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Research Article

Pharmacognostical studies on root and rhizomes of *Kyllinga nemoralis*

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ABSTRACT

Kyllinga nemoralis Hutch and Dalz, Family: Cyperaceae is a perennial herb, used in traditional folk medicine to treat many diseases and disorders. The rhizome assorted with milk is consumed as an internal medication for worm infection. The rhizome is used in the treatment of liver damage, disease of spleen, tumour and diabetes. This study has examined the anatomy of root and rhizome with the intention of supply sufficient information to the medicinal plant identification. The root let has prominent papillate rhizodermis, two concentric layers of rectangular cortical cell, an endodermoid layers and pericycle. The cortex of the root has well differentiated three zones of cells. The stele consisted of tetrarch xylem elements alternating with radial arrangement of phloem elements. Xylem and phloem elements were in radial arrangement. The powder microscopy revealed the presence of fibres, fibres sclereids, Parenchyma cells and vessel elements. The pharmacognostical characters witnessed in this study could serve as an anatomical tool to document and standardize the much valued medicinal plant, *Kyllinga nemoralis.*

Keywords: *Kyllinga nemoralis;* papillate rhizodermis; cortex; xylem and phloem elements.

INTRODUCTION

Kyllinga nemoralis Hutch and Dalz, Fam: Cyperaceae is an everlasting plant, grass-like in habit, propagated by seed and a creeping rhizome with many synonyms and common names. Synonyms included *Cyperus kyllingia* Endl, *Kyllinga monocephala* Rottb and *Kyllinga cephalotes* Jacq. Common names included whitehead spike sedge, white kyllinga, white water sedge, white-flowered kyllinga, poverty grass (Kirtikar KR and Basu BD 2000). The botanical species named *nemoralis* means, of woods or groves, grows in wet steppes. However, the herb also grows along with Mangrove grass, Indian pennywort and Bent spikerush (Daniel and Umamaheswari 2001). The herb is seldom cultivated in fertile soil with full sunshine and moist. But in some places like South Kanara, the species is found in farms which have dry soil. The much valued medicinal plant is considered as a foremost weed of improved pastures, and also arises in crops, gardens, farms and pavements. Cook (1996) considered this species as a non- aquatic plant. *Kyllinga nemoralis* is extensively spreaded in tropical and sub-tropical Old World. The plant is predominantly found in Southern part of India and also in Goa, Kashmir, Madhya Pradesh, Maharashtra, Meghalaya, Andaman and Nicobar Islands (Cook 1996). The leaves are accustomed for the treatment of malarial chills, skin disorders and thirst due to fever and diabetes (Quisumbing E. 1978). In India, the plant greeneries are acclaimed as anti-dote for snake poisoning (Oudhia P, 1999) (Manju Panghal et al, 2010). The rhizomes are sweetened and sweet-scented. The rhizomes promote appetite and diuresis. They provide symptomatic relief for diarrhoea. The rhizomes are used as expectorant and refrigerant (Khory NR et al, 1999) (Sivarajan VV et al, 1994). The rhizome assorted with milk, is used in the treatment of worm infection (Silja VP et al, 2008). It is also used in the treatment of fever, liver damage, splenopathy, tumour and diabetes (Warrier PK, et al, 1995). Underground parts have essential oils, enriched with terpenes, α-cyperone, β-selinene and α-humulene(Komai K, et al,1989). The methanolic and aqueous extract of leaves were positive for the presence of terpenoids, saponins and phenolic compounds (Jusal P. Quanico et al, 2008). The ethanolic extract of rhizomes was positive for the presence of flavonoids, triterpenoids and glycosides.

The pet ether extract has triterpenoids and glycosides (Arumugam S, et al, 2008). The GC-MS, GC analysis of essential oil from *Cyperus kyllingia* Endl. revealed the presence of twenty-three compounds, chiefly of oxygenated sesquiterpenes, sesquiterpene hydrocarbons, and carboxylic acid. The best descriptive compounds existed were α-cadinol, caryophyllene

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oxide, α- muurolol, α-humulene, and α-atlantone (Sorachai Khamsan et al, 2011). To the best of our knowledge, there is no literature documenting the microscopical studies of *Kyllinga nemoralis*, hence the present study analyse the anatomical characters of root and rhizomes of *Kyllinga nemoralis*, aiming to provide extensive information for the medicinal plant identification.

MATERIALS AND METHODS

Collection

The root and rhizomes of *Kyllinga nemoralis* Hutch and Dalz were collected from Theni (Dt), Tamilnadu in the month of December 2013 and authenticated by Dr. P. Jayaraman, Botanist, Plant Anatomy Research Centre (PARC), Chennai, India. (S.No. PARC/2013/157).

Sectioning

Utmost care was hand-picked to choice healthy plants and for normal organs. The necessary sample of different organs were scissored and detached from the plant and fixed in solution of formalin - 5ml + acetic acid - 5ml + 70% ethanol - 90ml. After 24 h of preserving, the specimens were desiccated with graded series of tertiary-butyl alcohol as per the schedule specified by Sass, 1940. Intrusion of the specimens was done by gradual addition of paraffin wax (melting point 58-60^{0}C) until tertiary-butyl alcohol solution attained super saturation. The specimens were cast into paraffin blocks. The paraffin fixed specimens were sectioned with the help of Rotary Microtome. The thickness of the sections was 10-12 µm. De-waxing of the sections was carried out according to customary procedure (Johansen, 1940). The sections were stained with toluidine blue as per the method defined by O'Brien et al 1964. Since toluidine blue is a polychromatic stain, the staining results were good and some phytochemical reactions were also achieved. The dye rendered pink colour to the cellulose walls, blue to the lignified cells, dark green to suberin, violet to the mucilage, blue to the protein bodies. Needed sections were also stained with safranin, Fast - green and and IKI for Starch. For powder microscopical studies, the crushed materials of different parts were treated with NaOH and mounted in glycerine medium after staining. Diverse cell components were examined and measured.

Photomicrographs

Microscopic images of tissues were complemented with micrographs wherever desirable. Photographs of different magnifications were pictured with Nikon Labphoto 2 microscopic unit. For normal observations bright field was used. The polarized light was employed for study of crystals, starch grains and lignified cells. Since these structures have birefringent property, under polarized light they seem bright against dark background. Magnifications of the figures were designated by the scale-bars. Descriptive terms of the anatomical features were followed as specified in the standard anatomy books (Esau, 1964).

RESULTS AND DISCUSSION

Root anatomy

The root let has prominent papillate rhizodermis, two concentric layers of rectangular cortical cell, an endodermoid layers and pericycle. The stele consisted of tetrarch xylem elements alternating with radial arrangement of phloem elements (Figure 2.1). The rootlet was 100 µm thick. The main thick root was 600 µm in diameter. It consisted of well differentiated ground tissue and stellar system (Figure 2.2). The rhizodermis was not well defined. The cortex consisted of three zones: The outer zone was the outer cortex which was 60 µm wide comprising about 6 layers of small thin walled, compact cells. The middle cortex comprises a ring of wide air chambers separated from each other by thin, short, 3 or 4 celled partition filaments (Figure 2.3). The inner cortex was 6 angled and the cells were fairly large tangentially stretched. The cells situated along the six angles were circular and disposed in regular radial lines (Figure 2.2; 2.5). The cells towards the stele were smaller, circular and compact. They were two or three layered and thick walled (Figure 2.2). The stele (Figure 2.2; 2.4) was 240 µm in diameter. It included an endodermoid layer of elliptic thick walled cells. Inner to the endodermoid radially oblong, wider, highly thick walled cells with reduced lumen (Figure 2.4). The cell walls were lignified. The central core of the stele was occupied by a wide circular metaxylem element measuring 40 µm in diameter. The central metaxylem element was surrounded by thick walled, lignified sclerenchyma tissue (Figure 2.4). These were about 13 outer metaxylem elements placed along the periphery of the pericycle. Alternating with the xylem elements were equal numbers of phloem strands. Xylem and phloem elements were in radial arrangement. The entire stele has lignified tissues which are evidenced by brightly glittering of these cells when viewed under the polarized light microscope (Figure 2.5, 2.6).

Powder Microscopy

Macerated preparation of the root was noted under microscope to study the components. The macerated powder includes the following elements: fibres, fibres sclereids, parenchyma cells and vessel elements.

Fibres

Long, narrow thick walled fibres with pointed ends were abundant in the powder. The lumen was narrow; no pits were evident on the walls (Figure 3.1). The fibres were 450- 700 µm long.

Fibres sclereids

The fibres sclereids (Figure 3.3) were less frequent in the powder. They were long, narrow needle shaped cells resembling the fibres. But they have thick walls,

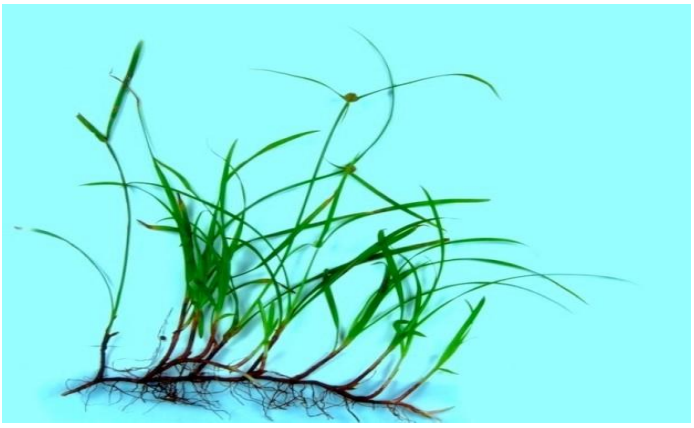

Figure 1: *Kyllinga nemoralis* Hutch and Dalz

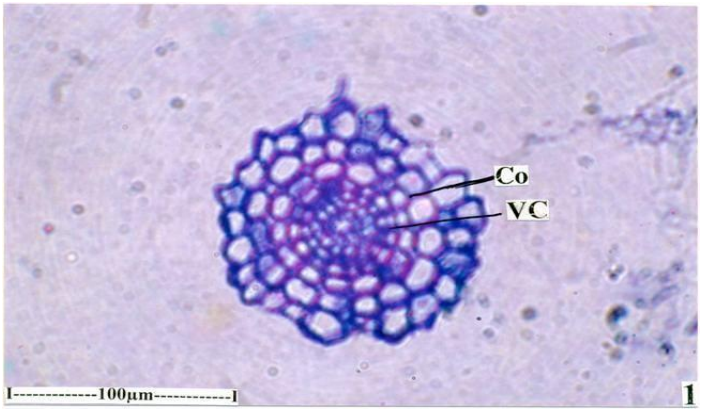

Figure 2.1: TS of thin root

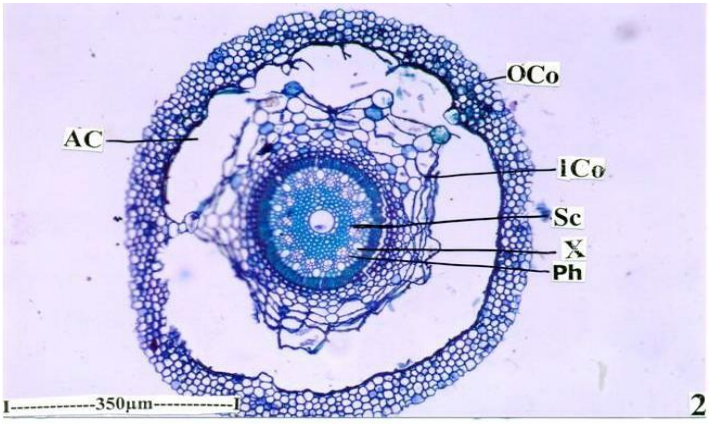

Figure 2.2: TS of thick root

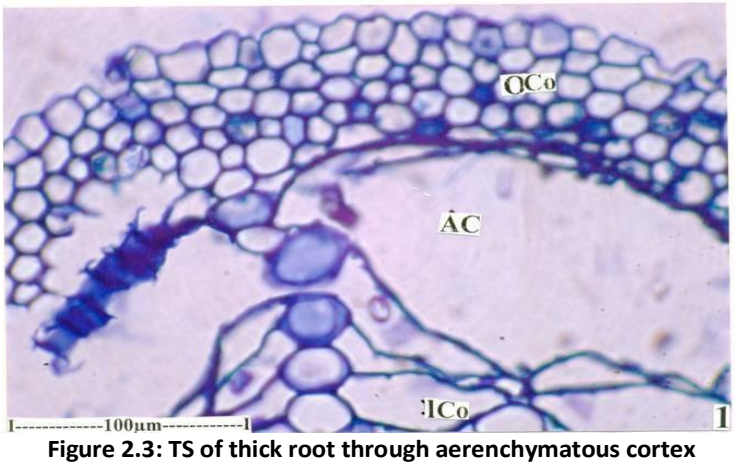

Figure 2.3: TS of thick root through aerenchymatous cortex

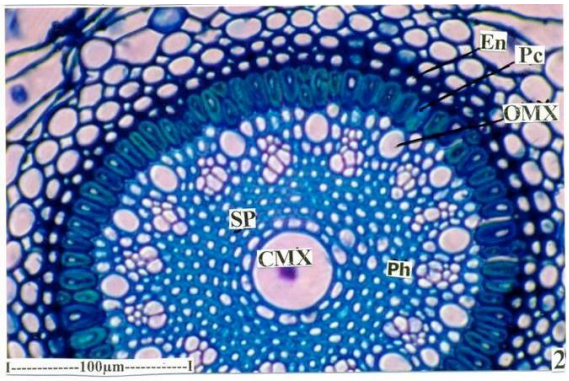

Figure 2.4: TS of thick root through stellar region

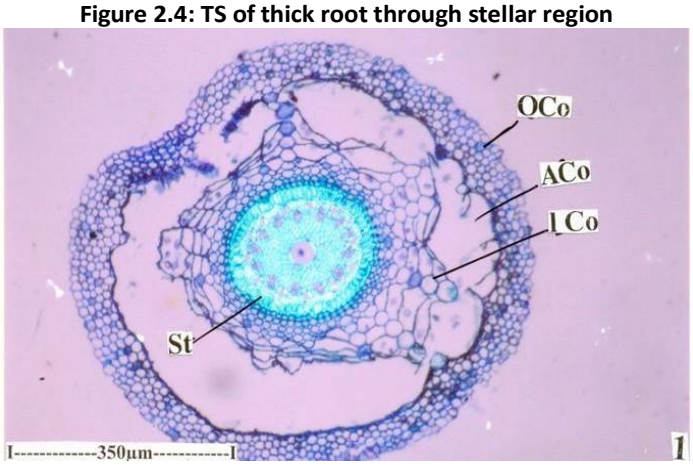

Figure 3.5: TS of root as seen under the polarized light microscope to show the lignification of the stellar tissues

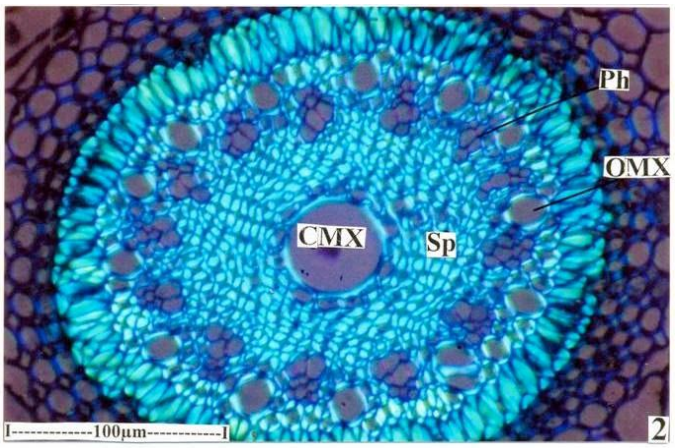

Figure 2.6: TS of stele – under polarized light microscope

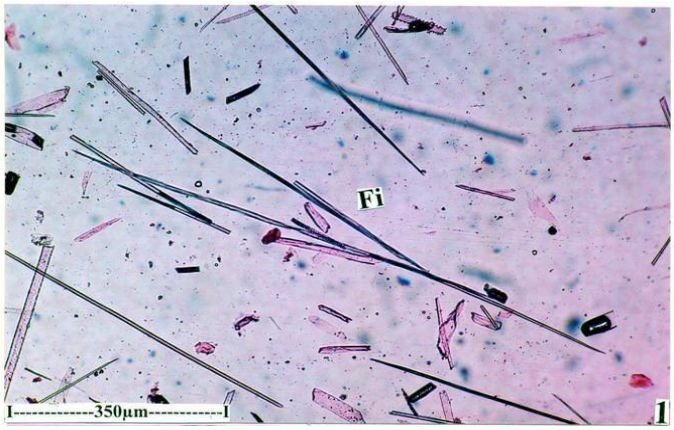

Figure 3 .1: Fibres

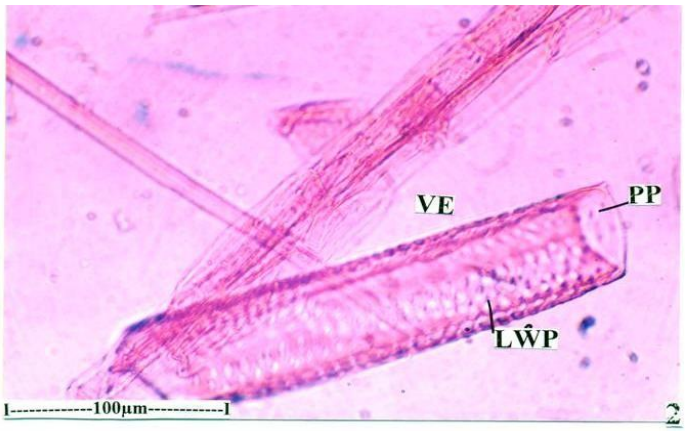

Figure 3.2: Vessel element

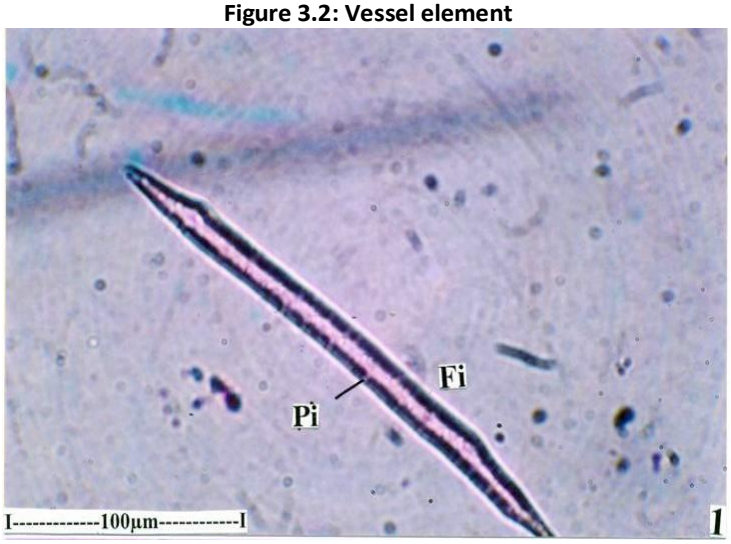

Figure 3.3: Fibre-sclerid

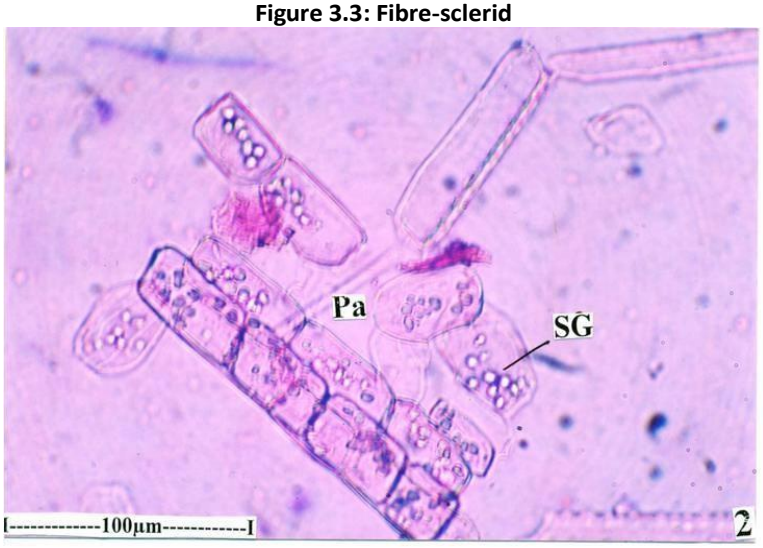

Figure 3.4: Parenchyma cells with starch grains

wide lumen and abundance of simple, canal like pits. The fibre sclereids were 210 µm long and 10 µm thick.

Vessel elements

The vessel elements (Figure 3.2) were quite frequent in the powder. The elements were long and cylindrical; they have simple perforation plate which was horizontal in orientation. The lateral walls have dense, elliptical lateral wall pits. The vessel elements were up to 850 µm long.

Parenchyma cells

The parenchyma cells (Figure 3.4), rectangular, thin

walled wide parenchyma cells were common in the powder. The cells were either isolated or in vertical rows of starch grains. They have large abundant

concentric striations and centric hilum. The parenchyma cells were 30-40 long and 20 µm wide.

Figure 2.1 and 2.2 (AC: Air-Chambers; ICo: Inner Cortex; Co: Cortex; OCo: Outer Cortex; Ph: Phloem; Sc: Sclerenchyma; VC: Vascular Cylinder; X: Xylem)

Figure 2.3 and 2.4(AC: Air – Chamber; En: Endodermoid layer; ICo: Inner Cortex; CMX: Central Meta Xylem elements; OCo: Outer Cortex; OMX: Outer Meta Xylem elements; Pc: Pericycle; Ph:Phloem; SP: Sclerenchyma Pith)

Figure 2.5 and 2.6 (ACo: Aerenchymatous Cortex; CMX: Central Meta Xylem elements; ICo: Inner Cortex; OMX: Outer Meta Xylem elements; OCo: Outer Cortex; Ph: Phloem; Sp: Sclerotic pith; St: Stele)

Figure 3.1 and 3.2 (Fi: Fibres; LWP: Lateral Wall Pits; PP: Perforation Plate; VE: Vessel Element)

Figure 3.3 and 3.4 (Fi: Fibre-sclerid; Pa: Parenchyma; Pi: Pith; SG: Starch Grains)

CONCLUSION

Anatomical characters observed in the present study provide referential information and may helpful to the future researchers to authenticate and validate the drug. The observed Pharmacognostical parameters may add value to the existing knowledge of *Kyllinga nemoralis.*

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