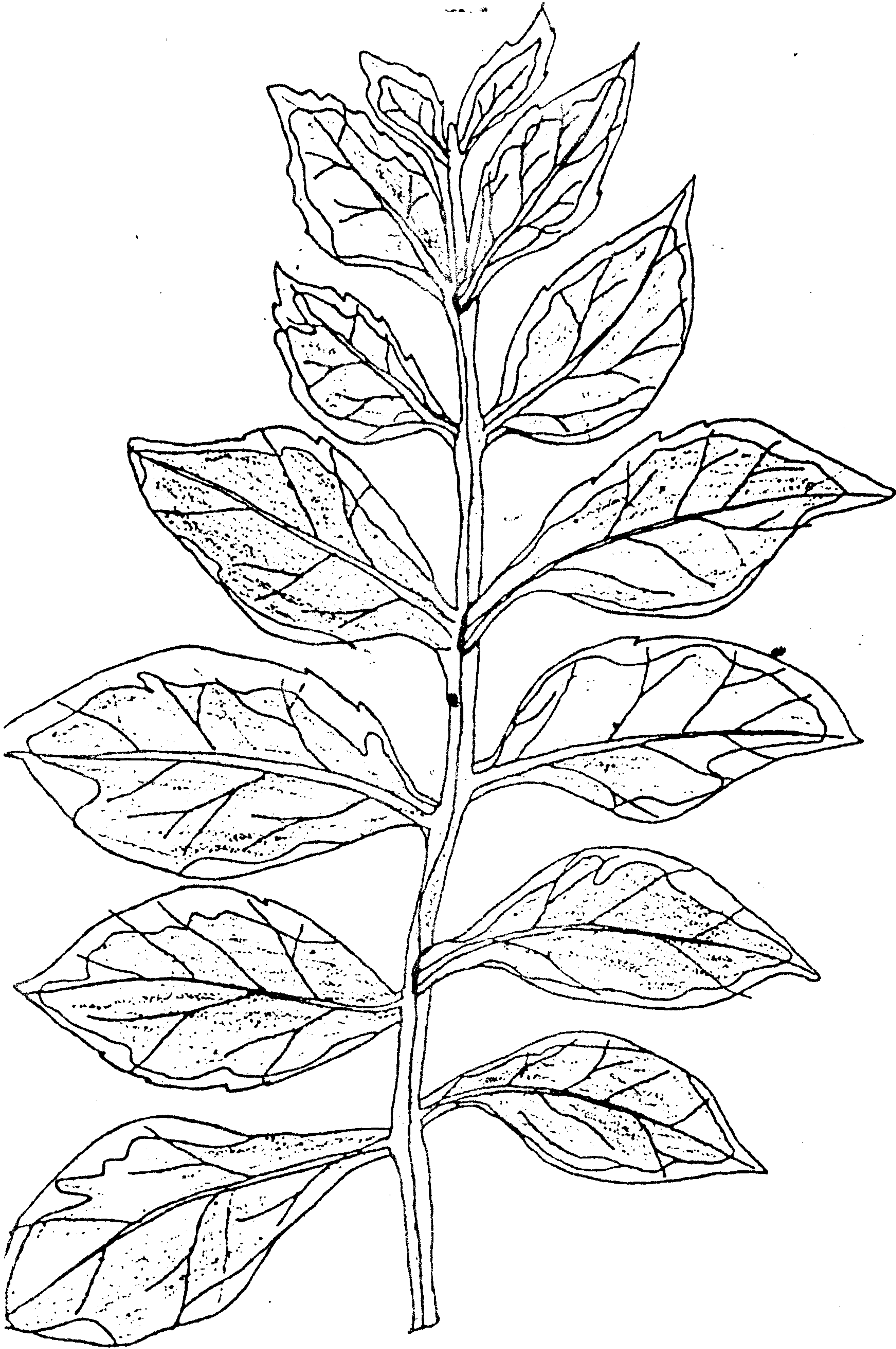


Fig . 2- Sketch of the branch

X 3/5

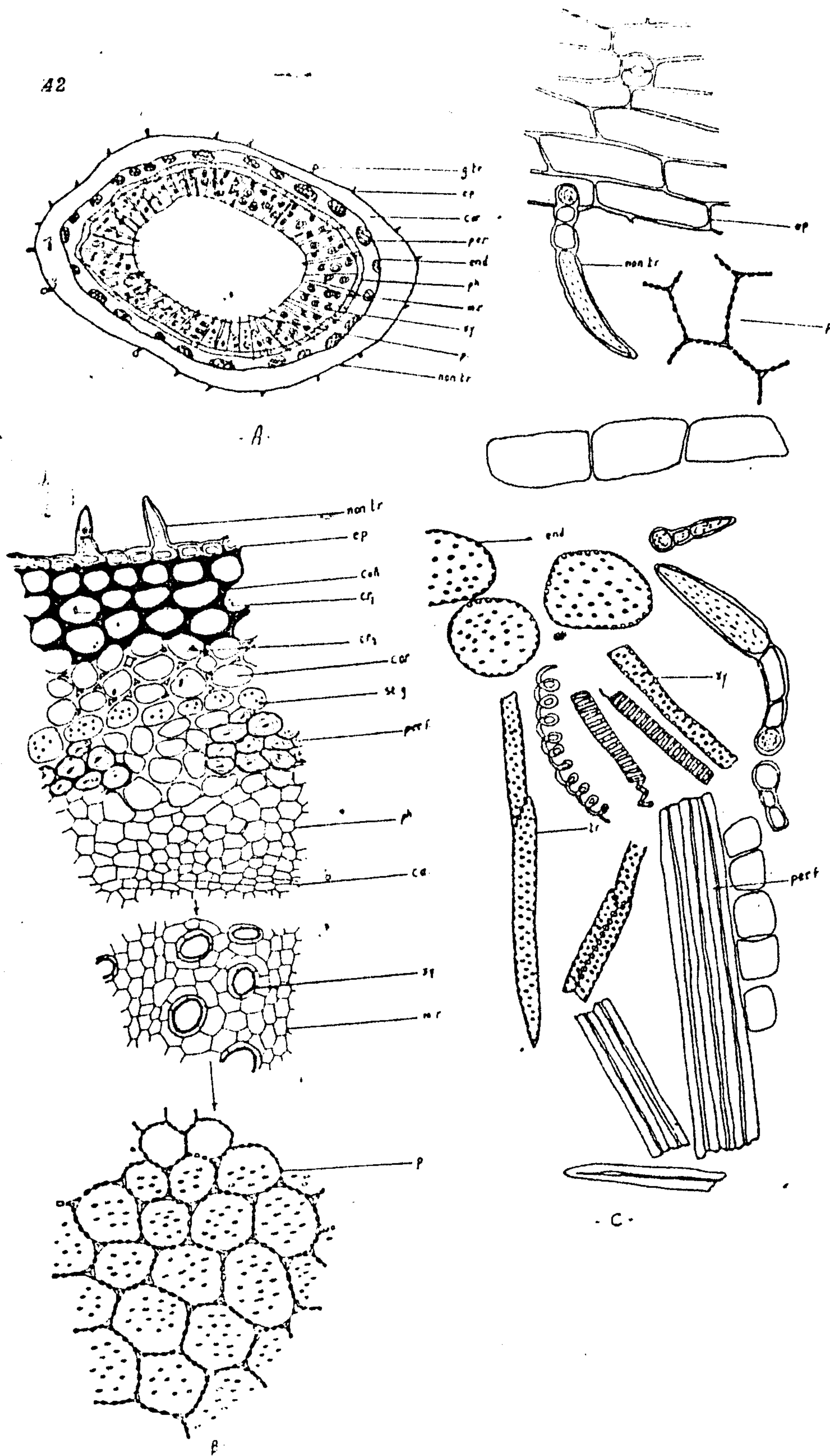


Fig 3- A. Diagrammatic T.S. of the stem X 21 .
 B. Detailed T.S. of the stem X 225
 C. Isolated elements of the stem X 225

ca., cambium; car., cortex; coll., collenchyma; cr₁.,
 prismatic crystal of calcium oxalate; cr₂., rosette; end.,
 end., endodermis; ep., epidermis; g.tr., glandular
 trichomes; m.r., medullary ray; non.tr., non-glandular
 trichomes; p.pith; per.f., pericyclic fibre; ph., phloem;
 st.g., starch grains; tr., tracheids; xy., xylem

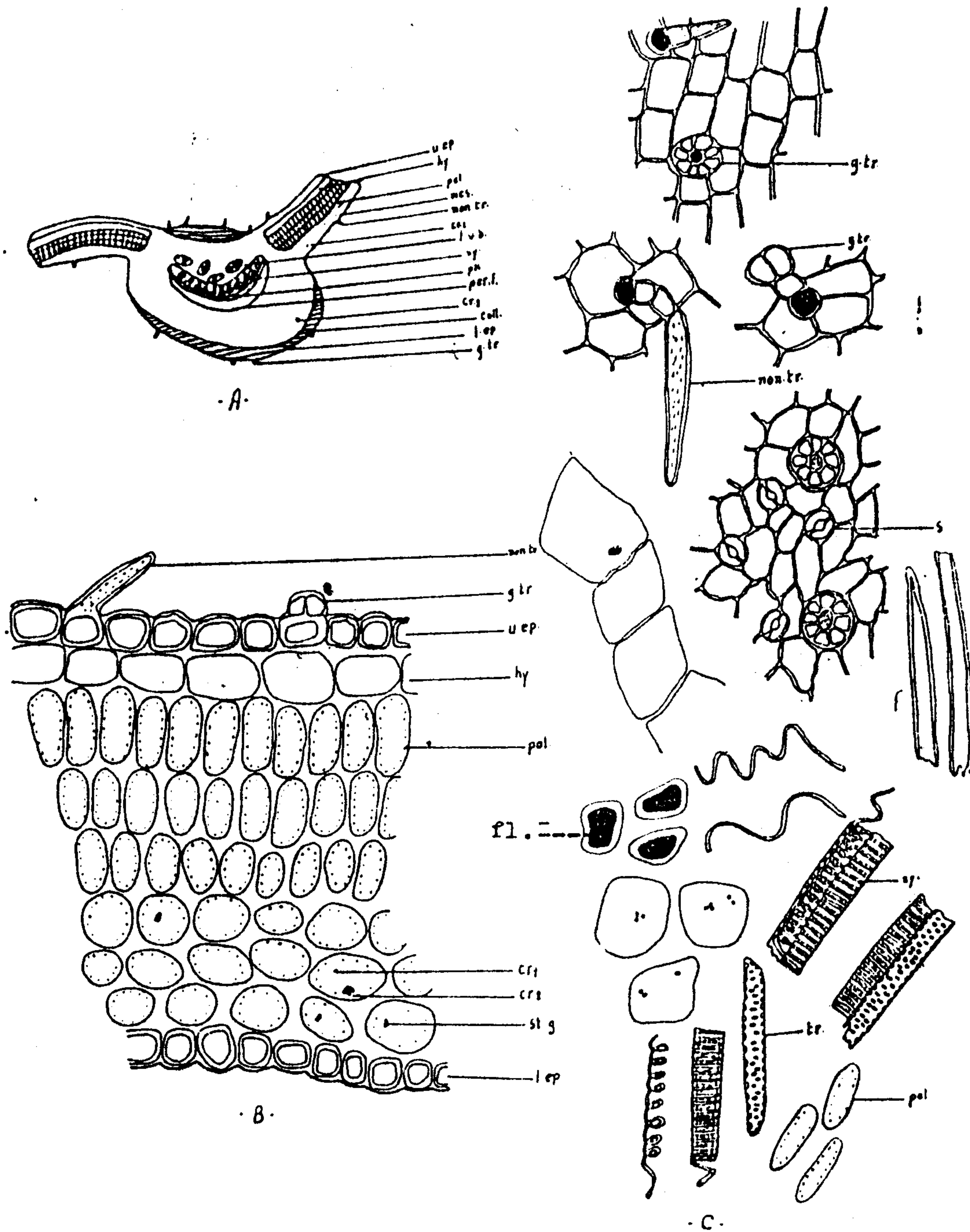


Fig.4- A. Diagrammatic T.S. of the leaf

X 21

B. Detailed T.S. of the lamina

X 225

C. Isolated elements of the leaf

X 225

coll., collenchyma; cr₁., prismatic crystall of calcium

oxalate; cr₂., rosette; f., fibres; g.tr., glandular

trichomes; hy., hypodermis; l.ep., lower epidermis; mes.,

mesophyll; non.tr., non-glandular trichomes; pal., palisade;

s., stomata; st.g., starch grains; tr., tracheid; xy., xylem.

fl., flavonoid.

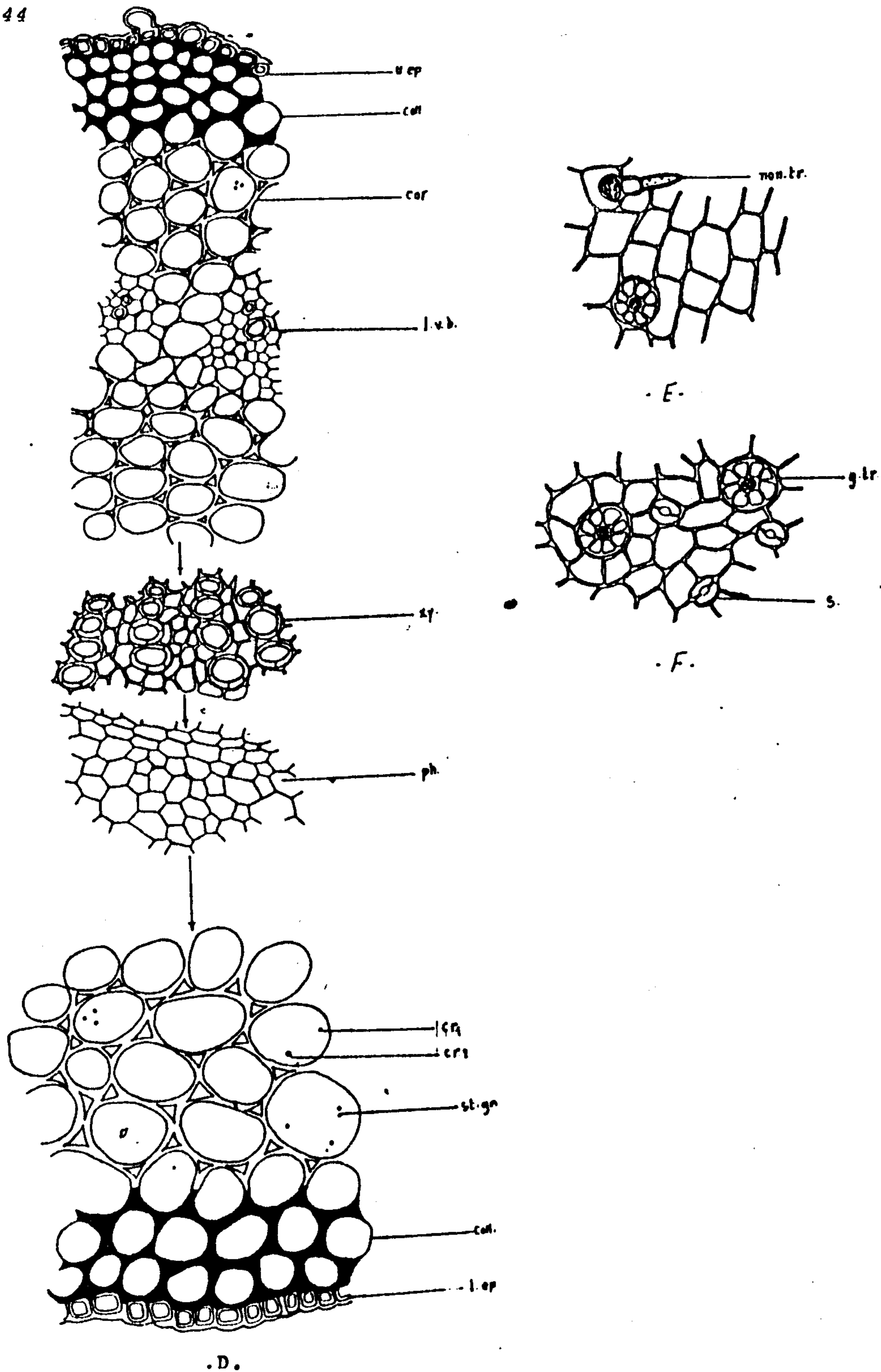


Fig. 5- D. Detailed T.S. of the midrib region X 225

E. Surface preparation of the upper epidermis X 225

F. Surface preparation of the lower epidermis X 225

coll., collenchyma; cor., cortex; cr_1 , prismatic crystal of calcium oxalate; cr_2 , rosette; g.tr., glandular trichomes; l.ep., lower epidermis l.v.b., lateral vascular bundle; non.tr., non-glandular trichomes; ph., phloem; s., stomata; st.gr., starch grains; u.ep., upper epidermis; xy., xylem.

REFERENCES

- 1) P.G., Louw, and J. Onderstepoort, *J. VET. Sci* 18:197 (1943), 22: 321, 329 (1948), 23 : 233 (1949).
- 2) S.I. Saad. " Classification of Flowering Plant"
Alexandria University P. 575:580, (1966).
- 3) R. Muschler " A Manual Flora of Egypt" Berlin R.
Friedlaender and Sohn, Karlstrasse 11, P. 811(1912).
- 4) علم الزينة للدكتور زكي جمعه مكتبة الانجلو - المصرية
ص ٢٢٥ (١٩٦٢)
- 5) A.M. Megahed, "Introduction to General Botany(In arabic)
Anglo Publishers P. 549-551, (1962).
- 6) R.N., Chopra, S.L. Nayar. and R.L., Badhwar, *Bombay Nat. Hist. Soc.* 42:854, (1941).

الصفات العيانية والمجهرية لسيقان واوراق الدورانتا

بوليمارى الذى ينمو فى مصر

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نبات الدورانتا بوليمارى ينمو فى مصر كاشجار الزينة فى الحدائق وعلى الاموار
وحيث ان للدورانتا الكثير من الاستعمالات الطبية والشعبية
وقد تم فصل قلويدات هذا النبات ووجد به نوع جديد امكن التعرف على تركيبه
الكيميائى . ومازال البحث ممتدا لفصل العديد من مكوناته الفلافونيدية وغيرها .
لذا من الضرورى دراسته عيانيا ومجهريا لامكانية التعرف على اجزائه سواء كانت
كاملة او فى صورة مسحوق .