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Research Article

Phytocenology of the species *Satureja macrantha* C.A. Mey. and *Satureja laxiflora* C. Koch, belonging to the Genus *Satureja* L. in the Nakhchivan Autonomous Republic

Shafiqa Suleymanova [1], Elsevar Asadov[1*]

[1]Department of Basic Medical, Faculty of Medical. Nakhchivan State University, Nakhchivan, Azerbaijan
[*]Email: asadoves1974@gmail.com

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Abstract

Savory (*Satureja* L.) is widespread in the plains, foothills, low mountains, and other areas of the Nakhchivan MP, as well as in the lower, middle, and partially upper mountain belts. Three species of Savory (Satureja L.) have been identified, the distribution of which in the territory has been established: Satureja macrantha C.A. Mey., *Satureja laxiflora* C. Koch, and *Satureja hortensis* L. All these plants are valuable, essential plants. The phytocenological characteristics of Savory plants were studied using geobotanical methods. In the Ordubad Julfa, Babek, Sadarak, and Kengerli districts, geobotanical indicators and natural resources were calculated using experimental methods.

Keywords: Satureja, Satureja macrantha, Satureja laxiflora, Garden wild mint, lowland

Introduction

The Nakhchivan Autonomous Republic is a predominantly mountainous country. Both in the mountainous part of the region and in the study area, which covers large areas, numerous plains, intermontane meadows, cliffs, dry stony-rocky slopes, rock outcrops, sand dunes, sandy-gravelly areas, river valleys, and low hills around lakes and reservoirs cover large areas (Babayev, S., 1999). The mentioned ecological conditions are the main habitats where the plant species of the genus Satureja L. develop and spread. Each of these places has its own unique flora and vegetation. Together they form the dry stony-rocky ecosystem of the area. Satureja is widely distributed in the

Aras-bound plains of the Nakhchivan Autonomous Republic, in the foothills, in the low mountains and other areas, as well as in the lower, middle and partly in the upper mountain belt.

The distribution of 3 species of wild mint in the area has been determined: Wild mint - Satureja macrantha C.A. Mey., Wild mint - Satureja laxiflora C. Koch and Garden (Scented) wild mint - S. hortensis L., are valuable essential oil plants (Mursal, S., et al, 2014; Ibadullayeva, S., et al, 2015; Azizollahi, Z., et al, 2019; Ибрагимов, А. Ш., et al, 2019; Novruzov, E., et al, 2021; Aliyeva, H. M., et al, 2024). The phytocenological characteristics of desert mint plants were studied using geobotanical methods. In each region, geobotanical indicators and natural resources were calculated using experimental methods (Alakbarov R.A., et al, 2017; Suleymanova, Sh.T. & Seyidov, M.M., 2020; Kolaylı, S., et al, 2024; Suleymanova, S., 2024)

Martial and methods

As a result of long-term research conducted in the flora of the Nakhchivan Autonomous Republic, it was determined that 4 species of the genus Satureja L. - Satureja macrantha C.A. Mey., S. laxiflora C. Koch, S. mutica Fisch. et Neg., S. sativa A.Sh. are widespread in the area.

They can be found in almost all areas of the autonomous republic. (Figure 1). The species Satureja macrantha C.A. Mey. and Satureja laxiflora C. Koch, which are widespread in the flora of the Nakhchivan Autonomous Republic, were taken as research material. Both the large-flowered wild mint - Satureja macrantha C.A. Mey., and the loose-leafed wild mint - Satureja laxiflora C. Koch species are species that mainly prefer xerophytic areas, spreading in the stony-rocky areas, bushes and scrublands of the lower and middle mountain belts of the Ordubad, Julfa, Sadarak and Shahbuz regions of the autonomous republic.

Routes were organized in various zones, geobotanical analyses were conducted during the research. During field research, herbarium specimens were collected and studied from these areas during expeditions organized to various areas.

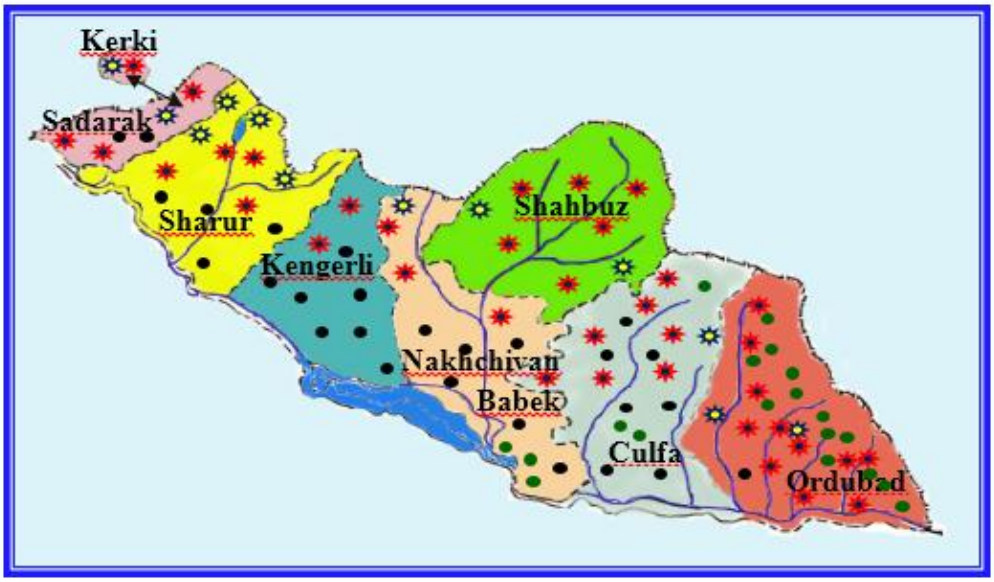

Figure 1. Distribution zones of species belonging to the genus Satureja L.

- Satureja macrantha C.A.Mey.
- Satureja mutica Fisch. et Neg.
- Satureja laxiflora C. Koch
- Satureja sativa A.Sh.

Field research was mainly conducted using ecological, floristic, systematic, phenological and modern methods, in expeditions and route conditions, the collected herbarium materials were processed using modern botanical-floristic methods and the "Flora Azerbaijana" (1957) and internet sites [Bordbar, F., & Mirtadzadini, M., 2024) were used for their identification. The life forms of plants were determined according to the systems of S.R. Raunkier (1934) and I.G. Serebryakov [Rakhimov, G., et al, 2023], the types of geographical areas of the studied plants were given according to A.A. Grossheim (1936) and N.N. Portenier (2000). Systematic taxa were specified according to T. H. Talybov, A., and Sh. Ibrahimov (2008).

Results and discussion

The conducted studies have led to the conclusion that the species of desert mint, which are mainly xerophytic plants, are more widespread in arid areas. In this regard, the plains, foothills and lower mountain belts are considered their main habitat. Satureja macrantha S.A. May. is found in the Nokhuddag, Nehramdag, Nehram-Daresham, Darıdag, Alinjagala, Nahajir Mountain, Ilanlı Mountain, Aracıg Mountain, Demirli Mountain, Kohne Kotam gorge and the surrounding steep

Rocky Mountains (Alakbarov, R., & Suleymanova, S., 2021; Flora of Azerbaijan, 1957). It occurs singly in a number of different types of phytocenoses. In some newly discovered areas, it develops abundantly, forming the Saturejeta macranthae formation and the Saturejetum macranthosum association (Figure 2).

Figure 2. Saturejeta macranthae formation in the Mamedey Gorge and Demir Dağ

The newly discovered plant groups are located between the Kotam village of Ordubad region and Soyugdag, covering a very wide area, and in particular, the grouping of the *S. macrantha* C.A. Mey. species with the *Colutea comarova*, *Atrophaxis angustifolius*, and *Zygophyllum atriplicoides* species typical for the flora of the Nakhchivan MR is very interesting from a scientific and theoretical point of view. The inclusion of Thymus collinus Bieb., Iris imbricata Lindl., I. lycotis L., Hypericum scabrum L., Prangos uloptera DC., Artemisia lerchiana L., Phlomis caucasica Rech. fil., Ph. tuberosa L., Eremostachys iberica Vis. and other plant species in this grouping leads to the enrichment of the species composition of the grouping (Ibragimov, A. S., 2005; Suleymanova Sh.T., 2021). The project budget of the group is 60-65%.

In the Old Kotam Gorge of Ordubad district, in the surrounding Rocky Mountains, S. macrantha S.A. May. are located very close to each other. Here, an average of 2-3 and sometimes 5-6 species were recorded per sq.m. sample plot. In the places covered by the phytocenosis, the vegetation cover consists of trees, shrubs and grasses. Geophytes and sedges are dominant.

The project cover is 80-85%. 55% of it is S. macrantha C.A. May., 20% are trees, shrubs, the remaining 25% are various life forms: annuals, biennials, perennials and, from that, geophytes. As a result of the research, the species composition of plant groups of each area was determined

and the tables show the abundance, height, phenophase (flowering, fruiting) and stratification (tiering) of each species in phytocenoses (Table 1).

Table 1. Species composition and structure of the phytocenosis dominated by Satureja macrantha C.A. Mey. around the village of Ohne Kotam, Ordubad district.

No	Plant's name	Abundance	Height, cm	Phenophase	Category
1.	*Satureja macrantha* C.A. Mey.	1-2	15-45	Flower-Fruit	II
2.	*Helichrysum callichrysum* DC.	2-3	18-35	Fruit	II
3.	*Koelpinia linearis* Pall.	2	15-30	Fruit	III
4.	*Ceratocarpus arenarius* L.	3	19-25	Fruit	III
5.	*Hypericum linarioides* Bosse	3	80-95	Flower-Fruit	II
6.	*Salsola crassa* Bieb.	3-4	5-50	Flower	III
7.	*Herniaria glabra* L.	3	5-15	Flower	III
8.	*Spinacia tetrandra* Stev.	1-2	10-40	Fruit	III
9.	*Tribulus terrestris* L.	2	10-60	Flower-Fruit	II
10.	*Buglossoides arvensis* (L.) Johnst.	1-2	25-75	Flower	II
11.	*Aegilops sylindrica* Host	2-3	25-40	Fruit	III
12.	*Atroplex tatarica* L.	1-2	25-80	Flower	II
13.	*Poa bulbosa* L.	2	10-20	Fruit	III
14.	*Anabasis eugeniae* İljin	2-3	37-45	Flower-Fruit	III
15.	*Acanthophyllum squarrosum* Boiss.	2	20-50	Flower	III
16.	*Achillea millefolium* L.	4	35-50	Flower	II
17.	*Hordeum leporina* (L.) Sternb.	2	10-25	flower	III
18.	*Camphorosma lessingii* Litv.	2-3	10-35	Fruit	III
19.	*Adonis flammeus* Jacq.	2-3	10-45	Fruit	II
20.	*Amoria ambigua* Sojak	3	50-60	Fruit	III
21.	*Eromopirum tritceum* Nevski	2-3	10-30	Fruit	III
22.	*Velezia rigida* L.	2	10-50	Fruit	III

Similarly, the species composition of plant groups including the species Satureja macrantha C.A. Mey., found in the Vang area of the Julfa region, was determined, and the abundance, height, phenophase (flowering, fruiting), and stratification of each species in phytocenoses were shown in the tables (Table 2).

Table 2. Species composition and structure of the phytocenosis formed with the participation of the species Satureja macrantha C.A. Mey. in the Vang area of the Julfa region.

No	Plant's name	Abundance	Height, cm	Phenophase	Category
1.	*Satureja macrantha* C.A. Mey.	1-2	60-70	Flower	III
2.	*Juniperus communis* L.	1-2	7-20	Flower-Fruit	IV
3.	*Daphne mucronata Royle*	2	35-50	Fruit	III
4.	*Astracantha microcephala* Podlech	3	35-45	Fruit	III

5.	*Adonis flammeus* Jacq.	2-3	10-45	Fruit	III
6.	*Amoria ambigua* Sojak	3	50-60	Flower	III
7.	*Eromopirum tritceum* Nevski	2-3	10-30	Fruit	IV
8.	*Rosa canina* L.	1-2	2,5-3,0 m	Fruit	I
9.	*Tribulus terrestris* L.	2	10-60	Flower-Fruit	III
10.	*Pyrus salicifolia* Pall.	1-2	4,5-6-7 m	Flower	I
11.	*Aegilops sylindrica* Host	2-3	25-40	Fruit	III
12.	*Atroplex tatarica* L.	1-2	25-80	Flower	III
13.	*Euphorbia marschalliana* Boiss.	3-4	15-40	Flower-Fruit	III
14.	*Euphorbia szovitsii* Fisch. et C.A. Mey.	1-2	2-10	Flower-Fruit	IV
15.	*Koelpinia linearis* Pall.	2	15-30	Fruit	III
16.	*Rhamnus pallasii* Fisch.	3	1,9-2,0 m	Fruit	I
17.	*Hypericum linarioides* Bosse	3	80-95	Flower	II
18.	*Achillea millefolium* L.	3-4	35-50	Flower	III
19.	*Hordeum leporina* (L.) Sternb.	2	10-25	Flower	IV
20.	*Coteneaster melanocarpus* Fisch.	2-3	1,0-1,5 m	Fruit	I
21.	*Poa bulbosa* L.	2	10-20	Fruit	III
22.	*Helichrysum callichrysum* DC.	2-3	18-35	Fruit	III
23.	*Stachys inflata* Btnth.	3	15-20	Fruit	IV

6-8 and 10-12 plants were recorded in $1m^2$ in relatively dense areas of the grassland.

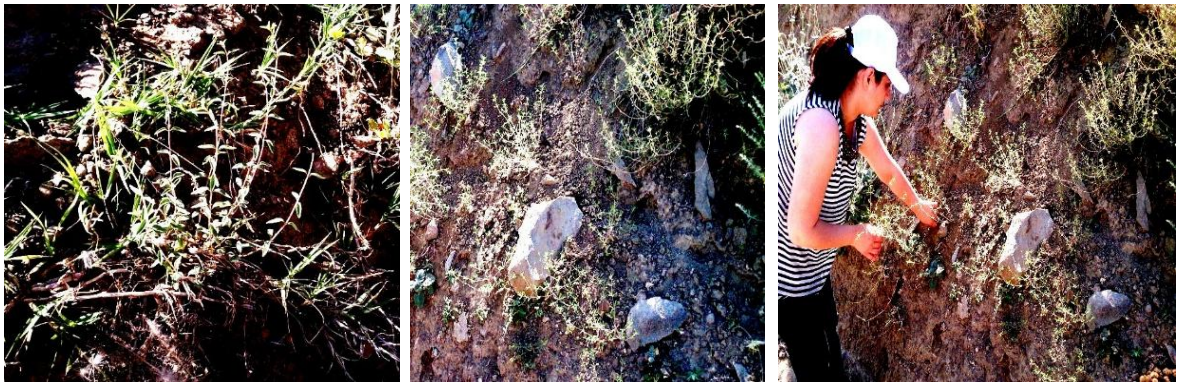

Figure 2. S. macranthae formation around the villages of Shurut and Gal, Julfa district.

The herbaceous vegetation includes 35-50 plant species. The most prominent are 26 species, of which 10 species: Ceratocarpus arenarius L., Suaeda microphylla Pall., Kochia prostrata (L.) Schrad., Aegilops sylindrica Host, Petrosimonia brachyata (Pal) Bunge, Salsola dendroides Pall., Euphorbia sequeriana L., Halocnemum strobilaceum (Pall) Bieb., Atriplex tatarica L., Camphorosma lessingii Litv. have a significant impact on the formation, vitality, and productivity of vegetation (Suleymanova Sh.T. & Seyidov M.M., 2020; Suleymanova Sh.T., 2021).

Table 3. Species composition and structure of phytocenosis with the presence of Satureja laxiflora C. Koch in the Chalkhangala, Lizbirt, and Buzgov valleys of Babek district.

№	Plant's name	Abundance	Height, cm	Phenophase	Category
1.	*Sature ja laxiflora* C. Koch	1-2	15-30	Flower-Fruit	III
2.	*Callygonum aphillum* (Pall.) Gurke.	2-3	180-200	Fruit	I
3.	*Rheum rupestre* Litw.	1-2	95-100	Flower	I
4.	*Euphorbia marschalliana* Boiss.	4	30-45	Flower-Fruit	II
5.	*Chenopodium botrys* L.	3-4	25-40	Fruit	II
6.	*Chenopodium vulvaria* L.	2-3	15-40	Flower-Fruit	III
7.	*Poa bulbosa* L.	2	10-20	Fruit	III
8.	*Koelpinia linearis* Pall.	2	15-30	Flower	III
9.	*Halostachys caspica* Ung.-Sternb	4	150-200	Flower	I
10.	*Hordeum leporina* (L.) Sternb.	2	10-40	Flower	III
11.	*Adonis flammeus* Jacq.	2-3	10-50	Fruit	II
12.	*Eromopirum tritceum* Nevski	2-3	10-30	Fruit	III
13.	*Spinacia tetrandra* Stev.	1-2	10-40	Fruit	III
14.	*Kalidium capsicum* (L.) Ung-Sternb.	4-5	10-70	Flower-Fruit	III
15.	*Thesim szovitsii* DC.	2	20-50	Flower	III

Similar studies have been conducted in some characteristic places of the regions of the autonomous republic, for example, in the Sadarak floodplain, Shish Tepe, Garatorpaglar of the Sadarak region, Velidag and Dahnadag of the Sharur region, Boyukduz, Duzdag of the Kangarli region, Kolani, Kand Shahbuz, Gizil Qishlag areas of the Shahbuz region, and in the Ilanlıdag, Babek Galasi, Alinja Galasi, Aracıqdag, Demirlidag areas of the Julfa region, and the results obtained are given in the relevant tables (Tables 4,5,6).

Table 4. Species composition and structure of phytocenosis with the presence of Satureja laxiflora C.Koch in the areas called Sadarak Selov, Shish Tepe, and Garatorpaglar of the Sadarak district.

№	Plant's name	Abundance	Height, cm	Phenophase	Category
1.	*Satureja laxiflora* C. Koch	1-2	12-18	Flower-Fruit	IV
2.	*S. sativa A.Sh. İbrahimov*	2	35-50	Fruit	III
3.	*Astragalus tribuloides* Delile	3	10-15	Fruit	IV
4.	*Adonis flammeus* Jacq.	2-3	10-45	Fruit	II
5.	*Amoria ambigua* Sojak	3	50-60	Flower	III
6.	*Eromopirum tritceum* Nevski	2-3	10-30	Fruit	III
7.	*Spinacia tetrandra* Stev.	1-2	10-40	Fruit	III
8.	*Tribulus terrestris* L.	2	10-60	Flower-Fruit	II
9.	*Aegilops sylindrica* Host	2-3	25-40	Fruit	III
10.	*Atroplex tatarica* L.	1-2	25-80	Flower	II
11.	*Euphorbia marschalliana* Boiss.	3-4	15-40	Flower	II
12.	*Koelpinia linearis* Pall.	2	15-30	Fruit	III
13.	*Ceratocarpus arenarius* L.	3	19-25	Fruit	III
14.	*Hypericum linarioides* Bosse	3	80-95	Flower	II
15.	*Achillea millefolium* L.	3-4	35-50	Flower	I
16.	*Hordeum leporina* (L.) Sternb.	2	10-25	Flower	III

17.	*Camphorosma lessingii* Litv.	2-3	10-35	Fruit	III
18.	*Poa bulbosa* L.	2	10-20	Fruit	III
19.	*Helichrysum callichrysum* DC.	2-3	18-35	Fruit	II
20.	*Hedipnois cretica* (L.) Dum. - Cours.	3	15-20	Fruit	III

Table 5. Species composition and structure of the phytocenosis with the presence of Satureja laxiflora C.Koch in the Boyukduz area of Kangarli district.

№	Plant's name	Abundance	Height, cm	Phenophase	Category
1.	*Satureja laxiflora* C. Koch	2-3	16-25	Flower-Fruit	II
2.	*Andrachne buschiana* Pojark**.**	2	13-35	Flower-Fruit	II
3.	*Helichrysum callichrysum* DC.	1-2	28-35	Fruit	II
4.	*Koelpinia linearis* Pall.	3	16-25	Flower-Fruit	III
5.	*Ceratocarpus arenarius* L.	1-2	10-20	Fruit	III
6.	*Hypericum linarioides* Bosse	2	85-90	Flower-Fruit	II
7.	*Salsola crassa* Bieb.	2-3	15-23	Flower	III
8.	*Herniaria glabra* L.	1-2	4-10	Flower	III
9.	*Spinacia tetrandra* Stev.	2	17-25	Fruit	III
10.	*Tribulus terrestris* L.	3	10-20	Flower-Fruit	II
11.	*Buglossoides arvensis* (L.) Johnst.	1-2	24-70	Flower	II
12.	*Aegilops sylindrica* Host	2-3	15-30	Fruit	III
13.	*Atroplex tatarica* L.	3	45-90	Flower	II
14.	*Poa bulbosa* L.	2	12-18	Fruit	III
15.	*Anabasis eugenia*	1-2	35-40	Flower-Fruit	III
16.	*Acanthophyllum squarrosum* Boiss.	3	25-54	Flower	III
17.	*Achillea millefolium* L.	3-4	30-40	Flower	II
18.	*Hordeum leporina* (L.)Sternb.	1-2	12-20	Flower	III
19.	*Camphorosma lessingii* Litv.	1-2	13-32	Fruit	III
20.	*Adonis flammeus* Jacq.	3	14-35	Flower-Fruit	II
21.	*Amoria ambigua* Sojak	1-2	40-55	Flower	III
22.	*Eromopirum tritceum* Nevski	3-4	10-15	Fruit	III
23.	*Velezia rigida* L.	1-2	11-400	Fruit	III
24.	*Allochrusa versicolor* (Bieb.) Boiss.	2-3	25-45	Flower-Fruit	III

Table 6. Species composition and structure of phytocenosis with the presence of Satureja laxiflora C. Koch in the Aracig, Leketagh and Demirli mountains of Julfa region.

№	Plant's name	Abundance	Height, cm	phenophase	Category
1	*Satureja laxiflora* C. Koch	4	80-95	Flower	II
2	*Hordeum bulbosum* L.	4	120-150	Flower-Fruit	I
3	*Deschampsia caespitosa* (L.) Beauv.	3-4	60-70	Flower	III
4	*Phalaroides arundinaceae* (L.) Rauschert	2	160-170	Flower	I
5	*Alopecurus ventricosus* Poir.	2-3	50-65	Flower-Fruit	III
6	*Calamagrostis epigejos* (L.) Roth.	2-3	58-75	Flower	III
7	*Phragmites australis*(Cav.) Trin. ex Steud.	3	180-210	Flower-Fruit	I
8	*Poa meyeri* Trin. ex Roschev	2	34-42	Flower	IV

9	*Glyceria arundinacea* Kunth.	2-3	110-169	Flower	I
10	*Agropyrumrepens* (Boiss. ex Steud.) Grossh.	3	45-60	Flower	III
11	*Carex diandra* Schrank	2-3	34-51	Fruit	III
12	*Dactylis glomerata* L.	3-4	100-130	Flower	II
13	*Gladiolus kotschyanus* Boiss.	3	75-80	Flower-Fruit	III
14	*Achillea millefolium* L.	3-4	90-95	Flower	III
15	*Thalictrum minus* L.	3	160-185	flower-Fruit	I
16	*Rhinanthus major* L.	3-4	46-52	vegetation	III
17	*Geum urbanum* L.	2-3	65-78	Flower	III
18	*Filipendula ulmaria* (L.) Maxim.	3	98-110	Flower	II
19	*Trifolium pratense* L.	3-4	16-18	Flower	V
20	*T.medium* L.	2-3	35-44	Flower-Fruit	IV
21	*Lotus corniculatus* L.	3-4	16-25	Flower-Fruit	V
22	*Securigeria varia* (L.) Lassen	1-2	40-59	Flower	IV
23	*Heracleum trachyloma* Fisch. & C.A.Mey.	2	190-210	Flower	I
24	*Lathirus pratensis* L.	1-2	34-57	Fruit	IV
25	*Persicaria hydropiper* L.	2	89-100	Flower	II
26	*Astragalus cicer* L.	2-3	53-68	Flower-Fruit	III
27	*A.glyciphylloides* DC.	2	80-100	Flower-Fruit	II
28	*Potentilla reptans* L.	2	12-15	Flower	V
29	*Briza media* L.	1-2	50-65	Fruit	III
30	*Medicago lupinoides* L.	1-2	18-25	Fruit	V
31	*Cirsium hydrophyllum* Boiss.	2	120-150	Flower-Fruit	II
32	*Cynodon dactilon* (L.) Pers.	3	28-37	Fruit	IV
33	*Aeluropus littoralis* (Gouan) Parl.	2-3	15-20	Fruit	V

The wild mint (*S. laxiflora*) is a plant widely distributed in the rocky and gravelly areas of the middle and high mountain belt of the Shahbuz region, as well as in other areas of the region, and mainly on the slopes. It is especially common on the rocky slopes and slopes around the villages of Kolanli and Bichenak (Alakbarov, R., & Suleymanova, S., 2021).

In general, although the distribution areas of both Satureja macrantha C.A. Mey. and Satureja laxiflora C. Koch. are often different, the species composition of phytocenoses is almost, and often similar to each other. The mentioned similarity also applies to the phytocenoses of the plant Satureja laxiflora C. Koch. However, Satureja laxiflora C. Koch develops in sparse groups on sandy, sandy-stony-gravelly, stony-rocky places and on outcrops without very hard rocks. It is distributed almost everywhere in the region at altitudes of 1200-1800 m. Although the composition of plant groups in the distribution areas of the species is mostly close to each other, some differences are noticeable. A grouping spread around the village of Bichenak included Scrophularia variegate Bieb., Scutellaria araxensis Grossh., Centaurea squarrosa Willd., Aethionema pulchellum Huet., Crupina crupinastrum Vis., Scabiosa bipinnata C. Koch, Galium

verum L., Eremostachys macrophylla Auch., Echinops sphaerocephalus L., Dactylis glomerata L., Helichrysum plicatum DC, Medicago sativa L., Centaurea glehnii Trautv., Bupleurum exaltatum Bieb., Eryngium billardieri Delaroche, Teucrium orientale L., Papaver orientale L., Euphorbia seguieriana Neck., Pyrethrum myriophyllum C.A.Mey., Scorzonera latifolia DC, Marrubium astracanicum Jacq, etc. Here, Satureja laxiflora C. Koch plants are located very close to each other, and in some places their above-ground parts are connected. The project yield varies between 65-80% (Suleymanova Sh.T. & Seyidov M.M., 2020).

Conclusıon

Representatives of the genus Satureja L. do not participate in phytocenoses in equal quantities. They are found singly, distant from each other, and in some areas small groups are observed. They settle on dry grassy slopes, characteristic of xerophytic plants, on rocky, stony-rocky places, and on sparse grassy areas on slopes. In such groups, the plant cover is 60-65%, and in relatively favorable places - 70-80%. There are abundant natural resources of other useful plant groups formed by species belonging to the genus Satureja L., and consideration should be given to using these plants efficiently (food, medicine, perfumery, etc.).

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