

PRUNUS VIRGINIANA L. (ROSACEAE) ON SYNANTHROPIC SITES IN POLAND

Władysław Danielewicz, Blanka Wiatrowska

Poznań University of Life Science

Abstract. Black cherry (*Prunus serotina* Ehrh.) belongs to quite common and the best known invasive woody plants of alien origin occurring in central Europe. On the other hand, little is known about the degree of settling of another North American representative of the *Prunus* genus from the *Padus* subgenus – the chokecherry (*P. virginiana* L.). A considerable morphological similarity of the above-mentioned taxon to *P. padus* L. is a cause of fairly significant problems associated with its identification. It is not easy to distinguish these related indigenous species, common in forests, as well as in mesophilous thickets in the area of entire Europe. That is why *P. virginiana* is usually unnoticed and, consequently, it is overlooked in floristic studies. On the basis of the data derived from a variety of sources, mostly collected by the authors in the course of their field trips, supplemented with information from literature, as well as unpublished notes obtained from different persons, information concerning the distribution of secondary *P. virginiana* sites in Poland is summed up. The article presents a list of 28 such sites together with a map on which their locations have been marked. The discussed species was observed most frequently in the forest environment on eutrophic as well as mesotrophic broad-leaved forest sites in shrub thicket areas at the edge of dense forests. It was also found in broad-leaved and pine coniferous forest underbrush as well as in mid-field thickets. It was established that in Poland, it was not only fully settled in on semi-natural sites but it also encroached upon forest phytocoenoses of natural character. In order to draw attention to possibilities of *P. virginiana* occurrence in other, hitherto unrecognised synanthropic sites, some remarks and observations concerning morphological features and phenological properties of this taxon in field conditions were included.

Key words: *Prunus virginiana*, Rosaceae, chokecherry, anthropophytes, alien plants, Poland

INTRODUCTION

From among approximately 120 alien species of woody plants established in Poland [Danielewicz and Maliński 2003, Tokarska-Guzik et al. 2012], *Prunus virginiana* L. belongs to the least recognised with respect to its distribution and dynamic tendencies.

It is one of the twenty species from the *Padus* subgenus mostly occurring in eastern Asia and one of the three of its representatives in North America, together with *P. serotina* Ehrh. and *P. alabamensis* C. Mohr [Rehder 1951, Krüssmann 1986, Gu et al. 2003, Liu et al. 2013].

Prunus virginiana is a small tree or a tall shrub spreading by means of root suckers or by branches enrooting in soil. It is similar to *P. padus* from which it differs, primarily, by sharply serrulate margins of leaves, smaller flowers, receptacle naked inside and a smooth stone endocarp [Rehder 1951, Kościelny and Sękowski 1970, Krüssmann 1986, Scholz and Scholz 1995, Core and Ammons 1999].

A wide, compact geographical range of *P. virginiana* extends from northern and central part of the USA and southern Canada to Newfoundland and New Scotland in the east to central British Columbia and Oregon in the west [Little 1977, Mulligan and Munro 1981, Johnson 2000]. The northern boundary of this range runs through the following provinces: Ontario, Manitoba, Saskatchewan, Alberta and British Columbia and in the south, through the following states: Ohio, Indiana, Illinois, Missouri, Kansas, Wyoming, Idaho and Oregon (Fig. 1). Due to such an extensive area of its natural occurrence *P. virginiana* grows in very diverse climatic and soil conditions. It is also a constituent of many different forest and thicket communities, mainly on fertile and wet sites. It is often found at the edges of forest or invades deforested areas becoming part of initial communities developing in the course of secondary successions [Mulligan and Munro 1981, Johnson 2000].

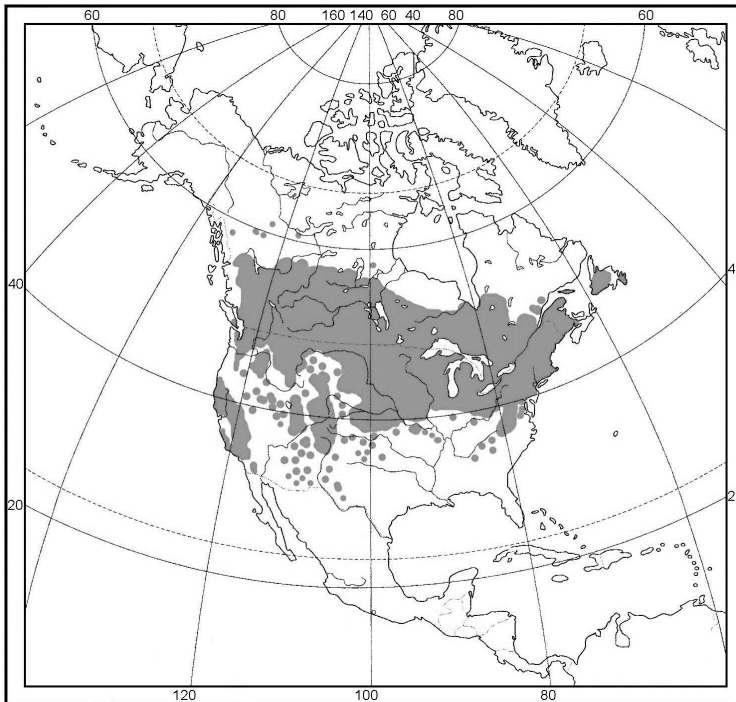


Fig. 1. Range of *Prunus virginiana* in the USA and Canada [Little 1977]

Rys. 1. Zasięg *Prunus virginiana* w USA i Kanadzie [Little 1977]

In general, two or three varieties of the discussed species are distinguished [Rehder 1951, Hitchcock and Cronquist 1974, Krüssmann 1986, Gleason and Cronquist 1991]. In the eastern part of its range *P. virginiana* var. *virginiana* occurs, while in the west – *P. virginiana* var. *demissa* (Nutt.) Torr. and *P. virginiana* var. *melanocarpa* (A. Nels.) Sarg. grow. Morphological differences between them consist, mainly, in the density and persistence of hair of the bottom part of the leaf blade and red or black colour of ripe fruits.

P. virginiana cultivation in Europe was initiated in England in 1724 [Bean 1951]. The species was mentioned as a neophyte in Belgium [Verloove 2006], the Czech Republic [Pyšek et al. 2002, 2012] and Slovakia [Medvecká et al. 2012]. In Norway [Tømmerås 1994], Sweden [Jonsell 2010] as well as in Finland it was included among potentially invasive plants [NOBANIS – *Prunus virginiana*]. Besides, it was placed on the ranking list of invasive species in Alaska on which it occupied the 29th position, just after the European *P. padus* [Nawrocki et al. 2011].

It is assumed that the first *P. virginiana* introduction to Poland took place in 1813 in Niedźwiedz [Hereźniak 1992]. Here, it belongs to rarely cultivated ornamental plants. There is scanty information about its sites in old parks [e.g. Czekalski 2000] and in dendrological collections and it is only represented in a few botanical gardens [Nowak 1999].

The first information about a *P. virginiana* site in Polish forest was reported by Szulczewski [1963] in an article dealing with alien flora constituents in the Wielkopolska National Park. Most of the latest information concerning places of occurrence of this species in Poland can be found in publications concerning the above-mentioned area [Danielewicz and Maliński 1995, 1997, Żukowski et al. 1995, Purcel 2009]. There is scanty information about other sites, e.g. in the Odra River valley [Danielewicz 2008]. According to Mirek et al. [2002], *P. virginiana* is a species known only from cultivation, while Rutkowski [2007] maintains that it is rarely planted. Only Seneta and Dolatowski [2011] mention that the species sometimes goes back to the wild. It cannot be found in the database of Alien Species in Poland [2013].

Insufficient information regarding the occurrence of *P. virginiana* in Poland is associated, first and foremost, with a great similarity of this taxon to the indigenous species of the common bird cherry (*Prunus padus* L.) from which it is frequently not distinguished. This prompted the authors to take a closer look at the species focusing on two aspects. Authors decided to collect information gathered so far concerning synanthropic sites of the discussed taxon and, on this basis, to ascertain its status in Polish flora. Bearing in mind problems with *P. virginiana* identification, an attempt was also made to determine morphological features of the highest diagnostic value in the process of discriminating this species from *P. padus* and *P. serotina*.

MATERIAL AND METHODS

Information about synanthropic sites of *P. virginiana* derives, primarily, from the authors' own field observations. The remaining data were obtained in the form of unpublished notes from the following botanists: Prof. Jerzy Zieliński, Dr Lucjan Rutkowski and Dr Tomasz Maliński. On the basis of the gathered materials, a map of distribution of the investigated species in Poland, as well as a summary of the information collected so far were elaborated.

In order to identify *P. virginiana*, selected morphological features of the species were compared with features of *P. padus* and *P. serotina* – two other representatives of the *Padus* subgenus, common in Poland. Materials for this part of studies derived from dendrological collections (Dendrological Garden of Poznań University of Life Sciences, PAN Arboretum in Kórnik), as well as from *P. virginiana* sites situated in Poznań and in its neighbourhood. Detailed studies on the variability of dormant shoot qualitative features, leaf blades, inflorescences, flowers and fruits as well as on the changeableness of quantitative features of leaves collected from 30 specimens of each compared species were carried out by Wiatrowska [2010]. In this article, only features of the greatest diagnostic significance, allowing to identify the discussed species in the field, were described. In addition, it also comprised remarks concerning its phenology derived from observations made in 2009-2013 in the area of the Dendrological Garden of Poznań University of Life Sciences.

RESULTS

Site distribution

Until now, data concerning 28 synanthropic *P. virginiana* sites identified in the area of Poland have been collected (Table 1). They are distributed only in the western part of the country and, in their majority, they are aggregated in the following three regions: Toruń, Poznań and in the central part of the Lower Silesian Coniferous Forests (Fig. 2). Single places of occurrence of this species have been also found in Western Pomerania, the Międzychód-Sieraków Lake District, Lubuski Region and southern Wielkopolska.

Table 1. List of synanthropic sites of *Prunus virginiana* in Poland
Tabela 1. Wykaz stanowisk *Prunus virginiana* w Polsce

No Nr	Site Stanowisko	Square of ATPOL Kwadrat ATPOL	Occurrence Występowanie	Date and author of observation Data i nazwisko autora obserwacji
1	2	3	4	5
1	Czarnogłowy near Golczewo Czarnogłowy koło Golczewo	AB-46	thickets on edge of oak-hornbeam forest zarośla na brzegu lasu dębowo-grabowego	11.07.2000 W. Danielewicz
2	Błotno near Ińsko Błotno koło Ińska	AB-99	thickets on edge of oak-hornbeam forest zarośla na brzegu lasu dębowo-grabowego	9.07.2000 W. Danielewicz
3	Gogolin near Chełmno Gogolin koło Chełmna	DB-90	mesophilous thickets mezofilne zarośla	12.08.1996 L. Rutkowski
4	Kielp near Chełmno Kielp koło Chełmna	CC-08	mesophilous thickets mezofilne zarośla	5.06.1993 L. Rutkowski

Table 1 – cont. / Tabela 1 – cd.

1	2	3	4	5
5	Cieleszyn near Chełmno (Reserve “Parów Cieleżyński”) Cieleszyn koło Chełmna (rezerwat „Parów Cieleżyński”)	CC-08	shrub layer in oak-hornbeam forest podszyt w lesie dębowo- -grabowym	29.09.1996 L. Rutkowski
6	Żołędowo near Bydgoszcz (Żołędowo Forest District) Żołędowo koło Bydgoszczy (Nadleśnictwo Żołędowo)	CC-16	thickets on edge of oak-hornbeam forest zarośla na brzegu lasu dębowo- -grabowego	21.05.1998 W. Danielewicz
7	Rybakówka near Głusko (Drawa National Park) Rybakówka koło Głuska (Drawieński Park Narodowy)	BC-22	mesophilous thickets mezofilne zarośla	7.1997 J. Kujawa- -Pawlaczyk
8	Toruń, Barbican Toruń, Barbakan	DC-30	thickets near pond zarośla nad stawem	9.2010 L. Rutkowski
9	Toruń-Bielawy	DC-30	shrub layer in pine forest podszyt w borze sosnowym	10.03.2011 L. Rutkowski
10	Toruń, Fort I	DC-30	mesophilous thickets mezofilne zarośla	13.05.2011 L. Rutkowski
11	Toruń, aerodrome Toruń, lotnisko	DC-30	shrub layer in pine forest podszyt w borze sosnowym	13.05.2011 L. Rutkowski
12	Siekierki near Cedynia (Odra river valley) Siekierki koło Cedyni (dolina Odry)	AC-40	mesophilous thickets on railway embankment mezofilne zarośla na nasypie kolejowym	12.09.1994 W. Danielewicz
13	Sieraków (at Lutomskie Lake) Sieraków (nad Jeziorem Lutomskim)	BC-73	shrub layer in oak-hornbeam forest and elm-ash riparian forest podszyt w lesie dębowo-grabowym oraz w łągu wiązowo- -jesionowym	16.08.1999 W. Danielewicz
14	Rokietnica near Poznań Rokietnica koło Poznania	BC-97	mesophilous thickets near drainage ditch mezofilne zarośla przy rowie meliora- cyjnym	13.05.1999 W. Danielewicz
15	Poznań (at Strzeszyńskie Lake) Poznań (nad Jeziorem Strzeszyńskim)	BC-98	shrub layer in secondary forest with pine stand on habitat of oak- -hornbeam forest podszyt w zbiorowisku zastępczym z sosną w drzewostanie na siedlisku lasu dębowo- -grabowego	21.05.1985 W. Danielewicz
16	Poznań (at Kierskie Lake) Poznań (nad Jeziorem Kierskim)	BC-98	thickets on edge of oak-hornbeam forest zarośla na brzegu lasu dębowo- -grabowego thickets on edge of ash-alder riparian forest zarośla na brzegu łągu jesionowo- -olszowego	15.05.1993 W. Danielewicz

Table 1 – cont. / Tabela 1 – cd.

1	2	3	4	5
17	Poznań (Marceliński Forest) Poznań (Lasek Marceliński)	BD-08	edge and interior of oak-hornbeam forest brzeg i wnętrze lasu dębowo-grabowego	15.05.1982 W. Danielewicz
18	Poznań (at Maltańskie Lake) Poznań (nad Jeziorem Maltańskim)	BD-09	thickets on edge of oak-hornbeam forest zarośla na brzegu lasu dębowo-grabowego	5.1980 J. Zieliński
19	Poznań-Zieleniec (at Swarzędzkie Lake) Poznań-Zieleniec (nad Jeziorem Swarzędzkim)	BD-09	thickest on edge of secondary community with pine stand on habitats of oak-hornbeam forest zarośla na brzegu zbiorowiska zastępczego z drzewostanem sosnowym na siedlisku lasu dębowo-grabowego	17.05.1998 W. Danielewicz
20	Puszczykowo near Poznań (Wielkopolska National Park) Puszczykowo koło Poznania (Wielkopolski Park Narodowy)	BD-18	shrub layer in secondary forest with pine stand on habitat of oak-hornbeam forest podszyt w zbiorowisku zastępczym z sosną w drzewostanie na siedlisku grądu	4.05.1988 W. Danielewicz
21	Racot near Kościan (Kościan Forest District) Racot koło Kościana (Nadleśnictwo Kościan)	BD-47	thickest on edge of secondary forest with pine stand on habitats of oak-hornbeam forest zarośla na brzegu zbiorowiska zastępczego z sosną w drzewostanie na siedlisku grądu	19.09.2013 T. Maliński
22	Dzikowo near Gubin (Gubin Forest District) Dzikowo koło Gubina (Nadleśnictwo Gubin)	AD-44	shrub layer in acidophilous oak forest and thickets on edge forest podszyt w zbiorowisku kwaśnej dąbrowy oraz zarośla na brzegu tego lasu	13.05.2000 W. Danielewicz
23	Belcz Wielki near Głogów (Odra river Valley) Belcz Wielki (dolina Odry)	BD-94	thickets on edge of elm-ash riparian forest mezofilne zarośla na brzegu łągu wiązowo-jesionowego	24.09.2005 W. Danielewicz
24	Przygodzice near Ostrów Wielkopolski Przygodzice koło Ostrowa Wielkopolskiego	CD-94	mesophilous thickets on railway embankment mezofilne zarośla na nasypie kolejowym	20.08.2011 W. Danielewicz
25	Jagodzin near Ruzów (Ruzów Forest District) Jagodzin koło Ruzowa (Nadleśnictwo Ruzów)	AE-16	shrub layer in fresh pine forest and thickets on edge forest podszyt w świeżym borze sosnowym, zarośla na brzegu lasu	16.06.2001 W. Danielewicz
26	Ruzów	AE-16	mesophilous thickets on railway embankment mezofilne zarośla na nasypie kolejowym	7.2011 B. Wiatrowska

Table 1 – cont. / Tabela 1 – cd.

1	2	3	4	5
27	Poświętne near Ruszów Poświętne koło Ruszowa	AE-17	mesophilous thickets mezofilne zarośla	5.2012 W. Danielewicz
28	Węgliniec (Węgliniec Forest District) Węgliniec (Nadleśnictwo Węgliniec)	AE-26	thickest on edge of moist pine forest zarośla na brzegu wilgotnego boru sosnowego	17.07.1998 J. Zieliński

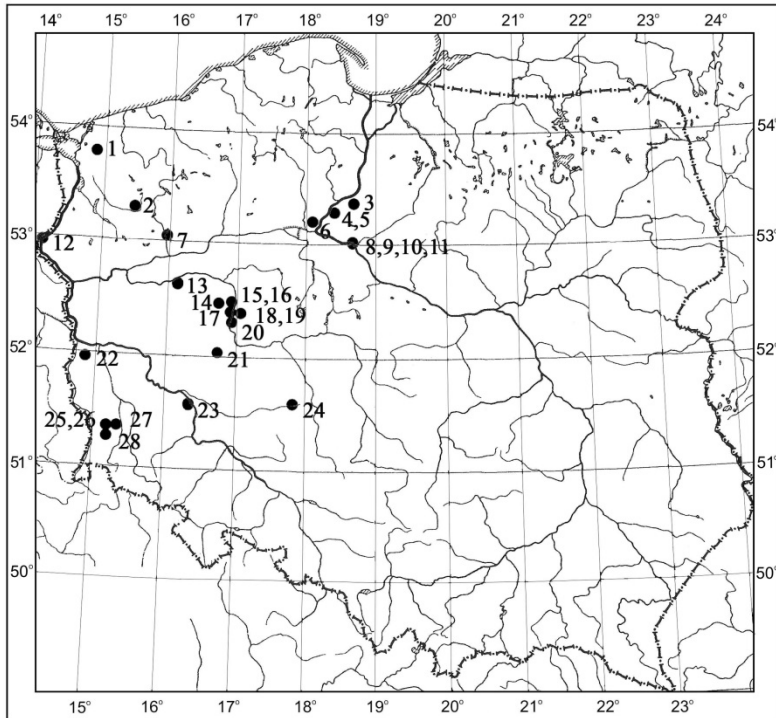


Fig. 2. Distribution of synanthropic sites of *Prunus virginiana* in Poland
Rys. 2. Rozmieszczenie synantropijnych stanowisk *Prunus virginiana* w Polsce

P. virginiana sites were recorded most frequently in the forest environment (18 sites) and less often outside it (10 sites), usually in thickets along roads, as well as in secondary sites, such as railway embankments or ruins of military facilities (Fig. 3). In the case of forest sites, the discussed taxon was observed more often in shrub communities sites at the edge of forests than deep in forest communities. Nearly 80% of the sites were found in fertile and moderately fertile habitats of broad-leaved forests, mainly oak-hornbeam forests, while the remaining sites – in areas with fresh and mixed pine coniferous forests. A considerable part of observations derives from municipal forests whose environment, as a rule, was strongly exposed to proliferation of alien species. However, as a matter of fact, *P. virginiana* sites were found a little more often in forest

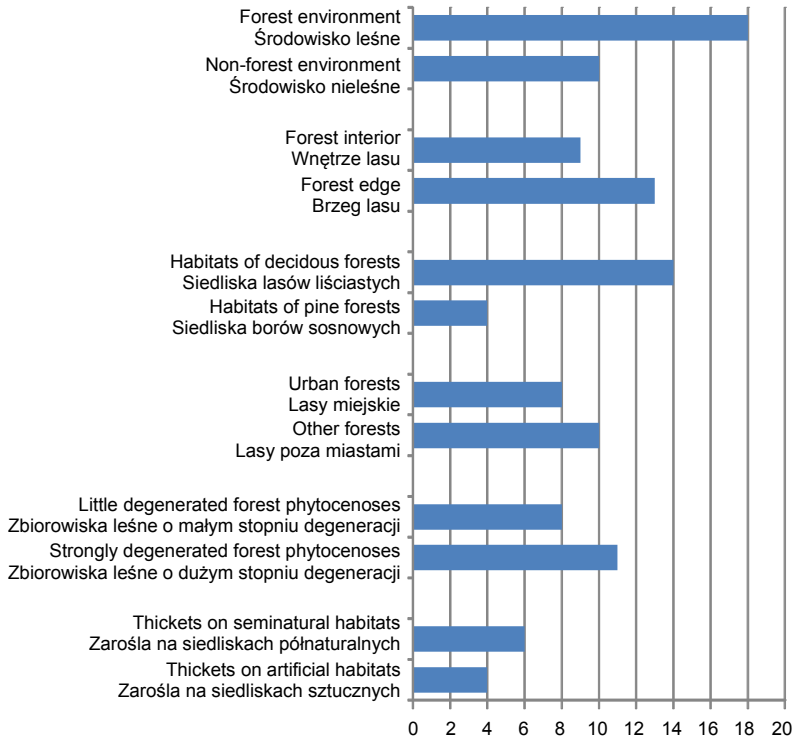


Fig. 3. Synanthropic sites of *Prunus virginiana* in different types of environment
 Rys. 3. Stanowiska synantropijne *Prunus virginiana* w różnych typach środowisk

complexes situated outside urban areas. It was worth emphasising that the discussed species occurred not only in forest communities of transformed species composition and distorted structure but also in vegetation of natural or close-to-natural character.

In the case of sites visited by the authors of this study, *P. virginiana* usually formed not very large clusters consisting of a few to several individuals occupying the area of about 50-100 m², although in the Wielkopolski National Park, compact patches of this species reached the size of up to 400 m². In the neighbourhood of Poznań, as well as in Lower Silesian Coniferous Forests, single, a few-year-old seedlings of *P. virginiana* were found usually close to or at a small distance (up to about 100 m) from fruit-bearing individuals most frequently growing at the edge of forests. One and two-year old seedlings of the species were not observed. Probably it was due to the fact that at this juvenile stage, it was impossible to distinguish *P. virginiana* from *P. padus*.

Species identification

In practice, the certainty of *P. virginiana* identification increases together with the number of analysed features, especially in situations when there is a possibility of confusing this species with *P. padus* or even *P. serotina*. Table 2 collates features of the highest diagnostic value.

In Poland, *Prunus virginiana* usually has a fairly characteristic bushy habit and rarely takes the form of a small tree up to the height of about 5 m. It differs from *P. padus* by lower growth and occurrence of very numerous, vertical root sprouts. Its thickest stems do not exceed the diameter of 20 cm, whereas in the case of the compared native species, they can reach the thickness of 50 cm [Kusiak et al. 2008]. Both taxa develop grey, smooth and matt outer bark of shoots and stems of similar thickness. Despite a considerable variability of winter annual shoots depending, among others, on the age of individuals and growth conditions, in *P. virginiana* they are most frequently dark-brown grey and matt. The widest part of buds is situated at half length. Scales at the base of buds are numerous and without gloss. Sometimes, dry fruits can be found on plants during the period of winter dormancy, while on the ground – fallen stones. A characteristic feature common for stones of both *P. virginiana* and *P. serotina* is a smooth endocarp surface which distinguishes these two species from *P. padus* (Fig. 4).

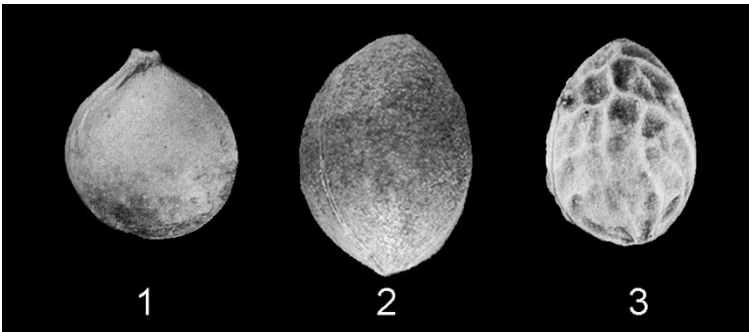


Fig. 4. Stones of: 1 – *P. serotina*, 2 – *P. virginiana*, 3 – *P. padus*
Rys. 4. Pestki: 1 – *P. serotina*, 2 – *P. virginiana*, 3 – *P. padus*

With respect to the leaf shape and size, *P. virginiana* and *P. padus* are very similar to each other. It was true that certain differences were discovered in the examined material (e.g. on average, longer leaf stalks, the widest part of blade set higher, smaller blade circumference and greater number of lateral vein pairs in the former of the above-mentioned species) but they were so insignificant that failed to differentiate the compared taxa. On the other hand, qualitative features are more important, first and foremost finer serrulation on the edge of leaves in *P. virginiana* (Fig. 5). In addition, leaf blades of this species on the top surface are smoother and less glossy. They have also less apparent nervation and unclear edge connections of lateral nerves. The following diagnostic features proved to be insignificant: stipule shape and size as well as their durability, leaf-blade hairs, number of glandules at the base of leaf stalks as well as the colour of the leaf blade surface.

The probability of the correct *P. virginiana* identification is increased by the possibility of observation of the compared species during the period of flowering. Inflorescences of this species exhibit great similarity to *P. serotina* inflorescences (Fig. 6). In comparison with *P. padus*, they are narrower; have a greater number of flowers set on shorter pedicels, smaller petal diameter and receptacle without indumentum. Another important diagnostic feature is stamen length, with filaments longer than petals in *P. virginiana* and *P. serotina*.

Table 2. Comparison of selected features of *Prunus virginiana*, *P. padus* and *P. serotina*
 Tabela 2. Porównanie *Prunus virginiana*, *P. padus* i *P. serotina* pod względem wybranych cech morfologicznych

Feature Cecha	<i>Prunus virginiana</i>	<i>Prunus padus</i>	<i>Prunus serotina</i>
1	2	3	4
Form of growth in optimal conditions Forma wzrostu w optymalnych warunkach	shrub or small tree, up to 5 m high krzew lub niskie drzewo, do 5 m wysokości	medium-size tree, up to 15 m high drzewo średniej wielkości, do 15 m wysokości	tall tree, up to 20 m high wysokie drzewo, ok. 20 m wysokości
Root sprouts Odrosty korzeniowe	numerous liczne	not numerous nieliczne	not numerous nieliczne
Surface of one-year-old twigs on the insolate side Powierzchnia rocznych gałązek po stronie nasłonecznionej	brown-grey, without gloss brunatnoszara, bez połysku	dark-brown or green-brown, with slight gloss ciemnobrunatna lub zielonobrunatna, z lekkim połyskiem	changeable, from light-brown to dark-brown with distinct gloss zmienna, od jasnobrązowej do ciemnobrunatnej, z wyraźnym połyskiem
Buds Pąki	large, egg-shaped, with the widest part in the middle of bud length, with acuminate apex duże, jajowate, z najszerszą częścią w połowie długości pąka, bardzo ostro zakończone	large, egg-shaped, with the widest part below the middle of bud length, with acute apex duże, jajowate, z najszerszą częścią poniżej połowy długości pąka, ostro zakończone	small, widely egg-shaped, lightly flattened, with the widest part at the base, with weakly acute apex drobne, szerokojajowate, lekko spłaszczone, z najszerszą częścią u nasady, słabo zaostrzone
Bud-scales Luski okrywające pąki	at the base of bud light-brown and matt, toward the apex of bud – dark-brown and glossy w dolnej części pąka liczne jasnobrązowe i matowe, w górnej – ciemnobrązowe i połyskujące	at the base of bud light-brown and matt, toward the apex of bud – dark-brown and glossy, with lighter margins w dolnej części pąka nieliczne jasnobrązowe i matowe, w większości ciemnobrązowe i połyskujące, na brzegach, jaśniejsze	brown, with darker edges, often greenish at base, all glossy brązowe, na brzegach ciemniejsze, u nasady często zielonkawe, wszystkie połyskujące
Leaves during development – Liście w czasie rozwoju			
Adaxial surface of blades Powierzchnia blaszek	smooth and matt gładka i matowa	wrinkled and glossy pomarszczona i błyszcząca	smooth and glossy gładka i błyszcząca
Indumentum on abaxial side of leaf-blade Owłosienie po spodniej stronie blaszki	numerous hair tufts in vein angles or without any hair liczne kępki włosków w kątach nerwów lub brak owłosienia	single hairs on veins or without any hairs pojedyncze włoski na nerwach lub brak owłosienia	initially none, with leaf development white hairs appear along the midrib początkowo brak, wraz z rozwojem liścia wzdłuż nerwu głównego wyrastają białe włoski

Table 2 – cont. / Tabela 2 – cd.

1	2	3	4
Fully developed leaves – Liście w pełni rozwinięte			
Adaxial surface of blades Powierzchnia blaszek	smooth or slightly wrinkled, matt gładka lub nieznacznie pomarszczona, matowa	distinctly wrinkled, lightly glossy wyraźnie pomarszczona, lekko połyskująca	smooth, distinctly glossy gładka, wyraźnie połyskująca
Indumentum on abaxial side of leaf-blade Owłosienie po dolnej stronie blaszki	numerous hair tufts in vein angles or without any hairs nieliczne kępki włosków w kątach nerwów lub brak owłosienia	single hairs on veins or without any hairs pojedyncze włoski na nerwach lub brak owłosienia	brown, brush-like, dense hairs along the midrib brązowe, szczoteczko- kowato skupione włoski po bokach nerwu głównego
Margin of leaf-blade Brzeg blaszki	fine and sharply serrulate drobno i ostro piłkowany	thick and sharply serrulate grubo i ostro piłkowany	glandularly-serrulate gruczołowato piłkowany
Lateral veins on the abaxial side of leaf-blade Nerwy boczne po dolnej stronie blaszki	slightly convex nieznacznie wypukłe	strongly convex silnie wypukłe	slightly convex nieznacznie wypukłe
Vein connections at the margin of blade Połączenia nerwów przy brzegu blaszki	unclear niewyraźne	very clear bardzo wyraźne	unclear niewyraźne
Mean number of flowers per inflorescence Średnia liczba kwiatów w kwiatostanie	40	26	45
Mean length of pedicels Średnia długość szypulek	0.5 cm	1-1.5 cm	0.8-1.0 cm
Mean flower diameter Przeciętna średnica kwiatów	0.9 cm	1.5 cm	1.1 cm
Area of the receptacle Powierzchnia dna kwiatowego	orange, naked pomarańczowa, naga	light-green, with white, thick hairs jasnozielona, z białym, gęstym owłosieniem	yellowish, with white, not numerous hairs żółtawa, z białymi, nielicznymi włoskami
Mean length of petals Średnia długość płatków	2.5 mm	8.0 mm	3.5 mm
Remains of the perianth on fruit Pozostałości okwiatu na owocu	falling off during fruit development odpadające w czasie rozwoju owocu	falling off after fruit ripening odpadające po dojrzaniu owoców	staying on after fruit ripening utrzymujące się po dojrzaniu owoców
Shape of stone Kształt pestek	ellipsoid elipsoidalny	ellipsoid elipsoidalny	ball-shaped kulistawy
Stone surface Powierzchnia pestek	smooth gładka	furrowed bruzdowana	smooth gładka

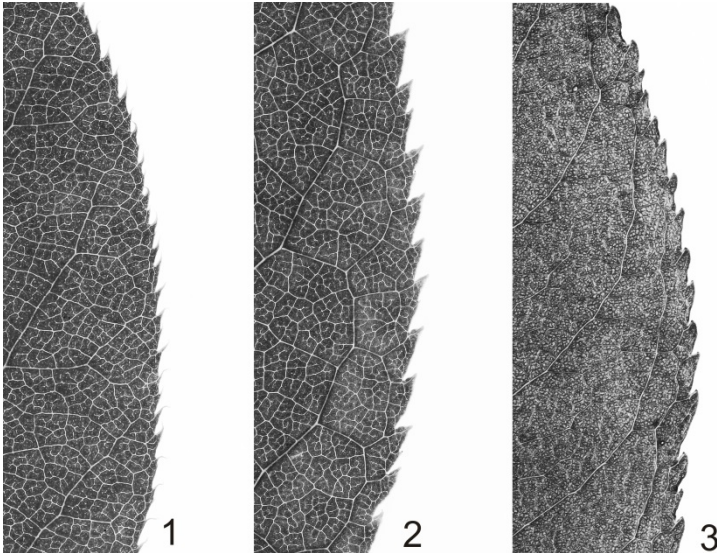


Fig. 5. Leaf edges of: 1 – *P. virginiana*, 2 – *P. serotina*, 3 – *P. padus*
 Rys. 5. Brzegi liści: 1 – *Prunus virginiana*, 2 – *P. padus*, 3 – *P. serotina*

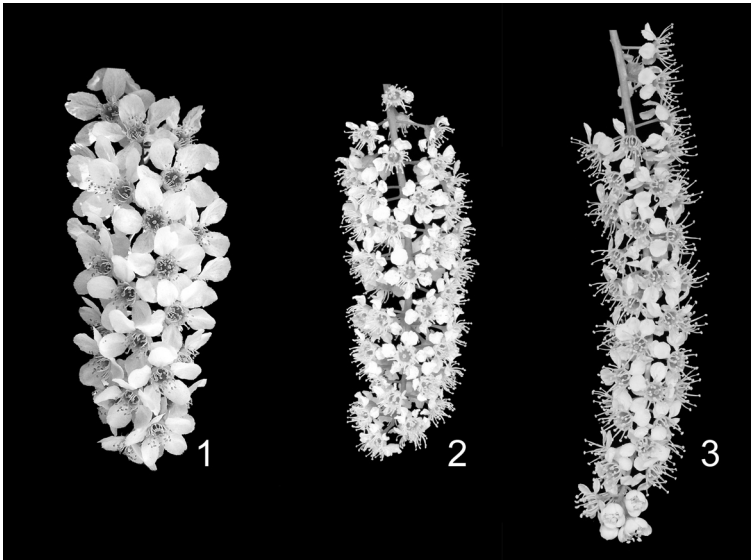


Fig. 6. Inflorescences of: 1 – *P. virginiana*, 2 – *P. serotina*, 3 – *P. padus*
 Rys. 6. Kwiatostany: 1 – *Prunus padus*, 2 – *P. virginiana*, 3 – *P. serotina*

Remnants of the calyx on developing fruits fall off the quickest in *P. virginiana*, than in *P. padus* and stay the longest in *P. serotina* (Fig. 7). Fully ripe fruits in these taxa are dark blue and black but in *P. virginiana*, for a long time before their final ripening, they change colour from red into dark cherry.

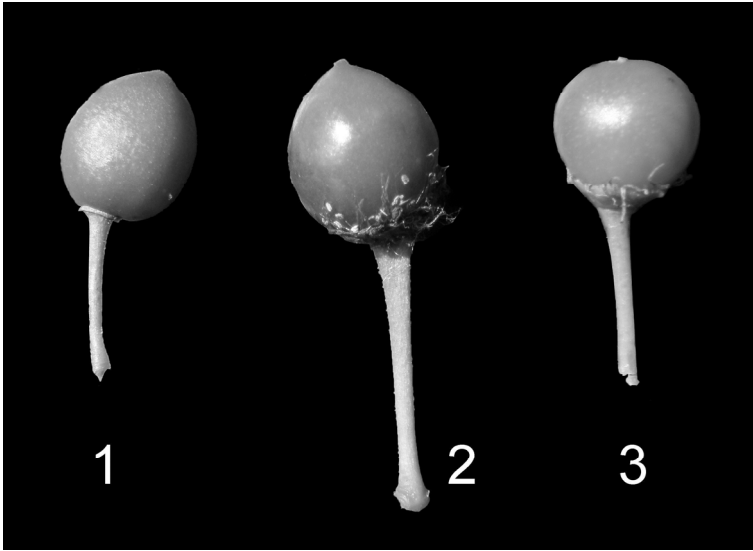


Fig. 7. Not fully mature fruits of: 1 – *P. virginiana*, 2 – *P. serotina*, 3 – *P. padus*

Rys. 7. Niedojrzałe owoce: 1 – *Prunus virginiana*, 2 – *P. padus*, 3 – *P. serotina*

The three investigated species are characterised by different courses of phenological developmental phases which, in the situation when they grow in the same place and in the same conditions, makes *P. virginiana* easier to recognise. In the neighbourhood of Poznań, buds of *P. padus* swell and open the earliest, usually at the end of March. Then *P. virginiana* turns about a week later and two weeks later *P. serotina* starts vegetation. Flowering of these species also takes place at similar time intervals. Usually flowers of *P. padus* open up the earliest, seven to ten days later – of *P. virginiana* and in the middle of May – those of *P. serotina*. On the basis of observations during the vegetation periods of 2009-2013 it can be said that, although the flowering of *P. virginiana* occurs after a fairly short period after the flowering of *P. padus*, there is a distinct separation of this phenological phase between these species. Consecutive phases of the annual developmental cycle of the discussed species take place in the same sequence, as bud opening, development of foliage and flowering. Fruits of *P. virginiana* fall off from mid-September (of *P. padus* – from the beginning of September and of *P. serotina* – at the end of this month) and leaves – from the mid-October (of *P. padus* – a week earlier and of *P. serotina* – a week later).

DISCUSSION

Information presented in this study concerning *P. virginiana* occurrence on secondary sites of which a significant part is situated in forests, makes it possible to conclude that, in Poland, this species belongs to permanently settled plants not only on semi-natural sites but also in conditions of natural or close-to-natural sites. The study shows that the species is capable of undergoing the full developmental cycle as well as sponta-

neous regeneration in the forest environment from seeds. In accordance with the classification system of synanthropic plants frequently applied in Poland [Kornaś 1968], the discussed species qualifies to be assigned to the group of agriophytes and among them to kenophytes and, at a lower level of division – to holoagriophytes. Using the terminology taken from the description of settling stages of alien species in natural communities [Faliński 1968, 1969], *P. virginiana* should be included among plants which have reached a euneophyte stadium, i.e. by closing the developmental phase, such plants become an enduring constituent of these communities. It is evident from the field observations carried out so far that the impact of this taxon on the structure, floristic composition and, most likely, on the functioning of phytocoenoses remains unknown. This species does not exhibit a reduction influence on other constituents and its relationship towards them can be described as ‘enriching their floristic composition’ or, according to Faliński [1968, 1969] ‘suppletive’.

In Poland *P. virginiana* is a rare species in cultivation, poorly known and barely investigated. Information in the available dendrological literature regarding, among others, its biology, developmental rhythmicity or the extent of acclimatisation of alien woody plants in conditions of central Europe is exceptionally scanty. On the basis of the authors’ own observations, it can be said that the *P. virginiana* species is fully acclimatised, at least in the region of western Poland. Low winter temperatures do not constitute an adaptation barrier for it, because in its northernmost natural range, it occurs in regions where minimum temperatures fall below -40°C [Mulligan and Munro 1981]. Krüssmann [1986] believes that plants of this species can be cultivated in regions situated in the 2nd climatic zone where annual minimal temperatures fluctuate from -45°C to -40°C . It is more resistant to extreme frosts than *P. serotina* and *P. padus*. According to the above-quoted researcher for these species, the 4th climatic zone with minimal annual temperatures ranging from -34°C to -29°C is more appropriate. Bearing in mind a wide range of soil conditions in which *P. virginiana* grows in the area of its natural occurrence [Johnson 2000], it can be assumed that this species does not face edaphic barriers.

One of the important questions associated with the naturalisation of *P. virginiana* in Poland shown in this study is connected with differences in the capability of penetrating forest communities that this taxon demonstrates in comparison with *P. serotina*. So far, nothing appears to indicate that it could become an invasive plant despite its similar biological and ecological properties [Johnson 2000]. It is quite probable that among important factors limiting expansion possibilities of *P. virginiana* is a lower tolerance of this species to the light deficit associated with the specificity of forest environment. In Poland, this species has been found relatively often in fringes of stands. In its homeland, it occurs more abundantly in its thicket forms, in clearings or open forest than in dark forest communities [Johnson 2000, Mulligan and Munro 1981]. It is true that *P. serotina* is classified as a tree of high light requirements [Marquiz 1990]; however, this does not refer to a generative regeneration which can take place and persist for a long time in a strong shadow [Vanhellemont 2009, Starfinger 2010, Halarewicz 2011].

Undoubtedly there are also other reasons which may be responsible for different behaviour of two *Prunus* species of American origin in central Europe whose explanation, in the case of *P. virginiana*, would require carrying out more detailed investigations. It is worth mentioning here that mass occurrence of *P. serotina* in Polish forests is associated not only with the invasive nature of this species but also with a long-term and repeated introduction carried out on a large scale in the entire area of the country [Danielewicz and Wiatrowska 2012].

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PRUNUS VIRGINIANA L. (ROSACEAE) NA STANOWISKACH SYNANTROPIJNYCH W POLSCE

Streszczenie. Do pospolitych i najbardziej znanych inwazyjnych roślin drzewiastych obcego pochodzenia w środkowej Europie należy czeremcha amerykańska (*Prunus serotina* Ehrh.). Problematyce jej występowania, uwarunkowań, przebiegu i skutków ekspansji poświęcono już wiele uwagi w badaniach naukowych. Mało natomiast wiadomo o zadomowieniu innego północnoamerykańskiego przedstawiciela rodzaju *Prunus* z podrodzaju *Padus* – czeremchy wirginijskiej (*P. virginiana* L.). Znaczne podobieństwo morfologiczne wymienionego taksonu do *P. padus* L. jest przyczyną dość dużych trudności z jego identyfikacją. Niełatwo go odróżnić od wspomnianego, pokrewnego gatunku rodzimego, częstego w lasach i zaroślach mezofilnych na terenie centralnej Europy. Dlatego *P. virginiana* zwykle jest niezauważana, a w konsekwencji rzadko uwzględniana w opracowaniach florystycznych. W polskich zbiorach zielnikowych też jest reprezentowana skromnie, przeważanie w postaci okazów zbieranych w parkach, ogrodach i kolekcjach dendrologicznych. Na podstawie danych pochodzących z różnych źródeł – w większości zgromadzonych przez autorów w czasie wyjazdów terenowych, uzupełnionych informacjami z literatury i notatkami niepublikowanymi uzyskanymi od różnych osób – podsumowano wiadomości na temat rozmieszczenia wtórnych stanowisk *P. virginiana* w Polsce. Przedstawiono wykaz obejmujący 28 takich miejsc oraz mapę, na której zaznaczono ich lokalizację. Najwięcej stanowisk podano z terenu środkowej Wielkopolski, rejonu Torunia i Bydgoszczy oraz Dolnego Śląska. Omawiany gatunek najczęściej był obserwowany w środowisku leśnym, na eutroficznych oraz mezotroficznych siedliskach lasów liściastych, w strefie występowania zarośli krzewiastych na obrzeżach zwartych drzewostanów. Znajdowano go także w podszyciu lasów liściastych i borów sosnowych oraz w zaroślach śródpolnych. Ustalono, że w Polsce nie tylko jest zadomowiony w pełni na siedliskach półnaturalnych, lecz wkracza do fitocenozy leśnych o charakterze naturalnym. Obecnie można stwierdzić, że na ogół powoduje jedynie wzbogacenie ich składu florystycznego, a czasami przejawia zdolność do wypierania i zastępowania gatunków rodzimych. Celem zwrócenia uwagi na możliwość występowania *P. virginiana* na innych, nierozpoznanych jeszcze stanowiskach synantropijnych zamieszczono spostrzeżenia dotyczące cech morfo-

logicznych i właściwości fenologicznych, pozwalających na dostrzeganie tego taksonu w warunkach terenowych. W Polsce na ogół jest on krzewem osiągającym wysokość do 5 m i wytwarzającym liczne odrosty korzeniowe. W odróżnieniu od *P. padus* i *P. serotina*, pędy zimowe ma brunatnoszare, bez połysku. Pąki są najszersze w połowie ich długości. W dolnej części okrywają je liczne jasnobrązowe i matowe łuski. Powierzchnia blaszek liściowych jest gładka lub nieznacznie pomarszczona, a ich brzeg wyróżnia się drobnym i ostrym piłkowaniem. Kwiatostany rozwijają się później niż u *P. padus*, a wcześniej niż u *P. serotina*. Wśród porównywanych gatunków, *P. virginiana* odznacza się: najmniejszymi kwiatami, nagim dnem kwiatowym i najkrócej utrzymującymi się pozostałościami okwiatu na dojrzewających owocach. Wspólną cechą taksonów północnoamerykańskich jest gładki endokarp, który jest wyraźnie bruzdowany u gatunku europejskiego.

Słowa kluczowe: *Prunus virginiana*, *Rosaceae*, czeremcha wirginijska, antropofity, gatunki obce, Polska

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