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Botanical standardization of the *Jatamansi*, their substitute and adulterant species

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Jatamansi, botanically equated to *Nardostachys jatamansi*, is an important drug of Ayurveda and used in different traditional systems of medicine. Rhizome of some other species such as *Valeriana wallichi* and *Selinum vaginatum*, being rich in essential oil contents, are also sold in herbal drug market by the same vernacular name. Present study is aimed to authenticate identity and validity all these species on the basis of taxonomical characters.

Keywords: *Jatamansi,* Anatomy, Rhizome

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*Jatamans*i, Botanically equated to *Nardostachys jatamans*i DC. (Family-Valerianaceae) is an important drug of Ayurveda. It is considered as a good stimulant, tonic, antispasmodic, laxative and also used in epilepsy. It is also applied locally in some skin problem by traditional healers in Himalayan region. Five iridoids, 1-homoacevaltrate, 1-homoisoacevaltrate, 1,1-homohydroxyldihydrovaltrate, 10-acetoxy-1-homovaltrate hydrin, and 10-acetoxy-1-acevaltrate hydrin, along with 10 known analogues, were isolated from the rhizomes and roots of *V. wallichi*[1]. A poly-oxygenated crystalline material together with β-eudesmol, elemol, β-sitosterol, angelicin and jatamansinol were isolated from the rhizome of *V. wallichi*[2]. A terpenoid - spirojatamol has isolated from rhizome of *V. wallichi*, Nardostachysin has also been elucidated[3]. Jatamols (A&B) has been also reported from the roots[4]. Because of high commerce, traders are subjecting it to adulteration/substitution. The rhizome of *N. jatamansi* is often contaminated with *S. vaginatum* as an adulterant[5]. A detailed chemical investigation of this species has been established, however, botanical investigations, *viz.* macro & microscopical comparison with the drugs used under the name of *jatamansi* have not yet been carried out. Therefore, the present study is an attempt to establish macro and microscopic characteristic of *N. jatamansi* as well to differentiate these three species, *viz. Nardostachys jatamans*i, *Valeriana wallichi* and *Selinum vaginatum*.

Methodology

Fresh plant material of *N. jatamansi, V. wallichi and S. vaginatum* was collected from Uttrakhand and washed thoroughly in running water. Identity was confirmed by matching with the authentic specimens of these three species loged at NBRI herbarium. The samples were deposited in institute's repository vide voucher specimen numbers LWG 262501, 262502 and 262503. Some of the fresh material is preserved in FAA (Formalin-Acetic acid-Alcohol) and the rest was dried at room temperature, for histological studies. The sections were stained with safranin and phloroglucinol followed by a drop of conc. HCl (Hydrochloric Acid) to detect the presence of lignin. Similarly iodine was used to detect to presence of starch. The powdered material were sieved through no.40 sieve mesh, cleared with chloral hydrate and mounted in glycerin for powder microscopy[6].

Results & discussion

Rhizome of these three species can easily be distinguished on the basis of macroscopic parameters such as organoleptic characters, odour and the taste which is bitter and quite characteristic. Microscopic studies revealed that *N. jatamansi* has large number of

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starch grains, *S. vaginatum* has broad cortex approx. 14-21 layer, as well as schizogenous canal is abundantly present and pith is absent and where as in *V. jatamansi schizogenous* canal is absent. In context to medullary rays which also varies from uniseriate to multiseiate within these species. (Fig.1 and Tables 1&2)

Details of powdered microscopy

Rhizomes of above species were dried, powdered and sieved through 40 mesh for powder microscopy. The powders were cleared with chloral hydrate and mounted in glycerin. The following cellular structures were seen as follows (Fig.2 and Table 3):

Table 1—Comparative general features of three species

	Nardostachys jatamansi DC.	*Valeriana wallichi* Jones Syn. *V. jatamansi*	*Selinum vaginatum* C.B. Clarke
Family	Valerianaceae	Valerianaceae	Apiaceae
Vernacular name	Hindi *: Jatamansi, bal-chir* Sans *: Jatamansi* Eng*: Jatamansi* Beng*: Jatamansi* Tamil*: Jatamanshi*	Hindi*: Mushkbala* Sans*: Tagarh* Eng*: Tagarh* Kan*: Tagar* Tamil*: Takaram*	Hindi*: Bhutkeshi* Kumaon*: Moor* Kash*:Pushwari bhootkeshi*
Habit	Erect perennial herb, 10-60cm high.	Perennial herb, 10-60cm tall.	Glabrous stout herb 1.0 to 1.5m tall.
Habitat	Growing at an altitude of 3000-5000m on an alpine Himalayan track[7]. Rhizome or root stock 2 to 10 cm long & up to 1.5cm thick densely covered with silky reddish brown tufted fibrous remains of the petiole of the radical leaves.	Growing at an altitude of 3048m in Himalayas from Kashmir to Bhutan & Kharia hills 1219 to 1828m[8]. Rhizome or root stock 2.5 to 12cm long & 2 to 3.5cm thick.	Distributed in western Himalayas between 1800 to 3800m[9]. Rhizome or root stock 10 to 15cm long abruptly tapers from the middle.
Chemical Composition	Roots contains essential oil having jatamasene, jatamansic acid, lupeol, jatamansin, rhizome also contains alkaloids actinidine[7,12].	Root yields essential oil (0.5-2.2%), α-pinene, limonene, cineole, isovaleric acid and caproic acid[8,13].	Roots contain coumarins like selinidin, vaginidine, angelicin. Dried roots yields aromatic oil 1.54% β-pinene, 45.5%, limonene, 25.3%[9,14].
Uses	Tonic, stimulant, antispasmodic, diuretic, stomachic, laxative. An infusion of rhizome is reported to be useful in epilepsy, hysteria, leprosy and respiratory disorders[9,15].	Aphrodisiac, antiseptic, cardiac, stimulant, expectorant, febrifuge, nervinetonic, ophthalmic, sedative, useful in hysteria and in epilepsy[10,11,15,16].	Hypotension, as sedative, aphrodisiac and having analgesic properties[9,13].

Table 2—Comparative Macro and Microscopic characters of rhizomes of *N. jatamansi*, *V. wallichi* and *S. vaginatum*

Characters	*N. jatamansi* DC. Fig. 1A (a-d)	*V. wallichi* Jones Fig. 1B (a-d)	*S. vaginatum* C.B.Clarke Fig.1C (a-d)
Macroscopic	Rhizome 2-10cm long & up to 1.5cm thick densely covered with silky reddish brown tufted fibrous remains.	Rhizome 2.5 to 12cm long and 2 to 3.5cm thick, covered with thick brownish rootlets.	Rhizome 10 to 15 cm long, covered with tufts of brittle hairs on each ends.
Fracture	Brittle	Short brittle	Short brittle
Organoleptic characters	Colour- Brownish black Taste- Slightly bitter Odour- Strongly aromatic	Colour- Brownish black Taste- Bitter &Slightly camphoraceous Odour- Strongly aromatic	Colour- Brownish black Taste- Bitter &Slightly camphoraceous Odour- Strongly aromatic
Microscopic (Fig. 1)	Transverse section of rhizome is more or less circular in outline.	Transverse section of rhizome is circular in outline.	Transverse section. of rhizome is circular in outline.
Cork	2-5 layers of cells filled with oil granules.	5-16 layers of lignified cells, occasionally containing oil globules.	4-8 layers of cells filled with brownish content.
Cortex	Cortex broad, 7-11 layers	Cortex broad, 9-14 layers	Cortex broad, 14-21 layers
Schizogenous canal	Present	Absent	Abundantly present
Cambium ring	Distinct and continuous	Distinct and continuous	Not distinct
Starch grains	Abundantly present in groups	Present single and occasional compound	Less in numbers
Medullary rays	Bi to multiserrate	Uni to multiserrate	Uni to multi serrate
Pith	Present parenchymatous	Pith, broad parenchymatous	Absent
Xylem	Vessels with pitted & scalariform secondary wall thickening.	Vessels with scalariform secondary wall thickening.	Vessels with scalariform thickening.

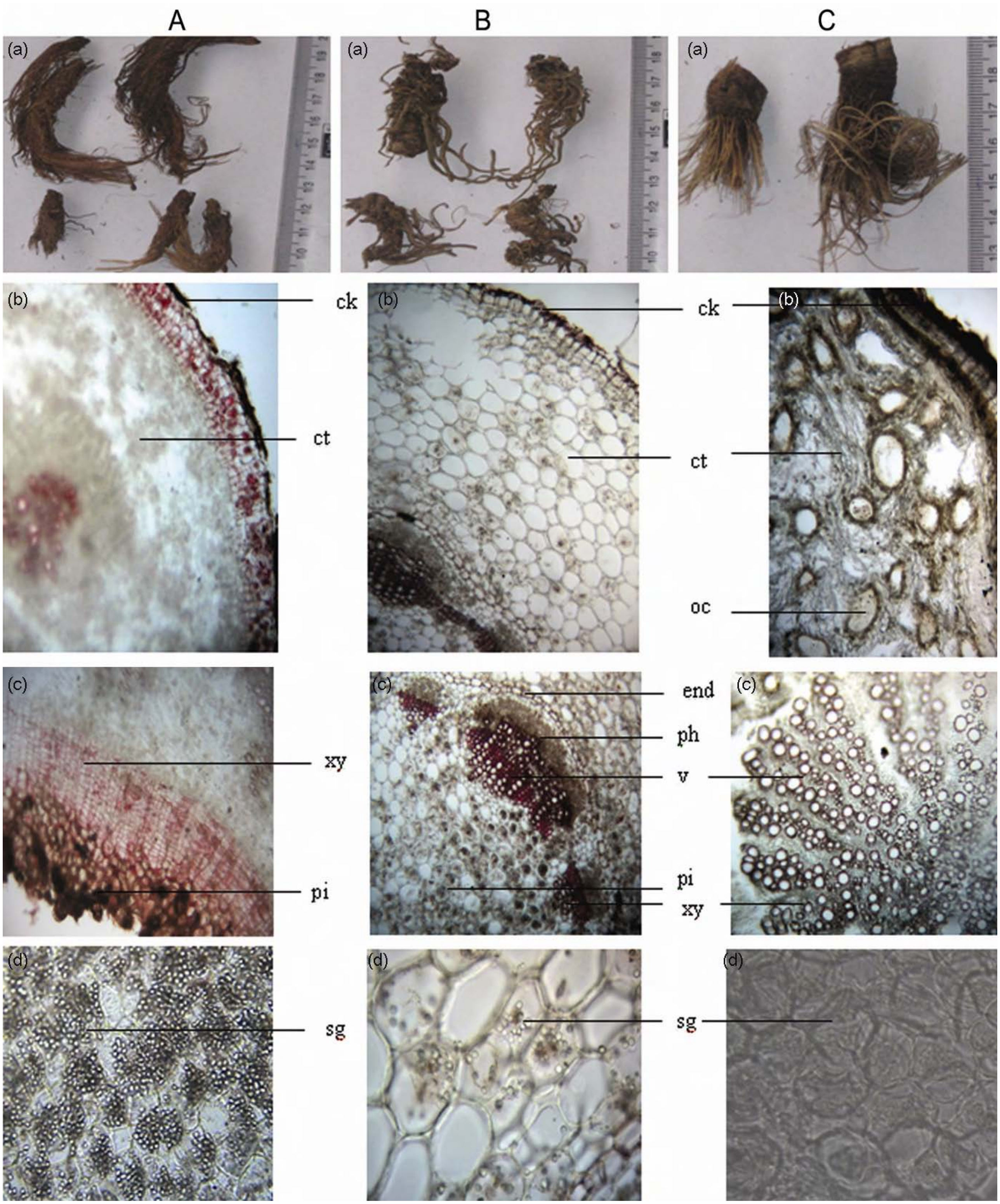

Fig.1A—(a-d) (*N. jatamansi*)-a rhizome, b TS of rhizome, c TS of rhizome showing vascular region with pith, d parenchymatous cells filled with starch grains; 1B—(a-d) (*V. wallichi*)-a rhizome, b TS of rhizome, c TS of rhizome showing vascular region with pith, d parenchymatous cells filled with starch grains; 1C—(a-d) (*S. vaginatum*)-a rhizome, b TS of rhizome, c TS of rhizome showing vascular region with pith, d parenchymatous cells filled with starch grains

Table 3—Comparative Powdered Microscopic characters of rhizomes of *N. jatamansi*, *V. wallichi* and *S. vaginatum*

Nardostachys jatamansi	*Valeriana wallichi*	*Selinum vaginatum*
Powder is light brown in colour, odour camphoraceous and taste bitter.	Powder is dull brownish with distinct odour and bitter in taste.	Powder is brownish coloured with bitter taste and characteristic odour.
On microscopical examination the powder revealed different type of hairs, schizogenous canals, medullary rays, cells filled with reddish brown content fibres, cork cells in surface view, xylem vessels with pitted and scalariform secondary wall thickening, starch grains, etc.	It shows cork cells in surface view, medullary rays, fragments of fibres, starch grains, cells filled with brownish contents.	Powder shows cork cells in surface view, schizogenous canal, fragment of fibres, medullary ray and starch grains are present.

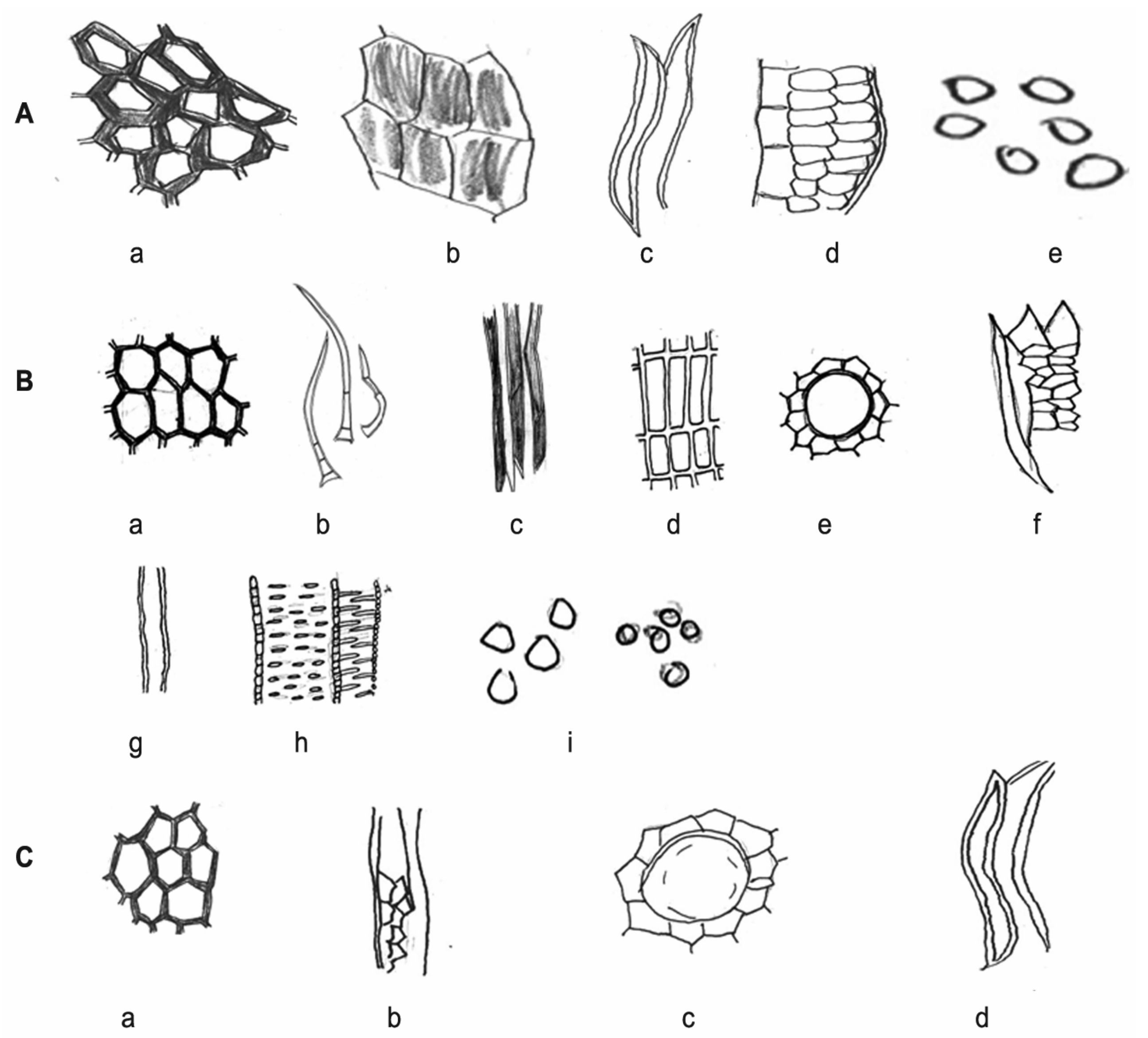

Fig. 2—Comparative powder study of 2A (a-e)(*N. jatamansi*)- a cork cells in surface view, b parenchymatous cells filled with yellowish brown content, c fibres, d tangentially cut medullary rays, e starch grains; 2B—(a-i)(*V. wallichi*)-a cork cells in surface view, b hairs, c elongated parenchymatous cells filled with yellowish brown content, d parenchymatous cell, e schizogenous canal, f medullary rays, g fibres, h vessels, I starch grains; 2C—(a-e) (*S. vaginatum*)-a cork cells in surface view, b schizogenous canal, c tangentially cut medullary rays , d fibres, e starch grains

Conclusion

The objective of the present paper is to compare the rhizome of three plant species generally used under the name of *jatamansi*. As *Nardostachys jatamansi* is an official drug mentioned in Ayurvedic Pharmacopoeia of India and *Valeriana wallichi* is 'Indian valerian' both belongs to family-Valerianaceae where as *Selinum vaginatum* is '*bhutkeshi'* belongs to Apiaceae. There is significant macro and microscopical differences. Macroscopical differences are as in size of rhizome, color, number and thickness of hairs. Microscopic dissimilarities are number of layers in cortex and cork region, abundance of starch grains, type of medullary rays, and presence and absence of schizogenous canals and pith. Thus, it is concluded that the rhizome of these three plant species which are commonly sold as *jatamansi* can be validated or authenticated on the basis of their macro and microscopical characters.

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