

The Phyto-Resources Potential of Makazhoy Basin

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Abstract –As the result of preliminary studies in the summer flora of the Makazhoy basin (the Chechen Republic), 10 species of higher vascular plants from... types and 30 families have been taken into account. Among them, the microstructure of the working surfaces confirmed the leading role of fatigue wear of polymeric materials during their friction on metal. The assumption that the filler is able to mechanically block fracture cracks during friction of the polymer is experimentally reasoned. The effect of shock load on friction and the wear of polymer composite materials are also considered in this article. It has been established that the materials of the oil-based group are highly resistant to frictional and bulk fatigue and are able to function for a long time without failure under the cyclical dynamic nature of loading.

Keywords – Chechen Republic, Makazhoy basin, flora, phyto-resources, rare species, protection, reproduction.

I. INTRODUCTION

The Makozhoy Basin is located in the mountainous (Cheberloevsky) district of the Chechen Republic, to the west of the famous Kezenoy-Am Lake, at an altitude of 1,500–1,820 metres above sea level.

Makazhoy village settlement includes such locations as: Makazhoy - regional capital, Buni, Orsoy, Rigakhoy Tungi-Aul, Sadoy, Tsikaroy, Hindoy, Boskhoy and Ari-Avla places.

At the end of 1940 in the Cheberloevsky district, there were 160 farms and settlements with a population of 17 thousand of people. Currently only 184 people are registered here. There is school in this place.

With the return of the Highlanders from the deportation, the Cheberloevsky district was not restored, and the majority of the populations of these villages now live in the flat part of the Chechen Republic. In the past, the area was famous for its rich alpine meadows, developed animal breeding and terraced farming. Here the Highlanders grew various crops.

The reason for the neglect of these high-mountainous territories in the Soviet period was their remoteness and inaccessibility, insufficient investment in the construction of the road network, the absence or poorly developed social infrastructure [1].

In November 2012, the Legislative Assembly of the Chechen Republic approved amendments to the Constitution of the Chechen Republic, providing for the restoration of historical areas of the republic, including Cheberloevsky district, although it remains temporarily in the Vedensky district.

With the adoption of the “Program of revival and development of mountain regions of the Chechen Republic for the period from 1996 to 2000” and the program of “Social and Economic Development of Mountain Territories (Vedenskiy, Itum-Kalinskiy, Nozhay-Yurtovskiy, Shatoyskiy, Sharoyskiy, for the period from 2017 up to 2020 and subsequent years)” [2] the revival of mountain areas, the development of internal and external tourism is given great attention.

More and more people are showing interest in the restoration of their villages. This region is rich in monuments of the Nakh historical, cultural, material and spiritual heritage. There are many medieval buildings, remains of castle fortifications and ancient tombstones [3]. There is a healing source in the Khoysko-Makazhoy basin [4].

Subalpine meadows with rich, highly productive grass-herbal vegetation, yielding up to 17-18 centers per hectare of dry weight [1], valuable cereal and leguminous plants, serve as the basis of the food supply of mountain farming. But at present they are only marginally used as hayfields and for grazing in the spring and autumn season.

Meanwhile, the soil and climatic conditions of the Makazhoy basin are very favorable for growing many crops - grain (rye, oats, barley), legumes (beans), potatoes (a yield of 134 tons / ha), vegetables (beet, cabbage, onions, garlic, carrot, radish, dill), oilseed (flax); fruit and berry – plums, pears, apples, currants, gooseberries, sea berries.

Effective use and sustainable development of mountain areas is impossible without a comprehensive study and rational use of their natural resource potential, including phyto-resources, which serve not only as a basis for mountain farming and the development of other industries, but also a source of economically useful plants.

II. METHODS AND MATERIALS

We studied the summer flora of the Makazhoy basin on August 8–9, 2011. The routes of different directions included plant species, flowering and fruiting during the observation period. To clarify the types we used three-volume determinant written by A.I. Galushko “Flora of the North Caucasus” [5]. The information about the resource value (useful properties) of plants is taken in the works of A.A. Grossheim [6], E.V. Wulf, O.F. Maleeva [7], A.A. Galushko [8], P.P. Sokolov et al. [9], A.F. Sunyakova [10], G. Garnier, L. Bezanger-Beauquesne. et al. [11], I.L. Hartwell [12], R.F. Chandler, S.N. Hopper. et al. [13], H. Dietz, P. Winterhalter [14]. Also we used multivolume publications - “Ornamental herbaceous plants” [15], “Plant resources of the USSR” [16-22], “Plant resources of Russia” [23]. For the considered species, their systematic affiliation and useful properties are indicated (Table 1): medicinal (m), food (f), honey (h), decorative (d), tanniferous, suitable for tanning leather (t), fodder (fod), dyeing (dy), used to obtain a tea substitute (ts) or a coffee substitute (cs), insecticidal, suitable for repelling insects (ins) and poisonous for humans or animals (pois). The results of research and analysis of literature materials are reflected in the table.

III. RESULTS

In the summer flora of Makazhoy basin, we accounted for 100 species of flowering plants from 83 types belonging to 34 families. The most numerous of species are the families *Asteraceae* (15 types, 20 species), *Fabaceae* (8 and 13, respectively), *Lamiaceae* (7 and 7). There are 5 types and the same number of species in the family of *Poaceae* and *Rosaceae*. There are 4 species in the *Apiaceae*, *Brassicaceae*, *Plantaginaceae*, *Scrophulariaceae* families. There are 3 species in the family of *Boraginaceae*.

The remaining 14 families contain only 1-2 species.

Among the 100 plant species counted, 73 species can be used for medicinal purposes: 73 (73%), fodder - 63, honey - 57, food - 38, ornamental - 36, dyeing - 23, tanniferous (tanning) - 15, insecticidal - 12, suitable for a surrogate of coffee or tea - 6, poisonous - 7.

Vitamin C was found in 38% of the species, vitamin A in 18, vitamin K in 5, vitamin B in 3, vitamin E in 2, vitamin P in 1. Multivitamin were *Hippophae rhamnoides*, *Daucus carota*, *Urtica dioica*, *Medicago caerulea*, *Medicago lupulina*.

The abundance of local flora herbs gives the opportunity of growing some of them here (caraway - *Sarum carvi*, chicory - *Cichorium inthybus*, Elecampane - *Inula helenium*, chamomile - *Matricaria recutita*, cverbigu east - *Bunias orientalis*, *Melilotus officinalis*, St. John's wort - *Hypericum perforatum*, five-blade wilderness - *Leonurus quinquelobatus*), long-leaved mint - *Mentha longifolia*, *Origanum vulgare*, ordinary stalk, *Lythrum salicaria*, plantain species (*Plantago*), etc., plantain species (*Plantago*), etc., a species of plantain (*Plantago*), and other species of plantain (*Plantago*), in eco-friendly conditions.

The abundance in the flora of honey plants is a reliable prerequisite for the development of the promising industry in the Makazhoy deposit - beekeeping, which is very poorly represented here nowadays. This should be preceded by detailed studies of the relevant resource base - honey flora, nectar and honey productivity of specific species and meadow coen.

Many plants can be used to dye wool, fabrics or paper in different colors or shades. Yellow colors give: lard pharmacy (*Agrimonia eupatoria*), chamomile pharmacy (*Matricaria recutita*), common nivyanka (*Leucanthemum vulgare*), St. John's wort (*Hypericum perforatum*), plantain species (*Plantago maior*, *P. media*, *P. lanceolata*), clover. *Trifolium pratense*, sorrel sour (*Rumex acetosa*), nettle (*Urtica dioica*). For purple coloration use virgin high (*Inula helenium*), knotweed (*Polygonum aviculare*); for black - oregano (*Origanum vulgare*), sorrel sour (*Rumex acetosa*); for green coloring apply nettle *dioica* (leaves). Birch Litvinova (*Betula litwiniwii*), bruise ordinary (*Echium vulgare*) give red-yellow color. Bruise ordinary (*E. vulgare*), bruise red (*Echium rubrum*), and Birch Litvinova (*Betula litwiniwii*) are suitable for red color; species of the borage and madder family can be promising (Grossheim, 1952).

The presence in culture (apples, pears, and plums) and in nature (cherry plums, Caucasian pears, buckthorn, oriental

currants) of wild fruits indicates the possibility of expanding fruit plantations, taking into account local conditions and their adaptive capabilities. The eastern currant found here at the upper border of the forest, the sea buckthorn growing on the approaches to the basin, and the Biberstein currant (*Ribes biebersteinii* Berl. Ex DC.), is a relict multivitamin species rarely present in a strip of beech forests, but often closer to the upper mountain forest, among the birch forests.

The vast majority of species have a complex of useful properties. There is no doubt that targeted floristic (during the entire vegetation period), biochemical and other studies of poorly studied taxa of the Makazhoy Basin will significantly complement the list of flora and resource-valuable species.

Among the protected species of the flora there are ones listed in Red Book [24]: elecampus high (*Inula helenium*), birch Radde (*Betula raddeana*), catchment of the Caucasus (*Aquilegia caucasica*), buckthorn (*Hyppopha rhamnoides*),

lilium monomerica (*Lilumomides*), single-bearing (*Lilum monomer*). The far incomplete list (taken into account only the summer period) of the flora indicates to its phyto-diversity, including many economically useful species that in the study area can serve as a reliable potential for the development of various branches of agriculture (animal farming, beekeeping, plant growing, including culture of medicinal plants) and meet the needs of the local population of the reviving mountain region. The geographical location, the soil and climatic conditions of the Makazhoy basin [25] are quite favorable for growing many crops - grain (rye, oats, barley), legumes (beans), potatoes (yield of which reaches 134 c / ha), vegetables (cabbage, beets, onions, garlic, carrots, radishes, dill, etc.), oilseeds (flax).

TABLE I. THE PHYTO-POTENTIAL OF SUMMER FLORA OF MAKAZHOY BASIN

№ nn	Families and types of plants	Types resource value											
		<i>m</i>	<i>f</i>	<i>h</i>	<i>d</i>	<i>t</i>	<i>fod</i>	<i>dye</i>	<i>ts</i>	<i>cs</i>	<i>ins</i>	<i>pois</i>	
	1. Apiaceae Lindl. (Umbelliferae)												
1	<i>Asrtrantia maxima</i> Pall.	+			+								
2	<i>Carum carvi</i> L.	+	+					+					
3	<i>Daucus carota</i> L. ▼*•♦	+											
4	<i>Pastinaca armena</i> Fisch. et C.A. Mey. ▼	+						+					
	2. Asteraceae Dumort. (Compositae)												
5	<i>Achillea millefolium</i> L.*	+	+		+			+					
6	<i>Arctium lappa</i> L. ▼	+	+	+									
7	<i>Artemisia vulgaris</i> L. ▼*	+	+		+			+		+		+	
8	<i>Carduus</i> (with white flowers)			+									
9	<i>Carduus nutans</i> L.	+	+	+				+					
10	<i>Cichorium inthybus</i> L. ▼	+	+	+				+				+	
11	<i>Cirsium</i> sp.			+									
12	<i>Cirsium arvense</i> (L.) Scop.	+		+									+
13	<i>Inula helenium</i> L.	+	+	+	+			+					
14	<i>Inula germanica</i> L.	+		+									
15	<i>Inula orientalis</i> Lam.												
16	<i>Leontodon hispidus</i> L.	+	+	+				+					
17	<i>Leucanthemum vulgare</i> Lam.	+	+	+	+			+	+			+	+
18	<i>Matricaria recutita</i> L. (<i>Matricaria chamomilla</i> auc) ▼	+						+	+				
19	<i>Petasites albus</i> (L.) Gaertn	+		+	+	+						+	
20	<i>Psephellus dealbatus</i> (Willd.)Boiss.	+						+	+				
21	<i>Pyrethrum</i> sp.				+							+	
22	<i>Pyrethrum roseum</i> (Adams) Bieb.	+			+							+	
23	<i>Senecio grandidentatus</i> Ledeb.												
24	<i>Tusillago farfara</i> L. ▼*	+		+				+					
	3. Betulaceae S.F. Gray												
25	<i>Betula litwiniwii</i> Doluch.	+						+	+	+			
26	<i>Betula raddeana</i> Trautv. 20	+						+	+	+			
	4. Boraginaceae Juss.												
27	<i>Echium russicum</i> J.F.Gmel.	+		+				+	+				
28	<i>Echium vulgare</i> L. ▼	+	+	+	+			+	+				
29	<i>Symphytum asperum</i> Lepech.	+		+				+					
	5. Brassicaceae Burnett (Cruciferae)												
30	<i>Alyssum hirsulum</i> Bieb.							+					
31	<i>Capsella bursa-pastoris</i> L. ▼	+	+	+									
32	<i>Descurainia Sophia</i> (L.) Webb	+	+										+

76	<i>Dactylis glomerata</i> (L.) Roth*					+		+				
77	<i>Festuca pratensis</i> L.							+				
78	<i>Phleum pratense</i> L. ▼◆							+				
	24. Polygonaceae R.Br.											
79	<i>Rumex acetosa</i> L. ▼	+	+	+		+	+	+				
80	<i>Rumex confertus</i> Willd. ▼	+	+			+	+	+				
	25. Primulaceae Vent.											
81	<i>Lysimachia verticillaris</i> Spreng	+				+						
	26. Ranunculaceae Juss.											
82	<i>Aquilegia caucasica</i> Bieb.					+						
83	<i>Thalictrum foetidum</i> L.	+		+				+				
	27. Rosaceae Juss.											
84	<i>Agrimoniae eupatoria</i> L.	+		+	+	+		+				
85	<i>Alchemilla</i> sp.							+				
86	<i>Filipendula ulmaria</i> (L.) Maxim. ▼	+	+	+	+	+				+		
87	<i>Prunus divaricata</i> Ledeb. ▼		+	+	+			+				
88	<i>Pyrus caucasica</i> Fed.	+	+	+				+		+	+	
	28. Rubiaceae Juss.											
89	<i>Galium aparine</i> L.	+						+	+			
90	<i>Galium ruthenicum</i> Willd.				+			+	+			
	29. Salicaceae Mirb.											
91	<i>Salix</i> sp.			+	+	+	+					
92	<i>Salix caprea</i> L.	+		+		+	+	+				
	30. Saxifragaceae Juss.											
93	<i>Ribes orientalis</i> Desv. ▼		+			+						
	31. Scrophulariaceae Juss.											
94	<i>Euphrasia caucasica</i> Juz.	+		+								
95	<i>Pedicularis daghestanica</i> Bonati					+						
96	<i>Rhinanthus minor</i> L.	+		+							+	
97	<i>Verbascum laxum</i> Tilar. et Jav.			+								
	32. Solanaceae Juss.											
98	<i>Hyoscyamus niger</i> L. ▼*	+		+							+	+
	33. Thpfaceae Juss.											
99	<i>Thypha angustifolia</i> L. ▼	+						+	+			
	34. Urticaceae Juss.											
100	<i>Urtica dioica</i> L. ▼* ◆◆■	+	+					+	+			
	Total	73	38	57	36	15	63	23	4	2	12	7

Note. The content of vitamins is designated as follows: ▼ – vitamin C, * – A group vitamin, ● – K group vitamin, ◆ – B group vitamin, ■ – E group vitamin, ▲ – P group vitamin.

IV. CONCLUSION

In the summer flora of the Makazhoy basin, there are 100 species of flowering plants found from 83 types and 34 families. The most numerous ones are represented by the families: *Asteraceae* (15 types, 20 species), *Fabaceae* (8 and 13), *Lamiaceae* (7 and 7), *Poaceae* and *Rosaceae* (5 types and species), *Apiaceae*, *Brassicaceae*, *Plantaginaceae*, *Scrophulariaceae* (4 species of each type), *Boraginaceae* (3 species).

Among resource-useful plants taken into account there are: 73 species of medicinal (%), fodder - 63, honey - 57, food - 38, ornamental - 36, dye - 23, tanniferous - 15, insecticidal - 12, suitable for coffee or tea surrogate 6, poisonous - 7.

Among 39 vitamin-containing species (%), multivitamin ones are *Hippophae rhamnoides*, *Daucus carota*, *Urtica dioica*, *Medicago caerulea*. *Mexico lupulina*.

The subalpine variety with an abundance of forage (legumes, cereals and other species) is not only a reliable resource for the revival of animal farming in the mountains

(cattle and small ruminants), but also for the development of new branches of plant cultivation (cultivation of medicinal plants in an ecologically clean environment) and beekeeping. The introduction to the culture of some wild (*Hippophae rhamnoides*, *Pyrus caucasica*, *Prunus divaricata*, *Ribes orientalis*, *Ribes biebersteinii*) and cultivated fruit and berry plants seems to be promising. Further deliberate floristic and geo-botanical studies of the Makazhoy basin and adjacent territories during the entire growing season will substantially complement the list of flora and useful plants and expand the natural resource base for economic activities for the revival of mountain region.

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