

## MACRO- AND MICROMORPHOLOGY OF THE LEAVES, STEM AND ROOTS OF *OCHRADENUS BACCATUS* DEL.

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### ABSTRACT

The macro- and micromorphology of the leaves, stem and root of *Ochradenus baccatus* Del. (Family Resedaceae) are presented with the aim of finding their diagnostic characters by which the plant can be easily identified in both entire and powdered forms.

### INTRODUCTION

*Ochradenus baccatus* Del. (Family Resedaceae)(1) is a perennial shrub growing wildy in Eastern Mediterranean coastal region, all deserts of Egypt, and the Red Sea coastal region(2).

Phytochemical screening of the plant showed the presence of alkaloids, coumarins, flavones and steroids(3). Moreover, Barakat et al.(4) isolated flavonoids from this plant(4). Nothing was reported concerning its botanical study except few data given by some flora (5).

In detailed chemical study(6,7), the authors reported the isolation and identification of five steroids, five flavonoids and four glucosinolates. So, it was of interest to carry out a pharmacognostical study of the plant.

In this study, the macro- and micromorphology of the leaves, stem and roots of this plant are presented to show the diagnostic characters of each organ by which one can identify it in both entire and powdered forms.

### EXPERIMENTAL

#### Plant Material :

Fresh samples of *Ochradenus*

*baccatus* Del. were collected from flowering plants growing wildy in the Eastern desert (near Suez City) and Sinai desert (near to Mettla Valley) in spring 1993. The identity of the plant was kindly verified by Prof. Dr. Nabil El-Hadidi Professor of Plant Taxonomy, Faculty of Science, Cairo University. A voucher sample of the plant is kept in the, Egypt.

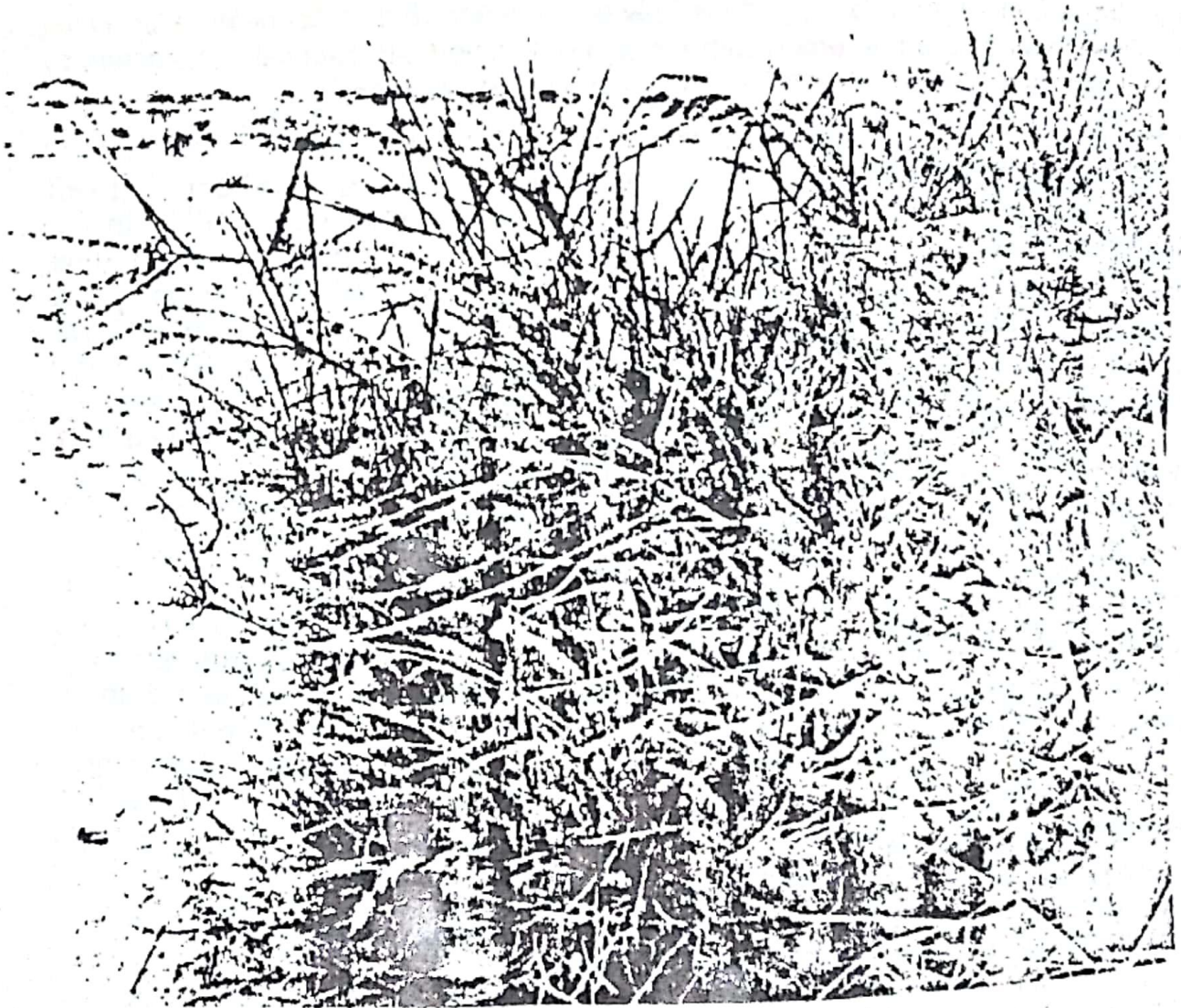
#### (A) Macromorphology :

*Ochradenus baccatus* Del. (Fig. 1,2 A) is a long perennial shrub attaining 2-2.5 m in height and 2 to 5.5 m in diameter. The plant is polygamous carrying spike-like yellow inflorescence. The stem has spinescent branches forming dense bushes in dry desert. It flowers from March to May (8).

#### The Leaf :

The leaves (Fig. 1,2A, 2B) are crowded, alternate, cauline, sessile, exstipulate and deciduous. They are linear with dark green glabrous surfaces, acute apex, entire margin symmetric base and measure 1 to 5 cm in length and 1.5 to 4 mm in breadth. They have reticulate pinnate venation, midrib is slightly prominent on the lower surface and slightly depressed on the upper one. They have slight odour and characteristic taste.





**Fig. (1): Photograph of *Ochradenus baccatus* Del.**

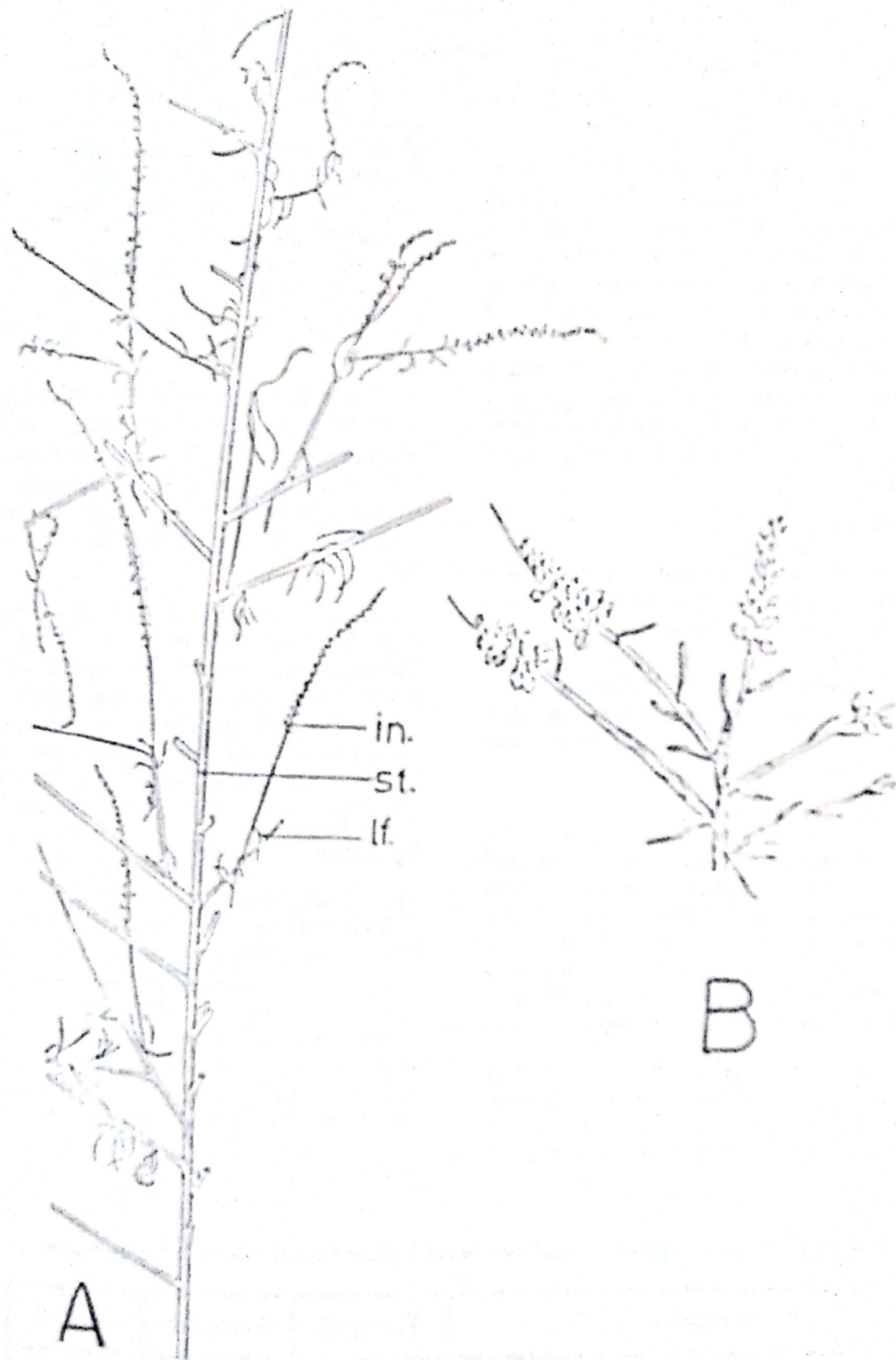


Fig. (2) Sketch of *Ocharadenus baccatus* Del.  
A. The flowering branch  
B. The fruiting tops  
(A x 0.25, B x 0.25)  
in, inflorescence B, leaf in. view



**The Stem :**

The stem (Fig. 1,2 A) is yellowish green, erect, woody glabrous and cylindrical with monopodial divaricate twigs or simple branches. The branches may terminate into sharp thorny ends. It is solid; internodes measuring 1.5 to 7 cm in length and 0.5 to 1 cm in diameter. The stem shows short fracture with green colour in the outer bark and splintery fracture with yellow colour in the centre. It has slight odour and slightly bitter taste.

**The Root :**

The root is cylindrical, fusiform, tap root, measures 15 to 35 cm long and 3 to 6 cm in diameter at the widest part. It is poorly branched, showing few lateral roots with smaller rootlets. It has rough surface, buff yellow colour and fibrous fracture. It has faint odour and slight bitter taste.

**(B) Micromorphology :**

A transverse section of the leaf (Fig. 3) shows isobilateral structure; both palisade layers are continuous in the midrib region. The midrib is more prominent on the lower surface. It shows an arc of 4-7 collateral vascular bundles with a collenchymatous pericycle.

A transverse section of the old stem (Fig. 4) is almost circular in outline. It shows an outer epidermis surrounding a parenchymatous cortex with 5 to 8

rows of sub-epidermal chlorenchyma; showing few small groups of sclereids. The pericycle consists of an interrupted ring of small groups of lignified fibres accompanied by sclereids. The vascular tissue is formed of a complete ring of an outer phloem, inner xylem with cambium in between. The pith is wide and lignified.

A transverse section of the young stem (Fig. 5) is similar but the cortex shows no sclereids; the vascular tissue is formed of a ring of 18 to 22 separate vascular bundles with parenchymatous pericycle and a wide parenchymatous pith.

A transverse section of the old root (Fig. 6) is almost circular in outline. It shows an outer brownish cork and wide phelloderm surrounding the vascular tissue. The vascular tissue consists of an outer phloem and inner xylem separated by well developed cambium. In the young root, the primary xylem is diarch.

**Epidermis :**

Both epidermis of the lamina (Fig. 7 A,C) consist of polygonal cells with straight or slightly curved anticlinal walls and covered with thick smooth cuticle. The neural epidermal cells (Fig. 7 B,D), as well as those of stem (Fig. 4c,5c) are axially elongated with straight anticlinal walls. The size of epidermal cells in microns are given in table (1).

**Table (1) : Size of epidermal cells of leaves and stem in microns.**

Epidermis	Length	Breadth	Height
Upper epidermis of the lamina	21 - 44	13 - 28	10 - 12
Lower epidermis of the lamina	21 - 44	14 - 33	10 - 14
Upper neural epidermis	29 - 77	11 - 27	11 - 14
Lower neural epidermis	23 - 72	11 - 27	11 - 14
Epidermis of old stem	40 - 76	16 - 43	32 - 35
Epidermis of young stem	22 - 57	7 - 16	7 - 9

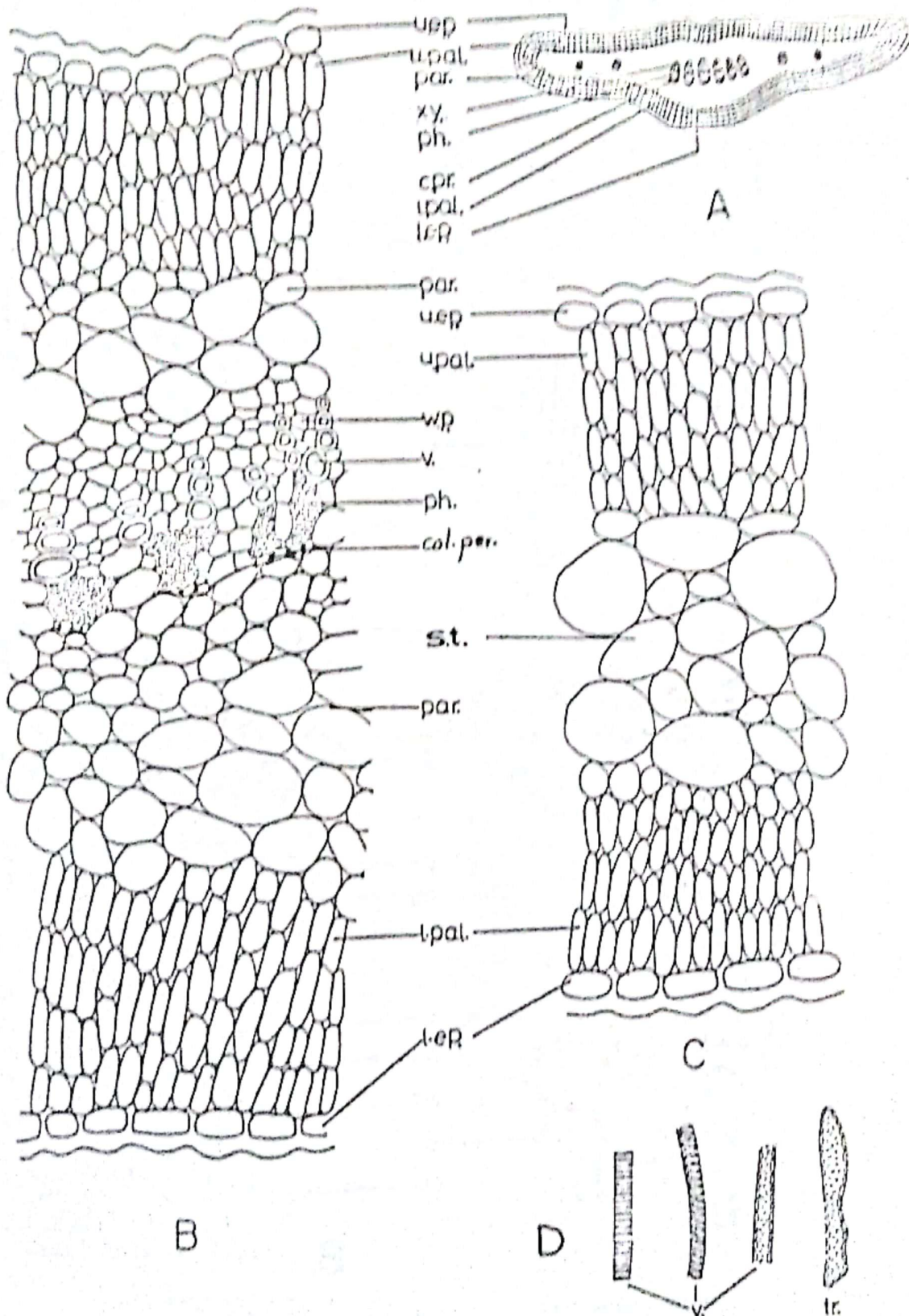


Fig. (3): The Leaf-

- A- Diagrammatic transverse section.
- B- Detailed transverse section of the midrib.
- C- Detailed transverse section of the lamina.
- D- Isolated elements from the leaf.

(All x 403 except A x 11).

col. per., collenchymatous pericycle; lcp, lower palisade; lpal., lower palisade; par., parenchyma; st., spongy tissue; tr., tracheids; ucp., upper epidermis; upal., upper palisade; v., vessel; wp., wood parenchyma; xy., xylem.



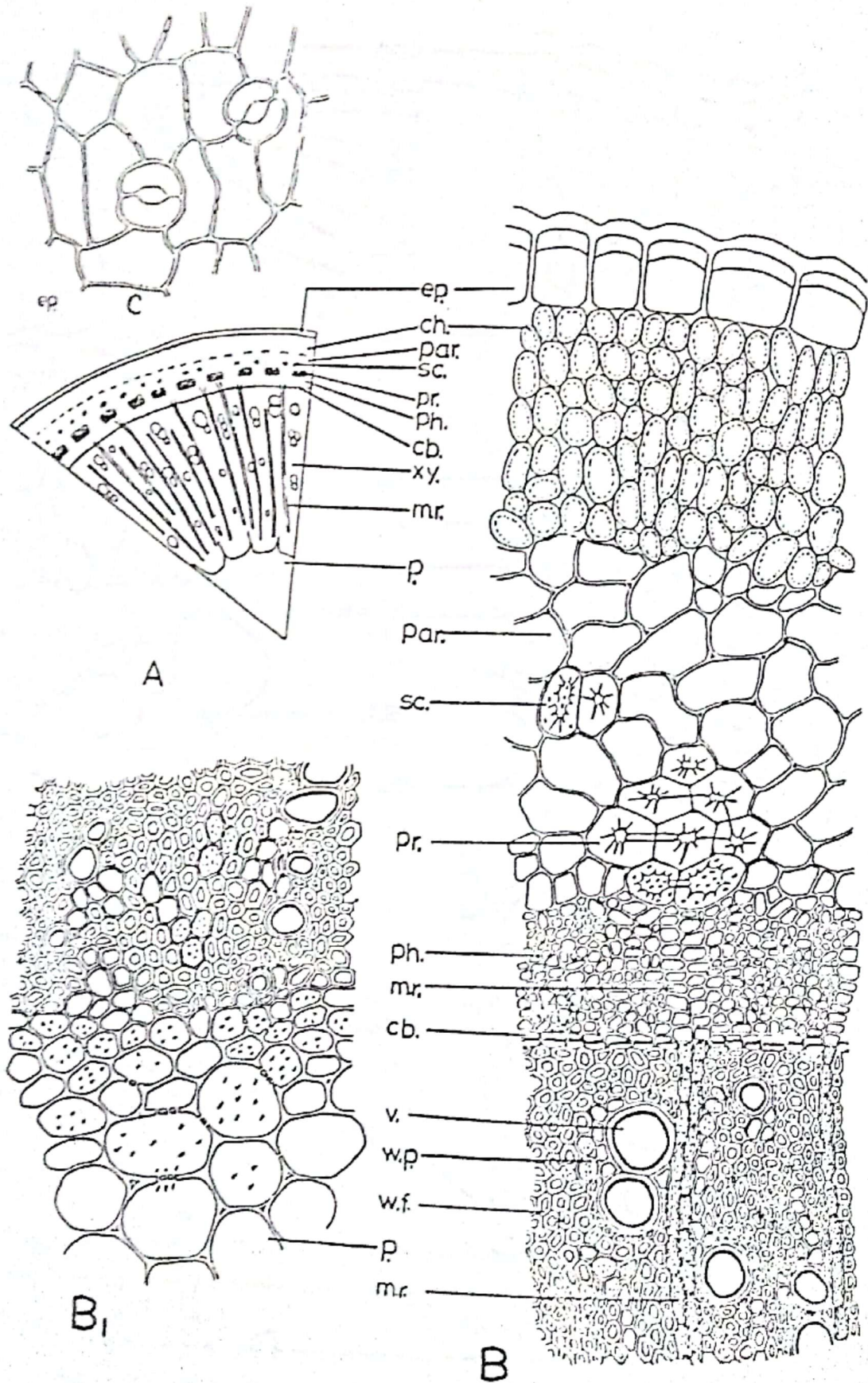


Fig. (4): The Old Stem:-

A- Diagrammatic transverse section.

B, B<sub>1</sub>- Detailed transverse section.

C- Epidermal cells.

(A x 31; B, B<sub>1</sub> x 463; C x 303).

cb., cambium; ch., chlorenchyma; epi., epidermis; m.r., medullary ray; p., pith; par., parenchyma; ph., phloem; pr., pericycle; sc., sclereids; v., vessel; w.f., wood fibre; w.p., wood parenchyma; xy., xylem.

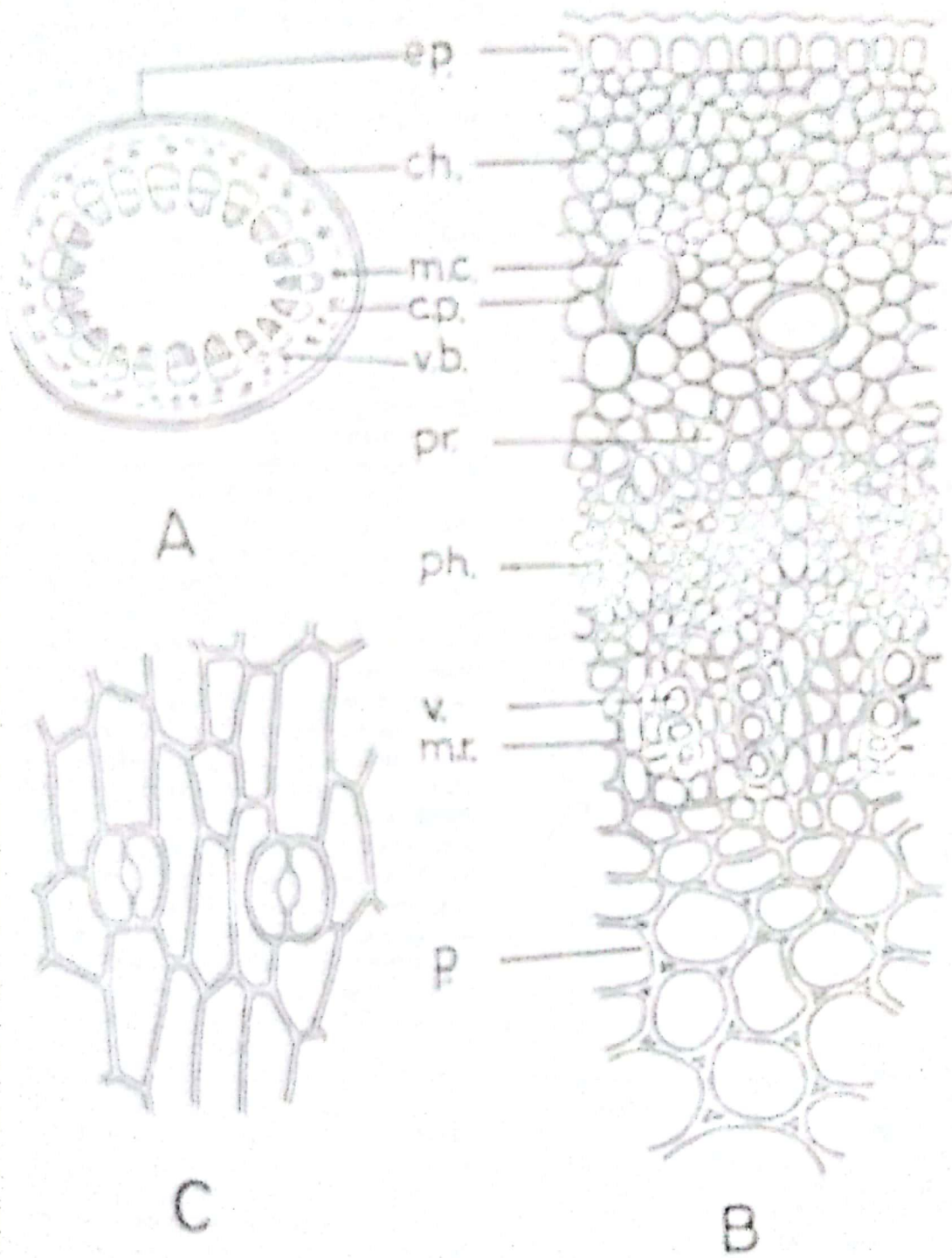


Fig. 55. The Young Stem:

A Diagrammatic transverse section

B Diagrammatic longitudinal section

C Epidermal cells

(All x 100 except A x 50)

ch, chlorenchyma; cp, cambium; mc, medullary cambium; ep, epidermis; mc, pith

ph, phloem; p, pith; pr, pith; vb, vascular bundle

v. mt, vascular cambium



### **Stomata :**

They are of anomocytic, rarely anisocytic type. They are present on both surfaces of the leaf as well as of the stem (Fig. 4,5 and 7). They are oval or rounded in outline measuring 25 to 35  $\mu$ , 31-38  $\mu$  in length and 21-27 h, 30-37  $\mu$  in breadth respectively.

### **Trichomes :**

Both glandular and covering trichomes are absent.

### **Cortex :**

The cortex of the midrib (Fig. 3 B) is parenchymatous with upper and lower palisade cells. The cortex of the stem (Fig. 4) is formed of an outer chlorenchyma and inner parenchyma. It shows scattered groups of sclereids with thick lignified pitted walls and wide lumen measuring 29 to 54  $\mu$  in length and 16-19  $\mu$  in breadth. In the young stem (Fig. 5) the cortex shows no sclereids, but scattered oval secretory cells measuring 16 to 33  $\mu$  in diameter. This exhibiting red colour when treated with Millon's reagent and red colour with Sudden's III, which is probably myrosin cells. The pericycle of the midrib (Fig. 3) is formed of an arc of 2 to 3 rows of collenchymatous rounded to oval cells measuring 3 to 7  $\mu$  in diameter.

The pericycle of the young stem (Fig. 5) is parenchymatous and that of old stem (Fig. 4) composed of groups of pericyclic fibres accompanied by sclereids, pericyclic fibres are spindle shaped with lignified thick walls, dentate edges, acute or blunt apices and wide or narrow lumen (Fig. 8) measuring 392 to 437  $\mu$  in length and 11 to 40  $\mu$  in diameter. Sclereids (Fig. 8) have thick lignified pitted walls and wide lumen. They measure 22 to 46  $\mu$  in length and 18 to 20  $\mu$  is width.

### **Vascular tissue :**

The vascular bundle of the leaf (Fig. 3) is formed of radiating xylem and phloem band underneath. The xylem (Fig. 3D) consists of lignified spiral,

pitted and annular vessels measuring 6 to 23  $\mu$  in diameter; few tracheids (Fig. 3) with pitted lignified walls measure 43 to 88  $\mu$  in length and 6 to 11  $\mu$  in diameter; wood parenchyma (Fig. 3) are cellulosic. In the young stem, (Fig. 5) the vascular tissue consists of 18 to 22 separate collateral vascular bundles of outer cellulosic phloem and inner of lignified spiral and pitted vessels, 7 to 12  $\mu$  in diameter.

The vascular tissue of the old stem (Fig. 4) and old root (Fig. 6) are formed of a complete ring of an outer phloem and inner xylem with cambium inbetween and traversed by medullary rays. The phloem (Fig. 4,6) consists of moderately thick-walled cellulosic elements. The xylem (Fig. 4,6) is wholly lignified. The wood fibres (Fig. 8,9) are spindle-shaped with thick, lignified walls moderately narrow lumen and acute or blunt apices. They measure 283 to 488  $\mu$  in length and 5 to 19  $\mu$  in diameter. The wood parenchyma (Fig. 8,9) are diffuse or paratracheal formed of polygonal and axially elongated cells with moderately thick pitted lignified wall showing numerous simple pits. They measure 54 to 75  $\mu$  in length and 5 to 28  $\mu$  in diameter. Tracheids (Fig. 8,9) are few polygonal, thick-walled showing oval bordered pits. They measure 85 to 132  $\mu$  in length and 21 to 33  $\mu$  in diameter. The tracheidal vessels (Fig. 9) are very few showing rounded lateral perforation and lignified pitted walls. They measure 101 to 135  $\mu$  in length and 16 to 30  $\mu$  in diameter. The M.R. (Fig. 4,6,8,9) are uni- to biseriate formed of lignified rectangular cells with thick pitted walls in the xylem region and cellulosic in the phloem region. The measure 7 to 53  $\mu$  in length and 3 to 39  $\mu$  in width in the phloem region and 9 to 48  $\mu$  in length, 5 to 16  $\mu$  in breadth in the xylem region.

### **The Cambium :**

The cambium (Fig. 4,6) is formed of 2-4 rows of thin walled, tangentially elongated, subrectangular meristematic cells.



**The Pith :**

The pith of old stem (Fig. 4) is wide, composed of large polyhedral cells with moderately thick, pitted lignified walls and narrow intercellular spaces. They measure 19 to 52  $\mu$  in length and 11 to 35  $\mu$  in breadth. In the young stem (Fig. 5) is parenchymatous. The cells measure 16 to 41  $\mu$  in diameter.

**The Periderm :**

It is formed only in the old root.

**The Cork :**

The cork (Fig. 6,9) is formed of 8 to 12 rows of polygonal to rectangular radially arranged cells with moderately thick suberized walls and brownish contents. They measure 23 to 60  $\mu$  in length and 8 to 41  $\mu$  in breadth and 15 to 43  $\mu$  length.

The phellogen arises in the pericycle and not distinguished in the old root. The phelloderm (Fig. 6) is very wide consists of 30 to 40 rows of polygonal moderately thick-walled parenchyma. It shows groups of thick-walled polygonal pitted lignified sclereids with narrow or wide lumen. They measure 11 to 42  $\mu$  in length and 11 to 27  $\mu$  in width.

Simple polyhederal starch grains with centric cleft hilum measuring 6 to 9  $\mu$  in diameter are present in cortex of the stem, root and pith of the stem.

**CONCLUSION**

From the previous mentioned study, one can conclude that, the characteristic features of the plant are the following :

- 1- The plant is shrub with spinescent branches forming dense bushes in dry desert.
- 2- The leaf is linear with acute apex and entire margin, deciduous; the stem is woody, cylindrical with splentry fracture; the root is yellowish, cylindrical and fusiform with few lateral branches.
- 3- The epidermis of the leaf and the stem is formed of polygonal cells with anomocytic or anisocytic stomata and thick smooth cuticle. They show no trichomes.
- 4- The pericycle of the leaf is collenchymatous while that of young stem is parenchymatous. The old stem shows scattered groups of fibres including sclereids.
- 5- The cork of the root is formed of polygonal suberized cells.
- 6- The mesophyll is isobilateral; both palisades are continuous in the midrib region.
- 7- The young root is diarch.
- 8- The xylem of the stem and root is wholly lignified showing pitted

**Table (2) : Numerical values of the leaf.**

Value	Number
1- Stomatal Index :	
a- Upper epidermis	13.8 to 15.9
b- Lower epidermis	14.9 to 17.7
2- Vein-Islet Number	7 to 9
3- Veinlet-Termination Number	4 to 7
4- Palisade Ratio :	
a- Upper palisade	2 to 4
b- Lower palisade	2 to 4

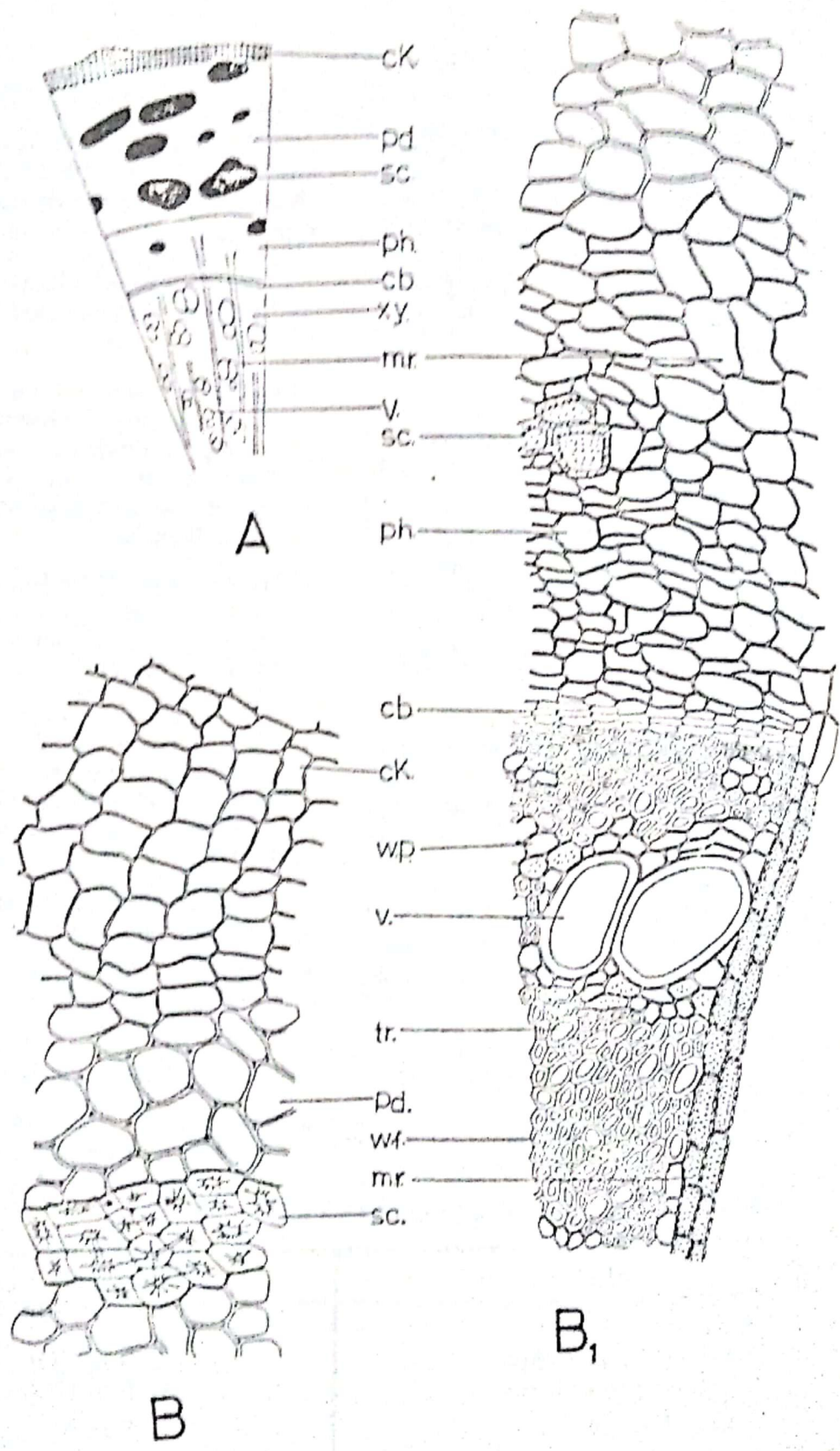


Fig. 16): The Root:-  
 A- Diagrammatic transverse section of old root.  
 B, B<sub>1</sub>- Detailed transverse section  
 (All x 290 except A x 22)  
 cb, cambium; ck, cork; mr, medullary ray; pd, phelloderm; ph, phloem;  
 sc, sclerids; tr, tracheid; v, vessel; wf, wood fibre; wp, wood  
 parenchyma; xy, xylem



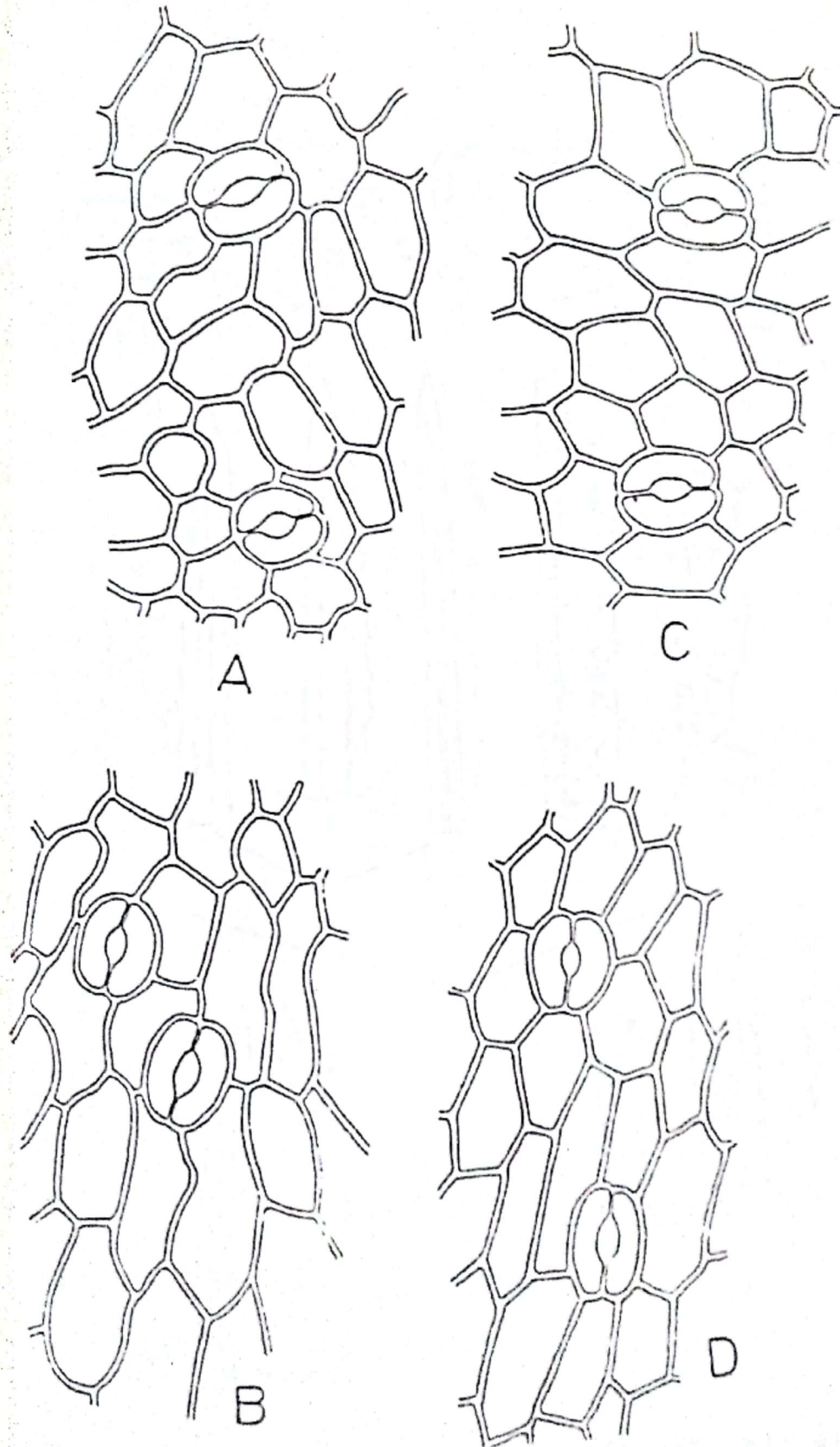


Fig. (7): Epidermis of The Leaf:-  
A- Upper epidermal cells of the lamina.  
B- Upper epidermal cells of the midrib.  
C- Lower epidermal cells of the lamina.  
D- Lower epidermal cells of the midrib.  
(All x 458).

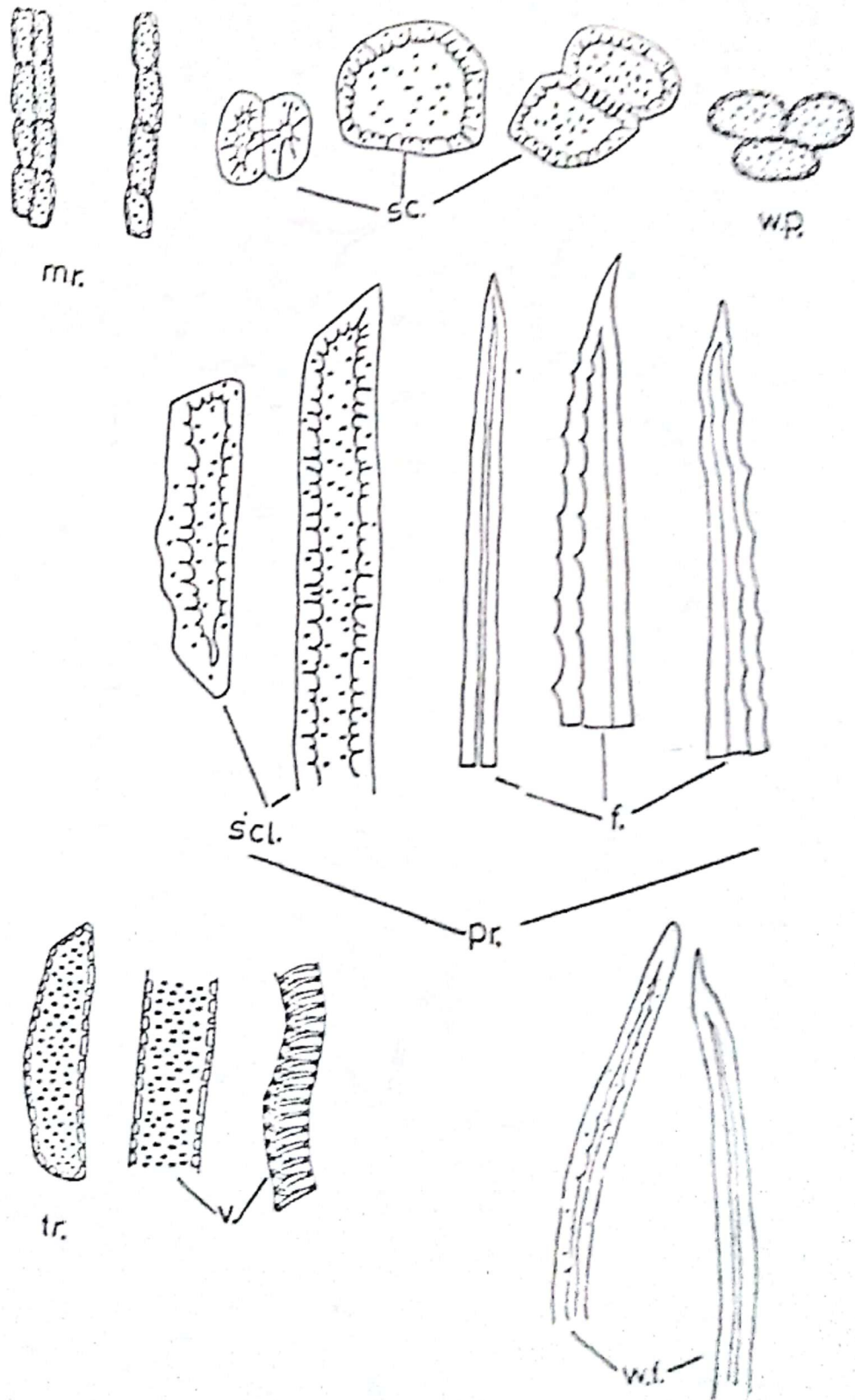


Fig. (8): Isolated Elements of the Old Stem:-  
 f. fibres; m.r. medullary rays; pr. petiole; sc. sclerids; scl. sclerenchymatous fibres; tr. tracheids; v. vessel; w.f. wood fiber; w.p. wood parenchyma.  
 (All x 403).



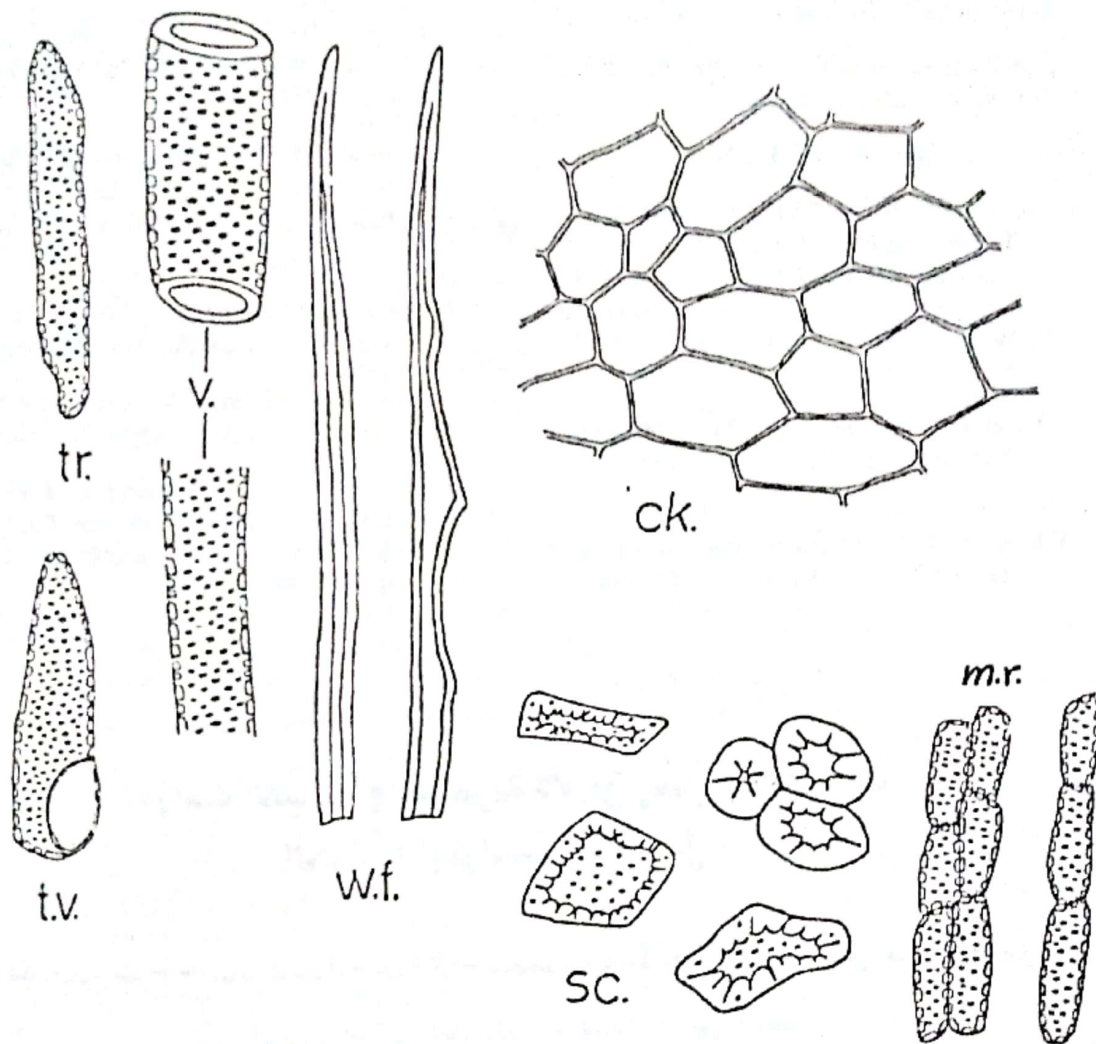


Fig. (9): Isolated Elements of the Old Stem:-

(All x 304).

ck., cork; m.r., medullary rays; sc., sclereid; tr., tracheid; t.v., tracheidal vessel;  
v., vessel; w.f., wood fibre.

reticulate and spiral vessels, tracheids and tracheidal vessels.

9- The leaf, stem and root are completely free from calcium oxalate.

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## الدراسة العيانية والمجهريية لأوراق وساق وجذور نبات الجرثى ( أوكرادينس بكاتس دل )

طه مصطفى سرج - سامية صلاح حافظ - محمود محمد عبدالعال - امل امين الجندى  
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سبق أن قام الباحثون بدراسة كيميائية لنبات الأوكرادينس بكاتس دل الذى ينمو فى مصر ويستخدم فى علاج الالتهابات وقد امكن فصل خمسة مواد استرولية وتربينية وايضا خمس فلافونيدات واربعة جلوكوزينولات لذا فقد رؤى أن يتم دراسة الصفات العيانية والمجهريية لهذا النبات حتى يسهل التعرف عليه سواء فى حالته الصحيحة أو على هيئة مسحوق، تتضمن هذه الدراسة الفحص العياني والمجهري لأوراق وساق وجذور هذا النبات.