J. Orchid Soc. India, 39: 163-167, 2025 ISSN 0971-5371
https://doi.org/10.64873/JOSI.v39.i1-2. 163-167

ON THE DISTRIBUTION PATTERN AND PHYTOCHEMICAL CONSTITUTION OF A TRADITIONAL HEALING HERB, *MALAXIS MUSCIFERA* (LINDL.) KUNTZE (ORCHIDACEAE)

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Abstract

Malaxis muscifera (Lindl.) Kuntze is a threatened orchid known for its healing properties since ancient times. It is one of the eight important herbs constituting the highly acclaimed group of therapeutic plants known as *Astavarga*. This monsoon blooming species, known as *Risabhak* in ayurvedic literature, inhabits semi-shady forest floors and open or shrubby grasslands in temperate and alpine regions (1800-4300 m). Several bioactive compounds (alkaloids, flavonoids, tannins, glycosides, saponins, *etc.*) extracted from its pseudobulbs, roots, stems, and leaves possess anti-aging, anti-allergenic, anti-cancer, anti-inflammatory, anti-malarial, anti-microbial, anti-mutagenic, antioxidant, anti-ulcer, and anti-viral activities. It is, therefore, collected illegally and unscientifically for its medicinal properties, from the wild. The present paper attempts to provide notes on its morphological characteristics, distribution pattern, and phytochemical constituents.

Introduction

ORCHIDS ARE well known for their ornamental importance and therapeutic properties. India with vast geographic expanse and a variety of climates is rich in orchid resources; occurrence of 1256 orchid species under 155 genera has so far been authenticated in the country (Singh *et al.,* 2019). Nearly 800 species, with varied life modes (terrestrial, epiphytic, myco-heterotrophic), occur in Indian Himalayan Region (IHR), and some of these find frequent mention in ancient Indian literature for their curative properties (Jaryal *et al*., 2021; 2025a,b; Kumari and Pathak, 2020, 2025a,b; Pathak *et al*., 2023; Prakash and Pathak, 2019; Sharma and Pathak, 2024; Vij *et al.*, 2013). In the Ayurvedic System of medicine, four Himalayan orchids namely *Crepidium acuminatum* (Jivak/ Jeevak), *Habenaria intermedia* (Ridhi), *Herminium edgeworthii*, and *Malaxis muscifera* (Risabhak/ Rishabhak), are part of *Astavarga* group of drugs, which forms the basis of several rejuvenating formulations (Balkrishna *et al*., 2020). Through the present paper, we provide details on morphological characteristics, distribution pattern, and phytochemical constituents of one of these herbs, *Malaxis muscifera* (Lindl.) Kuntze. Its pseudobulbs are used as an ingredient in various classical ayurvedic formulations such as *Astavarga churna, Chitrakadi taila, Chyavanprash rasayan, Himvana agad*a, *Jivaniya ghrita, Mahakalyan ghrita, Mahamayura ghrita, Mahapadma taila,* and *Vajikaran ghrita* for vitality, stamina, and respiratory disorders (Balkrishna, 2012; Gupta *et al.,* 2015).

It is important to mention here that there lies an ambiguity in the ayurvedic names used by different researchers for *Malaxis muscifera*. Chauhan (1990), Chinmay *et al.* (2011), Kant *et al.* (2012), and Vij *et al.* (2013) cited this taxon as *Jeevak*. However, Balkrishna (2012) used name *Rishabhak* for it. According to Virk *et al.* (2017), there is a controversy in the names of eight constituent taxa of *Astavarga*. Of these, the names *Malaxis muscifera* (syn. *Microstylis muscifera*), and *Crepidium acuminatum* (syn. *Malaxis acuminata, Microstylis wallichii*) have been interchangeably used for *Jeevak* and *Risabhak*. Moreover, *Pueraria tuberosa* (common name *Vidari kand*), a climber of family Fabaceae has been now used as substitute for both of these in various ayurvedic formulations. We have followed Balkrishna (2012) in this paper where *Malaxis muscifera* has been cited as *Rishabhak*.

Material and Methods

The details on morphology and distribution pattern of *Malaxis muscifera* in the Western Himalayan region are based upon the field surveys conducted by the authors from 2018 to 2025 at various localities of Himachal Pradesh and Uttarakhand. During such surveys, data on its morphological features, habitat characteristics, phenology, and threats were collected, and briefly presented here. For general distribution and phytochemical constituents, available literature was reviewed (Balkrishna, 2012; Chauhan, 1990; Chauhan *et al.,* 2008; Chinmay *et al.*, 2011; Dokalaa *et al.*, 2023;

Received: November 8, 2025; Accepted: December 15, 2025

Kant, 2015; POWO, 2025; Rautela *et al.*, 2024; Singh *et al.*, 2019; Vij *et al.*, 2013).

Results and Discussion

Taxonomic Treatment

Malaxis muscifera (Lindl.) Kuntze, Revis. Gen. Pl. 2: 673. 1891; Chowdhery & Wadhwa, Fl. Himachal Pradesh 3: 690. 1984; Deva & Naithani, Orch. Fl. N. W. Himal. 317. t. 181. 1986; Dhaliwal & Sharma, Fl. Kullu Dist. 614. 1999. Vij *et al*., Orchids Himachal Pradesh. 217. Fig. 69. 2013. *Microstylis muscifera* (Lindl.) Ridley, J. Linn. Soc. 24: 333. 1888; Hook.f., Fl. Brit. India 5: 689. 1890; Collett, Fl. Siml. 491. 1902; Duthie, Ann. Roy. Bot. Gard. (Calcutta) 9: 89. 1906. *Dienia muscifera* Lindl. Gen. Sp. Orchid. Pl. 23. 1830.

Species Description

Terrestrial herb. *Pseudobulbs* ovoid, 2-3 × 1-1.5 cm. *Stem* 10-30 cm long, 2-4 mm thick. *Leaves* 2, unequal, spreading, ovate round or ovate-lanceolate, obtuse or sub-acute, somewhat narrowed at the base to sheathing petiole, 3-10 × 2-4 cm. *Inflorescence* raceme, erect, stout, 6-12 cm long, many flowered. *Floral bracts* small, lanceolate, shorter than ovary. *Flowers* minute, yellow-green, 2-3 mm across. *Sepals* subequal, oblong lanceolate, 2.5-3 × 1-1.5 mm, *Petals* linear, shorter than sepals. *Lip* fleshy, as long as sepals, broadly ovate, excavated at the base, side lobes obscure, convex, thickened. *Column* very small, fleshy, *ca*. 1 mm long. *Pollinia* 4, sub-ovoid.

Distribution Pattern and Habitat Characteristics

The taxon is distributed in temperate and alpine climates (1800-4300 m) in the Himalaya and adjoining regions. In mid-hills (1800-2800 m), it inhabits semi-shady floors of Oak (*Quercus leucotrichophora*), Deodar (*Cedrus deodara*), Rhododendron (*Rhododendron arboreum*), Kail (*Pinus wallichiana*) and mixed forests. In high-hills (beyond 2800 m), it occupies open or shrubby grasslands. The populations, occurring as individual plants or groups of 4-6 plants, are highly discontinuous and scattered across the himalayan range. Grasses and ferns are its close associates, in majority of localities. However, some other orchid species (*Dactylorhiza hatagirea, Goodyera repens, Herminium monorchis,* and *Liparis rostrata*) occasionally share habitat with this taxon.

Phenology

Malaxis muscifera shows its growth in its natural habitats during pre-monsoon or monsoon showers in the mid- and high-Himalayan tracts. The species has short vegetative phase and it flowers during mid-July to mid-August. Fruits develop and dehisce during September-October. The epithet *muscifera* (Latin: fly-carrying) refers to the small flowers which resemble flies on a stick (Fig. 1).

Fig. 1. A population of *Malaxis muscifera* growing in its natural habitat.

General Distribution

India (Jammu and Kashmir to Arunachal Pradesh), Bhutan, China, Myanmar, Nepal, and Pakistan.

Therapeutic Potential

The species is a traditional healing herb, and its pseudobulbs serve as the main therapeutic part. These are known to contain various bioactive constituents, including alkaloids, flavonoids, tannins, glycosides and saponins (Balkrishna, 2012; Dokalaa *et al.,* 2023; Gupta *et al.,* 2015; Kant, 2015; Rautela *et al.,* 2024). Pharmacologically, it exhibits multiple therapeutic actions such as cooling, aphrodisiac, haemostatic, anti-diarrhoeal, anti-oxidant, anti-cancer,

anti-microbial, styptic, anti-dyseteric, anti-aging, febrifuge, and general tonic (Balkrishna, 2012; Dokalaa *et al.,* 2023). The key traditional therapeutic applications include treatment of seminal debility, haemorrhages, dysentery, fever, emaciation, excessive body heat, general weakness, enhancement of vitality, relief from joint and bone disorders, and support for reproductive health (Balkrishna, 2012; Chauhan *et al.,* 2008; Gupta *et al.,* 2015; Rautela *et al.,* 2024; Sharma and Samant, 2017; Suyal *et al.,* 2020). These uses highlight the importance of this taxon as a multi-functional medicinal plant across the himalayan region.

Phytochemical Profile

A few reports on the phytochemical profiling of *Malaxis muscifera* are available. Investigations of various plant parts (pseudobulbs, roots, stems, and leaves) revealed the presence of several bioactive compounds such as catechin, rutin, ellagic acid, p-coumaric acid, ferulic acid, stigmasterol, tocopherol, protocatechuic acid, limonene, eugenol, citronellal,1-8- cineole, piperitone, p-cymene, ceryl alcohol, rhamnose, choline, pyromeconic acid, 3-0-methybatatasin-II, gigantol, coelonin, batatasin-II, lusianthridin, â-sitosterol, stigmasterol, *etc*. (Bose *et al.,* 2017; Chinmay *et al.,* 2011; Rautela *et al.,* 2024). Fig. 2 presents structure of some of these compounds. Various phytochemical constituents reported from different plant parts of *M. muscifera* and their biological activities are summarized in Table 1. It this connection, it is worthwhile to mention that, medicinal utility of some of the other commercially important orchids has earlier been documented and phytochemical analysis has been successfully made (Hoque *et al*., 2024; Kumari and Pathak, 2025a,b; Rahman *et al*., 2023; Sharma and Pathak, 2024). However, orchids belonging to *Astavarga* group needs to be studied in detail, for their medicinal properties.

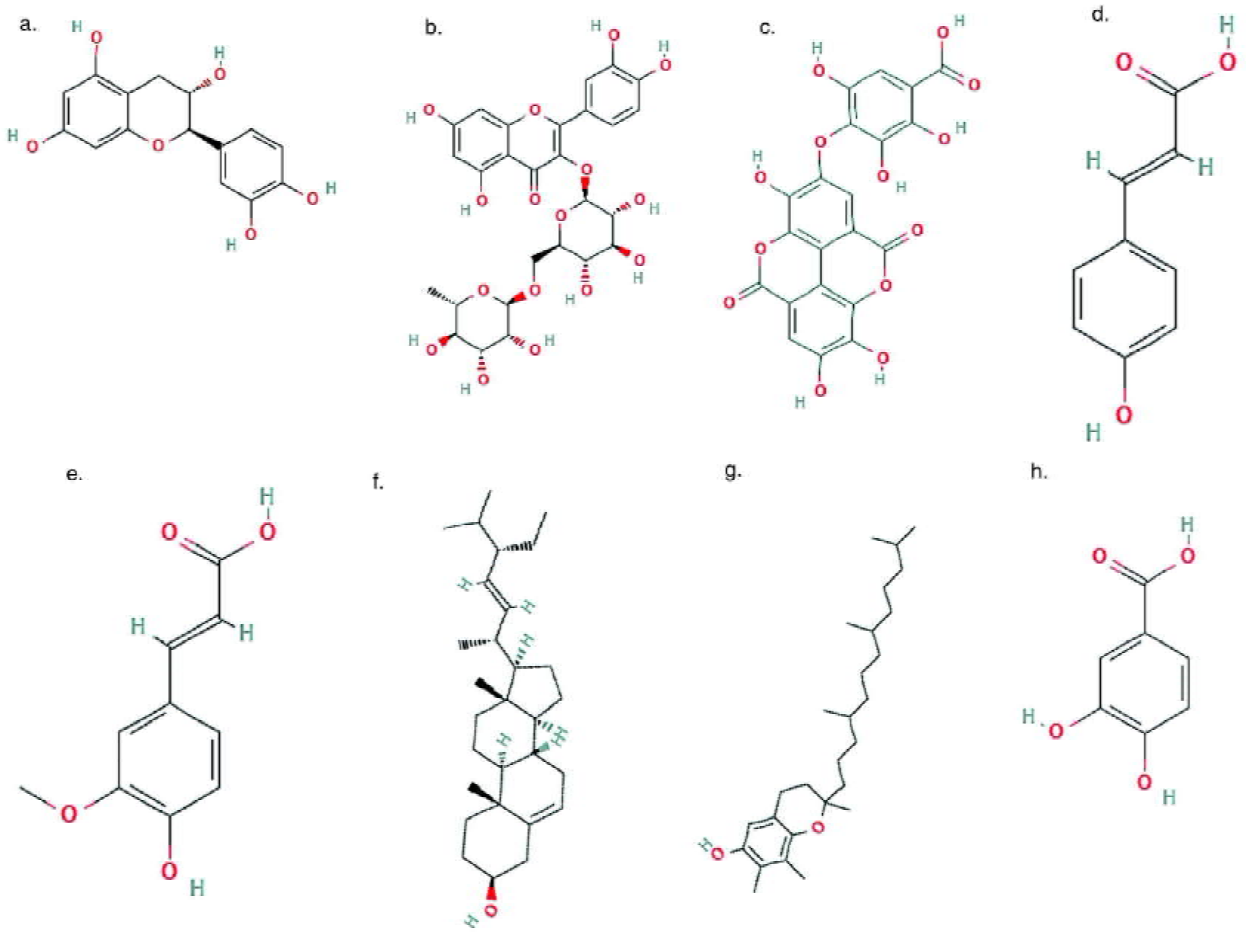

Fig. 2. Chemical structure of some bioactive compounds occurring in *Malaxis muscifera*: a, Catechin; b, Rutin; c, Ellagic acid; d, p-Coumaric acid; e, Ferulic acid; f, Stigmasterol; g, Tocopherol; h, Protocatechuic acid.

Table 1. Phytochemical constituents of different plant parts of *Malaxis muscifera* (Risabhak) and their biological activities.

Plant part used	Bioactive compounds	Biological activity	References
Root	Alkaloids; Flavonoids; Tannins; glycosides; Saponins	Antioxidant activity; Antimicrobial activity	Kant (2015); Dokalaa *et al.* (2023)
Pseudobulbs	3-Hydroxy benzoic acid; 4-Hydroxy benzoic acid; 3-Hydroxy-cinnamic acid; Chlorogenic acid; Catechin; Ellagic acid; Ferulic acid; Gallic acid; Rutin; Caffeic acid; Pyromeconic acid; 3-O-Methylbatatasin III; 3,7-Dimethyl-6-octenal; Rhodinal; 3,7-Dimethyloct-6-enal; Aspartic acid; Asparagine; Ethanolamine; Glutamic acid; Ornithine; Phenylalanine; Proline; Threonine; á-tocopherol; ã-tocopherol	Antioxidant activity; Prevent DNA damage; Anti-allergenic; Antimutagenic activity; Anti-aging activity; Antiproliferative activity against HL-60 cell line; Protect cells from UV induced damage; Antibacterial activity; Antiviral activity; Anti-parasitic activity; Anti-ulcer activity; Neuroprotective activity	Chinmay *et al.* (2011); Dokalaa *et al.* (2023); Rautela *et al.* (2024)
Leaf	3-Hydroxybutyric acid; Acetic acid; Alanine; Fumaric acid; Glycerol; Glycine; Hydrocinnamic acid; Leucine; Malic acid; Malonic acid; Myo-inisitol; p-coumaric acid; Pipecolic acid; Propanoic acid; Protocatechuic acid; Ribitol; Ribonic acid; Serine; Shikimic acid; Stigmasterol; Succinic acid; Valine	Anti-hyaluronidase activity; Antifungal activity; Antibacterial activity; Treatment of IGTs; Antioxidant activity; Anti-malarial activity against *plasmodium falciparum*; Anti-inflammatory; Anti-collagenase and anti-elastase activity; Cardiovascular diseases Strong chelating activity; Antioxidant activity; Prevent DNA damage; Induce apoptosis of human leukemia against liver toxicity; Anti-aging	Rautela *et al.* (2024)
Stem	D-Xylonolactone; Fumaric acid; Glycerol; Glycine; Hydrocinnamic acid; Leucine; Malic acid; Malonic acid; Myo-inisitol; p-coumaric acid; Propanoic acid; Ribitol; Serine; Shikimic acid; Stigmasterol; Succinic acid	Anti-collagenase; Anti-elastase activity; Anti-tyrosinase activity; Antioxidant activity; Anti-malarial activity; Anti-inflammatory activity; Anti- elastase Activity; Strong chelating activity; Prevent DNA damage	Rautela *et al.* (2024)

Threats to Natural Populations

Destruction and fragmentation of natural habitats owing to factors like deforestation, cloudbursts, landslips, overgrazing, unregulated tourism, *etc*. pose threat to natural populations of many orchid species across the Himalayan range. The therapeutically important species like *Malaxis muscifera* face high collection pressures, additionally. As the processes of seed germination and pollination are quite intricate in orchids, their natural regeneration is very slow (Dhillon and Pathak, 2023; Pathak *et al*., 2001; 2023). Therefore, orchids need immediate conservation attention both by means of *in situ* and *ex situ* practices.

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