

REVISION OF *AJUGA* LINN. (LABIATAE) FROM PAKISTAN

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Based on our studies regarding the species of *Ajuga* in the different herbaria of Pakistan as well as the herbaria at Kew, Edinburgh and Geneva, it was found that *Ajuga macrosperma* Wall has not been recorded from Pakistan so far, is reported in this paper. The distribution of *A. macrosperma* Wall, is so limited that only one specimen is lying at Kew herbarium, London and one is available at the PARC herbarium, Islamabad.

## INTRODUCTION

*Ajuga* is a small genus of Labiatae having about 50 species widely distributed in the temperate to subtropical regions of the world. Bentham in Decandolle [1] has divided the genus into three sections viz. *Chamaepitys* Benth., *Bugula* Benth., and *Phleobanthes* Tausch. The species i.e. *Ajuga bracteosa*, *A. parviflora* and *A. macrosperma* belong to the Section, *Bugula* Benth.

Bentham in Decandolle [1] distinguished the three species by the size of the corolla tube as compared to the calyx and the size of the stamens. Hooker [3] added the observation that the corolla tube is inflated in *A. macrosperma* and not inflated in the other two species Mukerjee [4] accorded more importance to the size of stamens; Rechinger [5] considers along with other characters the venation of the leaves, while the nature of roots is also distinguishable and, lastly, Hedge [2] holds the character of the corolla length to be quite important.

## MATERIAL AND METHOD

During the present study one thousand specimens were examined. These belonged to different herbaria, namely, the PARC herbarium, Islamabad; Karachi University herbarium; PCSIR herbarium, Peshawar; Royal Botanic Garden, Kew; Royal Botanic Garden, Edinburgh; and Bibliotheque du Conservatoire, Botanique, Geneva.

In all 49 specimen sheets available from various herbaria in Pakistan were included for statistical studies. A polygonal multi-dimensional graph, histogram, map and a table have been provided as a part of these studies. A list of specimens examined has been included. A key has been provided to differentiate the three species of *Ajuga*. In

addition brief descriptions have been provided along with the types and synonyms for each of the species.

## KEY TO THE SPECIES

- a) Corolla-tube inflated at the base, geniculate above the swelling. ————— *A. macrosperma*
- a) Corolla-tube not inflated, straight.
- b) Corolla 7-10 (-13) mm long; stamens exerted; bracts, lobed lanceolate to obovate. — *A. bracteosa*
- b) Corolla, 5-6 mm long; stamens included; bracts, entire, lanceolate. ————— *A. parviflora*

1. *Ajuga macrosperma*. Wall. ex Benth., Wall. Pl. Asiat. Rar. 1:58 (1830); Dc. Prodr. XII: 599 (1848); Hook. f. Fl. Brit. Ind. IV: 704 (1885); Kudo in Mem. Fac. Sc. and Agr. II, 2:290 (1929); Muk. Rec. Bot. Surv. of India, XIV, 1:225 (1940).

*Synonym: Ajuga repens* Roxb. Fl. Ind. III:3 (1832) *A. geniculata* Maxim. Mol. Biol. XI: 821(1832) *A. genevensis* Hyata, Gen. Index Fl. Formos. 56. *A. genevensis* var. *pallescens* Matsum at Hyata, Enum. Pl. Formoso 193. (not of Maxim).

*Type:* In Indiae Orientalis montibus Panduanis at ad Taong Dong montem (Wall., 2035), Assam et Khasiya (Griffith, [1].

*Description:* Muk. Bot. Surv. of India, 225 (1940).

*Specimens Examined:* Rawalpindi: Raval River, Sham Singh, 1937 (raw); Pathankot, R. R. and I.D. Stewart, 1232 (K).

*Distribution:* Pakistan and Afghanistan.

2. *Ajuga bracteosa* Benth., in Wall. Plant. Asiat. Rar. 1:59(1830); Lab. et Sp. 699 (1832-1836); DC. Prodr. XII: 799 (1848); Hook. f. Fl. Brit. Ind. IV: 702 (1885);

Boiss. Fl. Orient. IV:799 (1879); Duthie, Fl. Upp. Gang. II: 120 (1903); Muk. Bot. Surv. of India, 224 (1940); Hedge, Notes from Roy. Bot. Gard. Edin. XXVII: No.2, 150 (1966).

*Synonym:* *Ajuga remota* Benth. In Wall. Plant. Asiat. Rar. 1:59 (1830).

*Type:* Nepal (Wall.Cat. Herb. Ind. (2032).

*Description:* Muk. Bot. Surv. of India, 224 (1940).

*Specimens examined:* Hazara: Haripur, Kazmi and A. Jehan, 4856 (PES); Saran range, Shinkiyari, Inayat, 4.6.99 (K); Kot Najibullah, Kazmi and A. Jehan, 4837 (PES); Jafri and Ali, 3291 (K); S.I. Ali, 872 (KUH); Abbottabad, S. Abedin, 2965 (KUH); Farooqi and Qaiser, 2629 (KUH); Abbottabad, Burt, 470, (E); R.R. S., 9068, (RAW); Siddiqi and Zafar Ali, 3805 (RAW); Mansehra, Qaiser and S. Abedin, 5831 (KUH); E and Y. Nasir, 8056 (RAW); Kurrum Valley, Afandi, 290; 328 (PES); Harsukh, 15461 (RAW); Chitral, M.A. Siddiqi, 27087, (RAW); Rumber, Bowes Lyons, 674 (E); Dir (On way to Timargarh), S. Abedin, 8178 (KUH); Harris, 16491 (E); Swat (Between Jehanabad and Jabba), Qaiser and Ghafoor, 4758 (KUH); Marghuzar, S. Abedin, 8515 (KUH); Mingora, Kazmi, 2438 (PES); Utror, Reching, 1854 (E); Jabba, Jennifer, 1767 (E); Buner, R. R.S., Nasir and Siddiqi, 1443 (RAW); Malakand, Jawar, Kazmi and A. Jehan, 4244 (PES); Khawazerkhela, Kazmi and A. Jehan, 5308 (PES); Budal, Kazmi and A. Jehan, 5228 (PES); Peshawar, Harold Deane, 9-1907 (K); Nowshera, Qaiser, 2629 (KUH); Bajour and Jehlum vy., Dr. Stewart, 1121/H (K); Chirat, A. Jehan, 4915 (PES); Kohat, Jennifer, 1528 (E); Kohat: Samana Hill, Kazmi and Salim, 3303 (PES); D. I. Khan, Kazmi, 1953 (PES); Jennifer, 1490 (E); Waziristan: Suleman Khel, Qazalbash, 00; 000; 0000 (IC); Lahore: Changa-Manga Forest, Kazmi, 3400; 3385 (PES); Sargodha, Qaiser and Ghafoor, 4506 (KUH); Islamabad; Shakarparian, Kazmi, 3065 (PES); Aitchison, 973 (K); Chatter, Townsend, 73/928 (K); Kashmir; Kotli, Y. Nasir, 4559 (RAW); Tanmarg; Polunin, 56/404 (E); Pahkgam, Ludlow and Sherrif, 7599 (E); Feroze Nullah, 1305 (E); Tulin, A. H. Munshi, 2038 (K).

*Distribution:* Pakistan and Afghanistan.

3. *Ajuga parviflora* Benth. In Wall. Plant. Asiat. Rar. 1:59 (1830); DC. Prodr. 12; 598 (1848); Hook. f. Fl. Brit. Ind. IV: 703 (1885); Collett, Fl. Sim. 407 (1902); Muk. Bot. Surv. of India, 225 (1940); Hedge, Notes from Roy. Bot. Gard. Edin, Vol XXVII, No.2 149 (1967).

*Type:* India, Kumaon, (Wallich, Cat. Herb. Ind. (2031).

*Description:* Muk. Bot. Surv. of India, 225 (1940).

*Specimens examined:* Chitral: Jambotai, 16493 (E); Swat; Mingora, S. I. Ali, 25982 (RAW); Shangla Rest

House, Lamond, 1728 (E); Hazara: Kagan vy.: Kamal Bhan, R. R. S., 1.7.1920 (K); Swargali, Kazmi, 4709 (PES); Nathiagali, Qaiser and Ghafoor, 2078 (KUH); Ali, 281 (KUH); Murree, Abid and Farooqi, 8.4.1970 (E); Jafri and Ali, 3043 (KUH); (K); Sultan-ul-Abedin, 2807; 7331 (KUH); Qaiser and S. Abedin, 5590 (KUH); Mall Road, (hilly area), 5602 (KUH); Gora Dakka, Duthie, 146081 (K); Kurrum vy. Ziran (near Parachinar), Qaiser and S. Abedin, 6035 (KUH); Kazmi, 1670 (PES); Kashmir; Keran, R. R. and I. D. Stewart, 17569 (RAW).

*Distribution:* Pakistan and Afghanistan.

## DISCUSSION

As already mentioned, *A. macrosperma* has been recorded for the first time from Pakistan. However for the present it has not been possible to include this species in the statistical studies on the basis of only one specimen available in PARC. Herbarium, Islamabad and another at Kew Herbarium, London.

A polygonal multidimensional graph (Fig. 1) has been included to demonstrate simultaneously the six following characters of 49 specimens: (1) size of the stamen, (2) length of the leaf, (3) breadth of the leaf, (4) length of the bract, (5) breadth of the bract and (6) the length of corolla (Fig. 1A).

The graph shows a definite break in the length of corolla and size of the stamens, while variation in the other four characters is continuous, and therefore, the separation of taxa is possible on the basis of corolla length and size of the stamens.

Histogram has also been included (Fig. 2). This shows the frequency distribution of the length of corolla. This histogram provides a more clear view of the results obtained from the above polygonal graph. It definitely represents two taxa, *A. bracteosa* Benth., with corolla length from 7 mm to 13 mm and *A. parviflora* Benth., with corolla length from 5 mm to 6 mm. Out of the 49 specimens 35 belong to the first species and 14 to the second (Table 1).

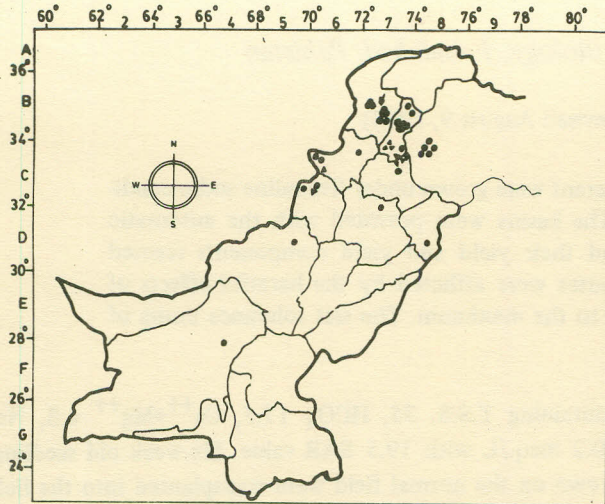
Observation of Hedge (2) in respect to the length of corolla are quite identical with this author's results if the averages of the variable lengths are taken but he does not mention the variation in *A. bracteosa* from 7-13 mm and in *A. parviflora* from 5-6 mm as is the case in the specimens from Pakistan.

As such the length of the corolla tube, stamens and the shape of the leaves are the important characters which distinguish the above specimens.

Table 1 showing the measurements of leaf (corolla bract and position of stamens of *Ajuga* spp).

Specimens		Position of Stamens in mm	Length of leaf in mm	Breadth of leaf in mm	Length of bract in mm	Breadth of bract in mm	Length corolla in mm
Azad Kashmir	4559	E	15-50	8-15	5-15	7-15	10
Azad Kashmir	3034	S.E.	35-80	8-30	15-30	5-25	8
Mansehra	5831	E			10-40	5-15	10
Azad Kashmir	8056	E	30-45	6-10	15-30	5-12	10
Balakot	3669	+	30-100	5-15	10-25	5-13	8
Kurramvy	323	E	25-50	8-12	8-20	5-10	10
Swat	4758	E	40-75	10-25	8-25	7-15	10
Timargarh	8178	E	40-	15-	8-15	6-10	10
Swat	8515	S.E.	35-60	12-15	8-25	5-13	8
Dir	7021	S.E.	30-100	7-30	15-30	5-15	7
Swat	2438	E	25-35	10-	10-25	6-15	10
Lahore	3385	S.E.	20-70	6-26	6-24	5-14	8
Fort Sandaman	1953	E	25-90	6-20	10-30	5-20	10
Waziristan	00	I	15-45	5-15	10-25	5-9	6
Waziristan	000	E	60-80	10-15	15-25	6-10	10
Waziristan	0000	E	90-	10-15	10-20	5-10	10
Abbottabad	2246	S.E.	30-80	7-23	15-20	6-10	8
Malakand	5308	S.E.	50-90	10-20	10-20	6-15	8
Dir	7020	S.E.	25-60	7-14	8-25	5-18	8
Kalat	3303	E	20-70	5-30	8-30	10-15	13
Hazara	4856	+	40-50	10-17	10-25	5-15	10
Kurramvy	290	S.E.	40-90	8-20	7-15	5-8	8
Abbottabad	2965	E	25-50	6-16	10-25	5-12	10
Nowshera	2629	E	25-75	5-15	8-20	4-10	10
Chakdara	6751	S.E.	30-35	6-14	10-25	6-12	6
Sargodha	4506	E	30-110	14-43	15-45	8-23	8
Balakot	2344	E	20-110	6-25	10-25	5-10	10
Hazara	4837	S.E.	40-60	20-	10-20	10-15	8
Malakand	5228	E			10-80	6-25	10
Abbottabad	2005	S.E.	10-15	6-10	20-35	10-15	10
Balakot	872	S.E.	80-	20-	10-35	6-14	8
Azad Kashmir	4983	E			10-30	5-15	8
Malakand	5244	E	120-	45-0	15-50	10-25	10
Ziran	1670	I	45-50	12-25	7-40	5-10	6
Hazara	3198	I	30-50	8-10	5-40	4-10	6
Murree	3145	I	20-65	8-15	8-30	3-10	5
Murree	3200	I	40-70	10-30	8-35	5-10	5
Baragali	4709	I	25-65	10-20	10-30	4-10	6
Murree	2807	I	40-100	15-35	6-30	6-18	5
Murree	3043	I	50-80	15-35	7-30	5-10	6
Nathiagali	2078	I	25-80	10-30	5-45	3-15	5
Nathiagali	281	I	30-60	8-10	5-20	4-10	5
Murree	5602	I	25-40	15-15	5-15	3-8	5
Murree	5590	I	90-120	10-20	8-70	5-18	5
Parachinar	6035	I	50-	15-	5-35	4-10	5
Murree	7331	I					

Looking into the regional distribution of the two species shown in Map 1 prepared with the help of herbarium sheets including those specimens examined at Edinburgh, Kew and Geneva, it appears that *A. bracteosa* is widely



Map. 1. Showing the geographical distribution of *A. Bracteosa* (●) & *A. Parviflora* (▲).

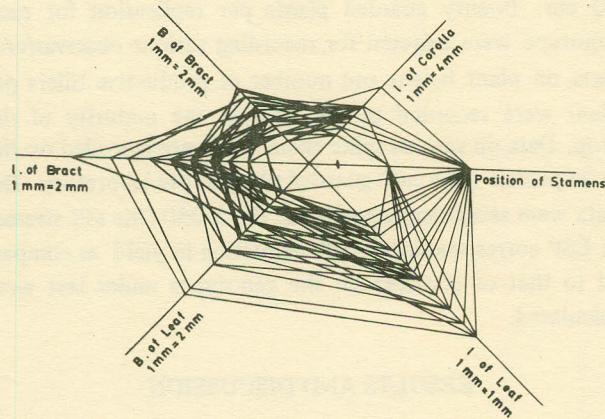


Fig. 1. Polygonal (Multidimension) graph of demonstrating simultaneously six characters of the 49 specimens bearing good flowers. (1) Length of leaf (2) Breadth of leaf (3) Length of corolla (4) Length of bract (5) Breadth of bract (6) Size of stamens.

distributed throughout the province of NWFP, northern parts of Punjab and western Kashmir while *A. parviflora* is confined to district Hazara only. As a matter of fact both species occur in Hazara side by side but still remain distinct from each other.

In the present paper an attempt has been made to clarify the distinguishing characters between the three species. During the course of this study, it was considered that *A. bracteosa* can further be classified into two sub-

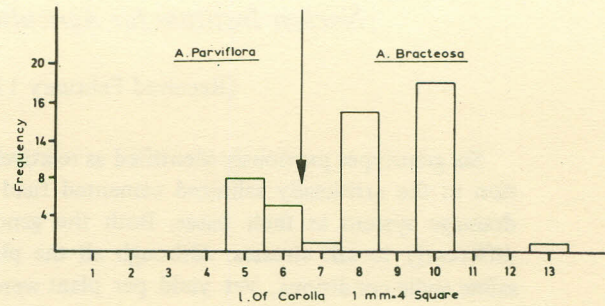


Fig. 2. Histogram showing the frequency distribution of length of corolla.

species but later on a visit to Edinburgh the author discussed this with Prof. P. Davis and abandoned the idea. A careful study of the specimens show that along with the main distinguishing characters such as the size of stamens and length of corolla and its shape, margin and the nature of bracts are also valuable for distinguishing the three species.

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