

DISTRIBUTION, MORPHOLOGY AND UTILIZATION OF MEDICINALLY IMPORTANT *VIOLA BETONICIFOLIA* SM. IN JAMMU PROVINCE

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Viola betonicifolia (mountain violet) is an important perennial herb of temperate Himalaya. This small rhizomatous species bears arrow-head shaped leaves, beautiful purple flowers and capsular fruits. During different surveys conducted from 2018-2020, *V. betonicifolia* plants were found growing at higher altitudinal sites namely, Gool in Ramban, Dharal in Rajouri, Thanala in Doda and Molsar and Mandi in Poonch districts, though scarcely. Ethnomedicinal information gathered from local people revealed the use of its flowers for treating cough, cold, fever, sore throat and leaves as vegetables. Besides, paste of its leaves and flowers is applied to treat pimples, boils and dry skin. Extensive foliar collections for medicinal purpose along with other anthropogenic activities seem to have accounted for the scarce distribution of *V. betonicifolia* and its rare occurrence in Jammu Province.

Key words: *Viola betonicifolia*, distribution, phenotypic aspects, ethnomedicinal uses

Northern Himalayan regions having varied topography and heterogeneous ecological and climatic conditions support nearly 8000 vascular plants (Thakur *et al.* 2019). Most of these are used by locals for culinary purposes and as medicines and ornamentals (Rana *et al.* 2013). *Viola* belonging to family Violaceae is one such genus. It is represented globally by 900 species (Valentine *et al.* 1968), in India by 12 species (Hooker 1872, Sharma *et al.* 1993) and in Jammu Province by 7 species (Sharma *et al.* 1993, Chandra *et al.* 2015). Later include *Viola betonicifolia*, *V. canescens*, *V. odorata*, *V. pilosa*, *V. biflora*, *V. indica* and *V. tricolor* var. *hortensis*. Of these, *V. odorata* is mainly used for preparing commercial 'Banafsha', though *V. betonicifolia* also contain many medicinally valuable components (Rizwan *et al.* 2019).

V. betonicifolia, also called mountain violet/arrow-head violet, has been reported from different South-east Asian countries (Nepal, Sri Lanka, Pakistan, Burma, China, Japan, Malaysia) including India (Rizwan 2019). In our country, it is found in Western Ghats (Ravikanthachari *et al.* 2018) and different Himalayan states/union territories namely Himachal Pradesh, Uttarakhand and Jammu and Kashmir (Rani *et al.* 2011, Rana *et al.* 2013, Chandra *et al.* 2015). In Jammu Province, *V. betonicifolia* has been

documented from varying altitudinal ranges viz. 1220-2500 m (Flora of British India by Hooker 1872), 1400-2800 m (Flora of India by Sharma *et al.* 1993) and 1000-3000 m (Flowers of the Himalaya by Polunin and Stainton 1997). Nevertheless, exact sites of its occurrence are not mentioned in local floras except for Flora of Udhampur wherein it reportedly grows at Latti Dhuna (Swami and Gupta 1998). This gap necessitated extensive surveying of Jammu Himalaya for locating *V. betonicifolia* plants and characterising them phenotypically. Going by the availability of limited data on its ethno-botanical uses, gathering knowledge regarding uses and methods of utilisation of its different plant parts also became important. In view of these limitations, mountain violet plants have been analysed presently for distribution, phenotypic characterisation and utilisation.

MATERIALS AND METHODS

Different mountainous regions of Jammu Province were visited from 2018-2020 for locating *V. betonicifolia* plants which were identified using different floras. Geo-positions of the study sites were noted using digital GPS (Garmin make), followed by determining distribution of its population through random

sampling. Morphometric data were taken from ten plants of Gool (Ramban). Different qualitative traits studied included plant habit; leaf shape, margin and apex; stipule shape, margin and apex; attachment of stipule to petiole, petiole shape; colour of sepals and petals and their shapes; fruit type, colour, its dehiscence and seed colour and its shape. Besides, various quantitative traits were also screened such as leaf number, length and breadth; petiole length, stipule number and length; seed length, breadth and weight. Standard deviation (S.D.) and standard error (S.E.) for each quantitative character was calculated using following formulae:

$$S.D.=\sqrt{\sum(X-\bar{X})^2/N-1}$$

$$S.E.=S.D./\sqrt{N}$$

Where,

X= Individual observation

\bar{X} = Mean

N = Number of observations

Detailed information on uses and methods of utilization of present species was gathered during different field trips through repeated interactions with local people. Twenty-five males and 20 females in the age group of 22-55 years, including farmers, shepherds, government employees, home-makers, Vadyas and Hakims were interviewed for this purpose.

RESULTS AND DISCUSSION

Distribution: Various localities (17) in seven

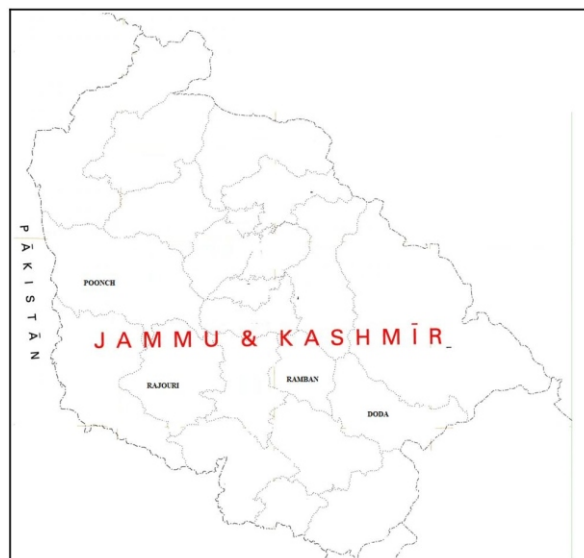


Figure 1: Map showing study sites

hilly districts of Jammu Province viz. Ramban (Sanasar and Gool), Doda (Kapra, Chinta, Thanala and Khani-Top), Reasi (Devi Pindiyan, Ramsoo and Bharon-Ghati), Udhampur (Patnitop, Nathatop, Sudh Mahadev and Mantalai), Kishtwar (Sangram Bhatta), Rajouri (Dharal) and Poonch (Molsar and Mandi) were surveyed during 2018-2020. Across these regions, *V. betonicifolia* plants were found growing only in Dharal (Rajouri), Gool (Ramban), Thanala (Doda), Molsar and Mandi in Poonch (Fig. 1). Geo-positions of these sites, habitat of present plants and their distribution is given in table 1.

A perusal of table 1 revealed mountain-violet plants growing at 1661m and 1850 m in Ramban and Rajouri and at 2202 m and 2491 m

Table 1: District-wise location, distribution and habitat of *V. betonicifolia* plants.

Locality, District (Altitude in masl)	Latitude	Longitude	Distribution	Habitat	Distribution type
Dharal, Rajouri (1661)	33°27.57'	74°25.03'	8 plants separated from each other by 1 meter	Moist-gritty soil of sloppy areas under <i>Pinus</i> trees	Scarce
Gool, Ramban (1850)	33°16.34'	75°10.44'	16 plants; with 7 occurring singly and 4-5 in two groups	Moist-gritty soil of sloppy and shady areas	Scarce
Thanala, Doda (2202)	33°55.13'	75°46.15'	7 plants separated by 1-2 meters	Gritty soil on road-side	Scarce
Molsar, Poonch (2491)	33°52.39'	74°19.21'	6 plants separated by 1 meter	Gritty soil of hilly slopes	Scarce
Mandi, Poonch (2039)	33°46.28'	74°16.33'	5 individual plants separated by 1 meter	Hilly slopes	Scarce



Figure 2 (A-F): A. *Viola betonicifolia* plants growing in a pot B. individual plant showing rhizome C. triangular leaves D. paired stipules adnate to petiole E-F purple flower and fruit showing tri-furcate dehiscence

in Doda and Poonch. Existence of these plants at varying altitudes is indicative of their great adaptability to different climatic conditions. Besides at each study site, only 5-17 plants were noted which were either growing singly or in clumps of four-five which denoted their scarce distribution.

Phenotypic details: *V. betonicifolia* plants are perennial (Fig. 2A). Each plant bears rhizome with its basal portion giving rise to slender, unbranched hairy roots (Fig. 2B) and upper region differentiating long, slender, tufted 7-14 (9.5 ± 0.41) bright-green leaves (Fig. 2C). Because of *V. betonicifolia* bearing triangular leaves resembling an arrow-head, it is locally called arrow-head violet. Individual leaf having leathery texture, crenate margins, obtuse apex, light green abaxial and dark green adaxial surface emits spicy fragrance. Lamina of each leaf is $4.2\text{cm} \pm 0.22$ (4-6.5) long and $3.1\text{cm} \pm 0.32$ (2.5-4.1) broad. Its petiole is longer than lamina, with its mean length being $5.1\text{cm} \pm 0.32$ (4.8-6.5 cm). Upper petiolar portion near attachment to lamina is winged and is nearly 0.25 cm broad. To each petiole, two linear foliaceous and persistent stipules (Fig. 2D) are adnate, which are 1-1.6 cm ($1.2\text{cm} \pm 0.23$) long.

V. betonicifolia plants bloom from May-August. Its bright-purple, axillary and solitary flowers are pentamerous, hermaphrodite and zygomorphic. They are held above the foliage on slender pedicels (Fig. 2E) and are frequently visited by butterflies. Lanceolate sepal of individual flower has acuminate apex and oblong-obovate petal has obtuse apex. Fruit of this species is three-valved ellipsoidal capsule which exhibits tri-furcate dehiscence (Fig. 2F). Each valve bears along its margins 30-40 dark-brown, ellipsoidal, smooth and shiny seeds. Individual seed is $0.13\text{ cm} \pm 0.03$ (0.1-0.15 cm) long, $0.054\text{ cm} \pm 0.02$ (0.05-0.1 cm) broad and $0.021\text{mg} \pm 0.01$ in weight. New plants generally emerge from the seeds dispersed of pre-existing plants.

Utilization: Interactive sessions conducted with local people revealed varying uses of foliar and floral parts of mountain violet. Its flowers, containing medicinally important components, are boiled in water to prepare decoctions which are recommended for patients suffering from sore throat, cough and fever. Its fresh and dried petals form important ingredient of tea which is taken to cure cold. Leaves of this species, containing fats, proteins, carbohydrates and nutrients as calcium, potassium, sodium, cobalt, cadmium, zinc, iron, nickel, copper, chromium and lead (Muhammad *et al.* 2012), are cooked by locals as vegetables. Besides, paste of its leaves and flowers is applied on face to cure pimples, boils and dry skin. Because of its differentiating beautiful flowers and adaptability to different soil types, *V. betonicifolia* is grown for landscape beautification and as pot herb. Rizwan *et al.* (2019)'s review report while revealing anti-bacterial, pyretic, fungal, anti-plasmodial, anti-larvicidal, anti-nematicidal and anti-helminthic properties of mountain violet, documented its utilization in skin creams recommended for curing dermal stains. Similarly, Chandra *et al.* (2015) reported its utilization for treating pneumonia, bronchitis and kidney diseases.

Extensive utilisation of *V. betonicifolia* seems to have built pressure on plants growing *in-situ*, leading to their scarce distribution. Various anthropogenic activities like grazing, browsing and trampling and increase in human population probably are other factors responsible for decline of present plants. Presence of *V. betonicifolia* plants in five of 17 localities surveyed and their scarce existence pointed towards their rare occurrence in Jammu Province. Nevertheless, detailed studies on distribution and population density of this species from larger geographical areas are required before giving final verdict regarding the threat to this in the areas of its occurrence.

CONCLUSION

V. betonicifolia plants grow at higher altitudinal sites of Jammu Province namely, Gool in Ramban, Dharal in Rajouri, Thanala in Doda and Molsar and Mandi in Poonch districts. In these regions, flowers are used by locals for treating cough, cold and fever and leaves as vegetables. Scarce distribution of this species at the study sites, however, is the matter of great concern.

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