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Chosen synanthropic plant species in the Bug river valley: routes and effects of expansion

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Abstract: The relatively low degree of transformation of the Bug river valley is the reason of its low synanthropization. The distribution of 12 synanthropic species (kenophytes) was analysed in view of their expansion routes and both observed and predicted ecological effects of their expansion in the Bug valley. *Acer negundo*, *Bidens frondosa* and *Xanthium albinum* proved to be common in natural and semi-natural plant communities in the study area, but *Solidago gigantea*, *Echinocystis lobata*, *Erigeron annuus* and *Bryonia alba* are rare there. *Heracleum mantegazzianum*, *Iva xanthiifolia*, *Parthenocissus inserata*, *Salix acutifolia* and *Lycium barbarum* are invasive but mainly in ruderal sites. Interestingly, also the native *Carex brizoides* behaves like a kenophyte at forest edges in the Bug valley.

Key words: synanthropic species, dynamic chorology, Bug river valley

1. Introduction

Valleys of large and medium-sized rivers naturally abound with habitats that are repeatedly damaged by running water or periodically disturbed by floods. Such habitats have always been favourable sites of colonisation and spread of varied plant species. Currently this applies mainly to kenophytes (Tokarska-Guzik 2003). A deep anthropogenic transformation of the valleys and beds of almost all large European rivers results in the disappearance of natural components of plant cover and their replacement by synanthropic communities dominated by invasive aliens (Faliński 2000; Kucharczyk 2003). The Bug river valley is relatively poorly transformed and characterised by a high participation of natural and semi-natural communities, so it constitutes a model for research on processes and effects of colonisation and expansion of synanthropic species.

This paper presents the sources and expansion routes of chosen synanthropic species in the Bug valley, as well as their current distribution on the grid of ATPOL squares (Zając & Zając 2001); moreover, it shows the observable ecological effects of the process. Species presented in this publication were selected so as to observe the level of expansion of kenophytes, depending on geomorphological conditions of the Bug River Valley. It was also important to compare this phenomenon in the study area with similar processes in other big river valleys of Polish lowland rivers, especially the Vistula and the Odra.

2. Material and methods

Twelve synanthropic species occurring in the area of two geographic mesoregions, the Podlasie Bug Gorge and the Lower Bug Valley (Kondracki 2002), were studied: *Acer negundo*, *Bidens frondosa*, *Bryonia alba*, *Echinocystis lobata*, *Heracleum mantegazzianum*, *Iva xanthiifolia*, *Lycium barbarum*, *Parthenocissus inserata*, *Solidago gigantea*, *Salix acutifolia*, *Xanthium albinum*, and *Xanthium strumarium*. Distribution maps were prepared for each species on the grid of ATPOL squares (2 km × 2 km), showing their occurrence in the Bug river valley and in the neighbouring areas. Information about the distribution of individual species came from published works (Ćwikliński & Głowacki 2000; Głowacki *et al*. 2002; Marciniuk *et. al*. 2002), the unpublished source information, and original material. Remarks concerning the sources, routes, and ecological effects of the expansion of individual species were based on 13-year observations conducted by our research team.

3. Results and discussion

Information about the studied species, including remarks regarding their distribution routes and expansiveness, is presented in Table 1. The distribution of the analysed species is given in Fig. 1.

The flood plain of the Bug river valley is still quite resistant to the expansion of some kenophytes, such as *Solidago gigantea*, *Echinocystis lobata*, *Erigeron annuus* or *Bryonia alba*, which have already colonised big areas in valleys of other big rivers, such as the Vistula (Kordakow 1971; Kępczyński & Rutkowski 1988; Kucharczyk 2001) and the Odra (Dajdok & Kącki 2003). This difference can be explained by environmental barriers associated with the more natural vegetation in the Bug River Valley.

However, there is a group of kenophytes that can easily spread in all big river valleys with mineral soils, for example: *Acer negundo*, *Bidens frondosa* and *Xanthium albinum*. These plants usually use the youngest alluvial deposits for their migration, which because of the sites' open character are prone to intensive expansion by anthropophytes (Faliński 2000). *Salix acutifolia* in the Bug valley spread on sandy areas, especially on higher river terraces, often on sand dunes. The river valley seems to be their main migration route, although they can be also found on sandy ruderal sites. Similar situations can be observed in the Vistula river valley (Kucharczyk 2001). Species like *Heracleum mantegazzianum*, *Parthenocissus inserta*, *Iva xanthifolia*, *Xanthium strumarium* or *Lycium barbarum* spread mostly within ruderal sites, and are rarely noticed in other parts of the Bug River Valley.

The distribution of *Carex brizoides* in the Bug river valley is particularly interesting. This species is considered to be native to Poland (Zając & Zając 2001), but in the study area its behaviour is typically invasive. So far the only site of this species in the lower Bug valley was found a few years ago on a pathless area adjacent to oak-lime forest (*Tilio-Carpinetum*).

Table 1. Characterisation of the chosen synanthropic species in the Bug river valley

Species	Sources and routes of expansion	Current and predicted ecological effects
Acer negundo L.	Commonly cultivated, occurring in synanthropic habitats and in willow-poplar marshy thickets in Bug valley	In natural marshy thickets of *Salicetum albo-fragilis* successfully competing with native willow species
Bidens frondosa L.	Expansive, occurring along river valleys	In Bug valley creating dense stands, forcing out native *Bidens* spp. from natural habitats
Bryonia alba L.	Escaping from gardens, occurring along valleys of small rivers; in Bug valley seemingly declining	Penetrating natural waterside climbing plant communities in Bug valley, playing no major role
Echinocystis lobata (Michx) Torrey et A. Gray	Escaping from gardens, occurring along valleys of small rivers, more frequent than *Bryonia alba* L.; in Bug valley mainly near mouths of small rivers	Highly invasive, successfully competing with native components of waterside climbing plant communities
Heracleum mantegazzianum Somm. et Levier	In Bug valley known from two sites as a garden escape; in Gnojno spreading very quickly, creating large and nearly pure stands	Dangerous, invasive species, quickly growing and spreading, leading to destruction of even managed meadows and other herb communities
Iva xanthiifolia Nutt.	Expansive, only in ruderal sites, migrating from Vistula valley	Currently relatively rare in Bug valley, but advancing transformations of plant cover may relatively quickly increase its ecological role
Lycium barbarum L.	Escaping from parks and gardens, mainly to transformed edges of Bug valley	In Bug valley creating dense thickets, eliminating thermophilic herbs species
Parthenocissus inserata (A. Kerner) Fritsch	Commonly cultivated, easily naturalised, more and more frequent in marshy meadows and forests in Bug valley, also at dry sites	In forests in Bug valley only as creeping forms, aggressive towards native components of undergrowth
Solidago gigantea L.	North-American, commonly cultivated and naturalised, spreading into ruderal sites, fallows, and river alluvia, often forming large patches, but in Bug valley common only in river mouth area, elsewhere limited to ruderal habitats, fallows, and neighbouring habitats	Creating large and very dense patches in valleys of big rivers, but well-preserved vegetation of Bug valley constitutes an efficient barrier against its penetration
Salix acutifolia Willd.	Introduced for sand dune fixation; at present spontaneously spreading in sandy sites along Bug river	Currently ecological effects difficult to foresee
Xanthium albinum (Widder) H. Scholz	Spreading in alluvia of bigger rivers; frequent in silt-covered land communities	In some places abundant, creating its own community
Xanthium strumarium L.	Ruderal habitats, relatively frequent in Bug valley	Component of ruderal communities

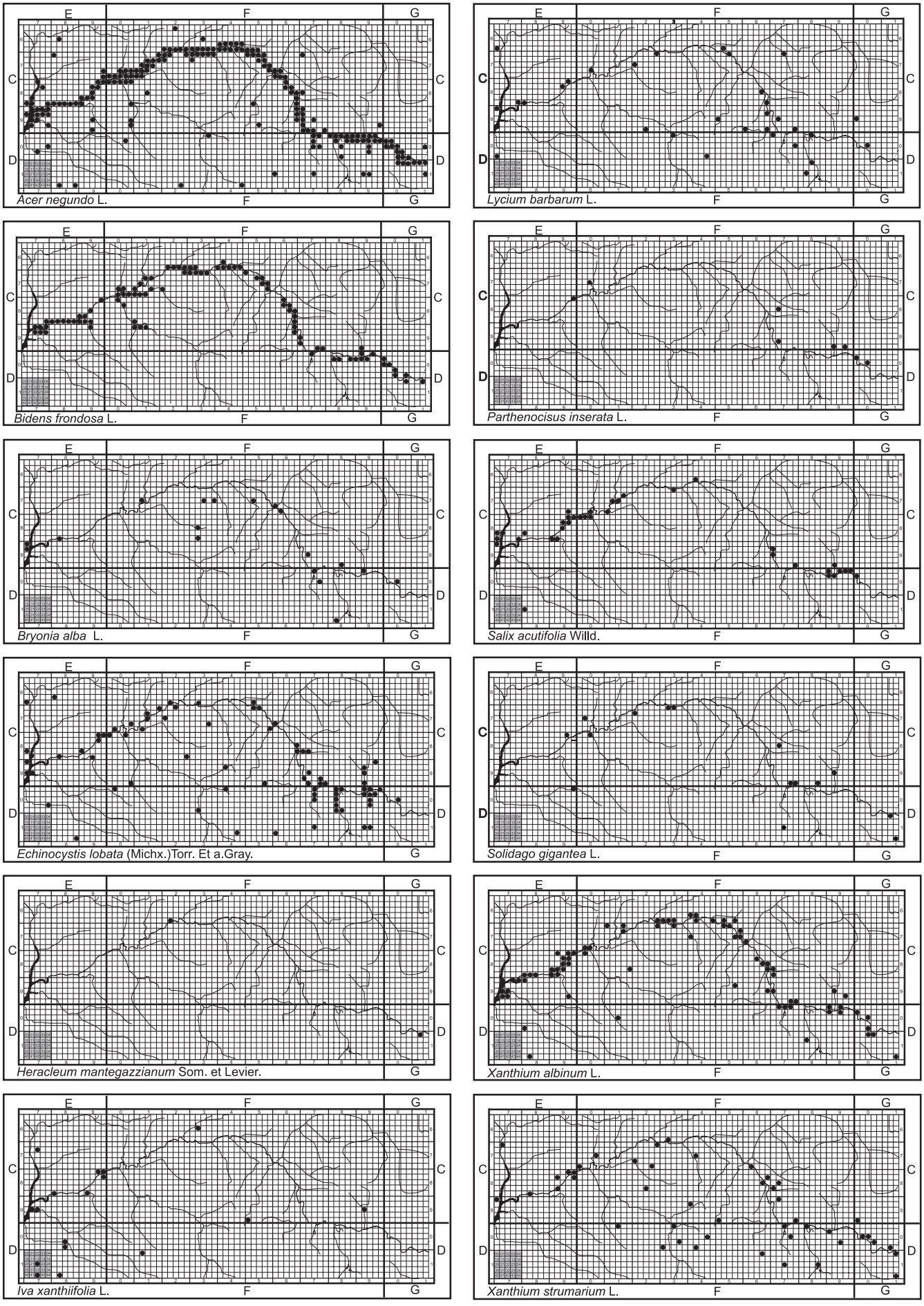

Fig. 1. The distribution of chosen species in Bug river valley

However, only for two years massive trespassing into this forest patch has been observed. The behaviour of *C. brizoides* is very similar to the expansion model characteristic for the kenophytes, such as *Impatiens parviflora*. This forms the basis for assigning *C. brizoides* to the group of neophytes in the study area. It is noteworthy that the presence of *Impatiens parviflora* in the Bug river valley is still restricted to roadsides in fertile deciduous forests. Only in several cases, where the natural site has been strongly transformed, e.g. due to drainage, this species dominates the undergrowth of large patches of vegetation. This situation applies mostly to drained *Fraxino-Alnetum* forests.

4. Conclusions

- Areas mostly overgrown by neophytes in the Bug river valley are young alluvial deposits.
- Neophytisation on flood plains, overgrown by the semi-natural vegetation of meadows and alluvial grasses, is much less intensive in the study area than in the Vistula and Odra river valleys.
- Regarding the recent arrival and the way of spreading in natural oak-and lime forest, *Carex brizoides* is regarded as a neophyte in the Bug valley.
- Three of the twelve synanthropic species analysed, i.e. *Acer negundo*, *Bidens frondosa* and *Xanthium albinum*, commonly occur in natural and semi-natural plant communities in the study area.
- The relatively well-preserved natural and semi-natural vegetation of the Bug river valley is an effective protecting barrier against the penetration of the species commonly inhabiting the Vistula and Odra river valleys, like: *Solidago gigantea*, *Echinocystis lobata*, *Erigeron annuus* or *Bryonia alba*.
- *Heracleum mantegazzianum*, *Parthenocisus inserata*, *Salix acutifolia* and *Lycium barbarum* have relatively low numbers of sites in the study area but they exhibit strong tendencies for expansion.

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