

A plea for ‘Outside protected-Area conservation’ of the Himalayan Mayapple (*Sinopodophyllum hexandrum* (Royle) T.S. Ying) in the wild — A Threatened Red Listed Anti-cancerous medicinal plant Rarely Revisited in East Sikkim (India)

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Abstract

Sinopodophyllum hexandrum (Royle) T. S. Ying, a threatened medicinal plant of the family Berberidaceae, is survived by a few individuals in the wild, mostly outside the Protected Areas observed in East Sikkim. Since its rediscovery in September, 2007 at Serabathang in East Sikkim, regular monitoring had been conducted till October, 2018. As a result of this monitoring, this work embodies field observations about its present status.

The Himalayan mayapple, *Sinopodophyllum hexandrum* (Royle) T. S. Ying, an anti-cancerous medicinal as well as Red Listed (Vulnerable) plant of the family Berberidaceae, is struggling for its existence in the wild, especially outside the Protected Areas (Plate 1). It is distributed in the alpine Himalayas of India, Pakistan, Afghanistan, Nepal, Bhutan and China. Nayar and Sastry¹¹ reported that *S. hexandrum* is distributed in restricted pockets throughout the alpine Himalayan region. The rhizomes of *S. hexandrum* yield cytotoxic lignan podophyllotoxin and resin due

to which it possesses anti-cancerous activity^{5,6}. Podophyllotoxin is also a major component of the drug used to cure lung cancer⁸. Another anti-cancerous lignan, Podophyllin (resin from rhizomes and roots of *S. hexandrum*) has been used especially in the treatment of ovarian cancer as well as roots also contain several other important anti-cancerous lignans including berberine (ref. <http://www.paypal.com>; <http://www.pfaf.org>). The root extract is cholagogue, cytostatic and purgative. Currently, extracts of the Himalayan mayapple are used in topical medications for genital warts, HIV-related oral

hairy leukoplakia and some skin cancers (ref. <http://www.naturalstandard.com>). Preliminary research also shows that CPH 82, an oral form of *Podophylum hexandrum* composed of two purified semisynthetic lignin glycosides, may be useful in treating rheumatoid arthritis (ref. <http://www.naturalstandard.com>). This is the main reason behind the high demand of *S. hexandrum* in the international herbal market. *S. hexandrum*, a threatened medicinal plant of the family Berberidaceae, is survived by a few individuals in the wild, mostly outside the Protected Areas observed in East Sikkim. Since its rediscovery in September, 2007 at Serabathang in East Sikkim, regular monitoring had been conducted till October, 2018. As a result of this monitoring, this work embodies field observations about its present status.

Based on field studies (2007-2009; 2012-2014; 2016-2018) in the Eastern Himalayas (Sikkim, Darjeeling of West Bengal and Arunachal Pradesh) and herbarium consultations in Indian herbaria viz., CAL, BSHC, BSD, DD, ASSAM³ reveal that the species is extremely threatened mainly due to indiscriminate collections of rhizomes and roots for its rich medicinal potentialities by the local ethnic groups as well as herbals and probably due to its minimum seed dispersal and germination potentialities. Most of the seeds are not germinated into seedlings (study based on a rare population in East Sikkim from 2007 – 2009; 2012 – 2014; 2016 – 2018 by the author).

Distribution and Literature Review :

In India, *S. hexandrum* is distributed in Jammu & Kashmir, Himachal Pradesh, Uttaranchal, Sikkim and Arunachal Pradesh

at altitudes ranging from 3000 (-2400) – 4600 m¹². Dasgupta² reported this species from West Bengal (Darjeeling). Literature and herbarium consultations reveal that the species was collected as common occurrence long ago by the eminent workers like Royle¹³. Hooker & Thomson⁴ from Kashmir Himalaya. After a long gap (after 1970) it was again collected as rare by several workers like M. A. Rau (Coll. no. 50310, CAL), P. K. Hajra (Coll. No. 74013, BSD), B. M. Wadhwa (Coll. No. 58716, BSD), J. N. Vohra & B. D. Naithani (Coll. No. 83007, BSD), T. A. Rao (Coll. No. 237, BSD). In Himachal Pradesh, the species was collected as common occurrence before independence by J. H. Lace (Coll. No. 1314, CAL) and N. L. Bor (Coll. No. 12115, DD), however after 1970, the species was collected as very rare by several workers like U. C. Bhattacharyya (Coll. No. 48609, BSD) and N. C. Nair (Coll. No. 34216, BSD). In Uttaranchal, the species was collected after 1960 by several workers like M. A. Rau (Coll. no. 15761, CAL), B. M. Wadhwa (Coll. No. 62447, BSD), B. D. Naithani (Coll. no. 48160, CAL) and U. N. Kanjilal (coll. No. 511, DD) as rare and threatened plant. In Sikkim, it was collected by Dr. Prain's Collectors in 1901 (Coll. no. 399, CAL), Ribu and Rhomoo in 1910 (Coll. no. 4425, CAL), W. W. Smith in 1910 (Coll. no. 3276, CAL, DD) and very recently observed by the author (2005 – 2007; 2012 – 2014; 2016 – 2018) in East Sikkim, although Maity & Chauhan⁹ reported from Thila-Jakthang of North Sikkim. They reported as Endangered and Threatened plant in very rare occurrence. In Arunachal Pradesh, it was collected as rare and threatened by R. S. Rao (Coll. no. 7784, CAL) and Mudgal *et al.*¹⁰ in Singh & Singh (2002) reported this species

from Dihang-Dibang Biosphere Reserve as the threatened plant. Based on the detailed investigation (both field observations as well as herbarium consultations), Chaudhary and Rao¹ mentioned “populations of *Podophyllum* throughout its range are declining”. They also enumerated the number of plants in a particular locality along with its altitude. They mentioned 30 localities, most of which possess one or two plants in a population.

Field observation :

During the course of field study in East Sikkim (2007 – 2009; 2012 – 2014; 2016 – 2018), author for the first time visited and observed the single plant of *S. hexandrum* (Plate-1: only photographed, due to its rarity it was not collected) near Serabathang at an altitude of c. 4600 m on 05.10.2007 in fruiting. This Serabathang plant in East Sikkim was revisited after W. W. Smith (1910). This

Serabathang plant remained single and revisited on 19th September, 2008 during the course of subsequent field study. The Serabathang mother plant produced single offspring as observed on 06.10.2009. Again Serabathang population was visited subsequently on 12th September, 2012; 22nd September, 2014; 29th September, 2016 and finally 3rd October, 2018. Unfortunately, only four individual plants were seen till 2018. This is probably due to minimum seed germination capabilities and least seed dispersal potentialities of this species.

Taxonomy :

Sinopodophyllum hexandrum (Royle) T. S. Ying in C. Y. Wu, Fl. Xizang, 2: 119. 1985. *Podophyllum hexandrum* Royle, Ill. Bot. Himal. Mts. 1: 64. 1834; *P. emodi* Falconer ex Royle; *P. emodi* var. *chinense* Sprague; *Sinopodophyllum emodi* (Falconer ex Royle) T. S. Ying.



Plate 1. *Sinopodophyllum hexandrum* (Royle) T.S. Ying; habit with fruit reported at Serabathang in East Sikkim in Sept. 2018.

Plants erect, rhizomatous herb up to 60 cm tall. Rhizome perennial, 2.5 x 1.5 cm, bearing roots; stems solitary, leafy at top, angulate, glabrous. Leaves 2 or 3, lamina orbicular-reniform, 8-14 x 4-10 cm, palmate, bilobed. Flowers not seen (although local Nepalese reported as solitary, cup-shaped, light pink). Fruits berries, fleshy, oblong-ovoid, 3-5 x 3 cm, bright orange-red. Seeds more than 15 seen, ovoid-triangular to suborbicular, 2-4 mm across, maroon.

Habitat: growing in shady and moist places rich in humus at altitudes ranging from 3000-4500 m, and associated with *Rhododendron anthopogon*, *R. setosum*, *Cassiope fastigiata*, *Salix* sp.

Flowering: May-June. *Fruiting:* July-September.

Presently, *S. hexandrum* is categorized as CITES Appendix II Listed Plant to ban its indiscriminate collection in the wild as well as international trade of wild parts. IUCN does not assess yet *S. hexandrum*, but it meets the criterion as Vulnerable (VU). As an important step towards conservation, the Government of India has legally banned the wild collection and trade of the species by including it in the Appendix II of CITES list. The species in the present locality is facing high risk of threat of extinction due to low seed germination and indiscriminate collection by local ethnic people and hence it warrants focused immediate conservation measures. Although, Kala⁷ reported that “the species is abundant in the Great Himalayan Park of Himachal Pradesh. In the fringes of the Valley of Flowers National Park, density of this species is about 1 individual

per sq. meter”. However, this is due to the rarest phenomenon of drastic conservation steps, but outside the Protected Areas, the condition is more and more vulnerable.

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