A PHARMACOGNOSTIC STUDY OF WITHANIA RADIX

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The macroscopic and microscopic characters of the root of *Withania somnifera* Dun, which is regarded as a tonic, alterative and aphrodisiac, and is used in consumption, emaciation of children, debility from old age, rheumatism etc. are described. In Rajputana the roots are regarded as beneficial in rheumatism and dyspepsia. In the former Panjab it is used for lumbar pains and in the former Sind it is used to produce abortion. An enema of the decorticated root is given to feverish infants by Zulus. They regarded the plant as a specific for gangrenous rectitis and in the treatment of syphilis. The drug is described as official in Indian Pharmaceutical Codex. Presence of periderm, large amount of starch grains in the secondary cortex and parenchyma of wood, are the chief distinguishing characters. The medullary rays are not very clear as the vessels are scattered irregularly. Absence of pigments and crystals in the cortex are diagnostic characters.

Withania radix consists of dried roots of *Withania somnifera* Dun and belongs to the family *Solanaceae*. The plant is found throughout the drier parts of the Indo-Pakistan sub-continent, is rare in lower Bengal, Ceylon and Afghanistan, and is distributed in the Mediterranean regions, the Canaries and the Cape of Good Hope.

The plant is an unarmed, erect undershrub. Branches are round, thinly wooly, and greyish, almost pointed, stalks 1/4-1/2″. Flowers 1/4-1/2″ greenish yellow, axillary, sessile or shortly stalked, solitary or clustered, hermaphrodite. Calyx 1/5″ in flower, 3/4″ in fruit, bell-shaped, 5-6 toothed, in fruit papery, swollen, enclosing the berry. Corolla bell-shaped, lobes 3-6, short, valvate in bud, 1/4″-1/2″, greenish or lurid yellow. Stamens 5-6, on the base of the corolla, anthers oblong, filaments linear, anthers level with the stigma, dehiscing longitudinally. Ovary 2-celled, style linear, stigma shortly bifid, glabrous. Berry 1/4″-1/3″ in diameter, subglobose, red, smooth, enclosed in enlarged, membranous calyx. Seeds very many, 1/12″ in diameter discoid, embryo periphic.

Materials and Methods

The roots were obtained from plants grown in the Experimental Farm of the North Regional Laboratories, Peshawar. Roots of different plants and of different sizes were taken and fixed in F.A.A. for microtome sectioning. Dehydration was done with normal butyl alcohol and ethyl alcohol. For maceration of root material Jeffrey's method was employed as this gave very satisfactory results. A few representative roots were dried and later on powdered. The powder was then cleared in chloral hydrate and studied. Fresh hand sections were used for microchemical tests.

Macroscopical Characters

The root is tap-root type tapering towards lower end. The diameter of the root varies from 8-18 mm. It is smooth and uniform in appearance and bears lateral rootlets. Its surface is dark brown in colour and is smooth. The internal colour is creamy. A smooth transversely cut surface reveals a core of yellowish wood which occupies from one-half of the diameter of the entire root in the younger roots to two - thirds of the root diameter in the mature and older roots. The remaining portion of the root comprises periderm. In the dried roots, fracture is short and starchy. The odour is pungent; the taste is bitter and acrid.

Microscopical Characters

On the outside lies a narrow crumpled cork, the outermost cells of which are disorganized. The cork cells are delimited from the outermost layer of the secondary cortex by a single layer of meristematic, rectangular, thin-walled, cells which constitute the phellogen. (Figs. 2 and 3). The cork cells are large and suberized. These also contain some starch grains. In transverse section these cells measure 28-34-60 μ in diameter. The outermost portion of periderm is light brown in colour, broken at places and is composed of dead cells. Below the phellogen is the phelloderm or secondary cortex which consists of 10-15 rows of thin-walled rectangular parenchyma cells. These cells contain copious starch grains. Secondary cortex cells measure about 18-28-41 μ in diameter. Pigments and crystals are lacking in cortex cells. Absence of pigments and crystals has also been proved by microchemical tests. Internal to secondary cortex is a narrow region of phloem which is composed

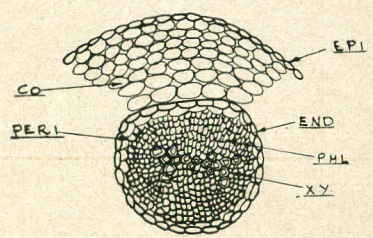

Fig. 1.—Transverse section of a young root showing primary diarch structure.

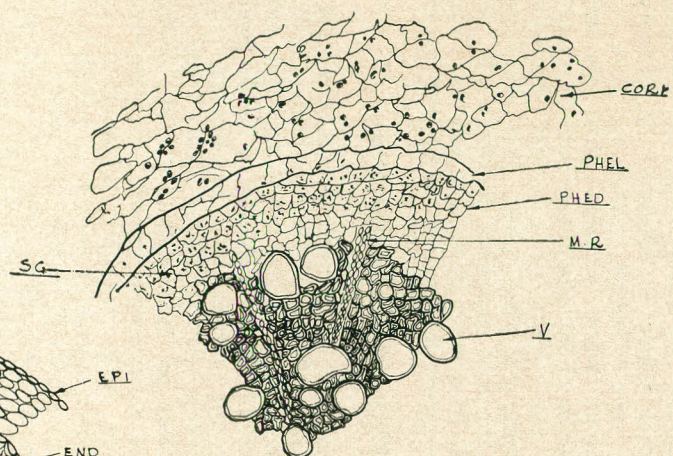

Fig. 2.—Transverse section of *Withania somnifera* Dun. root. Abbreviations: phel., phellogen; phed., phelloderm; S. Phl., Secondary phloem; M.R., Medullary ray; S. G., starch grain; v, Vessel.

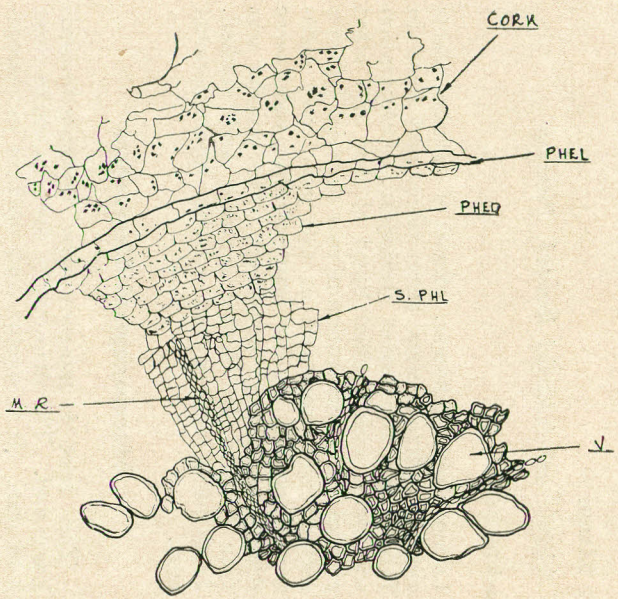

Fig. 3.—Transverse section of *Withania somnifera* root (older).

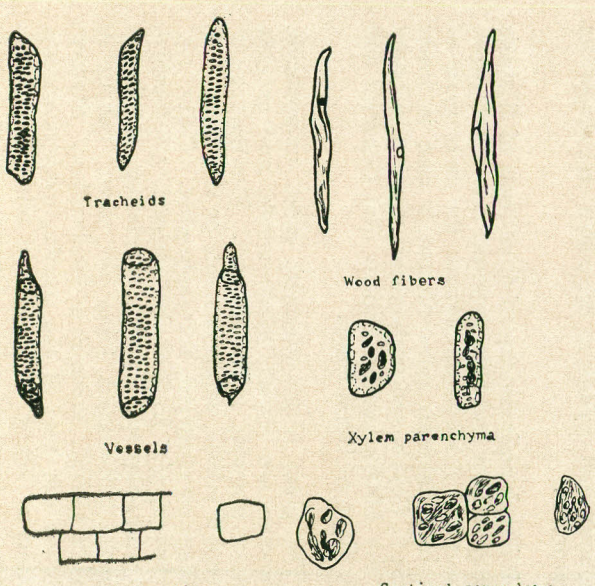

Fig. 4.—Macerated root showing different cell types (diagramatic).

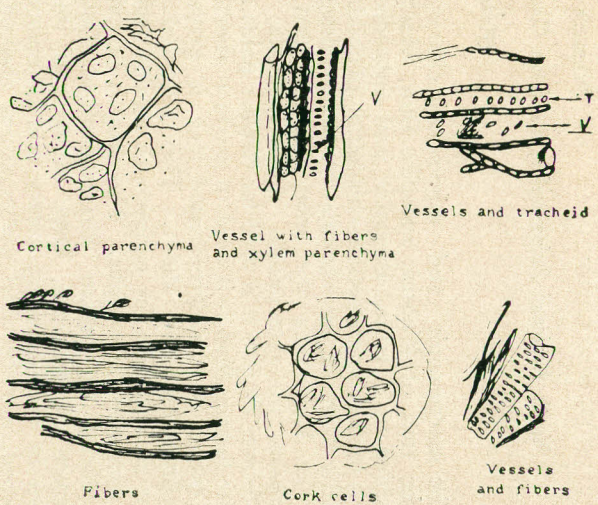

Fig. 5.—Powdered root of *Withania somnifera* showing different cell types (diagramatic).

of sieve tubes, companion cells and few medullary ray cells. The medullary rays are inconspicuous.

The xylem constitutes about one-half in a young root while in the older it occupies about two-thirds of the entire diameter of the root. The primary xylem in a very young root is diarch or tetrarch (Fig. 1). The primary xylem is composed of vessels, tracheids and parenchyma cells. The secondary xylem is composed of scalariform or pitted vessels, tracheids, wood fibres, a large amount of xylem parenchyma and medullary ray cells. The vessels may be large or small and are generally with end wall perforations. There is generally a tail towards the end wall perforations of the vessels. The vessel pitting is of bordered type. The vessels measure 105-165-270 μ in length from end to end, and 22-42-58 μ in breadth. The tracheids have bordered pits and measure 175-203-285 μ in length and 6-11-15 μ in breadth. The wood fibres are thick-walled cells and the ends are very much pointed (Fig. 4). These measure 315-426-480 μ in length and 5-7-9 μ in breadth. The xylem parenchyma cells are rectangular in outline and are associated with starch grains. The alkaloids are also indicated in xylem parenchyma cells by microchemical tests. There are bordered pits on all sides of xylem parenchyma cells (Fig. 4).

The medullary rays are not very prominent in the vascular region of this root. The rays are not straight as the vessels develop without any definite arrangement. The rays are uniseriate or biseriate. The medullary ray cells are few, narrow and rectangular in shape. These measure about 12-15-18 μ in diameter.

Microchemical Analysis

Microchemical tests were performed according to Johansen. These tests show the presence of starch grains in the cortex and xylem parenchyma cells. The tests for calcium oxalate and tannins gave negative results. Alkaloids were also tested and these were indicated to be present in the wood region. Some sugars are also present.

Powdered Root

The powder of the root is creamy brownish with pungent odour and acrid taste. The powder, when examined under a microscope, is characterized by the presence of (i) thick-walled cork cells, (ii) abundant starch grains, (iii) xylem elements, i.e. vessels with tracheids and fibres and xylem parenchyma with its characteristic pittings, (iv) cortical parenchyma cells with starch grains (Fig. 5).

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