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Juglans ×intermedia Carr. – an interesting finding in the Židlochovice Forest Enterprise

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ABSTRACT: A grown-up specimen of *Juglans ×intermedia* Carr. walnut was accidentally found in the stand of black walnut (*Juglans nigra* L.) in the Židlochovice Forest Enterprise in the forest district Velký Dvůr, Stand No. 224 D10. The tree was photographed, leafy shoots and fruits were sampled for later analyses. The paper brings a description of growth habit, rough bark, morphology of leaves, current year shoots and fruits. Discussed are dissimilarities from the parental species (*J. nigra* and *J. regia* L.).

Keywords: *Juglans ×intermedia* Carr.; morphology; biometry

Walnuts are woody species that readily crossbreed with one another. Therefore spontaneous hybridization of walnuts occurs relatively frequently. POKORNÝ (1952) presented a review of 13 interspecific hybrids. *Juglans ×intermedia* Carr. is a crossbred of Persian walnut (*Juglans regia* L.) and black walnut (*Juglans nigra* L.). The former parental species belongs to the group of old utility woody species, the latter originates from the eastern part of North America and has been grown in Europe as a park species of collections approximately since 1656 or 1686 (SVOBODA 1981; VĚTVIČKA 1999). It was planted for the first time in the Czech Republic in the Royal Game Preserve (Královská obora) in 1835 (SVOBODA 1981). The species began to be planted into forest stands in southern Moravia as early as in the first half of the 19th century. Most of the forests in question were in possession of the Lichtenstein duke family at that time (in the surroundings of Břeclav, Strážnice and Bučovice). The then foresters on these estates were great supporters of the introduction of new woody species into forest stands, North-American species in particular. Transplants for plantations were grown in nurseries established on the Lichtenstein estate and trade in seeds was blooming. The seeds were apparently collected also in parks where hybridization could not be excluded.

One spontaneous hybrid of *J. ×intermedia* whose age was determined to be approximately 100 years was found at a field walk in the area of Židlochovice Forest Enterprise in 2002. The maternal species is most probably *J. nigra* because the specimen was found in an even-aged black walnut stand artificially established from seeds. There is no other finding of the mentioned hybrid known from other places in the Czech Republic and this is why the paper aims at a detailed description of its morphological traits and basic biometric characteristics.

MATERIAL AND METHODS

DESCRIPTION OF LOCALITY OF FINDING

The described individual can be found in the territory of Židlochovice Forest Enterprise, s. p., Velký Dvůr forest district, Ivaň cadastral area, Břeclav District – Velký Dvůr-Dlouhá leč pheasantry. The elevation of the locality is about 175 m above sea level. The black walnut stand in question is marked as 224D10 in the forest management plan; an excerpt from tables in the Book of Management is presented in Table 1. Climatic characteristics for the given area are presented in Table 2.

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Table 1. Excerpt from the Book of Management (Forest Management Plan) for Stand 224 D10

Stand	Area (ha)	Age	MG	FT	Stocking	Species (mean height (m)/d.b.h. (cm))	Representation (%)	Actual stock (m^3 i.b.)	Stock per 1 ha (m^3 i.b.)
224D10	0.92	100	9185	1L2	10	ORC(31/49)	100	475	516

Legend: MG (Management Groups of Stands)
FT (Forest type)

Table 2. Climatic characteristics – Velký Dvůr, Pohořelice Station

Characteristic	Unit	Velký Dvůr – Pohořelice Station		
Average annual temperature	°C	9.0		
Average temperature in growing season (IV–IX)		15.6		
Average annual total precipitation	mm	499		
Average total precipitation in growing season (IV–IX)		319		
Arrival and end of frosts Average for years 1961–1997 Znojmo-Kuchařovice	Date (day-month)	Average	Earliest	Latest
Arrival of frosts – min. temperature –0.1°C and lower		23 Oct.	29 Sept.	23 Nov.
Minimum temperature –5.0°C and lower		28 Nov.	29 Oct.	23 Dec.
End of frosts – min. temperature –0.1°C and higher		19 April	28 March	12 May
End of frosts – min. temperature –5°C and higher		2 March	16 Jan.	24 March

METHODOLOGY

The found individual of *Juglans* ×*intermedia* Carr. was photographed on the spot with leafy branches being sampled for laboratory analyses and fallen nuts collected. Branches were also taken from black walnut and Persian walnut to make a comparison. Leaves were placed into press and later described for the number of yokes, blade shape and margin. Morphological parameters of leaves were evaluated in a statistic set of hundred items by the method of image analysis in the Lucia programme (laboratory of biometry at the Faculty of Forestry and Wood Technology, Mendel University of Agriculture and Forestry in Brno). Circumpolarity is the ratio of leaf area to leaf circumference. The apparel of leaves, petioles, shoots and the existence and shape of glands were explored under Nikon SMZ 2T macroscope. Nuts were cut into cross and longitudinal sections. All procedures were documented by Nikon Coolpix 950 digital camera.

RESULTS AND DISCUSSION

According to the Book of Management the tree age is about 100 years. Its crown differs from the adjacent black walnut trees in a more obtuse angle of primary branches, which makes the crown look more patulous (Fig. 1). The tree has bark of lighter colour, markedly smoother and lustrous in the upper third. With its growth parameters the specimen surmounts average characteristics applicable to the stand of black walnut (Fig. 2). Diameter at breast height is 80 cm in the hybrid, tree height is 35.6 m, height of the first branch setting is 11 m, height of crown setting 16.4 m, and stem volume amounts to 9.5 m^3. It means that the hybrid surmounts the mean d.b.h. of black walnut stand and its height by more than 30 cm and 4.6 m, respectively. The rapid growth can be explained by the effect of heterosis which can be seen in the first progeny of interspecific hybrids rather frequently (POKORNÝ 1952). The individual is fertile and its fruits are 7–9 cm long, globular on the longitudinal section and ellipsoid on the cross-section. The nut (Figs. 3, 4 and 5) is square-globular and flattened on the side, its dimensions are 4.4–4.9 cm × 4.5–5.1 cm × 3.5–4.0 cm, and its shape resembles that of *J. regia*. Endocarp reminds of black walnut, i.e. it is brown, striate, thick 0.4–0.8 cm, with sweet seed. Germinating seeds were found under the tree in the stand at the beginning of June. No seedlings at a more advanced stage of development were found.

Leaves are imparipinnate, with 3–5 yokes, composed of 7–11 leaflets with the terminal leaflet in the hybrid being not so markedly enlarged as in Persian walnut (Fig. 6). The margin of leaflets is distant serrate (Fig. 7) but quite often nearly entire. The leaflets have pubescence fascicles in vein axils, sparse star-like hairs on the back of the blade in the vicinity of 1st and 2nd order nervation, and pedunculated glands on veins occurring on the back of the leaf blade (Fig. 8). Annual shoots have thin long hairs (Fig. 9), petioles with dense hairs, particularly on the upper face (Fig. 10). These characters also confirm the intermediate form between the two parental species. A comparison of the described parameters with those of parental species is presented in Table 3.

For example, VĚTVIČKA (1999) mentions the number of yokes in Persian walnut to be 2–4, and in black walnut 5–11; KOBLÍŽEK (2000) claims the number of yokes in Persian and black walnuts to be 3–4 and 7–11, resp. The length of leaflets in black walnut is described by KOBLÍŽEK (2000) to range from 6 to 12 cm and their

Fig. 1. The habit of *Juglans* ×*intermedia* specimen is characterized by somewhat spreading crown and sturdy growth

Fig. 2. Stem diameter at breast height amounts to 80 cm

shape is claimed to be ovate-lanceolar to lanceolated, the length of Persian walnut leaflets is mentioned to range from 5 to 15 cm and their shape is claimed to be elliptical, elongated up to obovate.

The first reference to the hybrid was found in a monograph by DIPPEL (1892), who referred to data published in a horticultural journal (Revue horticole) in 1863. According to the characters described by KRÜSSMANN (1962), the found hybrid could belong to the variety of *Juglans* ×*intermedia* var. **pyriformis Carr.**, whose nut resembles much more that of *J. regia*. KRÜSSMANN described the hybrid with usually 11-pinnately compound leaves

Fig. 3. The endocarp of the hybrid resembles black walnut by its striation and colour

Fig. 4. Nut cross-section is of elliptical shape, endocarp thickness/nut size ratio is intermediate between the parental species

Fig. 5. Nut longitudinal section is of globular shape at the point of coalescence

Fig. 6. Comparison of leaves in the hybrid and parental species (from left: *J. nigra*, *J. ×intermedia*, *J. regia*)

Fig. 7. Comparison of leaflet shapes and margins in the hybrid and parental species (a: *J. nigra*; b: *J. ×intermedia*; c: *J. regia*)

(9–13 leaflets), and with elliptical, distantly serrate, on the frontside glabrous leaflets with fascicles of hairs in vein axils on the backside. The variety's fruits were obovate. However, the fruits of our specimen cannot be described as obovate, this indicating that the paternal species was probably other variety of Persian walnut than in the individual described by KRÜSSMANN.

Fig. 8. Leaf back of the hybrid; clearly obvious pedunculated gland and star-like hair (60 × magnification)

Table 3. Comparison of selected characters of black walnut, Persian walnut and their hybrid

Apparel and glands	*Juglans nigra*	*Juglans ×intermedia*	*Juglans regia*
Pedunculated glands on veins on the backside of leaves	Abundant	Sparse	Missing
Venous apparel on the backside of leaflets	Dense even in 2nd order veins, fascicles in vein axils	Nearly glabrous, fascicles in vein axils	Glabrous, fascicles in vein axils
Annual shoot	Densely shortly piliferous	Sparse long hairs	Glabrous
Petiole	Densely piliferous	One side less densely piliferous from above	Glabrous
Backside of the blade	Abundant star-like hairs	Thin star-like hairs	Glabrous
Leaves	*Juglans nigra*	*Juglans ×intermedia*	*Juglans regia*
Number of leaflets	11–23	7–11	5–7(9)
Length range (avg.)	4.9–14.5 (10.5) cm	4.0–15.3 (10.4) cm	4.1–16.8 (11.3) cm
Width range (avg.)	2.3–5.4 (3.9) cm	2.5–6.7 (5.0) cm	2.1–6.6 (4.7) cm
Surface area range (avg.)	8.9–48.7 (28.0) cm^2	8.2–68.4 (39.4) cm^2	5.6–76.9 (41.1) cm^2
Mean circumpolarity	1.13 cm^2/cm	1.56 cm^2/cm	1.54 cm^2/cm
Terminal leaflet	*Juglans nigra*	*Juglans ×intermedia*	*Juglans regia*
As compared with other leaflets	Not enlarged, sometimes missing	Slightly enlarged	Markedly enlarged
Length range (avg.)	6.0–10.2 (7.5) cm	7.7–15.9 (12.2) cm	15.2–20.3 (17.0) cm
Width range (avg.)	2.5–5.3 (3.7) cm	4.8–8.9 (7.1) cm	7.0–8.8 (8.0) cm
Surface area range (avg.)	7.9–33.6 (16.9) cm^2	25.7–82.1 (57.1) cm^2	72.9–120.1 (93.8) cm^2
Mean circumpolarity	0.94 cm^2/cm	1.89 cm^2/cm	2.31 cm^2/cm
Nuts	*Juglans nigra*	*Juglans ×intermedia*	*Juglans regia*
Shape	Globular	Square-globular, flattened on the side	Ellipsoid to obovate
Length range	3–4 cm	4.4–4.9 cm	3–6 cm (var. specific)
Width range 1	3–4 cm	4.5–5.0 cm	3.0–5.0 cm
Width range 2	3–4 cm	3.5–4.1 cm	2.7–4.5 cm
Endocarp thickness	0.5–0.9 cm	0.4–0.8 cm	0.1–0.2 cm

The authors met with a similar individual near Nordheim in Rhineland in floodplain forests on the embankment of the Rhine, in the locality of Steiner Wald (Hessen). Steiner Wald is a narrow belt of the floodplain forest on the right bank of the Rhine River, whose length is about 3 km and area approx. 150 ha.

According to the information from a guidebook issued by the Bensheim Forest Bureau in 1999, the hybrids can

Fig. 9. Comparison of annual shoot apparel in the hybrid (b) and black walnut (a)

Table 4. General climatic characteristics of Steiner Wald locality as measured in Biblis and Bensheim

Station (place)	Altitude (m a.s.l.)	Average annual temperature (°C)	Average temperature in growing season (°C)	Average annual total precipitation (mm)	Average total precipitation in growing season (mm)
Biblis	89	9.5	16.5	609	313
Bensheim	117	9.9	16.5	738	366

Fig. 10. Comparison of petiole apparel in the hybrid (right) and black walnut (left) (40 × magnification)

be found in the stands as few individuals whose hybrid origination was disclosed only recently. The trees were long considered to be black walnuts. For example one of the stems was sold in an auction in 1995 without any noticeable difference in timber quality.

Two individuals of respectable size were surveyed in winter 1998/99:

– Compartment 308 A: tree height 35.1 m, d.b.h. 97 cm, first branch setting height 8.9 m, stem volume 9.73 m³;
– Compartment 311: tree height 34.2 m, d.b.h. 101 cm, first branch setting height 17.8 m, stem volume 9.45 m³. Hybrid seedlings were found around the hybrid tree.

CONCLUSIONS

Although POKORNÝ (1952) described a number of interspecific hybrids within the *Juglans* genus, there are not many spontaneous hybrids found in the Czech territory. According to available data, the individual of *Juglans ×intermedia* described by the authors is the only known one originating from forest stands. It can be expected that other specimens will be found with increased efforts. Regarding the above-average production capacity of the hybrid, which was mentioned both by POKORNÝ (1952) and by ANONYMOUS (1999), controlled hybridization should deserve a consideration to regenerate the existing stands of black walnut. One of the pros can be the fact that timber quality of the hybrid does not probably exhibit any particular variance from that of black walnut and there were no complaints from buyers at so far random auctions in Germany either. It would also be quite interesting to determine the production capacity of trees from seeds originating from the mentioned hybrid (2nd generation).

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Zajímavý nález *Juglans ×intermedia* Carr. na LZ Židlochovice

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ABSTRAKT: Na LZ Židlochovice, polesí Velký Dvůr, v porostu č. 224D10 byl nalezen v porostu ořešáku černého (*Juglans nigra* L.) i jeden vzrostlý exemplář ořešáku prostředního (*Juglans ×intermedia* Carr.). Strom byl fotograficky zdokumentován,

pro pozdější analýzy byly odebrány olistěné prýty a plody. Uvádíme popis habitu, borky, morfologie listů, letorostů a plodů. Diskutovány jsou odlišnosti od rodičovských druhů (*J. nigra* a *J. regia* L.).

Klíčová slova: *Juglans ×intermedia* Carr.; morfologie; biometrie

Na LZ Židlochovice, polesí Velký Dvůr, v porostu číslo 224D10 byl nalezen v roce 2002 v porostu ořešáku černého (*Juglans nigra* L.) i jeden vzrostlý exemplář ořešáku prostředního (*Juglans ×intermedia* Carr.).

Ořešáky jsou dřeviny, které se mezi sebou snadno kříží. Je proto možné se setkat se spontánní hybridizací ořešáků poměrně často. POKORNÝ (1952) podal přehled o 13 mezidruhových hybridech. Ořešák prostřední je kříženec ořešáku královského (*Juglans regia* L.) a ořešáku černého. V České republice byl poprvé ořešák černý vysazen v roce 1835 v Královské oboře (SVOBODA 1981). V lesích na jižní Moravě se začal vysazovat do porostů již v první polovině 19. století.

Nalezený jedinec ořešáku prostředního je podle hospodářské knihy přibližně 100 let starý, koruna se liší od okolních ořešáků černých tím, že primární větve svírají tupější úhel a koruna se tak jeví rozkladitější (obr. 1). Strom má světlejší borku, v horní třetině výrazně hladší a lesklejší. Růstovými parametry předstihuje průměrné veličiny platné pro porost ořešáku černého (obr. 2). Výčetní tloušťka hybrida činí 80 cm, výška stromu 35,6 m, výška nasazení první větve je 11 m, výška nasazení koruny 16,4 m, objem (hmotnatost) kmene dosahuje 9,5 m^3. Střední výčetní tloušťku porostu ořešáku černého tak převyšuje o více než 30 cm a výšku o 4,6 m. Rychlý růst lze vysvětlit heterozním efektem, který se u prvního pokolení mezidruhových kříženců objevuje velmi často (POKORNÝ 1952). Jedinec plodí a jeho plody jsou dlouhé 7–9 cm, na podélném řezu kulovité, na příčném elipsoidní. Ořech (obr. 3, 4 a 5) je hranatě kulovitý, z boku zploštělý, má rozměry 4,4–4,9 cm × 4,5–5,1 cm × 3,5–4,0 cm a tvarově připomíná spíše *J. regia*. Endokarp je podobný spíše ořešáku černému, tj. hnědý, rýhovaný, tlustý 0,4–0,8 cm, semeno je sladké. V porostu pod stromem byla nalezena na začátku měsíce června klíčící semena. Semenáčky v pokročilejší fázi vývoje nebyly objeveny.

Listy jsou lichozpeřené, 3–5jařmé, složené ze 7–11 lístků, koncový lístek u kříženec není tak výrazně zveličelý jako u ořešáku královského (obr. 6). Okraj lístků je oddáleně pilovitý (obr. 7), často však i téměř celokrajný. Lístky mají svazečky chloupků v paždí žilek, roztroušené hvězdovité chlupy na rubu čepele v okolí žilnatiny 1. a 2. řádu i stopkaté žlázky na žilkách na rubu čepele (obr. 8). Letorosty jsou řídce dlouze chlupaté (obr. 9) a řapíky jsou hustě chlupaté, především ze svrchní strany (obr. 10). I tyto znaky potvrzují intermediální charakter mezi oběma rodičovskými druhy; srovnání popisovaných parametrů s rodičovskými druhy je uvedeno v tab. 3.

První zmínku o kříženci jsme nalezli v monografii DIPPELA (1892), který se odvolává na údaje uveřejněné v roce 1863 v zahradnickém časopise (Revue horticole). Podle znaků uváděných KRÜSSMANNEM (1962) by mohl nalezený hybrid patřit k varietě *Juglans ×intermedia* var. **pyriformis Carr.**, která má ořech více podobný druhu *J. regia*. KRÜSSMANN popisuje hybrida zpravidla s listy 11četnými (9–13 lístků), lístky eliptickými, oddáleně pilovitými, na líci lysými, na rubu se svazečky chloupků v paždí žilek. Plody variety jsou obvejcovité. Ovšem plody našeho exempláře jako obvejcovité označit nelze; pravděpodobně byl otcem jiný kultivar ořešáku královského než u jedince popisovaného KRÜSSMANNEM.

S podobným jedincem jsme se setkali v Porýní u Nordheimu v lužních lesích na břehu Rýna na lokalitě Steiner Wald (Hessensko). Steiner Wald je úzký pás lužního lesa v délce přibližně 3 km a rozloze 150 ha na pravém břehu řeky Rýna. V průběhu zimního období 1998/1999 zde byly inventarizovány dva stromy, dosahující značných rozměrů: výšek 34,2 a 35,1 m, $d_{1,3}$ 101 a 97 cm, hmotnatosti kmene 9,45 a 9,73 m^3.

Podle dostupných údajů je námi popisovaný jedinec *Juglans ×intermedia* z našeho území jediný známý strom pocházející z lesních porostů. Je pravděpodobné, že při zvýšené pozornosti budou nalezeny i další exempláře. Vzhledem k nadprůměrným produkčním schopnostem kříženec, které také uvádějí shodně jak POKORNÝ (1952), tak i ANONYMUS (1999), by stála za úvahu jeho řízená hybridizace pro účely obnovy současných porostů ořešáku černého. Kvalitou dřeva se totiž pravděpodobně výrazně neliší a při doposud náhodných dražbách v Německu nebylo dřevo ze strany kupujících reklamováno. Za ověření by stálo také zjistit produkční možnosti stromů z osiva pocházejícího z uvedeného kříženec (2. pokolení).

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