

**POLYGONATUM VERTICILLATUM (LINN.) ALL. AND
POLYGONATUM CIRRHIFOLIUM (WALL.) ROYLE: TWO
THREATENED VITAL HEALERS FROM ASTHAVERGA
NURTURED BY GARHWAL HIMALAYA, INDIA**

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Abstract: The biodiversity of Garhwal Himalaya supports a large number of medicinal plants used in various ailments as a drug. *Polygonatum verticillatum* and *Polygonatum cirrhifolium*, the healers from 'Asthverga' of 'Ayurveda', are reported from Garhwal Himalaya, but due to overexploitation are encompassed in threatened category. The present study is a documentation of these plants to facilitate the conservation of these crude drugs in their natural habitat and to domesticate them. The study also provides information regarding the resident's outlook, living in surrounding area of these species, towards these species.

Key words: conservation, medicinal, *Polygonatum verticillatum*, *Polygonatum cirrhifolium*

Introduction

India possesses the world's richest medicinal plant heritage and traditional and local knowledge and Himalaya is one of the mega biodiversity regions of the world [HEYWOOD, 2000]. The Indian Himalayan region (IHR) supports over 1748 (32.2% of India) plant species of known medicinal value [SAMANT, 1998]. The Garhwal Himalaya has been a centre of spiritual knowledge, religiosity and pilgrimage from ancient times and it is also rich in biodiversity. *Polygonatum verticillatum* and *Polygonatum cirrhifolium* are the two medicinal enticers from this goblet of biodiversity and key ingredients of 'Ashtaverga' of 'Ayurveda'.

Material and methods

The present manuscript was prepared by extensive literature survey of documented directories and a field survey was also conducted to verify the documentations.

The study was carried out in two districts of Uttarakhand viz. Pauri and Rudraprayag. Rudraprayag district covering an area of about 2439 sq. km lies between latitude 30°19' and 30°49' North and longitude 78°49' and 79°21'13" East. The climate varies from sub-tropical monsoon type (mild inter, hot summer) to tropical upland type (mild winter, dry winter, short warm summer). The soils are natural, dynamic, heterogeneous, non-renewable resource, which support plant and animal life [ANONYMOUS, 2009]. Pauri encompasses an area of 5230 sq. km and situated between

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Latitude 29°45' to 30°15' North and 78°24' to 79°23' Longitude East. The region has a sub-temperate to temperate climate, which remains pleasant throughout the year. The soils are derived from rocks and terraces present are silt to clayey loam and are very fertile [ANONYMOUS, 2011].

Local people were interviewed randomly concerning the local uses of the plants under study. During the interviews local name of the plants, parts used and formulations were asked (see Appendix). These participants were then divided into three groups according to the age groups and gender viz. category I (male 25-50 years), category II (male 51-90 years) and category III (female 25-90 years).

Result and discussion

Privileged Garhwal Himalaya

The hills of Uttarakhand, standing almost centrally in the long sweep of Himalaya, are also known as the 'Garh-Kum' region [KANDARI & GUSAIN, 2001]. Garhwal Himalaya lies between 77°33'5" to 80°6' E longitude and 29°31'9" to 31°26'5" N latitude [NAND & KUMAR, 1989]. Thus the Garhwal region enjoys a wide range of altitudes extending from about 325 m in the *Bhabar* tract to the height of about 7,817 m forming the Nanda Devi peak of the Greater Himalaya or Himadri [KANDARI & GUSAIN, 2001]. The Garhwal Himalayas due to its distinct meteorological, geographic, geological and ecological patterns is rich in bio-resources as well as diverse flora and fauna [GAIROLA & BISWAS, 2008]. The high altitude regions of Uttarakhand Himalayas can be divided into three main climatic zones viz. alpine, temperate and sub-tropical [SHAH & JIAN, 1988]. The alpine zone which ranges between 2500 to 4000 m is rich in wild medicinal plants like *Angelica glauca*, *A. archangelica*, *Dactylorhiza hatagirea*, *Carum carvi*, *Picrorhiza kurroa*, *Aconitum heterophyllum*, *Nardostachys jatamansi*, *Saussurea lapa*, *Podophyllum hexandrum*, *Rheum emodi*, *R. moorcroftianum*, *Aconitum balfourii*, *Swertia* spp. etc. The temperate zone commencing from 1000 to 2700 m elevation is rich in many orchids of medicinal importance, *Rhododendron arboreum*, *Corylus jackmontii*, *Hippophae rhamnoides*, *Polygonatum verticillatum*, *P. cirrhifolium*, *Hypericum oblongifolium*, *Arisaema intermedium*, *Hedychium spicatum* etc. The sub-tropical zone is the region existing in the valleys of the temperate zone. They are not characterized by as rich a variety of medicinal plants but they also account for the bio diversity of the state [ANONYMOUS, 2002]. The medicinal plant diversity available in tropical belt mainly incorporates: *Embelica officinalis*, *Terminalia chebula*, *T. bellirica*, *Cinnamomum tamala*, *Zanthoxylum alatum*, *Berberis* ssp., *Rubus ellipticus*, *Gloriosa superba*, *Withania somnifera*, *Rauwolfia serpentina*, *Aloe vera* etc. [KANDARI & GUSAIN, 2001].

Verve of "Ayurveda"

The literal meaning of "Ayurveda" is (Ayur = life and veda = knowledge) the way or science of life. Ayurveda (1000-500 BC) originated from our ancient literature – "Atherva-veda", the knowledge of which was documented in 'Charak-Samhita' (1000 BC) and 'Sushruta-Samhita' and are considered to be the authentic books. "Ayurveda" may be said to be a treasure house of knowledge about medicinal plants. All of the plants which are used for their medicinal properties have been thoroughly evaluated and classified for thousand of years. It is an ancient philosophy based on a deep understanding of eternal truths about the human body, mind and spirit. Unlike orthodox medicine, it is not based on

the frequently changing findings of specific research projects, but rather on permanent, wise, eternal principals of living [GODAGAMA & HODGKINSON, 1997].

"Ayurveda" is bestowed with "Asthverga" a group of eight plants used as tonic which promotes body heat, dries up serious fluids, carminative and antitussive, and are useful in vitiated conditions of pitta and vata, agalactia, seminal weakness, internal and external haemorrhages, cough, bronchitis, burning sensation and general debility. These eight plants belongs to two families, 'Liliaceae' comprising mahameda (*P. verticillatum*), meda (*P. cirrhifolium*), kakoli (*Roscoea alpina/purpurea*), ksheerakakoli (*Lilium pollyphyllum*), and 'Orchidaceae' comprising jeevak (*Malaxis acuminata*), rishibhak (*M. muscifera*), riddhi (*Habenaria edgeworthii*), vridhhi (*H. intermedia*) [VARIER, 1995].

Introduction to the plants

Polygonatum is a genus of erect or decumbent perennial herbs belonging to family Liliaceae and distributed in the temperate regions of the northern hemisphere. Thick fleshy creeping sympodial rhizomes characterize the genus. According to MILLER (1754) the generic name of *Polygonatum* is derived from the character of the rhizome which resembles much as yovi, a Knee, because it has many little Knees. LINNAEUS (1753) listed three species of *Polygonatum* under the genus *Convallaria*, namely, *C. verticillata*, *C. polygonatum* and *C. multiflora* in his book 'Species Plantarum'. These were treated under the generic name *Polygonatum* by ALLIONI (1785). In the natural system of classification of BENTHAM & HOOKER (1862-1883) family liliaceae was classified in the series Coronarieae.

The systematic position of *Polygonatum* according to phylogenetic system of classification of HUTCHINSON (1973) was:

Phylum: Angiospermae
 Subphylum: Monocotyledons
 Divison: Corolliferae
 Order: Liliales
 Family: Liliaceae
 Genus: *Polygonatum*

Polygonatum is represented by 57 species in the world concentrated in Himalayas [OHARA & al. 2007]. Out of the species occurring in IHR two are imperative ingredients of Asthverga.

Polygonatum verticillatum (Linn.) All. syn. *Convallaria verticillata* (Linn.), is known as whorled Solomon's seal in English and locally known as mitha dudhia [NAUTIYAL & NAUTIYAL, 2004] and Kantula [GAUR, 1999]. The species is recognized as 'mahameda' in Ayurveda and in Sanskrit as Tridanti, Devamani and Vasuchhidra (Fig. 1). It is an erect tall herb, 60-120 cm high. Leaves are whorled, sessile, 10-20 cm long, linear or lanceolate, acute or rarely tip carinate, glaucous beneath, occasionally ciliolate on margins and veins. Flowers are white, pinkish white or pale green, in whorled racemes, rarely lilac. The flowering and fruiting takes place in the month of June to October. This species is found in the temperate Himalayas at altitudes of 1800-3900 m amsl. From Garhwal Himalaya *P. verticillatum* was reported from Bhuna, Dunagiri and Niti by NAITHANI (1984), Binsar by GAUR (1999), Tungnath, Rudranath, Valley of Flowers and Dayara by VASHISTHA (2006).

Polygonatum cirrhifolium (Wall.) Royle syn. *Convallaria cirrhifolia* Wall. another member of Asthverga recognized as King's Solomon's seal in English, locally as Khakan

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[GAUR, 1999], 'meda' in Ayurveda, Dhara, Manichhidra and Svalpaparni in Sanskrit (Fig. 2). It is also a tall erect, perennial herb, 60-120 cm high with whorled (3-6) sessile, linear leaves having tendril like tips. Flowers white, green purplish or pink on short stocks and the fruit is round blue-black berry found in the temperate Himalayas at the altitudes of 1200-4200 m. Rhizomes are thick and fleshy. In Garhwal, NAITHANI (1984) reported it from Gulabkoti, Sitapur and Sutul while Gaur (1999) from Khirsu.



Fig. 1. *P. verticillatum*: Leaf pattern



Fig. 2. *P. cirrhifolium*: Leaf pattern

About 'mahameda' and 'meda' it was documented in "Abhinav niguntu" that 'meda' initiate from the same place from where 'mahameda' originates, simply implying that both *Polygonatum verticillatum* and *P. cirrhifolium* grows together. The term 'meda' used in both the species symbolize the 'mucilage' present inside the rhizomes of these plant species. Several workers explore these two species of 'Asthverga' either together or individually [VARIER, 1995; SINGH, 2006; HUSSAIN & HORE, 2008]. SZYBKA-HRYNKIEWICZ & JANECKO (2004) studied the effect of plant growth regulators and steroidal hormone on a quantity of diosgenin in callus tissue of *P. verticillatum*. In another study they examined the effect of coconut water (CW), plant growth regulators, and steroidal hormones on callus of *P. verticillatum*. Despite underground parts recently above ground aerial parts of *P. verticillatum* are also tested for insecticidal and leishmanicidal properties [SAEED & al. 2010].

Polygonatum is a complex genus with a wide range of chromosome counts ($2n = 16, 18, 20, 21, 22, 24, 26, 27, 28, 30, 31, 36, 38, 40, 42, 46, 59, 56, 60, 62, 64, 66, 84, 86-91, 90$) [LATOO & al. 2005]. In India, chromosome numbers reported for *P. cirrhifolium* are $2n = 38$ (Shimla), 26 (North Sikkim), 28 (Northeast Sikkim) and 56 (China hills, Western Burma) [KUMAR, 1959b, 1959c, 1960, 1964-1965]. LATOO & al. (2005) established a new chromosome number in *P. cirrhifolium* i.e. $2n = 32$. The most common chromosome number for *P. verticillatum* is $n = 28$. Although, one tetraploid strain with $2n = 60$ chromosomes and two hexaploid strains with $2n = 90$ chromosomes have been encountered [THERMAN, 1953].

Curative assets of the plants

Collectively, meda and mahameda are used as tonic and promotes body heat, dries up serious fluids, carminative and antitussive. Both species are used against loss of vigor, pain in the kidney and hips, swelling and fullness in the abdominal region, accumulation of fluids in bone joints, skin eruptions and cough [NAUTIYAL & NAUTIYAL, 2004].

Individually, *Polygonatum verticillatum* is eaten raw or cooked, the powder is given for gastric complaints, and the paste applied to wounds [NAUTIYAL & al. 1998; GAUR, 1999]. The rhizome is valued as salep, a strength giving food. The plants possess diuretic properties and the rhizome of this species is eaten as food in the Kurram valley [ANONYMOUS, 1969]. It contains digitalis glucoside, saponosides A, B, C and D, lysine, serine, aspartic acid and threonine [ANONYMOUS, 1969]. SOOD & al. (2005) mentioned rhizomes contain diosgenin.

Similarly, *P. cirrhifolium* is reported to be used as a tonic and vulnerary. A root infusion with milk is used as an aphrodisiac and blood purifier for tumors and piles. According to report of ANONYMOUS (2003), it is useful in burning sensation, skin diseases wounds, ulcers, tuberculosis, fever, cough, bronchitis and general debility. Investigations in China have reported hypoglycemic, hypotensive, antibacterial and antifungal effects of *P. cirrhifolium* [SINGH, 2006]. Rhizomes contain starch, protein, pectin and asparagin [NAUTIYAL & NAUTIYAL, 2004]. It was also reported to be used in major ayurvedic formulations like Asoka Ghrta, Sivagutika, Amrtaprasa Ghrta, Dasam, ularista, Dhanvantara Taila, Brhatmasa Taila, Mahanarayana Taila, Vasacandanadi Taila.

In the survey it was found that people included in category I were less aware about the plant and its uses while the category II was a combination of people who recognize the plant or were familiar about the uses of plants or the parts used for making formulations. The participants included in category III were least aware about the plant and its uses. Although, how to prepare formulations was unknown by most of the participants.

The vaidyas of both of the districts however recognize the habitat, uses, parts of plant used and how to prepare various formulations. These vaidyas were the local healers which cure the people from diseases. In olden times they were the only people to cure the inhabitants later medicinal facilities were provided by the Government, so now doctors were there for treatment of the inhabitants. But these vaidyas still heal the residents in far flung areas. Since earlier only vaidyas were aware about the distribution and methods of preparation therefore they limit the knowledge to themselves for the sake of their profession and to protect the plants from overexploitation by the villagers. Only the son or student who takeover the profession after the existing vaidyas was given the information regarding the distribution, identification, plant and part used, formulations and doses.

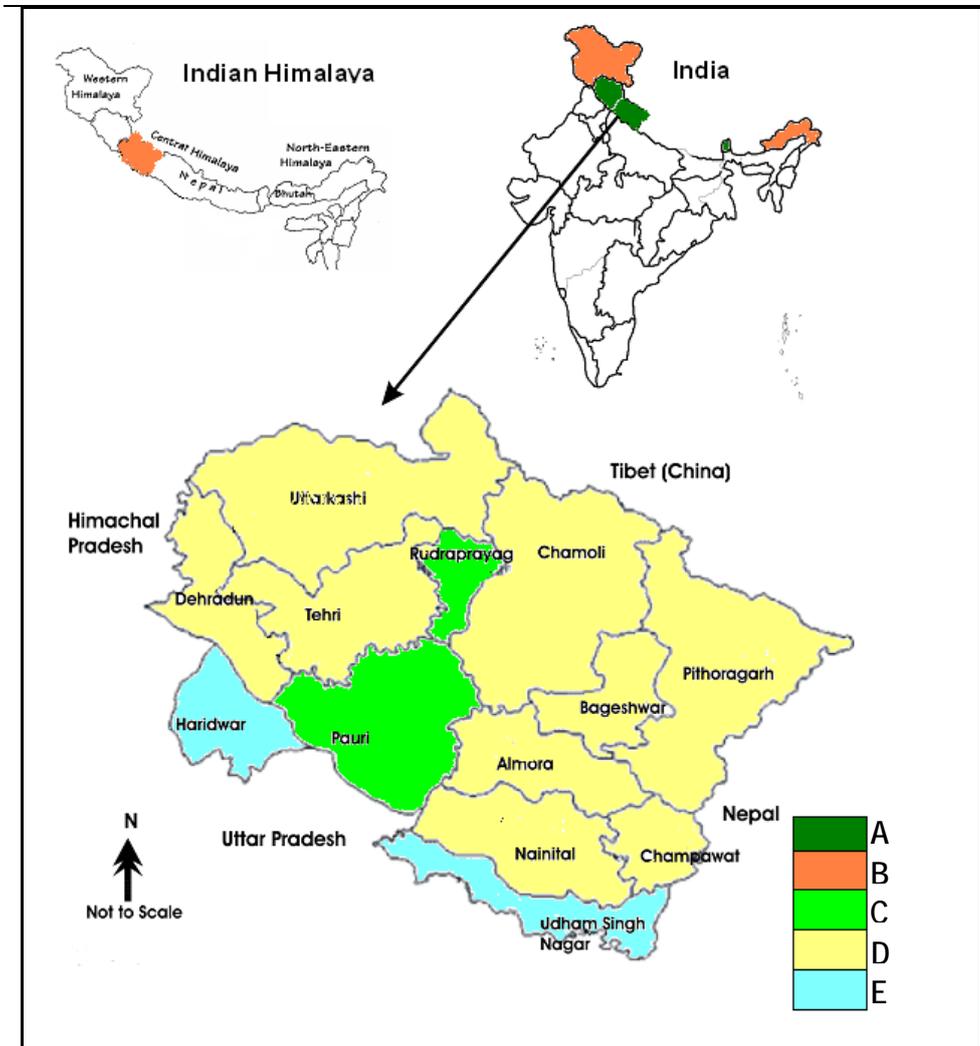
Threat of Extinction

It is accountable that Garhwal Himalaya is enriched by both the *Polygonatum* species which are potential future drugs and can be a milestone in the drift from allopathy to herbal health care system. *P. verticillatum* was found vulnerable in Uttarakhand, Himanchal Pradesh, Jammu & Kashmir and Arunachal Pradesh while *P. cirrhifolium* is endangered in Himanchal Pradesh and vulnerable in Uttarakhand (Fig. 3) [VED & al. 2003]. This status is assigned by IUCN through FRLHT (Foundation for Revitalization of Local Health Traditions) which utilized the CAMP (Conservation Assessment and Management Prioritization) process to undertake rapid assessment of prioritized medicinal plant species of conservation concern in different states/regions of India. Through this evaluation taxa have been assigned Red List status of “threatened” category i.e. critically endangered, endangered and vulnerable. The reason behind there threatened status is their exploitation for their medicinal value. In addition habitat specificity, narrow range of distribution, land-use disturbances, introduction of non-natives, habitat alteration, climatic changes, heavy livestock grazing, explosion of human density, fragmentation and degradation of plant density, population bottleneck and genetic drift [KALA & al. 2006; KALA, 2007] are the potential causes of rarity in medicinal plant species. The women of these areas carry all the activities of domestication of cattle. They collect the food and fodder from the nearby forests and due to lack of identification cut the *Polygonatum* species along with the fodder grasses. This is therefore one of the reasons of threatened status of these plant species.

Conclusions

The present study concludes that the distribution and ethnobotanical uses documented were correct but the knowledge was limited to only local healers and inhabitants were unknown towards the identification of plant species studied. This is although beneficial for protecting the plant from overexploitation and thereby illegal trade but this unfamiliarity is also posing threat for the existence of these species. Therefore immediate steps were needed for educating local residents about the plants in vigilance of Government so that plants can be protected from both overexploitation and negligence.

The study also emphasize that these two plant are suffering from negligence of people both common man and researchers and to revitalize these two magnificent species. Conservation initiatives are urgently required. The study also suggests that despite the so much work done there is still a dearth of research to prove the potential of the natural Himalayan habitats in terms of medicinal plant production.



A: Distribution of *Polygonatum verticillatum* and *P. cirrhifolium* in India; B: Distribution of *P. verticillatum* in India; C: Districts of Uttarakhand where present study was undertaken; D: Hill areas of Uttarakhand; E: Plain areas of Uttarakhand.

Fig. 3. Map of Uttarakhand showing the study areas in Garhwal Himalaya.

Appendix

Name of the participant

Age of the participant

What is the local name of the plant used?

For which diseases do you use the plant?

Which parts of the plant do you use?

How do you prepare the plant for use?

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