

A centre of occurrence of *Viscum album* subsp. *album* in eastern Bohemia and an overview of the diversity of its host plants in the Czech Republic

Ohnisko výskytu *Viscum album* subsp. *album* ve východních Čechách a přehled hostitelských dřevin v České republice

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A literature survey revealed that the semi-parasitic evergreen shrub *Viscum album* subsp. *album* (*Viscaceae*) has been recorded on 53 taxa of deciduous trees and shrubs (including five hybrids) in the Czech Republic. Of the host taxa, 26 are native and 27 alien to the Czech flora. The range of hosts covers 13 families. *Salicaceae* (11 taxa), *Rosaceae* (11) and *Aceraceae* (7) are most represented among families. Of the 22 genera harbouring mistletoe, *Populus* (7 taxa), *Acer* (7), *Tilia* (5) and *Fraxinus* (4) are most represented. A locality at the castle park in the town of Heřmanův Městec, E Bohemia, is reported in detail. In 1978–1981 and 2001, *Viscum album* subsp. *album* was observed on 15 host taxa of trees and shrubs, which represents the second highest diversity of host trees in a single locality in the Czech Republic; the richest one, previously reported by Unar et al. (1985) is the Lednice castle park, S Moravia, with 24 taxa. Four more host taxa were recorded in the studied town of Heřmanův Městec outside the park, giving the total of 19 hosts concentrated within a limited area. The occurrence of mistletoe on *Prunus padus* is reported for the first time from the Czech Republic.

Key words: Czech Republic, host trees and shrubs, semi-parasitic plant, *Viscum album* subsp. *album*

Introduction

Viscum album L. (*Viscaceae*) is a semi-parasitic evergreen shrub growing on branches, rarely also on trunks, of woody species. The species is dioecious, with fly-pollinated flowers. Fruits are taken by birds but viscid tissue on seeds prevents most seeds from being swallowed and birds scrape it off into bark crevices where it germinates (Mabberley 1997). Fruits spread by endozoochory germinate better than those not passed through bird intestines (Kubát 1997). As a semi-parasite, the species takes aqueous solutions of mineral substances and probably also assimilates from the host plant, and provides the host with part of its own assimilates that protect it from animal pests and fungal diseases. The presence of mistletoe usually does not result in a serious damage to the host plant. *Viscum album* is distributed in Europe, with a native range to S Scandinavia in the north, Ukraine and Crimea in the east, and as an introduced species in Ireland and the northern part of Great Britain. It is scattered in the temperate zone of Asia, up to E China and Japan (Kubát 1997). The species is reported as an alien in North America (Hawksworth & Scharpf 1886). In the Czech Republic, three subspecies occur: subsp. *austriacum* (Wiesb.) Vollmann and subsp. *abietis* (Wiesb.) Abromeit are confined to conifers, and subsp. *album* to dicotyledonous host trees and shrubs (Kubát et al. 2002).

The distribution of *V. album* subsp. *album* in the Czech Republic is rather uneven; it is missing from large areas, e.g. central and W Bohemia, but common in other parts of the country such as central and NE Moravia or the surroundings of the town of Břeclav in S Moravia (Kubát 1997). As to the phytogeographical regions (Skalický 1988), the occurrence is concentrated in the Mesophyticum altitudinal floristic region and it is only sporadically found in the warmer Thermophyticum; such localities are mostly close to the boundary with the former region. It grows only rarely at higher altitudes of the Oreophyticum region (Radhošťské Beskydy Mts in NE Moravia and Šumava Mts in SW Bohemia). The altitudinal maximum is in the SE part of the Šumava Mts at 755 m a.s.l. (Balda in Procházka & Kovářiková 1999).

In the Czech Republic, *V. album* subsp. *album* was reported to occur on about 20 genera of woody host plants, growing mostly as lone trees in parks, garden and alleys, along rivers and in settlements. Better knowledge of the mistletoe distribution on host plants is constrained by the fact, that despite a large body of literary data and herbarium specimens available, most of these records do not give information on the identity of host woody species. The present paper summarizes the results of long-term systematic observations on the occurrence of mistletoe in the town of Heřmanův Městec, where a remarkable number of host tree species was recorded, and reviews available data on the diversity of host plants of *V. album* subsp. *album* in the Czech Republic.

Study area

The occurrence of mistletoe in the town of Heřmanův Městec (district of Chrudim, E Bohemia) has been reported in the literature for more than hundred years. It was first mentioned by Zitko (1887: 21) who reported it as growing “on poplars in the castle park, most abundantly by the pond”. Almost 100 years later, Houfek (1973) reported the observations by R. Neuhäusl who observed *Viscum* “on limes in Heřmanův Městec, in castle park and alley along the road to Chrudim”.

The occurrence of *V. album* L. subsp. *album* in the town of Heřmanův Městec (49°57' N, 15°39' E; 5 500 inhabitants) and in adjacent villages was systematically studied by the present author in 1978–1981 and 2001, predominantly in the winter. The centre of the occurrence of mistletoe in this area is the castle park in Heřmanův Městec. The castle is a late-baroque building from 1784. Southwards of the castle, there is an English style park 0.36 km² in size. Unfortunately, nothing is known about its building. It is unlikely that it was built at the time the original baroque building was completed. It was probably built later, maybe as late as after 1828 when the castle was bought by the prince Rudolf Kinský. With the exception of several oaks that are much older than the park could possibly be, the age of the oldest trees, forming the basis of the park's architectural design, can be estimated at maximum of 170–200 years. This supports the idea that the park was founded in the 1800s–1830s. The park is valuable from the landscaping viewpoint, and consists almost exclusively of native trees, supplemented by only a few very common alien species (e.g. *Acer saccharinum*, *Pinus strobus*, *Quercus rubra*, *Robinia pseudacacia*¹).

The study area, including the park and the surroundings of the Heřmanův Městec, is located at the altitude of 240–400 m a.s.l.; the lowest part of the study area is formed by the

¹ Nomenclature of taxa follows Kubát et al. (2002), that of phytosociological units Neuhäuslová et al. (1998)

valley of the Klešice stream W of the Jezbořice village, the highest in the surroundings of the Kostelec near Heřmanův Městec and Uherčice villages. The park itself is located at the altitude of 290–300 m.

The area lies in a moderately warm climatic region, a humid hilly district with mild winters (B3 in the classification of climatic regions, Vesecký et al. 1958). In the north, it borders on the warm climatic region, a moderately dry district with mild winters (A3). Mean annual temperature is 8.2–8.5 °C, annual precipitation reaches 593–622 mm (Přelouč and Chrudim meteorological stations, 50 years average – Vesecký et al. 1958).

According to the map of potential natural vegetation (Neuhäuslová et al. 1998), Heřmanův Městec and its nearest surroundings lie in the area of oak-hornbeam and lime-oak woodlands (*Carpinion*), higher altitudes southward of the area studied in that of acidophilous beech and silver fir woodland (*Luzulo-Fagion*) and stream valleys S of Heřmanův Městec belong to alluvial woodlands (*Alnion incanae*).

Native species prevail in the flora of the castle park and many of them are characteristic of deciduous mesophilous forests of the order *Fagetalia*: *Acer campestre*, *Actaea spicata*, *Adoxa moschatellina*, *Aegopodium podagraria*, *Alliaria petiolata*, *Alnus glutinosa*, *Anemone nemorosa*, *Asarum europaeum*, *Carex brizoides*, *C. sylvatica*, *Carpinus betulus*, *Chaerophyllum temulum*, *Corydalis cava*, *C. pumila*, *Dactylis polygama*, *Euphorbia dulcis*, *Ficaria verna*, *Gagea lutea*, *G. villosa*, *Hedera helix*, *Lamium maculatum*, *Lathraea squamaria*, *Maianthemum bifolium*, *Mercurialis perennis*, *Petasites hybridus*, *Poa nemoralis*, *Polygonatum multiflorum*, *Primula elatior*, *P. veris*, *Prunus padus*, *Pulmonaria obscura*, *Ranunculus auricomus* agg., *R. lanuginosus*, *Veronica sublobata*, *Viola reichenbachiana*, *V. riviniana*, *Viola ×dubia*.

The avifauna of the park and its surroundings is rich. Of frugivorous birds, main dispersers of mistletoe, four species need to be mentioned: song thrush (*Turdus philomelos*) nests here, while fieldfare (*Turdus pilaris*), mistle thrush (*Turdus viscivorus*) and waxwing (*Bombycilla garrulus*) only occur as vagrants.

Occurrence of *Viscum album* subsp. *album* in Heřmanův Městec and its surroundings

The occurrence of *Viscum album* subsp. *album* in the castle park of Heřmanův Městec and details of the degree and frequency of colonization of particular host trees and shrubs is summarized in Table 1. *Acer pseudoplatanus* and *Tilia cordata* are often colonized to a very high degree; extensive colonization was also recorded on *Salix alba* and its hybrid with *S. babylonica* (= *S. ×sepulcralis*), but only on a single tree. The record of mistletoe parasitizing on *Loranthus europaeus* represents the third reported case in the Czech Republic. It was reported previously from Bytřice pod Hostýnem in Moravia where *Loranthus*, the host of mistletoe, parasitized on *Quercus petraea* (Zavřel 1973), and from between the villages of Strachotín and Dolní Věstonice (S Moravia) by Unar et al. (1985). In total, 15 taxa of woody plants were recorded as colonized by mistletoe in the park during the study period (Table 1). In addition, mistletoe was previously reported occurring on two more species in the park: *Aesculus hippocastanum* and *Fraxinus excelsior* (J. Krátká, pers. comm. 1980). However, despite thorough investigation during the study period, mistletoe was not found on these trees that are frequent in the park. The occurrence of *Viscum album* subsp. *album* on *Ae. hippocastanum* and *F. excelsior* cannot be excluded because

Table 1. – The degree and frequency of infestation of host trees by *Viscum album* subsp. *album* in the castle park in the town of Heřmanův Městec, E Bohemia, as recorded in 1978–1981 and 2001.

Host species	Degree of infestation	Frequency
<i>Acer campestre</i>	very low	on more trees in one place
<i>A. platanoides</i>	moderate	in more places
<i>A. pseudoplatanus</i>	high	in various places
<i>A. saccharinum</i>	moderate to high	in more places
<i>Alnus glutinosa</i>	very low	only in place near the pond
<i>Betula pendula</i>	moderate	on more individuals in two distant places
<i>Carpinus betulus</i>	very low	on several trees in one place
<i>Loranthus europaeus</i>	very low	on the host parasiting on <i>Quercus robur</i> trees forming two distant groups
<i>Populus nigra</i>	moderate	on a single tree at the W margin of the park
<i>Prunus padus</i>	very low	on a single tree
<i>Robinia pseudoacacia</i>	moderate	on several trees forming few groups
<i>Salix alba</i>	moderate to high	on a single tree near the W margin of the park
<i>S. xsepulcralis</i> ¹	high	on a single old tree between the pond and the castle
<i>Sorbus aucuparia</i>	low	on a single, rather young tree
<i>Tilia cordata</i>	very high	mostly on old trees in the park, but younger trees are also colonized

¹ *S. alba* × *S. babylonica*

both were reported as hosts from towns in neighbouring Slovakia, Bratislava (Hajdúk 1977) and Prešov (Rejmánek et al. 1978).

Taxa of woody plants recorded as hosts of mistletoe in the town of Heřmanův Městec are listed in Table 2. Outside the castle park, *Tilia cordata* trees are infested in the alley along the road to Chrudim (Neuhäusl in Houfek 1973) and on other places, e.g. the town square. *Viscum* was further found growing on *Robinia pseudoacacia* near the petrol station on the road to Chrudim and at the Jewish cemetery, on *Sorbus aucuparia* by the road opposite to the petrol station, on *Betula pendula* by the road to Konopáč, and on *Salix alba* in a garden behind the western wall of the park. In addition, four trees and shrubs that do not occur as hosts in the castle park were infested by mistletoe in the inhabited area of the town, namely in gardens adjacent to the W margin of park: *Crataegus monogyna* (a weak infestation of a single old tree), *Malus domestica* (a strong infestation of numerous old trees in several gardens), *Populus xcanadensis* (weak infestation in several places) and *Pyrus communis* (weak infestation in two gardens).

In the surrounding villages outside the Heřmanův Městec town limits, mistletoe occurs on several trees that were also recorded as hosts within the town: *Tilia cordata*, *Malus domestica*, *Populus nigra*, *Robinia pseudoacacia* and *Sorbus aucuparia* (see Fig. 1 for the distribution of mistletoe in particular villages). The occurrence of *Viscum* on *Tilia cordata* in Kostelec near Heřmanův Městec was reported already by Zitko (1887). In Morašice, the colonized rowan tree belongs to *Sorbus aucuparia* var. *moravica* Zenger.

Table 2. – Overview of host taxa of *Viscum album* subsp. *album* recorded in the present study and compared with other localities in the Czech Republic that were surveyed in detail and a high diversity of *Viscum* host trees and shrubs was recorded. Regions within the Czech Republic are indicated in parentheses (E – east, S – south, N – north; B – Bohemia, M – Moravia). Records marked ? are uncertain, i.e. not verified by the present study (see text for details); in totals these are considered in parentheses. Taxa are ranked according to decreasing frequency. Cultivars and forms are not listed.

Species	Family	Locality (region) and source													
		Hěřmanův Městec ¹ (EB) this study	Zlín ² (NM) Tomášek 1974, 1981	Kroměříž ² (SM) Zavřel 1973	Hranice na Moravě (NM) Unar 1981	Litomyšl ² (EB) F. Procházka & V. Faltyš, Skalkický 1974 unpubl.	Písek ² (SB) Houfěk 1973, Žlebčik 1975	Zašová (NM) Unar et al. 1985	Lednice ³ (SM) Unar et al. 1985	Number of occurrences (n = 8)					
<i>Tilia cordata</i>	Tiliaceae	+	+	+	+	+	+	+	+	+	+	+	+	8	
<i>Acer pseudoplatanus</i>	Aceraceae	+	+	+	+	+	+	+	+	+	+	+	+	7	
<i>Populus nigra</i>	Salicaceae	+	+	+	+	+	+	+	+	+	+	+	+	7	
<i>Robinia pseudoacacia</i>	Fabaceae	+	+	+	+	+	+	+	+	+	+	+	+	7	
<i>Sorbus aucuparia</i>	Salicaceae	+	+	+	+	+	+	+	+	+	+	+	+	7	
<i>Malus domestica</i>	Rosaceae	+	+	+	+	+	+	+	+	+	+	+	+	6	
<i>Acer platanoides</i>	Aceraceae	+	+	+	+	+	+	+	+	+	+	+	+	4	
<i>Acer saccharinum</i>	Aceraceae	+	+	+	+	+	+	+	+	+	+	+	+	3	
<i>Betula pendula</i>	Betulaceae	+	+	+	+	+	+	+	+	+	+	+	+	3	
<i>Carpinus betulus</i>	Corylaceae	+	+	+	+	+	+	+	+	+	+	+	+	3	
<i>Loranthus europaeus</i>	Loranthaceae	+	+	+	+	+	+	+	+	+	+	+	+	3	
<i>Acer saccharum</i>	Aceraceae	+	+	+	+	+	+	+	+	+	+	+	+	2	
<i>Alnus glutinosa</i>	Betulaceae	+	+	+	+	+	+	+	+	+	+	+	+	2	
<i>Crataegus monogyna</i>	Rosaceae	+	+	+	+	+	+	+	+	+	+	+	+	2	
<i>Juglans nigra</i>	Juglandaceae	+	+	+	+	+	+	+	+	+	+	+	+	2	
<i>Populus xcanadensis</i>	Salicaceae	+	+	+	+	+	+	+	+	+	+	+	+	2	
<i>Pyrus communis</i>	Rosaceae	+	+	+	+	+	+	+	+	+	+	+	+	2	
<i>Salix alba</i>	Salicaceae	+	+	+	+	+	+	+	+	+	+	+	+	2 (3)	
<i>Salix fragilis</i>	Salicaceae	+	+	+	+	+	+	+	+	+	+	+	+	1 (2)	
Total number of host species		19 (21)	14	11	9	5 (7)	6	5	24						

Host woody plants recorded in only one locality: Hěřmanův Městec: *Acer campestre*, *Aesculus hippocastanum*?, *Fraxinus excelsior*?, *Prunus padus*, *Salix xserpuleralis*; Zlín: *Aesculus xcarnea*, *Populus simonii*, *P. tremula*, *Quercus robur*; Kroměříž: *Aesculus pavia*, *Crataegus laevigata*; Lednice: *Acer negundo*, *Celtis occidentalis*, *Crataegus chrysoarpa*, *C. macrocarpa*, *Fraxinus americana*, *F. tomentosa*, *Malus dasycarpa*, *Populus canadensis*, *Salix xrubens*, *Tilia americana*, *T. tomentosa*.

Additional taxa recorded as hosts from the Czech Republic: *Acer tataricum*, *Betula papyrifera*, *Cercasus mahaleb*, *Fagus sylvatica*, *Fraxinus angustifolia*, *Populus alba*, *P. balsamifera*, *Tilia euchlora*, *T. platyphyllos* (Unar et al. 1985 from Moravia), *Corylus avellana* (Tubef 1923), *Fraxinus pennsylvanica*, *Malus floribunda* (Skalkický 1974).

¹ Castle park and the town; ² Settlement and its surroundings; ³ Castle park

Discussion

Castle park as a centre of mistletoe dispersal

The centre of occurrence of *Viscum album* subsp. *album* in the territory studied is the castle park, both in terms of the variation of host trees and of the degree of infestation. The number of mistletoe individuals in the park was estimated to exceed 5 000. More than 70 individuals were counted on several *Tilia cordata* trees in the close vicinity of the castle. In the park, *Viscum* grows on 15 host tree taxa, and four more were recorded in the study area outside the park. In total, 19 species and hybrids of host trees were recorded with certainty in the park and its surroundings, and the occurrence of two more, although they were not confirmed by the present study, cannot be excluded. Of the host trees recorded, *Prunus padus* was never reported as a host plant for *Viscum album* subsp. *album* in the Czech Republic before, and *Alnus glutinosa* only by Unar et al. (1985) from two localities in Moravia.

The park seems to act as a focus of mistletoe dispersal into adjacent landscape. This is supported by obvious decrease in both number of host trees and degree of their infestation in the surrounding villages with increasing distance from the park (Fig. 1). This pattern can be also observed in the alley along the road from Heřmanův Městec to Chrudim, where the high degree of *Tilia cordata* infestation gradually decreases with increasing distance from the town. The most distant occurrence was recorded in the Jezbořice village, only 4 km from Heřmanův Městec. Outside the town, only those species on which mistletoe grows frequently not only in Heřmanův Městec but also elsewhere in Czech Republic (*Tilia cordata*, *Malus domestica*, *Populus nigra*, *P. ×canadensis*, *Robinia pseudacacia*, *Sorbus aucuparia*) were recorded as hosts (Fig. 1)

Interestingly, the only historical source reporting the occurrence of *V. album* subsp. *album* in the castle park (Zitko 1887) does not mention *Tilia cordata* as a host tree; it only gives poplars. Currently, *Tilia cordata* is the most frequent host species, while only a single *Populus nigra* tree harbours mistletoe and this tree does not grow near the pond as reported by Zitko (1887). It is not possible to decide with certainty whether this historical record is erroneous (which is improbable) or whether the spectrum of host trees has changed in the course of the last century.

The occurrence of *Viscum album* subsp. *album* in Heřmanův Městec is obviously associated with the presence of the frugivorous bird species, northern waxwing (*Bombycilla garrulus*). During the past decades, when systematic ornithological investigation was carried out in this territory, this species was regularly recorded in winter, even in years when it was not reported as a vagrant from any other locality in Czech Republic. Moreover, Heřmanův Městec is the only locality where nesting of this bird was recorded and it is only known as vagrant from elsewhere in the Czech Republic (J. Sklenář, pers. com.). This indicates that a close relationship between this frugivorous bird species and its food source evolved in this limited area, and that mistletoe represents an important source of food in the winter, also in years when birds do not find sufficient supply of soft-fruit trees elsewhere. The presence of waxwings obviously facilitates the dispersal of *Viscum album* subsp. *album* within the area.

In the broader surroundings of the study area, *Viscum album* was recorded neither in the district of Chrudim (Zitko 1887) nor in that of Pardubice (Hadač & Hadač 1948). Only *Viscum album* subsp. *austriacum* occurs in these regions. In E Bohemia, the nearest localities of *V. album* subsp. *album* are in broader surroundings of Litomyšl, about 60 km from

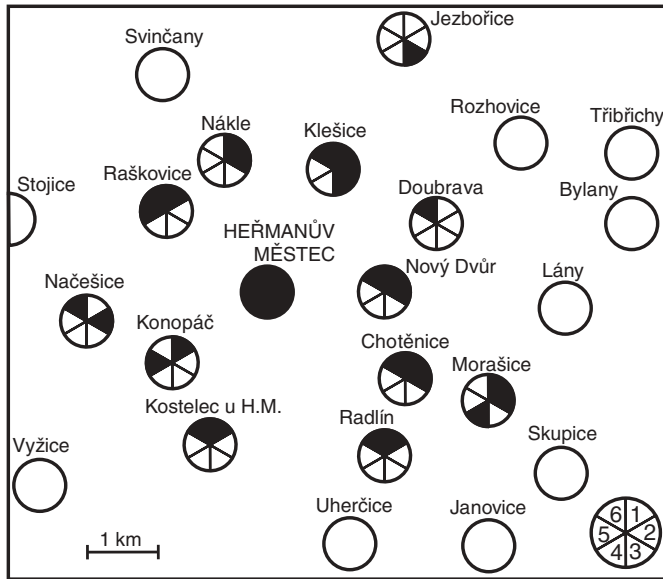


Fig. 1. – Occurrence of *Viscum album* subsp. *album* on host trees in the surroundings of Heřmanův Městec (E Bohemia). Species: 1 – *Malus domestica*, 2 – *Populus nigra*, 3 – *Populus x canadensis*, 4 – *Sorbus aucuparia*, 5 – *Robinia pseudacacia*, 6 – *Tilia cordata*.

Heřmanův Městec. It grows in Litomyšl, Janov, Pazucha, Kozlov, Suchá, Němčice, Dvořiště, Příluka, Chotovice, Nové Hrady and Strakov, most extensively in the latter village. In Litomyšl, the following host trees were recorded by the present author (Table 2): *Tilia cordata*, *Robinia pseudacacia*, *Malus domestica* and *Populus nigra*. In addition, *V. album* subsp. *album* grows on *Acer pseudoplatanus*, *Sorbus aucuparia* and *Salix* spec. div., probably also on *S. alba* and *S. fragilis* (V. Faltys, pers. com.).

Diversity of host trees and shrubs in the Czech Republic

The first overviews of host plants of *Viscum album* in the Czech Republic were published by Tubeuf (1923: 346–349) and Wangerin (1937). The latter author lists *Acer* sp., *Corylus avellana*, *Malus domestica*, *Populus* sp., *P. tremula*, *Pyrus communis*, *Robinia pseudacacia*, *Salix* sp., *Sorbus aucuparia* and *Tilia* sp. as host plants, and considers unfounded reports on the occurrence of mistletoe on *Alnus* sp., *Fraxinus excelsior*, *Prunus avium*, *P. domestica*, *Quercus* sp. and *Ulmus* sp. as dubious. At present, lists of host taxa of *V. album* subsp. *album* are available from 8 localities studied in detail in the Czech Republic (Table 2). The site richest in species is the castle park at Lednice (S Moravia) where 24 taxa were recorded (Unar et al. 1985). With 19 taxa, the study area reported in this paper is the second richest in host species, followed by the region of Zlín where 14 host trees were recorded (Tomášek 1974, 1981), Kroměříž and its surroundings with 11 tree species (Zavřel 1973) and Hranice na Moravě with 9 host tree species (Unar 1981). Fewer host trees are reported from other areas: 6 from the region of Litomyšl (F. Procházka & V. Faltys, unpubl.), 6 from Písek (Slaba in Houfek 1973, Skalický 1974) and 5 from the village of Zašová in the district of Vsetín (Žlebčík 1975).

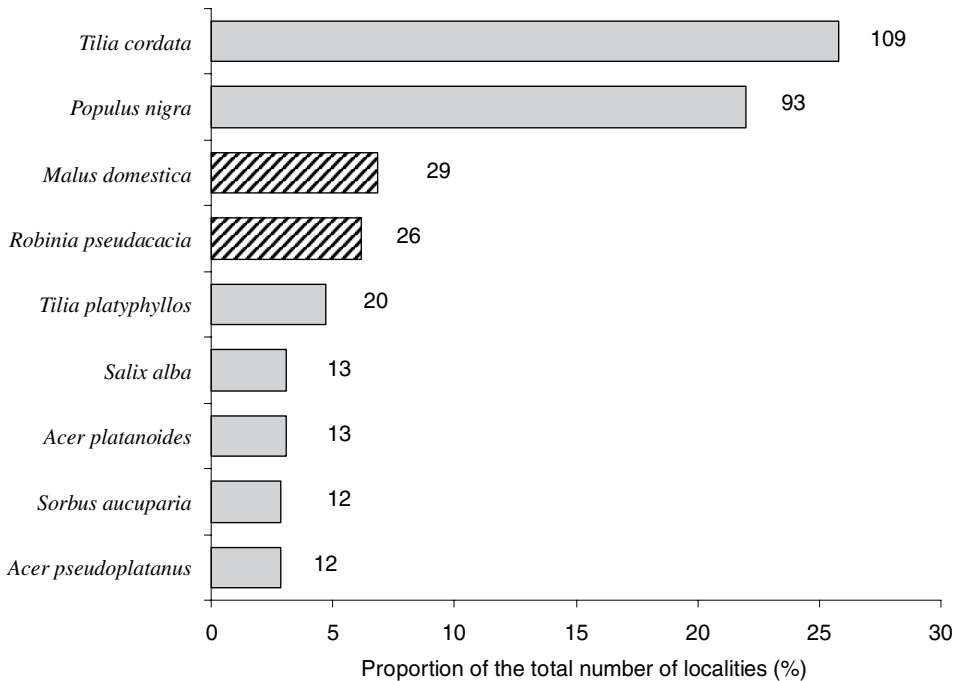


Fig. 2. – Species recorded as most frequent hosts of *Viscum album* subsp. *album*. Based on data of Unar et al. (1985) from Moravia (n= 423, localities where host woody were not determined to species level are excluded). Cultivars and forms and included within species. Alien species are indicated by hatched bars. Number of localities is shown next to the bar.

Some tree species found in the centres of occurrence (Table 2), namely *Acer pseudoplatanus*, *Malus domestica*, *Populus nigra*, *Robinia pseudacacia*, *Sorbus aucuparia* and *Tilia cordata*, were reported as mistletoe hosts also from other areas in the Czech Republic (Houfek 1973, Zavřel 1973, Kubát 1974, Skalický 1974, Skalický et al. 1978, Unar 1981, Jehlík & Větvíčka 1982, Unar et al. 1985, Kučera 1989). The overview of host taxa in the Czech Republic is completed by 9 additional species, not recorded in the centres of occurrence, that resulted from a detailed mistletoe distribution study in Moravia (Unar et al. 1985; see Table 2) and by few other reports from particular localities: *Corylus avellana* (Velká Bystřice – Tubeuf 1923: 349), *Fraxinus pennsylvanica* (Římice WNW of Litovel, Nové Mlýny – Skalický 1974), *Malus floribunda* (Prague – Nové Město, Botanical garden of the Charles University – Skalický 1974). Table 2 provides a complete overview of the diversity of host woody plants and documents that *Viscum album* subsp. *album* was up to now recorded on 53 taxa of deciduous trees and shrubs (excluding cultivars) in the Czech Republic, five of which are hybrids. Of the host taxa, 26 are native and 27 alien to the Czech flora. The range of hosts covers 13 families, among which *Salicaceae* (11 taxa), *Rosaceae* (11), *Aceraceae* (7), *Tiliaceae* (5) and *Oleaceae* (5) are most represented. Of the 22 genera harbouring mistletoe, *Populus* (7 taxa), *Acer* (7), *Tilia* (5), *Crataegus* (5) and *Fraxinus* (4) are most frequent in terms of host species numbers. This distribution, however, at least to some extent, reflects species richness of families and frequency of planting, which determines how often particular species are encountered as lone trees in the landscape.

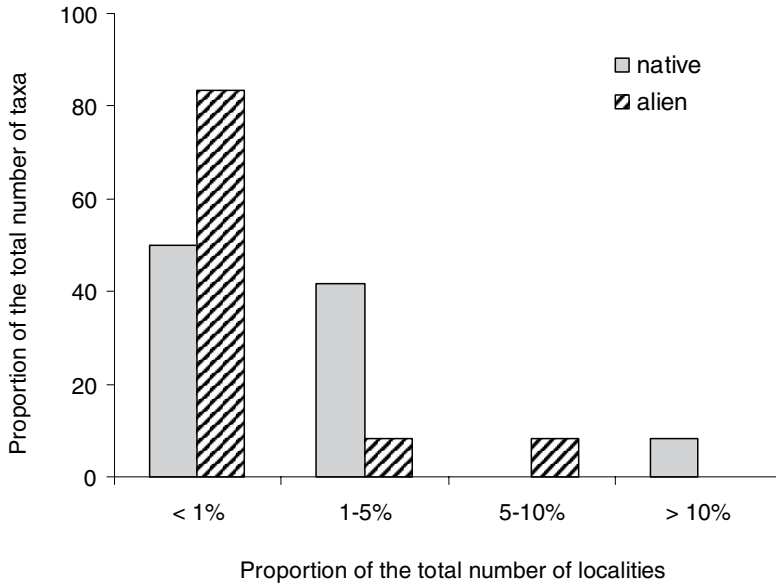


Fig. 3. – Frequency of native and alien taxa as host for *Viscum album* subsp. *album* in Moravia, Czech Republic. Based on data of Unar et al. (1985). Percentage of the total number of species recorded as hosts ($n = 24$ for both alien and native) with a given frequency ($n = 453$) is shown.

The survey made by Unar et al. (1985) provides a suitable basis for evaluating the frequency of host trees and shrubs over a broader geographical areas. These authors recorded 457 localities of *Viscum album* subsp. *album* in Moravia. Localities where the host tree was only determined to the genus level were excluded and the distribution of mistletoe in the resulting 423 localities is summarized in Fig. 2. *Tilia cordata* (25.8% of the total number of localities) and *Populus nigra* (22.0%) were the most frequent host trees, and together account for almost a half of the records. *Malus domestica* (6.9%), *Robinia pseudacacia* (6.1%) and *Tilia platyphyllos* (4.7%) are other frequent hosts and only nine species (Fig. 2) were found as hosts in more than 10 localities. They account together for 74.5% of the total number of records, while the other 39 species recorded by Unar et al. (1985) make up the remaining 25.5% of localities. It may be concluded that the ranking of the most frequent host species in Moravia corresponds well to the pattern observed for the distribution centres studied in detail (Table 2).

Although there are species that seem to be universal hosts for mistletoe in the Czech Republic (Fig. 2), in some areas *Viscum album* subsp. *album* prefers certain host species. In NW Bohemia it grows almost exclusively on *Malus communis* (Kubát 1997) while in E Bohemia, *Tilia cordata* is the most frequent host tree. This phenomenon is not sufficiently explained and requires further study.

Available information makes it possible to comment briefly on the intraspecific variation of host trees. Mistletoe may occur on different intraspecific taxa of the same species, e.g. *Betula pendula* f. *pendula*, *B. pendula* cv. *Laciniata* (Heřmanův Městec, Napajedla – Tomášek 1981) and *B. pendula* f. *dalecarlica* (Lednice – Unar et al. 1985), or *Sorbus*

aucuparia var. *aucuparia* and *S. aucuparia* var. *moravica* (Morašice, Bystřice pod Hostýnem – V. Faltys, pers. com.). The occurrence seems to be more restricted in other genera, e.g. *Populus*: Although *Viscum* is often found on *Populus nigra*, Kubát (1997) pointed out that there is no reliable report from Central Europe of it growing on *Populus nigra* cv. *Italica*. However, mistletoe has been reported growing on the latter in three localities in Moravia: Hranice na Moravě (Unar 1981), Osek, and between Strachotín and Dolní Věstonice villages (Unar et al. 1985). The present author found mistletoe growing on this cultivar of poplar in Bratislava, Slovakia (Szienkiewiczova street).

Data published by Unar et al. (1985) can be used to assess the pool of host trees and shrubs with respect to their origin. Among the total of 48 taxa recorded by these authors, there are 24 native and 24 aliens. However, *Viscum* is more often recorded on native (95 localities, i.e. 22.5%) than on alien (328; 77.5%) trees and shrubs. *Malus domestica* (an archaeophyte in the Czech Republic; Pyšek et al. 2002) and *Robinia pseudacacia* (a neophyte) are the only alien species among the most frequently recorded hosts (Fig. 2), and majority of alien species occur as hosts in less than 1% of localities (Fig. 3).

The diversity of mistletoe's host trees in the native distribution range, assessed in the present paper, can be compared with the situation from a region where the species is invasive. Hawksworth & Scharpf (1986) document fast range extension of *V. album* at regional scale in an area N of San Francisco, California, resulting from a remarkable rate of spread, a feature that is typical of invasive plants (Richardson et al. 2000, Pyšek et al. 2004, Mandák et al. 2004). First record from San Francisco Bay was from 1966 and by 1984, the gross area covered by *Viscum* has spread to about 114 km². This gives an average rate of spread 6.3 km²/year over the study period. In their study, Hawksworth & Scharpf (1986) reported at least 33 host trees; among these, *Acer saccharinum*, *Malus sylvestris*, *Robinia pseudacacia*, *Alnus rubra*, *Populus fremontii* and *Salix lasiandra* were the most common. This indicates quite a good coincidence at the level of genera, and two species, *Robinia pseudacacia* and *Acer saccharinum*, rank high among hosts in both native (Fig. 2, Table 2) and introduced distribution ranges.

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Souhrn

V České republice bylo *Viscum album* subsp. *album* zjištěno celkem na 53 taxonech, z toho 5 křížencích (*Aesculus ×carnea*, *Populus ×canadensis*, *Salix ×sepulcralis*, *Populus ×canadensis*, *Salix ×rubens*) listnatých dřevin, a to jak našich původních, tak introdukovaných (tab. 2). Nejčastějšími hostiteli jsou u nás *Tilia cordata*, *Populus nigra*, *Malus domestica*, *Robinia pseudacacia* a *Tilia platyphyllos* (obr. 3). Naopak výjimečnými hostiteli jsou v České republice např. *Alnus glutinosa*, *Loranthus europaeus* nebo *Prunus padus*. Mimo roztroušeného výskytu na jednotlivých stromech se jmelí v České republice vyskytuje ve výrazných centrech rozšíření s vysokou hustotou výskytu a obvykle i s početnějším zastoupením hostitelských dřevin (např. Heřmanův Městec, Zlínsko, Kroměřížsko, Hranice na Moravě, Lednice, Litomyšlsko, Písecko nebo Zašová na Vsetínsku).

V letech 1978–1981 a 2001 bylo studováno ohnisko výskytu jmelí ve východních Čechách v zámeckém parku a jeho okolí v Heřmanově Městci (okres Chrudim). Jmelí zde bylo zjištěno celkem na 19 různých hostitelích, což je druhý největší počet dosud zjištěný na jedné makrolokality v České republice, po zámeckém parku v Lednici, kde bylo nalezeno 24 hostitelských taxonů (Unar et al. 1985). Výskyt na *Prunus padus* zde byl zaznamenán v ČR

zřejmě vůbec poprvé. Nezodpovězenými otázkami zůstávají výrazná ohniskovost výskytu jmelí, vztah některých viscovitých ptáků k intenzitě jeho výskytu, a také zda se v čase mění struktura hostitelských dřevin a proč dává jmelí v různých územích přednost jen určitým hostitelům.

References

- Hadač J. & Hadač E. (1948): Květena Pardubicka. – Pardubice. [229 pp.]
- Hajdúk J. (1977): Poznámky k výskytu a ekologii *Viscum album* L. s. l. na Slovensku. – Zpr. Čs. Bot. Společ. 12: 201–205.
- Hawksworth F. G. & Scharpf R. F. (1986): Spread of European mistletoe (*Viscum album*) in California, U. S. A. – Eur. J. Forest Pat. 16: 1–5.
- Houfek J. (ed.) (1973): Rozšíření jmelí (*Viscum* L.) v Československu. – Zpr. Čs. Bot. Společ. 8: 210–214.
- Jehlík V. & Větvička V. (1982): Rozšíření jmelí (*Viscum album* s.l.) ve Frýdlantském výběžku a poznámky k jeho listové proměnlivosti. – Sborn. Severočes. Muz., ser. nat., 12: 109–119.
- Kubát K. (1974): *Viscum album* L. v Českém středohoří. – Zpr. Čs. Bot. Společ. 9: 29–31.
- Kubát K. (1997): *Viscum* L. – jmelí. – In: Slavík B. (ed.), Květena České republiky 5: 470–473, Academia, Praha.
- Kubát K., Hrouda L., Chrtek J. jun., Kaplan Z., Kirschner J., Štěpánek J. & Zázvorka J. (eds.) (2002): Klíč ke květeně České republiky. – Academia, Praha. [926 pp.]
- Kučera J. (1989): Příspěvek k rozšíření jmelí (*Viscum* L.) v okrese Rychnov nad Kněžnou. – Orchis 8/2: 1–3.
- Mabberley D. J. (1997): The plant book. Ed. 2. – Cambridge Univ. Press, Cambridge.
- Mandák B., Pyšek P. & Bímová K. (2004): History of the invasion and distribution of *Reynoutria* taxa in the Czech Republic: a hybrid spreading faster than its parents. – Preslia 76: 15–64.
- Neuhäuslová Z., Blažková D., Grulich V., Husová H., Chytrý M., Jeník J., Jirásek J., Kolbek J., Kropáč Z., Ložek V., Moravec J., Prach K., Rybníček K., Rybníčková E. & Sádlo J. (1998): Mapa potenciální přirozené vegetace České republiky. – Academia, Praha. [341 pp.]
- Procházka F. & Kovářiková J. (1999): Významnější nové nálezy v květeně české Šumavy a nejvyšších poloh Předšumaví. – Erica 8: 23–74.
- Pyšek P., Richardson D. M., Rejmánek M., Webster G., Williamson M. & Kirschner J. (2004): Alien plants in checklists and floras: towards better communication between taxonomists and ecologists. – Taxon 53: 131–143.
- Pyšek P., Sádlo J. & Mandák B. (2002): Catalogue of alien plants of the Czech Republic. – Preslia 74: 97–186.
- Rejmánek M., Šmíd I. & Krlička M. (1978): Hostitelské dřeviny *Viscum album* L. v Košiciach a Prešove. – Zpr. Čs. Bot. Společ. 13: 125–126.
- Richardson D. M., Pyšek P., Rejmánek M., Barbour M. G., Panetta F. D. & West C. J. (2000): Naturalization and invasion of alien plants: concepts and definitions. – Diversity Distrib. 6: 93–107.
- Skalický V. (1974): Poznámky k rozšíření jmelí (*Viscum* L.) v ČSSR. – Zpr. Čs. Bot. Společ. 9: 32–34.
- Skalický V. (1988): Regionálně fytogeografické členění. – In: Hejný S. & Slavík B. (eds.), Květena České socialistické republiky 1: 103–121, Academia, Praha.
- Skalický V. et al. (1978): Materiály z floristického kurzu ve Frýdku-Místku. – Frýdek-Místek.
- Tomášek J. (1974): Rozšíření jmelí (*Viscum* L.) na Gottwaldovsku. – Zpr. Čs. Bot. Společ. 9: 150–151.
- Tomášek J. (1981): Doplňky k výskytu jmelí (*Viscum* L.) na Gottwaldovsku. – Zpr. Čs. Bot. Společ. 15: 150–151.
- Tubeuf K. (1923): Monographie der Mistel. – München & Berlin.
- Unar J. (1981): *Viscum album* L. s. s. v intravilánu města Hranice na Moravě. – Zpr. Čs. Bot. Společ. 15: 96–98.
- Unar J. et al. (1985): Příspěvek k rozšíření jmelí bílého (*Viscum album* L.) na Moravě. – Zpr. Čs. Bot. Společ. 20: 115–127.
- Vesecký J., Petrovič S., Briedoň V. & Karský V. (1958): Atlas podnebí Republiky československé. – Praha.
- Wangerin W. (1937): 1. Gattung. *Viscum* L. – In: Wangerin W. & Schröter C. (eds.), Lebensgeschichte der Blütenpflanzen Mitteleuropas, vol. 2/1: 972–1146, Stuttgart.
- Zavřel H. (1973): Rozšíření jmelí bílého (*Viscum album* L. s. s.) na Kroměřížsku. – Zpr. Čs. Bot. Společ. 8: 76–78.
- Zitko J. (1887): Květena okolí Chrudimského. – Roční Zpr. Měšť. a Obec. Šk., Chrudim, 1887: 3–60.
- Žlebčík J. (1975): Poznámky k výskytu jmelí (*Viscum album* L.) – Zpr. Čs. Bot. Společ. 10: 2–26.

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