

A PHARMACOGNOSTICAL STUDY OF *OXALIS PES-CAPRAE* L. GROWING IN LIBYA.

PART 1: THE INFLORESCENCE

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ABSTRACT

The macro- and micromorphological characters of the inflorescence of *Oxalis pes-caprae* L. (Family Oxalidaceae) are described and illustrated with the aim to facilitate the identification of this plant in the entire or powdered forms.

INTRODUCTION

The family Oxalidaceae (wood sorrel family) includes 7 genera and about 1000 species (1). They exist mainly in tropical and subtropical regions. Few plants extend into temperate regions. *Oxalis* (about 850 species) is represented domestically by about 25 species. In Libya there is one genus which consists of 3 species; *Oxalis corniculata*, *Oxalis pes-caprae* and *Oxalis articulata* (2). *Oxalis corniculata* L., is known as Hhdmidah hhullwah, Hhamdid, El-Sol and Atba (3-5).

Oxalis acetosella L. (wood sorrel) has an astringent, expectorant, diuretic and thirst-quencher properties (6). For external use, it can be crushed and applied locally to dispel boils and abscesses.

The Literature concerning the botanical study of *O. pes-caprae* L., is inadequate. Therefore the present work is concerned with macro- and micromorphological studies of inflorescence of this plant, aiming to find out the diagnostic features by which it can be easily identified in the entire and powdered forms.

EXPERIMENTAL

Material :

The plant material including; single and double-whorled corolla was collected in March, 1993 from the flowering plant of *Oxalis pes-caprae* L., growing widely in the areas surrounding the buildings of Arab Medicinal University, Faculty of Pharmacy, Benghazi-Libya. The plant was identified by the author (2) and confirmed by Dr. Hasnaa Hosni, Assistant Professor of plant Taxonomy, the Herbarium-Botany Dept., Faculty of

science, Cairo University. Herbarium specimens are kept at the Department of Pharmacognosy, Faculty of Pharmacy, Cairo University. The material was used either fresh or preserved in glycerin-alcohol mixture.

I. Macromorphology :

The single-whorled corolla flowers (Fig. 1A) of *O. pes-caprae* are 2-12, axillary arranged in umbellate inflorescence. They are bright yellow in colour. They measure 25 to 35 mm in length and 5 to 6 mm in diameter at the mouth of corolla. The pedicel is 6 to 22 mm in length and 0.5 to 1 mm in diameter.

The flowers are actinomorphic, hermaphrodite and pentamerous. The Rachis of the inflorescence is cylindrical, solid, pubescent, with a green surface. It measures 25 to 40 cm in length and 2 to 4 mm in diameter.

The Bract (Fig. 2A) is green-yellow in colour, nearly triangular in shape, hairy, having an entire margin, acute apex and measuring about 7 mm in length and 0.2 to 0.3 mm in breadth.

The Calyx is tubular in shape. It consists of 5 free, imbricate sepals. Each sepal (Fig. 2B) is green, oval to ovate, with a subacute apex and an entire margin. It is traversed by one midvein and lateral veins anastomosing near the margin and apex. Each sepal measures 2 to 5 mm in length and 1 to 2 mm in breadth.

The corolla is formed of 5 free petals. They are twisted in bud. They are delicate with yellow colour. Each petal (Fig. 2C) is spatulate with smooth surface and longitudinally traversed by a

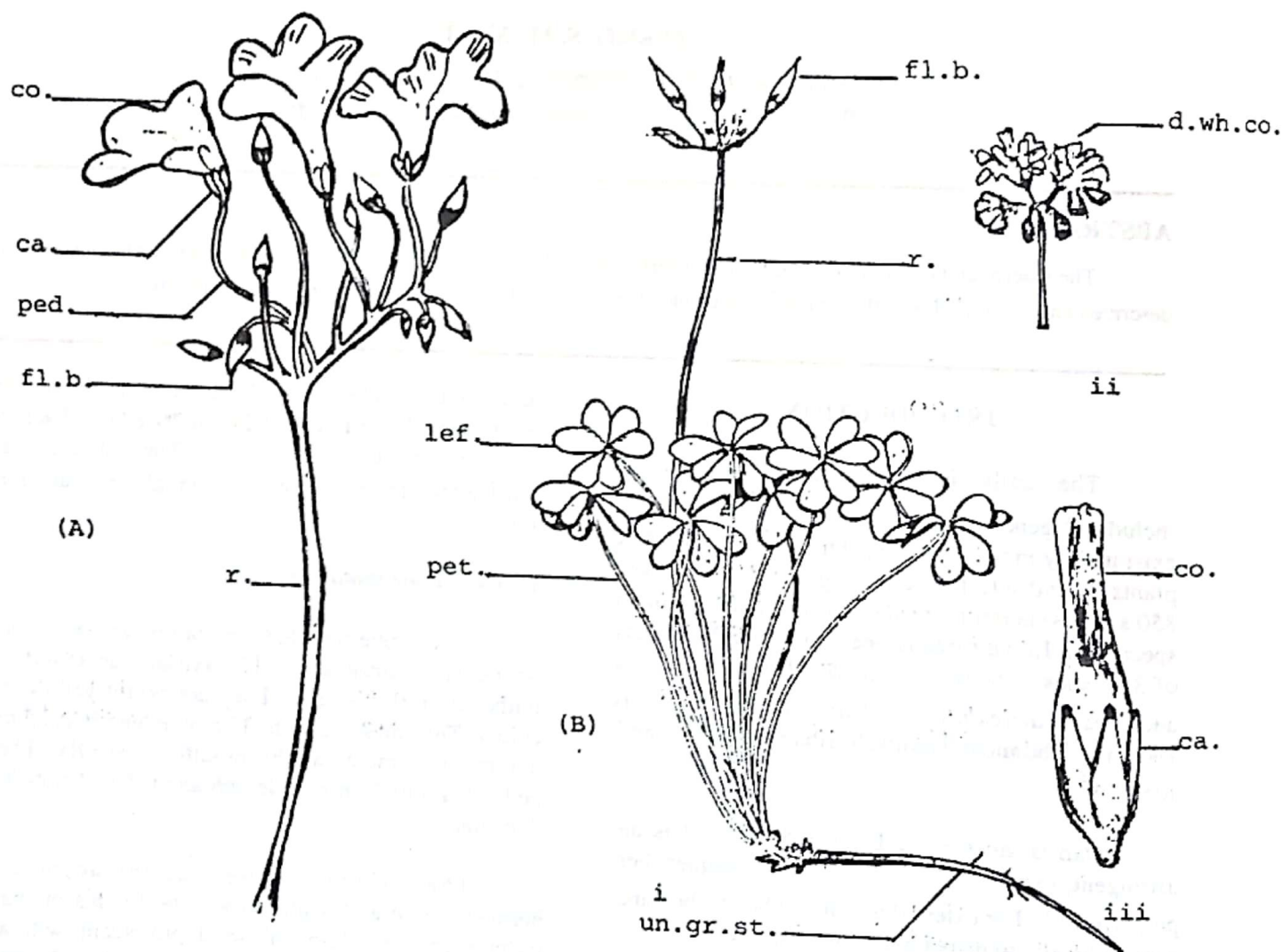


Fig. 1A: Macromorphology of Oxalis pes-caprae (single-whorled corolla flowers): Inflorescence (X 3/4).

Fig.1B: Macromorphology of Oxalis pes-caprae (double-whorled corolla flowers):
 i, Entire plant (X 1/3).
 ii, Inflorescence (X 1/2).
 iii, Flower bud (X 2 1/2).

Ca., calyx; co., corolla; d.wh.co., double-whorled corolla; fl.b., flower bud; lef., leaflet; ped., pedicel; pet., petiole; r., rachis; un.gr.st., underground stem.

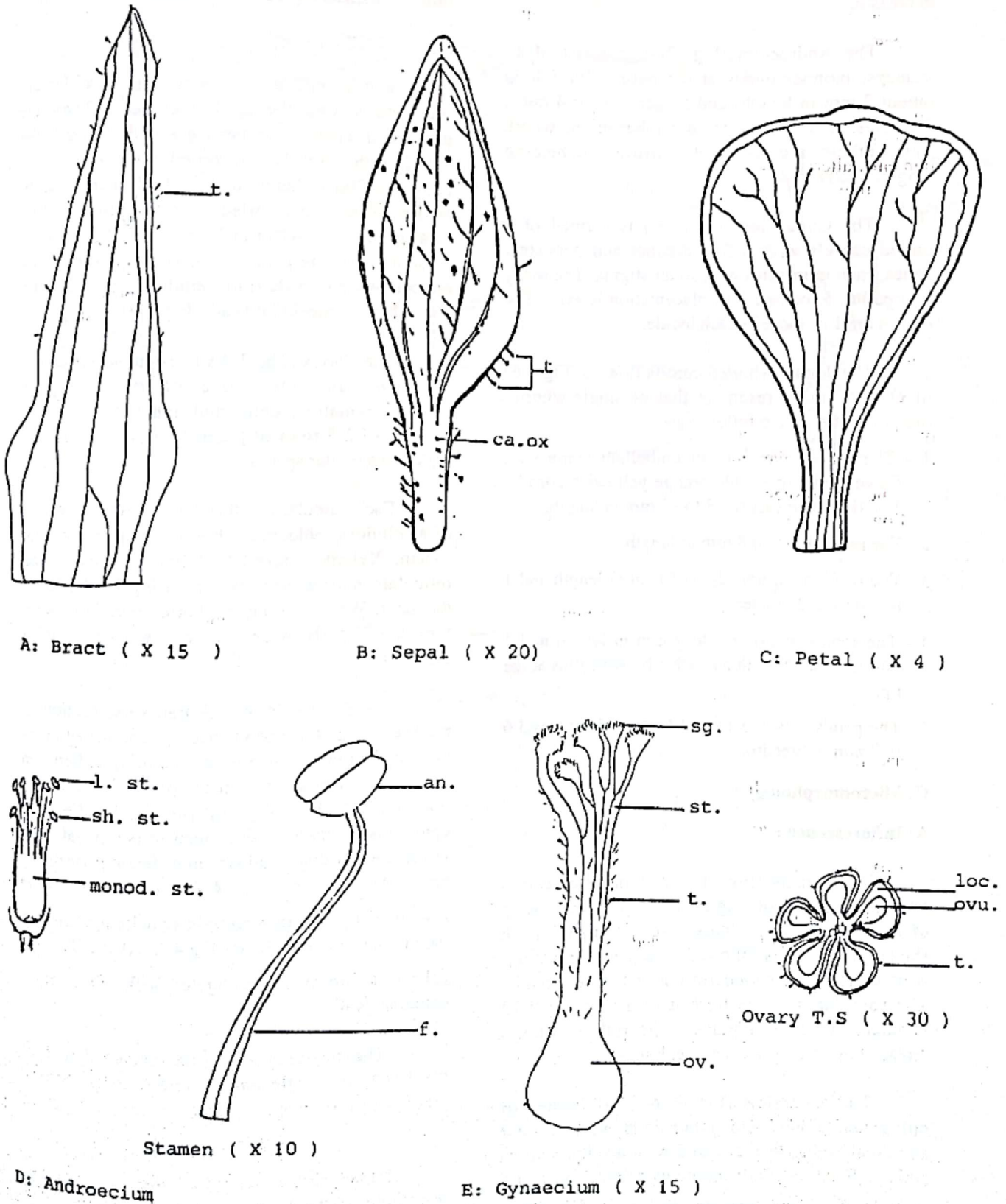


Fig. 2: Macromorphology of *O. pes-caprae* (single-whorled corolla flowers).

an., anther; ca.ox., calcium oxalate prism; f., filament; l.st., long stamen; loc., locule; monod.st., monodelphous stamens; ov., ovary; ovu., ovule; sh.st., short stamen; sg., stigma; st., style; t., trichomes.

main vein. It has a rounded apex, an entire margin and measures 18 to 20 mm in length and 8 to 10 mm in breadth.

The Androecium (Fig. 2D), consists of 10 stamens, monodelphous at the base, with 5 long (about 7 mm in length) and 5 short (about 4 mm) filaments, alternating with each other in one whorl. The anthers are 2-celled, introres, dehiscent longitudinally.

The Gynaecium (Fig. 2E) is formed of 5 united carpels with 5 free distinct and persistent styles, each terminates with small stigma. The ovary is superior, 5-loculed. The placentation is axile. The ovules are 1 or more in each locule.

The double-whorled corolla flowers (Fig. 1B) of *O. pes-caprae* resemble that of single-whorled ones but differ in the following:-

- 1 - The inflorescence is an umbellate cyme with flowers having double orange yellowish corolla. The flowers measure 18 to 22 mm in length.
- 2 - The pedicel is 5 to 8 mm in length.
- 3 - The rachis measures 24 to 30 cm in length and 1 to 2 mm in diameter.
- 4 - The sepals measure 3 to 7 mm in length and 1 mm in breadth, with a reddish brown callus at the tip.
- 5 - The petals measure 11 to 13 mm in length and 6 to 7 mm in breadth.

II. Micromorphology :

A) Inflorescence :

The Rachis (Fig. 3) : A transverse section through the rachis of single-whorled corolla flowers of *O. pes-caprae* is almost circular in outline. It shows an epidermis followed by a parenchymatous, wide cortex. The endodermis is indistinguishable. The vascular tissue is formed of a ring of 10-12 collateral vascular bundles. The pith is wholly replaced by an empty cavity i.e. hollow.

The Epidermis (Fig. 3 A-C) is formed of polygonal, axially elongated cells with straight anticlinal walls. It is covered with a thick smooth cuticle. It occasionally contains minute prismatic crystals of calcium oxalate measuring 2 to 7 μ in length. The epidermal cells measure 55-355-680 μ in length, 17-28-33 μ in breadth and 10-24-32 μ in height. While in double-whorled corolla flowers they are longer measuring 90-655-1065 μ in length,

11-28-55 μ in breadth and 13-23-33 μ in height. Stomata are of anomocytic type. They are oval in outline, measuring 33-36 μ in length and 7-11 μ in breadth.

Non-glandular trichomes (Fig. 3 A&D) are scattered among the epidermal cells. They are unicellular, conical and taper gradually towards the apex, with slightly thickened wall measuring 255-365-450 μ in length and 10-14-17 μ in breadth. While in double-whorled corolla flowers, they measure 255-310-410 μ in length and 11-17-22 μ in breadth. Very rare glandular hairs are present. They are composed of a short unicellular basal cell and a club-shaped unicellular head. (Fig. 3D).

The Cortex (Fig. 3 A&B) is parenchymatous. It shows an outer zone of two rows of chlorenchymatous cells and inner zone which consists of 2-5 rows of parenchymatous cells with wide intercellular spaces.

Each vascular bundle (Fig. 3 A,B&E) consists of a cellulosic phloem of thin-walled elements and xylem. Xylem is formed of lignified spiral and reticulate narrow vessels measuring 8-14-20 μ in diameter. While in double-whorled corolla flowers they are slightly wider measuring 10-17-27 μ in diameter.

The Bract (Fig. 4) : A transverse section in the bract (Fig. 4A) shows that it is composed of an outer and an inner epidermises enclosing in between a parenchymatous mesophyll traversed longitudinally by a delicate vascular bundle. The epidermis of the bract is formed of polygonal cells which vary in shape and size in different parts of the bract. At the apex (Fig. 4 A₁, B₁) the cells are isodiametric with thin straight anticlinal walls. At the middle and at the base (Fig 4 A₂, A₄ & B₂, B₄) ; the cells are axially elongated with thin straight anticlinal walls.

The measurements of the epidermal cells of the bracts of single and double-whorled corolla flowers of *O. pes-caprae* (in microns) are given in Table I.

Stomata are present mainly on the middle and over veins of the outer and inner epidermises. They are of anomocytic type.

Both non-glandular and glandular trichomes (Fig. 4B) are highly distributed mainly near the apex and middle part of the bract. They are found

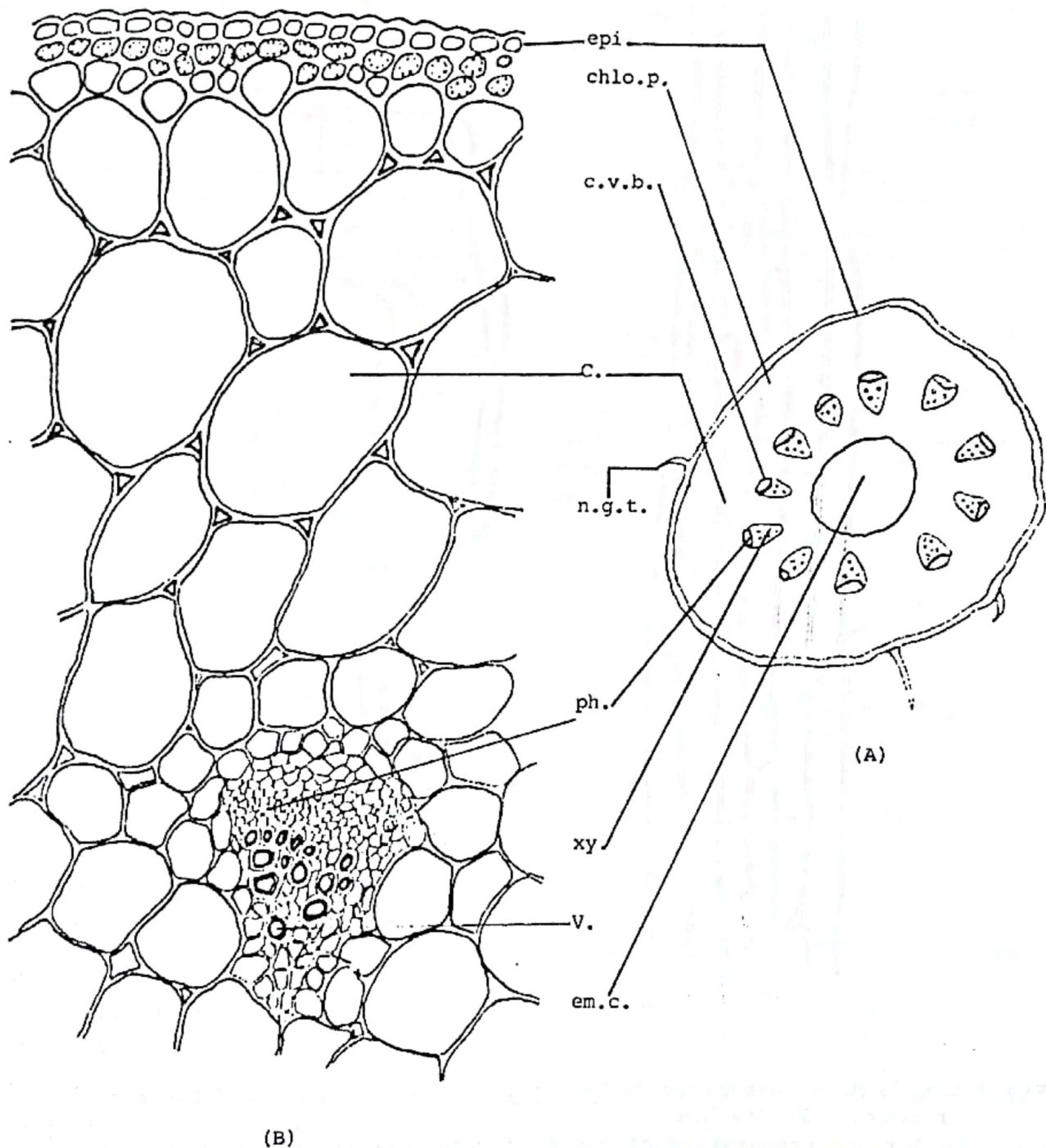


Fig. 3: Micromorphology of *Oxalis pes-caprae* (Single-whorled corolla flowers. The rachis:
 A- Diagrammatic T.S of the rachis (X 25).
 B- Detailed T.S of the rachis (X 210).
 C., cortex; chlo. p., chlorenchymatous parenchyma; c.v.b., collateral vascular bundle; em.c., empty cavity; epi., epidermis; n.g.t., non-glandular trichomes; ph., phloem; v., vessel; xy., xylem.

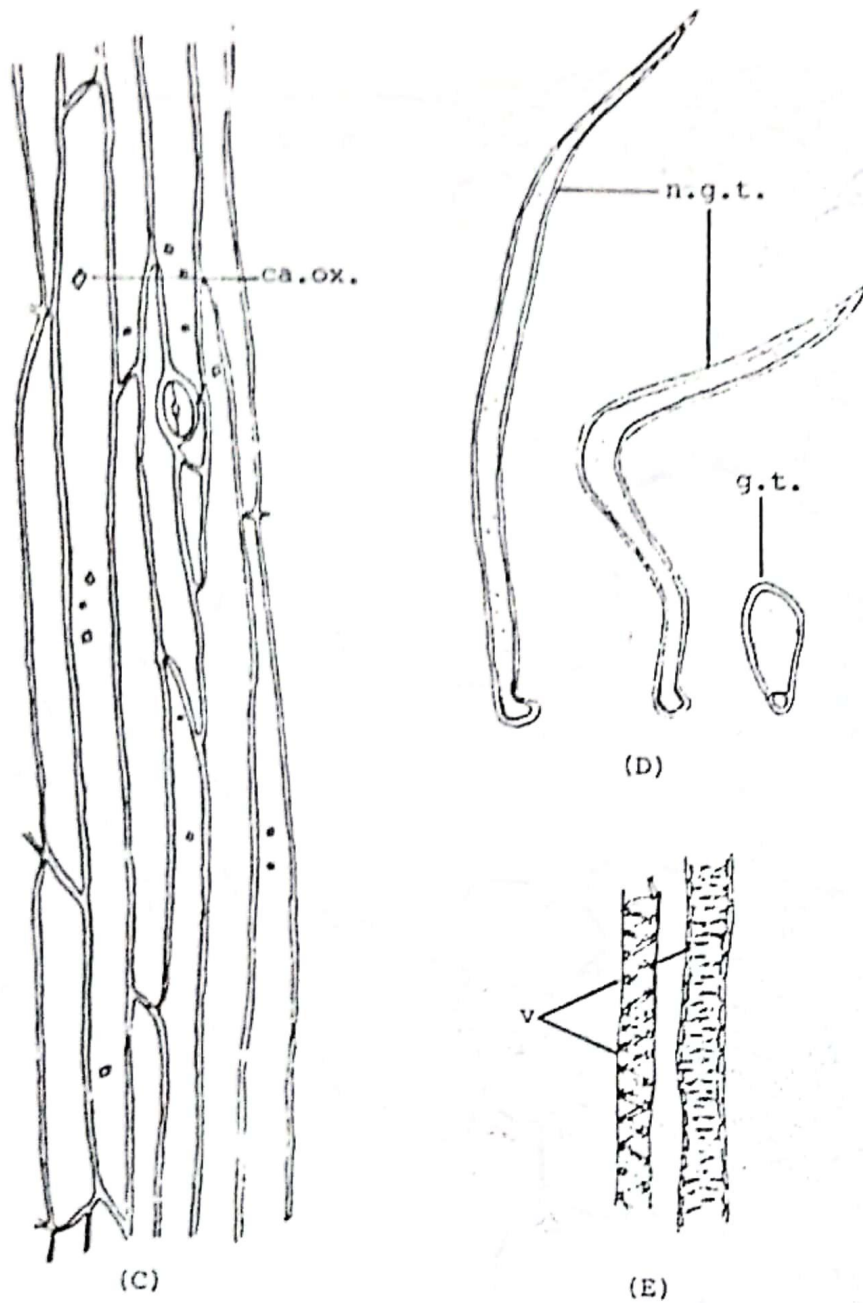


Fig. 3 Contd. Micromorphology of Oxalis pes-caprae (single-whorled corolla flowers). The rachis
 C- Surface preparation of the epidermal cells of the rachis (X 210).
 D- Trichomes (X 210).
 E- Vessels (X 210).
 ca.ox., calcium oxalate prism; g.t., glandular trichomes; n.g.t., non-glandular trichomes; v., vessels.

scattered or attached to fragments of the epidermis. The non-glandular trichomes are unicellular and conical. They taper gradually towards the apex. They are usually very thin-walled and vary considerably in length and are frequently very long. The glandular trichomes are of two types. The first type has a uniseriate, multicellular stalk which is composed of two to three cells and a club shaped unicellular head. The second type has a short unicellular basal cell and a club shaped unicellular head. The measurements of the trichomes on the epidermal cells of the bracts of both types of flowers of *O. pes-caprae* (in microns) are given in Table II. Generally, trichomes are smaller in case of double-whorled corolla flowers than those of single-whorled ones.

The mesophyll (Fig. 4A) is formed of parenchymatous cells with wide intercellular spaces and contains cluster crystals of calcium oxalate.

The Vascular Bundle (Fig. 4A) consists of an upper xylem with narrow lignified, spiral vessels measuring 3 to 7u in diameter and a lower phloem formed of thin-walled cellulosic elements.

B) The flower:

The pedicel in a transverse section (Fig. 5A & B), appears more or less circular in outline, with hairy surface. It consists of an outer epidermis, a very wide cortex, showing a ring of 6-9 collateral vascular bundles surrounding a central narrow pith. Clusters as well as prisms of calcium oxalate are scattered in the cortex.

The epidermis (Fig. 5A & B) consists of tabular, polygonal, nearly isodiametric cells, with straight anticlinal walls and covered with thin, smooth cuticle. Stomata are of anomocytic type and trichomes of both types glandular and non-glandular are numerous and similar to that of bract.

The Calyx : A transverse section in the sepal (Fig. 6) shows an outer an inner epidermises, with a row of chlorenchymatous cells under the inner one. The two epidermises enclose a homogenous mesophyll in which the vascular bundles are embedded. The epidermal cells of the sepal (Fig. 6) are polygonal and covered with a smooth cuticle. At the margin, middle and over the veins the cells are axially elongated with straight anticlinal walls; while at the base and apex they are isodiametric. The epidermal cells occasionally contain prismatic crystals of calcium oxalate. The measurements of the epidermal cells of the sepals of both types of flowers

of *O. pes-caprae* (in microns) are given in Table III.

Stomata are present in the middle part of both epidermises; but only in the basal part of outer epidermis. They are of anomocytic type.

Trichomes (Fig. 6) are numerous on both the inner and outer epidermises; but rarely present near the apex of the inner one. The non-glandular trichomes are similar to those on the bract but differ in their slightly sinuated pitted walls and slightly warty cuticle. They measure 71-100-356u in length and 7-12-19u in breadth. While in double-whorled corolla flowers, They measure 67-128-156u in length and 5-11-16u in breadth. The glandular trichomes are also similar to those of the bract; but mainly of uniseriate, multicellular stalk and club shaped unicellular head type. They measure 67-169-267u in length and 6-13-22u in breadth. While in double-whorled corolla flowers they measure 122-183-245u in length and 7-14-21u in breadth.

The corolla: A transverse section in the petal is similar to that of sepal. The epidermal cells of the petal (Fig. 7) are polygonal and covered with smooth cuticle. They resemble those of the sepals but differ in having slightly wavy anticlinal walls. They also have prismatic crystals of calcium oxalate. The measurements of the epidermal cells of the petals of both types of flowers of *O. pes-caprae* L. (in microns) are given in Table IV.

Stomata are present only on the basal part of the inner epidermis. They are of the anomocytic type.

Trichomes (Fig. 7) are distributed on the outer epidermis mainly near the margin of apex. They are less frequent on the inner one. The non-glandular trichomes are similar to those on the epidermal cells of the sepals but longer. They measure 155-525-778u in length and 8-12-18u in breadth. While in double-whorled corolla flowers, they measure 78-216-389u in length and 8-14-21u in breadth. The glandular trichomes are similar to those of the bract. The type which has a uniseriate, multicellular stalk and club shaped head measures 100-167-217u in length and 10-15-20u in breadth. The club shaped unicellular head type trichomes measure 70-76-87u in length and 5-8-11u in breadth. In double-whorled corolla flowers the glandular trichomes are rarely present.

Table 1: Cell dimensions of the outer and inner epidermises of the bracts of the inflorescences of single and double-whorled corolla flowers of *O. pes-caprae* L. (in microns).

Epidermis	Outer Epidermis			Inner Epidermis		
	L.	B.	H.	L.	B.	H.
At the apex						
Single-whorled co. fl.	30-41-50	20-23-28	8-14-20	17-43-70	15-18-27	6-11-19
Double-whorled co. fl.	20-27-30	8-13-17	5-11-19	20-24-37	12-14-20	4-13-18
Of the middle part						
Single-whorled co. fl.	70-113-137	12-20-30	8-14-20	30-58-107	13-28-47	6-11-19
Double-whorled co. fl.	73-114-190	17-22-27	5-11-19	83-128-173	13-18-20	4-13-18
Of the marginal part						
Single-whorled co. fl.	67-98-123	12-18-27	8-14-20	73-134-210	10-13-20	6-11-19
Double-whorled co. fl.	40-100-163	8-15-20	5-11-19	30-96-137	7-12-20	4-13-18
Of the basal part						
Single-whorled co. fl.	150-185-233	23-34-37	8-14-20	90-188-316	30-45-83	6-11-19
Double-whorled co. fl.	60-110-143	10-20-50	5-11-19	140-201-253	22-37-50	4-13-18
Over the veins						
Single-whorled co. fl.	80-118-150	12-19-30	8-14-20	113-146-167	12-18-37	6-11-19
Double-whorled co. fl.	63-90-127	10-13-23	5-11-19	123-145-169	15-20-23	4-13-18

L = Length B = Breadth H = Height co = Corolla fl = Flowers

Table 2: Measurements of the trichomes on the outer and inner epidermises of the bracts of the inflorescences of single and double-whorled corolla flowers of *O. pes-caprae* L. (in microns).

Epidermis	Outer Epidermis		Inner Epidermis	
	L.	B.	L.	B.
Non-glandular				
Single-whorled co. fl.	80-261-423	8-13-20	178-353-490	10-15-23
Double-whorled co. fl.	70-238-400	6-10-17	73-178-243	13-17-22
Glandular (multicellular stalk)				
Single-whorled co. fl.	87-197-303	15-30-43	178-265-378	22-30-40
Double-whorled co. fl.	65-125-205	12-25-38	45-135-150	15-19-24
Glandular (unicellular head)				
Single-whorled co. fl.	76-93-100	8-17-23	67-95-113	10-13-20
Double-whorled co. fl.	70-77-87	13-18-20	61-80-89	8-12-18

L = Length B = Breadth co = Corolla fl = Flowers

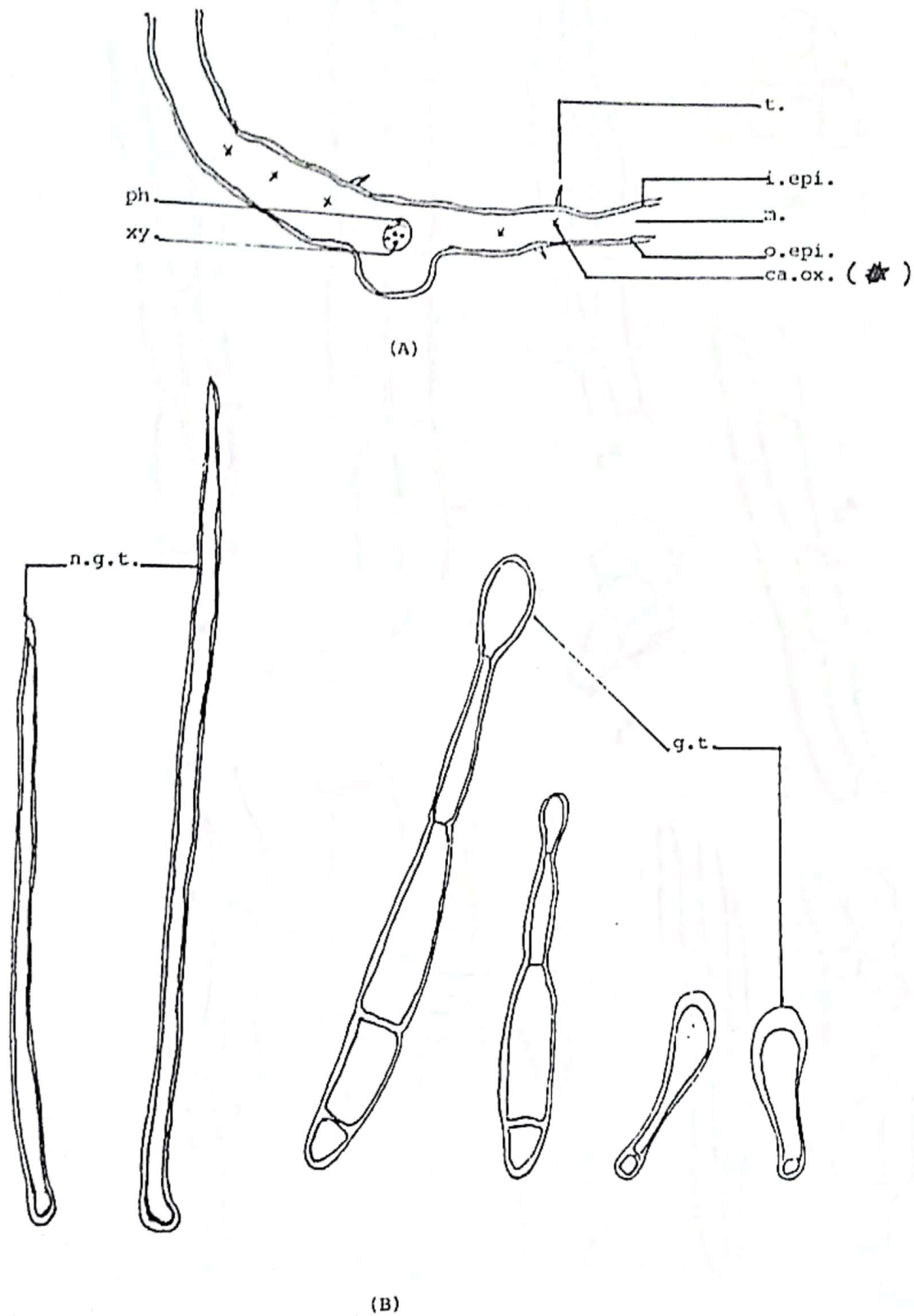


Fig. 4: Micromorphology of Oxalis pes-caprae (single-whorled corolla flowers).

The bract:

A- Diagrammatic T.S of the bract (X 90).

B- Trichomes (inner epidermis) (X 300).

ca.ox., calcium oxalate clusters; g.t., glandular trichomes; i.epi., inner epidermis; m., mesophyll; n.g.t., non-glandular trichomes; o.epi., outer epidermis; ph., phloem; t., trichomes; xy., xylem.

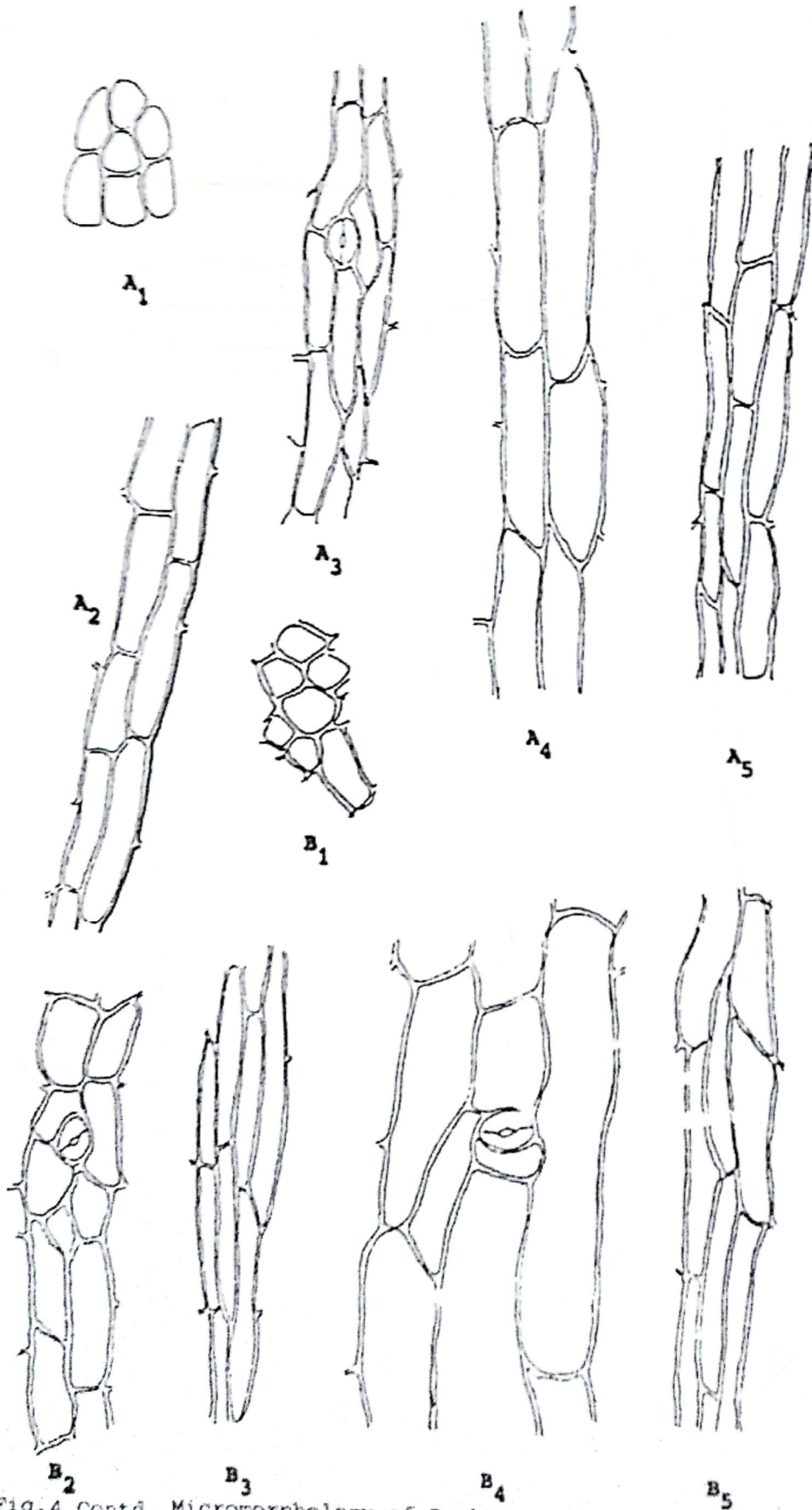


Fig. 4 Contd. Micromorphology of *Oxalis pes-caprae* (single-whorled corolla flowers). The bract:

A₁-A₅ : Outer epidermis of the bract (X 210).

B₁-B₅ : Inner epidermis of the bract (X 210).

A₁, B₁ at the apex; A₂, B₂ of the middle part; A₃, B₃ of the marginal part;

A₄, B₄ of the basal part; A₅, B₅ over the veins.

Table 3: Cell dimensions of the outer and inner epidermises of the sepals of single and double-whorled corolla flowers of *O.pes-caprae* L. (in microns).

Epidermis	Outer Epidermis			Inner Epidermis		
	L.	B.	H.	L.	B.	H.
At the apex						
Single-whorled co. fl.	43-53-77	18-22-28	7-15-19	20-43-83	5-16-28	8-13-20
Double-whorled co. fl.	20-37-63	17-20-25	5-12-17	10-25-37	5-10-17	5-14-18
Of the middle part						
Single-whorled co. fl.	107-180-213	12-23-27	7-15-19	93-138-180	12-20-25	8-13-20
Double-whorled co. fl.	47-84-173	17-27-37	5-12-17	93-184-200	15-20-23	5-14-18
Of the marginal part						
Single-whorled co. fl.	117-174-233	12-19-23	7-15-19	123-143-173	12-16-22	8-13-20
Double-whorled co. fl.	57-85-123	12-15-20	5-12-17	50-81-120	8-13-17	5-14-18
Of the basal part						
Single-whorled co. fl.	43-76-100	25-36-50	7-15-19	97-165-213	22-37-52	8-13-20
Double-whorled co. fl.	20-38-63	8-13-20	5-12-17	93-136-203	18-24-34	5-14-18
Over the veins						
Single-whorled co. fl.	107-148-213	15-22-26	7-15-19	97-142-157	15-22-28	8-13-20
Double-whorled co. fl.	28-81-105	17-25-38	5-12-17	53-96-137	12-17-23	5-14-18

L= Length B = Breadth H = Height co = Corolla fl = Flowers

Table 4: Cell dimensions of the outer and inner epidermises of the Petals of single and double-whorled corolla flowers of *O.pes-caprae* L. (in microns).

Epidermis	Outer Epidermis			Inner Epidermis		
	L.	B.	H.	L.	B.	H.
At the apex						
Single-whorled co. fl.	37-43-53	23-30-33	8-15-20	23-38-50	13-20-23	5-14-18
Double-whorled co. fl.	37-52-93	13-22-28	6-11-19	37-55-67	20-28-37	4-12-17
Of the middle part						
Single-whorled co. fl.	97-140-237	17-24-30	8-15-20	23-32-50	12-19-27	5-14-18
Double-whorled co. fl.	63-123-170	12-24-33	6-11-19	53-84-147	22-27-37	4-12-17
Of the marginal part						
Single-whorled co. fl.	100-159-237	15-20-30	8-15-20	63-105-147	10-17-30	5-14-18
Double-whorled co. fl.	77-124-200	8-15-27	6-11-19	55-105-120	15-21-30	4-12-17
Of the basal part						
Single-whorled co. fl.	83-118-167	23-30-33	8-15-20	33-157-234	10-18-30	5-14-18
Double-whorled co. fl.	120-237-317	25-32-43	6-11-19	100-163-220	12-22-33	4-12-17
Over the veins						
Single-whorled co. fl.	103-138-250	15-18-27	8-15-20	107-167-257	17-21-30	5-14-18
Double-whorled co. fl.	87-148-220	17-28-37	6-11-19	60-103-137	12-18-25	4-12-17

L= Length B = Breadth H = Height co = Corolla fl = Flowers

The Androecium

The filament: A transverse section of the filament (Fig. 8A) is more or less circular in outline, showing an epidermis surrounding a thin-walled homogenous parenchymatous ground tissue which is longitudinally traversed by a small central vascular bundle. The epidermal cells (Fig. 8B₁ & B₂) are polygonal axially elongated with straight anticlinal walls and are covered with thin smooth cuticle. The apical epidermal cells measure 20-45-57 μ in length, 5-7-10 μ in width and 4-6-12 μ in height. At the base and middle part, they measure 76-126-156 μ in length, 7-9-13 μ in width and 4-7-8 μ in height. The epidermal cells contain prismatic crystals of calcium oxalate. They show neither stomata nor trichomes.

The anther: A transverse section in the anther (Fig. 8C) shows 2 lobes separated by connective. The anther wall consists of an epidermis, fibrous layer and a collapsed tapetum. The epidermal cells (Fig. 8D) have tabular polygonal slightly wavy anticlinal walls and are covered with smooth cuticle. They measure 14-23-32 μ in length, 7-10-13 μ in breadth and 3 to 5 μ in height. They show neither stomata nor trichomes.

The fibrous layer (Fig. 8E) is formed of one row of lignified radially elongated cells with bar-like thickened walls. They appear in surface view (Fig. 8F) as very thin-walled rather indistinct cells; the rods of thickening on the walls appear as small elongated beads. They measure 29-41-60 μ in length, 10-14-17 μ in breadth and 7-10-15 μ in height.

The pollen grains (Fig. 8G) are fairly large when mature but a number of smaller, immature grains are frequently present, they are spherical, with three pores and three furrows with a finely warted exine. They attain 23-39-45 μ in diameter. In *O. pes-caprae* (double - whorled corolla flowers) they measure 17 - 20 - 24 μ in diameter.

The Gynaecium

A transverse section of the ovary wall (Fig. 9 A&B) shows an outer an inner epidermises enclosing in between a parenchymatous mesophyll traversed by several small vascular strands. The outer epidermal cells (Fig. 9 B₁ - B₃) are polygonal, almost isodiametric or axially elongated with straight anticlinal walls and covered with smooth cuticle. At the apex (Fig. 9B₁) the cells are axially elongated, thick-walled and contain scattered prismatic crystals of calcium oxalate. They measure 55-69-97 μ in length, 13-19-27 μ in breadth and 8 to 10 μ in height. At the base and at the middle part

(Fig. 9 B₂) the cells are axially elongated, thin-walled and measure 57-83-140 μ in length and 7-11-14 μ in breadth. Over the veins (Fig. 9 B₃) the cells are axially elongated and measure 147-216-274 μ in length and 10-17-23 μ in breadth. The epidermis shows no stomata but trichomes are present.

The style (Fig. 9C) appears in transverse section more or less circular in outline. It is formed of an epidermis enclosing a parenchymatous ground tissue traversed by a small central vascular strand.

The epidermis (Fig. 9 D1 & D2) consists of polygonal, axially elongated cells, having straight anticlinal walls and covered with thin smooth cuticle. At the apex (Fig. 9 D1) the cells measure 34-47-73 μ in length and 7-11-14 μ in breadth. The epidermal cells of the middle part (Fig. 9 D2) measure 43-80-110 μ in length and 8-14-23 μ in breadth. The epidermal cells show stomata of anomocytic type and non-glandular and glandular trichomes are densely distributed and resemble those of sepals.

The stigmatic surface is densely papillose and having papillae with round apices (Fig. 9 E).

Powdered Flower:

The dried powdered flowers of *Oxalis pes-caprae* (single and double-whorled corolla flowers) are brownish-yellow in colour, with a faint characteristic odour and a slightly sour taste. They have the following common characters (Fig. 10) :-

1. Abundant pollen grains, which are fairly large when mature but a number of small, immature grains are frequently present. They are spherical, with three germ pores and three spherical furrows and a finely warted exine.
2. Fragments of the fibrous layer of the anther. It is composed of very thin-walled, rather indistinct cells. The rods of thickening on the walls are very thin and lignified. they appear as small elongated beads in surface view.
3. Non-glandular and glandular trichomes are either found attached to the epidermal cells of different parts of flower. They may be detached.
4. Fragments of epidermal cells of sepal. They are polygonal, axially elongated with straight anticlinal walls and covered with smooth cuticle. They show anomocytic stomata and contain prismatic crystals of calcium oxalate.
5. Fragments of epidermal cells of corolla with wavy anticlinal walls. They show anomocytic stomata. They occasionally contain prismatic crystals of calcium oxalate.
6. Fragments of epidermal cells of filament with smooth cuticle. They are fairly small cells.

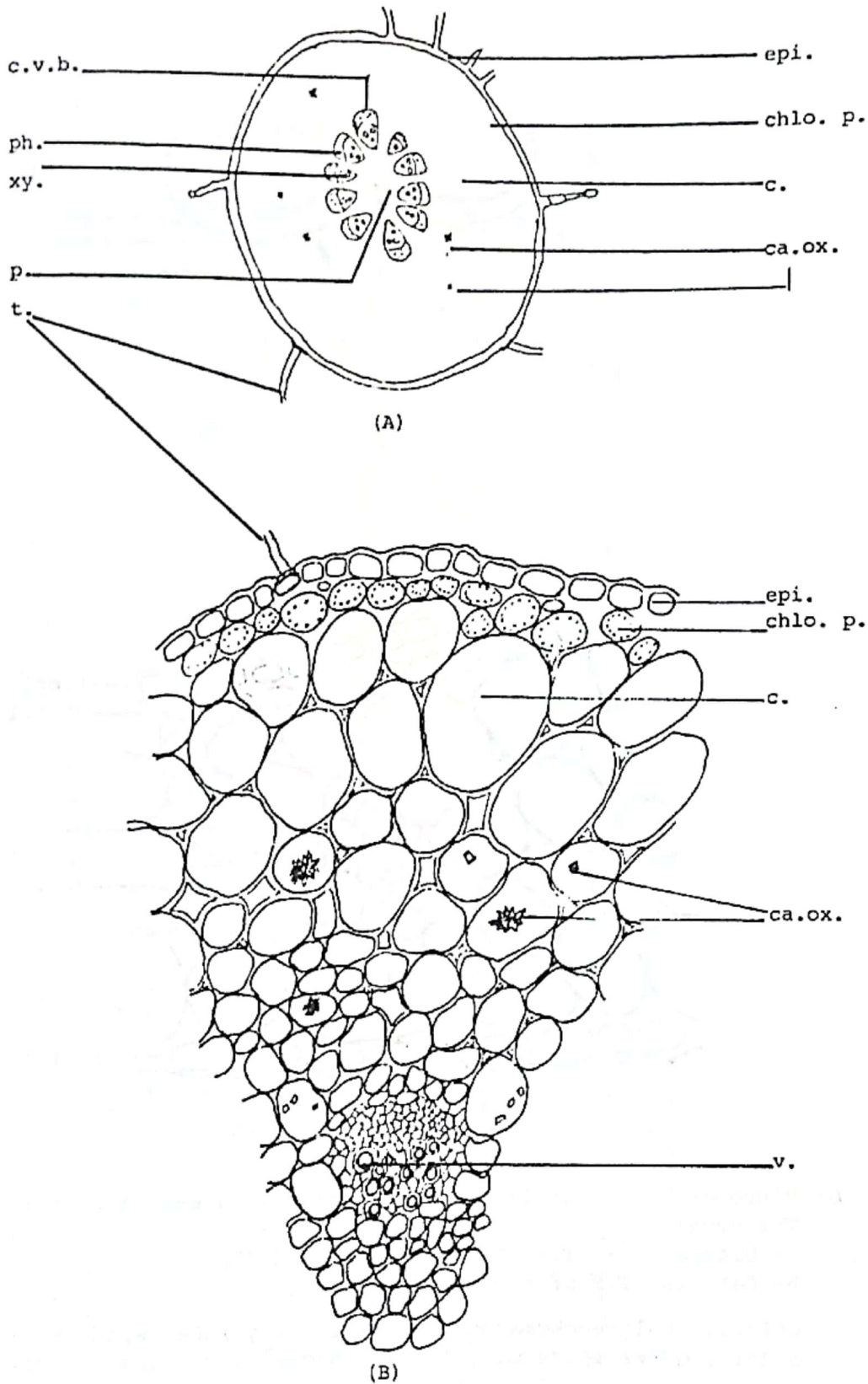
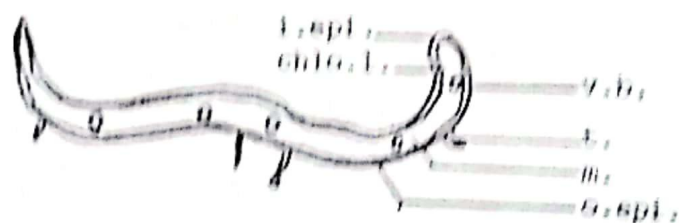
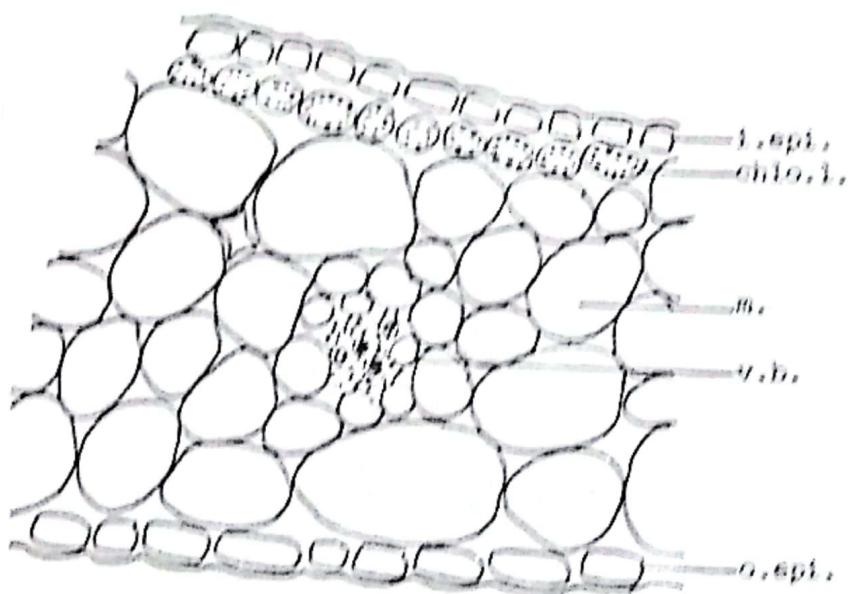


Fig. 5: Micromorphology of Oxalis pes-caprae (single-whorled corolla flowers).
 The pedicel:
 A- Diagrammatic T.S of the pedicel (X 70).
 B- Detailed T.S of the pedicel (X 245).
 c., cortex; ca.ox., calcium oxalate crystals; chlo. p., chlorenchymatous parenchyma; c.v.b., collateral vascular bundle; epi., epidermis; p., pith; ph., phloem; t., trichomes; v., vessel; xy., xylem.



(A)



(B)

Fig. 6: Micromorphology of *Oxalis pentacarpa* (single-whorled corolla flowers).
The sepal;

A= Diagrammatic T.S of the sepal (X 30).

B= Detailed T.S of the sepal (X 300).

chlo. l., chlorenchymatous layer; i. epi., inner epidermis; m., mesophyll;
o. epi., outer epidermis; t., trichomes; v. b., vascular bundle.

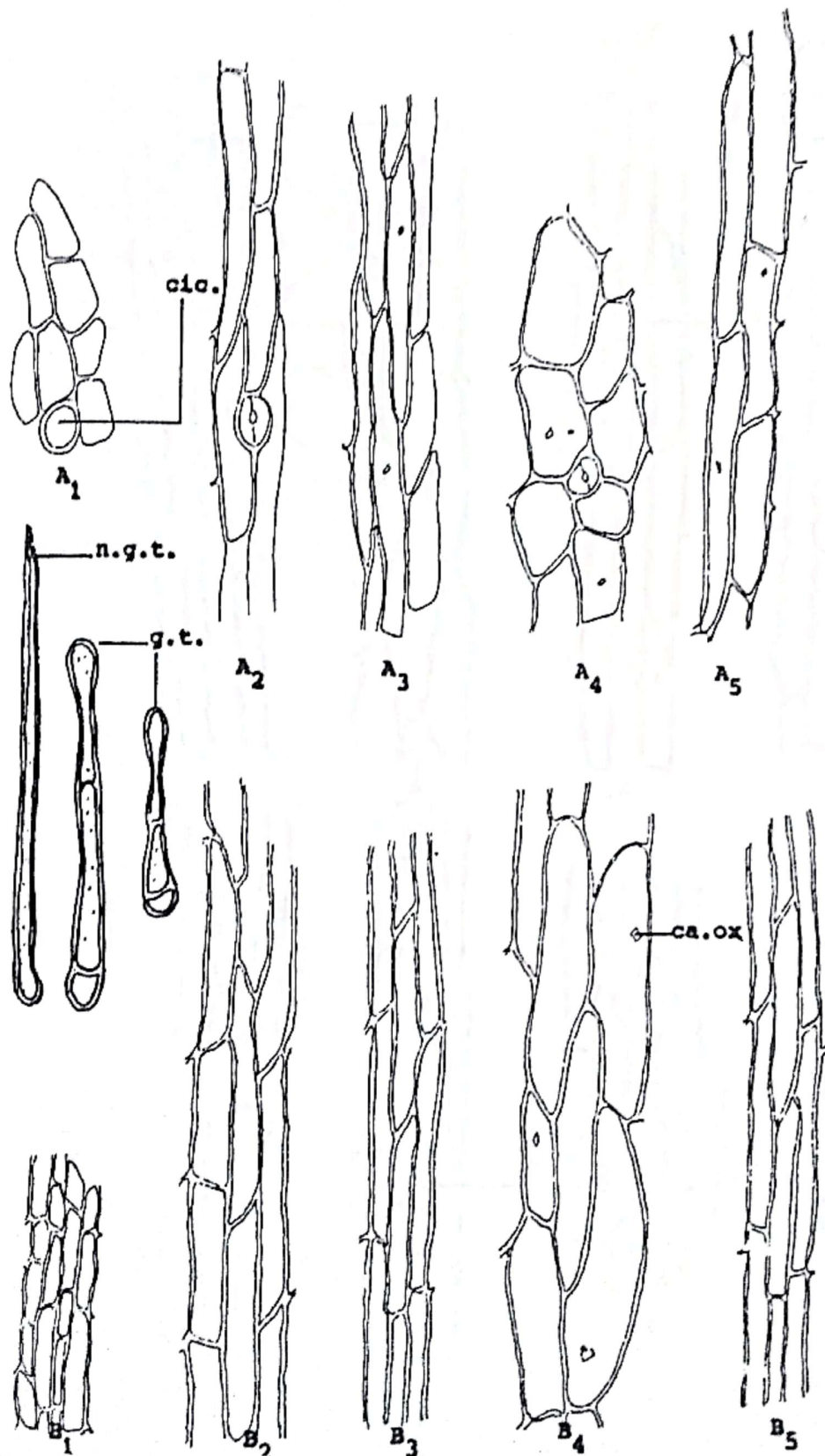


Fig. 6 Contd. Micromorphology of *Oxalis pes-caprae* (single-whorled corolla flowers). The sepal:

A₁-A₅ : Outer epidermis (X 210).

B₁-B₅ : Inner epidermis (X 210).

A₁,B₁ at the apex; A₂,B₂ of the middle part; A₃,B₃ of the marginal part;

A₄,B₄ of the basal part; A₅,B₅ over the veins; ca.ox., calcium oxalate

prism; cic., cicatrix of hair; g.t., glandular trichomes; n.g.t., non-glandular trichomes.

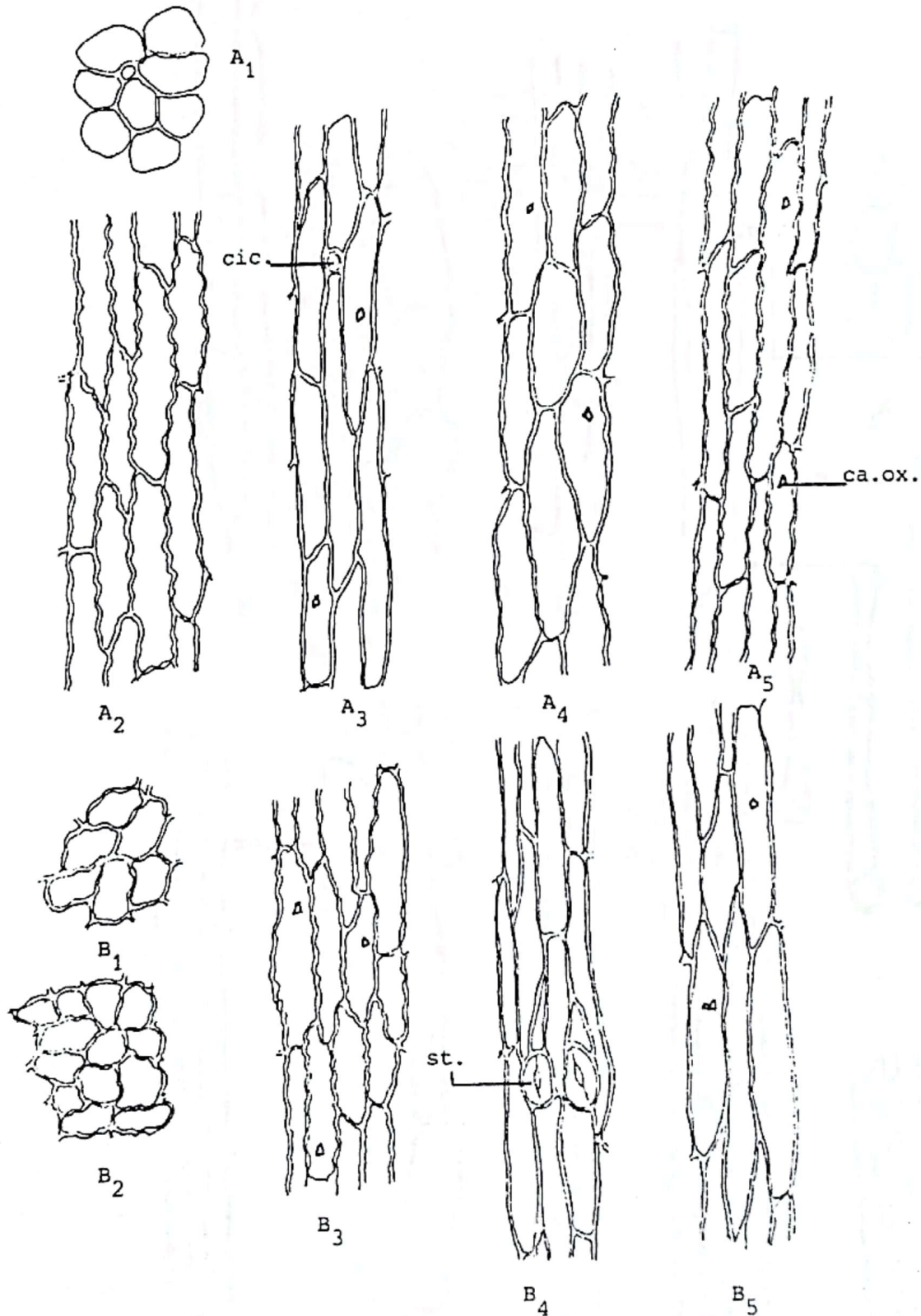


Fig. 7: Micromorphology of Oxalis pes-caprae (single-whorled corolla flowers).
 The petal:
 A₁-A₅ : Outer epidermis (X 210).
 B₁-B₅ : Inner epidermis (X 210).
 A₁, B₁ at the apex; A₂, B₂ of the middle part; A₃, B₃ of the marginal part; A₄, B₄ of the basal part; A₅, B₅ over the veins; ca.ox., calcium oxalate prism; cic., cicatrix of hair; st., stomata.

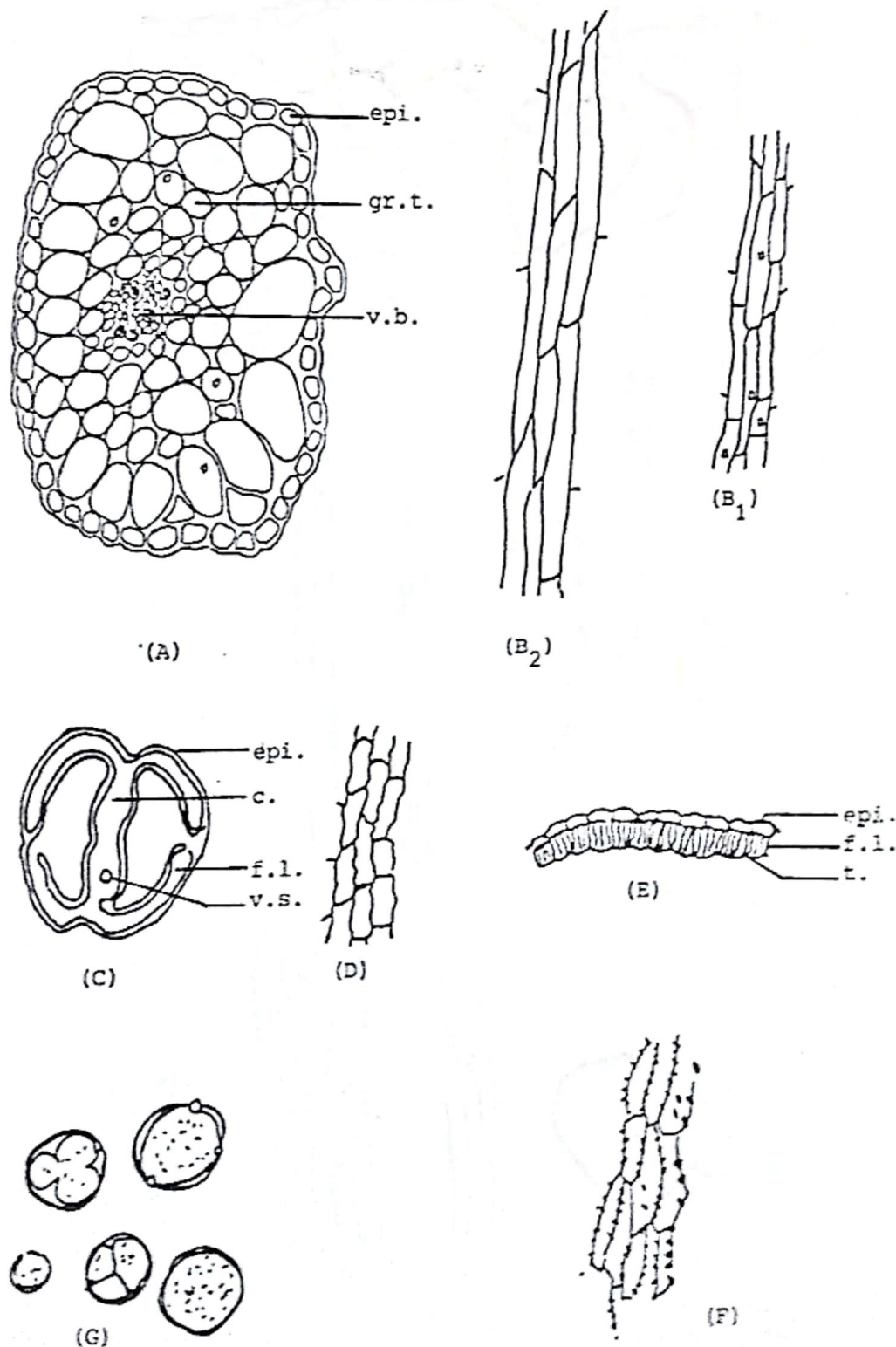


Fig. 8: Micromorphology of *Oxalis pes-caprae* (single-whorled corolla flowers).

The Androecium:

- A- Detailed T.S of filament (X 215).
- B - Epidermis of the filament at apex (X 300).
- B₁ - Epidermis of the filament at base and middle (X 300).
- B₂ - Epidermis of the filament at base and middle (X 30).
- C - T.s in the anther (X 300).
- D - Epidermis of anther (X 300).
- E - Detailed T.S of anther wall (X 300).
- F - Fibrous layer in S.V. (X 245).
- G - Pollen grains (X 245).

c., connective; epi., epidermis; f.l., fibrous layer; gr.t., ground tissue; t., tapetum; v.b., vascular bundle; v.s., vasculat strand.

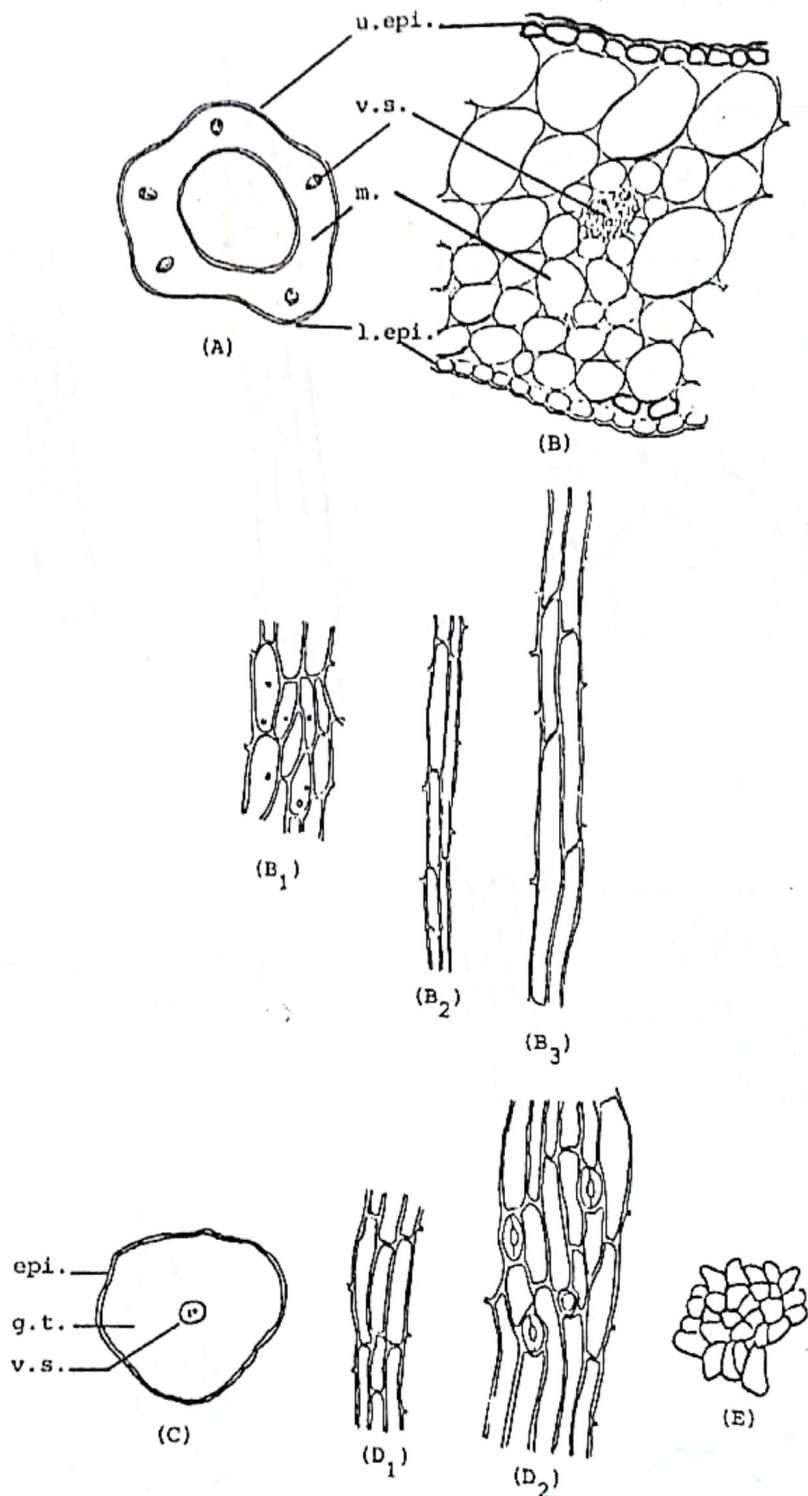


Fig. 9: Micromorphology of *Oxalis pes-caprae* (single-whorled corolla flowers).
The Gynaecium:

- A- Diagrammatic T.S of ovary wall
 - B- Detailed T.S of ovary wall (X 15).
 - B₁- Outer epidermis of the ovary wall at the apex (X 150).
 - B₂- Outer epidermis of the ovary wall at the base (X 150).
 - B₃- Outer epidermis of the ovary wall over vein (X 150).
 - C- Diagrammatic T.S of the style (X 150).
 - D₁- Epidermis of the style at apex (X 15).
 - D₂- Epidermis of the style at middle part (X 210).
 - E- The epidermis of stigma (X 240).
- epi., epidermis; g.t., ground tissue; l.epi., lower epidermis; m., mesophyll;
u.epi., upper epidermis; v.s., vascular strand.

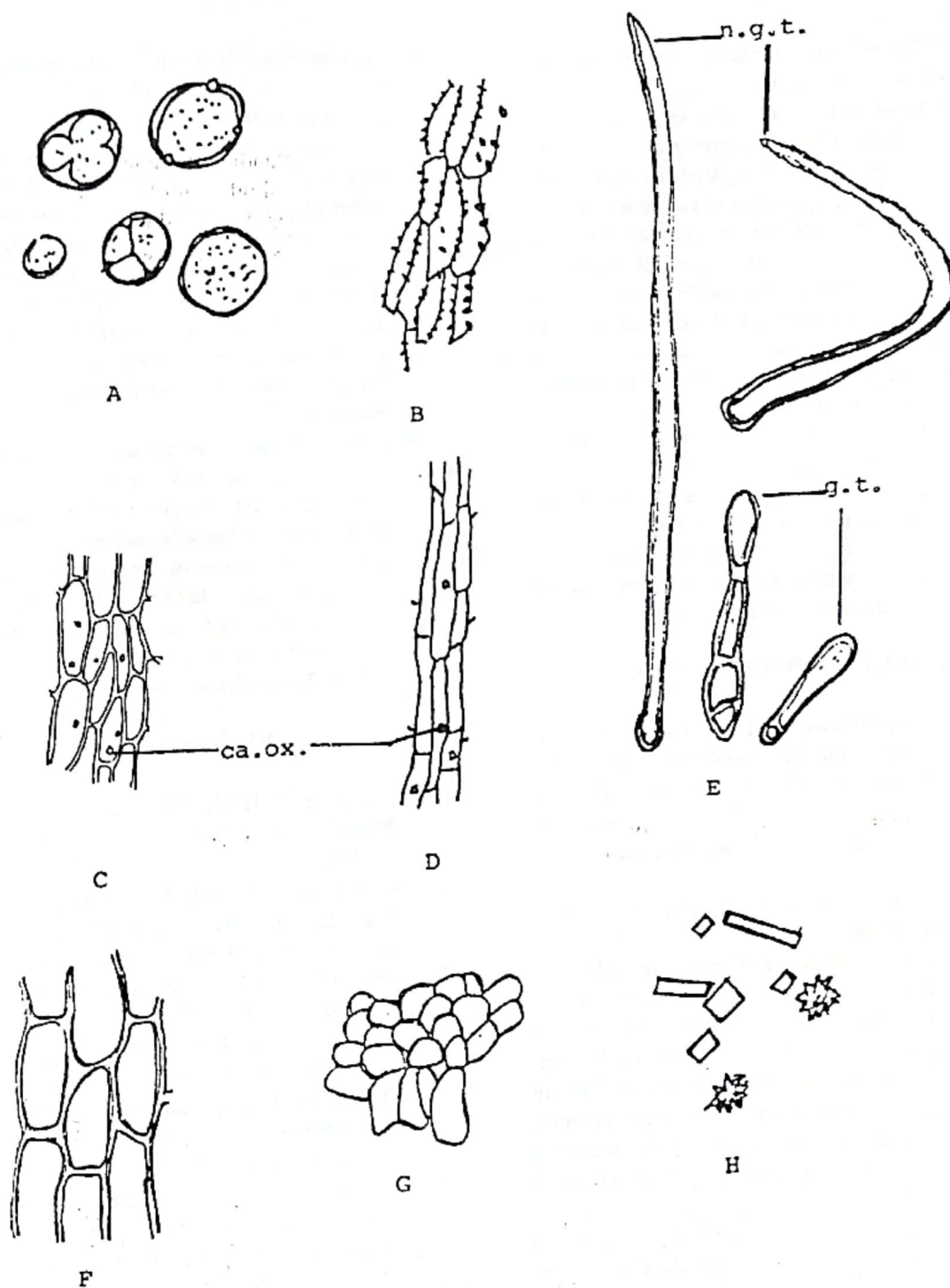


Fig. 10: Micromorphology of Oxalis pes-caprae (single-whorled corolla flowers).

The Powder:

- | | |
|--|------------|
| A- Pollen grains | (X 245). |
| B- Fibrous layer of the anther | (X 245). |
| C- Epidermal cells of the ovary | (X 150). |
| D- Epidermal cells of the filament | (X 300). |
| E- Non-glandular and glandular trichomes | (X 245). |
| F- Epidermal cells of pedicel | (X 245). |
| G- Epidermal cells of stigma | (X 245). |
| H- Calcium oxalate crystals | (X 245). |
- ca.ox., calcium oxalate prismatic crystals; n.g.t., non-glandular trichomes; g.t., glandular trichomes.

- axially elongated and contain scattered prismatic crystals of calcium oxalate.
7. Fragments of epidermal cells of ovary with smooth cuticle. They are polygonal, almost isodiametric or axially elongated, thick-walled and contain prismatic crystals of calcium oxalate.
 8. Fragments of papillosed epidermis of stigma.
 9. Fragments of epidermal cells of pedicel. They are tabular, polygonal nearly isodiametric, with straight anticlinal walls and covered with a smooth cuticle.
 10. Fragments of parenchyma which contain cluster crystals of calcium oxalate.
 11. Fragments of narrow xylem vessels with spiral and annular thickening.
 12. Cluster crystals of calcium oxalate are found either scattered or in some of the parenchymatous cells. they are large and frequently fragmented. Also prismatic crystals of calcium oxalate are found scattered.

RESULTS AND DISCUSSION

The pharmacognostical study of the inflorescences of single and double-whorled corolla flowers of *O. pes-caprae* L. provides the following characteristic features as key elements for differentiation between these two kinds of inflorescences :-

A) The macromorphological differences was mentioned before.

B) The micromorphological differences includes :-

- 1- The epidermal cells of the rachis of the inflorescence of single-whorled corolla flowers measure 55-355-680u in length, 17-28-33u in breadth and 10-24-32u in height; while those of double-whorled ones are larger in size, where they measure 90-655-1065u in length, 11-28-55u in breadth and 13-23-33u in height.
- 2- The epidermal cells on the different parts of sepal of single-whorled corolla flowers are generally longer than those of double-whorled ones (Table III).

- 3- The non-glandular trichomes on the sepals and petals of single-whorled corolla flowers are longer than those of double-whorled ones. On the sepals of single-whorled flowers, they measure 71-100-356u in length and 7-12-19u in breadth; while in double-whorled ones they measure 67-128-156u in length and 5-11-16u in breadth. On the petals of single-whorled flowers they measure 155-525-778u in length and 8-12-18u in breadth; while in double-whorled ones they measure 78-216-389u in length and 8-14-21u in breadth.
- 4- The glandular trichomes are highly distributed on the epidermal cells of petals of single-whorled flowers; while they are rarely present on double-whorled ones.
- 5- The pollen grains in single-whorled corolla flowers are larger than those in double-whorled ones; they measure 23-39-45u in diameter in the first and 17-20-24u in the second.

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دراسة عقاقيرية لنبات اوكساليس بين كابريره (اينيه) والذي ينمو في ليبيا

الجزء الاول : النورات

مصطفى سعيد محمد مجد

قسم العقاقير - كلية الصيدلة - جامعة القاهرة مصر

لم يسبق دراسة هذا النبات سواء من الناحية العيانية او المجهرية الا ما ذكرته بعض المراجع عن وصف مختصر لقليل من الصفات العيانية له. لذلك فقد روعي ان يتم دراسة الصفات العيانية والمجهرية لنورات هذا النبات والتي يعتمد عليها في التعرف عليه.