

Conference Paper

Geographical Patterns of Weed Diversity in the Central Urals

A. S. Tretyakova and P. V. Kondratkov

Institute of Natural Sciences and Mathematics, Ural Federal University, 620000 Ekaterinburg, Russia

Abstract

The weed flora of arable lands was studied in four areas: the mountainous part of the Central Urals, the eastern macroslope of the Ural Mountains, the western piedmont of the Ural Mountains and the Transural region. These areas matched vegetation types such as middle taiga, southern taiga and northern forest-steppe. The weed flora consisted of 256 species from 41 families and 166 genera. The greatest taxonomical diversity was revealed in the eastern macroslope of the Ural Mountains (208 species); however, in the mountainous part of the Central Urals and the western piedmont of the Ural Mountains, it was as low as 141–143 species. About 40% of weeds occurred in all areas: the group of territory-specific weeds was clearly significant in the Transural region (14%). In the forest-steppe zone, the group of alien species approached 50%, while in the taiga zone it reached 40%.

Keywords: Central Urals, weed plants, diversity, life-forms, geographical differentiation of diversity

Corresponding Author:

A. S. Tretyakova
 alyona.tretyakova@urfu.ru

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1. Introduction

The origin of weed species was driven by the development of arable farming. Investigating weeds makes it possible both to examine the basic regularities of the anthropogenic transformation of natural flora under arable farming conditions and to study important practical aspects of the diversity, biology and ecological features of weeds that can lead to production loss on arable lands. In recent years, studies of weed diversity have been carried out [1, 5], especially in terms of regional latitudinal patterns [6, 9]. There are no similar studies for the Central Urals, although an analysis of the geographical patterns of weed diversity is not without interest. In this area, a zone of intensive arable farming is constituted by the western piedmont of the Ural Mountains (the outskirts of East European Plain), the Urals and the Transural region (the outskirts of the plains of Western Siberia): with respect to latitudinal direction, it is enclosed


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by the central and southern taiga. The aim of the article is to study longitudinal and latitudinal patterns of geographic diversity in weeds.

2. Methods

Multi-year research into weeds on arable lands in the Central Urals (Sverdlovsk region) is the basis of the present article. The field of research measures approximately 560 km from west to east (extending from 57°46' to 63°43' E) and 330 km from south to north (extending from 56°24' to 57°51' N). More than 150 fields of spring crops, winter crops and tilled crops were examined. Three geographical patterns were designated: the mountainous part of the Central Urals (the middle taiga zone), the eastern macroslope of the Ural Mountains (the southern taiga zone), the western piedmont of the Ural Mountains and the Transural region (both are in the northern forest-steppe zone). The diversity of weeds in each pattern was identified, as well as its life-form spectrum in accordance with the Raunkiaer system and the ratio of native-alien plant species. To assess species similarity within the patterns, the Jaccard similarity coefficient was used. The data obtained enabled us to distinguish two groups of species: the first consisted of weeds distributed in all zones in the Central Urals while the second included weeds that occurred in different zones.

3. Results

A checklist of weed plants in Sverdlovsk region records 256 species from 41 families and 166 genera. A large variety of weed species is revealed in the eastern macroslope of the Ural Mountains and in the Transural region – 208 and 166, respectively. In the mountainous part of the Central Urals and the Western piedmont of the Ural Mountains, weed saturation is significantly lower: 141 and 143, respectively (Table 1).

About one third of the weeds (94 species, 37%) occur in all zones of the Central Urals. Among those native to the region from this list, there are 53 species (36%). These weeds are *Achillea millefolium* L., *Artemisia vulgaris* L., *Elytrigia repens* (L.) Nevski, *Capsella bursa-pastoris* (L.) Medik., etc. There are 41 species of alien plants, just over 40%: *Bunias orientalis* L., *Centaurea cyanus* L., *Convolvulus arvensis* L., *Conyza canadensis* (L.) Cronquist, *Echinochloa crus-galli* (L.) P.Beauv., etc. All these species are surveyed in arable lands more frequently, thus forming groups of highly and middling active species in plant communities in the Central Urals [10].

TABLE 1: Geographical patterns and floristic features of weeds in the Central Urals.

Floristic Features	Geographical Patterns of Weed Flora							
	Mountainous part of the Central Urals (middle taiga zone)		Western piedmont of the Ural Mountains (northern forest-steppe zone)		Western piedmont of the Ural Mountains (south taiga zone)		Transural region (northern forest-steppe zone)	
	Number	%	Number	%	Number	%	Number	%
Totals species	143	100	141	100	208	100	166	100
Native species	84	58.7	74	52.5	116	55.8	86	51.8
Alien species	59	41.3	67	47.5	92	44.2	80	48.2
Therophytes	70	49.0	94	45.2	71	50.4	82	49.4
Hemicryptophytes	62	43.4	98	47.1	60	42.6	72	43.4
Cryptophytes	8	5.6	10	4.8	7	5.0	9	5.4
Chamaephytes	3	2.1	4	1.9	2	1.4	2	1.2
Phanerophytes	0	0	2	1.0	1	0.7	1	0.6

Source: Authors' own work.

In each area, territory-specific species are recorded. A great number of these species were surveyed in the eastern macroslope of the Ural Mountains (29, 14%). It is only in this area that we find native plants such as *Amoria montana* (L.) Sojak, *Dianthus deltoides* L., *Geranium sylvaticum* L., *Lamium album* L. and *Lysimachia vulgaris* L. (in total 21 species) and alien plants such as *Hyoscyamus niger* L., *Lamium purpureum* L., *Puccinellia hauptiana* (Krecz.) Kitag., *Conringia orientalis* (L.) Dumort. etc. Among weeds in the mountainous part of the Central Urals, 14 territory-specific species are present (10%). Most species are native plants, such as *Alisma gramineum* Lej., *Angelica sylvestris* L., *Androsace septentrionalis* L., etc.: 5 species are alien plants that occur sporadically in crops, such as *Apera spica-venti* (L.) P.Beauv. *Bromus secalinus* L., *Chenopodium hybridum* L., etc.

In the northern forest-steppe area, territory-specific species are almost nonexistent. Thus, in the Transural region, only 6 species are recorded. Among these species, *Calamagrostis arundinacea* (L.) Roth, *Nonea rossica* Steven and *Poa angustifolia* L. are native plants; *Consolida regalis* Gray, *Mentha x piperita* L. and *Stachys annua* (L.) L. are alien. For the weeds identified in the western piedmont of the Ural Mountains, only one territory-specific species is present: *Spergularia rubra* (L.) J. Presl & C. Presl.

As can be seen from the aforementioned, the group of territory-specific species amounts to 50 species (20%). Among weed species, native plants prevail – 34 species.

All territory-specific species are considered to be random members of crop plant communities that are only rarely recorded on arable lands, which makes it possible to regard them as not very active or inactive weeds [10].

Geographical patterns of weed flora do not reveal similarity in species composition (Table 2). The northern forest-steppe in the western macroslope of the Ural Mountains and in the Transural region shows high levels of similarity between weed species. Similarity between weeds is true of groups of both native and alien plants. Less similarity between weeds is observed in the eastern macroslope of the Ural Mountains. The eastern macroslope and the Transural region reveal more similarity between native plants (0.67), but the eastern macroslope and the western piedmont have more similarity between alien plants (0.59). The lowest level of similarity between weeds is recorded in the mountainous part: it is slightly higher among native plants than among alien plants.

TABLE 2: The Jaccard similarity coefficient of species composition within native plants (top right) and alien plants (bottom left).

Weed Flora	1	2	3	4
(1) Middle taiga (mountainous part of the Central Urals)	–	0.61	0.57	0.58
(2) Southern taiga (the eastern macroslope of the Ural Mountains)	0.37	–	0.67	0.61
(3) Northern forest-steppe (Transural region)	0.45	0.52	–	0.72
(4) Northern forest-steppe (the western piedmont of the Ural Mountains)	0.50	0.59	0.67	–

Source: Authors' own work.

4. Conclusion

The weed flora of the Central Urals is not an integral formation but is made up of a series of geographical patterns which match natural zones: middle taiga, southern taiga and northern forest-steppe. The designated geographical patterns of weeds are distinguished by a level of species richness and do not reveal similarity in species composition. Just about 40% of similar weed plants occur in all zones. In each area, non-territory-specific species are represented. The largest distinction can be found in weeds in the eastern macroslope of the Ural Mountains, where territory-specific species amount to 14%. A single territory-specific species is noted in the western piedmont of the Ural Mountains. Alien plants in the forest-steppe area approach 50%:

48.2% in the Transural region and 47.5% in the western piedmont of the Ural Mountains. In taiga areas, the amount of alien species decreased to 40%. The ratio of weed life-forms does not reveal any significant geographical differences. Annual and half-year plants prevail: 45–50% and 42–47%, respectively.

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