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# CONTRIBUTION TO THE RED LIST OF THE PLANTS OF PAKISTAN: A CASE STUDY OF A NARROW ENDEMIC *ASTRAGALUS CHITRALENSIS* ALI (FABACEAE-PAPILIONOIDEAE)

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**Abstract**

Narrow endemic plants are more prone to the process of extinction; this is due to their narrow ecological amplitude and habitat specificity as compared to the sufficively rare or widely distributed endemic taxa. In this paper the conservation status of *Astragalus chitralensis* Ali (Fabaceae-Papilionoideae) is given according to IUCN Red List Categories and Criteria. It is a narrow endemic plant of district Chitral Pakistan. This taxon was previously reported from one locality i.e. Birmoghlasht-Chitral. Whereas, during our 3 years of field excursions in Chitral we have collected it from 6 more localities. On the basis of the data of population size (174 mature individuals), extent of occurrence (780.49 $km^2$) and area of occupancy (24 $km^2$) this taxon is categorized as Critically Endangered. Furthermore, a continuing decline in number of mature individual plants was also observed with fluctuation in the AOO in all the subpopulations. Whereas, the total number of mature individual plants in each subpopulation was less than 50. These results of low population size with continuing decline and extreme fluctuation collectively suggest the category of Critically Endangered (CR). Grazing and habitat destruction are the main causes of depletion of this taxon. Early conservation measures are extremely necessary in order to protect the taxon from extinction.

## Introduction

The current biological extinction (sixth mass extinction) is the greatest in magnitude and severity as it has been caused by the impact of various anthropogenic activities (Wake & Vredenburg, 2008). Population explosion unplanned urbanization, deforestation and over-exploitation of natural resources are the main causes of the present biodiversity loss (Ali, 2000; Ali & Qaiser, 2010a). This impact has increased at an alarming rate with every year in the most recent decades (McKinney, 2002) and about 60,000 plant species would become extinct during our life time (Arroyo *et al.*, 1992; Ali, 2000). It is feared that future climate change will threaten a range of plants and animals with extinction. The species that are already declining could become extinct if things continue as they are. Therefore, it is suggested that threatened species should be prevented from becoming extinct by protecting them from threats like habitat loss due to unplanned urbanization, population growth and pollution.

In this context endemic and rare taxa are more prone to the process of extinction (Callamander *et al.,* 2005) which is due to their lowest geographical range of distribution and occurrence in specified ecological niche (Ali & Qaiser, 2011). According to the GSPC target 15, special attention should be extended to these "rarest" species with focus on local and national endemics. The targets already been set up by CoP (conference of the parties) 2010 are not achieved up till now (Anon., 2010). It is therefore proposed in (draft) GSPC 2011-2020 objectives 3(c) (Anon., 2012) "no species of plants will be at risk of extinction because of human activities, and the genetic diversity of plants will be safeguarded".

Beside the importance of going into the details of various rarity types, special attention should be given to their conservation on urgent basis (Ali & Qaiser, 2012). Assessing accurate conservation status based on the data of current population size, extent of occurrence and area of occupancy are the fundamental steps which should be taken into account before taking actions for conservation of these taxa (Burton, 2003; Callamander *et al.,* 2005). The extent of endemism of an area can rightly be regarded as the uniqueness of the diversity of that area, which is as a result important for prioritizing sites for conservation (Werff & Consiglio, 2004; Myers *et al.,* 2000).

It is suggested that special importance should be assigned to the areas having high endemism for conservation activities, because endemic plants may actually be competitively inferior to other more widespread taxa (Kessler, 2001) besides they are more susceptible to various environmental calamities, most important being the destruction of habitat (Romero *et al*., 2004; Bernardos *et al*., 2006). Chitral in particular has a high number of endemic plants i.e. 34 species (9.1%) (Ali, 2010) and is recognized as the centre of radiation (Ali & Qaiser, 1986).

The aim of the present study was (i) to determine whether the species is still present in its type locality or it has vanished due to various anthropogenic activities (ii) to find out new areas with habitats suitable for its occurrence (iii) to find out its present conservation status based on the data collected for three consecutive years.

## 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 plant specimens. The routs 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 $km^2$ 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. Plant specimens collected were deposited at Karachi University Herbarium (KUH). For EOO the geographical coordinates were plotted on a geo-referenced imagery obtained from Anon., (2012) 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 4$km^2$ area (Ali and Qaiser, 2010b). All the data collected were analyzed in view of IUCN Red List Categories and Criteria (Anon., 2001).

## Results and Discussion

*Astragalus chitralensis* Ali (Fabaceae-Papilionoideae) is endemic to Chitral (Ali, 1977) and was described from Birmoghlasht Chitral. Historically it was collected from this type locality only, whereas, we could collect it from 6 more localities in Chitral (Table 1; Fig. 2) in the altitudinal range of 2300-3288 m. It is a perennial herb with life form of Hemicryptophyte (Raunkier, 1934). Flowering and fruiting is observed in May-June.

According to the data analysis its extent of occurrence is 780.49 $km^2$ and area of occupancy is 24 $km^2$. According to the 3 years data of population size, total of 177 mature individual plants were observed in 2005, 90 in 2006 and 174 in 2007, with average of 147 mature individual plants per year. This indicates a prominent fluctuation in the population size, with decrease of 87 individual plants in the second year while, increase of 84 individual plants during the third year. Hence, a total decrease of only 3 mature individual plants was observed during the three years of study. As a result it is concluded that it is a rare species with fluctuation in population size in all the localities (Table 1).

It is found on undulating grassy gentle slopes and grows singly (Figs. 1a & b). According to our observations this taxon is accessible to the local community and exposed to all the anthropogenic activities particularly grazing etc. As a result of these threats a total of 39 mature individual plants (22.03%) were found as grazed in 2005, 15 (16.66%) in 2006, whereas, in 2007 only 27 mature individual plants (15.51%) were found grazed (Table 1).


Fig. 1. *Astragalus chitralense* Ali: A, habit; B, flower.

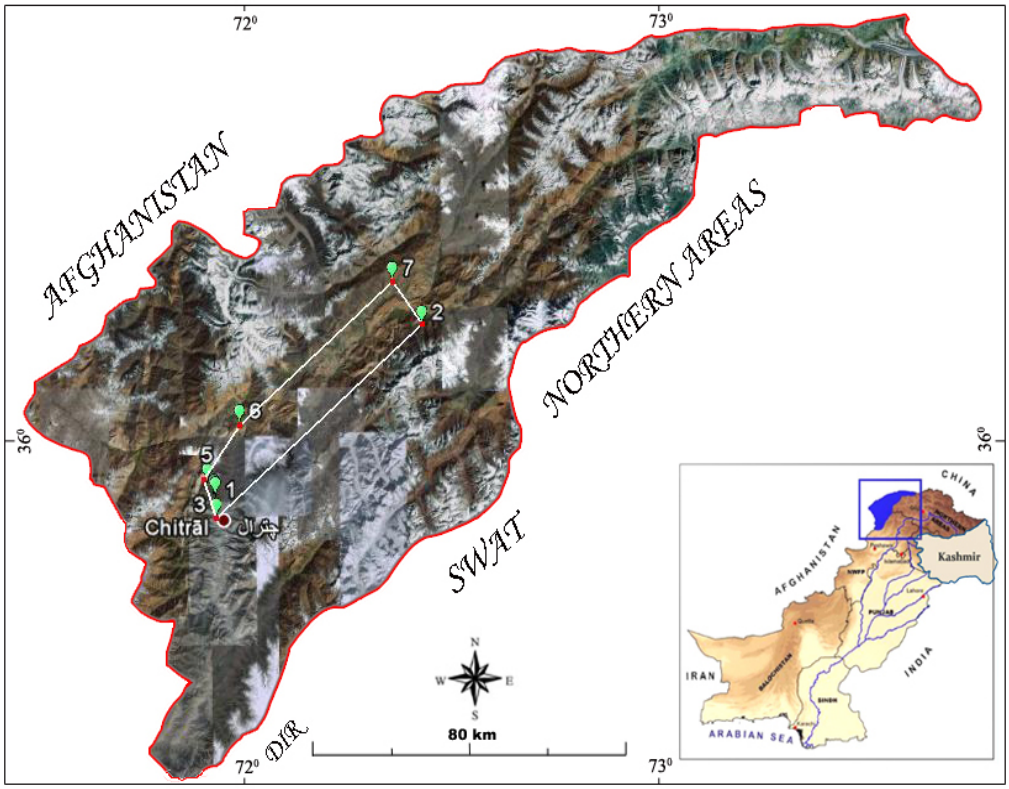


Fig. 2. Distribution of *Astragalus chitralense* in 2007, numbers correspond with the localities in the table.

**Table 1. *Astragalus chitralense*: 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. | Chitral-Bakamak hill | 2300 | 42-749533, 3970220 | 31 | 41 | 49 | 15 | 9 | 12 |
| 2. | Molikhoo-Qaqlasht | 2527 | 43-259723, 4019824 | 29 | 13 | 15 | - | - | - |
| 3. | Chitral-Birmoghlasht CGNP | 2703 | 42-749166, 3975190 | 31 | - | 27 | 7 | - | - |
| 4. | Chitral-Ishpeder CGNP | 2829 | 42-746470, 3979546 | 41 | 15 | 32 | 17 | 6 | 15 |
| 5. | Chitral-Chaghbene hut | 2836 | 42-748765, 3975824 | 27 | - | 31 | - | - | - |
| 6. | Molikhoo-Shermali Sahat | 2912 | 43-252680, 4024888 | 7 | 21 | 9 | - | - | - |
| 7. | Molikhoo-Ojhore top between Karimabad & Parsan | 3288 | 42-754661, 3992154 | 11 | - | 11 | - | - | - |
| | Total | | | 177 | 90 | 174 | 39 | 15 | 27 |
| | Average | | | | 147 | | | 27 | |

**Conservation status**

As the Extent of Occurrence of the taxon is 780 km$^2$ (i.e., less than 5000km$^2$) and AOO is only 24km$^2$ (i.e. less than 500 km$^2$) therefore, according to the IUCN Red List Categories & Criteria (2001) it should be placed under the Endangered Category. Whereas, its population size is 174 mature individual plants (i.e. less that 250). Subpopulations are severely fragmented i.e. distributed in 7 small localities. Furthermore, due to continuing decline in number of mature individual plants (Table 1) and fluctuation in the AOO during the 3 years of field study (Figs. 3.20, 3.21 & 3.22) and in all the subpopulations the number of mature individual plants was less than 50, 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 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 1 2 a (i) 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
a = population structure in the form of:
(i) = no subpopulation estimated to contain more than 50 mature individuals
b = extreme fluctuations in number of mature individuals

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