

**ALIEN PLANT SPECIES BIOLOGY  
AND DISTRIBUTION**

**POSTERS**  
in alphabetical order

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### ***RUMEX ALPINUS* L. IN KARKONOSZE (THE SUDETEN MOUNTAINS) APOPHYTE OR ANTROPOPHYTE?**

Human activity is one of the basic factors that decide about the character and directions of changes of floras of various regions of the country. Some plant species lose many of their stations and their range decreases. On the other hand – some spread and appear in synantropic communities where they were not recorded earlier. In case of this second group of plants very often it is difficult to ascertain their initial ranges. *Rumex alpinus* is such a problematic taxon. The species is characterized enabling intensive expansion in places significantly transformed by man. Primarily, it is a highly nitrophilous plant, showing strong demands with respect to light and humid conditions. Due to well developed rhizome it reproduces vegetatively very well. It also produces many seeds which keep the ability to germinate for many years. All the above characters enable expansion of the species which in favorable conditions forms dense groups (ass. *Rumicetum alpini*). Within the area of the Karkonosze National Park the discussed species can be included to a group of the most expansive plants. In majority, sources describe *R. alpinus* as a plant native to the Sudeten Mountains. Nevertheless, numerous factors justify the statement that the species is an alien plant, at least within the area of the Karkonosze Ridge, where it has numerous stations. All stations, however are associated with places of human activity such as: vicinities of huts, bygone settlements, roadsides and tourist trails. Until now the plant has not been recorded in natural plant communities (of the *Betulo-Adenostyletea* class). It declines in places where human activity ceased. Furthermore, the species is especially characteristic of the subalpine belt. In the Karkonosze Ridge most stations are located within the lower plant belts. Hence, numerous factors prove that *R. alpinus* should be considered an alien plant (antropophyte) and not a native one (apophyte) to this highest ridge of the Sudeten Mountains.

keywords: *Rumex alpinus*, Karkonosze Mountains, apophyte, antropophyte

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### ***BROMUS ERECTUS* HUDS. – AN ALIEN INVASIVE SPECIES OR NATIVE SPECIES FOR THE SILESIAN UPLAND AREA (SOUTHERN POLAND)?**

*Bromus erectus* is considered to be a probable anthropophyte in the area of Poland but some botanists suggest that it can have a native character in some of western and southern regions of the country (Zajac A., Zajac M. 2001). This grass is not a very frequent species in the Silesian Upland, however its localities are distributed rather evenly. The occurrence of *B. erectus* is usually correlated there with the presence of calcareous rocks, and mainly Triassic ones.

The most of *B. erectus* localities in the Silesian Upland area have been noted during the last 20-30 years. However, the older data are not numerous, even on the areas where the floristic investigations were carried out intensively at the turn of the 19<sup>th</sup> and 20<sup>th</sup> centuries (Fiek 1881, Schube 1903). Those two facts could suggest that this grass has spread in the area of the Upland during the last decades.

In the Silesian Upland *B. erectus* was most frequently noted in the disturbed xerothermic grasslands and in the grassland-like communities. It usually grows in sodded excavations and in their close neighbourhood, also in “warpie”-called excavations and roadside escarpments. The discussed grass sometimes forms almost single-species aggregations there.

The arguments for the affiliation of *B. erectus* to the group of anthropophytes in the Silesian Upland area are the following: (1) the great number of relatively new localities, (2) the connection with the synanthropic or strongly disturbed seminatural habitats and (3) its very distinct domination on the majority of localities.

keywords: grass, domination, species spreading, Silesian Upland

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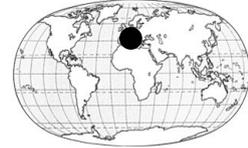
## **JAPANESE HOP (*HUMULUS JAPONICUS*), A LESS-KNOWN INVASIVE ECOLOGICAL WEED IN HUNGARY**

The Japanese hop (*Humulus japonicus* Sieb. et Zucc., syn. *H. scandens* (Lour.) Merrill) is native to East Asia, primarily in the deciduous forest zone of Japan, China, Korea, Russian Far East and the neighbouring islands. It is a rambling or climbing, fast-growing herbaceous vine, a hapaxanth, dioecious, wind pollinated species. Since it has no lupulin glands, it has nearly no economical value in contrast with the common hop (*H. lupulus* L.); on the contrary, it is a pollen allergenic plant. It was brought to Europe and North America as an annual ornamental (incl. f. *variegatum* Sieb. et Zucc.). The plant easily growing wild, sowing itself. In its native area this plant also occurs as weed especially along roads and in ruderal habitats. In North America it is an introduced species occurring from the eastern coast to the centre of the continent. It is planted in the European gardens since 1886. Since then, several countries reported it as a casual alien, but its naturalisation is known only from N-Italy, Hungary and Slovenia today. The Japanese hop in Great Britain, Germany, Czech Republic, Austria, Romania and Ukraine is a casual neophyte till now. It spreads in Hungary since 1894 in a slow but continuous manner. As a garden escapee it occurs in ruderal habitats as well, however it is predominantly spread by water streams, like a typical riparian migrant. At the same time *H. japonicus* is an invasive plant endangering the vegetation along rivers and brooks. Even the stronger herbs' shoots bend under the load of its thick, heavy and shady mesh. It is often forms dense carpets on bare alluvial banks, beneath of which only a few or no any other species occurs. The Japanese hop draws the attention to itself as a dangerous ecological weed in Hungary. Present work summarizes the knowledge on this species according to the local field surveys and the accessible literature on the subject.

keywords: *Humulus japonicus*, ecological weed, Hungary

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## **SPREAD AND OCCURRENCE OF JAPANESE KNOTWEED (*FALLOPIA JAPONICA*) IN PIEDMONT (NW-ITALY): TRANSALPINE INVASION**

Occurrence of *Fallopia japonica* (Houtt.) Ronse Decraene in Piedmont as well as in northern Italy has been underestimated in the European context up to now. Since few decades after its introduction to Italy in the middle of 19<sup>th</sup> century as cultivated plant, *F. japonica* has spread widely in particular in Piedmont in ruderal areas, along river and roadsides and up to about 1000m (maximum altitude 1500m) in alpine valleys.

Actual distribution of the species in Piedmont is reported from herbarium specimens (TO-HP), bibliographical data and field surveys. The use of GIS allowed to map the spread in time and space of the species. The distribution data have been related to environmental factors: climate, altitude, human impact and habitat to highlight the plant behaviour close to the southern boundary of its range. A correct identification of collected samples has been made on the basis of morphological differences and chromosome numbers in order to distinguish among *F. japonica*, its relatives and hybrids. The role of both vegetative and generative reproduction and hybridisation in the spread of these taxa in Piedmont have been focused analysing both the genetic structure of *F. japonica* populations and the occurrence of seed production.

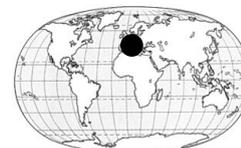
keywords: *Fallopia japonica*, Piedmont, distribution, genetic diversity

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## THE INVENTORY OF THE ITALIAN ALIEN FLORA. STATE OF THE PROJECT

The development of databases of alien species is a fundamental first step in the study of biological invasions. Although political boundaries are not an ideal framework for compiling alien floras, the importance of national inventories is becoming increasingly recognised and management-oriented. Moreover, the historical, economic and political aspects of plant invasions related to human activities may be positively addressed at a national and subnational level, especially in the Mediterranean region. Consequently, a project aimed at compiling a catalogue of the alien flora of Italy is in progress, which will report on the current state of non-native flora and establish a basis for future research on plant invasion in the country. Botanists, plant ecologists, phytosociologists and local experts from each of the Italian administrative regions are participating in the project. Data from Herbaria, literature and oriented field surveys are used in order to:

- (a) compile a comprehensive check-list of the alien vascular plant species occurring outside cultivation in Italian national territory;
- (b) evaluate the immigration status of each species, i.e. whether casual, naturalized or invasive;
- (c) record habitat type, *syntaxa* and ecological region (bioclimate, geomorphology and land use) in which the species occur;
- (d) record the distribution and frequency in each of the Italian administrative regions;
- (e) collect basic background information on each species, such as origin; year of first introduction into the country; residence time (i.e. whether archaeophyte or neophyte); life form; phenology.

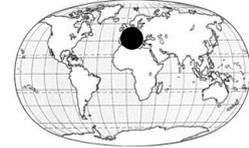
The aims of this paper are to:

- (a) highlight the increasing importance of alien floras compiled at a national level;
- (b) present the details of the project for the catalogue of the alien flora of Italy;
- (c) discuss the first results of the project.

keywords: alien flora, Mediterranean region

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## THE EXOTIC FLORA OF CHAD. UPDATING THE CHECKLIST

Scientific researches and actions to prevent and mitigate the effects of invasive alien species have been focused largely within developed countries. But some of the most obvious and severe impact of alien plants occur in Africa. Sensitive wetland ecosystems are threatened by a significant contingent of IAS, forming thick mats on water bodies, reducing light and oxygen, affecting biodiversity, fishing and navigation. Thus, IAS are posing a serious threat to biodiversity and associated economic activity in Africa and under current trends, it is likely that the situation will deteriorate. One of the most important pathways of introduction was and is intentional. Many invasive tree species have been introduced because of their potential multi-purpose uses and benefits, e.g. around Lake Chad (in Nigeria and Chad), but while they have indeed provided some benefits, the unanticipated costs may often turn out to be greater. Accidental introduction of aliens is also likely to increase, in agricultural and urban areas, along roads. Trade is now fuelling the development. Thus, there are good reasons why the opportunities for alien species to enter Africa can be expected to increase. In fact, it might be desirable that the opportunities do increase, since they signify and are usually associated with economic development. The first checklist of the exotic flora of Chad was produced by the authors after field surveys from 1999 to 2003 in southern BET (Borkou-Ennedi-Tibesti), Kanem, Lake Fitri, Batha, Biltine, Ouaddai, Lake Chad, Chari-Baguirmi, Guéra, Salamat, Mayo-Kébbi, for more than 12,000 km of track, collecting 1,000 exsiccata and recording more than 3,000 GPS waypoints. During 2004 the North-east region of the country (from N'Djamena to salt lakes in southern Tibesti) was surveyed and examination of herbarium material in N'Djamena and in European herbaria was achieved. We therefore present an updated checklist of the exotic flora of this poorly studied African country.

keywords: Chad, alien flora

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### THE INVENTORY OF THE EXOTIC FLORA OF SARDINIA (ITALY)

The first checklist of the alien flora of the island of Sardinia (Italy), was completed in the beginning of 2000 by the Dept. of Botany and Plant Ecology of the University of Sassari. The project was founded by the Nature Conservation Service of the Italian Ministry of the Environment. This first catalogue and the accompanying geo-database have been updated in the following years and so far, in the framework of the EU funded project EPIDEMIE (5th FP) and by mean of other research projects dealing with Sardinian exotic flora.

Sardinian plant aliodiversity was largely underestimated by the previous existing studies, mainly based on bibliographic records and herbarium samples, and ranged from 70 (Weber, J. Veg. Sci., 8: 565-572, 1997) to 184 species (with 160 naturalized species (according to Viegi, Boll. Soc. Sarda Sci. Nat., 29: 116-234, 1993).

The check-list produced and regularly updated should be the more comprehensive inventory actually available (1.200 taxa). It has been compiled using historical data (e.g. local floras, bibliographic records, herbarium exsiccata, *index seminum* etc.) and oriented field GPS surveys and collections. The total number includes all alien species ever recorded or surveyed in the territory of the Region, including most commonly cultivated species (e.g. in garden centres, forest nurseries, botanical gardens) and ephemeral species. The mapping part of the projects addresses the distribution of only a selected set of 110 alien species (naturalised and/or invasive *sensu* Richardson et al., 2000 and Pyšek et al., 2004), according to a grid of 310 cells (10 x 10 km), covering all the Sardinian territory.

keywords: alien flora, mediterranean region

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### **SOLIDAGO GRAMINIFOLIA IN POLAND: THE STATUS OF SPREAD**

*Solidago graminifolia* is one of the North American species, which were introduced to Europe as ornamental plants and in Poland were naturalized in 19th century. But this species contrary to *Solidago gigantea* or *S. canadensis* yet did not show such expansive abilities to spread. In the 80 of 20th century there were known only 26 localities of the species in Poland. The vast majority of them were restricted to vicinity of Niemodlin in Opole Province. Estimations of the potential distribution of exotic goldenrods shows that their spread has not yet reached its limits on the territory of Europe and that expansion range of *S. gigantea* and *S. altissima* (= *S. canadensis* var. *scabra*) will continue. Large parts of Europe were estimated to be climatically suitable to *Solidago graminifolia* and discrepancy between current and potential range in Europe was highest in case of this species because of its restricted distribution. Our research conducted during last five years shows that actual distribution of the species in SW Poland and its occurrence in plant communities differs significantly from that known 20 years ago. The main aim of the study was to check actual distribution margins of the species, its occurrence in plant communities and habitat conditions. In SW Poland individuals of *S. graminifolia* nowadays are being noticed more often on abandoned field or meadows and in ruderal habitats e.g. quarries. Analysis of phytocoenoses with *S. graminifolia* shows its abilities to compete with many native species, among the other with grasses which form dense stands, as *Calamagrostis epigeios*, *Molinia caerulea*, *Phalaris arundinacea* or *Phragmites communis*. Individuals of *S. graminifolia* were also noticed in company of other alien species, as *Spiraea tomentosa*, *Rudbeckia laciniata*, *Solidago gigantea*. Together with those plants it forms stands mainly on banks of some rivers.

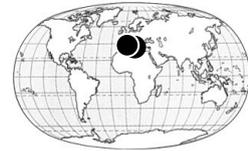
keywords: alien plant, anthropogenic habitats, Silesia

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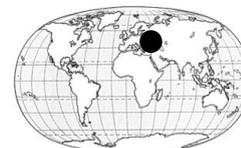
## THE INVENTORY OF THE EXOTIC FLORA OF CRETE

The Mediterranean comprises one of the largest group of islands in the world. The region is of high value to global biodiversity due to its diversity of plant species, relatively high rate of endemism, long history, and tolerance to many kind of disruptions. The continuous environmental pressure maintained by humans in the Mediterranean through history is now an inescapable component of all Mediterranean ecosystems and landscapes. However, over the last few decades, mainly since the 1960s, major socio-economic changes have increased the negative impact of such human activity, mainly along the coast and agricultural areas. In this respect, the islands are extremely vulnerable, as their small size increases the effects of disruptions. In particular, the islands of the Mediterranean basin are highly vulnerable to the entrance of alien species, e.g. due to their dependence on external trade, the high rate of urban development in coastal areas and the relative large communication network. The distribution of endemic and native taxa in the Mediterranean basin is relatively well known, although the lack of distribution maps sometimes makes difficult to obtain a global overview of the situation. On the contrary, the distribution of exotic species is less documented and fragmented and many Mediterranean islands lack updated checklists or maps of their exotic floras. To this aim a project is in progress, for the island of Crete, and it will hopefully have duration of three years (2005-2007). Preliminary results, main abundant species and operational logic are present herewith.

keywords: alien flora, mediterranean islands

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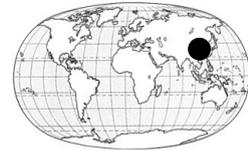
## ARMENIA AS A POSSIBLE SOURCE FOR BIO-CONTROL OF INVASIVE WEEDS

Armenia is situated at the junction of two floristic provinces - Caucasian and Armeno-Iranian (Takhtajan, 1986). The peculiarity of each, enhanced by vertical zonation, is the cause of the great variety of the country's vascular flora and vegetation. About 3500 vascular plant species occur on its territory, slightly more than the average figure for Mediterranean countries – a remarkable amount of biodiversity. One reason - beside mosaic conditions, relief variation, diverse geological history, etc. - is that Armenia is situated between two very distinct phytogeographical domains: the Boreal and Ancient Mediterranean Subkingdoms of Takhtadzhjan (1986). Armenia is a country where many invasive weed species took their origin. There are 4 Armenian plant species in the list of '100 of the Worlds Worst Invasive Alien Species' (ISSG/IUCN) - *Arundo donax*, *Imperata cylindrica*, *Lythrum salicaria*, *Tamarix ramosissima*. These species are not invasive in Armenia yet. More than 40 species are growing in Armenia, and at the same time they are very dangerous weeds in the North America. Also we can notice *Heracleum sosnowskyi* (close relative to *H. mantegazzianum*) and *Nymphoides peltata* growing in Armenia and are invasive weeds in Europe and North America. According to our data many species now show their invasive potential in threatened natural ecosystems - *Geranium tuberosum*, *Cirsium congestum*, *Centaurea behen*, *Lepidium vesicarium*, *Xeranthemum squarrosum*, *Tripleurospermum transcaucasicum*, *Euphorbia seguieriana*, *Cardaria draba*, *Cirsium arvense*, *C. incanum*, etc. Investigation of potentially invasive species in Armenia may be very important for different countries around the World. It is necessary to investigate populations of invasive and potentially invasive plant species and insects, fungus.

keywords: flora of Armenia, natural ecosystems, bio-control

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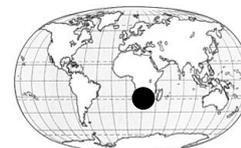
## BIOMASS ALLOCATION, MORPHOLOGY AND PHYSIOLOGY OF INVASIVE AND NONINVASIVE EXOTIC PLANT SPECIES GROWN IN FIVE IRRADIANCE LEVELS

*Ageratina adenophora* is noxious invasive plant species in southwest China, while the impact of *Gynura sp.* was small in this area. We studied their morphology, growth, and biomass allocation in seedlings grown under 4 light levels for more than 50 days. At low light plants enhanced light interception through increasing plant height, decreasing branch, and increasing biomass allocation to leaves and forming big-sized, thin leaves with high specific leaf area (SLA), leading a high leaf area ratio (LAR). At high light plants reduced transpiration losses and increased carbon gain by making small-sized, thick leaves with a low SLA, leading to a low LAR and leaf area root mass ratio. Under most of light regimes, compared with *Gynura sp.* *A. adenophora* was higher in Leaf mass ratio (LMR), leaf mass fraction (LMF), LAR, root mass ratio and root mass/crown mass, but lower in supporting organs biomass ratio (SBR), MLA and branch number. In 100% irradiance, LMR, LMF, and leaf area index of *A. adenophora* were higher, and leaves were much more self-shaded. This might be a strategy for its vigorous invasiveness because high-shaded canopy could prevent other plant species surviving and growing under it. The branches of *Gynura sp.* was much more in 100% irradiance than in other light regimes. This was beneficial for *Gynura sp.* because more branches could produce more flowers and then more seeds. The relative growth rate (RGR) increased with the increase of light intensity in *A. adenophora*, but decreased in *Gynura sp.* With the decrease of light intensity, both *A. adenophora* and *Gynura sp.* tried to intercept more light energy by growing higher and fewer branching. All these results presented above indicated that *A. adenophora* acclimated more adequately to light conditions, especially to low light regimes, than *Gynura sp.*, and its light acclimation advantage might explain its greater invasiveness.

keywords: *Ageratina adenophora*, *Gynura sp.*, invasiveness, Growth related traits, Light levels

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## IMPACTS OF *ARUNDO DONAX* ON RIPARIAN BIODIVERSITY: COMPOSITION, STRUCTURE AND FUNCTION

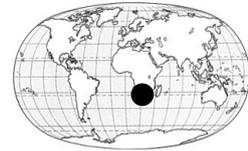
Invasive alien plants have long since had a bad reputation due to their damaging impacts on indigenous biodiversity. However, the impacts on biodiversity have been and are difficult to quantify because of the range of definitions of biodiversity. In this study we use a characterization of biodiversity as used by Noss (1990). According to Noss (1990), biodiversity can be divided into different components: composition, structure and functioning of ecosystems. Composition has to do with the identity and variety of elements in a collection. Structure is the physical organization or pattern of a system. Function involves evolutionary and ecological processes, including disturbances and nutrient cycling. These components are further divided into different levels or scales: regional-landscape, community-ecosystem and population-species levels. By assessing impacts on biodiversity according to this characterization we can assess the impact on biodiversity as a whole. We look at the impacts on biodiversity of the invasive alien reed *Arundo donax*. *Arundo donax* is an invasive alien reed in many parts of the world. Mostly, *A. donax* occupies riparian habitats and tends to form monocultures. The study will take place in riparian areas dominated by *A. donax*, and will include plant and aquatic invertebrate diversity assessments; fire behavior models; measurements of decomposition of *A. donax* material over time; and measurement of growth rates of mature *A. donax* plants under various treatments over time. We hypothesize that riparian habitats of rivers dominated by *A. donax* (1) become poor in indigenous vegetation and ultimately become monocultures of *A. donax*, (2) have fewer indigenous aquatic invertebrates, (3) have changed fire behavior, and (4) are nutrient-poor because *A. donax* is a high nutrient user and decomposes very slowly.

keywords: invasive plants, biodiversity, *Arundo donax*, fire behavior, decomposition

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## IMPACTS OF THE INVASIVE SPECIES *ARUNDO DONAX* (GIANT REED) ON BIODIVERSITY AT THE COMMUNITY-ECOSYSTEM LEVEL

*Arundo donax* is an invasive alien reed in many parts of the world. In California, *A. donax* causes flooding and fires, and displaces indigenous plants. Both South Africa and California have a mediterranean-type climate, thus the impacts on ecosystems are likely to be similar. In South Africa, *A. donax* has been classified as a category 1 invader (declared weed), meaning that its destructive potential has already been realised. The impacts of *A. donax* on biodiversity have not been assessed in the Western Cape, South Africa.

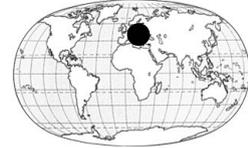
The impacts of invasive alien plants on biodiversity have been and are difficult to quantify because of the range of definitions of biodiversity. In this study we use a characterization of biodiversity as used by Noss (1990). Accordingly, biodiversity can be divided into different components: composition, structure and functioning of ecosystems. *Composition* has to do with the identity and variety of elements in a collection; *structure* is the physical organization or pattern of a system; and *function* involves evolutionary and ecological processes, including disturbances and nutrient cycling. Noss (1990) also divides the approach into different levels: genetic, population-species, community-ecosystem, and regional-landscape. We assess the impacts on biodiversity at the community-ecosystem level.

The study will assess these components by looking at plant and aquatic invertebrate diversity, fuel models, decomposition of *A. donax* and other material, and growth rates of mature *A. donax* plants under various treatments. We hypothesize that riparian habitats of rivers dominated by *A. donax* have (1) suppressed indigenous plant and aquatic invertebrate diversity, and (2) altered soil nutrient status and fire regimes.

keywords: *Arundo donax*, biodiversity, community-ecosystem

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## **DISPERSAL OF INVASIVE CONIFER *PINUS STROBUS* IN THE SANDSTONE AREA OF THE BOHEMIAN SWITZERLAND (CZECH REPUBLIC)**

*Pinus strobus* is an invasive tree in the sandstone areas in the Czech Republic. In many places it creates dense self-sown stands, which are suppressing the undergrowth vegetation and native tree regeneration. This study takes place in the Bohemian Switzerland. We studied distribution of self-sown trees of *P. strobus* in different habitats with respect to the distance of the diaspore sources and use these data to derive dispersal curve of the species. The data were confronted with a theoretical dispersal modelled on the basis of a seed terminal velocity and known wind speed. Further, we studied demography and habitat requirements of the species and plan to use these data to build a model of spread of the species in the landscape.

We found that (i) *Pinus strobus* density sharply decreases with distance from the seed trees and approaches nearly zero at the distance of 100 m. This prediction corresponds well with the seed dispersal under the wind prevailing in the area. While the short-distance dispersal affects most diaspores, we assume that it is less relevant for the spatial spread. (ii) Only small fraction of the self-sown trees was found further than 100 m suggesting that long-distance dispersal is rare. Nevertheless, it may be the driving force of the whole invasion process. (iii) There are significant differences in regeneration in the different habitats along the sandstone microclimate gradient.

keywords: dispersal, invasion, regeneration

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### **LINDERNIA DUBIA IN THE CZECH REPUBLIC: DISTRIBUTION AND ECOLOGY**

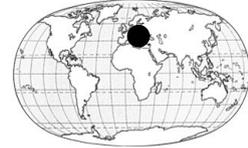
*Lindernia dubia* is a North American species colonizing mainly muddy big river banks. It was imported to Europe in the middle of the 19th century. The species has been spreading from France and Italy into Central and Eastern European countries, probably with waterfowl and men. In the Czech Republic *L. dubia* was firstly found in 1989 in southern Bohemia. Nowadays 8 localities are known for this species. At 4 localities it has been observed by authors; other 4 localities are known from literature. The most abundant population of neophytic *L. dubia* was found together with native species *L. procumbens* on exposed bottoms of storage ponds in the town of Hluboká nad Vltavou, southern Bohemia. We compared the ecological requirements of both species following data of phytosociological relevés. Both species are thermophilous herbs. In storage ponds (Hluboká nad Vltavou) the seedlings of both species appear generally at the same time – at the end of May or beginning of June. Development of vegetation on exposed bottoms of storage ponds depends on time of ponds drying. In case of early drying period – before germination time of *Lindernia* species, the storage ponds are overgrown by vegetation. Then, in the end of May *L. procumbens* is not able to penetrate into vegetation anymore. Beyond that *L. dubia*, thank to its more robust growth than *L. procumbens*, has a capability to penetrate on these taller plant stands. If storage ponds are dried in germinating period of *Lindernia* species, than both species successfully participates on the succession from the beginning and have the best conditions to colonize free space of exposed storage pond bottoms. It is likely that *L. dubia* is competitively stronger herb than *L. procumbens*. Therefore its spreading is expected. In this connection there is meantime unconfirmed assumption of invasiveness of *L. dubia*.

keywords: *Lindernia* species, neophyte, exposed bottoms, storage ponds, southern Bohemia

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## **POTENTIAL DISTRIBUTION MODELING OF THE INVASIVE TREE *ACER NEGUNDO* IN THE CZECH REPUBLIC**

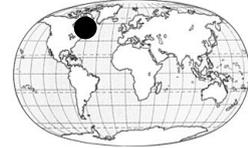
Information about *Acer negundo* distribution was investigated using recently collected data from national mapping, from national phytosociological database and observed in two last seasons. Topological (elevation, slope, aspect and their combination), climatic (mean annual temperature, mean annual sum of precipitation), geographic (roads, rivers, towns, railways) and thematic (potential vegetation, geology, land cover) GIS layers were used as predictors of boxelder naturalization sites. Several models based on logistic regression (GLM, GAM) were fitted and prediction of potential naturalization sites was performed. 6 different models were built to compare more approaches different in model type and in complexity. GAM models seemed the most accurate following training datasets and are suitable for prediction based on large distribution database. GLM models are more sensitive in case of categorical variable input and such as can be used for process of predictors selection. The predictors selection as well as prediction in different scales were partially analysed and will be deeper discussed in following study.

key words: distribution, modeling, GLM, GAM, *Acer negundo*

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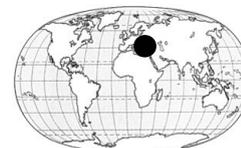
## THE INVASIVE COMMON REED (*PHRAGMITES AUSTRALIS*) ALONG HIGHWAYS IN QUÉBEC (CANADA): A GENETIC AND BIOGEOGRAPHICAL ANALYSIS

During the last century, *Phragmites australis* (Cav.) Trin. ex Stued. (common reed) colonies expanded in marshes of northeastern North America. This species is highly problematical because it has a strong impact on plant and animal diversity. In the province of Québec (Canada), the spread of common reed coincided with the expansion of the highway network from 1963 to 1984. We hypothesized that highways contributed to the spread of common reed by creating dispersal corridors and favourable habitats to the growth of the species. To test this hypothesis, we mapped in 2003 the spatial distribution of common reed colonies along all Québec's highways (2800 km). We also sampled 260 populations to determine whether common reed found along highways is native or exotic. Globally, 24% of roadsides were invaded by common reed. Highest common reed densities (250 stems per m<sup>2</sup>) were registered near the city of Montréal, in the southwestern part of the province. In this region, common reed formed hedges several kilometres long. Genetic analyses indicated that 99% of common reed colonies found along highways were exotic (haplotype M from Eurasia). Only 3 out of 260 colonies were dominated by a North American genotype. The spread of common reed in Québec probably resulted from the introduction of an exotic genotype in the first part of the 20th century. This genotype likely benefited from the expansion of the highway network to establish new colonies in most regions of southern Québec. The maintenance of the highway network (ditch digging, roadside mowing) also probably contributed to the spread of common reed and to the improvement of growth conditions for the species.

keywords: *Phragmites australis* exotic genotype roadsides

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## PLANT INVADERS IN THE FLORA OF SLOVENIA

In the territory of Slovenia about 30 plant species can be ranked as invaders in the narrower sense. That means that they are non-native and perfectly naturalized in natural or semi-natural habitat types where they are outcompeting the native flora and so radically changing the structure of the habitat. They were brought to Slovenia or neighboring countries at least half a century ago incidentally or deliberately (as ornamentals or other cultivated plants). In about one third of Slovenian plant invaders first records of their occurrence in the wild are more than a century old but in majority of them quick expansion of populations took place in the last 50 years. The most "invasion prone" habitats are riverine ecosystems and disturbed sub-Mediterranean forest, where in certain areas we could not recognize the native vegetation anymore because it has been completely replaced by a neophytic plant communities. About 2/3 of Slovenian plant invaders are native to North America and about 1/3 to East Asia where they are quite widespread in similar climatic conditions. One third of our plant invaders are phanerophytes and just a bit less hemicryptophytes and therophytes, respectively. All the field records and published data on occurrence of invaders is taken from the Flora Slovenia database at Centre for Cartography of Fauna and Flora, where also the detailed distribution maps with temporally differentiated data were prepared.

keywords: IAS, invasive plants, Slovenia

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## **EDIBLE FRUIT, NUTS, VEGETABLES AND CROPS AS POTENTIAL INVASIVE PLANT TAXA: CASE STUDIES FROM THE RUHRGEBIET (GERMANY)**

Ergasiophygophytic occurrences of most non-ornamental useful plants are accidental and often depend on waste disposal from gardens. In most cases such occurrences are ephemeral. On the other hand there are some typical habitats where edible plants from different sources can be found frequently and where establishment of such taxa can be studied. In the Ruhrgebiet, the former biggest industrial agglomeration in Europe, the river banks of the Rhine are such a typical habitat. Because the Ruhrgebiet is a highly anthropogenic region with many new, ecologically unstable habitats, escapes are frequently recorded and establishment of species found casually in other localities is possible. The development of some frequently recorded taxa to potential invasive plants are investigated thoroughly with case studies, e.g.: *Brassica napus*: Since the early 1990's spreading along roadsides, railways and channeled streams has been observed. *Ficus carica*: Since approx. 1995 persistence was proofed and some plants have started to generate fruits. The seeds tested were germinable. *Juglans regia*: Seedlings and young individuals have increased conspicuously – often without a potential founder tree nearby. *Physalis peruviana*: Has come into fashion within the last few years and escaped/xenophytic occurrences also increased. Highest frequency can be found on the Rhine banks, but “populations” seem to be casual and are founded every year anew from seeds. Other observed species are *Malus domestica*, *Ribes* spp., *Solanum lycopersicum* and *Rubus armeniacus*, the only invasive fruit known by now. Additionally, some curiosities are also studied, especially *Eriobotrya japonica*, a edible fruit in the Mediterranean, which is sometimes sold by turkish greengrocers. Some plants were grown in basement light shafts in front of a grocer's store and have survived for more than three years.

keywords: Germany, Ruhrgebiet, Northrhine-Westphalia, ergasiophygophytes, xenophytes

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## LINE MIGRATION AND TENDENCIES OF SPREAD OF *HERACLEUM* *MANTEGAZZIANUM* IN THE RUHRGEBIET (GERMANY)

One frequency centre of *Heracleum mantegazzianum* in the German state Northrhine-Westphalia is the riparian area of river Ruhr and its side valleys. The species was first detected in 1954 at Hagen-Dahl in the Volme valley, tributary of the Ruhr. While it was found at several locations in Westphalia in the following years no long distance dispersal of populations was indicated. But it seems that dispersal was overlooked, because after some years without new discoveries, in 1968 extended populations were investigated in the Volme valley. Probably, dispersal in this valley was caused mainly from the mentioned founder population. But in general there are additional effects of populations based on locally escaped individuals and more or less coherent line migrations. The present distribution along the Ruhr and its tributary waters seems to be a consequence of unidirectional line migration, but it resulted from a fusing of the distribution areas of numerous local escapes that spread in one or several directions. Today *H. mantegazzianum* is present within the whole extent of the Ruhr area, but not always represented by occurrences of high density. As the rivers are accompanied by roads, the line migration of the species also extends to the road sides, from which the dispersal of the species crosses over to roads in other directions. In the areas of Fröndenberg and Essen - Duisburg, the species migrated from the west-east directed Ruhr valley northwards along roads and spread along "Bundesstraße" 1 aka federal highway 40, a west-east directed road axis. In inner urban areas of the Ruhrgebiet occurrences of the Giant Hogweed are less frequent and, in most cases, their extensions are very local with few tendencies to long distance dispersal. Probably, habitats are too isolated and sometimes the species is controlled by municipal offices. The most important factor may be the decrease of fallow areas in urban regions.

keywords: *Heracleum*, Germany, line migration, river, roadside

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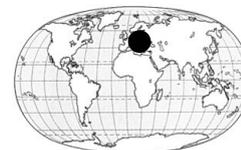


### **THE VARIABILITY IN MORPHOLOGY OF HERMAPHRODITIC FLOWERS OF SUBDIOECIOUS TREE BOX-ELDER (*ACER NEGUNDO* L.) IN INVASIVE POPULATIONS IN CENTRAL AND EASTERN POLAND**

*Acer negundo* L. (box-elder) is a woody species native to North America. It is invasive on almost all other continents including Eurasia, South America and Australia. In its native range it has become a model dioecious species. However, the occurrence of hermaphrodite individuals in some populations in invasive range has recently been reported. The aim of this study was to verify: what is the variability of stamens number in the hermaphroditic flowers at the level of a raceme and an individual in a number of invasive populations; whether any temporal variability exists, and finally – to what extent the occurrence of stamens affects female functions in flowers. We investigated 28 hermaphroditic individuals in 16 populations, located along 250 km long gradient from Białowieża to Warsaw in 2000, 2004 and 2005. We found that the occurrence of stamens in flowers of hermaphroditic individuals is highly variable at all levels. Studied individuals divide roughly into two groups: one with one or two single, small stamens per raceme, and the second with 4 to 20 large stamens per raceme. However, there were no flower with 5 stamens, as in typical male flowers. Our research confirmed regular occurrence of hermaphroditism in the majority of individuals studied in 2000, 2004 and in 2005. Last part of our study indicate that at the level of a single flower the biomass allocation into female functions was inversely correlated with the number of stamens. We conclude that beside the substantial variability in the floral morphology the subdioecy is neither isolated nor ephemeral phenomenon in invasive populations of box-elder in Central and Eastern Poland. Its functional role has yet to be proven, but the occurrence of the phenomenon in the invasive, secondary range and not in primary one may pose interesting questions about the “distinctive selective forces” hypothesis and the importance of the dioecy in the success of invasion.

keywords: subdioecy, “distinctive selective forces” hypothesis, woody alien species

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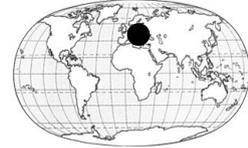
### **SOME ASPECTS OF VARIABILITY IN SMALL BALSAM (*IMPATIENS PARVIFLORA*)**

We started studies on a broad range of issues concerning variability in *Impatiens parviflora* – from plant to plant variation in experimental populations to genetic variation at a geographical scale. Here, we report some preliminary results. (1) Germination trials were a necessary starting point for further experiments. Seeds, collected at several sites, were stratified at various temperatures. Stratification between layers of wet filter paper at variable temperatures about 0°C and slightly below resulted in the shortest time (12-16 weeks) to attain high ability to germinate (about 90%). (2) Variability in germination speed strongly depended on conditions. Germination of stratified seeds kept at about 5°C in the darkness spanned over 7 weeks. Seedlings appearing from fast-germinating seeds performed worse than those from the middle period of germination – in terms of height, stem diameter and chlorophyll content index. (3) In a glasshouse experiment, plants showed marked response to competition in terms of height, stem diameter, dry mass of parts, crown projection area, leaf size, branching. Both allometric relationships between size measures and patterns of size – mineral content relationships differed across population densities. The percentage of variation in element concentration explained by a set of size measures ranged from about 0% (for N and P at low population density) to 64% (for Zn at high density). (4) AFLP analyses suggested very low level of genetic polymorphism among selected Polish populations.

keywords: *Impatiens parviflora*, variability, germination, mineral content, AFLP

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## **KENOPHYTES IN THE RIVER VALLEY - THE VISTULA VALLEY AS AN ECOLOGICAL CORRIDOR**

The Vistula river is the only large Central European river which has retained many of its natural features, especially in its middle course. The low degree of anthropogenic transformation allows one to conduct research on the dynamics of the distribution of alien plant species. So far, in the Lublin part of the Vistula valley, 1383 vascular plant species have been recorded, 124 of which are kenophytes.

To determine the role of different parts of the valley in the spread of kenophytes, the spatial distribution of epocophytes and agriophytes and the stability of their locations have been analysed. The distribution and frequency maps used in the study were made by a cartogramme method in grid of 1 x 1 km.

On the edges of the valley epocophytes occur numerously. It is connected with the location of rural and urban settlements. The percentage of kenophytes on the river terraces outside the embankments is the smallest. The number of agriophytes, and in part - epocophytes, increases on the floodplain. Distribution patterns and the stability of locations point out to the different functions of the valley as an ecological corridor for different kenophytes:

- habitat and conduit - all analysed species are permanent elements of the flora, 25 kenophytes are of the river corridor plants type, they occur mainly on the floodplain and on slopes of the valley,
- sink - epocophytes enter the floodplain,
- source - a few species emanate from the floodplain to other parts of the valley and outside the valley.

keywords: kenophytes, distribution, river valley, ecological corridor, Vistula river

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### ***PULMONARIA RUBRA* SCHOTT NATURALISED IN KAMIENNE MTS (SUDETY MTS, SW POLAND)**

*Pulmonaria rubra* is a woodland plant from SE Europe. A sizeable population was found along the Sokołowiec stream (Sokołowsko) in the Sudety Mts (SW Poland). This species has never been reported in the wild in Poland.

The species' distribution was mapped. It grows exclusively in the Sokołowiec stream valley, where three localities were found. The largest one (ca. 1000 individuals) occurs in a patch of natural flood-plain forest, where it, together with *Anemone nemorosa*, dominates the ground cover along nearly 100 m of the stream side. Some individuals managed to colonise the adjacent old spruce plantation. A population of about 100 individuals grows 300 m down the stream, exclusively in *Reynoutria sachalinensis* thickets. A third locality is a group of four individuals, another 300 m downstream, where it grows in a semi-shaded forb community (with such spp as *Rubus idaeus*, *Urtica dioica* and *Chaerophyllum aromaticum*).

The species has presumably escaped from cultivation as it is located a few hundred metres downstream from a once-fashionable resort, Sokołowsko. The likelihood of finding strange species of plants in Sokołowsko area is increased by the fact that it was there that princess Daisy Hochberg von Pless, an English aristocrat married to the German owner of the local forests, spent her last years. She was famous for her love of plants and she used to import exotic species to her estates. However no specimens were found growing in the gardens of Sokołowsko. Another explanation is that *P. rubra* was transported unintentionally with exotic trees or shrubs planted ca.100 years ago in the resort's park which is located a few hundred metres upstream. The occurrence of *P. rubra* in a well-preserved flood-plain forest indicates that it may spread further, as the species seems to flourish on the site and it has already achieved the status of neophyte.

keywords: exotic species, hydrochory, garden escape, neophyte

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### **THE INVASION OF SUBHALOPHYTIC TATARIAN ORACHE (*ATRIPLEX TATARICA* L.) AND THE ROAD SALT DEICING IN WARSAW, POLAND**

The Tatarian orache (*Atriplex tatarica* L.) is an invasive plant from Asia. We investigated the patterns of its occurrence in Warsaw, Poland. We hypothesised, that: a) the current spread of the species is wider than detected earlier, b) its occurrence is limited to roadsides along streets with salt deicing, and c) its occurrence across roadside depends on the local soil salt concentration.

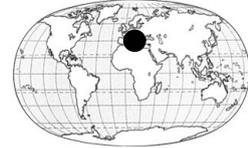
We studied the occurrence of the species in the grid of 1sq. km used in earlier floristic studies, then we mapped its presence along more than 150km of streets, and finally set up 50 research plots composed of 150 to 300 0.25 sq. m quadrats. On each of ca. 6500 0.25 sq. m quadrat the abundances of the Tatarian orache, other vegetation and bare soil were assessed and mixed soil samples were taken.

Our results indicate that the Tatarian orache did get much more widespread in Warsaw in last 20 yrs, however, there seem to be little turnover in the set of colonised areas. The species seems to be almost completely limited to the roadsides along the streets sprayed with salt, not entering the side streets with no salt deicing. However, the abundance of the Tatarian orache is only partially correlated with the local soil salt content. We conclude that the invasion of such a sub-halophytic plant in the city need not to be the simple effect of the salinity of the roadsides. Other factors, like the heavy metal contamination and air and soil water deficit may play an important role in the promotion of such a species in a city.

keywords: halophytes, roadsides, contamination

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## **CHARACTERIZATION AND DISTRIBUTION OF EXOTIC FLORA IN THE RIPARIAN SYSTEM OF CEDRINO RIVER (SARDINIA, ITALY)**

Riparian ecosystems are very important habitats for the peculiarity of animal and vegetal species living there, and for the problems concerning their conservation and management.

Actually this habitats are recently touched by a general process of reduction, erosion and alteration. These phenomena are due to different factors as pollution anthropic uses, construction of dams and embankments, intentional or unintentional introduction of exotic species.

In this work we study the exotic component of the flora of Cedrino's riparian system (Sardinia, Italy), including Cedrino river and its most important tributaries: Sologo-Isalle and Flumineddu rivers.

The main objectives of our study are:

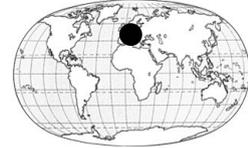
- 1) identification of exotic species presents in this system,
- 2) analysis of growth forms, chorological and phenological types,
- 3) analysis of distribution of species along the river system in relation to different environmental variables such as height, climate, geology.

keywords: alien plants, riparian vegetation, mediterranean riparian ecosystems

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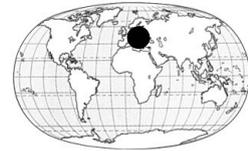
## **REGENERATIVE CAPACITIES OF TWO EXOTIC HYDROCHARITACEAE, *ELODEA NUTTALLII* AND *E. ERNSTIAE* IN RESPONSE TO FLOODING REGIMES**

*Elodea nuttallii* and *E. ernstiae* are two exotic species found in North-Eastern France. If *E. nuttallii* has been invasive since 1990, *E. ernstiae* is recorded locally at low abundance. The main objectives of this project is to investigate why these species with similar ecological niches, morphological form and reproductive strategies display different invasiveness. We aim especially to determine if *E. ernstiae* shows less regeneration capacity than *E. nuttallii* while submitted to different flooding treatments. Two types of regenerative fragments were used, apical buds and 4-internodes stem fragments. They were put for one month into experimental containers fixed into three different sites in the Alsacian floodplain. These three sites were characterized by no connection, partial connection and regular connection with the Rhine and corresponded therefore to an increasing gradient of disturbance through flooding. The survival and growing capacities of the two types of fragments were surveyed for both species through the measurement of 9 morphological traits. Results show that plant regeneration depends on site connection to the Rhine and therefore to flooding duration and frequency. Besides, *E. ernstiae*'s fragments, either apical buds or stem fragments, display similar and sometimes higher growing capacities than *E. nuttallii*'s. This study suggests that *E. ernstiae*'s low invasiveness may be linked with other than regenerative life-traits.

keywords: regeneration, *Elodea*, disturbance, flooding

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## **DISTRIBUTION AND HABITAT PREFERENCES OF KENOPHYTES OCCURRING IN BARLINEK-GORZÓW LANDSCAPE PARK (NW POLAND)**

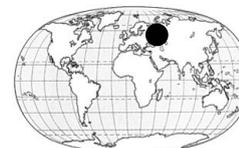
The paper presents the distribution and habitat preferences of 77 kenophytes currently occurring in the area of Barlinek-Gorzów Landscape Park (240 km<sup>2</sup>, NW Poland) and represents an attempt to estimate the resistance of particular habitats to invasion. The analyses were based on data obtained in 1998-2002 during field surveys on vascular plants in the Park. The study area was divided into 271 squares of 1x1 km size, coherent with the ATPOL grid – Atlas of distribution of vascular plants in Poland. Floristic notes were made inside each square, taking into consideration the whole range of habitats. Altogether 33 types of habitats were distinguished. Kenophytes most often invade transformed habitats. The most efficient colonizers of natural and semi natural phytocoenoses are as follows: *Impatiens parviflora*, *Padus serotina*, *Picea abies* and *Alnus incana*.

keywords: kenophytes, distribution, habitat preferences, NW Poland

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## ON THE STUDY OF ALIEN FLORA GENESIS

The numerous studies on regional alien floras have formed a sufficient basis for the historical analysis of alien floras. The growth of interest towards this problem can be explained by the high rate of the invasion process and the urgent need of prognosticating its results. Alien flora can also serve as a model object for studying the regularities of florogenetic processes and for their reconstruction.

When modeling the genesis of alien flora, it is necessary to take into account its specific characteristics. To compare to native flora, alien flora is characterized by a higher dynamics, inconsistency of its composition and structure, and active interaction with native and economic and ornamental components. This explains why alien flora has lower integrity, and why it is sometimes difficult to distinguish between alien and native components. On the one hand, alien flora is constantly enriched by economic and ornamental plants that become wild or by alien species that are native to other regions. On the other hand, the species composition of the regional floras can be considerably enlarged as a result of alien species naturalization. In this light the need in reconsidering the florogenetic and invasion status of all floras becomes apparent. The florogenetic status is determined by attributing a species to alien, native or economic floras. The invasion status can be determined by evaluating the persistency of an alien species in the regional flora. The evaluation technique is being actively developed.

The methods of historical reconstruction of alien flora genesis depend on the relative size (range) of the territory in question. With floras of relatively small areas you can easily distinguish between alien and native components, as the florogenetic status of the species is more or less defined. In this case it is possible to exclude natives and archeophytes. The aim of the analysis is to clarify the dynamics and the species composition of alien flora. The invasion dynamics of alien floras is well reflected in retrospective databases. Such databases have been already developed for some regions of Central Russia (the Tula and the Tver regions). In the course of work major types of florogenetic statuses have been determined (ephemerophytes, colonophytes, epekophytes, agriophytes), as well as their dynamics. With floras of larger regions it is necessary to take into account the fact that the same species can have a different status (native, archeophyte, established alien, casual alien) depending on the part of the region. In this case it is necessary to analyze alien and native floras simultaneously, and to evaluate florogenetic and invasion status for every part of the region. The study on the dynamics of alien flora in the smaller parts of large regions can help to define major migration waves, the rate of their movement, and the degree of spreading. It is impossible to create a retrospective database without active interaction between specialists on alien floras and taxonomists. The correct chronology of alien flora is possible only with references to map materials. Besides, the regional status of every individual species should be clearly defined. Perhaps, the best example

of florogenetic status systematization can be found in Scandinavian Floras (Retkeilykasvio, 1998; Flora Nordica, 2000, 2001). The analysis of the map materials enables to define the directions of species migration, but it is also necessary to consider the historical data. The rich factual data has been accumulated for the floras of Eastern Europe. Its critical analysis with due regard to contemporary taxonomic studies can help to clear out the specific characteristics of migration and regional florogenetic status of alien species. Unfortunately, the development of retrospective databases is hindered by the inconsistency of the studies. At present it seems possible to develop such bases only for the regions where the collection of data on alien species was started as early as in XIX century. For the sake of the future analysis the regions must be grouped according to their latitude and longitude. In Europe such model regions are: the Leningrad, Tver, Moscow, and Tula regions (the latitude group), and Estonia, the Leningrad and Ivanovo regions (the longitude group). The multifold analysis of the databases is required to put in order the chronological dynamics of florogenetic and invasion territorial statuses and to define the main trends. The task of modeling alien flora genesis can be successfully solved only on a larger scale. The historical analysis of alien floras should be carried out in national and international projects.

keywords: alien flora, naturalization, historical analysis of alien flora

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## THE EXPANSION OF *ARTEMISIA BIENNIS* IN RZESZÓW

*Artemisia biennis* Willd. is probably native to the Rocky Mountains, and other areas of North America. It is an aggressive weed on roadsides and open ground (e.g. empty yards) worldwide. The species was first reported in Poland by Scheuermann in 1956 (railway station Szczecin-Dąbie), and in 1980 Dobrzańska found it on a roadside bank in Mikołów (in Upper Silesia). In 1998 *A. biennis* was found in the vicinity of the main square in Rzeszów in a yard where buildings have been recently demolished. In the area of ca. 200 m<sup>2</sup> around 50 specimens of *A. biennis* grew. In 2000 the species was found near the border of the city of Rzeszów and the village of Przybyszówka. These few specimens grew on rubble. In the following year a few other specimens were recorded on a building site in the vicinity of the dam on the Wisłok (centre of the city). In 2004 three new localities in various parts of Rzeszów were recorded, the largest one composed of 30 individuals. At the moment the species occupies six localities in Rzeszów and in one of them the size of the locality shrank due to the construction of a bar. It seems that the above described expansion is an indicator of the invasion of the species in Poland and in the next years the number localities will dramatically increase, therefore I propose the moving of *A. biennis* from the list of ephemerophytes to hemiagriophytes.

keywords: *Artemisia biennis*, invasive plants, Rzeszów, SE Poland

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## ECOLOGICAL SPECTRUM OF *BROMUS CARINATUS* OCCURRENCE IN KATOWICE TOWN (SILESIA UPLAND, POLAND)

*Bromus carinatus* Hook. & Arn. native to North America is currently expanding all over the territory of Poland and in some other European countries. This neophyte was introduced to Europe as a forage grass. The cultivation of this plant started in Poland in the 60's. *B. carinatus* is presently naturalized in Poland. There are some recent reports about increasing occurrence of this species in various regions of Poland and including semi-natural habitats. In Poland *B. carinatus* is most often recorded in synanthropic habitats: nitrophilous ruderal herbs, segetal communities, grassy roadside communities, trampled communities, urbanised areas and harbours. However, *B. carinatus* is also found in wet meadow communities, forest islands and their edges.

The objectives of this research are to present the habitat spectra of the *B. carinatus* occurrence and its relationship with the forms of spatial utilization recorded in the city and determine the patterns of its distribution in administrative borders of Katowice city. We also attempt to determine group of species that co-occur with *B. carinatus* in various habitats. Numerical ecological methods have been used to analyze the data. The vegetation samples were collected from the following habitats: roadsides, railways, meadows, forests and ruderal sites by using the modified Braun-Blanquet method. The localities of *B. carinatus* were also plotted on maps, on which forms of spatial utilization have been recorded.

Preliminary result of presented study revealed that *B. carinatus* is distributed linearly along roadsides and invade mainly ruderal habitats. The numerical analyses also revealed that investigated grass species co-occur with many meadow species such as *Poa pratensis*, *Arrhenatherum elatius* and ruderal species such as *Artemisia vulgaris* and *Solidago canadensis*.

keywords: *Bromus carinatus*, Silesia Upland

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## REPRODUCTIVE ASSURANCE MECHANISM IN INVASIVE *HERACLEUM* *MANTEGAZZIANUM*

*Heracleum mantegazzianum* (Apiaceae), native to Caucasus, has become a widespread invader across Europe including the Czech Republic. This monocarpic species reproduces exclusively by seed, is self-compatible and has hermaphrodite but protandrous flowers, arranged in compound umbels. The umbels are of four orders and mature in sequence. Reproductive potential of *H. mantegazzianum* is enormous and seems to be a crucial feature of its invasion success.

Observation in an experimental garden and in natural stands in NW Bohemia, Czech Republic, showed that individual flowers are fully protandrous, precluding self-pollination. At the whole plant level, stigmas of higher-order umbels are exposed to cross-pollination for almost entire female phase, but at the end they often overlap with initial male phase of lower order umbels, allowing for geitonogamous pollination if out-crossing has not been realized. Such opportunity for delayed between-flowers self-pollination can ensure seed set of this monocarpic species if sexual partner is not available. Moreover, an overlap between flowers of the same umbel was sometimes observed. At the end of the male flowering period, the presence of several late dehiscing anthers and receptive stigmas overlaps in flowers of the same umbel, which may play role under pollinator limitation.

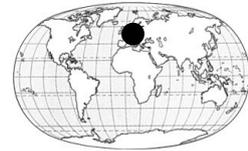
To verify selfing ability within an umbel without the presence of pollinators, 40 umbels were bagged and produced viable seeds; their mean germination was 54%, and not related to umbel position. Relative growth rate of selfed seedlings was 0.17 g/day, slightly less than RGR of open-pollinated seedlings (0.18 g/day).

*H. mantegazzianum* has a mating system which provides sufficient opportunity for outcrossing but maintains selfing as a mechanism of reproductive assurance under unsuitable conditions. Such reproductive strategy enables the species to start invasion by a single isolated plant spread by a long-distance dispersal event.

keywords: *Heracleum mantegazzianum*, reproductive assurance, self-pollination, protandry, RGR

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## DOES LANDSCAPE STRUCTURE INFLUENCE INVASIVE PLANT SPECIES DISTRIBUTION?

Landscape structure has been proven to affect plant populations distribution and dynamics as rare plant species occurrence in fragmented habitats. Landscape ecology principles have seldom been applied to the biological invasion process. We hypothesised that ecological landscape is a pertinent scale to study factors influencing plant invasions. We studied relationships between the distribution of five of the most invasive plant species (or species complex) in Belgium and the structure of two landscape units (Comblain and Kessel). Selected species were: *Fallopia japonica* / *F. bohemica*, *Heracleum mantegazzianum*, *Impatiens glandulifera*, *Senecio inaequidens*, *Solidago gigantea* / *S. canadensis*. In 2003, each landscape unit was surveyed to localize all target species populations. Landscape composition and structure were interpreted in a GIS (ArcView 30.2). Based on each species population number, *I. glandulifera* exhibited the highest invasive success in both landscapes. Habitat selection indices (SI) indicated that some habitats were more prone to invasion than expected under a random distribution hypothesis and were different between species. Based on the number of habitat selected, *F. japonica* in Comblain and *I. glandulifera* in Kessel exhibited the highest invasive success. The roads, rivers and railways networks influence on the populations distribution was also been tested. In Comblain, 87 % of populations were located under 5 m from these networks instead of 55 % in Kessel, these areas representing 9 % and 15 % of the landscape units area respectively. Landscape structure influence was assessed by logit regressions based on selected habitat patches structural characteristics. Only few tests were significant. We concluded that within-patch micro-habitats probably played a major role in the invasive plants distribution at the landscape level as shown from collected field data.

keywords: landscape structure, habitat selection, Belgium

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## THE PARTICIPATION OF THE INVASIVE ALIEN PLANTS IN THE FLORA OF THE ŁĘDZINY DISTRICT

The town and district of Łędziny is situated in the south-eastern part of the Silesian province. The environmental changes made by very intensive development of industry and lack of detailed knowledge of this area had become the basis for the research performed during the years 1999-2001. The purpose of this study was to prepare a list of species and to recognize particular distribution for each species on this area. The comparison of the research results with earlier published information showed that there are some new species, which occurred during the last 20-30 years.

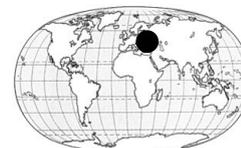
The floristic list includes 580 species of plants which were noted from this area and 497 out of this number are species found during local, own research. The Participation of kenophytes in the all flora was 8, 96 %- 52 species. The status of kenophytes was specified on the base of actual list of kenophytes in Poland. 34 species of this group were numbered among the alien invasive plants. 14 species were earlier noted from literature whereas 20 were found for the first time. Among species which were not noted earlier there are species which have only one occurrence and those which are fairly frequent as well. Regarding the species occurrence frequency on this area 10 species were recognized as very rare region, 10 species as rare, 11 species as not frequent and 3 species as frequent. There were no species recognized as very frequent or common. The habitat's group analysis showed the superiority of the species which on ruderal places- 23 species. There is an influence of the way of the Łędziny district arrangement on high ruderal species participation. There is a lot of agricultural areas (62 % of area), industrial structures and barrens. The dominating configuration is one-family dwelling-place. The Presence of some of the species might be explained by the artificial planting near The "Ziemowit" coal mine.

Clear changes which have been observed in the flora of Łędziny over the last 30 years, the growth of the kenophytes participation in the flora give the arguments for the future observation. The next local research and the analysis of the alien invasive plant distribution can provide the possibility of observing the expansion speed of the plants and give information about their habitat preferences.

keywords: Łędziny District, kenophytes

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### **TENDENCY OF DISTRIBUTION OF *ELAEAGNUS ANGUSTIFOLIA* L. IN NORTHERN BLACK SEA REGION (UKRAINE)**

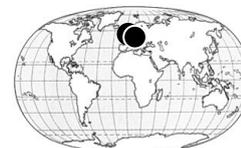
Active dispersal of *Elaeagnus angustifolia* L. is observed in the Northern Black Sea region at the end of the 20th c. The initial centers of its invasion were roadside plantations where this species was widely cultivated. Now *E. angustifolia* spread spontaneously and occurs in the region sporadically, forming more or less large stands consisting of mature and young trees, and seedlings. In man-made habitats it occurs as solitary trees or small groups. In semi-natural habitats it prefers sandy steppes, overgrazed pastures, open sands, high coastal sand dunes, floodplain meadows, steppe and stony slopes of ravines, occurring on dry soils. It penetrates in shrubby and steppe communities. On seaside dunes it forms communities of *Elaeagneta angustifoliae* formation, also occurring in *Hippophaeta rhamnoidis* formations together with *Amorpha fruticosa* and *Tamarix ramosissima*. In coastal ecotopes of the Dnepr and the S. Bug *E. angustifolia* is spreading among willow-poplar floodplain woods of the coastal strip, often together with *Amorpha fruticosa*. However, *E. angustifolia* does not tolerate prolonged flooding, and perishes at higher humidity levels. In steppe habitats this species behaves both as a weed, occupying free sites with disrupted vegetation, and also as a species actively spreading in sandy steppe and open sands. The arboreal level projective cover in these stands ranges from 10 up to 50(-70) %, that of the herbaceous layer, 40-80 %. In such places the number of steppe and psammophilic species decreases; they are replaced by meadow-steppe species; the number of mesophilic species increases. In overgrown vernal pool areas the species is suppressed, and soon perishes. There is a danger of overcompeting of natural steppe communities by this species and replacements of these communities by more mesophilic ones, which can result in degradation of the ecosystem. This work is supported by the State Fund of Fundamental Research of Ukraine.

keywords: *Elaeagnus angustifolia*, distribution, ecology, Ukraine

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## SEEDLING ESTABLISHMENT AND GENETIC DIVERSITY IN A MIXED PLOIDY POPULATION OF *FALLOPIA X BOHEMICA* IN ALSACE

There are many populations of Japanese Knotweed *s.l.* in the Alsace plain (north-east of France), extending from the Vosges (origin of the introductions) towards the Rhine along the dense network of rivers. In spite of a relatively early introduction (probably at the beginning of the 20th century), the rapid expansion of Japanese knotweed *s.l.* is relatively recent (past few decades). Many factors may be involved: 1) human causes: increase of suitable habitats by continuous forest fragmentation, embankment building, water pollution); deposits of very small portions of rhizomes along rivers or roads; 2) phenotypic plasticity associated with recent genetic diversity.

The aims of the study were first to examine the genetical diversity of populations along a ecological gradient from the Vosges (Fecht; Giessen) to the Rhine; and secondly to study in depth a portion of river where the populations show high variation in morphology and phenology. The study was carried out from 2003 to 2005.

1) Cytology and molecular analyses were performed on 33 samples of Japanese knotweed *s.l.*, mainly along the rivers Fecht and the Giessen, where populations are the most diverse and abundant. Cytologically, the results indicate an unique mix of hexaploids, octoploids and aneuploids. Without the molecular data, it is still not possible to determine whether the distribution of the octoploids is from clonal spread, spontaneous seed germination or a mixture of both processes. The three 2-3 years old seedlings (*F. x bohemica*) found along the Fecht had the following cytological composition:  $2n=66$ ; (? back-cross);  $1x2n=88 + b2n=77$  (back-cross);  $2n=75$  (back-cross). The following accessions have been examined for chloroplast haplotype using PCR RFLP analysis of the *trnK* intron, and all were found to have the *F. japonica* var. *japonica* haplotype. We are thus increasingly thinking that the most likely origin of the 8x is from an unreduced gamete from *F. sachalinensis* pollinating an octoploid *F. japonica* var. *japonica*, and these data support this hypothesis for this area of France.

2) Five of the 33 samples from the Fecht river were examined for biological traits, both vegetative (total height; size of the larger leaves; growth rate) and sexual (size and colour of inflorescences; phenology; germination success of clones producing seed). The surface area occupied by each clone was estimated along 150m. The results are currently being analysed but indicate high variations for most of these traits.

keywords: *Fallopia x bohemica*, ploidy, ecology, seedling establishment, river plain

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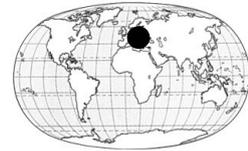
## FLORA AND VEGETATION ON WALLS IN SOUTHERN AND WESTERN MORAVIA (CZECH REPUBLIC)

Walls are specific man-made habitats, typical of human settlements and exposed to strong anthropogenic influences. Nevertheless, they provide new ecological niches and can be occupied by different types of synanthropic vegetation. Colonization of walls by vascular plants strongly depends on the availability of diaspores from the surrounding ruderal or semi-natural vegetation types. This study focuses on the wall vegetation in southern and western Moravia, Czech Republic. In total, species composition of 302 plots was recorded on vertical and horizontal wall surfaces in villages, towns and on castle ruins together with the information about local conditions, walls' surroundings and macroclimate. Altogether, 288 species of vascular plants and 39 bryophytes were recorded. Flora of the studied walls included 40 % of alien species. Compared with the representation of alien species on walls reported from other parts of the Czech Republic, this proportion is rather high and results from presence of several garden-escapes, deliberate introductions by man for ornamental purposes and higher annual temperature in the study area. The representation of archaeophytes was 24 % and the most common species were *Chelidonium majus*, *Capsella bursa-pastoris*, *Bromus sterilis*, *Ballota nigra* and *Sonchus oleraceus*. Neophytes made up 16 % of the total species number and the most frequent species were *Conyza canadensis*, *Syringa vulgaris*, *Sisymbrium loeselii*, *Erigeron annuus* and *Sedum spurium*. The ratio of native species, archaeophytes and neophytes was assessed with regard to the wall microhabitats, type of human settlement and altitudinal gradient in the study region. Moreover, the composition of families, life forms, life strategies and dispersal strategies of plants colonizing walls was described. The relationship between species composition and environmental factors was analyzed with canonical correspondence analysis.

keywords: wall flora, alien species

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## ALIEN SPECIES IN POLAND: AN ONLINE DATABASE

Collection and dissemination of information on IAS are key elements to help in solving the problems caused by invasions. In 1999, a database on all species introduced in Poland, including animals, plants, fungi was developed at the Institute of Nature Conservation, Polish Academy of Sciences in Cracow. The database was prepared for the Ministry of Environment. In 2003, part of the data was made accessible via the Internet at [www.iop.krakow.pl/ias](http://www.iop.krakow.pl/ias).

Of 575 alien species, currently present in the database, 279 belong to vascular plants. For each species, information on taxonomical position, synonyms, biology, natural distribution and distribution in Poland is compiled, as well as data on the population numbers and trend, invaded habitats, plant communities and impact upon native species. Details on the introduction are also gathered, including time, place, number of introduced individuals and pathway of introduction. For each species, need and methods of control are indicated. The majority of listed species are neophytes i.e. taxa introduced and naturalized after 1500. Only few are casual or archaeophytes (introduced before 1500) which still expand their range.

In future, new alien species will be added to the database and data on the species already included will be updated. The database will be linked to the Nordic-Baltic Network on Invasive Species (NOBANIS) and Global Invasive Species Information Network (GISIN).

keywords: alien species, invasive species, databases

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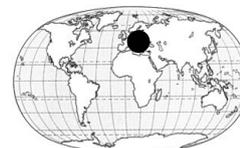
## **NOBANIS: NORDIC-BALTIC NETWORK ON INVASIVE SPECIES**

The Nordic/Baltic Network on Invasive Alien Species (NOBANIS) ([www.sns.dk/nobanis](http://www.sns.dk/nobanis)) will develop a distributed but integrated network of common databases encompassing national and regional specialist databases in the Nordic/Baltic countries. A common portal will facilitate access to the IAS-related data, information and knowledge in the region. NOBANIS will provide a tool for exchanging information on invasive alien species from Greenland to Northern Russia and from Northern Norway to Germany and Poland. NOBANIS will provide administrative tools for making the precautionary approach operational in preventing the unintentional dispersal of invasive alien species and mitigating adverse effects of IAS on biological diversity. NOBANIS will include searchable lists of alien species, a catalogue of experts on alien species, species accounts, species distributions and recommended preventative, eradication and control measures. The lists of introduced species in NOBANIS will be used to identify species that are invasive at present and species that may in the future become invasive. NOBANIS will also provide the foundation for the future development of an early warning system for invasive alien species. It will be possible to extract information from NOBANIS for facts sheets for dissemination to authorities, specialists, the news media and the general public. NOBANIS will establish a network for cooperation between competent authorities of the region and contribute to implementing recommendations from the 6th Conference of Parties of the Convention on Biodiversity's and Recommendation No. 99/2003 of the Bern Convention to establish regional cooperation to aid in eradication, control and mitigation of ecological effects of invasive alien species.

keywords: alien species, databases, Nordic-Baltic region

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## **THE CHARACTERISTIC OF THE ARCHAEOPHYTES APPEARING IN THE AREA OF THE CEDYNSKI LANDSCAPE PARK (NW POLAND) – DISTRIBUTION, HABITAT CONDITIONS, THE DEGREE OF NATURALIZATION AND PRESENT THREATS**

On the basis of the original field studies made in 1998-2003 and historical data recorded during 149 years of geobotanical investigations carried out in the area of Cedyński Landscape Park 105 species of archaeophytes were found, including mainly segetal (61) and ruderal (41) species.

The highest number of archaeophytes appears occasionally on the natural and seminatural habitats (44 species), or do not appear in these habitats at all (19 species), as in the case of *Hordeum murinum* L., *Thlaspi arvense* L. The other archaeophytes are very often associated with these type of habitats (19 species) and 6 species became fully naturalized, like *Carduus crispus* L., *Camelina microcarpa* Andr. subsp. *sylvestris* (Wallr.) Hiitonen. During the research 17 species of archaeophytes, which have been recorded by previous authors, were not found any more, and 35 species of the species (approx. 40%) were considered as rare and very rare.

keywords: archaeophytes, synantrophization, threatened plants

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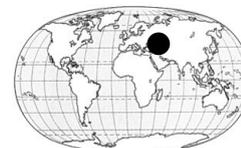
## THE MORPHOLOGICAL AND ECOLOGICAL CHARACTERISTIC OF INVASIVE PLANT FROM *SOLIDAGO* L. GENUS

The *Solidago* genus is one of the most complexes among the genera of higher plants. Variability of this genus is still enlarged by hybridization and introgression, due internal properties, additionally influenced by ecological factors. In Central Europe occur naturally five representatives of *Solidago* (goldenrods), but only one species, *S. virgaurea* L. is native in Europe. Other four taxa; *S. canadensis* L. s.l. (var. *canadensis* and var. *scabra*), *S. gigantea* Ait. and *S. graminifolia* (L.) Salisb. are of alien origin. They were introduced into Europe from areas of its original distribution in eastern North America in the 18th century as horticultural plants. In Lower Silesia territory the most often taxons are *S. canadensis* var. *scabra* and *S. gigantea*, *S. canadensis* var. *canadensis* occurs rarer. Actually these species are considered as a dangerous to native vegetation and function of ecosystems of meadows and riversides in Poland. Expensive taxa of genus *Solidago* shows morphological similarity and they taxonomical status in Europe (particularly *S. canadensis* s.l.) is still discussed. To the contrary, *S. graminifolia* doesn't show any evidence of aggressive expansion, area of distribution this species is limited to a single geographical locality in Lower Silesia. The micrometrical features witch depressed *Solidago* taxa are: leaf type, hairs on adiaxial epidermis, stomata index of adiaxial epidermis and leaf thickness.

keywords: expansive neophytes, goldenrods, leaf morphology, epidermis, intergenera variability, SEM

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## INVESTIGATION ON INVASIVE PLANTS IN ARMENIA

The study and control of invasive alien plants are one of the main priorities in nature and biodiversity conservation. At present, data on the spread and distribution of invasive plant species in the territory of the Republic of Armenia, and their impact on agricultural and natural areas are missing.

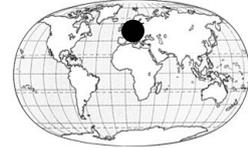
Armenia is presently crossed by the main route between Iran and Georgia and toward Russia. The deficiency of the State Quarantine Service has much facilitated the entry of new alien plant species in particular along transport routes. These alien species are potential hazards for the conservation of native biodiversity, agriculture and natural ecosystems. In addition, large stocks of crop seeds received as humanitarian assistance were probably contaminated by weeds. Indeed, this is a very well known route of introduction worldwide.

In the last two years we started the study of the recent spread of invasive species and their impact on biodiversity and natural ecosystems with special concern to pastures and hayfields. We focussed our researches on recently invaded areas: border territories and representative areas along the main roads in the country as well as in the surroundings of the main railway stations. Estimates of invasion dates and history will be inferred from our survey and existing herbarium and literature records, so that older, widespread invasions may be discriminated from new, emerging invasions (for which control may be more feasible).

keywords: flora of Armenia, natural ecosystems, invasive plants

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## **HYBRIDIZATION AND SEXUAL REPRODUCTION IN THE ALIEN INVASIVE COMPLEX *FALLOPIA* ADANS. (POLYGONACEAE) IN BELGIUM**

In this paper, we consider the role of the sexual reproduction in the dispersal capacity of the invasive alien complex *Fallopia* Adans (Polygonaceae) in Belgium: *F. japonica*, *F. sachalinensis*, *F. baldschuanica* and hybrids (*F. x bohémica*, *F. x conollyana*). Hybridization in this complex may contribute to the formation of new populations capable of sexual reproduction and backcross with the parent plants and potentially adapted to climatic conditions of their new environment.

We followed the different steps of the sexual reproduction including: the floral biology, the reproductive success, the total seed production, the seed rain, the seed bank, and the germination capacity of seeds, seedlings survival. The taxonomic status of adults and seedlings issued from sexual reproduction were assessed by mitotic root tip chromosome counts.

The flowering period lasts from August to October. The sterile male character of *F japonica* is confirmed, clones produce little or not pollen, compared with the hybrids ones. However, in both of them, the number of pollen deposited on the stigma is relatively low and the fructification is weak (about 0,20 %). Nevertheless, there is a significant production of seeds that have a high rate of viability, a capacity of dispersal to more 12 meters around the parent plant and a significant proportion of seedlings that survive outside.

keywords: *Fallopia*, *Polygonaceae*, floral biology, reproductive success, total seed production, seed rain, seed viability, seed bank, seedlings survival

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## REGIONAL SCALE ASSESSMENT OF ALIEN PLANT INVASIONS: A CASE STUDY FOR THE SILESIAN UPLAND (SOUTHERN POLAND)

The aim of this study is to compile a list of alien invasive species occurring in the Silesian Upland with an estimation of their status in the region and with special attention to those species which have the largest share in transformations of natural and semi-natural plant communities.

From the total number of 460 alien species considered to be naturalised in the Polish flora, 336 species which occur in the Silesian Upland have been subjected to analysis. For subsequent selection and estimation of the threat posed by these species, the following criteria have been adopted: number of localities in the region, population size (abundance) in each locality, invasion rate, occupied biotopes. Detailed evaluation has been carried out with regard to the group of species which infiltrate natural and semi-natural plant communities. Necessary data for estimation of the degree of invasiveness for these species have been collected during field studies conducted in Silesian Upland in the years 1990-2004 (species mapping in a grid of 2 x 2 km<sup>2</sup>).

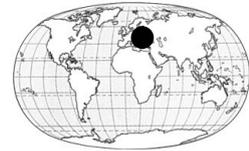
Phytosociological relevés have also been carried out in communities with a large share of species that most seriously threaten the native plant cover.

The regional list of invasive plants includes 123 species. Within this group, 61 species have been characterised as "non-harmful", 22 as "weeds", and 40 as "transformers". 14 species belonging to the group of "transformers" which are characterised by exceptional competitive abilities have been selected as most important with regard to the threat they pose to native flora and vegetation. The following species pose the most serious threat to the native flora: *Impatiens parviflora*, *Heracleum sosnovskii*, *Solidago canadensis*, *S. gigantea*, *Reynoutria japonica*, *R. sachalinensis*, *R. x bohemica*, *Quercus rubra*, *Padus serotina*, *Bidens frondosa*, *Aster novi-belgii*, *Echinocystis lobata*, *Acer negundo* and *Robinia pseudoacacia*. The obtained results will form a basis for future multi-faceted studies on alien invasive species in this region as well as for practical actions.

keywords: evaluation, criteria, threatened natural habitats, Upper Silesia, Poland

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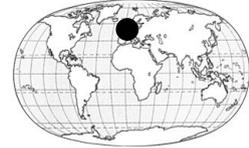
## STRATEGY AND BEHAVIER OF ALIEN SPECIES IN INDUSTRIAL REGION

It has been determined that all the stream of alien species going to the south east of Ukraine, being distributed in technogenous ecotopes, is differentiated by some basic groups of ecotopes according to the degree of species anthropotolerance and ecologic capacity of ecotope. By means of multidimensional statistics methods it has been ascertained that adventive fractions of technogenous ecotope floras form in a factor space three separate groups which are formed in: non-toxic primary and secondary technogenous ecotopes; toxic secondary ecotopes (by-product coke industry, chemical, metallurgical works); toxic primary ecotopes (ash-, slag and sludge dumps, ferromanganese dumps, zirconium quarries). Special investigations of the differences among the adventive fractions groups testify that spontaneous separation of all migrating species into various groups in factor space is explained by the fact that they are colonizing technogenous ecotopes of different degree of anthropogenic transformation and in result they have different anthropogenous tolerance. Under the increase of anthropogenic impact in technogenous ecotope, there is observed the increased number of annual plants, xeromesophytes, terophytes from holarctic, pluriregional or Euroasian range types, North American, Mediterranean or Asian species from Asteraceae and Chenopodiaceae families in adventive fractions of floras.

keywords: alien flora, anthropogenic habitats

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### **ALIEN PLANTS IN THE FLORA OF THE UK BLACK COUNTRY**

For the last seven years we have been recording the vascular plant flora of the 700 km squares which make up the old industrial area of the UK West Midlands. This includes the cities of Birmingham and Wolverhampton and the Boroughs of Walsall, Sandwell and Dudley, some areas of which have had a history of industrialisation spanning more than 200 years. We will present distribution data for a range of species and discuss spatial and temporal patterns in the alien flora.

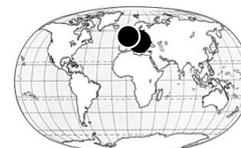
keywords: industrialisation; spatial distribution; urban flora

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### **DO ALIEN PLANTS REALLY PREFER POST-INDUSTRIAL WASTE SITES?**

The invasion of habitats by non-native species is a global phenomenon. Most alien plants are considered to be pioneer species that colonise urban-industrial disturbed areas.

Long-term investigations on post-industrial waste sites have in part focused on the quantitative and qualitative characteristics of the neophytes which are able to establish on the sites studied and their environmental requirements. Floristic data were collected by preparing plant lists for each of 137 coal mine water sedimentation pools and 100 coal spoil heaps. Site substrate samples were also collected and analysed to determine the site conditions in which the neophytes had established. Lists of the most frequent neophytes will be presented in the paper together with data about their frequency, abundance and localities.

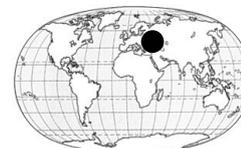
The preliminary results show that for the coal mine water sedimentation pools neophytes made up less than 25% of the whole flora (453 species). Neophytes constituted 12% of the whole of the flora of the coal mine heaps (581 species). Supporting data is drawn from the literature, including investigations of the flora of a brown coal excavation and Solvay process slurry tips. It is concluded that the floras of many post-industrial sites include a smaller proportion of neophytes than characterise the regional floras as a whole and that the extreme conditions which prevail appear to favour native species.

keywords: post-industrial waste sites, neophyte establishment

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## STRUCTURE AND CHARACTERISTICS OF THE RECENT ALIEN FLORA AT REGIONAL SCALE: THE EXAMPLE OF THE KRAKÓW-CZĘSTOCHOWA UPLAND (SOUTHERN POLAND)

Recent alien flora (neophytes, newcomers) was a subject of studies conducted during the years 1997-2004 in the Kraków-Częstochowa Upland, situated in southern Poland. Total number of recorded species amount to 152, including mostly adventive species, several taxa of anthropogenic origin (e.g. species from genus *Oenothera*), and some species of uncertain origin. Flora of newcomers is much diversified. The species differ in origin, frequency, ability of spread and range of ecological tolerance. Based on above-mentioned criteria they were divided into 3 groups:

1. Plants which do not tend to spread further. These are species introduced by man, mostly of anthropogenic or unknown origin.
2. Species expanding their range and abundance but only limited to man-made habitats.
3. Invasive plants, entering semi- and natural biotopes. These species are capable to exclude native elements of flora, what leads to changes in structure of plant communities.

On the basis of distribution of the studied species in the Kraków-Częstochowa Upland it is concluded that they occur the most abundantly in vicinities of large towns and along transport routes (highways, railways). Statistical analyses of frequency and tendency to occurrence in particular habitats by aliens and of their traits reveal some significant relationships. More invasive alien plants seem to occur in less lit places. They also prefer colder conditions and show calcareous/nitrogen input gradient compared to less invasive plants. The species which are more often to be found in natural and semi-natural habitats also belong to the group of the most frequent plants. Only few species, compared to whole newcomers flora, invade natural plant communities in protected areas i.e. nature reserves and landscape parks. Despite this, species as *Impatiens parviflora*, *Solidago canadensis* or *S. gigantea* are serious threat to native biodiversity.

The study was partially supported by KBN, no. project 3 P04 G 093 25 and 6 P04 G 052 19 (Urbisz A. 2004. Synopsis of the vascular plant flora of the Kraków-Częstochowa Upland. Uniwersytet Śląski. Katowice, Poland, pp. 285)

keywords: alien flora, regional scale, Poland

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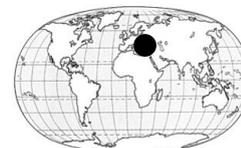
## EXPANSION OF *IMPATIENS GLANDULIFERA* ROYLE ON THE AREA SURROUNDING THE BABIA GÓRA NATIONAL PARK

The first localities of *Impatiens glandulifera* from neighbouring area were published in the sixties of the previous century. They were localized in Porąbka and Żywiec (Żywiecka Basin) and also Sucha Beskidzka (vale of Skawa river). Near the Babia Góra massif, *Impatiens* became very popular species of cultivated plant. The way of its propagation, migration pace and habitat requirements caused expansion on the area surrounding the Babia Góra National Park. In 2004 season there were observed over 50 stands of this species. 50 % of them are localized on natural and seminatural habitats (alluvia of streams, tall herbs, meadows) the rest, on synanthropic habitats (roadside thicket). Moreover it was stated that it is cultivated, around the Babia Góra massif, in about 100 domestic gardens, which have been still main source of the expansion. The highest locality is on the southern side of the massif (769 m a. s. l., Zubrzyca Górna). The locality nearest the border of the Babia Góra National Park is in Zawoja Markowa (730 m a. s. l., northern slopes). The most frequently *Impatiens glandulifera* occurs in groups of 10–150 specimens in *Phalarido-Petasitetum hybridi*, *Chaerophylletum aromatici*, *Petasitetum kablíkiani* and *Alnetum incanae* phytocoenoses.

keywords: *Impatiens glandulifera*, expansion, Babia Góra

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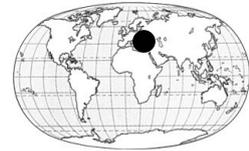
## INVASIVE AND POTENTIALLY INVASIVE PLANTS IN BALKAN PART OF SERBIA

Most of Serbian territory belongs to Balkans area, which is separated from Pannonian part (Vojvodina) by rivers Sava and Danube. For a long time it was believed that Vojvodina due to its position, absence of relief barriers and agricultural character, is predestined for the immigration and further spread of adventive plants, while the further spread toward south is stopped or impeded by Sava and Danube and the hilly-mountain massifs of Balkan part. Due to misconception that adventive plants are primarily weeds or ruderal plants, their spread in the Balkan part of Serbia has for a long time been poorly documented. The new data, particularly regarding the invasive plants, show that above-mentioned estimations were groundless. Certain weed invasive species (*Ambrosia artemisiifolia*, *Iva xanthifolia*) which were for a long time known only for Vojvodina, presently in the Balkan part form thick stands in the ruderal habitats along roads, and are also recorded in many places with the cultivated species. The group of invasive and potentially invasive weeds also includes *Conyza canadensis*, *Erigeron annuus*, *Xanthium spinosum*, *Amaranthus retroflexus*. Primarily grown as decorative plants, *Helianthus decapetalus* and *H. rigidus*, long known for the ruderal habitats, in recent years show a tendency of invasive spontaneous spreading. The special threat for the region are those invasive species (*Ailanthus altissima*, *Amorpha fruticosa*) which from the anthropogenous habitats spontaneously spread to habitats of autochthonous vegetation threatening the natural diversity of flora and the plant communities structure. The recent arrival in Serbia of *Reynoutria japonica* deserves a special attention concerning the data on invasive spreading in neighboring regions. The report will show the results of floristic, classification and chorological analysis, distribution and ecology, as well as the estimate of further behavior of invasive and potentially invasive species in the Balkan part of Serbia.

keywords: Serbia, Balkan part, invasive plants

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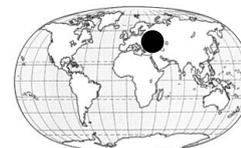
## TOP TEN INVASIVE SPECIES IN THE BULGARIAN FLORA

The Bulgarian flora comprises some 3900 vascular plant species including the neophytes. Until recently alien and invasive species have not received any particular attention. However, at the end of 2004 the Ministry of Environment and Waters funded two projects: 1) on the invasive plants and fungi and 2) on the invasive animals. The overall goal of the invasive plant project is to make an inventory of the alien and invasive plants and fungi in the country as well as strengthen the scientific basis for elaboration of a national strategy on the invasive species. The poster presents the mid-term results for ten invasive alien plants in Bulgaria among which are *Ailanthus altissima*, *Ambrosia artemisiifolia*, *Bidens frondosa*, *Conyza canadensis*, *Galinsoga parviflora*, *Impatiens glandulifera* and *Reynoutria bohemica*. Data about the paths and means of entering the country and further spreading are presented. Also, the research needs and future steps in the prevention and control of the invasive plants in Bulgaria are discussed.

keywords: Bulgaria, invasive species, vascular plants

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### ***HERACLEUM SOSNOWSKYI* MANDEN AND *H. MANTEGAZZIANUM* SOMMIER & LEVIER IN THE AREA OF SUB TATRA TROUGH (SOUTHERN POLAND)**

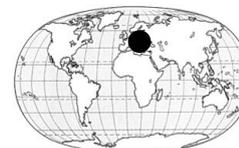
*Heracleum sosnowskyi* Manden is a species of Asiatic origin, introduced to Poland as a fodder plant. It is herb plant, characterized by fast growth of biomass and presence of substances of photo-allergic reactions (Blazek 1969, Lutyńska 1974, Kohlmünzer 2003, Jędrzejko, Walusiak 2004). The acclimatization and experimental studies on *H. sosnowskyi*, as a fodder plant, were conducted in 1970s in Chair of Pasture Plants, Institute of Plants Cultivation and Acclimatization in Gubałówka (Zakopane). Despite promising results of these investigations (Lutyńska 1980) regular cultivation of this plant never became popular in Poland. After cessation of the cultivation in Gubałówka the species quickly spread within the area of Sub Tatra Trough. Its main migration pathways are watercourses. At the river and streams banks there are favorable habitats for its development. It was observed that within borders of Zakopane town Giant Hogweed grows abundantly along river Zakopianka but more numerous populations are at further sections of the river. The second Giant hogweed species, native of Asia, is *Heracleum mantegazzianum* Sommier & Levier which colonizes more frequently natural habitats in the study area in recent years. This is similar plant in the structure and traits to *H. sosnowskyi* but differing in leaves margins. It was probably introduced as an ornamental plant to gardens and further it escaped from cultivation sites to natural habitats. Both mentioned species of *Heracleum* are strongly invasive (highly competitive) in the colonized habitats. Thanks to shoot competition they limit growth of other plants, especially native species of smaller sizes. Huge shoots and leaves hamper influx of sunlight to herb and moss layers. Also root competition, for water and nutrients, is of considerable importance.

The study was supported by KBN, no. project 2PO4G 02527

keywords: *Heracleum sosnowskyi*, *H. mantegazzianum*, Sub Tatra Trough

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## **ALIEN SPECIES IN VASCULAR FLORA OF SMALL RIVERS IN WEST POMERANIA LAKELAND**

Human activity can change local flora significantly. Rare local species disappear, and new alien species come in their place. The most exposed to these changes are riverside carrs, communities of an open character that can easily be invaded by allochthonous elements. The river serves as an effective transport pathway for their diaspores. Therefore, the aim of this study was to draw the most comprehensive list of alien species in some rivers in the West Pomerania Lakeland and present their spatial distribution in the area. I tried to determine how invasive the alien species are and to find the possible routes of migration. The study covered four rivers: Ina, Pezinka, Krępa and Płoń. I have used also the results from floristic studies carried out between 1998 and 2002. The field studies were carried out using ATPOL cartogram grid. The cartograms show the present state of alien species distribution in the selected little rivers of the West Pomeranian Lakeland and the possible directions of their expansion.

keywords: alien species, small rivers, NW Poland

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## ANTHROPOPHYTES IN THE VASCULAR FLORA OF THE SELECTED NATURE RESERVES OF THE SILESIAN PROVINCE

Plant resources protected in 61 nature reserves of the Silesian Province are influenced by anthropopressure. Human activity results in synanthropisation of the flora. One of the symptoms of this negative process is the penetration of protected forest communities by anthropophytes. This study was an attempt at assessing the frequency of anthropophytes occurring within 7 nature reserves of different anthropopressure intensity. As a result of floristic investigation and on the basis of published information, a total of 37 species of anthropophytes were identified within these nature reserves. Among alien species, kenophytes were the most numerous group (22 species). Archaeophytes (10 species) were less numerous. With regard to diaphytes, i.e. new arrivals not established permanently within the Silesian Province, only one ephemerophyte and four ergasiophytes were noted. For each examined nature reserve, two floristic indices were calculated in order to assess the contribution of alien plants to their floras: total flora anthropophytisation index and permanent flora anthropophytisation index. The values of these indices were highest in the nature reserves situated within cities, near housing estates and transport routes. Thus, in Katowice they reached 10.9 and 9.33 in Las Murckowski and 7.22 and 6.85 in Ochojec, while in Segiet Nature Reserve in Bytom – 7.08 and 7.08. The lowest values were recorded in Zadni Gaj Nature Reserve (2.62 and 2.62) and in Kopce Nature Reserve (1.58 and 1.58). The most invasive alien plant is *Impatiens parviflora*, which was frequent in all investigated nature reserves. This species was found not only along forest roads and paths, but also on the edges of nature reserves and in ruderal habitats. Furthermore, this anthropophyte was noted frequently and abundantly in typical forest habitats, where it caused a decrease in the number of native species of the herb layer.

keywords: Silesian Province, antopophytes, nature reserves

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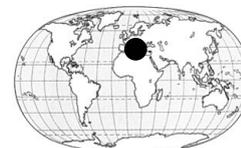


## **ANTHROPOPHYTES IN THE FLORA OF SELECTED LIMESTONE HILLS IN THE REGION OF PODLESICE IN THE CZESTOCHOWA UPLANDS**

Attractive landscape and natural assets of the area around Podlesice are the reason of launching research in this region. The village of Podlesice, which belongs to the Kroczyce district is situated in the Czestochowa Uplands. This area is characterized by numerous limestone hills forming ranges and rock groups, including the Kroczyckie, Rzedkowickie, Morskie and Podlesickie Rocks, all of which stand out from the landscape. Great site mosaic is conditioned by various geological structure and surface features, which is reflected by the great number of plant community types. Therefore beech woods, dry-ground forests, pine woods, thermophilous thicket and xerothermic grass can be found here. The aim of the research was to inventory the vascular plants in the rock groups of the Rzedkowickie, Morskie and Kroczyckie Rocks. Particular attention was given to rare and synanthropic species because of anthropic pressure which has been growing locally in recent years. Among the 415 vascular plants species which have been listed there are a lot of rare plants, e.g. 64 taxa listed in the Upper Silesia Vascular Plants Red List and 33 protected species. At present man influences in the studied stands comprises rock climbing, tracking, camping and related activities such as lighting of fires and littering. Such activities result in the appearance of synanthropic species. Nearby ploughlands have also influenced the flora. The share of anthropophytes in the flora of these hills is about 13%, archeophytes being the most numerous among them (7 %). Newcomers comprise also species which are planted in nearby gardens for aesthetic reasons, which find a new home in seminatural and natural communities, e.g. *Echinops sphaerocephalus*, *Solidago canadensis*.

keywords: limestone hills, anthropophytes, Czestochowa Upland

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### AFLPS TO ASSESS THE STATUS OF *POPULUS ALBA* L. OF SARDINIA

*Populus alba* L. is a common species of central-European and Mediterranean riparian forest. Molecular analysis demonstrated a high level of genetic variability and the presence of hybrid individuals in Northern Italy. On the basis of these results and on recent evidences of the indigenous status in the western Mediterranean, we extended the survey to the spontaneous populations of *P. alba* present in the island of Sardinia (Italy), whose origin is still a subject for discussion. A total of 105 trees were sampled in 2003 in natural and semi-natural habitat types, over a large area located in the North-West of Sardinia. DNA was purified from apical shoots and AFLP analysis was performed using three primer pair combinations. Geographic coordinates of the sampled trees, collection site features and AFLP profiles were stored on a GIS system for further geographical visualisation and GLM analysis of the data. The AFLP analysis originated a wide array of reproducible and informative DNA bands, however only three different fingerprintings, geographically clustered, were observed among the 105 assayed trees. The lack of paleobotanical evidences of an ancient presence of *P. alba* in Sardinia, together with AFLP results raise the question about the origin status of this taxon. AFLP and geographical analyses would suggest that the spontaneous population of white poplar of the North-West of Sardinia has been originated by vegetative propagation from only three ancestor genotypes. Several hypotheses on the origin of the Sardinian white poplar can be drawn. Our molecular data, at present, cannot confirm or refuse any of the hypotheses, therefore a deeply survey at molecular level of *P. alba* populations present in the Mediterranean basin is necessary to track the origins of Sardinian white poplar. To this end, since 2004, we started a second collection campaign on South Sardinia and on other islands and sites of the Mediterranean basin.

keywords: AFLP, *Populus alba* L., Sardinia, assessing origin status