Bull. Pharm. Sci., Assiut University,
Vol. 13, Part 1, PP 83-96

MACRO-AND MICROMORPHOLOGY OF *VERBENA OFFICINALIS* L. CULTIVATED IN EGYPT

PART 1: THE STEM AND LEAF.

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ABSTRACT

The macro-and micromorphology of the stem and leaf of Verbena officinalis L. Cultivated in Egypt have been investigated in order to determine the diagnostic features by which each organ could be identified both in the entire and powdered forms.

INTRODUCTION

Verbena is a genus of tropical and temperate regions [1]. *Verbena officinalis* L. is a herbaceous plant belonging to the family Verbenaceae [2,3]. It is used medicinally in Korea, China, Taiwan and Indo-China for treatment of chronic eczema, chronic bronchitis, menstrual disorders and as a diaphoretic. It is also used as an anthelmintic [4].

From *Verbena officinalis* L. growing abroad verbenalin, verbenin and hastatoside iridoids were isolated [5,6,7].

From *Verbena officinalis* L. growing in Egypt lupeol, β-sitosterol, ursolic acid, aucubin and artemetin were isolated and identified [8].

Reviewing the current literature, very little was mentioned about its macromorphology [1,2], however, nothing was traced concerning micromorphological study of the different organs of *Verbena officinalis* L. hence detailed study was thought to be pertinent.

Material :

The material used in this investigation was obtained from the plants cultivated in Experimental Station of Faculty of Agriculture, Assiut University, Assiut -Egypt.

The plant was identified by Prof. Dr. N.A.El-Keltawy Prof. of Horticulture, Faculty of Agriculture, Assiut University, Assiut, Egypt.

Habitate :

Verbena officinalis L. is perennial herbaceous plant about 60 to 100 cm in height with erect stem. It

bears green, simple, pinnatifid opposite decussate leaves, from their axial buds arise two small opposite leaves and sometimes branches. Long-stalked inflorescences arise from the terminal buds of the main stem and branches.

Flowers are usually very small in slender spikes, white to pinkish-white. The flowering starts from October to April.

A- THE STEM

Macromorphology : (Fig.1)

The main stem is erect, with long spreading branches, green in colour, hairy, solid in the young stem, while the old one is hollow. It is quadrangular in outline, reaching from 30-80 cm in height and from 1 to 1.5 cm in diameter at the basal part. The stem carries shortly petiolate leaves arranged in opposite decussate manner. From the apical part of the stem arises long-stalked inflorescence. The stem has faint aromatic odour and a slight bitter astringent taste.

Micromorphology:

A transverse section in the young stem (Fig. 2A) is more or less square in outline, showing outer hairy epidermis surrounding the cortical tissue. The cortex consists of outer layers of collenchyma cells which are abundant in the ridges and inner layers of parenchyma cells limited internally by an endodermis. The vascular system is continuous, consists of phloem and xylem separated by a cambial layer and surrounded by incomplete ring of pericyclic fibres. The pith is wide and parenchymatous.

The Epidermis :

It consists of subrectangular cells as shown in transverse section (Fig. 3). In surface view (Fig. 2B) the cells appear elongated, polygonal with more or less straight anticlinal walls and measure 16-20 μ in height, 40-68-132 μ in length and 16-24-30 μ in width. The cells are covered with thick, smooth cuticle. Stomata are of the anomocytic type and surrounded by 4-5 epidermal cells. Trichomes are long, non-glandular unicellular with broad bases and acuminate apices. They are coverd with warty cuticle and cystolith with calcium carbonate crystals in their enlarged basis,(effervesce and give needle crystals with dil. Sulphuric acid). The trichomes measure 120-184-200 μ in length and 36-48 μ in width at the base. Glandular trichomes with unicellular stalk and bicellular head divided vertically measure 28-40 μ in height.

The Cortical Tissue : (Fig. 3)

It consists of 2-3 layers of subepidermal cells of collenchyma, which are rounded having thick-walls. The inner parenchymatous region consists of 3-5 rows of thin-walled cells with narrow intercellular spaces, contain prisms and clusters of calcium oxalate. Minute starch granules are also present.

The endodermis, is formed of one row of slightly tangentially elongated cells containing simple starch granules.

The Vascular System :(Fig. 3 &4)

The pericycle consists of incomplete ring of lignified fibres interrupted by parenchyma. The fiber is elongated with irregular outline, wide lumina, acumi-

nate rarely forked apices, it measures 372-496 μ in length and 16-20 μ in width at the middle part. The phloem is formed of sieve tubes, companion cells and phloem parenchyma. The cambium is formed of 3-5 rows of celluosic thin-walled cells which are tangentially elongated. The xylem vessels are lignified with pitted, annular, scalariform and spiral thickenings measuring from 16-40-80 μ in diameter. Tracheids are elongated with blunt ends and lignified pitted walls. They measure 172-252 μ in length and 20-30 μ in width. The wood parenchyma consist of lignified pitted cells. Medullary rays are uni-or biseriate formed of elongated, subrectangular cells with thick lignified, pitted walls.

The Pith : (Fig. 3)

The parenchyma cells of the pith are nearly rounded with thin walls. They contain prisms and clusters of calcium oxalate as well as minute simple starch granules.

The old stem, shows nearly the same structure, with the presence of several scattered small groups of phloem fibres, wide region of xylem, and a partially hollow center.

The Powder : (Fig. 4)

The powdered young stem is dark green in colour, with faint odour and bitter astringent taste. It is characterised microscopically by the following features.

1-**Fragments** of the epidermal cells, with frequent anomocytic stomata. The epidermal cells are elongated, covered with thick-smooth cuticle. Trichomes are unicellular with broad base showing cystolith of calcium carbonate. Also glandular type is seen with unicellular stalk and bicellular head divided vertically, either with the epidermal cells or free in the field.

2-Fragments of lignified pericyclic fibres with some what irregular outline, wide lumina and acuminate apices simple or forked.

3-Xylem vessels which are lignified, together with tracheids and wood parenchyma.

4-Medullary ray cells with thick, pitted and lignified walls.

5-Fragments of parenchyma cells of pith, with thin walls, containing clusters and prisms of calcium oxalate and minute starch granules.

6-Free prisms and clusters of calcium oxalate.

7-Starch grains are simple.

B- THE LEAF

Macromorphology:

The leaves are simple, opposite decussate, shortly petiolate, ovate triangular or oblong in shape pinnatifid with crenate margin obtuse apex and papery texture. Both surfaces are hairy. They have dark green upper surface and a paler lower surface. The midrib is prominent on the lower surface but sunken on the upper one. Venation is pinnate reticulate and anastomose near the margin. The leaf measure from 2-8.2-9.2 cm long and

1.2-3.5-4.5 cm wide in the middle part. The leaves have a faint odour and slightly bitter taste.

Micromorphology :

A transverse section in the leaf (Fig. 5 A) appears more or less planoconvex in outline with the midrib projecting on the lower surface. It shows a dorsiventral structure with an upper palisade consisting of 3 rows, the outer row is longer than the other two rows. The palisade is not continuous in the region of the midrib where it is replaced by subepidermal mass of collenchyma. Another layer of collenchyma is present abutting on the lower epidermis. The midrib region shows a large main vascular bundle. The pericycle is parenchymatous. Both the upper and the lower epidermises show glandular and non-glandular trichomes which increase in number over the midrib region.

The Upper Epidermis

It consists of one row of tangentially elongated cells (Fig. 6B). In surface view (Fig. 5B), the cells appear polygonal, isodiametric or slightly elongated, with more or less straight anticlinal walls, being about 16-20-24 μ in height, 36-52-60 μ in length and about 20-36-48 μ in width. The cells are covered with thick smooth cuticle. Stomata of the anomocytic type surrounded by 4-5 epidermal cells. Trichomes are abundant, both of glandular and non-glandular types. The glandular type are numerous, with globular bicellular head and the stalk is mostly unicellular sometimes multicellular uniseriate of 2-4 cells (Fig. 8). The nonglandular trichomes are unicellular, conical or elongated in shape, slightly bent with acuminate apices, covered with warty cuticle measuring 140-148-208 μ in length and 28-40-60 μ at the base. Some of these hairs show cystloith of calcium carbonate in their enlarged bases.

The Lower Epidermis :

It forms one row of square cells as seen in transverse section (Fig. 6 B). In surface view (Fig. 6 A), the cells are polygonal, mostly isodiametric with slightly wavy anticlinal walls measuring 28-40-60 μ in length and 16-32-40 μ in width. The cells are covered with thin smooth cuticle. Stomata and trichcmes are similar to those of the upper epidermis but more numerous.

The Mesophyll : (Fig. 6 B)

The palisade consists of 3 rows of columner cells measuring 24-44-60 μ in height and 12-16-20 μ in diameter. The spongy parenchyma are irregular cells of 4-5 rows containing minute starch granules and prismatic crystals of calcium oxalate.

The Cortical Tissue : (Fig. 7)

Collenchyma cells are arranged in 3-4 rows of nearly rounded cells measuring 16-40-48 μ in width. The parenchyma surrounding the vascular bundle are rounded in shape with slightly irregular walls somewhat wide intercellular spaces. They contain minute starch granules as well as prisms and clusters of calcium oxalate.

The Vascular System : (Fig. 7,8)

It is represented by a large central crescent shaped vascular bundle, formed of an upper xylem and a lower phloem separated by the cambium. The xylem consists of pitted, spiral and scalariform lignified vessels measuring 12-16-36 μ in diameter. The phloem con-

sists of thin walled, shining soft cellulosic elements. The pericycle is formed of 2-3 rows of thin-walled parenchymatous cells.

THE POWDER

Powdered leaf of *Verbena officinalis* L. is dark green in colour, with faint aromatic odour and slightly bitter taste. It is characterized microscopically by the following features (Fig. 8).

1-Fragments of the upper epidermis showing polygonal, isodiametric cells with straight anticlinal walls, showing non-glandular trichomes, usually unicellular stalk and enlarged base with cystolith of calcium carbonate.

2-Fragments of the lower epidermis showing polygonal cells with slightly wavy anticlinal walls, showing anomocytic stomata as well as glandular and non-glandular trichomes.

3-Scattered entire or fractions of glandular and non-glandular trichomes.

4-Fragments of mesophyll tissue with green columnar palisade cells and spongy parenchyma containing prisms of calcium oxalate.

5-Fragments of lignified pitted, spiral and scalariform vessels.

6-Fragments of parenchyma cells containing prisms of calcium oxalate and minute starch granules.

7-Numerous free simple starch grains and scattered prisms and clusters of calcium oxalate.

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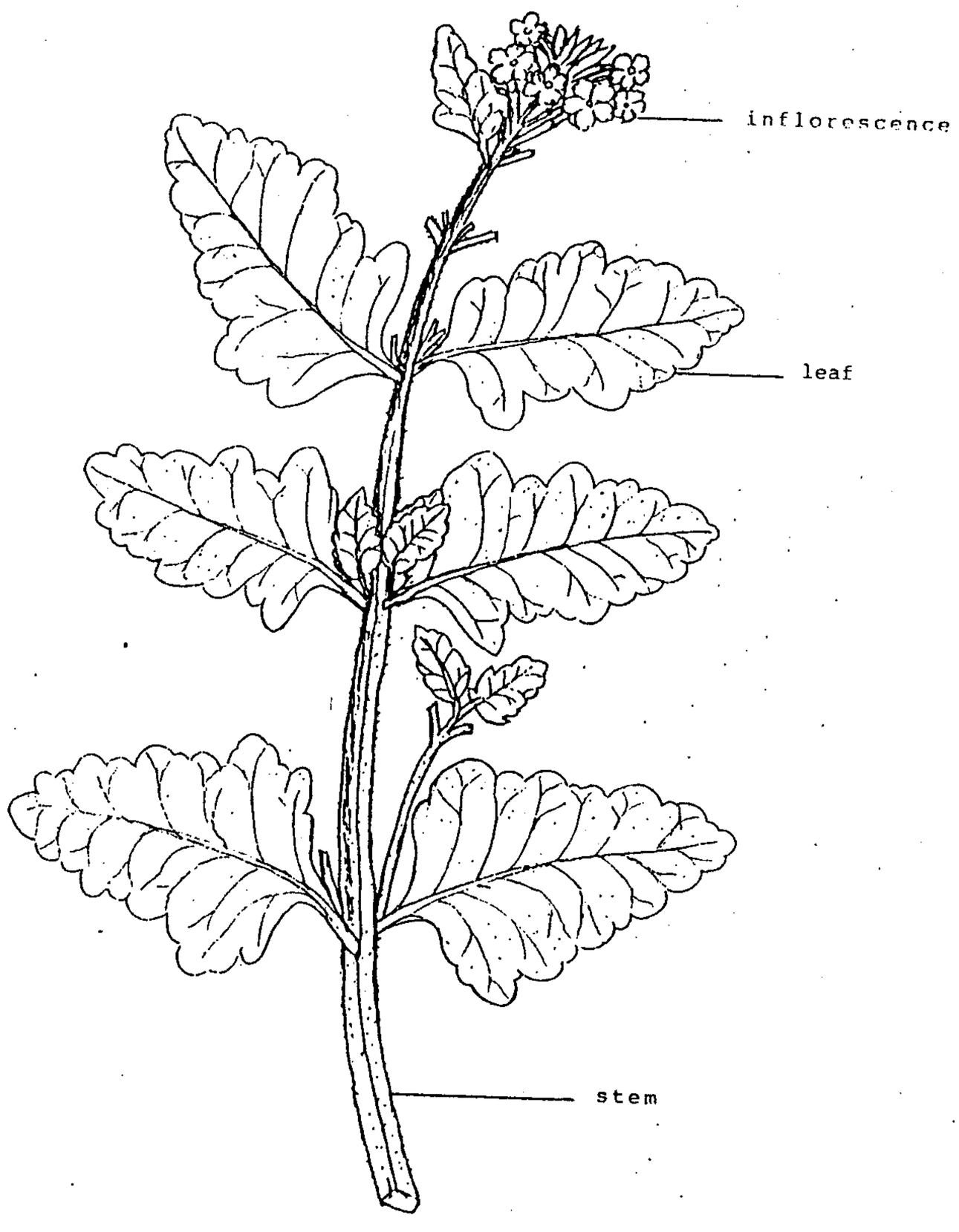


Fig. 1: Flowering branch of Verbena officinalis L. x 1/2

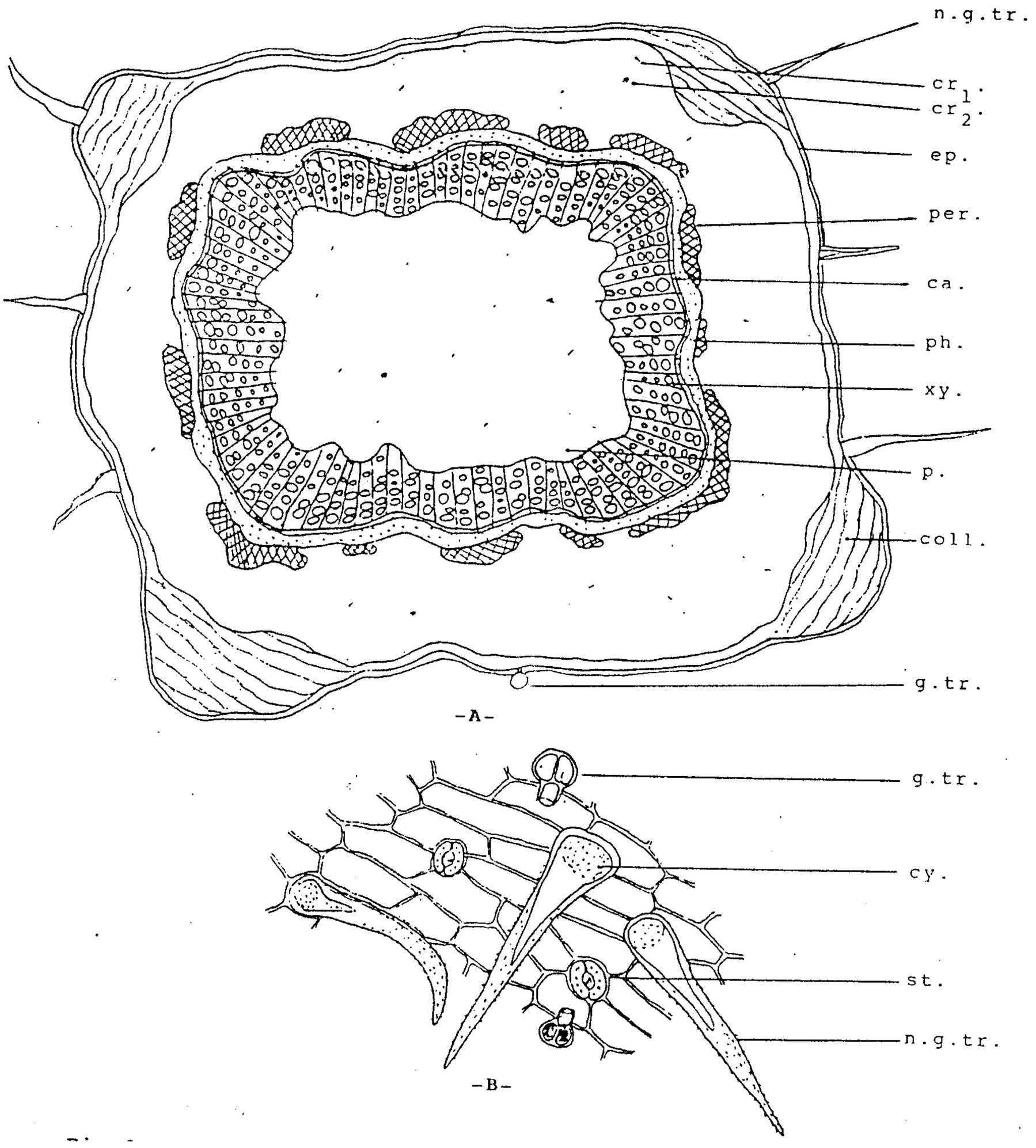


Fig. 2: A.Diagrammatic T.S. of the stem. x 30
B.Surface preparation of the stem. x 198

ca., cambium; coll., collenchyma; cr_1., prisms of calcium oxalate; cr_2., cluster of calcium oxalate; cy., cystolith of calcium carbonate; ep., epidermis; g.tr., glandular trichome; n.g.tr., non-glandular trichome; p., pith; per., pericycle; ph., phloem; s., stomata; xy.,xylem

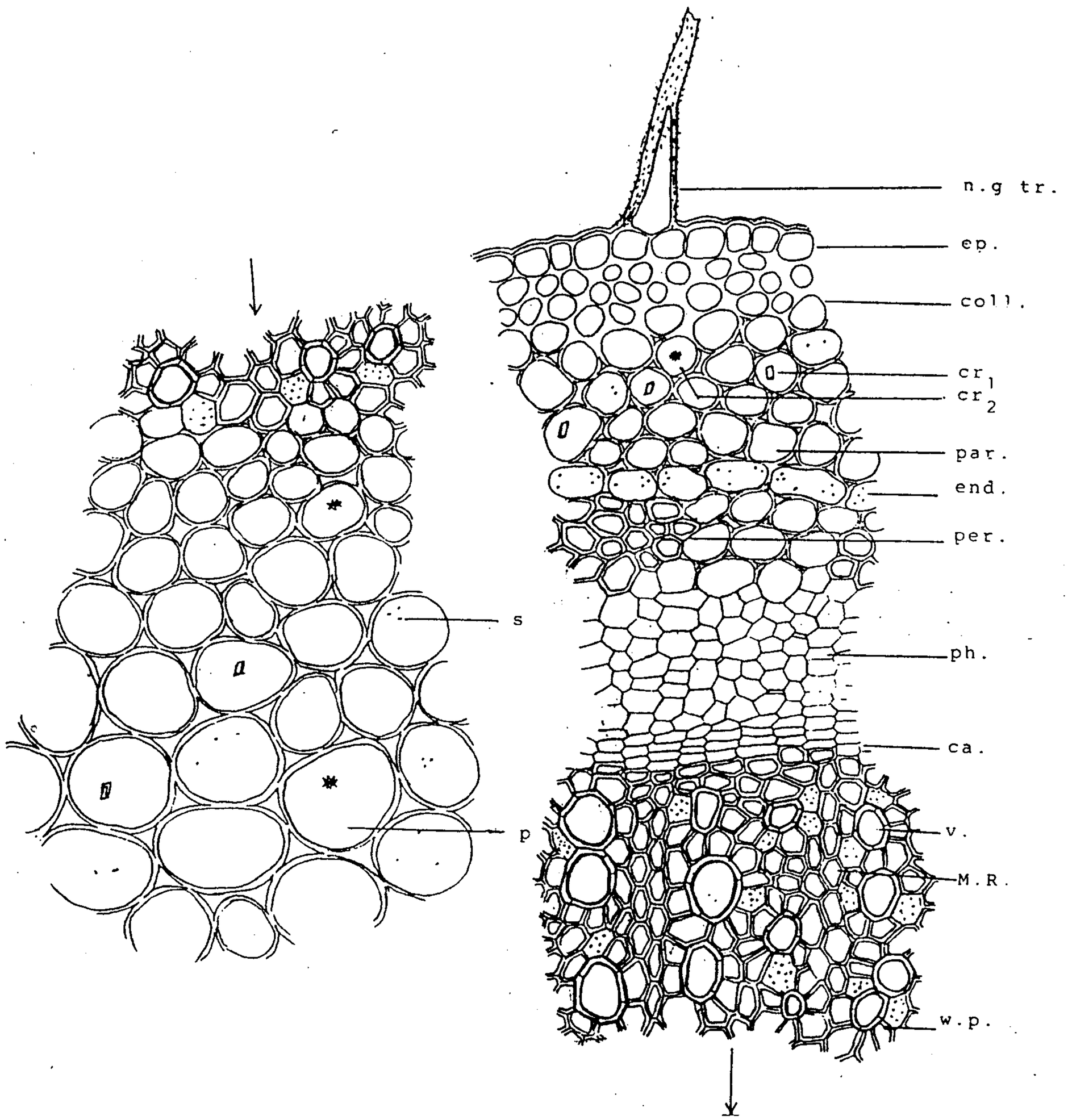


Fig. 3: T.S. sector of the stem. x 198

ca., cambium; cr_1., prisms of calcium oxalate; cr_2., cluster of calcium oxalate; coll., collenchyma; end., endodermis; ep., epidermis; m.r., medullary ray; p., pith; par., parenchyma; per., pericycle; ph., phloem; s., starch. granules; v., vessels; w.p., wood parenchyma.

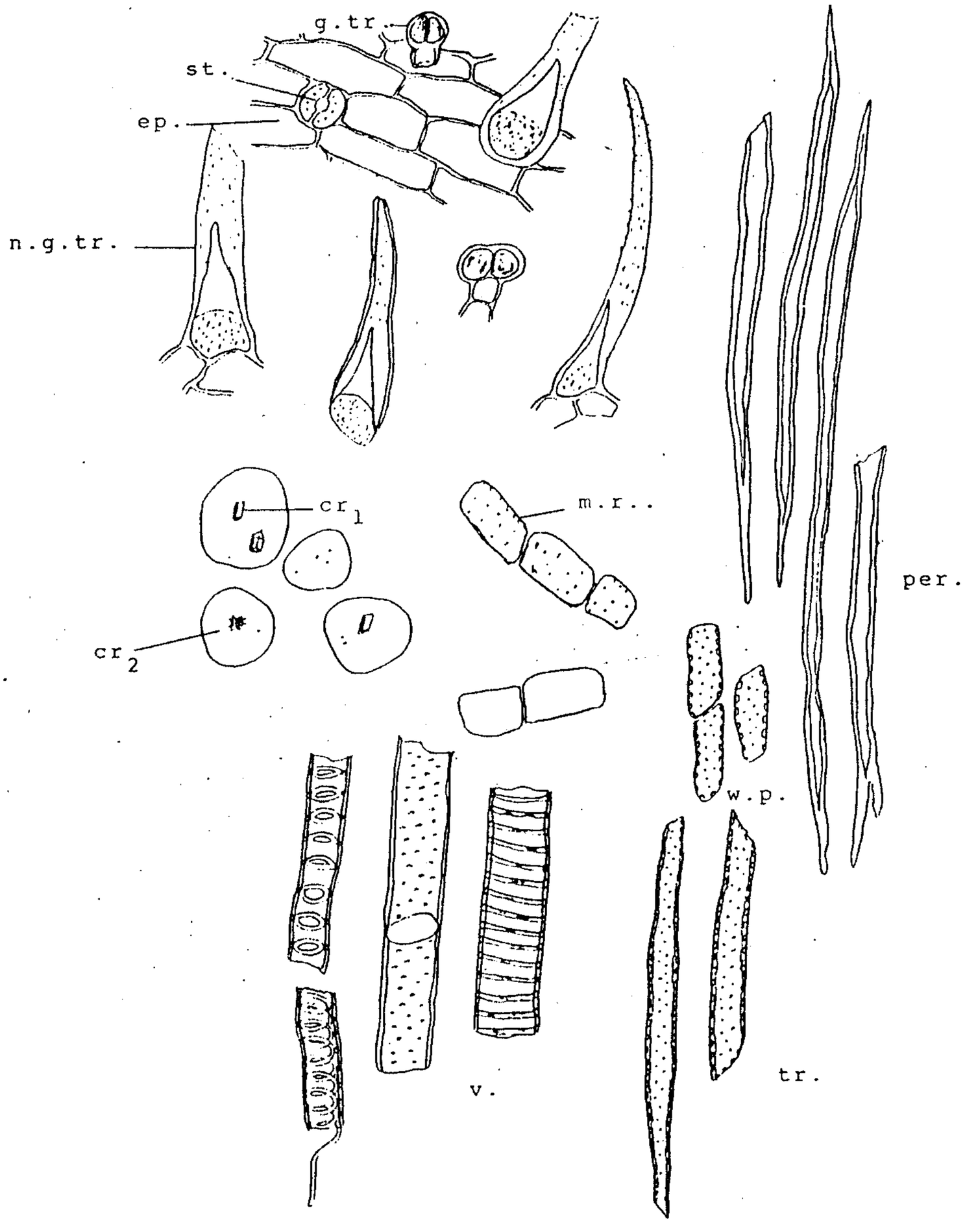


Fig. 4: Powder of the stem. x 198

cr_1., prisms of calcium oxalate; cr_2., cluster of calcium oxalate; ep., epidermis; g.tr., glandular trichome; m.r., medullary ray; n.g.tr., non-glandular trichome; per., pericyclic fibres; tr., tracheid; v., vessels; w.p., wood parenchyma.

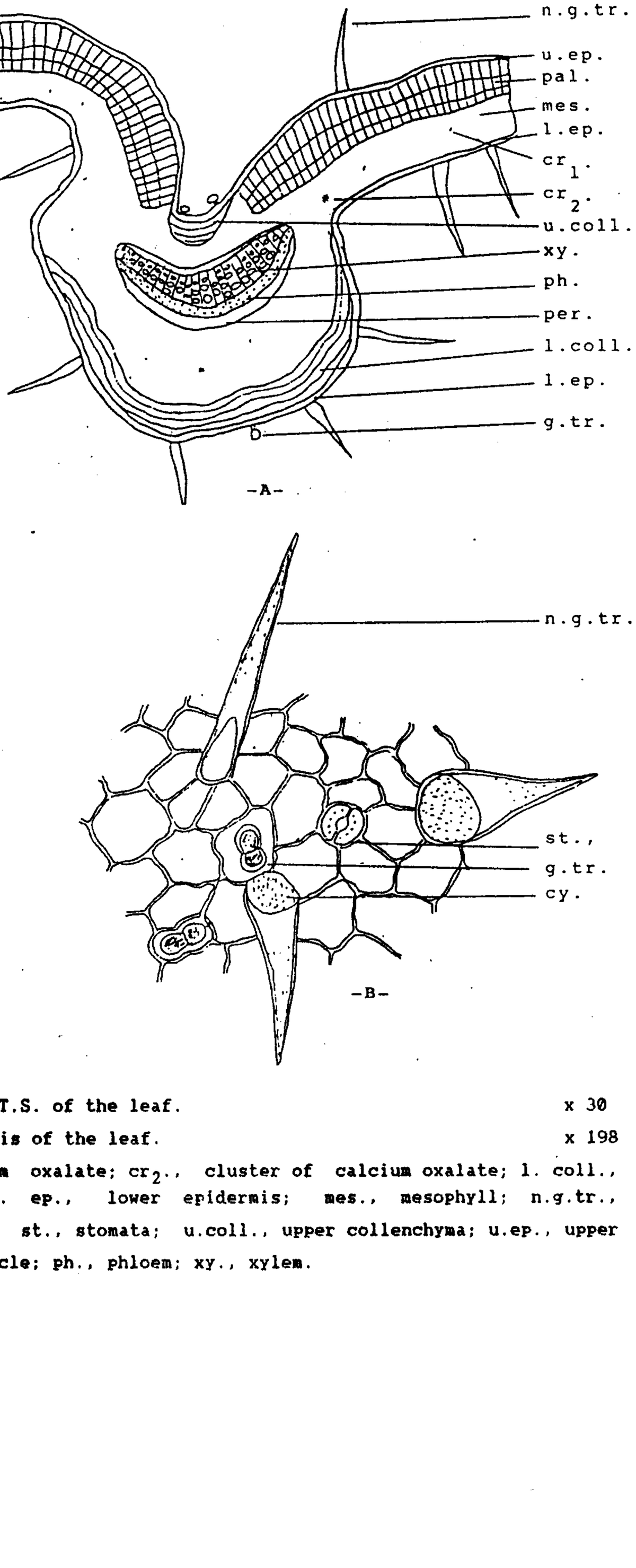


Fig. 5: A.Diagrammatic T.S. of the leaf. x 30

B.Upper epidermis of the leaf. x 198

cr_1., prisms of calcium oxalate; cr_2., cluster of calcium oxalate; l. coll., lower collenchyma; l. ep., lower epidermis; mes., mesophyll; n.g.tr., non-glandular trichome; st., stomata; u.coll., upper collenchyma; u.ep., upper epidermis; per., pericycle; ph., phloem; xy., xylem.

Macro-and Micromorphology of Verbena officinalis L. Cultivated in Egypt

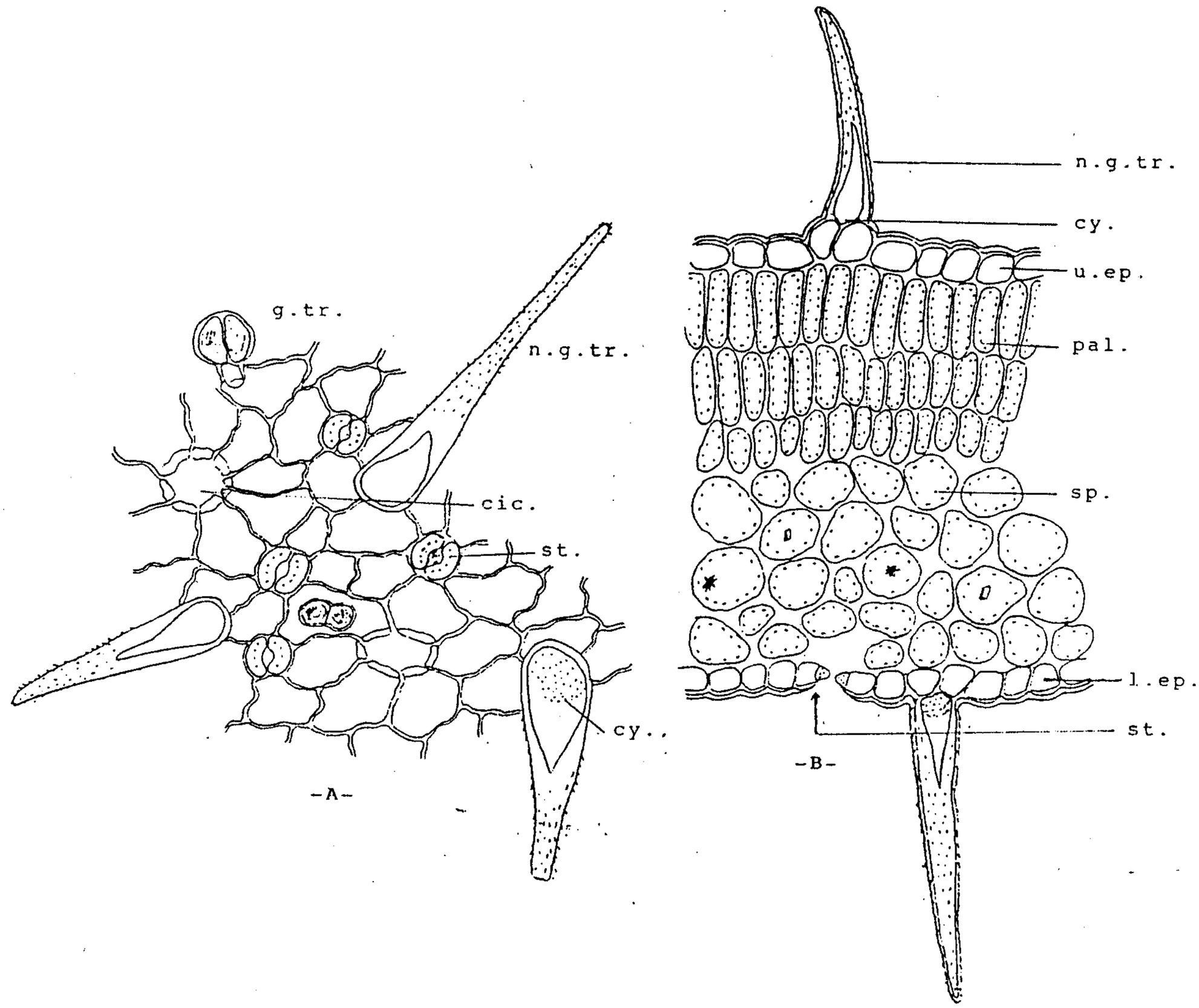


Fig. 6: A.Lower epidermis of the leaf. x 198

B.T.S. sector of the lamina. x 198

cy., cystolith; cic., cicatrix; n.g.tr., non-glandular trichome; pal., palisade; st., stomata; sp., spongy tissue; u. ep., upper epidermis.

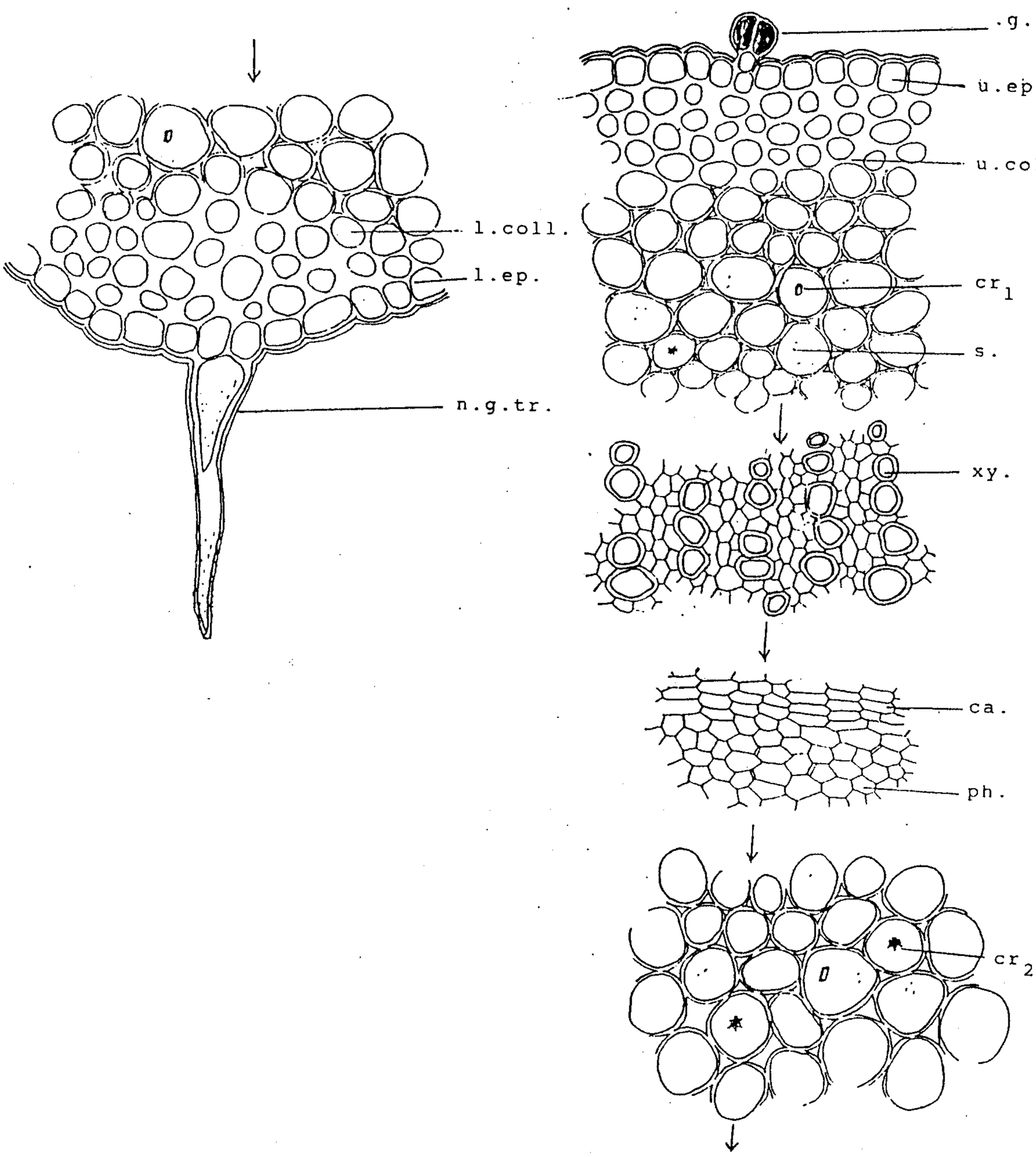
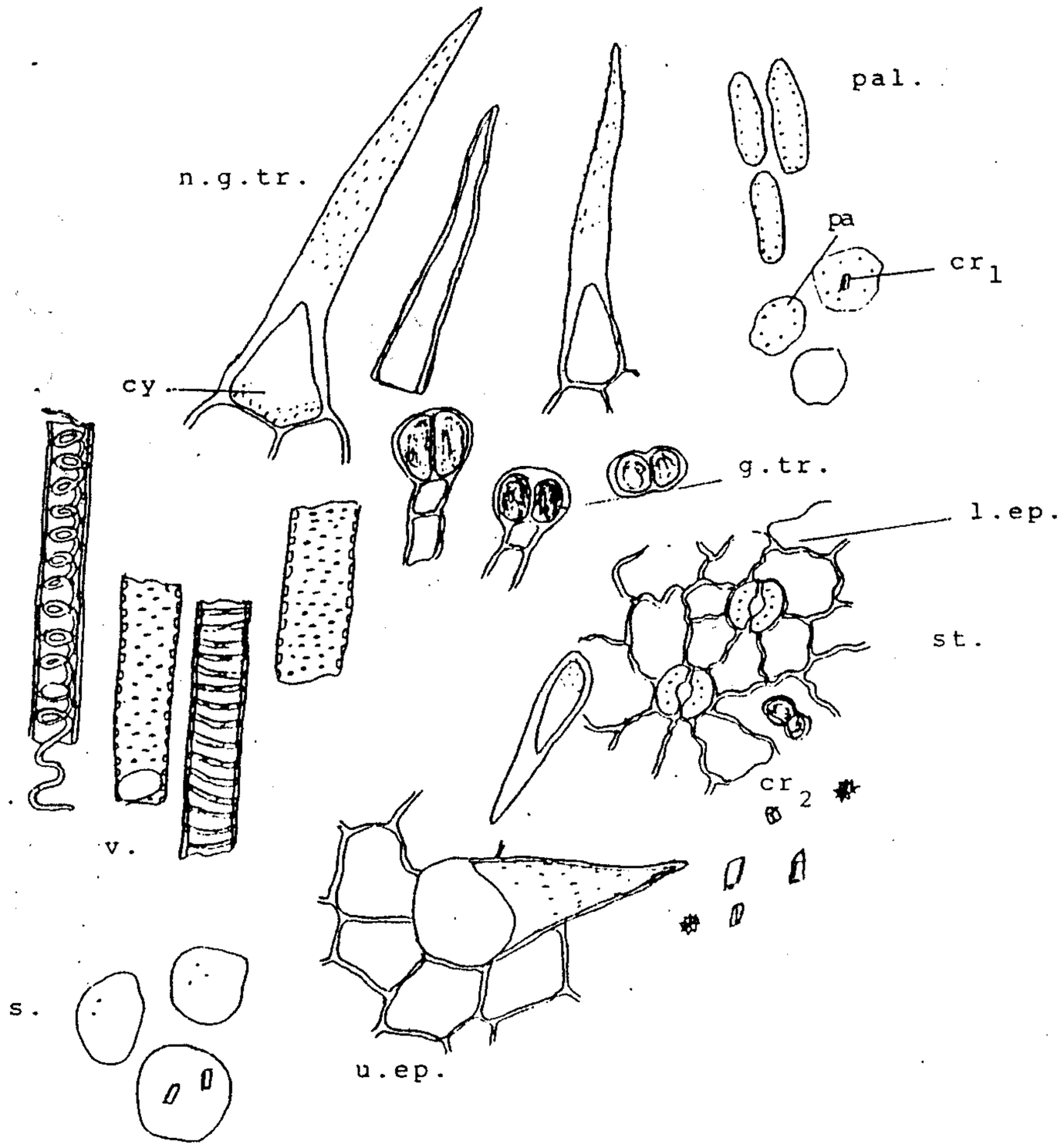


Fig. 7: T.S. Sector of the midrib. x 198

ca., cambium; cr_1., prismis of calcium oxalate; cr_2., cluster of calcium oxalate; g.tr., glandular trichome; l.coll., lower collenchyma; l.ep., lower epidermis; n.g.tr., non-glandular trichome; s., starch granules; u.coll., upper collenchyma; u. ep., upper epidermis; xy., xylem.

Macro-and Micromorphology of Verbena officinalis L. Cultivated in Egypt



x 198

Fig. 8: Powder of the leaf.

cr_1., prisms of calcium oxalate; cr_2., cluster of calcium oxalate; cy., cystolith of calcium carbonate; g.tr., glandular trichome; l.ep., lower epidermis;

الصفات العيانيه والمجهريه لنبات فيربينا أوفسينال ال المنزرع فى مصر

الجزء الأول: الساق والورقه

عفاف محمد عبد الباقى

قسم العقاقير - كلية الصيدلة - جامعة أسيوط

نبات الفيربينا أوفسينال ال من نباتات المناطق الاستوائية والحاره وينتمى الى الفصيله الفيربينية.

ولهذا النبات عدة استعمالات فى الطب الشعبى فى كوريا والصين وغيرها فهو يستعمل لعلاج الاكزيما المزمنه، ضيق الشعب، طارد للديدان، معرق وكذلك لعلاج الاضطرابات المصاحبه للطمث.

وقد فصل من هذا النبات بعض المركبات مثل الايرودويدات، اللوبيول، ب-سيتو-ستيرول، حمض البورسوليك، اكيوبين وأرتيمتين.

وقد تم فى هذا الجزء عمل دراسة عقاقيريه لهذا النبات لدراسة الصفات العيانيه والمجهرية للساق والأوراق لامكان التعرف عليها سواء كانت كاملة أو على هيئة مسحوق.

Received in 26/3/1990 & accepted in 29/5/1990.