

MACRO AND MICROMORPHOLOGY OF CLIVIA MINIATA
REGEL CULTIVATED IN EGYPT

PART II. The Inflorescence and Fruit

A.M. El-Moghazy, S.A. Ross, A.A.Ali. and S.A. El-Moghazy
Department of Pharmacognosy, Faculty of Pharmacy, Assiut
University, Assiut, Egypt.

The macro and micromorphology of the inflorescence and fruit of Clivia miniata Regel cultivated in Egypt are dealt with and illustrated for the purpose of their identification either in the entire or in the powdered form.

The authors have previously¹ studied the macro and micromorphology of the root, corm and leaf of C. miniata Regel cultivated in Egypt. The present work is a study of the macro and micromorphology of the inflorescence and fruit of this plant.

Material:

Samples were collected from plants cultivated in the Experimental Station of the Faculty of Pharmacy, Assiut University Assiut, Egypt.

A- The inflorescence

Macromorphology: (Fig. 1)

It is a terminal, umbellate, racemose of 10 to 20 flowers carried on a hollow, greenish, flattened, leafless flowering stem or scape, arising from the apical bud of the corm. The scape is marked by longitudinal ridges and measures about 30-45 cm. in length and 2-3 cm in diameter.

Each flower is subtended by a sessile, strap-shaped bracteole with an entire margin and an acute apex. The bracteole measures about 3-4 cm. long and 0.5-1 cm. wide.

The flower is pedicellate, funnel-shaped, orange to reddish in colour, odourless and having a slight bitter taste. It measures about 6-7.5 cm. in length and 1.5-3 cm. in diameter at the mouth of the funnel. The flower is actinomorphic, hermaphrodite, pentacyclic, trimerous, epigenous and having the following floral formula:



The perianth consists of 6 delicate segments arranged in 2 whorls and joined at the base to form a tube. The surface of the perianth tube is smooth with longitudinal furrows. The segments are ovate lanceolate, with entire slightly undulated margin and acute apex. The inner segments are slightly smaller than the outer ones. Each segment is traversed by parallel veins.

The androecium consists of 6 epipetalous stamens arranged in 2 whorls attached on the perianth tube. Each stamen is composed of long, cylindrical, purple, simple filament and a narrow anther. The anther is yellow in colour, versatile and entrose.

The gynaecium is inferior, consisting of a tricarpiary, trilocular, syncarpous ovary and long style ending with a 3-lobed stigma. The style is cylindrical and purple-red in colour.

stigma is 3 lobed and whitish in colour. The ovary contains few anatropous ovules in each cell arranged on the typical axial placenta.

The pedicel is hollow, cylindrical, greenish in colour externally smooth and ribbed and measuring 2-2.5 cm. long and 2-3 mm. in diameter.

Micromorphology:

1- The Perianth:

The perianth segment is formed of an inner and an outer epidermis enclosing inbetween few layers of an undifferentiated parenchymatous mesophyll.

The cells of the apical and middle regions of both upper and lower epidermises (Fig. 2) are slightly papillosed, polygonal, isodiametric, with slightly curved anticlinal walls and measure from 40 to 80 microns in length and 35 to 75 microns in width. At the basal regions the cells are not papillosed, polygonal, axially elongated with straight or slightly curved anticlinal walls and measure from 70 to 142 microns in length and 20 to 30 microns in width. Most of the epidermal cells show warty raised parts of cuticle. Stomata are present only on the free part of the segment surface while on the perianth tube they are not observed. Stomata are of anomocytic type, usually surrounded by 4 to 6 epidermal cells and measuring from 18 to 28 microns in diameter. Trichomes are absent.

2- Androecium: (Fig. 3)

The filament appears in transverse section to be more or less circular in outline; showing an epidermis surrounding a wide cortical tissue of soft loose parenchymatous cells. In the center there is a small vascular bundle consisting of small soft phloem and xylem of narrow lignified spiral vessels. Mucilagenous masses and starch granules are observed in the cortical tissue. The starch is frequently simple or compound of 2-3 components. The individual grain is mostly rounded or oval and measuring from 3-12 microns in diameter. Bundles or raphides as well as isolated single acicular crystals

of calcium oxalate are scattered in the cortical tissue measuring from 28-35 microns in length.

The epidermis of the filament is formed of polygonal, axially elongated, subrectangular cells, with straight anticlinal walls and covered with smooth cuticle. They measure from 146-220 microns in length, 25-35 microns in width and 25-37 microns in height. Many of the cells contain red anthocyanin pigments. No stomata or trichomes are observed.

The anther (Fig. 3) consists of 2 nearly equal anther lobes, attached together by the connective through which runs a small vascular strand. Each anther lobe is formed of 2 equal pollen sacs containing numerous pollen grains. The anther wall is formed of an epidermis, a fibrous layer and the remains of tapitum. The pollen grains are pale yellow in colour, spherical to subspherical, sometimes oval in outline and possess one germinal furrow. The grains have warty granular exine and measuring from 65-75 microns in diameter. Germinal pores are not observed.

3- Gynaecium: (Fig. 4)

A transverse section in the ovary wall is subrounded in outline and shows a glabrous outer and inner epidermises enclosing a wide parenchymatous ground tissue traversed by several closed, collateral vascular strands. Each bundle is surrounded by parenchymatous pericycle and shows an outer batch of soft phloem and an inner batch of lignified vessels with spiral and annular thickenings. Mucilage, starch and crystals of Calcium oxalate are of common occurrence in the parenchyma and resemble those of the filament in all aspects.

The outer epidermis of the ovary (Fig. 4 C) is formed of polygonal, usually isodiametric, subrectangular cells with straight anticlinal walls, covered with thick smooth cuticle and measure from 25 to 45 microns in length and 20-32 microns in width. Stomata of anomocytic type are present and measure from 25-40 microns in diameter. Epidermal trichomes are absent.

The epidermal cells of the style (Fig. 4 E) are polygonal, axially elongated, with straight anticlinal walls and covered with thin smooth cuticle. No trichomes are observed.

The epidermal cells of the stigma (Fig. 4 D) are polygonal, isodiametric, papillose and with straight anticlinal walls. The papillae are oval in shape and long measuring from 25 up to 190 microns in length.

4- Pedicel: (Fig. 5)

A transverse section in the pedicel appears to somewhat subcylindrical in outline. The glabrous epidermis is followed by a wide parenchymatous ground tissue with a peripheral zone of subepidermal collenchyma. Numerous closed, collateral vascular bundles are arranged in a more or less dispersed ring in the ground tissue. Each bundle is surrounded by parenchymatous pericycle and shows an outer batch of soft phloem and an inner batch of xylem vessels which have spiral thickenings. The central part of the pedicel is narrow and consisting of large ordinary parenchyma.

Mucilage, starch and raphides as well as prisms of calcium oxalate are of common occurrence in the parenchyma.

The epidermis of the pedicel (Fig. 5 C) is formed of polygonal, mainly axially elongated, subrect-

angular cells, with more or less straight, minutely beaded anticlinal walls. They are covered with thick smooth cuticle and measuring 42-116 microns in length, 24-45 microns in width and 20-28 microns in height. Stomata of anomocytic type are present.

5- Scape: (Fig. 6)

The scape is typically a hollow stem. The transverse section shows that the scape appears oval to subcylindrical in outline. The glabrous epidermis is followed by a wide ground tissue consisting mainly of ordinary parenchyma with a peripheral zone of collenchyma. Numerous closed collateral vascular bundles are scattered in the ground tissue, they are smaller in size outwards but being larger towards the hollow center. Mucilage, starch and acicular crystals of calcium oxalate are of common occurrence in the parenchyma.

The epidermal cells of the scape are polygonal, almost axially elongated, with straight anticlinal walls and covered with thick smooth cuticle. They measure from 190 to 320 microns in length, 14 to 31 microns in width and 14 to 26 microns in height.

Stomata are of anomocytic type.

The Powder:

The powdered flower is brownish to reddish purple in colour with slight odour and bitter mucilagenous taste. It shows:

- 1- Fragments of the floral leaves showing polygonal, isodiametric and elongated epidermal cells having straight anticlinal walls and covered with thick smooth cuticle. Some fragments show anomocytic stomata.
- 2- Numerous spherical pollen grains with finely granular warty exine, each showing one germinal furrow.

- 3- Fragments of the anthers, showing polygonal, isodiametric and elongated epidermal cells with thin anticlinal walls and covered with striated cuticle. Polygonal isodiametric cells of the fibrous layer with lignified bar-like thickening.
- 4- Fragments of parenchymatous cells containing mucilagenous masses, acicular crystals of calcium oxalate in raphides or single prisms as well as starch granules.
- 5- Fragments of xylem elements, showing lignified spiral and annular vessels.
- 6- Free starch granules, acicular crystals of calcium oxalate and mucilagenous masses.
- 7- Absence of sclereides, fibres and trichomes.

B- The Fruit

Macromorphology:

The fruit is a berry derived from a syncarpous, trilocular, inferior ovary. Fruits are fully grown but unripe as it seldom reaches the stage of maturity and consequently the seeds are almost immature. It is globular to ovoid in shape. The outer surface is smooth, shining and greenish-brown in colour. It measures from 8 to 12 mm. in diameter and has a short stalk of about 10-20 mm. long. The remains of the style appears as a small point at the apex. The fruit has 3 chambers with usually 1 rarely 2 or 3 seeds in each, sometimes one seed is present and the others are aborted. The fruit possesses a faint odour and bitter taste.

Micromorphology:

The transverse section in the pericarp of the mature fruit (Fig. 7), appears to be ovoid to rounded in outline. The fruit wall consists of smooth epicarp and an endocarp enclosing inbetween a wide parenchymatous mesocarp. The mesocarp is axially, traversed by numerous scattered closed vascular bundles. It shows starch granules, masses of mucilage and raphides of calcium oxalate.

The epicarp:

The epicarp consists of a single row of square cells which appear in surface view polygonal, usually axially elongated, subrectangular. They are covered with smooth cuticle and measure from 30 to 35 microns in height, 85 to 280 microns in length and 26 to 40 microns in width. Occasional anomocytic stomata but no hairs are present.

The Mesocarp:

It consists of one or two rows of thick-walled collenchymatous cells beneath the epicarp, followed by several rows of parenchymatous cells. The cells contain starch granules, masses of mucilage and raphides of calcium oxalate.

The Vascular system:

It is represented by numerous closed collateral vascular bundles scattered in the mesocarp. Each vascular bundle is closely identical to that of the pedicel or scape.

The Endocarp:

It is formed of one layer of square to subrectangular cells with thin walls. In surface view, the cells are polygonal, almost isodiametric.

Stalk of the Fruit:

In the fruiting stage a transverse section in the pedicel shows the fundamental structure of the pedicel of the ovary, but differs in the following:

- 1- The cells of the epidermis show small projections or minute papillae.
- 2- The pericycle shows few fibres with comparatively wide lumen, thick lignified wall and acute to rounded apex. They measure from 120 to 255 microns in length.

The Powder:

The powdered fruit is brownish-green in colour, having a slight odour and bitter taste. It shows:

- 1- Fragments of the epicarp, with polygonal axially elongated cells covered with smooth cuticle. Some fragments show occasional stomata of anomocytic type.
- 2- Fragments of the mesocarp, showing thin-walled parenchymatous cells containing starch granules, masses of mucilage and raphides of calcium oxalate.
- 3- Fragments of endocarp, showing thin-walled cellulosic polygonal cells.
- 4- Fragments of spiral and scalariform vessels.

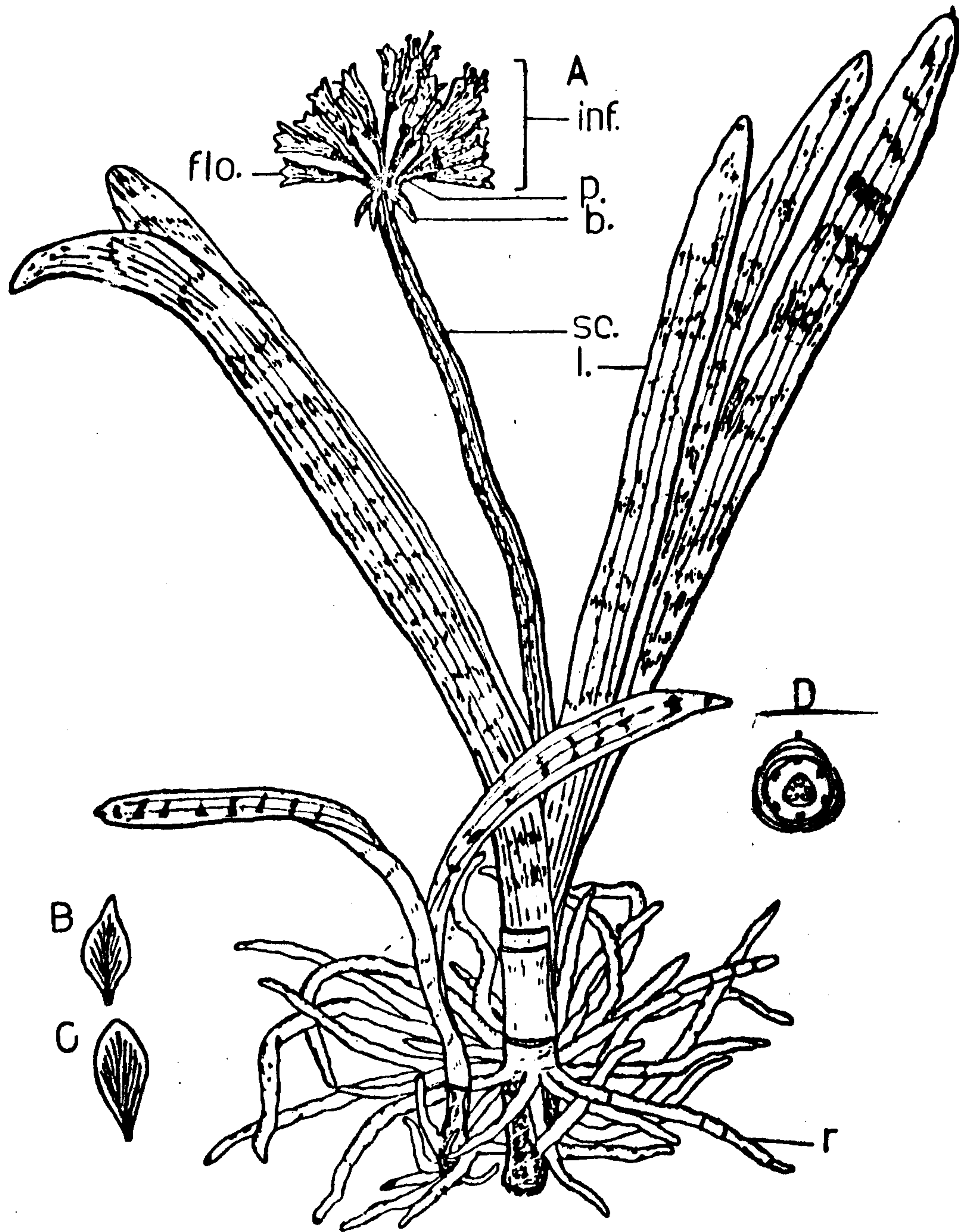


Fig. 1- Sketch of *Clivia miniata* Regel

- | | |
|--------------------------------------|-------|
| A- Unexpanded inflorescence | X 1/3 |
| B- The inner segment of the perianth | X 1/2 |
| C- The outer segment of the perianth | X 1/2 |
| D- Floral diagram | |

inf., inflorescence; flo., flower; p., pedicel; b., bract; l., foliage leaf; sc., scape; r., root.

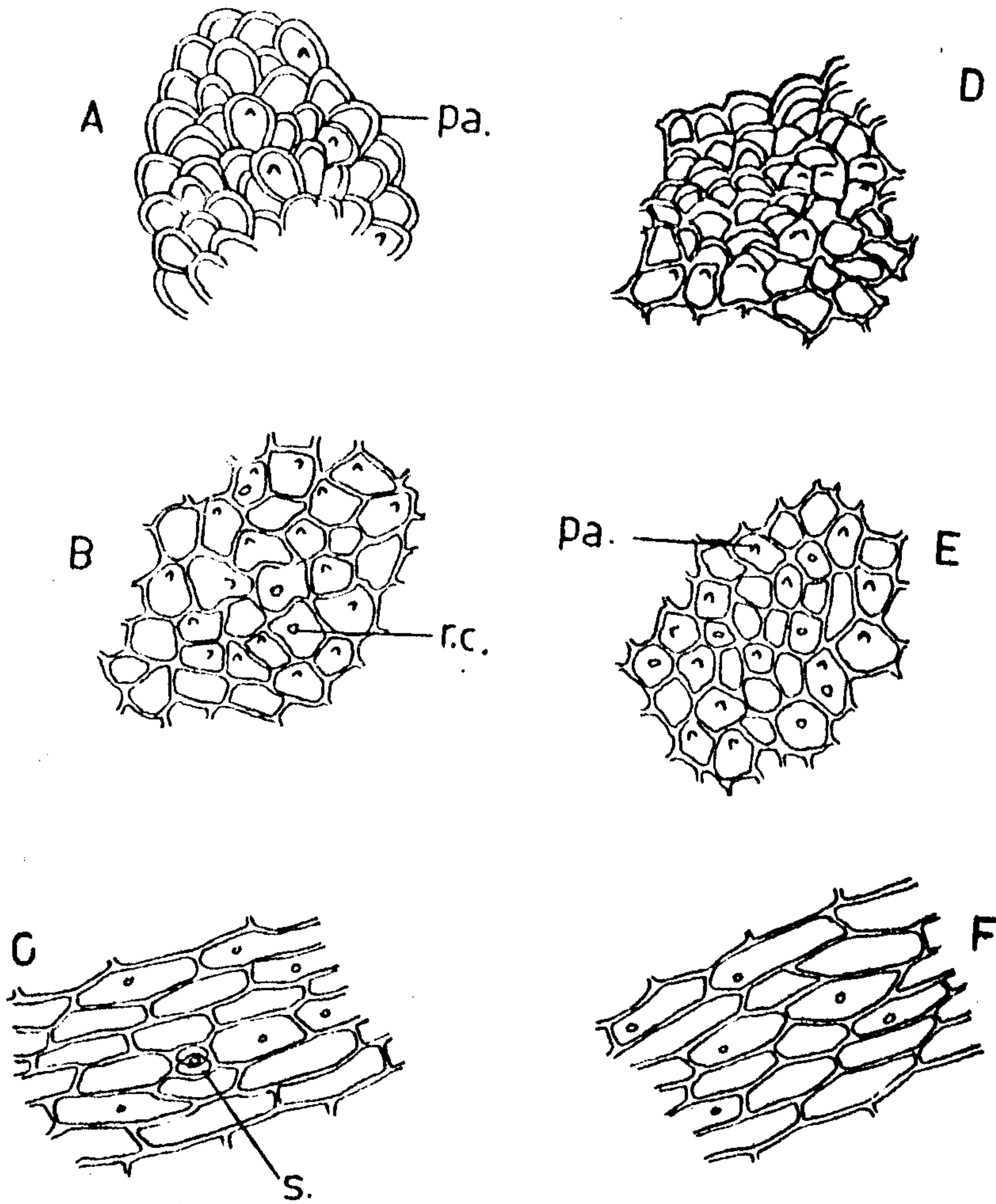


Fig. 2- Surface view of the upper and lower epidermises of the perianth.

- | | |
|---|------|
| A- Apical region of the upper epidermis | X 60 |
| B- Middle region of the upper epidermis | X 60 |
| C- Basal region of the upper epidermis | X 60 |
| D- Apical region of the lower epidermis | X 60 |
| E- Middle region of the lower epidermis | X 60 |
| F- Basal region of the lower epidermis | X 60 |

Pa., papillae; r.c., raised part of cuticle; S., stomata.

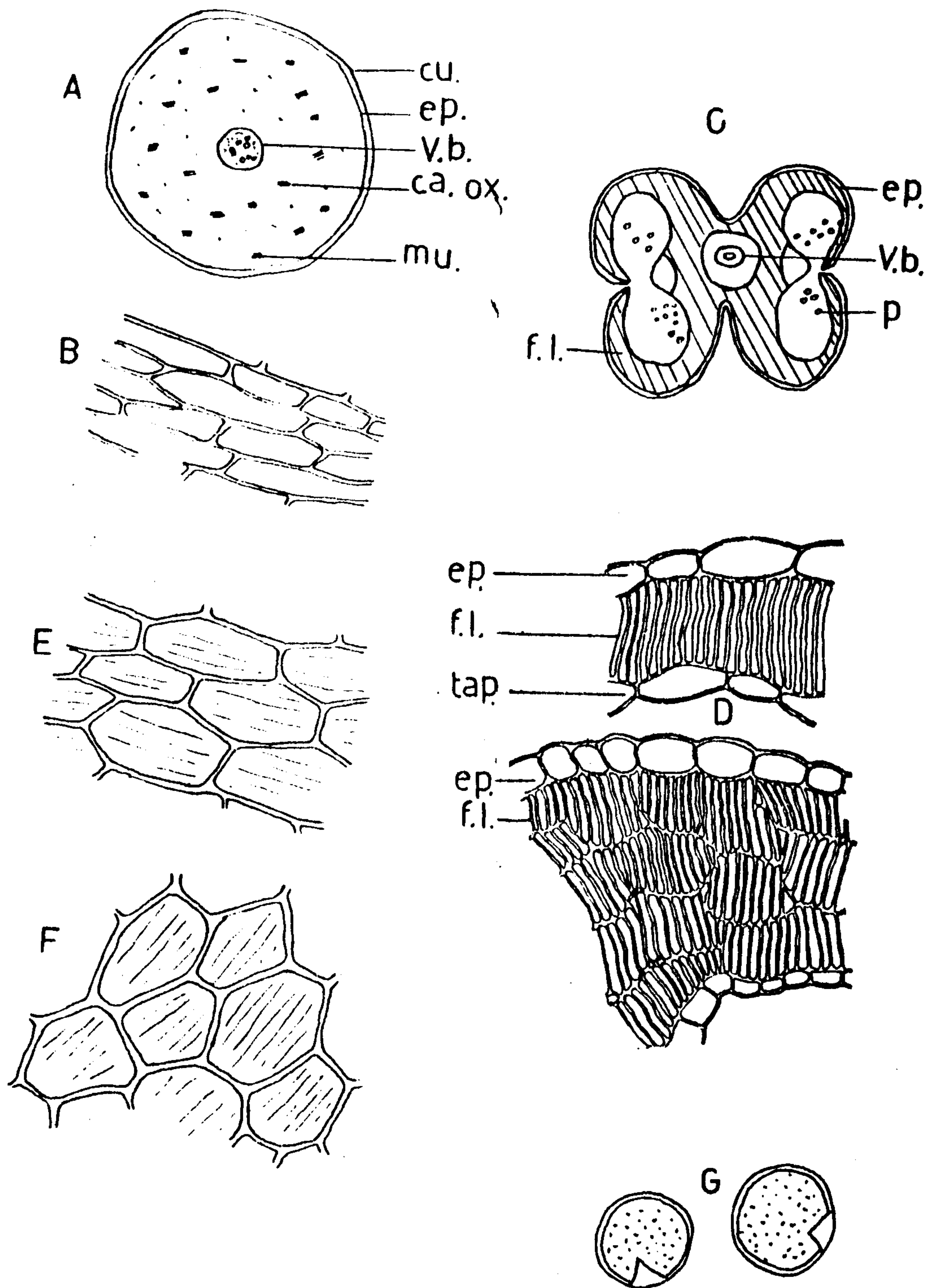


Fig. 3- The Androecium

- | | | |
|----|--|------|
| A- | Diagrammatic T.S. in the filament of the anther | X 36 |
| B- | Surface view in the epidermis of the filament | X135 |
| C- | Diagrammatic T.S. in the anther wall | X 36 |
| D- | Detailed T.S. in the anther wall | X135 |
| E- | The epidermal cells of the anther in the connective region | X135 |
| F- | The epidermal cells of the anther | X135 |
| G- | Pollen grains | X135 |

Cu., cuticle; ep., epidermis; v.b., vascular bundle; mu., mucilage; ca.Ox., calcium oxalate; F.L., fibrous layer; tap., tapetum; p., pollen grain.

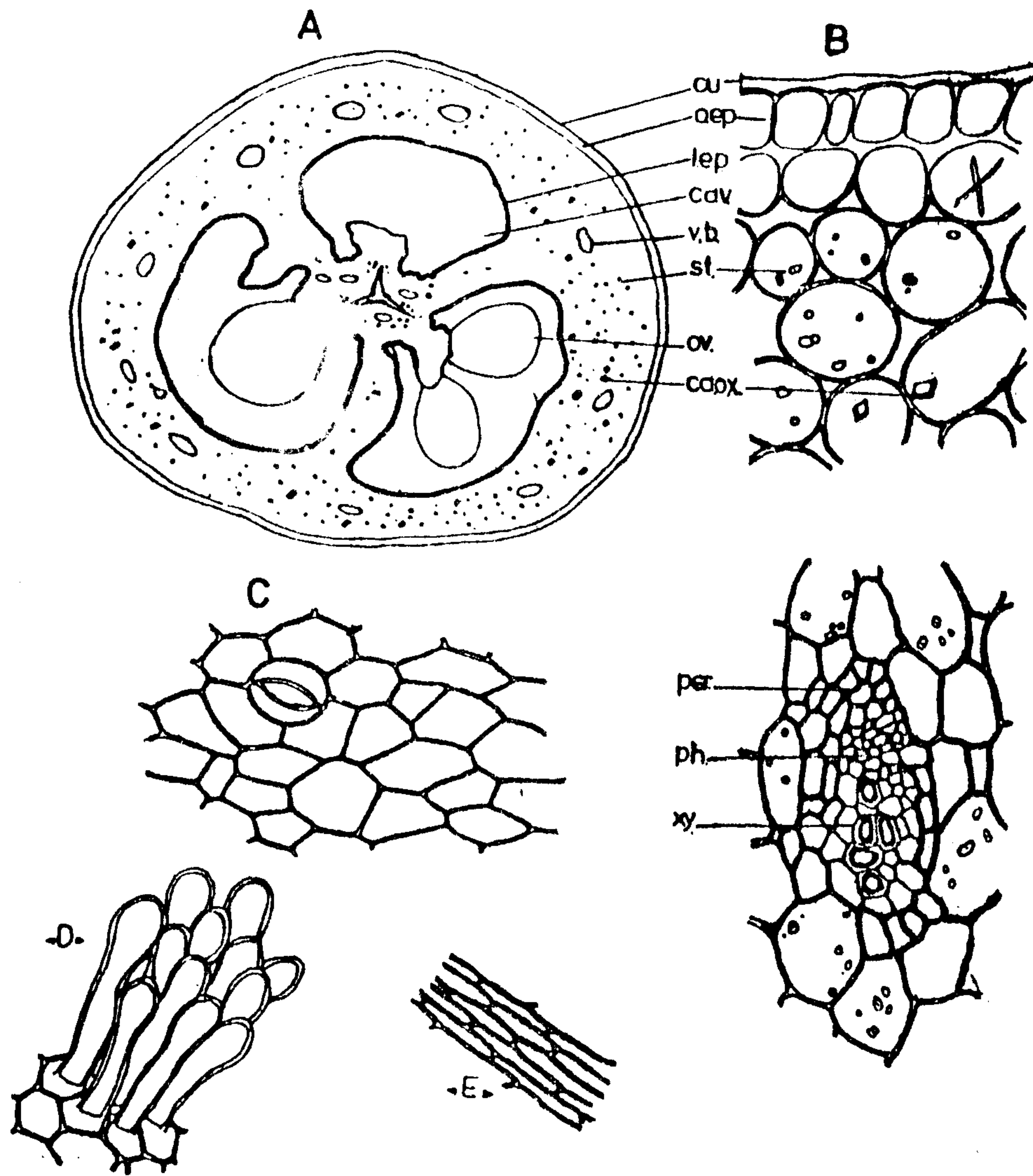


Fig. 4- The Gynaecium

A- Diagrammatic T.S. in the ovary	X 24
B- Detailed T.S. in the ovary	X135
C- Surface preparation of the ovary	X135
D- Surface preparation of the stigma	X135
E- Surface preparation of the style	X135

Cu., cuticle; O.ep., outer epidermis; I.ep., inner epidermis; cav., cavity; V.b., vascular bundle; st., starch granule; ov., ovule; ca. ox., calcium oxalate; Per., pericycle; ph., phloem; xy., xylem.

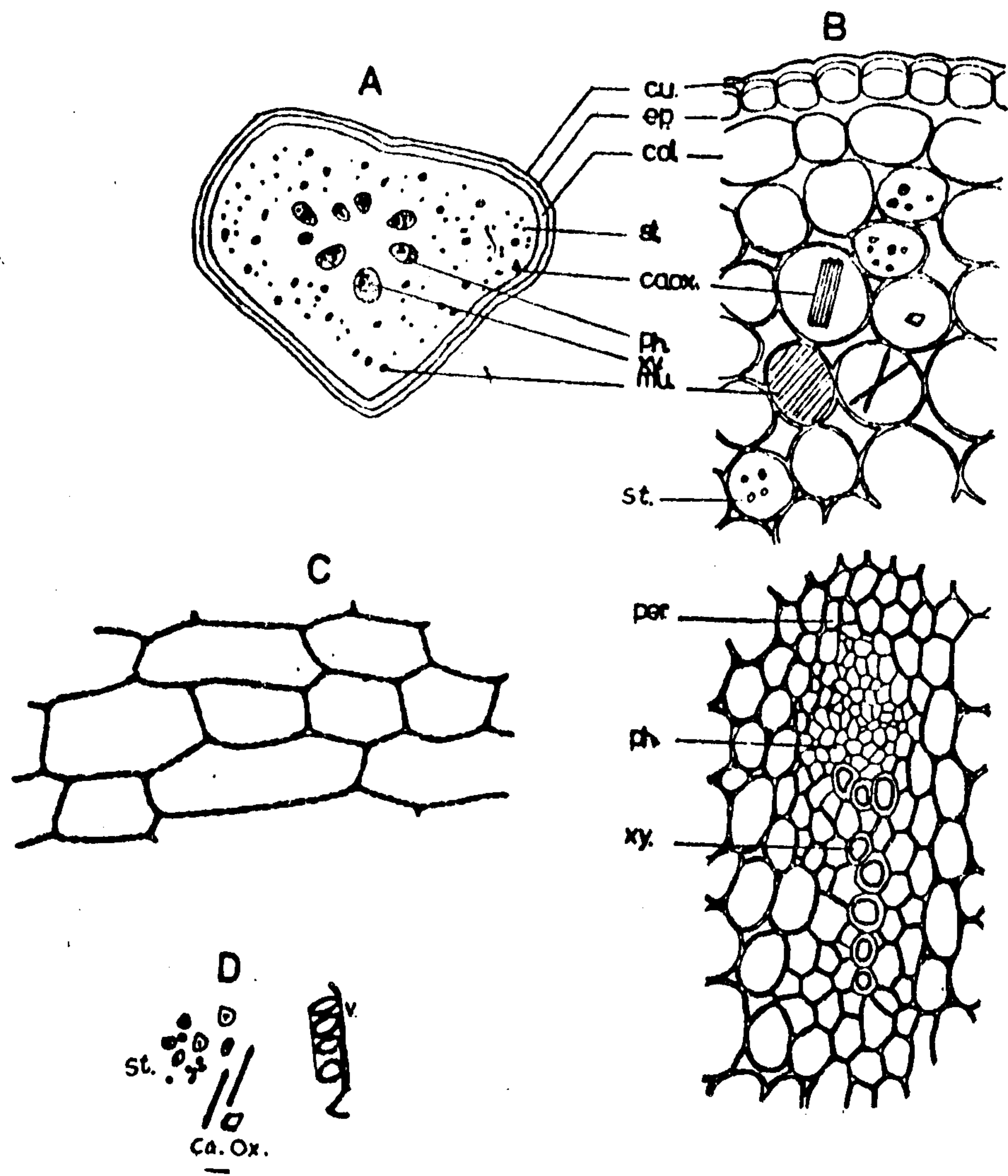


Fig. 5- The Pedicel

A- Diagrammatic T.S. in the pedicel	X 26
B- Detailed T.S. in the pedicel	X 149
C- Surface preparation of the pedicel	X 149
D- Isolated elements	X 149

Cu., cuticle; ep., epidermis; col., collenchyma; st., starch granule; ca. ox., calcium oxalate; ph., phloem; xy., xylem; mu., mucilage; per., pericycle; v., vessels.

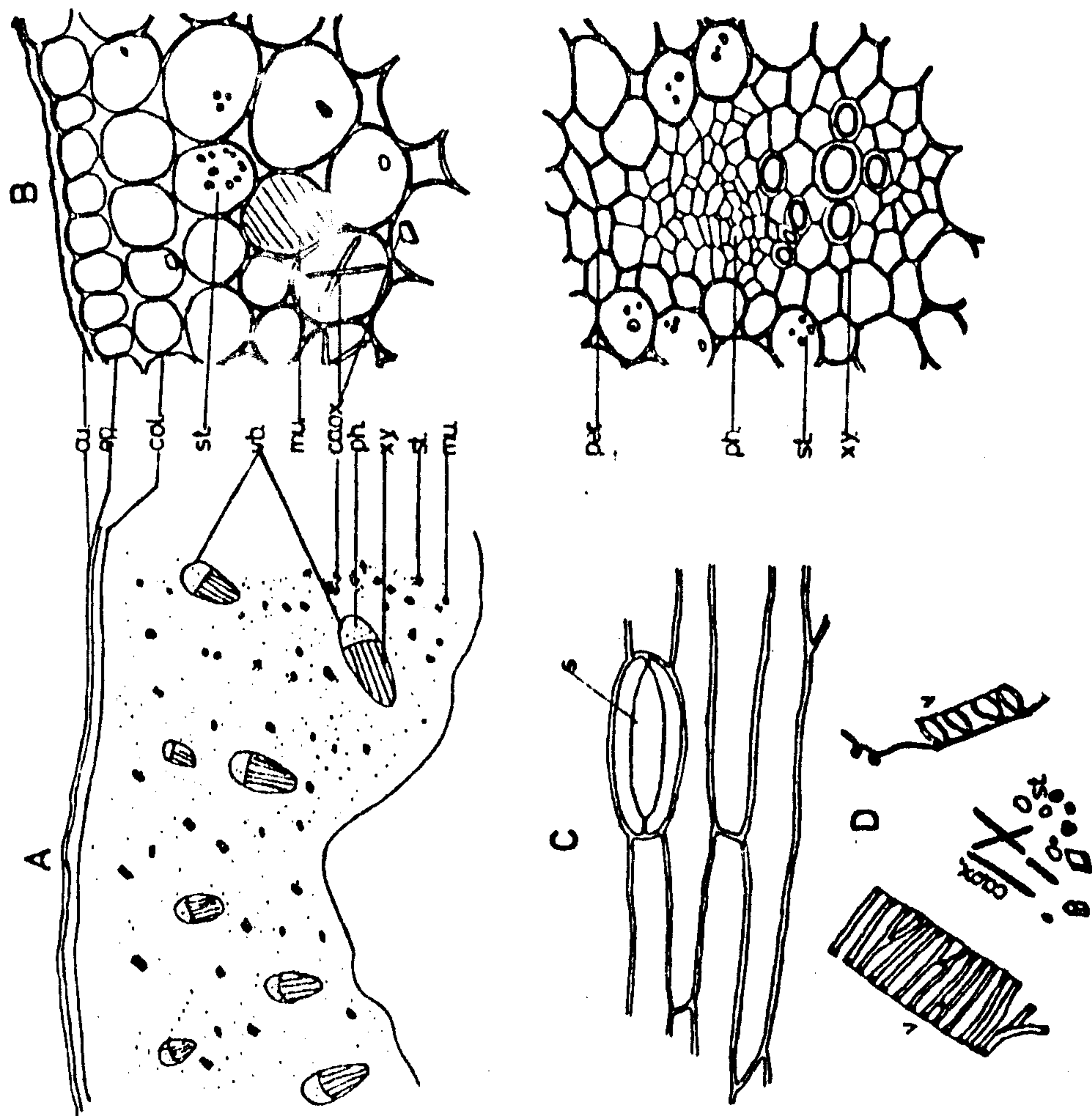


Fig. 6- The Scape

A- Diagrammatic T.S. in the scape	X 24
B- Detailed T.S. in the scape	X 135
C- Surface preparation of the scape	X 135
D- Isolated elements	X 135

Cu., cuticle; ep., epidermis; col., collenchyma; st., starch granule; v.b., vascular bundle; mu., mucilage; ca. ox., calcium oxalate; ph., phloem; xy., xylem; per., pericycle, v., vessel.

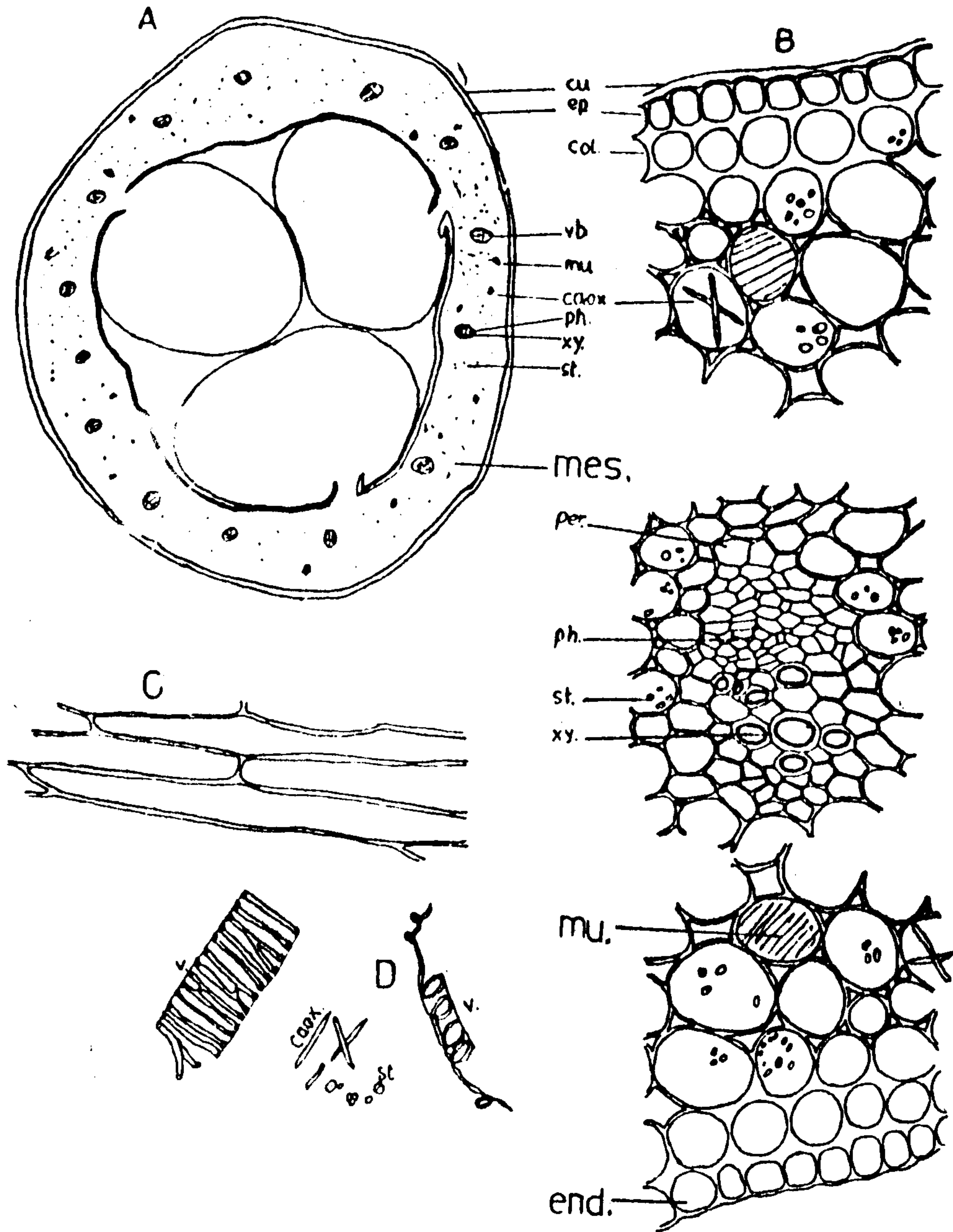


Fig. 7- The Fruit

- A- Diagrammatic T.S. in the fruit
B- Detailed T.S. in the fruit
C- Surface preparation of epicarp
D- Isolated elements

X 24
X 135
X 135
X 135

Cu., cuticle; ep., epicarp; col., collenchyma; v.b., vascular bundle; mu., mucilage; ca.ox., calcium oxalate; ph., phloem; xy., xylem; st., starch granule; mes., mesocarp; per., pericycle; end., endocarp; v., vessels.

REFERENCES

- 1) A.M. El-Moghazy, A.A. Ali, S.A. Ross, S.A. El-Moghazy, Assiut Bull. Pharm. Sci.; Vol. 5, PP (1982).

الصفات العيانية والمجهرية لنبات الكليفيامنياتا (رجل)

المنزوع في مصر

الجزء الثاني : النورة والثمرة

احمد محمد المغازي - سير انيس روس - احمد عبد الرحمن علي - صفاء احمد محمد المغازي

يشتمل هذا البحث على دراسة الصفات العيانية والمجهرية

لنورة وثمره نبات الكليفيامنياتا (رجل) الذي ينزرع

في جمهورية مصر العربية بهدف التعرف على نورات وثمار

هذا النبات صحيحة كانت او على هيئة مسحوق