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Conservation status of *Ajuga bracteosa* Wall ex Benth: An important medicinal plant species of Kashmir Himalaya

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ABSTRACT

Ajuga bracteosa Wall ex Benth. is an important medicinal plant species of Kashmir Himalaya. Traditionally the species is used to treat various diseases in Kashmir valley. In the present study, the threat status of the species was evaluated in accordance with IUCN Regional Guidelines 2003 version 3.0 following IUCN categories and Criteria 2010 version 8.1. The present investigation revealed that the total number of sub-populations in Kashmir valley is 42 and the mature individuals are 30,850. The calculated Extent of Occurrence and Area of Occupancy of the species turned out to be 583 and 336 km^2, respectively. The rigorous data collected during the course of present study revealed that the plant species does not qualify for any of the threat category in Kashmir valley. The species is subjected to various threats like construction of roads and buildings, landslides, exploitation for local use etc. if these threatening factors continue to prevail, the species may become threatened in near future.

Keywords: Traditional, IUCN regional guidelines, sub-population, extent of occurrence, area of occupancy.

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INTRODUCTION

Wild plants are rapidly disappearing due to tremendous increase in human population, urbanization, habitat fragmentation and the increased dependency of the poor on the limited natural resources (Woodruff, 2001). As a result of these anthropogenic activities, the rate of plant extinction has reached an unprecedented rate which is considered to be 1000 to 10000 times faster than could naturally occur (Hilton-Taylor, 2000) and if the trend remains constant - 60,000 to 100,000 plant species would disappear during the next 50 years (Pujol et al., 2006). It is expected that as many as half of the world's plant species would be threatened by extinction if assessment is made according to the IUCN categories and criteria (Pitman and Jorgensen, 2002). The total number of identified vascular plant species is estimated to be between 310,000 (Prance et al., 2000) and 420,000 (Bramwell, 2002). The 2010 Red List (IUCN, 2010) contains ≥12,000 plant taxa but ≤1,000 are properly documented (≤8.3% of global plant diversity). The process of conservation assessments clearly needs to be accelerated. The emerging magnitude of the contemporary extinction crises has inspired a massive effort to evaluate and monitor the risk of extinction faced by the species worldwide (Burton, 2003). Growing awareness about the possible extinction of certain taxa is largely attributed to the development of the World Conservation Union's (IUCN) Red List and/ or Red Data Books (RDBs) concept, which allow conservation scientists to establish the nature and extent of such declines, introduce conservation actions, research and the monitoring of such taxa and has proven to be helpful by drawing public focus towards these taxa, as well as their declining habitats (Magin et al., 1994). The IUCN categories and criteria were originally developed to evaluate the threat status of the species at global level. However, need was felt to develop the guidelines which would be applied at either regional or national level. Accordingly Guidelines for Application of IUCN Red List Criteria at Regional Levels (2003) version 3.0.were developed. The IUCN Regional Red Lists would provide

a more objective evaluation of the threats which a taxon is facing either at national or regional scale (Gärdenfors, 2001) and also the national or regional threat lists can be helpful in the determination of different threat levels and the inclusion of these threat levels into the National Conservation Planning. Henceforth, setting priorities is a key process for conservation purposes throughout the world (Mace, 1995; Ali and Qaiser, 2010).

To determine the threat status of a taxon, it is necessary to monitor the population size in the form of number of mature individuals, geographical range in terms of the Extent of Occurrence (EOO), and Area of Occupancy (AOO) and the nature and extent of threats faced by the taxon and the decline and fluctuations in the number of mature individuals (IUCN, 2010).

Ajuga bracteosa is an important medicinal plant species growing in Kashmir valley. Traditionally the plant species is used to cure fever, skin infection, jaundice, rheumatic pain and also as a lice killer. Keeping in view the immense medicinal importance of the species, it was thought worthwhile to evaluate the threat status of the species in accordance with IUCN regional guidelines. The information regarding the threat status will work as a bed rock for long term and sustainable use of the plant species.

MATERIALS AND METHODS

Study area

Kashmir Himalaya represents the main valley of Kashmir together with the side-valleys of Tilel, Guraiz, Keran and Karnah. The region falls within the biogeographic zone of the North-Western Himalaya in India. It lies between 33° 20′ to 34° 54′ N Latitudes and 73° 55′ to 75° 35′ E Longitudes, covering an area of 15948 sq. km. Kashmir Valley, the 'Paradise on Earth', is situated in the biogeographic zone of Northwest Himalaya in India between 33° 20' to 34° 54' N latitudes and 73° 55' to 75° 35' E longitudes, covering an area of 15,948 km^2. Topographically, it is a deep elliptical bowl-shaped valley bounded by lofty mountains of the Pir Panjal in the South and Southwest and by the Great Himalayan range in the North and East, with 64% of the total area being mountainous (Ganie and Tali, 2013). The Valley is asymmetrical, with 187 km diagonal length (from southeast to northwest corner), and considerably varying breadth, being 115.6 km along the latitude of Srinagar. The altitude of the Valley basin at Srinagar is 1,600 m and rises to 5,420 m at Kolahoi or "Gwashibror', the highest peak among its surrounding mountains (Figure 1).

Field explorations

During the present investigation extensive field surveys were conducted throughout the Kashmir valley. Field surveys were carried out in the localities from where the taxon had previously been collected as well as the localities that had not previously been surveyed but are within the altitudinal range and habitat typical of *A. bracteosa*. When a population of the species was located 1 to 2 days were spent in the location to determine the extent of the population by walking within an area of at least 2 km^2 in each locality. The number of mature individuals was counted (Ali and Qaiser, 2010). Only those individuals were counted as mature which bear flowers or fruits. Decline in the number of mature individuals (if occurs) were also recorded by comparing the number of individual plants present during the 1st year to the individuals of the 2nd year. Comprehensive field notes on habit, habitat, life form and altitudinal range of the species were recorded. Any anthropogenic threats (grazing, expansion of agriculture, road building, landslides, over exploitation for local use, effect of tourism and deforestation) were recorded. Plant specimens collected were deposited at Kashmir University Herbarium (KASH). The Extent of Occurrence (the area contained within the shortest continuous imaginary boundary that can be drawn to encompass all the known sites of occurrence of a taxon, excluding cases of vagrancy) of the species were calculated by α- hull method (IUCN, 2010). Area of occurrence (the area within the extent of occurrence that is occupied by a taxon) was calculated by overlaying a grid of 2 × 2 km squares on the distribution map and summing the area of the squares in which the species was located (IUCN, 2010). The data gathered were evaluated in light of IUCN Red List Categories and Criteria 2010 version 8.1 following Guidelines for Application of IUCN Red List Criteria at Regional Levels 2003 version 3.0.

RESULTS AND DISCUSSION

Local distribution

The present study revealed that *A. bracteosa* occurs at forty two different locations (Reshiwari, Langate, Kupwara,Charari-sharief, Yousmarg, Nilnag, Badipora, Budgam, Chadoora, Doodhpathri, Khanshab, Salamabad, Baramullah,Drang, Ferozpora,Gulmarg, Tangmarg,Watlab, Bandipora, Mansbal, Chakisangri, Dachigam, Khrew, Awantipora, Aharbal, Dubjan, Shopian, Sonamarg, Ganderbal, Narayannag, Kangan, Daksum, Kokernag, Pahalgam, Betab valley, MatiGawran, Chanderwari, Aru, Kokernag, Achabal, Pandobal, Gulabbagh and Jawahir Tunnel) in Kashmir valley. The species grows in sloppy and landslide prone areas with low moisture content in temperate to sub-alpine zones at an altitudinal gradient of 1620 to 2900 m asl.

Taxonomic description

Perennial herb up to 15 to 40 cm long, stoloniferous; stems branched from base, gray villous or lanate-villous especially on young parts; basal petioles 1 to 1.5 cm; basal leaf blade spatulate to oblanceolate, 2-4 × 0.7-1.2 cm; stem blades sessile or subsessile, obovate to subcircular, 1-1.5 × 0.6-1 cm, pilose or strigose, base cuneate-decurrent, margin inconspicuously to irregularly undulate-crenate, ciliate, apex obtuse to subrounded; basal verticillasters widely spaced, apical verticillasters in dense spikes; basal floral leaves densely lanate-villous, incised, ciliate; calyx campanulate, 4.5 to 6 mm, villous especially on teeth; teeth subulate-triangular, regular, 1/2 or more as long as calyx, apically acute, margin villous-ciliate; corolla purple or purplish with dark purple spots, tubular, slightly exserted, puberulent, yellowish glandular, villous annulate inside; upper lip straight, apex

Figure 1. Study area.

Figure 2. Habit and habitat of *A. bracteosa*.

emarginate; middle lobe of lower lip obcordate, lateral lobes oblong; nutlets oblong to oblong-obovoid, adaxially swollen at middle, areole to 2/3 or more as long as adaxial side of nutlet (Figure 2).

Assessment of threat status

In order to evaluate the threat status of the species in accordance with the IUCN guidelines, the population size, Extent of Occurrence (EOO) (Figure 3) and Area of Occupancy (AOO) (Figure 4) and the different types of threats to the species were recorded. The most common operative threats are landslides and overexploitation for local use (Table 1).

Conservation status

The total number of sub-populations in the Kashmir valley is 42 and the mature individuals of the species in the across these subpopulations turned out to be 30850. The data gathered during the present study revealed that the values obtained for the number of mature individuals are higher than the threshold values of IUCN for any of the threat category. The Extent of Occurrence and Area of Occupancy of the species are 583 and 336 km^2 respectively, though the values of AOO and EOO fall within the threshold of IUCN threat category but the species did not show any decline in the specified parameters laid by the IUCN. During the course of present study, a cumulative increase of 1,666 mature

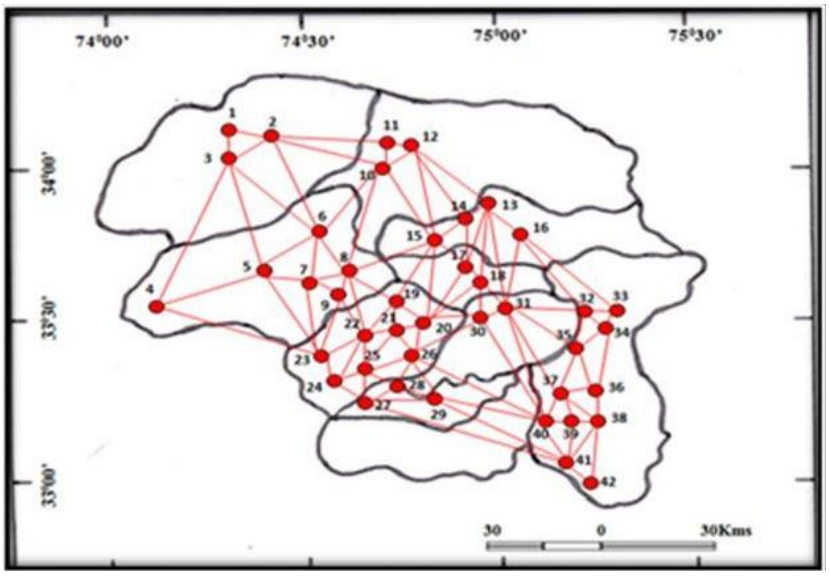

Figure 3. Map showing EOO of *A. bracteosa* in Kashmir valley. 1.Handwara; 2.Reshiwari; 3.Langate; 4.Salamabad; 5.Gulmarg; 6.Baramullah; 7.Ferozpora; 8.Drang; 9.Tangmarg; 10.Sopore; 11.Watlab; 12.Bandipora; 13.Naranag; 14.Kangan; 15.Ganderbal; 16.Sonamarg; 17.Dachigam; 18.Chacksangri; 19.Budgam; 20.Chadoora; 21.Badipora; 22.Khanshab; 23.Doodhpathri; 24.Yousmarg; 25.Nilnag; 26.Charieresharief; 27.Dubjan; 28.Shopian; 29.Aharbal; 30.Awantipora; 31.Khrew; 32.Aru; 33.Chandanwari; 34.Betab valley; 35.Pahalgam; 36.Matigawran; 37.Achabal; 38.Daksum; 39.Pandobal; 40.Kokernag; 41.Gullab Bagh; 42.Jawahar Tunnel.

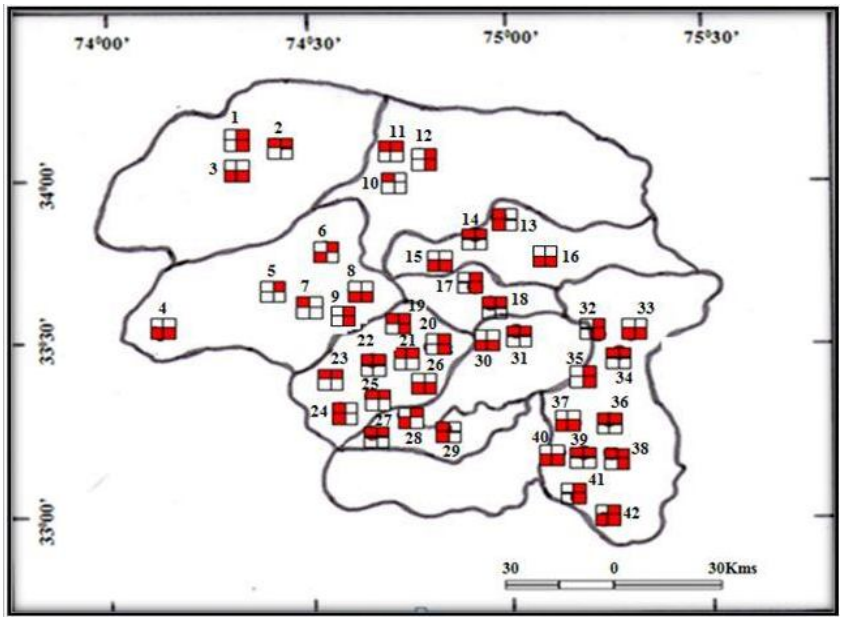

Figure 4. Map showing AOO of *A. bracteosa* in Kashmir valley. 1.Handwara; 2.Reshiwari; 3.Langate; 4.Salamabad; 5.Gulmarg; 6.Baramullah; 7.Ferozpora; 8.Drang; 9.Tangmarg; 10.Sopore; 11.Watlab; 12.Bandipora; 13.Naranag; 14.Kangan; 15. Ganderbal; 16.Sonamarg; 17.Dachigam; 18.Chacksangri; 19.Budgam; 20.Chadoora; 21.Badipora; 22.Khanshab; 23.Doodhpathri; 24.Yousmarg; 25.Nilnag; 26.Charieresharief; 27.Dubjan; 28.Shopian; 29.Aharbal; 30.Awantipora; 31.Khrew; 32.Aru; 33.Chandanwari; 34.Betab valley; 35.Pahalgam; 36.Matigawran; 37.Achabal; 38.Daksum; 39.Pandobal; 40.Kokernag; 41.Gullab Bagh; 42.Jawahar Tunnel.

Table 1. Sub-populations, population size, Area of Occupancy and the threats of the *A. bracteosa* recorded at different locations.

S. No.	Sub-populations	Population size		AOO (km^2)	Threats
		2011	2012		
1.	Handwara	422	459	4,4	Landslides
2.	Reshiwari	800	850	4,4	Landslides, Exploitation for local use
3.	Langate	650	630	4,4	Landslides, Exploitation for local use
4.	Salamabad	800	900	4,4	No apparent threat
5.	Gulmarg	175	150	4	Construction of roads, Landslides
6.	Baramullah	1050	1100	4,4	Construction of roads
7.	Ferozpora	200	230	4	Construction of roads, Landslides
8.	Drang	515	495	4,4	Construction of roads, Landslides, Exploitation for local use
9.	Tangmarg	775	750	4,4	Construction of roads, Landslides
10.	Sopore	235	250	4	No apparent threat
11.	Watlab	789	810	4,4	No apparent threat
12.	Bandipora	1500	1698	4,4	No apparent threat
13.	Naranag	990	1050	4,4	Construction of roads, Landslides, Exploitation for local use
14.	Kangan	1290	1370	4,4	Construction of roads, Landslides, Exploitation for local use
15.	Ganderbal	550	575	4,4	Landslides, Exploitation for local use
16.	Sonamarg	1039	1005	4,4	Construction of roads, Landslides
17.	Dachigam	740	770	4,4	Construction of roads, Landslides
18.	Checksangri	1235	1265	4,4	Landslides
19	Budgam	632	625	4,4.4	Construction of roads, Landslides, Exploitation for local use
20.	Chadoora	600	644	4,4	Landslides, Exploitation for local use
21.	Badipora	245	233	4,4	Landslides, Exploitation for local use
22.	Khanshab	853	880	4,4	Construction of roads, Landslides
23.	Doodhpathri	500	550	4,4	Construction of roads
24.	Yousmarg	200	210	4,4	Construction of roads, Exploitation for local use
25.	Nilnag	230	250	4,4	Construction of roads, Landslides, Exploitation for local use
26.	Chararisharief	444	432	4,4	Landslides
27.	Dubjan	822	750	4,4	Construction of roads, Exploitation for local use
28.	Shopian	710	722	4,4	Landslides, Exploitation for local use
29.	Aharbal	1250	1222	4,4	Construction of roads, Landslides
30.	Awantipora	234	269	4,4	Landslides
31.	Khrew	1400	1260	4,4	Construction of roads, Landslides, Mining, Cement dust
32.	Aru	1076	1998	4,4	Construction of roads, Landslides, Exploitation for local use
33.	Chanderwari	650	630	4,4	Construction of roads, Landslides, Tourism
34.	Betab valley	900	850	4,4	Construction of roads, Landslides
35.	Pahalgam	630	650	4,4	Construction of roads, Landslides, Exploitation for local use

Table 1. Continues.

36.	Matigawran	454	514	4,4	Landslides, Exploitation for local use
37.	Achabal	330	310	4,4	Construction of roads, Landslides
38.	Daksum	632	650	4,4,4	Construction of roads, Landslides
39.	Pandobal	700	760	4,4	Landslides, Exploitation for local use
40.	Kokernag	345	369	4,4	Construction of roads, Landslides
41.	Gulabbagh	650	700	4,4	No apparent threat
42.	Jawahir Tunnel	942	1022	4,4,4	Construction of roads, Landslides
Total		29,184	30,850	336	

individuals was recorded across the different identified subpopulations. Therefore, *A. bracteosa* does not qualify for any of threat category according to IUCN categories and criteria 2010, however, the natural habitats of the species have been altered or destroyed by overexploitation for local use, unplanned construction of buildings, roads, bridges etc. in the name of development which may restrict the distributional range of the species in future and also the 2nd major threat to the species is landslides which also get enhanced by the unplanned constructions (Tali et al., 2014). If these threatening factors continue to prevail, the species may become threatened in near future. To maximise conservation attention at a regional scale, it may be necessary to give priority to species for which the region under consideration represents an important part of their distribution, that is, they are not widespread outside of the region (Burgman, 2002; Schmeller et al., 2008). In order to obtain the benefits in a sustainable manner not only at local level but also at global level, it is the responsibility of the state to conserve their biodiversity. Hence, it is necessary to identify important components of biodiversity and identify priorities which may need special conservation measures (Ganie and Tali, 2013). The present study will act as bedrock for identifying the different threats operative in the region. The study will also help in devising the long term conservation strategies for the sustainable use of this particular species in the biodiversity rich region of Himalaya.

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