

CONTRIBUTION TO THE RED LIST OF PAKISTAN: A CASE STUDY OF *GAILLONIA CHITRALENSIS* (RUBIACEAE)

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Abstract

Gaillonia Chitralensis Nazim .(Rubiaceae) is endemic to Chitral district, Pakistan. This species was previously known from type locality only. After 3 years of extensive field studies, it is now reported from 15 new localities, but could not be found in the type locality. Based on population size, Extant of occurrence (EOO), Area of occupancy (AOO) and fragmented populations, it is classified as Endangered (EN) Category according to IUCN Red List categories and criteria 2001. In order to save the taxon from extinction, there is an urgent need to develop specific conservation strategies at ground and national level.

Introduction

Endemic taxa deserve special attention regarding conservation as they are more exposed to threats and their distribution is restricted to limited geographic range. These taxa face a high risk due to their low population size and limited geographic distribution, and a single disturbance on a small scale might trigger their extinction (Vischi *et al.*, 2004). Since endemic taxa are dependant on a single area for their survival therefore they are under the risk of extinction (Heywood & Watson, 1995; Behera *et al.*, 2005). Similarly, species endemic to small countries are more likely to be threatened than species endemic to large countries (Pitman & Jorgensen, 2002). Moreover, the areas containing more endemics should be given priority regarding the conservation activities. In this context, district Chitral deserves the position of a hotspot as the number of endemic taxa reported is much higher than any other adjacent district of the country (Ali, 2010).

Precise evaluation of the conservation status of concerned species is considered to be the most important step in order to successfully prevent its extinction (Vischi *et al.*, 2004). As a result of excessive increase in human population, urbanization and habitat fragmentation the natural flora has been rapidly decreased (Davis *et al.*, 1994; Heywood, 1995; Western, 2001). Due to these human induced effects, the rate of extinction has reached to one species per day and this rate is considered to be 1000-10000 times faster than would naturally occur (Hilton-Taylor 2000). It is predicted that if the present rate of extinction remains constant 60,000-100,000 plant species may disappear during the next 50 years (Bramwell, 2002). Moreover recent investigations suggest that as many as half of the world's plant species may be threatened by extinction if assessed according to the IUCN categories and criteria (Pitman & Jorgensen, 2002).

In the current red list (Anon., 2009), 19 flowering plant species are listed from Pakistan. Of these, 2 are Vulnerable (VU), 11 Least Concern (LC), 3 Near Threatened (NT) and remaining 3 were classified as Data Deficient (DD). Ali & Kaiser (2010a) determined the conservation status of *Astragalus gahiratensis* for

Pakistan based on three-years field observation, according to IUCN red list categories and criteria (Anon., 2001). They have placed this species under the Critically Endangered category due to its small geographic distribution, single location and habitat degradation. Similarly Ali & Qaiser (2010b) have determined the conservation status of *Silene longisepala* for Chitral-Pakistan, based on three years observation according to the IUCN Red List Categories and Criteria (Anon., 2001) and placed the taxon under the Endangered (EN) Category due to its small population, geographic distribution and habitat degradation. From the point of view of vulnerability, the endemic and rare taxa of an area are most important because these plants have small populations, which occupy small geographic ranges and specific habitats (Rabinowitz, 1981; Kruckeberg & Rabinowitz, 1985; Mills & Schwartz, 2005; Ricketts *et al.*, 2005). Necessary steps therefore should be taken for their protection (Mauchamp *et al.*, 1998). Hence, keeping in mind the above facts, endemic and rare species, particularly narrow endemic species of Pakistan deserve our immediate attention.

Materials and Methods

In order to find out the conservation status, comprehensive field studies were conducted for three consecutive years starting from 19th May 2005 to 30th September 2005; from 1st May to 30th September 2006 and from 1st June to 30th September, 2007. The taxon was searched in lower Chitral in the months of May and June while upper Chitral was studied from July to the end of September, as the area is mostly snow bound and inaccessible during winter. Special attention was paid to the type locality (i.e. Rosh Gol) from where the taxon was collected for the first time and then the inaccessible and previously non-visited localities were studied during long excursions of 7-10 days campaign in these areas. These excursions were conducted with the help of local guides and porters, using horses or sometimes yak for transportation of plants and plant pressers. The routes followed were traced by using GPS (Lowrance, iFinder), altimeter and a topographic map (scale, 1:50,000, provided by survey of Pakistan). In addition to this the taxon was also searched in other localities containing the same altitudinal range and habitat in order to get the whole range of its distribution. When a population was located an additional 1-2 days were spent to determine the extent of the population by walking extensively in an area of at least 1-2 km² around each population (Ali & Qaiser, 2010). For population size, mature individuals were counted in each locality. Those individuals were considered as mature which contained fruits or flowers (Anon., 2001). Comprehensive field notes like, habit, habitat, life form, phenological status and altitudinal range was studied in the field. Various anthropogenic threats like grazing, agricultural land extension and deforestation were also studied. Grazed individuals were counted and tabulated for each locality. Collected plant specimens were deposited at Karachi University Herbarium (KUH). For extant of occurrence (EOO), the geographical coordinates were plotted on a georeferenced imagery obtained from Google (2009) in ArcView v.9.3 and a polygon was prepared by encompassing line through all the known localities of the taxon, excluding the localities which come inside the boundary of the polygon. Similarly the Area of Occupancy (AOO) was calculated by the presence of the taxon in a grid of 4km² area. All the data collected were analyzed according to IUCN Red List Categories and Criteria (Anon., 2001).



Fig.1. *Gaillonia chitralensis*: A, habit; B, flower.

Results and Discussion

Gaillonia chitralensis Nazim. is a small shrub, much branched and woody at base, growing on steep rock slopes (Fig.1). This species was previously known from the type locality only i.e., Holotype was described from Rosh Gol, Chitral 22.8.1981, Kamal Akhtar Malik & S. Nazimuddin 1688 (KUH) (Nazimuddin & Qaiser, 1989). We have been able to find it from 15 more localities (Table 1) but even a single individual could not be found in the type locality. *Gaillonia chitralensis* is a Phanerophyte (following Raunkier, 1934) with a plant height ranging up to 60cm. Its altitudinal range varies between 2439-3471m (Table 1). Flowering and fruiting was observed in August. This species was collected from 15 localities in Chitral with extent of occurrence of 3010km² and area of occupancy of 36 km² (Table 1). Total of 639 mature individual plants were observed in 2005, 518 in 2006 and 544 in 2007, with an average of 564 mature individual plants per year. Fluctuation was observed in the population size, with decrease of 121 mature individual plants (18.93%) in the second year while, increase of 26 mature individual plants (4.77%) were observed during the third year. Hence, a total decrease of 95 mature individual plants (14.86%) was observed during the three years of study which clearly indicated that it was a rare species with extreme fluctuation in population size in all the localities (Table 1). In 4 localities 100% decrease has been observed and a single individual plant could not be found in these localities. Whereas, in 3 localities i.e., Torikhoo-Ujnu near bridge, Mastooj-Khuj Chumarkan and Molikhoo-Baznerh, 98%, 71.79% and 72.72% decrease has been observed in its population size, respectively. The main threat posed to the taxon is its habitat degradation. Soil erosion resulted from deforestation and grazing is among the other main threats responsible for the reduction in population size.

Conservation status

As the Extent of Occurrence of the taxon is 3010 km² (i.e., less than 5000km²) and AOO is only 36 km² (i.e. less than 500 km²) therefore, according to the IUCN Red List Categories and Criteria (Anon., 2001) it should be placed under the Endangered Category. Whereas, its population size is 564 mature individual plants . which shows a fragmented distribution i.e. distributed in 15 small localities. Further more, there was a continuing decline in number of mature individual plants (Table 1) and also extreme fluctuation in the AOO was observed during the 3 years of field study (Figs. 2, 3 & 4) along with the extreme fluctuation in number of mature individual plants. These results of low population size with continuing decline and extreme fluctuation collectively suggest the category of Endangered. Hence, based on the values of population size this taxon is placed under the Endangered category.

The Hierarchical Alpha Numeric Numbering System is as follows:

EN B 1 a c (i) (ii) (iii) (iv) 2 a c (i) (ii) (iii) (iv) C 2 a (i) b

Where:

EN = Endangered

B = Geographic range in the form of:

1 = Extent of occurrence estimated to be less than 5000 km²

a = severely fragmented

c = extreme fluctuation in:

(i) = extent of occurrence

(ii) = area of occupancy

(iii) = number of locations or subpopulations

(iv) = number of mature individuals

2 = area of occupancy estimated to be less than 500 km²

a = severely fragmented

c = extreme fluctuation in:

(i) = extent of occurrence

(ii) = area of occupancy

(iii) = number of locations or subpopulations

(iv) = number of mature individuals

C = Population size estimated to number fewer than 2500 mature individuals and either:

2 = a continuing decline observed in number of mature individuals

a = population structure in the form of:

(i) = no subpopulation estimated to contain more than 250 mature individuals

b = Extreme fluctuation in number of mature individuals

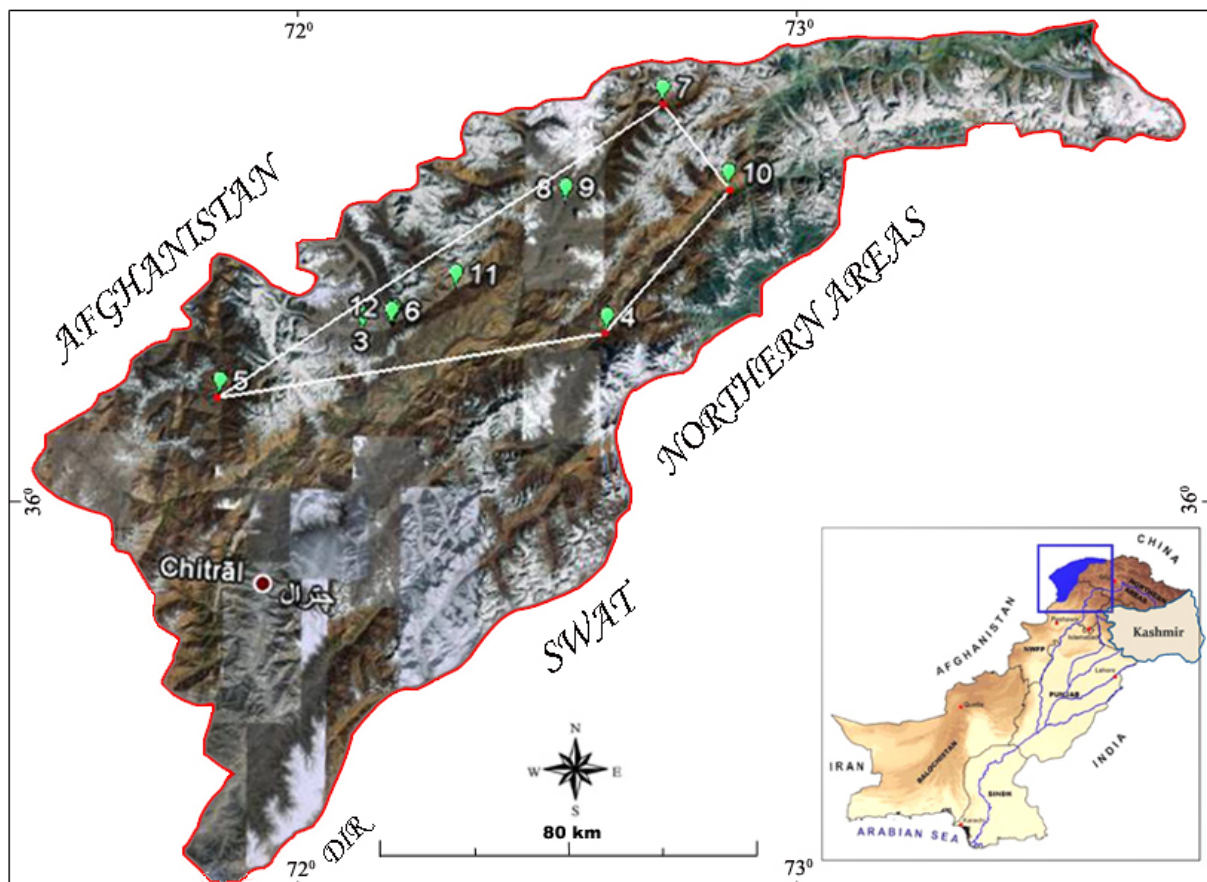


Fig.2. *Gaillonia chitralensis* during 2005, number corresponds with the localities in the table.

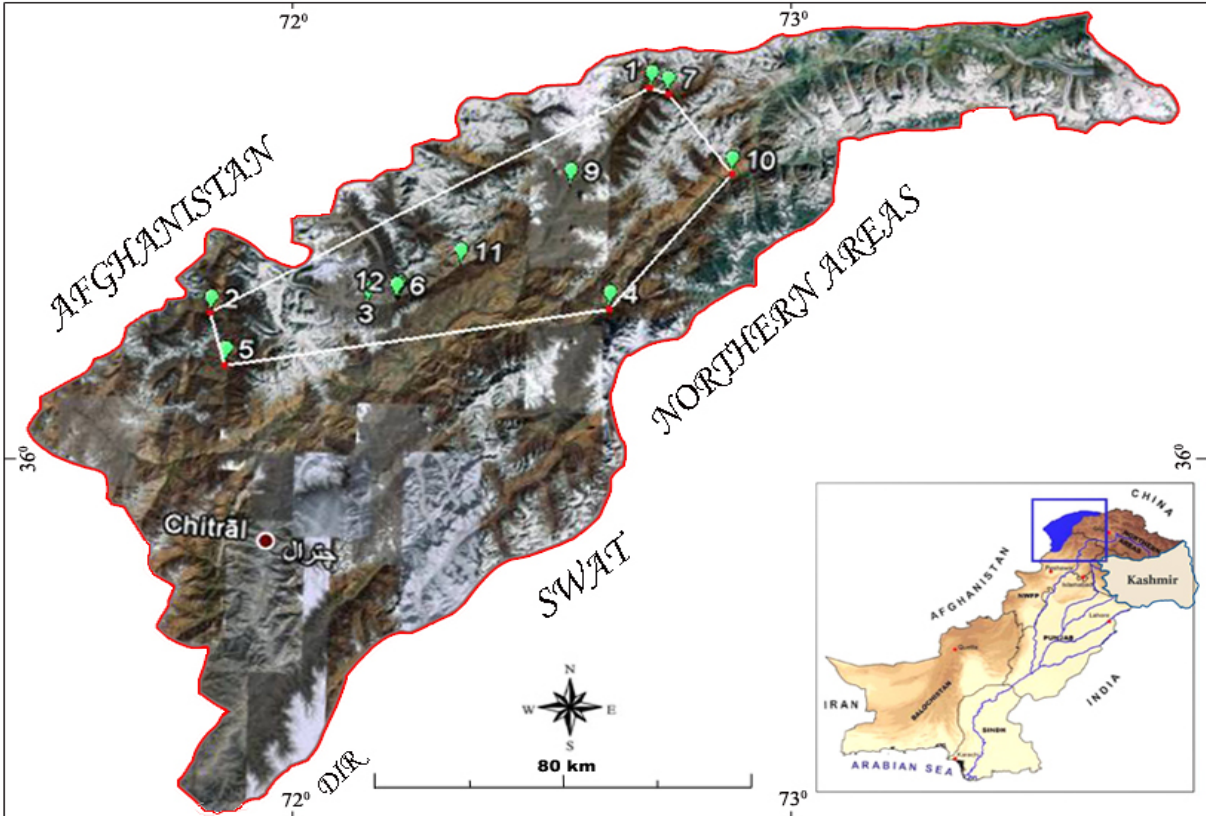


Fig.3. *Gaillonia chitralensis* during 2006, number corresponds with the localities in the table.

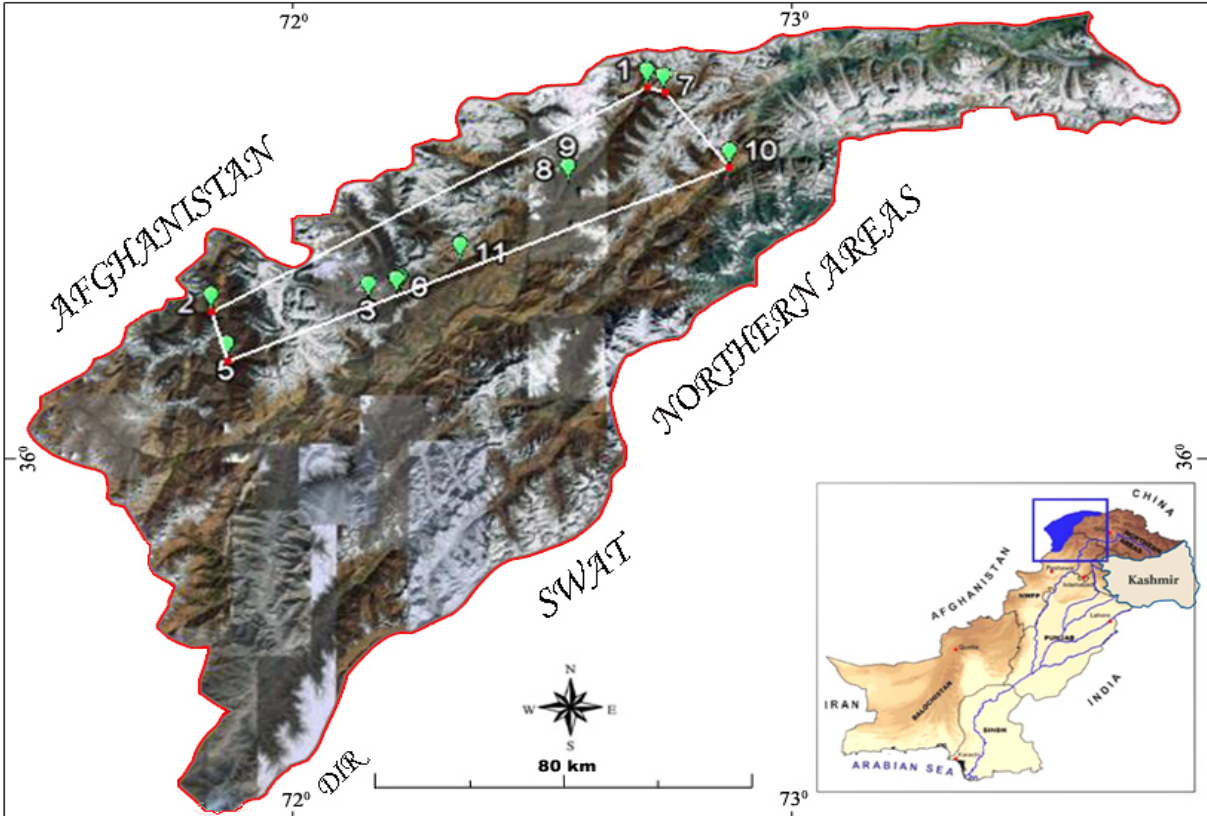


Fig.4. *Gaillonia chitralensis* during 2007, number corresponds with the localities in the table.

Table 1. *Gaillonia chitralensis*: locality, GPS value, altitude, habitat, population size and number of grazed individuals.

Locality No.	Locality	Alti. (m)	GPS value (UTM) E-N	Population size			Grazed individuals		
				2005	2006	2007	2005	2006	2007
1.	Torikhoo-3 km from Moghlang on way towards Shajinali	2983	43-290834, 4069723	-	3	63	-	-	5
2.	Lutkhoo-Agram Gol Arkari	3063	42-736667, 4018945	-	6	18	-	-	-
3.	Molikhoo-Attahk Terich	3471	43-230941, 4022581	66	86	102	56	42	44
4.	Mastooj-Chowinch Ghari	3280	43-281710, 4021381	22	59	-	-	-	-
5.	Chitral-Mojegan Arkari	2492	42-740264, 4007956	47	49	24	12	3	-
6.	Molikhoo-Shagroom Terich	3093	43-236912, 4023543	92	62	87	54	6	21
7.	Torikhoo-Shah Jinali	3315	43-292210, 4068504	29	42	95	-	-	-
8.	Torikhoo-Ujnoo near bridge	2459	43-273687, 4048499	66	-	01	13	-	-
9.	Torikhoo-Ujnoo Gol	2439	43-273699, 4048440	51	42	45	42	3	-
10.	Mastooj-Khuj Chumarkhan	2716	43-307595, 405085	39	69	11	6	4	7
11.	Molikhoo-Tirich	2651	43-250453, 4031065	59	55	95	-	-	-
12.	Molikhoo-Tirich Ghari	3065	43-237313, 4023734	59	7	-	-	-	-
13.	Yarkhoon-Yarkhoon Lasht	3065	43-237313, 4023734	84	-	-	-	-	-
14.	Molikhoo-Baznerh	3042	43-237781, 4024090	11	31	3	-	-	-
15.	Molikhoo-Tirich Ghari	3065	43-237313, 4023734	5	7	-	-	-	-
Total				630	518	544	183	58	77
Average							106		

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