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SPECIFIC COMPOUND OF WEEDS IN FOREST NURSERIES OF TAIGA SUBZONE

Nikolay A. Babich, Svetlana N. Marich

Northern (Arctic) Federal University named after M.V. Lomonosov, Severnaya Dvina Emb. 17,

Arkhangelsk, Russia; 163002

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The experimental data of weed study in forest nurseries of the southern, middle and northern taiga subzone in North-West Russia (including the regions of Vologda, Arkhangelsk and the Republic of Karelia) is viewed in the paper. Research of producing and auxiliary nurseries' area, using conventional methods of geobotanical descriptions in the southern taiga subzone was made. Taxonomic, geographic, botanical and ecological distribution of segetal species is explained. Weed flora of the forest nurseries showed great diversity of species' composition and included 209 species belonging to 110 genera and 33 families. The role of the head families in the nursery is 77% of the total species, it shows significant degree of anthropogenic transformation of the flora. The absolute number of indicators and systematic floristic diversity tend to increase in the direction from north to south and from west to east.

Key words: *forest nursery, segetal flora, weed vegetation, analysis of flora*

In forest nurseries there is a competitive interaction between coniferous seedlings and saplings, and weed species. Forest vegetation management is about supporting the survival and growth of the cultivated species by changing the competitive interaction in favour of the cultivated ones. This can be done by reducing the competitive strength of undesired species or enhancing the competitive strength of the cultivated species, or both. There is no unique definition of 'weed', but it is commonly considered to be an undesirable plant species imposing competition on grown species (Bentsen et al., 2009). Competition may be defined as: passive – competition for water, light and nutrients; indirect –weeds encourage the appearance or occurrence of other harmful organisms or incidents, e.g. mice or spring frost; active – weeds inflict physical damage or growth retardation to the crop, e.g. by allelopathy or thigmomorphogenesis (Henriksen, 1988). The weeds' compound in a nursery depends on the edaphic, climatic and hydrological conditions as well as the level of mechanization. To provide comprehensive care of sowing and plants in nurseries the most complete information on the weed species' composition is needed. The objects of our study are forest nurseries of the southern taiga subzone in the Vologda region, such as the nurseries in Kadnikov (area of 54 hectares, established in 1967), Totjma (15 ha, 1985), Ustyuzhna (8.3 ha, 1968) and Cherepovets (21 ha, 1986). We explored both producing and auxiliary nurseries' area, using conventional methods of geobotanical descriptions. Corresponding data from the middle taiga subzone nurseries in Nyandoma, Plesetsk, Kargopol, Konosha, and Ustyany in the Arkhangelsk region (Babich & Nechaeva, 2010), and the northern taiga subzone nurseries in Olonets, Pryazha, Salmi, Petrozavodsk, Kondopoga, Medvezhegorsk, Segezha, Kalevala in the Republic of Karelia (Kryshen, 1999), is used for comparison.

Weed flora of the forest nurseries showed great diversity of species' composition and included 209 species belonging to 110 genera and 33 families (Table 1). On the territory of forest nurseries of the Vologda region 167 weed species were found, belonging to 110 genera and 28 families. In Arkhangelsk region were found 109 species belonging to 86 genera and 29 families. In forest nurseries in Karelia 70 herbaceous species were detected belonging to 55 genera and 20 families. Taxonomic analysis showed that in all cases the set of families is typical of the boreal floras.

Table 1 – Distribution of species, genera and families of weed in nurseries

Class	Number of species		Number of genus		Number of families	
	absolute	%	absolute	%	absolute	%
Equisetophyta						
Equisetopsida	4	1,9	1	0,7	1	3,0
Magnoliophyta						
Liliopsida	28	13,4	19	13,6	2	6,0
Magnoliopsida	177	84,7	120	85,7	30	91,0
Total	209	100,0	140	100,0	33	100,0

Distribution of the ten most common families (i.e. head-families) is presented in Table 2. The main part of the floristic spectrum are 3 families: *Asteraceae*, *Poaceae* and *Fabaceae*. The total percentage of these families indicates the flora transformation; the value varies within 53...70%. The role of the head-families in the nursery is 77% of the total species, it show significant degree of anthropogenic transformation of the flora. On closer inspection, the appearance of species of the families *Salicaceae*, *Betulaceae* in nurseries of the Vologda region should be noted. The segetal flora of nurseries in the Arkhangelsk region includes species of the family *Ericaceae*, which is not typical for other florocenotical complexes. In Karelian forest nurseries representatives of the families *Grossulariaceae*, *Apiaceae*, *Campanulaceae* have been identified, typical for nurseries of the other two areas. The results obtained, on the one hand show the similarity of the species' composition of weed phytocenoses, and on the other – high specific diversity in each nursery.

Table 2 – Number of species and genera in the head-familial species' spectrum

Families	Vologda region		Arkhangelsk region		Republic of Karelia	
	number of species	number of genera	number of species	number of genera	number of species	number of genera
Asteraceae	33	23	19	18	16	14
Poaceae	24	16	15	13	11	9
Fabaceae	14	7	7	4	4	3
Caryophyllaceae	10	9	7	6	6	5
Rosaceae	10	7	6	5	4	2
Brassicaceae	8	7	3	3	3	3
Scrophulariaceae	8	3	8	5	1	1
Lamiaceae	7	4	4	3	3	3
Polygonaceae	6	4	5	2	5	2
Ranunculaceae	5	2	3	2	1	1

We used indicators of floristic diversity for comparising weed composition in different regions: number of species, number of genera, number of families, and systematic diversity; the average number of species and genera in the family, the average number of species in the genus. It's worth paying attention to one notable pattern: the absolute number of indicators and systematic floristic diversity tend to increase in the direction from north to south and from west to east, as seen from the values in Table 3.

Table 3 – Indicators of floristic and systematic diversity of weed in nurseries

Indicators	Vologda region	Arkhangelsk region	Republic of Karelia
Number of species	167	109	70
Number of genera	110	86	55
Number of families	28	29	20
Number of species in family	5,6	3,7	3,5
Number of genera in the family	3,7	2,9	2,7
Number of species in the genus	1,5	1,3	1,2

The degree of similarity of taxonomic compositions by Jaccard similarity coefficient is presented in Table 4. The similarity of species and genus composition varies slightly (from to 0.38 to 0.44, respectively). At the family level, the similarity is much higher – 0.73; the commonality of higher taxa points to their long historical

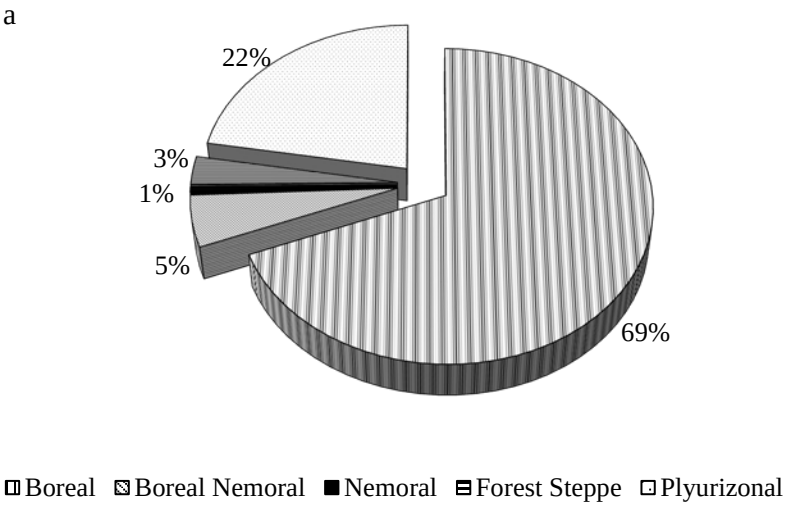
proximity during the forming of floras in these areas. The segetal flora of Arkhangelsk and Vologda regions are most similar in all respects.

Table 4 – Similarity coefficients of systematic segetal composition

The similarity of weed floras	Region	Vologda region	Arkhangelsk region	Republic of Karelia
Species composition	Vologda region	-	0,38	0,31
	Arkhangelsk region	0,38	-	0,35
	Republic of Karelia	0,31	0,35	-
Genus composition	Vologda region	-	0,43	0,40
	Arkhangelsk region	0,43	-	0,44
	Republic of Karelia	0,40	0,44	-
Family composition	Vologda region	-	0,73	0,56
	Arkhangelsk region	0,73	-	0,63
	Republic of Karelia	0,56	0,63	-

Typological analysis conducted by geographical, ecological, biological signs, is not reducible to family. Latitudinal and longitudinal distribution of geographical elements of flora is shown in Figure 1. The geographical structure showed that 46.1% of the species (95) belong to the Eurasian boreal element flora (B-EA), determining the overall geographical character (Table 5).

a



b

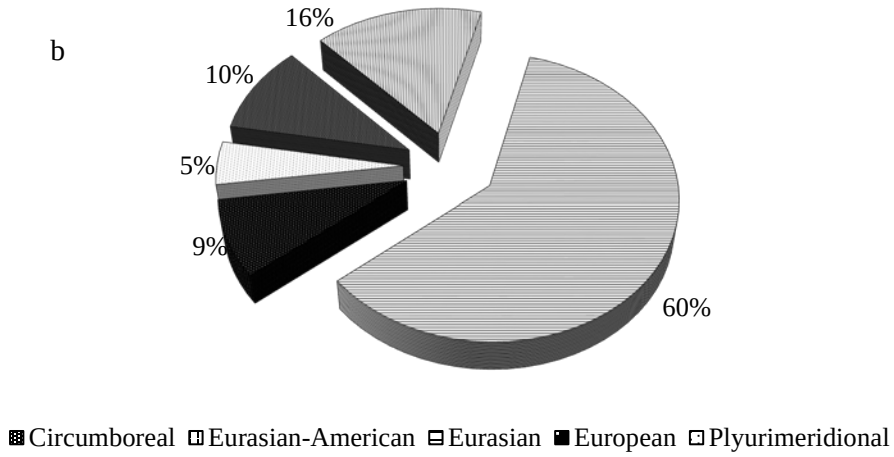


Figure 1 – Latitudinal (a) and longitudinal (b) distribution of geographic structure

Boreal Eurasian (B-EA) and the Plyurizonal Eurasian (PL-EA) groups are of rather large presence. Dissemination of plyurizonal components associates with the historical influence of anthropogenic factors. Lack of some geographical elements, represented in the flora of the regions, is due to the loss of elements of northern factions dedicated to zonal habitats that are not under nurseries.

Table 5 – Geographic structure of segetal composition, %

Latitudinal element	Longitudinal element					Total	
	Circumboreal	Eurasian-American	Eurasian		Plyurimeri-dional		
Boreal			Eurasian	European		Factions	Groups
Boreal							
Boreal	9,7	6,8	46,1	5,8	-	68,4	77,5
Boreal-Nemoral	-	1,4	2,4	1,9	-	5,7	
Nemoral	-	-	-	0,5	-	0,5	
Forest-Steppe	-	-	2,9	-	-	2,9	
Plyurizonal							
Plyurizonal	0,5	7,8	8,8	0,5	4,9	22,5	22,5
Factions	10,2	16,0	60,2	8,7	4,9		
Groups	10,2	16,0	68,9		4,9	100,0	

Analysis of life forms showed that in the flora of forest nurseries is completely dominated by species of herbaceous plants. The largest groups are the perennial polycarpous creeping grasses (33.3%). Weeds, propagating vegetatively through upground or underground organs are the most malignant in the nurseries. Widely represented is the group of vegetatively sedentary polycarpic weeds, consisting of species propagated vegetatively and by seed. The share of vegetatively fixed polycarpous species is also significant – 13.6 %, the characteristic method of their reproduction is by seed. Group of biennial and annual plants represented by monocarpic annuals and biennials species, representatives biomorphs confined mostly to annual cultivated species and can partially be found in fallows. An extended period of germination and long-term preservation of

seeds in the soil necessitates using systematic application of mechanical treatment. There are spring annuals, overwintering, winter and ephemeral species in the group of annual plants. Separately it is necessary to distinguish a group of parasitic annual plants, formed by four species from the *Scrophulariaceae* family, their presence in the fields poses a significant threat to cultivated plants. Segetal trees and shrubs in nurseries are represented by 14 species (7.6%). Their presence is not dangerous in our opinion; because most of them are represented in the juvenile stages of ontogenesis and at this stage cannot reproduce vegetatively or by seed. Most likely, they got on the field with the surrounding nursery windbreaks and during care will be completely eradicated. The biomorphological structure is shown in Figure 2.

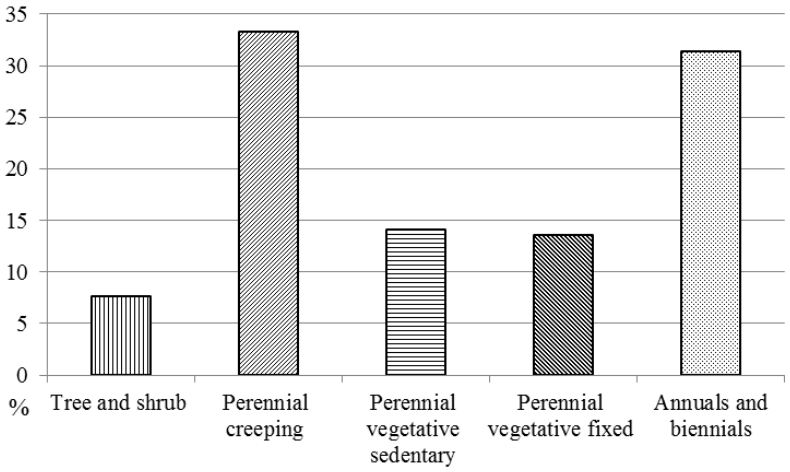


Figure 2 – Biomorphological structure of nurseries coenofloras

The phytocoenotic structure analyze shows the pathways of weeds in nurseries. Most of coenofloras belong to weed species, which are divided into groups depending on their locus. Thus, the proportion of ruderal plants is 18.0 %. It is including the inhabitants of roadsides, quarries, landfill sites. Number of segetal species, growing among cultivated plants is half as less. Share of plants, considered as transitional, capable of growing both among crops and along roadsides etc., so-called segetal-ruderal, in nurseries reaches is 25.0%. Cultivated and introduced plants, behaving as weeds, occur in equal quantity – 4 species (2.3%). Forest (17.4%) and meadow (27.0 %) species play an important role in segetal cenoses.

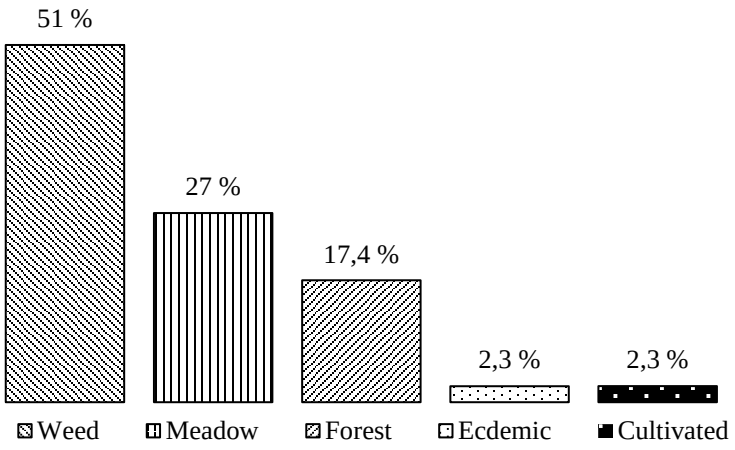


Figure 3 – Phytocenotic structure of nurseries' coenofloras

Thus, the greatest similarity is exhibited between the weed floras of Arkhangelsk and Vologda regions. The analysis of the systematic structure of all the floras shows similar conclusions expressed, the Bravais-Pearson correlation coefficient reaches a maximum of 0.98 (Schmidt, 2005). Familia composition is typical of the boreal type floras; with the geographical flora determined by Boreal Eurasian species. Core components form a grassy weed perennial creeping and annual species belonging to segetal-ruderal cenotic group. It is worth to note that the majority of nurseries were established more than 20...30 years ago and mostly on former forest areas. Pioneer weeds in the early stages of community development were mostly forest species. Today, the most common species are apofit meadow and weed species. Species that are most active in the fields of nurseries and require special controls are: *Achillea millefolium, Cirsium arvense, Elytrigia repens, Rumex acetosella, Taraxacum officinale*. In the Vologda region *Chenopodium album* is also widely spread; in the Arkhangelsk region more typical *Deschampsia cespitosa*; in Karelia *Spergula arvensis* is also widely found.

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