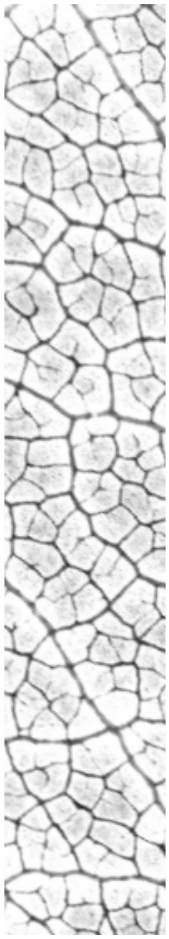

EurAsian Journal of BioSciences
Eurasia J Biosci 13, 1915-1918 (2019)

Floral complexes with the involvement of *Adonis Vernalis L.* (fam. Ranunculaceae juss.) and environmental assessment of the conditions of their formation in the Southwest of Central-Russian Upland

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Abstract
The article presents the results of the study of structures of floral complexes with the involvement of Adonis vernalis L., the number of genera, families and species is indicated. Average points of severity of environmental factors were calculated, allowing assessing the environmental conditions in these ecotopes. Ecobiomorphs of species of the floral complexes in natural and quasi-natural ecotops are determined.

Keywords: Adonis vernalis L., south-west of the Central Russian Upland, Ellenberg scale, ecobiomorphs of plants

Tokhtar VK, Kirilova IA, Tokhtar LA, Kaliuzhnaya EV (2019) Floral complexes with the involvement of *Adonis Vernalis L.* (fam. Ranunculaceae juss.) and environmental assessment of the conditions of their formation in the Southwest of Central-Russian Upland. Eurasia J Biosci 13: 1915-1918.

INTRODUCTION

The ecological assessment of environmental conditions makes it possible to assess the influence of various factors on the growth of plant species, as well as to identify environmental groups in terms of water regime and drought tolerance. There are many developed methods for determining the ecological assessment of environmental conditions related to plant communities. On the territory of the former USSR, they were first developed by Ramensky in 1956, in the 1960-70s, regional ecological scales were actively developed, and they allowed us to obtain a more objective assessment of the environmental conditions of all floral complexes of the country (Burda 1992, 2005, Korolyuk 2007). In the future, the experience of using ecological scales was improved, becoming less massive. In geobotanical studies, the Ellenberg scale is often used to assess the ecological conditions of the environment, due to its informativeness and structuredness. The Ellenberg technique is based on the following environmental factors: light, humidity, soil acidity and nitrogen content in the soil. As a result of calculations, the average degree of the environmental factor manifestation is obtained. The average score of the factor manifestation was determined by the formula

$$X = \frac{K_1X_1 + \cdots + K_nX_n}{K_1 + K_2 + K_3 + \cdots + K_n} = \frac{\sum KX}{\sum K}$$

X is the average factor manifestation, K_1- K_2 is the species score on the Brown-Blanke scale, X_1-X_n is the environmental formula score (Korolyuk 2007).

OBJECTS AND METHODS

The object of the study was the floral complexes with the involvement of *A. vernalis* L., which are formed on the slope surfaces of the meadow-steppe plant communities of the south-west of the Central Russian Upland, which we consider within the administrative boundaries of the Belgorod Region. The study of the species representation in the floral complexes with the involvement of *A. vernalis* L. was carried out within the limits of the scented grounds established for the study (Kirilova 2015, Shahpar and Esmaeilpoor 2018, Tokhtar 2013, 2014). To collect the field material, route methods were used to study the plant cover of specific areas with subsequent mathematical processing of data using the Excel 2016 software. Ecobiomorphic representation of floral complexes in the structure was evaluated in the following categories: hygromesomorphic, xeromorphic, xeromesomorphic, mesomorphic, mesoxomorphic, mesogelomorphic, hygromorphic, helohigomorphic (Glukhov 2011, Ovcharenko 2009, Shabanova 2014).

Received: August 2019
Accepted: November 2019
Printed: December 2019

MAIN PART

In the course of the study, plant communities with the involvement of *Adonis vernalis* L., represented in the quasi-natural and natural ecotopes of the region, were described using the route method. The general taxonomic analysis of all the studied communities indicates that they contain representatives of 25 families, 90 genera, 114 plant species. The leading families of plant groupings with the involvement of *Adonis vernalis* were: Poaceae Barnhart., Asteraceae Bercht., Fabaceae Lindl., Lamiaceae, Ranunculaceae Juss. The smallest number of species was observed in the following families: Asclepiadaceae R. Br., Campanulaceae Juss., Caprifoliaceae Juss., Convolvulaceae Juss., Euphorbiaceae Juss., Geraniaceae Juss., Hypericaceae Juss., Hyacinthaceae Dumort., Polygalaceae Juss., Scrophulariaceae Juss., Violaceae Batsch (Tokhtar 2005, 2011, 2012).

Based on our research, it was found that the dominant species of the plant communities under study were: *Achillea millefolium L., Agrimonia eupatoria L., Artemisia austriaca Jacq., Centaurea sumensis (Kalenicz), Cichorium intybus L., Delphinium consolida L., Elytrigia repens L., Falcaria vulgaris Bernh., Festuca valesiaca Schleich.ex Gaudin, Galium verum L., Medicago falcata L., Phlomis tuberosa (L.) Moench., Poa angustifolia L., Salvia verticillata L., Vicia cracca L.*

Mesomorphic species accounted for the maximum number in the total population of species, with *A. vernalis L.*, 27.1%. The dominant species in them were: *Agrimonia eupatoria L., Convolvulus arvensis L., Dactylis glomerata L., Elytrigia repens L., Fragaria vesca L., Galium aparine L.* Their localization is confined to territories with a high degree of vegetation cover, which mostly cereals and meadow grasses. The frequency of occurrence of these species increased in natural habitats (Gopalakrishnan et al. 2016).

The proportion of xeromesomorphic species was 26.3%. Plants of this group are resistant to moisture deficiency, and in more hydrated habitats they can manifest themselves as mesophytes. The dominant species of these groups were: *Avena fatua L., Centaurea sumensis, Cirsium arvensis (L.) Scop., Crepis tectorum L., Delphinium consolida L., Euphorbia esula L., Hieracium pilosella Schuliz ex Sch., Salvia verticillata L.* In quasi-natural ecotopes, the proportion of weed plants increases, for example: *Avena fatua L., Artemisia absinthium L., Capsella bursa-pastoris (L.) Medik., Cirsium arvensis (L.) Scop, Cynoglossum officinale L., Plantago major L., Senecio vulgaris L.* and others.

Xeromorphic plants accounted for 16.6% of the total share of floral complexes. The dominant species of ecobiomorphs were: *Artemisia absinthium L., Artemisia austriaca Jacq, Cichorium intybus L., Eryngium planum L., Falcaria vulgaris Bernh, Festuca valesiaca L.* These species are well adapted to the lack of moisture, therefore they are often found in quasi natural habitats, having a high tolerance to adverse environmental conditions (Parveen et al. 2014).

The hygromesomorphic group of plants also turned out to be rather small in the overall structure of the floral complexes (2.6%). We identified 3 species of them: *Ajuga repens L., Poa trivialis L., Taraxacum officinale Wigg.* The presence of these plants in plant communities is explained by the fact that they were formed in the zone of unstable moistening and were localized in low-lying areas.

The hygromorphic group consisted of two types: *Gagea lutea L., Geranium pratense L.* Their share was the smallest in the aggregate of all species and was 1.7%. They were mostly found in natural habitats with the dominance of meadow, meadow-grass communities, where the optimum balance of moisture in the soil is maintained. For example, *Alopecurus myosuroides Huds., Fragaria vesca L., Inula hirta L., Potentilla argentea L., Vicia cracca L., Viola canina L.*

When calculating the mean score of the environmental factors manifestation, we noted the prevalence of light and light-loving plants in plant communities, mf (L) - 7.4. In relation to soil moisture, the average coefficient mf (F) was 4.3, which characterizes the relatively high degree of adaptation of species to variable wetting of habitats and change in dry periods. According to our data, in all studied plant groups, the soil reaction was neutral or slightly acid mf (R) - 6.9. The average nitrogen content mf (N) is 4.4. The lowest indices of nitrogen in the soil are characteristic of plant groups that form near highways.

CONCLUSION

The study of plant florocomplexes with the involvement of *Adonis vernalis*, a rare species for the south-west of the Central Russian Upland, made it possible to determine the species accompanying this species in its populations.

The general taxonomic analysis of all the studied communities indicates that they contain representatives of 25 families, 90 genera, 114 plant species. The leading families of plant groupings with the involvement of *Adonis vernalis* were: Poaceae Barnhart., Asteraceae Bercht., Fabaceae Lindl., Lamiaceae, Ranunculaceae Juss. The smallest number of species was observed in the following families: Asclepiadaceae R. Br., Campanulaceae Juss., Caprifoliaceae Juss., Convolvulaceae Juss., Euphorbiaceae ecological assessment of the ecobiomorphological structure of plant communities indicates the predominance of species of the mesomorphic group (28%), in the second place are plants of the xeromezomorphic ecobiomorph (25.4%). Estimation of habitats by Ellenberg aggregate indices, characteristic for plant communities of *Adonis*

vernalis, allows us to speak about some differences in their formation in natural and quasi-natural habitats. This is reflected in the uneven distribution of the spectrum of leading families, and the quantitative ratio of the species composition changes, depending on the localization in the selected ecotopes.

The dominant species of natural and quasi-natural ecotopes are identified. It is noted that in natural populations, species of the families Geraniaceae Juss., Hypericaceae Juss., Hyacinthaceae Dumort., Lamiaceae, Polygalaceae Hoffm., Ranunculaceae Juss., Rosaceae Perleb. predominate, whereas in the disturbed habitats, representatives of the families Asteraceae Barnhart, Plantaginaceae Juss.

In addition, it was noted that in quasi-natural ecotopes located in close proximity to highways, the proportion of weeds and xerophilous species increases. In natural ecotopes, soil moisture increases, which is reflected in changes in the species composition of plant groups, in which species are adapted to the conditions of increased moisture, for example: *Gagea lutea* L., *Geranium pratense* L.

When calculating the mean score of the environmental factors manifestation, we noted the prevalence of light and light-loving plants in plant communities, mf (L) - 7.4. In relation to soil moisture, the average coefficient mf (F) was 4.3, which characterizes the relatively high degree of adaptation of species to variable wetting of habitats and change in dry periods. According to our data, in all studied plant groups, the soil reaction was neutral or slightly acid mf (R) - 6.9. The average nitrogen content mf (N) is 4.4. The lowest indices of nitrogen in the soil are characteristic of plant groups that form near highways.

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