Pharmaceutical Standardisation

A comparative pharmacognostical profile of Desmodium gangeticum DC. and Desmodium laxiflorum DC.

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Abstract

Shaliparni is one of the Laghupanchamoola ingredients. Desmodium gangeticum DC. is an accepted source of Shaliparni as per Ayurvedic Pharmacopoea of India (API). Desmodium laxiflorum DC. is the drug commonly used instead of D. gangeticum in the Saurashtra region. The study is an attempt to compare the above said two species on the basis of their pharmacognostical profiles. The macroscopy and microscopy of roots of both plants were studied as per standard procedures. Root powders of both Desmodium species used in the experimental study to ascertain its Rasa by dilution method. Both the species show the same Rasa and Anurasa i.e., Madhura and Kashaya and almost same morphological and microscopical characters like prismatic crystals, starch grains etc. Hence it is concluded that D. laxiflorum may be considered as a substitute for D. gangeticum on the basis of present pharmacognostical study.

Key words: Desmodium gangeticum DC., Desmodium laxiflorum DC., pharmacognosy

Introduction

Shaliparni is one of the most potent drugs of Dashamoola. However, due to less availability, Desmodium gangeticum DC. is often substituted with other Desmodium species like Desmodium laxiflorum DC., etc., to meet the remarks. Both these Desmodium species have closely related morphological and microscopical characters. They are erect stout herbs under shrubs, growing 40-120 cm high, stems angled, more or less hairy.[1] Both species traditionally used for Atisara (diarrhea) and Grahani (dysentery).[2] The present investigation includes morphological and anatomical evaluation of the both species. D. gangeticum and D. laxiflorum are the herbs belonging to the same family Fabaceae, widely found in Saurashtra region of Gujarat. Commonly, these plants are known as Ekpanipandadiyo and Runchhadopandadiyo respectively.[3]

Materials and Methods

Collection and authentication of plant materials
The plant D. gangeticum and D. laxiflorum were collected during July-August and October-November from Jamnagar and Junagadh region respectively and authenticated through Pharmacognosy Laboratory, Institute for Post Graduate Teaching and Research in Ayurveda, Gujarat Ayurved University, Jamnagar. Voucher specimen was also preserved for further references. The roots were separated, washed under running tap water; air dried under shade, coarsely powdered and kept in air tight container for further use.

Rasa Nirdharana (dilution method)
Root powders of both Desmodium species used in the experimental study to ascertain its Rasa by dilution method.[6] Study was conducted in 40 volunteers who can identify and express the taste. Volunteers were the scholars of the post-graduate course in I.P.G.T. and R.A and were in the age range of 23-35 years.

Volunteers were requested to taste the plant powder after gargling with normal drinking water. They were requested to write down the taste they felt immediately after putting the powder on tongue and after half-a-minute on slip of paper. The results were interpreted based on the Rasa perceived. The taste immediately felt in the first half minute is considered as the Pradhana Rasa and that perceived after is Anurasa.

Macroscopic and microscopic analysis
The macroscopy and microscopy of both the roots were studied as per standard procedures. For the microscopic studies, cross sections were prepared and stained with phloroglucinol and hydrochloric acid as per the procedures. The powder study has done following the same method.[5]
Histochemical tests
The histochemical tests of powdered drugs were performed as per standard procedures[6] (Table 1).

Observations and Results

Macroscopic characters
The plant D. gangeticum is a stout herb, up to 1 m height generally, has poorly developed tap root system and 5-15 or more, long deep growing prominent spreading lateral roots, arising from its basal part. The lateral roots are very strong and cord like, long, nearly uniformly cylindrical and smooth. They have thick central strand of wood surrounded by a comparatively thin but tough bark. The root grows 2-3 foot deep. The outer surface is yellowish brown in color. Wood part is light yellow in color, hard, woody. Fracture is hard and short. The drug has slight characteristic odor and taste.

The plant D. laxiflorum is an erect herb, up to 20-25 cm height, generally and well developed, nearly uniformly cylindrical, long, deep growing tap root system with lateral roots. They have thick central strand of wood surrounded by a comparatively thin but tough bark. The root grows 2-3 foot deep. The outer surface is yellowish white in color. Wood part is light yellowish white in color, hard, woody. Fracture is hard and short. The drug has slight characteristic odor and taste.

Microscopic characters

Transverse section
1. D. gangeticum
Outer most thin layered cork, consist of light yellowish brown colored, 4-8 rows of tangentially elongated rectangular, nearly twice as long as broad cork cells [Figure 1a].
Cortex is broad and composed of several rows of thin walled, tangentially elongated ovate shaped parenchyma cells embedded with starch grain and contains scattered group of lignified selerenchymatous fibers of various sizes and shapes, each group consisting of 4-15 small thick walled cells.
Phloem composed of polygon to rectangular thin walled tangentially elongated somewhat compressed parenchyma cells encircling the central wood portion [Figure 1b].
The wood comprises of vessels, parenchyma, and fibers and occupies largest portion of the root. The medullary rays bi- to multi-seriated parenchymatous cells, radiates across cortex, passes through phloem and ends toward in xylem. The xylem has diffused porous arrangement of xylem vessels, group of 2-3 isolated units, thick walled xylem parenchymatous and fibers. Prismatic crystals of calcium oxalate and starch grain observed embedded in cortical parenchyma and ray cells [Figure 1a].

2. D. laxiflorum
Outer most thin layered cork, consist of light brownish yellow colored; in which outer 1-2 rows made up of tangentially elongated compressed parenchyma, while inner most 3-4 layers consists of rectangular parenchymatous cork cells [Figure 2a].
Cortex is broad and composed of several rows of thin walled, tangentially elongated ovate shaped parenchyma cells embedded with starch grain, also contains scattered group of lignified selerenchyma fibers. Each group consists of 4-15 small thick walled cells.
Phloem composed of polygon to rectangular thin walled tangentially elongated somewhat compressed parenchyma cells encircling the central wood portion [Figure 2b].
The wood comprises of vessels, parenchyma and fibers and occupies largest portion of the root. The medullary rays bi- to multi-seriated parenchymatous cells, radiates across cortex, passes through phloem and ends toward in xylem. The xylem has diffused porous arrangement of xylem vessels, group of 2-3 isolated units, thick walled xylem parenchymatous and fibers. Prismatic crystals of calcium oxalate and starch grain observed embedded in cortical parenchyma and ray cells [Figure 2a].

Powder characteristics
The presence of prismatic crystals of calcium oxalate, starch grain, lignified parenchyma, transversely elongated cork cells, septed fibers, pitted vessels, and simple fibers observed during the powder microscopy of D. gangeticum DC [Figures 3 and 4].

Table 1: Histochemical tests of crude powders

| Plant materials | Reagents | Observations |
|-----------------|----------|--------------|
| Section/powder of drug | Phloroglucinol+HCl | Gives pink color to lignified elements like xylem vessels and fibers |
| Section/powder of drug | Iodine solution | Gives blue color to starch grains |

Figure 1: T.S of Desmodium gangeticum DC. root. (a) Unstained, (b) Stained. Ck: Cork, Ph: Phloem, Mr: Medullary rays, PC: Prismatic crystal, Xy: Xylem, Co: Cortex, Sg: Starch grain, Fb: fibers

Figure 2: T.S of Desmodium laxiflorum DC. root. (a) Unstained, (b) Stained. Ck: Cork, Ph: Phloem, Mr: Medullary rays, PC: Prismatic crystal, Xy: Xylem, Co: Cortex, Sg: Starch grain, Fb: fibers
In the powder microscopy of *D. laxiflorum*: prismatic crystal of calcium oxalate, starch grains, brownish content, bordered pitted vessel, simple fiber, lignified pitted parenchyma cells, brownish colored cork cell in surface view was observed [Table 2].

**Rasa determination**

*Rasa* determination was done by method developed by Dhyani in 40 volunteers. Madhur *Rasa* and Kashaya *Anurasa* was perceived in maximum number of volunteers [Table 3].

**Discussion**

**Organoleptic study**

Both the species had Madhura Kashaya *Rasa*, color brownish in *D. gangeticum* and light brownish cream in *D. laxiflorum* and both perceived characteristic odor [Table 4]. Based on the morphology and microscopical study done by pharmacognostical methods; the study reveals that both the species shows almost similar characters. However, it can be differentiated by some characters. Macroscopically, the color, size, and shape of the roots are the only the differentiating characters of the both species. *D. gangeticum* has poorly developed tap root system with deep growing prominent spreading lateral roots, arising from its basal part. While, *D. laxiflorum* has well developed, long, deep growing tap root system with strong and cord like lateral roots. Microscopically; *D. gangeticum* shows thin 4-8 layered yellowish brown colored parenchymatous cork, broad cortex with approximately 4-20 celled group of sclerenchymatous fibers and 2-5 seriated medullary rays. While *D. laxiflorum* shows thin, light brownish yellow colored, 1-2 outer and 3-4 inner-layered parenchymatous cork, broad cortex with 3-15 celled groups of sclerenchyma fibers and bi- to multi-seriated medullary rays, as differentiating characters. Prismatic crystals and starch grains observed commonly in both the species.

| Plant materials          | Reagents            | Results |
|--------------------------|---------------------|---------|
| Section/powder of both species | Phloroglucinol+HCl  | Positive|
| Section/powder of both species | Iodine solution    | Positive|

Figure 3: Powder microscopy of *Desmodium gangeticum* DC. root. (a) Prismatic crystals of calcium oxalate. (b) Starch grains embedded in parenchyma cells. (c) Lignified parenchyma cells. (d) Tangentially elongated cork cells. (e) Septed fiber. (f) Lignified thick walled parenchyma cells. (g) Pitted vessel. (h) Simple fibers.
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Figure 4: The diagnostic characters of powder of Desmodium laxiflorum DC. root. (a) Prismatic crystal of calcium oxalate and starch grains. (b) Brown content with starch grains. (c) Bordered pitted vessel. (d) Simple fiber. (e) Lignified pitted parenchyma cells. (f) Brownish colored cork cell in surface view

Table 3: Rasa Nirdharana by dilution method

| Sample            | Madhura | Amla | Lavana | Katu | Tikta | Kashaya | Avyakta |
|-------------------|---------|------|--------|------|-------|---------|---------|
| Pradhana Rasa     |         |      |        |      |       |         |         |
| D. gangeticum     | 72.5    | -    | -      | -    | -     | 12.5    | 15      |
| D. laxiflorum     | 62.5    | -    | -      | -    | -     | 35      | 2.5     |
| Anurasa           |         |      |        |      |       |         |         |
| D. gangeticum     | 17.5    | -    | --     | -    | 35    | 22.5    | 25      |
| D. laxiflorum     | 27.5    | -    | --     | -    | 2.5   | 42.5    | 27.5    |

D. gangeticum: Desmodium gangeticum, D. laxiflorum: Desmodium laxiflorum

Table 4: Organoleptic characters of both the species

| Sample          | Taste          | Color           | Odor         |
|-----------------|----------------|-----------------|--------------|
| D. gangeticum   | Madhura, Kashaya | Brownish       | Characteristic |
| D. laxiflorum   | Madhura, Kashaya | Light brownish | Characteristic |

D. gangeticum: Desmodium gangeticum, D. laxiflorum: Desmodium laxiflorum

The Rasa Nirdharana study was conducted, the study reveals that - both the Desmodium species are having Madhura Rasa (D. gangeticum-22.5%, D. laxiflorum-42.5%) as Pradhana Rasa and Kashaya Rasa (D. gangeticum-72.5%, D. laxiflorum-62.5%) as Anurasa respectively (Table 3).

Conclusion

From the study conducted for both plants, it can be concluded that, both the species show the same Rasa and Anurasa. Both the plants have almost similar morphological and microscopical characters as observed in pharmacognostic study. Therefore,
Based on present pharmacognostic study, it can be concluded that *D. laxiflorum* DC may be used in the scarcity of *D. gangeticum* DC.

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