

MACRO-AND MICRO-MORPHOLOGY OF POLYGONUM SALICIFOLIUM
BROUSS EX WILID (STEM AND LEAF).

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ABSTRACT

The macro-and-micro-morphology of the stem and leaf of Polygonum salicifolium Brouss ex Wilid growing in Egypt, are presented with the view of determining the diagnostic features by which the organs can be identified both in the entire and powdered forms.

INTRODUCTION

The family polygonaceae includes 40 genera and 800 species distributed in north temperate regions. The plants belonging¹ to this family are annual or perennial herbs, shrubs or rarely trees. The stem is axially branched and are characterized by having swollen nodes. Leaves are alternate, rarely opposite or whorled, simple with entire or lobed margin and with stipules commonly forming a sheath (ochrea) at the base of the leaf^{1,2,3,4}.

Polygonum comprises several species which are reputed by folklore medicinal uses as expectorant, diuretic, tonic, astringent, haemostatic, in treatment of gout and haemorrhoids⁵.

The astringent effect (in dysentery, diarrhoea and various types of haemorrhage) is attributed to their tannin contents (tannic acid, polygonic acid and gallic acid⁵).

Several workers reputed that polygonum species contain flavonoids and chalcones⁵⁻⁸.

Reviewing the current literature, the botanical study of Polygonum salicifolium Brouss ex Wilid (Family Polygonaceae) was not reported. Hence a detailed study was thought to be pertinent due to important situation among other Polygonum species.

The present work deals with the macro-and micro-morphology of the stem and leaf of the plant. Also a phytochemical study of this plant is under way.

EXPERIMENTAL

Material :

The separated organs of Polygonum salicifolium Brouss ex Wilid were collected at different stages of growth from the growing plants in marshy places near Assiut.

The identity of the Plant was verified by Prof. Dr. Nabil El-Hadidi.

The material used in this study was fresh or preserved in alcohol 70% containing 5% glycerin. The powder was obtained from air-dried plants.

MACROMORPHOLOGY

Habitat:

Polygonum salicifolium Brouss ex Wilid (Fig. 1) is a perennial, erect, glabrous herb, 1-1.75m in height. The plant shows several spreading branches with sessile leaves. It flowers early winter to late summer.

1. The Stem (Fig. 1 B) is woody, herbaceous, cylindrical and glabrous. It is up to 1.5 m long and 5-10 mm in diameter. It is simple or axially branched with several branches. The nodes are slightly swollen and bear the characteristic stipules and sessile simple leaves. Internodes are 4-6 cm. long. Slender adventitious roots often come out from the nodes present at the basal part of stem. The stem is brown in colour, it has indistinct odour and acrid taste.

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ex Wilid (Stem and Leaf)

2. The Leaf (Fig. 1 B) is cauline, sessile, simple, alternate having entire or obscurely serrulate margin, acuminate apex and symmetric base. The upper and lower surfaces are green in colour. Vennation is pinnate reticulate. The leaf is stipulate. The stipules are united to form a membranous brownish viened sheath (ochrea) around the stem. The sheath is bristly hairy and fingered at the apex. The leaves are varying from 9 to 13 c. in length and 1 to 1.5 cm. in width. They are odourless and bitter in taste.

MICROMORPHOLOGY

1. The Stem : A transverse section in the stem (Fig. 2 A) is more or less rounded in outline.

The epidermis (Fig. 2 B&C) is formed of one row of cells which in surface view appear polygonal, tabular, isodiametric with straight or slightly wavy thin cellulosic anticlinal walls. They are covered with smooth cuticle. Stomata are not observed. The epidermal cells measure 35-44-52 u in length 31-39-48 u in width and 9-12-16 u in height.

The cortex (Fig. 2 B) is comparatively narrow and formed of 2-3 rows of collenchymatous cells and 2-3 rows of thin-walled parenchymatous cells with intercellular spaces. Few cluster crystals of calcium oxalate are scattered in the parenchymatous cells and measure 17-37-57 u in diameter.

The pericycle (Fig. 2 B) is formed of a complete ring of pericyclic fibres interrupted by parenchymatous tissue. The fibres are strap-shaped with slightly thick lignified walls, wide lumena and acute apices. The walls of the fibres show simple pits. They measure 652-725-826 u in length and 13-17-21 u in width.

The phloem (Fig. 2 B) is formed of a complete ring of phloem tissue, hardly differentiated into sieve tubes, companion cells and phloem parenchyma.

The cambium (Fig. 2 B) is represented by a complete ring of 2-3 rows of tangentially elongated, radially arranged, thin-walled meristematic cells.

The xylem (Fig. 2 B & 3) is formed of a cylinder of lignified elements. The vessels are mainly solitary or in small groups having pitted, spiral and scalariform thickenings and measure 34-60-86 u in diameter. The tracheids are cylindrical tapering with pointed, blunt or bluntly pointed ends with lignified pitted walls. They measure 217-261-305 u in length and 13-16-30 u in width. The wood fibres have slightly irregular thin lignified walls with wide lumina and acute apices. They measure 521-564-608 u in length and 17-30-43 u in width.

The medullary rays (Fig. 2 B&3) are 4-6 cells wide. The cells are radially elongated with slightly thick lignified and pitted walls.

The pith (Fig. 2 B63) constituting a wide region in the centre and formed of polygonal, more or less rounded wide parenchymatous cells and wide intercellular spaces. Cluster crystals of calcium oxalate, resembling those of the cortex, are observed. The starch grains are simple, round to ovoid or polyhedral in outline and devoid of striations or any obvious hilum.

The Powder

Powdered stem (Fig. 3) is greyish in colour, odourless, and bitter in taste. Microscopically it shows the following :-

- 1- Fragments of polygonal epidermal cells.
- 2- Numerous cluster crystals of calcium oxalate either free or within the cells.
- 3- Fragments of both lignified pericyclic and wood fibres.
- 4- Fragments of tracheids, tracheidal vessels and medullary ray cells with pitted lignified walls.
- 5- Fragments of xylem vessels with spiral, pitted and scalariform thickenings on their walls.

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ex Willd (Stem and Leaf)

2- The leaf:-

A transverse section in the lamina through the midrib (Fig. 4 A) appears biconvex, and reveals a dorsiventral mesophyll interrupted in the midrib.

The upper epidermis (Fig. 4A, 5B) is formed of polygonal tabular, elongated cells with straight, thin anticlinal walls covered with smooth cuticle and show oval paracytic and anomocytic stomata 65-82-100 u in length and 52-59-66 u in width. The epidermal cells measure 57-80-100 u in length, 13-28-43 u in width and 18-24-30 u in height.

The lower epidermis (Fig. 4A, 5C) is more or less similar to the upper one, but the stomata are more abundant and the anticlinal walls are wavy. The margin of the leaf carries multicellular non-glandular woolly trichomes [the number of the basal cells is from 5-7 cells and each cell originates from one epidermal cell. The basal cells have thickened, non-lignified walls and the hair terminates with elongated acute cell].

The mesophyll (Fig. 4A, 5A) is dorsiventral, the palisade being composed of two rows. The cells measure 34-47-60 u in length and 13-17-31 u in width. The spongy tissue is formed of 4-6 rows of chlorenchymatous cells which are slightly irregular in shape. Some cells contain cluster crystals of calcium oxalate resembling those of the stem.

The cortical tissue (Fig. 4B) is formed of an upper and lower subepidermal masses of collenchyma of 3-4 rows of collenchymatous cells with narrow inter cellular spaces. The rest of the cortical tissue is formed of almost rounded large thin-walled parenchymatous cells. Cluster crystals of calcium oxalate are present in the parenchymatous cells.

The vascular tissue (Fig. 4B) in the midrib is represented by four vascular bundles in a circle, with xylum inward and phloem outward. Each vascular bundle is surrounded by a sheath of lignified pericyclic fibres.

The pericyclic fibres (Fig. 4B, 6) are elongated, with slightly thick, lignified, walls, wide lumina and blunt apices. They measure 478-499-521 u in length and 21-28-35 u in width.

The phloem (Fig. 4B) is formed of small thin-walled, shining cellulose cells, hardly differentiated into sieve tubes, companion cells and phloem parenchyma.

The xylem (Fig. 4B, 6) is formed of xylem vessels with spiral, scalariform and pitted thickenings and measure 21-43-65 u in diameter. The vessels are separated by thick lignified walled parenchyma.

Epidermis of ochrea (Fig. 5D) in the form of membranous sheath around the stem is present at the base of the leaf at each node and carrying non-glandular trichomes similar to those present at the margin of the leaf.

The Powder

Powdered leaf (Fig. 6) is greenish in colour, odourless and bitter in taste. Microscopically it shows the following:

- 1- Fragments of both upper and lower epidermises with paracytic stomata.
- 2- Numerous cluster crystals of calcium oxalate.
- 3- Very rare sessile glands of 2 cells are present on the epidermal cells.
- 4- Fragments of pericyclic fibres with slightly lignified walls, wide lumina and blunt apices.
- 5- Fragments of spiral, scalariform and pitted lignified vessels.

Macro-and Micro-Morphology of Polygonum salicifolium Brouss
ex Willd. (Stem and Leaf)

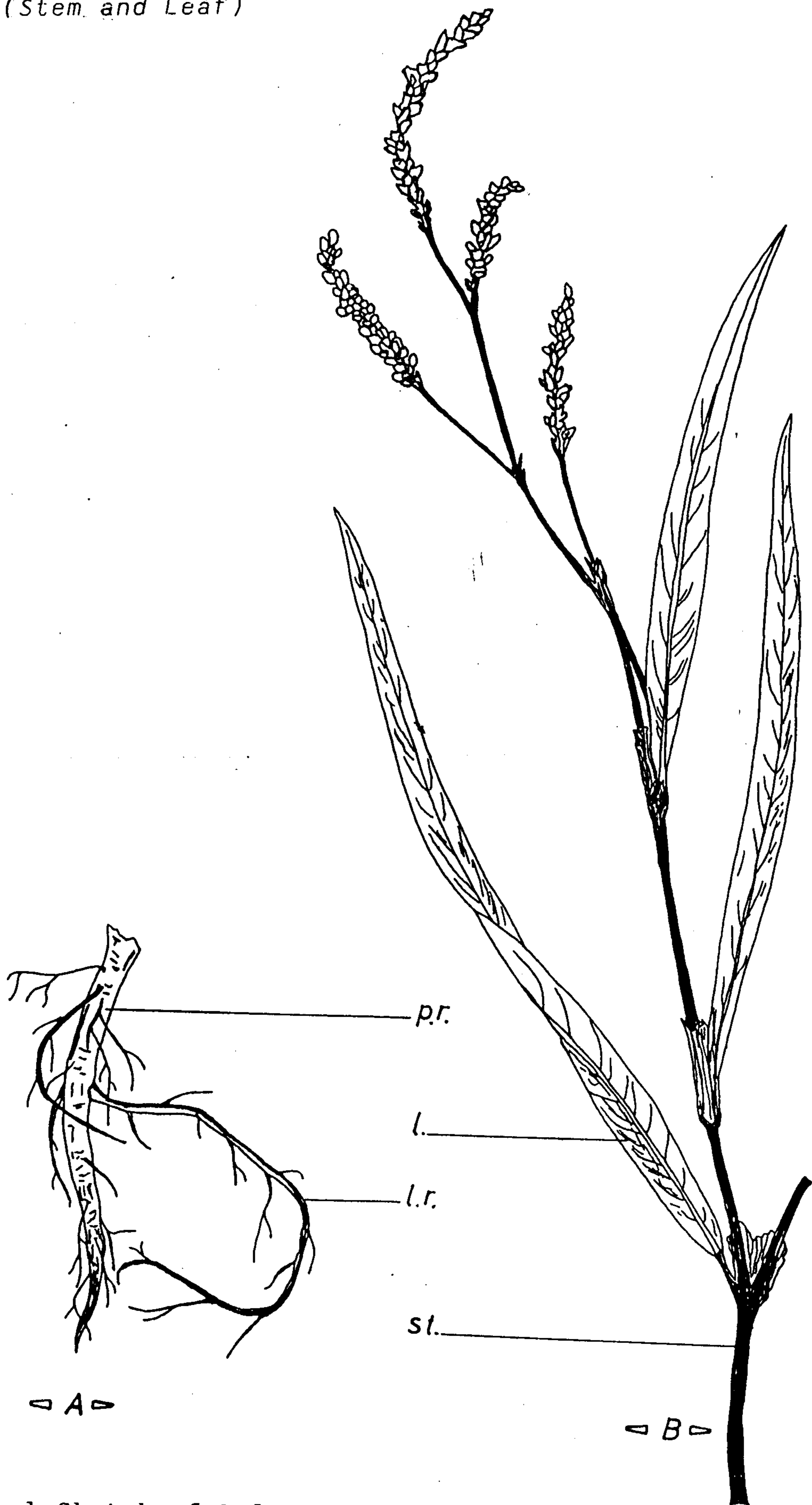


Fig. 1 Sketch of Polygonum salicifolium .

A. The root x 1

B. Aerial part. x 1

l., leaf; l.r., lateral root; p.r. primary root; st., stem.

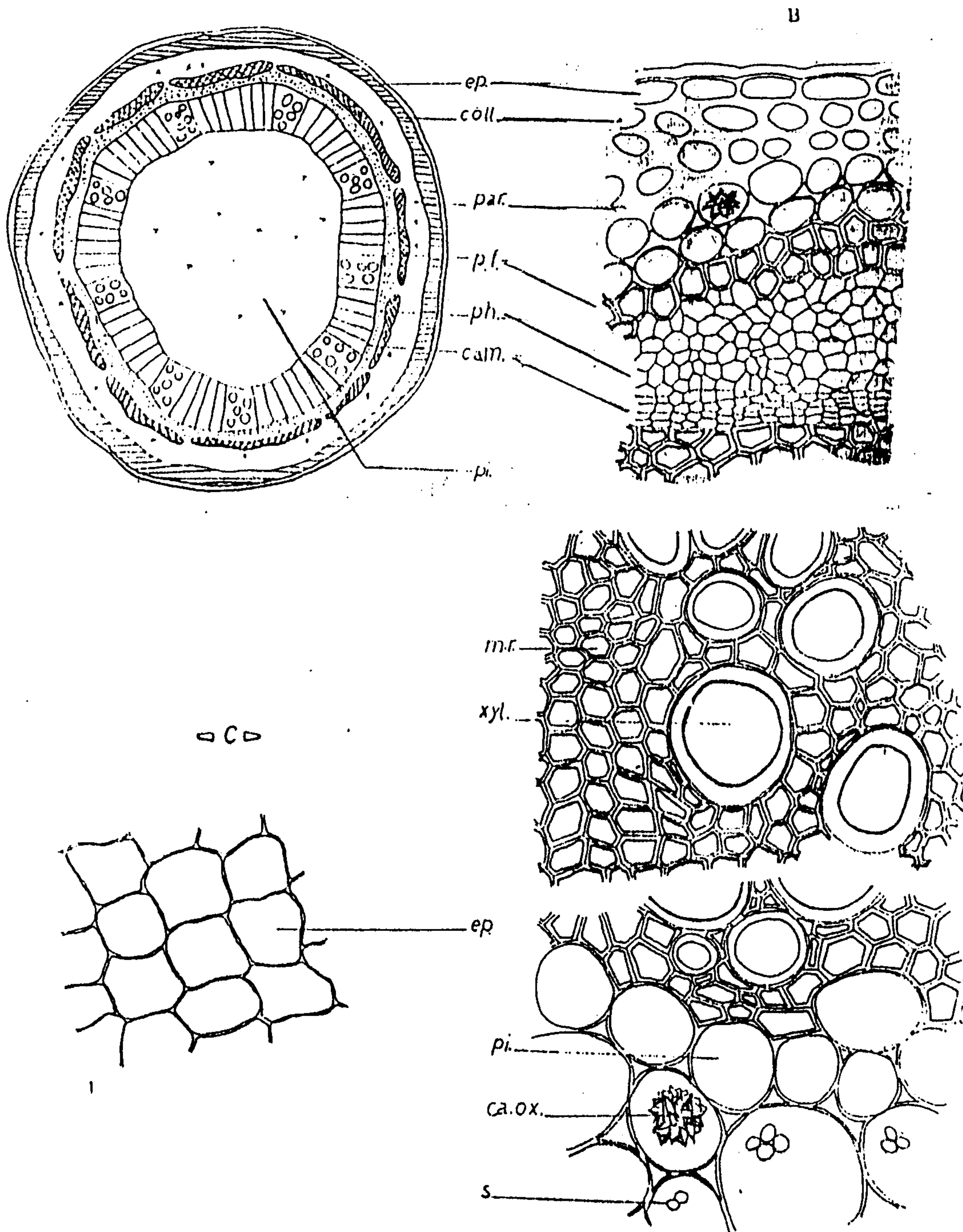


Fig.2 Stem

A-Diagrammatic T.S in the stem x 25

B-Detailed T.S in the stem x 225

C-Surface preparation of the epidermis x 225

ca.ox., calcium oxalate; cam., cambium; coll., collenchyma;
 ep., epidermis; m.r., medullary rays; par., parenchyma; ph., phloem
 p.f., pericyclic fibre; pi., pith; s., starch; xyl., xylem.

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Ex Wild Stem and Leaf

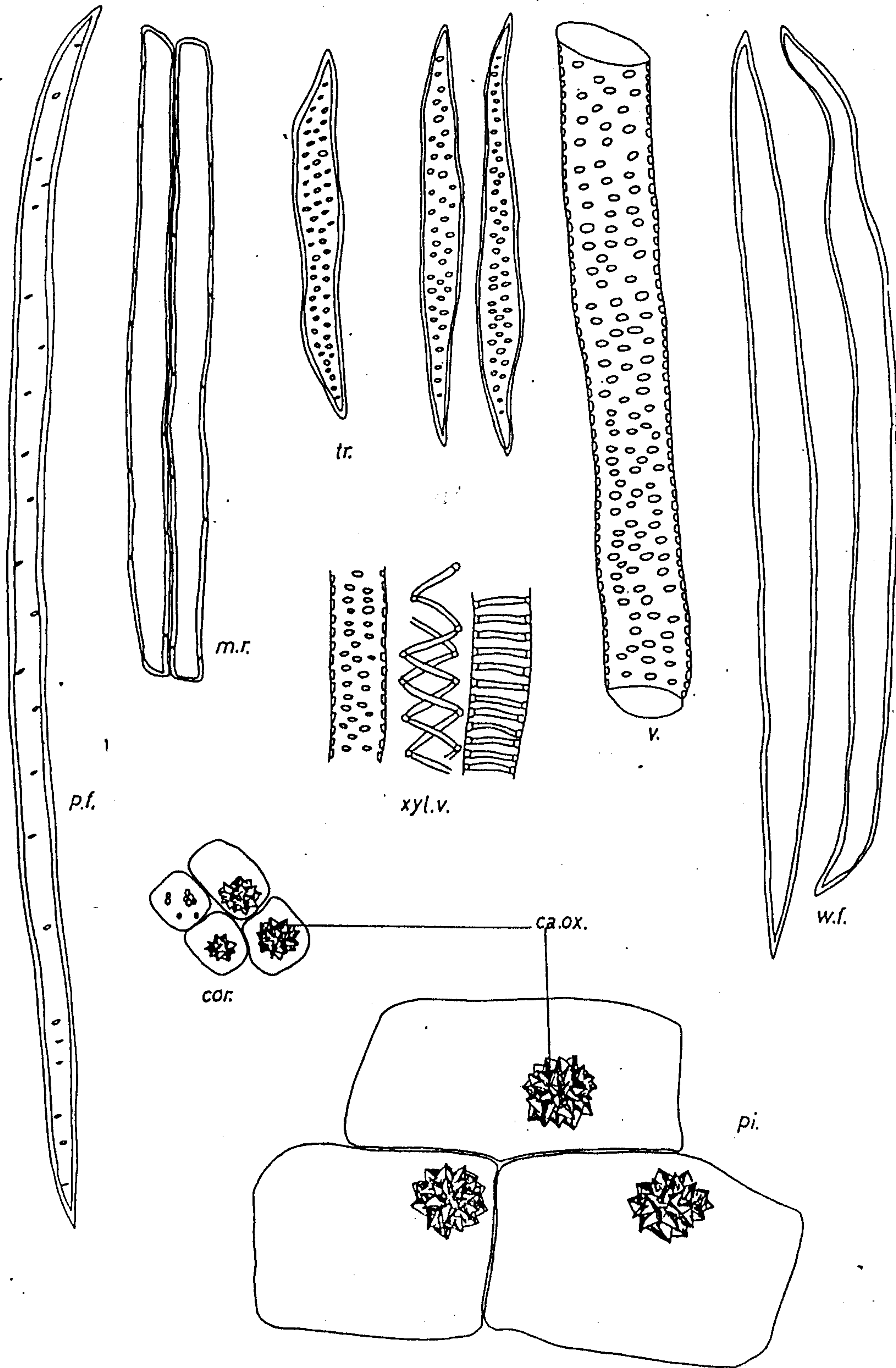


Fig. 3 :- Isolated elements of the stem

x 225

ca.ox., calcium oxalate; cor., cortex; m.r., medullary rays;
p.f., pericyclic fibre; pi., pith; tr., tracheids; v., vessels;
w.f., wood fibre; xyl.v., xylem vessels.

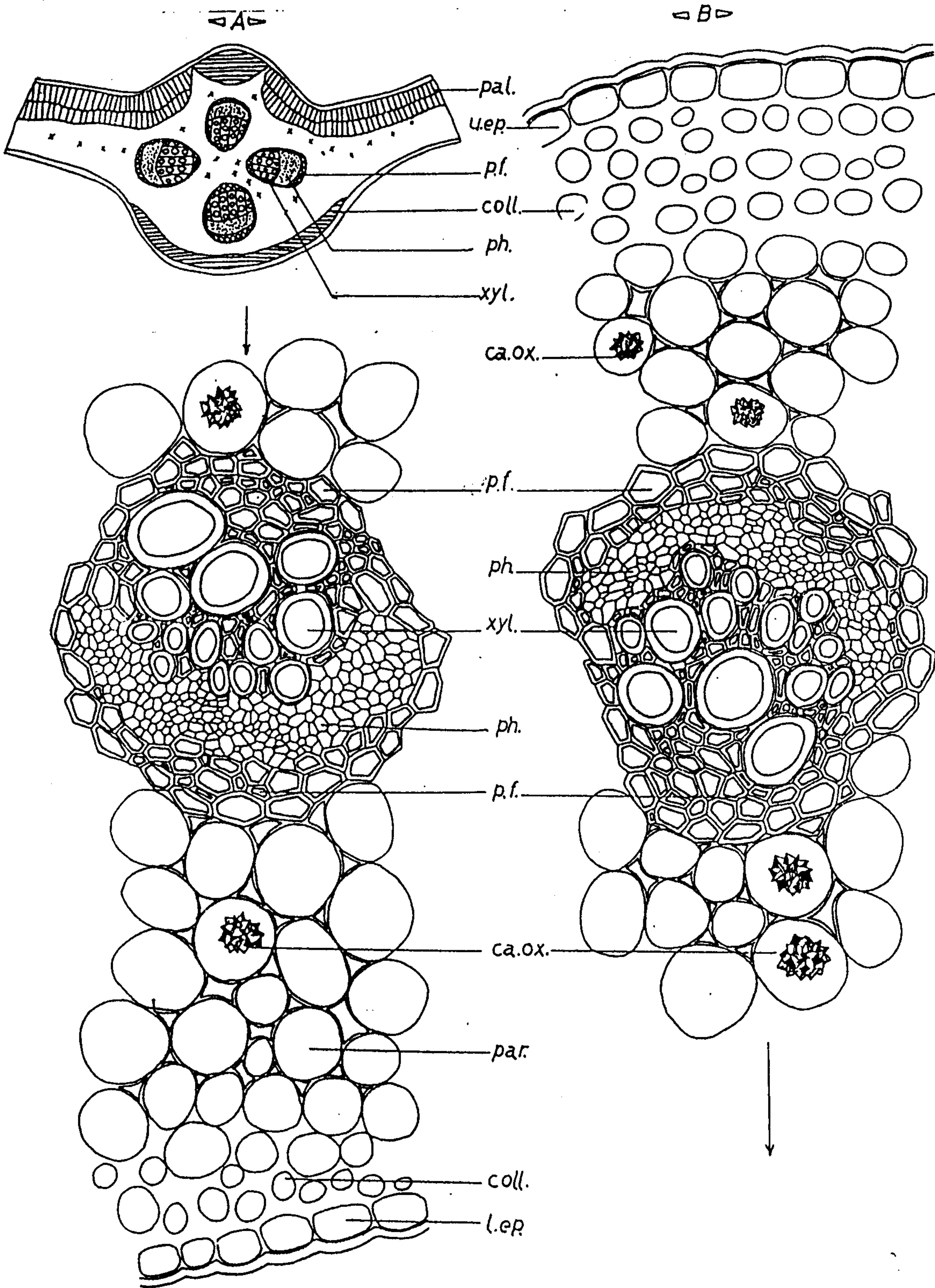


Fig. 4 :-

A- Diagrammatic T.S of the leaf.

x 25

B- Detailed T.S. of the leaf .

x 225

ca.ox., calcium oxalate; coll., collenchyma, l.ep., lower epidermis; p.f., pericyclic fibre; pal., palisade; par., parenchyma; ph., phloem; u.ep., upper epidermis; xyl., xylem.

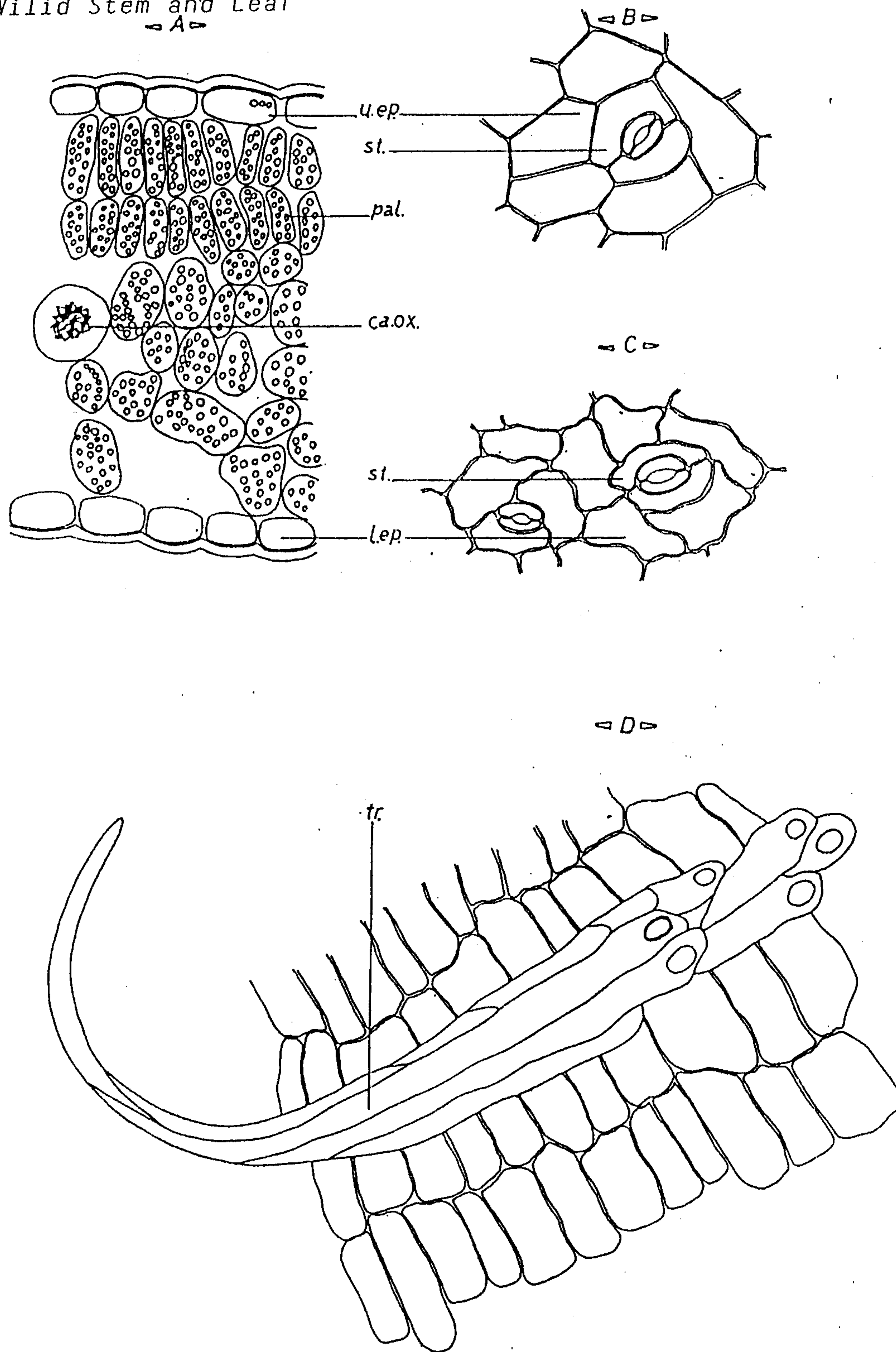


Fig. 5 :-

- A- Detailed T.S. of the leaf x 225
 B- Surface preparation of the leaf (upper epidermis)
 x 225
 C- Surface Preparation of the leaf (lower epidermis)
 x 225
 D- Surface view of ochrea. x 225

Ca.Ox., calcium oxalate; l.ep., lower epidermis;
 pal., palisade; st., stomata; tr., trichome; u.ep., upper
 epidermis.

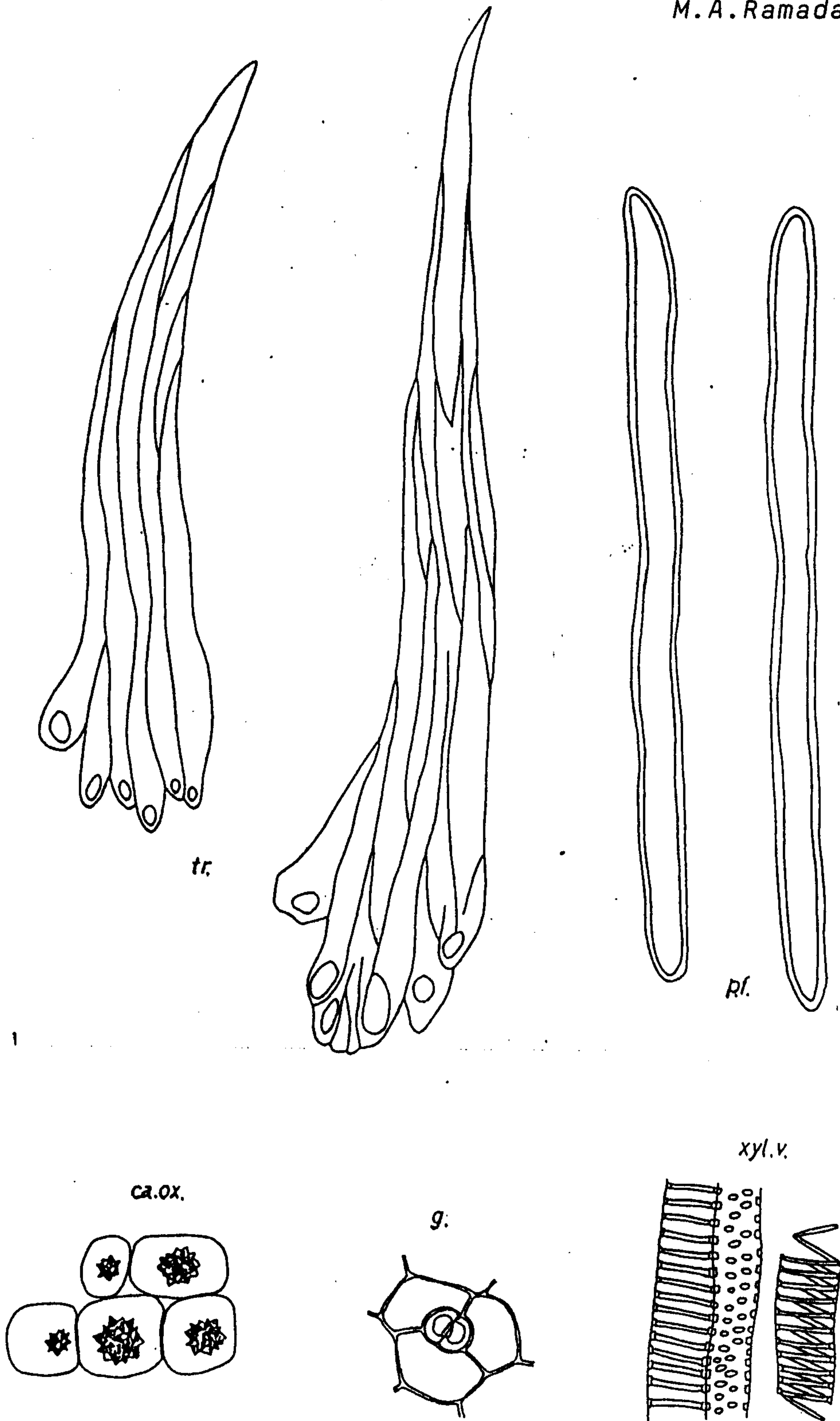


Fig. 6: Isolated elements of the leaf x 225

ca.ox., calcium oxalate; p.f., pericyclic fibres; tr., trichomes; s.g., sessile gland; xyl.v., xylem vessels.

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Ex Wild Stem and Leaf

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