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Studies on the problem of the preservation of the biodiversity of ephemeroid geophytes in Transcarpathia

Vladimir Krichfalushy

Uzhgorod University, Zhovtneva 54, 294 000 Uzhgorod, Ukraine

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ABSTRACT: One of the possible variants of the population analysis of the endangered plants is suggested on the basis of ephemeroid geophytes studies of the East Carpathians flora. This represents complex bioecological investigations based on the synthetic approach to the population studies. The program of the investigations includes ecological and phytocoenotic studies of the species, the structure and demography of the populations, their biomorphological peculiarities, life cycles, reproductive biology, intraspecific differentiation and population parameters monitoring. Scientific principles of conservation of the biodiversity of rare and disappearing species of wild flora are formulated.

KEYWORDS: Rare plants, biodiversity, ephemeroid geophytes, bioecology, data bank, protection.

Protection of plant kingdom and, in particular, of its rare biodiversity forms is one of the most important elements of the integral problem of environmental protection. First of all it is caused by the fact, that under the increasing anthropogenic influence during the last decades, a biological multiplicity of forms of the natural flora is noticeably reduced. To reveal rare and disappearing species which need protection we investigated East Carpathians flora within the area of Ukraine (Transcarpathia region). As a result of the observation of about 2000 vascular plant species, a regional list of the plants which need protection including some 400 species (20 %) has been compiled

(KOMENDAR 1988, MALINOVSKY and TSARIK 1991). But only 44 species have been included into the Red Data Book of the USSR (BORODIN et al. 1985), 82 species have entered the Red Data Book of the Ukrainian SSR (1980), 23 species being published in both books. This is only 4.4 % of the regional flora.

By now the work on an inventory of rare forms of the Transcarpathia has mainly been completed. Today, complex research of rare disappearing species is a problem of urgent necessity. However, a great majority of available studies only involve some of the peculiarities of biology of the threatened plants. Starting from the populational and specific conception of plant protection generally accepted nowadays, we need complex research of separate species to reveal their taxonomic and populational structure, morphological and geographic, ecological and genetic differentiation, origin and evolution. This complex research would signify a new synthetical direction of investigations, their object being a population as a natural historical unit, as an independent level of life, and an evolutionary unit.

Among the plants of Transcarpathia which need protection, ephemeroid geophytes are forms the most sensitive to the anthropogenic pressure. As a result of land reclamation, forest felling and soil ploughing during the last decades, their areas reduce rapidly up to the complete disappearance of many populations. Insularization, or fragmentation of areas and extinction of some species take place, leading to the erosion of diversity of genetical structures. Moreover, many species belong to the taxa whose system has not been elaborated quite well. Studies in these problems are very important for preservation of the whole genetic diversity of the natural flora, for perception of the microevolution and prospects of survival of each plant species. Following these suppositions within the complex bioecological program, we study ephemeroid geophytes (bulb and bulbotuber polycarpics), which are threatened by disappearance (KRICHFALUSHY 1984). Twenty six species are studied which, according to the new system of flowering plants by TAKHTADZHAN (1987), belong to the following families:

1. Alliaceae

1. *Allium senescens* L. subsp. *montanum* (F. W. Schmidt) Holub, 2. *A. ursinum* L., 3. A. *victorialis* L.

2. Amaryllidaceae

4. *Galanthus nivalis* L., 5. *Leucojum aestivum* L., 6. *L. vernum* L., 7. *Narcissus angustifolius* Curt.

3. Hyacinthaceae

8. *Muscari botryoides* (L.) Mill. (= *M. pocuticum* Zapał.= *M. carpaticum*

Racib.), 9. *M. comosum* (L.) Mill. (= *Leopoldia comosa* (L.) Parl.), 10. *M. neglectum* Guss. (= *M. racemosum* (L.) DC.), 11. *Ornithogalum boucheanum* (Kunth) Aschers., 12. *O. divergens* Bor., 13. *O. kochii* Parl., 14. *O. umbellatum* L., 15. *Scilla kladnii* Schur.

4. Iridaceae

16. *Crocus banaticus* J. Gay, 17. *C. heuffelianus* Herb., 18. *C. vernus* (L.) Hill (= *C. albiflorus* Kit.).

5. Liliaceae

19. *Erythronium dens-canis* L., 20. *Fritillaria meleagris* L., 21. *Gagea fistulosa* (Ram.) Ker.-Gawl., 22. *G. spathacaea* (Hayne) Salisb., 23. *Lilium bulbiferum* L., 24. *L. martagon* L., 25. *Lloydia serotina* (L.) Reichenb.

6. Melanthiaceae

26. *Colchicum autumnale* L.

The studies are carried on in accordance with the standard program and unified techniques, the results are accumulated in the data bank on IBM-PC/AT computer (KRICHFALUSHY and KOMENDAR 1987). We suggest one of the possible variants of the population analysis of natural flora species which need protection. Program problems of this line may be studied at different degrees of particularization depending on the possibilities of the researcher (research group) and particular object. Using the group of ephemeroid geophytes as an example, we should like to show in what way an adequate approach could be useful both for populational biology studies of separate species and development of tactics and strategies for preserving the biodiversity. In what follows, a plan of the study of threatened wild species is given.

1. Geographical distribution and ecological requirements

1.1. Geographical distribution

General area. Distribution in the Transcarpathia. Computer grid mapping. Brief historical survey of the chorology of the plants in question.

1.2. Ecological and phytocoenotic features

Geobotanical studies of rare species associations and their links with the soil conditions. The role of these species in composing cenoses, and floristic analysis of their composition. Tolerance range of the species. Basic limiting ecological factors.

2. Biomorphological features

2.1. Morphogenesis and seasonal development rhytm, annual life cycle. Stages of organogenesis at different phenophases and their basic ecological factor dependence.

2.2. Onthogenesis and stages in the populations whole life cycle. Principal age states of plants. Onthogenesis pace features. Polyvariance of individual development.

2.3. Age spectra and population density

Ecological and phytocoenotic optima of ephemeroid geophytes in different altitude belts. Types of population age spectra.

3. Reproductive Biology

3.1. Vegetative reproduction

Morphological structure of bulbs and bulbotubers of ephemeroid geophytes. Ways of vegetative plant reproduction, their cenotic role. Clone formation. Ecological factor dependence of vegetative reproduction energy.

3.2. Flowering and pollination

Functional flower structure. System of primary and secondary attractants. Heterostyly, protandry and incompatibility reaction as protective mechanisms, preventing self-pollination. Anthecological features of ephemeroid geophytes. Consortive associations.

3.3. Embryology

Microsporogenesis and male gametophyte development. Megasporogenesis and female gametophyte development. Morphology and vitality of the pollen. Fertilization. Development of the endosperm and embryo. Embryological features of altilocate populations.

3.4. Seed productivity

Dissemination. Principal elements of seed productivity. Statistic analysis of population seed renewal regulations. Basic factors responsible for the level of species seed productivity.

3.5. Viability and germination of seeds

Seed germination features. Annotinous dynamics of seed viability. Field and laboratory viability and seed germination energy. Influence of physical, chemical and biological factors on the seed viability and germination.

4. Intraspecific variability

4.1. Morphological variability

Morphological description of intraspecific forms. Teratological variations and fasciations. Analysis of intraspecific variability. Correlation relationship between the morphological parameters. Interpopulational variability.

4.2. Anatomical variability

Anatomical structure of vegetative organs. Diagnostic importance of the features. Intrapopulational differences in anatomical structure of the leaf.

4.3. Caryotypical variability

Characteristics of the standard species caryotype. Principal variations of chromosome sets. Interpopulational caryotypic features according to SAT and accessory chromosomes. Occurence regularities of B-chromosomes.

5. Systematic Position, Intraspecific Structure and Microphylogenesis

5.1. Systematic position

Systematic position of the plants studied, synonyms. Brief history of their systematics.

5.2. Intraspecific composition

Intraspecific differentiation. Description of newly discovered intraspecific taxa.

5.3. Origin and evolution

Reconstruction of microphylogenesis. Principal microevolutional factors responsible for allopatric differentiation of the studied species.

6. Ways and Forms of Conservation, Recovery and Use of the Populations

6.1. Anthropogenic affect and threatened species survival.

Analysis of the modern distribution range of rare ephemeroid geophytes and its changes during the last decades. Main anthropogenic factors influencing the area. Ways and tasks of conservation and recovery of the disappearing plants number.

6.2. Prospects of use

Ephemeroids as highly decorative, volatile oil bearing and drug plants. Recommendations for foundation of reserves in the range of the endangered species.

This program is given in a more detailed variant, and illustrated by concrete examples in the monograph "Bioecology of rare plant species" by KRICHFALUSHY and KOMENDAR (1990).

The list of main publications on this problem is also given in the monograph. On the basis of the above principles, we suggest the following scheme of description of the threatened wild species.

1. Nomenclature. 2. Systematic position. 3. Intraspecific systematics (morphological, anatomical, karyotypic, biochemical and other variability). 4. General morphology. 5. Geographical distribution. 6. Ecology and phytocoenology (the leading factors of the habitat, syntaxonomy). 7. Intraspecific ecological structure. 8. Life form. 9. Development cycles (morpho- and onthogenesis). 10. Seasonal development rhytm. 11. Age grades, density and vitality of the populations. 12. Demography of the

populations. 13. Reproductive biology (modes of reproduction, anthecology, embryology, viability and germination of seeds). 14. Consortive associations. 15. Origin and microphylogenesis. 16. Practical value (biochemical composition, useful properties and prospects of application). 17. Measures aimed at protection (category of the threatened state, protection measures, introduction data).

Extensive numerical data yielded as a result of the investigations need processing by means of variation statistics. Elaboration of various population models is necessary to estimate the critical state and survival prospects under the influence of the anthropogenic factors and a wide range of loads. On this basis there is a possibility to organize monitoring of the state of specific populations and to estimate their recovery after the anthropogenic affect has ceased.

Actual material accumulated in the process of the studies carried out according to this program must be used as a basis for the data bank of plant species which need protection.

On the ground of the findings, practical measures are worked out aimed at the conservation of biodiversity of rare and disappearing ephemeroid species of Transcarpathia, in particular, organization of the network of reserves and nurseries of various types.

Summary

To develop tactics and strategy for preservation of rare forms, complex biological studies based on the synthetic populational approach to the plants studied are necessary. They must reveal the most important features of the biology of different species, their internal structure, trends of microphylogenesis and prospects of survival.

References

BORODIN A. M. et al. (1985): Krasnaya kniga SSSR. Tom 2, Ed. 2. Moskva.

Červona knyga Ukrainskoy RSR. (1984). Kyiv.

KOMENDAR V. I. (1988): Problemy okhorony fitogenofondu Karpat. - Ukr. Bot. Zh., 45(3): 1-10.

KRICHFALUSHY V. V. (1984): Ekologo-biologitscheskye osobennosti i nauchnye osnovy ochrany Narcissus angustifolius Curt. v Zakarpate. Dissert. Kiev.

KRICHFALUSHY V. V. and KOMENDAR V. I. (1987): O neobkhodimosti sozdanya bazy dannykh monitoringa redkikh vidov rasteny.

In: Principy i metody ekoinformatiki. VINITI: 153-155. Moskva [msc.]
KRICHFALUSHY V. V. and KOMENDAR V. I. (1990): Bioekologiya redkikh vidov rasteny (na primere efemeroidov Karpat). Lvov.
MALINOVSKY K. A. and TZARIK I. V. (1991): Problema vyvtschennya i okhorony populacy ridkisnykh vidiv flory Ukrainskikh Karpat. - Ukr. Bot. Zh. 48(3): 13-21.
TACHTADZHAN A. L. (1987): Sistema magnoliofitov. Leningrad.

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