BOTANICAL PHARMACOGNOSTIC STUDY OF RHAZYA STRICTA DECAISNE

Part I.—Stem and Leaf

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The macroscopic and microscopic characters of the stem and leaf of *Rhazya stricta* Decaisne are described.

The stem is characterized by the presence of large amount of included phloem bands in the xylem and internal phloem. Periderm is formed superficially just below the epidermis unlike *Rhazya orientalis*, in which it is deep seated.[1] Presence of non-articulated branched and non-articulated unbranched laticifers and the absence of crystals in the stem tissues are the distinguishing characters. The leaf is isobilateral and is characterized by the absence of trichomes on both the surfaces and the presence of an arc shaped xylem. Internal phloem is also present like the stem.

Introduction

Rhazya stricta Decaisne. (Vern. Vena, Candera) belonging to the family *Apocynaceae* is a small shrub widely but sparsely distributed from Yemen to the north western region of Indo-Pakistan sub-continent and Sind. The leaves carry a considerable reputation as a bitter tonic for fevers and general debility. The drug is rich in alkaloids (8—10%), of which four have been isolated in pure and crystalline state. Recently a new alkaloid Rhazine has also been reported.[2] As this plant is of medicinal importance and there is no publication existing on this subject, the present work was undertaken.

Botanical Description

The plant is a small, glabrous, very stout, erect and sparingly branched leafy shrub. Leaves yellowish and leathery when dry, sessile. Flower short, axillary, stoutly branched cymes, shortly and stoutly pedicelled. Bracts subulate, persistent. Calyx short, 5 partite, without glands, lobes acute. Corolla white, upper half inflated, salver-shaped, tube cylindric, throat constricted, hairy. Stamens above the middle of the tube, included, anthers lanceolate, disc annular or obscure. Carpels 2, distinct, style filiform. Follicles erect, parallel, slightly compressed, thinly coriaceous.[3,4]

Materials and Methods

The material used for the present study was obtained from the suburbs of Peshawar i.e. Jamrud and Khyber Agency. The identity of the material was checked in each case by referring to the descriptions available in different floras [3-5] and was rechecked by comparing them with authentic herbarium specimens available in these Laboratories. Stems and leaves in different stages of development were obtained from plants of different sizes and were fixed in F.A.A. for microtome sectioning. Pieces of stem were softened before dehydration and embedding was done by Lendrum's technique which consists in immersing the tissues in 4% aqueous phenol for one to three days, after washing out the fixative.[6] Dehydration was done with normal butyl alcohol and ethyl alcohol, and paraffin wax embedding was done according to Zirkle's method given by Youngken.[7] The sections were stained with Safranin, and Fast green. For maceration of the material Jeffrey's method[8] was employed because this gave very satisfactory results. Hand sections of fresh material were cut for the various microchemical tests as given by Johansen and E. Gurr.[6,8] Quantitative data concerning palisade ratio and stomatal index were obtained by procedures as given by Youngken[9] and analysed statistically. The uniform powdered material was obtained by sifting it through a No. 80 sieve and studied after clearing in chloral hydrate. Cell measurements were taken with an eyepiece micrometer.

Description of the Stem

Macroscopic Characters.—The young stem is green and smooth while the older stem is yellowish brown in colour and rough. Leaves are crowded and spirally arranged (Fig. 1). Large number of lenticels are seen on the larger stems. The diameter of the stem varies from about a few mm. to 3-4 cms. Internally the stem presents a creamy appearance. The amount of the xylem as indicated by its yellow colouration comprises about one half of the entire diameter of the stem in young plant. It however, increases as the plant ages and constitutes about three-fourths in 2 to 3-year old stem. The odour is slight, taste bitter and acrid.

Microscopic Characters.—Young stem shows a somewhat circular outline surrounded by a single layered epidermis, the cells of which are cuticulariz-

ed and rectangular in shape. Below the epidermis is a collenchymatous region, 3-4 cells in width. The cortex is thin walled and contains laticifers with coloured contents. The vascular xylem is in the form of a ring encircled by phloem. There is also internal phloem towards the pith. The pith is parenchymatous. Pith cells in T.S. measure 21 μ – 57 μ – 80 μ.

In the older stem the epidermis does not rupture for a long time even after a considerable amount of secondary xylem has been formed. The epidermal cells together with the cortex go on dividing anticlinally and keep pace with the superficially formed phellogen. In this respect it differs from *R. orientalis* in which the phellogen is deep seated

Fig. 1.—Shoot of *Rhazya stricta*.

(Fig. 2).[1] Later, the continuity of the epidermal cells is broken by the formation of lenticels (Fig. 3). The epidermal cells measure 15 μ –20 μ – 28 μ in transverse section. Below the epidermis arises a single layer of meristematic, rectangular, thin walled cells which constitute the phellogen (Figs. 2 and 3). This contributes phellem towards the outer side and phelloderm towards the inner side. The activity of the cork cambium or phellogen is not much pronounced in this plant. The cork cells in T.S. measure 20 μ – 50 μ – 70 μ. Below the phellogen is the primary cortex which contains proteins and a few starch grains. These cells in T.S. measure 15 μ – 45 μ – 65 μ. Pigments and crystals are lacking in the cortex.

Beneath the cortex are the phloem elements which occur in the form of a cylinder. Some of the primary phloem elements are transformed into white phloem fibres which are present in the secondary phloem formed through the activity of the vascular cambium. The phloem is composed of sieve tubes, companion cells and phloem rays. There is also internal phloem in bands towards the interior of the xylem in the young as well as old stems as in *R. orientalis* (Figs. 2 and 3). The old stem is also characterized by the presence of included phloem (Interxylary phloem) in the xylem. It is present in the form of irregularly shaped islands containing sieve tubes with wide lumina. Presence of interxylary phloem is characteristic of this genus like other members of the family and also in *R. orientalis*.[1] Laticifers are also present in the phloem.

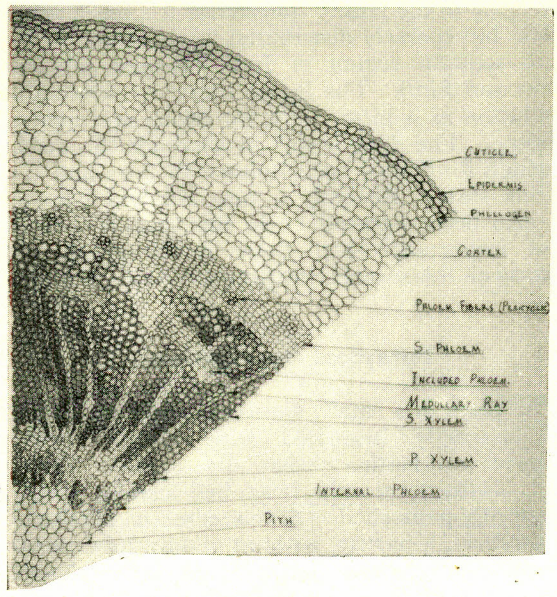

Fig. 2.—T. S. *Rhazya stricta* Stem Old.

The xylem as already pointed out constitutes about three-fourths of the area in the older stems. It is generally in the form of a continuous cylinder traversed by narrow, uniseriate or rarely biseriate rays and included phloem. The primary xylem is composed of vessels, tracheids and xylem parenchyma. The secondary xylem formed through the activity of vascular cambium is composed of vessels, tracheids, fibres, xylem parenchyma and a few ray cells. In the vigorously growing plant the cambium is not well differentiated. Vessels are typically small but a few medium sized vessels are also present. Perforations are simple and typically small in relation to the diameter of the vessels and with wide rims. Inter-

vascular pitting alternate, very small to minute; pits in ray and wood parenchyma similar. The vessels measure about 271 μ – 357 μ – 428 μ in length and 28 μ – 30 μ – 35 μ in width, and have typically bordered pitting. Tracheids of different shapes are irregularly scattered. Some of the tracheids are with scalariform and reticulate thickenings while others show spiral and annular thickenings. They measure about 285 μ – 600 μ – 800 μ in length and 15 μ – 21 μ – 28 μ in width. Fibres with bordered pits having elongated pit apertures are seen in the xylem. These measure about 400 μ – 500 μ – 625 μ in length. Medullary rays are usually uniseriate but occasionally a biseriate ray may also be found. Xylem parenchyma is apotracheal and the cells are short and irregular. (Fig. 4)

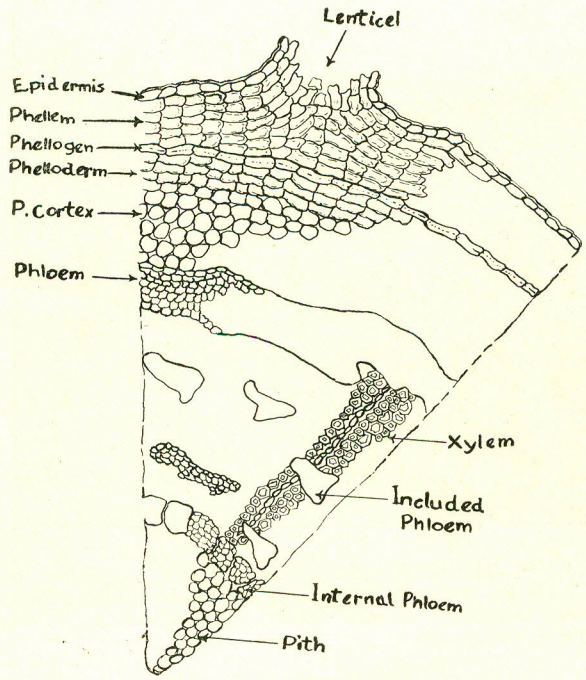

Fig. 3.—T. S. *Rhazya stricta* Older with Periderm (Diagramatic)

Non-articulated branched and unbranched laticifers are seen in the cortex, phloem, and pith. The pith cells are parenchymatous with starch, alkaloids and proteins in them, whose presence is also confirmed by microchemical tests.

Powdered Stem

The powdered stem is light green in colour having bitter and acrid taste. The colour of the powder changes to yellowish green on exposure to light for sometime. Odour is slight and distinctive. Its salient microscopic characters are (i) presence of broken pieces of epidermis, (ii) broken and complete vessels, (iii) fibres, (iv) xylem parenchyma, (v) cork and cortical cells and (vi) broken non-articulated laticifers which are seen in abundance (Fig. 5).

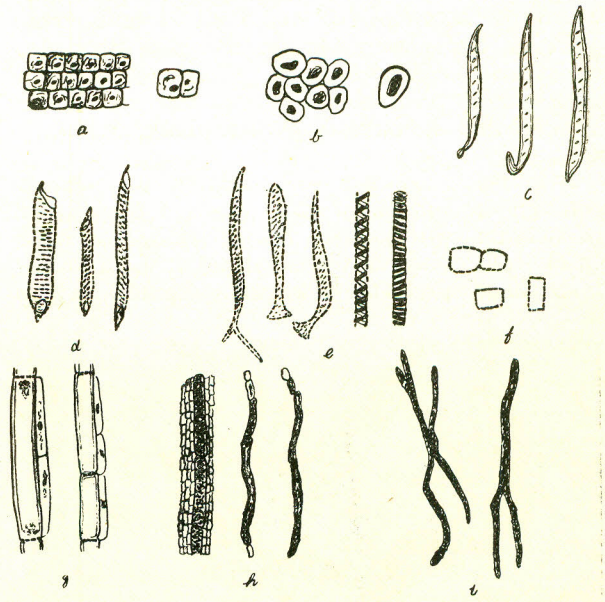

Fig. 4.—Macerate Stem (Diagramatic), a, Corkcells; b, Cortical cells; e, Fibres; d, Vessels, e, Tracheids, f, Xylem Parenchyma, g, Sieve Tubes, h, Non-articulated unbranched laticifers, i, Non-articulated branched laticifers.

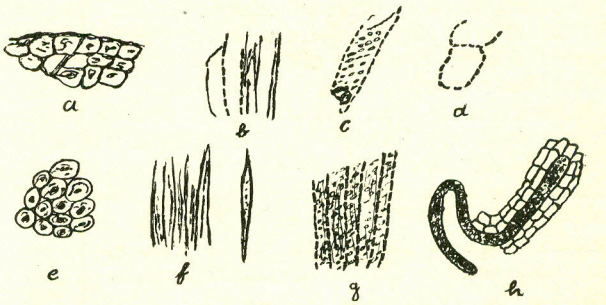

Fig. 5.—Powdered Stem a, Cork cells, b, Vessels and Tracheids, e, Vessels d, Xylem parenchyma, e, Cortical cells, f, Fibres, g, Vessels, h, Non-articulated laticifer.

Microchemical Tests

The reagents used for the detection of various substances in the cell tissues were the same as given by Johansen and E. Gurr.[8,6] Alkaloids are present in all the tissues of the stem. Starch is present only in a few cortical and pith cells. Cal-

cium oxalate crystals are absent. Proteins are abundant in all the tissues of the stem.

Description of the Leaf

Macroscopic Characters.—Leaves are spirally arranged and crowded; lamina linear, elliptic, lanceolate or oblanceolate, narrowed at both ends, glabrous but puberulous on the midrib, alone, coriaceous, bright, yellowish green and leathery, midrib stout with lateral nerves obscure. Taste is bitter and the odour slight and distinctive[4,3],

Microscopic Characters.—A transverse section through the lamina (Fig. 6) shows a thick layer of striated cuticle; the cells of epidermis have thick walls towards the outer side. Leaf is isobilateral without any trichomes. Epidermal cells

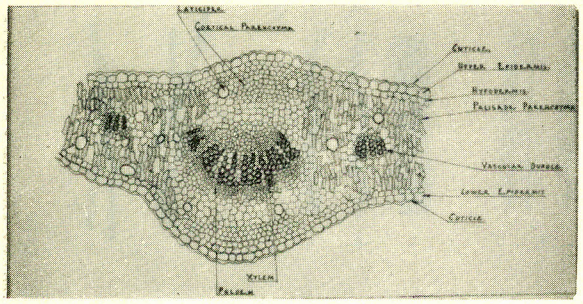

Fig. 6.—T. S. of *Rhazya stricta* leaf.

are rectangular in shape and measure in T. section 15 μ – 21 μ – 35 μ. A hypoderm of one layer of cells in thickness is seen on both sides of the leaf except in the midrib region where it is 2-3 layered. Its cells in T.S. measure about 10 μ – 15 μ – 25 μ. Stomata are present on both the surfaces. Palisade parenchyma is seen towards both the surfaces. These cells are filled with chloroplasts. Within the palisade layer large number of air spaces and laticifers are to be seen. The palisade cells measure about 55 μ – 100 μ – 128 μ in length. The palisade tissue found in the middle of the leaf, however, is composed of almost isodiametric cells which cannot be considered as spongy parenchyma. Laticifers are scattered irregularly. Palisade and spongy parenchyma is absent in the midrib region but is replaced by cortical parenchyma with a few layers of collenchyma. Vascular bundle of the midrib resembles that of a young stem without secondary growth. Midrib exhibits a crescent shaped median vascular strand with phloem on both sides i.e. typically bicollateral bundle. The phloem on the lower side is in the form of an arc while the intraxylary (internal) phloem is in the form of patches. Xylem is composed of vessels and tracheids. Vessels have spiral, annular and sclariform thickenings. They measure 35 μ – 57 μ – 85 μ in length and 15 μ – 20 μ – 28 μ in width. Phloem fibres are absent. Large amounts of non-articulated branched and unbranched laticifers are seen in the macerated tissue. (Fig. 7)

Powdered Leaf

Powdered leaf is green in colour with bitter taste and slight odour. The important structures seen under the microscope are:

Fig. 7.—Macerate of leaf a, Epidermis of midrib, b, Epidermis of leaf blad, c, Latix cells, d, Non-articulated unbranched laticifers, e, Non-articulated branched laticifers, g, Tracheids, h, Xylem fibres, i, Palisade cells.

(i) large amount of broken pieces of laticifers,

(ii) broken pieces of epidermis of the lamina and midrib,

(iii) palisade cells,

(iv) pieces of vessels, tracheids and fibres (Fig. 8).

Microchemical Tests

As in the case of stem the reagents employed for microchemical tests were the same as given by E. Gurr and Johansen.[6,8] Alkaloids are present in all the parts of the leaf while starch is seen only

in a few cells of the palisade and a few cells of the cortical parenchyma of the midrib region. Calcium oxalate and potassium nitrate are absent. Proteins are present in all the cells of the leaf.

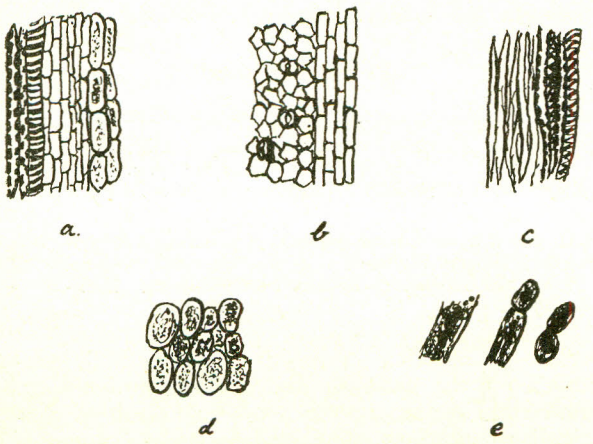

Fig. 8.—Powdered leaf a, Vessels with Epidermis and palisade cells, b, Epidermis of midrib and leaf blade, c, Vessels, tracheids and fibres, d, Palisade cells, e, laticifer.

Quantitative Data

The palisade ratio is 2.75–3.46 (±0.15)–4. Stomatal index of the upper epidermis varies in different portions of the leaf i.e. in the base, middle and upper regions, it is, 7.4–7.82–8.3; 8.3–8.95–9.6 and 8.3.8.72–9.4, respectively. Same is the case with lower epidermis where in the base, middle and apex, it is, 5.8–6.21–6.8; 8.6–9.07–9.4; and 7.4–7.86–8.4, respectively.

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