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THE REVIEW OF THE FLORA OF THE ROMODANOVO DISTRICT (REPUBLIC OF MORDOVIA, RUSSIAN FEDERATION): ITS CHARACTERISTICS AND FEATURES

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Introduction

Romodanovo district is located in the eastern part of the Republic of Mordovia in the Central Russia. Synopsis of flora of the region was published in 2010. It included 673 species of vascular plants (532 of them–native and 141–invasive plants) for territory of Romodanovo district [1]. Despite this, not all parts of this territory have been well studied. Special floristic researches have allowed add 87 species of vascular plants to the list of flora Romodanovo district. Several steppe plots with many rare plants of the Red Book of the Republic of Mordovia were found [2].

Study area

Romodanovo district located between 54°35'23" N to 54°15'37" N latitude and 45°01'44" E to 45°37'01" E longitude; length from north to south for about 35 km, west to east – 33 km. It occupies an area 77,730 hectares. Of these, area of the agricultural land accounts 60,259 ha (77.5%), including 49,569 ha of the arable land [3]. Romodanovo district located on the north-western of the Volga Uplands in the basin Insar river. The terrain is gently undulating. Territory of Romodanovo district is the very flat watershed and the slightly undulating slope to Insar river. The total slope of terrain is 0.5–1° from the south-east to north-east. Watersheds between the ravines have narrow peaks and slopes of southern and northern exposure. The northern slopes are very gently sloping. Southern slopes are very short and large. There preserved

vegetation of upland meadows and elements of meadow steppe. Ravines on territory of Romodanovo district are pretty deep. For the most part their slopes are large and some plots of slopes are devoid of vegetation in some places. Shallow streams cut through scenery along the bottom ravines. Numerous springs nourish them. Ravines in the area occupy 424 ha [4].

The climate is temperate continental. The average annual temperature of study area is +3.9°C. Romodanovo district is located in area of an unstable wetting. Years with sufficient moisture alternate with dry. The average annual precipitation is 427 mm. Soils of Romodanovo district are transitional from the non-chernozem zone I to the chernozem (leached and ashed heavy loamy chernozems). In the northern part of the district can be seen whitish soils on arable land due to the proximity of the limestone. Water bodies in Romodanovo district occupy about 366 ha. The hydrographic network of the study area is presented mainly by the Insar river basin. Its tributaries flowing on territory of the district is the shallow rivers. Their flow is weak. Insar flows north and empties into the Alatyr river in the Ichalki district [1, 4].

Vegetation of the Romodanovo district is the result of combined effects of natural, historical and human factors. It, with exception of water bodies, is secondary, transformed in one way or another. It consists mainly of fields, forest plantations, deposits, grazed meadows and forests of secondary origin. Forest vegetation is only 4% of the study area. On this background it is possible to separate the individual parts with a unique, naturally recurring set of species. Forest vegetation consists mainly from 14 more or less major arrays, which are located separately in Romodanovo district. There are deciduous (aspen, lime, oak) and pine (artificial plantations) forests, which are sometimes interspersed in one and the same array. Shrub vegetation is part of the undergrowth of forest associations and includes light-loving species. Herbaceous vegetation over most of the Romodanovo district is secondary, which arose and there was a long time under conditions mowing, grazing, felling forests for arable land. The natural vegetation preserved in conditions unfavorable for the growth of woody vegetation and unsuitable for agricultural use, such as in swamps, shallow waters or steep slopes. Aquatic vegetation developed in floodplain

lakes, rivers, backwaters of rivers, ponds. Weed vegetation appeared with the beginning of the era of agriculture [1].

History of flora research

The first information about flora of the Romodanovo district belongs to the second half of the XVIII century. Proceedings of P.S. Pallas are the most significant work for that time [5]. Important role in the study of flora present territory of Romodanovo district of the Republic of Mordovia has played the Nizhegorodskaya expedition of V.V. Dokuchaev. Only the work V.N. Aggenko refers to the territory of Romodanovo district from all published reports of the expedition [6]. Important role belongs to botanist I.I. Sprygin. Some of his works includes information on the flora and vegetation of present territory of the Romodanovo district [7, 8].

In 1968 the work “Flora Mordovskoy ASSR” [“Flora of the Mordovian ASSR”] was published, in which 207 species was noted for Romodanovo district [9]. Until recently, the diploma work of G.K. Agafonova “Flora okrestnostey poselka Romodanovo Romodanovskogo rayona” [“Flora near the village. Romodanovo Romodanovo district”] was the only floristic work that relates directly to the Romodanovo district. It covered a small area of the central part of the district [10]. 275 species of vascular plants was noted in it, but 25 of them were presented for the territory of the Romodanovo district mistakenly.

The most intensive study of flora Romodanovo district began in the 1990-s. N.A. Barmin specifically investigated alien plants of the Republic of Mordovia [11–14]. Flora of the Romodanovo district was studied while writing candidate dissertations “Adventivnaya flora Respubliki Mordoviya” [“Alien flora of the Republic of Mordovia”] by N.A. Barmin [15], “Flora basseyna reki Alatyr” [“Flora of the Alatyr river basin”] by G.G. Chugunov [16], “Ekologiya i biologiya redkikh rasteniy Respubliki Mordoviya” [“Ecology and biology of rare plants of the Republic of Mordovia”] by I.V. Kiryukhin [17], “Flora sosudistykh rasteniy vodoemov i vodotokov basseyna Sredney Sury” [“Flora of vascular plants of water bodies and watercourses of Middle Sura basin”] by E.V. Vargot [18], doctoral dissertation “Flora basseyna reki Sury (sovremennoe sostoyanie, antropogennaya transformatciya i

voprosy okhrany)" ["Flora of Sura river basin (current state, anthropogenic transformation and protection issues)"] by T.B. Silaeva [19].

In 2003, 14 species of vascular plants of the Red Book of the Republic of Mordovia was indicated for the Romodanovo district [2]. In the following years this number has increased to 26 species as a result of annual monitoring of flora this area. Of these, two were recommended for inclusion in the main list of the future regional Red Book. Five steppe plots of the Romodanovo district were encouraged for the creation of the protected areas [20–28].

Work "Sosudistye rasteniya Respubliki Mordoviya (konspekt flory)" ["Vascular plants of the Republic of Mordovia (synopsis flora)"] (2010) has the result of many years of floristic researches in the Republic of Mordovia [1]. In this study 673 species was indicated for flora of Romodanovo district. From them 532 are native plants and 141 are alien species.

In recent years, the flora of the Romodanovo district was actively studied by E.V. Pismarkina and D.S. Labutin. They made several additions to the flora of this area [29, 30]. Left bank of the Insar river basin in the Romodanovo district was studied specially [31–36]. As a result, 63 species of vascular plants were found for flora of the Romodanovo district the first time [37]. In 2011–2012 M.S. Samoshkina specifically was studied alien flora of the Romodanovo district. As a result, list of species was supplemented by a further 20 plants. Master's thesis on the topic "Adventivnaya flora Romodanovskogo rayona Respubliki Mordoviya" ["Adventive flora of the Romodanovo district of the Republic of Mordovia"] was written by M.S. Samoshkina in 2012 [38]. In the end currently flora of the Romodanovo district supplemented on 88 species compared to the regional flora synopsis, "Vascular plants of the Republic of Mordovia" [1] and include 761 species of vascular plants from 386 genera and 89 families.

Materials and Methods

Field researches and literature analysis were carried out during 2009–2012. New species and new locations of plants were found at this time for the territory of the Romodanovo district. The author has done photographs of plants, have collected

herbarium material of Standard Practice. The herbarium specimens were transferred to the several herbarium collections: Herbarium of Mordovian State University, Saransk (GMU); Herbarium of Moscow State University, Moscow (MW); Herbarium of Botanical Institute, St. Petersburg (LE) [39]. The traditional route method have used in field researches. It has been combined with the study of floras individual strong points – local floras and drafting of floristic lists [40, 41]. The GPS-method has been used for mapping of locations of rare species of plants under the project to establish a database of distribution of rare species [42]. During researches the main focus was on identifying the natural undisturbed habitats and natural plots with high species richness. Many of them are home of rare and disappearing species of regional flora.

Results and Discussion

Currently flora of the Romodanovo district includes 761 species of 386 genera and 89 families. Native and alien species, cultivated and runs wild also included in this number. Some species of the flora are known only from one location (91, 12.0% of the flora).

Here we present some features of flora of the Romodanovo district and its analysis. It includes taxonomic, biological, ecological-cenotical, geographical, ecological analysis; for alien species – florogenetical analysis and analysis according of time introduction, of way of introduction and of the degree of naturalization of alien species. We conduct a separate analysis of native and alien fractions of the flora to closer look at their individual features.

Native flora of the Romodanovo district

Native flora includes 585 species (76.9% of the flora) of 297 genera and 81 families (Table 1).

As can be seen from Table 1, the 10 leading families include 61% of all species of native flora Romodanovo district. *Rosaceae* family of by number of species ranks third after *Compositae* and *Gramineae*, as well as in the flora of the Republic of Mordovia [1]. Boreal family *Cyperaceae* is just on the 6th place, but more “southern” family *Legumenosae* and *Umbelliferae* are higher than in the flora of the region – in the fourth and seventh places respectively. All of this indicates a more southerly

nature of the flora of Romodanovo district and small impact of boreal elements. In addition, representatives of such families as *Ericaceae*, *Droseraceae* are missing in the flora, families *Pyrolaceae, Orchidaceae* represented by small number of species.

Table 1

The leading families of native flora of the Romodanovo district

Family	Number of species	% total of number species
Compositae	75	12,8
Gramineae	57	9,7
Rosaceae	37	6,3
Leguminosae	35	6,0
Caryophyllaceae	30	5,1
Cyperaceae	29	5,0
Umbelliferae	28	4,8
Labiatae	23	3,9
Cruciferae	22	3,8
Scrophulariaceae	21	3,6
Total	357	61,0

Allocation of ecological-cenotical and environmental groups carried out on the basis of information literature and author's own observations in nature, considering classifications adopted in a number of sources [1, 43–45]. Ecological-cenotical characteristic of flora (Table 2) shows the predominance of steppe (104 species); meadow (104), weed (98) and forest (94) plants. Prevalence of steppe and meadow communities explains the historical past of the territory of Romodanovo district, where most of area had been used for arable and pasture. Not numerous areas of planted forests and upland oak groves contain 16.0 % of forest species in native flora of the Romodanovo district. Weed species ranked third highest number of species, which indicates a significant violation of the vegetation cover.

Ecological-cenotical groups of forest-meadow (57), marsh (57) and aquatic (52) include approximately equal numbers of species. Wetland plants are represented by only 19 species.

The ratio of life forms on the basis of classification K. Raunkiaer [46] shown in Table 3. The analysis revealed that hemicryptophytes considerably prevail in the native flora of the Romodanovo district (332 species). This is characteristic of all floras of Central Russia. Group of geophytes (51 species) is located in second place, significantly inferior hemicryptophytes. Therophytes with 49 species ranked third.

Other groups include a total of 26.1% of the species composition of native flora Romodanovo district.

Table 2

Ecological-cenotical groups of native flora of the Romodanovo district

Ecological-cenotical **groups** and *subgroups*	Number of species	% total number of species
Steppe	**104**	**17,8**
Steppe	*53*	*9,1*
Calciphilic-steppe	*4*	*0,7*
Meadow-steppe	*34*	*5,8*
Weed-steppe	*13*	*2,2*
Meadow	**104**	**17,8**
Meadow	*54*	*9,2*
Floodplain meadow	*12*	*2,1*
Meadow and edge of the forest	*38*	*6,5*
Forest-meadow	**57**	**9,7**
Weed	**98**	**16,8**
Weed	*47*	*8,1*
Weed-forest	*6*	*1,0*
Weed-meadow	*45*	*7,8*
Forest	**94**	**16,0**
Forest	*71*	*12,1*
Nemoral-forest	*21*	*3,6*
Psammophilous	*2*	*0,3*
Marsh	**57**	**9,7**
Swamp	*2*	*0,3*
Forest swamp	*18*	*3,1*
Meadow swamp	*37*	*6,3*
Aquatic	**52**	**8,8**
Aquatic	*21*	*3,6*
Littoral-aquatic	*31*	*5,2*
Wetland	*4*	*0,7*
Steppe	**19**	**3,3**
Total	585	100,0

Geographical analysis is mandatory part of analysis of any flora. It carried out by examining nature of modern ranges – by assigning species to the latitudinal and longitudinal distribution.

In considering of longitude distributions of species (Table 4) groups of ranfes are shown without of sub-groups which they include. Species of large longitudinal groups of areas predominate in the flora Romodanovo district: Eurasian includes 328 species, smaller number (94) represented Holarctic species. European group include 62 species and is ranked third. The other of them have between 42 (Euro-Siberian-Ancient Mediterranean group) to 7 (European-North American group) representatives.

Table 3

The ratio of life-form groups in native flora of the Romodanovo district according to the Raunkiaer's life-form classification

Life forms	Number of species	% total number of species
Phanerophytes	30	5,1
Nanophanerophytes	17	2,9
Hemicryptophytes	332	56,8
Chamaephytes	17	2,9
Geophytes	51	8,7
Hydrophytes	13	2,2
Therophytes	49	8,4
Helophytes	18	3,1
Hemicryptophytes or therophytes	21	3,6
Helophytes or hemicryptophytes	13	2,2
Helophytes or geophytes	8	1,3
Hemicryptophytes or chamaephytes	4	0,7
Geophytes or hemicryptophytes	12	2,1
Total	585	100,0

Table 4

Longitudinal ranges groups of native flora of the Romodanovo district

Longitudinal groups	Number of species	% total number of species
Eurasian	328	56,1
Holarctic	94	16,0
European	62	10,6
Euro-Siberian-Ancient Mediterranean	42	7,2
Euro-Ancient Mediterranean	29	5,0
Multiregional	23	3,9
European-North American	7	1,2
Total	585	100,0

Analysis of the latidudinal distribution of species of native flora (Table 5) is shown that plants of multizonal group are predominated (277 species). Participation in the flora of the Romodanovo district forest-steppe (22.1%) and boreal-nemoral (17.3%) species significantly. This is explained by the geographical location of the study area that lies on the border of the forest and steppe zones.

Table 5

Latitude ranges groups of native flora of the Romodanovo district

Latitudinal groups	Number of species	% total number of species
Multizonal	277	47,4
Forest-steppe	129	22,1
Boreal-nemoral	101	17,3
Nemoral	35	6,0
Steppe	27	4,5
Boreal	16	2,7
Total	585	100,0

Ecological analysis of native flora (fig. 1) was carried out in relation of plants to the provision of water.

As seen in Fig. 1, mesophytes (196 species) occupied the leading position in native flora of the Romodanovo district; this is plants that adapted to the average moisture. Group of xeromesophytes ranked second with 102 representatives; these plants are more confined to the arid conditions, but they can exist in conditions of average moisture. Hydrophytes ranks third position in native flora with 84 species.

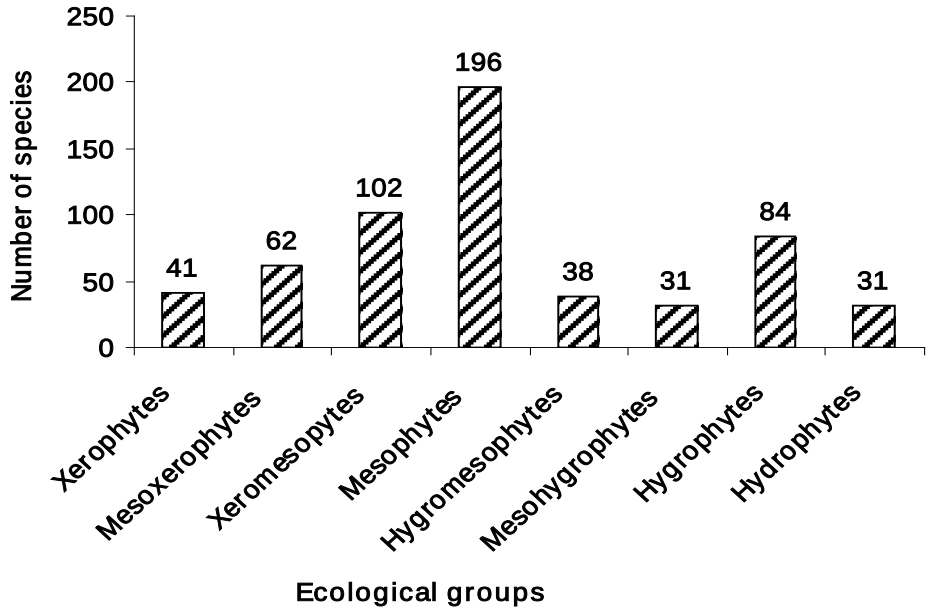

Fig. 1. Ecological groups of native flora of the Romodanovo district

This is a group of plants that prefers wetlands habitat. This is explained by a complex system of water bodies and watercourses in the Romodanovo district.

Alien flora of the Romodanovo district

Alien flora of the Romodanovo district includes 176 species of 131 genera and 40 families (Table 6).

Table 6

The leading families of alien flora of the Romodanovo district

Family	Number of species	% total number of species
Compositae	26	14,8
Gramineae	23	13,1
Cruciferae	20	11,4
Chenopodiaceae	13	7,4
Rosaceae	12	6,8
Leguminosae	8	4,5
Labiatae	6	3,4
Caryophyllaceae	5	2,8
Total	113	64,2

As can be seen from Table 6, families *Compositae* and *Gramineae* occupy leading positions in alien flora, as for native flora of the Romodanovo district. Family *Cruciferae* and *Chenopodiaceae* contain fewer species (20 and 13 respectively). Many of them are annual weeds. Remarkable that most of the leading families of

adventive flora (*Cruciferae*, *Chenopodiaceae*, *Rosaceae*, *Legumenosae*, *Labiatae*, *Caryophyllaceae*) are more “southern” for the territory of the Republic of Mordovia. The families *Amaranthaceae*, *Umbelliferae*, *Polygonaceae*, *Euphorbiaceae*, *Solanaceae* include at four species. This is followed 5 families that include at 3 species, 6 families contain 2 species. 15 families represented by one species in the alien flora Romodanovo district.

Biological analysis of alien flora of the Romodanovo district on the K. Raunkiaer classification [46] showed that the group therophytes (91 species) is significantly dominant (Table 7). Reason is that the natural vegetation of the study area is significantly disturbed. Hemicryptophytes is on the second place and has 39 species. The other groups include from 1 (hydrophytes) to 17 (phanerophytes) of representatives.

The ecological-cenotical analysis of alien flora of the Romodanovo district showed that the group weed contains a large number of species (125) (Table 8). This demonstrates that species of alien flora are confined to secondary habitats. The group of cultivated species ranked second with 37 species, the meadow group include 6.3% of all alien flora. Other groups (steppe, marsh, aquatic) are presented by one species.

Table 7

The ratio of life-form groups in alien flora of the Romodanovo district according to the Raunkiaer's life-form classification

Life forms	Number of species	% total number of species
Therophytes	91	51,7
Hemicryptophytes	39	22,2
Phanerophytes	17	9,7
Nanophanerophytes	12	6,8
Therophytes of hemicryptophytes	8	4,5
Geophytes	8	4,5
Hydrophytes	1	0,6
Total	176	100,0

Alien plants of the Romodanovo district classified to 11 florogenetical elements (Table 9), that characterizes the geographical structure of alien flora. In this case, the latest information about their distribution and origin has been used [47–50]. The plants that have arisen in culture and plants, origin of which is not established are forming a separate groups.

Table 8

Ecological-cenotical groups of alien flora of the Romodanovo district

Ecological-cenotical **group** and *subgroups*	Number of species	% total number of species
Weed	**125**	**70,9**
Weed	*87*	*49,3*
Cultivated and runs wild	*38*	*21,6*
Cultivated	**37**	**21,0**
Meadow	**11**	**6,3**
Meadow weed	*11*	*6,3*
Steppe	**1**	**0,6**
Steppe weed	*1*	*0,6*
Swamp	**1**	**0,6**
Meadow swamp	*1*	*0,6*
Aquatic	**1**	**0,6**
Total	176	100,0

As seen in Table 9, the plants that originate from Mediterranean (49 species) and the Iran-Turan (41) areas predominate in alien flora of the Romodanovo district. Group of North American plants (28 species) ranked third. Other florogenetic groups include from 1 (Caucasian, African) to 12 (East Asian) species.

Ecological analysis in relation of plants to the provision of water in alien flora of the Romodanovo district showed, that group of mesophytes predominate (Fig. 2). The result revealed that the greatest number of species contains in groups of plants which are adapted to arid environments. That is, alien flora of the Romodanovo district for the most part has xerophilic appearance.

Table 9

Florogenetic groups proportions of alien flora of the Romodanovo district

Florogenetic groups	Number of species	% total number of species
Mediterranean	49	27,8
Iran-Turan	41	23,3
North American	28	15,9
East Asian	12	6,8
West European	11	6,3
Origin not established	9	5,1
East European	5	2,8
Species of cultural origin	5	2,8
Siberian	6	3,4
South Asian	4	2,3
South & Central American	4	2,3
Caucasian	1	0,6
African	1	0,6
Total	176	100,0

Characteristic of alien flora according of time introduction, of way of introduction and of the degree of naturalization of alien species is important part its analysis for any study areas. Classification of N.A. Barmin is used in this study [15].

Two basic groups are identified according of time introduction: kenohytes and archeophytes. Alien species classified into three groups according of way of introduction: xenophytes, ergasiophytes and xeno-ergasiophytes. According of the degree of naturalization there are four main groups: ephemerophytes, colonophytes, epecophytes and agriophytes. Numerical relationship of groups of alien flora of the Romodanovo district presented in Table 10.

According of time introduction the kenophytes dominated (129 species). Thus, the majority of alien plants (73.3%) penetrated in the flora of the Romodanovo district during the last century.

Table 10

Numerical relationship of groups of the Romodanovo district alien flora according of time introduction, of introduction way and of the degree of naturalization of alien species

Groups of alien species		According of the degree of naturalization				
		Ephemerophytes	Colonophytes	Epecophytes	Agriophytes	**Total**
According of way of introduction	According of time introduction	Number of species				
Xenophytes	Archeophytes	0	0	30	3	**33**
	Kenophytes	13	7	35	6	**61**
	Total	**13**	**7**	**65**	**9**	**94**
Ergasiophytes	Archeophytes	11	0	0	1	**12**
	Kenophytes	14	18	8	6	**46**
	Total	**25**	**18**	**8**	**7**	**58**
Xeno-ergasiophytes	Archeophytes	1	0	1	0	**2**
	Kenophytes	2	13	4	3	**22**
	Total	**3**	**13**	**5**	**3**	**24**
Total		**41**	**38**	**78**	**19**	**176**

According of way of introduction, group of xenophytes contains the largest number of species (94), 58 vascular plants classified as ergasiophytes and intermediate group of xeno-ergasiophytes includes 24 representatives. Xeno-ergasiophytes can penetrate accidentally to the flora as well as the representatives of the group xenophytes. Therefore we can say that most part of the alien flora of the Romodanovo district (67.0%) is caused by unintentional skid of plants on study area. According to the degree of naturalization group of epecophytes is numerically dominant with 78 species. Groups of ephemerophytes (41), colonophytes (38) and

agriophytes (19 species) contain a less number of representatives. Significant dominance of epecophytes (44.3% of the all alien flora) indicates the success of their invasion in the natural flora and is caused by a significant degree of disturbance of the natural vegetation of study area.

"Chernaya kniga flory Sredney Rossii (Chuzherodnye vidy rasteniy v ekosistemakh Sredney Rossii)" ["Black Book of flora of Central Russia: alien species in the ecosystems of Central Russia)"] [49] is the most extensive work in recent years to the study of alien plant species in Central Russia. Information on 52 of the most aggressive invasive species is shown in it. There are 30 species from the "Black Book..." in flora of the Romodanovo district [1, 49]. Must be noted that there are regional features of degree of invasiveness of a species of the "Black Book..." [49]. Some species from this list have a low degree of invasiveness, and vice versa – the plants, which are not included in this list, can penetrate into the natural communities and to be widely distributed in the region.

For example, species of the "Black Book..." [49] *Fraxinus pennsylvanica* Marshall, *Impatiens grandulifera* Royle, *Elaeagnus angustifolia* L. are known in study area in a few points, single specimens.

Rare species of flora of the Romodanovo district

Red Book of the Republic of Mordovia was published in 2003. 170 species of vascular plants was included in it, 14 of which were noted for flora of the Romodanovo district. As a result of floristic researches 26 additional rare species of vascular plants have been registered. So now their number is 40 (5.3% of the all flora of the study area). Red List Categories and plants of the Romodanovo district that are specified to these categories, given below (with an asterisk "*" indicated species that was proposed to be included in the main list in 2004–2012.).

0 – species that are probably have disappeared from the territory of the Republic of Mordovia completely. In any case, these plants not registered in the wild in over the past 50 years in points where species were known previously, or at other potential places of location. However possibility of saving their populations can not be excluded: 2 species – *Silene multiflora* (Ehrh.) Pers., *Astragalus sulcatus* L.

1 – Endangered species, status of which has reached critical level and / or their habitats have been changed so significant that its survival unlikely unless impact of threat factors will continue: 6 species – *Helictotrichon desertorum* (Less.) Nevski, *H. schellianum* (Hack.) Kitag., *Stipa sareptana* A. Beck., *Silene amoena* L., *Silaum silaus* (L.) Schinz et Thell., *Hieracium virosum* Pall.

2 – Vulnerable species, which characterized by steadily declining populations and their number in region, which upon further impacts unfavorable factors can quickly fall into the category of endangered species: 26 species – *Stipa capillata* L., *Stipa pennata* L., *Stipa tirsa* Stev., *Carex supina* Wahlenb., **Carex tomentosa* L., *Lilium martagon* L., *Iris aphylla* L., *Platanthera chlorantha* (Cust.) Reichenb., *Silene sibirica* (L.) Pers., *Dianthus superbus* L., *Anemone sylvestris* L., *Pulsatilla patens* (L.) Mill., *Adonis vernalis* L., *Spiraea crenata* L., *Astragalus austriacus* Jacq., *Linum flavum* L., *Polygala sibirica* L., *Senecio schvetzovii* Korsh., *Helichrysum arenarium* (L.) Moench, *Artemisia armeniaca* Lam., *A. latifolia* Ledeb., *A. pontica* L., *Aster amellus* L., *Galatella linosyris* (L.) Reichenb. fil., **Echinops ritro* L., *Cirsium canum* (L.) All.

3 – Rare species, which are characterized by heightened vulnerability because of their small size of population in region. They are distributed in a limited area or a large scale, but with a very low density: 4 species – *Rosa rubiginosa* L., *Lathyrus palustris* L., *Hypericum elegans* Steph. ex Willd., *Angelica palustris* (Bess.) Hoffm.

4 – Indeterminate species, populations of which can be classified into one of the previous categories, but information about their present state are insufficient for accurate determine their status: 2 species – *Dianthus campestris* Bieb., **Rosa lupulina* Dubovik.

Together with the main list of regional Red Book there an additional list that includes species status of populations which there does not cause fears, but which may become rare for several reasons. 43 species of the additional list of the Red Book of the Republic of Mordovia registered in flora of the Romodanovo district. There are 2 species of vascular plants which were proposed to be included in the additional list

in 2004–2012 – *Sisymbrium polymorphum* (Murray) Roth, *Potentilla alba* L. Categories of species are shown in parentheses into list that given below.

1* – There are beautifully blooming and other ornamental plants that suffer from recreational pressure. Picking of these species should be banned in the green areas, in the neighborhood of major population centers, recreation centers, health centers, etc.

2* – There are species that associated with specific ecotopes. They are encountered sporadically and rarely, due to low prevalence of these ecotopes. Here, populations of these species are generally relatively stable and numerous.

3* – There are species that are near the borders of their ranges. But the state of populations of these species is not critical.

4* – There are species that are important in economic terms (food, technical, medical) that reduce their numbers due to uncontrolled exploitation of their resources.

5* – There are species with uncertain systematic status.

6* – Information on the distribution of these species in the Republic of Mordovia is extremely scarce. Often the information is not supported by herbarium or presented by message of individuals or information of literature. The inclusion of these species in the number of protected plant species may be, if the existence of these species in the republic will be confirmed.

7* – Rare synanthropic species (antropophytes), including rare ruderal weeds.

Stipa praecapillata Alech. (5*), *Trisetum sibiricum* Rupr. (2*, 3*), *Scolochloa festucacea* (Willd.) Link (2*), *Schoenoplectus tabernaemontani* (C. C. Gmel.) Palla (2*), *Carex arnellii* Christ (3*), *Convallaria majalis* L. (1*), *Platanthera bifolia* (L.) Rich. (1*), *Dactylorhiza fuchsii* (Druce) Soó (1*), *D. incarnata* (L.) Soó (1*, 2*), *Polygonum alpinum* All. (3*), *Arenaria longifolia* Bieb. (3*), *A. micradenia* P. Smirn. (1*, 3*), *Silene chlorantha* (Willd.) Ehrh. (3*), *Nymphaea candida* J. et C. Presl (1*), *Nuphar lutea* (L.) Smith (1*), *Trollius europaeus* L. (1*), *Corydalis intermedia* (L.) Merát (1*, 2*), *C. marschalliana* (Pall. ex Willd.) Pers. (1*, 2*), *C. solida* (L.) Clairv. (1*), *Sisymbrium polymorphum* (Murr.) Roth (2*, 3*, 6*), *Parnassia palustris* L. (2*), *Potentilla alba* L. (4*), *Prunus spinosa* L. (3*, 4*),

Cerasus fruticosa Pall. (3*, 4*), *Oxytropis pilosa* (L.) DC. (3*), *Euphorbia subtilis* Prokh. (3*), *Xanthoselinum alsaticum* (L.) Schur (3*), *Laser trilobium* (L.) Borkh. (2*, 3*), *Fraxinus excelsior* L. (3*, 4*), *Gentiana pneumonanthe* L. (1*, 2*), *Pulmonaria angustifolia* L. (1*), *P. obscura* Dumort. (1*), *Dracocephalum ruyschiana* L. (1*), *Salvia nemorosa* L. [*S. tesquicola* Klok. et Pobed.] (3*), *Origanum vulgare* L. (4*), *Campanula persicifolia* L. (1*), *Campanula trachelium* L. (1*), *Adenophora liliifolia* (L.) A. DC. (1*), *Inula hirta* L. (3*), *Cirium serrulatum* (Bieb.) Fisch. (3*), *Serratula coronata* L. (3*), *S. lycopifolia* (Vill.) A. Kerner (3*), *Centaurea scabiosa* L. [*C. apiculata* Ledeb.] (6*), *Scorzonera purpurea* L. (1*, 3*).

Species of the Republic of Mordovia, known only in the Romodanovo district

Originality of flora of the Romodanovo district formed by species that known in the Republic of Mordovia only here. This group represented by 10 species of vascular plants, including 8 – of alien and 2 native species. They are listed below along with information on their whereabouts.

Agropyron desertorum (Link.) Schult. (*Gramineae*). As the introduction plant was recorded only once among several specimens: Chufarovo, in the village, along the road, 13.08.1995, N. Barmin, det. Yu. Alekseev (GMU).

Bassia sedoides (Pall.) Aschers. [*Sedobasia sedoides* (Pall.) Freitag et G. Kadereit] (*Chenopodiaceae*). It was found in the Romodanovo district more than 30 years ago, in neighborhood of Kochunovo, upper slopes of southern exposure, 07.09.1979, V. Levin (GMU).

Amaranthus hypohondriacus L. (*Amaranthaceae*). This species is widely used as an ornamental plant. In recent years, was found outside the culture at several points: 1) near residential houses in the village Urishka, 25.06.2012, M. Samoshkina; 2) near the houses in the village Romodanovo, 07.02.2012, M. Samoshkina; 3) on edge of the pea field on north from the village Romodanovo, hill “Kichava Gora”, 26.07.2011, S. Bolshakov (all – observations).

Silene multiflora (Ehrh.) Pers. (*Caryophyllaceae*). Steppe species included in the Red Book of the Republic of Mordovia [2] with a category 0. Known according to

the old herbarium specimens on the border of Mordovia and the Nizhny Novgorod region: on the right bank of the Bolshaya Atma river against the Ivashevka, 06.23.1926, V. Alekhin, D. Averkiev (MW).

Sisymbrium polymorphum (Murr.) Roth (*Cruciferae*). It was found in the flora of the Romodanovo district recently: steppified western slope in 3.1 km northwest of the village Lipki, 24.05.2011, A. Khapugin (GMU; [51]). This species recommended for inclusion in the additional list of the Red Book of the Republic of Mordovia [27].

Mercurialis annua L. (*Euphorbiaceae*). Only once was found by N. Barmin: on side of the road on the railway station "Krasny Uzel", 09.06.1995, N. Barmin (GMU).

Euphorbia cyparissias L. (*Euphorbiaceae*). Species is cultivated as an ornamental plant in graveyards, in the gardens. It registered outside of culture: near the fence on the unused section of the cemetery west of the village Salma, 19.06.2012, A. Khapugin [38].

Orobanche cumana Wallr. (*Orobanchaceae*). The species was recorded about 40 years ago: neighborhood of the village Altary, in the sunflower crops of farm "Shefnaya Zvezda", June 1971, Agafonova (GMU).

Ambrosia psilostachya DC. (*Compositae*). Introduced plant, originated from North America. According to G.K. Rusakova, in 1993, the species was found and annihilated over the territory of Bread Factory in the village Romodanovo [15].

Artemisia santonica L. (*Compositae*). 3 specimens of the species were found along railway at the railway station "Krasny Uzel" in the village Romodanovo, 16.09.1998, N. Barmin (MW, GMU).

Of these, *Agropyron desertorum*, *Mercurialis annua*, *Ambrosia psilostachya*, *Artemisia santonica* not observed here about 10–20 years, *Bassia sedoides* – 30 years, *Orobanche cumana* – 40 years, *Silene multiflora* – about 90 years.

Conclusions

Agroclimatic conditions and the history of formation of vegetation cover of the Romodanovo district contributed to the formation of vegetation with a predominance of meadow-steppe elements of native flora, and introduction of a large number of

weed species at the cost highly developed transport infrastructure. A large proportion of species (11.8%) were noted only once in the flora; significant number of species were found in the last two years (11.6%). This demonstrates the need for additional floristic studies to clarify their distribution on the territory of the Romodanovo district. Special studies are needed to clarify the status of the species, the findings of which can not be repeated for many years. This is especially true of species known in the Republic of Mordovia only in the Romodanovo district.

References

1. Silaeva T. B., Kiryukhin I. V., Chugunov G. G., Levin V. K., Mayorov S. R., Pismarkina E. V., Ageeva A. M., Vargot E. V. Sosudistye rasteniya Respubliki Mordoviya (konspekt flory) (Vascular plants of the Republic of Mordovia (synopsis of flora)). Saransk: Publisher of the Mordovian State University, 2010. (in Russian).

2. Krasnaya kniga Respubliki Mordoviya: v 2 t. T. 1: Redkie vidy rasteniy, lishaynikov i gribov (Red Book of the Republic of Mordovia: in 2 vol., vol. 1: Rare species of plants, lichens and fungi). Saransk: Publisher of the Mordovian State University, 2003. (in Russian).

3. Romodanovo: istoriya i sudby: istoriya i sovremennost Romodanovskogo rayona v ocherkakh, vospominaniyakh, fotografiyakh (Romodanovo: history and destinies: history and modernity of the Romodanovo district in essays, memoirs, photographs), Saransk: Publisher: Krasny Oktyabr, 2005. (in Russian).

4. Yamashkin A.A., Ruzhenkov V.V., Yamashkin Al.A. Geografiya Respubliki Mordoviya (Geography of the Republic of Mordovia). Saransk: Publisher of the Mordovian State University, 2004. (in Russian).

5. Pallas P.S. Puteshestvie po raznym provinczіyam Rossiyskoy imperii (Journey to the different provinces of the Russian Empire). Part. 1. St. Petersburg, 1773. (in German).

6. Aggeenko V.N. Otchet ob issledovaniyakh v Nizhegorodskoy gubernii (The report on researches in the Nizhny Novgorod province) // Proceeding of St. Petersburg Society of Naturalists. Vol. 16, №1. 1885. pp. 311-336. (in Russian).

7. Sprygin I.I. Iz oblasti Penzenskoy lesostepi (From area of Penza forest-steppe) Part 1 in: Travyanye stepi Penzenskoy gubernii (Meadow steppe of the Penza province). Moscow, 1925. (in Russian).

8. Sprygin I.I. Iz oblasti Penzenskoy lesostepi (From area of Penza forest-steppe) Part 2. Kustarnikovaya step (Shrub steppe) in: I.I. Sprygin: Nauchnoe nasledstvo. Materialy k poznaniyu rastitelnosti Srednego Povolzhya (Scientific heritage. Materials to the knowledge of the vegetation of the Middle Volga). Vol. 11. 1986. pp. 194-241. (in Russian).

9. Kukhalskaya N.P., Zeleneeva Z.V., Levin V.K. Flora Mordovskoy ASSR (Flora of the Mordovian ASSR). Saransk: Mordovian Book Publisher, 1968 (in Russian).

10. Agafonova G.K. Flora okrestnostey poselka Romodanovo Romodanovskogo rayona (Flora of neighborhood of the village Romodanovo of the Romodanovo district). Diploma. Saransk: Mordovian State University, 1972. (in Russian).

11. Barmin N.A. Novye zanosnye vidy v Mordovii (New alien species in the Mordovia) // Byulleten Moskovskogo obshchestva ispytateley prirody. Otdel Biologicheskiy (Bulletin of Moscow Society of Naturalists. Biological series). Vol. 103, №6. 1998a. pp. 59-60. (in Russian).

12. Barmin N.A. Kharakteristika adventivnoy flory Mordovii (Characteristic of adventive flora of the Mordovia) // Vodnye i nazemnye ekosistemy i okhrana prirody levoberezhnogo Prisurya (Aquatic and terrestrial ecosystems and conservation of the left bank of the Prisurye). Saransk: Publisher of the Mordovian State University, 1998b. pp. 46-52. (in Russian).

13. Barmin N.A. Napravlennost proczessa sinantropizaczii adventivnoy flory Mordovii (Orientation of process of synanthropization of the alien flora of the Mordovia) // Rol botanicheskogo sada v introdukczii, sokhranenii redkikh vidov

rasteniy i ekologicheskom vospitanii (The role of botanical gardens in the introduction, conservation of rare plant species and environmental education). Saransk: Publisher of the Mordovian State University, 2001a. pp. 37-41. (in Russian).

14. Barmin N.A. Adventivnaya flora Respubliki Mordoviya i ee analiz (Alien flora of the Republic of Mordovia and its analysis) // Floristicheskie issledovaniya v Czentralnoy Rossii na rubezhe vekov (Floristic studies in Central Russia at the turn of the centuries). Moscow: Publisher of Botanical Garden of the Moscow State University, 2001b. pp. 18-21. (in Russian).

15. Barmin N.A. "Adventivnaya flora Respubliki Mordoviya (Alien flora of the Republic of Mordovia). Ph.D. Dissertation. Moscow State University, 2000 (in Russian).

16. Chugunov G.G. "Flora basseyna reki Alatyr (Flora of the Alatyr river basin). Ph.D. Dissertation. Mordovian State University, 2002 (in Russian).

17. Kiryukhin I.V. Ekologiya i biologiya redkikh rasteniy Respubliki Mordoviya (Ecology and biology of rare plants of the Republic of Mordovia). Ph.D. Dissertation. Mordovian State University, 2004. (in Russian).

18. Vargot E.V. Flora sosudistykh rasteniy vodoemov i vodotokov basseyna Sredney Sury (Flora of vascular plants of water bodies and watercourses of Middle Sura basin). Ph.D. Dissertation. Moscow State University, 2009 (in Russian).

19. Silaeva T.B. Flora basseyna reki Sury (sovremennoe sostoyanie, antropogennaya transformacziya i voprosy okhrany) (Flora of Sura river basin (current state, anthropogenic transformation and protection issues)). Doctoral Dissertation. Moscow State University, 2006. (in Russian).

20. Silaeva T.B., Ageeva A.M., Barmin N.A., Kiryukhin I.V., Pismarkina E.V., Smirnov V.M., Chugunov G.G. Redkie rasteniya i griby: materialy dlya vedeniya Krasnoy knigi Respubliki Mordoviya za 2004 god (Rare plants and fungi: materials for maintenance of the Red Book of the Republic of Mordovia for 2004). Saransk: Publisher of the Mordovian State University, 2004 (in Russian).

21. Silaeva T. B., Kiryukhin I. V., Pismarkina E. V., Ageeva A. M., Barmin N. A., Vargot E. V., Smirnov V. M., Chugunov G. G. Redkie rasteniya i griby:

materialy dlya vedeniya Krasnoy knigi Respubliki Mordoviya za 2005 god (Rare plants and fungi: materials for maintenance of the Red Book of the Republic of Mordovia for 2005). Saransk: Publisher of the Mordovian State University, 2005. (in Russian).

22. Silaeva T. B., Kiryukhin I. V., Pismarkina E. V., Barmin N. A., Chugunov G. G., Ageeva A. M., Vargot E. V., Grishutkina G. A., Smirnov V. M. Redkie rasteniya i griby: materialy dlya vedeniya Krasnoy knigi Respubliki Mordoviya za 2006 god (Rare plants and fungi: materials for maintenance of the Red Book of the Republic of Mordovia for 2006). Saransk: Publisher of the Mordovian State University, 2006 (in Russian).

23. Silaeva T. B., Kiryukhin I. V., Pismarkina E. V., Barmin N. A., Chugunov G. G., Ageeva A. M., Vargot E. V., Grishutkina G. A., Smirnov V. M. Redkie rasteniya i griby: materialy dlya vedeniya Krasnoy knigi Respubliki Mordoviya za 2007 god (Rare plants and fungi: materials for maintenance of the Red Book of the Republic of Mordovia for 2007). Saransk: Publisher of the Mordovian State University, 2007. (in Russian).

24. Silaeva T.B., Kiryukhin I. V., Pismarkina E. V., Chugunov G. G., Vargot E. V., Ageeva A. M., Smirnov V. M., Khapugin A. A. Redkie rasteniya i griby: materialy dlya vedeniya Krasnoy knigi Respubliki Mordoviya za 2008 god (Rare plants and fungi: materials for maintenance of the Red Book of the Republic of Mordovia for 2008). Saransk: Publisher of the Mordovian State University, 2008 (in Russian).

25. Silaeva T.B., Kiryukhin I. V., Pismarkina E. V., Chugunov G. G., Ivoylov A. V., Ageeva A. M., Vargot E. V., Smirnov V. M. Redkie rasteniya i griby: materialy dlya vedeniya Krasnoy knigi Respubliki Mordoviya za 2009 god (Rare plants and fungi: materials for maintenance of the Red Book of the Republic of Mordovia for 2009). Saransk: Publisher of the Mordovian State University, 2009. (in Russian).

26. Silaeva T. B., Kiryukhin I. V., Chugunov G. G., Ageeva A. M., Vargot E. V., Pismarkina E. V., Khapugin A. A., Bolshakov S. Yu., Ivoylov A. V., Smirnov

V. M. Redkie rasteniya i griby: materialy dlya vedeniya Krasnoy knigi Respubliki Mordoviya za 2010 god (Rare plants and fungi: materials for maintenance of the Red Book of the Republic of Mordovia for 2010). Saransk: Publisher of the Mordovian State University, Russia, 2010 (in Russian).

27. Silaeva T. B., Vargot E. V., Khapugin A. A., Chugunov G. G., Ageeva A. M., Bolshakov S. Yu., Ivoylov A. V., Grishutkin O. G., Kiryukhin I. V. Redkie rasteniya i griby: materialy dlya vedeniya Krasnoy knigi Respubliki Mordoviya za 2011 god (Rare plants and fungi: materials for maintenance of the Red Book of the Republic of Mordovia for 2011). Saransk: Publisher of the Mordovian State University, 2011. (in Russian).

28. Silaeva T. B., Vargot E. V., Bolshakov S. Yu., Khapugin A. A., Chugunov G. G., Ivoylov A. V., Grishutkin O. G., Kiryukhin I. V. Redkie rasteniya i griby: materialy dlya vedeniya Krasnoy knigi Respubliki Mordoviya za 2012 god (Rare plants and fungi: materials for maintenance of the Red Book of the Republic of Mordovia for 2012). Saransk: Publisher of the Mordovian State University, 2012. (in Russian).

29. Pismarkina E. V. O flore okrestnostey sela Pushkino (Romodanovskiy rayon Respubliki Mordoviya) (About flora of neighborhood of the Pushkino village (Romodanovo district, Republic of Mordovia)) // Fitoraznoobrazie Vostochnoy Evropy (Phytodiversity of East Europe). №9. 2011. pp. 145-148. (in Russian).

30. Pismarkina E. V., Labutin D. S. Redkie vidy rasteniy na transportnykh putyakh severo-zapada Privolzhskoy vozvyshennosti (Rare species of plants on transport ways on north-west of the Volga Upland). // Ekologiya i geografiya rasteniy i soobshchestv Srednego Povolzhya (Ecology and geography of plants and communities of Middle Volga). Tolyatti: Publisher “Kassandra”, 2011. pp. 153-156. (in Russian).

31. Khapugin A.A. About Finding of *Rosa glauca* Pourr. (*Rosaceae*) in the Republic of Mordovia. Russian Journal of Biological Invasions. Vol. 3, № 1. 2012. pp. 56-57. doi: 10.1134/S2075111712010043

32. Khapugin A.A., Silaeva A.A. Uchastki lugovoy stepi v Romodanovskom rayone Respubliki Mordoviya (Plots of meadow steppe in the Romodanovo district) // Samarskaya Luka: problemy regionalnoy i globalnoy ekologii (Samara Luka: problems of regional and global ecology). Vol. 20, №3. 2011. pp. 171-173. (in Russian).

33. Khapugin A.A., Samoshkina M.S. K adventivnoy flore Romodanovskogo rayona (To alien flora of the Romodanovo district) // Tretyi chteniya pamyati professora O. A. Zauralova (Third reading to the memory of professor O. A. Zauralov). Saransk: Publisher of the Mordovian State University, 2011a. pp. 84-86. (in Russian).

34. Khapugin A.A., Samoshkina M.S. Kriticheskiy konspekt vidov roda *Rosa* L. Romodanovskogo rayona Respubliki Mordoviya (Critical synopsis of genus *Rosa* L. in Romodanovo district of the Republic of Mordovia) // Sbornik trudov biologicheskogo fakulteta MGU im. N. P. Ogareva (Proceeding of biological faculty of Mordovian State University). Saransk: Publisher “Mordovia-Expo”, 2011b. pp. 56-58. (in Russian).

35. Silaeva T.B., Khapugin A.A., Labutin D.S., Samoshkina M.S. Invazivnye rasteniya na transportnykh putyakh v Romodanovskom rayone Respubliki Mordoviya (Invasive plants on transport ways of Romodanovo district of the Republic of Mordovia) // Sbornik trudov biologicheskogo fakulteta MGU im. N.P. Ogareva (Proceeding of biological faculty of Mordovian State University). Saransk: Publisher “Mordovia-Expo”, 2011. pp. 62-65. (in Russian).

36. Khapugin A.A., Silaeva T. B. Uchastok stepi s *Verbascum phoeniceum* L. i *Stipa pennata* L. na vostoke Respubliki Mordoviya (Steppe plot with *Verbascum phoeniceum* L. and *Stipa pennata* L. on east of the Republic of Mordovia) // Rezhimy stepnykh osobo okhranyaemykh prirodnykh territoriy (Regimes of the steppe protected areas). Kursk, 2012. pp. 264-266. (in Russian).

37. Khapugin A.A., Silaeva T.B., Samoshkina M.S. Dopolneniya k flore sosudistykh rasteniy Romodanovskogo rayona Respubliki Mordoviya (Additions to flora of vascular plants of Romodanovo district of the Republic of Mordovia) //

Fitoraznoobrazie Vostochnoy Evropy (Phytodiversity of the East Europe). №10. 2012. (at print). (in Russian).

38. Samoshkina M. S. Adventivnaya flora Romodanovskogo rayona (Alien flora of the Romodanovo district). Master's Thesis. Saransk: Mordovian State University, 2012. (in Russian).

39. Skvorczov A.K. Gerbariy. Posobie po metodike i tekhnike (Herbarium: Manual on methods and techniques). Moscow: Nauka, 1977. (in Russian).

40. Alekhin V.V. Metodika polevogo izucheniya rastitelnosti i flory (Methods of field study of vegetation and flora). Moscow: Narkompros, 1938. (in Russian).

41. Schcherbakov A.V., Mayorov S. R. Inventarizacziya flory i osnovy gerbarnogo dela (Inventory of flora and basis of herbarium). Moscow: United science publisher KMK, 2006. (in Russian).

42. Chugunov G. G., Khapugin A. A. O sozdanii elektronnoy bazy (na osnove programmy "Ozi Explorer") rasprostraneniya vidov rasteniy v basseynakh rek Mokshi i Sury (About electronic base of distribution of plants species in Moksha river basin and Sura river basin) // Izuchenie i okhrana flory Sredney Rossii (Studying and protecting of flora of the Middle Russia). Moscow: Publisher of Botanical Garden of Moscow State University, 2011. pp. 183-186. (in Russian).

43. Nosova L.M. Floro-geograficheskiy analiz severnoy stepi evropeyskoy chasti SSSR (Phytogeographical analysis of northern steppe of European part of the USSR). Moscow: Nauka, 1973. (in Russian).

44. Czvelev N. N. Opredelitel sosudistykh rasteniy Severo-Zapadnoy Rossii (Leningradskaya, Pskovskaya i Novgorodskaya oblasti) (Flora of vascular plants of North-Western part of Russia (Leningrad, Pskov and Novgorod regions)). St. Petersburg: Publisher SPKhFA, 2000. (in Russian).

45. Kulikov P. V. Konspekt flory Chelyabinskoy oblasti (sosudistye rasteniya) (Synopsis of flora of the Chelyabinsk region (vascular plants)). Ekaterinburg; Miass: Publisher "Geotur", 2005. (in Russian).

46. Raunkiaer C. The life forms of plant and statistical plant geography". Oxford: Clarendon Press, 1934.

47. Takhtadzhyan A.L. Floristicheskie oblasti Zemli (Floristic areas of Earth). Moscow: Nauka, 1978. (in Russian).

48. Vinogradova Yu. K., Mayorov S. R., Khorun L. V. Pervye itogi realizaczii proekta "Chernaya kniga" Sredney Rossii (The first results of realization of project "Black Book" of Middle Russia) // Floristicheskie issledovaniya v Sredney Rossii (Floristic researches in the Middle Russia). Moscow, 2006. pp. 45-48. (in Russian).

49. Vinogradova Yu. K., Mayorov S. R., Khorun L. V. Chernaya kniga flory Sredney Rossii: chuzherodnye vidy rasteniy v ekosistemakh Sredney Rossii (Black Book of flora of Central Russia: alien species in the ecosystems of Central Russia)). Moscow: GEOS, 2009 (in Russian).

50. Notov A.A. Adventivnyi komponent flory Tverskoy oblasti: dinamika sostava i struktury (Adventive component of flora of the Tver region: dynamic of composition and structure). Tver: Publisher of the Tver State University, 2009. (in Russian).

51. Vargot E. V., Khapugin A. A., Chugunov G. G., Ivashina A. A., Silaeva T. B., Vargot I. V. Dopolneniya k flore Respubliki Mordoviya (Additions to the flora of Mordovia) // Byulleten Moskovskogo obshchestva ispytateley prirody. Otdel Biologicheskiy (Bulletin of Moscow Society of Naturalists. Biological series). Vol. 117, №3. 2012. pp. 73-74. (in Russian with English abstract).

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TRANSPORT ROUTES AS NEW HABITATS FOR SENECIO SCHVETZOVII KORSH. IN THE NORTH-WEST OF THE VOLGA UPLAND

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In many regions the northern regions of Central Russia meadow steppe remained only on those areas where it is difficult or impossible to human activities - on the southern fringes of oak forests on the slopes of ravines. Should be kept for each species population confined to fragments of steppe communities located on the southern limits of distribution. One of these plants is Senecio schvetzovii Korsh. It is a perennial herbaceous plant 50-200 cm stem is straight, branching only in flowering parts. Leaves are simple, large, 15-30 cm long, leathery, margin serrate-toothed, glabrous. Calathidia numerous bell-shaped, 3-5 mm wide, corymbose-paniculate inflorescence. Flowers are yellow, lozhnoyazychkovye - including 5-8, equal in length to the basket. Fetus - achene, about 4 mm long, glabrous or slightly pubescent with, ribbed. Flowers in June - August. Propagated by seeds and growth of roots [4].

Senecio schvetzovii circulated in Central and Eastern Europe, the Mediterranean, Central Asia, Western Siberia. He is listed in the Red Book of Ryazan (category 1), Belgorod, Volgograd, Kursk, Lipetsk, Penza (category 3), Nizhny Novgorod (category "D") regions and republics of Mordovia and Chuvashia (category 2) [10,4,5,13], recommended for inclusion in the Red Data Book of the Volga basin [11].

View of likes to the light, living on soils of different composition. Gravitates to places of out of limestone. In Mordovia finds Senecio schvetzovii known only in the eastern part of the country [6 - 8, 15]. Since the release of the Red Book of the Republic of Mordovia year found new habitats [4, 9, 10]. The situation is similar in the neighboring regions of Mordovia. It is noteworthy that there are cases Senecio schvetzovii growing on roadsides, or very close to the highways. We set a a task to trace the connection of this species from the highways.

Materials and Methods

Studies were conducted in the summer of 2010 in the north-west of Ulyanovsk, south-east of Nizhny Novgorod regions, in the south-eastern part of the Republic of Mordovia. Field observations made by the traditional route. Initial assessment of the size and population status held by conventional methods of observation recommended for studying populations of rare species [3, 14]. Studies have documented herbarium material collected according to the standard guidelines [13], and photographs. With GPS-navigator determined the exact coordinates of locations. A total of four coenopopulations Senecio schvetzovii.

Results and Discussion

In the course of the research was able to identify New localities Senecio schvetzovii, located in close proximity to transportation routes in several administrative regions (fig. 1). Below are their regions. In the Ulyanovsk region: on the side of the road between the villages of Nikitin and Astradamovka Sura area (24.VII.2010, D. Labutin, E. Pis'markina, M. Puzyr'kina); near the highway Saransk - Ulyanovsk on the segment of the road between the village of Surskoe and Ust'-Uren' (17.VII.2010, D. Labutin, E. Pis'markina, M. Puzyr'kina); sublimity of the road near the village of Kargin Veshkaymsky area (15.VIII.2010, D. Labutin, E. Pis'markina, M. Puzyr'kina). Nizhny Novgorod Region: roadside embankment and the exclusion zone of the road between the villages of Pochinki and Novospasskoye, Pochinok district (20.VI.2010, D. Labutin, E. Pis'markina, M. Puzyr'kina); on the mound of the road near the village Urazovka, Krasnookiabrskij area (21.VII.2010, D. Labutin., E. Pis'markina).

Large population discovered in the Republic of Mordovia, along the road between the city of Saransk and Ulyanovsk. 4.5 km northeast of the village of Bol'shaya Elkhovka, Lyambirsky area, stop "Dacha" (17.VII.2010, D. Labutin, M. Puzyr'kina). The population is extent along the road about 440 meters, the plants grew on both sides of the road. Its area of about 23 000 m^2, there are parts of both thin and with a pretty decent distribution plants, more densely overgrown areas density ranged from 8 to 20 plants on 1 m^2, found in other populations, the density

does not exceed 5-10 (Pochinkovsky district, the road to the village Novospasskoye) plants per 1 m^2.

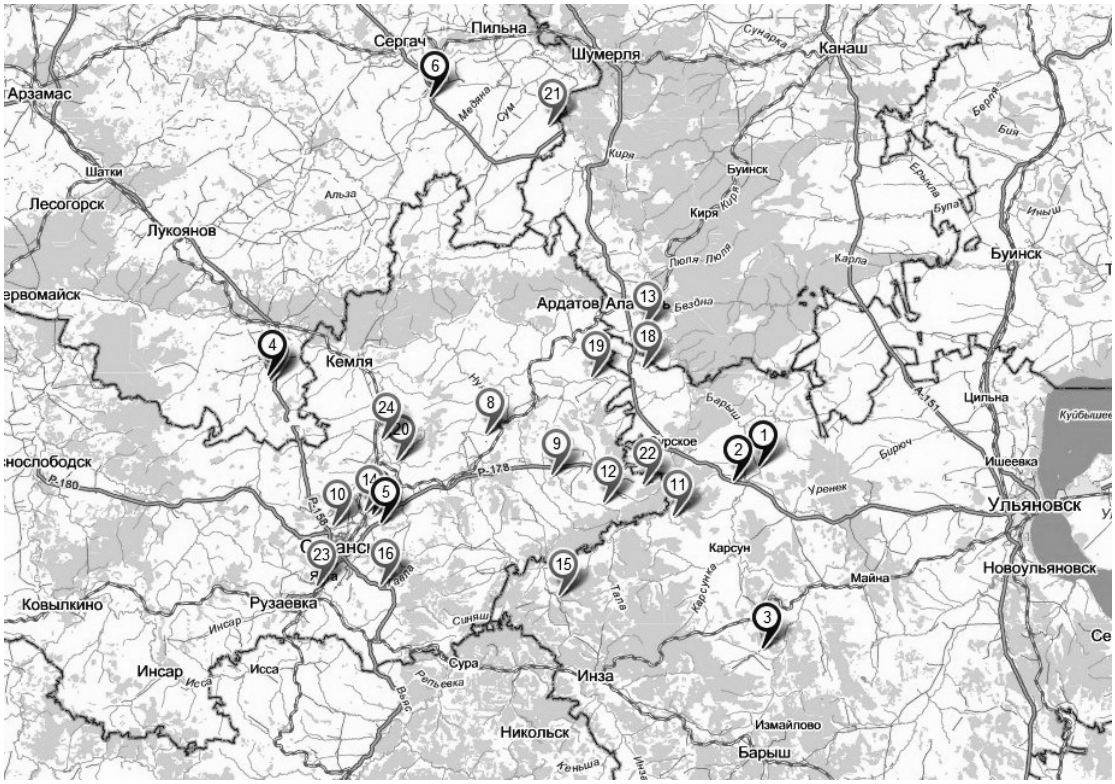

fig. 1. Finds Senecio schvetzovii Korsh. Points 1 - 6 location on transport ways, points 7 - 24 previously known habitat (GMU).

Good condition of the plants, many plants bloom and bear fruit. Multi-age structure of the population have been observed numerous juveniles. In some areas, a continuous "carpet". Here grows with Senecio *Iris aphylla* L., S*alvia stepposa* Schost., *Asparagus officinalis* L., *Lupinus polyphyllus* Lindley, *Helianthus tuberosus* L., *Armoracia rusticana* Gaertn., B. Mey. et Schreb.

Observed that Senecio can grow with other species. Thus, in the Nizhny Novgorod region is noted in a small cenopopulation cenosis from Inula helenium L., Silene nutans L., or typical ruderal communities (Nizhny Novgorod region., Republic of Mordovia). In a population in Karsunskom area Ulyanovsk region, Senecio schvetzovii grows with Hieracium virosum Pall. and Aster amellus L.

It is known that this species is optional kaltsefitom and halophytes, thereby expanding its ecological range [4]. Perhaps the frequency of occurrence of this rare species along highways related with universal conditions formed within road and

their exclusion zones. Often the basis for road embankments of carbonate rocks, which create favorable conditions for the growth of Senecio schvetzovii. Some soil salinity is a consequence of winter highways processing various salt additives, which is also favorable for the growth of this species.

As can be seen from (Fig.1), almost near each roadside populations are steppe areas with natural populations of Senecio. Otherwise, we attribute this to insufficient knowledge of the vicinity. Probably S. schvetzovii, despite his ability to master the roadside ecotopes, not far from spread along transportation routes, and remains close to initial habitat of the population. Also studied the railways in these areas. Not found Senecio populations along the tracks. Perhaps the reason is particularly chemical treatment.

Conclusion

Our studies have shown that the north-west of the Volga Upland Conservation and partial distribution Senecio schvetzovii, as an elective kaltsefila contribute automobile highways in the region, along which formed habitats, corresponding to ecological requirements form.

Further study of the biology and ecology of S. schvetzovii and cenotical confines, which will serve for the prediction future findings of this rare species and the development of effective measures to protect its populations, clarify its conservation status.

References:

1. Dospehov, B.A. The method of field experience (the basics of statistical processing of research results). - Moscow: Agropromizdat, 1985. - 351 p.

2. Glotov, N.N. Estimation of the parameters of the age structure of plant populations // Life populations in heterogeneous environments. Part 1. - Yoshkar-Ola Mari El Periodicals, 1998. - S. 146-149.

3. Ermakova, I.M. Tcenopopuljatcij vitality and methods to determine // Cenopopulation plants. - Moscow: Nauka, 1976. - S. 92-105.

4. Levin, V.K. Senecoi schvetzovii // Red Book of the Republic of Mordovia. Volume 1: Rare plants, lichens and fungi / Compiled by T.B. Silaeva. - Saransk Mordovian book publishers, 2003. - S. 205.

5. Novikov, L.A. Senecoi schvetzovii / Red Book of the Penza region. Volume 2: Plants and fungi. - Penza, 2002. - S. 42-43.

6. Rare plants and fungi: Materials of the Red Book of the Republic of Mordovia in 2004 / edited by T.B. Silaeva. – Saransk: Mordovia university publishing, 2004. - 48 p.

7. Rare plants and fungi: Materials of the Red Book of the Republic of Mordovia in 2006 / edited by T.B. Silaeva. - Saransk Mordovia university publishing, 2006. – 68 p.

8. Rare plants, lichens and fungi: proceedings of the Red Book of the Republic of Mordovia in 2008 / edited by T.B. Silaeva. - Saransk Mordovia university publishing, 2008. – 104 p.

9. Red Book of the Belgorod region / General science redredaktsiya A.V. Prisniy - Belgorod, 2004. - 532 p.

10. Red Book of the Kursk region. Volume 2: Rare and endangered species of plants and fungi. - Tula, 2001.

11. Sagalaev, V.A. Check-list of rare and in need of protection of vascular plants of the Lower Volga region within the territory of Saratov, Volgograd and Astrakhan regions and the Republic of Kalmykia (Materials for the Red Data Book of the Volga basin / / Flora Foliumii. № 17 (53). Pp. 2-10.

12. Shestakova, A.A. Senecoi schvetzovii / Red Book of the Nizhny Novgorod region. Volume 2: Vascular plants, algae, lichens and fungi. - Nizhny Novgorod. 2005. - 328 p.

13. Skvortcov, A.K. Herbarium. Manual on methods and techniques. - Moscow: Nauka, 1977. - 199 p.

14. Study tcenopopuljatcij plant "Red Book of the Udmurt Republic" in nature and introduction: Ucheb. method. Manual / Comp. A. Baranov. - Izhevsk: Publishing House "Udmurtia University", 2006. - 74.

15. Vascular plants of the Republic of Mordovia (List of flora): monograph / T.B. Silaeva, I.V. Kiryukhin, G.G. Chugunov [etc.], edited by T.B. Silaeva. - Saransk: Mordovia university publishing, 2010. - S. 223.

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POPULATION DYNAMICS AND PHASES OF DEVELOPMENT OF EAR MITES *OTODECTES CYNOTIS* (HERING, 1938) (*PSOROPTIDAE*) OF DOMESTIC CAT IN TREATMENT BY EAR DROPS «BARS»

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The report deals with the phylogeny and biology of ear mites of cats and ineffectiveness of recommended treatment of otodektoz, caused by ear drops «Bars».

Keywords: domestic cat, ear mites, akaridoz, otodektoz, ear drops, larva, protonymph, teleonymph, imago.

The procedure for treatment of pets for parasitic diseases requires knowledge of their biology – location, duration of phases and cycles of development, etiology of diseases, the vulnerabilities of parasite biology, on the basis of which tactics of treatment is done. Among these pathogens of invasion, having practical meaning for a person, you can call fleas, lice, skin and itch-mites. Some of them can be contagious to humans, and some parasites show species specificity.

Among sarcoptiform mites ear mites *Otodectes cynotis* (Hering, 1938), are certainly the most common cause of cats invasions. It is believed that ear mites on their prevalence in cats are second only to fleas. Therefore, the aim of our research was to study the population dynamics and the development phases of domestic cat ear mites *Otodectes cynotis* (Hering, 1938) (*Psoroptidae*) in the treatment with ear drops «Bars».

Systematics and phylogeny

The representatives of the suborder Psoroptidia, where ear mites belong, can be called biting or chewing acariform mites. Most of them have chelated chelicerae with strong claws of chewing type. They feed mostly hard plant food, and passing on to parasitism on vertebrate animals, feed skin, feather, hair, secretions of skin glands. Zakhvatkin Y.A. singles out three groups of mites – *Acariform*, *Parazitiform* mites and *Opilliones* [3].

According to modern concepts the subclass Acari includes three superorder (*Opilioacariformes, Parasitiformes, Acariformes*), more than 350 families, about 4,000 genera and more than 48 thousand species [8]. Systematic position of ear mite is as follows:

Arthropods type – *Arthropoda*

Chelicerata subtype – *Chelicerata*

Class Arachnida – *Arachnida*

subclass *Acari* Leach, 1817

superorder acariform – *Acariformes*, Zakhvatkin, 1952

class *Sarcoptiformes*

order *Astigmata* (*Acaridida*) G. Canestrini, 1891

suborder *Psoroptidia*

superfamily *Psoroptoidea*

family *Psoroptidae*

Morphology and Development Biology of *Otodectes cynotis* (Hering, 1938)

Psoroptidae family includes three genera: *Psoroptes*, *Chorioptes* and *Otodectes* [7]. *O. cynotis* (from Otodectes genus) as a pathogene of ear itch in wolves, dogs, cats, fur animals (blue foxes, foxes, sables) and other carnivorous animals has importance. The body of the mite is oval, grey-yellow in color. Females reach sizes 0,4-0,5×0,27-0,3 mm, and males – 0,3-0,4×0,2-0,3 mm. They have long, well-developed long limbs, the fourth pair of limbs is reduced in females (fig. 1).

Fig. 1. Ear mite *Otodectes cynotis* imago (Hering, 1938) (orig.)

Proboscis is gnawing, horseshoe-shaped (fig. 2), suckers on the limbs are large, tulip-shaped, arranged at short unsegmented rods. Suckers at females are on the first and second pairs of limbs, in males – on all fours.

Fig. 2. Photos of the front part of the body and mouth apparatus of the ear mite *Otodectes cynotis* (Hering, 1938) (orig.)

Males develop under optimal conditions 14-16 days, females – 18-20 days. Females lay clusters of eggs, sometimes in several dozens (fig. 3). For 3-6 days larva comes out from the eggs (fig. 4), in 3-4 days – protonymph (or the first nymph) (fig. 5-7), in 3-7 days – teleonymph (second nymph) (fig. 8), which turns into imago in 2-3 days (fig. 1).

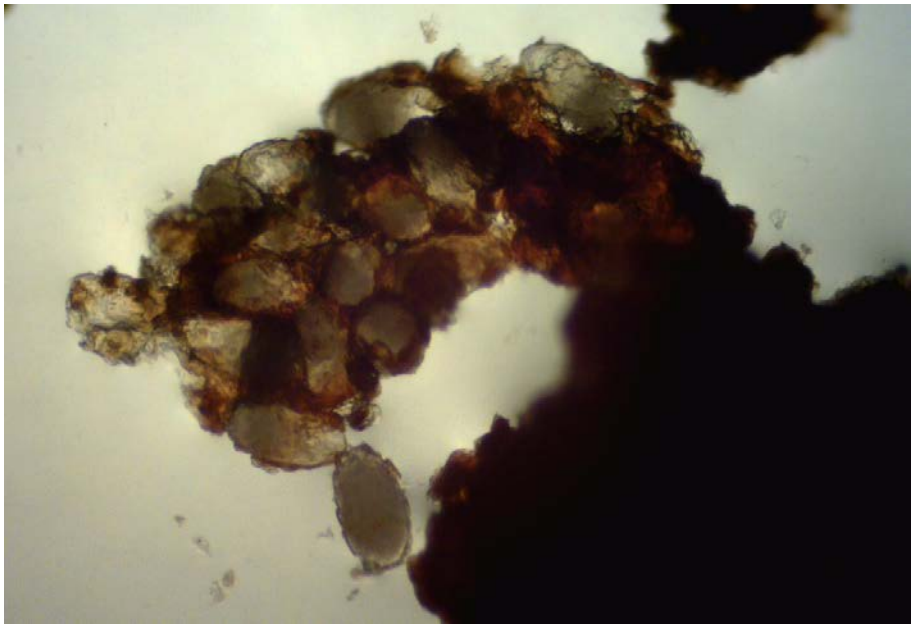

Fig. 3. Egg laying of the ear mite *Otodectes cynotis* (Hering, 1938) (orig.)

Fig. 4. Egg and larva of *Otodectes cynotis* (Hering, 1938) (orig.)

Fig. 5. Protonymph of *Otodectes cynotis* (Hering, 1938) (orig.)

Fig. 6. Protonymph *Otodectes cynotis* (Hering, 1938); body length – 0.25 mm (orig.)

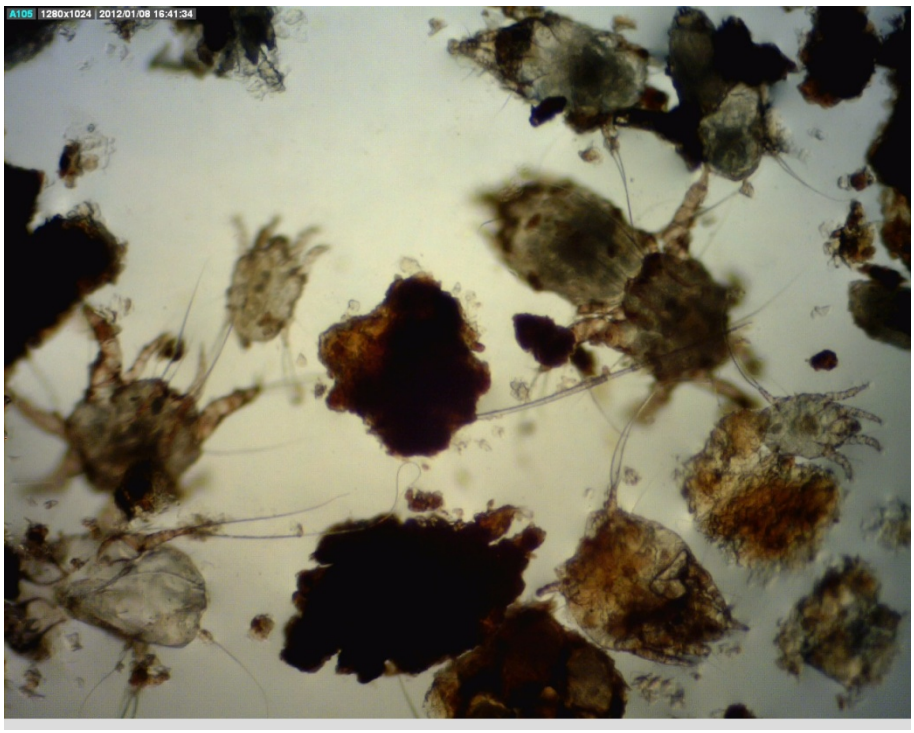

Fig. 7. Larvae and protonymphs of *Otodectes cynotis* (Hering, 1938) (orig.)

Fig. 8. Teleonymph of the ear mite of *Otodectes cynotis* (Hering, 1938) (orig.)

Mites fertilization occurs in two stages: first male mates with a female teleonymph and introduces its genital products into her genital foramen, and then after its transformation into imago the fertilization occurs.

Etiology, pathogenesis and symptoms of otodektoz

Pathogen of otodektoz (ear itch) is a widespread parasite, little species-specific mite parasitizing in the external ear apparatus of cats and to a lesser extent of dogs, foxes, arctic foxes, polecats and other predatory animals. The disease is very contagious to animals. Most susceptible to ear mite are kittens, young cats and animals with weakened immune systems. Cat ear mite is not transmitted to people.

The disease occurs at any time of the year. These parasites are feeling well in warm and damp conditions. At a temperature of -5 ... -20 ° C mites die within 1-5 days. They die instantly in the boiling water.

Mites affect the inner surface of the ear, ear canal and eardrum of an animal. They hide in ears, causing irritation, inflammation and an increased secretion of earwax. They may occur on the surface of cats' body. Otodektoz often affects more than 50 % of cats with externa otitis. This disease however occurs very rarely in dogs. It affects about 2 % of dogs with inflammation of the external ear canal.

Mites' secrets and feces can cause a hypersensitivity reaction of a master. As a result, there is intense itching. By mechanical irritation inflammation of the ear canal occurs. Mites by their long bristles on their feet and suckers irritate skin receptors and cause itching. When a mite bites skin, microdamages are formed and toxic parasite saliva gets into them, lymph accumulates on the surface, which eventually thickens, dries and along with dead cells of epidermis turns into dense crusts. Pathogens well develop in the crusts and scabs complicating the ear mange. Otodektoz runs hard when the desease is complicated by secondary infection. Exudation of bad smell comes out from the ears and sticks hair at the lower edge of the ear together. In neglected states animals hearing worsens. If untreated, ears become inflamed and swollen, in severe cases the inflammation can spread to the middle and inner ear and then to the meninges, which can lead to death of an animal. Yard and homeless cats are usually carriers of infection.

Affected animals often sit with a bowed or bent head in the direction of the affected ear, or worry occasionally shaking their head, scratch ears with claws and rub ears on different objects. Scratching a diseased ear a cat moves mites to the other ear. In a neglected condition scratches, sores and high temples appear around the ears which can become inflamed. Puppies and kittens are stunted and have a dull hair. The animals can have a crooked head (a head turned 90 degrees towards the affected ear). A sick cat's ear canal is filled with dark brown mass resembling a coffee sediment. The ear is painful, itches and under intensive scratching hematoma can occur. There is a considerable hardening of submaxillary lymph nodes. With complicated form the process spreads to a middle and inner ear where suppurative exudation is formed. In some cases the affected area is not restricted by the outer ear but spreads to other parts of the body, especially neck and tail. *O. cynotis* mite attack on the back part of the body depends on the habits of cats to sleep rolling up into a ball.

The disease is diagnosed by finding the parasite in a microscopic study of the ear canal content. In scrapings from ears a large number of ticks are revealed.

General information about the ear drops «Bars» – Guttae auriculares «Bars»

The product contains diazinon and components which have antimicrobial and anti-inflammatory effect. The active components included in the preparation have acaricidal, bactericidal and anti-inflammatory effect. The preparation belongs to mid-toxic compounds for warm-blooded animals. In recommended doses it has no local irritation, skin-resorptive and with sensitized effect. According to the instruction 3-5 drops of the preparation are put pipetted into each ear: for cats and small dogs – 3, average dogs – 4 and big ones – 5 drops. For a more complete treatment of the entire surface of the ear and the ear canal the ear is put along and its bottom is gently massaged . According to the instruction a course of treatment is carried out twice with 5 to 7-days interval. If necessary, the treatment is repeated. The drops have to enter into both ears, even if otodektoz affects only one. Sometimes, cats may experience hypersensitivity and allergic reactions to the preparation.

The conditions of the study

The work was based on materials about otodektoz infected domestic cats *Felis catus* (Linnaeus, 1758) collected in the cities Naberezhnye Chelny and Elabuga (Republic of Tatarstan), in 2011-2012. From the point of view of the temporal biological systematics a domestic cat (*Felis silvestris catus*) is a subspecies of a forest cat (*Felis silvestris* Schreber.). The breed definition of cats was carried out by the reference-determinant book [5].

On the presence of otodektoz we examined 17 cats, 12 of them are individuals older than a year, 5 – less than a year. Among 17 examined cats 12 individuals are not thoroughbred, then two individuals are «Siamese», 2 individuals are «Siberian color-point» (of which 1 individual is 7 months), one individual is «Persian». All not thoroughbred individuals had access to the external environment, that is they did not live permanently in the homes of people or walked out of doors. One «Siamese» individual also walked out of doors. The rest were exclusively at home. However, with the external examination otodektoz primary signs were detected only in 11 cats. It turned out that 9 cats were infected by ear mites. Two individuals have led a vagabond life, and their further observation was not possible. Thus, among the inspected animals about 53 % of the individuals suffered otodektoz. Further we observed seven individuals which lived at home, and most of them had free-range access (Table 1). Material samples to detect ear mites in cats were selected in summer, autumn and winter. The disease has no affinity to season and equally affects cats of both sexes and any breeds.

To collect samples for identification of ear mites we inspected the cats' ear and ear canal. When the signs of mites presence were found, we took the samples of ear wax and exudation by cotton stics. From each ear we took scrapes using 4-6 cotton sticks, which were sealed in small packets indicating the date, place of collection, species, approximate age. We examined the content of the packets under a light microscope at ×64-160. In the preparation of samples for microscopy we, using a dissecting needle, placed a scrape of ear wax and exudation from a cotton stick on a slide which then were poured out by water drops. For these purposes you can use

lactic acid (for enlightenment), glycerin or vaseline. At detection of ear mites we counted their number and did microfilming (photo and video) for further identification of species belonging of mites and the phases of their development. The definition of mites was made by the determinants [2, 3, 4, 6]. Microfilming was carried out using a camera eyepiece AM 423X based on software «Dino Lite / Digital Microscope / Dino Capture».

Efficiency of the preparation «Bars» in the treatment of domestic cats for otodektoz

For the treatment of cats for otodektoz we used ear drops «Bars» – Guttae auriculares «Bars». Before using the preparation the ears and ear canals were cleaned from ear wax and dirt with cotton sticks, which were kept for microscopy. Then we dropped 3 drops of the preparation into each ear. The treatment was carried out thrice with 5-7-day intervals. The drops were introduced into both ears. The use of the preparation in an hour after dropping the ears was combined with the use of acaricidal shampoo for cats, as the survived mites can spread from the ear to the outer covers of body and hair.

In the instruction of ear drops «Bars» there is a double application of the complete cycle of treatment or retreatment. It turned out that a double use of the preparation is not enough, since some species of mites and especially the eggs survived. The eggs have a dense cover and little susceptible to the preparation. The final destruction of ear mites occur only at thrice using of the preparation, after going out of larvae from the remaining eggs.

The results of treatment for otodektoz, population dynamics and identified development phases of ear mite are shown in Table 1.

In the distribution of development phase relations of the mite no appropriateness has been identified.

Table 1

Population dynamics and development phases of ear mites *Otodectes cynotis* (Hering, 1938) in the treatment of domestic cats with ear drops «Bars»

Cat's individual №		1			2			3			4			5			6			7		
Breed		Not thorough-bred			Siberian color-point			Siberian color-point			Not thorough-bred			Not thorough-bred			Siamese			Siberian		
Age		8 month			7 month			3 years			2 years			5 years			2 years			1 year		
Gender		♂			♀			♂			♂			♂			♀			♀		
Repetition (date) of the preparation use		11.10.11	17.10.11	23.10.11	09.01.12	14.01.12	20.01.12	09.01.12	14.01.12	20.01.12	12.03.12	18.03.12	24.03.12	05.04.12	11.04.12	17.04.12	20.07.12	26.07.12	01.08.12	22.07.12	28.07.12	03.08.12
The phases of mite development	egg	75	21	0	199	17	5	215	25	0	142	31	7	46	27	0	92	16	2	178	32	2
	larva	135	37	7	47	55	2	25	76	17	89	54	9	78	37	3	128	32	5	113	23	4
	protonymph	63	27	2	28	13	1	36	9	5	47	27	3	91	40	0	44	12	0	54	9	0
	teleonymph	257	16	0	157	3	0	133	0	0	105	4	0	56	14	1	26	3	0	78	10	1
	imago	118	1	0	93	0	0	67	0	0	99	2	0	24	5	0	38	7	0	62	16	0
	In all	648	102	9	524	88	8	476	111	22	482	118	19	295	123	4	328	70	7	485	90	7

After a single application of the preparation there was a sharp decrease in all phases, and after repeated application eggs or younger larvae and protonymphs

survived, small number of which allows them to restore the number of individuals at the same level, if not carry three times use of preparation (α = 5 and 1 %) (Table 2).

Table 2

Average number of all phases of ear mites *Otodectes cynotis* (Hering, 1938) in the treatment of domestic cats with ear drops «Bars»

Cat's individual №	Repetition use of the preparation				
	I		II		III
	$\overline{X} \pm S_{\overline{X}}$	α, %	$\overline{X} \pm S_{\overline{X}}$	α, %	$\overline{X} \pm S_{\overline{X}}$
1	129,60±30,86	1	20,40±5,35	5	1,80±0,04
2	104,80±28,97	1	17,60±8,08	1	1,60±0,70
3	95,20±31,63	1	22,00±11,12	–	4,40±2,52
4	96,4±13,65	1	23,60±8,58	–	3,80±1,23
5	59,00±10,56	5	24,60±5,98	1	0,80±0,44
6	65,6±17,19	5	14,00±4,48	5	1,40±0,73
7	97,00±20,25	1	18,00±3,85	1	1,40±0,54

In summary, it can be noted that out of 17 cats 9 individuals were affected by otodektoz that is about 53 %, among which there were cats of different breeds, genders and ages. The seasonal dependence of population dynamics and of development phase relation has not been identified. The effectiveness of ear drops «Bars» is somewhat overstated than that indicated in the instructions. Double application is not enough for complete destruction of ear mites *Otodectes cynotis*, as the preparation gives little effect on the eggs phase. After three times use of the preparation all phases of the mite died.

References:

1. Bochkov A.V. Akariform mites constantly parasitizing on mammals: phylogeny, systematics and host-parasite relation: summary of thesis … Doctor of Biology: 03.02.11 – parasitology. – St. Petersburg, 2011. – P. 46.

2. Dubinin V.P. Scabies mites. – Moscow: Soviet Science, 1954. – P. 324.

3. Zakhvatkin U. A. Acarology – the science about mites: History of development. Modern state (condition). Systematics. – Moscow: Publishing house: Book House «LIBROKOM», 2012. – P. 192.

4. Zemskaya A. A. Parasitic gamasid mites and their medical significance – M.: Medicine, 1973. – P. 168.

5. Kets P. Cat breeds: reference book- determinant. – Moscow: EKSMO-Press, 2000. – P. 80.

6. Determinant of mites living in soil Sarcoptiformes / edited by MS Gilyarova. – Moscow: Science, 1975. – P. 240.

7. Polyakov V.A., Uzakov U.Ya., Veselkin G.A. Veterinary Entomology and Arachnology: reference book. – Moscow: Agropromizdat, 1990. – P. 239.

8. Harvey M. S. The neglected cousins: what do we know about the smaller arachnid orders? Journal of Arachnology, vol. 30, 2002. – P. 357-372.

9. Norton R.A., Behan-Pelletier V.M. Chapter fifteen. Suborder Oribatida // A manual of acarology. Third edition. – Texas: Texas Tech University Press, Lubbock, 2009. – P. 430-564.

10. Subias L.S. Listado sistematico, Sininimico y Biogeografico de los Acaros Oribatidos (Acariformes: Oribatida) Del Mundo (Excepto fosiles) Version: April 2009.

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THE USE OF UNTRADITIONAL REGENERATE BIORESOURCES FOR PRODUCING ADEQUATE COMPOUND ANIMAL FEEDSTUFF

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This article is devoted to the obtaining of adequate compound animal feedstuff from regenerate plant and animal raw material and by products of processing industry.

Key words: adequate compound animal feedstuff, regenerate biological resources, reeds, oilcakes, oilseed meals, zebra mussel, farm animal, domestic animals.

When breeding and keeping farm and domestic animals there exists a problem of supplying available and adequate compound animal feedstuff. The main drawback of traditionally used fodders is either a high cost for well-balanced feeding or unbalance for cheap fodders. For the purposes of cost reduction and supplying of feeding value one may use untraditional regenerate biological resources that can be found in many different regions. For instance, on the territory of Volgograd region one can find a great number of bioresources both of plant and animal origin, that may be used for producing compound animal feedstuff for feeding farm and domestic animals, birds, fish and crawfish [1,2,3].

The use of such resources as biomass of reeds, by-products of oil-producing industry (oilseed meals, oilcakes) and mollusks of genus zebra mussel let us solve some ecological problems [1,2,4]. A great quantity of reed beds (pic.1) on the territory of some regions does them a fire risk. A fire in reedbeds may go into an uncontrolled conflagration in dry and windy weather. Reedbed fires in Volgograd region are systematical and numerous. So vast territories suffer from the fires, a huge damage is brought to the forestland, and biological variety of different types of ecosystem. There appears a threat of household outbuildings, industrial facilities, lines of electricity and health and lives of people. While burning a great number of carbon dioxide goes into the atmosphere. One of the main ways of solving this problem is a haying of reed beds in a warm season (May-June) with further utilization. The ecosystem damage from reedcutting is minimal in comparison with damage from conflagrations. Young shoots of reed is a perfect raw material for producing animal feedstuff and feed additives, as they contain a lot of ascorbic acid, amylum, simple protein, lipos, dietary fibre, saccharum [3].

Pic. 1. Reed beds in the Volga-Akhtuba flood-lands

In south regions of Russia and the Ukraine oil-plants such as sunflower, oil seed rape, mustard, orange agaric and some others are grown. Due to obtaining oil a great number of by-products of oilseed meals, oilcakes should be utilized.

A serious problem of exploitation of hydraulic engineering structures is an encrustation underwater parts of these structures by mollusks of genus zebra mussel (pic.2). That becomes a real threat for work and causes excessive loads and biocorrosion of construction materials. One of the most wide-spread and effective methods of elimination mollusks encrustation is draining and mechanical purification. As a result of mechanical purification scraped off mollusks form a huge mass and make an unfavorable ecological environment in district of hydraulic engineering structures. Biological disintegration of soft mollusks tissues forms such negative factors as an unpleasant smell that attracts some synanthropes (birds, rodents, and insects), an elimination of toxic volatile substances (ammonia, hydrogen sulfide, volatile amines etc.), mass development of pathogenic microbial flora, parasite fauna that can lead to the occurrence of infectious diseases. Scraped off dead mollusks are very often thrown back in water basin. This causes its rapid destruction with elimination of toxics in the environment, especially post-mortem poison that can do a serious damage to biological biodiversity and people's health [1,4].

Pic. 2. Molluscs of the genus Zebra mussel

As a rule all the listed resources, are considered waste products. So, they are not used or their usage has a low efficiency. But all these substances have a great feeding value and can be used for producing adequate compound animal feedstuff. It gives the primecost reduction of fodders. There is a lot of ascorbic acid, amylum, simple protein, lipos, dietary fibre, saccharum in young shoots of reed. Oilseed meals, oilcakes are valuable fodders where approximately 95% of nitrogen is albuminous nitrogen. Some of these waste products are similar to the fodder of animal origin, although have some deficits. Mass content of rye protein in these products is about 30-50%. They are used in feed rations and compound animal feedstuff for balancing them according to protein norms. Oilseed meals, oilcakes are rich in vitamins of B- and E-groups and contain potassium, phosphorus and other mineral resources. Feeding value of 1 kg of oilseed meals and oilcakes may vary. It depends upon oily raw material, technology that used for fat recovery and additional processing. Mass content of protein may vary from 18,6% to 46% and fodder units from 0,56 to 1,32.

Nowadays a great problem becomes a deficit of protein feed of animal origin. Flesh of mollusks of genus zebra mussel is an abundant source of native protein, indispensable amino acid and useful therapeutic substances. There are a lot of water-soluble (B_1 B_2, B_6, PP, C etc.) and lipid soluble (A, E, D, K etc.) vitamins, an adequate set of macro- and microelements, bioelements in tissues of mollusks. Mollusks shells contain calcspar that is necessary for growing ossa and eggshell. In natural conditions mollusks of genus zebra mussel is a fodder base for numerous types of fish, which includes sturgeons and waterfowl [4].

The staff members of VPI (branch) VolgSTU together with the staff members of the laboratory of Analysis of fodder and products of stock farming VSAU worked out recipes of adequate compound animal feedstuff on the basis of reeds with use of oilseed meals, oilcakes and cut mollusks of genus zebra (pic.3). The Analysis of feeding value of these recipes was conducted. The results are represented in the Table (table 1) [5,6].

Table 1

The Analysis of feeding value

Units of feeding value	In a natural state, %	In a dry state, %
protein	3,24 - 9,99 (zebra mussel)	22,05 - 52,2 (zebra mussel)
crude fat	0,17-0,37	1,28-4,63
crude fiber	21,17 - 40,85 (compound animal feedstuff)	
ash content	50,4 - 74,5	

The Analysis of results let us conclude that the recipes are adequate compound animal feedstuff and can be used for feeding poultry (chickens, ducks, quails, geese etc.).

Pic. 3. Granules of mixed fodders on the basis of the cane and mollusc Zebra mussel

The fodders approbation was conducted at the laboratory of VPI (fish and crawfish) (pic.4) and VSAU vivarium (quails, rodents) (pic.5) [6].

Pic. 4. Cancer and crucian carp silver - research objects and consumers of mixed fodders

Pic. 5. Quail - the objects of studies and consumers received mixed fodders

The prime cost of producing such fodders can be much lower than the cost of the analogues due to the usage of untraditional regenerate biological resources and by-products of processing industry.

References:

1. Gamaga, V.V., Kablov, V.F., Kostin, V.E., Rodionov, S.N., Sokolova, N.A. Improvement of the ecological situation in the district of hydraulic engineering structures after collecting and utilizing mollusks of genus zebra mussel. / News of Samara Scientific Center of Russian Academy of Sciences. – 2010. – Volume 12, № 1. – P. 2104-2107.

2. Sokolova, N.A., Kostin, V.E., Kablov, V.F., Chen, L.E., Gamaga, V.V., Rodionov, S.N. Development of animal feedstuff production technology by using regional secondary resources of raw materials. Steady development. Considerate use of nature. Health technology. International scientific conference, edited by E.M. Sokolov. – Tula, «Innovative technologies» Publishing House, 2011. – 187 p.

3. Sokolova, N.A., Kostin, V.E., Kablov, V.F., Komkova, I.V. Perspectives of using reeds as a renewable resource on the territory of Volga-Akhtuba flood-lands. /

Materials of the International scientific conference «Protected wildlife territories of the Lower Volga as an important mechanism for preserving biological diversity: results, problems, and prospects» / June 4th-6th 2010, Volgograd, 2010. – P. 154-155.

4. Chen, L.E., Kostin, V.E., Lapshina, S.V., Sokolova, N.A. Technology of obtaining granulated feedstuff from mollusks of genus zebra mussel. / Science Potential in the XXI century: materials of the IVth International scientific conference of students, postgraduates, and young scientists. Volume 1. / The North Caucasus State Technical University [and others]. – Stavropol, 2011. – P. 108-112.

5. Gamaga, V.V., Kablov, V.F., Kostin, V.E., Sokolova, N.A., Chen, L.E. Feedstuff obtained from mollusks of genus zebra mussel as the best way of using renewable resources to improve the ecological situation at hydraulic engineering structures. / The 10th staff scientific conference at VPI (branch) VolgSTU (Volzhsky, 2011) [Electronic resource]: Collected materials of International scientific conferences. Issue 1. – Volzhsky: VPI (branch) VolgSTU, 2011.

6. Sokolova, N.A., Kostin, V.E., Chen, L.E., Gamaga, V.V., Rodionov, S.N. Interaction of higher education institutions in working out recipes and determining the biological value of compound animal feedstuff obtained from mollusks of genus zebra mussel / «Interaction between enterprises and institutions of higher education in increasing production efficiency and innovative activity»: The VIIth Inter-regional scientific conference, Volzhsky, May, 2011. / Volzhsky Polytechnical Institute (branch) VolgSTU. – Volgograd, 2011. – P. 93-95.

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THE FORMATION OF MORPHOLOGICAL STRUCTURES OF WOODY PLANTS' YEARLY GROWTH IN URBAN ENVIRONMENT CONDITIONS

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Researches on studying features of formation of yearly vegetative shoots of woody plants growing in the plantings of different ecological areas in a large industrial centre were conducted. Clusters were identified by the pattern of change in morphological structures of the shoot. In the conditions of anthropogenic impact on the environment the growth reactions, such as the changes in dimension and in the number of structural elements of the shoot, are specific to different species.

Key words: urban environment, plantations of trees, yearly vegetative shoots, morphogenesis.

INTRODUCTION

The plants growing in the urban environment suffer from stress which causes the changes in biochemical composition, physiological processes and, as a result, in morphological characteristics. The analysis of morphological structure peculiarities of woody plants' yearly growth in the urban environment allows to estimate the complex influence of the anthropogenic and natural factors on the formation and growth of the shoot [1, 2]. These results can be used for biological indication and monitoring the state of ecotopes, in urban area zoning according to the intensity degree of anthropogenic impact.

OBJECTS AND METHODS

The studies were conducted in Izhevsk, a large industrial centre with the population of over 640 thousand people and with well-developed industry, transportation network and social infrastructure. The level of pollution is characterized as high.

The climate in Izhevsk is moderate continental. The average annual temperature is +2.4 ^{o}C. The frost-free period lasts for about 128 days. The length of the sunny period is 1.839 hours per year. The annual amount of rainfalls is monthly non-uniformed and at the average it is 508 mm per year [4].

Nine species of trees which account for about 70% of the city green area were chosen as the objects for study. The studied species grew in different structural and functional areas of plantings: along highways (Udmurtskaya Street and K. Libkneht Street); sanitary-protective zones (SPZ) of industrial enterprises that are the main polluters of the city such as plc “Izhstal”, plc “Neftemash”, plc “Bummash”, plc “Avtozavod”, Izhevskii electrical and mechanical plant. Using the methodical approaches by N. S. Krasnoshekova [3], we selected the suburban area and the territory of the largest city park named after S. M. Kirov which has a compact, unified configuration area of 113 hectares. According to mapping, conducted by the Laboratory of Soil Ecology of the Udmurt State University (the total index of soil pollution (TISP), which was calculated as the sum of the coefficients of concentration, i.e. the ratio of the element content in the studied soil to the background concentration, was used), the soils in the conventional control zones have a low level of pollution. The level of soil pollution along highways and in sanitary-protective zones of industrial enterprises is assessed as moderate and high, and in the area of enterprises “Izhstal” and “Avtozavod” it is extremely high.

The selection of studied plants (10 -15 trees of different species in each area of study) was conducted on the basis of the description of testing plots (5 – 10 items on the territory of at least 0.25 hectares). The studied plants had good or satisfactory life and middle aged generative ontogenetic state.

Morph metrical characteristics of annual shoot (annual growth) of trees and shrubs were recorded after the growth processes stopped (in early September). To do it, we selected ten apical vegetative shoots in the middle part of the crown of studied plants growing in the southern exposure. We specified the length, the number of metameres, the mass (wet and dry) and the leaves' area on the annual shoot (by contour and weight method) and calculated the specific leaf weight as the ratio of dry weight of the leaves to the area of the leaf surface.

To interpret the obtained results we used the program "Statistica 5.5" and applied the methods of principal component, cluster and variance analysis.

RESULTS AND DISCUSSION

As it allows us to organize and classify large amounts of data in a descriptive stage of research, we applied the procedure of cluster analysis using Euclidean distance as the most common type. We failed in allocating clusters by categories of plantations. Clustering occurred by the specificity of morphological structure of annual growth: in one of them box elder (*Acer negundo* L.) and mountain ash (*Sorbus aucuparia* L.) united, in the second one – the other species studied by us. Moreover, while studying maple and ash, we identified groups with similar sets of morphological characters according to the zones of growth: in the plantations in sanitary-protective zones of industrial enterprises and plantings along highways (with the distance of 20 – 30%) and in the plantations in zones of conventional control (15 – 20%) (Fig.1). Thus, we can assume that in the conditions of severe pollution ash and maple show a significant change in morphological characteristics of the annual growth.

The check of statistical significance of the most possible regularity of the formation and growth of the shoot was further performed by using the principal component analysis and multiple-factor analysis of variance. Using the method of principal component, the structure of the relationship among fixed characteristics of the shoot was revealed and the number of variables was grouped. The first principal component reflects the characteristics of the assimilation apparatus of plants, it is highly significant and negatively correlate with crude (correlation coefficient r = -

0.91) and dry weight (r = -0.88), as well as the area (r = -0.86) of leaves. This component accounts for 39% of the variability, indicating a significant change in these characteristics of plant shoots in sanitary-protective zones of industrial enterprises and in the plantings along highways. The second principal component covers 15% of variability, the annual shoot length (r = -0.75) is closely correlated with it. The principal components 3 and 4 can be characterized as components of the number of shoot metameres and mass index of the leaf area unit. They account for 14% and 10% of the variability, respectively.

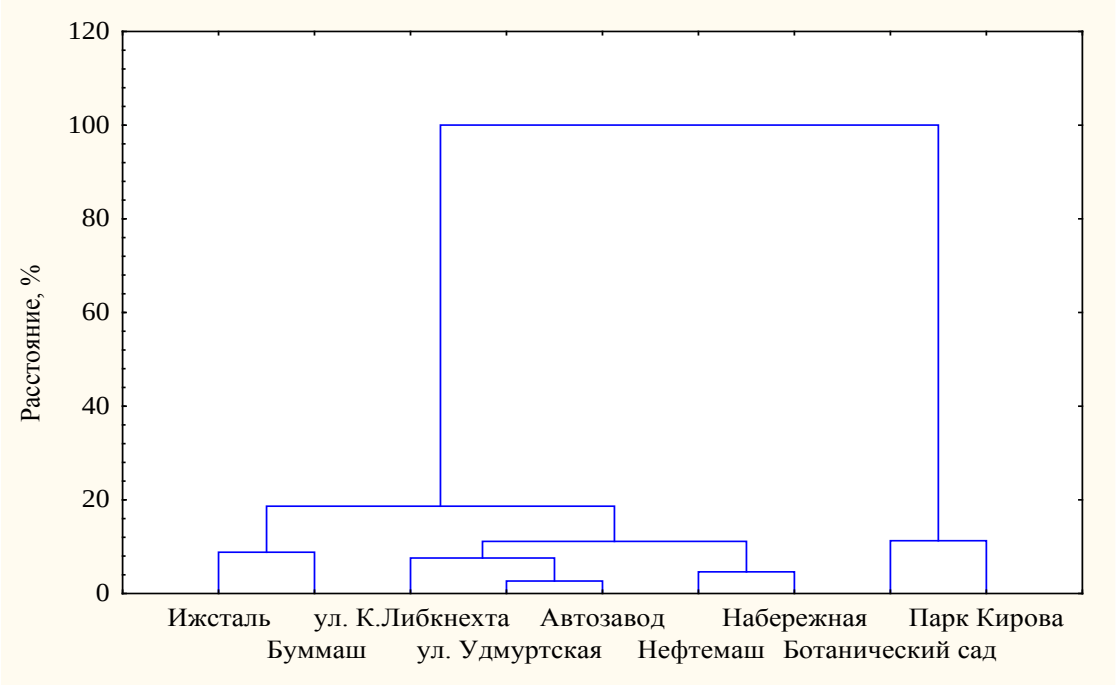

Fig. 1. The results of cluster analysis of morphometric characteristics of *Acer negundo* L. growing in different functional zones (Izhevsk)

Plotting the position of objects of study in the coordinate axes principal components 1 and 2 (Fig. 2) showed that the ash-leaved maple and mountain ash growing in the area of intensive pollution change the mass and leaf area, while the box elder, in addition, changes the length of its annual shoot.

A multiple-factor cross-hierarchical analysis of variance was conducted to detect the significant effect on the individual morphological characteristics of annual shoot of trees such factors as specific characteristics and conditions of the growth place. It was stated that the influence of these factors and their interaction are important to the

structure of the shoot (the significance level is $P < 0.05$). The method of multiple comparisons, LSD-test, was used to compare these differences.

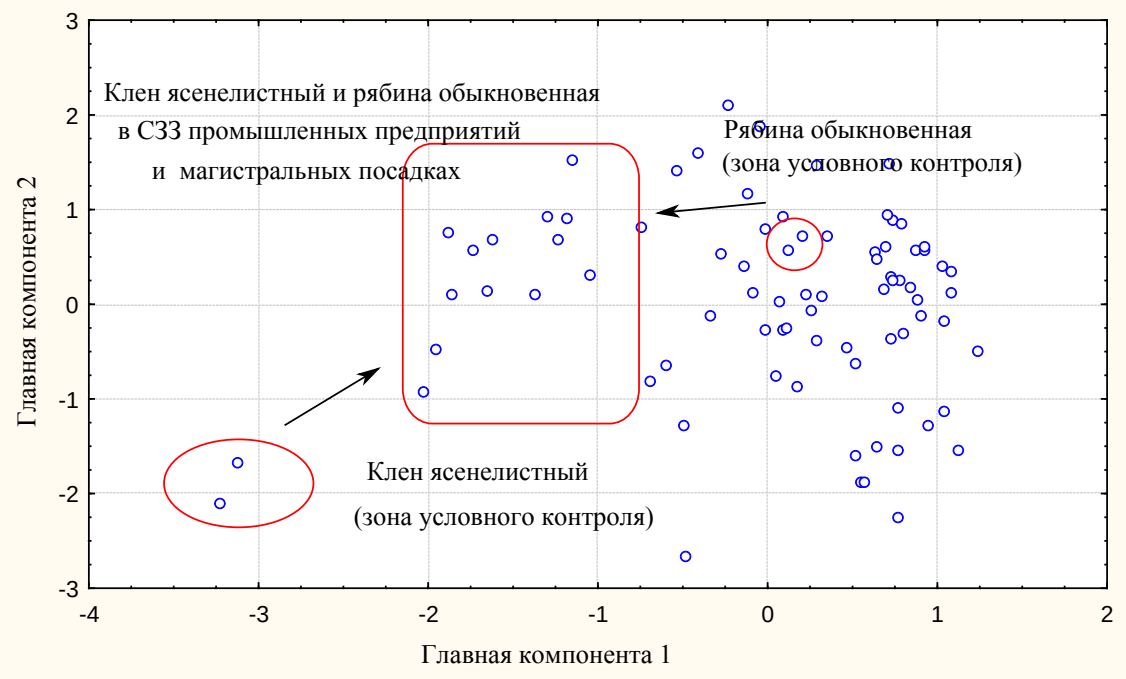

Fig. 2. The location of objects in axis of principle component 1 and 2

The analysis of specific characteristics showed that annual shoots of May rose (*Rosa majalis* Herrm.) became shorter by 2.7-4.4 sm (95% of confidence interval) with the increasing number of nodes and decreasing area of the leaf (Figure 3 - 5).

The annual shoot length of the box elder growing in the area with higher level of pollution also shortened by 5.9-8.6 sm (Fig. 3) and the leaf area reduced almost halve (Fig. 4) which fits with the results of cluster and factor analysis. The annual growth of the tree Caragana (*Caragana arborescens* Lam.) in the zone of industrial enterprises is also decreased, the area of its assimilating surface is reduced and the nodes are situated closer on the shoot. As the researchers note, shortening of the length, reducing the number and size of the shoot structural elements corresponds to the phenomenon of plant structure xerophytization in the condition of anthropogenic impact [5].

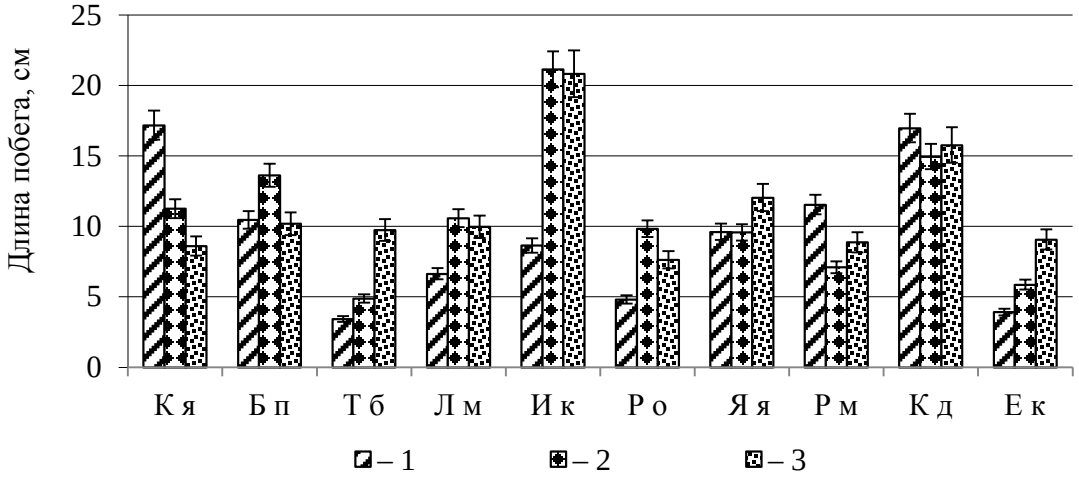

Fig. 3. The length of the annual shoot of woody plants growing in different functional zones of the city, see:

1 – conventional control zone, 2 – sanitary protective zone of industrial enterprises, 3 – highways; Кя – *Acer negundo* L., Бп – береза повислая, Тб – *Populus balsamifera* L.), Лм – *Tilia cordata* Mill., Ик – *Salix caprea* L., Ро – *Sorbus aucuparia* L., Яя – *Mallus baccata* L., Рм – *Rosa majalis* Herrm., Кд – *Caragana arborescens* Lam., Ек – *Picea pungens* Engelm **.**

But in scientific literature there is evidence that in the conditions of pollution in some fairly resistant species the annual shoot elongation can occur (for example, silver birch) [2, 6]. It was found out that in the plantings along highways the annual shoots of goat willow (*Salix caprea* L.) and mountain ash become longer by 12.2 and 2.8 sm. respectively due to the increase in the number of metameres and the weight and size of the leaves on the shoot also increase.

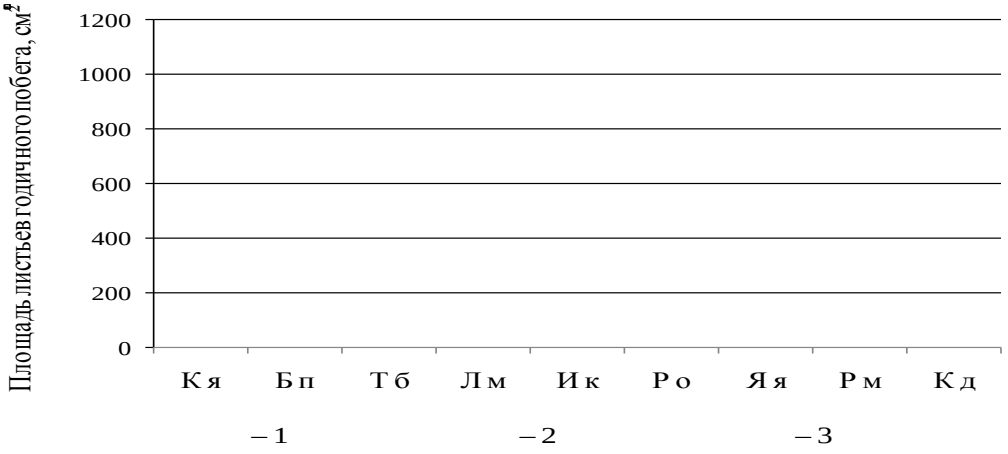

Fig. 4. The leaves area of the annual shoot of woody plants growing in different functional zones of the city, sm^2

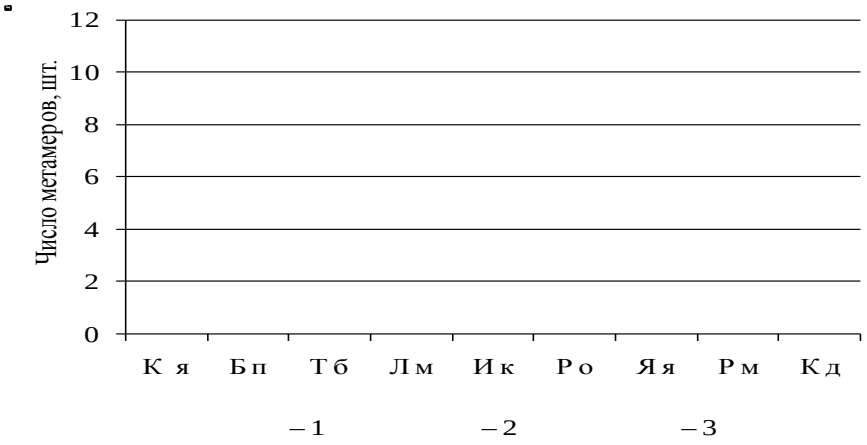

Fig. 5. The number of metameres on the annual shoot of woody plants growing in different functional zones of the city, items

The annual shoots of Tilia cordata (Tilia cordata Mill.) (in sanitary protective zones of industrial enterprises and along highways), apple berry (Mallus baccata L.) (only along highways) and silver birch (*Betula pendula* Roth.) (in sanitary protective zones of industrial enterprises) grow longer due to the increasing number of metameres but mass index and the area of leaf surface remain unchanged. A significant increase in the length of shoot (by 6.3 sm) of balsam poplar (*Populus balsamifera* L.) was observed only along highways plantings and the number of nodes on the shoot doesn't change while the area and leaf weight increase.

In our opinion, the lengthening of annual growth of most studied species can be caused by a stimulating effect of low concentrations of heavy metals, some of which are nutrients, as well as higher air temperatures and abundant rainfalls occurred in recent years. There is no doubt that it is necessary to study the intracellular mechanism of this phenomenon.

Specific leaf mass index is closely related to the rate of growth, intensity of photosynthesis and gas exchange and serves as a measure of sclerophilous leaves [6]. According to the variance analysis results, its value is significantly influenced by specific peculiarities ($P = 10^{-3}$) and the conditions of growing location ($P = 2\times10^{-7}$). Statistically proven differences during the years of research haven't been identified. Balsam poplar (7.64), mountain ash (7.12) and May rose (7.14 mg×sm^{-2}) have the

highest specific leaf weight. But this index of apple berry (6.33 mg×sm^{-2}) is somewhat lower. The index of the other tree species is within 5.0-5.5 mg×sm^{-2}, the differences among three groups of plants are statistically reliable.

The leaf area mass per unit of the majority of studied species in plantations growing in sanitary protective zones of industrial enterprises increases (except for goat willow tree and tree Caragana). It also increases for mountain ash and May roses growing along highways. But this index, on the contrary, decreases for the goat willow growing along highways in the conditions of intense anthropogenic impact. Tree Caragana in different types of plantations has stable specific leaf mass. Combining the data relating to the leaves of studied tree species growing in different types of plantings, we found out that the increase of this index depends on the increasing degree of anthropogenic impact.

CONCLUSION

The results of the study show that in anthropogenic environment there is xerophytization of morphological structures of the annual growth of some tree species (maple, box elder, May rose, tree Caragan), the other species have the annual shoot elongation (goat willow, mountain ash, small-leaved lime, apple berry, balsam poplar and silver birch). This annual shoot elongation in most studied species of woody plants is accompanied by a substantial increase in the number of its metameres. It indicates that the conditions of urban environment affect not only the post-embryonic stage of tree shoot formation which is reflected in the change of the annual shoot length and its internodes, the size of the assimilation system, as a result of the influence of carbon oxides, acidifying the epidermal cells and imitating the action of auxin [1, 10]. There is an effect on embryonic development phase of the shoot when metameres start forming (the number of shoot metameres, the number of leaves, etc.).

Identified significant changes in area indicator and mass of leaves on the annual growth of box elder and mountain ash and the shoot length of box elder, growing in the conditions of amplification degree of anthropogenic impact, allow us to

recommend shoot morph metric characteristics of these species for using them in efficient monitoring the urban environment state.

References:

1. Bukharina I. L., Dvoeglazova A. A. Bioecological characteristics of herbaceous and woody plants in urban plantations: a monograph. – Izhevsk: Publishing House “Udmurt University”, 2010. – 184 p.

2. Bukharina I.L., Povarnizina T.M., Vedernikov K.E. Ecological and biological peculiarities of woody plants in urban area: monograph. – Izhevsk, Izhevsk State Agricultural Academy, 2007. – 216 p.

3. Krasnoshekova N. S. Improvement of the environment by means of landscaping in Moscow// Environment improvement. M/: CESTI Minzhilkomhoz USSR, 1973. – pp. 60 -70.

4. Makalskaya V. N. The climate//The nature of Izhevsk and its neighborhoods: Izhevsk: Udmurtia, 1998. pp. 17-38.

5. Turmuhametova N. V. Birch adaptation to the conditions of urbanization// Principals and methods of conservation of biological species variations. Russia’s conference proceedings. Yoshkar-Ola: MarSU, 2006. pp. 336-337.

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AMINO ACID COMPOSITION OF SOME PLANTS OF FAMILY PEONY

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The study of the amino acid composition of the four types of plant materials peony. In a sample identified 14 amino acids, 7 of which are irreplaceable; established their quantitative content.

Keywords: amino acids, peony roots, stems, leaves, flowers.

In recent years, the interest in the issue of introduction of plants containing valuable biologically active substances (essential oils, polysaccharides, amino acids, etc.) required by the human body. In this regard, there is a need to study the chemical composition of plant parts peony as promising sources of medicinal herbs. I's known that the amino acid composition of most species of peony hasn't been studied.

Amino acids - the building blocks from which proteins are built, necessary to the human body and are the biogenetic precursors of a large group of valuable biologically active substances, alkaloids, flavonoids, etc. Many elements play a role in metabolism, affect many physiological processes and, in some cases, can have a therapeutic effect. Amino acids enter the human body mainly from natural products, and so an additional study of new plant sources for diversification is used.

The objects used plant material 4 species of peony (*Paeonia hybrida*, *P. tenuifolia*, *P. anomala*, *P. lactiflora*), dried to air-dry. Studied the dynamics of accumulation of amino acids in different parts of plants: the above-ground parts - stem, leaves, flowers and ground - roots. The amounts of amino acids were determined in the analytical samples of the objects produced in the laboratory in triplicate. Quantitative determination of amino acids in the samples was performed at the amino acid analyzer AAA 339 (Czechoslovakia) at standard conditions.

Results of the study of amino acid composition in the table.

Established the presence of 14 amino acids, 7 of which are irreplaceable. On the total amino acid content leading position occupied by *P. tenuifolia* and *P. anomala*. The maximum accumulation of amino acids found in the stems and leaves. The amount of essential amino acids is from 2.53 to 3.97 mg /%, the amount of amino acids - 5,64-8,68 mg /%, reflecting the biological value of the objects of study.

The analysis to identify amino acid composition of four species of peony showed that the accumulation of certain amino acids in the leaves and stems of the pion is more intense than, for example, the leaves *Adenophora liliifolia* or *Echinacea purpurea.* The results obtained on the content of certain amino acids indicate the feasibility of revival of the traditions of the pions in the food and use for medicinal purposes.

Table

The content of amino acids in samples of raw pion

Types	Type of raw material	The amino acid content, %															
		лизин*	метионин*	цистеин	гистидин	аргинин	треонин*	серин	пролин	глицин	валин*	изолейцин*	лейцин*	тирозин	фенил-аланин*	The amount of essential amino acids	The total content
P. hybrida	root	0,88	0,11	0,86	0,18	0,41	0,08	0,27	0,93	0,49	0,64	0,27	0,33	0,03	0,22	2,53	5,7
	flower	0,90	0,06	0,54	0,46	0,22	0,10	0,15	0,54	0,55	1,35	0,32	0,88	0,16	0,08	3,69	6,31
	list	0,32	0,30	0,50	0,04	0,52	0,40	0,42	2,14	1,05	0,28	0,58	0,25	0,19	0,39	2,52	7,38
	stem	1,42	0,22	0,94	0,48	0,11	0,11	0,08	0,81	0,51	0,53	0,53	0,89	0,02	0,05	3,75	6,7
P. tenuifolia	root	1,25	0,22	0,96	0,31	0,20	0,06	0,13	0,58	0,35	0,64	0,29	0,54	0,03	0,08	3,08	5,64
	flower	0,72	0,03	0,50	0,41	0,09	0,03	0,07	0,68	0,65	1,37	0,25	0,78	0,20	0,01	3,19	5,79
	list	0,55	0,38	0,44	0,08	0,64	0,49	0,52	2,03	1,12	1,01	0,38	0,24	0,30	0,49	3,54	8,67
	stem	1,30	0,19	0,99	0,42	0,49	0,14	0,28	1,32	0,71	0,76	0,52	0,77	0,12	0,29	3,97	8,3
P. anomala	root	0,95	0,11	0,92	0,24	0,33	0,06	0,26	1,12	0,52	0,53	0,43	0,47	0,03	0,15	2,7	6,12
	flower	0,59	0,04	0,53	0,37	0,02	0,03	0,03	0,94	0,74	1,22	0,36	0,73	0,21	0,05	3,02	5,86
	list	0,43	0,35	0,56	0,14	0,62	0,45	0,49	1,96	1,12	0,92	0,44	0,29	0,26	0,46	3,34	8,49
	stem	1,84	0,36	1,11	0,59	0,18	0,27	0,12	0,99	0,55	0,64	0,61	1,09	0,09	0,24	5,05	8,68
P. lactiflora	root	0,96	0,10	0,86	0,29	0,24	0,04	0,23	1,17	0,55	0,57	0,54	0,59	0,03	0,08	2,88	6,25
	flower	0,61	0,06	0,58	0,34	0,23	0,12	0,17	1,18	0,77	1,25	0,31	0,66	0,18	0,19	3,2	6,65
	list	0,28	0,30	0,50	0,09	0,70	0,44	0,52	1,81	1,06	0,77	0,48	0,29	0,22	0,47	3,03	7,93
	stem	1,17	0,12	1,10	0,45	0,40	0,09	0,31	1,81	0,77	0,19	0,85	0,95	0,08	0,10	3,47	8,39

* essential amino acids

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METHODS OF BIOTESTING IN THE ECOLOGICAL STATE ASSESSMENT OF THE LAKE SOLONOYE, PETROVSKY DISTRICT

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The article represents the research data of the anthropogenic factor influence on the ecological state of the lake Solonoye, Petrovsky district.

Key words: biotesting, natural reserve, ecological condition.

Quality control over the environment with the use of the biological objects has actual scientific and applied direction in the last decades. Because of its simplicity, efficiency and accessibility biotesting has been widely recognized throughout the world and is often used along with physical and chemical methods.

Biotesting is the procedure when environmental toxicity is established with the use of test-objects that signal of danger no matter what substance and in what combination will cause changes in vital functions of these test-objects. For the assessment of the environmental parameters standardized responses of living organisms (separate organs, tissues, cells or molecules) are used [4].

Lake Solonoye in Petrovsky district is the State Natural Reserve of regional importance. Therapeutic mud of the lake is very popular and attracts a lot of tourists, as from nearby districts, as from the distant regions of the country. This has significant anthropogenic influence on all components of the Reserve, including the lake Solonoye. But authorities do not pay much attention to the ecological state of the lake. So method of biotesting can help in this situation to determine the quality and the toxicity of the environment rather quickly and it will affect the methods of maintaining the ecological balance in the reserve in future [2].

The aim of the work is to assess the ecological state of the lake Solonoye, Petrovsky district, using the methods of biotesting.

During the research following techniques were used: biotesting of water pollution with the help of Lemna minor, methods of morphophisiological assessment of winter wheat sprouts.

Then the primary data were processed at the personal computer.

For hydrobiological methods of water quality assessment practically all kinds of aquatic organisms that live in water bodies and water courses are used (bacteria, algae, macrophytes, zooplankton, zoobenthos, fish). However, their role in indicating water quality varies. In particular, fish have secondary importance in biotesting water [1, 5].

Studied areas of the lake Solonoye experience different anthropogenic impact, that allows to give comparative description of water phytotoxicity depending on the quality and quantity of pollution sources.

The results of the study revealed that changes in phytotoxicity depended on anthropogenic burden. These data are presented in Table 1.

Table 1 shows that irrespective of the sampling time there is a tendency of phytotoxicity increase on approximation to a settlement (zone 1).

Thus, the more is anthropogenic burden on the lake near any settlement, the more is pollution, and water phytotoxicity of the lake. One of the reasons may be a large number of tourists especially in summer period.

Table 1

The seasonal dynamics of the water phytotoxicity in the lake Solonoye.

The place of sampling, Phytotoxicity, %	Zone 1	Zone 2
Spring	28	14
Summer	33	19
Autumn	29	16
The average index	30	16,33

Comparative assessment of the morphophysiological characteristics of winter wheat sprouts in different functional zones of the lake Solonoye (Fig. 1) shows that

the greatest depression of sprouts growth and germination is typical for Zone 1 - coastal, on the part of the village Solonoye Lake.

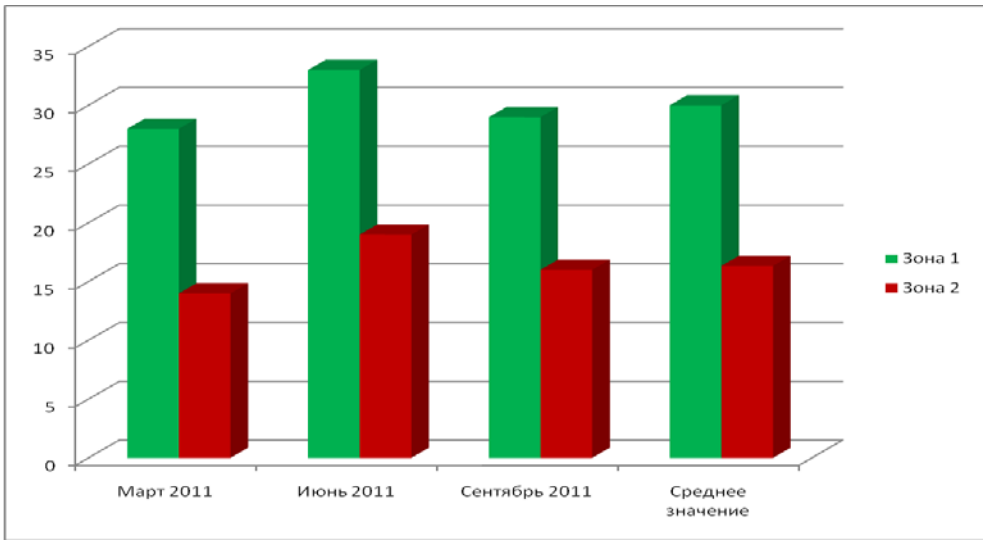

Fig. 1. Seasonal water phytotoxicity of the lake Solonoye. (by the number of germinated seeds)

Increase of water pollution in Zone 1 may be seen in the number of seeds with defects in their development. In average their number is about 10%, while in Zone 2 this rate is about 6%. According to the number of not germinated seeds Zone 1 also exceeds zone 2. For Zone 1 the average minimum is 21% while for Zone 2 this indicator is the highest. Thus, ecosystems balance destroyed by human activities, is recovering very slowly. Uncontrolled sewages, forests burned away by shepherds for the grass rejuvenation are very dangerous for the representatives of the flora and fauna of our Reserve. In fact, rare species of plants, water springs, animals are under the threat [3].

References:

1. Gromov E.I. systems approach to the study of the state and prospects of development of social, ecological and economic systems agroorientirovannyh regions / E. Gromov, N. Eremenko, AV Murdugov / / Economics and Entrepreneurship. - 2012. - № 5. - S. 79-85.2.

2. Zelenskaya T. G. The study of the air reserve "Russian Forest" Stavropol method lihenoindikatsii / / T. Zelenskaya, RS Eremenko, EE Stepanenko / / Bulletin of the Krasnoyarsk State Agricultural University. 2012. Number 9. Pp. 94-97.3.

3. Zelenskaya T.G. study of anthropogenic load industrial district of Stavropol method lihenoindikatsii / T. Zelenskaya, RS Eremenko, EE Stepanenko / / success of modern science. - 2012. - № 2. - S. 20-21.4.

4. Melekhova, O.P. Biological control environment: bioindication and bioassay / O.P. Melekhova, E.A. Egorova, T.I .Evseeva - Moscow: Publishing Center "Academy", 2007. - 288 p.

5. Boris Fomin Problems of ecological monitoring and ecosystem modeling / BI Fomin. - St., 1992. - 178 p.

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