Pharmacognostical Research

Pharmacognostical study of Tamalaki (Phyllanthus fraternus Webster), a herb used in Tamaka-svasa

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Introduction

There is considerable variation in the identity of the source plant of Tamalaki by different scholars. It got more than hundreds of synonyms, broad spectrum of properties, actions as well as therapeutic indices. These are the reasons behind consideration of more than one plant by different experts. It is often a difficult task to take a particular species with the name Tamalaki in all medicated formulations used in Ayurveda. Therefore, it is essential to consider the single species for specific purpose along with specification of morphological characters. A preliminary pharmacognostical study of three different species of Tamalaki namely Phyllanthus fraternus, P. amarus, and P. urinaria had been carried out by the scholar himself.[1] In this study, P. fraternus has only been selected by giving more emphasis on its therapeutics in the treatment of Tamaka-svasa.

Literary research

In Ayurveda, since Tamalaki is attributed with Kasahara and Svasahara properties.[2,3] Acaryas have incorporated it in many formulations used for the treatment of respiratory diseases. Some of them are Cyavanaprasa, Amritaprasha ghrita, Satyadi churna, Tejovatyadi ghrita, Kantakari ghrita, Padmakadi leha,[4] Talisadi ghrita,[5] and Jivantyadi churna.[6,7] A single drug remedy (Tamalaki decoction) is found in the treatment of Rajayakṣa associated with six symptoms.[8] In contrast of morphological characters, different terminologies such as Dalaphalika[9,10] and Sahapatrāphala[11] are equated with Tamalaki by the ancient commentators, which signify general morphological characters observed in Phyllanthus species and thus identification of any particular species on this ground is not possible.

Among the Nighantus, it is surprisingly noticed that the source plant described in Bhava Prakasa Nighantus is Tikta, Kasaya, and Madhura in Rasa. The actions and indications are predominant in the respiratory system and the synonym Ajata (‘नल इक्षवक,’ अत्यन्त हर्ष्यतिः व जटा मूलःत्यक्ता: less and short fibrous roots) suggesting toward Phyllanthus fraternus Webster.[12] Some of the research works revealed that Phyllanthus niruri Linn. is an antihistaminic in the experimental model[13] and clinically effective in non-bacterial upper respiratory tract infection.[14] It has been reported that P. niruri Hook. f. (Fl Br Ind.) non-Linn. has been renamed as P. fraternus Webster in 1957.[15] In a clinical study, it was found beneficial for the patient of Tamaka-svasa.[16] P. amarus was investigated as hepatoprotective[16,17] and P. urinaria Linn. as diuretic.[18] Synonyms Jata (‘कट वट संचालते धातीः’ having more fibrous root) and Drdhapada (‘हर्द वरद मुख्य धारतिः इति’ hard root system) appeared in Nighantus indicate P. urinaria and P. amarus, respectively.[19] On the basis of the literary research, the source plant of Tamalaki appeared in Kasahara, Svasahara groups, used in the treatment of Tamaka svasa and other respiratory diseases, is taken as P. fraternus.

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Materials and Methods

Collection of plant materials and procedures
The whole plant was collected from BHU campus, Varanasi (UP, India) during the month of June–July. Macroscopic characters were established from the available source books as well as the observations made by the experts of Department of Dravyaguna and Department of Botany, BHU, followed by microscopic studies in the Pharmacognosy laboratory in Department of Dravyaguna. For a microscopic study, plant materials (root, stem, and leaf) were immersed into alcohol for 15 days to become soft and then cross sections obtained from an electronic microscope. Staining and mounting were done following the usual procedures of plant microtechnique (Jahnson 1940). The respective diagram was sketched with the help of camera lucida (from slides, ×80) and digital camera (from dissecting microscope, ×10).

Plan of study
This study has been performed in following two divisions:
• Macroscopic study
• Microscopic study

Observations

Macroscopic study
Ayurvedic aspects
Based on the synonyms, these indicate morphological characters:\n\begin{align*}
\text{तामलकीं-तनु-भारारम्यकींच्र} 1 \\
\text{भूमीमलकीं-भूरी आम्लकीं इति} 1 \\
\text{यो ग्रीवात्त समान और आलकीं इति} 1 \\
\text{माला- मालमलांगिन फलानि यस्या} । \\
\text{The fruits (capsules) appear as beads in a string.} 1 \\
\text{अल्यण्या- अतीती महुनि मध्यमानि भीजानि यस्या} । \\
\text{अल्यण्या- अधिकाति अम्लानि भीजानि यस्या} । \\
\text{Having numerous (six) seeds in each capsule.} 1 \\
\text{सहस्रमलांका- पक्की- फुत्त जीते इति} 1 \\
\text{Capsule appears in axils of the leaf.} 1 \\
\text{दलकलिका- दलेल्या पर्यासांगिन्द्र फलानि यस्याम्} । \\
\text{Capsule appears as if attached with the leaf.} 1 \\
\text{अज्ञा- भूमीमलकीं, हृद्मुक्तलात्} । \\
‘न्जतू हर्दमदूर्’; अल्यानि हुमानि च जरा मूलम्यश्च। । \\
\text{Having less and short fibrous root system.} । \\
\text{Modern aspects} 1 \\
\text{Leaf: The leaf is simple, numerous, somewhat imprecated, alternate, opposite, thin and almost sessile. The upper surface is green and glabrous while the lower surface is pale green and somewhat glaucous in fresh condition., often in two rows with a whitish rachis, elliptic-oblong shaped, margin entire, apex rounded, obtuse (rarely sub-acute), base rounded, 6–13 by 3–6 mm, unisulcate reticulate venations. The main lateral nerves are usually four to five pairs, petioles very short, stipules simple, minute, free-lateral, awl-shaped, lanceolate-subulate, very acute [Figures 1a-c]. Taste is slightly bitter and odor indistinct.}^{20-22} \\
\text{Stem: Herbaceous, quite smooth, aerial, erect, green, branching profuse toward the upper region, 30–60 cm in height and up to 4 mm in diameter. Stem naked below with 5–11 pairs leaves bearing branches, pale green, angular, slender, and spreading. The internodes are small, 1–1.5 cm long [Figures 1a and d]. Taste is slightly bitter and odor indistinct.} \\
\text{Root: The taproot is more or less straight, small, 2.5–11.0 cm long, gradually tapering, with a number of whitish fibrous secondary and tertiary roots, external surface light brown, fracture short [Figure 1d].} \\
\text{Capsule: 2.5 mm diameter, smooth, globose, slightly depressed at the top faintly 3-lobed with six enervations, Sepals 6, enlarged more than half portion of the capsule, generally light green [Figure 1c].} \\

Microscopic study
Stem: Transverse section of the young stem shows a pentagonal outline having a small wing-like protrusion in each angle [Figure 2a]. As the stem maturing, the protrusion becomes less pronounced and lastly becomes almost circular due to bulging out of the compressed inner mass.

Older stem shows four to five layers of cork, composed of thin-walled, tubular, tangentially elongated and radially arranged cells, filled with reddish-brown content; epidermis consists of a single layer of broad but short barrel-shaped cells with a thick cutinized outer wall. The epidermis is followed by cortex consists of a continuous
ring of collenchymatous tissue, followed by chlorenchymatous and zone of oval, tangentially elongated, thin-walled, parenchymatous cells which has prominent patches of phloem. The cells of the outer most layer of the cortex are comparatively larger and closely placed, while the cells of the innermost layer of the cortex are flattened and tangentially elongated [Figures 2b and c]; secondary phloem narrow, composed of a sieve tube, companion cells and phloem parenchyma; secondary xylem consists of vessels, tracheids, fibers, and xylem parenchyma; centre occupied by a pith composed of thin-walled, circular to oval parenchymatous cells, contain starch grains and crystals of calcium oxalate [Figures 2b-d].[20-22]

**Root:** Transverse section shows four to six layers of cork, consisting of thin-walled, rectangular, tangentially elongated and radially arranged cells, filled with reddish-brown content; secondary cortex consists of 8–10 layers of thin-walled, tangentially elongated parenchymatous cells; secondary phloem is a narrow zone consists of sieve tube, companion cells and phloem parenchyma, and the whole is traversed by narrow phloem rays; secondary xylem represented by a broad zone composed of vessels, tracheids, fibers and xylem parenchyma; pith parenchymatous [Figures 3a-d].

**Leaf:** Transverse section of leaf shows epidermis on either side composed of thin-walled, tangentially elongated cells, covered externally by a thick cuticle; mesophyll differentiated into palisade and spongy parenchyma; palisade single-layered, occupy nearly half the space between the two epidermis; anisocytic-type stomata present on both epidermis, stomata are followed by respiratory cavities beneath; mesophyll composed of three to five layers of loosely arranged cells having a number of veins traversed in this region, a few cluster crystals of calcium oxalate present in spongy parenchyma [Figures 4a-c].[20-22]

**Discussion**

*Tamalaki* has been in use since the *Samhita* period. Different properties, actions, and synonyms mentioned in Ayurvedic literatures indicate more than one species of it. Some experimental and clinical studies had already been carried out on different species taken as *Tamalaki* for different actions. The word *Tamalaki* thus reasonable to consider as a generic name in the present time which includes different species of *Phyllanthus*, and are subjected to further investigation for their specific action. It is observed that *P. fraternus* and *P. amarus* have six and five prominent tepals respectively, but *P. urinaria* got very minute six tepals. Capsule of *P. urinaria* is echinatus, whereas rest two is smooth. Short and less fibrous (Ajata), relatively more fibrous (Jata) root system and hard tap root Drdpadpa, are seen in *P. fraternus, P. urinaria*, and *P. amarus*, respectively.

**Conclusion**

*P. fraternus* is reasonable to consider as a source plant of *Tamalaki* used in the treatment of *Tamaka svasa*. Profuse branching toward the upper region of stem, whitish rachis, elliptic-oblong leaf, smooth capsule with six tepals, less and short fibrous root system, pentagonal outline with wing-shaped young stem are some of the specific characters observed in this herb.

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