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Identification of tissue systems, histochemistry and phytocompounds of *Lygodium flexuosum* (L.) Sw. (*Rudrajata*)

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ABSTRACT

Lygodium flexuosum (L.) Sw. is a fern and has great linkage with *Rudra Jata* as ethnobotanical marker like tribal name and similar uses of the plant which is described in classical text of Ayurveda. The studies on tissue systems of medicinal parts mainly rhizome and roots of the plants, their histochemistry and phytocompounds are delineated in the paper would be most useful towards proper evaluation in perspectives of consideration as *Ruda Jata* and future more pharmacological and clinical studies in Ayurveda.

Key words: *Lygodium flexuosum* (L.) Sw., ethnobotanical marker, *Rudra Jata*, tissue systems, histochemistry, phytocompounds.

INTRODUCTION

Rudra Jata is a controversial classical herbal medicine of India. In *Chakradutta* [1] *Rudra Jata* is prescribed for the treatment of urinary trouble and spermatorrhoea (*Mutraghat*) and hydrocele (*Vridhi*) while *Guduchyadi varg* of *Raj Nighantu* [2] states that it is useful for the treatment of heart diseases and cough. Sharma [3] mentioned about *Celosia cristata* L. as *Rudra Jata*. Singh [4] in his book *'Bihar Ki Vanspatiyan'* mentioned that *Lygodium flexuosum* (L.) Sw. seems to be a *Rudra Jata*. Indeed *Jata* or hairs always occurs in head but the resemblance of roots appears like hairs attracted for ethnic people to nomenclature as *Jata* . Still, there is no confirmation or proper identification by scholars of Ayurved about *Rudra Jata*. The ayurvedic scholars have also taken the morphological basis of the roots towards the name *Rudra Jata.*

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The best endeavors of author are to evaluate *Lygodium flexuosum* (L.) Sw. as *Rudra Jata* based on the information of tribal medicine as ethnobotanical marker and to link with classical uses of *Rudra Jata*. Infect the meaning of *Jata* is hairs. The rhizome and roots of the above plants looks like black hairs or *Jata*. The Bengalis people called the plant as *'Kali mayer chool'* means hairs of Godess *Kali*. *Tantrikman* know the plant as '*Bhutraj'* and *'Bhutbhairvi'*. In Jhrkhand, Santhal tribe calls the plants as 'Badgocak', 'Durgajhap' and 'Mahadebjata' while Paharia tribe knows the plant as 'Shankarjata' and 'Mahadebjata'. It is a basis that Mahadev or Lord Shankar is *Rudra* and the *Jata* word associated with the plant is important to link with classical *Rudra Jata* which reveals enough folklore name links.

The tribal people as ethnomedicine uses the rhizome and roots in haematuria, spermatorrhoea like *mutraghat* or urinary trouble, cough and pleurisy as mentioned in classical texts. There are many other uses of the plant [5-19] like fever, atrophy, emaciation, icterus, constipation, abdominal pain, loose motion, rheumatism, snake bite, dysmenorrheal, jaundice, stomachache, scabies, sprains, eczema, cuts, wounds, ulcer and carbuncles, chronic malarial fever, cholera and debility. As ethnomedicine the plant is popular among the tribal communities like

Santhal and Paharia (Jharkhand), Kondh(Orissa), Rabha, Oraon, Mech, Lodh (West Bengal), Katkaris, Thakurs, Warli, Kokne, Mahadeo kolis (Maharashtra) and Tharu (Uttar Pradesh). The considerable folklore uses of the plant as medicine are very much interesting and need for evaluation. Preventive and curative effect of the plant on carbon tetrachloride induced hepatic fibrosis in rats has been evaluated by Willis & Asha [20]

***Lygodium flexuosum* (L.) Sw. :** The plant is a scandent fern with woody and creeping rhizome with dark black hairs roots belonging to family Lygodiaceae. It has glabrous frond, large 3-4 pinnate, clefted at the base, linear oblong and margin of the pinnate serrulate. Stem long, climbing, 2-3(3.5) mm thick at the base and cylindrical. It is widely distributed throughout plains to mountainous regions [21] in south India up to 1200m elevation and in north India plains up to 1500m on the Himalaya [22] open and dry areas of forests.

MATERIALS AND METHODS

The plant material was collected from Dumka district of Jharkhand. To know the tissue system or micromorphology free hand section and standard staining techniques [23-24] were used for chemical test of histological zone or histochemistry.The specific reagents have been used for tests of different constituents and nature of color change has been noted. The measurement of different cells of useful medicinal parts of plants has been carried out as micrometry. The fundamental phytoconstituents in different extracts have been studied using phytochemical methods [25].

RESULTS

The dark black , solid, hard stock, 3-4(-5) mm thick, glabrous, tufted rhizome of the

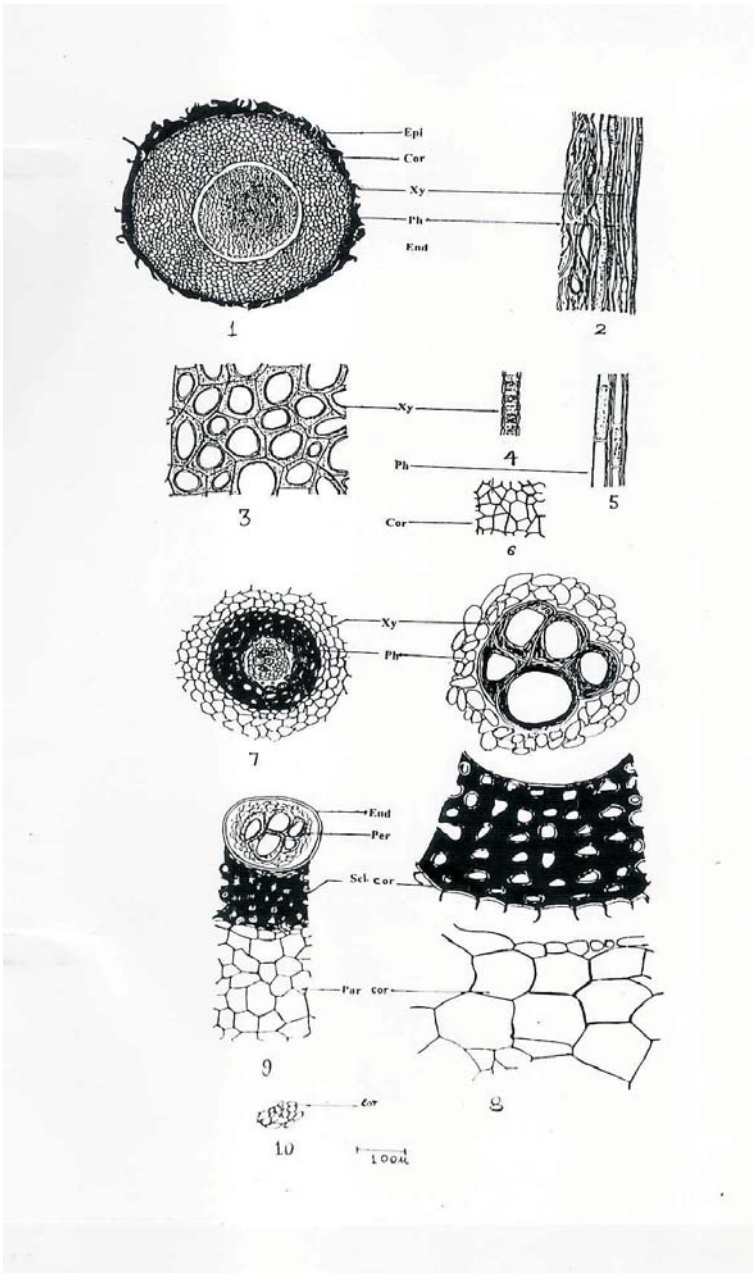
plant is densely covered by a long, thick, blackish wiry roots and persistent leaf bases and often clothed by blackish uniseriate multicellular hairs. The root is tufted 1-2 mm thick, up to 8 cm long, solid and shining black features.

The cell and tissue systems (Plate)

Rhizome: The transverse section of rhizome is 2.5 mm in diameter with dark black surfaces covered by thick epidermal layered. The sclerenchymatous cortex are present below this layer which are 10-12 layer of compact broad (Fig. 1) while in longitudinal section there are some notches in the cortex (Fig.2).

Plate: Showing fig. of tissue systems and cells

Fig.1. T.S. of rhizome, Fig.2-L.S. of rhizome (a part cellular), Fig.3-4. Vascular bundle (a part in T.S. of rhizome), Fig. 5. L.S. view of phloem, Fig.6.- a cellular part of cortex. Fig.7. T.S. of roots, Fig. 8. Vascular bundle and cortex (a cellular view). Fig. 9. A cellular part of T.S. of roots. Fig. 10. Particles of powder



The endodermis is seen which surrounds the central stelar region. A marked gap of 24-54µ are present in between sclerenchymatous cortex and endodermis. Thin layers of pericycle are presenting adjacent to endodermis. In fact, the vascular region or stelar organization is typical protostyle type. Usually solid xylems are present, consisting of tracheids and scattered parenchyma. It is surrounded (Fig.3-6) by phloem and there is no typical protoxylem. Tracheids are sclariform and it is scattered around the periphery of the xylem core.

Roots: The transverse section of roots reveals that it is 2.0 mm in diameter and almost circular and there is no marked epidermis (Fig. 7). The wall of outer cortex consists 4-6 layers of parenchyma cells while in inner side of cortex, dark thick and 6-8 layers of sclerenchyma cells are distinguished. The cellular spaces are observed in the cortex. The endodermis layer is present below the sclerenchmatous cortex. Pericycle layers are present after the endodermis. It surrounds the diarchal stele condition. There are five tracheids in xylem. The phloem bundles (Fig. 8-9) are alternate with xylem and it is composed by 3-4 layers of sieve cells.

In the powder particles of rhizome and roots a few cells of sclerenchyma and fragment of tracheids (Fig.10) and it is 0.28-0.33x 0.11-0.14 mm in size. It is mild in odour, black colored, astringent in taste and rough in touch.

Abbreviation

Cor(cortex), Epi(epidermis), End(endodermis),Par.cor (parenchymatous cortex), Per (pericycle),Ph (phloem), Scl.cor (sclerenchymatous cortex), Xy (xylem).

The size of different cells

The length x width of different cells in micron (µ) in rhizome are *viz*. epidermal layer- 36-45 width; sclerenchymatous cortex- 22.5-34.6-40.5x 18-25-36; endodermis -9-12.5-13.5x 6.7-8.2-9; xylem- 22.5-40.5-76.5x 27-60.5-85.5; phloem- 11.2-12-13.5x 9-11.5-13.5. The roots consist length x width in micron (µ) in parenchymatous cortex- 36.5-98.5-171x 27-74.6- 121.5; sclarenchymtous cortex- 11.2-30.5-54 x 13.5-34.2-49.5; endodermis- 22.5x 36; pericycle- 13.5x 22.5, xylem- 54-96.5-139.5x 49.5-78.4-117 and phloem- 13.5-54.4-81 x 11.2-30.5-52.

Histochemistry

The test for starch, lignin, oil globule, tannin, terpene and alkaloid through specific reagents in histological zones have been presented in Table 1.

Phytocompounds

Qualitatively in the rhizome and roots the presence of preliminary phytocompounds like steroid has been observed in the extract of petroleum ether, benzene and chloroform. Reducing sugar is in methanol and water extract while glycoside found in water extract. The phenolics has been evaluated in methanol and water and amino acids is in extract of water only. Although, it has been reported that [26-27] the compounds like dryocrasol, tectoquinone, kaempferol, kaempferol-3-â-D-glucosides, â-sitosterol, stigmasterol, o-*p*-coumaryl-drycrassol are present in the plant.

DISCUSSION AND CONCLUSION

In fact, Sharma supports the work of Singh that *Lygodium flexuosum* (L.)Sw. may be evaluated as *Rudra Jata*. However, he deals about *Celosia cristata* L. as *Rudra Jata* . But, in Dravya guna vigyan [28] he has mentioned that *Celosia cristata* L. used as classical medicine 'Mayurshikha' by some vaidya in place of *Adiantum caudatum* L. Although, the ethnopharmacognostical studies of *Lygodium flexuosum* (L.)Sw. has been already published by Kumar including present anatomical work (plate) which is a basic guideline of herbal crude drug identification [29]. Nevertheless, Rao & Singh [30] carried out studies on pharmacognostical studies on whole plant of *Lygodium flexuosum* (L.)Sw. without providing micromorphology or anatomical works. Therefore, the studies on identification of tissue systems and histochemistry has been represented would be immense useful towards proper identification of useful botanical parts like rhizome and roots of the plant. The

ethnobotanical marker related with wisdom of tribes mainly uses and folk name have been used in the paper towards consideration of *Lygodium flexuosum* (L.)Sw. as *Rudra Jata.* The above studies would be significant for the scholars of ayurveda. The phytocompounds have provided for analysis of the biodynamic constituents and bioactive potential in modern pharmacological parameters.

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Table 1: Nature of color changes through reagents in histological zone

Rhizome	Nature of color change	Root	Nature of color change	Test for	Reagents
Sclerenchymatous Cortex	Blue	Trachieds	Blue	Starch	Iodin solution
Endodermis	Violet	Parenchyma cells	Light violet	Lignin	Phloroglucinol+ conc. HCl+Alcohol
Parenchymatous cortex	Red	Sclerenchyma cells	Light red	Oil globule	SudanIII solution
Stelar region	Blue black	No change	No colour	Tannin	Aqueous ferric chloride solution
Cortex	Pink	Sclerenchyma cells	Pink	Terpene	Libberman-Burchard reagent
No change	No color	No change	No color	Alkaloid	Dragandorff's reagent

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