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Expansion of *Acer platanoides* L. in areas freed from human impact

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Abstract: The participation of *Acer platanoides* was studied in so-called synanthropic wildwoods, which developed spontaneously on synanthropic sites after the cessation of direct human impact, in 2002-2004 in Poznań and its surroundings. The ruderal sites where the maple wildwoods arose and floristic differences between them are described on the basis of phytosociological relevés. *A. platanoides* was the most frequently noted tree species in wildwoods on potential sites of oak-hornbeam forests. In many patches it was the dominant plant. With a high constancy it occurred in wildwoods composed of various trees of meso- and eutrophic deciduous forests. The degree of cover by the herb layer and its species richness were low in the young maple wildwoods. Nitrophilous tall-herbs characteristic of forest edges, fallow species of the order *Agropyretalia*, as well as meadow species had the highest degrees of cover there. The unstable species composition and the domination of common species with wide ecological scales characterized the wildwoods with *A. platanoides*. The floristic differences between phytocoenoses were connected with the type of occupied anthropogenic site.

Key words: *Acer platanoides*, expansion, anthropogenic habitats, plant communities

1. Introduction

In Poland, the area of grounds where human impact has been reduced, has increased since the late 1980s. A lot of shrub and tree species are encroaching on these places, especially *Acer platanoides* (Jackowiak 1990; Boratyński & Filipiak 1999), which in favourable conditions forms dense woods there (Tumiłowicz 1999; Tylkowski 1999). The initial maple forests that arose in urban areas were first documented in Germany (Passarge 1990). There are no data from Poland about parallel communities.

This paper describes the participation of *A. platanoides* in phytocoenoses that developed spontaneously in ruderal sites after the cessation of direct human impact, i.e. in so-called 'synanthropic wildwoods' or 'wild urban woodlands' (Jorgensen *et al.* 2005; Kowarik 2005). Attention was paid to the characterizing of the disturbed places where maple wildwoods arose and floristic differences between them.

2. Material and methods

The presented results are a part of a larger project concerning the phenomenon of encroachment of trees and shrubs on synanthropic sites.

Field investigations were carried out in 2002-2004 in Poznań city and its surroundings. All the documented wildwoods are spontaneously developing communities. They are not relicts of forest communities or forest degeneration and regeneration stages. The examined plant communities were documented with the aid of phytosociological relevés, which were made according to the Braun-Blanquet approach, modified by Barkmann *et al.* (1964). The vertical structure of phytocoenoses and the ruderal sites where wildwoods developed were characterized. The time of human impact cessation was determined on the basis of various maps, data about the way the land is used, as well as oral information from inhabitants.

The nomenclature of vascular plants was given after Mirek *et al.* (2002). The names of syntaxonomic units followed Brzeg & Wojterska (1996).

In the analysis, 344 phytosociological relevés with *A. platanoides* (Norway maple) were used. The description of wildwoods dominated by this species was based on 61 phytosociological relevés. In these patches, the share of *A. platanoides* in the canopy was above twice as big as that of other tree species, as regards the cover-abundance value (according to the scale of Barkmann *et al.* 1964). These were the maple-dominated

wildwoods after about 10-20 years of secondary succession.

3. Results and discussion

A. platanoides was the most frequently noted tree species in synanthropic wildwoods on potential habitats of oak-hornbeam forests. In many patches this species was the dominant plant. It was observed on various ruderal sites (Fig. 1): very often on roadsides, fallow lands, in abandoned gardens as well as around old sheds and garages. *A. platanoides* occurred with a very high constancy (about 90% of relevés) in wildwoods with *A. pseudoplatanus* and *Carpinus betulus*. Frequently it also grew in wildwoods with *Robinia pseudoacacia* (50%) and *A. negundo* (50%) as well as in phytocoenoses with *Fraxinus excelsior* (41%) and *Ulmus laevis* (33%). Seedlings of *A. platanoides* were very often noted under *C. betulus* (77% of relevés). *A. platanoides* was the most frequently observed tree species among seedlings also in the woods dominated by *A. pseudoplatanus, R. pseudoacacia* and *U. laevis*.

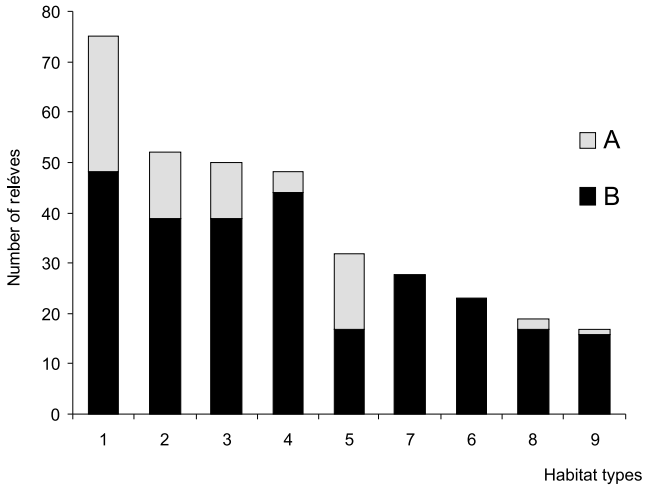

Fig. 1. Domination (A) or lower contribution (B) of *Acer platanoides* on various anthropogenic sites
Explanations: 1 – roadsides; 2 – abandoned gardens; 3 – around old sheds and garages; 4 – along tramlines and railway tracks; 5 – fallow lands; 6 – near soccer stadiums; 7 – sites disturbed by earthworks; 8 – along fences and hedges; 9 – others

According to Jackowiak (1990), *A. platanoides* occurs on diverse anthropogenic sites. It occupies fallow lands, abandoned gardens and orchards, ruins of buildings, as well as railway embankments (Boratyński & Filipiak 1999; Tylkowski 1999).

A. platanoides has a large share in forests dominated by *R. pseudoacacia* (Chojnacki 1991). Some authors (Kohler & Sukopp 1964; Kowarik 1990) suggest that in these phytocoenoses, *A. platanoides* may in time become a dominant species. Its seeds slow down the germination of seeds of *R. pseudoacacia*, which in turn stimulate the germination of *A. platanoides* seeds (Zaicev 1960, from Tylkowski 1999).

The ecological expansion (in meaning of Jackowiak 1999) of *A. platanoides* is a result of its biological ability and accessibility of diaspores, as it is a commonly planted tree. *A. platanoides* shows a lot of characteristics of pioneer species. Besides, the maple seedlings and saplings can grow under a dense canopy of other trees (Boratyński & Filipiak 1999).

The documented phytocoenoses dominated by *A. platanoides* occupied small areas (mean 47 m^2, max. 100 m^2). Under a dense tree canopy (mean degree of cover 95%), herb and moss layers had a low degree of cover (means 8% and 3%, respectively). The average number of herbs in patches was only 9. The majority of the 87 recorded herb species occurred sporadically. Only 13 species were observed with constancy >20% and 3 species with constancy >40%.

Nitrophilous tall-herbs of forest edges (31%), fallow species of the order *Agropyretalia* (30%), as well as meadow species (15%) had the highest degrees of cover. Trees and shrubs made up a numerous group (33 taxa), but the average number of shrub species per relevé was merely about 4. The trees most commonly growing with *A. platanoides* were *A. pseudoplatanus* (51% relevés) and *Fraxinus excelsior* (39%). Among seedlings, only *A. platanoides* occurred with a high constancy (64%).

According to Boratyński & Filipiak (1999), a dense shade under *A. platanoides* reduces the growth of seedlings of other tree species and herbaceous plants. The rich forest litter of *A. platanoides* has an allelopathic influence on undergrowth (Boldyrev 1992, from Boratyński & Filipiak 1999).

The floristic differences between the maple wildwoods were connected with the types of occupied anthropogenic sites (Table 1). *Clematis vitalba* and *Solidago canadensis* grew with a high constancy in phytocoenoses that developed around old sheds and garages. Fallow species of the order *Agropyretalia* (*Cirsium arvense* and *Equisetum arvense*) as well as the weed *Vicia angustifolia* distinguished patches on abandoned fields. Nitrophilous species, such as *Lactuca serriola*, *Urtica dioica* and *Chelidonium majus*, were noted in abandoned gardens. In wildwoods on roadsides, meadow species (e.g. *Festuca rubra*, *Dactylis glomerata* and *Arrhenatherum elatius*), fallow species (e.g. *Elymus repens* and *Convolvulus arvensis*), and ruderal species (e.g. *Melandrium album*, *Artemisia vulgaris* and *Atriplex patula*) occurred with high constancy. Thermophilic species (e.g. *Poa angustifolia*, *Agrimonia eupatoria* and *Torilis japonica*), species with strong rhizomes (*Calamagrostis epigejos*), and plants with procumbent stems (*Potentilla reptans* and *Trifolium repens*) were noted along tramlines and railway tracks.

Similar initial maple woods were reported by Passarge (1990). The patches developed around old sheds and garages seem to represent the *Artemisia-Acer* community (Passarge 1990, Table 2, rel. 1 and 5). The wildwoods found in abandoned gardens are similar to the *Alliaria-Acer* community (Passarge 1990, Table 3, rel. 2 and 3) as well as the *Hedera-Acer platanoides* community (Passarge 1990, Table 4, rel. 2-12). A new association *Anthrisco-Aceretum platanoides*, described by Passarge (1990), includes older secondary maple

Table 1. Floristic differentiation of undergrowth in woods with *Acer platanoides* on various anthropogenic sites

Number of anthropogenic sites	3		5		2		1		4	
Number of reléves on sites	7		16		10		24		4	
Total number of herb species in sites	16		26		26		79		21	
Mean number of herb species in relevé	4		9		8		12		8	
Ch. *Stellarietea mediae*										
Vicia angustifolia			**II**	**69**						
Lactuca serriola	I	1			**III**					
Atriplex patula					II	**6**	I	3		
Descurainia sophia					I	15	III	75		
Fallopia convolvulus					I	1	II	7		
Ch. *Agropyretalia*						1	II	5		
Cirsium arvense			III	13	I					
Equisetum arvense			IV	173	III	1	II	8		
Elymus repens	I	7	II	284	III	71	II	29		
Convolvulus arvensis			I	7	I	75	V	473	1/4	3
Carex hirta						55	III	20		
Calamagrostis epigejos							II	34		
Ch. *Artemisietea*							I	21	**2/4**	**450**
Urtica dioica			I	3	**V**					
Artemisia vulgaris			I	4	II	**248**	I	8		
Melandrium album						20	IV	26		
Poa compressa	II	14	I	3			IV	108		
Cichorium intybus									1/4	12
Ch. *Molinio-Arrhenatheretea*									1/4	3
Taraxacum officinale agg.	IV	100	III	244	II					
Festuca rubra	II	14				11	IV	23	2/4	5
Dactylis glomerata			I	3	II		III	77	1/4	12
Arrhenatherum elatius			I	6		20	III	42		
Heracleum sphondylium							II	50		
Poa pratensis							II	10		
Rumex acetosa							II	29		
Potentilla reptans							I	3	2/4	5
Trifolium repens							I	5	1/4	3
Ch. *Festuco-Brometea et *Trifolio-Geranietea***									1/4	12
*Euphorbia cyparissias**										
*Poa angustifolia**							**II**	**29**		
Agrimonia eupatoria							I	21	2/4	25
*Pimpinella saxifraga**							I	4	2/4	25
Astragalus glycyphyllos							I	3	1/4	3
Hypericum perforatum									2/4	5
Ch. Galio-Calystegietalia									1/4	12
Clematis vitalba	V	1893								
Solidago canadensis	III	10	II	125	I				1/4	125
Geum urbanum	I	7	III	46	I	5			1/4	12
Chaerophyllum temulum	I	71	I	34	I	10	II	82	3/4	443
Anthriscus sylvestris			I	3		10	II	67		
Veronica sublobata	I	250					II	69		
Galium aparine			III	8	III	411	I	2		
Chelidonium majus					IV	121	I	6		
Torilis japonica			I	3	IV	640				

Shortened table

Explanations: 1 – roadsides; 2 – abandoned gardens; 3 – around old sheds and garages; 4 – along tramlines and railway tracks; 5 – fallow lands

forests with large shares of: *Tilia cordata*, *Quercus robur*, *Robinia pseudoacacia*, and *A. pseudoplatanus*. In that community, nitrophilous tall-herbs of forest edges dominate in the undergrowth, which resembles ruderal communities.

4. Conclusions

- *Acer platanoides* is the most expansive species among the trees that encroach on fertile anthropogenic sites.
- In disturbed places, *A. platanoides* is a pioneer species, which initiates the development of forest. On the other hand, this plant is one of the best-adapted species to self-sowing and growth under a dense canopy of trees of meso- and eutrophic deciduous forests.
- *A. platanoides* strongly reduces both the development of herbs characteristic of open sites and the natural regeneration of other tree species.
- The young maple wildwoods are aggregations with an unstable and poor species composition of undergrowth. Common species with wide ecological scales dominate among herbaceous plants.
- The floristic differences between the initial maple wildwoods are connected with the various types of occupied anthropogenic sites.

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References

Barkman J. J., Doing H. & Segal S. 1964. Kritische Bemerkungen und Vorschläge zur quantitativen Vegetationsanalyse. Acta Bot. Neerl. 13: 394-419.

Boratyński A. & Filipiak M. 1999. Zarys ekologii. In: W. Bugała (ed.). Nasze drzewa leśne. Klony, pp. 275-327. Instytut Dendrologii PAN w Kórniku. Bogucki Wyd. Nauk., Poznań.

Boldyrev K. A. 1992. Reasons for the absence of a herbaceous cover in broadleaved forest of the Volga uplands. Lesovedenie 4: 15-21.

Brzeg A. & Wojterska M. 1996. Przegląd systematyczny zbiorowisk roślinnych Wielkopolski wraz z oceną stopnia ich zagrożenia. Bad. Fizjogr. Pol. Zach. seria B-Botanika 45: 7-40.

Chojnacki J. 1991. Zróżnicowanie przestrzenne roślinności Warszawy. 227 pp. Wyd. Uniw. Warszaw., Warszawa.

Jackowiak B. 1990. Antropogeniczne przemiany flory roślin naczyniowych Poznania. Wyd. Nauk. UAM, seria Biologia, 42, 232 pp. Poznań.

Jackowiak B. 1999. Modele ekspansji roślin synantropijnych i transgenicznych. Phytocoenosis vol. 11 (N.S.) Sem. Geobot. 6: 3-16.

Jorgensen A., Hitchmough J. & Dunnett N. 2005. Living in the urban wildwoods: a case study of Birchwood, Warrington New Town, UK. In: I. Kowarik & S. Körner (eds.). Wild urban woodlands. New perspectives for urban forestry, pp. 95-116. Springer-Verlag, Berlin-Heidelberg-New York.

Kohler A. & Sukopp H. 1964. Über die soziologische Struktur einiger Robinienbestände im Stadtgebiet von Berlin. Sber. Ges. Naturf. Freunde Berlin 4: 74-88.

Kowarik I. 1990. Zur Einführung und Ausbreitung der Robinie (*Robinia pseudoacacia* L.) in Brandenburg und zur Gehölzsukzession ruderaler Robinienbestände in Berlin. Verh. Berliner Bot. Ver. 8: 33-67.

Kowarik I. 2005. Wild urban woodlands: towards a conceptual framework. In: I. Kowarik & S. Körner (eds.). Wild urban woodlands. New perspectives for urban forestry, pp. 1-32. Springer-Verlag, Berlin-Heidelberg-New York.

Mirek Z., Piękoś-Mirkowa H., Zając A. & Zając M. 2002. Flowering plants and pteridophytes of Poland. A checklist. In: Z. Mirek (ed.). Biodiversity of Poland 1, 442 pp. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków.

Passarge H. 1990. Ortsnahe Ahorn-Gehölze und Ahorn-Parkwaldgesellschaften. Tuexenia 10: 369-384.

Tumiłowicz J. 1999. Klony w zadrzewieniach. In: W. Bugała (ed.). Nasze drzewa leśne. Klony, pp. 547-566. Instytut Dendrologii PAN w Kórniku. Bogucki Wyd. Nauk., Poznań.

Tylkowski T. 1999. Rozmnażanie generatywne. In: W. Bugała (ed.). Nasze drzewa leśne. Klony, pp. 199-227. Instytut Dendrologii PAN w Kórniku. Bogucki Wyd. Nauk., Poznań.

Zaicev G. M. 1960. Vzaimodejstvie prorastajuščich semjan ostrolistnogo klena i robinii. Priroda, Moskva 49(10): 86-87.