

CONTRIBUTION TO THE RED LIST OF PAKISTAN: A CASE STUDY OF *ASTRAGALUS GAHIRATENSIS* ALI (FABACEAE-PAPILIONOIDEAE)

HAIDAR ALI¹ AND M. QAISER²

¹Department of Weed Science, Agricultural University Peshawar-25130, Pakistan

²Federal Urdu University for Arts, Science and Technology, Karachi / Islamabad, Pakistan

Abstract

Astragalus gahiratensis Ali (Fabaceae-Papilionoideae) is endemic to District Chitral Pakistan. The population size i.e. 127 mature individuals were found in 4 localities in 2005, 28 mature individuals were found in 03 localities in 2006 and 107 mature individuals were found in 4 localities in 2007, the taxon deserved the status of Critically Endangered (CR) category. The main threat posed to the taxon is its habitat degradation. Soil erosion resulted from deforestation and grazing are among the other main threats responsible for the reduction in population size. In 3 localities i.e., Chitral-Chaghbeni towards Ishpeder, Chitral-Gokhshal and Chitral Gol-Ishpeder, 75%, 13.79% and 18.64% decrease has been observed in its population size, respectively. There is urgent need to develop species specific conservation strategies, followed by comprehensive conservation action plan and thereafter their implementation at ground root level on national scale.

Introduction

The total number of identified vascular plants is estimated between 310,000 (Prance *et. al.*, 2000) to 420,000 species (Bramwell *et. al.*, 2002), but still we are far from having any kind of authoritative "World Checklist" (Callmander *et. al.*, 2005). All of the known taxa are not assessed against the IUCN categories and criteria, as it is evident from 2008 Red Data List (Anon., 2008) which contains only 10779 taxa of vascular plants a tiny fraction (<3%) of global plant diversity. Therefore the process of conservation status assessment must be greatly accelerated to get reasonable results.

On the other hand the incredible increase in human population with subsequent urbanization has resulted in over exploitation of natural resources, fragmentation of the habitat and rapid decrease in natural flora (Davis *et al.*, 1994; Heywood, 1995; Western, 2001). According to Hilton-Taylor (2000) due to the anthropogenic activities the rate of plant extinction has reached to one species per day and this rate is considered to be 1000-10000 times faster than would naturally occur. 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). The 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). Hence, evaluation of the degree of risk of the taxon further leads us to assign it a standardized threatened category (Alam & Ali, 2009).

In the current red list (Anon., 2008a), 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).

Alam & Ali (2009) determined the conservation status of *Astragalus gilgitensis* for Pakistan based on five-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 (2010) 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

Comprehensive field studies were conducted from 19th May 2005 to 30th September 2005; from 1st May to 30th September 2006 and from 1st June to 30th September, 2007. The lower Chitral was studied in May and June while upper Chitral was studied from July to the end of September, because of the inaccessibility (snow bound area) and also the lack of flowering period. Special attention was paid to those localities from where the taxon was previously collected and to the inaccessible and previously non-visited localities 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 localized 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. For population size, mature individuals were counted in each locality. Those individuals were considered as mature which contained fruits or flowers. 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 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 AOO was calculated by the presence of the taxon in a grid of 4km² area. All the data collected were analyzed in view of IUCN Red List Categories and Criteria (Anon., 2001).

Results and Discussion

Astragalus gahiratensis Ali is a perennial herb growing on steep rock slopes. This species was previously known from the type locality only i.e., Holotype was described

from West of Gahirat, Chitral (Ali, 1977). We have been able to find it from 4 more localities (Table 1). *Astragalus gahiratensis* Ali is a Hemicryptophyte (following Raunkier, 1934) with a plant height ranging up to 33cm (Fig. 1). Its altitudinal range varies between 2735-3700 m (Table 1). Flowering and fruiting is observed in May-June, where forests dominant tree species are *Fraxinus hookeri* Wenz., *Quercus baloot* Griff., and *Pinus roxburghii* Sarg. This species was collected from 4 localities in Chitral with extent of occurrence of 140.60 km² and area of occupancy of 16 km² (Table 1). Total of 127 mature individual plants were observed in 2005, 28 in 2006 and 107 in 2007, with an average of 87.33 mature individual plants per year. Fluctuation was observed in the population size, with decrease of 99 mature individual plants in the second year while, increase of 79 individuals were observed during the third year. Hence, a total decrease of 20 mature individual plants was observed during the three years of study which clearly indicates that it is a rare species with extreme fluctuation in population size in all the localities (Table 1).

Taxa which are distributed over a wide range but are constantly rare throughout their distribution are more vulnerable (Rabinovitz, 1981) and should be given special attention in this regard. *A. gahiratensis* is distributed in 3 localities of lower Chitral (1) Chaghbeni towards Ishpeder (2) Gokhshal (3) Ishpeder and from a single locality in upper Chitral i.e. Chikar Beroghil-Yarkhun (Table 1), but its population size has never exceeded 59 mature individuals in any of these localities. Therefore in view of small and extreme fluctuation in Population Size, distributed in four localities it is concluded that *A. gahiratensis* is a rare taxon and need special attention in order to save it from extinction.

During the three years of continuous field studies we did not find even a single mature plant individual from the type locality.

Conservation status: As the Extent of Occurrence of the taxon is 140.60 km² (i.e., less than 5000km²) and AOO is only 16 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 107 mature individual plants (i.e. less than 250). It shows a fragmented distribution i.e. distributed in 4 small localities. Furthermore, due to continuing decline in number of mature individual plants (Table 1) and extreme fluctuation in the AOO during the 3 years of field study (Figs. 2 & 3) and 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 Critically Endangered.

Although, due to values of EOO and AOO, the taxon should be placed under the Endangered category but as suggested by the IUCN Criteria (Anon., 2001) the most serious category should be considered. Hence, based on the values of population size this taxon is placed under the Critically Endangered category.

The Hierarchical Alpha Numeric Numbering System is as follows: **CR C 2 b**

where:

CR = Critically Endangered

C = Population size estimated to number fewer than 250 mature individuals and either:

2 = a continuing decline observed in number of mature individuals

b = extreme fluctuations in number of mature individuals

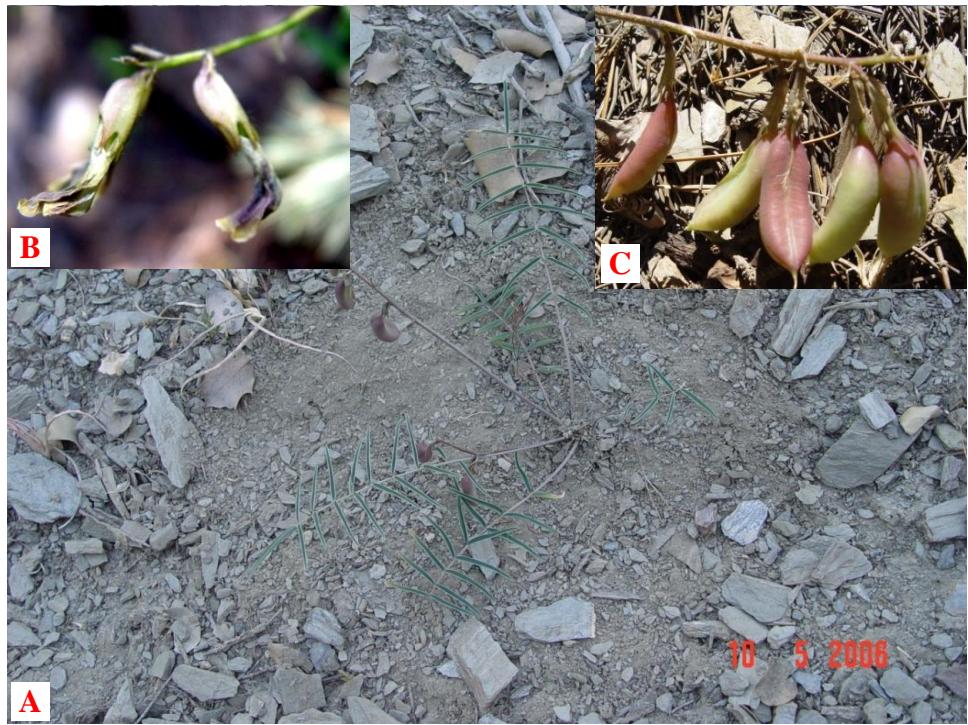


Fig. 1. *Astragalus gahiratensis*: A, habit; B, flower; C, fruits.

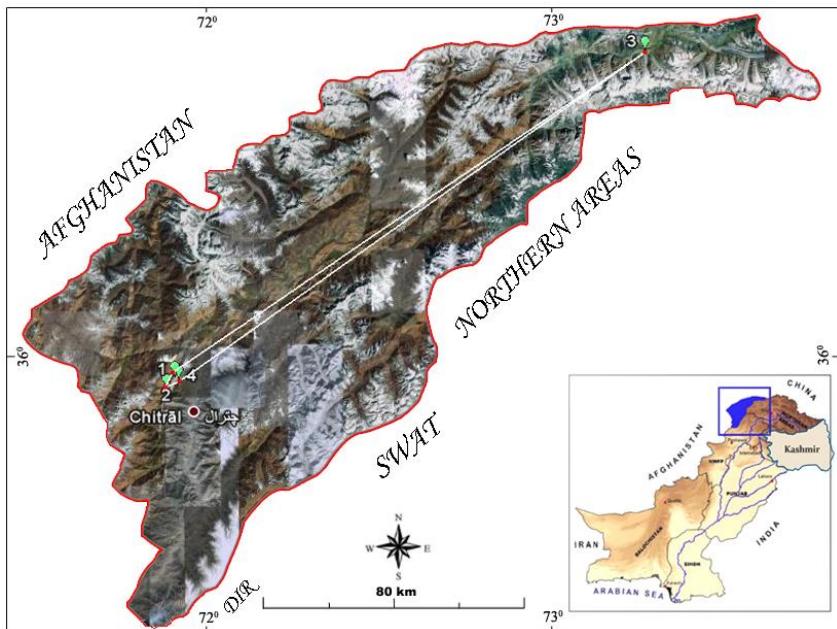


Fig. 2. Distribution of *Astragalus gahiratensis* in 2005 and 2007, numbers correspond with the localities in the table.

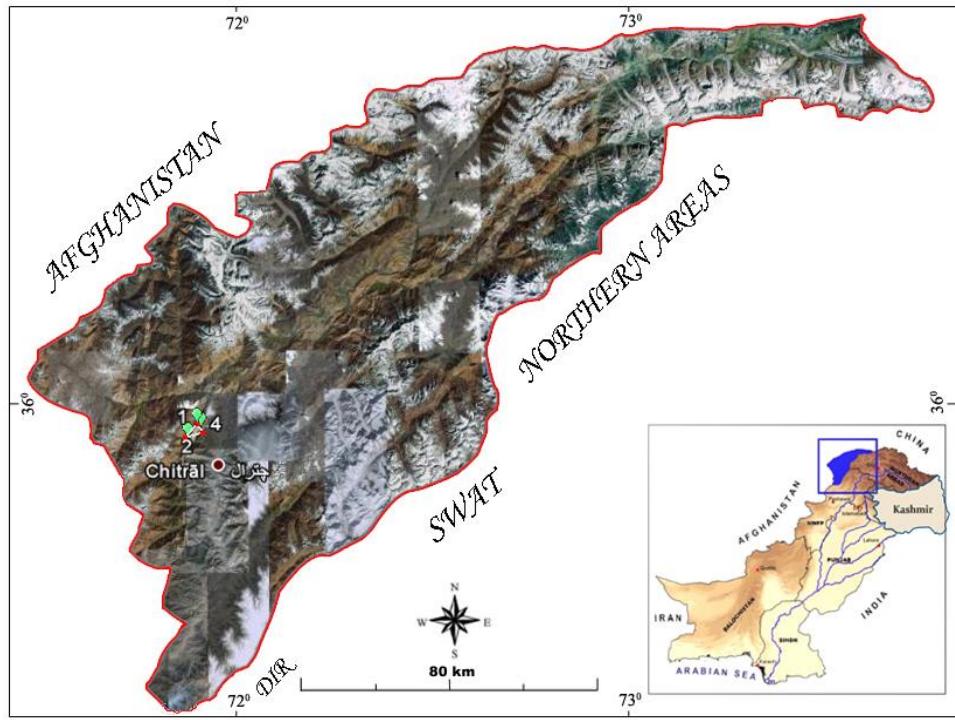


Fig. 3. Distribution of *Astragalus gahiratensis* in 2006, numbers correspond with the localities in the table.

Table 1. *Astragalus gahiratensis*: locality, GPS value, altitude, habitat, Population size in different years.

Locality No.	Locality	Altitude (m)	GPS value (UTM) E-N	Population size		
				2005	2006	2007
1.	Chitral-Chaghbeni towards Ishpeder	2958	35.93540663, 71.72140053	12	6	3
2.	Chitral-Gokhshal	2735	42-743073, 3976383	29	11	25
3.	Yarkhoon-Chikar Beroghill	3700	43-348549.59, 4075556.38	27	-	31
4.	Chitral-Chitral Gol, Ishpeder	2829	35.925404, 71.733715	59	11	48
Total				127	28	107
Average				87.33		

Acknowledgement

This paper is an outcome of the Ph.D. research of the first author. Higher Education Commission of Pakistan is gratefully acknowledged for financing the project.

References

Alam, J. and I.S. Ali. 2009. Conservation status of *Astragalus gilgitensis* Ali (Fabaceae): a critically endangered species in Gilgit District, Pakistan. *Phyton* (Horn, Austria), 48: 211-223

Ali, H. and M. Qaiser. 2010. Contribution to the Red List of Pakistan: a case study of *Silene longisepala*. *Oryx-The International Journal of Conservation*. (Accepted for publication).

Ali, S. I. 1977. Papilionaceae In: *Flora of Pakistan*. (Eds.): E. Nasir & S.I. Ali. No. 100. Karachi; 183.

Bramwell, D. 2002. How many plant species are there? *Plant Talk*, 28: 32-34

Bramwell, D., P.H. Raven and H. Syng. 2002. Implementing the Global Strategy for plant conservation. *Plant Talk*, 30: 32-37.

Callmander, M.W., G.E. Schatz and P.P. Lowry II. 2005. IUCN Red List assessment and the Global Strategy for Plant Conservation: taxonomist must act now. *Taxon*, 54(4): 1047-1050.

Davis, S.D., V.H. Heywood and A.C. Hamilton. (Eds.). 1994. Centers of Plant Diversity: A Guide and Strategy for their Conservation. IUCN Publication Unit, Cambridge, UK.

Heywood, V. (Ed.) 1995. *Global Biodiversity Assessment*. Published for United Nations Environmental Program. Cambridge University Press, UK.

Hilton-Taylor, C. 2000. 2000 IUCN Red List of Threatened Species. IUCN, Gland, Switzerland and Cambridge, UK.

Anonymous. 2001. IUCN Red List Categories and Criteria: Version 3.1 IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.

Anonymous. 2008a. IUCN Red List of Threatened Species www.iucnredlist.org accessed on March 02, 2008

Anonymous. 2008b. Standards and Petitions Working Group. Guidelines Using for the IUCN Red List Categories and Criteria: Version 7.0 Prepared by Standards and Petitions Working Group of the IUCN SSC Biodiversity Assessments Sub-Committee in August 2008.

Kruckeberg, A.R. and D. Rabinowitz. 1985. Biological aspects of endemism in higher plants. *Annual Reviews of Ecological Systematics*, 16: 447-479.

Mauchamp, A. 1998. Threatened species, re-evaluation of the status of eight endemic plants of the Galapagos. *Biodiversity and Conservation*, 7: 97-107.

Mills, M.H. and M.W. Schwartz. 2005. Rare plants at extremes of distributions: broadly and narrowly distributed rare species. *Biodiversity and Conservation*, 14: 141-1420.

Pitman, N.C.A. and P.M. Jorgensen. 2002. Estimating the size of the world's threatened flora. *Science*, 298: 989

Prance, G.T., H. Beetje, J. Dransfield and R. Johns. 2000. The tropical flora remains under collected. *Ann. Missouri Bot. Garden*, 87: 67-71.

Rabinowitz, D. 1981. *Seven forms of rarity*. In: *The Biological Aspects of Rare Plant Conservation*. (Eds.): Syng. Wiley & Sons Ltd., 205-217.

Ricketts, T.H., E. Dinerstein, T. Boucher, T.M. Brook, S.H.M. Butchart, M. Hoffman, J.F. Lamoreux, J. Morrison, M. Parr, J.D. Pilgrim, A.S.L. Rodrigues, W. Sechrest, G.E. Wallace, K. Berlin, J. Bielby, N.D. Burgess, D.R. Church, N. Cox, D. Knux, C. Loucks, G.K. Luck, L.L. Master, R. Moore, R. Naidoo, R. Ridert, G.E. Schatz, G. Shire, H. Strand, W. Wettenge and E. Wikranmanayake. 2005. Pinpointing and preserving imminent extinctions. *Proceedings of the National Academy of Sciences of the United States of America, Washington*, 102(51): 18497-18501.

Vischi, N., E. Natale and C. Villamil. 2004. Six endemic plants species from central Argentina: an evaluation of their conservation status. *Biodiversity and Conservation*, 13: 997-1008.

Western, D. 2001. Human-modified ecosystems and future evolution. *PNAS* 98(10): 5458-5465.