

MACRO-AND MICROMORPHOLOGY OF THE LEAVES, STEM AND ROOT OF CENTAUREA ERYNGIOIDES LAM.

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ABSTRACT :

The macro-and micromorphology of the leaves, stem and root of Centaurea eryngioides are presented with the aim of finding out the characters of these organs by which the plant could be identified, characterized and differentiated from other species, both in the entire and powdered forms.

INTRODUCTION

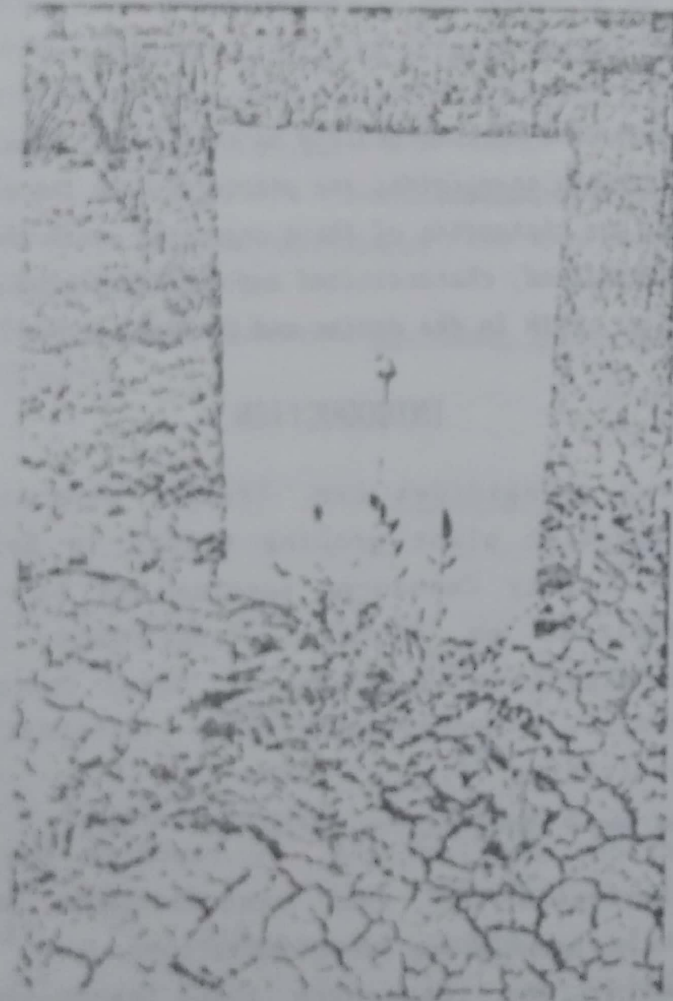
Centaurea eryngioides Lam. (Family Compositae) is a persennial Egyptian plant growing wildly in Saint Catherine, Sinai⁽¹⁾. Many Centaurea species are currently used in folk medicine as diuretic, astringent, stomachic, bitter and digestive⁽²⁾. Some of these species shows antihypertensive, hypoglycaemic⁽³⁾, cytotoxic and/or antitumor activities⁽⁴⁾.

In previous publications, we reported the isolation and characterization of four sesquiterpene lactones⁽⁵⁾, five flavonoids and five steroidal compounds⁽⁶⁾. Nothing was reported in the literature about macro-and micromorphology of the plant except few data given by some flora⁽¹⁾.

IN the present work, we are dealing with the macro-and micromorphology of the leaves, stem and root of the plant.

EXPERIMENTAL

Fresh samples of Centaurea eryngioides Lam. used in this work was collected from Saint Catherine, Sinai,



(Fig. 1) : A Photograph of Centaurea eryngioides Lam. (X 0.14)

Egypt, in April 1986 and May 1987. Identification of the plant was kindly verified by Dr. N. El-Hadidi Prof. of Plant Taxonomy, Cairo University.

A - MACROMORPHOLOGY :

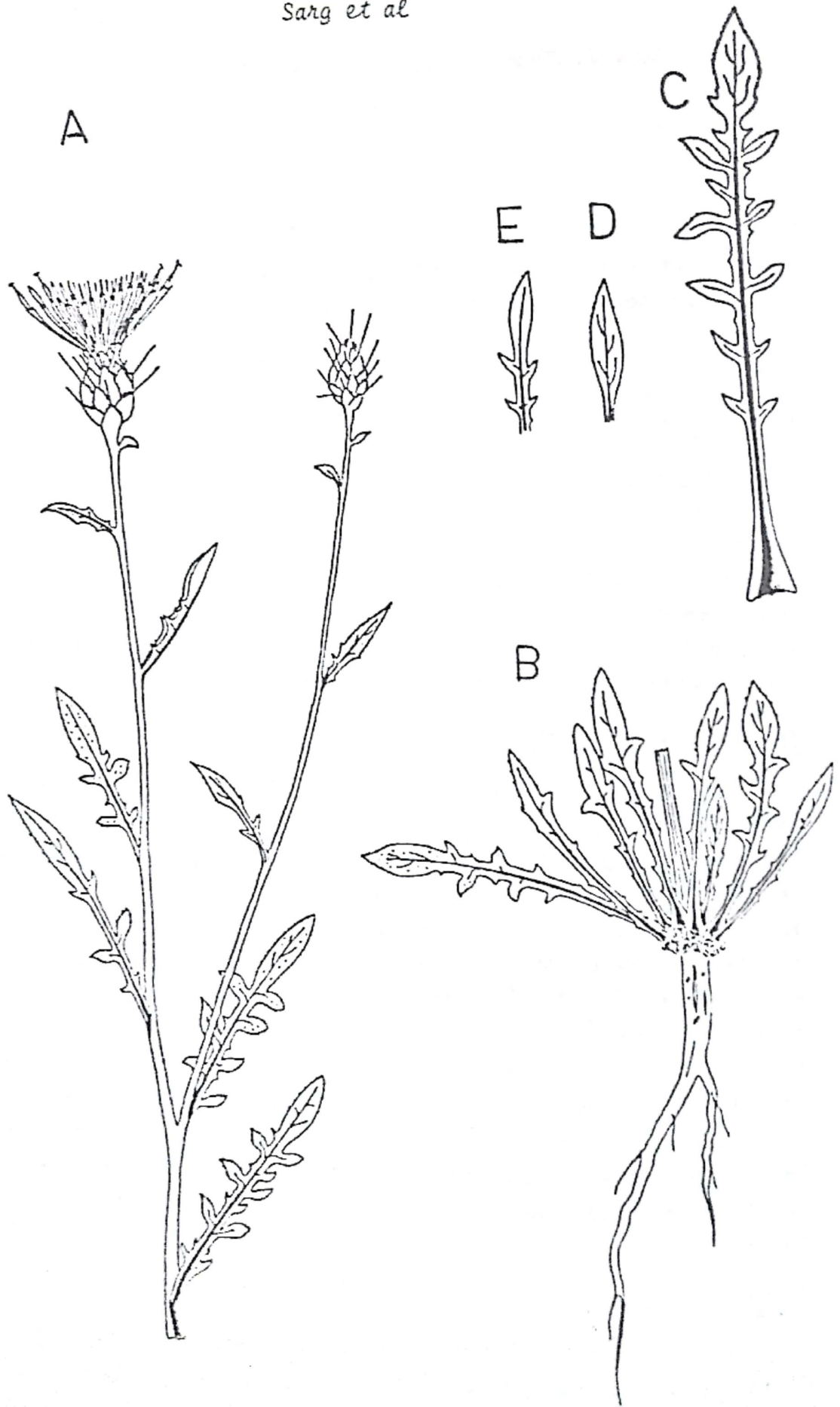
Centaurea eryngioides Lam. (Fig. 1 & 2) is a perennial, erect, branched hairy herb attaining 50 cm. in height with rosette of 7-12 radical leaves and small cauline ones. The plant has green cylindrical stem carrying few terminal and axillary large rose red capitulum, with an involucre scale showing white fringes and terminal long, yellow spines. It flowers from March to May.

The leaf : (Fig. 2)

The leaves include a rosette of 7-12 radical leaves as well as two types of cauline leaves. They are simple, sessile, exstipulate with green and hairy surfaces. The leaves have pinnately reticulate venation. The radical and lower cauline leaves (Fig. 2C & E) are oval lanceolate to linear spatulate deeply pinnatisect, acute apices and entire margins. The upper cauline leaves (Fig. 2D) are alternate, small, ovate-lanceolate, having entire margin, hairy surfaces and acute apices. It measure 3-10 cm. in length and 0.6-1.0 cm. in broad. The lower cauline measure 6-10 cm in length and 0.6-0.9 cm in breadth. The radical leaves measure 13-20 cm in length and 0.7-1.6 cm in broad. The leaf has a slight odour and a slight bitter taste.

The Stem : (Fig. 2)

It is erect, herbaceous, cylindrical, solid with glabrous green ridged surface; showing 6-8 ridges. The stem shows alternate monopodial branching and long inter-



(Fig. 2) : Sketch of *Centaurea eryngioides* Lam. (All X 0.5)

A. The stem and capitulum.

C. Radical leaf.

E. Lower cauline leaf.

B. The root and radical leaves.

D. Upper cauline leaf.

nodes reaching up to 12 cm. in length. The stem measures 20-50 in length and 0.5-1.0 cm in diameter. The fresh stem is flexible, while dry one breaks with fibrous fracture. The stem has slight odour and slight bitter taste.

The Root : (Fig. 2B)

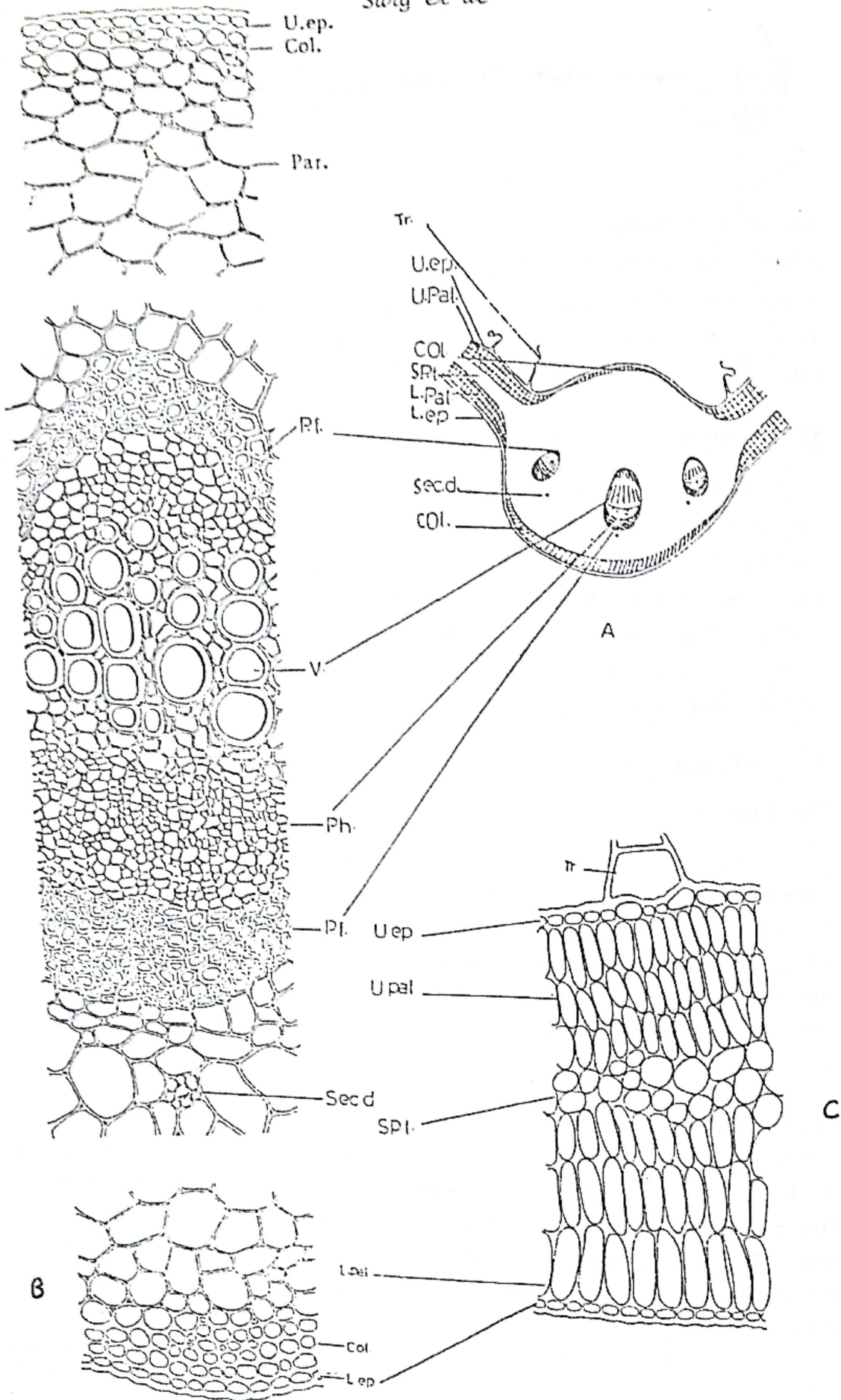
The plant possesses a terete gap root, bearing few lateral roots and numerous rootlets. Externally, it is earthy brown in colour with rough longitudinally wrinkled surface. The root measure 15-29 cm. in length and 0.5-1.5 cm. in diameter at the widest part. It has fibrous fracture showing yellow interior. The root has slight odour and slight salty taste.

B - MICROMORPHOLOGY :

The Leaf :

The transverse section of the leaf (Fig. 3 A,B) shows an isobilateral structure, palisade being discontinuous in the region of the midrib. The midrib is more prominent on the lower surface showing three collateral vascular bundles, each consists of radiated xylem and phloem with an upper and a lower arcs of pericyclic fibres.

Epidermis : the epidermal cells of both upper and lower surfaces (Fig. 4A,B,C,D) are polygonal with slightly wavy anticlinal walls being more wavy in the lower one and are covered with smooth cuticle. The neural epidermal cells are subrectangular and axially elongated with straight anticlinal walls. The cell dimensions are shown in table (1).



(Fig. 3) : The leaf : (All X 159, except A X 21).

A. Diagrammatic transverse Section.

B. Detailed transverse Section of the midrib.

C. Detailed transverse Section of the Lamina.

col., collenchyma; L.et., Lower epidermis; L. pal., lower palisade; P.f., pericycle fibers; Ph., phloem; Sec.d., Secretory duct; Sp.t., spongy tissue; Tr., trichome; U. ep. upper epidermis; U.pal., upper palisade; V., vessels of xylem.

Table (1) : Epidermal Cell Size of the Leaf (in micron).

Region of Epidermis	Length	Width	Height
Upper epidermis of the lamina	28-68	17-53	10-21
Lower epidermis of the lamina	28-72	20-43	7-13
Upper neural epidermis	34-96	11-26	9-14
Lower neural epidermis	40-91	7-28	7-16

Stomata : (Fig. 4A,B,C); They are slightly sunken, oval, anomocytic, occasionally anisocytic present on both surfaces, being more numerous on the lower. They measure 32-34u in length and 23-25 u in width.

Trichomes : (Fig. 4E); They are of the covering type only and present mostly on the upper surface and the margin of the leaf. They are uniseriate, multicellular (6-13 cells), covered with smooth cuticle and ending with a long slender whip-like terminal cell, few having occasionally collapsed cell. They measure 749-1000 u in length and 65-82 u in width. At the basal part of the radical leaves, there are numerous narrow, uniseriate multicellular covering trichomes measuring 795-1022 u in length and 8-9 u in width, having narrow apical cells with acute apices.

Mesophyll : (Fig. 3B)

The mesophyll consists of an upper and a lower palisade each of 3 rows of short columnar cells, measuring 40-102 u in length and 15-32 u in breadth as well as a spongy tissue formed of 3 rows of rounded parenchymatous cells.

Midrib :

Cortical tissue (Fig. 3B); is formed of thinwalled parenchyma with 1 to 4 rows of subepidermal collenchyma. Few small schizogenous ducts are found in the cortex.

The endodermis : It is not well differentiated.

Pericycle : the pericycle consists of two arcs of lignified fibres above and below each vascular bundle. The fibres (Fig. 4F); are spindle-shaped, with thick lignified pitted walls, narrow lumen and pointed ends. They measure 176-270 u in length and 17-20 u in diameter.

The vascular tissue : (Fig. 4F); consists of a central and two lateral vascular bundles, each consists of upper lignified radiating xylem and lower soft parenchymatous phloem elements. The xylem is formed of lignified spiral, annular and reticulate vessels measuring 13-28 u in diameter, separated by thin cellulosic wood parenchyma.

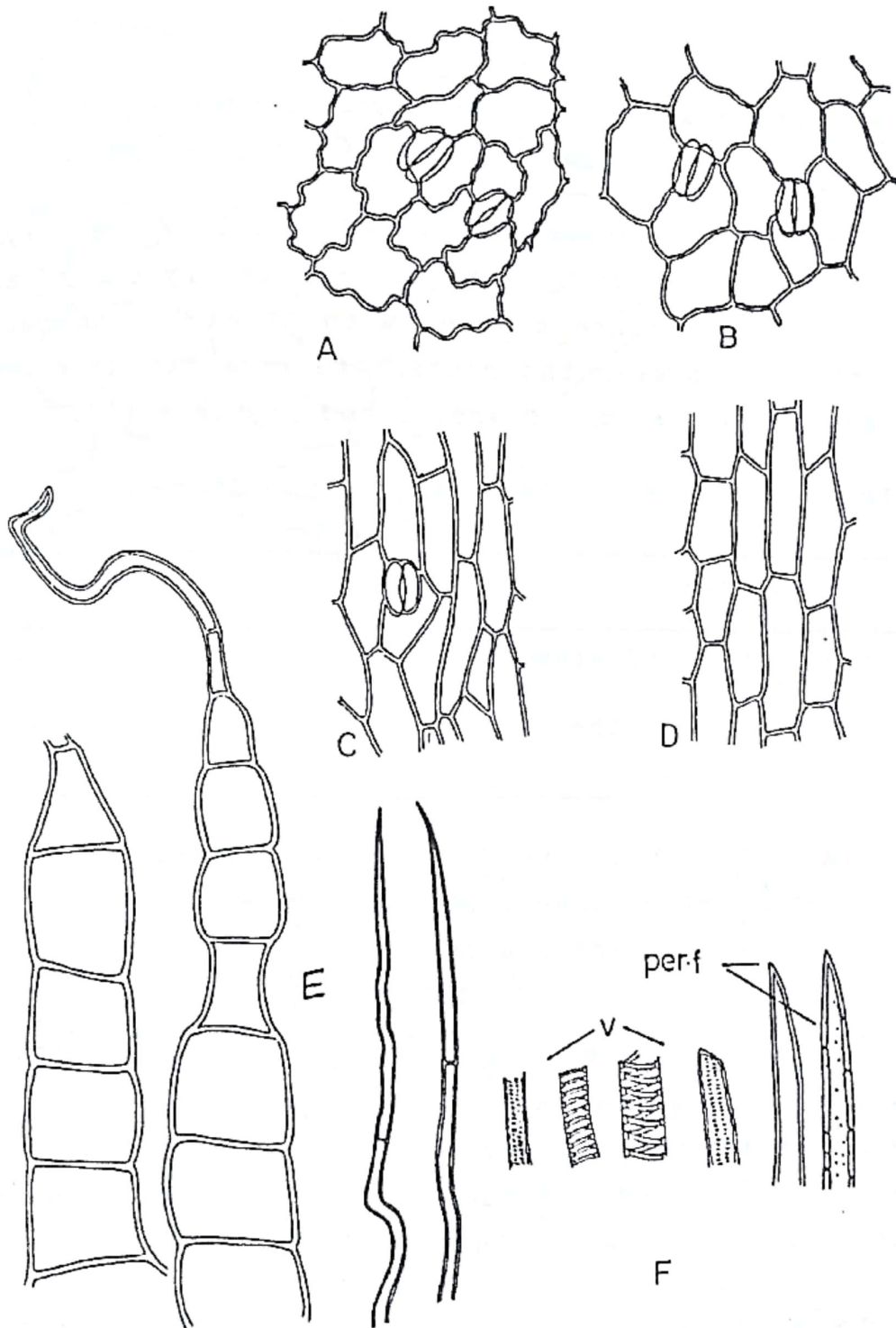
The numerical values of the leaf are listed in table (2).

Table (2) : Numerical values of the leaf.

	Values
1- Stomatal index :	
a) The upper epidermis	18-25
b) The lower epidermis	20-28
2- Vein islet number	11-14
3- Vein termination number	19-23
4- Palisade ratio :	
a) Upper	3-4
b) Lower	2-3

The Stem :

A transverse section of the stem (Fig. 5A,B); is almost circular in outline with 6-8 slightly prominent ridges. It shows an outer epidermis followed by a narrow



(Fig. 4) : The leaf : (All X 330)

- A. Lower epidermal cells of the lamina.
- B. Upper epidermal cells of the lamina.
- C. Lower epidermal cells of the midrib.
- Per. f., Pericyclic fiber; V., vessels.

- D. Upper epidermal cells of the midrib.
- E. Trichomes of the leaf.
- F. Isolated elements from the leaf.

cortex, lined with endodermis enclosing a ring of 13-18 vascular bundles surrounding a wide lignified pith.

Epidermis : The epidermal cells (Fig. 6C,E); are polygonal axially elongated with straight or slightly curved anticlinal walls and are covered with thick smooth cuticle. Epidermal cells over the ridges are somewhat narrower and longer. Cells dimensions are listed in table (3).

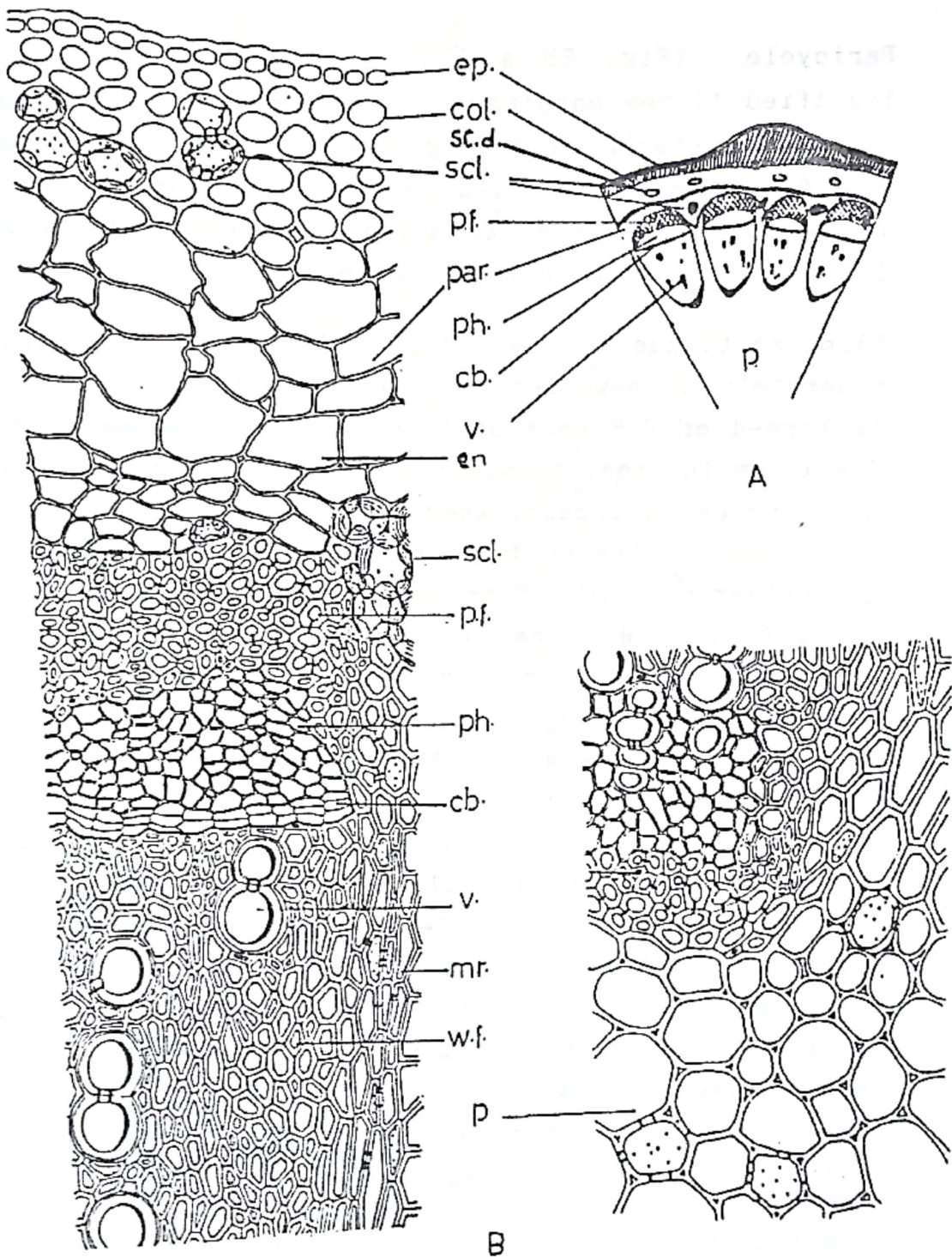
Table (3) : Epidermal Cell Size of the Stem. (in micron).

Epidermis	Length	Width
Epidermal cell of stem.	23-65	11-34
Epidermal cell on the ridges	85-106	14-23

Stomata : (Fig. 6E); are few of the anomocytic and anisocytic types being sunken, absent over ridges and measuring 22-31 u in length 18-22 u in breadth.

Trichomes : (Figure 6C₂), few, covering trichomes are present being uniseriate, multicellular 5-10 cells and covered with thin smooth cuticle. The apical cell is small with pointed and curved apex. They measure 170-210 u in length and 10-18 u in breadth.

Cortex : (Fig. 5B), is formed of 8-15 rows of thin walled parenchyma cells, four to six rows of collenchyma in the ridges with scattered single or groups of lignified thick-walled sclereids. The cortex is lined its inner side by tangentially elongated small endodermal cells, free of any contents. The cortex shows 5-7 small schizogenous secretory ducts.



(Fig. 5) : The stem : (All x 246.4 except B x 22.4)

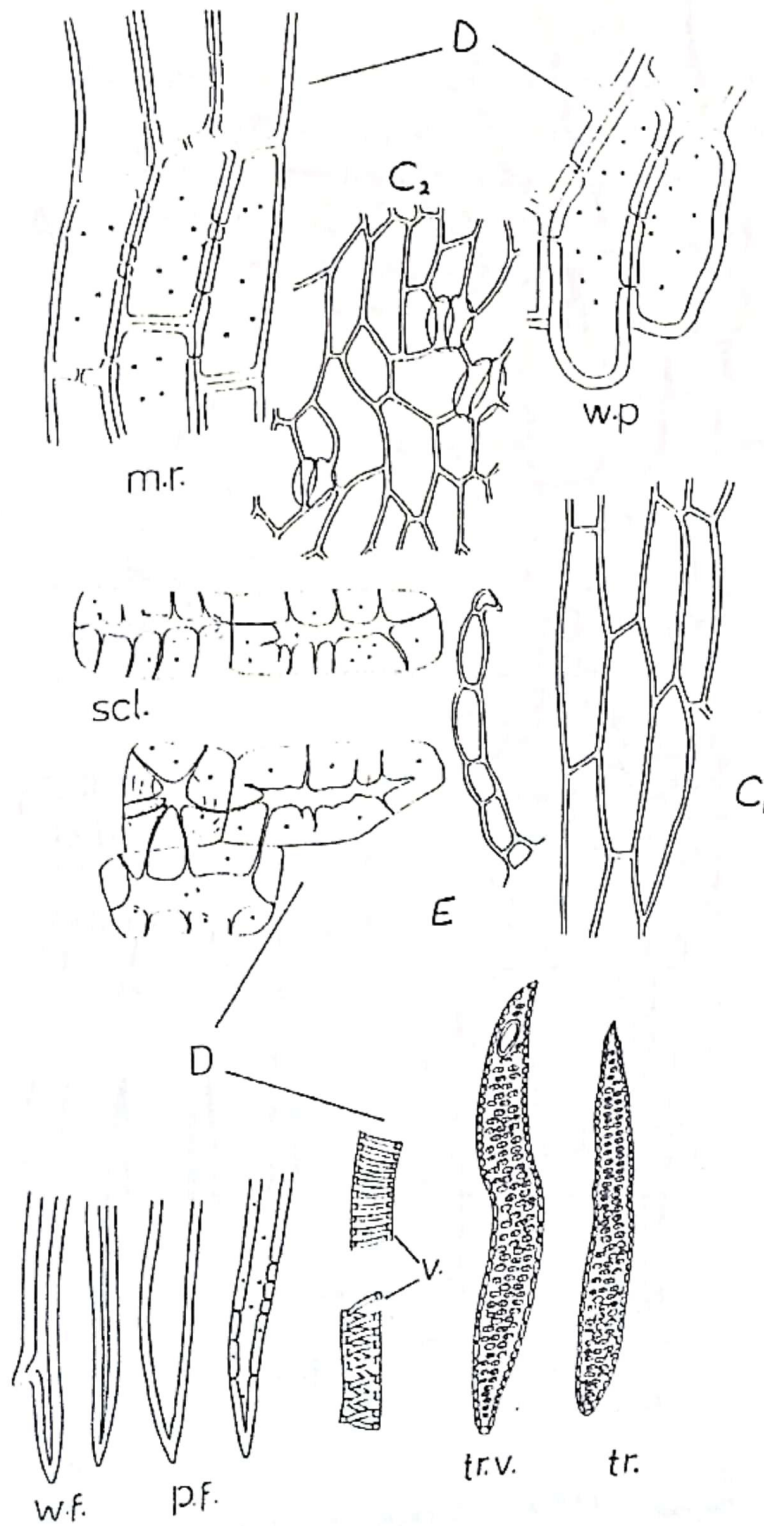
A. Diagrammatic transverse Section of stem. B. Detailed transverse Section of the stem.
 Cb., cambium; Col., Collenchyma; ep., epidermis; m.r., medullary ray; par., parenchyma;
 P.f., pericyclic fiber; Ph., phloem; P. pith; Scl., scleride; Sc.d. secretory ducts; V., vessel;
 W.f., wood fiber.

Pericycle (Fig. 5B & 6D); is composed of groups of lignified fibres capping the vascular bundles and parenchyma in between including small groups of sclereids. The fibres are lignified and spindle-shaped with wide lumina and blunt or acute apices measuring 375 to 610 u in length and 17-22 u in diameter.

Vascular tissue : (Fig. 5A,B); The phloem; consists of moderately thin-walled cellulosic elements. The cambium is formed of 2-5 rows of thin-walled meristematic cells. The xylem is wide, consists of lignified vessels arranged solitary or in groups, wood fibres, wood parenchyma, few tracheids and tracheidal vessels. The xylem is traversed by uniseriate lignified medullary rays. The vessels (Fig. 6D); have spiral and annular thickening, 12-19 u in diameter. The wood fibres have thick lignified pitted walls and acute or rarely forked apices, they measure 395-698 u in length and 11-17 u in diameter. The wood parenchyma is formed of lignified cells with thick pitted walls. The vascular bundle are separated by wide multiseriate lignified medullary rays. The cells measure 77-93 u in length and 23-37 u in breadth. A band of sclerenchyma formed of 4-10 cells caps is located in the periphery of medullary rays. The sclereids are more or less rounded, lignified with fine striation and simple pits, they measure 48-93 u in length and 36-48 u in breadth. The pith is composed of lignified thick-walled large pitted parenchymatous cells.

The Root :

A transverse section of the root (Fig. 7A,B); shows an outer brown cork and parenchymatous phelliderm surrounding a wide vascular cylinder traversed by medullary rays. The cork (Fig. 7B,C); consists of about 3-6 layers of polygonal thin-walled suberised tangentially elongated

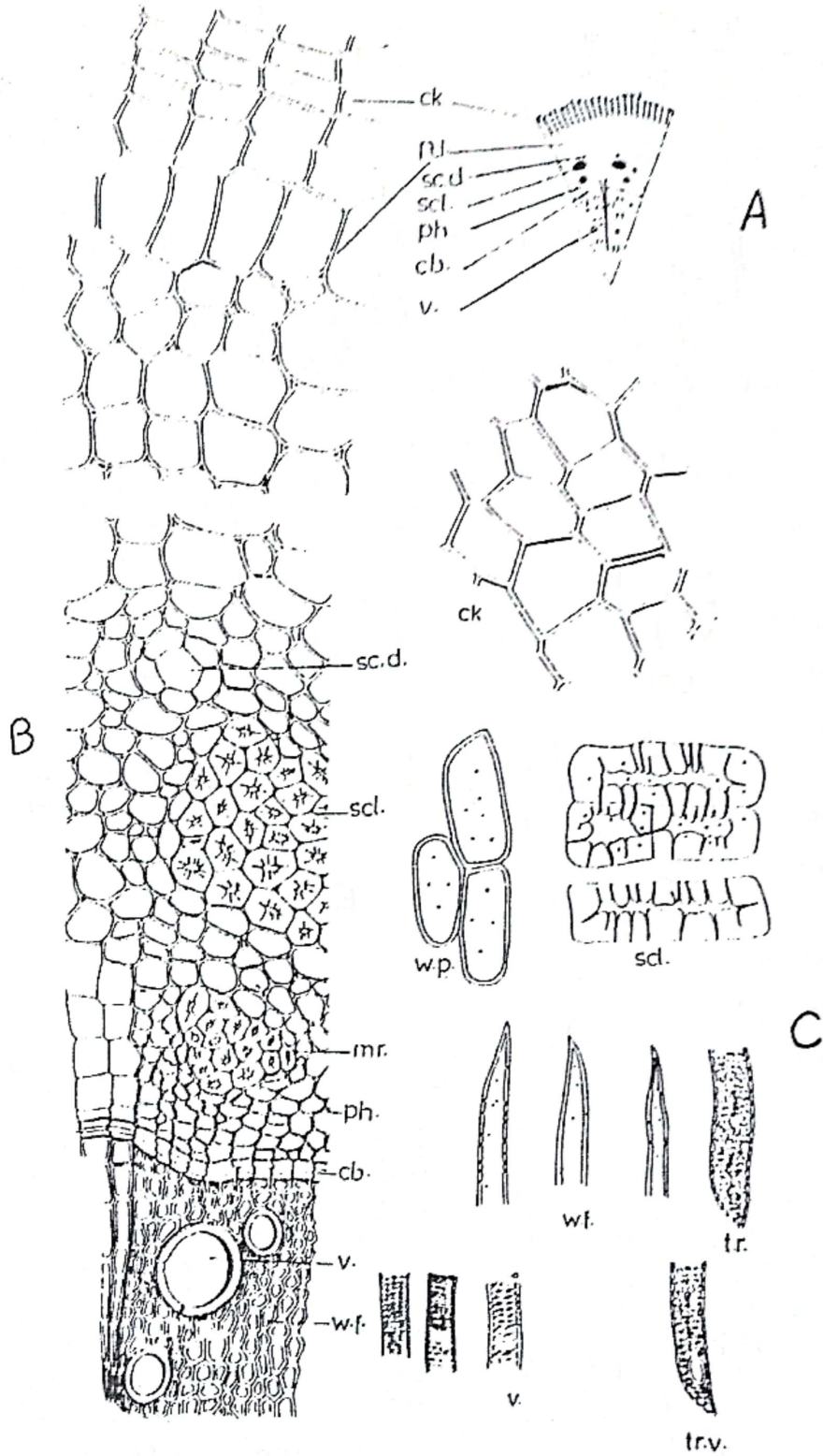


(All x282 except E x246)

(Fig. 6) : The stem :

C₁-Epidermal cells of the stem on the ridge. C₂-Epidermal cells of the stem.
 D. Isolated elements from the stem. E. Trichome of the stem.

m.r., medullary ray; p.f., pericyclic fiber; scl., sclerides; tr., tracheids; tr.v., tracheidal vessel; V., vessel; w.f., wood fiber; w.p., wood parenchyma.



(Fig. 7) : The root : (All x 193.6 except A x 17.6)

A. Diagrammatic transverse Section of old root.

B. Detailed transverse Section of old root.

C. Isolated elements from root..

Ch.,cambium; CK., cork; m.r., medullary ray; pd., phelloderm; ph., phloem; Sc.d., Secretory duct; scl., sclerides; tr., tracheid; tr.v, tracheidal vessel; V., vessel; W.F., wood fibers

cork cells arranged in radial rows. The phelloderm is formed of thin-walled, more or less tangentially elongated parenchymatous cells. It shows groups of stone cells with thick lignified pitted walls and narrow lumen. It also shows a diffused ring of schizogenous secretory ducts.

The vascular tissue consists of an outer phloem and an inner ring of xylem with cambium in between. Phloem is formed of thin-walled, soft cellulosic elements. Cambium is formed of several rows of radially arranged meristematic cells. Xylem is lignified with tetrarch primary xylem at the centre. It is formed of annular, spiral and oval bordered pitted vessels, 21 to 51 u in diameter. Tracheids and tracheidal vessels are few with lignified walls showing oval bordered pits and acute to acuminate apices. Tracheids measure, 227-297 u in length and 23-28 u in diameter. Tracheidal vessels measure 345-479 u in length and 15-23 u in diameter. Wood parenchyma have thin pitted lignified walls. Medually rays; are uni-to trisseriate being lignified with pitted walls in xylem region.

CONCLUSION

As a result of this study one can conclude the following characteristic features.

1. The plant is herbaceous with 7-12 radical leaves and two types of cauline leaves. The plant flowering from March to May carrying both terminal and axillary large rose red capitula with an involucre scale showing white fringes and terminal long, yellow spines.
2. The leaf shows an isobilateral structure, three collateral vascular bundle, each consists of radi-

- ated xylem and phloem surrounded by two arcs crescent-shaped pericyclic fibres above and beneath.
3. The stem is almost circular in outline with 6-9 ridges. The transverse section showing an outer epidermis followed by narrow cortex then endodermis enclosing a ring of vascular tissue surrounding a wide pith.
 4. Stomata of anomocytic and anisocytic types are present in the epidermis of the leaves and stem. Trichomes of non-glandular uniseriate and multicellular are numerous in leaves being few in stem.
 5. The young root is tetrach.
 6. The pericycle of the leaves and stem are formed of lignified sclerenchymatous fibres with thick pitted walls and acute, subacute or forked apices.
 7. The xylem vessels in root, stem and leaves shows annular, spiral, reticulate or boarded pitted thickening, tracheids and tracheidal vessels.
 8. The leaves, stem and root are completely free of starch granules and calcium oxalate crystals.

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سبق أن قام الباحثون بدراسة كيميائية للنبات وتم فصل والتعرف على المحتويات الكيميائية مثل لاكتونات السيسكويترين والفلافونيدات ، والثربينات الثلاثية وكذلك تحليل الأحماض الدهنية وإختبار خلاصات النبات المختلفة ضد الميكروبات وتخفيض نسبة سكر الدم وفى هذا البحث قام الباحثون بدراسة الصفات العيانية والمجهرية لأوراق وساق وجذر النبات لإمكان التعرف عليه فى صورته الصحيحة وعلى هيئة مسحوق .