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## ***Rubus occidentalis* (Rosaceae) – a new naturalized raspberry species in the Polish flora**

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**Abstract:** *Rubus occidentalis* L., native to eastern North America, is recorded for the first time as naturalized in Poland. Its spontaneous occurrence in Europe has hitherto been mentioned only from several stands in the Czech Republic and from single localities in Slovakia and Russia. The increasing popularity of black raspberry cultivation and its ability to survive under different environmental conditions suggest that the number of instances of its appearances in semi-natural habitats will grow over time. At the moment, *R. occidentalis* can be considered as a locally established, non-invasive neophyte.

**Additional key words:** black raspberry, introduced species, chorology, geographical distribution

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### **Introduction**

*Rubus occidentalis* L. Sp. Pl. 1: 493. 1753, occurs naturally in eastern North America and is closely related to the *R. leucodermis* Dougl. ex Torr. & Gray, replacing it in the western part of the continent (Jennings 1988). Both species share the common name ‘black raspberry’ because of the color of their fruit. They belong, along with the red raspberry (*R. idaeus* L.), to the same subgenus *Idaeobatus*, which is the second largest sub-set in the genus comprising over 200 species distributed principally in Asia (with the greatest species diversity in southwest China, which is presumably the center of its origin) and less numerously in Africa, Australia, Europe and North America (Jen-

nings 1988; Tomlik-Wyremblewska et al. 2004; Hancock 2008).

Black raspberry was not domesticated until the 19<sup>th</sup> century, probably because of its abundance in natural stands and the people’s preference for the red raspberry (Jennings 1988). The species has relatively modest commercial production when compared to red raspberries or blackberries. Nevertheless, demand for black raspberry fruit has been growing in recent years because of the health benefits resulting from a particularly high content of anthocyanins, and it is now cultivated in many parts of the world with temperate climates (Kresty et al. 2006; Dossett et al. 2010).

## Species identification (Figs. 2–5)

Black raspberry is, like other *Rubus* species, a deciduous shrub with a biennial shoot habit: first-year non-fruiting vegetative shoots (primocanes) and second-year generative shoots (floricane) are present, and with fruit being an aggregate of small drupelets. The species is easy to distinguish in Poland. The black raspberry could be only mistaken with *R. idaeus*, sharing the distinctively white underside of the leaves and the ability of their mature fruits to separate cleanly from the conical receptacle. It differs

in the main with the ripe fruit being black (similarly to blackberry, but different taste) and in its whitish waxy (glaucous), prickly stems. The flowers are different by having long, slender sepals, more than twice as long as the petals (Jennings 1988; Weber 1995). The black raspberry nearly always has ternate leaves and if there are five leaflets they are almost exclusively palmately compound (quinquefoliolate), whereas in red raspberry they are always pinnate (it is reported sometimes that *R. occidentalis* may have pinnate leaves, but this information concerns probably very rare situation and needs confirmation).

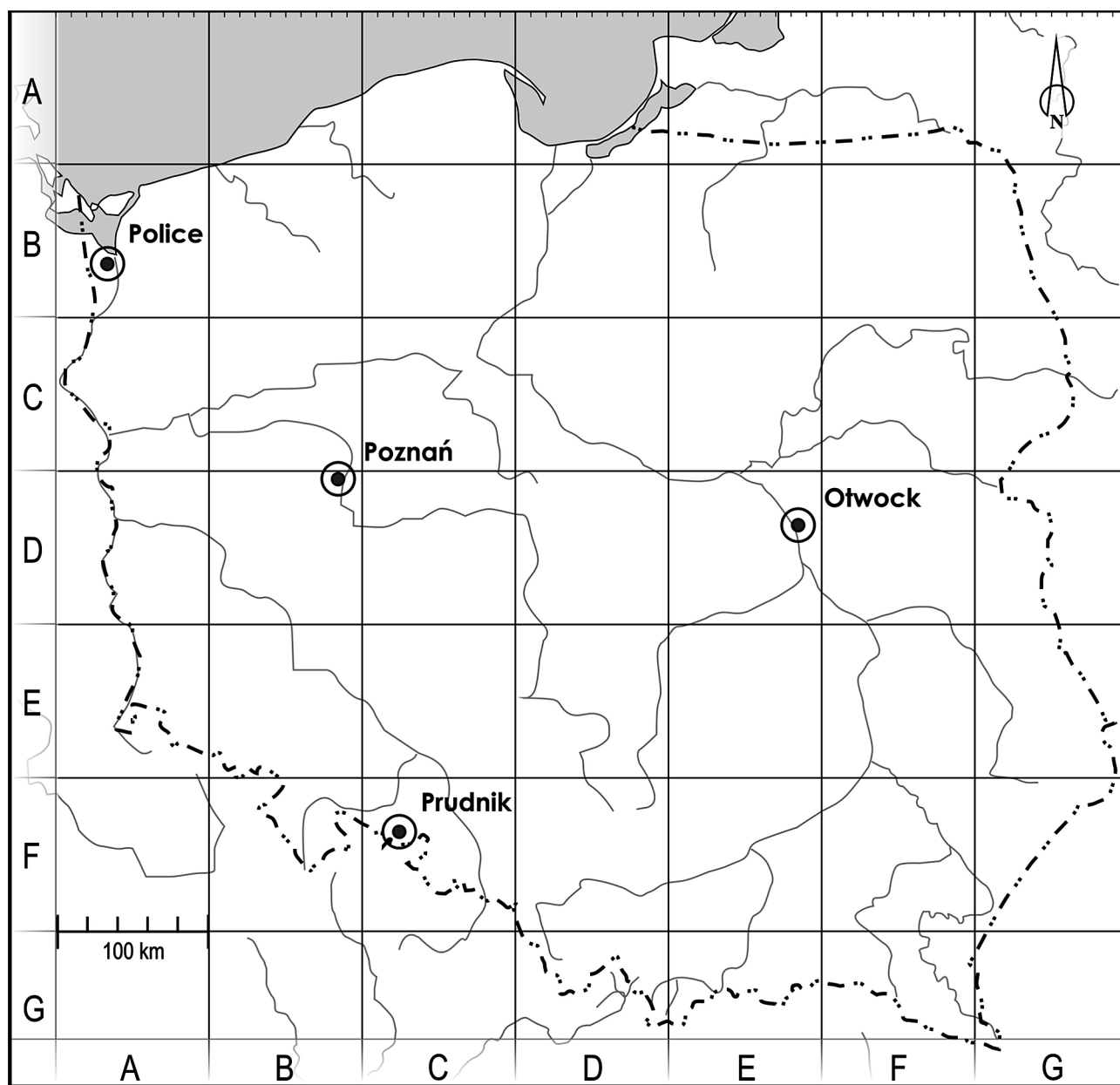


Fig. 1. Distribution of *Rubus occidentalis* in Poland; 10 km × 10 km grid in accordance with ATPOL grid applied in Distribution Atlas of Vascular Plants in Poland (Zajac and Zajac 2001)

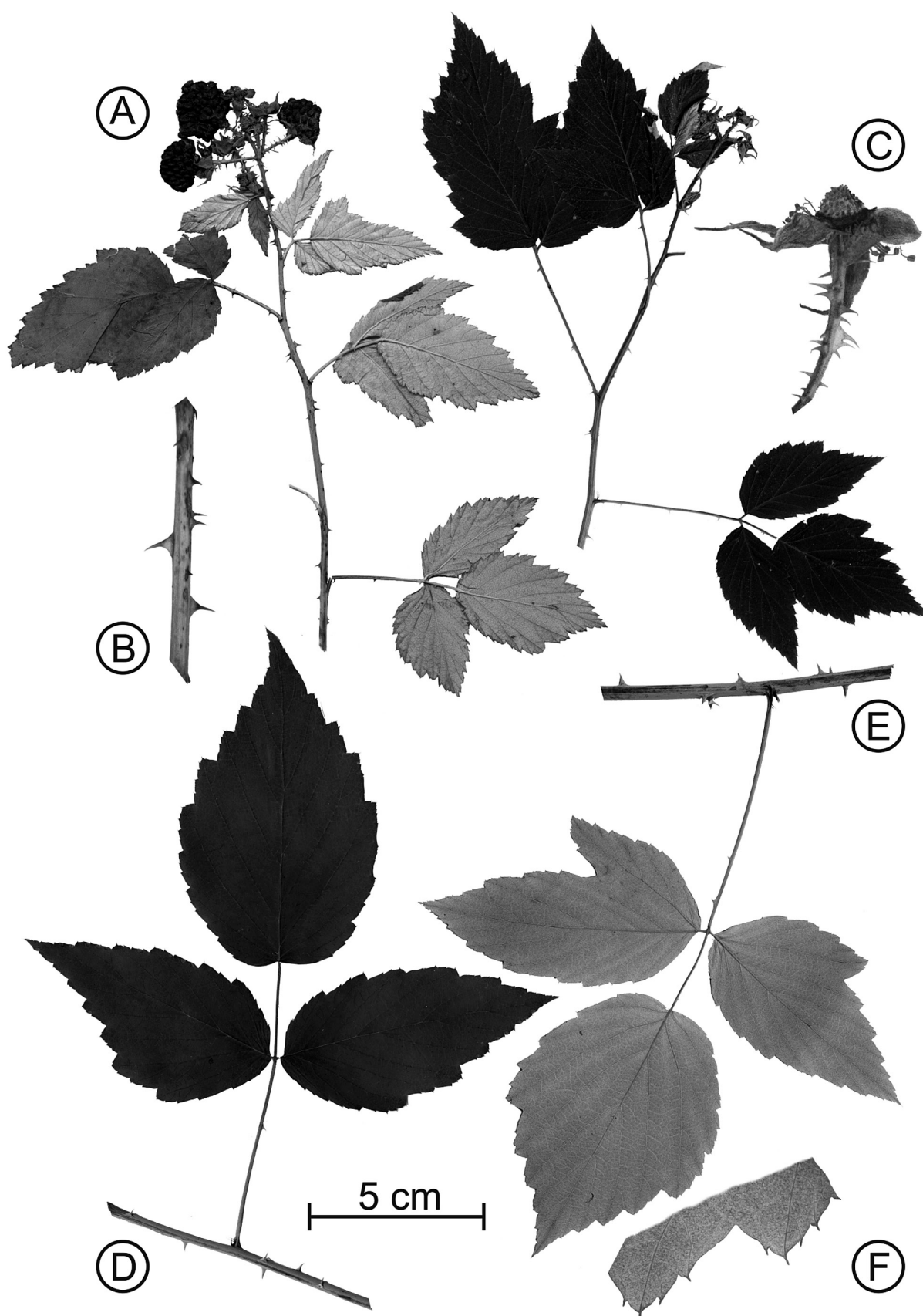


Fig. 2. Morphology of *Rubus occidentalis*: A – generative shoots; B – fragment of inflorescence axis; C – overblown flower (with long sepals, hairy ovaries of apocarpous gynoecium, and prickly pedicel); D – vegetative shoot (upper side); E – vegetative shoot (underside); F – margin of terminal leaflet (KOR 49930, 'A' left – KOR 48911)





Fig. 3. Vegetative shoot of *Rubus occidentalis*, the stand near Police, 08.2012 (photo P. Kosiński)

## Spontaneous distribution in Europe

*R. occidentalis* is a relatively recent newcomer to the European continent. Its spontaneous occurrence in Europe has hitherto only been recorded from several stands in the Czech Republic and from single localities in Germany (historical), Slovakia and Russia (Weber 1995; Kurtto et al. 2010).

## Distribution in Poland

The species has not been reported in Poland until now. It was found on four distant stands (Fig. 1). Black raspberry is probably more widespread, however the sporadic nature of these small naturalized/feral populations makes detecting them difficult.

Province: West Pomerania (Zachodniopomorskie); district: Police, east of road between Dębostów and Niekłończyca (53°36'30.98"N, 14°31'15.65"E; ATPOL: AB6313); 09.2010; sparsely (about 10 specimens); in pine forest, with other bramble species: *R. plicatus* and *R. idaeus* (numerously); 08.2012, Kosiński (KOR 49930).

Province: Mazovia (Mazowieckie); Otwock, about 200 m NE from allotment gardens by a housing estate

on W. S. Reymonta Street (67, 52°6'49"N, 21°17'27"E; ATPOL: ED3847); in pine forest; singly (three specimens), together with *R. schnedleri* and *R. nessensis* (both species quite numerous); 09.2010, Kosiński (KOR 49929).

Province: Opole (Opolskie), Prudnik, NE outskirts of the city, Zielona Street (50°19'50"N, 17°35'32"E; ATPOL: CF3259); in roadside thickets, between fields, on loess substrate; several individuals; 06.2003, Maliński (KOR 48911).

Province: Greater Poland (Wielkopolskie); Poznań, SE outskirts of Marcein Forest (Lasek Marceiński), near the end of Węgorka Street (52°23'53.22"N, 16°50'57.14"E; ATPOL: BD0833); 09.2013; sparsely (four clumps); in pine forest, with *R. caesius* and *R. idaeus*; 09.2013, Kosiński, Maciejewska (KOR 49995).

## Ecology

Within its native range, black raspberry mainly occupies disturbed habitats and forest edges, and generally has a more southerly distribution than *R. idaeus*. Both species co-occur regularly over approximately the northern quarter of the range of *R. occidentalis* in North America and can often be found growing side-by-side in these areas (Jennings 1988; Dossett and



Fig. 4. *Rubus occidentalis* – fragment of vegetative stem, the stand near Police, 08.2012 (photo P. Kosiński)



Fig. 5. The fruiting stem of *Rubus occidentalis* with aggregated fruit which is not fully developed, consisting only of a few drupelets, the stand near Police, 08.2012 (photo P. Kosiński)



Finn 2007). In Poland, it was observed in semi-natural mesotrophic habitats of fresh mixed coniferous forest developed on sandy rusty soils (Police, Otwock and Poznań) and in wayside thickets on fertile loess soil (Prudnik). The understory of the pine forest does not seem optimal for the species growth, probably because of insufficient light level. The black raspberry there exhibited signs of weakened vitality: only trifoliate leaves on vegetative stems and a lack of fruit or not fully developed aggregate fruit consisting of only a few drupelets (Fig. 5). In such habitats, it can slowly spread out, mainly vegetatively. In an open field, *R. occidentalis* fruits well (Prudnik), but it is exposed to higher competition with native plant species, and this also limits its expansion. This observation corroborates closely those in a recently-published thesis on black raspberry ecology (Bajcz 2012). Essentially, in poorly lit areas, *R. occidentalis* can persist in a vegetative state with little or no reproductive success where it can slowly spread to areas with better lighting or until disruption in the canopy changes lighting conditions.

## Discussion and Conclusions

The small populations of *R. occidentalis* have probably descended from feral cultivated plants. It is especially likely in the case of the three stands in Otwock, Poznań and Prudnik, which are located in the vicinity of home gardens and allotments. The fourth site (Police) was more remote from settlements. Spontaneous occurrence of the species in the semi-natural habitats of various types indicates that it has wide tolerance range. It should be expected that with the increased popularity of black raspberry in cultivation, the number of cases of escape from cultivation may increase. Introductions of new varieties will enlarge the genetic pool of this plant, and this should facilitate an adaptive response. The cross of *R. occidentalis* × *R. idaeus* is also possible if *R. occidentalis* is used as the female parent, and this may contribute to a horizontal gene transfer between the two species (Hellman et al. 1982; Moore and Tople 1999), which can also translate into better adaptation to the prevailing environmental conditions. However, in the light of other studies the possibility of hybridization between both species is rather small. Dossett et al. (2012) found a very small number of hybrids in a broad sample of wild *R. occidentalis* germplasm. They noted little evidence of increased genetic differentiation in wild populations where both species co-occur (a few populations of *R. occidentalis* had “extra” alleles, but no definitive *R. idaeus* alleles were identified).

Apart from the black raspberry, there are two other bramble species of eastern North American origin in Poland, formerly cultivated for their fruit and locally

naturalized: *R. allegheniensis* PORTER and *R. canadensis* L. (Kosiński 2007, 2010; Kosiński and Bednorz 2003; Kosiński and Zieliński 1998; Oklejewicz 2006; Zieliński 2004; Zieliński et al. 2004). The most common is the first one, which is discovered on an increasing number of stands, often remote from human settlements. At the same time, it occurs much more frequently in some parts of Germany and southern Sweden. Perhaps this is related to its greater popularity in cultivation in the past and the time of its introduction.

The pace of colonization of the area by an alien species depends on its biology, firstly on its adaptability and the ability to compete with other plants. Some alien species remain limited to a small area around the point of introduction (non-invasive species), whereas others spread extensively (invasive species). The difference between non-invasive and invasive species is often vague because expanding the spatial distribution depends partly on time since establishment, which is not always precisely recognized. It should be taken into account that the phase of invasion is usually preceded by a latent phase of waiting (lag phase), which may be longer or shorter in different species (Kolar and Lodge 2001). At the moment, *R. occidentalis* can be considered as an established locally, non-invasive neophyte. It can be expected that the number of its appearances in semi-natural habitats will increase with time. It is difficult to draw conclusions about the possible expansion of the black raspberry in Poland, but further monitoring of populations is required to identify its potential to invade.

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