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MACRO-AND MICROMORPHOLOGICAL STUDY OF LEAF AND STEM OF LAUNAEA SPINOSA GROWING IN EGYPT

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ABSTRACT

The macro-and micromorphological characters of leaf and stem of Launaea spinose (Forssk.) Fam. Asteraceae are described and illustrated. These characters were found useful in the identification of each of the two organs both in the entire and powdered forms.

INTRODUCTION

Launaea spinosa (Forssk) (Fam. Asteraceae) is a spiny shrub growing in the Eastern desert, Sinai and Red Sea coastal region in Egypt. It is known by the Arabic names: kebaath, kabath, keddad or Zaggwa[1].

Chemical studies of the aerial parts of the plant lead to the isolation of the coumarins: cichorin, dihydroscopoletin; the flavonoids: luteolin 7-0-glucoside, apigenin 7-glucoside and gentiobioside, luteolin 7-glucoside, 7-rutinoside, 7,3'-diglucoside, 7,4'-diglucoside and gentiobioside-4'-glucoside; the triterpenes; friedelin, lupeol and its acetate, taraxasterol,-taraxasterol-30-aldehyde, moreten-3 ß, 19 α-diol moreten-3 ß, 28-diol and olean-3 ß, 19-diol; the sterols, ß-sitosterol, stigmasterol and their glucoside and the sesquiterpene lactone glucoside crepidiaside A[2-4].

The macro-and micromorphological characters of the flower of L. spinosa has been reported[5]. It was deemed important to carry out the macro-and micromorphology of the leaf and stem of the plant aiming at finding out the diagnostic features of both organs which can help in identifying each of the two organs both in the entire and powdered forms.

EXPERIMENTAL

Material:

Fresh sample of Launaea spinosa (Forssk.) was collectred from the shrub growing wildly in Waddi Hagool (Cairo-Suez road) in April 1989. The plant was kindly authenticated by Mr. M. El-Gebail, Technical Assistant of Plant Taxonomy, National Research Centre, Cairo. Fresh branch and leaf samples preserved in a mixture of alcohol-glycerol-water (1:1:1) were used.

Macromorphology:

Launaea spinosa (Forssk) (Fig. 1) is a shrub reaches up to 150 cm in length. It shows cylindrical, erect, green branches bearing numerous green spines and small cauline leaves. Flowers are terminal and axillary yellow capitula.

Leaves (Fig. 1) are deciduous, cauline, alternate, sessile, exstipulate, green, glabrous with pinnate reticulate venation. The upper leaves have decurrant symmetric bases, while the older lower ones have amplexicauls. The lamina is pinnatisect with linear or triangular lobes, entire margins and acuminate apices measuring 4-5.5 cm in length and 0.6-1.2 cm in width.

Stem (Fig. 1) is solid, erect, spiny, almost cylindrical monopodially

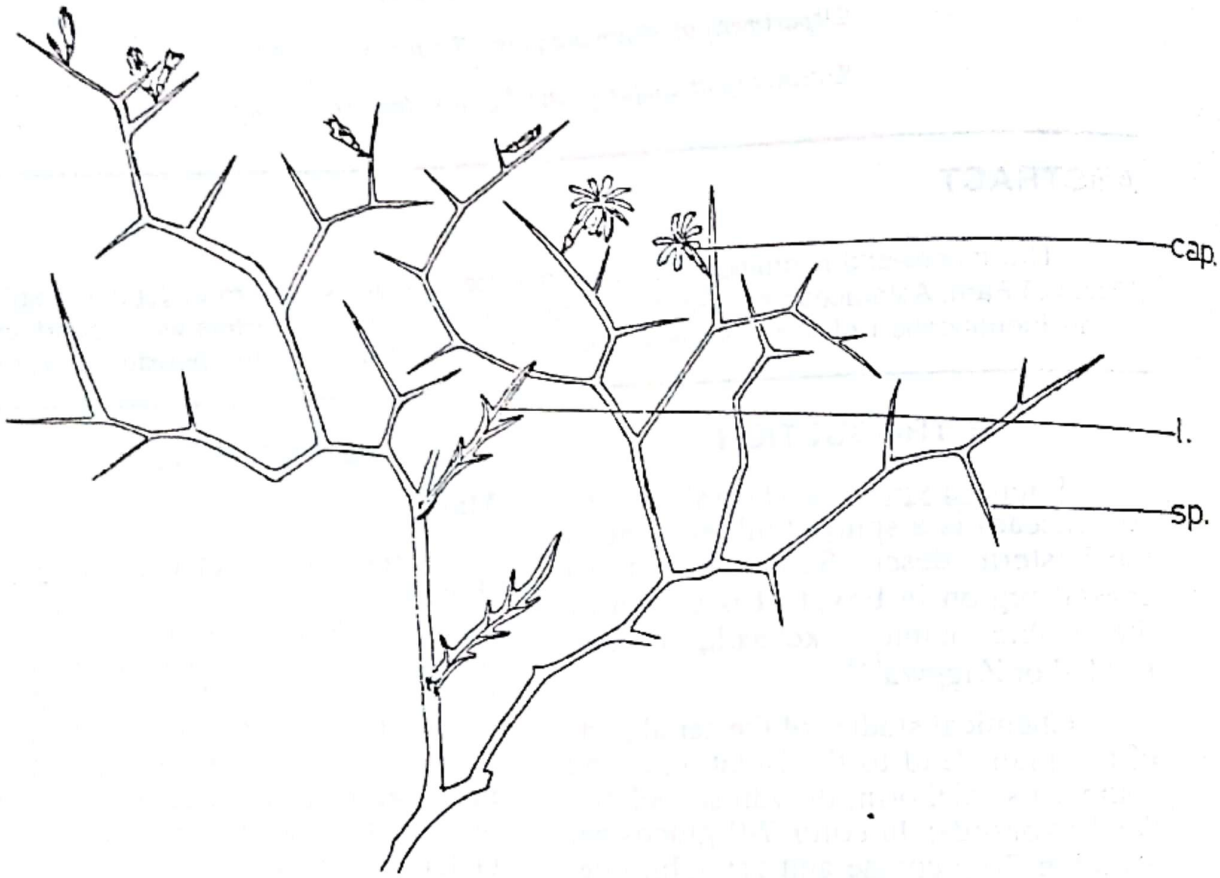

Fig. (1): Macromorphology of Launaea spinosa (Forssk.) (x 1/166).

cap., capitulum; 1., leaf; sp., spine.

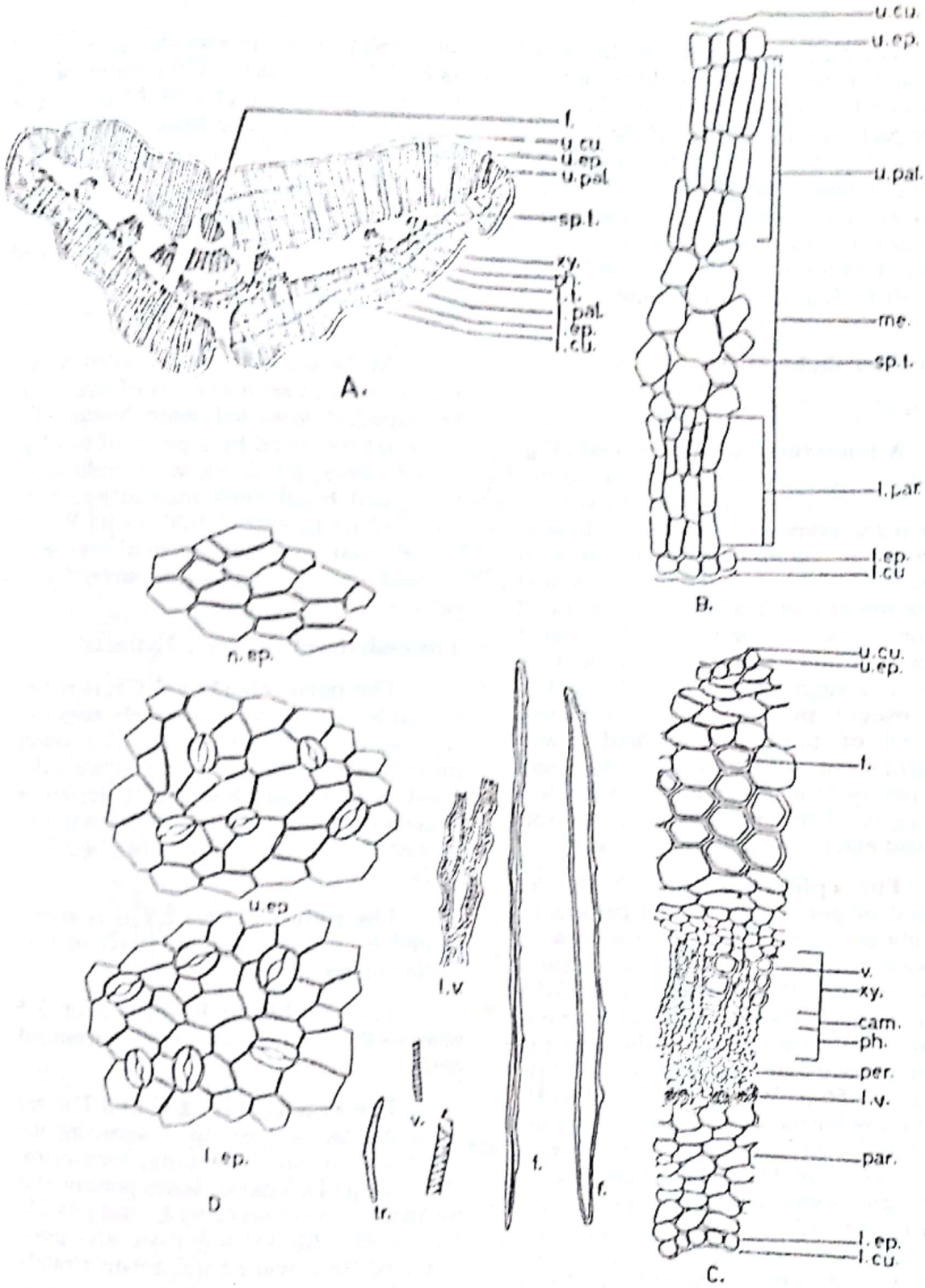

Fig. (2): Micromorphology of Launaea spinosa (Forssk.).

The Leaf: A. Diagram of T.S. (x 43). B. Detailed T.S. passing through the cortical region (x 221). C. Detailed T.S. passing through the vascular bundle (x 248). D. Isolated elements (all, x 195 except fiber, x 267).

cam., cambium; f. fiber; l. cu., lower cuticle; l. ep., lower epidermis; l. par., lower parenchyma; l.v., laticiferous vessel; me., mesophyll; n. ep., neural epidermis; per., pericycle; ph., phloem; sp.t., spongy tissue; u.cu., upper cuticle; u.ep., upper epidermis; tr., tracheid; v., vessel; xy., xylem.

branched, glabrous, green on the upper part and rough showing longitudinal cracks and yellowish brown on the elder lower part. The internodes of the branches measure 2-5 cm in length and 0.02-2.5 cm in diameter. The spines are green, located at short alternate intervales and measure 1-3 cm in length. The fresh stem is flexible while the dry one breaks with short fracture in the outer and fibrous in the inner part.

Micromorphology:

The leaf:

A transverse section in leaf (Fig. 2 A): appears nearly planner on the upper surface, slightly depressed over the midrib and convex on the lower surface. It shows an isobilateral structure with palisade layer formed of 3 or 4 rows next to the upper and lower epidermises and discontinous over the midrib. The spong tissue is a layer formed of parenchyma cells. The vascular bundle of the midrib is crescent in shape and collateral, formed of upper xylem and lower phloem separated by a cambiform zone. The pericycle is presented by collenchyma cells. The upper cortical region showed patches of lignified fibers.

The epidermis (Fig. 2 D): is formed of polygonal, tabular cells with straight anticinal walls and covered with smooth cuticle. The upper epidermal cells measure (36-51-97 μ) L., (20-35-56 μ) W. and (27-30-36 μ) H. The lower epidermal cells are similar to those of the upper surface and measure (30-51-82 μ) L., (15-35-56 μ) W. and (18-20-23 μ) H. Neural epidermal cells are axially elongated and measure (35-51-82 μ) L. and (15-23-41 μ) W. Oval-shaped anomocytic and anisocytic stomata are present on both upper and lower surfaces measuring, (36-43-51 μ) L. and (25-28-30 μ) W. and (41-48-56 μ) L. and (43-35-29 μ) W. respectively. Trichomes are not present on both surfaces.

The mesophyll (Fig. 2 B): is represented by pallisade and spong tissue. The palisade is composed of 3 or 4 rows of columnar cells abutting both the upper and lower epidermises. The upper palisade cells are longer than those of the lower and measure (45-56-72 μ) L. and (18-20-23 μ) W. The lower cells measure (32-40-59 μ) L. and (17-19-21 μ) W.

The spongy tissue consists of a thin-walled irregularly round parenchyma. Calcium oxalate, starch granules and secretory structures are not present.

The cortical tissue (Fig. 2 C):

At the adaxial side, the cortical tissue consists of several rows of irregularly shaped, thin-walled parenchyma cells. They are traversed by a patch of 6-8 lignified fibers, fusiform, with undulating walls and blunt ends measuring (616-635-657 μ) L. and (10-20-33 μ) W. At the abaxial side, the cortical tissue is formed of 7-10 rows of parenchyma cells.

The endodermis : is not distinct:

The pericycle (Fig. 2 C): is represented by 4-6 rows of relatively small irregular collenchyma cells. The outer most layer of the pericycle is well defined by numerous, branched laticiferous vessels containing yellowish-brown, bitter taste contents and measure (14-20-31 μ) D.

The phloem (Fig. 2 C): is represented by a soft tissue consists of thin walled elements.

The cambium: is formed of 3-5 rows of thin-walled tangentially arranged cells.

The vessels (Fig. 2 C and D): are lignified, radially arranged, showing annular and spiral thickening, measuring (5-10-16 μ) D. Tracheids are present and measure (118-123-128 μ) L. and (10-13-15 μ) W. Medullary rays are non-lignified, thin-walled uniseriate strands extended in xylem region.

Powdered Leaf (Fig. 2 D):

The powdered leaf of Launaea spinoea (Frossk.) is green in colour, with characteristic odour and has a bitter taste. It is characterised microscopically by the

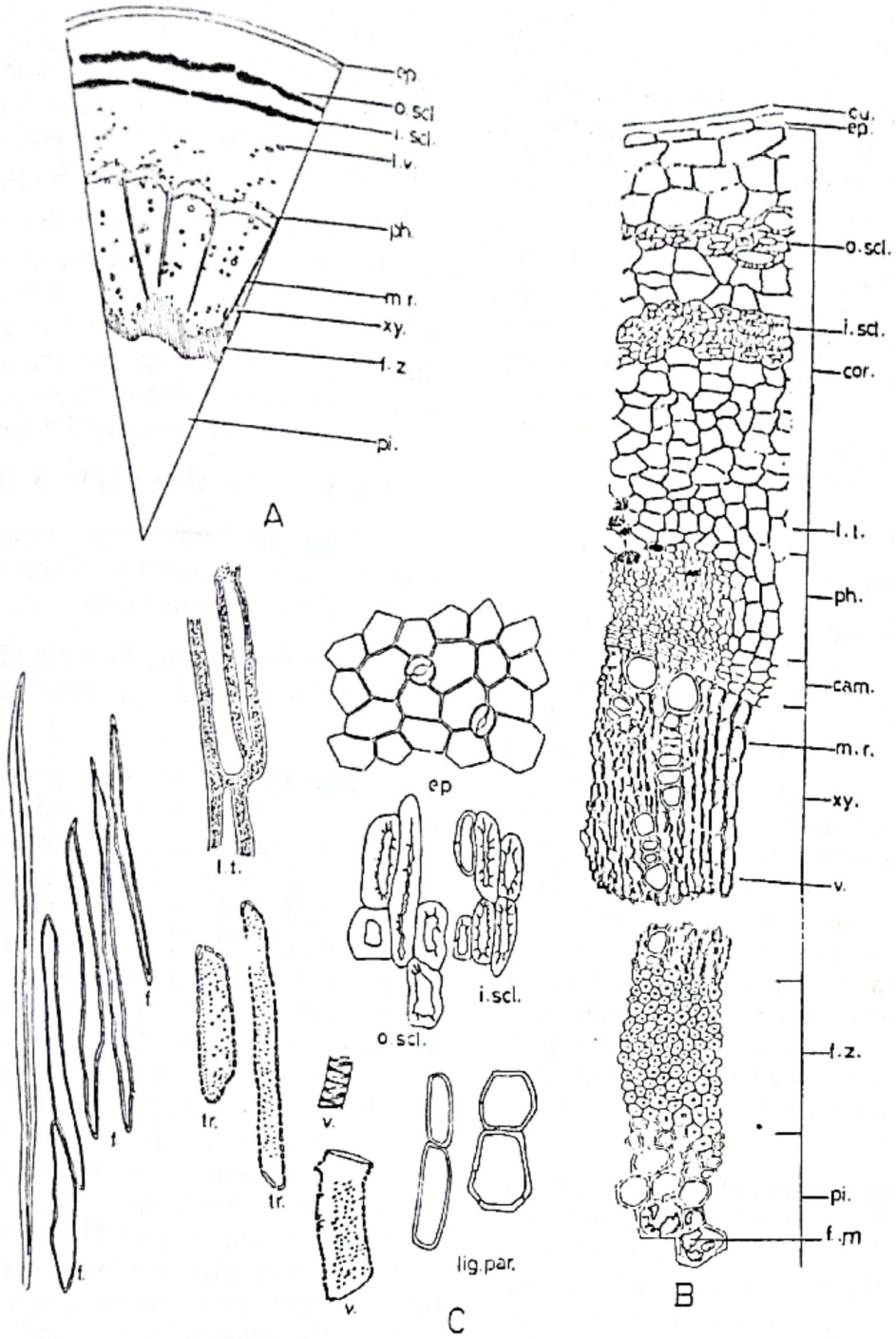

Fig. (3): Micromorphology of Launaea spinosa (Forssk.).

The Branch:

A. Diagram of T.S. (x 39).
B. Detailed T.S. (x 110).
C. Isolated elements. (x 202).

c., cuticle; cam., cambium; cor., cortex; ep., epidermis; f., fiber; f.m., flavonoid masses; f.z., fibrous zone; l.t., laticiferous tubes; lig.par., lignified parenchyma; m.r., medullary ray; o.scl., outer sclerenchyma; ph., phloem., pi., pith, tr., tracheid; v., vessel; xy., xylem.

presence of fragments of thin-walled epidermal cells with straight anticlinal walls, smooth cuticle and anomocytic and anisocytic types of stomata; thin-walled parenchyma cells; columnar thin-walled palisade cells filled with chloroplasts; lignified fibers with undulating walls and blunt ends; lignified vessels with spiral and annular thickenings and laticiferous vessels with brown contents. Starch granules, calcium oxalate crystals and trichomes are absent.

The Stem:

A. The Branch:

A transverse section in the branch (Fig. 3A) is more or less circular in outline. It shows an outer epidermis followed with a relatively wide cortical region (slightly less than 1/2 the diameter) having two discontinous separate layers of outer and inner sclereids. Branched laticiferous tubes are scattered in parenchyma next to the inner sclereids and extended in phloem region. The wide vascular tissue (about 1/3 diameter) is present as a continous ring, traversed by a tri-or most commonly pleuriseriate medullary ray strands. The central pith (about 1/3 the diameter) is surrounded at perifery by a thick fibrous zones of the primary tissue.

The epidermis (Fig. 3 C): of the branch: consists of polygonal axially elongated subrectangular epidermal cells with straight anticlinal walls and covered with smooth cuticle, measuring (35-50-69 μ) L., (25-30-35 μ) W. and (18-20-27 μ) J.; stomata are occasionally of anomocytic type, measuring (29-33-35 μ) L. and (24-27-29 μ) W. Trichomes are absent.

The cortex: consists of several rows of polygonal, thin-walled parenchyma cells. The anticlinal walls of the inner parenchyma are slightly more wavy than those of the outer cells. Two discontinous layers of outer and inner sclereids are present. They are polgyonal isodiametric or tangentially elongated with rounded angles and thick, lignified walls. The outer sclereids are present in 1-3 rows and measure (54-88-188 μ) L. and (36-40-109 μ) W, while those of the inner layer are arranged in 3-4 rows and measure (49-70-99 μ) L. and (19-24-29 μ) W.

The endodermis and the pericycle are parenchymatous and not differentiated from the parenchyma of the cortex. The parenchyma cells next to the inner sclereids are irregulary traversed by laticiferous tubes similar to those present in leaf but more numerous and wider.

The vascular tissue (Fig. 3 B):

The pholem: consists of thin-walled, soft, cellulosic elements with branched laticiferous vessels.

The camibum: is formed of 2-4 rows of thin-walled tangentially elongated cells.

The xylem: is mostly secondary and consists of lignified wood elements; vessels are rarely solitary but mostly in small radial groups of 2-4, they are wide, with pitted and reticulate thickening; measuring (28-50-72 μ) D; the tracheids are present in groups accompanying the vessels and measure (163-200-310 μ) L. and (24-30-35 μ) W.; the fibers are fusiform with straight or undulating walls adn bluntly tapering ends, measuring (183-280-396 μ) L. and (10-20-29 μ) W; wood parenchyma cells are rectangular in shape with modeately thick, slightly pitted, lignified walls. The medullary rays are tri-or pleuriseriate arranged in radial strands of elongated, thin-walled cells in the pholem region and slightly lignified cells in the xylem region.

The vascular elements of the primary tissue is formed of pirally lignified vessels, measuring (19-22-25 μ) L.; lignified thick walled wood fibers fusiform in shape and measure (440-500-658 μ) L. and (18-20-24 μ) W.; tracheids with pitted reticulate lignification and thick-walled, lignified wood parenchyma.

The pith: is formed of relatively large polygnal, moderately thick-walled and lignified cells with wide lumen and blunt angles. Some of the pith cells contain colouless masses of flavonoids

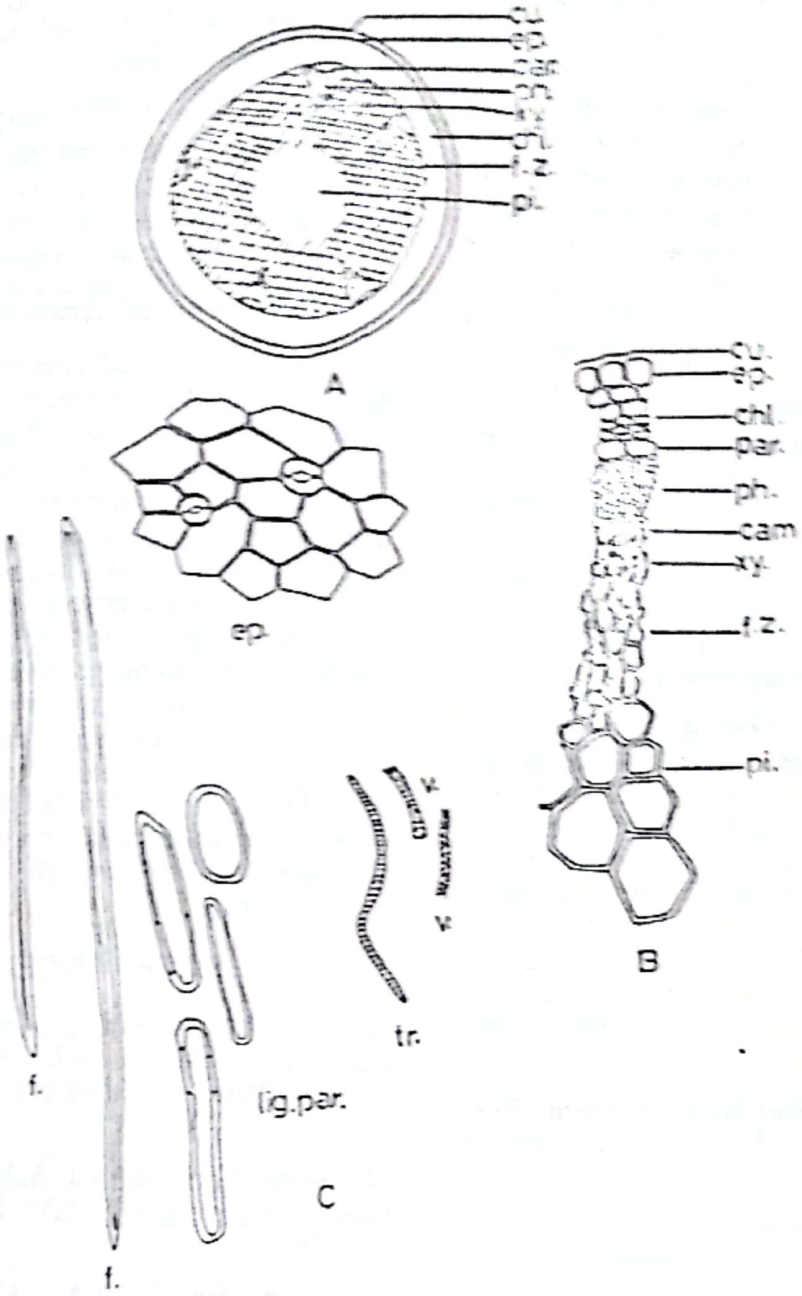

Fig. (4) Micromorphology of Launaea spinosa (Forssk.).

The Spine:

A. Diagram of T.S. (x 61).
B. Detailed T.S. passing through one of the vascular bundles (x 203).
C. Isolated elements (x 203).

c., cambium; chl., chlorenchyma; cu., cuticle; ep., epidermis; f., fiber, f.z., fibrous zone; lig.par., lignified parenchyma; par., parenchyma; ph., phloem; pi., pith.; tr., tracheid; v., vessel; xy., xylem.

which dissolve in dilute sodium hydroxide solution.

B. The spine:

A transverse section (Fig. 4 A) in the spine is nearly circular in outline, resembing a section in ayoung stem. The cortical tissue is comparatively wide (about 2/3 the diameter). The stele is formed of 5-7 vascular bundles and a central pith (about 1/3 the diameter).

The epidermis (Fig. 4 C): is formed of polygonal axially elongated subrectangular cells with straight anticlinal walls and covered with smooth cuticle measuring (17-54-69 μ) L., (30-39-47 μ) W, and (15-16-17 μ) H,; stomata are occasionally of anomocytic type and measure (20-27-30 μ) L. and (20-24-30 μ) W. Trichomes are absent.

The cortex (Fig. 4 B): consists of 3-4 rows of chlorenchymatous cells followed by 1-2 rows of thin-walled parenchyma cells, and 12-16 rows of lignified, thick-walled fibers, fusiform in shape, with moderately wide or narrow lumens and blunt or bluntly tapering ends measuring (384-483-542 μ) L and (8-17-22 μ) W; the endodermis and pericycle are parenchymatous and undifferentiated from the cortical tissue.

The vascular tissue system (Fig. 4 B): is formed of 5-7 collateral vascular bundles.

The phloem: consists of thin-walled, soft, cellulosic elements.

The cambium: is formed of 2-3 rows of thin-walled, tangentially elongated cells.

The xylem: consists of thick-walled lignified vessels present in 3-5 radial rows, with reticulate, spiral and annular thickening, measuring (4-7-10 μ) D. The tracheidial vessels have rounded or blunt ends and lignified walls like the vessels measuring (148-172-197 μ) L. and (4-6-9 μ) W. Wood parenchyma cells are lignified thick walled with a wide and pitted lumen.

The Pith: is formed of a thick-walled, lignified parenchyma cells containing colourless masses of flavonoids soluble in 10% sodium hydroxide solution giving a yellow coloured medium.

The Powdered Branch:

The powdered branch of Launaea spinosa (Forssk.) is green in colour with characteristic odour and has a bitter taste. Microscopically, it is characterised by the presence of fragments of thin-walled axially elongated epidermal cells with a straight anticlinal walls and anomocytic stomata; xylem elements consist of spiral, annular and pitted vessels; lignified tracheids and lignified wood fibers with straight or slightly wavy walls and tapering or bluntly tapering ends; lignified rectangular wood parenchyma; sclereids with thick, lignified pitted walls and laticiferous vessels with brown contents. Calcium oxalate, starch granules and hairs are absent.

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دراسة عقاقيرية لأوراق وسيقان نبات لاونيا سبينوزا الذى ينمو فى مصر

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فى هذا البحث تمت دراسة الصفات العيانية والمجهرية لأوراق وسيقان نبات الاونيا سبينوزا الذى ينمو فى مصر والتى اسفرت عن إمكانية الإستفادة بها فى التعرف على كلا من اوراق وسيقان هذا النبات والتفرقة بينها وبين الأعضاء الأخرى سواء كانت صحيحة أو على هيئة مسحوق