International Journal of Engineering & Technology, 7 (4.38) (2018) 434-438

International Journal of Engineering & Technology

Website: www.sciencepubco.com/index.php/IJET

Research paper

Bioresources of Wild Medicinal Plants in Canyons Gulobod and Saphedchashma (Gissar Ridge, Tajikistan)

Jamshed Saidovich Sattarov[1]*, Sultan Khadjibukarovich Vishegurov[2], Shamsulom Safarovich Murodov[1], Rinat Raifovich Galeev[2], Ivan Sergeevich Samarin[2]

[1] *National Republican Center of Genetic Resources of the Tajik Academy of Agricultural Sciences, Mahmadshohi bolo, Sarikishti, 735104, Tajikistan*

[2]*Novosibirsk State Agrarian University, Dobroljubova St., 16, Novosibirsk, 0630039, Russian Federation*

**Corresponding author E-mail: sattarov.j.s@mail.ru*

Abstract

The results of assessing the biodiversity and resources of wild plants on the territory of Gulobod and Saphedchashma canyons in the Hissar Mountains of Tajikistan have been presented. In the territory of the Gulobod canyon, 79 various species of medicinal plants have been identified. Out of these, three plants are listed in the Red Book of the Republic, eight are endemic ones, and four are adventive plants. Out of the studied 15 vegetation beds, commercial ones were 7, which were formed by horseheal – Inula helenium L.- and small-flowered oregano – Origanum tyttanthum Gontsch., the total area of which reached 3.3 ha. In the territory of the Saphedchashma canyon, 50 most common medicinal plants had been identified, formed by representatives of 38 species belonging to 17 various families.

Keywords: *wild medicinal plants, biodiversity, resources, canyon, taxa, phylogenetic classification, flora.*

1. Introduction

The Republic of Tajikistan, due to its unique climatic conditions, is among the most significant parts of the world in the context of its flora. At least 4,000 – 4,500 species of only higher plants grow in this area [1].

The first floristic studies in the Central Asian region were initiated as early as before the October Revolution by geographers and botanists, including prominent researchers, such as A. Leeman, A. P. and O. A. Fedchenko, A. E. Regel, V. L. Komarov, S. I. Korzhinsky, V. I. Lipsky, B. A. Fedchenko, O. E. Knorring – Neustruyeva, M. G. Popov, O. Paulsen, I. Bornmuller, at al. [2].

According to the results of floristic studies performed between 1957 and 1991, a 10-volume book "Flora of the Tajik SSR" under the editorship of academic P. N. Ovchinnikov [3] was published.

However, the progress of human development, intensification of production, population growth, improved recreation through development of new lands and recreational use of tourist zones entail gradual reduction of resources, and disappearance of various wild plant species [4-8]. Ensuring natural regeneration and protection of the existing flora needs information on the diversity and resources of wild medicinal plants [9-13].

Research of the resources of wild medicinal plants on the southern slope of the Hissar Mountains are shown in several studies [14, 15], and the stock of the Tajik ferula was studied in the works of A. Khalimov, S. Rakhimov [16].

The work was aimed at studying the biological diversity and abundance of wild medicinal plants in some canyons of the districts of Varzob and Vahdat (canyons Gulobod and Saphedchashma), which, in turn, were the buffer zones of Dushanbe city, the capital of the Republic of Tajikistan.

2. Conditions and Methods of Research

The research was performed in 2014-2016. The Gulobod canyon is located at the distance of 26 km to the North of the city of Dushanbe, in the Central part of the southern slope of the Hissar Mountains. From the Dushanbe – Khojend highway, it extends from the southwest to northeast for more than 5 to 6 km. The canyon is narrow, and the distance between the opposite slopes on both sides of the river is 50-75 m. The average annual rainfall in the Gulobod area is 800-1,200 mm, and during the year, the rain falls unevenly. The highest level of rainfall is in the spring. The average annual temperature is +160C, the maximum is +430C, the minimum is -230C. In this area, the winter is soft and moderate.

It should be noted that at the confluence of the Gulobod River and the Varzob River with the altitude above the sea level of 1,100 meters, a recreational area is situated, and the canyon is fairly well protected from the negative influence of the anthropogenic factors, thereby creating favorable conditions for the growth of various vegetation.

Along the bed of the Gulobod River that runs along the bottom of the canyon, up to the elevation of 1,250-1,300 m above sea level, broad-leaved (deciduous) forest grows with the normality 0.5-0.7, where linearifolious willows – Salix linearifolia E. Wolf - and dense-aglet willows – Salix pycnostachya Anderss - are the predominant species, with sporadic presence of Turkestan maples – Acer turkestanicum Pax., Regel's maples – A. regelii Pax., Oriental planes – Platanus orientalis L., walnuts – Juglans regia L., Sivers Apples – Malus sieversii M. Roem., and Syrian ashes – Fraxinus syriaca Boiss. Higher along the riverbed and along the vertical profile, this forest formation is displaced by shibliak with the forest stand density of 0.3-0.6, which is dominated by bitter almonds – Amygdalus bucharica Korsh., Pontic hawthorns – Crataegus

pontica C. Koch, Turkestan hawthorn – C. turkestanica Pojark. and Caucasian Hackberries – Celtis caucasica Willd. The shrub layer is mainly formed of the following species: Korolkov's honeysuckle – Lonicera korolkowii Stapf and coin leaved L. nummulariifolia Jaub. et Spach., Hissar cotoneaster– Cotoneaster hissaricus Pojark., tangy cotoneaster– C. subacutus Pojark., coin-leaved – C. nummularioides Pojark. and Paulsen's senna – Colutea paulsenii Freyn. Starting with the altitude of 1,600-1,700 m, formation of shibliak is replaced by thermophilic juniper stands that mainly consist of Seravschan juniper – Juniperus seravschanica Kom.

The prevailing soil types in the lower zone of the canyon are finely crushed moderately washed dark-gray soils, brown calcareous and brown forest soils, which in the upper zone close to the dividing crests become Alpine meadow soils.

The Saphedchashma canyon is located at the distance of 39 km to the east of Dushanbe, on the eastern part of the southern slope of the Hissar Mountains. The canyon consists of several small canyons adjoining from the northeast, such as Ogalak, Obi Surma and Obi Zagora.

From the fork of the main highway Ramit, this canyon extends from northwest to southeast for over 18 km and is zigzag-shaped. It should be noted that the first 8 km of the Saphedchashma canyon are a densely populated area with 5 settlements.

The herbarial material during identification of plants was processed and verified according to the standard techniques [17] and electronic resource (Guide to plants), systematic affiliation of the taxon - according to [18], and the abundance was assessed with the use of Drude scale with the additions of A. A. Uranova [19]. The studies for identification of plant reserves were performed using the conventional method [20], while the reserves of medicinal plants were determined by the plot method. Along with that, the influence of factors like height above the sea level, steepness and exposition of the slopes was taken into account, due to which distribution of medicinal plants in the mountain areas was very diverse and multilateral; for more veracious data collection, 5x5 m plots were laid. Sample plots in the thickets of plants were laid diagonally and around the perimeter after every 2, 3 and 5 m. Due to the fact that medicinal raw material in horseheal – I. helenium - were roots, the undergrowth recovery time was taken equal to 15 years and restoring the thickets of small-flowered oregano – O. tyttanthum - took 4 years. For determining the average mass of medicinal plant material (MPM), 15 adult plants of horseheal – I. helenium - were sampled in each commercial thicket. The average mass of medical plants and other indicators - O. tyttanthum - were accounted for by 30 adult plants in each commercial thicket. To determine the standard deviation of variability to the arithmetic average aggregate, the coefficient of variation V was determined. Statistical calculations were made according to the method of B. A. Dospekhov [21].

3. Results

Comprehensive assessment of the diversity and bioresources of wild medicinal plants was made in the Gulobod canyon (Table 1).

Table 1: Diversity and prevailing resources of wild medicinal plants in the territory of the Gulobod canyon in 2016

No.	Plant Name	Forest Formation	Abundance according to Drude
1	*Asyneuma argutum* (Regel) Bornm.	D	sol
2	*Althaea officinalis* L.	S	sp
3	*Arum korolkowii* Regel	D	sp
4	*Astragalus sieversianus* Pall.	S	sp
5	*Astragalus mirabilis* Lypsky	S	sol
6	*Heracleum lehmannianum* Bung	D	sol
7	*Crataegus pontica* C. Koch	S	sp
8	*Crataegus turkestanica* Pojark.	S	sp
9	*Dianthus baldshuanicus* Lincz.	S-J, A	sol
10	*Geranium collinum* Steph. ex Willd.	S	sp
11	*Geranium robertianum* L. ***	S	sol
12	*Gentiana olivieri* Griseb.	S	sp
13	*Coronaria coriacea* Schischk. ex Gorschk.	D	sol
14	*Inula helenium* L.	D, S	cop 1
15	*Origanum tyttanthum* Gontsch.	D, S	cop 1
16	*Rubus caesius* L.	D	sol
17	*Hypericum perforatum* L.	S	sp
18	*Hypericum scabrum* L.	S	sp
19	*Ziziphora pamiroalaica* Juz. ex Nevski	S	sp
20	*Scorzonera circumflexa* Krasch. et Lipsch.	S	sol
21	Scorzonera bracteosa C. Winkl.	D, S	sol
22	*Tragopogon paradoxus* S.A. Nikit.	D, S	sol
23	*Verbascum songaricum* Schrenk	S	sol
24	*Cousinia tomentella* C. Winkl.**	S	sol
25	*Cousinia integrifolia Franch.*	S	sol
26	*Polygonatum sewerzowii* Regel	D	sol
27	*Atraphaxis pyrifolia* Bunge	S	sol
28	*Potentilla kulabensis* Th. Wolf **	S	sol
29	*Lactuca tatarica* (L.) C.A. Mey.	D, S	sol
30	*indelofia macrostyla* (Bunge) PopOv	D, S	sol
31	*Pseudosedum condensatum* Boriss. **	D, S	sol
32	*Arctium leiospermum* Jus.et Serg.	D, S	sp
33	*– Allium stephanophorum* Vved.	D-S, S	sp
34	*Allium suworowii* Regel *	D-S, S	sp
35	*Papaver pavoninum* Schrenk	S	sp
36	*Melissa officinalis* L.	D	sp
37	*Amygdalus bucharica* Korsh .	S	sp-cop1
38	*Daucus carota* L.	S	sp
39	*Mentha asiatica* Boriss.	D, D-S	sp
40	*Taraxacum officinale* F.H. Wigg. ***	D, S	sp
41	*Ostrowskia magnifica* Regel *	D	sp
42	*Oxytropis roseiformis* B. Fedtsch.**	S	sol
43	*Tanacetum pseudachillea* C.Winkl.	S	sol
44	*Plantago major* L. ***	D, S	sp
45	*Plantago lanceolata* L.	D, S	sp
46	*Galium pamiro-alaicum* Pobed.	D	sol
47	*Artemisia vulgaris* L.	S, A	sol
48	*Pseudohandelia umbellifera* (Boiss.) Tzvel.	S, A	sol
49	*Phlomoides lehmanniana* (Bunge) Adylov, Kamelin & Makhm.	S	sol
50	*Phlomoides tadschikistanica* (B. Fedtsch.) Adylov, Kamelin & Makhm.	S	sp
51	*Matricaria recutita* L. ***	D, S	sp
52	*Stemmacantha integrifolia* (C. Winkl.) Dittrich	S, S-J	sol
53	*Rheum maximowiczii* Losinsk.	S, A	sp
54	*Scabiosa songarica* Schrenk	S	sp
55	*– Glycyrrhiza glabra* L.	S	sol
56	*Rhus coriaria* L.	S	sp
57	*Crepis pulchra* L.	S	sp
58	*Thermopsis dolichocarpa* V.Nikit.**	S	sp
59	*Achillea filipendulina* Lam.	S	sp
60	*Tulipa praestans* T.M. Hoog **	D, S	sp
61	*Ungernia victoris* Vved. *	S, A	sol
62	*Ferula kuhistanica* Korov.	S, A	sp-cop1
63	*Ferula clematidifolia* K. - Pol.	D	sp-cop1
64	*Handelia trichophylla* Heimerl	S	sol
65	*Salvia sclarea* L.	S	sp
66	*Rosa achburensis* Chrshan. **	D, S	sol
67	*Rosa kokanica* (Regel) Juz.	S	sol
68	*Eremurus brachystemon Vved.***	S	sp
69	*Sternbergia lutea* (L.) Spreng.	S, A	sp
70	*Althaea nudiflora* Lindl.	S	sp
71	*Rumex paulsenianus* Rech. f.	D, S	sp
72	*Ephedra equisetina* Bunge	S, A	sp
73	*Juno vicaria* Vved.	S, A	sol
74	*Uechtritzia kokanica* (Regel et Schmalh.) Pobed.	D, D-S	sol
75	*Dictamnus tadshikorum* Vved.	S	sp

Note: sol – single; sp – scattered (average minimum distance between individuals of the species was 100-150 cm); cop 1 – fairly abundant (average minimum distance between individuals of the species was 40-100 cm).
**- plants listed in the Red book of the Republic of Tajikistan;*
***- endemic plants of the Middle Asia and Pamir-Alay, with the exception of Tulipa praestans, which was endemic for the Western and Southern Pamir-Alay;*
**** - adventive plants.*
D – deciduous forest; S – shibliak; J – juniper stand.

Analysis of the table shows that in the territory of the Gulobod canyon, the most common are 75 plant species. Out of these, 3 species are listed in the Red Book of the Republic, 8 are endemic ones, and 4 are adventive plants. Commercial thickets are formed by small-flowered oregano and horseheal. Plants like Ferula kuhistanica and Ferula clematidifolia form small commercial thickets, and the areas of Amygdalus bucharica increase due to artificial promotion of natural regeneration, and a number of erosion control measures.

Table 2 shows addresses of commercial thickets for procurement of horseheal raw materials – I. helenium - in the Gulobod plot in 2016. In the territory of the Gulobod canyon, 3 commercial thickets of horseheal – I. helenium - had been formed with the total area of 1.0 ha. Commercial thickets were small, and their areas varied between 0.25 and 0.45 ha. The biological stock of raw materials of horseheal – I. helenium - in the air-dry form amounted to 622.6±48.8 kg, the operating stock was 398.5±31.3 kg, and the possible annual procurement amount (PAPA) was 26.5±2.1 kg.

Table 2: Stocks of raw materials (roots) of commercial thickets of horseheal – Inula helenium - in the Gulobod plot, 2016

No	Total area, ha	The average number of plants on the 5 x 5 m plots	The average weight of air-dry raw material per 1 plant, g	Air-dry stock of raw materials, kg		PAPA, kg
				biological	operational	
1	0.25	12.5±1.0	120.9±9.7	151.1±12.1	96.7±7.8	6.4±0.5
2	0.30	10.0±0.8		145.1±11.6	92.9±7.4	6.2±0.5
3	0.45	15.0±1.1		326.4±25.1	208.9±16.1	13.9±1.1
∑	1.00			622.6±48.8	398.5±31.3	26.5±2.1

The variation coefficient in the calculations was V=7.8, which showed reliability of the calculations and their being within the root-mean-square permissible error of variability to the mean arithmetic aggregate.

Table 3 shows the data about the stock of raw materials in commercial thickets of small-flowered oregano – O. helenium - in the Gulobod plot in 2016.

Table 3: Stock in commercial thickets of small-flowered oregano – Origanum tyttanthum - in the Gulobod plot, 2016

No	Total area, ha	The average number of plants on the 5 x 5 m plots, pcs.	The average number of stems per plant, pcs.	The average weight for air-dry raw material per 1 stem, g	Air-dry stock of raw materials, kg		PAPA, kg
					biological	operational	
1	0.4	32.0±1.9	10.0±0.6	2.06± 0.15	105.5±6.7	70.2±4.5	17.6±1.1
2	0.65	36.0±2.3	11.4±0.9		219.8±15.8	142.9±10.3	35.7±2.6
3	0.5	29.0±1.6	9.2±0.6		109.2±7.0	69.7±4.5	17.4±1.1
4	0.75	34.0±1.7	10.4±0.8		218.5±14.9	140.7±9.6	35.2±2.4
∑	2.3				653.0±44.4	423.5±28.9	105.9±7.2

In the territory of the Gulobod canyon, 4 commercial thickets of small-flowered oregano – O. tyttanthum - had been formed with the total area of 2.3 ha. Commercial thickets were small and their areas varied between 0.4 and 0.75 ha. The biological stock of raw small-flowered oregano – O. tyttanthum - in the air-dry form in 2016 amounted to 653.0±44.4 kg, the operational stock - to 423.5±28.9 kg, and the possible annual amount of procurement (PAPA) - to 105.9±7.2 kg. The variation coefficient of the experimental data was V=6.8, which showed their reliability.

Table 4 shows data about diversity of spread and the taxonomic identity of prevailing wild medicinal and other plants in the territory of the Saphedchashma canyon.

Table 4: Diversity and taxonomic identity of prevailing wild medicinal and other plants in the territory of the Saphedchashma canyon, 2014

No	Plant Name	Taxon Identity		Abundance according to Drude
		family	genus	
1	*Althaea officinalis* L.	Malvaceae Juss.	Althaea L.	sol
2	*Astragalus aksuensis Bunge*	Fobaceae (Leguminosae Juss.)	Astragalus L.	sol
3	*Astragalus sieversianus* Pall.	Fobaceae (Leguminosae Juss.)	Astragalus L.	sp
4	*Crataegus pontica* C.Koch In Verh	Rosaceae Juss.	Crataegus L.	sp
5	*C. turkestanica* Pojark.	Rosaceae Juss.	Crataegus L.	sp
6	*Dianthus seravschanicus* Schischk.	Caryophyllaceae Juss.	Dianthus L.	sol
7	*Inula helenium* L.	Asteraceae Compositae Giseke	Inula L.	cop1
8	*Origanum tyttanthum* Gonsch.	Lamiaceae (Labiatae Juss.)	Origanum L.	sp
9	*Hypericum perforatum* L.	Hypericaceae (Guttiferae Juss.)	Hypericum L.	cop1
10.	*Hypericum scabrum* L.	Hypericaceae (Guttiferae Juss.)	Hypericum L.	sp
11	*Ziziphora pamiroalaica* Juz.	Lamiaceae (Labiatae Juss.)	Ziziphora L.	sol
12	*Scorzonera hissarica* C. Winkl.	Asteraceae (Compositae Giseke)	Scorzonera L.	sol
13	*Scorzonera circumflexa* Krasch. Et Lipsch.	Asteraceae (Compositae Giseke)	Scorzonera L.	sol
14	*Tragopogon paradoxus* S. Nikit.	Asteraceae (Compositae Giseke)	Tragopogon L.	sol
15	*Verbascum songaricum* Schrenk in Fisch. Et Mey. Enum.	Scrophulariaceae Juss.	Verbascum L.	sol
16	Cousinia Grigoriewii Juz.	Asteraceae (Compositae Giseke)	Cousinia Cass.	sol
17	*Atraphaxis pyrifolia* Bge.Mem.Acad.	Polygonaceae Juss.	Atraphaxis L.	sp
18	*Potentilla kulabensis* Th.Wolf.	Rosaceae Juss.	Potentilla L.	sp
19	*Lindelofia macrostyla* (Bunge) M. Pop.	Boraginaceae Juss.	Lindelofia Lehm.	sol
20	*– Alium stipitatum* Regel.	Amaryllidaceae Lindl.	Allium L.	sol
21	*– Allium stephanophorum.* Vved.	Amaryllidaceae Lindl.	Allium L.	sol
22	*Melissa officinalis* L.	Lamiaceae (Labiatae Juss.)	Melissa L.	sp
23	*Amygdalus bucharica* Korsh .	Rosaceae Juss.	Amygdalus L.	sp
24	*Daucus carota* L.	Umbelliferae Moriss.	Daucus L.	sp
25	Mentha asiatica Boiss.	Lamiaceae (Labiatae Juss.)	Mentha L.	sp
26	*Plantago major* L.	Plantaginaceae Juss.	Plantago L.	sp
27	*Plantago lanceolata* L.	Plantaginaceae Juss.	Plantago L.	sp
28	*Eremostachys arctiifolia* M. Pop.	Lamiaceae (Labiatae Juss.)	Eremostachys Bunge	sol
29	*Eremostachys tadschikistanica* B. Fedtsc.	Lamiaceae (Labiatae Juss.)	Eremostachys Bunge	sol
30	*Rheum hissaricum* Losinsk.	Polygonaceae Juss.	Rheum L.	sol
31	*Rheum maximowiczii* Losinsk.	Polygonaceae Juss.	Rheum L.	cop1
32	*– Glycyrrhiza glabra* L.	Fobaceae (Leguminosae Juss.)	Glycyrrhiza L.	sol
33	*Rhus coriaria* L.	Anacardiaceae Lindl.	Rhus L.	sp
34	*Thermopsis dolichocarpa* V. Nikit.	Fobaceae (Leguminosae Juss.)	Thermopsis R. BR.	sp

35	*Achillea Biebersteinii* Afan.	Asteraceae (Compositae Giseke)	Achillea L.	sp
36	*Achillea filipendulina* Lam.	Asteraceae (Compositae Giseke)	Achillea L.	sp
37	*Ferula kuhistanica* Korov.	Umbelliferae Moriss.	Ferula L.	sp
38	*Handelia trichophulla* (Schrenk) Heimerl in Osterr.	Asteraceae (Compositae Giseke)	Handelia Heimerl	sol
39	*Cichorium intybus* L.	Asteraceae (Compositae Giseke)	Cichorium L.	sol
40	– *Salvia sclarea* L.	Lamiaceae (Labiatae Juss.)	Salvia L.	sp
41	*Rosa canina* L.	Rosaceae Juss.	Rosa L.	sp
42	*Rosa foetida* Herrm. In Diss	Rosaceae Juss.	Rosa L.	sp
43	*Rosa divina* Sumn.	Rosaceae Juss.	Rosa L.	cop1
44	*Sternbergia lutea* (L.) Ker-Gavl. In Roem.	Amaryllidaceae Lindl.	Sternbergia W. et K.	sp
45	*Eremurus robustus* Regel.	Liliaceae Hall.	Eremurus M.B.	sp
46	*Eremurus brachystemon Vved.*	Liliaceae Hall.	Eremurus M.B.	sp
47	*Rumex paulsenianus* Rech. F. in Feddes	Polygonaceae Juss.	Rumex L.	sp
48	*Ephedra equisetina* Bunge	Ephedraceae Wettst.	Ephedra L.	sp
49	*Prangos pabularia* Lindl.	Umbelliferae Moriss.	Prangos Lindl.	cop1
50	*Dictamnus tadshikorum* Vved.	Rutaceae Juss.	Dictamnus L.	sol

It has been shown that in the territory of the Saphedchashma canyon, the most common are 50 species of plants that belong to various botanical taxa. These species include representatives of 38 genera that belong to 17 different families. Of these plants, *Inula helenium* L., *Hypericum perforatum* L., *Rheum maximowiczii* Losinsk., *Rosa divina* Sumn. and *Prangos pabularia* form commercial thickets.

Figure 1 shows quantitative distribution of plants, their affiliation to divisions, classes, families, genera, and species according to the phylogenetic classification of academician A. L. Takhtajan [22].

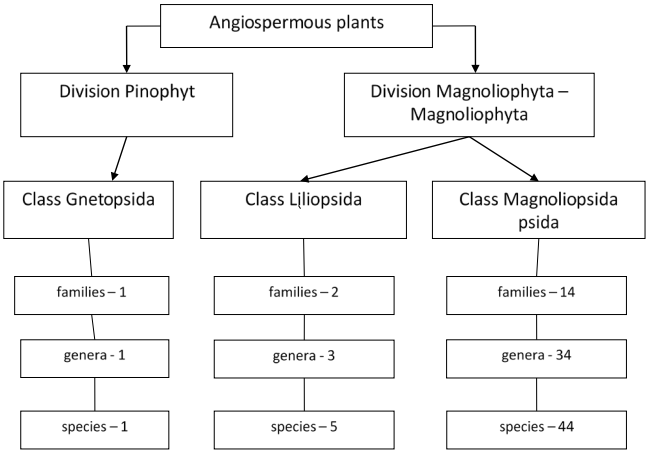

Fig. 1: Quantitative distribution of plants according to the phylogenetic classification of academician A. L. Takhtajan

In the territory of the Saphedchashma canyon, flowering plants are mainly represented by angiosperms: two classes (monocotyledons and dicotyledons), 16 families, 37 genera and 49 species; of gymnosperms there is only one plant that belongs to the Ephedraceae family, class Gnetaceae.

Figure 2 shows the spread ratios for the prevailing families of wild medicinal plants in the territory of the Saphedchashma canyon.

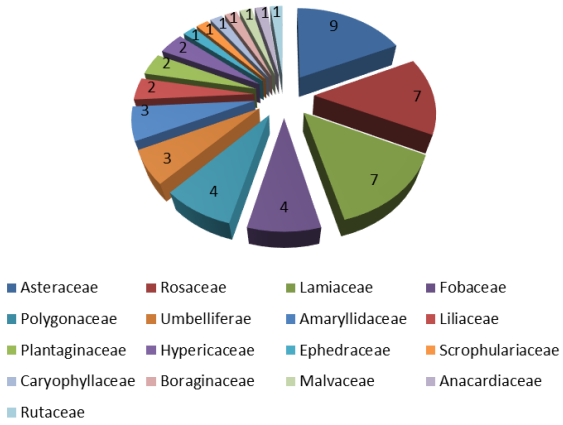

Fig. 2: Spread ratios for the prevailing families of wild medicinal plants in the territory of the Saphedchashma canyon

It has been noted that the territory of the Saphedchashma canyon is dominated by representatives of Asteraceae (9 species), Rosaceae and Lamiaceae (7 species each), Polygonaceae and Fabaceae (4 each).

4. Discussion

The problem of preserving the fauna of the unique natural zones in the Republic of Tajikistan is of paramount importance. To monitor the dynamics of degradation or regeneration of biological diversity and resources of wild medicinal plants, accounting for their stock is required. In this regard, studies for assessing biodiversity and resources of wild plants in the territories of canyons Gulobod and Saphedchashma (the Southern slope of the Hissar Mountains) are of paramount importance in preserving unique objects of the flora in the Republic of Tajikistan.

5. Conclusion

1. It has been found that in the territory of the Gulobod canyon (the Hissar Mountains, Tajikistan) the most common are 79 species of medicinal plants that belong to various botanical taxa. Out of these, 3 plants are listed in the Red Book of the Republic, 8 are endemic ones, and 4 are adventive plants. It has been shown that in the territory of the Gulobod canyon, out of the studied 15 plants, 7 are commercial ones and have economic value, with the total area of 3.3 ha. Horseheal – I. helenium - formed 3 commercial thickets with the total area of 1.0 hectare and the biological stock of 622.6±60.5 kg, and the operational margin of 398.5±38.7 kg. Small-flowered oregano – O. tyttanthum - formed 4 thickets with the total area of 2.3 ha and the biological stock of 651.5±47.8 and the operating margin of 423.5±31.0 kg.
2. The small size of commercial thickets and their small number, as well as solitaire arrangement or arrangement in small spots dispersed with other plant species indicate gradual regeneration of the biological diversity and stock of the plants in the territory of this canyon after its protection has been organized.
3. In the territory of the Saphedchashma canyon (the Southern slope of the Hissar Mountains), the most common are 50 species of plants that belong to various botanical taxa. These species include representatives of 38 genera that belong to 17 different families. The most common are representatives of Asteraceae (9 species), Rosaceae and Lamiaceae (7 species each), and the small stocks, and poor abundance of these plants indicate significant deterioration of the natural resources due to the increased anthropogenic load in the territory of the canyon.

References

[1] Ikonnikov SS, Ismailov M, Knorring IG et al (1975) *Flora Tadzhikskoi SSR* [Flora of the Tajik SSR.]. M.-L: Nauka, 1, 547.

[2] Kamelin RV (1973), *Florogeneticheskii analiz estestvennoi flori gornoi Srednei azii* [Flora genetic analysis of the natural flora in the mountains of Middle Asia]. L: Nauka, 353.

[3] Hisoriev HH, Mirsaburov S, Ibodi AG (2014), *Materiali k fitogeografii presnovodnih vodoroslei TSentral'noi azi* [Materials for phytogeography of freshwater algae in Central Asia]. DAS RT, 57(1), 63-72.

[4] Kim JH, Kim YS, Lee SH, Lee KS, Choi GY, Chung SI et al. (2016), Chemical components of herbal medicines in Ungok Herbology. Jeonju: Woosuk Press.

[5] Abou-Arab AAK, Abou Donia MA (2001), Pesticide residues in some Egyptian spices and medicinal plants as affected by processing. *Food Chemistry*, 72(4), 439– 445.

[6] Annan K, Kojo AI, Cindy A, Samuel A, Tunkumgnen, BM (2010), Profile of heavy metals in some medicinal plants from Ghana commonly used as components of herbal formulations. *Pharmacognosy Research*, 2(1), 41–44.

[7] Dey S, Saxena A, Dan A, Swarup D (2009), Indian medicinal herb: a source of lead and cadmium for humans and animals. *Archives of Environmental & Occupational Health*, 64(3), 164–167.

[8] Dewick PM (2009), Medicinal natural products. UK, Chichester, *John Wiley & Sons*.

[9] Heinrich M, Barnes J, Gibbons S, Williamson EM (2012), Fundamentals of pharmacognosy and phytotherapy. *Elsevier Health Sciences Churchill Livingstone.*

[10] Saxena M, Saxena J, Nema R, Singh D, Gupta A (2013), Phytochemistry of medicinal plants. *Journal of Pharmacognosy and Phytochemistry*, 1.

[11] Wink M (2015), Modes of action of herbal medicines and plant secondary metabolites. *Medicines*, 2, 251-286.

[12] Tassaneeyakul W, Razzazi-Fazeli E, Porasuphatana S, Bohm J (2004), Contamination of aflatoxins in herbal medicinal products in Thailand. *Mycopathologia*, 158, 239–244.

[13] Wah CL, Hock SC, Yun TK (2012), Current scientific status and regulatory control of traditional/herbal medicinal products: globalization challenges. *PharmEng Technology*, 32(6), 1–11.

[14] Sattarov DS, Saidov NS (2015), Otsenka raznoobraziya i resursov dikorastuschih lekarstvennih rastenii uschelya Odzhuk (Gissarskii hrebet, Tadzhikistan) [Assessing diversity and resources of wild medicinal plants in the Odjuk canyon (Hissar Mountains, Tajikistan)]. News of AS RT. *Department of Computational Biology and Medical Sciences*, 3(191), 18-24.

[15] Sattarov DS (2016), *Otsenka bioraznoobraziya dikorastuschih lekarstvennih rastenii uschelya Semiganch (Gissarskii hrebet, Tadzhikistan)* [Assessment of wild medicinal plants' biodiversity in the Semiganch (Hissar Mountains, Tajikistan)]. DAS RT, 59(1-2), 78-83.

[16] Rakhimov S (2007), Biologo-morfologicheskaya harakteristika Ferula foetidissima Regel et Schmalh [Biological and morphological characteristics of Ferula foetidissima Regel et Schmalh]. *The Siberian Ecological Journal*, 14(3), 505-509.

[17] *Flora Tadzhikskoi SSR* (1991) [Flora of the Tajik SSR]. M.-L: Nauka, 1–10.

[18] Takhtajan AL (1987), *Sistema magnolifitov* [Magnoliophytae system]. L: Nauka, 439.

[19] Neronov VV (2002), *Polevaya praktika po geobotanike v srednei polose Evropeiskoi Rossii*. [Field practice in geobotany in the middle zone of European Russia]. M: Publishing House of the Center of Wildlife Preservation, 139.

[20] *Metodika opredeleniya zapasov lekarstvennih rastenii* (1986) [Method of identifying the stock of medicinal plants]. Moscow, 52.

[21] Dospekhov BA (1985), *Metodika polevogo opita (s osnovami statisticheskoi obrabotki)* [Methodology of field experiment (with basics of statistical processing)]. Moscow: Agropromizdat, 351.

[22] *Plants Index online*. www.plantarium.ru.