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ECOLOGICAL ASSESSMENT OF THE CENOPOPULATIONS OF SOME SPECIES OF IRISES IN THE GANJA-GAZAKH REGION

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Abstract

The increasing anthropogenic impact on the places of natural growth of plant communities leads to the fact that the population of wild ornamental irises decreases from year to year. The aim of the study is to determine the limiting environmental factors affecting the distribution of certain species of irises (*Iris* L) in the Ganja- Gazakh region. The assessment of the potential and real ecological valence of species was carried out, the coefficient of ecological efficiency and the tolerance index of species were calculated. With the help of amplitude ecological scales, it is possible to determine the state of the growing environment in the response of the cenopopulation to changes in certain environmental factors. It was revealed that the species of irises growing on the territory in the Ganja- Qazakh region. Are assemblers in the structure of ecological and cenotic groups, and changes in the soil and climate of the region can be determined by their condition in the cenopopulation. The results of the research can be used in phyto-indication of territories and monitoring of plant resources.

Keywords: Potential Ecological Valence, Climatic, Soil Factors, Ecological Scales.

INTRODUCTION

To determine the environmental conditions changing as a result of anthropogenic impact on ecosystems, it is productive to use the phytoindication method. The phyto-indication method makes it possible to assess changes in the environment less costly than using measuring instruments and laboratory studies. (Didukh, Y., Vasheniak, I., & Bednarska, I. (2022)., Gamrat, R., & GAŁCZYŃSKA, M. (2021)., Glibovytska, N., & Mykhailiuk, Y. (2020)., Kunakh, O. M., Lisovets, O. I., Yorkina, N. V., & Zhukova, Y. O. (2021)., Tsyganov, D. N. (1983).)

Vegetation is the most directly observable component of it, sensitively reacting to all changes in soils, rocks, groundwater, minerals, etc. (27). (Tsyganov, D. N. (1983).)

Due to the relationship of plants with environmental factors, it is possible to determine not only the needs of plants, but also to determine the state of the ecotope plants. Simply put, use vegetation cover as an indicator of environmental conditions.

The adaptation of vegetation and even populations of individual species to climatic and soil factors makes it possible to apply bioindication methods and compile regional ecological scales. (Vikto-rov, S. V., &Remezova, G. L. (1988)., Zverev, A. A. (2020).)

With the help of amplitude ecological scales, it is possible to determine the limiting factors affecting the spread of plants, such as illumination, variable humidification, temperature regime, nitrogen richness of soils, soil acidity, and salt regime. The ecological analysis makes

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it possible to correctly assess the role of cenopopulations in the vegetation cover for planning further work on biodiversity conservation and reintroduction of endangered species (26) (The Red Book of the Republic of Azerbaijan. Rare and endangered species of plants and fungi. Second edition. (2013)).

MATERIAL AND METHODS

The object of research was the rhizomatous species of irises growing in the Ganja-Qazakh region. Some types of irises (*İris* L) are rare and are listed in the Red Book of Azerbaijan. (Ibadullayeva, S. J., & Huseynova, I. M. (2021), Nurlana, N. (2021).)

Rhizomatous irises – ephemeroids have highly decorative qualities (Grossheim, A.A. (1940)., Roguz, K., Gallagher, M. K., Senden, E., Barlev, Y., Lebel, M., Heliczer, R., & Sapir, Y. (2020)) because of which they are subjected to haphazard collection by the population, but the main reason for their decrease is the anthropogenic impact on the places of their growth – the use of territories for growing crops, an increase in urban territories, recreational zones, haphazard grazing (in early spring, agricultural trample the places of growth of rare species of irises). (Askerova, L. A. (2019).)

Geobotanical descriptions were made to study the cenopopulation and ecology of some species of the genus *Iris* L growing on the territory of the western part of Azerbaijan. Transects were established, and the sizes of transects varied from the location of the cenopopulation. The type of vegetation, the class and group of formations, the degree of tiering, the projective cover, and the degree of distribution and abundance of phytocenoses in which species of irises occur were clarified. (Ipatov, V. S. (1997).)

To identify the effect of environmental factors on the range of endurance of rhizomatous irises, the method of amplitude scales by D. N. Tsyganov was used. (The Red Book of the Republic of Azerbaijan. Rare and endangered species of plants and fungi. Secondedition. (2013), Zhivotovsky, L. A., & Osmanova, G. O. (2021).)

Amplitude scales contain estimates of all conditions in which the species occurs, and are expressed by the amplitude (scope) of gradations of the environmental factor. (Ipatov, V.S. (1997).

To analyze the characteristics of environmental factors, the following parameters were taken: thermoclimatic (TM), climate continentality scale (KN), ombroclimatic aridity-humidity scale (OM), cryoclimatic scale (Cr), soil moisture (Hd), soil salt regime (Tr), soil nitrogen richness scale (Nt), soil acidity scale (Rc), variable soil moisture scale (fH), illumination–shading scale (Lc). (The Red Book of the Republic of Azerbaijan. Rare and endangered species of plants and fungi. Secondedition. (2013), Viktorov, S. V., &Remezova, G. L. (1988).)

Taking into account the scale of D.N. Tsyganov, the method of assessing the potential and real ecological valence of L.A. Zhukova's species was used. (Dorogova, Yu.A., Zhukova, L.A., Turmukhametova, N.V., Gavrilova, M.N., & Polyanskaya, T.A. (2010)., Kosolapova, N.V., Gudovskikh, Y.V., Egoshina, T.L., Kislitsyna, A.V., & Luginina, E.A. (2021, November),

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Viktorov, S. V., & Remezova, G. L. (1988).)

Ecological valence is defined as the adaptation of a species to environmental factors in a particular range. For qualitative assessment of a certain ecological factor, the potential ecological valence (PEV) of a species is considered as a mechanism for adapting changes in the ecological factor in the cenopopulation. (Dorogova, Yu.A, Turmukhametova, N.V., &Zhukova, L.A. (2019), Dorogova, Yu. A., Zhukova, L. A., Turmukhametova, N. V., Gavrilova, M. N., &Polyanskaya, T. A. (2010)., Viktorov, S. V., &Remezova, G. L. (1988).)

The potential ecological valence of a species is considered an adaptation of the cenopopulation only to a certain ecological factor. (Dorogova, Yu.A, Zhukova, L.A., Turmukhametova, N. V., Gavrilova, M. N., &Polyanskaya, T. A. (2010).)

In the course of the study, the real ecological valence of this cenopopulation in the phytocenosis was calculated by the formula:

The environmental efficiency coefficient is calculated as a percentage of the REV/REV ratio to each environmental factor as an indicator of the ecological potential of the species: (Dorogova, Yu. A., Zhukova, L. A., Turmukhametova, N. V., Gavrilova, M. N., &Polyanskaya, T. A. (2010).)

$$\text{Koef.ec.eff.} = \frac{REV}{PEV} \text{x}100\% \quad (1)$$

In a certain phytocenosis, several environmental factors simultaneously interact with plants, but the needs of plants in each environmental factor are different. The influence of several factors on a species determines the tolerance coefficient (index) (Ti). The tolerance index (Ti) is determined by whether a particular species is affected by general factors:

$$\text{Ti} = \frac{\sum PEV}{\sum scale} \quad (2)$$

where: PEV is the potential ecological valence, and REV is the realized ecological valence.

If the tolerance index (Ti) of a species is high, then there is a high probability of the spread of the cenopopulation in various ecological zones. (Dorogova, Yu. A., Zhukova, L. A., Turmukhametova, N. V., Gavrilova, M. N., & Polyanskaya, T. A. (2010).)

Based on the research results, it is possible to monitor the ecological state of the environment, cenopopulation, and species diversity.

RESULTS

5 studied species of rhizomatous irises by thermoclimatic factors (*Table 1*.) (TM) (*Iris lineolata* (Trautv) Grossh.; *I. camillae* Grossh., *I. shelkownikowii* Fomin; *I. annae* Grossh.; *Iris grossheymii* Woronow ex Grossh) are stenovalent, 2 species (*Iris alexeencoi* Fomin; *I. iberica* Hoff) hemistenovalent, 2 species (*Iris germanica* L, *I. pseudacorus* L) – mesovalent.

According to the climate continentality scale (K N), 7 species (*Iris alexeenkoi* Fomin; *I. lineolata* (Trautv) Grossh.; *I. camillae* Grossh.; *I. schelkownikowii* Fomin; *I. annae* Grossh.;

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Meyer; *Iris grossheimii* Woronow ex Grossh.; I. iberica Hoff) are stenovalent, 2 species (*Iris germanica* L, *I. pseudacorus* L) – mesovalent. This is an indicator that 7 stenovalent species are not tolerant to changes in the conditions of the continental climate.

Table 1 : Potential and Real Ecological Valences (REV, REV), Ecological Efficiency Coefficient (Ek.ef. ef.), and Tolerance Index (TI) of the Studied Species According to D.N.Tsyganov Climatic Scales

N	Species	TM			KN			OM			Cr			Tİ
		PEV	REV	Ek.ef. koef.	PEV	REV	Ek.ef. koef.	PEV	REV	Ek.ef. koef.	PEV	REV	Ek.ef. koef.	
1	*İris germanica* L	0,58	0,53	91,3	0,61	0,53	88,3	0,61	0,5	88	0,42	0,3	83	0,55
2	*İ.pseudacorus* L	0,47	0,29	87,2	0,66	0,6	90,9	0,53	0,5	87	0,53	0,5	87	0,55
3	*İ.alexeencoi* Fomin	0,23	0,17	73,9	0,26	0,13	50	0,13	0,1	46	0,2	0,1	65	0,20
4	*İ.lineolata* (Traut) Gross	0,35	0,29	82,8	0,2	0,13	65	0,33	0,3	100	0,2	0,1	65	0,27
5	*İ.camillae* Gross	0,35	0,29	82,6	0,33	0,26	78,88	0,33	0,3	79	0,27	0,2	74	0,32
6	*İ.shelkownikowii* Fomin	0,24	0,29	82,9	0,33	0,3	79	0,33	0,3	79	0,27	0,2	74	0,32
7	*İ.iberica* Hoff	0,35	0,24	75	0,33	0,3	82	0,4	0,3	83	0,27	0,2	74	0,31
8	*İ. annae* Gross	0,35	0,35	82,9	0,33	0,3	79	0,4	0,3	83	0,2	0,1	65	0,32
9	*İ.grossheymii* Woronow ex Gross	0,35	0,35	82,9	0,33	0,3	79	0,4	0,3	83	0,2	0,1	65	0,32

According to the ombroclimatic scale (OM), 5 studied species (*Iris lineolata* (Trautv) Gross; *Iris alexxencoi* Fomin, *I. camillae* Gross, *I. shelkownikowii* Fomin; *I. grossheymii* Woronow ex Grossh.) are stenovalent, 2 species (*Iris annae* Gross, *I. iberica* Hoff) are hemistenovalent; 1 species (*Iris pseudacorus* L) is mesovalent, 1 species (*Iris germanica* L) is hemievalent.

According to the indicators of the cryoclimatic scale (Cr), 7 studied species of irises (*Iris alexeencoi* Fomin, *I. lineolata* (Trautv) Grossh *I. camillae* Grossh., *I.shelkownikowii* Fomin; *I. iberica* Hoff, *I. annae* Grossh, *Iris grossheymii* Woronow ex Grossh.) are stenovalent, 1 species (*Iris germanica* L) – hemistenovalent, 1 species (*Iris pseudacorus* L) – mesovalent.

Thus, all climatic factors (TM, KN, OM, Cr) for the species of irises common in this territory are limiting. This affects the competitiveness of price populations during a period of small climate changes, which leads to a decrease in the number of populations.

To determine the potential ecological valence, the factors of the scale soil moisture content (Hd), soil acidity (Rc), soil nitrogen richness (Nt), salt regime (Tr), soil moisture variability (fH), as well as illumination-shading (Lc) of the territory were used. (*Table 2*).

According to the soil moisture scale (Hd), 8 species of irises (*Iris germanica* L, *I. lineolata* (Trautv) Gross, *I. alexeencoi* Fomin, *I. camillae* Gross, I.shelkownikowii Fomin, *I. iberica* Hoff, *I. annae* Groos, *Iris grossheymii* Woronow ex Grossh), 1 species (I. pseudacorus L) are stenovalent, 1 species (*I. pseudacorus* L) is mesovalent. Thus, according to the scale of soil moisture, all types of irises common in this territory are stenovalent.

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According to the scale of the salt regime of soils (Tr) 8 species of irises (*Iris germanica* L, *I. lineolata* (Trautv) Gross, *I. alexeencoi* Fomin, *I. camillae* Gross, *I.shelkownikowii* Fomin, *I. iberica* Hoff, *I. camillae* Gross, *I. annae* Gross, *Iris grossheymii* Woronow ex Grossh) They are stenovalent and only 1 species (*Iris pseudacorus* L) is hemistenovalent.

According to the scale of soil nitrogen richness (Nt), 5 species of irises (*Iris shelkownikowii* Fomin; *I. lineolata* (Trautv) Gross; *I. camillae* Gross; *I. annae* Gross; *I. grossheymii*Woronow ex Grossh) are hemistenovalent, 2 species (*Iris alexeencoi* Fomin, *I. iberica* Hoff) are stenovalent; 1 species (*Iris germanica* L) – hemievalent, 1 species (*Iris pseudacorus* L) – mesovalent. The species of irises growing on this territory can also adapt to less nitrogen-rich soils.

According to the soil acidity scale (Rc), 2 species (I.alexeencoiFomin, I. shelkownikowiiFomin) are stenovalent, 6 species (*Iris germanica* L, *Iris lineolata* (Trautv) Grossh, *Iris camillae* Grossh, *Iris iberica* Hoff, *I. Annae* Grossh., *Iris grossheymii* Woronow ex Grossh.) are hemistenovalent and only 1 species (I. pseudacorus L) is evivalent.

According to the scale of soil moisture variability (fH), 4 common species (*Iris alexeencoi* Fomin, *I. lineolata* (Trautv) Gross, *I. annae* Gross, *I. grossheymii* Woronow ex Grossh, *I. pseudacorus* L) are stenovalent, 3 species (*I. alexeencoi* Gross, *I. camillae* Gross, *I. shelkownikowii* Fomin) hemistenovalent.

According to the indicators of soil scales, the adaptability of common irises to the arid arid zone is confirmed.

Most common species of irises are adapted to well-lit areas. According to the illumination-shading scale (Lc), 2 species of irises (*Iris alexeencoi* Fomin, *I. iberica* Hoff) are stenovalent, 7 species (*Iris germanica* L, *I. lineolata* (Trautv) Gross, *I. camillae* Gross, *I. shelkownikowii* Fomin, *I. annae* Gross, *I. grossheymii* Woronow ex Grossh) – hemistenovalent, 1 species (*Iris pseudacorus* L) – mesovalent, According to the indicators of this scale, the species common in this territory are light-loving, some are common on the edges of the forest.

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Table 2: Potential and Real Ecological Valences (REV, REV), Ecological Efficiency Coefficient (Ek.ef. ef.), and Tolerance Index (TI) of the Studied Species According to the Soil Scales of D. N. Tsyganov

N	Species	Hd			Tr			Nt			Rc			fH			Tİ
		PEV	REV	Ek.ef. koef.	PEV	REV	Ek.ef. koef.	PEV	REV	Ek.ef. koef.	PEV	REV	Ek.ef. koef.	PEV	REV	Ek.ef. koef.	
1	*İris germanica* L	0,3	0,2	81	0,2	0,2	71	0,6	0,5	86	0,4	0,3	79	-	-	-	0,3
2	*İ.pseudacorus* L	0,5	0,4	91	0,6	0,5	91	0,5	0,5	83	1	0,9	92	0,5	0,4	67	0,62
3	*İ.alexeencoi* Fomin	0,3	0,2	81	0,2	0,2	71	0,3	0,2	56	0,2	0,2	65	0,3	0,2	67	0,26
4	*İ.lineolata* (Traut) Gross	0,3	0,3	87	0,2	0,2	71	0,5	0,4	80	0,4	0,3	79	0,3	0,2	67	0,34
5	*İ.camillae* Gross	0,3	0,2	81	0,2	0,2	71	0,5	0,4	80	0,4	0,3	79	0,4	0,3	75	0,36
6	*İ.shelkownikowii* Fomin	0,3	0,2	81	0,2	0,2	71,4	0,4	0,4	93	0,3	0,2	65	0,4	0,3	75	0,32
7	*İ.iberica* Hoff	0,3	0,2	85	0,2	0,2	76,2	0,3	0,2	67	0,3	0,2	77	0,4	0,3	75	0,30
8	*İ. annae* Gross	0,3	0,3	87	0,2	0,2	71,4	0,5	0,4	80	0,4	0,3	79	0,3	0,2	67	0,30
9	*İ.grossheymii* Woronow ex Gross	0,3	0,3	87	0,2	0,2	71,4	0,5	0,4	80	0,4	0,3	79	0,3	0,2	67	0,34

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DISCUSSION

Thus, it was found that in the ecological and cenotic groups of the western region of Azerbaijan, the species of irises have a narrow distribution area. There are almost no ewrybiont species here, and their ability to spread is limited. Stenobiont species are relatively predominant.

According to the indicators of the climatic scale (*Table 3*), stenobiont species predominate (78%). There is a relatively small percentage of mesobiont species (22%).

According to the indicators of the soil scale, the iris species common in the territory are mainly hemistenobionts (56%). Stenobiont species make up 44%, stenobiont, and eurybiont species do not occur.

Table 3: Tolerance Index (Ti) and Ecological Niche of Iris Species Depending on Climate, Soil, and Illumination

N	Species	Climatic factors		Soil factors		Illumination factors	
		Ti	Ecological niche	Ti	Ecological niche	Ti	Ecological niche
1	*İris germanica L*	0,55	Mezobiont	0,30	Stenobiont	0,44	Mezobiont
2	*İris pseudacorus L*	0,55	Mezobiont	0,62	Hemievri-biont	0,55	Mezobiont
3	*İris alexeencoi*Fomin	0,20	Stenobiont	0,26	Stenobiont	0,33	Stenobiont
4	*İrislineolata* (Trautv*)* Grossh.	0,27	Stenobiont	0,34	Hemisteno-biont	0,44	Mezobiont
5	*İriscamillae*Grossh.	0,32	Stenobiont	0,36	Hemisteno-biont	0,44	Mezobiont
6	*İ. Shelkownikowii*Fomin	0,32	Stenobiont	0,32	Stenobiont	0,44	Mezobiont
7	*İris iberica*Hoff	0,31	Stenobiont	0,30	Stenobiont	0,33	Stenobiont
8	*İris annae*Grossh.	0,32	Stenobiont	0,34	Hemisteno-biont	0,44	Mezobiont
9	*İris grossheymii* Woronow ex Grossh	0,32	Stenobiont		Hemisteno-biont	0,44	Mezobiont

According to the scale of illumination of the territory, stenobiont species make up 78%, mesobiont 22%. On the other hand, there are no eurybiont species.

CONCLUSION

As a result of the research, it was found that according to the indicators of the climatic and soil scale, rhizomatous species of irises in the western region of Azerbaijan have a very narrow range, are adapted to their distribution sites and the tolerance of these species is low. They have adapted only to the ecological conditions of growth, and a change in one of the environmental factors limits their spread. It can be said that most of the iris species common here have small distribution areas due to their steno- and hemistenovalence. Since these species are considered to be assemblers, they have little effect on the structure of the ecological-cenotic groups in which they are distributed. It belongs to rare and endangered species for the region and needs special protective measures.

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