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Asteraceae in Flora of Argunskiy Biological Reserve

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***Abstract* – A study of flora in Argunskiy Biological Reserve in Chechen Republic, with over 490 species of vascular plants. Asteraceae family was investigated in particular detail, including 60 species and 38 genera. Centaurea is presented in 7 species, Artemisia, Inula – 5 species each; 3 species each of Cirsium and Hieracium genera, 2 species each – Ambrosia, Achillea, Arctium, Carduus, Matricaria, Petasites, Senecio, Sonchus, Xanthium. The abovementioned genera total to 42 species and 67.7 % of the family. 20 species with a sole genus constitute 32.3%. The family is represented by species of various geographic origin - 6 geotypes and 20 geo-elements with significant prevalence of golarctic(35, 4%) and boreal (33.8%) geotypes. Species useful for various purposes are listed. Rare and protected species of the family are indicated.**

Keywords – Chechen republic, Argunskiy Biological Reserve, flora, Asteraceae, benefits, rare species, protection, reproduction.

I. Introduction

Asteraceae family (Asterales) is the largest family of flowering plants, with over 20000 species and 1150-1300 genera [1]. Asteraceae species have a cosmopolitan distribution and can be found in all continental zones. [2]. They play a major role in forming phytocenosis and plant cover. Asteraceae is an economically important family. Argunskiy Biological Reserve was founded in 1977 in floodplain forest of the rivers Sunzha, Argu and Dzhalka, on the area of Groznensiy and Gudermesskiy districts of Chechen Republic. Forest areas constitute 8.7 thousand hectares of the total area (15 thousand hectares). Gardens, fields, haylands, vegetable gardens and pastures constitute 6.3 thousand hectares [3]. Various habitats and ecological niches are presented on the area of the reserve. Focused research of plant cover and flora is being carried out. Preliminary results identified approximately 500 species of higher vascular plants from 96 families in the flora of the reserve. We focus our research on the analysis of the family containing the largest number of species and genera. Asteraceae.

II. Methods And Materials

We have been investigating flora and vegetation of Agunskiy Biological Reserve since 2015. During this period, we attended all accessible areas and habitats, populated by various phytocenoses, in autumn and spring. We covered and herborized all the species we came across. To specify the identification, we used «Identification of Kavkaz plants» by A. A. Grossgeim, [4], «Flora of the North Caucasus» by Galushko [5], bulletin by S. K. Czerepanov [6]. We compiled a preliminary systematic list of flora that includes over 490 species of vascular plants. A more detailed research was performed for one of the largest families in the reserve - Asteraceae. We accounted for systematic and quantative composition and geographical elements by N. N. Portenier [7], their ratio, distribution of species on the territory of the reserve, their useful properties. Resource potential of the species is borrowed from A. A. Grossgeim, [8], E. V. Wolf, O. F. Maleeva [9], H.A. Hoppe. [10], J. Harvey [11], N. I. Maznev [12], «Plant resources of USSR» [13], M. U.Umarov and M. A. Taimusov [14] et al. The following types of species are identified by their resource potential: medicinal (M), food (N), honey (H), decorative (D), containing tannin (T), feed (F), dyeing (C), used for coffee surrogate (Cf), insecticides, suitable to deter insects (I) and arthropods - repellents (A), weeds (W), poisonous for humans or animals (P), allergenic (Al), aromatic (Ar), rubber-containing (R), oil-bearing (O). The distribution of species outside the reserve is indicated according to altitude zones of the Chechen Republic. The results of research and analysis of scientific sources are reflected in tables 1 and 2.

III. Results

According to our preliminary data, the flora of the biological reserve contains about 500 species of flowering plants from 107 families, Asteraceae family being the largest in terms of genera (34) and species I (62). Centaurea is presented by the largest amount of species - 7 species, Artemisia, Inula by 5 species each; 3 species each of Cirsium and Hieracium genera, 2 species each – Ambrosia, Achillea, Arctium, Carduus,

Matricaria, Petasites, Senecio, Sonchus, Xanthium. The abovementioned genera total to 42 species and 67.7 % of the family. 20 species with a sole genus constitute 32.3%. The family is represented by species of various geographic origin - 6 geotypes and 20 geo-elements with significant prevalence of golarctic and boreal geotypes (33.9% each).

The representation of Asteraceae in the reserve by different geotypes, geo-elements and 62 species indicates its phyto-diversity. Analysis of the spectrum of geographic elements indicates prevalence of golarctic (22 species, 35.4%) and boreal geotypes (21 species, 33.8%). The following geotypes were identified, in descending order: adventive (8 species, – 12.9 %), ancient mediterranean (6 species– 9.6 %), connecting (4 species – 6.4 %), multiareal (1 species – 1,6 %). However, the distribution of geoelements in geotypes is uneven.

Palearctic geoelements significantly prevail in golarctic geotype (81.8 %), where areals cover moderate and subtropical areas of the Old World Golarctic (Eurasia and Africa), with only 18.2 % of golarctic. Boreal geotype contains 7 geoelements with significant prevalence of pontic-southern Siberian (28.6%), typical for Eurasian steppe [15] and euro-Siberian (23.8 %). Caucasian (14.3%) euro-caucasian and contic geoelement (9.5%) are represented on much rarer basis. In adventive geotype, 7 out of 8 total species are non-native, introduced from North America (Ambrosia trifida, Ambrosia artemisifolia, Erigeron canadensis, Matricaria matricarioides, Phalachroloma annuum, Xanthium spinosum, Xanthium strumarium) and only one (Sigesbeckia orientalis) is from Southeast Asia. As for connecting geotype, which accounts only for 4 species, all geoelements - Sub-Mediterranean., Sub-Caucasian, subpontic and subtourian – are presented equally infrequent – by 1 species.

The fact that the family contains the species of different geographic origin indicates multi-directional migration routes during the florogenesis process.

There are a lot of valuable species among the recorded 62 species of Asteracxeae family. The family is plentiful in medicinal plants. The majority of them is used in scientific medicine and folk medicine: common yarrow (Achillea millefolium), common wormwood (Artemisia vulgaris), Common chicory (Cichorium inthybus), Elecampane – (Inula helenium), wild camomile (Matricaria recutita), three-lobe beggarticks (Bidens tripartita), cornflower (Centaurea cyanus), coltsfoot (Tusillago farfara), dandelion (Taraxacum officinale), greater burdock (Arctium lappa) and others.

The following species are suitable for eating (as salads, dressings or spices): Spanish salsify (Scorzonera hispanika) – roots and green leaves, dandelion (Taraxacum officinale) – leaves, roots, flower stalks, greater burdock – fresh stems and roots, welted thistle (Carduus crispus) – green leaves, nodding thistle (C. nutans) – green shoots, leaves, receptacle, spiny cocklebur (Xanthium spinosum) – green leaves, and others.

The following are considered good nectar-bearing plants: species of genera plumeless thistles (Carduus), thistle (Cirsium), burdock (Arctium), centory (Centaurea), dandelion, common cocklebur (Xanthium strumarium), whereas yarrow (Achilea), butterburs species (Petasites), hawkweed (Hieracium echinoides), spanish salsify, species of the Senecio genus are considered secondary.

The following are distinguished as ornamental plants: goldenrods (Solidago virgaurea), wormwood, yarrow, oxeye daisy (Leucanthemum vulgare) bonesets (Eupatorium cannabinum), species of Innula вIDы, common chicory, cornflower, Centaurea ruthenica, yellow star-thistle (Centaurea solstitialis), annual everlasting (Xeranthemum annuum), glandular globe-thistle (Echinops spaerocephalus) and others.

Many composite flowers can be used for dyeing wool, fabrics, and paper in different colors and shades. Suitable as yellow dye: chamomile, oxeye daisy, European goldenrod, common cocklebur; horse-heal is used for purple color. Three-lobe beggarticks can be used to dye wool and silk in yellow, beige and brown shades, sweet wormwood (Artemisia annua) for lemon-yellow color. Cornflowers can color fabrics blue. Leaves and stems of Eupatorium cannabinum and dry roots of elecampane are used for blue coloring. Common cocklebur dyes wool in yellow and green. Stems, leaves and flowers of Groundsel (Senecio vulgaris) and glandular globe-thistle are suitable for green color.

The following oil-bearing plants can be mentioned: woolly distaff thistle (Carthamus lanatus), cotton thistle (Onopordum acanthium), common cocklebur.

Yarrow, common ragweed, absinthe wormwood (Artemisia absinthium) and common wormwood (Artemisia vulgaris), burdock, horseweed, and chamomile contain essential oils.

Common ragweed contains a dangerous allergic agent, whereas common ragweed, yarrows, species of wormwood genera are anthelmintic.

Among the representatives of sunflower family in the reserve are also feeding plants, spices and aromatic plants (yarrow, wormwood, horse-heal), rubber-plants (Jurinea arachnoidea, rush skeletonweed (Chondrilla juncea), horseweed (Erigeron canadensis)

Some species contain vitamins: yarrow, common nipplewort – vitamin A; burdock, common chicory, horseweed, rush skeletonweed, cotton thistle (Onopordum acanthium), common cocklebur – vitamin C; common wormwood, European goldenrod, coltsfoot chamomile – vitamins A and C.

Burdock, common chicory, spanish salsify and dandelion are suitable for coffee-like beverages.

Abundance of weeds signifies intensive agricultural activity in the reserve (herding cattle, adjacent fields and settlements): common cocklebur and spiny cocklebur, three-part beggarticks, horseweed, cornflower and low cornflower, common thistle (Cyrsium vulgare), as well as the types of weeds that are hard to eliminate – creeping thistle (Cirsium arvense), blue lettuce (Lactuca tatarica), field milk thistle (Sonchus arvensis), annual fleabane (Phalachroloma annuum), two ragweed (Ambrosia) species.

TABLE I. DISTRIBUTION OF ARGUNSKIY RESERVE FLORA AMONG GEOGRAPHICAL BELTS OF CHECHEN REPUBLIC

№	Name of species	Distribution by belt						Geoelements	Economic use
		I	II	III	IV	V	VI		
1	**Achillea** biebersteinii Afan.	+	+	+				East Ancient Mediterranean	M.F.Cf.Ar.O
2	A. millefolium L.	+	+	+		+		Euro-Siberian.	M.N.D.F.A.O
3	Ambrosia artemisifolia L.							Adventive. N-American.	M.C.Al
4	Ambrosia trifida L.							Adventive. N-American.	W
5	**Arctium** lappa L.	+	+	+				Palearctic	M.N.H.D.E.Cf
6	A. palladinii (Marc.) Grossh.	+	+	+				Caucasian	M.H.
7	**Artemisia absithium L.**	+	+	+		+		Palearctic	M.N.D.F.Пр.Ar.I.P
8	**Artemisia annua L.**	+	+	+				Palearctic	M.D.F.C.I..Ar.Пр
9	**Artemisia** austriaca Gacg.	+	+		+	+		Pontic-South-Siberian	M.K.O..
11	**Artemisia** taurica Willd. (A. graveolens Minatullaev)	+	+					Pontic	M.D.K.P.P.O
12	Artemisia vulgaris L.	+	+	+				Golarctic	M.N.D.K.Сч.I.O.
13	**Aster** amelloides Bess.		+	+	+			Pontic-South-Siberian	F.D.
14	Bidens tripartita L.		+	+				Multiareal	M.F.C
15	Carduus crispus L.	+	+	+	+			Palearctic	M.N.H.F.
16	Carduus nutans L. (C. thoermeri Weinm.)–	+	+	+	+			Palearctic	M.N.H.F.
17	Carthamus lanatus L.	+	+	+				General Ancient Mediterranean	M.N.F.C.Mc
18	Centaurea cyanus L.	+	+	+				Golarctic	M.H.D.C.W..P
19	Centaurea depressa Bieb.	+	+	+				East Ancient Mediterranean	M.H.D.W.
20	Centaurea diffusa Lam.	+	+	+				Pontic	M.H.F.P
21	Centaurea iberica Trev. ex Spreng	+	+	+				Iranian- Turanian	M.H.F
22	Centaurea ruthenica Lam.	+	+	+				Sub-turanian	T.H. D.F
23	Centaurea salicifolia Bieb.			+				Subcaucasian	M.F
24	Centaurea solstitialis L.	+	+					Iranian- Turanian	M.D.R
25	**Chondrilla** juncea L. сІтнІковІDнаР	+	+	+				Submediterranean	M.N.F
26	**Cichorium** intybus L.	+	+	+				Palearctic	M.N.H.F.Cf
27	**Cirsium** arvense (L.) Scop.	+	+					Euro-Siberian	M.N.R.P
28	Cirsium canum (L.) All. (C. biebersteinii Charadze)							European	N.H.C.
29	Cirsium vulgare (Savi) Ten.	+	+	+				Palearctic	M.H.C
30	**Echinops** sphaerocephalus L.	+	+	+				Pontic South-Siberian	M.N.H.D.T.P.
31	**Erigeron** canadensis L.	+	+	+				Adventive. N.American	M.H.F.W
32	**Eupatorium** cannabinum L.	+	+	+				Palearctic	M. H.D. W.T.P
33	**Hieracium** echioides Lumn.		+	+				Palearctic	M
34	**Hieracium** pilosella L.		+	+		+	+	Euro-Caucasian	M.P
35	**Hieracium** umbellatum L.		+	+				Golarctic	M.H.F. W
36	Inula aspera Blum. ex Ledeb.	+	+	+				Pontic.- South-Siberian	M
37	Inula britannica L.	+	+	+				Palearctic	M.H.F
38	Inula caspica Blum ex Ledeb.	+	+					Turanian	M.H.F
39	Inula germanica L.	+	+	+				Euro Caucasian	M.H.F
40	Inula helenium L.	+	+	+				Palearctic	M.N.H.D.K.W.Пр
41	Jurinea arachnoidea Bunge	+	+	+	+	+		Pontic-South-Siberian	M.F.D.R
42	Lapsana communis L.	+	+	+				Palearctic	M.N
43	Leucanthemum vulgare Lam.		+	+		+		Euro-Siberian	M.N.H.D.F.W.I.P
44	Matricaria matricarioides (Less.) Porter ex Britt.	+	+					Adventive N-American	M.Al.I.
45	Matricaria recutita L.	+	+	+				Golarctic	M.F.C.Ar
46	Onopordum acanthium L.	+	+	+				Palearctic	M.N.H.D.T.F.O
47	Phalachroloma annuum (L.) Dumort. (Erigeron annuus (L.) Pers., Stenactis annua (L.) Cass.	+	+	+				Adventive. N-American	D.C
48	Petasites albus (L.) Gaerhn.			+				Caucasian-European	M. H.D. I.R.
49	Petasites hybridus (L.) Gaerth.,Mey et Schreb.		+	+				Caucasian-European	M.H.N.F.R
50	Scorzonera hispanika L. (Sc. taurica Bieb.)	+	+	+				Pontic South-Siberian	M.N.H.F.Cf
51	Senecio macrophyllus Bieb.		+					Caucasian (eucaucasian)	F
52	Senecio vulgaris L.	+	+	+				Palearctic	M.C.W.R
53	Sigesbeckia orientalis L.	+	+	+				Adventive :S.E.Asia	M.P
54	Silubum marianum (L.) Gaertn.	+	+	+				Palearctic	M.П.D.F.D.O
55	Solidago vulgaurea L.			+		+	+	Euro-Siberian	M.H.P. (sheep)
56	Sonchus arvensis L.	+	+	+				Palearctic	M.N.H.F
57	Sonchus palustris L.	+	+	+				Palearctic	M.N.H.F
58	Taraxacum officinale Wigg.	+	+	+				Palearctic	M.N.Пр.A.Cf.H.I.F
59	Tussilago farfara L. урож.:8—1024 ц/га	+	+	+				Euro-Siberian	M.H.F
60	**Xanthium spinosum L.**	+	+	+				Adventive. South-Siberian rudimental	C.M.N.P.(for cattle)
61	Xanthium strumarium L.	+	+	+				Adventive. South-Siberian	M.H.F.T.C.W.P
62	**Xeranthemum** annuum L.	+	+	+				Subpontic	M.D.F
Total		**46**	**52**	**49**	**5**	**5**	**5**		

TABLE II. RATIO OF GEOTYPES AND GEOELEMENTS OF ASTERACEAE FAMILY IN ARGUNSKIYBIOLOGICAL RESERVE

Geotypes and geoelements	Number of species	% in	
		family	Geotype
MULTIAREAL	**1**	**1,6**	**100**
Multiareal	1	1.6	100
GOLARCTIC	**22**	**35.4**	**100**
Golarctic	4	6.4	18.2
Palearctic	**18**	29	81.8
BOREAL	**21**	**33.8**	**100**
Euro-Siberian	5	8.1	23.8
Euro-Caucasian	2	3.2	9.5
European	1	1.6	4.8
Caucasian-European	2	3.2	9.5
Pontic South-Siberian	600	9.7	28.6
Pontic	2	3.25	9.5
Caucasian	3	4.8	14.3
ANCIENT MEDITERRANEAN	**6**	**9.6**	**100**
General Ancient Mediterranean	1	1.6	16.7
East Ancient Mediterranean	2	3.2	33.3
Iranian-turanian	2	3.2	33.3
Turanian	1	1.6	16.7
CONNECTIVE	**4**	**6.4**	**100**
Submediterranean	1	1.6	25
Subcaucasian	1	1.6	25
Subpontic	1	1.6	25
Subturanian	1	1.6	25
ADVENTIVE	**8**	**12.9**	**100**
Adventive	8	12.9	100

The only Red book species in the reserve is horse-heal (Inula helenium) [14]. However, some species are rare for this territory or inconsiderable in number, such as yellow star-thistle(Centaurea solstitialis), oxeye daisy (Leucanthemum vulgare),pineappleweed (Matricaria matricarioides), Queen Anne's thistle (Cirsium canum), Senecio macrophyllus, milk thistle (Silubum marianum), coltsfoot (Tussilago farfara).

Research of the plant cover of the reserve continues, and it is likely that it will allow us to add some new species to the list. In general, the reserved is characterized by abundant various habitats and ecological niches, significant diversity of flora, abundance of economically valuable species of different geographic origin. Conservation, reproduction and protection of existing biodiversity are among the most pivotal objectives of the state biological reserve, focused on sustainable functioning of its natural ecosystems.

IV. CONCLUSION

We identified 62 species from 34 genera of Asteraceae family in Argunskiy biological reserve (Chechen republic)

The largest genera are: Centaurea is presented in 7 species, Artemisia, Inula – 5 species each; 3 species each of Cirsium and Hieracium genera, 2 species each – Ambrosia, Achillea, Arctium, Carduus, Matricaria, Petasites, Senecio, Sonchus, Xanthium. The abovementioned genera total to 42 species and 67.7 % of the family. 20 species with a sole genus constitute 32.3%.

The family is represented by species of various geographic origin - 6 geotypes and 20 geo-elements with significant prevalence of golarctic (35.4 %) and boreal geotypes (33.8 %).

The family is rich in valuable plants used for different purposes: medicinal plants, adornment (decorative) plants, plants that could be used as food, honey plants, dyeing plants, animal feed species, essential-oil plants and others.

Special attention and reproduction is required for the Red Book species horse-heal (Inula helenium), which is a valuable medicinal plant, and for some species that are rare for this territory or inconsiderable in number, such as yellow star-thistle(Centaurea solstitialis), oxeye daisy (Leucanthemum vulgare),pineappleweed (Matricaria matricarioides), Queen Anne's thistle (Cirsium canum), Senecio macrophyllus, milk thistle (Silubum marianum), coltsfoot (Tussilago farfara).

The studies are focused on a detailed research of plant cover (flora and vegetation) in order to develop a complex approach for conservation, protection and reproduction of biodiversity and ecosystems in a specially protected natural area.

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