

PHARMACOGNOSTICAL STUDY OF GYNANDROPSIS
PENTAPHYLLA (HURHUR) GROWING IN EGYPT

PART II: Macro and Micromorphology of the Flower and
Fruit.

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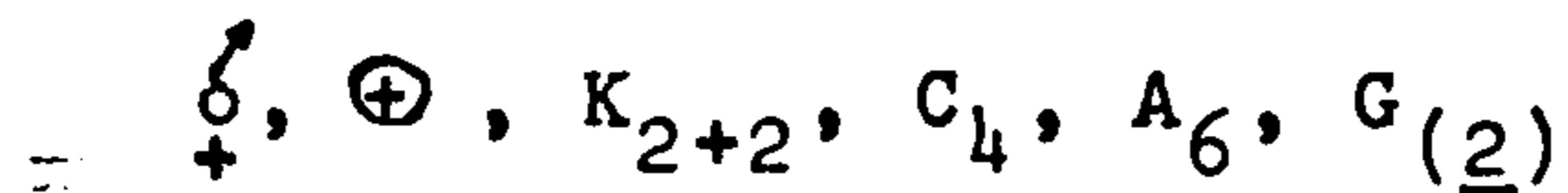
A detailed study of the macro and micromorphology of the flower and fruit of Gynandropsis pentaphylla Hurhur growing in Egypt are presented to help in their indentification both in the entire and powdered forms.

In a previous paper¹ the macro and micromorphology of the root, stem and leaf of Gynandropsis pentaphylla Hurhur growing in Egypt are presented. The present work deals with the macro and micromorphology of the flower and fruit of the same plant.

MACROMORPHOLOGY

1- The inflorescence (Fig. 1,A) is a terminal raceme. The flower (Fig. 1,B) is small, pedicellate, purplish in colour, has no odour and a slightly bitter taste. It measures from 2.5 to 3.5 cm in length and 0.6 to 1.3 cm in diameter. The flower is regular, bisexual and hypogynous. It has at its base a 3-foliate leafy bract. The flower has the floral formula

(Fig. 1,C):



The pedicel (Fig. 1,B) is cylindrical, green in colour and measures from 2 to 4 cm in length and 0.06 to 0.1 cm in diameter.

The calyx (Fig. 1,D) consists of 4 free sepals arranged in two whorls. The sepal is green, hairy, nearly lanceolate with acute apex and entire margin. It measures from 0.5 to 0.6 cm in length and 0.07 to 0.08 cm in width.

The corolla (Fig. 1, E) consists of one whorl of 4 free purplish imbricated petals. They are long-clawed, oval to oblong in shape with entire margin and blunt to rounded apices measuring from 0.7 to 0.9 cm in length and 0.2 to 0.3 cm in width.

The androecium (Fig. 1,B) is formed of 6 free epigynous stamens arranged in two whorls. Filaments are filiform, pale yellow in colour. The anthers are linear in shape, bilobed, basifixed and orange in colour.

The gynaecium (Fig. 1,B) is syncarpous, bicarpillary and unilocular. The ovary is raised on a stalk (gynophore), superior, linear to subcylindrical in shape and green in colour. It measures from 1 to 1.8 cm in length and 1 to 2 mm in diameter.

Many anatropous ovules carried on a parietal placenta.

The style is absent and the stigma is capitulate.

2- The fruit (Fig. 1,A) is a capsule, narrow-linear, tapering, green in colour with striated rough surface, measuring from 4 to 8 cm in length and 0.4 to 0.5 cm in diameter. The remains of the stigma appear at the apex. The gynophore measure from 2 to 4 cm in length, with the scar of the stamen near the middle. The capsule dehisces by valves. The

fruit has no characteristic odour and a bitter taste. The ripe, fruit usually contains numerous seeds which are arranged on a parietal placentation.

MICROMORPHOLOGY

1- The Flower :

The calyx (Fig. 2,A): A transverse section in the sepals shows an outer and an inner epidermises, enclosing in between a homogeneous mesophyll traversed by numerous vascular strands.

The inner and outer epidermises (Fig. 2,B,C,D &E) show marked variation in shape and size of the cells at different parts of the sepals. The cells at the apical region are polygonal, usually axially elongated with nearly straight anticlinal walls. They measure from 46 to 120 μ in length and 15 to 30 μ in width. Those of the middle region are polygonal, isodiametric with almost straight anticlinal walls and measure from 45 to 85 μ in length and 15 to 60 μ in width. Those of the marginal region are polygonal, axially elongated with nearly straight anticlinal walls, measuring from 56 to 90 μ in length and 30 to 50 μ in width. Those of the basal region are polygonal axially elongated with almost straight anticlinal walls and measure from 55 to 120 μ in length and 30 to 45 μ in width.

All cells are covered with smooth cuticle. Glandular trichomes of multicellular biseriate stalk and multicellular head are observed on both epidermises. The stalk measures from 15 to 50 μ in length and 15 to 55 μ in width and the head measures from 35 to 60 μ in diameter and covered with smooth cuticle. Stomata of anomocytic type are present in the middle

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region and measure from 25 to 45 μ in length and 20 to 35 μ in diameter.

The corolla: The petal (Fig. 2, F) is formed of inner and outer epidermises enclosing in between few layers of undifferentiated parenchymatous mesophyll traversed by numerous vascular strands.

The outer epidermis: (Fig. 2, G, H & I) The cells of the apical region are polygonal, isodiametric with straight anticlinal walls and measure from 25 to 45 μ in length and 15 to 40 μ in width. The cells of the middle region resemble those of the apical but being slightly larger, measuring from 30 to 60 μ in length and 20 to 40 μ in width. In the basal region, the cells are polygonal, axially elongated with straight anticlinal walls and measure from 50 to 120 μ in length and 15 to 30 μ in width.

All cells are covered with smooth cuticle. Stomata and trichomes are not observed.

The inner epidermis (Fig. 2, J, K, L) shows slight variation in shape and size of the cells at different parts of the petals. The cells are more or less isodiametric with straight or slightly curved anticlinal walls and covered with striated cuticle. The cells of the apical and basal regions are papillosed. The cells measure from 30 to 45 μ in length and 25 to 40 μ in width at the apical region, from 25 to 60 μ in length and 15 to 45 μ in width at the middle region, and from 45 to 80 μ in length and 20 to 45 μ in width at the basal region. Stomata and trichomes are absent.

The androecium (Fig. 3, A): The filament (Fig. 3, a) is circular in transverse section, showing an epidermis, a comparatively narrow cortex and a ring of separate collateral vascular bundles surrounds a wide pith. The epidermal cells (Fig. 3, b) are subrectangular or polygonal, axially elongated with nearly

straight anticlinal walls, covered with smooth cuticle and measure from 30 to 100 μ in length and 15 to 40 μ in width.

The anther (Fig. 3,c) consists of two equal lobes attached together by the connective and has a central vascular strand. Each lobe is formed of two pollen sacs. The anther wall is thin consisting of an epidermis, a fibrous layer and the remains of the tapetal layer. The epidermis (Fig. 3, d) is of polygonal, slightly elongated cells with nearly straight anticlinal walls, measuring from 30 to 90 μ in length and 30 to 100 μ in width. The fibrous layer (Fig. 3,e) is formed of one row of lignified cells with bar-like thickened walls. They measure from 60 to 120 μ in length and 30 to 60 μ in width.

The pollen grains (Fig. 3,f) are rounded in outline with smooth exine and having 3 germ pores. They measure from 35 to 55 μ in diameter.

The gynaecium (Fig. 3,B): The ovary wall (Fig. 3,g&i) consists of an outer epidermis, a parenchymatous ground tissue traversed by several vascular strands and an inner epidermis. Both epidermises (Fig. 3,h) are similar, formed of polygonal, isodiametric cells with nearly straight anticlinal walls and covered with smooth cuticle. They measure from 25 to 60 μ in length, 15 to 35 μ in width and 20 to 50 μ in height. Glandular trichomes of multicellular pluriseriate stalk and multicellular head (shaggy glandular hairs) are present, non-glandular trichomes, stomata and calcium oxalate are absent.

The epidermis of the stigma (Fig. 3,j) is distinctly papillosed with more or less conical elongated papillae, measuring from 40 to 400 μ in length and 15 to 50 μ in width.

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The pedicel (Fig. 4,A) : A transverse section through the pedicel is nearly rounded in outline. It shows an epidermis, followed by a collenchymatous hypodermis, a comparatively narrow cortex limited with a distinct endodermis.

The endodermis is followed by a ring of collateral vascular bundles surrounded by groups of pericyclic fibres interrupted by thin walled parenchyma. The pith is wide and parenchymatous.

The epidermis (Fig. 4,B) : consists of polygonal or nearly 4 sided axially elongated cells with straight anticlinal walls and covered with smooth cuticle. They measure from 90 to 160 μ in length, 15 to 40 μ in width and 10 to 50 μ in height. Trichomes are similar to those of calyx but slightly larger in size.

The cortex (Fig. 4,C) : consists of two zones, an outer formed of 1-3 rows of collenchymatous cells and an inner formed of parenchymatous cells with wide intercellular spaces. The endodermis consists of a conspicuous layer of thin-walled cells containing starch granules. The pericycle consists of groups of fibres separated by thin walled parenchyma. The fibres are long with thick lignified walls, wide lumina and acute to acuminate apices, measuring from 300 to 800 μ in length and 15 to 35 μ in diameter. The vascular system is formed of a ring of vascular tissue. The phloem consists of soft thin walled cellulosic elements. The xylem consists of lignified spiral, pitted and reticulate vessels, being about 15-60 μ in diameter. The medullary rays are bi-sometime triseriate formed of subrectangular cells with simple pitted lignified walls. The wood parenchyma cells are subrectangular, axially elongated with pitted lignified walls.

The pith consists of rounded or oval cells with intercellular spaces.

Powdered flower

Powdered flower is purplish-green in colour, having no odour and slightly bitter taste. Microscopically it is characterised by the following:

- 1- Fragment of epidermal cells of calyx, corolla, stamen, ovary and pedicel with or without anocytic stomata and glandular trichomes.
- 2- Glandular trichomes of multicellular biseriate stalk and multicellular head.
- 3- Fragments of the fibrous layer of anther, formed of cells having bar-like lignified thickening.
- 4- Fragments of the stigma showing small polygonal, isodiametric papillosed cells.
- 5- Pollen grains, rounded in outline with 3 germ pores and having a smooth exine.
- 6- Numerous fragments of parenchymatous cells of different parts of the flower.
- 7- Fragments of annular or spiral rarely reticulate or pitted lignified vessels.

2- The Fruit:

A transverse section in the pericarp (Fig. 5, A) is nearly rounded in outline, formed of the epicarp and the endocarp enclosing in between a parenchymatous mesocarp, axially traversed by numerous vascular bundles.

The epicarp (Fig. 5, B) is formed of one row of cells which appear square or subrectangular in transverse section. In surface view the cells are polygonal axially elongated with nearly straight to curved anticlinal walls and covered with a thin smooth cuticle. They measure from 75 to 170 μ in

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length, 30 to 80 μ in width and 35 to 90 μ in height. Anomocytic stomata are present and measure from 35 to 85 μ in length and 30 to 65 μ in diameter. Glandular trichomes of multicellular, pluriseriate stalk and multicellular head are present, the stalk measures from 100 to 300 μ in length and 50 to 100 μ in width, and the head measures from 40 to 80 μ in diameter.

The mesocarp (Fig. 5,B) is formed of several rows of thin-walled parenchymatous cells containing tannine especially near the vascular bundles.

The vascular system is represented by numerous collateral vascular bundles which are present in the inner part of the mesocarp. Each consists of a small patch of phloem, formed of sieve-tubes, companion cells and phloem parenchyma. The xylem is formed of vessels, wood fibres and wood parenchyma, the whole being lignified (Fig. 5). The vessels show simple or bordered pits, some have spiral, annular and reticulate thickening and measure from 15 to 50 μ in diameter. The wood fibres are long with thick lignified walls, wide lumens and acute apices, measuring from 15 to 40 μ in diameter and 400 to 1000 μ in length. The wood parenchyma cells are subrectangular axially elongated with pitted lignified walls. The medullary rays are usually uni- to multiseriate formed of subrectangular cells with simple pitted lignified walls.

The endocarp is formed of one layer of cells, similar to those of the epicarp but smaller in size.

Fruit stalk (Fig. 5,D,E & F): A transverse section through the fruit stalk is more or less rounded in outline resembling to a great extent the fundamental structure of the flower pedicel (p. 6) but differs in the following:

- 1- The pericycle is more developed than that of the pedicel. The fibres are irregular in outline with thick, lignified walls, moderately wide lumen and acute apices, measuring from 500 to 1300 μ in length and 10 to 65 μ in diameter.
- 2- The xylem is well developed and distinctly radiating. The vessels are larger in size, measuring from 20 to 85 μ in diameter.
- 3- The wood fibres possess thick, lignified walls, wide lumena and acute apices, measuring from 20 to 40 μ in diameter and 500 to 1000 μ in length.

Powdered Fruit:

Powdered fruit is greenish brown in colour and has no characteristic odour and a bitter taste. Microscopically it is characterised by the following:

- 1- Fragments of epidermis of the pericarp or fruit stalk, showing polygonal axially elongated cells with nearly straight to curved anticlinal walls and covered with smooth cuticle. These fragments may carry anomocytic stomata and glandular trichomes of multicellular biseriate or pluriseriate stalk and multicellular head.
- 2- Fragments of lignified vessels which have usually pitted, spiral, annular and reticulate thickenings.

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- 3- Fragments of lignified wood parenchyma or medullary ray cells.
- 4- Fragments of lignified pericyclic fibres of the fruit stalk bundles. These fibres have thick walls, wide lumena and blunt apices.
- 5- Fragments of thin-walled parenchyma cells containing tannin.
- 6- Calcium oxalate, non-glandular hairs are not observed.

REFERENCES

- 1) A.A. Ali, M.K.M. Mesbah & H.M. Sayed; *Assiut Bull. Pharm. Sci.*, Vol. 7 ; (1983)

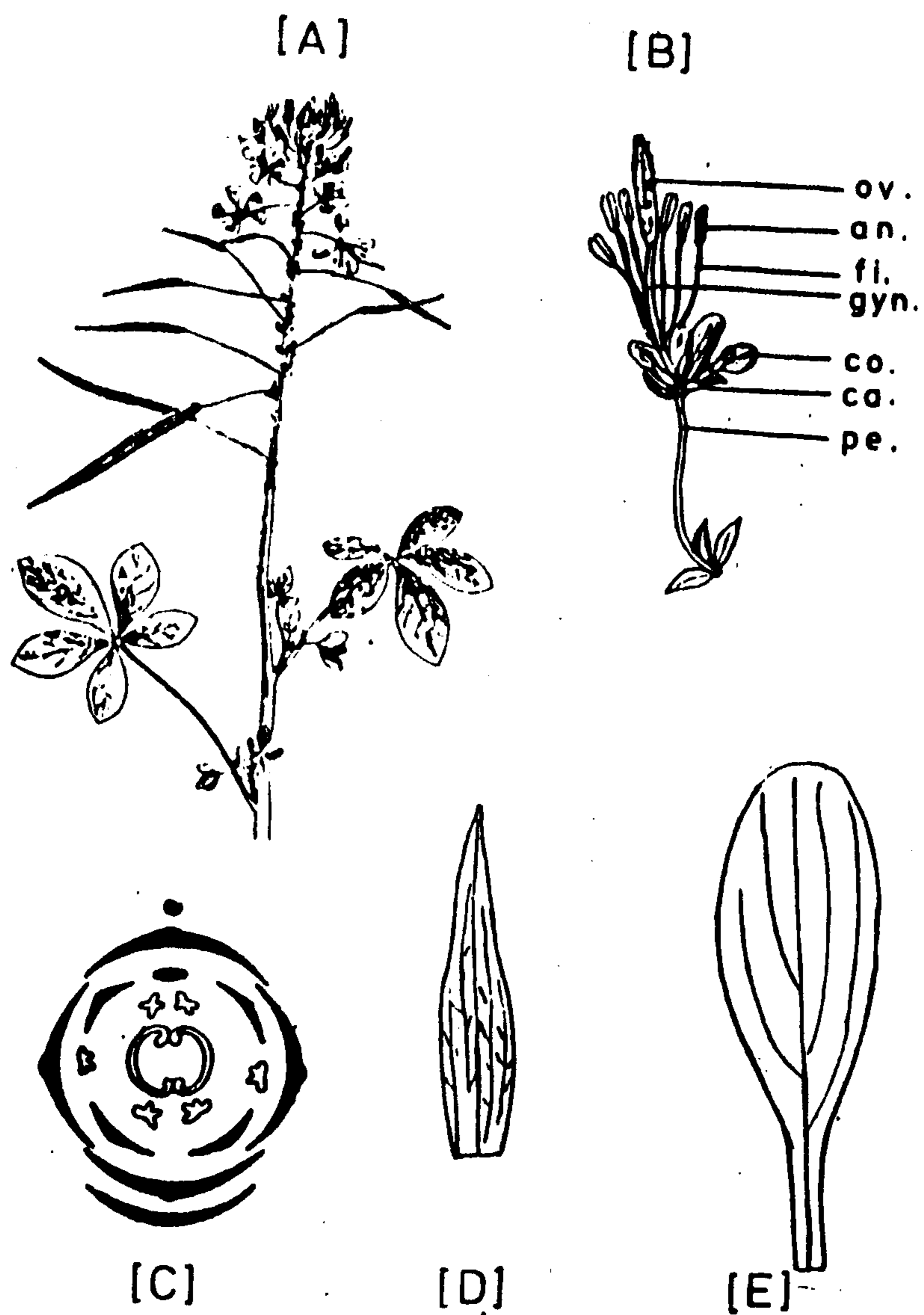


Fig. 1: A. The flowering branch
 B. Flower
 C. Floral diagram
 D. Sepal.
 E. Petal

X $\frac{1}{2}$
 X $1\frac{1}{2}$
 X 10
 X 10

an., androecium; ca., calyx; co., corolla; fi., filament;
 gyn., gynaecium; ov., ovary; pe., pedicel.

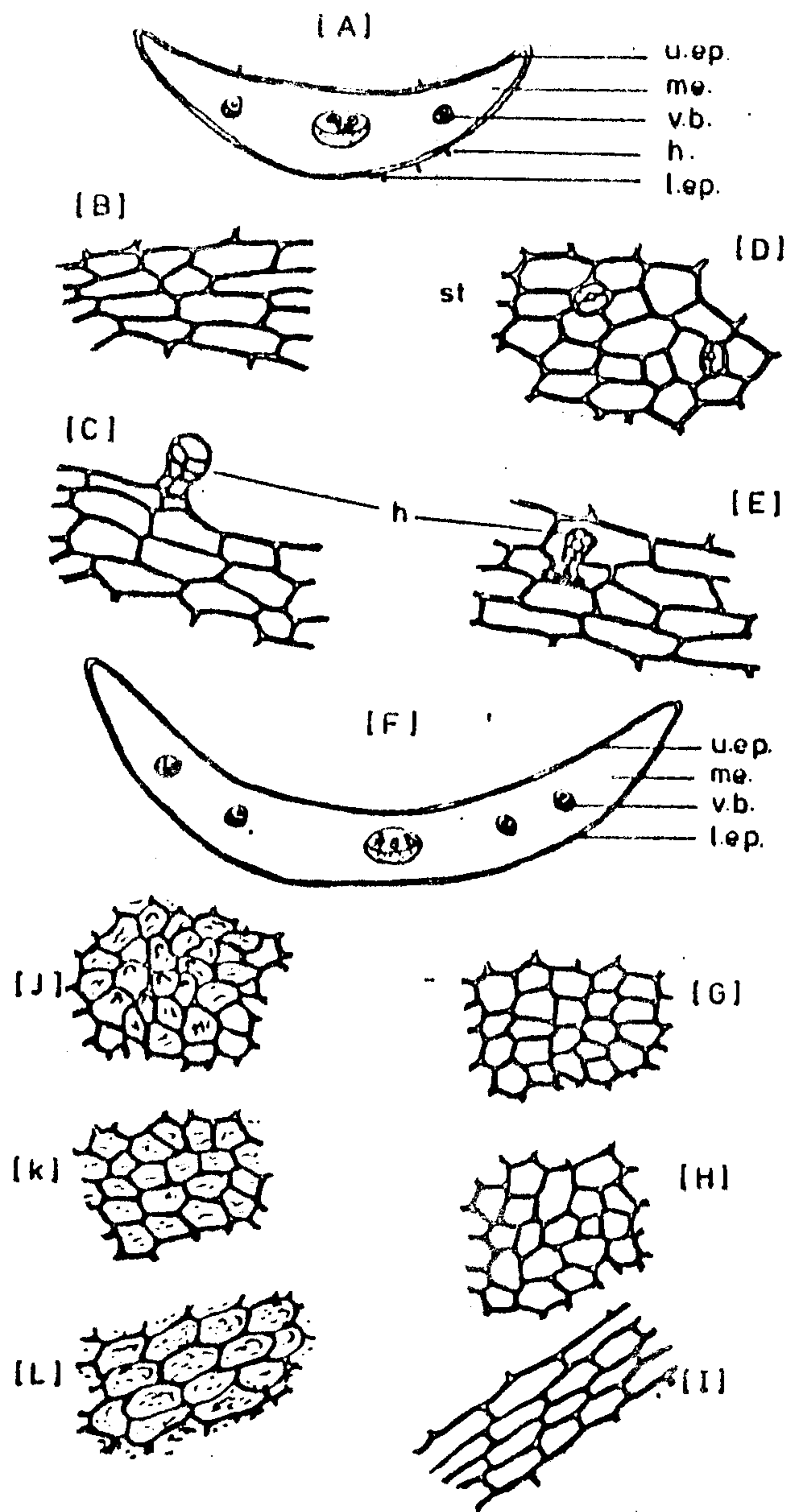


Fig. 2: The sepal and petal.

A. Diagrammatic T.S. of the sepal	X 24
B. Epidermal cell of apical region	X 180
C. Epidermal cell of marginal region	X 180
D. Epidermal cell of middle region	X 180
E. Epidermal cell of basal region	X 180
F. Diagrammatic T.S. of the petal	X 24
G. Outer epidermal cell of apical region	X 180
H. Outer epidermal cell of middle region	X 180
I. Outer epidermal cell of basal region	X 180
J. Inner epidermal cell of apical region	X 180
K. Inner epidermal cell of middle region	X 180
L. Inner epidermal cell of basal region	X 180

h., hair; l.ep., lower epidermis; me., mesophyll; st., stomata; u.ep., upper epidermis; v.b., vascular bundle.

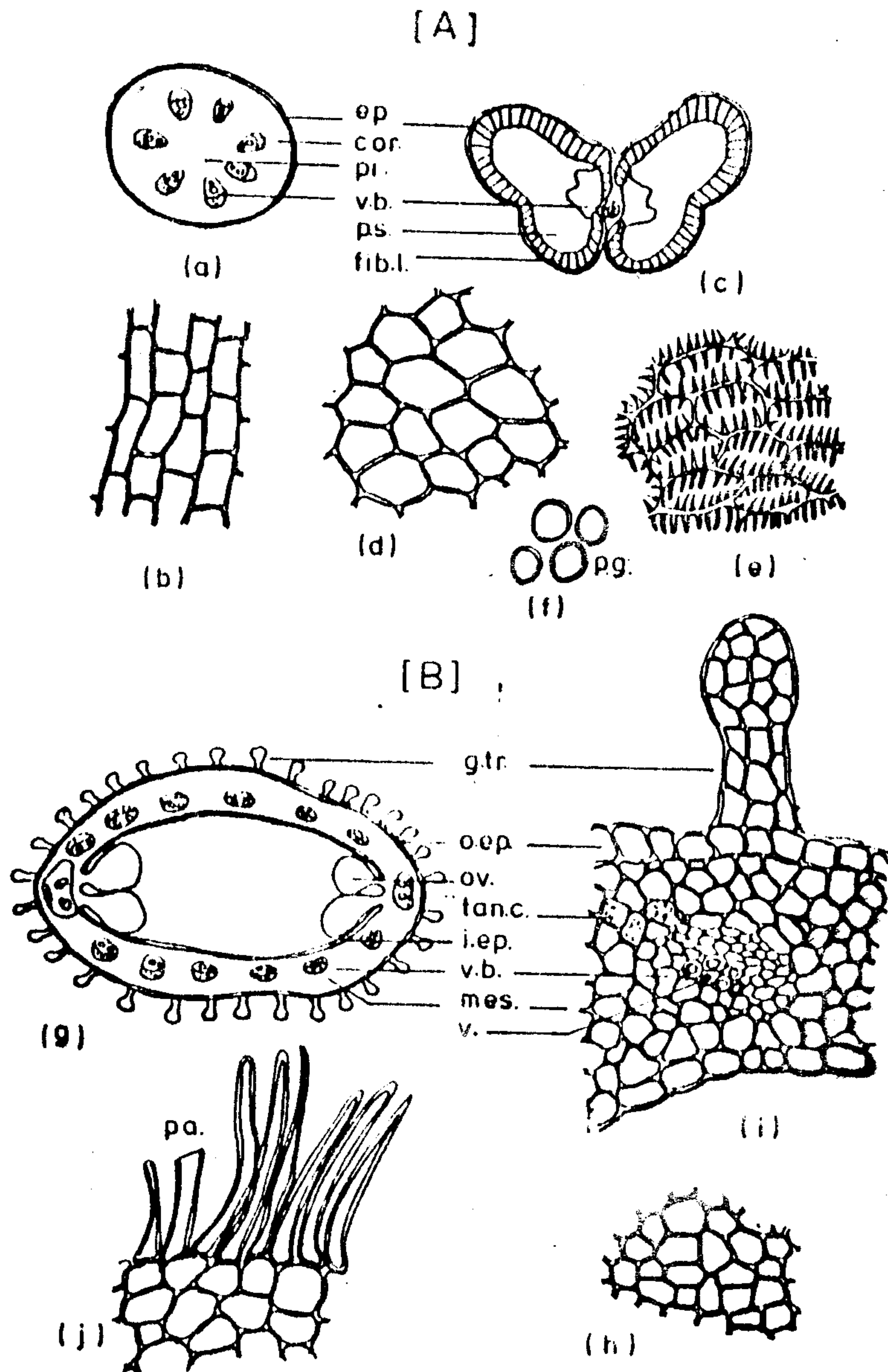


Fig. 3: A. The androecium

a- Diagrammatic T.S. of the filament	X 27
b- Surface preparation of the filament	X 204
c- Diagrammatic T.S. of the anther	X 27
d- Surface preparation of the anther	X 204
e- Fibrous layer of the anther	X 204
f- Pollen grains	X 204

B. The gynaecium

g- Diagrammatic T.S. of the ovary	X 27
i- Detailed T.S. of the ovary	X 204
h- Surface preparation of the ovary	X 204
j- Surface preparation of the stigma	X 204

cor., cortex; ep., epidermis; fib. l., fibrous layer; g. tr., glandular trichome; i.ep., inner epidermis; mes., mesophyll; o.ep., outer epidermis; ov., ovule; pa., papillae; p.g., pollen grain; p.s. pollen sac.; tan.c. tanniferous cell; v.b., vascular bundle; v., vessl.

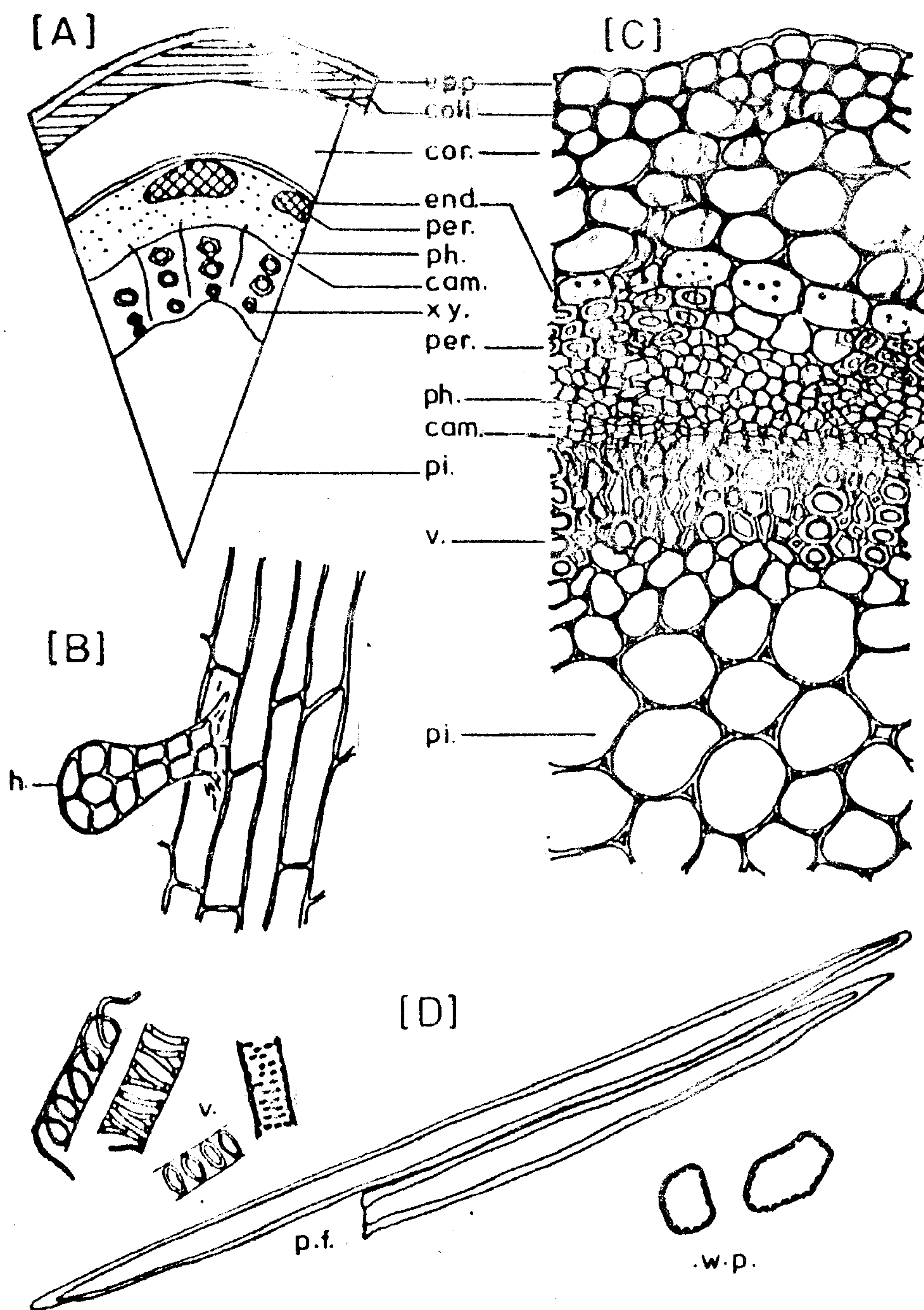


Fig. 4: A. Diagrammatic T.S. of the flower pedicel X 120
 B. Surface preparation of the flower pedicel X 270
 C. Detailed T.S. of the flower pedicel X 270
 D. Isolated elements of the flower X 270

cam., cambium; coll., collenchyma; cor., cortex; end., endodermis;
 ep., epidermis; h., hair; m.r., medullary ray; ph., phloem; pi.,
 pith; per., pericycle; p.f., pericyclic fibre; v., vessel; x., xylem;
 w.p., wood parenchyma.

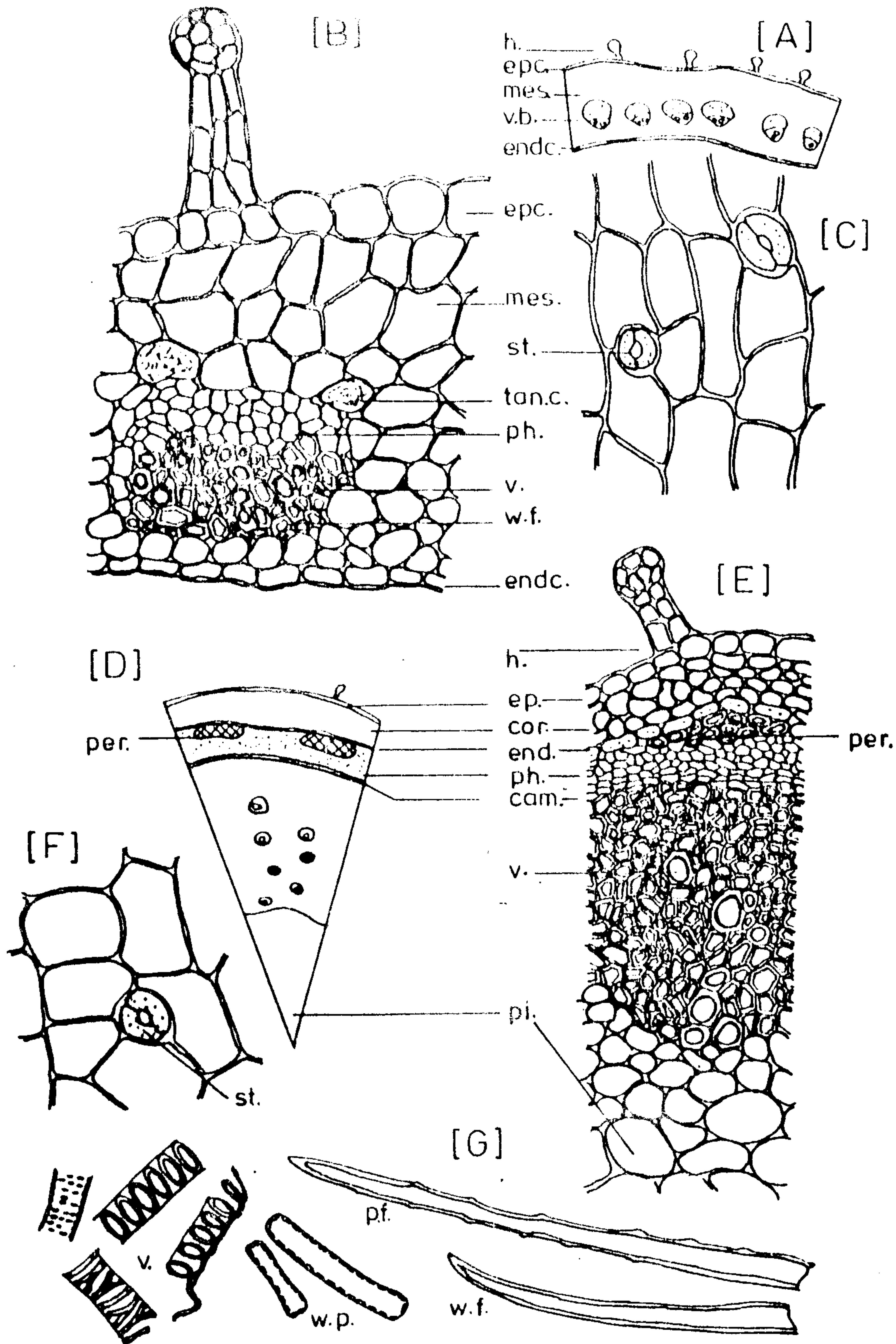


Fig. 5: A. Diagrammatic T.S. of the fruit X 80
 B. Detailed T.S. of the fruit X 180
 C. Surface preparation of the fruit X 180
 D. Diagrammatic T.S. of the fruit stalk X 80
 E. Detailed T.S. of the fruit stalk X 180
 F. Surface preparation of the fruit stalk X 180
 G. Isolated elements of the fruit X 270

cam., cambium; cor., cortex; end., endodermis; endc., endocarp; epc., epicarp; h., hair; mes., mesocarp; mr., medullary ray; ph., phloem; pi., pith; per., pericycle; p.f. pericyclic fibre; st., stomata; tan.c., tanniferous cell; v., vessel; v.b., vascular bundle; w.f., wood fibre; w.p., wood parenchyma.

دراسة عقاقيرية لنبات الجيناندروبس بنتافيليا (هرهر)

الذي ينمو في مصر

الجزء الثاني - دراسة عيانية ومجهريّة للزهرة والشميرة

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قسم العقاقير - كلية الصيدلة - جامعة اسيوط

تم في هذا البحث دراسة الصفات العيانية والمجهريّة لازهار
وثمار نبات الجيناندروبس بنتافيليا (هرهر) الذي ينمو في
مصر بغرض معرفة الصفات التي تيسر التعرف عليها سواء
كانت صحيحة او على هيئة مسحوق.