

# Ecological status of three Angiosperms (*Alysicarpus bupleurifolius* var. *hybridus* DC, *Hibiscus hoshiarpurensis* and *Ceropegia bulbosa* Roxb. var. *lushii*) in Punjab (India)

## Abstract

Around the world, several plant species are fighting for their survival in the new urbanized world to which they are not adapted to and these species face a significant risk of extinction in the near future. Such species are categorized as “threatened species” in the IUCN redlist. In India, there are several herbaceous plant species that are getting pushed to those zones of existence and the scenario is no different in the northwestern state of Punjab where changes in the land cover use has been challenging the survival of several plant species including a few natives. This article focuses on existing knowledge base on the three angiosperm species in Punjab, *Alysicarpus bupleurifolius* var. *hybridus* DC and *Hibiscus hoshiarpurensis* and *Ceropegia bulbosa* Roxb. var. *lushii*, that have been identified by Punjab Biodiversity Board as threatened in the state. It is important to understand here that comprehensive information on geographic distribution, ecology and threats to these species is lacking on global databases and even the threat status is apparently ambiguous. *Alysicarpus bupleurifolius* var. *hybridus* DC, which has been identified as endemic herb in the state, is listed as endangered species by Punjab Biodiversity Board, however the variety itself has not yet found its place in the IUCN redlist. The species, *Alysicarpus bupleurifolius*, is listed as the Least Concern species in the IUCN red list. Similarly, the global IUCN status of *Hibiscus hoshiarpurensis*, another herb identified as endemic to the state, is not known however the species is listed as threatened by the Punjab Biodiversity Board. According to *The Plant list* (database maintained by The Royal Botanic Gardens, Kew and Missouri Botanical Garden), the plant species status is still unresolved. *Ceropegia bulbosa* Roxb. var. *lushii*, that has a distribution in a few states of India, has been identified as threatened on regional scale however the species has not yet been assessed for the IUCN Redlist.

**Keywords:** *Alysicarpus bupleurifolius* var. *hybridus* DC, *Hibiscus hoshiarpurensis* and *Ceropegia bulbosa* Roxb. var. *lushii*, threatened, redlist, Punjab (India)

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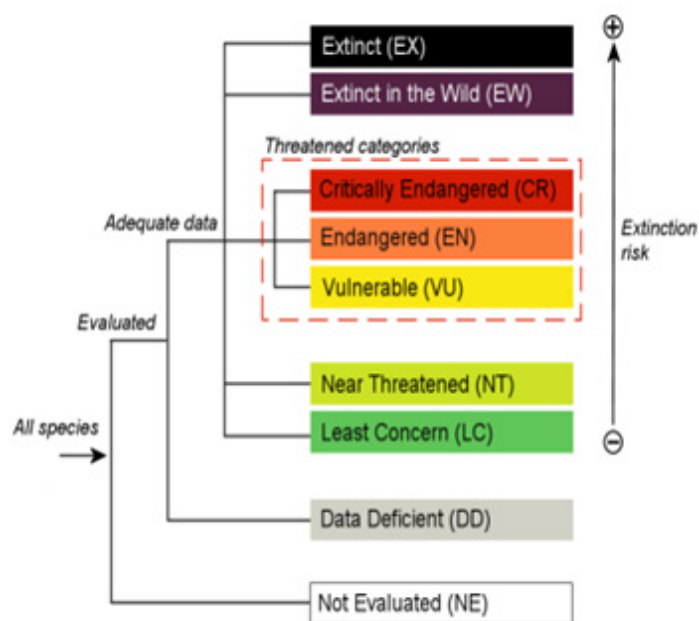
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## Introduction

IUCN Red list of Threatened species was established in 1964 to compile information on global conservation status of animal, fungi and plant species based upon the extinction risk. To evaluate the extinction risk to any species, a criteria has been set that is relevant to all species and all regions of the world. Each species is evaluated and assigned a status under nine categories specified depending upon the risk of extinction (Figure 1). The list not only provides information on the threats and conservation status of species but also summarises information on the habitat, ecology, biogeographic range, population size, threats and conservation status of species. According to the latest update of IUCN Red List worldwide, a total of 71,576 species have been assessed of which 21,286 are threatened with extinction worldwide. Since analysing the status of a diverse variety of species at such level is very difficult, 11,881 species are deemed data deficient. As per the IUCN 2016 RedList data in India, a total of 988 get to the threatened category list (Figure 2), out of which 332 are plant species. Urbanization, habitat degradation, global warming and environmental pollution are considered major causes of loss of species in the through various states of India including Punjab.

Punjab is one of the premiere small agricultural states in northwestern India that houses huge floral diversity. About 1939 species of angiosperms and 21 species of gymnosperms have been recorded in the state with several natives.<sup>1,2</sup>

In Doaba region alone of Punjab (Figure 2) that includes four districts of the state, Hoshiarpur, Kaputhala, Jalandhar and Nawanshahar, about 464 species of angiosperms of 337 genera and 99 families have been recorded.<sup>3</sup> Almost 50 tree species are native to the state that include banyan, amla, sohanjna baheda, tilkan and simbal etc. However, this large floral diversity in is currently facing threats from unsustainable development and lack of appreciation that has lead to shrinking of population sizes of several angiosperm species to an extent where they have been assessed to be threatened with extinction. In consultation with Botanical Survey of India and Forest Department, Punjab Biodiversity Board has identified six angiosperm species as threatened in Punjab that include three herb species, one shrub and two tree species (Table 1 & 2). This article discusses the ecology, habitat, threats and conservation status of three threatened herbs of Punjab i.e. *Alysicarpus bupleurifolius*, *Hibiscus hoshiarpurensis* and *Ceropegia bulbosa* Roxb. var. *lushii* (Table 2) in northwestern state of India, Punjab.



Category	Definition
Extinct	No reasonable doubt that the last individual has died
Extinct in the wild	Known only to survive in captivity or as a naturalised population outside the past range
Critically endangered	Facing an extremely high risk of extinction in the wild
Endangered	Facing a very high risk of extinction in the wild
Vulnerable	Facing a high risk of extinction in the wild
Near threatened	Close to qualifying for a threatened category in near future
Least concern	Widespread and abundant
Data deficient	Inadequate information to make assessment of risk of extinction

Figure 1 IUCN red list status categories and their definitions.



Figure 2 The northwestern state of Punjab on the map of India.

**Table 1** Threatened angiosperms of Punjab (India) as identified by Punjab biodiversity board in consultation with Botanical survey of India & Forest Department, Punjab

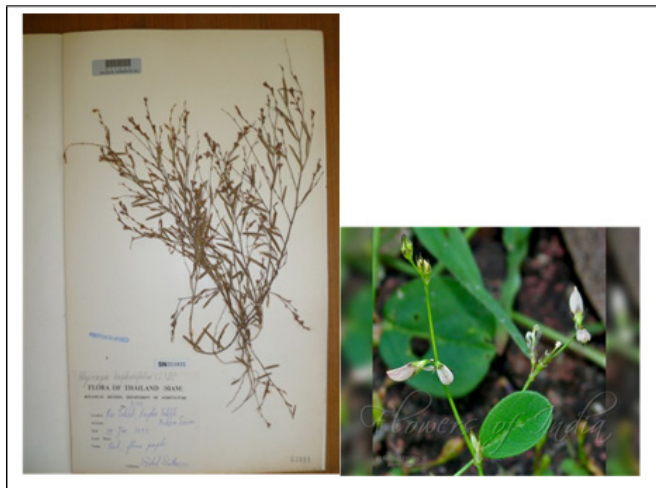
Angiosperm	Family & habit	Status (Global & Regional)
<i>Alysicarpus bupleurifolius</i> DC var. <i>hybridus</i> DC	Leguminosae-Papilionideae (Endemic Herb)	Red Listed/ Least Concern on global scale/ threatened on regional scale
<i>Hibiscus hoshiarpurensis</i>	Malvaceae (Endemic Herb)	Unknown/Threatened
<i>Ceropegia bulbosa</i> Roxb. Var. <i>lushii</i>	Asclepiadoideae (Herb)	Vulnerable
<i>Withania coagulans</i> (Stocks) Dunal	Solanaceae (Shrub)	Vulnerable
<i>Tecomella undulata</i>	Bignoniaceae (Tree)	Endangered
<i>Anogeissus sericea</i> Brandis var. <i>nummularia</i> King ex Duthie	Combretaceae (Endemic Tree)	Rare

**Table 2** Taxonomic classification of threatened herbs of Punjab (India)

	<i>Alysicarpus bupleurifolius</i> DC var. <i>hybridus</i> DC	<i>Hibiscus hoshiarpurensis</i>	<i>Ceropegia bulbosa</i> Roxb. Var. <i>lushii</i>
Kingdom	Plantae	Plantae	Plantae
Phylum	Magnoliophyta	Tracheophyta	Tracheophyta
Class	Magnoliopsida	Magnoliopsida	Magnoliopsida
Order	Fabales	Malvales	Gentianales
Family	Fabaceae	Malvaceae	Asclepiadaceae

### *Alysicarpus bupleurifolius* var. *hybridus* DC

*A. bupleurifolius* (*Hedysarum bupleurifolium* L.) that is commonly known as Sweet Alyce Clover is a native to India. It's a perennial herb that has a 1-2 ft tall stem with a line of hairs. It's fairly smooth unifoliate leaves with a length ranging between 8 mm-6 cm and breadth (3-8 mm) are carried on long stalks. The inflorescence is a lax raceme, with red flowers in distant pairs. Flower stalks are almost 2 mm long and sepal cup is 6-7 mm long. Flowering time is September and October every year (Figure 3). This is a palatable species which is readily eaten by horses and cattle and it responds strongly to fertilizer. The species is also used for medicinal purposes or as fodder.<sup>4</sup>



**Figure 3** *Alysicarpus bupleurifolius* (*Hedysarum bupleurifolium*) (Sweet Alyce clover).

*Alysicarpus bupleurifolius* has a widespread native distribution across temperate region ranging from China to India, Pakistan to Papua New Guinea. Globally, it is found in several countries including Australia, Bangladesh, Cambodia, China, Hong Kong, Indonesia, Malaysia, Myanmar, Nepal, Pakistan, Papua New Guinea, Philippines, Sri Lanka, Taiwan, Province of China, Thailand, and Vietnam. In India, it has been recorded in different states including Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chattisgarh,

Dadra-Nagar-Haveli, Daman, Delhi, Diu, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu-Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Orissa, Pondicherry, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttaranchal, Uttar Pradesh, West Bengal.<sup>5</sup>

The population of *Alysicarpus bupleurifolius* is believed to be stable at present at the global scale, hence it has been listed as Least Concern species in the IUCN red list; however its native variety *hybridus* DC that is endemic to Punjab has been identified as endangered species in the state by the Punjab Biodiversity Board in consultation with Botanical Survey of India and Forest department.

### *Hibiscus hoshiarpurensis*

About 526 species of flowering plants have been recorded in the Shivaliks by the Punjab State Council for Science and Technology out of which two herbs have been identified as endemic to this region (*Argyrolobium album* & *Hibiscus hoshiarpurensis*). *Hibiscus* is a perennial herb that can attain a height of 1.5 meters. It has erect stem that is densely covered with both stiff and soft stellate hairs mixed with a few simple hairs. The leaves are lanceolate, unlobed, cuneate at base and acute at apex but are irregularly serrate (5.5 - 10 x 1 - 4 cm). The mid-vein is prominent and stellate-pubescent on both surfaces. Petioles are 0.5 - 2.5 cm long, densely stellate-pubescent and nearly hirsute. The stipules can be 5 mm long, linear, covered with simple and few stellate hairs. Flowers are axillary, solitary; Pedicels are hairy and can be 1 - 4 mm long. Epicalyx segments 10, free, 0.8 - 1.3 cm long, linear, forked at apex with 3 - 5 mm long linear appendage arising from the base of the oblanceolate tip, stiff hairy throughout. Calyx (1.2 - 1.7 cm long) is campanulate and divided up to the middle. Corolla is bright yellow with long petals (2.5 cm) that are sparsely stellate-hairy outside. Staminal column (1.5 cm long) is antheriferous throughout and Ovary is ovoid-oblong with white silky hairy. Seeds (3 - 4 x 2 mm) are ovoid and dotted with white scaly structures.<sup>6</sup> Global IUCN status of the species is not known however the species is listed as threatened by the Punjab Biodiversity Board. As per *the Plant list* (the data base maintained by the Royal Botanic Gardens, Kew and Missouri Botanical Garden), the plant species is unresolved and the database does not establish this name as an accepted name.

## *Ceropegia bulbosa* Roxb. Var *lushii*

Out of almost 49 species of *Ceropegia* that are found in India, *Ceropegia bulbosa* Roxb is widely distributed yet threatened. It's a climber to 60 cm high with a root system that is a discoid or depressed globose tuber ( $\pm 40\text{--}60$  mm diameter  $\times$  30 mm deep) with many fibrous roots arising from sides and base, smooth or with a rough, grey peeling bark. The stem is sparsely branched, wiry and mostly glabrous. The Leaves are herbaceous, sessile to shortly petiolate; lamina is linear (30–70  $\times$  3–5 mm) and the base cuneate, apex acute and sometimes apiculate, both surfaces glabrous and sometimes tinged purplish, margin sparsely ciliate. Inflorescence a pseudumbellate cyme, 5–6-flowered, flowers developing successively, scent very faint musky; peduncle 6–15. Sepals (1–2  $\times$  0.5 mm) in size, recurved, greenish or faintly purplish in color and are glabrous (Figure 4). The corolla of the plant is (17–28 mm long) with a tube (13–23 mm) in basal with a globose inflation ( $\pm 5 \times 5$  mm), narrows abruptly and bends through  $\pm 90^\circ$  into an ascending cylindrical part. In the fruit, follicles are paired and acutely diverging and apically tapering. The two varieties of *Ceropegia bulbosa* Roxb. var. *bulbosa* and *Ceropegia bulbosa* Roxb. var. *lushii* are morphologically very similar. Major morphological differentiation lies in the broad leaves of var. *bulbosa* and narrow leaves of var. *lushii*.<sup>7</sup> *Ceropegia bulbosa* Roxb. var. *lushii* is locally known as khappar kaddu, Bhuu-tumbi, Pataal-tumbi, Gilothi, Galot (Punjab) and Hhadulo in Rajasthan.<sup>8</sup>



**Figure 4** *Ceropegia bulbosa* var *lushii*.

The species is found in wooded grassland with having its distribution in Cameroon, Ethiopia, Somalia, North Yemen, Oman, Saudi Arabia, Pakistan and India and *Ceropegia bulbosa* Roxb. var. *lushii* is known to be distributed in several states of India (Punjab, Rajasthan, Kerala, Karnataka and TamilNadu). *Ceropegia* is medicinally important plant species. The tuber of *C. bulbosa* var *lushii* contains valuable constituents which are used in many traditional Indian ayurvedic drug preparations against many diseases. It has been used as an antimicrobial, antifungal or anticancerous agent. It also exhibits analgesic and diuretic activities. *Ceropegia*, the

major constituent in the *Ceropegia* tubers is considered active against diarrhoea and dysentery. *Ceropegia bulbosa* Roxb. Var *lushii*, has been identified as threatened on regional scale by the Punjab Biodiversity Board, however the species has not yet been assessed for the IUCN redlist. Apparently, habitat destruction, and over-exploitation could be the major threats to variety *lushii*, however tissue culture and micropropagation can provide an effective alternative source for clonal propagation of *Ceropegia* species.<sup>9</sup>

## Conclusion

The greatest threat to the survival of a species in the state of Punjab, is the widespread destruction of the habitat, unsustainable development, deforestation, climate change and urbanization. Based upon the local and regional assessment of three species, all of three species have been listed as threatened within the state. This makes it important that the challenges to survival of species must be identified. A proper plan should be chalked out on how the status of the species can be revived. If needed, specific conservatories must be set up for the species depending upon their requirement. All the remedial measures must be initiated to protect the species either *in-situ* or *ex-situ*.

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None.

## Conflicts of interest

The author declared that there are no conflicts of interest.

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