

## MACRO-AND MICROMORPHOLOGY OF RHYNCHOSIA MINIMA

L.DC. (ROOT, STEM AND LEAF)

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### ABSTRACT

*The macro-and micromorphological characters of the root, stem and leaf of Rhynchosia minima L.DC., growing in Egypt are presented with the aim of finding out the characteristic features by which these organs could be identified in both the entire and powdered forms.*

### INTRODUCTION

*Rhynchosia* is a small genus belonging to the sub-family papilionoidae, family leguminosae<sup>1,2,3</sup>. It is represented in Egypt by only one species *Rhynchosia minima*<sup>1</sup> L.DC., from which C-glycosyl flavonoides only were isolated<sup>4</sup>, and no further investigations could be traced in the literature.

Al-Magboul et al<sup>5</sup> reported that the chloroformic and methanolic extracts of the fruit of *Rhynchosia viscosa* (Roth) DC. had an antibacterial activity against *Bacillus subtilis* and *Pseudomonas aeruginosa*.

The present work deals with the macro-and micromorphological characters of the roots, stems and leaves of *Rhynchosia minima* L.DC. aiming to present the diagnostic characters of these organs by which they could be identified.

### EXPERIMENTAL

#### Plant Material :

Flowering plants of *Rhynchosia minima* L.DC. growing wildly in El-Kharga (the New Valley) were collected in January 1990.

The plant was kindly verified by Dr. Moamen Mostafa, lecturer of plant Taxonomy, Faculty of Sciences, Assiut University. The material used in this study was fresh or preserved in alcohol 70% containing 5% glycerin.

### MACROMORPHOLOGY

#### Habitat :

*Rhynchosia minima* L.DC. (Fig. 1) is an annual, erect herb, 60-80 cm high. It flowers during January to February.

**The Root** (Fig. 1A); tap root system, yellowish-brown, 30 cm in length and 7-10 mm. in diameter at its upper part, bears several lateral rootlets, outer surface shows fine longitudinal wrinkles on drying, flexible and tough to break, fibrous interior and faint odour.

**The Stem** (Fig. 1B): twining, cylindrical, solid, longitudinally striated, green to yellowish-green. 40-60 cm in length and 5-10 mm in diameter, smooth, flexible, fibrous fracture, odourless and has a slight bitter taste.

**The Leaf** (Fig. 1B); compound of three leaflets, stipulate, the central leaflet is broadly ovate while the other two leaflets are oval in shape. The leaflets are membranous, thin and brittle when dry, have symmetric bases, rounded apices and entire margin. The lamina measures 1-2.5 cm in length and 1-2 cm in width. Venation is pinnate reticulate, the midrib and veins are prominent on the lower surface and slightly depressed on the upper. The leaf has a green

long petiole measuring 2-3 cm in length and about 2 mm in diameter. The leaflets are green in colour when fresh changing to yellowish green on drying, odourless and have a slight bitter taste.

### MICROMORPHOLOGY

#### The Root:

A transverse section of the root (Fig. 2A) is more or less rounded with slightly wavy outline. It shows reddish brown cork followed by a comparatively narrow parenchymatous secondary cortex and then a pericycle surrounding a central cylinder of vascular tissue. It comprises a narrow phloem and a wide xylem, traversed by biseriate medullary rays.

**The Cork** (Fig. 2B,3); consists of 4 or 5 radially arranged rows of thin-walled non lignified polygonal, tabular cells. They measure 22-33-44 u in length, 18-31-44 u in width and 9-14-18 u in height.

**Cortex** (Fig. 2B); consists of 5-7 rows of rounded thin-walled parenchymatous cells with intercellular spaces. The cortex contains prisms of caox and tanniferous cells. The starch granules are simple, spherical and small or compound with two to four or more components some of the granules show a faint, rounded shaped hilum.

**The pericycle** (Fig. 2B,3); is formed of 5-8 layers of thin walled parenchymatous cells in which scattered groups of thick-walled lignified fibres with narrow lumina and tapering pointed to blunt apices, accompanied by a crystal sheath.

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**The Phloem** (Fig. 2B); is represented by a continuous ring composed of sieve tubes, companion cells, phloem parenchyma with no fibres.

**The Cambium** (Fig. 2B); consists of 3-7 rows of tangentially elongated radially arranged, thin-walled meristematic cells.

**The Xylem** (Fig. 2B,3); is formed of lignified secondary elements traversed by biseriate medullary rays. The vessels are wide, radially arranged, pitted and measure 58-116-173 u in diameter. The tracheids are short with rounded apices, and pitted lignified walls and measure 151-195-240 u in length and 16-36-45 u in width. Fibrous tracheids are lignified and measure 208-226-244 u in length and 13-16-18 u in diameter. Wood fibres have moderately thickened lignified walls, wide lumina and blunt or tapering apices and measure 510-555-600 u in length and 18-22-26 u in diameter. Wood parenchyma are elongated to subrectangular with lignified pitted walls. The medullary rays are mainly biseriate consisting of radially elongated slightly pitted parenchymatous cells.

### Powdered Root

**Powdered root** (Fig. 3); is brownish yellow in colour, odourless and has a slightly bitter taste. It is characterised microscopically by the following:

- 1-Fragments of polygonal, thin-walled, non-lignified cork cells.
- 2-Fragments of xylem vessels, tracheids and wood parenchyma with lignified pitted walls.

- 3-Fragments of pericyclic fibres with thick walls, narrow lumina and pointed apices, accompanied by crystal sheath.

- 4-Fragments of lignified wood fibres.

- 5-Fragments of medullary rays.

- 6-Numerous starch granules, simple or compound of 3-5 components with faint, rounded centric shaped hilum.

### The Stem:

A transverse section of the stem (Fig. 4A); appears more or less circular in outline with 6-10 slightly prominent ridges. It consists of an epidermis followed by a comparatively narrow parenchymatous cortex with collenchyma in the ridges, a pericycle of a continuous band of sclerenchymatous fibres, and a stele of continuous cylinder of vascular elements surrounding the pith.

**The Epidermis** (Fig. 4B,5); consists of polygonal, isodiametric or slightly elongated cells, having straight anticlinal walls, covered with smooth cuticle, and measure 18-31-44 u in length, 13-29-44 u in width and 11-15-18 u in height. Stomata are rarely present and are of the paracytic type. Trichomes of both glandular and non-glandular types are present. Glandular trichomes consist of a unicellular stalk and large spherical unicellular head.

The non-glandular trichomes are bicellular uniseriate the basal cell being very-short and small while the apical cell is very long with thick, shining wall.



wide lumen and covered with smooth cuticle. They measure 153-225-300 u in length and 13-16-18 u in width.

**The Cortex** (Fig. 4B); is comparatively narrow, consisting of 4-5 rows of collenchymatous cells in the ridges followed by 2-3 rows of thin-walled parenchymatous cells containing prismatic crystals of calcium oxalate and starch granules similar to those of the root. The endodermis could not be differentiated.

**The Pericycle** (Fig. 4B,5); consists of a continuous band of lignified fibres. The fibres vary in size measuring 444-512-580 u in length and 18-20-22 u in diameter, usually with thick lignified walls, narrow lumina and acute apices. The pericyclic fibres are surrounded by a crystal sheath.

**The Vascular System** (Fig. 4B,5); is formed of a continuous ring of phloem to the outside and xylem to the inner side separated by cambium and surrounding a narrow pith.

**The Phloem** (Fig. 4B); is formed of thin-walled, cellulosic soft elements of sieve tubes, companion cells and phloem parenchyma, with scattered tanniferous cells. Bast fibres are absent.

**The Xylem** (Fig. 4B,5); is formed of a comparatively wide cylinder of lignified elements. The vessels are mainly isolated or in small groups of 2-4 measuring 18-56-94 u in diameter with bordered pitted walls, which are accompanied with tracheids, wood fibres and wood parenchyma. The tracheids are lignified with simple pits and measure 240-296-351 u in length and 22-31-40 u in width. Fibrous tracheids are ligni-

fied and measure 230-233-235 u in length. Wood fibres have slightly thick lignified walls, wide lumina and blunt or tapering apices and measure 395-420-444 u in length and 22-27-31 u in width. Wood parenchyma cells are rectangular or subrectangular in shape with pitted lignified walls. The medullary rays are multiseriate formed of radially elongated cells with slightly lignified pitted walls having simple and bordered pits.

**Pith** (Fig. 4B); is narrow formed of a large cellulosic, thin walled more or less rounded parenchymatous cells with occasional secretory tanniferous cells.

**Powdered Stem** (Fig. 5); is pale brownish-yellow in colour, odourless with slightly bitter taste. It is characterized microscopically by the following:

- 1-Fragments of polygonal isodiametric, slightly elongated epidermal cells with straight anticlinal walls, covered with smooth cuticle and showing occasional stomata of the paracytic type.
- 2-Non-glandular trichomes with short basal cell and long apical one having thick shining walls.
- 3-Glandular trichomes consisting of unicellular stalk and large spherical head.
- 4-Fragments of lignified pericyclic fibres accompanied by crystal sheath, containing prismatic crystals of calcium oxalate.
- 5-Fragments of radially elongated cells of medullary rays with slightly lignified pitted walls having simple and bordered pits.

6-Fragments of lignified xylem vessels with bordered pits accompanied by tracheids, fibrous tracheids and wood fibres.

7-Fragments of wood parenchyma with rectangular and subrectangular shape and pitted lignified walls.

8-Numerous starch granules, simple or compound of 3-5 components with faint rounded centric hilum.

### The Leaf:

A Transverse section through the lamina of the leaflet (Fig. 6A); is more or less planoconvex in outline, showing an isobilateral structure. The palisade layers are interrupted in the midrib region by hypodermal collenchymatous cells. In the midrib region, there is a central arc of vascular tissue with xylem above and phloem below. The pericycle is formed of an upper and lower arc of lignified fibres. Both the upper and lower epidermises carry trichomes. The cells of mesophyll contain prisms of calcium oxalate.

**The Epidermis** (Fig. 6B,8); both upper and lower epidermises consist of polygonal, cells covered with thin smooth cuticle with straight anticlinal walls on the upper and wavy ones on the lower. The upper epidermis measures 35-53-71 u in length, 26-44-62 u in width and 14-16-18 u in height while the lower epidermis measures 18-43-57 u in length, 18-29-40 u in width and 14-16-18 u in height. Stomata of paracytic type are present on both surfaces, being more frequent on the lower surface, measuring 18-30-40 u in length and 18-22-26 u in width. Trichomes of both glandular and non-glandular types similar to those of the stem are present.

The lower palisade is longer than the upper one, the upper palisade cells measures 80-90-98 u in length and 9-14-18 u in width, are longer than the lower cells 48-75-102 u in length and 13-16-18 u in width.

The spongy tissue is formed of one or two rows of tangentially elongated or round thin-walled parenchyma with wide intercellular spaces.

**The Cortical Tissue** (Fig. 6B); in the midrib region consists of cellulosic round to tangentially elongated parenchyma cells with intercellular spaces and containing prismatic crystals of calcium oxalate measuring 13-29-44 u in length and 8-13-18 u in width. Below the upper and above the lower epidermis in the midrib region, 2-5 rows of nearly rounded collenchymatous cells, with no intercellular spaces are present.

**The Pericycle** (Fig. 6B,8); the vascular strand is surrounded by two arcs of pericyclic fibres, each of 5-7 rows. The fibres are elongated thick walled, lignified with narrow lumina and blunt apices, measuring 444-512-580 u in length and 18-30-31 u in diameter and surrounded by a crystal sheath of calcium oxalate.

**The Vascular System** (Fig. 6B,8); consists of upper arc of radiating xylem and a lower patch of cellulosic thin-walled phloem. The xylem shows lignified spiral vessels 13-18-22 u in diameter and thin-walled cellulosic parenchyma. The medullary rays are uni-triseriate consisting of subrectangular thin walled non-lignified cells.



**Numerical Values:**

Vein islet number : 14-18-23.2

Stomatal index:upper: 4.2-5.1-6.1

lower: 7.2-8.5-10

Palisade ratio:upper: 6-7-8.1

lower: 5-5.5-6.2

**The Petiole:**

A transverse section of the petiole (Fig. 7A); is more or less rounded in outline with two rounded projections on its upper side and shallow groove in between. It shows an epidermis surrounding a cortex followed by a circle of pericycle enclosing 5-7 collateral vascular bundles arranged in a circle and surrounding a parenchymatous central pith.

**The Epidermis** (Fig. 7B,8); consists of polygonal axially elongated cells with straight anticlinal walls, covered with moderately thick smooth cuticle and measuring 100-230-155 u in length, 16-26-32 u in width and 8-12-16 u in height. Stomata are rarely present and are of paracytic type. Trichomes of both glandular and non-glandular types similar to those of the leaf are also present.

**The Cortex** (Fig. 7B); is formed of 2-4 rows of collenchymatous cells present in the projections and ridges followed by 4-5 rows of parenchymatous cells containing minute oval to round starch granules. The cells adjacent to pericyclic fibres contain prisms of calcium oxalate forming a crystal sheath.

**The Pericycle** (Fig. 7B,8); is composed of 2-4 continuous rows of pericyclic fibres surrounding the vascular bundles. The pericyclic fibres have thick lignified walls, narrow lumena and blunt or pointed apices. They are surrounded by a crystal sheath.

**The Phloem** (Fig. 7B); is formed of thin-walled soft cellulosic elements, with occasional tannin cells.

**The Xylem** (Fig. 7B,8); is formed of lignified pitted and spiral vessels.

**Medullary Rays** (Fig. 7B); are biseriate, occasionally triseriate formed of radially elongated, thin-walled cells.

**Pith** (Fig. 7B); consists of large cellulosic, thin-walled more or less rounded parenchymatous cells with scattered secretory tanniferous cells and starch grains similar to those present in the root.

**Powdered Leaf** (Fig. 8); is green, having faint odour and slightly bitter taste. It is characterised microscopically by the following :

1-Fragments of polygonal isodiametric cells of the upper epidermis with straight anticlinal walls and occasional paracytic stomata.

2-Fragments of the lower epidermal cells with wavy anticlinal walls and paracytic stomata.

3-Numerous bicellular covering trichomes with short basal cell and long apical one, having wide lumena and smooth cuticle.

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4-Glandular trichomes consisting of unicellular stalk and large spherical head.

5-Fragments of the epidermal cells of the petiole with polygonal, axially elongated cells having straight or slightly wavy anticlinal walls and covered with smooth cuticle.

6-Fragments of mesophyll parenchyma containing minute oval to round starch grains and prisms of calcium oxalate.

7-Fragments of lignified xylem vessels with spiral thickening.

8-Fragments of lignified pericyclic fibres surrounded by a crystal sheath of calcium oxalate.

9-Absence of sclereids.

10-Numerous starch grains are present.

11-Fragments of columnar cylindrical palisade cells.



Fig. 1: Macromorphology of *Rhynchosia minima* L. DC.  
 A: The root (X 0.7)  
 B: Aerial parts of the plant (X 0.5)  
 f., fruit; l., leaflets; l.r., lateral rootlets;  
 p.r., primary root; st., stem.



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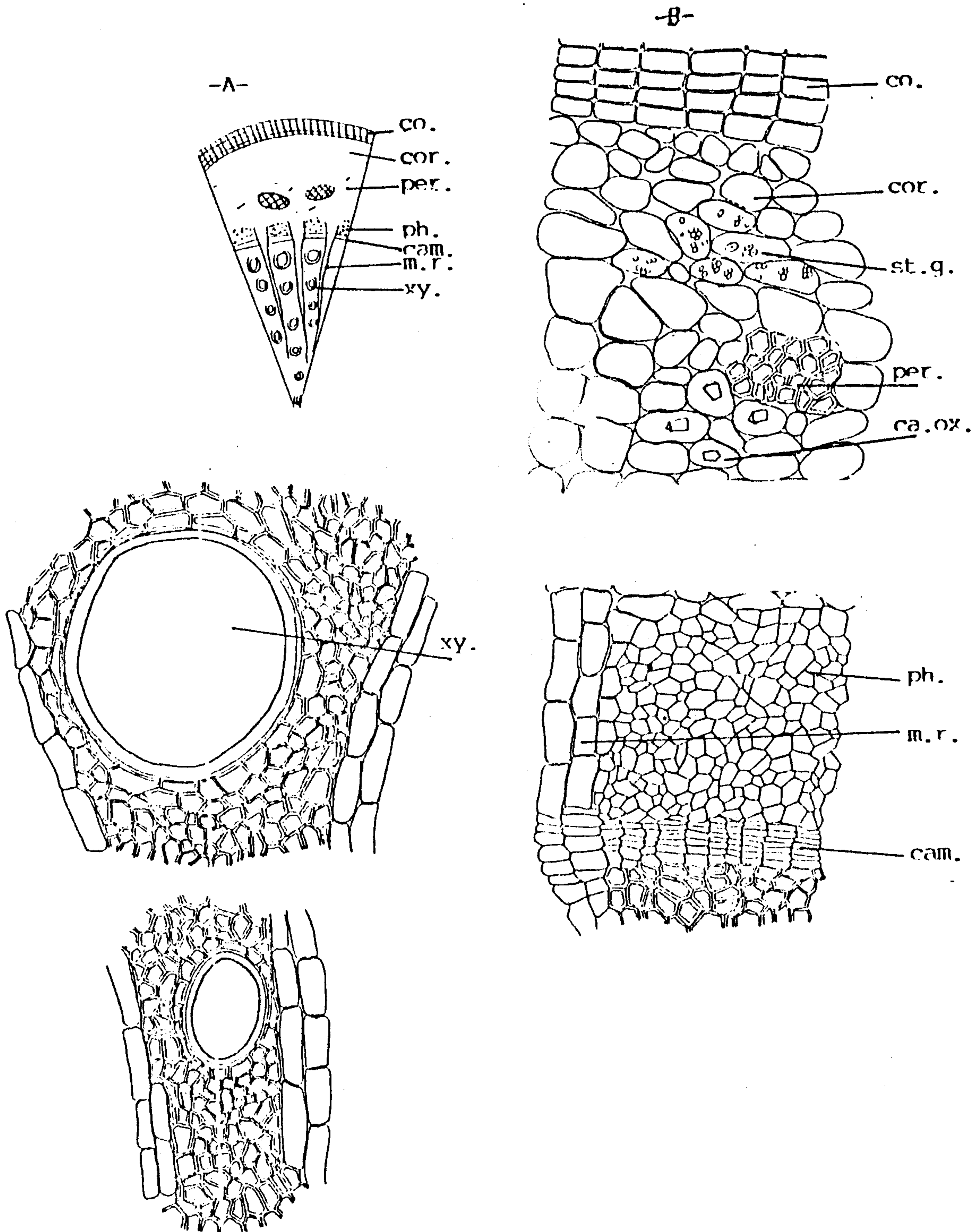


Fig. 2: The root of *Rhynchosia minima* L.DC.

A: Diagrammatic T.S. (X 18)  
 B: Detailed sector (X180)  
 cam., cambium; ca.ox., calcium oxalate; co., cork;  
 cor., cortex; m.r., medullary rays; per., pericycle;  
 ph., phloem; st.g., starch grains; xy., xylem.

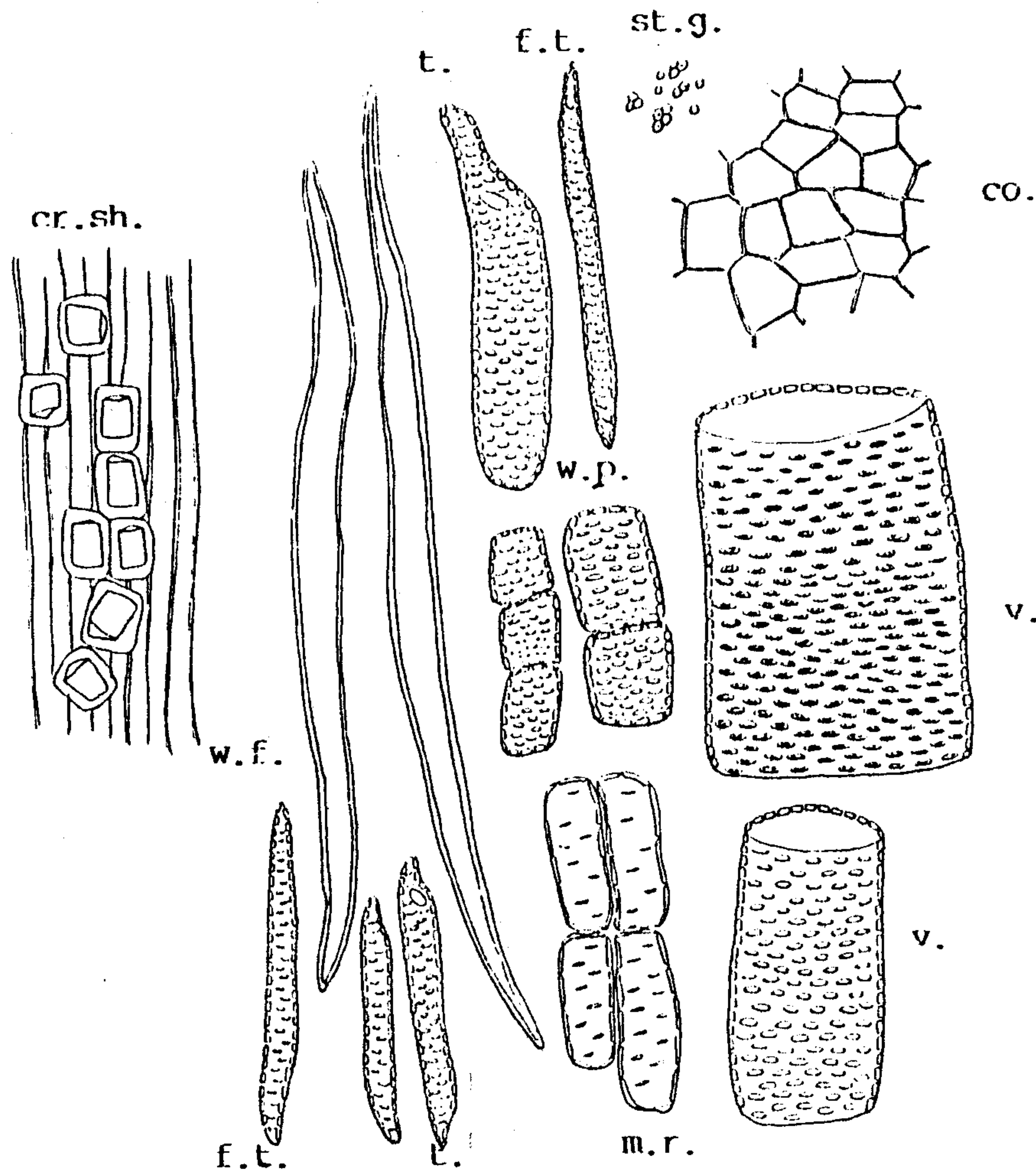


Fig. 3: Powdered root of *Rhynchosia minima* L.DC. (180)  
 co., cork; cr.sh., crystal sheath; f.t., fibrous  
 tracheid; m.r., medullary rays; st.g., starch gra-  
 ins; t., tracheid; v., vessel; w.f., wood fibre;  
 w.p., wood parenchyma.

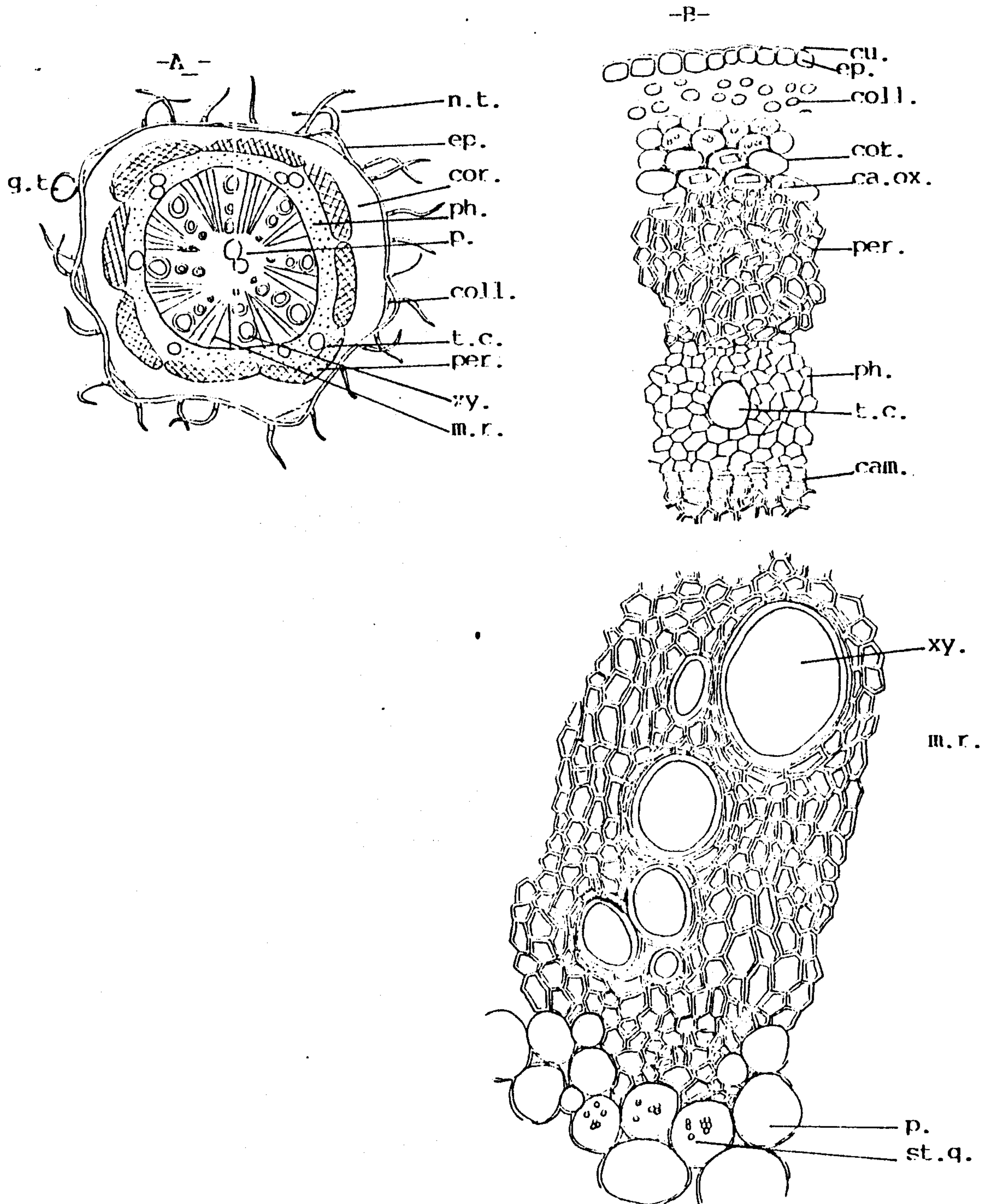


Fig. 4: The stem of *Rhynchosia minima* L.DC.

A: Diagrammatic T.S.

(X 18)

B: Detailed sector

(180)

can., cambium; ca.ox., calcium oxalate; coll., collenchyma; cor., cortex; cu., cuticle; ep., epidermis; g.t., glandular trichome; m.r., medullary rays; non-glandular trichome; p., pith; per., pericycle; ph., phloem; st.q., starch grains; t.c., tanniferous cell; xy., xylem.



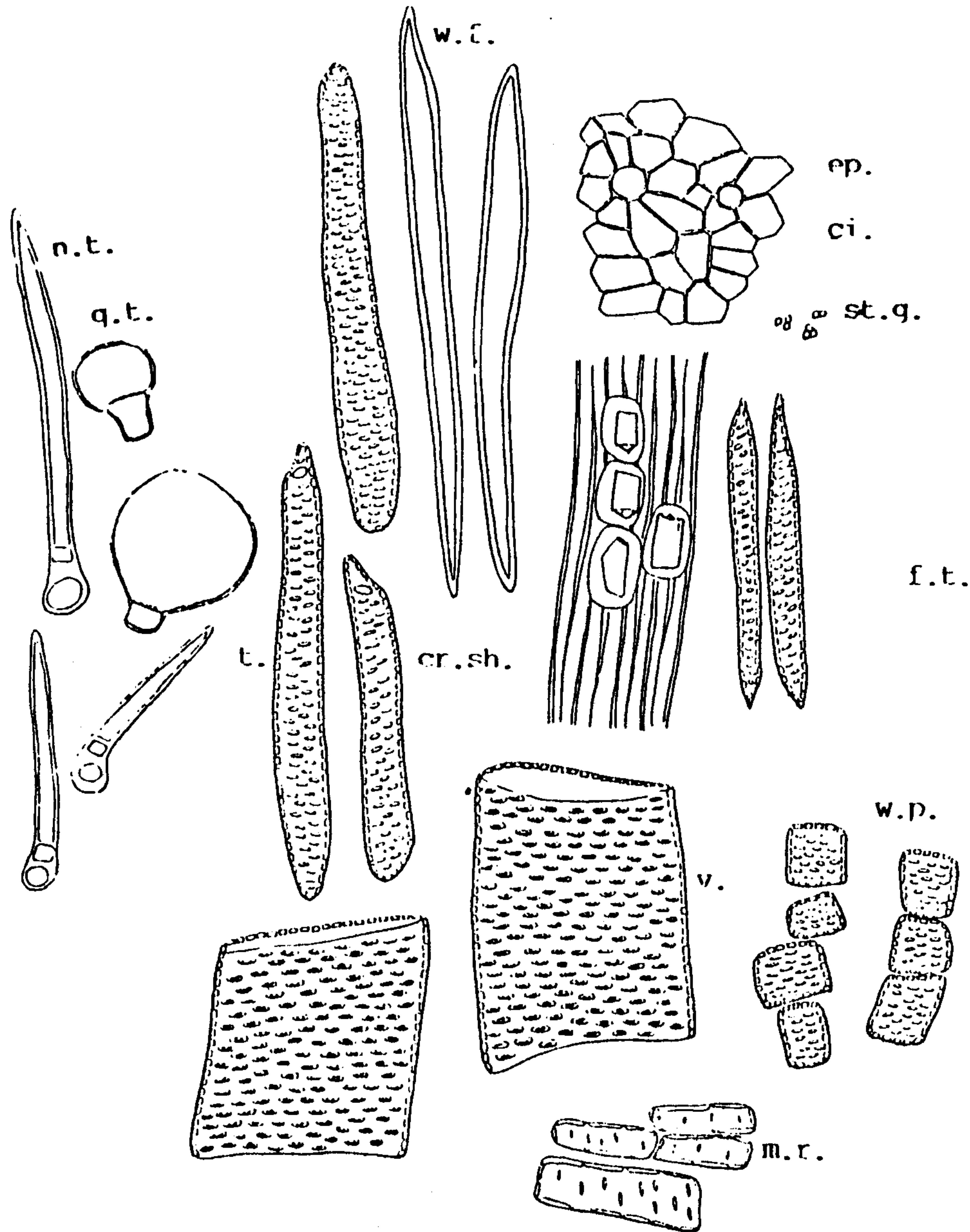


Fig. 5: Powdered stem of *Rhynchosia minima* L. DC. (X 180)

ci., cicatrix; cr.sh., crystal sheath; ep., epidermis; r.t., fibrous tracheid; st.g., starch; t., tracheid; v., vessel; w.f., wood parenchyma; g.t., glandular trichome; n.t., non-glandular trichome.

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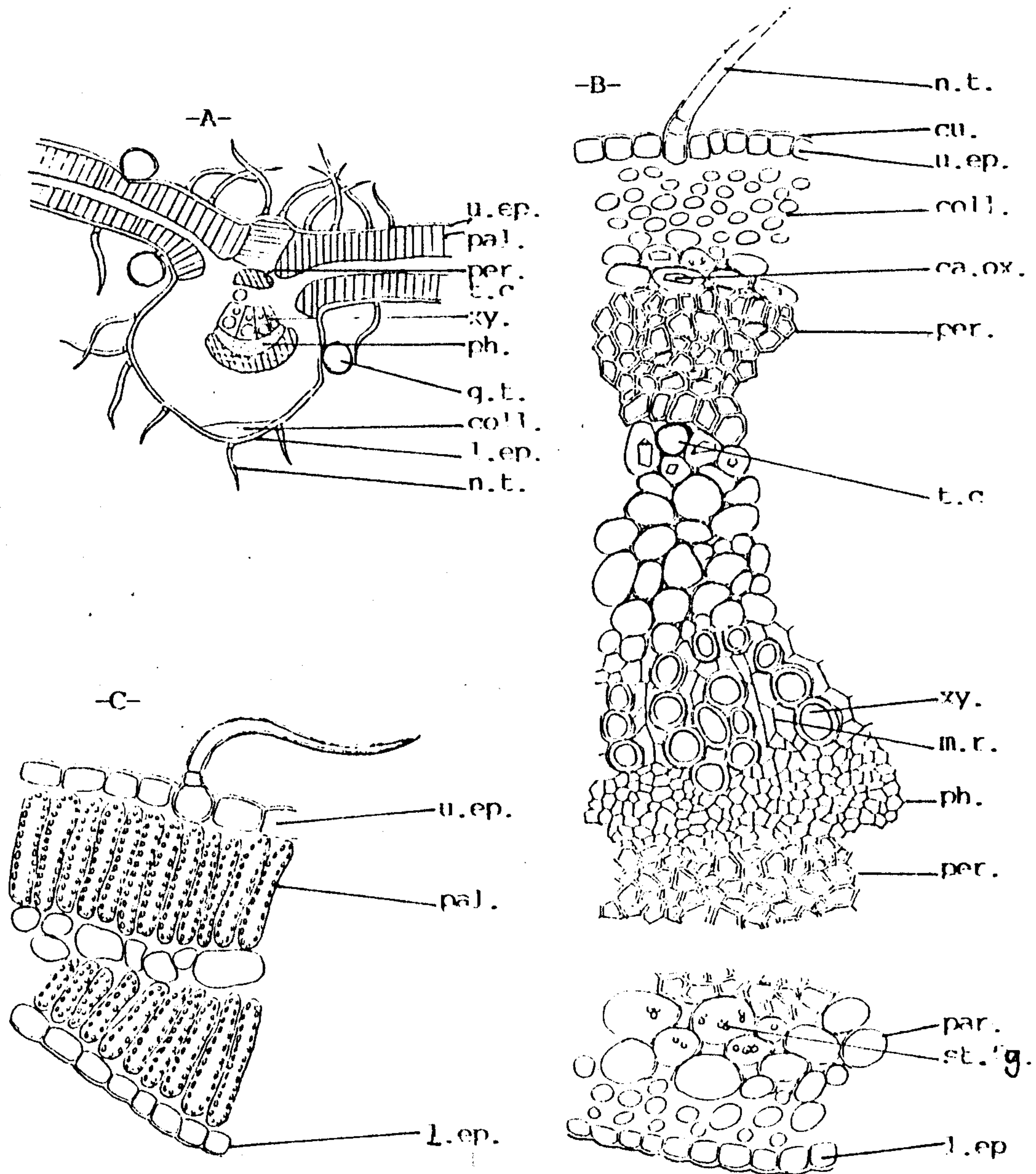


Fig. 6: The leaf of *Rhynchosia minima* L.DC.

A: Diagrammatic T.S. (X 36)

D: Detailed sector in the midrib (X180)

C: Detailed sector in the lamina (X180)

ca.ox., calcium oxalate; coll., collenchyma; cu., cuticle; g.t., glandular trichome; l.ep., lower epidermis; m.r., medullary rays; n.t., non-glandular trichome; pal., palisade; par., parenchyma; per., pericycle; ph., phloem; st.g., starch grains; t.c., tanniferous cell; e.ep., upper epidermis; xy., xylem.

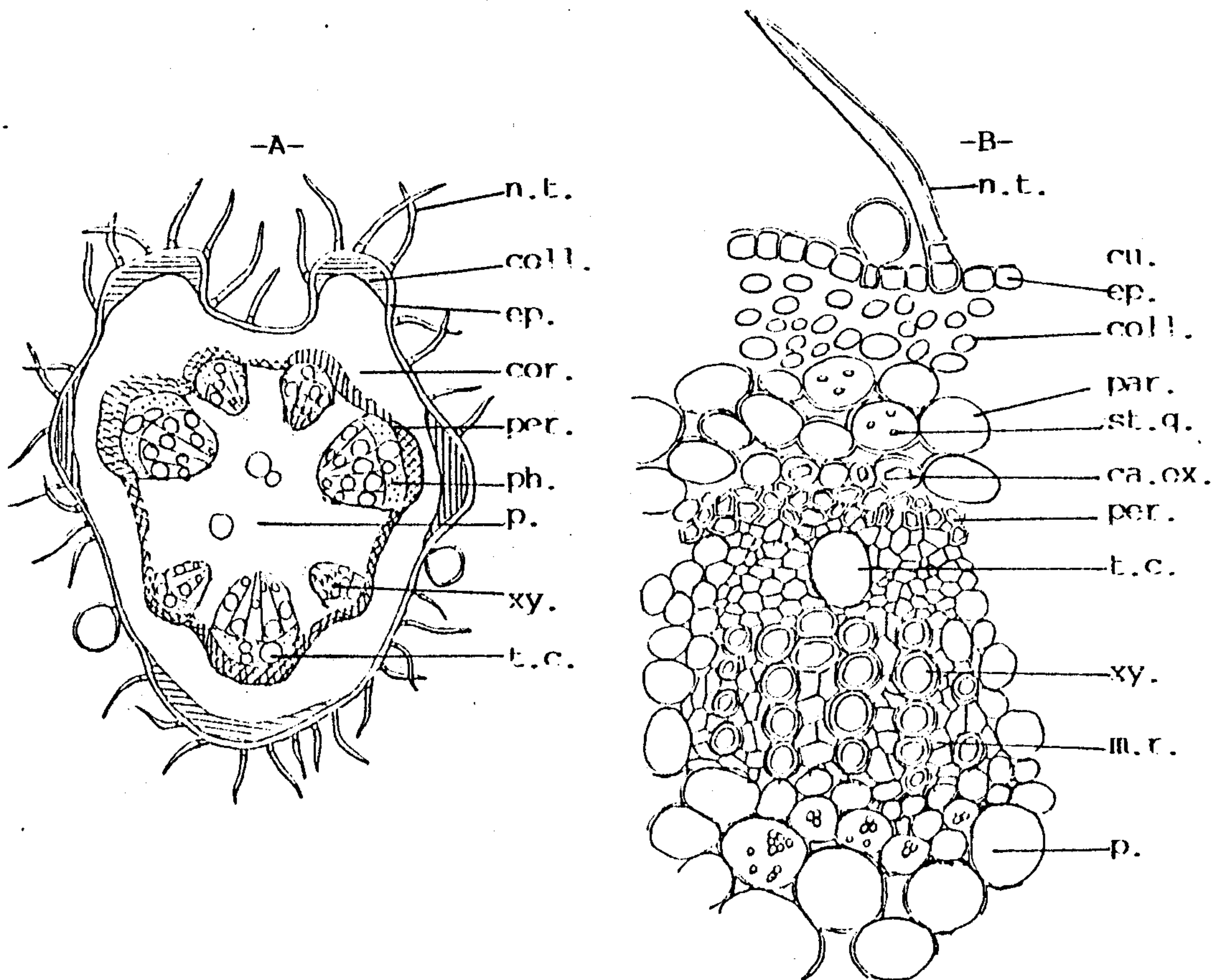


Fig. 7: The petiole of *Rhynchosia minima* L. DC.

A: Diagrammatic T.S.

(X 36)

B: Detailed sector

(X180)

ca.ox., calcium oxalate; coll., collenchyma; cu., cuticle; ep., epidermis; m.r., medullary rays; n.t., non-glandular trichome; p., pith; par., parenchyma; per., pericycle; ph., phloem; st.g., starch grains; t.c., tanniferous cell; xy., xylen.



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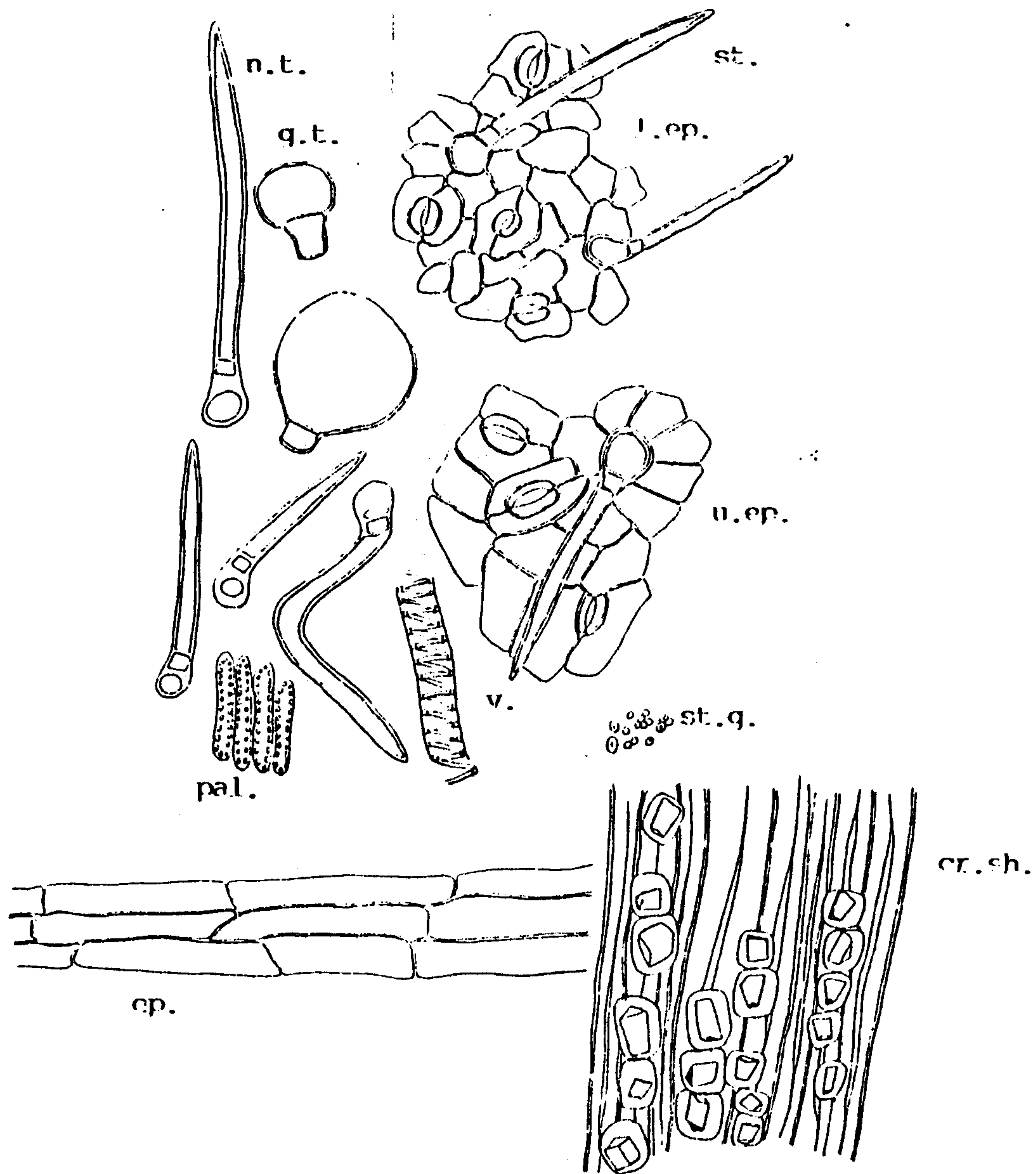


Fig. 8: Powdered leaf of *Rhynchosia minima* L.DC. (X 180)

cr.sh., crystal sheath; ep., epidermis of the petiole; g.t., glandular trichome; l.ep., lower epidermis; n.t., non-glandular trichome; pal., palisade; st., stomata; st.g., starch grains; v., vessels.

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دراسة الصفات العيانية والمجهريّة لنباتات

الرينكوزيا منيمال . دت ( الجذر - الساق - الورقة )

عزة عباس خليفة - عمر محمود عبدالله

قسم العقاقير - كلية الصيدلة - جامعة اسيوط

نبات الرينكوزيا منيمال . دت من النباتات التي تتبع الفصيلة البقولية وهو نبات حولي ينمو برياً في الواحات الخارجية . وقد فصلت بعض جلوكوزيدات المركبات الفلافونيدية من هذا النبات .

وباستقصاء المراجع المتوافرة وجد ان لخلصة الكلوروفورم والكحول الميثيلي تأثير مضاد للبكتيريا .