

Expansion of alien plants in settlements of the Tisa river basin (Transcarpathia, Ukraine).

VERA PROTOPOPOVA, MIROSLAV SHEVERA

M. G. Kholodny Institute of Botany, National Academy of Science of Ukraine, 252601, Kiev, MSP-1, Tereshchenkivska, 2, Ukraine; tel. +380 44 2252038, fax: +380 44 2241064; e-mail: smos%kiev.ua@monolit.kiev.ua

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ABSTRACT: The riverside flora of the basin of the Transcarpathia is characterized, in urbanized areas, by an impoverished species composition and noticeable presence of the allochthonous element. At present, the expansion of some ornamental alien species, such as taxa of the genus *Helianthus*, *Echinocystis lobata* (MICHX.) TORR. et GRAY, *Reynoutria japonica* HOUTT., *Impatiens glandulifera* ROYLE is observed in the Tisa river basin. The genus *Helianthus*, represented by 7 species, is noticeably the most aggressive.

KEYWORDS: alien plants, ergasiophytes, *Helianthus*, *Echinocystis lobata*, *Reynoutria japonica*, *Impatiens glandulifera*, expansion, Tisa river basin.

Introduction

The riverside flora of the Transcarpathia basin is characterized, in urban areas, by an impoverished species composition and noticeable presence of the allochthonous element. Aggregation and mixed groups of adventive plants and apophytes outnumber in places the associations of the autochthonous species. At present, the expansion of some ornamental alien species (such as *Helianthus* sp. div., *Echinocystis lobata* (MICHX.) TORR. et GRAY, *Reynoutria japonica* HOUTT., *Impatiens glandulifera* ROYLE), which have recently been attributed to the ergasiophytes group (according to the classification of Kornaś, 1968) is observed in the Tisa river basin, the Transcarpathia, Ukraine. This expansion

results in ruderalization of the hydrophilic florocomplex (PROTOPOPOVA & SHEVERA 1995, SHEVERA 1996).

The results of our investigations carried out in the Transcarpathian region during 1990-1992, 1995-1997 have shown that these species are naturalized in both anthropogenous and natural habitats. Now they are creating a threat of considerable change to the natural vegetation of river bank habitats caused by their easy adaptation to such conditions.

The settlements (small towns, villages, farms, etc.) play the main role in their distribution; species are often cultivated in kitchen-, and flower gardens. Anthropogenic transformation of the flora of the urban settlements, wide cultivation of these species in numerous gardens located near rivers, railways, and along roads and highways also promote their spread. The dispersal units (diaspores) are spread by both anthropochoric (agesto-, and speyrochoric) and natural (zoo-, and hydrochoric) distribution modes. They form large colonies when they establish on wastelands and rubbish heaps, especially in areas of newly erected buildings.

The spontaneous distribution of alien species is increasing considerably along the river banks, these habitats being the most suitable from the point of view of their ecological and coenotic requirements, especially in riverside localities within urban sites where degradation of plant cover of the hydrophilous florocomplex has a catastrophic character.

Every year the biological pollution of the Transcarpathian settlements increases. Anthropophilous species are a considerable part of urban flora. For example, in the main town of the region, Uzhgorod, the synanthropic flora includes 460 species, i.e. 58,7% of the urban flora. In other urboecosystems, Svalyava, Mukachevo, Beregovo, Volovets, Chop, the synanthropic flora numbered from 292 to 347 species, i.e. 52,1-68,6 % of the urban flora (PROTS 1994).

Results and discussion

Helianthus L.

The expansion of species of the genus *Helianthus* L. in the Transcarpathia is most evident. In the course of our investigations it was found that the colonies of *Helianthus* included at least 6 species: *H. decapetalus* L., *H. subcanescens* (A. GRAY) E. E. WATS., *H. tuberosus* L., *H. strumosus* L., *H. laetiflorus* PERS., *H. annuus* L. var. *macrocarpus* (DC.) COCKRELL, and 1 hybrid, *H. rigidus* (CASS.) DESF. x *H. subcanescens*. *Helianthus decapetalus*, *H. laetiflorus* and *H. subcanescens* are more usual growing in large groups. *Helianthus tuberosus* and *H. strumosus* are sporadically growing as isolated individuals. These species are very polymorphic and ecologically plastic. *Helianthus annuus* var. *macrocarpus* is a typical cultivated plant in the field, but is rarely noted along railways. *Helianthus rigidus* was found only in culture in flower gardens.

The range of various morphological features among the escaped naturalized sunflowers is wider than among the cultivated ones. Perhaps most of the diversity is a result of hybridization.

Helianthus grows in different geographical regions and ecology-coenotic habitats in the distribution area in North America (HEISER 1969, GLEASON & CRONQUIST 1991): for example, from Maine to Iowa and Georgia, in prairies (*H. rigidus*), in rich soil forests and gorges (*H. decapetalus*), from Florida to the West via Texas, Saskatchewan, Ontario, and other states of the USA and Canadian provinces on moist, clay soil, especially along river banks and roads (*H. tuberosus* and *H. subcanescens*), in Arkansas and Minnesota and others states, in dry forests, hills and fields (*H. strumosus*).

In the Transcarpathian region, all these species grow together. This leads to the development of interspecific hybridization among the wild sunflowers in natural conditions. Hybrid specimens were noted in North America in places where *H. decapetalus*, *H. tuberosus*, *H. laetiflorus*, *H. annuus*, etc. grew together (ZHUKOWSKI 1971, HEISER 1969). The hybrid forms (*H. decapetalus* x *H. rigidus*, *H. subcanescens* x *H. rigidus*, etc.) in the Transcarpathian flora often occur. Perhaps, hybridization promotes the appearance of more stable forms. They are more adapted to local conditions.

About thirty years ago, the expansive tendency of species of the genus *Helianthus* in the Transcarpathian was not observed. For example, 15 year ago *H. decapetalus* was rare in this region and it was recommended for conservation (KOMENDAR & FODOR 1980), *H. subcanescens* just escaped from cultivation, *H. tuberosus* was noted only as a cultivated plant (DUBOVİK 1977).

At present, the colonies of these species pass along the rivers Uzh, Latoritza, Borzhava, Tisa, canals and ditches by compact belts of high density. Within small towns and villages (especially Velykyi Bereznyi, Peretchin, Kamyanytsa, Uzhgorod, Chop, Solomonovo, Mukachevo, Chinadiyevo, Svalyava, Berezinka, Lalovo, Beregovo, Nove Selo, Vinogradovo, Korolevo, Hust, Bushtyn, Tyachiv, V. Bychkiv), species of the genus *Helianthus* form large colonies, increasing their area of occupation along the river banks, on waste lands, near railway stations.

The character of sunflowers distribution allows one to suggest that these species have more widespread areas of distribution. Sometimes there are monodominant colonies of sunflowers, and in other habitats there are included few anthropophilous species, mostly *Urtica dioica* L., *Carex vesicaria* L., *Echinocystis lobata*. Sometimes these colonies are polyspecific [about 50 species, part of them (ca. 50%) are representative the species of natural hydrophilous complex] but with dominance of the species of *Helianthus*. The most usual satellites of *Helianthus* in the river bank habitat are *Heracleum sibiricum* L., *Urtica dioica*, *Tanacetum vulgare* L., *Arctium lappa* L., *A. minus* (HILL) BERNH., *Ranunculus repens* L., *Potentilla anserina* L., *Pastinaca sylvestris* MILL., *Centaurea jacea* L., *Rumex crispus* L., *Carex vesicaria*, *Artemisia vulgaris* L., *Cirsium palustre* (L.) SCOP., *Geum urbanum* L., *Polygonum hydropiper* L., *Bidens tripartita* L., *Rubus caesius* L., *Humulus lupulus* L., *Plantago major* L., *Typha latifolia* L., etc.

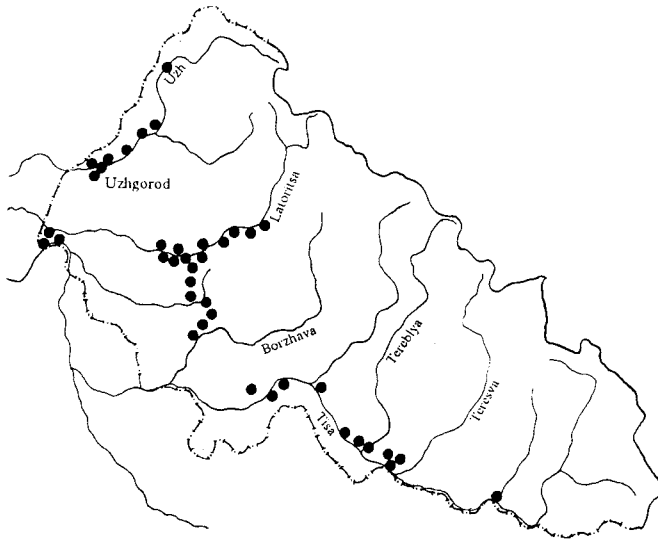


Fig. 1. Distribution of species of the genus *Helianthus* L. in Transcarpathia.

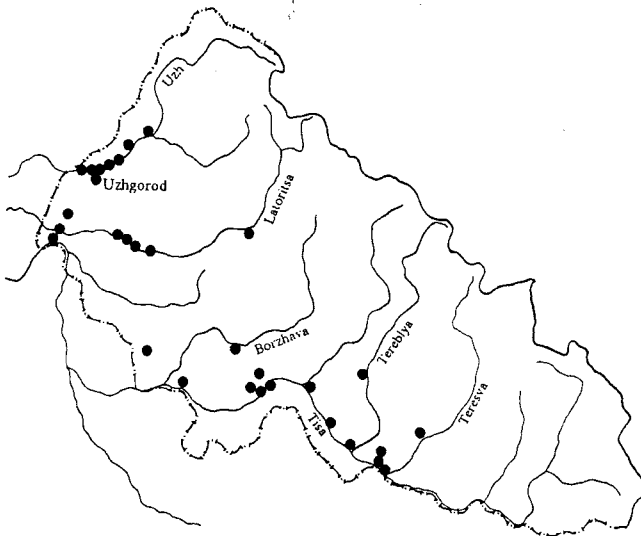


Fig. 2. Distribution of *Echinocystis lobata* (MICHX.) TORREY et GRAY in Transcarpathia.

***Reynoutria japonica* HOUTT.**

The character of the present spread of *Reynoutria japonica* also allows to project this species as most probably a potential agriophyte in the Transcarpathian flora.

Different problems of biology, ecology and distribution of this species are discussed in SUKOPP & SUKOPP (1988), SUKOPP & SCHICK (1991, 1993), BAILEY (1994), PYŠEK & PRACH (1994) etc.

The native area of *R. japonica* is in Japan. The species escaped from cultivation and in the northeastern states of the USA and adjacent regions of Canada and Central America (KORNAS 1990), and Europe.

For the first time in the Transcarpathia this species was by K. DOMIN (POPOV 1949) in 1929 in anthropogenic localities. Later on, in Ukrainian literature this species was noted as a ornamental plants. However, we found considerable colonies along the rivers Uzh, Latoritsa, Tisa. Often *R. japonica* moves along railways and roads in large colonies. Dense colonies were noted in old cemeteries, waste lands, deposits, ditches. Sometime solitary plants and small groups occur in grasslands, in parks and forests close to settlements or in towns (Peretchin, Kamyanytsa, Uzhgorod, Chop, Mukachevo, Svalyava, Shyrokyi Lug, Novoselycyia, Neresnycyia, Mizhgirya, Beregovo, Onok, Vinogradovo, from Korolevo to Tyachiv, Rahiv, etc.).

Active and mass character of distribution of rather dense patterns occurring in habitats suggests the possibility of this species expanding to both the Transcarpathian region and others of Ukraine. There are separate localities of this species there as well. There is a clear tendency in the adaptation *R. japonica* to conditions of ruderal river bank ecotopes, which may be responsible for its ecology-coenotic requirements and may represent its whole naturalization in such ecotopes in the future.

More frequent satellites of *R. japonica* within river bank plant communities or wet habitats are *Typha latifolia*, *Cirsium palustre*, *C. arvense* (L.) SCOP., *Heracleum sibiricum*, *Polygonum hydropiper*, *P. mite* SCHRANK, *Tanacetum vulgare*, *Calystegia sepium*, *Arctium major* L., *Artemisia vulgaris*, *Urtica dioica*, *Bidens tripartita*, *Echinochloa crus-galli* (L.) BEAUV., *Eupatorium cannabinum* L., *Helianthus* sp. div., *Echinocystis lobata*, *Phalacrocoma annua* NEES, rarely *Impatiens glandulifera*, *Chenopodium album* L., *Centaurea jacea*, *Galeopsis speciosa* MILL., *Melandrium album* (MILL.) GARCKE., etc.

Dense colonies develop from rhizomes and are composed of juvenile and adult blooming shoots.

R. japonica - agriophyte, mesophyte, eu-, mesochemerob, urbanneutral.

***Impatiens glandulifera* Royle**

Impatiens glandulifera have been introduced to the Transcarpathia as a garden plant. The first notice of the occurrence of this species in natural and semi-natural habitats in this region was in the 60-ies of XX cent.

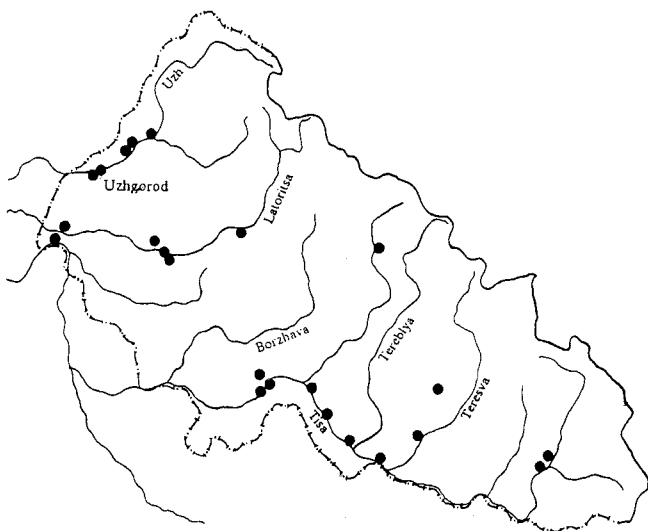


Fig. 3. Distribution of *Reynoutria japonica* HOUTT. in Transcarpathia.

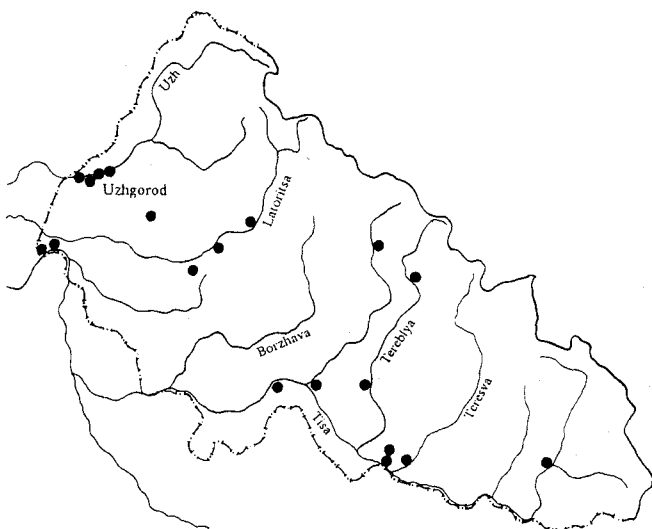


Fig. 4. Distribution of *Impatiens glandulifera* ROYLE in Transcarpathia.

At present this species does not express any active expansion, which is evident in Central Europe and North America (LHOTSKÁ & KOPECKÝ 1966, BEERLING & PERRINS 1993, DRESCHER & Prots 1996). Stands of *I. glandulifera* range from isolated plants to clumps covering 30-100 m².

In the Transcarpathia, its typical habitats are wet willow-beds and transformed riverside forests consisting of *Populus tremula* L., rarely open banks of canals near towns and settlements (Uzhgorod, Chop, Solomonovo, Serednye, Berezynka, Chynadyjevo, Holubine, Korolevo, Hust, Novoselycya, Vilchivci, Chumalevo, Negrovec, Mizhgirya, Tyachiv, etc.). The most frequent satellites of *I. glandulifera* in river bank plant communities are *Galium aparine*, *Calystegia sepium*, *Symphytum officinale* L., *Lycopus europeus* L., *Mentha aquatica* L., *Solanum dulcamara* L., etc.

According to Vinogradova (1992), the period of adaptation of *I. glandulifera* equals 100-150 years. Therefore, the expansion of this species is possible in future, as there are individual widespread and viable colonies in many regions of the Transcarpathia available.

I. glandulifera - agriophyte, hydromesophyte, eu-, mesochemerob, urban-neutral.

Conclusion

Taking into account the ecological and coenotic requirements of the adventive migrants, such as *Helianthus* sp. div., *Echinocystis lobata*, *Reynoutria japonica*, *Impatiens glandulifera*, and their pronounced tendency to spread, we can assume that they will become fully naturalized in the spontaneous flora of the Transcarpathia. This development will bring significant changes in the riverside flora both at the compositional and structural levels (PROTOPOPOVA & SHEVERA, 1995).

The degree of spread of these species in the Transcarpathia seems to be smaller than in Western Europe. But increasing of the rate of spontaneous distribution, high quantitative and stable of populations testify to start of expansion of this species in the Transcarpathia.

Moreover, pronounced tendency to spreading eastward of these neophytes is observed. *Echinocystis lobata* is sporadically spread all over the Ukraine mainly as ergasiophytes and rarely as agriophytes (Khmelnitsky, Vinnytsya, Donetsk regions). *Impatiens glandulifera* is noted as an escaped plant in the Forest and Forest-Steppe zones of Ukraine (Khmelnitsky, Vinnytsya, Rivne, Zhytomyr, Kyiv, Kharkiv regions) in wet habitats, mainly near settlements. *Helianthus* species formed large colonies in outskirts of Kyiv, and sporadically grows along railways in Kyiv and Donetsk Regions. These species are particularly effective at colonizing the banks of urban rivers. *Reynoutria japonica* is much rarer. It is found only in cities (Kyiv) as an escaped plant in parks and ruderal habitats.

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