

MACRO AND MICROMORPHOLOGY OF PANCRATIUM
SICKENBERGI ASCH. ET SCHWEINF. EX BOISS. GROWING IN EGYPT

PART 2: The Inflorescence

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ABSTRACT

In a previous paper¹ the macro and micro-morphology of the roots, bulbs and foliage leaves of Pancratium sickenbergi Asch. et Schweinf. ex Boiss. was presented. The present work deals with the micro and macroamorphology of the inflorescence of the same plant.

EXPERIMENTAL

A. Macromorphology:

The inflorescence (Fig. 1): is a terminal, umbellate racemose with two unequal bracts and carried on greenish scape. The scape measures about 30 to 40 cm long and 1.6 cm in diameter at its base. It carries from 3 to 6 flowers in an umble.

The Bract (Fig. 1): is large, leathery, spathaceous, sessile, triangular-lanceolate and deciduous. The outer surface is greenish in colour while the inner one is of paler colour. The bract has an entire revolute margin and an acute apex. The margin of the outer (larger) bract is recurved so as to overlap the inner one thus forming a sword-like sheath enclosing the flowers before opening. The bracts are traversed longitudinally with parallel veins and measure about 3 to 5 cm long and 1.5 to 2.5 cm wide at the base.

The Bracteole (Fig. 1) : Each flower is subtended by a sessile, strapshaped bracteole with an entire margin and acute apex. The outer surface is greenish in colour while the inner surface is of paler colour. The bracteole measure about 1 to 1.6 cm long and 0.4 to 0.7 cm wide.

The flower (Fig. 1): is pedicellate, funnel-shaped, white in colour, possesses no odour and having a bitter mucilaginous taste. It is actinomorphic, hermaphrodite, inferior and measuring about 7 to 9 cm long and 1.5 to 2.5 cm in diameter at mouth of the funnel.

The Perianth (Fig. 1): Consists of 6 delicate segments arranged in two alternate whorls . They are connate below forming nearly subcylindrical tube. The perianth tube is smooth with longitudinal furrows representing the edge of the perianth leaves, being about 5 cm long and 0.6 cm in diameter. The perianth segments are white in colour, lanceolate in shape , having entire slightly undulated margins and acute apex.

The flower is characterised by an obvious corona, a petaloid development at the junction of corolla-tube and limbs. It rises to form a funnel-shaped staminal cup, from its edge the stamens appear to spring.

The Androecium (Fig. 1): Consists of 6 epipetalous stamens arranged in two whorls attached on the margin of the corona. Each stamen consists of a filiform simple filament and narrow anther. The filament is long cylindrical, whitish in colour and measuring 0.4 to 0.5 cm long and about 1mm in diameter. The anther is yellow in colour, versatile, entrose and measuring 0.5 to 0.6 cm long and 1 to 1.5 mm in diameter.

The Gynaecium (Fig. 1): Is inferior consisting of a tricarpellary, trilocular, syncarpous ovary and long style ending with a 3 lobed stigma. The ovary is smooth, ribbed

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greenish in colour and measuring about 0.8 to 1 cm long and 0.3 to 0.5 cm in diameter. The ovary contains few anatropous ovules in each locule arranged on axile placenta.

The Pedicel (Fig. 1): Is cylindrical, externally smooth, green in colour and measuring 1.5 to 2.5 cm long and 0.3-0.4 cm in diameter.

The floral formula could be expressed as follows:

$$\oplus, \ominus, P \overset{\text{-----}}{\text{-----}} (3+3 + \text{corona}), A_{3+3}, G(\bar{3})$$

B- Micromorphology

The perianth : The perianth segment is formed of inner and outer epidermises enclosing in between a few layers of undifferentiated parenchymatous mesophyll.

The Inner (upper) Epidermal cells (Fig. 2 A, B,C): The cells vary in size and shape at different regions. The cells of the apical region are papillosed, polygonal, isodiametric with more or less straight anticlinal walls. They measure from 40-65-80 μ in length and from 40-60-70 μ in width. The cells of the middle region are papillosed, polygonal, isodiametric with straight or slightly curved anticlinal walls and measure from 60-90-120 μ in length and from 40-60-80 μ in width. At the basal part, the cells are polygonal, axially elongated with more or less straight anticlinal walls and measure from 80-140-180 μ in length and from 30-40-60 μ in width. Most of the cells show warty raised parts of cuticle. Stomata of anomocytic type are present, being oval or rounded in shape usually surrounded by 4 to 6 epidermal cells and measure from 30-45-60 μ in diameter. Trichomes are absent.

The Outer (lower) Epidermal cells (Fig. 2, C, D, E):

The cells are more or less similar to those of the inner epidermis. Stomata are absent.

The Androecium (Fig. 3):

The Filament (Fig. 3 A, B, C): A transverse section through the filament appears circular in outline showing an epidermis surrounding a wide cortex and central vascular bundle.

The Epidermis (Fig. 3 C): Is formed of elongated, subrectangular cells with straight anticlinal walls and covered with smooth cuticle, measuring from 110-180-220 μ in length, 35-50-65 μ in width and 25-35-40 μ in height. Trichomes and stomata are absent.

The Cortical Tissue (Fig. 3): It is formed of nearly rounded thin walled parenchymatous cells. The vascular bundle consists of soft phloem and xylem of narrow, lignified spiral and annular vessels, measuring from 15-35 μ in diameter. 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 8-15-20 μ in diameter. Raphides as well as isolated single acicular crystals of calcium oxalate are scattered in the cortical tissue measuring 20-35-45 μ in length.

The Anther (Fig. 3): Consists of two nearly equal antherlobes attached by the connective, through which runs a small vascular strand. Each anther lobe is formed of two, equal pollen sacs, which are full of numerous comparatively large pollen grains, the anther wall is formed of an epidermis, a fibrous layer of 1 to 4 rows and the remains of the tapitum.

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The Epidermal Cells (Fig. 3, F,C): They are polygonal isodiametric or slightly elongated with thin anticlinal walls and covered with thick cuticle. The cells measure from 120-150-190 μ in length and 90-120-135 μ in width.

In the connective region, the epidermal cells are polygonal, usually axially elongated and measure from 180-220 μ in length and 70-95 μ in width. Trichomes and stomata are not observed.

The Fibrous Layer (Fig. 3D): It is formed of one to four rows of cells. The number usually increases towards the connectives and decreases towards the lines of dehiscence. The cells have usually bar-like thickening, and appearing in surface view to be polygonal to isodiametric with distinct beaded walls, measuring from 160-230-290 μ in length and 90-110-125 μ in height. Within the fibrous layer a thin walled collapsed and ruptured parenchymatous cells constituting the remaining of the tapitum.

The Pollen Grains (Fig. 3 H): Are spherical to subspherical, sometimes oval in outline. Each grain possesses one germinal furrow which extends from pole to pole. The grains have warty granular exine and measuring from 90-105-115 μ in diameter. Germinal pores are not observed.

The Gynaecium:

The Ovary (Fig. 4): A transverse section in the ovary is rounded in outline and shows glabrous outer epidermis enclosing the ground tissue and three locules. Each locule contains two ovules. The ovary wall shows glabrous outer and inner epidermises enclosing a wide ground tissue formed of several vascular strands.

The Outer Epidermis (Fig. 4C): It appears in surface view to consist of polygonal usually isodiametric, sometimes sub-rectangular small cells with straight anticlinal walls and covered with thick smooth cuticle, measuring from 40-75-110 μ in length and in width. Stomata of anomocytic type are present, being oval or rounded and measure from 45-55-75-110 μ in diameter.

The Ground tissue (Fig. 4): It consists of several rows of parenchymatous cells with relatively wide intercellular spaces. The parenchyma of the ground tissue contains starch granules, calcium oxalate crystals (Page 4) and mucilaginous masses of cellulosic type which stain red with ruthenium red and blue with methylene blue and does not stain with corallin soda.

The Vascular System: Consists of numerous closed, collateral strands traversing the ground tissue. Each bundle is surrounded by parenchymatous pericycle. The phloem is formed of an outer batch of sieve tubes and companion cells. The xylem is formed of an inner batch of lignified vessels with spiral and scalariform thickening, measuring 15-20-40 μ in diameter. These vessels have long segments and are surrounded by small thin-walled non lignified parenchyma.

The style: The epidermis of the style (Fig. 4F) consists of polygonal axially elongated cells with straight anticlinal walls, measuring 200-280-400 μ in width. The cells are covered with thin smooth cuticle. Trichomes are absent.

The Stigma: The epidermal cells of the stigma (Fig. 4 E) are small, polygonal isodiametric with straight anticlinal walls. The cells are 130-150-175 μ length.

The Bract (Fig. 5A,B): A transverse section in the spatheous bract shows glabrous outer and inner epidermises enclosing a narrow mesophyll tissue, which is traversed by several closed

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collateral vascular bundles. The arrangement of the tissue is more or less similar to that of the foliage leaves¹. Mucilage, starch and acicular crystals of calcium oxalate are of common occurrence in the parenchyma.

The Upper Epidermis (Fig. 5 C): It consists of polygonal, usually elongated, subrectangular cells with straight anticlinal walls and covered with thick smooth cuticle, measuring 80-150-220 μ long & 25-40-60 μ wide. Stomata of anomocytic type are present being usually rounded in shape and surrounded by 4 to 6 epidermal cells, measuring from 40-50-60 μ in diameter.

The Lower Epidermis (Fig. 5 D): The cells are similar to those of the upper epidermis but the stomata are more frequent.

The Pedicel (Fig. 6 A): It is formed of thick walled cells which appear square to subrectangular in transverse section, but in surface view they are polygonal, axially elongated with more or less straight anticlinal walls. The epidermal cells are covered with thick, smooth cuticle and measure 205-280-340 μ in length, 35-50-65 μ in width and 60-65-70 μ in height. Stomata of anomocytic type are present, being oval to rounded in outline and measuring 75-80-90 μ in length and 35-38-43 μ in diameter.

The ground Tissue: Consists of parenchyma cells, those towards the periphery contain chloroplast. The cells contain mucilage, starch granules and acicular crystals of calcium oxalate.

The Vascular System: Consists of numerous strands traversing the ground tissue. Each of which is a typical collateral vascular bundle surrounded by an outer parenchymatous pericycle. The phloem is formed of an outer batch of sieve tubes and companion cells. The xylem is formed of an inner batch of lignified vessels with spiral, scalariform and

annular thickening, measuring 17-25-35 μ in diameter. These vessels have long segments and are surrounded by thin walled non lignified parenchyma. The central part of the pedicel consists of ordinary parenchyma.

The Scape (Fig. 7): A transverse section in the scape appears oval in outline. The glabrous epidermis is followed by a wide parenchymatous ground tissue, those towards the periphery contain chloroplast. Numerous closed collateral vascular bundles are scattered in the ground tissue, they are more crowded and larger outwards but being smaller in number towards the center. Mucilage, starch and acicular crystals of calcium oxalate are of common occurrence in the parenchyma.

The Epidermis (Fig. 7 C): The epidermal cells are similar to those of the pedicel but measuring 470-485-510 μ in length 40-45-55 μ in width and 40-45-55 μ in height.

The Ground Tissue: It consists of a large zone of thin-walled, polygonal to rounded parenchymatous cells, those towards the periphery contain chloroplast. The cells contain mucilage, starch granules and acicular crystals of calcium oxalate.

The Vascular System: It consists of numerous strands traversing the ground tissue. The vascular strands are similar to those of the pedicel.

Powdered Flowers:

The dried powder is whitish to yellowish in colour with slight odour and bitter mucilagenous taste.

The diagnostic microscopical characters are the followings:

- 1- Fragments of the floral leaves showing polygonal, isodiametric and elongated epidermal cells having straight anticlinal walls, covered with thick smooth

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- cuticle, occasionally showing anomocytic stomata.
- 2- Fragments of the anthers showing polygonal, isodiametric epidermal cells with thin anticlinal walls and covered with striated cuticle, as well as polygonal almost isodiametric cells of the fibrous layer with lignified bar-like thickening.
 - 3- Numerous spherical pollen grains with finely granular warty exine, each showing one germinal furrow.
 - 4- Fragments of parenchymatous cells containing mucilaginous masses, acicular crystals of calcium oxalate in raphides or single forms as well as starch granules frequently simple usually compound of 2 to 5 components.
 - 5- Fragments of xylem elements showing lignified spiral, annular and scalariform thickening.
 - 6- Free starch granules, acicular crystals of calcium oxalate or raphides and mucilage masses.
 - 7- Absence of sclereids, fibres, pitted or reticulate elements and trichomes.

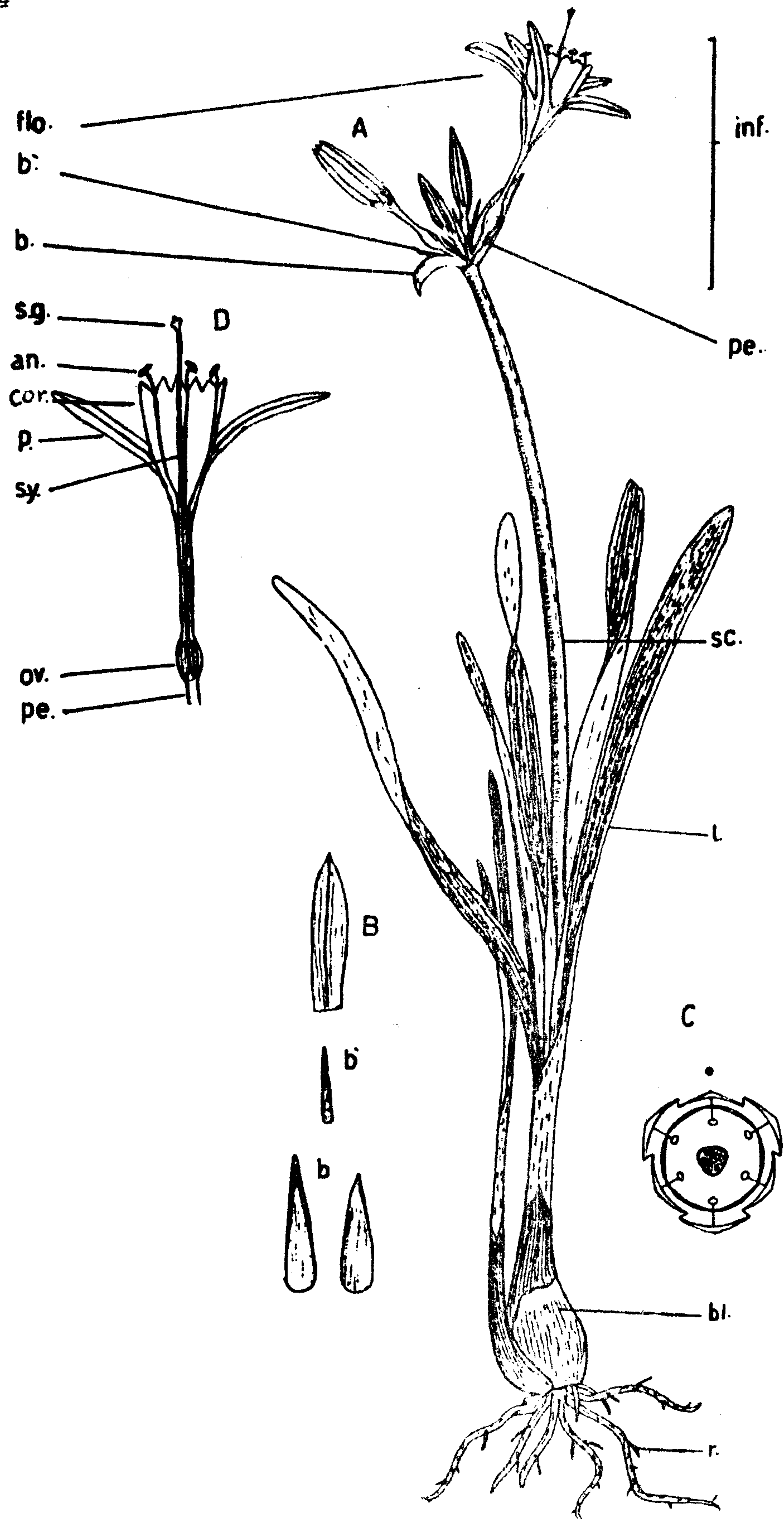
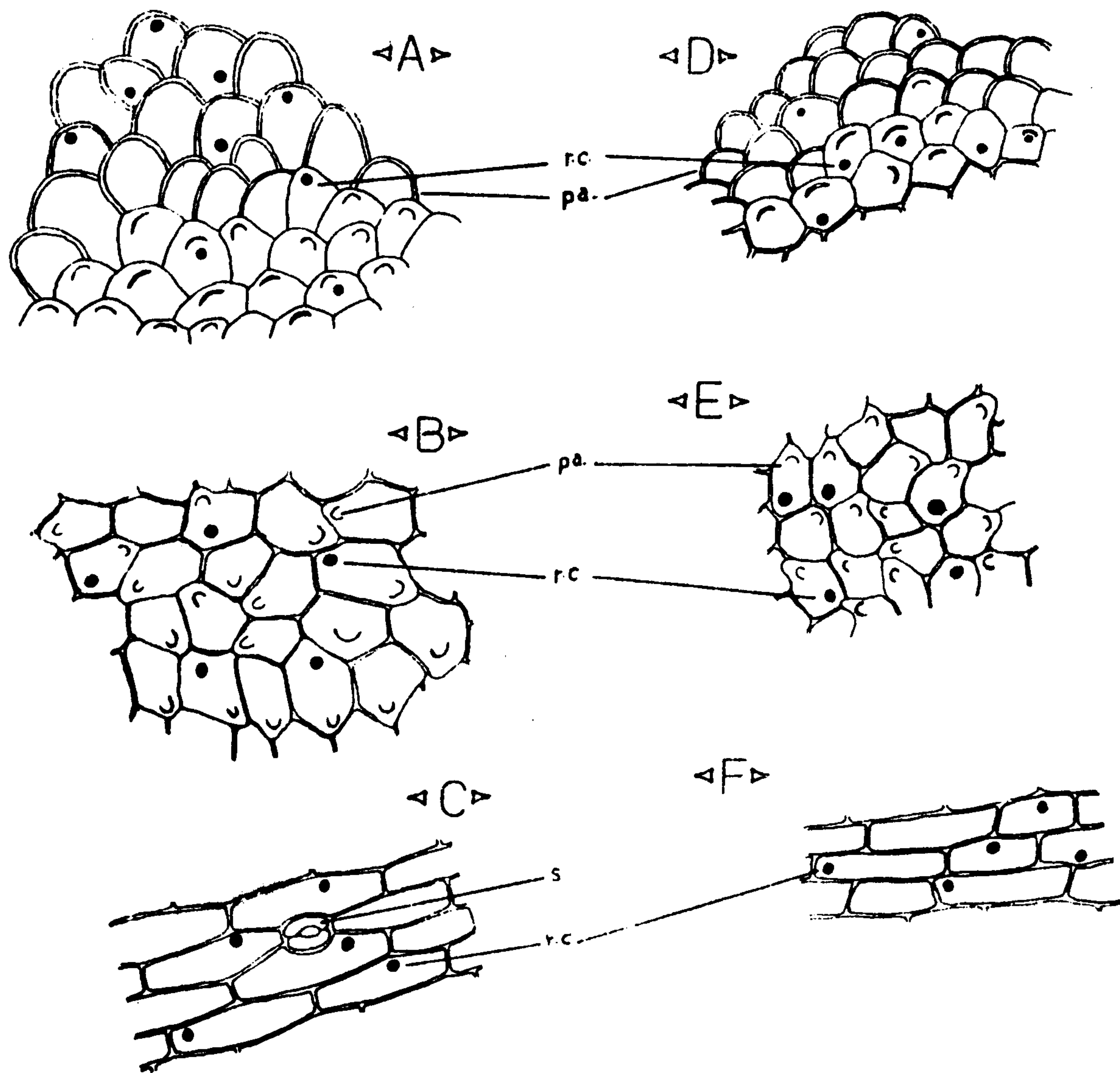


Fig. 1: Sketch of *Pancratium sickenbergi* Asch. et Schweinf. ex Boiss X 1/3
 A- Inflorescence X 1/3
 B- Perianth segment X 1/2
 C- Floral diagram
 D - Vertical section in the flower X 1/2
 an., anther; b., bract; b!, bracteole; bl., bulb; cor., corona; flo., flower; inf., inflorescence; l., foliage leaf; ov., ovary; pe., pedicel; p., perianth; r., root; sc., scape; s.g., stigma; s.y., style.

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Fir. 2: Surface view the inner and outer epidermises of the perianth:

- | | | |
|-----|----------------------|-------|
| i- | The inner epidermis: | |
| | A- Apical region | X 120 |
| | B- Middle region | X 120 |
| | C- Basal region | X 120 |
| ii- | The outer epidermis: | |
| | D- Apical region | X 120 |
| | E- Middle region | X 120 |
| | F- Basal region | X 120 |
- pa., papillae; r.c., raised part of cuticle; s., stomata.

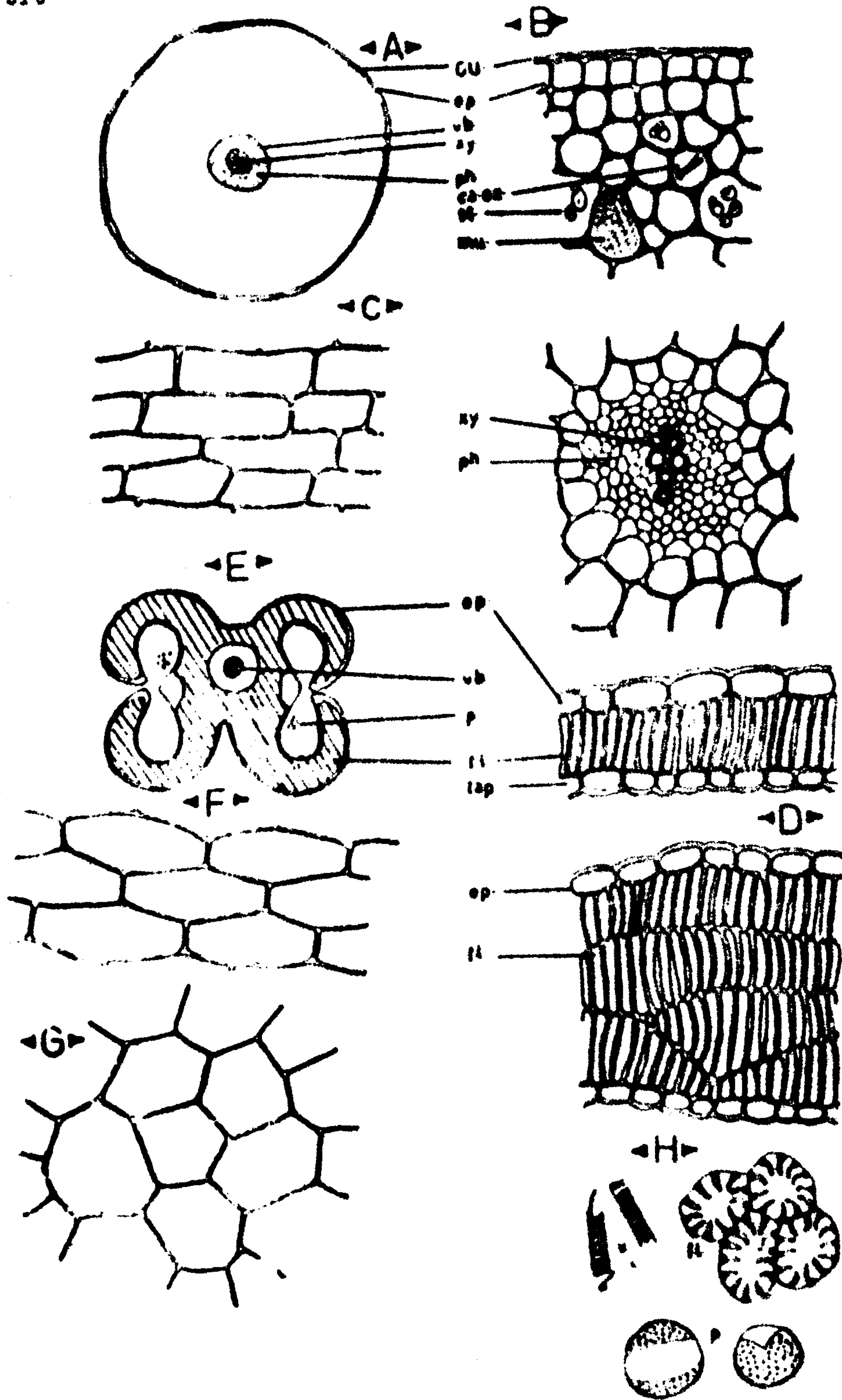


Fig. 3: Androecium:

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|----|---|-------|
| A- | Diagrammatic T.S. in the filament of the anther | X 12 |
| B- | Detailed T.S. in the filament of the anther | X 115 |
| C- | Surface view of the epidermis of the filament | X 115 |
| D- | Detailed T.S. in the anther wall | X 115 |
| E- | Diagrammatic T.S. in the anther wall | X 12 |
| F- | The epidermal cell of the anther in the connective region | X 115 |
| G- | The epidermal cell of the anther | X 115 |

ca.ox., calcium oxalate; cu., cuticle; ep., epidermis; f.l., fibrous layer; mu., mucilage; ph., phloem; p., pollen grain; st., strach granule; tap., tapitum; v.b., vascular bundle; v., vessels; xy., xylem.

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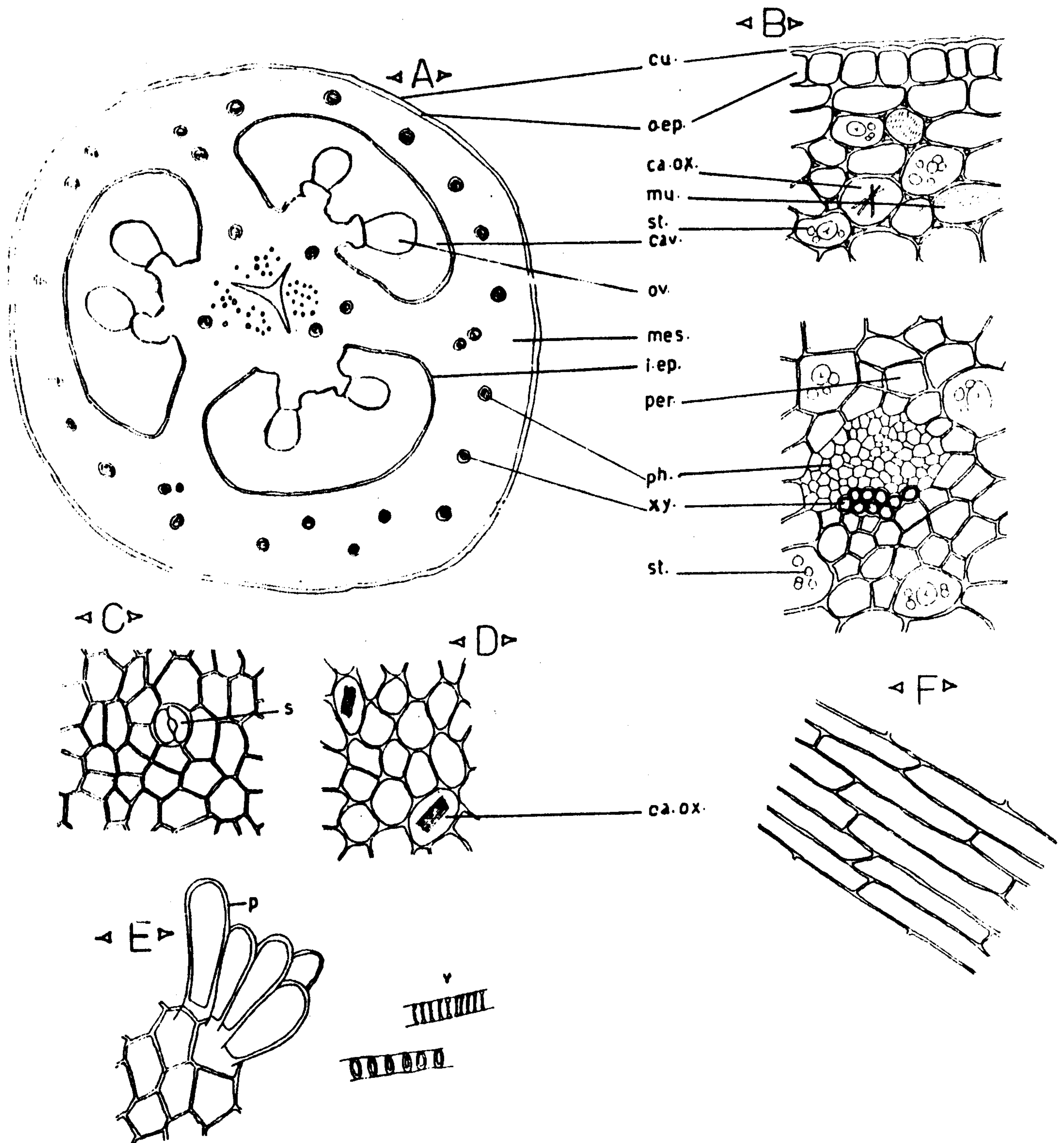


Fig. 4: Gynaecium:

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|--------------------------------------|-------|
| A- Diagrammatic T.S. in the ovary | X 12 |
| B- Detailed T.S. in the ovary | X 120 |
| C- Surface preparation of the ovary | X 120 |
| D- L .S. in the ovary wall | X 120 |
| E- Surface preparation of the stigma | X 120 |
| F- Surface preparation of the style | X 120 |
- ca.ox., calcium oxalate; cav., cavity; cu., cuticle; i.ep., inner epidermis; mes., mesophyll; mu., mucilage; o.ep., outer epidermis; ov., ovule; p., papillae; per., pericycle; ph., phloem; st., starch granule; v.b., vascular bundle; xy., xylem.

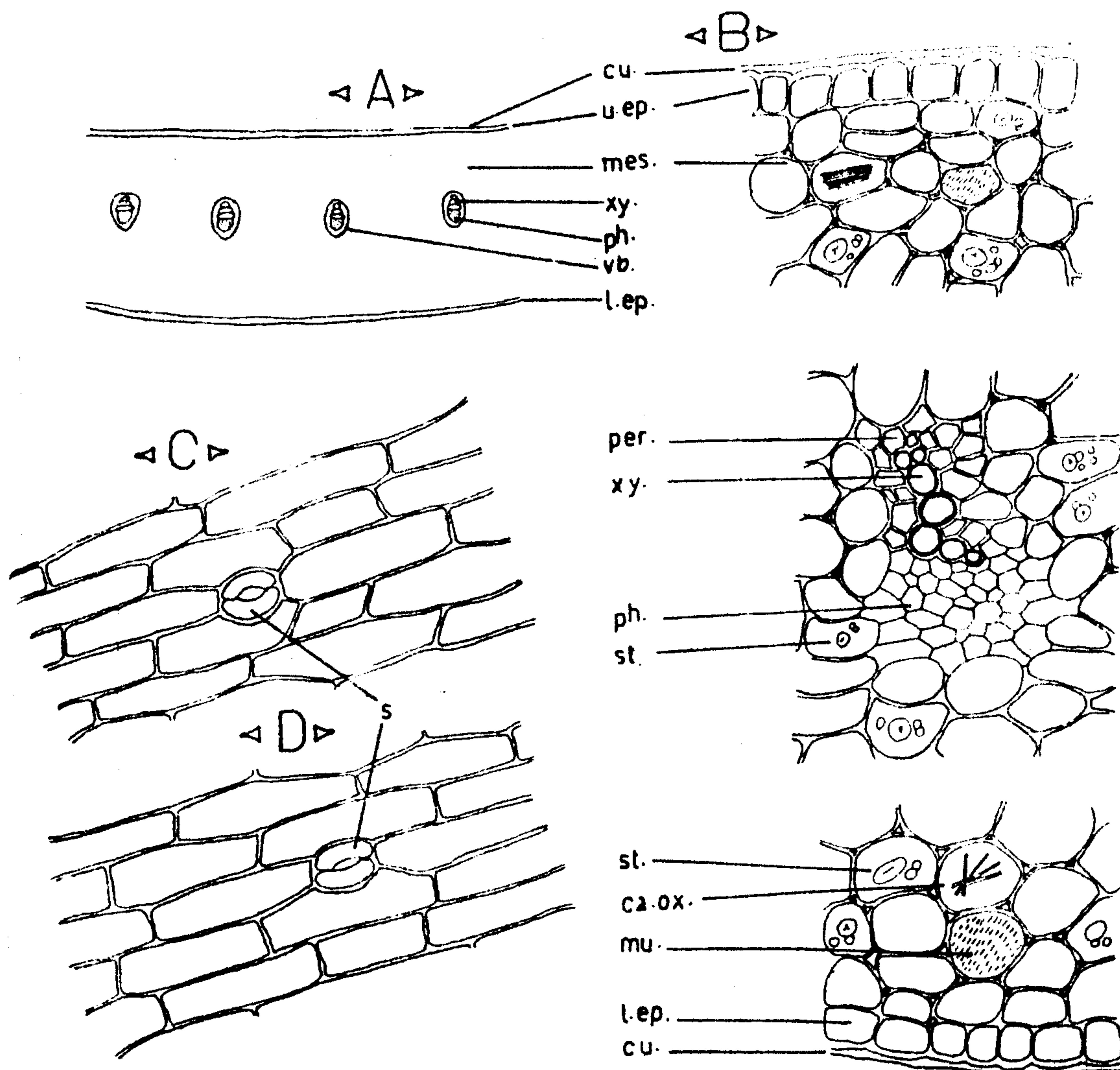


Fig. 5: The Bract:

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|-----------------------------------|-------|
| A- Diagrammatic T.S. in the bract | X 12 |
| B- Detailed T.S. in the bract | X 120 |
| C- Upper epidermis | X 120 |
| D- Lower epidermis | X 120 |

ca.ox., calcium oxalate; cu., cuticle; l.ep., lower epidermis; mes., mesophyll; mu., mucilage; per., pericycle; ph., phloem; s., stomata; st., starch granule; u.ep., upper epidermis; v.b., vascular bundle; xy., xylem.

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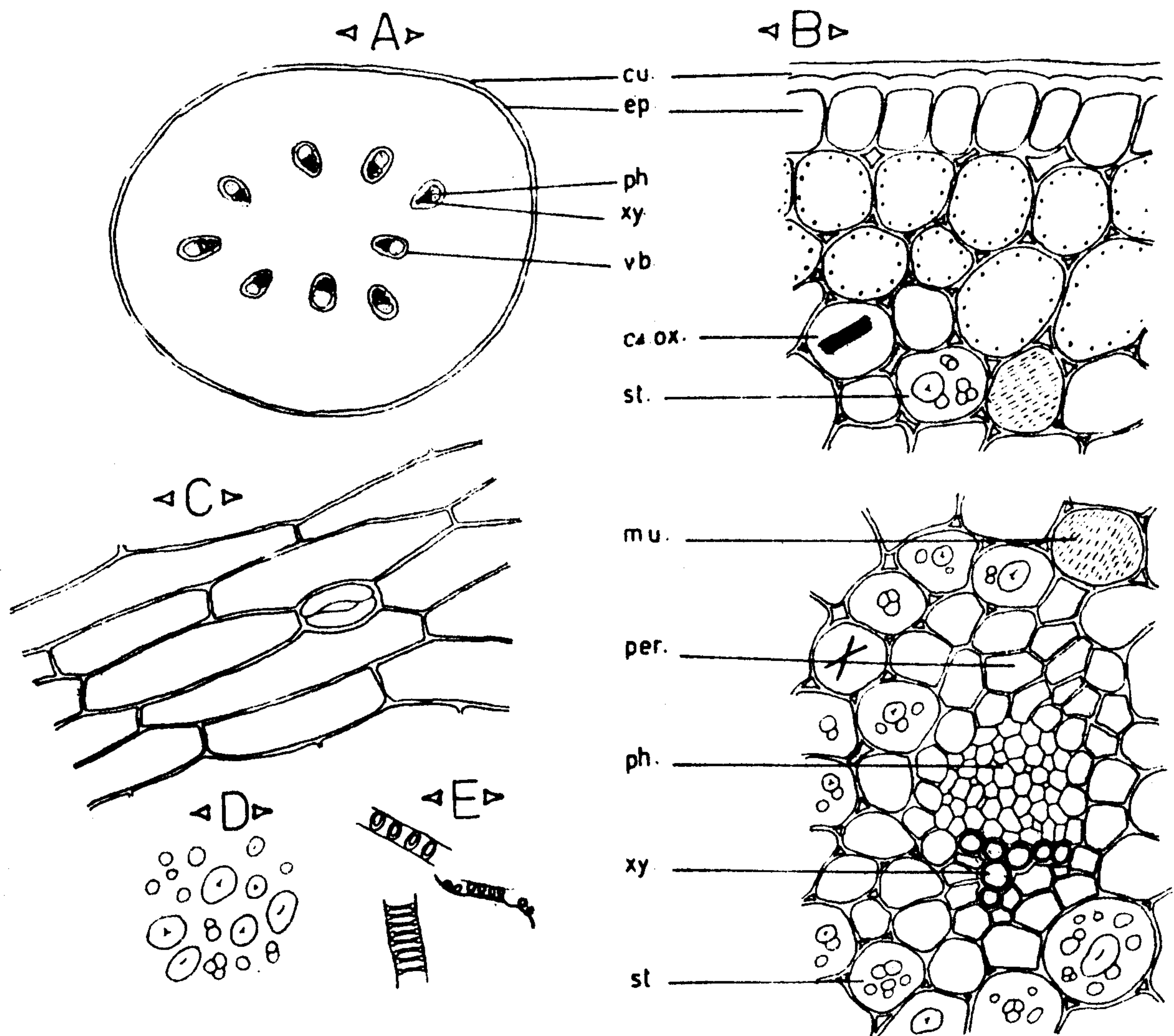


Fig. 6: The Pedicel

A- Diagrammatic T.S. in the pedicel	X 12
B- Detailed T.S. in the pedicel	X 120
C- Surface preparation of the pedicel	X 120
D- Strach granules	X 120
E- Vessels	X 120

ca.ox., calcium oxalate; cu., cuticle; ep., epidermis; mu., mucilage; per., pericycle; ph., phloem; st., starch granule; v.p., vascular bundle; xy., xylem.

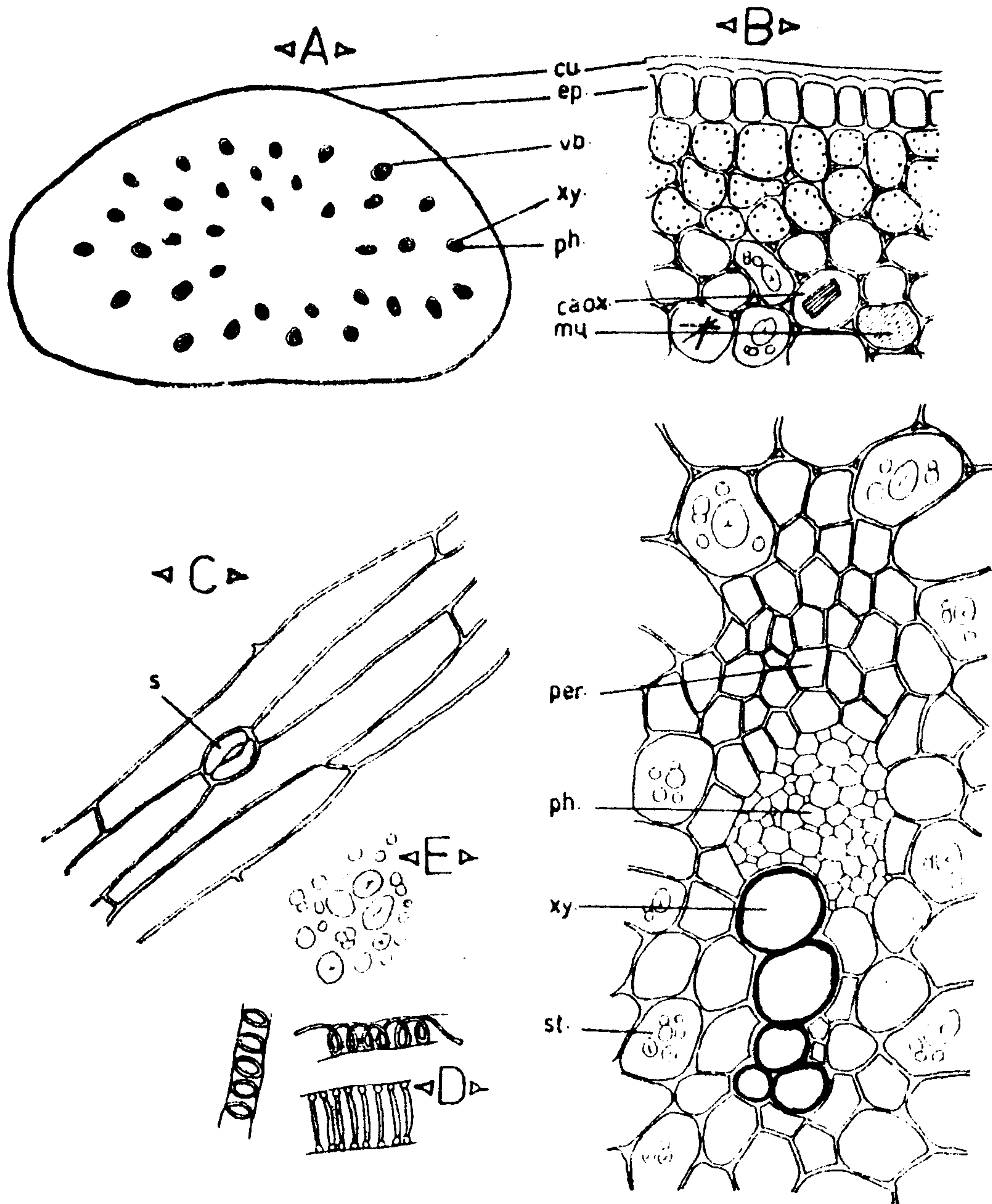


Fig. 7: The Scape:

A-	Diagrammatic T.S. in the scape	X 6
B-	Detailed T.S. in the scape	X 120
C-	Surface preparation of the scape	X 120
D-	Vessels	X 120
E-	Starch granules	X 120

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