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CONTRIBUTION TO THE RED LIST OF THE PLANTS OF PAKISTAN

JAN ALAM* AND S. I. ALI

Centre for Plant Conservation
University of Karachi, Karachi-75270, Pakistan

Abstract

In this paper, the conservation status of 19 taxa is given according to IUCN Red List Categories and Criteria. Of these, *Asparagus gharoensis* Blatter is now extinct; *Scaevola plumierii* (L.) Vahl., and *Scaevola taccada* (Gaertn.) Roxb., are regionally extinct; *Allium gilgiticum* Wang & Tang, *Arabidopsis brevicaulis* (Jafri) Jafri, *Christolea mirabilis* (Pamp.) Jafri, *Consolida schlagintweitii* (Huth) Munz, *Elymus russellii* (Meld.) T. A. Cope, *Mattiastrum karakoricum* Podlech & Sadat, *Plantago baltistanica* Hartmann and *Saxifraga duthiei* Gandogar are possibly extinct; *Androsace russellii* Y. Nasir, *Asperula oppositifolia* Reg. & Schmalh. subsp. *baltistanica* Nazim., *Astragalus clarkeanus* Ali, *Berberis pseudumbellata* Parker subsp. *gilgitica* Jafri, *Haplophyllum gilesii* (Hemsl.) C. C. Townsend and *Tanacetum baltistanicum* Podlech are critically endangered, while the remaining two taxa i.e., *Aconitum violaceum* Jacquem. ex Stapf var. *weileri* (Gilli) H. Riedl and *Rhodiola saxifragoides* (Fröd.) H. Ohba are vulnerable.

Introduction

It is widely recognized that the rate of plant extinction has reached to one species per day as a result of anthropogenic activities and this rate is considered to be 1000-10000 times faster than would naturally occur (Hilton-Taylor, 2000; Akeroyd, 2002) and if the trend remains constant, 60,000 and 100,000 plant species may disappear in the near future (Akeroyd, 2002; Bramwell, 2002). Major cause of the current event is the habitat loss by various anthropogenic activities, resulting in the habitat alteration, habitat fragmentation and destruction of habitats. Further, climate change has become another serious factor in this connection (Thomas *et al*., 2004).

Unfortunately no critical work has been done on threatened plants of Pakistan according to IUCN Red List Categories and Criteria (Anon., 2001). Very little information is available on this subject. Recently the conservation status of *Astragalus gilgitensis* Ali (Alam & Ali, 2009) and *Cadaba heterotricha* Stocks (Abbas *et al.*, 2010) was determined for Pakistan based on field studies. *Astragalus gilgitensis* is placed under the Critically Endangered category, while *Cadaba heterotricha* is kept under Endangered category due to their narrow geographic distribution, single location and habitat degradation.

In the present account, a checklist of 19 flowering plants is given with their conservation status and citation by following the IUCN Red List Categories and Criteria (Anon., 2001), Guidelines for Application of IUCN Red List Criteria at Regional Level (Anon., 2003) and Guidelines Using for the IUCN Red List Categories and Criteria (Anon., 2008). Of these, 16 taxa are exclusively endemic to Gilgit and Baltistan (Alam, 2009), one taxon is endemic in Sind (Ali, 2009), while the remaining 2 taxa are widely distributed and reported only along coastal area of Karachi for Pakistan (Ali, 1972). During field studies, of these, only 8 taxa could be collected (Table 1), while remaining 11 taxa could not be found in the respective localities or anywhere else (Table 4). Detailed account of each taxon will be published separately.

*E-mail: janalamkuh@yahoo.com; Ph. 00 92 (0)21 99261382

Studied taxa are categorized into the following sections:

a. Threatened taxa

These taxa belong to the following threatened categories:

a. Critically Endangered (CR) taxa: Six taxa viz., *Androsace* russellii, *Asperula oppositifolia* subsp. *baltistanica*, *Astragalus clarkeanus*, *Berberis pseudumbellata* subsp. *gilgitica*, *Haplophyllum gilesii* and *Tanacetum baltistanicum* are Critically Endangered (CR) (Table 1). The population sizes of these taxa have a range from 39 to 599 individual plants. In the case of *Berberis pseudumbellata* subsp. *gilgitica* and *Astragalus clarkeanus*, the population sizes are alarmingly small and extremely under threat from extinction i.e., below 50 individual plants per taxon. *Asperula oppositifolia* subsp. *baltistanica* and *Berberis pseudumbellata* subsp. *gilgitica* are known only from single locality. Likewise, *Androsace russellii, Astragalus clarkeanus* and *Haplophyllum gilesii* are known from 2-3 localities per species, while *Tanacetum baltistanicum* are known for 8 localities. Similarly, the Area of occupancy of the taxa is ranging from 0.5-8.15-km^2 each, while the extant of occurrence is in the range from 2.5-1907.26 km^2 per taxon. In addition, many anthropogenic and natural (i.e. soil erosion) threats are also involved (Table 2).

b. Vulnerable (VU) taxa: *Rhodiola saxifragoides* and *Aconitum violaceum* var. *weileri*, each taxon has more than 3620 individual plants. The extent of occurrence is more than 1000 km^2 per taxon are recorded. Likewise, the area of occupancy is in the range from 26.5-30 km^2 area per taxon having 10 localities each (Table 3).

b. Taxa that could not be collected

These taxa are classified into the following categories:

a. Extinct (EX) taxon

***Asparagus gharoensis* Blatter:** *Asparagus gharoensis* is a small shrub and belongs to the family Asparagaceae (Ali & Khan, 2009). Previously, this species was collected from Sind (Thatta, Ghulamullah, Charo) by Blatter. These collections were made in 1922.

From previous decades till to date many efforts were made to recollect this plant from the respective localities Gharo, Ghulam (now known as Ghulamullah). However, this species could not be collected. According to Ali & Khan (2009), lot of developments have taken place, during the last 88 years. What may have been small villages have now attained the status of districts like Thatta and Gharo. On way to Ghulamullah there are cement and crushing factories, thus the ecology of the area is completely changed.

As recommended in the criteria of IUCN (Anon., 2001) that a taxon should be considered extinct when there is no reasonable doubt that the last individual has died. Therefore, based on the above facts, it is most likely that this species is now extinct. Habitat degradation could be the main cause for extinction of the species.

b. Regionally extinct (RE) taxa: *Scaevola plumierii* (L.) Vahl and *Scaevola taccada* (Gaertn.) Roxb., are branched shrubs and belong to the family Goodeniaceae (Ali, 1972). Details of each species are as follow:

1. *Scaevola plumierii* (L.) Vahl: This species is generally distributed in India (Bombay, Madras); Ceylon; widely distributed along the African Coast, from Somali Republic to Senegal including Madagascar; U.S.A. (Florida, Lower California); Islands in the Gulf of Mexico; West Indies; Bahama Islands; Brazil; Galapagos. In Pakistan, only 3 specimens of this species from Karachi along coastal area were collected by J. E. Stocks and Vicary (Ali, 1972). All these specimens are in the Kew Herbarium. Except these specimens, *Scaevola plumierii* (L.) Vahl could not be collected again. It is most likely that the taxon is now regionally extinct. Due to subsequent increase of anthropogenic activities in coastal zone, this species has disappeared from the locality.

2. *Scaevola taccada* (Gaertn.) Roxb.: *Scaevola taccada* is also widely distributed species found in India (Bombay, Madras); Maldive Islands; Burma; along the African coast, from Kenya to S. Africa; Malaysia; Hong Kong; Hainan; New Herbrides; New Caledonia; Samoan Island, Fiji Islands; Christmas Island; Cooke Island; Tahiti, Hawaiian Islands etc. (Ali, 1972). In Pakistan, *Scaevola taccada* was reported from Sind by Cooke (1904) and from mouth of Indus by Blatter McCann & Sebnis (1929).

According to Guidelines for Application of IUCN Red List Criteria at Regional Level (Anon., 2003), this taxon is extinct within the region but extant in other part of the world, should be classified as Regionally Extinct (RE). As *Scaevola taccada* has not been reported from Pakistan after 1929. i.e., during the last 81 years. Therefore, this species is regarded as regionally extinct.

c. Possibly extinct: Eight taxa viz., *Allium gilgiticum* Wang & Tang, *Arabidopsis brevicaulis* (Jafri) Jafri, *Christolea mirabilis* (Pamp.) Jafri**,** *Consolida schlagintweitii* (Huth) Munz**,** *Elymus russellii* (Meld.) T. A. Cope, *Mattiastrum karakoricum* Podlech & Sadat, *Plantago baltistanica* Hartmann and *Saxifraga duthiei* Gandogar are tagged as possibly extinct (Table 4).

We thoroughly explored the localities from where these taxa were reported but we failed to collect the above eight taxa during the field studies from 2003-2007. As these taxa are restricted in mountainous region, therefore, there could be two possibilities for this situation. The first possibility is that the population size of these taxa may be alarmingly small and confined to inaccessible micro-sites on the mountains. Other possibility is that taxa may be present outside the study area. Based on these possibilities placement of the taxa under the category of Extinct is doubtful until a thorough survey is made in the adjacent areas also. Therefore, as recommended in "Guidelines for Using the IUCN Categories and Criteria (Anon., 2008), these taxa are tagged as "possibly extinct" and further efforts should be made in order to confirm their actual conservation status.

Table 1. Threatened taxa along with their conservation status and citation.

Taxa	Conservation status	Citation of the threatened category
Aconitum violaceum Jacquem. ex Stapf var. *weileri* (Gilli) H.Riedl	Vulnerable (VU)	VU B1ab +B2a
Androsace russellii Y.Nasir	Critically Endangered (CR)	CR B1ab (vi)+B2ab (vi); C2a (ii)
Asperula oppositifolia Reg. & Schmalh. subsp. *baltistanica* Nazim.	Critically Endangered (CR)	CR B1a2ab (iii)
Astragalus clarkeanus Ali	Critically Endangered (CR)	CR B1ab (iii) + 2ab (iii); C2 (ii); D
Berberis pseudumbellata Parker subsp. *gilgitica* Jafri	Critically Endangered (CR)	CRB1ab (iii) + 2ab (iii); D
Haplophyllum gilesii (Hemsel.) C.C. Townsend	Critically Endangered (CR)	CR B1ab (ii,iii,iv) + 2ab (ii, iii, iv)
Rhodiola saxifragoides (Fröd.) H.Ohba	Vulnerable (VU)	VU B1+2(a); C
Tanacetum baltistanicum Podlech	Critically Endangered (CR)	CRB2ab (i, ii, iii)

Key: VU, Vulnerable; CR, Critically Endangered; B1, Extent of Occurrence; B2, Area of Occupancy; a, Known localities or fragmentation; b, Continuing decline, observed, inferred or projected; i, Decline in extent of occurrence; ii, Decline in area of occupancy; iii, Quality of habitat; iv, number of locations; C2, Population size estimated to be fewer than 250 and a continuing decline; a (With C2), Population structure; ii (with C2), At least 90 % of mature individuals in one subpopulation; D, Population estimated to be number fewer than 50 mature individuals.

Table 2. Summary of known localities, population size, geographic range and various threats observed in the critically endangered taxa

Taxa	Known localities	Population size	Geographic range		Anthropogenic and natural impacts				
			E. O. km^2	A.O. km^2	A	B	C	D	E
Androsace russellii	2	69	21.85	0.5	-	-	-	-	-
Asperula oppositifolia subsp. *baltistanica*	1	251	2.5	2.5	+	-	-	-	-
Astragalus clarkeanus	2	48	10	2.5	+	+	-	-	-
Berberis pseudumbellata subsp. *gilgitica*	1	29	2.5	2.5	+	+	+	+	+
Haplophyllum gilesii	3	118		1.5	-	+	-	-	+
Tanacetum baltistanicum	8	599	1907.26	8.15	-	+	-	-	-

Key: E. O., Extent of occurrence; A.O., Area of Occupancy; A, Grazing; B, Soil Erosion; C, Fuel wood collection from the habitat; D, medicinal Use; E, land expansion for agricultural purposes

Table 3. Summary of known localities, population size, geographic range and various threats observed in the vulnerable taxa.

Taxa	Known localities	Population size	Geographic range		Anthropogenic and natural impacts				
			E. O. km^2	A.O. km^2	A	B	C	D	E
Aconitum violaceum var. *weileri*	10	3620	1337.56	30	+	-	-	-	-
Rhodiola saxifragoides	10	4982	402.287	26.5	-	-	-	-	-

Key: E. O., Extent of occurrence; A.O., Area of Occupancy; A, Grazing; B, Soil Erosion; C, Fuel wood from the habitat; D, medicinal Use; E, land expansion for agricultural purposes

Table 4. Taxa that could not be collected.

Taxa	Conservation status
Asparagus gharoensis Blatter	Extinct
Scaevola plumierii (L.) Vahl	Regionally Extinct
Scaevola taccada (Gaertn.) Roxb.	Regionally Extinct
Allium gilgiticum Wang & Tang	Possibly Extinct
Arabidopsis brevicaulis (Jafri) Jafri	Possibly Extinct
Christolea mirabilis (Pamp.) Jafri	Possibly Extinct
Consolida schlagintweitii (Huth) Munz	Possibly Extinct
Elymus russellii (Meld.) T. A. Cope	Possibly Extinct
Mattiastrum karakoricum Podlech & Sadat	Possibly Extinct
Plantago baltistanica Hartmann	Possibly Extinct
Saxifraga duthei Gandogar	Possibly Extinct

References

Abbas, H., M. Qaiser and J. Alam 2010. Conservation status of *Cada heterotricha* Stocks (Capparidaceae): an endangered species in Pakistan. *Pak. J. Bot.*, 42(1): 35-46.

Akeroyd, J. 2002. A rational look at extinction. *Plant Talk*, 28: 35-37.

Alam, J. 2009. Endemic *Flora Of Gilgit and Baltistan and Conservation Strategies For Threatened Endemic Taxa*- Ph. D Thesis, University of Karachi.

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

Ali, S.I. 1972. Goodeniaceae. In: *Flora of Pakistan*. No. 30, Karachi (Eds.): E. Nasir & S. I. Ali.

Ali, S.I. and S.W. Khan 2009. Asparagaceae. In: Flora of Pakistan. No. 217, Karachi.12 (Eds.): S.I. Ali and M. Qaiser.

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

Anonymous. 2003. Guidelines for Application of IUCN Red List Criteria at Regional Level: Version 3.0 IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.

Anonymous. 2008. 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.

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

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

Thomas, C.D., A. Gameron, R.E. Green, M. Bakkenes, L.J. Beaumont, Y.C. Collingham, B.F.N. Erasmus, M.F. Siqueira, A. Grainger, L. Hannah, L. Hughes, B. Huntley, A.S. Jaarsveld, G. F. Midgley, L. Miles, M.A. Ortega- Huerta, A.T. Peterson, O.L. Phillips and S.E. William 2004. Extinction risk from climate change. *Nature*, 427: 145-148.

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