

A PHARMACOGNOSTICAL STUDY OF CLERODENDRON INERME L.

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The macro and micromorphological characters of the flowering tops of Clerodendron inerms, L. were studied with the aim to identify the organs both in the entire and powdered forms.

Clerodendron inerms is a small shrub indigenous to south Africa, belonging to the family Verbenaceae. It is cultivated in Egypt for ornamental purposes and as a fence plant. Various Clerodendron species have been reported to be used in folk medicine. Clerodendron capitatum root and bark were reported as a purgative and to relieve intestinal troubles¹. In Rhodesia, Clerodendron glabrum E. Mey was used by the Indians in calf as purgative², as cough and fever remedy and for the treatment of intestinal parasites. Infusion of the root was used as emetic, antirheumatic³, anticonvulsant for the children⁴ and for the treatment of snake bites⁵. The leaf of Clerodendron johnstoni Oliv. was used as expectorant, while the bark was used in the treatment of diarrhoea⁶ and the root was used as a remedy for spleen enlargement. Clerodendron satrium L. was used in Angola for the treatment of malaria and Pneumonia⁷. The Indians claimed the juice of Clerodendron inerme Leaves as alterative, febrifuge and for resolving buboes when used

in the form of a Poultice⁸.

The pharmacognostical study including macro and micro-morphology could not be traced in the literature. Therefore, it was aimed to carry out this investigation to identify the plant in both entire and powdered forms.

EXPERIMENTAL

Material:

The material used in the investigation was taken from the plants cultivated in Tanta vicinity. Its identity was confirmed by the late Vivi Tackholm, Ex. Professor of Taxonomy, Cairo, University.

Macromorphology:

Clerodendron inerme (Fig. 1 A) is an evergreen, woody shrub attaining 2-4 meters in height and carrying numerous branches. It bears simple, exstipulate, shortly petiolate, opposite decussate leaves and white flowers arranged on dichasial inflorescence.

- 1- Stem (Fig. 1 A, B & C) is erect, solid, subcylindrical in outline, up to one meter long, 2-4 mm in \emptyset . It is monopodially branched with 3 cm long internodes. It is yellowish - green to green in color, has a faint odour and a bitter taste.
- 2- Leaves (Fig. 1 A, B & C) are simple, shortly petiolate, exstipulate, ovate to ovate lanceolate in shape, with blunt apex, decurrent base and entire margin. Size 2.5-4-5 Cm L. and 1-1.5-2.5 Cm W. It is papery in texture

in texture and has a green upper surface and a paler lower one, both surfaces being smooth and pubescent. The venation is reticulate. The petiole is subcylindrical, pale green to green in color and is covered with numerous hairs.

3- Inflorescence (Fig. 1 B) is a dichasial cyme up to 10 Cm in length, bearing three shortly petiolate flowers; these are small; up to 7 Cm long, white tubular in shape with cylindrical greenish calyx of 5 sepals measuring about $\frac{1}{10}$ of the total length of the flower. Corolla is funnel shaped 5 Cm L. formed of five syngenesious petals, the lower $\frac{4}{5}$ of the petals being joined together forming a 5 free lobes.

The flower is tetracyclic actinomorphic, hermaphrodite tetrandrous, possessing 4 epipetalous stamens. Each stamen has a slender filament 4.5 Cm L. and a bilobed basifixed anther. Gynaecium is formed of superior, ovoid ovary, bicarpellary, monolocular having a long style 5.5 Cm L. and a small oval stigma 0.2 Cm L.

II- Micromorphology:

A. Stem: The T.S. of the Stem' (Fig. 2A and B) is circular to slightly irregular in outline showing a layer of epidermis followed by a somewhat wide cortex about $\frac{1}{4}$ of the diameter. The pericycle is formed of groups of sclerenchymatous fibres surrounding a complete ring of vascular elements which encloses a wide pith.

The epidermis (Fig. 2B & C) is formed of one layer of rectangular cells, covered with smooth and thin cuticle. In surface preparation, they appear elongated, polyhederal with slightly thickened walls and measure L 55 - 66 - 76 μ , W 25- 33 - 40 μ and H 10 - 15 - 20 μ . The epidermal cells show covering trichomes and anomocytic stomata. The trichomes are non-glandular uniseriate either unicellular or multicellular. They measure L 120 - 270 - 360 μ and W 50 - 60 - 70 μ .

The cortex, consists of one layer of hypodermal chlorenchyma, followed by groups of sclerenchymatous fibres 2-4 up to 12 fibres, interrupted and followed by parenchyma. These fibres are thick walled and lignified. The endodermis is indistinguishable. Pericycle is formed of more or less complete ring of lignified fibres in groups which are interrupted with parenchyma. The fibres have thick walls, comparatively wide lumen, blunt ends and measure L 500 - 600 - 700 μ and 20 - 35 - 50 μ .

The vascular system (Fig. 2 B) is formed of four rows of phloem tissue; 2 rows of meristematic cells of cambium. The xylem consists of lignified, pitted and thick walled radially arranged elements.

The vessels are solitary or in small groups (2-4) usually with long segments, measuring D 20 - 33 - 45 μ . The vessels are either pitted, spiral or annular and are accompanied with lignified tracheids which have mostly bordered pits and measuring D 24 - 30 - 35 μ . Wood fibres are abundant and possess wide lumen, thick walls and blunt ends; they measure D 15 - 20 - 26 μ . Wood parenchyma are subrectangular, axially elongated slightly thickened cells and arranged in vertical rows. Medullary rays are usually biseriate, made of subrectangular cells with thick, lignified and pitted walls.

Pith is wide parenchymatous, composed of rounded to polygonal with thickened and pitted walls.

Powder:

The powdered stem of Clerodendron inerme is yellowish green in color with characteristic odour and slightly bitter taste. It shows the following elements (Fig. 3).

- 1- Fragments of elongated epidermal cells with straight anticlinal walls, covered with a smooth cuticle and having numerous uniseriate, unicellular or multicellular covering trichomes and stomata of anomocytic type.
- 2- Fragments of lignified fibres with wide lumen and blunt apices.
- 3- Fragments of lignified vessels and tracheids with bordered pits; also fragments of spiral and annular vessels.
- 4- Fragments of polygonal and rectangular pitted walled cells of the wood parenchyma and medullary rays.
- 5- Fragments of rounded, pitted slightly thickened walled cells of the pith.

B- Leaves : The T.S. in leaf (Fig. 4 A) shows planconvex outline with the midrib bulging on the lower surface.

It shows a dorsiventral structure with an upper palisade consisting of 3 rows of columnar cells and interrupted in the midrib region with a mass of sub-epidermal collenchyma. There is another collenchymatous mass abutting the lower epidermis in the midrib region. Vascular tissue is formed of 7 vascular strands each one is capped with a group of pericyclic fibres.

Upper epidermis (Fig. 4.B & C) consists of one row of tabular cells with straight anticlinal walls and smooth cuticle. In surface view, the cells appear isodiametric to slightly elongated, measuring H 26 - 33 - 40 μ , W 33 - 66 - 80 μ and L 60 - 80 - 100 μ . The epidermal cells show numerous anomocytic stomata and very few diacytic type. Cove-

ring and glandular trichomes are similar to that of the stem, while the glandular trichomes are of the labiaceous type.

Lower epidermis (Fig. 4 B & D) is formed of one row of subrectangular cells. In surface view, the cells are polygonal, mostly isodiametric with wavy anticlinal walls. They measure, H 26 - 33 - 40 μ , W 33 - 40 - 66 μ and L 50-66 - 80 μ . The cells are usually covered with striated cuticle. Stomata and trichomes are similar to those of the upper epidermis in all aspects but more numerous.

Mesophyll (Fig. 4 B) is a wide heterogenous region showing an upper palisade which is formed of 3 rows of columnar cells. The cells of the two upper rows are much longer than those of the lower one. The cells measure, L 120 - 140 - 170 μ and D 30 - 50 - 70 μ . The spongy tissue is formed of rounded to rectangular parenchymatous cells with wide intercellular spaces.

Cortical tissue in the midrib region (Fig. 4 E) is formed of rounded to subrectangular parenchymatous cells with wide intercellular spaces. There are two masses of sub-epidermal collenchyma, one below the upper epidermis of 3-4 rows of nearly rounded collenchyma cells and the other abutting the lower epidermis consisting of 2-3 rows. Endodermis is not conspicuous.

The vascular system (Fig. 4 E) is formed of collateral bundles, each consisting of upper xylem and lower phloem. The vessels are spiral and annular, measuring, D 12 - 24 - 36 μ . The phloem is formed of 4-5 rows of thin walled cells of sieve tubes and phloem parenchyma. The pericycle is formed of 4-6 rows of parenchymatous cells interrupted above the vascular bundles by groups of sclerenchymatous fibres. The fibres are slightly lignified, each has a wide lumen, thick walls

and blunt ends.

Petiole : The T.S. of the petiole (Fig. 5 A) is more or less planoconvex showing two masses of collenchyma abutting the upper and lower epidermis in the vascular bundle region, a wide parenchymatous cortex and the vascular tissue. The latter is formed of 9-11 vascular bundles, each bundle is capped with a small group of pericyclic fibres.

The upper epidermis in T.S. (Fig. 5 B & C) consists of one row of rectangular cells. They appear in surface view as axially elongated cells with straight walls and covered with smooth cuticle. They measure, H 8 - 10 - 12 μ , W 20 - 30 - 40 μ and L 30 - 45 - 60 μ . The trichomes are mostly of the covering types similar to those of the leaf; stomata are rare and of the anomocytic type.

The lower epidermis is formed of one row of subrectangular cells (Fig. 5 B & C). In surface view they are axially elongated cells, exactly identical with the upper epidermis in shape, trichomes and stomata. They measure, H, 6 - 8 - 10 μ , W 18 - 25 - 32 μ and L 30 - 40 - 55 μ .

The collenchymatous hypodermis is formed of 3 rows on the upper side and only one row of cells on the lower side.

Vascular system is identical with that of the midrib in structure except that the pericyclic fibres are lignified.

Powdered of the leaf, is dark green in color with characteristic odour, bitter taste and shows the following elements (Fig. 6):

- 1- Fragments of the epidermal cells of the lamina of polygonal isodiametric cells with straight walls and covered

with smooth cuticle (upper epidermis) or wavy anticlinal walls with stratified cuticle (lower epidermis) The cells showing numerous stomata, mostly of anomocytic type with few diacytic and glandular as well as non-glandular trichomes.

- 2- Fragments of uniseriate, unicellular or multicellular non-glandular trichomes and labiate type glandular trichomes.
- 3 - Fragments of lignified spiral and annular vessels.
- 4 - Fragments of fibres with thick walls, wide lumen, lignified and blunt ends.

C. Inflorescence:

1- The flower:

- A) Calyx , the tissues of the sepals comprise an outer and an inner epidermis enclosing inbetween a homogeneous mesophyll which is traversed by several vascular strands.

The outer epidermis (lower, Fig. 7A) is formed of polygonal isodiametric cells with straight anticlinal walls, covered with smooth cuticle and measures L 36 - 50 - 60 μ and W 26 - 38 - 42 μ .

The inner (upper) epidermal cells (Fig. 7B) are similar to those of the outer epidermis in shape but differ in size, measuring L 40 - 46 - 53 μ and W 27 - 33 - 40 μ .

- B) Corolla is formed of an outer and an inner epidermis enclosing inbetween few layers of undifferentiated parenchymatous mesophyll.

The upper (inner) epidermis (Fig.7C) is formed of polygonal isodiametric cells with thin cellulosic wavy anticlinal walls. The cells show no variation in different parts of the surface regarding the shape and size. They measure L 50 - 57 - 66 μ and W 26 -

33 - 40 μ .

C) Androecium:

- 1- The filament, shows an epidermis followed by a wide undifferentiated parenchymatous mesophyll surrounding a central vascular bundle.

The epidermis of the filament (Fig. 7 E) appears in surface view as subrectangular axially elongated, cells with wavy anticlinal walls and covered with smooth cuticle. They measure L 60 - 70 - 80 μ and W 25 - 33 - 40 μ .

- 2- The anther consists of two anther lobes attached through the connective. Each anther lobe has two pollen sacs with numerous pollen grains.

The epidermis of the anther (Fig. 7F) is formed of polygonal cells with straight anticlinal walls and measure L 66 - 72 - 78 μ and W 26 - 33 - 40 μ . The cells are covered with thin smooth cuticle, and show no stomata or trichomes.

Fibrous layer (Fig. 7 G) is formed of rectangular radially elongated cells with lignified bar-like thickening, in surface view the cells appear polygonal in shape with distinct beaded walls. They measure L 60 - 66 - 72 μ and W 33 - 40 - 47 μ .

Pollen grains (Fig. 7 H) are subspherical in shape with warty exine. They are yellow in color, each possessing 3 germinal pores and 3 germinal furrows . They measure D 53 - 60 1-66 μ . in \emptyset .

D) The gynoecium:

- 1- The ovary, T.S. in the ovary (Fig. 8 A) shows ovary wall formed of an outer and an inner epidermis enclosing inbetween a wide parenchymatous ground tissue

which is traversed by 10 - 12 vascular bundles. The ovary is bicarpellary unilocular and having two ovules with basal placentation.

The outer epidermis (Fig. 8 B & C) consists of one layer of subrectangular cells appearing in surface view as polygonal cells with straight anticlinal walls and smooth cuticle, they measure L 40 - 45 - 50 μ and W 26 - 33 - 40 μ .

The ground tissue is formed of 14 rows of parenchymatous cells containing occasional clusters of CaOX; these are traversed by small vascular bundles; each bundle is formed of an outer parenchymatous phloem and an inner xylem. The xylem consists of small spiral and annular lignified vessels, measuring D 8 - 12 - 17 μ together with non-lignified wood parenchyma.

The inner epidermis (Fig. 8 B) is formed of large non-lignified subrectangular cells; these are thickened on the two tangential walls, each having a small rectangular lumen.

- 2- The style; it has polygonal axially elongated epidermal cells with straight walls and covered with smooth cuticle (Fig. 8 D); these measure L 50 - 54 - 60 μ and W 18 - 26 - 33 μ .
- 3- The stigma (Fig. 8 E): The epidermal cells of the stigma are polygonal in shape with straight wall and covered with smooth cuticle. The cells show numerous papillae which are oval to triangular in shape, measure L 20 - 42 - 65 μ and W 16 - 24 - 30 μ .
- 2- The peduncle: The T.S. in the peduncle (Fig. 9A) is oval in outline. It shows an epidermis, followed by a parenchymatous cortex. The pericycle is formed of a continuous

ring of pericyclic fibres; surrounding the stele which consists of an outer phloem ring, followed by a xylem ring surrounding a wide parenchymatous pith.

The epidermis (Fig. 9 B & C) consists of one layer of nearly square cells, appearing in surface view as subrectangular cells with straight anticlinal walls and smooth cuticle. Occasional anomocytic stomata and covering trichomes measuring L 66 - 76 - 84 μ and W 33 - 40 - 46 μ are present.

The cortex is formed of six rows of nearly rounded parenchyma with intercellular spaces.

The pericycle is formed of one row of lignified fibres, forming a ring surrounding the vascular bundle.

The phloem is formed of 4 - 5 rows of thin walled sieve tubes and phloem parenchyma.

The combium is formed of two rows of meristimatic cells.

Xylem, consists of thickened mostly lignified elements radially arranged. The vessels are spiral or annular, arranged in groups of 3 - 5, measuring D 20 - 26 - 33 : They are usually accompanied with lignified tracheids with bordered pits, measuring D 18 - 24 - 30 μ . Wood parenchyma are formed of subrectangular thickened non lignified cells. The wood fibres are similar to those of the stem but much smaller measuring D 16 - 23 - 26 μ .

The pith is wide made of rounded to polygonal pitted and thick walled non lignified cells.

Powdered Inflorescence; is yellowish white in color with characteristic odour and a slightly bitter taste; it shows the following diagnostic elements(Fig. 10):

- 1- Fragments of the epidermal cells of the calyx of polygonal to isodiametric cells with straight anticlinal walls and smooth cuticle.
- 2- Fragments of the epidermal cells of the corolla of polygonal, isodiametric cells, with wavy anticlinal walls.
- 3- Fragments of the epidermal cells of the filament which are subrectangular axially elongated cells with wavy anticlinal walls.
- 4- Fragments of the fibrous layer of the anther with polygonal to subrectangular cells possessing lignified bar-like thickening.
- 5- Numerous pollen grains, yellowish in color and subspherical in shape with warty exine.
- 6- Fragments of papillosed stigma.
- 7- Fragments of spiral, annular vessels and pitted tracheids; both are lignified.
- 8- Fragments of lignified fibres with blunt ends.

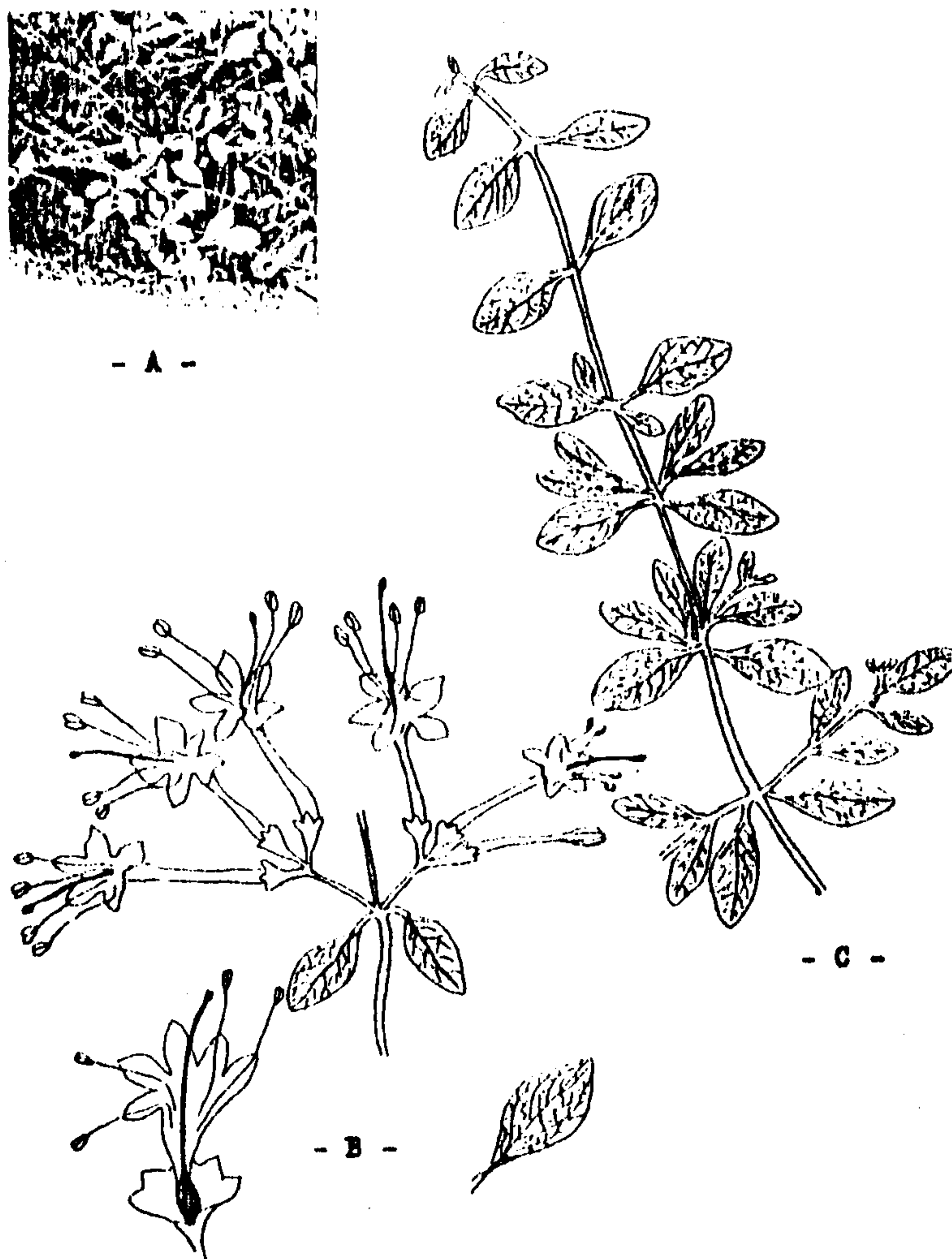


Fig. 1- A. Photograph of *Clerodendron ininerve*

B. Sketch of flowering branch.

X 4

C. Sketch of the branch

X 1/4

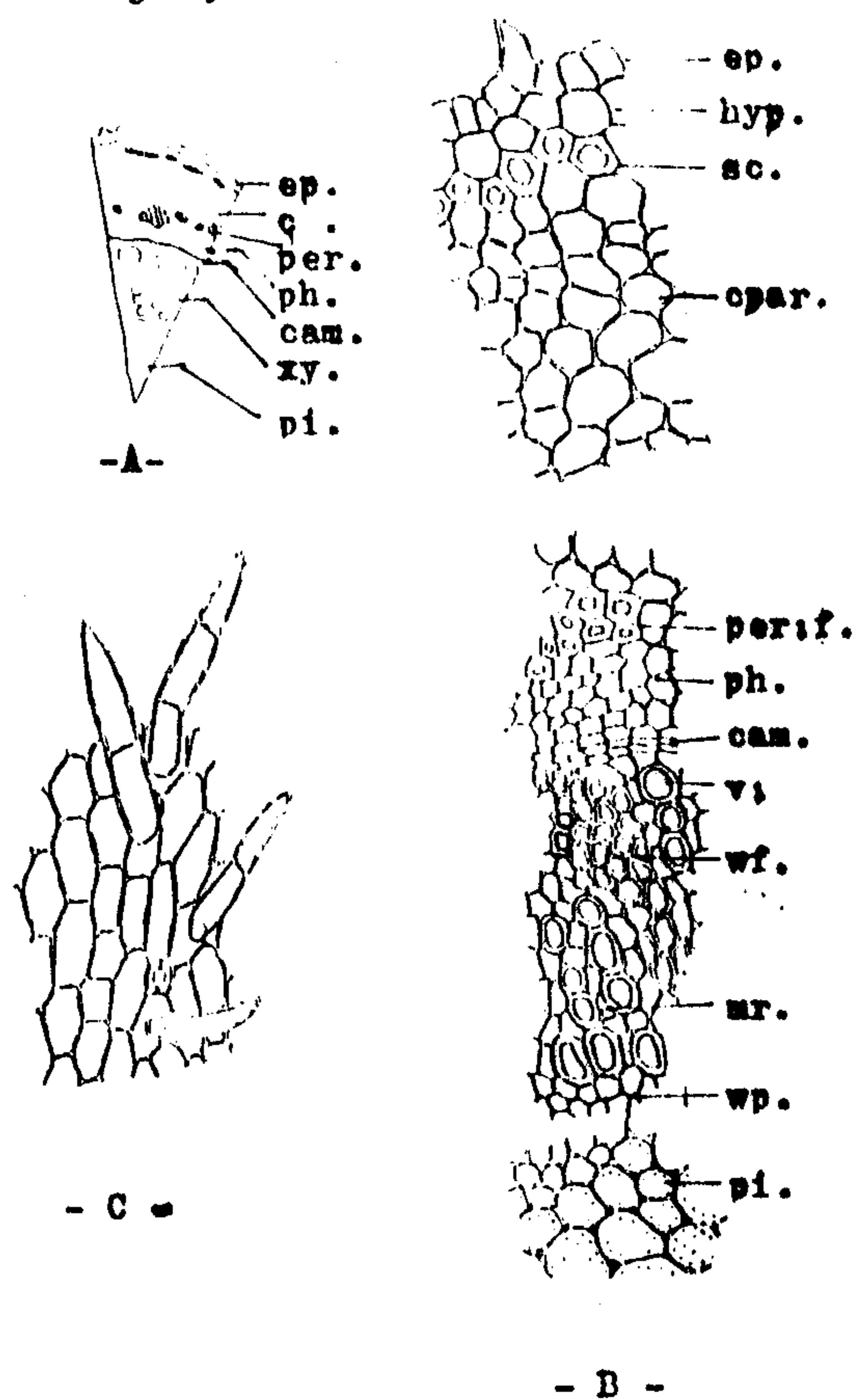


Fig. 2- A. Diagrammatic T.S. of the stem. X 5
 B. Detailed T.S. of the stem. X 23
 C. Surface preparation. X 23

ep., epidermis; c., cortex; hyp., hypodermis; sc., sclerenchyma; cpar., cortical parenchyma; per., pericycle; per. f., pericyclic fibre; ph., phloem; cam., cambium; xy., xylem; v., vessel; wf., wood fibre; wp., wood parenchyma; mr., medullary ray; pi., pith.

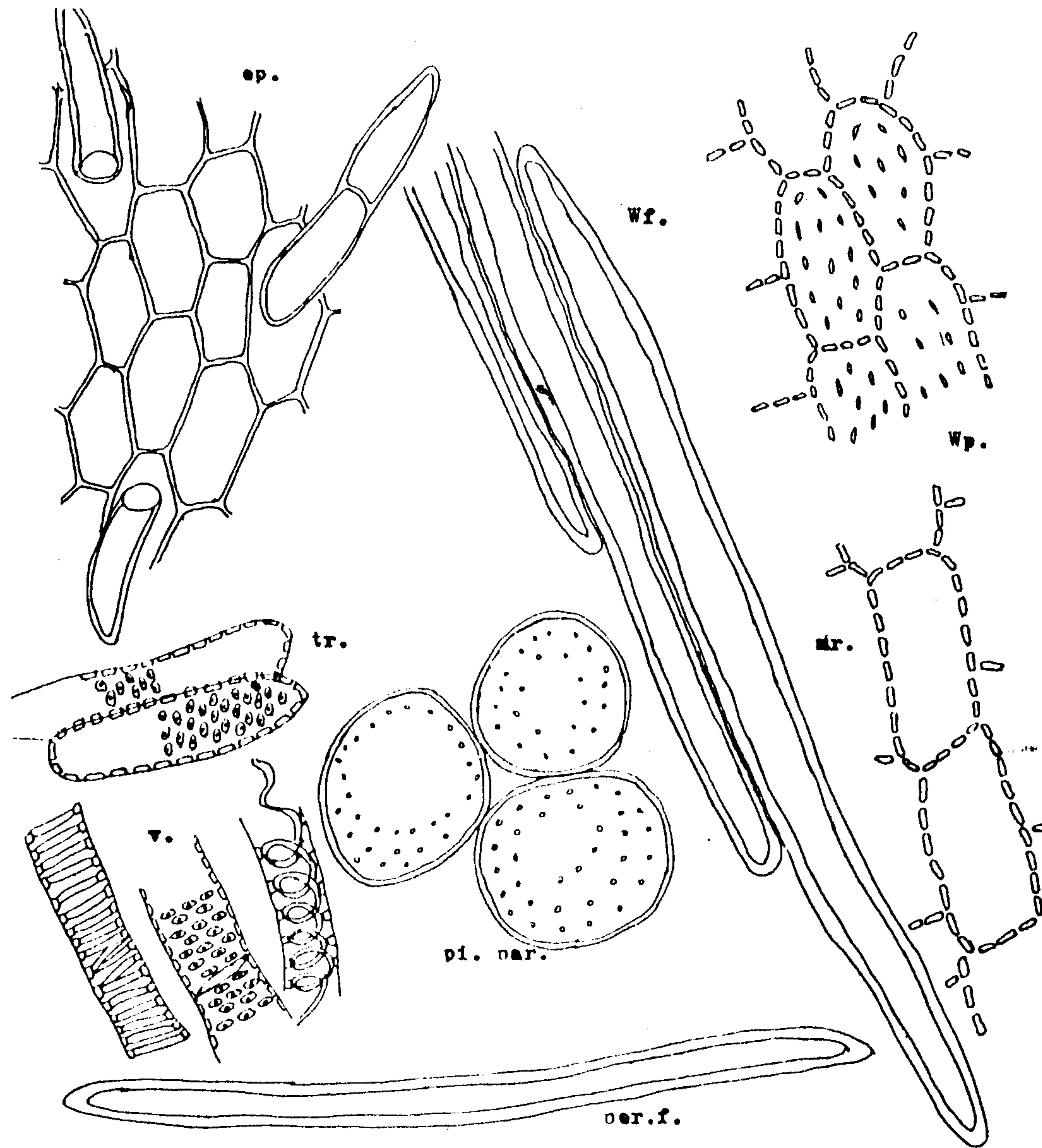


Fig. 3- The powder of the stem.

X 35

ep., epidermis; wf., wood fibre; wp., wood parenchyma; mr., medullary ray; pi.par., pith parenchyma; v., vessel; tr., tracheid; per.f., pericyclic fibre.

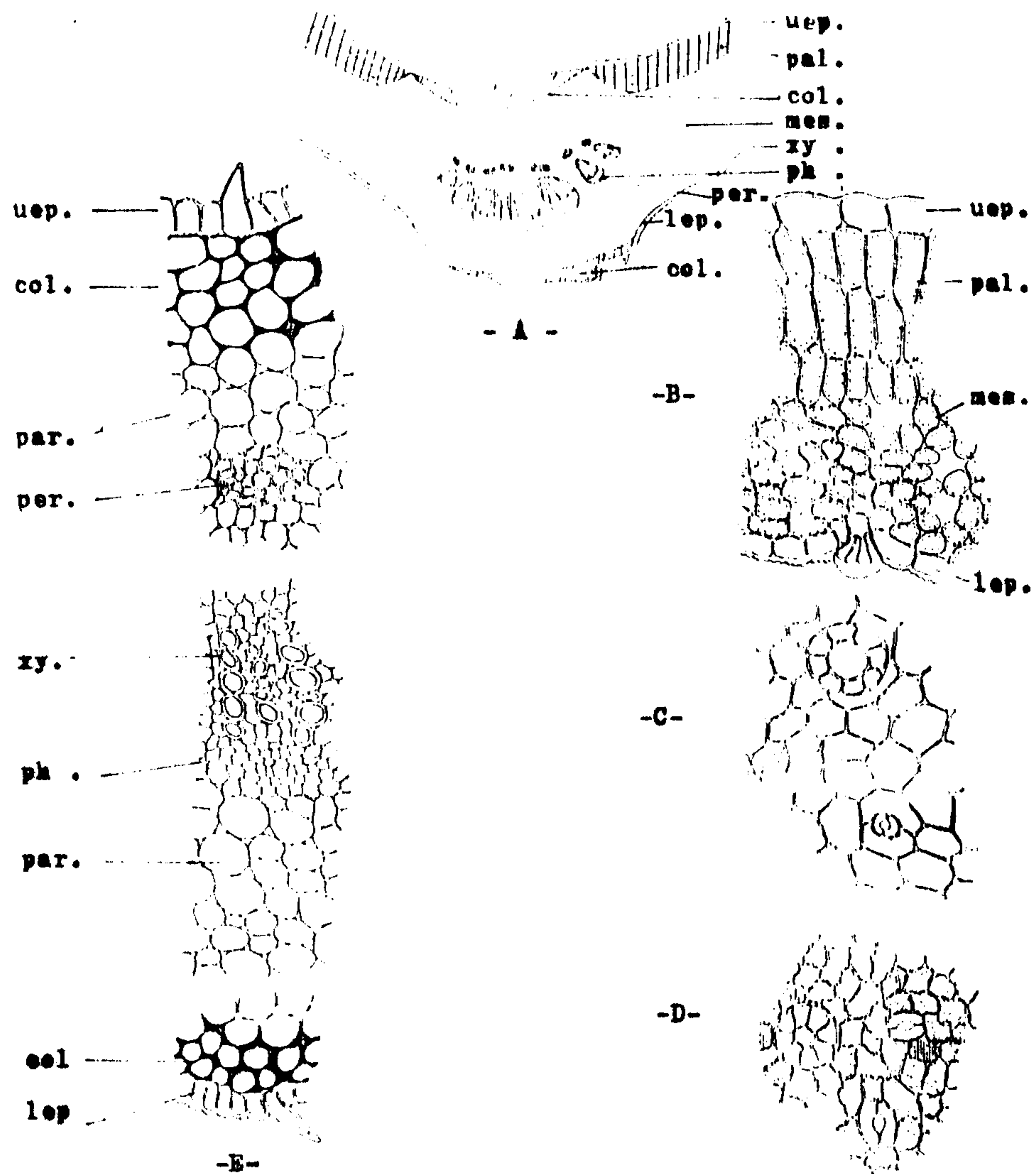


Fig. 4- A. Diagrammatic T.S. of the leaf. X 7.5
 B.& E. Detailed T.S. of the leaf X 35
 C. Upper epidermis X 35
 D. Lower epidermis X 35

uep., upper epidermis; pal., palisade; mes., mesophyll; xy., xylem; ph., phloem; per., pericycle; col., collenchyma; lep., lower epidermis; par., parenchyma.

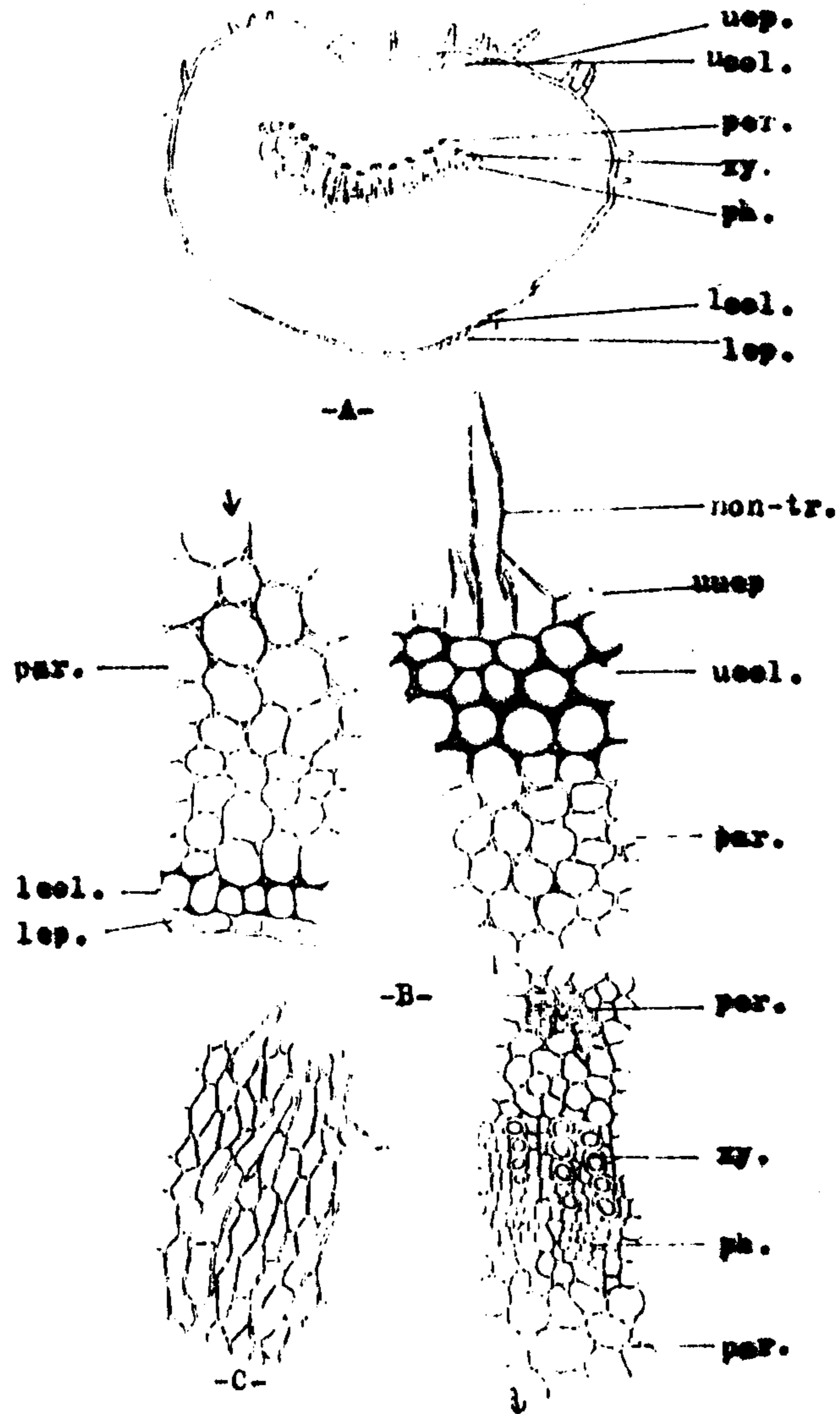


Fig. 5- A. Diagrammatic T.S. of the petiol. X 7.5
 B. Detailed T.S. of the petiol. X 35
 C. Surface preparation X 35

non-tr., non-glandular trichomes; uep., upper epidermis; ucol., upper collenchyma; par., parenchyma; per., pericycle; xy., xylem; ph., phloem; locl., lower collenchyma; lep., lower epidermis.

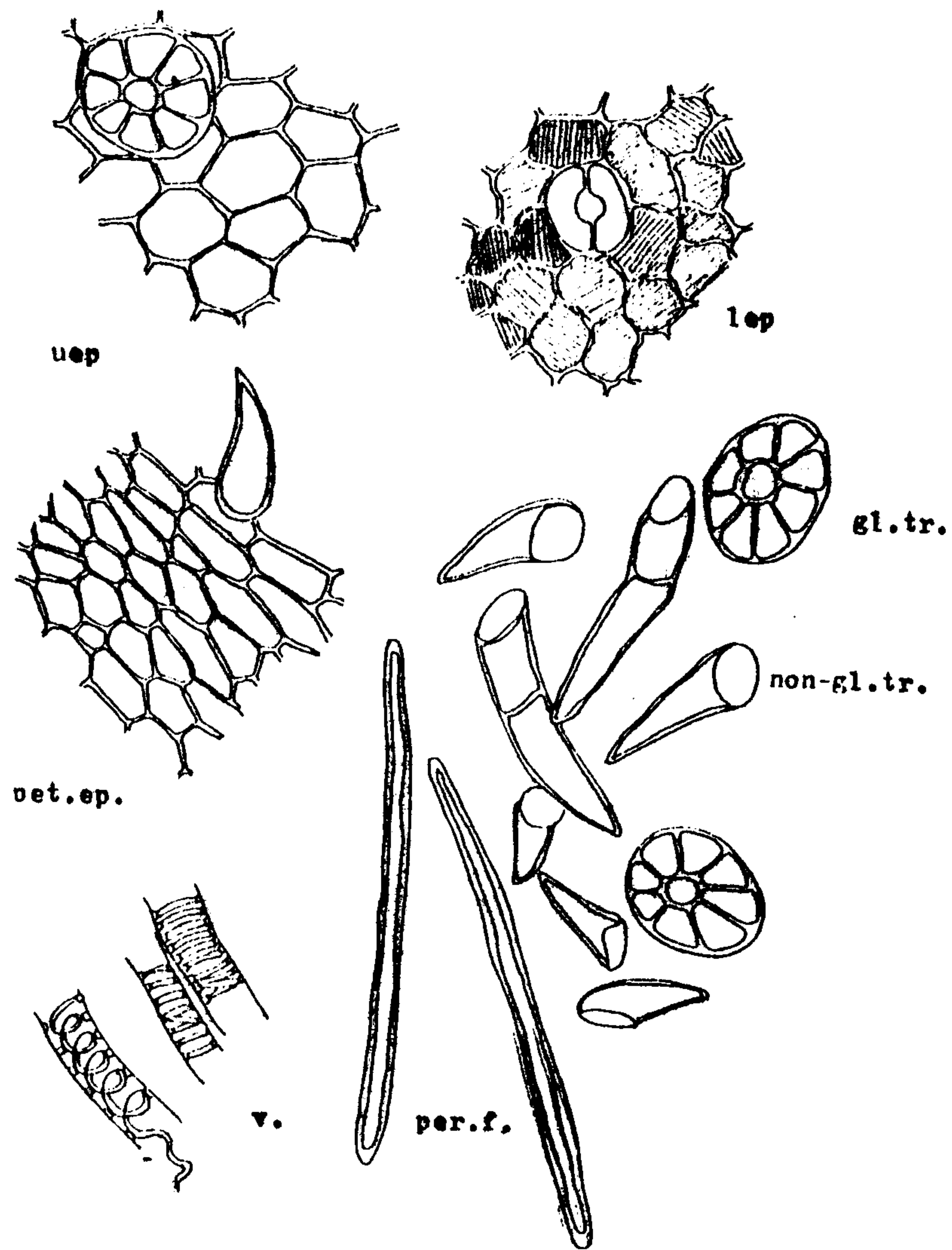


Fig.6- The powder of the leaf

X 35

uep., upper epidermis; lep., lower epidermis; pet.ep., petiol epidermis; v., vessel; per.f. pericyclic fibre; gl.tr., glandular trichomes; non-gl.tr., non-glandular trichomes.

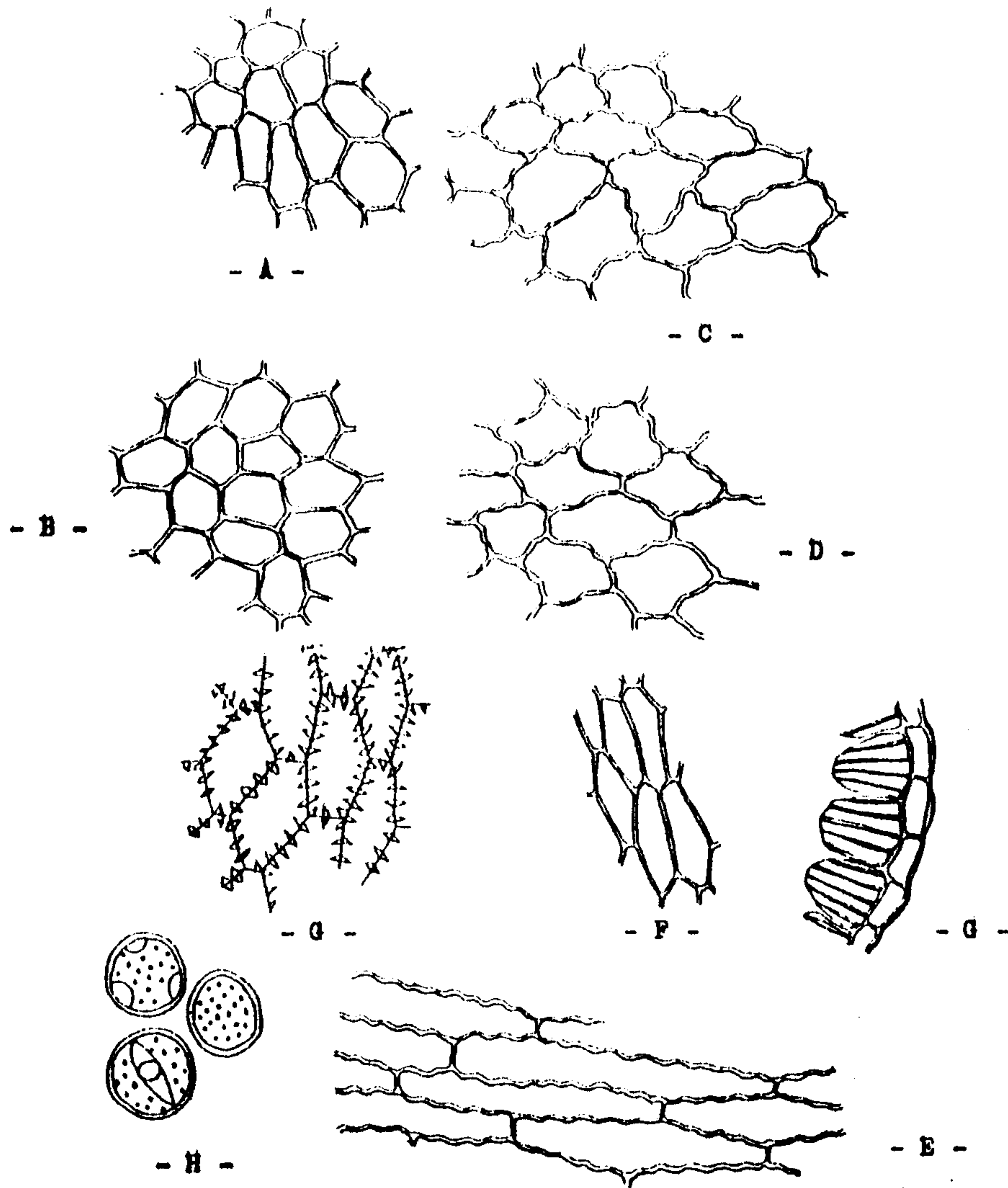


Fig. 7- A. Upper epidermis of the calyx X 35
 B. Lower epidermis of the calyx X 35
 C. Upper epidermis of the corolla X 35
 D. Lower epidermis of the corolla X 35
 E. Epidermis of the filament X 35
 F. Epidermis of the anther X 35
 G. Fibrous layer of the anther X 35
 H. Pollen grains X 35

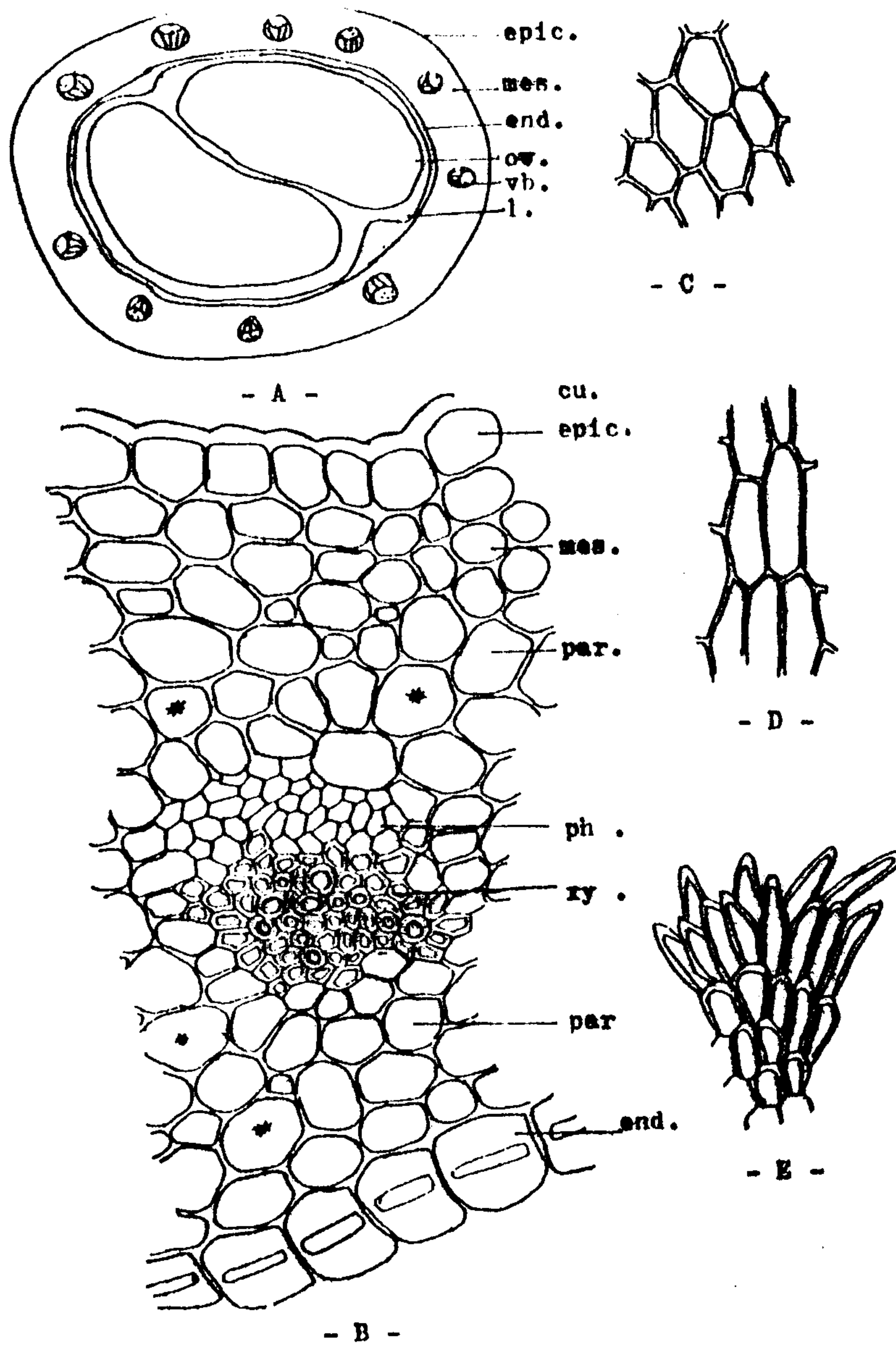


Fig. 8- A. Diagrammatic T.S. of the ovary X 15
 B. Detailed T.S. of the ovary X 70
 C. Surface preparation of the ovary X 70
 D. Surface preparation of the style X 70
 E. Papillosed stigma. X 70

epic., epicarp; mes., mesocarp; end., endocarp; ov., ovule; vb., vascular bundle; l., locule; cu., cuticle; par., parenchyma; ph., phloem; xy., xylem.

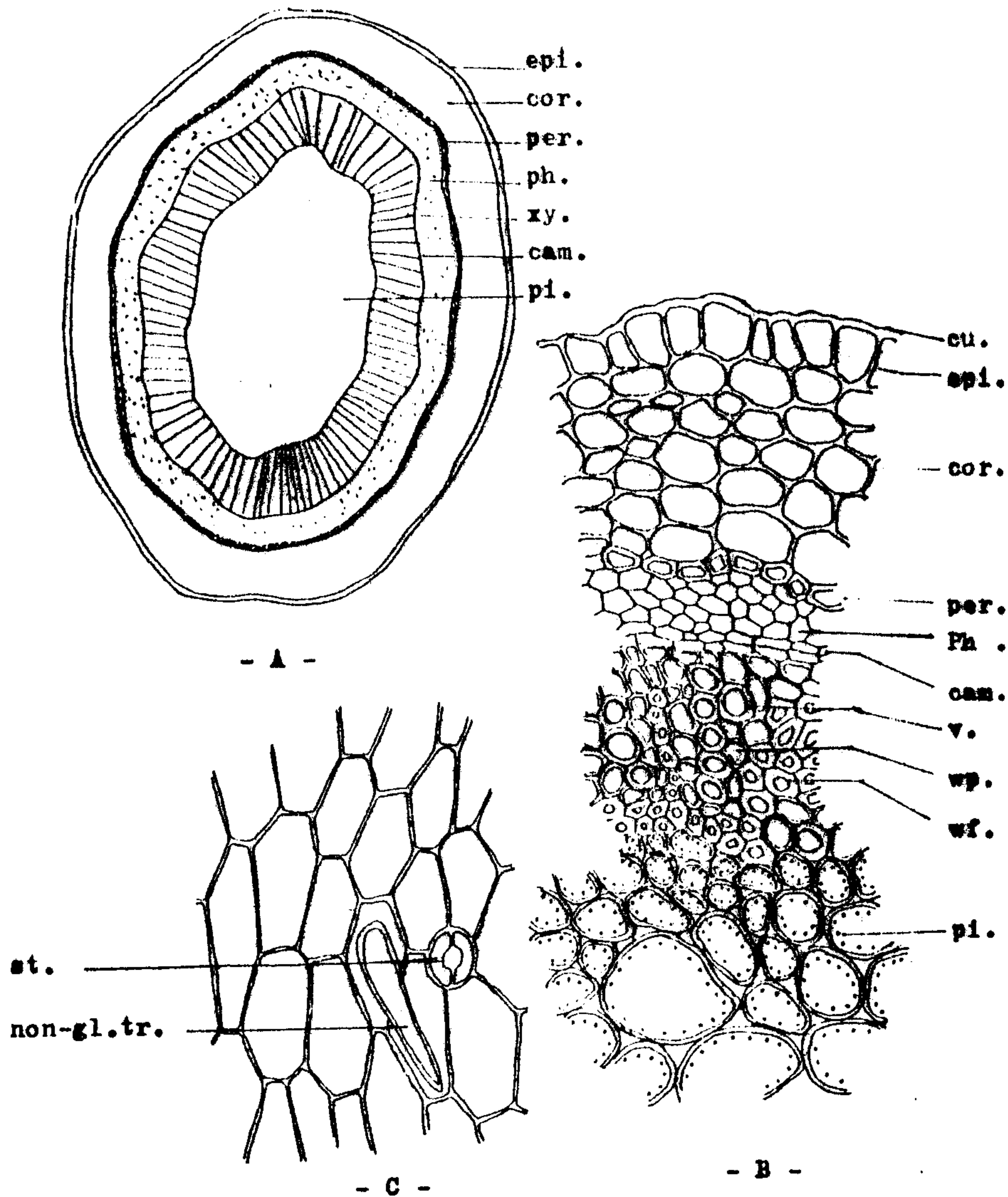


Fig. 9— A. Diagrammatic T.S. of the peduncle X 7.5
 B. Detailed T.S. of the peduncle X 35
 C. Surface preparation of the peduncle X 35

cu., cuticle; epi., epidermis; cor., cortex; per., pericycle;
 ph., phloem; xy., xylem; v., vessel; wp., wood parenchyma;
 wf., wood fiber; pi., pith; cam., cambium; non-gl.tr., non-
 glandular trichom; st., stomata.

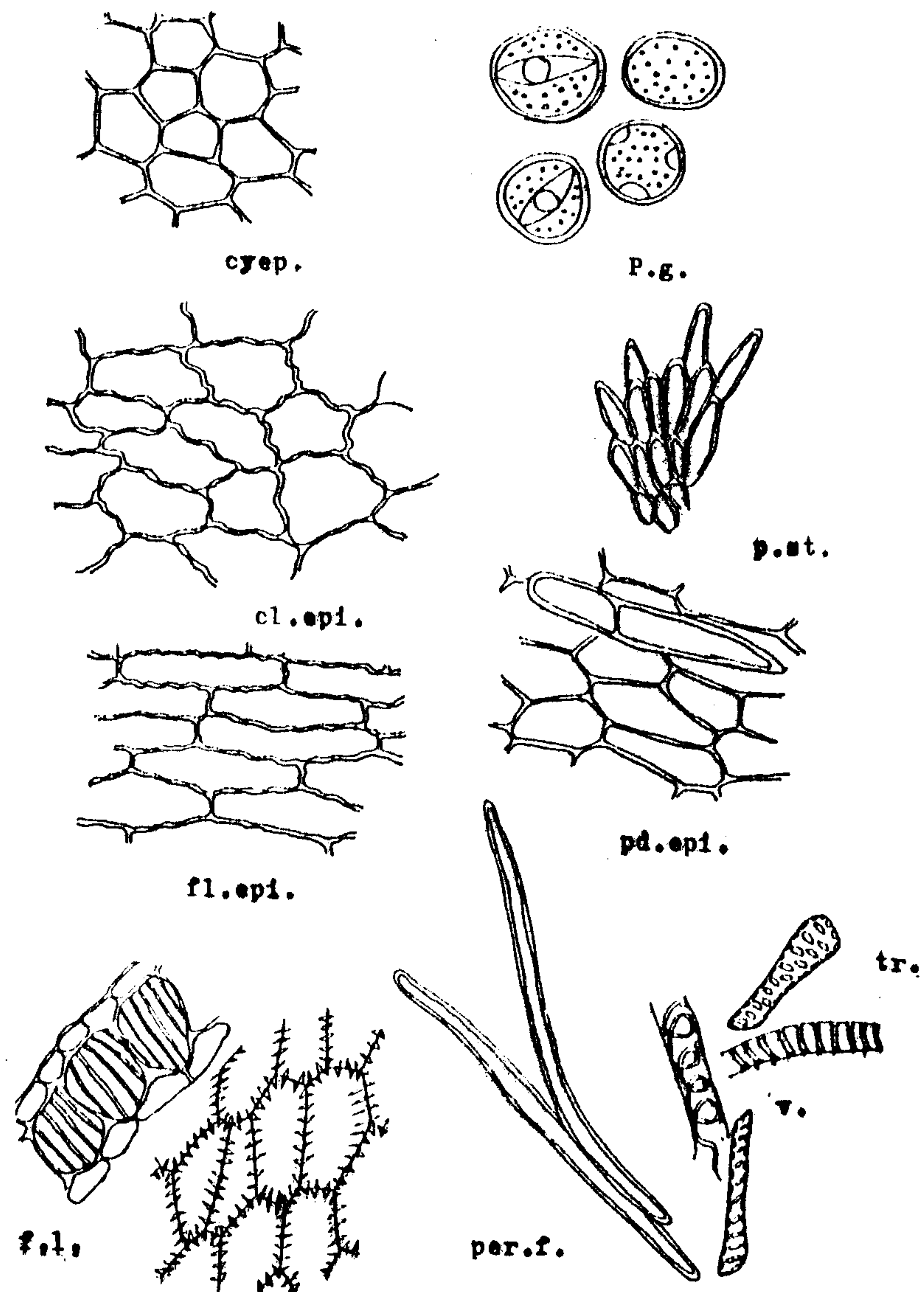


Fig. 10- The powder inflorescence

X 35

cy.epi., calyx epidermis; cl.epi., corolla epidermis; fl.epi., filament epidermis; p.g., pollen grains; p.st., papillosed stigma; pd.epi., peduncle epidermis; tr., tracheids; v., vessel; f.l., fibrous layer; per.f., pericyclic fibres.

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دراسة عقاقيرية لنبات الياسمين الزفر

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تم دراسة الصفات الظاهرية والتشريحية للقامة الزهرية
لنبات الياسمين الزفر بهدف التعرف على هذه الاجزاء عندما
تكون في حالة كاملة او على هيئة مسحوق .

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