



***Vincetoxicum cardiostephanum* A Threatened Sub-Endemic Species in Koh-e-Safaid Range, Pakistan**

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Abstract

Vincetoxicum cardiostephanum (Rech. F.) Rech. f. is a sub-endemic narrow species to Pakistan. The conservation status has been assessed according to International Union for Conservation of Nature Red List Categories and Criteria 2001. The genus *Vincetoxicum* is comprised of 20 species. Pakistan hosting 6 species including *Vincetoxicum* which is uniregional endemic to Upper Kurram, Pakistan. Earlier it was reported from Khaiwas by Aitchison (1881), Upper Kurram. This investigation was based on field trips conducted all over the Koh-e-Safaid ranges of Kurram valley, during April, 2015 to 2017. Based on the data collection, population size of the species was 43 individuals, Extent of occurrence (3.1 km²), Area of occupancy (0.9 km²). The taxon is under severe biotic stress due to uprooting & overgrazing. *Vincetoxicum cardiostephanum* has been classified as Critical Endangered following IUCN Criteria 2001.

Key words: *Vincetoxicum cardiostephanum*, Sub-Endemic, Critical Endangered, Koh-e-Safaid, Pakistan

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***Vincetoxicum cardiostephanum* Pakistan, Koh-e-Safaid Range'de Dar Endemik Bir Tür Tehdit Ediyor**

Özet

Vincetoxicum cardiostephanum (Rech. F.) Rech. f. Pakistan'a göre dar bir endemik türdür. Koruma durumu Uluslararası Doğayı Koruma Birliği Kırmızı Liste Kategorileri ve Kriterler 2001'e göre değerlendirilmiştir. *Vincetoxicum* cinsi 20 türden oluşmaktadır. Pakistan, Yukarı Kurram, Pakistan için endemik olmayan *Vincetoxicum* da dahil olmak üzere 6 türe ev sahipliği yapıyor. Daha önce Aitchison (1881), Yukarı Kurram tarafından Khaiwas'dan bildirilmiştir. Bu araştırma, Nisan 2015 ile 2017 yılları arasında Kurram vadisinin Koh-e-Safaid aralıklarının tamamında gerçekleştirilen saha gezilerine dayanıyordu. , Doluluk alanı (0.9 km²). Takson kökünden sökülme ve otlama nedeniyle ciddi biyotik stres altındadır. *Vincetoxicum cardiostephanum*, IUCN Criteria 2001'den sonra Kritik Tehlike Altında olarak sınıflandırılmıştır.

Anahtar kelimeler: *Vincetoxicum cardiostephanum*, Sub-Endemik, Kritik Tehlike Altında, Koh-e-Safaid, Pakistan

1. Introduction

Vincetoxicum cardiostephanum belongs to Family Asclepiadaceae, comprises 180 genera and 22,00 species distributed mainly in Tropical and Sub-tropical areas of the world; reported in Pakistan, 23 genera and 41 taxa (Figure 1). The genus *Vincetoxicum* has 10-20 species distributed in Asia, Europe, and Afghanistan. Pakistan represents 6 species i.e. *Vincetoxicum arnottianum* (Wight) Wight from Hazara, *Vincetoxicum cardiostephanum* from Kurram Agency, *Vincetoxicum canescens* Wind Dcne From Kashmir., *Vincetoxicum hirundinaria* Medik from Waziristan, *Vincetoxicum sakesarense* Ali & S, Khatoon from Sargodha, and *Vincetoxicum stocksii* Ali & Khatoon from Baluchistan. Of these one taxon is Sub-endemic to Kurram and Afghanistan Pakistan [1].

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Figure 1. *Vincetoxicum cardiostephanum* (Rech.f) Rech.f, A. Habit and Habitat; B. Plant in flowering; C. Mature plant

Nowadays extinction of plants has become headlines of the print and electronic media and they are taking interest of the future of these threatened species. International Union for Conservation of Nature is making incredible efforts to protect hundreds of species [2]. Different attributes effect the endemism includes uneven habitats and different climatic conditions and edaphic parameters within short space in highlands areas, and some of the anthropogenic activities such as unsustainable use of plants (uprooting), deforestation, grazing, and mining as results isolation of small species populations [3, 4, 6, 7, 8]. According to the recent studies about endemism have been emphasized, the role of pollination, life form and eco-physiological type effect the endemism at species and community level [9, 10, 11]. Pakistan has great diverse list of plants as a result of distinct geographical and topographic location. Above six thousand different vascular plants have been recorded, about 400 species are endemic [12]. As reported by IUCN Red List Criteria 2001, conservation of fifty-two species have been assessed, of these twenty-one species are Critically Endangered, ten species Endangered, two Vulnerable, eight possibly extinct [13-18]. This number rarely corresponds to around 0.8 % of Pakistan's Flora. Therefore, the assessments of the status of conservation of the flora of Pakistan should focus in particular on endemic species of Pakistan. [12]. The objective of the present study was to assess the conservation status of *Vincetoxicum cardiostephanum* through to IUCN Red List Criteria [19].

2. Materials and methods

2.1 Location

Kurram is a newly-formed Tribal District of Khyber Pakhtunkhwa, Pakistan [20]. The global geographic position of Kurram is between 33° 20' to 34° 10' North latitudes and 69° 50' to 70° 50' East longitudes (Figure 4). It has total area of 3380 (square kilometer) and highest peak is Sikaram with 4,728 meters. It makes a natural boundary with Tora Bora Mountains of Afghanistan, and is snowcapped round the year [21, 22].

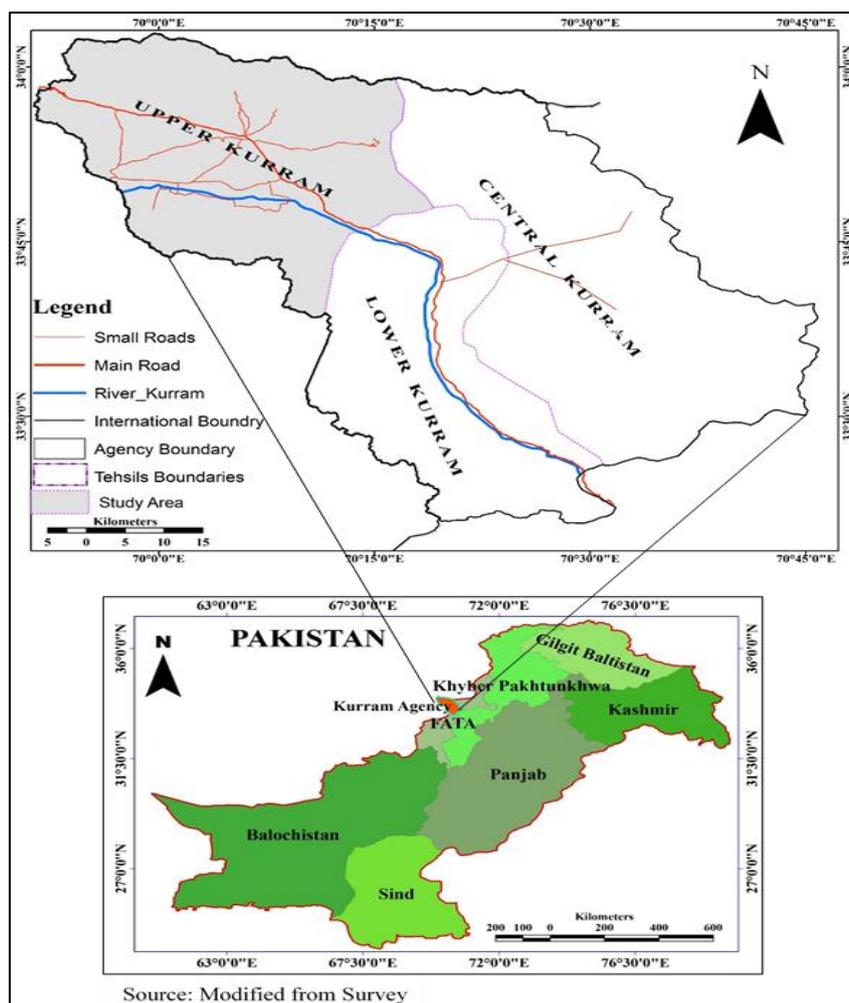


Figure 4. Location Map of Study area: 1. Khaiwas 2. Gandaw

2.2 Experimental design

The objective of the current study was to assess the conservation status of *Vincetoxicum cardiostephanum* through to International Union for Conservation of Nature Red List Criteria [19]. For the data collection field trips were made through the whole Koh-e-Sufaid ranges of district Kurram, during March 2015 to August 2017. The geographic distribution, Size of population, Habit, Phenology, habitat features, types of propagation, life form, leaf size & folk knowledge uses were recorded in the study area of the concerned taxa. Plants samples were collected preserved and voucher specimens were allotted. During the survey notebook, pencil, tags, polythene bags, newspaper and camera were used. In each trip specimens of complete plants were collected from two different localities. Plants specimen were tagged on the spot and identified with help of standard literature method [23, 24, 25]. The voucher specimen (W. Hussain, Voucher No. Bot. Huss. 055 (PUP) was placed in Herbarium; University of Peshawar for the further investigation. For the size of population, matured number of plants was calculated by totaling number of plants per unit area. Nature of habitation was calculated by observing grazing effect, anthropogenic impacts and approachability to an area, soil erosion, and ecological attributes. Ethnobotanical data was collected through; trips of the study area by interviewing 30 inhabitants. Conservation assessment of the species was done through International Union for Conservation of Nature Red List Criteria [19].

3. Results

3.1 Habit and Taxonomy

Vincetoxicum cardiostephanum is 350-400 millimeter tall glabrous perennial herb with many branches. Leaves c. 20-50 millimeter x 7-10 millimeter, ovate lanceolate, Flowers clustered in axillary cymes. Pedicels 1-6 millimeter long, Calyx 2.6 millimeter long, Corolla c. 4.5 millimeter long, pale-green, lobes glabrous, and Corona lobes cordate-truncate. Fruit 53-67 millimeter in length follicle (Fig.1)

3.2 Habitat and Community Structure

This species grows between the transition zone of subtropical and temperate zone (2000-2250 meter). Most individuals of the species were growing on the moist gentle North and South facing slopes in sparsely dense forest of *Quercus baloot* Griffith. About 31 taxon were present as linked with this species. The leading taxon viz., *Quercus baloot* Griffith, *Leptorhabdos parviflora* (Benth.) Benth, *Thymus linearis* Benth., *Sophora mollis* (Royle) Baker., *Rabdosia rugosa* (Wall ex.Benth.) , *Scutellaria orientalis* L. and *Themeda anathera* (Nees ex Steud) Hack in DC were observed. These 31 species were from 16 families and 30 genera as shown in Table 1.

Table 1. Recorded associates of *Vincetoxicum cardiostephanum* with their ecological characteristics

S.No	Family	Name	Habit	Life form
1	Asclepiadaceae	<i>Vincetoxicum cardiostephanum</i> (Rech.f) Rech.f	Herb	Geophyte
2	Anacardiaceae	<i>Cotinus coggyria</i> Scop.	Shrub	Nanophanerophytes
3	Asteraceae	<i>Artemisia biennis</i> Willd.	Herb	Chamaephyte
4	Asteraceae	<i>Circium falconeri</i> (Hook. F) Petrak	Herb	Therophyte
5	Asteraceae	<i>Heteropappus altaicus</i> Willd	Herb	Therophyte
6	Asteraceae	<i>Hertia intermedia</i> (Boiss) O. Ktze	Shrub	Nanophanerophytes
7	Asteraceae	<i>Launea sps</i>	Herb	Geophyte
8	Asteraceae	<i>Tagetes minuta</i> L.	Herb	Therophyte
9	Berberidaceae	<i>Berberis lycium</i> Royle	Shrub	Nanophanerophytes
10	Boraginaceae	<i>Cynoglossum glochiadum</i> Wall.ex Benth.	Herb	Hemicryptophyte
11	Dipsacaceae	<i>Scabiosa columbavia</i> L.	Herb	Hemicryptophyte
12	Fagaceae	<i>Quercus baloot</i> Griff.	Tree	Phnerophyte
13	Lamiaceae	<i>Thymus linearis</i> Benth.	Herb	Hemicryptophyte
14	Lamiaceae	<i>Perovskia atriplicifolia</i> Benth	herb	Nanophanerophytes
15	Lamiaceae	<i>Rabdosia rugosa</i> (Wall ex. Benth)	Shrub	Nanophanerophytes
16	Lamiaceae	<i>Salvia reflexa</i> Hornm	Herb	Therophyte
17	Lamiaceae	<i>Scutellaria orientalis</i>	Herb	Hemicryptophyte
18	Scrophulariaceae	<i>Leptorhabdos parviflora</i> (Benth).Benth	Herb	Therophyte
19	Solanaceae	<i>Solanum villosum</i> L.	Herb	Therophyte
20	Papilionaceae	<i>Indigofera heterantha</i> Well.ex Brandis	Shrub	Phanerophyte
21	Papilionaceae	<i>Sophora mollis</i> (Royle) Baker	Shrub	Chamaephyte
22	Papilionaceae	<i>Caragana brevispina</i> var. <i>brevispina</i> Royle ex. Benth	Shrub	Chamaephyte
23	Poaceae	<i>Aristida cyanantha</i> Nees ex Steud	Herb	Hemicryptophytes
24	Poaceae	<i>Themeda anathera</i> (Nees ex Steud.) Hack	Herb	Hemicryptophytes
25	Polygalaceae	<i>Polygala abyssinica</i> R.Br.Ex.fresen	Herb	Therophyte
26	Primulaceae	<i>Androsace rotundifolia</i>	Herb	Geophyte
27	Rosaceae	<i>Cotoneaster microphyllus</i> var. <i>thymifolius</i> .	Shrub	Phanerophyte
28	Rosaceae	<i>Cotoneaster macrophyllus</i> (Lindl.) Schneider.	Shrub	Phanerophyte
29	Rosaceae	<i>Spiraea corymbosa</i> Raf.	Shrub	Phanerophyte
30	Rosaceae	<i>Rosa Webbenia</i> Wall ex. Royle	Shrub	Nanophanerophytes
31	Thymelaeaceae	<i>Daphne oleoides</i> Schreb.	Shrub	Nanophanerophytes

3.3 Distribution

Generally, this species is restricted to Village Shalozan Wazir Takhat Kaiwas and Nawoo Ghar Gandaw of Koh-e-Safaid mountain range. During the survey it has been observed that some fragmented areas in the study area (Table 3). Presence of taxon was frequently restricted to north & south facing slopes in rocky area but mean while some plants of the specie were also present in sparsely dense forest of *Quercus baloot*, *Leptorhabdos parviflora*, *Thymus linearis*, *Sophora mollis*, *Rabdosia rugosa*, *Scutellaria orientalis* and *Themeda anathera*. This species is severely endemic to the study area. All the total locations collectively cover an area of approximately 3.1 Km² as the extent of occurrence. The estimated collective occupation area was 0.9 km²(Table 2).

Table 2. *Vincetoxicum cardiostephanum* (Rech.f) Rech. f.: Summary of geographic range

viz. Extent of occurrence & area of occupancy in in Km²	
Extent of occurrence in Km ²	Area of occupancy Area in Km ²
3.1	0.9

3.4 Population Size

Population size of *Vincetoxicum cardiostephanum* was recorded from village Khaiwas from two different areas (Table 3). Maximum number of individuals (population size) was reported from Wazir Takhat Khaiwas (24) individual plants and less number of individual plants (19) from Nawoo Ghar Gandaw (Figure 4).

Table 3. Population size detail of *Vincetoxicum cardiostephanum* from two reported spots

S.No	Locality	Altitude (m)	Coordinates	Population Size	Percentage
1	Wazir Takhat Khaiwas	2198 m	33°57.73.1N 069°59.831E	24	55.81
2	Nawoo Ghar Gandaw	2231m	33°57.62.6N 069°59.604E	19	44.18

3.5 Mode of reproduction

During the study period two kind of reproduction were reported vs. Sexual & Asexual.

3.6 Sexual Reproduction

It is the most common method of reproduction. *Vincetoxicum cardiostephanum* starts flowers from the mid of April to the end of July. The population peak flowering period was recorded after 25th May to 5th July. The average number of fruits per individual was recorded 2-3 (Table 4; Figure 3).

Table 4. *Vincetoxicum cardiostephanum* numerical analysis of the habits of the plants in relation to the habitat.

S. No	Habit	Observed species	Percentage in the Total
1	Herb	18	58
2	Shrub	12	38.70
3	Tree	01	3.2



Figure 3. Reproduction of *Vincetoxicum cardiostephanum* I, Asexual (buds); J, Sexual (Seeds)

3.7 Asexual reproduction

Asexually *Vincetoxicum cardiostephanum* is reproduce through vegetative method. The reproductive tissues like rhizome are sprout during favorable conditions and giving rise to new individual (Figure2)

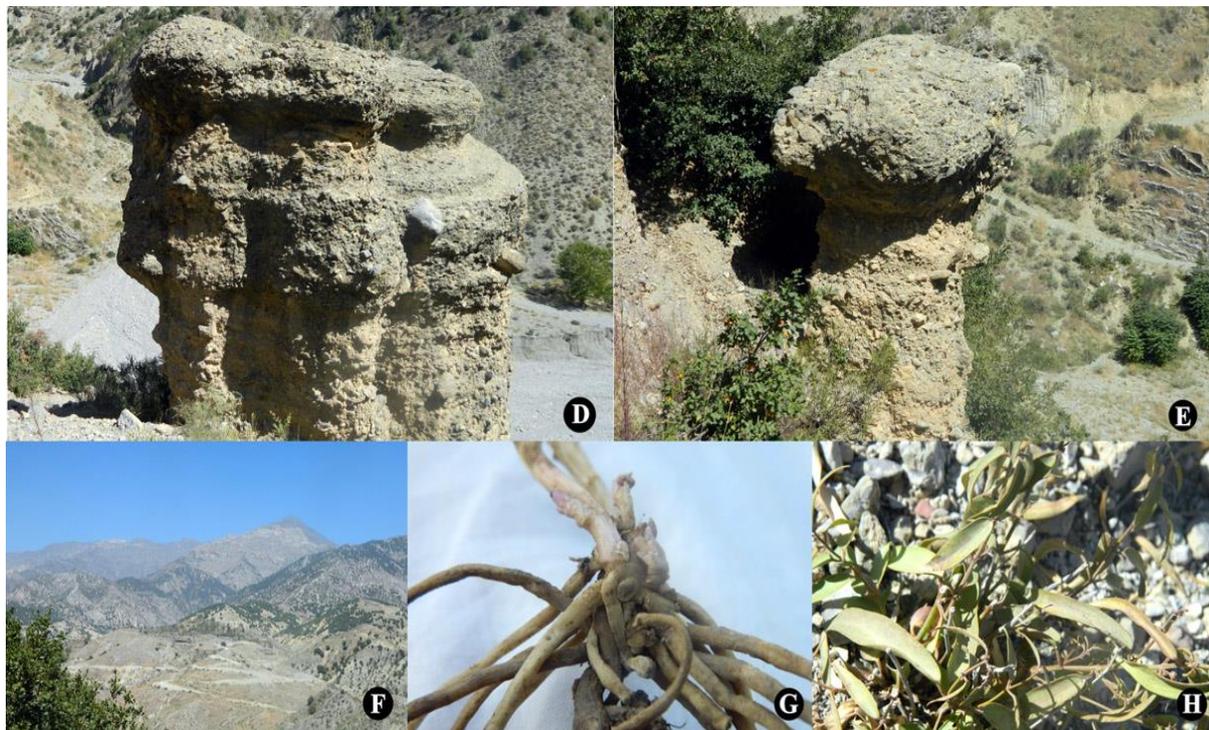


Figure2. Anthropogenic & natural threats to *Vincetoxicum cardiostephanum*: D & E, Erosion, F, Roads construction, G, Uprooting, H, Grazing

4. Conclusions and discussion

This specie was reported previously from Khaiwas Koh-e-Safaid range Upper Kuram by Aitchison. During the current survey, this taxon was recorded from the two areas of the village Khaiwas. In these two areas, the occurrence of the species is limited to mountains slopes of Sub-Tropical Zone. During the field observation this taxon was found to be in isolated micro habitats. Current results showed that the nature of taxon is limited and isolated.

According to Rabinowitz [27], rarity of a taxon is due to small size population, pint distribution area, specific habitation or a grouping of all these units. In the case of *Vincetoxicum cardiostephanum*, an average presence of 24 individuals plants in locality 01 and 19 individuals in locality 02 and their restriction in particular habitat from 2165-2250 meters and presence c 0.9 Kilometer squares the area of occupancy show that this is an actual rare species (Table. 3). According to International Union for Conservation of Nature Red List Criteria 2001 [20] when a matured plants > 250 (i.e. 43) and habitation is constantly degraded as result of sever grazing and facing many anthropogenic threats, *Vincetoxicum cardiostephanum* belongs to criterion “C” of critically endangered group. Moreover, 90% population of the concerned species is limited in Wazir Takhat Khaiwas, this numeral falls under sub-criterion 2 (ii) of “C” of Critically Endangered Category. The extent of occurrence is nearly 3.1 Kilometer square that is below 100 Kilometer square and area of occupancy is 0.9 Kilometer square that is below 10 Kilometer square. Moreover, this taxon is greatly fragmented into 2 areas and habitation is also degraded. On the bases of current findings this taxa is placed under B₁ & B₂ of critically endangered group. For example, if the matured plants are recorded below fifty plants and taxon is classified under the criterion “D”. Short geographical zones, very small population size, overgrazing and fragmented habitation strongly suggest that *Vincetoxicum cardiostephanum* should be consider as critically endangered. By following the hierarchical alphanumeric numbering system of the criteria [20], assessment of the conservation status of *Vincetoxicum cardiostephanum* summarized in this way:

CRB1ab (iii) +2ab (iii); C2 (ii)

Where CR, Critically Endangered species; B, Geographic ranges; 1, a Extent of occurrence; 2 (B), Area of occupancy; a, Severely disjointed; b, continuing decline, observed, predicted; iii, Quality of habitat; C, Estimated populace size; 2 (C), A continuously decreasing no. of matured plants; ii, As a minimum 88% matured plants are in one sub-population (Table. 5).

Table 5. Summary of known Localities, Population Size, Geographical Range and Various Anthropogenic and Natural Threats Observed in the Study Area

Plant Speices	Known localities		Population Size	Geographical range		Anthropogenic and natural threats						
				E.O Km ²	A.O Km ²	U	V	W	X	Y	Z	
<i>Vincetoxicum cardiostephanum</i>	02	43	3.1	0.9	+	+	+	+	+	-		

Key: E.O; Extent of occurrence, A.O; Area of occupancy, U, Medicinal uses, V, uprooting, W, Grazing X, Road Construction, Y, Soil Erosion, Z, Deforestation (+ Present, -Absent)

4.1 Anthropogenic impacts

Over grazing and unwise medicinal uses were recorded as the main threats to concern species.

4.2 Grazing

Vincetoxicum cardiostephanum is palatable plant during pre-reproductive stage. The local population grazed their livestock in the study areas, which seriously affected the habitats of concern specie. In each season, these individual plants were grazed during pre-reproductive stage before the formation of fruits as result the concern specie is in threaten position (Tab. Figure 2).

4.3 Unsustainable Medicinal uses

Vincetoxicum cardiostephanum is highly medicinal plant and local people, who are living in the foothill of koh-e-Safaid range, uproots the whole plants. The fresh leaves were shade dried crushed fine powder were used for the treatment of chest problems, hepatitis C and rhizome are used for the blood purification and urinary infections as reported by the local inhabitants. Due to uprooting the concern specie become threatens (Figure 2)

4.4 Road construction

Due to road construction to locality Khaiwas, the road passes through the habitat rich area of the specie which added a serious threat (Figure 2).

4.5 Recommendations

- i) *Vincetoxicum cardiostephanum* had better to include in the Red list category of taxa of Pakistan.
- ii) The cultivation of *Vincetoxicum cardiostephanum* in botanical gardens should be encouraged to protect them from extinction.
- iii) Grazing in research area is should be banned through local Bandar system to protect the concern specie.
- iv) To educate the local inhabitants through awareness program to avoid the unsustainable use.

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