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PHARMACOGNOSTICAL STUDY OF GYNANDROPSIS PENTAPHYLLA (HURHUR) GROWING IN EGYPT

PART: 1: Macro and micromorphology of the Root, Stem and Leaf

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The macro and micromorphology of the root , stem and leaf of Gynandropsis pentaphylla Hurhur growing in Egypt are presented with view of finding the diagnostic characters for their identification in the entire and powdered forms.

Gynandropsis pentaphylla Hurhur (Fam. Capparidaceae) is an erect annual herb grows wild in Egypt. The plant is common in waste places, in fields and about villages and used as a pot-herb[1].

The Gynandropsis species are well known for their thioglycosides content[2] which are considered as rubefacients and counterirritants.

Gynandropsis species have attracted only scant chemical and botanical interest[3,4,5,6]. It was therefore, necessary to perform a comprehensive study of all vegetative organs of some plants within this genus. The present article deals with the macro- and micromorphology of the root, stem and leaf of Gynandropsis pentaphylla growing in Egypt.

Habitat:

Gynandropsis pentaphylla (Hurhur) is an annual weed, common in field during the rainy season. The herb attaining 20 to 60 cm in height and has erect herbaceous stems. It bears green, alternate, long-stalked compound leaves and numerous purplish flowers in a terminal raceme.

The plant propagates by seeds and gives its flowers in February and March. The fruits are capsule, long and striated.

EXPERIMENTAL

Materials:

Collection was made from plants growing wild in the Experimental Station of Medicinal Plants, Faculty of Pharmacy, Assiut University. The plant was identified by late Prof. Dr. Foad Y. Amin, Prof. of Floriculture, Faculty of Agriculture, Assiut University. Fresh plants as well as plants preserved in a mixture of alcohol: glycerin: water (1:1:1) were used.

MACROMORPHOLOGY

The root (Fig. 1) is a cylindrical, fusiform tap root, measures about 12 to 18 cm in length and 0.5 to 1.8 cm in diameter at the middle part. The tap root bears numerous lateral roots which bear in turn numerous rootlets. Externally the root is greyish-brown in colour with rough surface. It is almost odourless and has a bitter tast.

The stem (Fig. 1) is erect, herbaceous, hollow and cylindrical , reaching up to 40 cm in length and 1.5 cm in diameter at the basal part. It shows monopodial branching .

The stem is smooth, green to greyish-green in colour, with a faint odour, slightly bitter tast and breaks with fibrous fracture.

The leaf (Fig. 1): The plant carries alternate, exstipulate, long stalked, compound palmate leaves with 3 to 5 leaflets. The leaflets are sessile, obovate or oblanceolate in shape, having acute or obtuse apex, entire margin and measures from 2 to 4 cm in length and 1 to 1.8 cm in width at the widest part. The surfaces are hairy and the upper surface is dark green in colour but the lower one is lighter. Venation is pinnate reticulate.

The rachis is nearly cylinderical to subcylinderical in outline, green in colour, hairy and measures from 4 to 7 cm in length and 0.1 to 0.2 cm in diameter. The leaf possesses a characteristic odour and a slightly bitter taste.

MICROMORPHOLOGY

The Root:

A transverse section through the root (Fig. 2A) is nearly rounded in outline showing a superficial layer of irregular cork surrounding a comparatively wide bark. The pericycle is parenchymatous followed by a ring of soft phloem. The cambium forms a distinct layer, followed by a wide region of radiating xylem.

The primary xylem is diarch and hardly distinct in the center of the old root. Uni or biseriate medullary rays are numerous and traverse the phloem and the xylem. No cell-contents are observed.

The cork (Fig. 2,B and C) : is formed of a narrow zone of several rows of brownish, tabular, somewhat tangentially elongated cells. In surface view, they are polygonal, usually elongated to subrectangular in shape. The cells have thin non-lignified walls and measure about 50-130 μ in length, 50 to 95 μ in width and 20 to 45 μ in height.

The cortex (Fig. 2,B): the outer few layers of the cortex (phelloderm) are formed of thin-walled, tangentially elongated, subrectangular to polygonal parenchymatous cells. The remaining layers constitute the primary cortex which is formed of ordinary parenchymatous cells, showing intercellular spaces. No cell contents are observed.

The vascular system (Fig. 2,B and C): the phloem is formed of soft cellulosic elements showing collapsed sieve tubes, companion cells and phloem parenchyma. The cambial zone is composed of few rows of thin-walled tangentially elongated cells. The xylem is formed of a comparatively wide cylinder of lignified, pitted elements and ordinary parenchyma. It is difficult to trace the primary xylem strands in old root. The vessels are mostly solitary and arranged in radial and tangential rows of 2 to 6. They are wide, lignified, showing mostly transversly elongated simple and bordered pits and transverse or oblique end walls. They measure from 40 to 150 μ in diameter. The vessels are usually

accompanied by few tracheids. They have pointed and rounded tips with lignified pitted walls, measuring from 30 to 100 μ in diameter and 120 to 360 μ in length. Wood fibres are numerous, with moderately thin lignified walls, showing acute to acuminate apices, wide lumena and measuring from 250 to 490μ in length and from 10 to 35μ in diameter.

The wood parenchyma are usually in vertical rows, consisting of rectangular, axially elongated cells, with pitted, lignified walls.

The medullary rays are numerous usually uni or biseriate. They are formed of moderately thick-walled, lignified pitted cells in the xylem and thin-walled cellulosic cells in the phloem.

The Powder :

Powdered root is light brown to yellowish brown in colour. It has no characteristic odour and a bitter taste. It shows:

1- Fragments of brown, thin-walled, non lignified cork cells.
2- Fragments of thin-walled, parenchymatous cells from the cortex.
3- Fragments of soft cellulosic and parenchymatous phloem cells.
4- Fragments of lignified xylem elements consisting of vessels having simple and bordered pits, tracheids with pitted walls, wood parenchyma and wood fibres.
5- Absence of calcium oxalate, starch and sclereids.

The Stem:

A transverse section in the stem (Fig. 3.A) is nearly circular in outline. It shows an epidermis enclosing a

collenchymatous hypodermis followed by a comparatively narrow parenchymatous cortex. The pericycle is formed of groups of thick-walled lignified pericyclic fibres which are interrupted by thin-walled parenchyma. The pericycle surrounds the central cylinder which is formed of a complete ring of vascular elements. The vascular cylinder consists of an external narrow phloem and internal radiating xylem ring. The phloem and xylem are traversed by narrow uni or biseriate medullary rays and separated by a cambial zone. The pith is centric and partly hollow.

The epidermis: (Fig. 3,B and C) appears in transverse section as one row of square to subrectangular cells. In surface view (Fig. 3,C) the cells appear polygonal mainly axially elongated with straight anticlinal walls and measure from 50 to 200 μ in length, 40 to 80μ in width and 35 to 60 μ in height. The epidermal cells are covered with thin smooth cuticle. Stomata of anomocytic type are numerous, each is surrounded with 4 to 6 subsidiary cells. The stomata are oval to rounded in shape and measur from 25 to 50 μ in length and from 35 to 45 μ in diameter. No trichomes or cell contents are observed.

The cortex: (Fig. 3,B) Shows an outer layer of 3 to 5 rows of more or less rounded or oval collenchymatous cells. These are followed by several rows of large thin-walled, parenchymatous cells with wide intercellular spaces. Secretory cells filled with brownish amorphous masses of tannin, which gives greenish blue colour with ferric chloride T.S. are

scattered.

The pericycle (Fig. 3,B & D): Consists of lignified groups of fibres interrupted by thin-walled parenchyma. These fibres are subcylindrical in shape having slightly thick-walls, wide lumena and blunt to rounded apices. They measure from 400 to 590 μ in length and 25 to 45μ in diameter.

The vascular system (Fig. 3,B and D) is represented by a continuous ring consisting mainly of secondry elements and is traversed by narrow medullary rays.

The phloem is formed of a complete narrow ring, consisting of thin-walled, cellulosic soft elements of sieve tubes, companion cells and phloem parenchyma. The cambial zone is formed of few rows of cellulosic, thin-walled cambiform cells, which are subrectangular, tangentially elongated, and radially arranged.

The xylem is formed of lignified vessels, fibres tracheids and parenchyma. The vessels show simple or sometimes bordered pits, some have spiral or reticulate thickening. They measure from 40 to 110 μ in diameter. The vessels are accompanied by lignified pitted tracheids having simple or bordered pits and measuring from 25 to 60 μ in diameter and 90 to 220 μ in length . The wood fibres have straight, lignified walls, wide lumena, acute and tapering apices and measure from 15 to 30 μ in diameter and 300 to 480 μ in length. The wood parenchyma cells are lignified, pitted and measure from 20 to 60 μ in width and 50 to 105 μ in length.

The medullary rays are usually uniseriate, sometimes biseriate. These cells are subrectangular with simple pitted

non-lignified walls in the phloem, but lignified in the xylem .

The pith is formed of somewhat large, rounded, moderately thin-walled parenchymatous cells, with narrow intercellular spaces. No cell contents are present.

The Powder:

The powdered stem is yellowish-green in colour having a faint odour and a bitter taste. It shows:

1- Fragments of polygonal, axially elongated epidermal cells, having straight anticlinal walls covered with smooth cuticle, showing anomocytic stomata.
2- Fragments of slightly lignified pericyclic fibres with wide lumena and blunt to rounded
3- Fragments of lignified vessels with pitted, spiral and reticulate thickening.
4- Fragments of tracheids and tracheidal vessels with pitted and lignified walls.
5- Fragments of lignified wood parenchyma and medullary rays with pitted walls.
6- Fragments of thin-walled parenchymatous cells, containing amorphous substance which give greenish-black colour with ferric chloride T.S..
7- Absence of calcium oxalate, starch and sclereids.

The Leaf:

1- The lamina of the leaflet: (Fig. 4, A) A transverse section in the lamina through the midrib appears concavo-convex in outline. It shows dorsiventral, heterogenous

mesophyll traversed by several collateral vascular bundles.

The epidermis(Fig. 4,a ,b, & c): The epidermal cells of the upper and lower surfaces of the lamina are polygonal, isodiametric or somewhat elongated with slightly wavy anticlinal walls and covered with thin smooth cuticle. It contain protein bodies which stain yellow with alcoholic picric acid solution and orange-brown with N/50 iodine solution. The cells of both epidermises are somewhat equal in size and measure from 25 to 50 μ in height, 55 to 150 μ in length and 40 to 75 μ in width.

The neural epidermal cells (Fig. 4,c) of both surfaces are polygonal, axially elongated with straight anticlinal walls, ameasuring from 125 to 230 μ in length, 25 to 70 μ in width and 35 to 75 μ in height.

Stomata of anomocytic type are present in both surfaces, measuring from 20 to 40 μ in width and 35 to 60 μ in length.

Glandular and non-glandular trichomes, covered with smooth cuticle, are present on both surfaces, being more frequent on the lower surface. The glandular trichomes usually have multicellular, biseriate stalk and multicellular head. The stalk measures from 70 to 115 μ in length and 45 to 105 μ in width, the head is nearly globular and consists of 5 to 8 cells and measures from 50 to 75 μ in diameter.

The non-glandular trichomes are usually multicellular, biseriate with acute apices. They measure from 150 to 300 μ in height and 55 to 110 μ in width at the base.

The mesophyll (Fig. 5,B): The palisade forms an upper zone of one layer of cylindrical columnar cells containing chloroplasts, measuring from 40 to 80 μ in length and 15 to 35 μ in width. The spongy mesophyll is formed of thin-walled more of less rounded to irregular parenchyma with wide

intercellular spaces. It contains protein bodies and secretory cells filled with brownish amorphous masses of tannin which give greenish- blue colour with ferric chloride T.S.

The cortical tissue (Fig. 5,A): it consists of upper and lower collenchyma formed of about 2 to 3 rows of rounded or oval somewhat irregular rounded cells with thin walls and narrow intercellular spaces. The rest is formed of parenchyma cells with wide intercellular spaces, containing protein bodies and tannin.

The vascular system (Fig. 5,A & 4 C): The vascular tissue consists of several radially arranged collateral vascular bundles surrounded by a parenchymatous pericycle which is interrupted by isolated groups of collenchymatous cells above and below the vascular bundles. The phloem is formed of soft cellulosic elements showing sieve tubes, companion cells and phloem parenchyma. The xylem is formed of spiral, reticulate and annular lignified vessels measuring from 15 to 75 μ in diameter. Medullary rays are uniseriate, rarely biseriate and non-lignified.

The subsidary vascular bundles show the same general charaters as described above except that the pericycle is parenchymatous,

2- <u>The Rachis</u>: (Fig. 4, B & 5 C)

A transverse section through the rachis is somewhat rounded in outline. The epidermis encircles a wide parenchymatous cortex with peripheral collenchymatous zone of 2 to 3 rows.

The vascular system is represented by 6 to 9 separate collateral vascular bundles arranged in a ring. The bundles show the same general characters as that of the midrib of

the lamina except that the pericycle is formed of a patch of fibres at the top of each vascular bundles. The fibres have thin lignified walls with wide lumena, and tapering pointed apices.

In the center, the wide parenchymatous pith occupies about one half of the diameter.

The epidermis (Fig. 4, C): The epidermal cells are polygonal, axially elongated with nearly straight anticlinal walls, covered with smooth cuticle and bears trichomes as those of the lamina. Stomata are rare .

The Powder:

The powdered leaves are green in colour with a characteristic odour and a slightly bitter tast.

Microscopically the powder shows the following:

1-Fragments of epidermal cells showing polygonal, isodiametric cells with slightly wavy anticlinal walls and covered with smooth cuticle. These fragments show anomocytic stomata, multicellular, biseriate non-glandular hairs and multicellular, biseriate stalk , multicellular head glandular hairs. Fragments of the neural region and of the rachis with elongated epidermal cells.

2- Fragments of mesophyll, showing palisade and spongy parenchyma cells.

3- Fragments of cortical tissue consisting of collenchyma and parenchyma cells.

4- Fragments of pericycle fibres of the rachis isolated or in groups with wide lumena, lignified walls and tapering ends.

5- Fragments of parenchyma containing protein bodies and scattered tannin cells.

6- Fragments of broken reticulate, spiral and annular lignified xylem vessels.

Pharmacognostical study of Gynandropsis pentaphylla (Hurhur) growing in Egypt

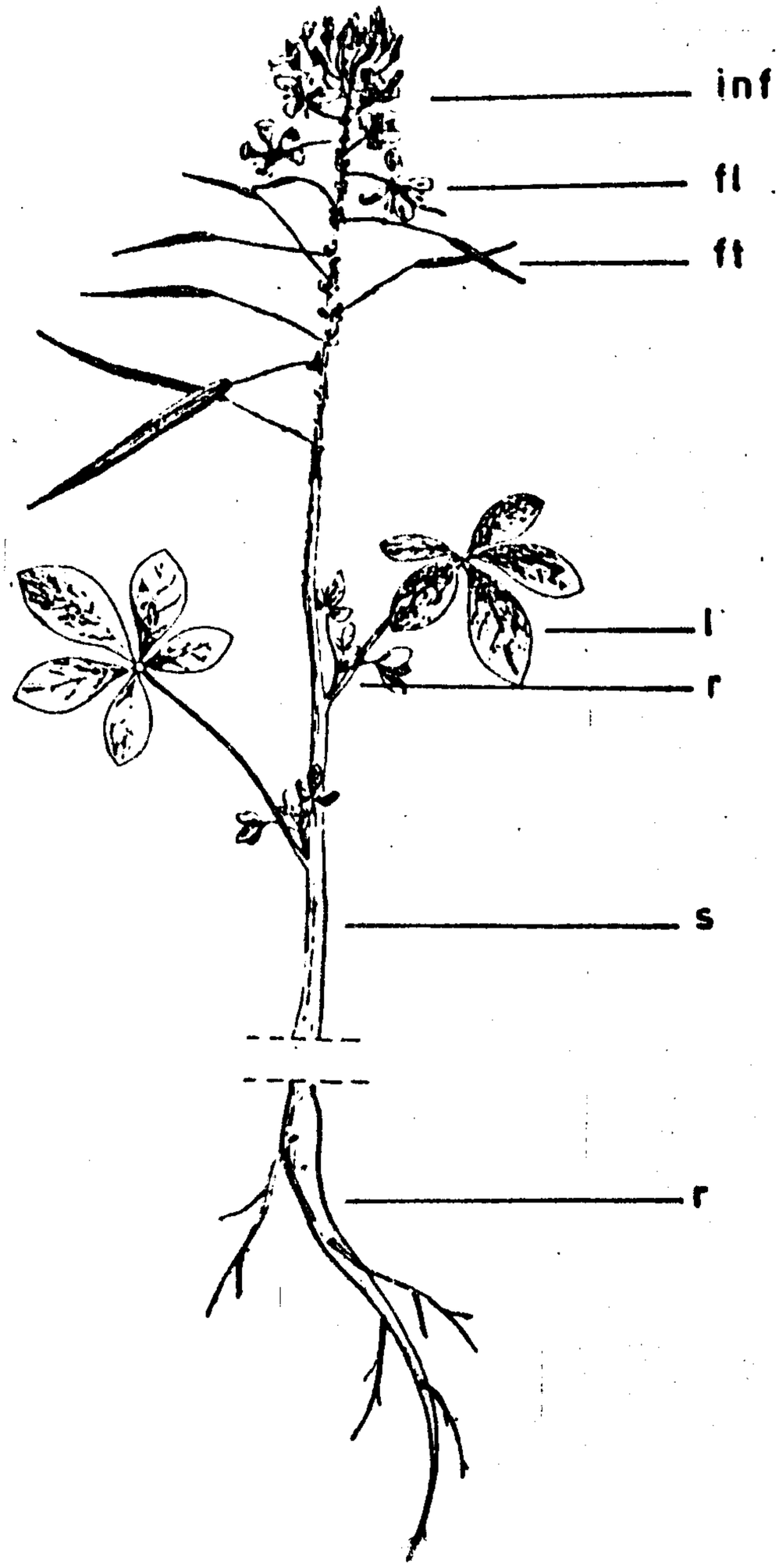


Fig. 1: Sketch of Gynandropsis pentaphylla X 2

fl., flower; inf., inflorescence; ft., fruit; l., leaflet; r., rachis; rt., root; s., stem.

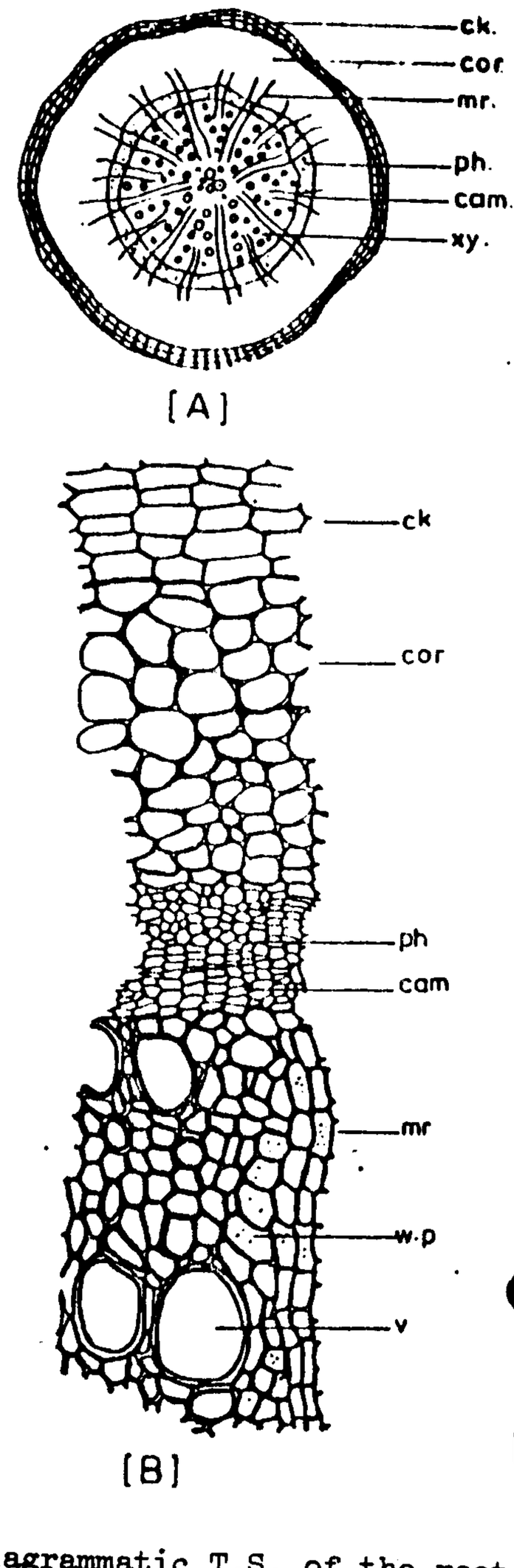
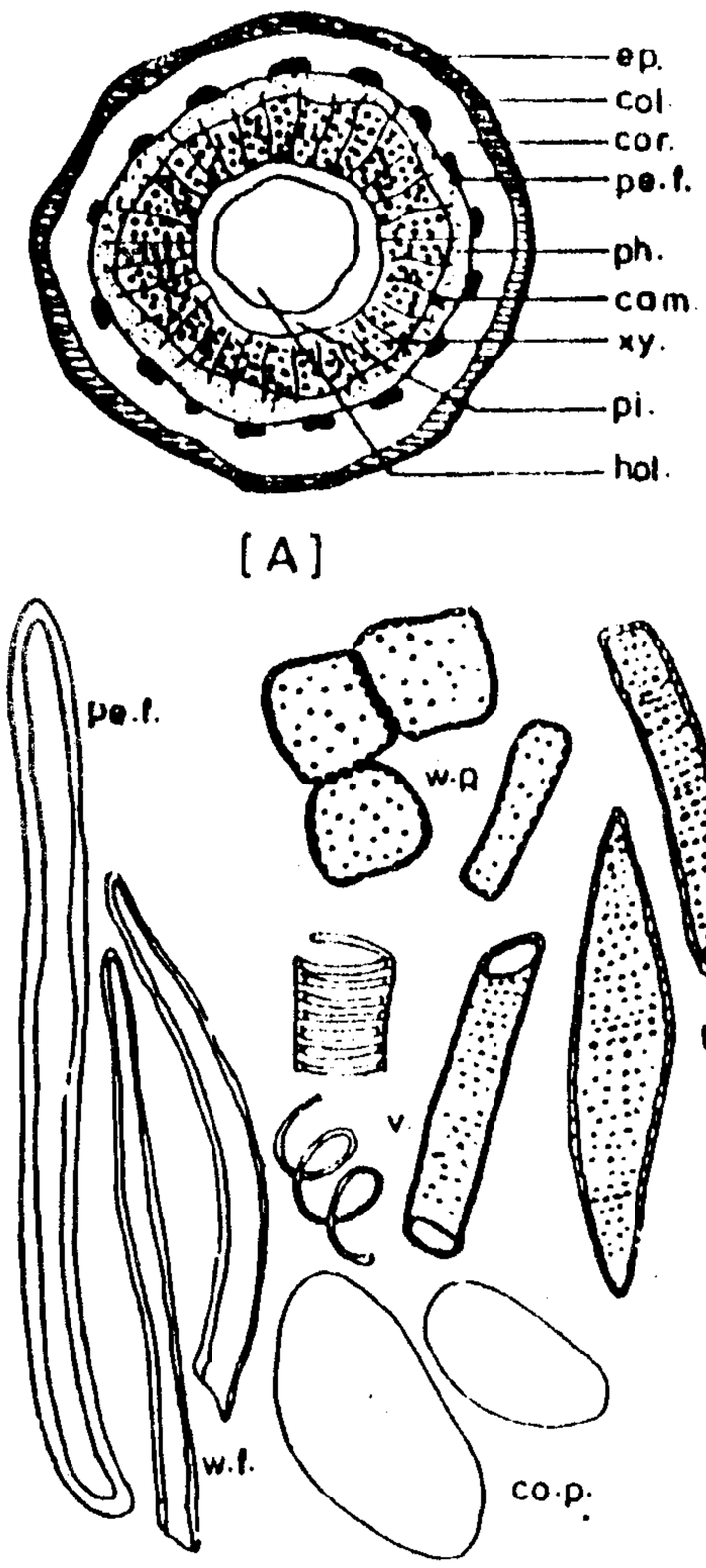


Fig. 2: A. Diagrammatic T.S. of the root X 4
B. Detailed T.S. of the root X 120
C. Isolated elements of the root X 200

cam., cambium; ck., cork; cor., cortex; mr., medullary ray; ph., phloem; tr., tracheid; v., vessel; w.f., wood fibre; w.p., wood parenchyma; xy., xylem.



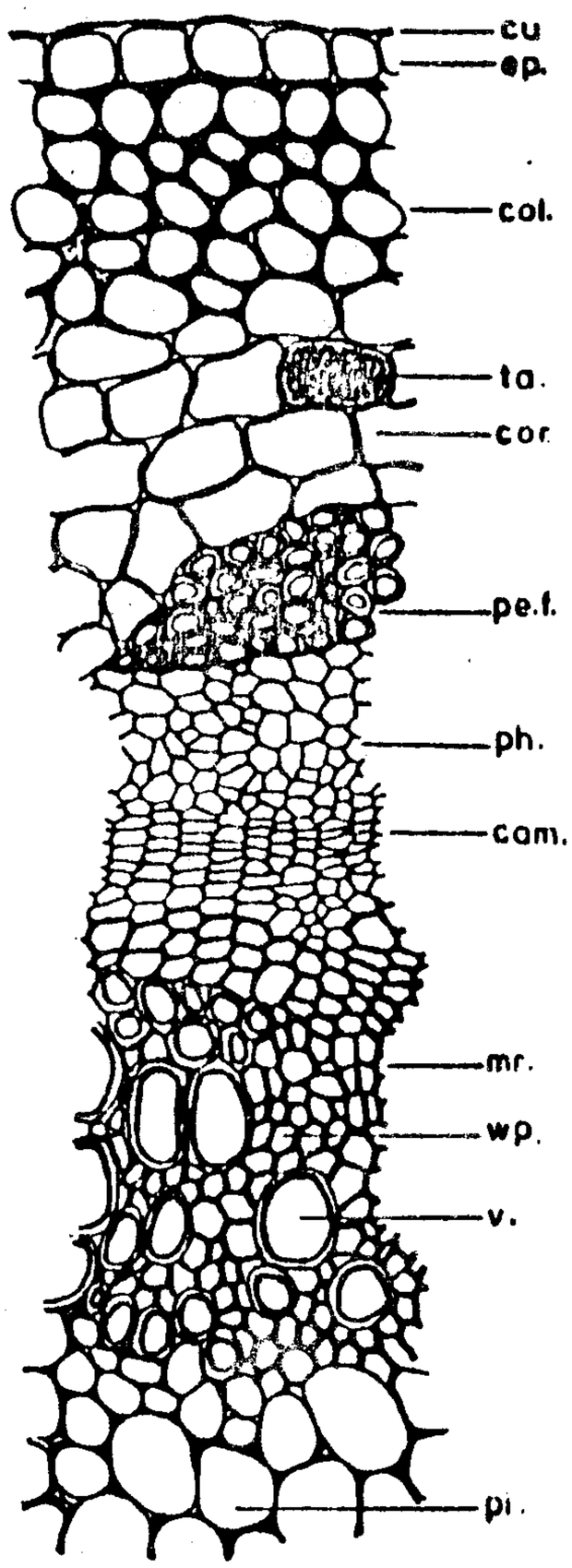


Fig. 3: A. Diagrammatic T.S. of the stem X 5
B. Detailed T.S. of the stem X 120
C. Surface preparation of the stem X 200
D. Isolated elements of the stem X 200

cam., cambium; co.p.,cortical paremchyma; col., collenchyma; cor., cortex; cu., cuticle; ep., epidermis; hol., hollow; mr., medullary ray; pe.f; pericyclic fibre; ph., phloem; pi., pith; s., stomata; ta., tannin; tr., tracheid; v., vessel; w.f., wood fibre; w.p., wood parenchyma; xy., xylem.

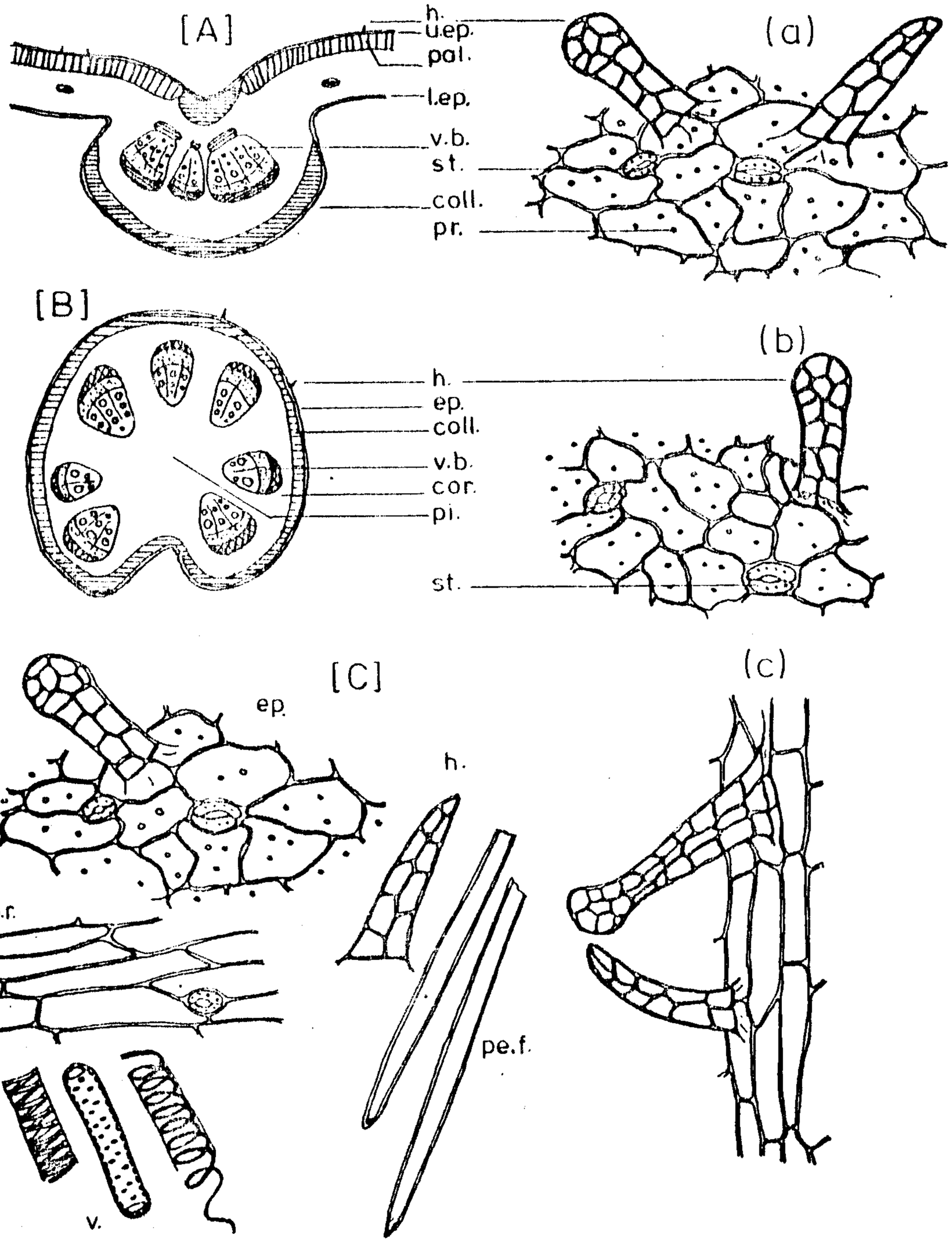


Fig. 4: A. Diagrammatic T.S. of the leaf X 27
B. Digrammatic T.S. of the rachis X 27
C. Isolated elements of the leaf X 204
a- Surface preparation of the leaf (Upper Surface) X 204
b- Surface preparation of the leaf (Lower Surface) X 204
c- Surface preparation of the leaf (Neural) X 204

coll., collenchyma; cor., cortex; ep., epidermis; ep. r., epidermis of the rachis; h., hair; l.ep., lower epidermis; pal., palisade; par., parenchyma; pe.f., pericyclic fibre; pi., pith; st., stomata; u.ep., upper epidermis; v.b., vascular bundle.

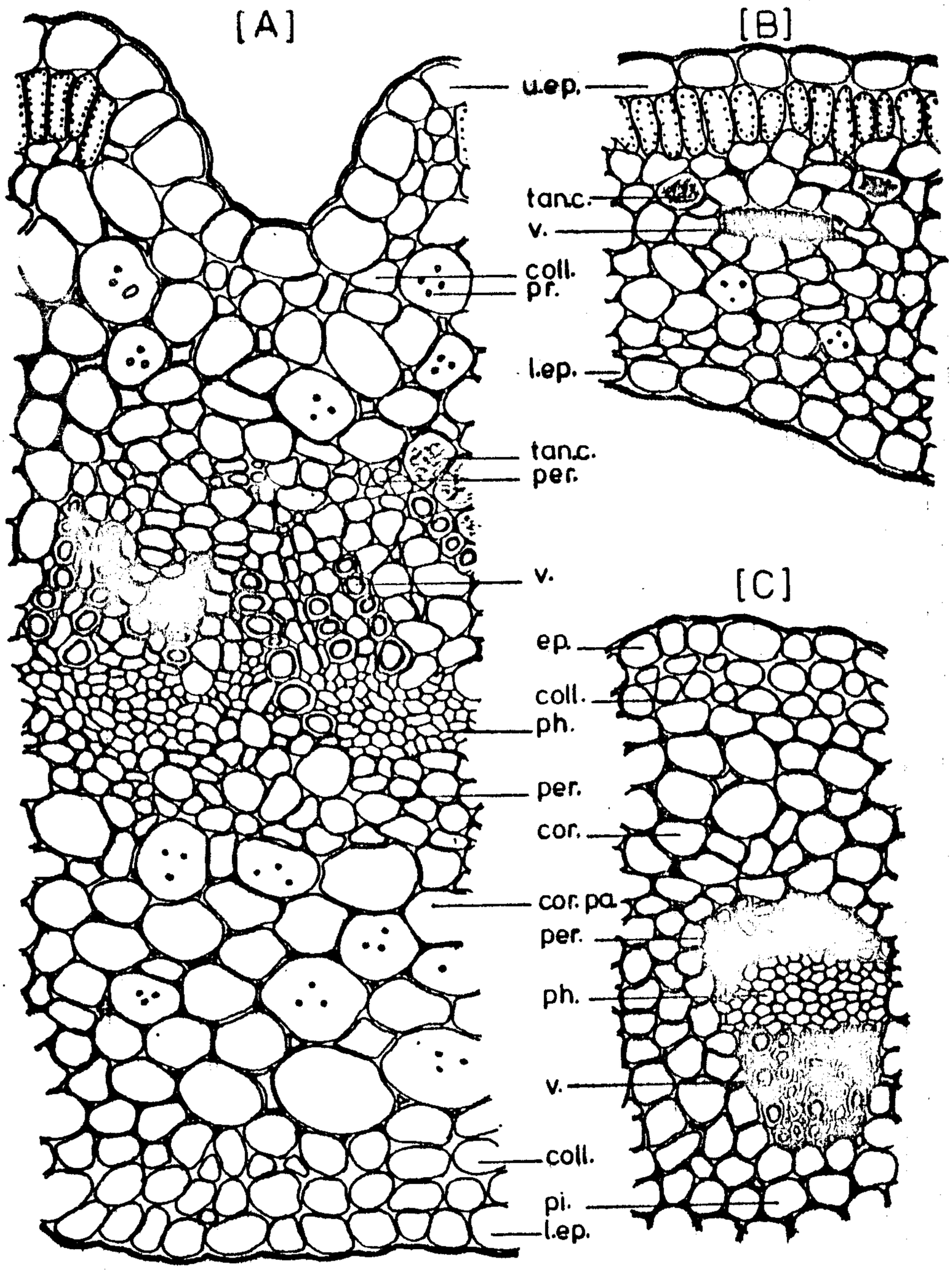


Fig. 5: A & B. Detailed T.S. of the leaf. X 204
C. Detailed T.S . of the rachis X 204

coll., collenchyma; cor., cortex;cor.par., cortical. parenchyma; ep., epidermis; L.ep., lower epidermis; m.r., medullary ray; pal., palisade; ph.,phloem; pi., pith; pr., protein; per., pericycle; tan.c., tanniferous cell; u.ep., upper epidermis; v. vessel;

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دراسة عقاقيرية لنبات الجيناندروبس بنتافيلا (هرهر) الذى ينمو فى مصر

الجزء الاول: دراسة عيانية ومجهرية للجذر والساق والورقة

احمدعبد الرحمن على ـ مصطفي كامل مصباح ـ هناء محمد سيد
قسم العقاقير ـ كلية الصيدلة ـ جامعة اسيوط

فى هذا البحث اجريت دراسة عيانية ومجهرية لجذر وساق وورقة نبات الجيناندروبس بنتافيلا (هرهر) الذى ينمو فى مصر . وهذه الدراسة تساعد على التعرف عليه سواء كانت صحيحة او على هيئة مسحوق.

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