



New Associations of *Ajuga Turkestanica* (Regel) Briq. Distributed in Uzbekistan

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ABSTRACT:

This article presents geobotanical research conducted in the mountainous regions of the southern regions of Uzbekistan – Kashkadarya and Surkhandarya, aimed at determining the raw material reserves of *Ajuga turkestanica*. The research identified the participation of the studied species in plant communities, its position, community structure, and floristic composition. As a result, 11 new associations were identified within a single formation including *A. turkestanica*. The geolocation of the formations and associations of *A. turkestanica* in Uzbekistan was determined, and a schematic map was compiled.

Introduction: The distribution of *Ajuga turkestanica* (Regel) Briq. on the Earth's surface depends on the geographical distribution of soils within natural zones (Tojiboev, 2012). In Kashkadarya and Surkhandarya regions, geobotanical research was also conducted to determine the raw material reserves of *A. turkestanica*. The research results identified the participation of the studied species in plant cover, its role, the structure of the cover, floristic composition, raw material reserves, and geographical distribution.

Main part: As a result of the research, the formation of 11 new associations within a single formation of *A. turkestanica* was identified and described. Based on the obtained data, a schematic map

was compiled reflecting the occurrence of *A. turkestanica* in the plant cover of Southern Uzbekistan (Egamberdiev, 2000, 2002, 2003, 2022) (Table 1).

***Ajugeta turkestanicae* formation.** In the studied area, this formation occupies an area of 1300 hectares. They are mainly distributed in the areas from the villages of Jiydalisay and Derbend, Yukori and Pastki Derbend of Denav district to Sherobod district, and around the villages of Sayrob, Pasurxi, and Shurob, at altitudes of 845-2405 m above sea level on gravelly soils containing gypsum, reddish-brown variegated deposits (N38,124138 E66,584395). As a result of the research, we identified 10 new associations within this formation.

Table 1 Associations with *Ajuga turkestanica*

Formation Name	Association Name	Dry yield, kg/ha
<i>Ajuga turkestanica</i>	1. <i>Ajuga turkestanica</i> - <i>Poa bulbosa</i> - <i>Ehinops lipskyi</i> - <i>Festuca maritima</i> + <i>Artemisia tenusecta</i> + <i>Ziziphora tenuior</i>	156
	2. <i>Ajuga turkestanica</i> - <i>Ephedra ciliata</i> - <i>Onosma atrocyanea</i> + <i>Bromus scoparius</i>	125
	3. <i>Ajuga turkestanica</i> - <i>Artemisia tenuisecta</i> - <i>Phlomis spinidens</i> + <i>Carex pachystylis</i> + <i>Diarthron vesiculosum</i> + <i>Nigella integrifolia</i>	126
	4. <i>Ajuga turkestanica</i> - <i>Crambe cordifolia</i> - <i>Bromus tectorum</i> + <i>Inula grandis</i>	220
	5. <i>Artemisia tenusecta</i> - <i>Ajuga turkestanica</i> - <i>Poa bulbosa</i> + <i>Galium pamiralaicum</i> + <i>Sophora pachycarpa</i>	117
	6. <i>Artemisia tenusecta</i> - <i>Ajuga turkestanica</i> - <i>Salvia bucharica</i> + <i>Rosa kokanica</i> + <i>Taraxacum maracandicum</i> + <i>Koelpinia linearis</i>	106
	7. <i>Rosa kokanica</i> - <i>Ajuga turkestanica</i> + <i>Mixtoherbosa</i> .	161
	8. <i>Perovskia scrophulariifolia</i> - <i>Ajuga turkestanica</i> - <i>Eremurus baissunensis</i> + <i>Hordeum murinum</i> + <i>Bunium hissaricum</i>	141
	9. <i>Eremurus luteus</i> - <i>Ajuga turkestanica</i> - <i>Prangos pabularia</i> + <i>Taeniatherum caput-medusae</i> + <i>Koelpinia linearis</i>	113
	10. <i>Salvia bucharica</i> - <i>Ajuga turkestanica</i> - <i>Gallium pamiralaicum</i> + <i>G.spurium</i> .	162
	11. <i>Prangos pabularia</i> - <i>Artemisia tenuisecta</i> - <i>Ajuga turkestanica</i> + <i>Galium pamiralaicum</i> + <i>Prunus verrucosa</i> + <i>Poa bulbosa</i>	156

These include:

1. Association of *Ajuga turkestanica* - *Poa bulbosa* - *Ehinops lipskyi* - *Festuca maritima* + *Artemisia tenusecta* + *Ziziphora tenuior*. This association was identified and described on May 11, 2020, south of the village of Derbend (N38°13'24.99" E67°7'14.13"). The soil is reddish-colored variegated deposits, on a south-facing slope with a gradient of 12°. In this association, the plant cover consists of 22% *Ajuga*

turkestanica, 5% *Poa bulbosa*, and 3% *Ehinops lipskyi*. The life forms of the plants making up the association are distributed as follows: shrubs - 3, subshrubs - 1, perennial herbs - 8, biennial herbs - 1, annual herbs - 14. The total area of the association is 275 ha, with a yield of 156 kg/ha. The total plant cover in the association is 35% (Table 2, Figure 1).



Table 2

Floristic composition of the association

No.	Plant name	Height, cm	Density	Life form	Phenophase
1.	<i>Ajuga turkestanica</i> (Regel) Briq	35-40	sp ³	subshrub	g
2.	<i>Poa bulbosa</i> L.	10-15	sp ²	annual herb	my
3.	<i>Ziziphora tenuior</i> L.	15-20	sol	annual herb	tg
4.	<i>Garhadiolus papposus</i> Boiss. & Buhse	25-30	sp	annual herb	tg
5.	<i>Filago griffithii</i> (A.Gray) Andrés-Sánchez & Galbany	5-10	sp	annual herb	v
6.	<i>Artemisia tenuisecta</i> Nevski	45-50	sp ³	shrub	v
7.	<i>Nigella integrifolia</i> Regel.	15-20	sp	annual herb	v
8.	<i>Bromus sterileis</i> L.	20-25	sp ²	annual herb	mb
9.	<i>Rosa persica</i> Michaut ex Juss.	25-30	sp ¹	shrub	tg
10.	<i>Festuca maritima</i> L.	15-20	sp	annual herb	tg
11.	<i>Echinops lipskyi</i> Iljin	30-35	sol	perennial herb	tg
12.	<i>Prunus spinosissima</i> (Bunge) Franch.	150-180	sol	shrub	tg
13.	<i>Festuca orientalis</i> (Boiss.) B.Fedtsch.	5-10	sol	annual herb	g
14.	<i>Callipeltis cucullaris</i> (L.) DC.	15-20	sol	annual herb	mb
15.	<i>Rochelia cardiosepala</i> Bunge	20-25	sol	annual herb	mb
16.	<i>Bromus tectorum</i> L.	15-20	sol	annual herb	tg
17.	<i>Euphorbia franchetii</i> B.Fedtsch.	5-10	sol	annual herb	tg
18.	<i>Allium griffithianum</i> Boiss.	15-20	sol	perennial herb	tg
19.	<i>Allium verticillatum</i> Regel	20-25	sol	perennial herb	tg
20.	<i>Allium gypsaceum</i> Popov Vved.	25-30	sol	perennial herb	mb
21.	<i>Roemeria refracta</i> (Stev.) DC.	35-40	sol	annual herb	mb
22.	<i>Minuartia hamata</i> (Hausskn.) Mattf.	5-10	sol	annual herb	tg
23.	<i>Diarthron vesiculosum</i> (Fisch. & C.A.Mey) C.A.Mey.	15-20	sol	annual herb	mb
24.	<i>Astragalus rumpens</i> Meff.	35-40	sol	perennial herb	tg
25.	<i>Cousinia rotundifolia</i> C.Winkl.	40-45	sol	perennial herb	tg
26.	<i>Achillea millefolium</i> L.	25-30	ol	perennial herb	g



Note: v - vegetation, g - flowering (initial flowering), tg - full flowering (peak flowering), mb - beginning of fruiting, my - fruit ripening.

1: Recorded Locations:

№1 12.05.2020. Located south of Derbend village, Baysun district.

№2 13.05.2020. West side of Derbend village, Machoy village.

№3 14.05.2020. Sunset side of Derbend village, around the Derbend post.

№4 15.05.2020. Around Derbend village, approximately 3 km north of Sayrob village on the Tashkent-Termez road.

№5 16.05.2020. 18 km north of Derbend village towards Baysun city, on both the left and right sides of the road.



Figure 1. *Ajuga turkestanica* - *Poa bulbosa* - *Ehinops lipskyi* - *Festuca maritima* + *Artemisia tenusecta* + *Ziziphora tenuior* association.

2. *Ajuga turkestanica* - *Ephedra ciliata* - *Onosma atrocyanea* + *Bromus scoparius* association. This association was identified on April 12, 2020, around the village of Sayrob (N38.35924 E66.581688). The soil is reddish sandy, slope is 33°, northern aspect. In the association, the plant cover is composed of *Ajuga turkestanica* - 27%, *Ephedra ciliata* - 6%, *Poa bulbosa* -

5%. The floristic composition of the association consists of plants in the following life forms: shrub - 1, semi-shrub - 1, perennial herbs - 5, biennial - 1, annual herbs - 13. The total area of the association is 18 hectares, and the productivity is 125 kg per hectare. The plant cover in the association is 52% (Table 3, Figure 2).

Table 3. Floristic composition of the association

No.	Plant name	Height, cm	Density	Life form	Phenophase
1.	<i>Ajuga turkestanica</i> (Regel) Briq.	30-35	sp ²	subshrub	v
2.	<i>Ephedra ciliata</i> Fisch. & C.A.Mey.	60-65	sp ³	perennial herb	g
3.	<i>Bromus scoparius</i> Guss	15-20	sp ²	annual herb	tg
4.	<i>Bromus tectorum</i> L.	20-25	sp ¹	annual herb	tg
5.	<i>Onosma atrocyanea</i> Franch.	30-35	sp ¹	perennial herb	mb
6.	<i>Poa bulbosa</i> L.	15-20	sp ¹	annual herb	mb
7.	<i>Cousinia rotundifolia</i> C.Winkl.	35-40	sol	perennial herb	mb
8.	<i>Trigonella grandiflora</i> Bunge	15-20	sol	annual herb	g
9.	<i>Nigella integrifolia</i> Regel.	10-20	sol	annual herb	tg
10.	<i>Noccaea perfoliata</i> (L.) Al-Shehbaz	10-20	sol	annual herb	my



11.	<i>Ranunculus testiculatus</i> Crantz	5-10	sol	annual herb	my
12.	<i>Astragalus rumpens</i> Meffert	30-35	sol	biennial herb	tg
13.	<i>Allium griffithianum</i> Boiss.	15-20	sol	perennial herb	tg
14.	<i>Festuca maritima</i> L.	20-25	sol	annual herb	mb
15.	<i>Artemisia turanica</i> Krasch.	35-40	sol	shrub	v
16.	<i>Valeriana ficariifolia</i> Boiss.	15-20	sol	annual herb	mb
17.	<i>Roemeria refracta</i> DC.	25-30	sol	annual herb	g
18.	<i>Koelpinia linearis</i> Pall.	15-20	sol	annual herb	g
19.	<i>Holosteum umbellatum</i> L.	15-20	sol	annual herb	my
20.	<i>Euphorbia franchetii</i> B.Fedtsch.	5-10	sol	annual herb	mb

Note 2: Recorded Locations:

№6 12.04.2020. Northern part, 3 km from Sayrob village, around Derbend village on the Tashkent – Termez road.

№7 13.04.2020. Western part of Sayrob village.

№8 14.04.2020. West side of Sayrob village, around the Sherabad River.

№9 15.05.2020. Southern side of Panjob village, around the Sherabad River.



Figure 2. *Ajuga turkestanica* - *Ephedra ciliata* - *Onosma atrocyanea* + *Bromus scoparius* association.

3. *Ajuga turkestanica* - *Artemisia tenuisecta* - *Phlomis spinidens* + *Carex pachystylis* + *Diarthron vesiculosum* + *Nigella integrifolia* association. This association was identified on May 28, 2020, around the village of Gaza in the Baysun district, on a brown soil with a slope of 17° facing north (N38.103879 E67.131212). In the association, the plant cover consists of 14% - *Ajuga turkestanica*, 9% - *Artemisia tenuisecta*,

8% - *Phlomis spinidens*. The plants participating in the association are distributed according to their life forms as follows: shrub - 2, semi-shrub - 1, perennial herbs - 6, annual herbs - 14. The total area of the association is 29 hectares, and the productivity is 126 kg per hectare. Plants cover 45% of the soil surface in the association (Table 4, Figure 3).

Table 4. Floristic composition of the association

No.	Plant name	Height, cm	Density	Life form	Phenophase
1.	<i>Ajuga turkestanica</i> (Regel) Briq.	30-35	sp ²	subshrub	v
2.	<i>Phlomis spinidens</i> Nevski	35-40	sp ³	perennial herb	g



3.	<i>Artemisia tenuisecta</i> Nevski	45-50	sp ³	shrub	v
4.	<i>Carex pachystylis</i> J.Gay	15-20	sp ²	perennial herb	mb
5.	<i>Diarthron vesiculosum</i> (Fisch. & C.A.Mey. ex Kar. & Kir.) C.A.Mey.	25-30	sp ¹	annual herb	mb
6.	<i>Nigella integrifolia</i> Regel.	15-20	sp ¹	annual herb	tg
7.	<i>Zoegea baldshuanica</i> C.Winkl.	10-15	sp ¹	annual herb	mb
8.	<i>Poa bulbosa</i> L.	15-20	sp	annual herb	v
9.	<i>Valeriana ficariifolia</i> Boiss.	10-15	sp	annual herb	tg
10.	<i>Echinops lipskyi</i> Iljin	25-30	sol	perennial herb	tg
11.	<i>Cousinia rotundifolia</i> C.Winkl.	35-40	sol	perennial herb	tg
12.	<i>Ziziphora tenuior</i> L.	10-15	sol	annual herb	tg
13.	<i>Astragalus sesamoides</i> Boiss.	5-10	sol	annual herb	mb
14.	<i>Acanthophyllum elatius</i> Bunge	25-30	sol	annual herb	tg
15.	<i>Veronica argute-serrata</i> Regel & Schmalh.	15-20	sol	annual herb	mb
16.	<i>Psammogeton capillifolius</i> (Regel va Schmalh.) Musaviy, Mozaff. & Zarre	10-15	sol	annual herb	tg
17.	<i>Bromus oxyodon</i> Schrenk	15-20	sol	annual herb	mb
18.	<i>Strigosella africana</i> (L.) Botsch.	25-30	sol	annual herb	tg
19.	<i>Holosteum umbellatum</i> L.	15-20	sol	annual herb	my
20.	<i>Festuca maritima</i> L.	15-20	sol	annual herb	mb
21.	<i>Allium griffithianum</i> Boiss.	15-20	sol	perennial herb	tg
22.	<i>Erodium cicutarium</i> (L.) L'Hér.	35-40	sol	annual herb	mb

Note 3: Recorded Locations:

№10 28.05.2020. Around Gaza village in the Baysun district.

№11 29.05.2020. Southern side of Gaza village, around a large ravine.

№12 30.05.2020. On the southern side of the road going from Gaza village towards Denav district.



Figure 3. *Ajuga turkestanica* - *Artemisia tenuisecta* - *Phlomis spinidens* + *Carex pachystylis* + *Diarthron vesiculosum* + *Nigella integrifolia* plant association.



4. *Ajuga turkestanica* - *Crambe cordifolia* - *Bromus tectorum* + *Inula grandis* plant association. This association was identified on May 28, 2022, near the village of Jyudalisay in the Denav district, on a brown soil with a slope of 23° facing northeast (N38.135126 E67.313881). Within the association, the plant cover consists of 15% - *Ajuga turkestanica*, 9% - *Crambe cordifolia*, 5% - *Bromus tectorum*, 4% - *Inula grandis*.

The plants participating in this association are distributed according to their life forms as follows: shrub - 3, subshrub - 1, perennial herbs - 15, annual herbs - 13. The total area of the association is 96 hectares, with a productivity of 220 kg per hectare. Plants cover 45% of the soil surface within this association (Table 5, Figure 4).

Table 5. Floristic composition of the association

No.	Plant Name	Height, cm	Density	Life Form	Phenophase
1.	<i>Ajuga turkestanica</i> (Regel) Briq.	35-40	sp ²	subshrub	g
2.	<i>Crambe cordifolia</i> (Boiss.) Jafri	35-40	sp ³	perennial herb	v
3.	<i>Bromus tectorum</i> L.	20-25	sp ²	annual herb	my
4.	<i>B. microstadyis</i> L.	15-20	sp ²	perennial herb	my
5.	<i>Andrachne rotundifoliya</i>	40-45	sp ²	perennial herb	v
6.	<i>Diarthron vesiculosum</i> (Fisch. & C.A.Mey. ex Kar. & Kir.) C.A.Mey.	20-25	sp ¹	annual herb	g
7.	<i>Carex pachystylis</i> J.Gay	15-20	sp ¹	perennial herb	v
8.	<i>Nigella integrifolia</i> Regel.	15-20	sp ¹	annual herb	v
9.	<i>Zoegea baldshuanica</i> C.Winkl.	10-15	sp ¹	annual herb	v
10.	<i>Poa bulbosa</i> L.	15-20	sp	annual herb	v
11.	<i>Valeriana ficariifolia</i> Boiss.	15-20	sp	perennial herb	v
12.	<i>Taraxacum maracandicum</i> Kovalevsk.	15-20	sol	perennial herb	mb
13.	<i>Tulipa rosea</i> Vved.	10-15	sol	perennial herb	mb
14.	<i>Haloxylon griffithii</i> (Moq.) Boiss.	25-35	sol	perennial herb	tg
15.	<i>Inula grandis</i> Schrenk ex Fisch. & A.Mey.	35-40	sol	perennial herb	mb
16.	<i>Xylosalsola richteri</i> (Moq.) Akhani & Roalson	40-45	sol	shrub	v
17.	<i>Capparis spinosa</i> L.	20-25	sol	perennial herb	tg
18.	<i>Echinops lipskyi</i> Iljin	20-25	sol	perennial herb	tg
19.	<i>Cousinia rotundifolia</i> C.Winkl.	30-35	sol	perennial herb	tg
20.	<i>Zizihpora tenuior</i> L.	10-15	sol	annual herb	tg
21.	<i>Astragalus sesamoides</i> Boiss.	5-10	sol	annual herb	mb
22.	<i>Acanthophyllum elatius</i> Bunge	20-25	sol	annual herb	tg



23.	<i>Veronica argute-serrata</i> Regel & Schmalh.	15-20	sol	annual herb	mb
24.	<i>Psammogeton capillifolius</i> (Regel va Schmalh.) Musaviy, Mozaff. & Zarre	15-20	sol	annual herb	tg
25.	<i>Strigosella africana</i> (L.) Botsch.	20-25	sol	perennial herb	tg
26.	<i>Holosteum umbellatum</i>	10-15	sol	annual herb	my
27.	<i>Festuca maritima</i> L.	10-15	sol	annual herb	mb
28.	<i>Allium griffithianum</i> Boiss.	15-20	sol	perennial herb	tg
29.	<i>Erodium cicutarium</i> (L.) L'Hér.	30-35	sol	annual herb	mb
30.	<i>Eremurus baissunensis</i> O. Fedtsch.	35-40	sol	perennial herb	g
31.	<i>Prunus spinosissima</i> (Bunge) Franch.	150-180	sol	shrub	tg

Note 4: Recorded Locations:

№13. 29.05.2022. In the Burijar stream, on the northern side of Pulhakim village, Baysun district.

№14. 30.05.2022. Eastern side of Jiydalisay village, Denav district.

№15. 01.06.2022. Southwestern side of Jiydalisay village.

№16. 02.06.2022. On the right side of the Tulkiysay valley, Jiydalisay village.



Figure 4. *Ajuga turkestanica* - *Crambe cordifolia* - *Bromus tectorum* + *Inula grandis* plant association.

5. *Artemisia tenuisecta* - *Ajuga turkestanica* - *Poa bulbosa* + *Galium pamiralaicum* + *Sophora pachycarpa* plant association. This association is located south of Chulbair village, with a red sandy soil and a 19° north-facing slope (N38.252855 E66.595753), and was observed on June 26, 2020. In this association, the plant cover consists of 14% *Artemisia tenuisecta*, 11% *Ajuga*

turkestanica, and 9% *Poa bulbosa*. The association includes trees - 1, shrubs - 3, subshrubs - 1, perennial herbs - 12, biennial herbs - 1, and annual herbs - 14 species. The total area of the association is 42 hectares, with a productivity of 162 kg per hectare. Plants cover 48% of the soil surface (Table 6, Figure 5).



Table 6. Floristic composition of the association

No.	Plant name	Height, cm	Density	Life form	Phenophase
1.	<i>Artemisia tenuisecta</i> Nevski	40-50	sp ²	shrub	v
2.	<i>Ajuga turkestanica</i> (Regel) Briq.	30-45	sp ³	subshrub	g
3.	<i>Galium pamiralaicum</i> Pobed.	30-35	sp ²	perennial herb	v
4.	<i>Poa bulbosa</i> L.	10-15	sp ²	annual herb	mb
5.	<i>Sophora pachycarpa</i> Schrenk ex C.A.Mey.	30-35	sp ²	perennial herb	g
6.	<i>Nigella integrifolia</i> Regel.	10-15	sp ¹	annual herb	mb
7.	<i>Zoegea baldshuanica</i> C.Winkl.	10-15	sp ¹	annual herb	mb
8.	<i>Bromus tectorum</i> L.	20-25	sp ¹	annual herb	tg
9.	<i>Alhagi pseudalhagi</i> (M. Bieb.) Desv. ex Wangerin	25-30	sp ¹	perennial herb	mb
10.	<i>Galium spurium</i> L.	25-30	sp	annual herb	mb
11.	<i>Taeniatherum caput-medusae</i> (L.) Nevski	15-20	sp	annual herb	tg
12.	<i>Arenaria serpyllifolia</i> Bourg. ex Willk. & Lange	15-20	sp	biennial herb	g
13.	<i>Festuca myuros</i> L.	15-20	sp	annual herb	mb
14.	<i>Roemeria refracta</i> DC.	25-30	sp	annual herb	g
15.	<i>Rochelia cardiosepala</i> Bunge	15-20	sol	annual herb	mb
16.	<i>Euphorbia franchetii</i> B.Fedtsch.	10-15	sol	annual herb	g
17.	<i>Koelpinia linearis</i> Pall.	15-20	sol	annual herb	v
18.	<i>Trigonella aristata</i> Vassilcz.	15-20	sol	annual herb	g
19.	<i>Minuartia hamata</i> (Hauskn.) Mattf.	5-10	sol	annual herb	g
20.	<i>Cerastium dichotomum</i> L.	10-15	sol	perennial herb	mb
21.	<i>Allium griffithianum</i> Boiss.	15-20	sol	perennial herb	mb
22.	<i>Drepanocaryum sewerzowii</i> (Regel) Pojark.	35-40	sol	perennial herb	tg
23.	<i>Rosa persica</i> Michaut ex Juss.	20-35	sol	shrub	tg
24.	<i>Prunus divaricate</i> Ledeb.	320-380	sol	tree	tg
25.	<i>Cousinia rotundifolia</i> C.Winkl.	30-35	sol	perennial herb	g
26.	<i>Ziziphora tenuior</i> L.	10-15	sol	annual herb	mb
27.	<i>Noccaea perfoliata</i> (L.) Al-Shehbaz	10-15	sol	perennial herb	tg
28.	<i>Taraxacum maracandicum</i> Kovalevsk.	15-20	sol	perennial herb	tg



29.	<i>Gentiana olivieri</i> Griseb.	25-30	sol	perennial herb	tg
30.	<i>Astragalus rumpens</i> Meffert	30-35	sol	perennial herb	tg
31.	<i>Pseudopodospermum hissaricum</i> (C. Winkl.) Zaika, Sukhor. & N.Kilian	40-45	sol	perennial herb	mb

Note 5: Recorded Locations:

№17. 26.06.2020. Southern part of Derbend village, Baysun district, on both the right and left sides of the Machay River.

№18. 27.06.2020. Eastern side of Chulbair village, Dehkanabad district.

№19. 28.06.2020. Southeast of Chulbair village, 1 km from the Kichikuradarya [river].

№20. 29.06.2020. Around Bocharbog village, Dehkanabad district, on both the right and left sides of the road, less than 6 km from Chulbair village.



Figure 5. *Artemisia tenuisecta* - *Ajuga turkestanica* - *Poa bulbosa* + *Galium pamiralaicum* + *Sophora pachycarpa* plant association.

6. *Artemisia tenuisecta* - *Ajuga turkestanica* - *Salvia bucharica* + *Rosa kokanica* + *Taraxacum maracandicum* + *Koelpinia linearis* plant association. This association is located in the northeastern part of Chashmiron village, Dehkanabad district, on calcareous and gypsiferous soil, with a 72° south-facing slope (N38.223880 E66.555393), and was identified on June 14, 2021. In this association, the plant cover consists of

18% *Artemisia tenuisecta*, 12% *Ajuga turkestanica*, and 4% *Salvia bucharica*. Based on their life form, the association includes: trees - 1, shrubs - 3, subshrubs - 1, perennial herbs - 10, and annual herbs - 6 species. The total area of the association is 49 hectares, with a productivity of 106 kg per hectare. The projective cover of plants is 40% (Table 7, Figure 6).

Table 7. Floristic composition of the association

No.	Plant name	Height, cm	Density	Life form	Phenophase
1.	<i>Artemisia tenuisecta</i> Nevski	35-45	sp ²	shrub	g



2.	<i>Ajuga turkestanica</i> (Regel) Briq.	40-45	sp ³	subshrub	tg
3.	<i>Salvia bucharica</i> Popov	45-50	sp ²	perennial herb	v
4.	<i>Eremurus baissunensis</i> O. Fedtsch	60-65	sp ¹	perennial herb	g
5.	<i>Ziziphora tenuior</i> L.	15-20	sp ¹	annual herb	g
6.	<i>Garhadiolus papposus</i> Boiss. & Buhse	25-30	sp ¹	annual herb	g
7.	<i>Poa bulbosa</i> L.	15-20	sp ¹	annual herb	tg
8.	<i>Rosa kokanica</i> (Regel) Regel ex Juz.	70-95	sp	shrub	tg
9.	<i>Rosa persica</i> Michaut ex Juss.	20-35	sp	shrub	tg
10.	<i>Koelpinia linearis</i> Pall.	15-20	sp	annual herb	g
11.	<i>Centaurea squarrosa</i> Willd.	25-35	sp	perennial herb	tg
12.	<i>Cousinia rotundifolia</i> C.Winkl.	20-25	sol	perennial herb	tg
13.	<i>Taraxacum maracandicum</i> Kovalevsk.	15-20	sol	perennial herb	tg
14.	<i>Astragalus maverranagri</i> Popov	40-45	sol	perennial herb	mb
15.	<i>Allium griffithianum</i> Boiss.	15-20	sol	perennial herb	v
16.	<i>Onosma dichroanta</i> Boiss.	25-30	sol	perennial herb	v
17.	<i>Veronica argute-serrata</i> Regel & Schmalh.	15-20	sol	annual herb	tg
18.	<i>Ferula tadshikorum</i> Pimenov	100-110	sol	perennial herb	tg
19.	<i>Callipeltis cucullaris</i> (L.) DC.	15-20	sol	annual herb	tg
20.	<i>Achillea santolinoides</i> K.Koch.	25-35	sol	perennial herb	tg
21.	<i>Prunus spinosissima</i> (Bunge) Franch.	190-210	sol	tree	tg

Note 6: Recorded Locations:

№21. 14.06.2020. On the right and left sides of Chashmiron village, Dehkanabad district.

№22. 15.06.2020. Southern side of Chashmiron village, Dehkanabad district, at an altitude of 1300 meters above sea level.

№23. 16.06.2020. Southeast of Chulbair village, 1 km from the Kichikuradarya [river].

№24. 17.06.2020. Around Bocharbog village, Dehkanabad district, on both the right and left sides of the road, less than 6 km from Chulbair village.



Figure 6. *Artemisia tenuisecta* - *Ajuga turkestanica* - *Salvia bucharica* + *Rosa kokanica* + *Taraxacum maracandicum* + *Koelpinia linearis* association where *A. turkestanica* occurs.



7. *Rosa kokanica* - *Ajuga turkestanica* + Mixtoherbosa [Mixed Herb] association. This association was recorded on May 28, 2020, in the eastern part of Yonakishlok village, on calcareous and gypsiferous soil, with a 32° northeast-facing slope (N38.252065 E66.595897). In this association, the plant cover consists of 16% *Rosa kokanica*, 12% *Ajuga*

turkestanica, 4% *Acer tataricum*, and 3% *Ephedra intermedia*. The floristic composition of the association is made up of plants from the following life forms: trees - 3, shrubs - 2, subshrubs - 4, perennial herbs - 13, and annual herbs - 11. The total area of the association is 28 hectares, the productivity is 168 kg per hectare, and plants cover 45% of the soil surface (Table 8, Figure 7).

Table 8. Floristic composition of the association

No.	Plant Name	Height, cm	Density	Life Form	Phenophase
1.	<i>Rosa kokanica</i> (Regel) Regel ex Juz.	70-110	sp ³	shrub	v
2.	<i>Ajuga turkestanica</i> (Regel) Briq	35-40	sp ²	subshrub	v
3.	<i>Euphorbia franchetii</i> B.Fedtsch.	10-15	sp ¹	annual herb	v
4.	<i>Ephedra intermedia</i> Schrenk & C.A.Mey.	95-110	sp	shrub	g
5.	<i>Galiumpamiroalaicum</i> Pobed.	30-35	sp	perennial herb	g
6.	<i>Nigella integrifolia</i> Regel.	10-15	sp	annual herb	g
7.	<i>Taeniatherum caputmedusae</i> (L.) Nevski	15-20	sp	annual herb	mb
8.	<i>Biebersteinia multifida</i> DC.	25-30	sp	perennial herb	g
9.	<i>Artemisia tenuisecta</i> Nevski	30-35	sp	ярымбута	tg
10.	<i>Poa bulbosa</i> L.	15-20	sp	annual herb	mb
11.	<i>Acer tataricum</i> (Regel & Herder)	150-210	sp	tree	g
12.	<i>Sophora pachycarpa</i> C.A.Mey.	30-35	sp	perennial herb	v
13.	<i>Festuca myuros</i> (L.) C.C.Gmel.	15-20	sp	annual herb	g
14.	<i>Inula grandis</i> Schrenk ex Fisch. & A.Mey.	50-60	sol	perennial herb	mb
15.	<i>Bromus tectorum</i> L.	20-25	sol	annual herb	mb
16.	<i>Alhagi pseudalhagi</i> (M. Bieb.) Desv. ex Wangerin	25-30	sol	perennial herb	mb
17.	<i>Roemeria refracta</i> DC.	25-30	sol	annual herb	mb
18.	<i>Koelpinia linearis</i> Pall.	15-20	sol	annual herb	tg
19.	<i>Trigonella africana</i> Vassilez.	15-20	sol	annual herb	mb
20.	<i>Alyssum szovitsianum</i> Fisch. & CAMEy.	10-20	sol	annual herb	g
21.	<i>Cerastium dichotomum</i> L.	15-20	sol	annual herb	mb
22.	<i>Taraxacum maracandicum</i> Kovalevsk.	20-25	sol	perennial herb	g
23.	<i>Gentiana olivieri</i> Griseb.	25-30	sol	perennial herb	g



24.	<i>Astragalus rumpens</i> Meffert.	30-35	sol	perennial herb	g
25.	<i>Fritillaria bucharica</i> Regel.	15-20	sol	perennial herb	g
26.	<i>Lonicera nummulariifolia</i> Jaub. & Spach	133-142	sol	shrub	g
27.	<i>Acantholimon hissaricum</i> Linsz.	30-35	sol	perennial herb	g
28.	<i>Phlomis spinidens</i> Nevski	25-30	sol	subshrub	mb
29.	<i>Ziziphora pamiralaica</i> Juz.	10-15	sol	subshrub	tg
30.	<i>Eremurus turkestanicus</i> Regel.	60-65	sol	perennial herb	tg
31.	<i>Noccaea perfoliata</i> (L.) Al-Shehbaz	10-15	sol	perennial herb	tg
32.	<i>Verbascum songaricum</i> Schrenk ex Fisch.	15-20	sol	perennial herb	mb

Note 6: Recorded Locations:

№25 28.05.2020. On the right and left sides of Yonakishlok [village], Dehkanabad district, and at 1250 meters above sea level in the right tributary of the Kichikuradarya [river].

№26 28.05.2020. East-southeast of Chashmiron village, Dehkanabad district, at an altitude of 1200 meters above sea level.

№27 28.05.2020. Southeast of Turk village, Dehkanabad district, around the Kichikuradarya [river].

№28 28.05.2020. Around Dugoba village, Dehkanabad district, on the right and left sides of the main road.



Figure 7. *Rosa kokanica* - *Ajuga turkestanica* + *Mixtoherbosa* [Mixed Herb] association where *A. turkestanica* occurs.

8. *Perovskia scrophulariifolia* - *Ajuga turkestanica* - *Eremurus baissunensis* + *Hordeum murinum* + *Bunium hissaricum* plant association. This association was studied near Dugoba village, with a red sandy soil and a 33° west-facing slope (N38.19150 E38.19150) on June 4, 2020. In this association, the plant cover consists of 18% *Perovskia scrophulariifolia*, 16%

Ajuga turkestanica, and 7% *Eremurus baissunensis*. The association includes shrubs - 2, subshrubs - 3, perennial herbs - 8, and annual herbs - 24 species. The total area of the association is 82 hectares, with a productivity of 141 kg per hectare. Plants cover 55% of the soil surface (Table 9, Figure 8).

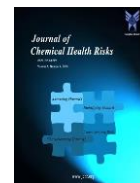


Table 9. Floristic composition of the association

No.	Plant name	Height, cm	Density	Life form	Phenophase
1.	<i>Perovskia scrophulariifolia</i> (Bunge) B.T.Drew	50-70	sp ²	subshrub	g
2.	<i>Ajuga turkestanica</i> (Regel) Briq.	35-45	sp ³	subshrub	tg
3.	<i>Sophora pachycarpa</i> Schrenk ex C.A.Mey.	30-35	sp ³	perennial herb	g
4.	<i>Elwendia hissarica</i> (Korovin) Pimenov	30-35	sp ³	annual herb	tg
5.	<i>Bromus pumilio</i> (Trin.) P.M.Sm.	15-20	sp ³	annual herb	mb
6.	<i>Poa bulbosa</i> L.	15-20	sp ³	annual herb	mb
7.	<i>Eremurus baissunensis</i> O. Fedtsch	55-65	sp	perennial herb	g
8.	<i>Marrubium anizodon</i> K.Koch	45-50	sp	perennial herb	mb
9.	<i>Hordeum murinum</i> L.	25-30	sp	annual herb	v
10.	<i>Garhadiolus papposus</i> Boiss.	25-30	sp	annual herb	tg
11.	<i>Koelpinia linearis</i> Pall.	15-20	sp	annual herb	g
12.	<i>Galium pamiroalaicum</i> Pobed.	25-30	sp	perennial herb	v
13.	<i>Filago pyramidata</i> L.	15-20	sp	annual herb	mb
14.	<i>Bromus oxyodon</i> Schrenk	25-30	sp	annual herb	mb
15.	<i>Bromus scoparius</i> L.	15-20	sp	annual herb	v
16.	<i>Triticum compactum</i> (Host)	35-40	sol	annual herb	tg
17.	<i>Capparis spinosa</i> (Willd.) Fici	25-30	sol	shrub	mb
18.	<i>Alhagi pseudalhagi</i> Desv. ex Wangerin	25-35	sol	perennial herb	my
19.	<i>Astragalus sesamoides</i> Boiss.	20-25	sol	perennial herb	mb
20.	<i>Ziziphora tenuior</i> L.	15-20	sol	annual herb	mb
21.	<i>Euphorbia franchetii</i> B. Fedtsch.	10-15	sol	annual herb	mb
22.	<i>Noccaea perfoliata</i> (L.) Al-Shehbaz	15-20	sol	perennial herb	mb
23.	<i>Lepidium ferganense</i> Korch.	40-45	sol	perennial herb	mb
24.	<i>Bromus sterilis</i> L.	35-40	sol	annual herb	mb
25.	<i>Drepanocaryum sewerzowii</i> (Regel) Pojark.	35-40	sol	annual herb	tg
26.	<i>Trigonella grandiflora</i> Bunge	15-20	sol	annual herb	g
27.	<i>Cerastium dichotomum</i> L.	15-20	sol	annual herb	tg
28.	<i>Veronica argute-serrata</i> Regel & Schmalh.	15-20	sol	annual herb	mb
29.	<i>Haplophyllum bucharicum</i> Litv.	25-35	sol	subshrub	tg



30.	<i>Ixiolirion tataricum</i> (Pall.) Schult. & Schult.f.	35-40	sol	perennial herb	tg
31.	<i>Nonea melanocarpa</i> Boiss.	25-30	sol	annual herb	tg
32.	<i>Polygonum biaristatum</i> Aitch. & Hemsl.	5-10	sol	shrub	tg
33.	<i>Adonis turkestanica</i> (Korsh.) Adolf	15-20	sol	perennial herb	mb
34.	<i>Rochelia cardiosepala</i> Bunge	15-20	sol	annual herb	mb
35.	<i>Minuartia hamata</i> (Hausskn.) Mattf.	5-10	sol	annual herb	mb
36.	<i>Nigella bucharica</i> Schipcz.	15-20	sol	annual herb	tg

Note 8: Recorded Locations:

№29 4.06.2020. Around Dugoba village, Baysun district, for a length of 1 km, at 1300 meters above sea level.

№30 28.05.2020. Western side of Upper Derbend village, Baysun district, at an altitude of 1200 meters above sea level.



Figure 8. *Perovskia scrophulariifolia* - *Ajuga turkestanica* - *Eremurus baissunensis* + *Hordeum murinum* + *Bunium hissaricum* association where *A. turkestanica* occurs.

9. *Eremurus luteus* - *Ajuga turkestanica* - *Prangos pabularia* + *Taeniatherum caput-medusae* + *Koelpinia linearis* plant association. This association was identified on May 14, 2021, in Pasurkhisoy village, on rocky-gravelly, reddish soil, with a 27° south-facing slope (N38.111679 E67.2269). In this association, the plant cover consists of 23% *Eremurus luteus*, 17% *Ajuga turkestanica*, and 6% *Prangos pabularia*. The plants

participating in the identified diverse herbaceous - *Ajuga* - Baysun Shirach association, based on their life form, include: shrubs - 1, subshrubs - 5, perennial herbs - 12, and annual herbs - 16 species. The total area of the association is 53 hectares, the productivity is 113 kg per hectare, and the projective cover of plants is 65% (Table 10, Figure 9).

Table 10. Floristic composition of the association

No.	Plant name	Height, cm	Density	Life form	Phenophase
1.	<i>Eremurus luteus</i> O. Fedtsch	45-75	sp ³	perennial herb	tg
2.	<i>Ajuga turkestanica</i> (Regel) Briq.	35-40	sp ²	subshrub	mb



3.	<i>Prangos pabularia</i> Lindl.	50-55	sp ¹	perennial herb	v
4.	<i>Artemisia tenuisecta</i> Nevski	45-50	sp	subshrub	tg
5.	<i>Poa bulbosa</i> Steud.	15-20	sp	annual herb	g
6.	<i>Taeniatherum caput-medusae</i> (L.) Nevski	25-30	sp	annual herb	mb
7.	<i>Bromus moeszii</i> Pénzes	25-30	sp	annual herb	tg
8.	<i>Filago arvensis</i> L.	15-20	sp	annual herb	mb
9.	<i>Salvia bucharica</i> Popov.	50-55	sol	subshrub	mb
10.	<i>Callipeltis cucullaris</i> (L.) DC.	15-20	sol	annual herb	tg
11.	<i>Koelpinia linearis</i> Pall.	15-20	sol	annual herb	mb
12.	<i>Anisum vulgare</i> Gaerth.	30-35	sol	annual herb	mb
13.	<i>Ziziphora tenuior</i> L.	15-20	sol	annual herb	tg
14.	<i>Valerianaella coronate</i> (L.) DC.	15-20	sol	annual herb	mb
15.	<i>Filago griffithii</i> Andrés-Sánchez & Galbany	5-10	sol	annual herb	mb
16.	<i>Bromus sterilis</i> L.	15-20	sol	annual herb	tg
17.	<i>Zoegea baldshuanica</i> C.Winkl.	15-20	sol	perennial herb	g
18.	<i>Pseudopodospermum hissaricum</i> N.Kilian	35-40	sol	perennial herb	tg
19.	<i>Diarthron vesiculosum</i> C.A.Mey.	25-30	sol	annual herb	g
20.	<i>Scrophularia striata</i> Boiss.	50-55	sol	subshrub	mb
21.	<i>Clypeola jonthlaspi</i> L.	15-20	sol	annual herb	tg
22.	<i>Nigella bucharica</i> Schipcz.	15-20	sol	annual herb	mb
23.	<i>Astragalus sesamoides</i> Boiss.	15-20	sol	perennial herb	tg
24.	<i>A.rumpens</i> Meff.	30-35	sol	perennial herb	v
25.	<i>Ferula kuhistanica</i> Korovin	60-75	sol	perennial herb	mb
26.	<i>Allium drepanophyllum</i> Vved.	25-35	sol	perennial herb	tg
27.	<i>Cirsium brevipapposum</i> Tschern.	45-50	sol	annual herb	tg
28.	<i>Crepis multicaulis</i> Ldb.Fl.	50-55	sol	annual herb	v
29.	<i>Echinops cornigerus</i> DC.	25-35	sol	perennial herb	tg
30.	<i>Drepanocaryum sewerzowii</i> (Regel) Pojark.	30-35	sol	subshrub	tg
31.	<i>Pseudosedum longidentatum</i> Boriss.	15-20	sol	perennial herb	v
32.	<i>Convolvulus pseudocantabrica</i> Schrenk W.	50-60	sol	perennial herb	g
33.	<i>Minuartia hamata</i> (Hausskn.) Mattf.	5-10	sol	annual herb	mb

**Note 9: Recorded Locations:**

№31 14.05.2021. On the right and left sides around Pasurkhisoy village, Baysun district, at 1250 meters above sea level.

№32 15.05.2021. Northern side of Derbend village, Baysun district, at an altitude of 1200 meters above sea level.



Figure 9. *Eremurus luteus* - *Ajuga turkestanica* - *Prangos pabularia* + *Taeniatherum caput-medusae* + *Koelpinia linearis* association where *A. turkestanica* occurs.

10. *Salvia bucharica* - *Ajuga turkestanica* - *Gallium pamiralaicum* + *G. spurium* plant association. This association was identified 1.5 km north of Derbend village on June 17, 2020, distributed on rocky, gravelly, red sandy soil, with a 28° north-facing slope (N38.13273 E67.03049). In this association, the plant cover consists of 23% *Salvia bucharica*, 18% *Ajuga turkestanica*, and 9% *Gallium pamiralaicum*. The plants participating in

the identified diverse herbaceous – *Ajuga* – Bokharan Sage association, based on their life form, include: shrubs - 2, subshrubs - 3, perennial herbs - 15, and annual herbs - 17 species. The total area of the association is 23 hectares, with a productivity of 218 kg per hectare. The plant cover in the association is 70% (Table 11, Figure 10).

Table 11. Floristic composition of the association

No.	Plant name	Height, cm	Density	Life form	Phenophase
1.	<i>Salvia bucharica</i> (M.Pop.)	45-55	sp ³	subshrub	v
2.	<i>Ajuga turkestanica</i> (Regel) Briq.	30-35	sp ³	subshrub	tg
3.	<i>Gallium pamiralaicum</i> Pobed.	30-35	sp ²	perennial herb	v
4.	<i>Poa bulbosa</i> Steud.	10-15	sp	annual herb	tg
5.	<i>Noccaea perfoliata</i> (L.) Al-Shehbaz	15-20	sp	perennial herb	tg
6.	<i>Astragalus juratzkanus</i> Freyn va Sint.	25-30	sp	perennial herb	mb
7.	<i>Senecio olgae</i> Regel & Schmalh.	25-30	sp	perennial herb	v
8.	<i>Koelpinia linearis</i> Pall.	15-20	sp	annual herb	mb
9.	<i>Artemisia tenuisecta</i> Nevski	45-50	sp	subshrub	mb
10.	<i>Ferula kuchistanica</i> Korovin	60-75	sol	perennial herb	mb



11.	<i>Galium spurium</i> L.	25-30	sol	annual herb	mb
12.	<i>Galium tenuissimum</i> M. Bieb.	15-20	sol	annual herb	my
13.	<i>Minuartia hamata</i> (Hauskn.) Mattf.	5-10	sol	annual herb	mb
14.	<i>Elwendia hissarica</i> (Korovin) Pimenov & Kljuykov	35-40	sol	perennial herb	g
15.	<i>Eremurus luteus</i> Baker	45-55	sol	perennial herb	mb
16.	<i>Biebersteinia multifida</i> DC.	15-20	sol	perennial herb	mb
17.	<i>Scandix stellata</i> Banks & Sol.	35-40	sol	annual herb	tg
18.	<i>Gentiana olivieri</i> Griseb.	15-20	sol	perennial herb	tg
19.	<i>Medicago medicaginoides</i> (Retz.) E.Small	35-40	sol	annual herb	mb
20.	<i>Thalictrum sultanabadense</i> Stapf	45-50	sol	perennial herb	mb
21.	<i>Thalictrum isopyroides</i> C.A.Mey.	15-20	sol	perennial herb	mb
22.	<i>Festuca maritima</i> L.	15-20	sol	annual herb	tg
23.	<i>Ziziphora tenuior</i> L.	10-15	sol	annual herb	tg
24.	<i>Cerastium dichotomum</i> L.	15-20	sol	annual herb	mb
25.	<i>Allium griffithianum</i> Boiss.	25-30	sol	perennial herb	tg
26.	<i>Valeriana chionophila</i> Popov & Kult	15-30	sol	perennial herb	mb
27.	<i>Roemeria refracta</i> DC.	15-30	sol	annual herb	g
28.	<i>Holosteum umbellatum</i> (M.Bieb.) Nyman	25-30	sol	annual herb	g
29.	<i>Semeiostachys drobovii</i> Nevski.	5-10	sol	perennial herb	my
30.	<i>Rochelia cardiosepala</i> Bunge	20-25	sol	annual herb	v
31.	<i>Veronica argute-serrata</i> Regel & Schmalh.	15-20	sol	annual herb	mb
32.	<i>Turgenia latifolia</i> (L.) Hoffm.	15-20	sol	annual herb	mb
33.	<i>Draba nuda</i> (Bél.) Al-Shehbaz & M.Koch	10-15	sol	annual herb	mb
34.	<i>Arenaria griffithii</i> Boiss.	10-15	sol	shrub	mb
35.	<i>Bromus pumilio</i> (Trin.) P.M.Sm.	15-20	sol	perennial herb	tg

Note 10: Recorded Locations:

№33 17.06.2020. North of Derbend village, Baysun district, around the right and left tributaries of the Machaydarya river basin, at 1250 meters above sea level.

№34 18.06.2020. 1.5 km north of Derbend village, Baysun district, at an altitude of 1300 meters above sea level.



Figure 10. *Salvia bucharica* - *Ajuga turkestanica* - *Gallium pamiralaicum* + *G. spurium* association where *A. turkestanica* occurs.

11. *Prangos pabularia* - *Artemisia tenuisecta* - *Ajuga turkestanica* + *Galium pamiralaicum* + *Prunus verrucosa* + *Poa bulbosa* plant association. This association was identified in the southwestern part of Charvoqsoy village on May 8, 2021, and is found on brown soil, with a 75° north-facing slope (N38.26241 E67.04405). In this association, the plant cover consists of 17% *Prangos pabularia*, 14% *Artemisia tenuisecta*,

11% *Ajuga turkestanica*, and 8% *Inula macrophylla*. Based on their life form, the plants participating in this association include: shrubs - 2, subshrubs - 2, perennial herbs - 12, and annual herbs - 14. The total area of the association is 38 hectares, the productivity is 156 kg per hectare, and the plant cover in the association is 45% (Table 12).

Table 12. Floristic composition of the association

No.	Plant name	Height, cm	Density	Life form	Phenophase
1.	<i>Prangos pabularia</i> Lindl.	55-60	sp ³	perennial herb	v
2.	<i>Artemisia tenuisecta</i> Nevski	60-65	sp ³	subshrub	mb
3.	<i>Inula grandis</i> Schrenk ex Fisch.& C.A.Mey.	75-80	sp ²	perennial herb	v
4.	<i>Ajuga turkestanica</i> (Regel) Briq.	35-45	sp ²	subshrub	v
5.	<i>Poa bulbosa</i> L.	10-20	sp ¹	annual herb	tg
6.	<i>Noccaea perfoliata</i> (L.) Al-Shehbaz	10-15	sp ¹	perennial herb	mb
7.	<i>Prunus verrucosa</i> Franch.	35-40	sp	shrub	mb
8.	<i>Galium pamiralaicum</i> Pobed.	25-35	sp	perennial herb	v
9.	<i>Galium spurium</i> L.	25-30	sp	annual herb	g
10.	<i>Taeniatherum caput-medusae</i> (L.) Nevski	25-30	sp	annual herb	mb
11.	<i>Valeriana ficarifolia</i> Boiss.	15-20	sp	perennial herb	tg
12.	<i>Bromus sterilis</i> L.	30-35	sp	annual herb	mb
13.	<i>Cousinia rotundifolia</i> C.Winkl.	35-40	sp	perennial herb	mb
14.	<i>Allium griffithianum</i> Boiss.	15-20	sp	perennial herb	mb



15.	<i>Geranium robertianum</i> L.	30-35	sol	annual herb	mb
16.	<i>Nigella bucharica</i> Schipcz.	15-20	sol	annual herb	mb
17.	<i>Bromus tectorum</i> L.	20-25	sol	annual herb	tg
18.	<i>Euphorbia franchetii</i> B. Fedtsch.	15-20	sol	annual herb	mb
19.	<i>Pseudopodospermum hissaricum</i> N.Kilian	35-40	sol	perennial herb	tg
20.	<i>Alyssum marginatum</i> Steud. ex Boiss.	15-25	sol	annual herb	mb
21.	<i>Allium drepanophyllum</i> Vved.	20-25	sol	perennial herb	tg
22.	<i>Eremurus luteus</i> Baker	35-45	sol	perennial herb	g
23.	<i>Scandix stellata</i> Banks & Sol.	45-50	sol	annual herb	g
24.	<i>Ziziphora tenuior</i> L.	20-25	sol	annual herb	tg
25.	<i>Senecio olgae</i> Regel & Schmalh.	45-50	sol	perennial herb	mb
26.	<i>Trigonella geminiflora</i> Bunge	10-15	sol	annual herb	mb
27.	<i>Taraxacum maracandicum</i> Kovalevsk	15-20	sol	perennial herb	my
28.	<i>Festuca maritima</i> L.	15-20	sol	annual herb	g
29.	<i>Veronica argute-serrata</i> Regel & Schmalh.	15-25	sol	annual herb	tg
30.	<i>Acer tataricum</i> (Regel & Herder)	160-180	sol	shrub	mb

Note 11: Recorded Locations:

№35 08.05.2021. Southwest of Charvaksay village, Baysun district, at 1350 meters above sea level.

№36 28.05.2020. 1.5 km north of Derbend village, Baysun district, at an altitude of 1300 meters above sea level.

Generally, the above associations are currently widespread around the basins of the Kizildarya, Egrisuv, Kattauradarya, Kichikuradarya, Machaydarya,

Sherabaddarya, Pulhakim, Jyidalisay, and Khalkadjar rivers. The associations contain 227 species of higher plants, and based on their life forms, trees and shrubs make up 17 (5%), subshrubs and semishrubs make up 15 (4%), perennial herbs make up 88 (40%), and biennial and annual species make up 107 (51%).

The total area of associations where *A. turkestanica* occurs in the southern region of Uzbekistan reaches 732 hectares, with raw material reserves exceeding 112.91 tons (Table 13).

Table 13 Productivity and reserves of *Ajuga turkestanica* in the plant cover

№	Associations	Area, (ha)	Dry matter productivity (kg/ha)	Biological reserves, t
1.	<i>Ajuga turkestanica</i> - <i>Poa bulbosa</i> - <i>Ehinops lipskyi</i> - <i>Festuca maritima</i> + <i>Artemisia tenusecta</i> + <i>Ziziphora tenuior</i>	274	156	42,7
2.	<i>Ajuga turkestanica</i> - <i>Ephedra ciliata</i> - <i>Onosma atrocyanea</i> + <i>Bromus scoparius</i>	18	125	2,25



3.	<i>Ajuga turkestanica</i> - <i>Artemisia tenuisecta</i> - <i>Phlomis spinidens</i> + <i>Carex pachystylis</i> + <i>Diarthron vesiculosum</i> + <i>Nigella integrifolia</i>	29	126	3,6
4.	<i>Ajuga turkestanica</i> - <i>Crambe cordifolia</i> - <i>Bromus tectorum</i> + <i>Inula grandis</i>	96	220	21,1
5.	<i>Artemisia tenuisecta</i> - <i>Ajuga turkestanica</i> - <i>Poa bulbosa</i> + <i>Galium pamiralaicum</i> + <i>Sophora pachycarpa</i>	42	117	4,9
6.	<i>Artemisia tenuisecta</i> - <i>Ajuga turkestanica</i> - <i>Salvia bucharica</i> + <i>Rosa kokanica</i> + <i>Taraxacum maracandicum</i> + <i>Koelpinia linearis</i>	49	106	5,19
7.	<i>Rosa kokanica</i> - <i>Ajuga turkestanica</i> + <i>Mixtoherbosa</i> .	28	168	4,70
8.	<i>Perovskia scrophulariifolia</i> - <i>Ajuga turkestanica</i> - <i>Eremurus baissunensis</i> + <i>Hordeum murinum</i> + <i>Bunium hissaricum</i>	82	141	11,56
9.	<i>Eremurus luteus</i> - <i>Ajuga turkestanica</i> - <i>Prangos pabularia</i> + <i>Taeniatherum caput-medusae</i> + <i>Koelpinia linearis</i>	53	113	5,98
10.	<i>Salvia bucharica</i> - <i>Ajuga turkestanica</i> - <i>Galium pamiralaicum</i> + <i>G.spurium</i> .	23	218	5,01
11.	<i>Prangos pabularia</i> - <i>Artemisia tenuisecta</i> - <i>Ajuga turkestanica</i> + <i>Galium pamiralaicum</i> + <i>Prunus verrucosa</i> + <i>Poa bulbosa</i>	38	156	5,92

Table 14. *Ajuga turkestanica* dominant and subdominant associations

Nº	Association names	Coordinates	Regions	Number of plant species	Total plant cover (%)
1.	<i>Ajuga turkestanica</i> - <i>Poa bulbosa</i> - <i>Ehinops lipskyi</i> – <i>Festuca maritima</i> + <i>Artemisia tenuisecta</i> + <i>Ziziphora tenuior</i>	N38,132499 E67,71413	Derbend village, Surkhandarya region	38	35
2.	<i>Ajuga turkestanica</i> - <i>Ephedra ciliata</i> - <i>Onosma atrocyanea</i> + <i>Bromus scoparius</i>	N38,35924 E66,581688	Sayrob village, Surkhandarya region	34	52
3.	<i>Ajuga turkestanica</i> - <i>Artemisia tenuisecta</i> - <i>Phlomis spinidens</i> + <i>Carex pachystylis</i> + <i>Diarthron vesiculosum</i> + <i>Nigella integrifolia</i>	N38,103879 E67,131212	Gaza village, Baysun district, Surkhandarya region	46	45



4.	<i>Ajuga turkestanica</i> - <i>Crambe cordifolia</i> - <i>Bromus tectorum</i> + <i>Inula grandis</i>	N38,135126 E67,313881	Jiydalisay village, Denav district, Surkhandarya region	32	45
5.	<i>Artemisia tenusecta</i> - <i>Ajuga turkestanica</i> - <i>Poa bulbosa</i> + <i>Galium pamiralaicum</i> + <i>Sophora pachycarpa</i>	N38,252855 E66,595753	Chulbair village, Kashkadarya region	39	48
6.	<i>Artemisia tenusecta</i> - <i>Ajuga turkestanica</i> - <i>Salvia bucharica</i> + <i>Rosa kokanica</i> + <i>Taraxacum maracandicum</i> + <i>Koelpinia linearis</i>	N38,223880 E66,555393	Chashmiron village, Dehkanabad district, Kashkadarya region	36	40
7.	<i>Rosa kokanica</i> - <i>Ajuga turkestanica</i> + <i>Mixtoherbosa</i> .	N38,252065 E66,595897	Yonakishlok [village], Kashkadarya region	48	45
8.	<i>Perovskia scrophulariifolia</i> - <i>Ajuga turkestanica</i> - <i>Eremurus baissunensis</i> + <i>Hordeum murinum</i> + <i>Bunium hissaricum</i>	N38,19150 E38,19150	Dugoba village, Baysun district	37	55
9.	<i>Eremurus luteus</i> - <i>Ajuga turkestanica</i> - <i>Prangos pabularia</i> + <i>Taeniatherum caput-medusae</i> + <i>Koelpinia linearis</i>	N38,111679 E67,2269	Pasurkhisoy village, Baysun district	41	65
10.	<i>Salvia bucharica</i> - <i>Ajuga turkestanica</i> - <i>Galium pamiralaicum</i> + <i>G.spurium</i> .	N38,13273 E67,03049	1.5 km north of Derbend village, Baysun district	47	70
11.	<i>Prangos pabularia</i> - <i>Artemisia tenuisecta</i> - <i>Ajuga turkestanica</i> + <i>Galium pamiralaicum</i> + <i>Prunus verrucosa</i> + <i>Poa bulbosa</i>	N38,26241 E67,04405	Charvoqsoy village, Surkhandarya region	38	45

Conclusion: Currently, the demand for *A. turkestanica* raw material for the production of the preparations "Ekdisten," "Eksumid," "Ayustan," "Ayulin," and "Jestin" is increasing. Therefore, the dominant and subdominant associations in which *A. turkestanica* participates were studied, and their coordinates were determined. The results of the scientific research aimed at determining its role in the plant communities mentioned above allow for the continuous monitoring of *A. turkestanica* cover (Table 14).

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