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Revisiting the taxonomy of *Populus lasiocarpa* × *P. wilsonii* hybrids

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Abstract: Although hybrids between *Populus lasiocarpa* and *P. wilsonii* have been known for many years, they have not been given a valid nothospecies name. Resolving the classification issue of these bigleaf poplars is now even more necessary because they are known not only from cultivation, but recent evidence confirms their spontaneous occurrence in Hubei Province, China (Zhang, unpublished information). The two species were first artificially crossed in 1956 in Poland and again independently in 1974 in Sweden. Initially, this taxon was described as *P. ×wilsocarpa* (Bartkowiak & Bugała, 1978). However, this name was invalid due to the lack of Latin diagnosis (which was required at that time) and lack of type designation. In 1996, Böcker and Koltzenburg proposed the name *P. ×kornicensis* for this hybrid, but it too was invalid for similar reasons and lack of description. In our work, we revisited these poplars and validated the name proposed by Böcker and Koltzenburg by providing a description and type designation. Considering the overall appearance of these hybrid poplars (silhouette, branching pattern), they bear a closer resemblance to *P. wilsonii*. Other analyzed morphological features are mostly intermediate compared to the parent species, but overall, they lean slightly more towards *P. lasiocarpa*. We highlight the main diagnostic characteristics that distinguish these species.

Keywords: Leucoides, allopatric hybridization, Kórnik arboretum, poplar, typification

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Introduction

The genus *Populus* L. (Salicaceae Mirb.) consists of deciduous and dioecious tree species, commonly known as aspens, cottonwoods, and poplars, that are widely distributed across the Northern Hemisphere. The number of its taxa varies depending on

the methodology employed. According to different studies, the estimate ranges from around 30 (Eckenswalder, 1996; Dickmann & Kuzovkina, 2014) to over 100 species (Fang et al., 1999; Govaerts et al., 2021). Many still require further taxonomical study, particularly in Mexico and Asia (Dickmann & Kuzovkina, 2014; Korbik, 2020).

The genus is generally accepted to consist of six sections (e.g. Eckenwalder, 1996; Dickmann & Kuzovkina, 2014; Korbik, 2020; Du et al., 2022). The section *Leucoides* Spach. (bigleaf poplars) includes North American *P. heterophylla* L. and three Asian species: *P. glauca* Haines, *P. lasiocarpa* Oliv. and *P. wilsonii* C.K.Schneid. (Govaerts et al., 2021). The ornamental value of these poplars is widely recognized, but their commercial utilization is limited because they are difficult to propagate from cuttings and have poor grafting success rates. Many authors consider *P. wilsonii* as a synonym of *P. glauca* (Haines, 1906; Schneider, 1917; Hara, 1982; Schilling, 1999; Trees and Shrubs Online; Eckenwalder, 1996; Dickmann & Kuzovkina, 2014). Nonetheless, specific crucial morphological characteristics of the flowers and fruits indicate that they are two distinct species (Zhang et al., 2021; Korbik & Andrzejczak, 2022). We adopt this approach in this work.

Different flowering time represents a significant impediment to the hybridization of *P. lasiocarpa* and *P. wilsonii*. In the climate of Poland, *P. wilsonii* flowers approximately one to two weeks earlier than *P. lasiocarpa* (Białobok, 1973). Bartkowiak and Bugała (1978) have documented spontaneous pollination of *P. wilsonii* by *P. lasiocarpa*, but few viable seeds resulted from such crosses. However, no information is available concerning the effective spread of these hybrid seeds. Zhang (unpublished data) recently confirmed the spontaneous hybridization of both species within their natural range in Hubei province, China.

The first successful hybridization of both species was reported by Bartkowiak and Bugała (1978) from the Institute of Dendrology of the Polish Academy of Sciences in Kórnik. In 1956, pollen from flowering shoots of *P. lasiocarpa* (stimulated in the greenhouse) was collected and used to pollinate isolated female flowers of *P. wilsonii*. In 1963, the six most promising resulting plants were grafted onto *P. ×jackii* Sarg. ‘Gileadensis’ and planted in the Kórnik Arboretum. Fifteen years later, Bartkowiak and Bugała (1978) described this hybrid as *P. ×wilsocarpa*. This name is currently used worldwide, despite its invalidity due to lacking a Latin description and type designation. Bugała (2000) also utilized this epithet as a cultivar name, *P. ‘Wilsocarpa’*. At present, only 13 hybrid specimens have survived in the Kórnik Arboretum, representing probably only three clones, 11981 (♀), 11982 (♂), and 11985 (♀).

In 1974, Bengtsson and Nitzelius conducted the same cross at Gothenburg Botanical Garden in Sweden, unaware of the work by Bartkowiak and Bugała. They obtained five hybrids, from which Lorentzon selected the fastest-growing one and named it ‘Beloni’. This Swedish cultivar is often designated with the letter “E” in its name (‘Beloni’ E), indicating its elite status. Bengtsson (1992) applied the name *P. ×wilsocarpa* to this cultivar.

Böcker and Koltzenburg (1996) proposed an alternative name for hybrids between *P. wilsonii* and *P. lasiocarpa*, which is infrequently used, *P. ×kornicensis*. This name was also invalid due to the lack of

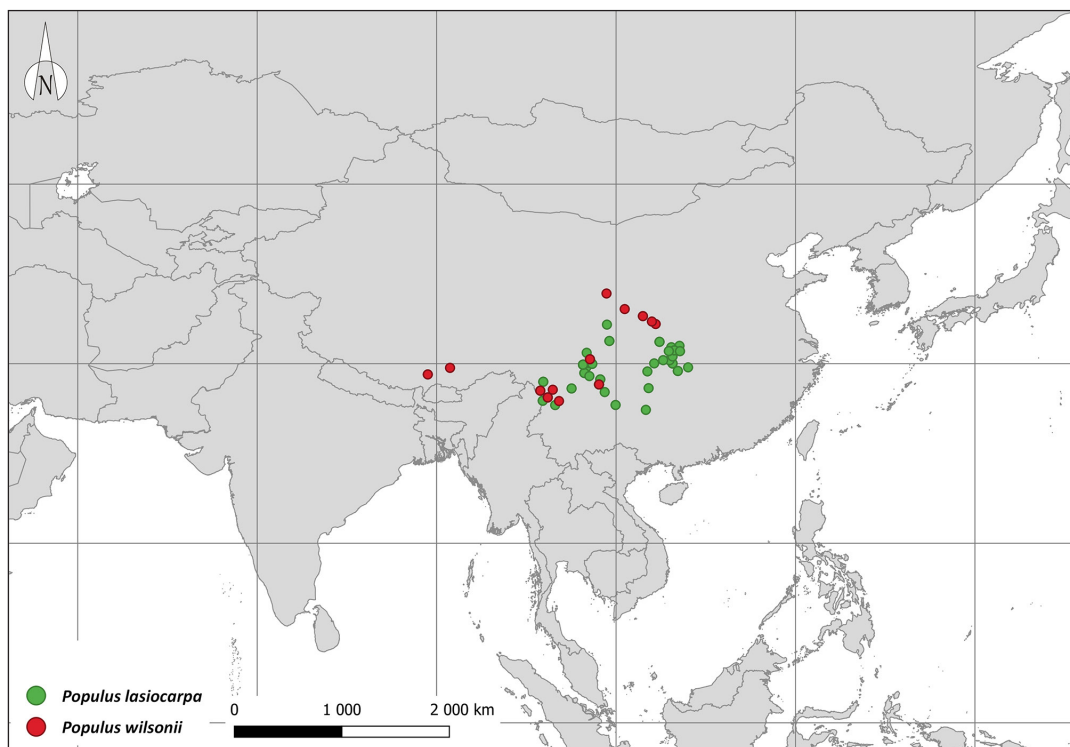


Fig. 1. The geographical distribution of *Populus lasiocarpa* (GBIF.org 2023a) and *P. wilsonii* (GBIF.org 2023b)

a formal description and type specimen designation. However, the name change was fully justified; the epithet “*wilsocarpa*,” which combines the names of the parent species, is semantically problematic.

This study aimed to identify distinctive characteristics that could distinguish the hybrid specimens. Recognizing hybrids requires a broad understanding of the parent species. As is typical of hybridization, the hybrid offspring inherit traits from their parents in varying degrees. We validated the name *P. ×kornicensis* by providing a comprehensive description and designating a type specimen. However, it should be noted that our research relied solely on trees cultivated in Europe, which represent only a fraction of the entire spectrum of the variability of the parental species and their possible hybrids.

Material and methods

We have examined all the known specimens of *P. lasiocarpa* × *wilsonii* cultivated in Poland. Male and female clones of Kórnik origin were found in several dendrological collections, including the Wojsławice Arboretum, Botanical Garden in Powsin (Polish Academy of Sciences), UMCS Botanical Garden in Lublin, and Wirty Arboretum. However, some of these trees are mislabeled as *P. wilsonii*. The collected specimens

were deposited in the Herbarium of the Institute of Dendrology in Kórnik (KOR). The morphological description and illustrations were based on the herbarium specimens and fresh materials from the plants grown in garden collections. Morphological terminology used in this study follows the works of Eckenwalder (2010), Fang et al. (1999), Dickmann and Kuzovkina (2014), and Radford et al. (1974). Spontaneous hybridization of *P. lasiocarpa* and *P. wilsonii* in Hubei Province, China (31°43'45.2"N, 110°28'38.6"E), was documented by photos of a group of trees and saplings (Zhang, unpublished information).

Taxonomic treatment

Populus ×kornicensis Böcker & Koltzenburg ex Korbik & Kosiński, *nothosp. nov.*

the hybrid between *P. lasiocarpa* Oliv. and *P. wilsonii* C.K.Schneid.

LSID: urn:lsid:ipni.org:names: 77327816-1

(Figs 2–6, S1–S7)

=*P. ×wilsocarpa* S.Bartkowiak & W.Bugała, *nom. inval.*, *Arbor. Kórnickie* 23: 225 (1978)

=*P. ×kornicensis* Böcker & Koltzenburg, *nom. nud.*, *Pappeln an Fließgewässern. Handbuch Wasser* 2: 30 (1996)



Fig. 2. *Populus ×kornicensis*, a female specimen. Kórnik Arboretum (specimen ID: 11981-037-001) (Photo by P. Kosiński)



Fig. 3. *Populus ×kornicensis*, branch with infructescences. Kórnik Arboretum (specimen ID: 11981-037-001) (Photo by P. Kosiński)

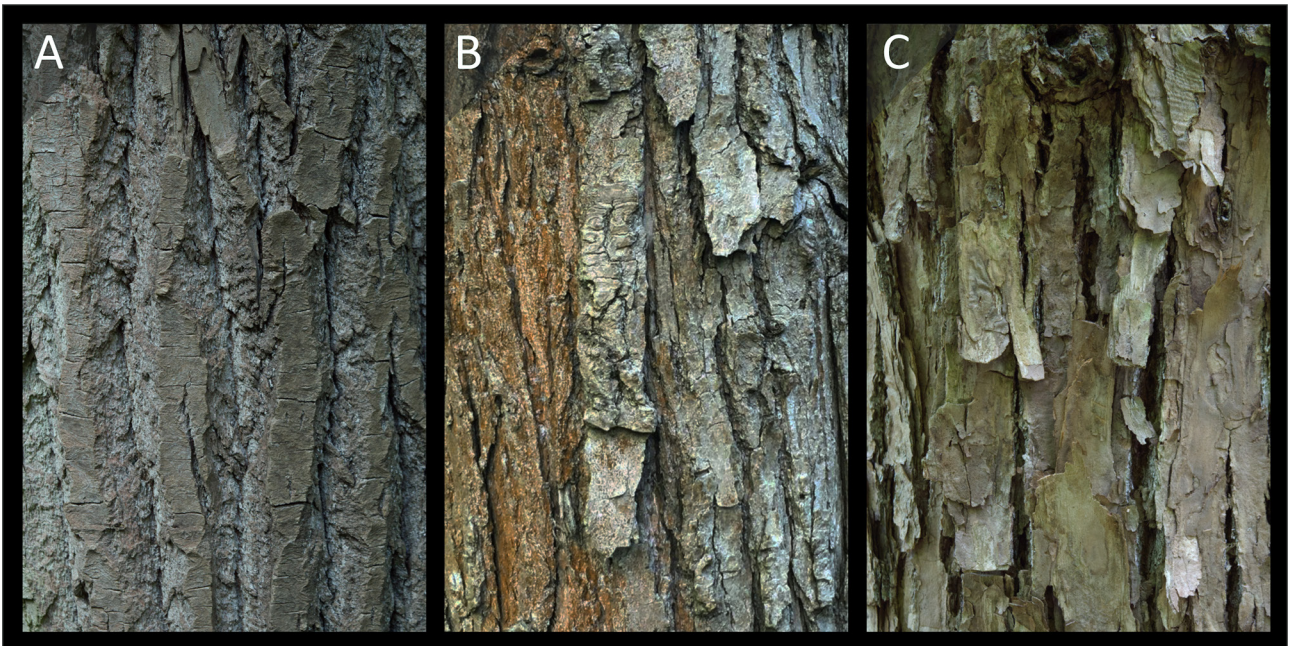


Fig. 4. The bark on the trunks of *Populus wilsonii* (A), *P. ×kornicensis* (B) and *P. lasiocarpa* (C) (Photos by M. Korbik)



Fig. 5. Long shoots with apical buds of *Populus wilsonii* (A), *P. ×kornicensis* (B), and *P. lasiocarpa* (C) (Photos by P. Kosiński)

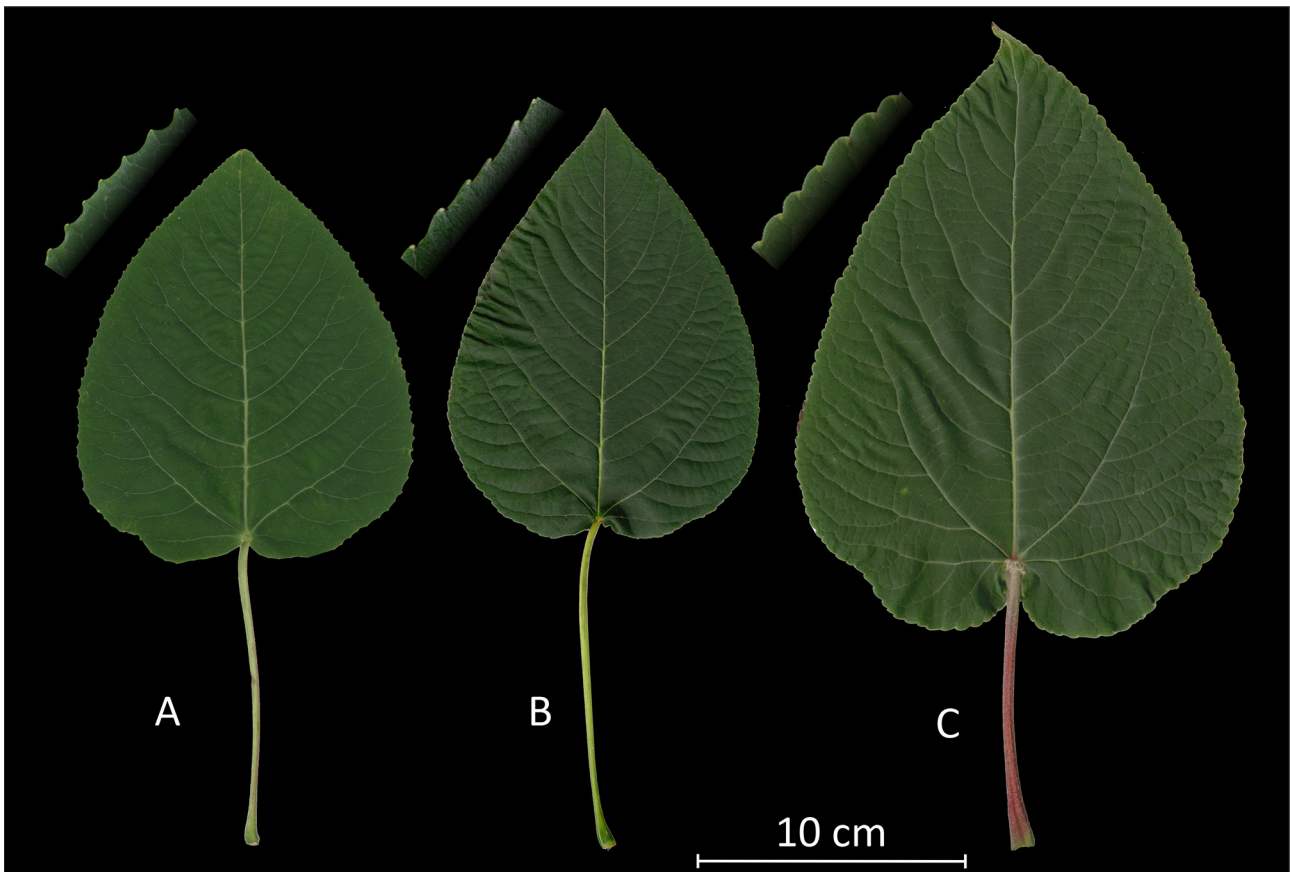


Fig. 6. Neofomed leaves of *Populus wilsonii* (A), *P. ×kornicensis* (B), and *P. lasiocarpa* (C) (Photos by M. Korbik)

Type. Poland. Wielkopolska Province, Kórnik Arboretum, sect. XXXVII, inv. no. 11981-037-001; 52°14'42.7"N, 17°05'56.9"E; 24.06.2023; coll. Piotr Kosiński & Jerzy Zieliński s.n.; KOR 56092 (Fig. 7).

Diagnosis

Crown shape and branching pattern closer to *P. wilsonii* (Figs S1–S3). The bark slightly furrowed with a tendency to exfoliate with short, vertical strips (exfoliating in *P. lasiocarpa* and deeply furrowed in *P. wilsonii*). Shoots olive-green, ±glabrescent, terete to slightly angled with usually intermediate, pale orange pith (in *P. lasiocarpa* yellowish-gray, ±dull and angled with bright orange pith; in *P. wilsonii* dark green, glabrescent and terete with green pith). Terminal bud ovoid-conical with ±conspicuous vertical rib, pointed apex, the base of the bud often with remains of stipules, basal scales ±glabrous (in *P. lasiocarpa* often tomentum-covered basal scales; in *P. wilsonii* ovoid-globose buds with obtuse apex, slightly viscid and ±glabrous, without remains of stipules at the base).

The leaf blade with more or less acuminate apex (acuminate on *P. lasiocarpa* and obtuse on *P. wilsonii*); base ±deeply cordate with basilaminar glands (absent in *P. wilsonii*); margin of the lamina intermediate

between parent species (glandular crenate and revolute between teeth on *P. wilsonii* and glandular crenate-serrate on *P. lasiocarpa*). The number of leaves on brachyblasts usually 6–8, sometimes more (6–8 in *P. lasiocarpa* and 8–12 in *P. wilsonii*). Infructescence usually very long, up to 40 cm (25 cm and 15 cm in *P. lasiocarpa* and *P. wilsonii*, respectively), with shortly pedicellate capsules (typically sessile in specimens of *P. lasiocarpa* known in cultivation and pedicellate in *P. wilsonii*) and pubescent rachis (in *P. lasiocarpa* pilose to almost glabrous, while in *P. wilsonii* densely pubescent) (Figs S4–S7). For detailed differences between *P. ×kornicensis* and its parental species, please refer to Table 1.

Description

Trees up to 20 m tall. Crown regular, ovoid, with a central leader and numerous medium-sized, raised branches (Fig. S2). Bark initially greyish and smooth, later greyish brown, slightly furrowed with a tendency to exfoliate with short, vertical strips. Shoots thick, rounded to ±angular; olive-green, ±glabrescent, sometimes with a red tint on the side exposed to the sun; pilose at first to glabrous in the winter; pith pale orange (orange); leaf scars raised with ±sunken bundle scars. The terminal bud large, ovoid-conical

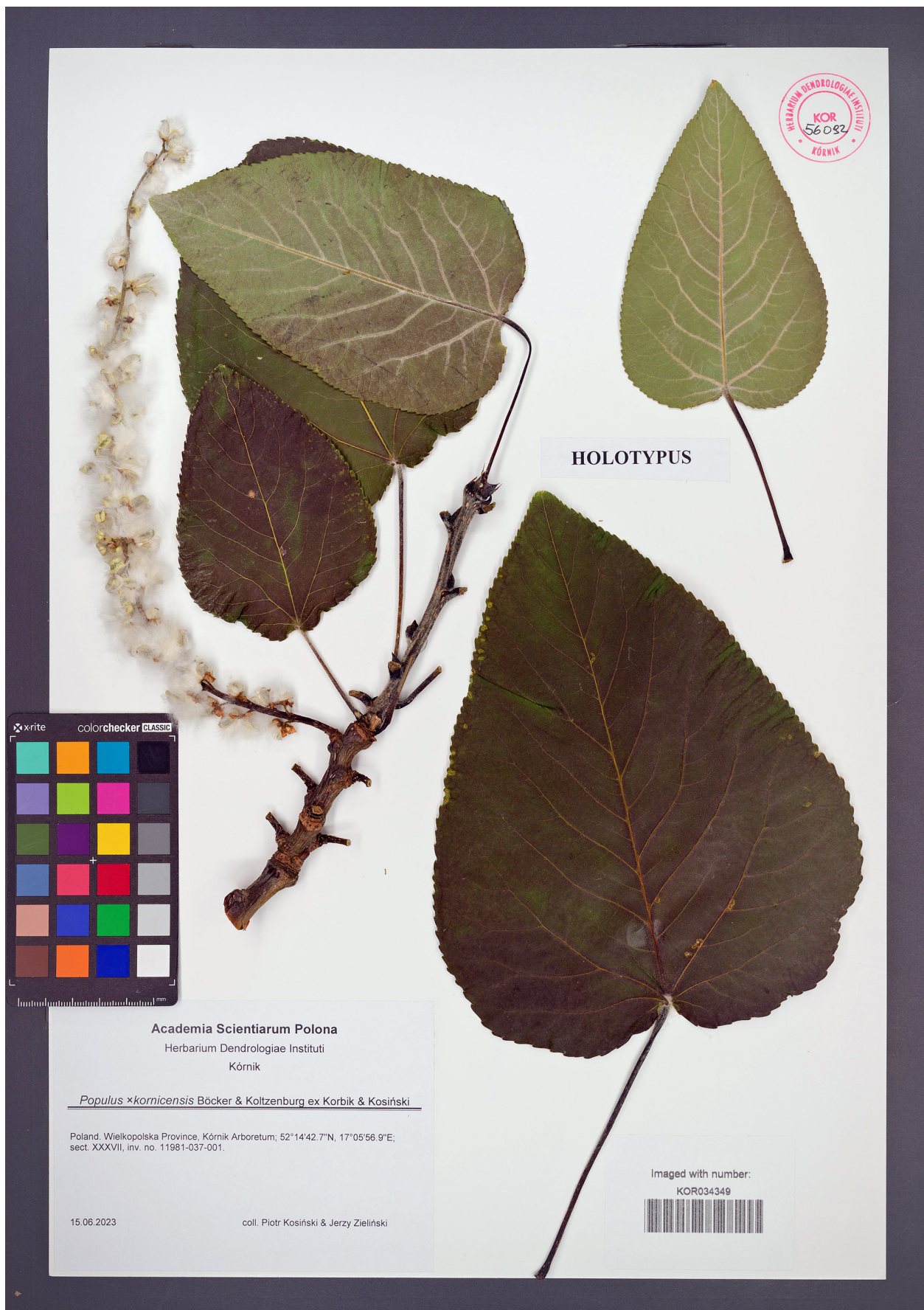


Fig. 7. A holotype of *Populus x kornicensis*, KOR 56092

with acute apex, slightly viscid, often with remains of stipules at the base. Bud scales greenish-brown with darker margins, frequently with \pm conspicuous vertical rib, basal scales \pm glabrous. The axillary buds with the apex pointed \pm outwards from the shoot; flower buds larger than leaf buds. The preformed and neoformed leaves similar in shape and size. Unfolding leaves red tinted and \pm tomentose abaxially. The number of leaves on brachyblasts approximately (6)8–10(12). The leaf blade up to 28 cm long and 24 cm wide; ovate with a cordate base and usually 1–2 round basilamiar glands; the apex shortly acuminate. The leaves adaxially dark green, slightly wrinkled

and \pm glabrescent; abaxially pale green and \pm tomentose at first, especially along veins. The leaf margin non-translucent, unciliated, glandular (crenate-)serrate and \pm recurved between each tooth. Venation usually \pm red tinted, with tertiary veins \pm visible; petioles flattened near the leaf union, \pm red coloured, slightly tomentose to glabrous. Staminate aments about 10 cm long; each flower with up to 40 stamens with yellowish to red coloured, apiculate anthers; rachis pubescent (Fig. S6). Pistillate flowers with the deeply lobed disc; carpels (2-)3 with yellow stigmas, sometimes with red tint; bracteoles broad, irregular, unciliated, slightly pubescent abaxially and with

Table 1. Main differences among *Populus lasiocarpa*, *P. wilsonii* and their hybrids (specimens known in cultivation)

Trait	<i>P. lasiocarpa</i>	<i>P. ×kornicensis</i>	<i>P. wilsonii</i>
Tree			
Height [m]	up to 20	up to 20	up to 25
Trunk			
Bark	greyish-brown, shallowly furrowed, exfoliating	brownish-gray, shallowly furrowed and slightly exfoliating	grey, deeply furrowed
Shoots			
Colour	yellowish-brown, dull	olive-green, \pm glossy	green, glossy
Shape	angled	slightly angled	terete
Pubescence	\pm tomentose at first to almost glabrous	\pm pilose at first to glabrous	\pm pilose at first to glabrous
Pith	bright orange	pale orange (sometimes orange)	green
Number of leaves on brachyblasts	6–8	6–8(–12)	8–12
Terminal buds			
Shape	conical with acute apex and vertical rib in the middle of the scales	ovoid-conical with acute apex and \pm conspicuous vertical rib in the middle of the scales	ovoid-globose with obtuse apex; vertical rib in the middle of the scales absent
Scales	green with darker margin; basal scales covered with tomentum	greenish-brown with darker margin and slightly viscid; basal scales \pm glabrous	green, often with a reddish tint on the side exposed to the sun; basal scales \pm glabrous
Stipules remains	present	present	absent
Leaves (neoformed, on long shoots)			
Blade width \times length [cm]	15–25 \times 19–35	14–24 \times 18–28	7–15 \times 10–21
Adaxial side of the leaf	dark green and shiny	dark green and \pm glabrescent	dark bluish-green and matt
Abaxial side of the leaf	bright green and dull, tomentose along veins	intermediate	bright green and shiny; tomentose only young leaves
Apex	acuminate	acuminate or intermediate	\pm obtuse
Margin	glandular crenate-serrate	intermediate	glandular crenate and revolute between teeth
Basilaminar glands	present	present, rarely absent	absent
Petiole cross-section	round and slightly flattened close to the leaf blade	round and strongly flattened close to the leaf blade or intermediate	round and strongly flattened close to the leaf blade
Petiole/lamina length ratio	usually about 1/3, not longer than 1/2	more than 1/2, but not more than 3/4	more than 1/2, usually more than 3/4 (even >1)
Inflorescence			
Hermaphroditism	rarely present	absent	absent
Rachis	pubescent to \pm glabrous	intermediate	densely pubescent
Stigmas colour	yellow; sometimes red, slightly reddish	yellow; occasionally red, slightly reddish	yellow
Infructescence			
Length	up to 25 cm	up to 40 cm	up to 15 cm
Capsules	ovoid, but often irregular, sessile or rarely shortly pedicellate	intermediate	ovoid and regular, pedicellate

deeply cut apex. Infructescence about 30(40) cm long, with pubescent to almost glabrous rachis; capsule ovoid, ±irregular and pubescent, up to 15 mm long, pedicellate, (2-)3 valved (Figs S4–S7).

Eponymy

The epithet “kornicensis” refers to Kórnik Arboretum in Poland, where the first cross between *P. wilsonii* and *P. lasiocarpa* was done by Stanisław Bartkowiak and Władysław Bugała in 1956.

Specimens examined

Poland. Greater Poland Province, Kórnik

Kórnik Arboretum, sect. II, 52°14'44.1"N, 17°05'32.6"E (specimen ID: 01869-002-001); 52°14'43.6"N, 17°05'32.9"E (specimen ID: 01869-002-002); 52°14'43.9"N, 17°05'32.7"E (specimen ID: 01869-002-003); 52°14'44.3"N, 17°05'32.4"E (specimen ID: 01869-002-004); sect. VII, 52°14'38"N, 17°05'31.1"E (specimen ID: 01869-007-001); sect. XXV, 52°14'41.6"N, 17°05'47.4"E (specimen ID: 01869-025-001); sect. XXX, 52°14'38.3"N, 17°05'52.5"E (specimen ID: 51212-030-001); sect. XXXI, 52°14'42.2"N, 17°05'49.6"E (specimen ID: 11985-031-001); 52°14'40.8"N, 17°05'50.9"E (specimen ID: 11982-031-001); 52°14'39.1"N, 17°05'51.9"E (specimen ID: 51323-031-001); sect. XXXVII, 52°14'42.7"N, 17°05'56.7"E (specimen ID: 11981-037-001); 52°14'41.2"N, 17°05'58.7"E (specimen ID: 11675-037-001); sect. CI 52°14'45.8"N, 17°06'0.2"E (specimen ID: 55747-101-001)

Lower Silesian Province, Niemcza: Wojsławice Arboretum, 50°42'43.2"N, 16°51'44.4"E

Mazovia Province, Warszawa: Botanical Garden in Powsin, 52°06'32.9"N, 21°05'25.8"E

Lublin Province, Lublin: UMCS Botanical Garden, 51°15'37.4"N, 22°30'56.3"E (group of five trees)

Pomerania Province, Wirty: Wirty Arboretum, 53°53'56.5"N, 18°22'36.8"E and 53°53'57.8"N, 18°22'53.6"E.

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information about spontaneous hybrids between *P. wilsonii* and *P. lasiocarpa* occurring in China.

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