

## MACRO-AND MICROMORPHOLOGY OF THE FLOWER-HEADS OF LAUNAEA NUDICAULIS GROWING IN EGYPT

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### ABSTRACT

The macro-and micromorphology of the flowers of *Launaea nudicaulis* (L.) Hook are presented in order to find the diagnostic characters of the flower-heads by which the plant can be easily identified both in entire and powdered form.

### INTRODUCTION

In previous publications (1-3), a chemical study of *Launaea nudicaulis* as well as the macro-and micromorphology of the leaves, stem and root were given. In this article, the macro-and micromorphology of the capitulum are presented.

### EXPERIMENTAL

#### Plant material :

Fresh samples of *Launaea nudicaulis* (L.) Hook. were collected from flowering plants growing wildly in the eastern desert of Sharkia province about 30 kilometers from Zagazig, Egypt.

#### A- Macromorphology :

The plant bears numerous yellowish axillary and terminal capitula on short pedicel.

**The capitulum:** (Fig.1) is D. 1.5 to 2.5 cm and H. 1.5 to 2 cm. It consists of 28 to 38 yellow, ligulate florets arranged on a flat receptacle and subtended by an involucre of 15 to 22 imbricated bracts with whitish margins and arranged in 2 to 3 alternate whorls.

**The receptacle:** (Fig. 1,A) is flat, solid, pithy, green in colour and measures D. 3 to 4 mm and H. 1 to 2 mm. The surface shows numerous minute depres-

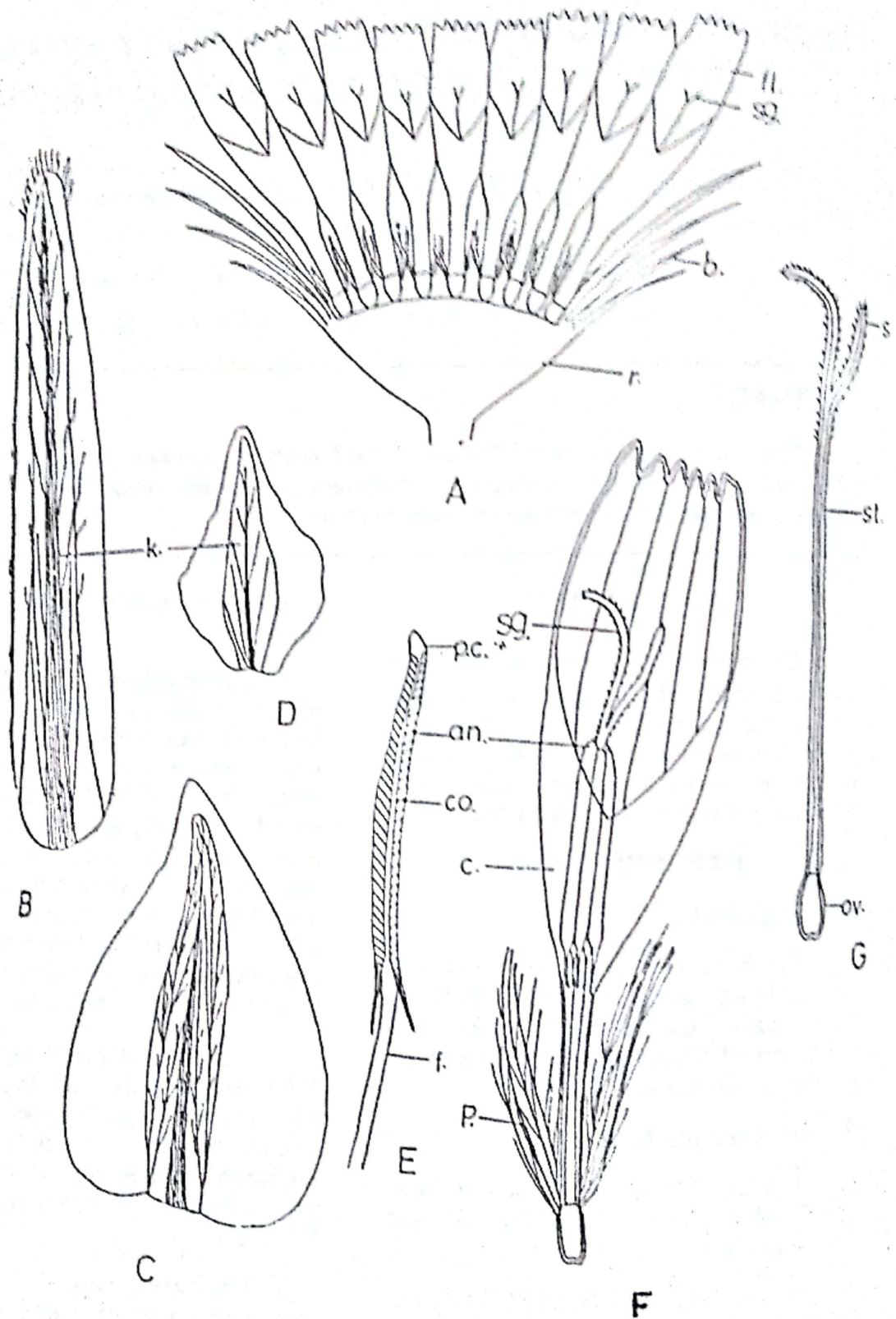
sions corresponding to the seats of the florets.

**The involucre:** (Fig. 1,A) consists of 2 to 3 alternate whorls of 15 to 22 bracts; the bracts have green central keel, whitish entire scarious margins and symmetric bases. The bracts of the outer whorl (Fig. 1,C) are broadly ovate with acute apex, they measure L. 3.8 to 4.2 mm and B. 2.4 to 3 mm at the widest part. The bracts of the inner whorls (Fig. 1,B) are linear lanceolate with rounded apex showing tuft of hairs; they measure L. 12 to 14 mm and B. 2 to 2.4 mm.

**The florets :** The capitulum (Fig. 1,A) shows only one type of florets which is the ligulate type; each capitulum shows 23 to 38 ligulate florets. They are bright yellow, sessile, hemaphrodite, zygomorphic, epigynous and measure L. 1.3 to 1.7 cm.

**The calyx:** (Fig. 1,F) is epigynous and represented by white sessile papus measuring L. 5 to 9 mm.

**The corolla:** (Fig. 1,F) is sympetalous, yellow in colour, strap-shaped with five equal teeth at the apex and whitish tubular part of the base. It is traversed longitudinally by six main veins which are connected by five archs below the apical teeth. The strap-shaped part measure L. 10 to 12 mm and B. 3 to 3.5



(Fig. 1 ) : The inflorescence : ( All X 25 except A X 10 ).

A- Vertical section of the capitulum .

B- Inner bract .

C- Outer bract .

D - Bracteol .

E- Stamen .

F - Floret .

G- Gynaecium .

an . , anther ; br . , bract ; C . , corolls ; Co . ,Connective ; f . , filament ; fl . , floret ; k . , keel ; ov . , ovary ; p . pappus ; p . c . , prolongation of connective ; r . , receptacle ; st . , stigma ; st . , style .

mm while the tubular part is about L. 5.48 mm and D. 0.4 mm.

**The androecium:** (Fig. 1.E) consists of 5 equal, epipetalous stamens with syngenesious anthers. Each stamen is formed of a long whitish epipetalous filament and a yellow to orange introse and basifixed anther. The filament is whitish, slender and measure L. 2.38 to 2.5 mm and D. 12.5 to 13  $\mu$ . The anther is yellow to orange, basifixed and formed of two spindle-shaped lobes with sagitate base, each with basal prolongation covered by dense hairs. The whitish connective is protruded beyond the anther lobes into a conical projection. The anther measures L. 3.3 to 3.7 mm and D. 28  $\mu$ .

**The gynaecium:** (Fig. 1.G) is bicarpellary. The ovary is ovoid, with whitish smooth outer surface being unilocular with a single basally placented ovule; it measures L. 1 to 1.4 mm and D. 54 to 120  $\mu$ . The style is filiform, slender, greenish-yellow in colour and measure L. 12 to 15 mm and D. 190-250  $\mu$ . The stigma is bifid. Papillosed and dark brownish in colour; each lobe measures L. 4 to 4.5 mm.

## B. Micromorphology:

### 1. The bract:

The tissue of the involucre bracts (Fig. 2.A) is composed of outer and inner epidermis enclosing in between a homogenous mesophyll traversed by numerous vascular bundles.

The midrib showing a band of lignified cells under the outer epidermis. Both epidermises of the bract (Fig. 2 and 3) are formed of polygonal cells with wavy anticlinal walls being straight at the apex, the base and over veins. They are covered with smooth cuticle.

The cell dimensions of the different epidermal parts of the outer and inner bracts are shown in microns in Table (1).

**Stomata:** (Fig. 2, D 4 & 3) are present on both epidermises of the inner bracts and outer epidermis of outer

bracts being of anomocytic or anisocytic type.

They are oval or rounded and measuring L. 13 to 35  $\mu$  and B 11 to 23  $\mu$ . Trichomes are absent all over the surfaces of outer and inner bracts. Only, a tuft of covering trichomes is present on the apex of the inner bracts. They (Fig. 3.C) are unicellular or multicellular, uniseriate with thin cellulosic walls, wide lumen and smooth cuticle.

Many of the cells of the trichomes show lateral rounded projections which may be long appearing as side branches. They measure L. 70 to 220  $\mu$  and D 13 to 21  $\mu$ .

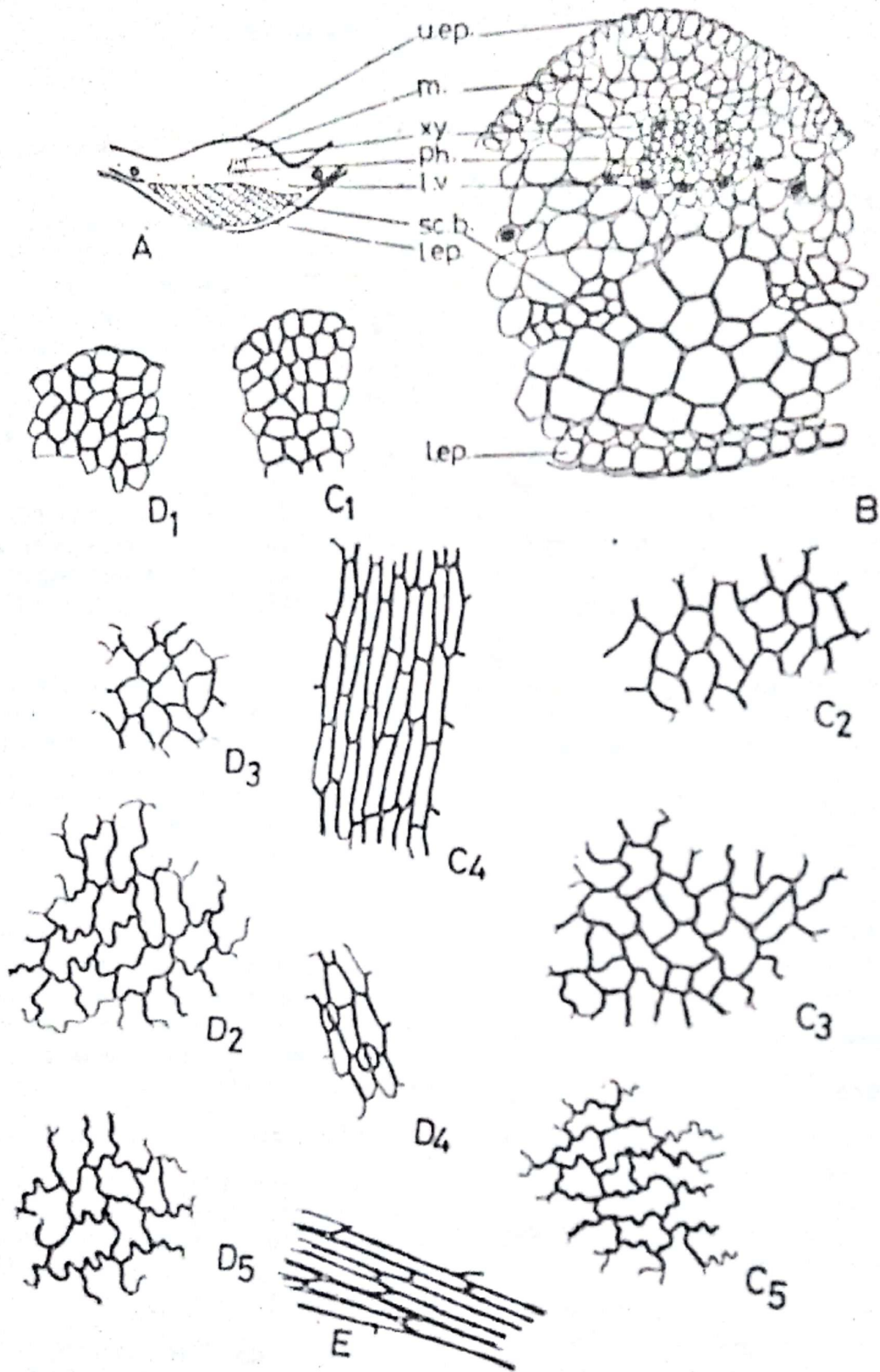
The cortical tissue of bracts (Fig. 2.B) is parenchymatous showing a sclerenchymatous band below the outer epidermis and formed of fusiform lignified cells with moderately thick pitted walls, wide lumen and subacute apices; they measure L 30 to 120  $\mu$  and D 10 to 20  $\mu$ .

The vascular bundle is formed of a radiate xylem showing lignified spiral vessels and a cellulosic phloem; pericycle being parenchymatous showing branched and anastomosing laticiferous vessels. D 4 to 12  $\mu$ .

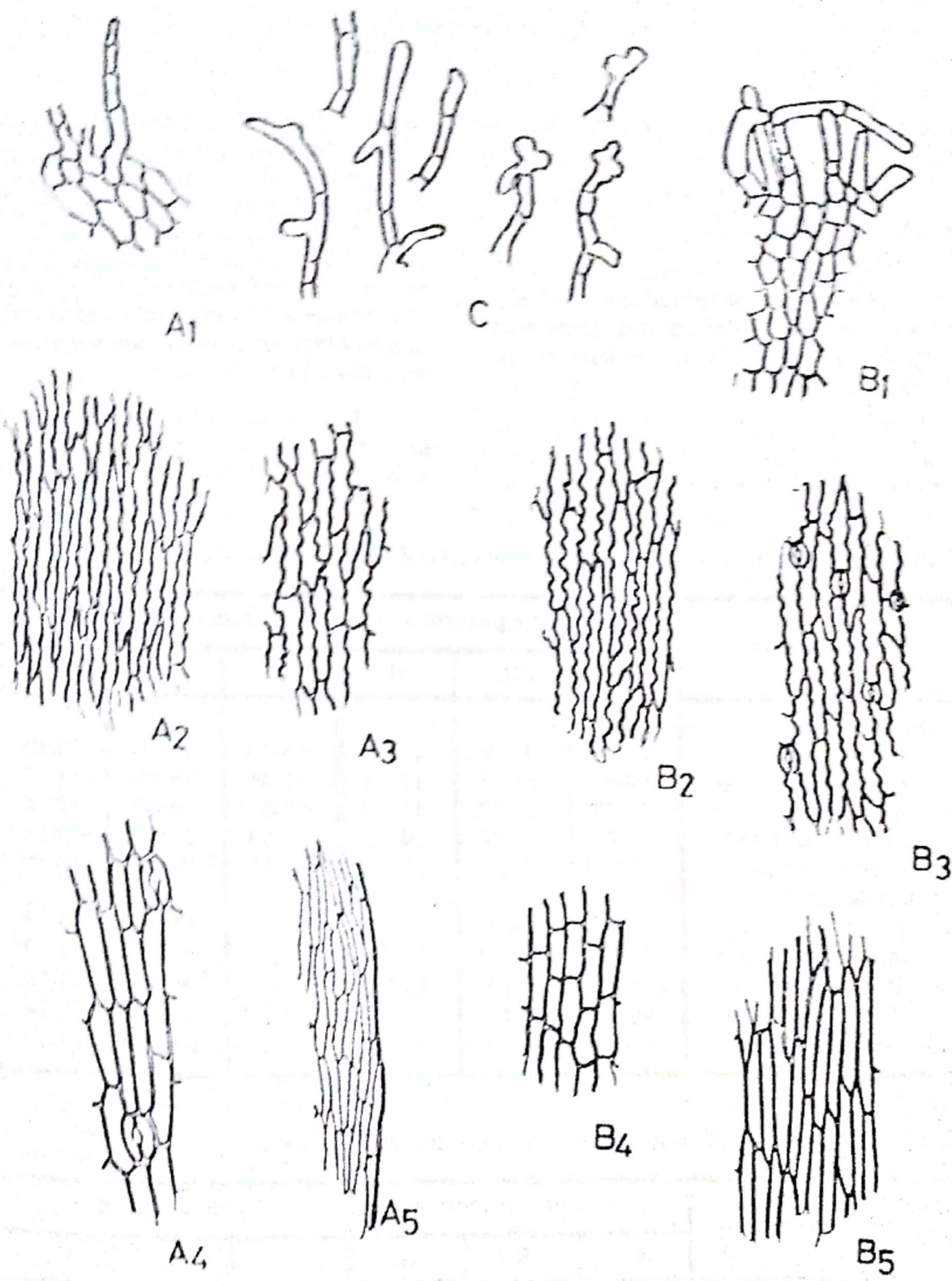
### 2- The floret:

The calyx is represented by bristly papus; each bristle (Fig. 4, G) is triseriate in the form of a conical projection with acute apex. The cells are L. 62.5 to 187.5  $\mu$  and B 4 to 10  $\mu$ .

**The corolla:** The transverse section of corolla (Fig. 4.A) is formed of an inner and outer epidermis enclosing a somewhat narrow mesophyll traversed by about 5 to 6 vascular strands each formed of xylem with phloem underneath. The epidermal cells of corolla (Fig. 4) are polygonal, isodiametric or axially elongated with straight beaded anticlinal walls. The outer epidermis is covered with striated cuticle, while the inner one is covered with smooth cuticle. The epidermal cells vary in the shape



(Fig. 2 . .) : The Bract ; ( All X 240 except A X 60 ).  
 A- Diagrammatic transverse section of the bract .  
 B- Detailed transverse section of the bract .  
 C- Inner epidermis of outer bract : C<sub>1</sub> - At the apex .  
 C<sub>2</sub> - At the middle . C<sub>3</sub> - At the margin . C<sub>4</sub> - Over vein . C<sub>5</sub> - At the lower part .  
 D- outer epidermis of outer bract : D<sub>1</sub> - At the apex . D<sub>2</sub> - At the middle  
 D<sub>3</sub> - At the margin . D<sub>4</sub> - Over vein . D<sub>5</sub> - At the lower part . E- Sclerenchymatous cells .  
 l. ep., lower epidermis ; l.v. , laticiferous vessel ; m. , mesophyll ; ph. , phloem ; sc. , sclerenchymatous band ; u. epi , upper epidermis ; xy. , xylem .



(Fig. 3 .) : The Inner Bract : (All X 240 )A - outer epidermis of the inner bract ;  
 A1 - At the apex . A2 - At the margin .  
 A3 - At the middle part A4 - Over vein . A5 - At the lower part .  
 B- Inner epidermis of the inner bract . B1 - At the apex .  
 B2 - At the margin . B3 - At the middle part  
 B4 - Over vein . B5 - At the lower part .  
 C- Hairs of the inner bract B (All X 240 ) .

and size in the different parts of the corolla.

The epidermal cells of the apical teeth (Fig. 4, C1 & D1) show short rounded papillae.

The outer epidermal cells of the middle portion of the strap-shaped part (Fig. 4, C2, D2, C4, C5 & D5) have wavy anticlinal walls.

The epidermal cells of the strap-shaped part over veins (Fig. 4, C3 & D3) are polygonal, axially elongated with

straight finely beaded anticlinal walls. The epidermis of the apical part of corolla-tube (Fig. 4, E) is formed of rectangular or polygonal cells with beaded straight anticlinal walls. The epidermal cells of corolla-tube (Fig. 4, C6, D6) and of strap-shaped over veins (Fig. 4, C3, D4) are axially elongated. The cell size of epidermal cells of corolla are given in micron in Table (2).

Trichomes of non-glandular type are present on the tubular part of corolla only. They (Fig. 4, F) are unicellular or

Table (1) : Dimensions of the epidermal cells of bract in microns.

Epidermis	Outer Epidermis			Inner Epidermis		
	L.	B.	H.	L.	B.	H.
<b>Outer bracts :</b>						
At the apex.	17-35	8-21	15-19	15-13	10-19	10-16
of the middle part	19-67	15-35	17-21	31-46	15-19	15-19
of the margin	29-67	17-42	16-17	50-67	19-60	13-16
of the lower part	29-65	23-31	14-19	38-63	21-42	13-16
over the veins	42-104	8-15	17-19	31-52	10-19	10-15
<b>Inner bract :</b>						
At the apex	13-33	6-21	17-19	19-42	13-21	10-15
of the middle part	52-92	13-19	15-19	27-108	10-19	14-17
of the margin	104-135	6-13	13-17	73-126	8-17	15-18
of the lower part	46-73	4-10	16-20	115-77	6-10	10-14
over the veins	46-94	10-21	17-19	38-60	10-15	13-19

Table (2) : The size of epidermal cells of corolla in microns..

Epidermis	Outer Epidermis			Inner Epidermis		
	L.	B.	H.	L.	B.	H.
<b>At the apical teeth of the strap-shaped</b>	8-35	8-15	10-15	8-31	6-17	8-13
a. Apical part	33-66	4-10	13-17	23-54	6-13	10-12
b. Middle part	52-81	4-10	12-15	40-63	6-10	9-14
c. Lower part	54-79	6-15	11-14	50-79	6-15	11-13
<b>of the tubular part :</b>						
a. Apex	35-40	5-27	10-13	31-54	13-25	12-15
b. Middle and lower	42-83	6-13	9-14	46-94	10-19	13-17
c. over the veins	45-62	6-13	8-13	53-88	6-13	10-14

multicellular, uniseriate with thin walls, blunt apex and wide lumen. They are covered with smooth cuticle and measure L. 104 to 292  $\mu$  in length and D. 10 to 21  $\mu$ . The stomata are completely absent from the epidermis of corolla.

**The Androecium:** The filament (Fig. 5,C) is composed of an epidermis surrounding a parenchymatous ground tissue traversed longitudinally by a small vascular strand. The epidermal cells (Fig. 5, H & I) are rectangular or polygonal, axially elongated and covered with smooth cuticle; they have straight, thick, beaded and lignified anticlinal walls at the apical parts and thin straight cellulose walls at the lower part. The cells measure L. 18 to 29  $\mu$ , B. 5 to 8  $\mu$  and H 8 to 10  $\mu$  in the apical parts and L. 73 to 125  $\mu$ , B. 3 to 10  $\mu$  and H. 12 to 15  $\mu$  in the lower part.

The epidermis showing neither stomata nor trichomes. The anther (Fig. 5,A) consists of two lobes enclosing two pollen sacs and separated by a connective which protruded beyond the antherlobes into a membranous appendage. The epidermis (Fig. 5,E) composed of rectangular or polygonal cells with or moderately is moderately thick straight polygonal cells with thin or moderately thick straight anticlinal walls and covered with thin smooth cuticle. They measure L. 8 to 38  $\mu$ , B. 4 to 13  $\mu$ . The epidermis shows no stomate. Each anther lobe has a basal projection which is completely covered by long covering trichomes (Fig. 5,C). They are long, unicellular or bicellular with thin walls, wide lumen, rounded apices and are covered with thin smooth cuticle. The trichomes measure L. 250 to 396  $\mu$  and D 10 to 13  $\mu$ .

The fibrous layer (Fig. 5,F) is formed of one row of polygonal, axially elongated cells having straight anticlinal walls with lignified spiral bands of thickening which appear as bars in the anticlinal plane and as beads in surface view. They measure L 30 to 44  $\mu$ , B. 4 to 8  $\mu$  and H. 10 to 14  $\mu$ . The tapetum (Fig. 5,B) is formed of collapsed cells.

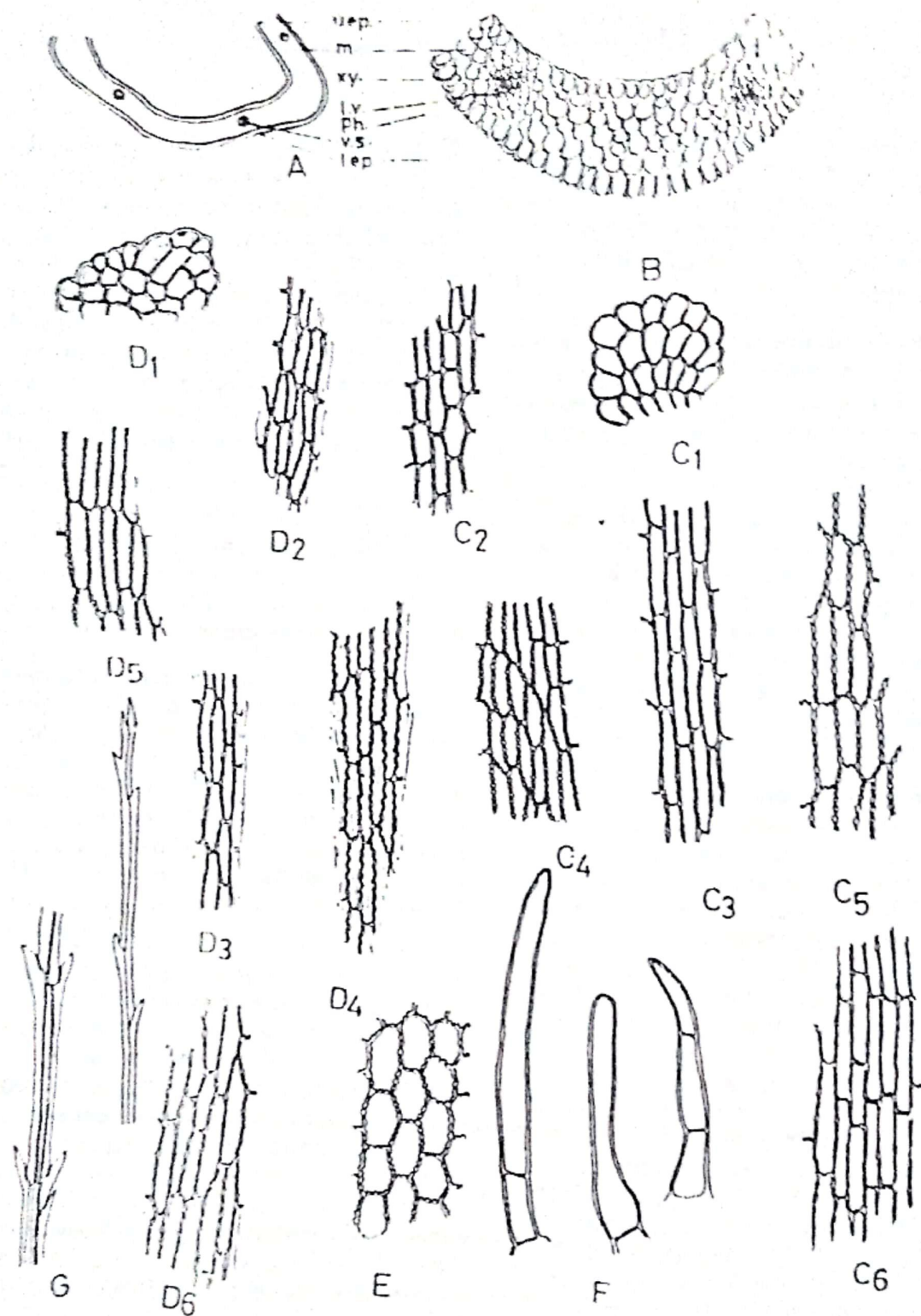
The pollen grains: (Fig. 5,J) are spherical, yellow with 3 germ pores, 3 germinal furrows and a spiny exine. The mature pollen grains contain oil globules and are D. 25 to 31  $\mu$ . The epidermal cells of the connective as well as its projection (Fig. 5,D) are polygonal axially elongated with straight or polygonal, thin-walled axially elongated with straight or slightly curved anticlinal walls and are covered with thin smooth cuticle they measure L. 35 to 70  $\mu$  and B 4 to 13  $\mu$ .

**The gynaecium :** The stigma-lobe is formed of an epidermis enclosing a parenchymatous ground tissue traversed by a central vascular strand.

The epidermis (Fig. 6,D) is formed of polygonal, thin-walled axially elongated cells with straight or slightly curved anticlinal walls and are covered with thin smooth cuticle. The cells are prolonged into conical papillae with acute or subacute apex showing cuticularised thickening. They measure L. 31 to 98  $\mu$  and B. 10-12  $\mu$ .

The style (Fig. 6,C) is composed of an epidermis surrounding a parenchymatous ground tissue traversed longitudinally by 2 narrow vascular strands each shows few lignified spiral vessels, D 2 to 6  $\mu$ . The epidermis (Fig. 6,E) is formed of polygonal, axially elongated cells with thin straight anticlinal walls. At the apex, each cell projects outwards into a long uni-or bicellular trichome (Fig. 6,C) with subacute cuticularised apex; they measure L. 90 to 94  $\mu$  and B 14 to 21  $\mu$ . The epidermal cells of the middle part (Fig. 6, E2) measure L. 48 to 115  $\mu$ , B 10 to 19  $\mu$ , while that at the base (Fig. 6, E3) measure L. 31 to 58  $\mu$  B 10 to 16  $\mu$ . The epidermis shows no stomata.

The ovary-wall (Fig. 6,2) is formed of an outer and inner epidermis enclosing a mesophyll formed of rounded thin-walled parenchyma. The outer epidermis (Fig. 6, F) is formed of polygonal cells with straight anticlinal walls and covered with thin smooth cuticle. They measure L. 13 to 23  $\mu$  and B. 6 to 15  $\mu$ .



( Fig . 4 . ) The corolla and calyx : ( All X 280 except A X 74 ) .

A - Diagrammatic transverse section of corolla .

B - Detailed transverse section of corolla .

C - Inner epidermis of the corolla .

C2 - At the upper part .

C4 - At the middle part

C6 - At the middle and lower parts of the corolla tube .

E - Epidermis of the upper part of the corolla tube .

F - Hairs of the corolla tube .

G - The bristle of the pappus (calyx).

C1 - At the apical part.

C3 - Over vein .

C5 - At the lower part .

D - outer epidermis of the corolla

D2 - At the upper part .

D4 - At the middle part

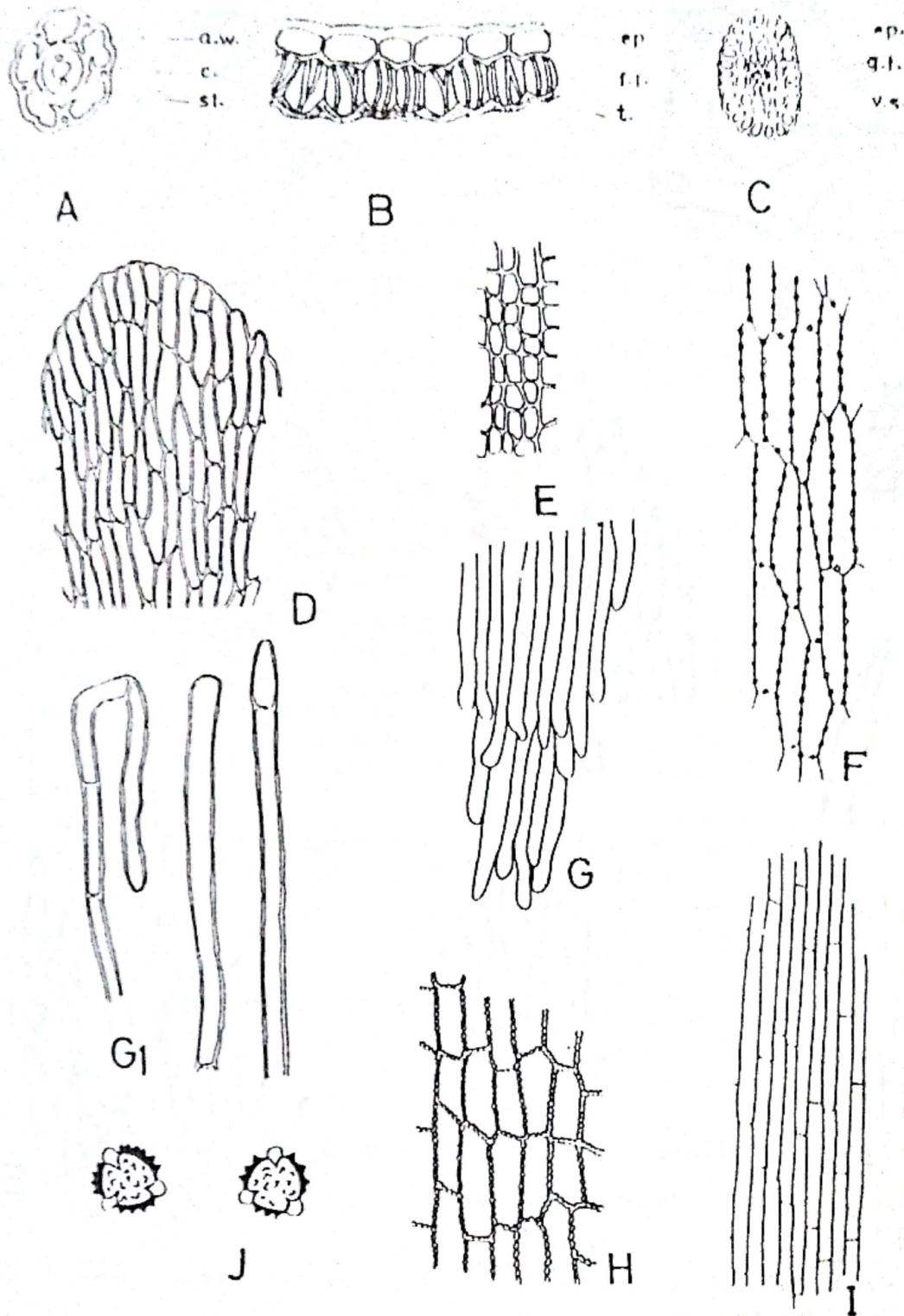
D1 - At the apical part.

D3 - Over vein .

D5 - At the lower part .

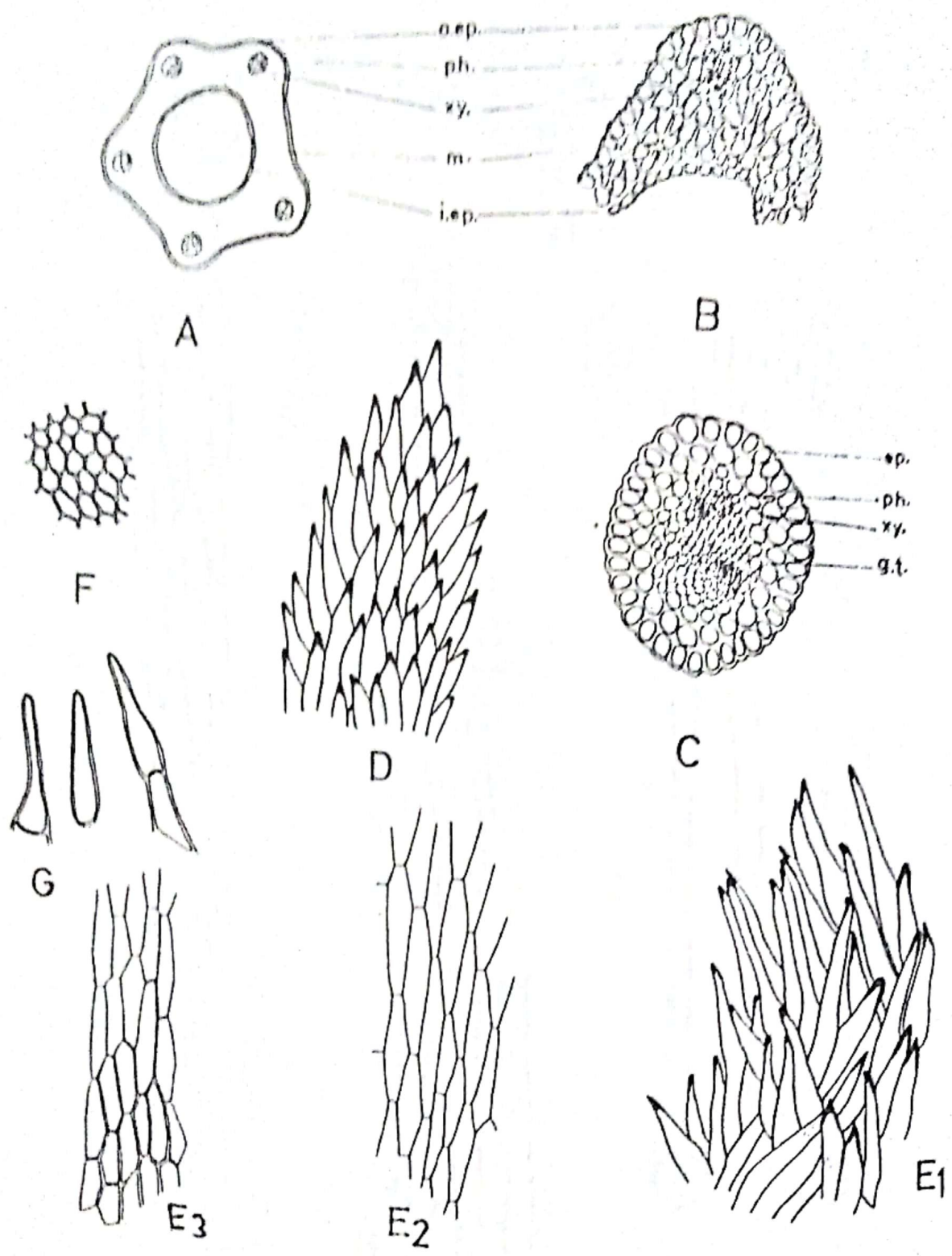
l . ep . , Inner epidermis ; l . v . , laticiferous vessel ; m . , mesophyll ;  
O . ep . , outer epidermis ; ph . , phloem ; v . s . , vascular strand ; xy . , xylem .





(Fig. 5): The androecium : (All X 310 except B , H X 810, A X 80 and G X 45).

- A - Transverse section of anther - tube .
  - B - Detailed transverse section of anther - wall .
  - C - Detailed transverse section of filament . D - Prolongation of connective .
  - E - Epidermis of anther . F - Fibrous layer in surface view .
  - G - Hairy basal prolongation of anther lobe .
  - G<sub>1</sub> - Hairs of basal prolongation of anther lobe .
  - H - Epidermis of filament at the apex .
  - I - Epidermis of filament at the base . J - pollen grains .
- a. w., anther - walls ; c. , connective ; epi ., epidermis ;  
 f.l ., fibrous layer ; g. t., ground tissue ; st ., style ;  
 t. ., tapetum ; v. s. , vascular strand .



( Fig . 6 ) : The Gynaecium :  
 A- Diagramatic transverse section of ovary - wall .  
 B- Detailed transverse section of anther - wall .  
 C - Transverse section of the style .  
 D- The epidermis of the stigma .  
 E1 - The epidermis of the upper part of the style .  
 E2 - The epidermis of the upper part of the style .  
 E3 . The epidermis of the upper part of the style .  
 F- The outer epidermis of ovary .  
 G- Hairs of the style .(All X 325 except A X 82) .  
 ep ., epidermis ; g. l. , ground tissue , i. ep . , inner epidermis ; m., mesophyll ; o. ep ., outer  
 epidermis ; ph., phloem ; xy., xylem .

The epidermis shows neither stomata nor trichomes.

### CONCLUSION

The previously mentioned study reveals that the characteristic features of the flower heads are the following:

- 1- The plant bears numerous axially and terminal capitulae showing yellow ligulate florets arranged on flat solid receptacle.
- 2- The involucre consists of 15 to 22 bracts, with whitish margins, arranged in 2 to 3 whorls; those of the inner whorl show apical tuft of hairs.
- 3- The floret is hermaphrodite; calyx; represented by pappus; corolla, with five apical teeth; stamens, 5 with orange syngenesious anthers having sagitate base covered by dense hairs; gynaecium, bicarpellary with bifid brownish stigma.
- 4- The midrib of the bract shows a band of sclerenchymatous cells with pitted lignified walls.
- 5- The epidermal cells of bracts have wavy anticlinal walls, being curved or straight near apex, base and over veins.

- 6- Covering trichomes of inner bracts are uni- or multicellular, many cells have rounded projections.
- 7- The epidermis of corolla is formed of isodiametric or axially elongated with beaded, sinuous or straight anticlinal walls, the outer epidermis is covered by striated cuticle while the inner is covered by smooth cuticle.
- 8- Pollen grains are spherical with 3 germ pores, 3 germinal furrows and spiny exine, D 25 to 31  $\mu$ .
- 9- Basal prolongations of anther lobes are covered by long, uni- or bicellular trichomes with rounded apices.
- 10- The epidermal cells of stigma are prolonged into conical papillae with acute or subacute cuticularised apices.

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دراسة عقاقيرية لزهور (هامات) نبات لاونيا نوديكا وليس

(لينيه) هوك الذي ينمو في مصر

طه مصطفى سرج - عبدالله عبد الرازق عمر\* - عبد المنعم محمد عطية

وسامية صلاح حافظ

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سبق أن قام الباحثون بدراسة المحتويات الكيميائية لهذا النبات وكذلك دراسة الشكل الظاهري والمجهري لأوراق وساق وجذور النبات. وفي هذا البحث تم دراسة الشكل الظاهري والمجهري لهامات (أزهار) النبات وذلك لإمكانية التعرف على النبات في صورته الصحيحة أو المسحوقة.