PHARMACOGNOSTIC STUDIES ON *XANTHIUM STRUMARIUM* L -A FOLK UNANI MEDICINAL HERB

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ABSTRACT

Xanthium strumarium L. widely used in traditional as well as folk medicinal systems is locally known as Gokhru and in unani as Kutta Jhad. In Amravati district (Maharashtra), it was found that the whole plants as well as leaves are used by hakims as blood purifier and in scabies. Here pharmacognostic studies are made regarding whole plant and also only leaves. For standardization of drug material morphological and anatomical characterization is done. Phytochemical investigations were made to know the presence of various bioactive molecules, amino acid composition and minerals. The herb is characterized by unisexual capitula, scabrid surface with scales, trichomes and glands. Root with pith and multiseriate rays; stem with secondary growth restricted to fascicles and xylem with broad vessel elements; mesophyll with multilayered palisade and anomocytic stomata. Plant is rich in potassium and containing flavonoids, catechol, alkaloids, cardenoloids and many free amino acids.

Keywords: *Xanthium strumarium* L., folk medicinal herb, anatomy, phytochemistry.

INTRODUCTION

Xanthium strumarium L. grows as weed throughout on waste lands. Locally it is known as Gokharu and Kutta zad. Interviews with local hakims revealed that whole plant is used as blood purifier and in treatment of scabies (Ahmad, 2003). Survey of Unani literature did not reveal any mention of the herb as medicinal. However, in Ayurveda it is called 'Shankeshwara'and 'Arishta', and is considered anthelmintic, antipyretic, diuretic, cooling, laxative, alexiteric, tonic, digestive, appetizer, improves voice, complexion, used in epilepsy, leucoderma and as antidote for insect bite (Agharkar, 1991). The herb is reputed as medicine in Europe, China, Indo-china, Malaysia and America also. It is credited with powerful diaphoretic emollient and sedative properties. It is used in chronic malaria, leucorrhoea, urinary diseases as styptic and in hydrophobia. (Anonymous, 2003).

Fruits are rich in vitamin C and are considered to be cooling and demulcent in indigenous system of medicine. Ash is applied to sores on lips and mouth. Roots are bitter and used in cancer and scrofula (Kirtikar and Basu, 1935). Roots used on boils , ulcers; leaves used in herpes, malaria, ringworm, scrofula; fruits and seeds used as cooling; in eye diseases, headache, piles, cancerous wounds. Flowers and fruits are used to prepare a drink while seedlings and leaves used as vegetable (Jain, 1991). Talakal *et al.,* (1995) demonstrated inhibition of *Trypanosome evansi* infection by leaf extract. Leaf extract also inhibits proliferation of leukaemia HL-60 cell and *Trypanosoma brucei brucei* bloodstream forms *(*Nibret *et al.,* 2011). Anti-microbial activity of methanol leaf extract is reported by Srinivas *et al.,* (2011).

MATERIALS AND METHODS

The hakims consulted for the study use to collect plant material themselves from the field. For identification, plant was brought to the laboratory, described and identified with the help of standard flora (Naik, 1998). Fresh plants were collected and preserved in 70% FAA. Hand sections of root, stem, node and leaf were taken. For vessel studies thin slices of old roots and stems were treated with macerating fluid (5% solution of HNO_3 and 5% solution of $K_2Cr_2O_7$) for 12 to 24 hr. The macerate was then thoroughly washed, stained with 1% aqueous safranin and measurements were made by occular scale lens. Camera lucida sketches were drawn. Classification of Radford *et al.,* (1974) is followed for categorizing the vessel elements. For chemical analysis mature plants were collected, shade dried and powdered.

Powder was preserved in zip lock bags at 4°C and tested qualitatively for various bioactive compounds (Harborne, 1973, Gibbs 1974, Peach and Tracey 1979, Kokate *et al.*, 1990 and Evans, 1996). Amino acid profile was studied by two dimentional chromatography (Lederer and Lederer, 1957; Harborne, 1973).

Plant ash was prepared (A.O.A.C, 1975) at 400°C and various ash values were estimated following Kulkarni and Apte (2000). Qualitative analysis was undertaken to detect various mineral elements (Johannson, 1940), while quantitative estimation was done using flame photometer.

RESULTS AND DISCUSSION

In case of herbal drugs it is very important to collect the genuine plant material. Morphological and anatomical standardization of drug plants, therefore, is very much essential.

Macromorphology

Erect, annual, undershrubs, 30-120 cms. tall; stem stout, terete, rough with short, spiny hairs. Leaves alternate, broadly ovate or suborbicular, slightly broader than long, cordate-cuneate at base, often 3- lobed, irregularly inciso-serrate acute, rough with appressed hairs on both surfaces; petioles long, hairy. Heads in axillary and terminal racemes, sterile/neutral heads many, crowed at the top of the stem, fertile heads fewer, mostly axillary. Capitula monoecious; male terminal, females in axillary, sometimes terminal clusters. All florets tubular, pappus absent. Male capitula single flowered, subsessile, aggregated on conical receptacle; mixed with neutral flowers; subtended by 2-3 seriate involucral bracts. Involucral bracts ovate,acute, rough, pubescent. Male florets bracteate; bracts spathulate, 2-3/0.7 - 0.8 mm, pubescent on upper part; corolla greenish. Male florets of two types noted - **a.** corolla tube narrow; stamens monoadelphous; filament tube long, exerted, **b.** corolla tube broader, anthers distinct, covered, hastate, apiculate, and inserted at the apex of corolla. Female flowers in two flowered capitula, crowded together. Each capitulum with two outer free involucral bracts and inner bracts fused together, bracts spiny, horned, enclosing the flowers; flowers apetalous; styles exerted from horns of fused involucre. Achenes oblong-ovoid, compressed, glabrous (Fig. 1-10).

Micromorphology

Root pentarch to tetrarch. Pith parenchymatous. Secondary growth normal. Vessels either solitary or in chains, few in groups of 2-3. Vessel elements very short (Class B 212-250 um X 81-115 um broad), moderately short (Class C 292-335 um x 85-115 um broad) and medium (Class D 358-423 um x 85-115 um broad). Rays mostly multiseriate, few bi or uniseriate. Cortex with resin canals and air chambers producd by stretching and breaking of cells. Cork superficial (Fig. 11-14).

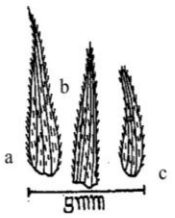
Stem striate when young. Epidermis bloched with anthocyanin.Stomata restricted to anthocyanin containing patches. Hypodermis collenchymatous. Cortex parenchymatous with scattered, small resin canals. Endodermis not distinct; pericycle sclerenchymatous opposite the vascular bundles. Vascular bundles conjoint, collateral, open, arranged in a ring, widely separated from each other or closely placed. With growth, vessels in most of the bundles get organized in palmate fashion due to invasion of medullary cells between the series of vessels. Pith large, parenchymatous; cells containing numerous small sphaeraphides. Secondary growth starts early with the establishment of normal cambial ring in normal fashion. However, the activity of cambium is differential. Secondary vascular elements get added in the fascicular region while in the interfascicular region only thin walled conjunctive tissue is added; as a result individual bundles grow in size. In later stage of development secondary vascular bundles get differentiated in interfascicular region (Fig. 15-17). Vessel elements moderately short -Class C 277-331 um x 62-96 um broad (Fig. 18).

Node trilacunar three trace.

Petiole: Three vascular bundles enter the petiole and get arranged in a shallow C-shaped arc; bundles widely separated from each other. Immediately at base the traces start branching. The number of bundles increases higher above and a double C-shaped arc of vascular bundles is seen in the middle of petiole. Sphaeraphides present in ground tissue (Fig. 19a, b).

Lamina dorsiventral, amphistomatous. Epidermis thickly cutinized. Stomata anomocytic, at some places appear anisocytic (Fig. 20-21). Mesophyll differentiated into palisade and spongy tissue. Palisade 3 layered. Spongy tissue 8-10 layered, cells somewhat compactly placed. Vein bundles surrounded by non- chlorophyllose bundle sheath; bundle sheath extends upto both the epidermis interrupting the palisade on upper side and spongy tissue on lower side (Fig. 22). Midrib shows same structure as that of petiole, however, vascular bundles are much closely placed. Sphaeraphides present in ground tissue (Fig. 23).

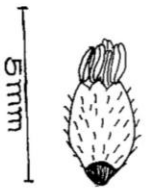
1. Twig



2. a-c Bracts of Capitulum

3. Neutral Flower

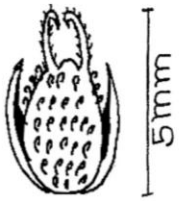
4. Bract of Male Flower



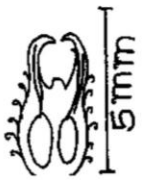
5. Male flower with free stamens

6. Male flower with long filament tube

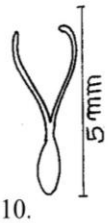
7. Stamen



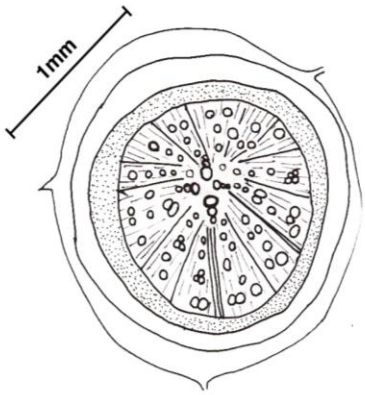
8. Female capitulum with bracts removed



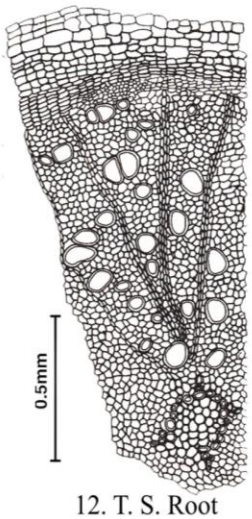
9. L.S. Female Capitulum



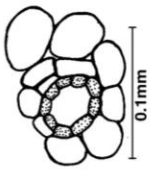
10. Gynoecium



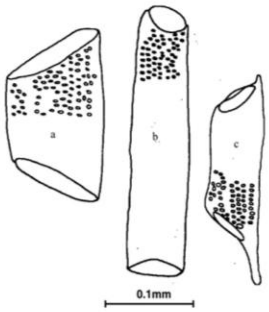
11. T. S. Root (Diagrammatic)



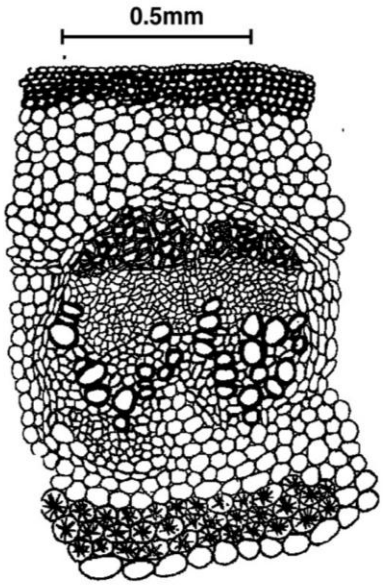
12. T. S. Root (Sector Magnified)



13. Resin Canal

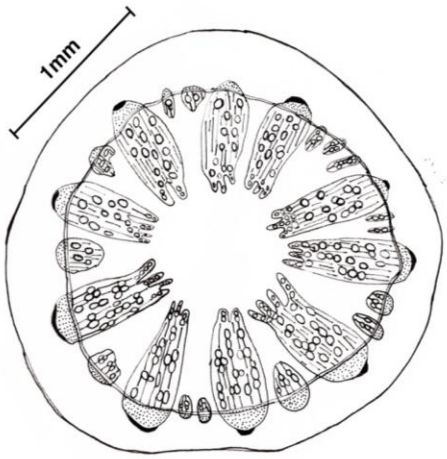


14. a-c Root Vessels



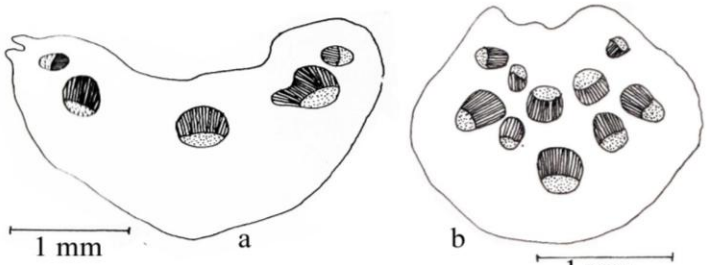
16. T.S. Young Stem (Sector Magnified)

15. T.S. Young Stem (Diagrammatic)

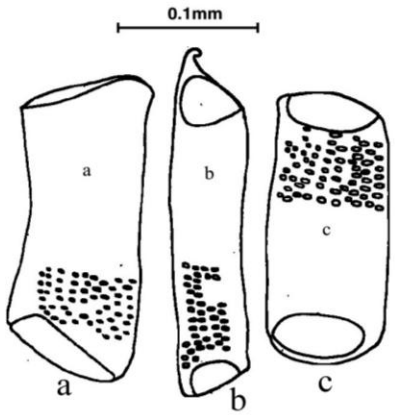


17. T.S. Old Stem

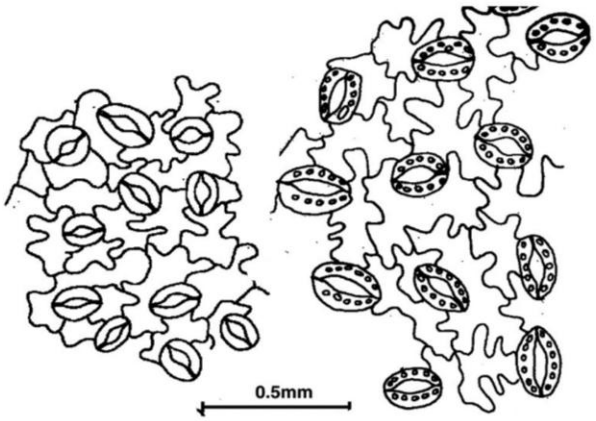
Plate I, Fig. 1-17



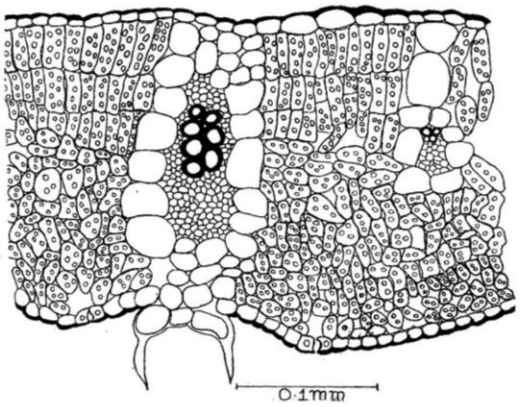
19 a. - b. T. S. Petiole



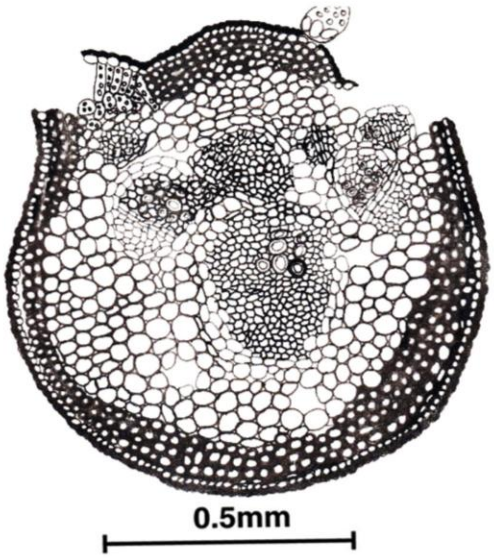
18. a,b,c, - Stem Vessels



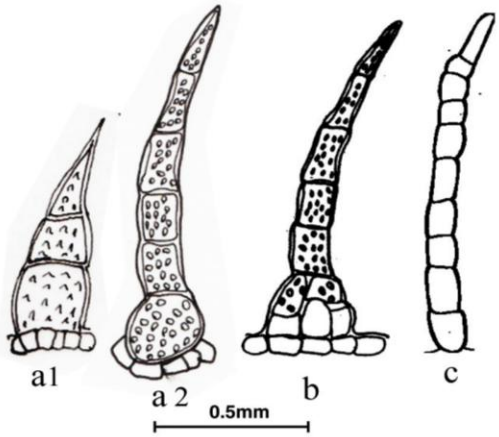
20. Upper Epidermis 21. Lower Epidermis



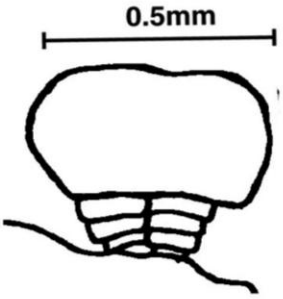
22. T. S. Lamina



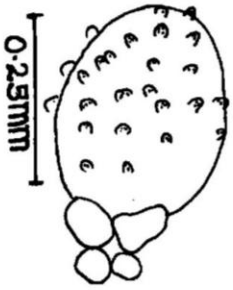
23. T.S.Mid Rib



24. a-e - Simple Trichomes



25. Gland



26. Scale

Plate II, Fig. 18-26

Trichomes present on all plant parts. Both simple and glandular trichomes present (Fig. 24-26).
A. Non glandular trichomes are of various types: i. Uniseriate, scabrid trichomes –
a) trichomes with unicellular base with spiny tip and with blunt tip

b) trichomes with multicellular base and blunt tip. ii. Uniseriate, anthocyanin containing long trichomes with unicellular base and smooth walls.

B. Glandular trichomes with biseriate stalk and with large unicellular head.

C. Scales - Unicellular, spherical scales with multicellular base, Surface scabrid.

Phytochemistry

Phytochemical analysis was done for whole plant and leaves as they are used medicinally. Whole plant was found to contain anthraquinone, cardenolide, leucoanthocyanin, simple phenolics (Catechol) and triterpenoids. Nine free amino acids were found to be present in whole plant. These are glutamic acid, alanyl glycine, threonine, Dl alanine, argenine mono hydrochloride, proline, valine, isoleucine and methionine. Ash yield was found to be 864 mg/gm dry tissue. HCl soluble fraction is 908 mg/gm and insoluble is 92 mg /gm. HNO_3 soluble ash is 802 mg/gm while insoluble is 198 mg/gm. Ash was found to be rich in potassium i.e. 375 mg/gm while calcium is 84.89 mg/gm and sodium is much less in quantity – 10 mg/gm.

Leaves were found to contain alkaloids, anthraquinone, cardenolide, flavonoids (flavonol), leucoanthocyanin, simple phenolics (Catechol) and triterpenoids.. Eleven free amino acids were found to be present in leaves. These are glutamic acid, tyrosine, alanyl glycine, glycine, glucosamine Hcl, threonine, Dl alanine, argenine mono hydrochloride, proline, valine and isoleucine. Ash yield was found to be 98 mg/gm dry tissue. HCl soluble fraction is 758 mg/gm and insoluble is 242 mg /gm. HNO_3 soluble ash is 620 mg/gm while insoluble is 380 mg/gm. Ash was found to be rich in potassium i.e.133.49 mg/gm while calcium is 69.91 mg/gm and sodium is much less in quantity – 10.16 mg/gm. Sulphur, calcium magnesium iron and chlorine.

DISCUSSION

Xanthium strumarium exhibits some characteristic features by which it can be distinguished easily from other asteraceous plants. The plant is characterized by scabrid surface, unisexual capitula, root with pith, anomalous secondary growth of the stem, primary vascular bundles in palmate fashion and presence of spiny trichomes and scales.
Whole plant of *Xanthium strumanrium* as well as all parts separately is used in medicine. Senthil kumar *et al.,* (2011) have shown dose dependant analgesic and antiinflammatory actions of petroleum ether extracts. Sravani *et al.,* (2010) demonstrated notable diuretic effect of the herb.

Phenolic compounds are known to have wide range of biological activites. Catechol detected here might be responsible for antiinflammoatory activity. Flavonoids also are anti-inflammatory. Alkaloids are well known for their extraordinary spectrum of pharmacological activities especially as central nervous system depressant. Anthraquinones act as antiseptic. These authenticate the use against scabies.

Presence of cardenolides makes the herb useful in cardiac treatments. Amino acids are also used in several kinds of ailments. Tyrosine and glucosamine HCl noted in leaves might be present in very small amounts and hence could not be detected in whole plant tissue. Free amino acids present also impart some medicinal properties to the herb - Glutamic acid is a constituent of vitamin folate, tyrosine precursor of hormones like adrenaline and melanin and influences urinogenital systems, glycine is responsible of formation of porphyrin ring in haeme. Proline and hydroproline are constitutents of collagen. Valine and isoleucine are involved in formation of succinyl Co-A (Styer 1975).

The chemical constitution thus clearly indicates the potential efficacy of *Xanthium strumarium* as drug plant.

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