





*Jerzy Zieliński, Dominik Tomaszewski, Piotr Kosiński**

Salix × *browiczii* (Salicaceae) – a new nothospecies from northeastern Greece

Abstract: A hybrid between *Salix triandra* and *S. xanthicola*, occurring in the Rhodope Mountains in northeastern Greece, is described as a new nothospecies. It differs from *S. triandra* by having distinctly hairy young stems and more deeply serrate-dentate leaf margins, and from *S. xanthicola* by a smooth, unstructured (without conicoids) wax layer on the lower side of the leaves and the presence of subsessile glands on the petioles.

Keywords: willows, sympatric hybridization, Balkans

Addresses: J. Zieliński, D. Tomaszewski, Institute of Dendrology, Polish Academy of Sciences, Parkowa 5, 62-035 Kórnik, Poland; JZ e-mail: jeziel@man.poznan.pl; DT  <https://orcid.org/0000-0001-7768-5747>, e-mail: dominito@man.poznan.pl;

P. Kosiński, Institute of Dendrology, Polish Academy of Sciences, Parkowa 5, 62-035 Kórnik, Poland; Faculty of Agronomy and Bioengineering, Poznań University of Life Sciences, Wojska Polskiego 28, 60-637 Poznań, Poland;  <https://orcid.org/0000-0001-6104-4267>, e-mail: kosinski@up.poznan.pl

*Corresponding author

Introduction

Willows hybridize incredibly readily, which is often considered a distinctive characteristic of this genus (e.g. Argus, 1974; Argus et al., 2010; Belyaeva, 2020; Rechinger, 1964, 1992; Rechinger & Akeroyd, 1993; Skvortsov, 1968, 1999). Hybridization, however, blurs the boundaries between species, which is one of the reasons why taxonomists face difficulties in identifying them. In other words, a comprehensive understanding of potential hybridization events is necessary to delineate *Salix* species accurately. Moreover, this knowledge contributes to our understanding of biodiversity, evolutionary processes, and conservation efforts.

Recently, during the revision of the *Salix* herbarium collection of the Institute of Dendrology of the Polish Academy of Sciences in Kórnik (KOR), we

identified a previously unknown hybrid of *Salix triandra* L. × *S. xanthicola* K.I.Chr. The herbarium specimen of this hybrid was collected in 1979 during a field trip to Greece, i.e. 12 years before the name *S. xanthicola* was published. Until now, the hybrid was stored under the name “*Salix triandra* L. forma!”.

The first of putative parents, *Salix triandra*, is a deciduous shrub or small tree native to Europe and Western and Central Asia (Skvortsov, 1968, 1999). The second one, *S. xanthicola*, is an erect shrub that has a significantly smaller range, limited mainly to the Rhodope Mountains, on the borderland of southeastern Bulgaria and northeastern Greece (Christensen, 1991, 1997, Christensen et al. 2006). It was described relatively recently (Christensen, 1991), and to date, its two hybrids, with *S. alba* L. and *S. amplexicaulis* Bory & Chaub., were reported from Bulgaria by Zieliński et al. (2006). A few years later,

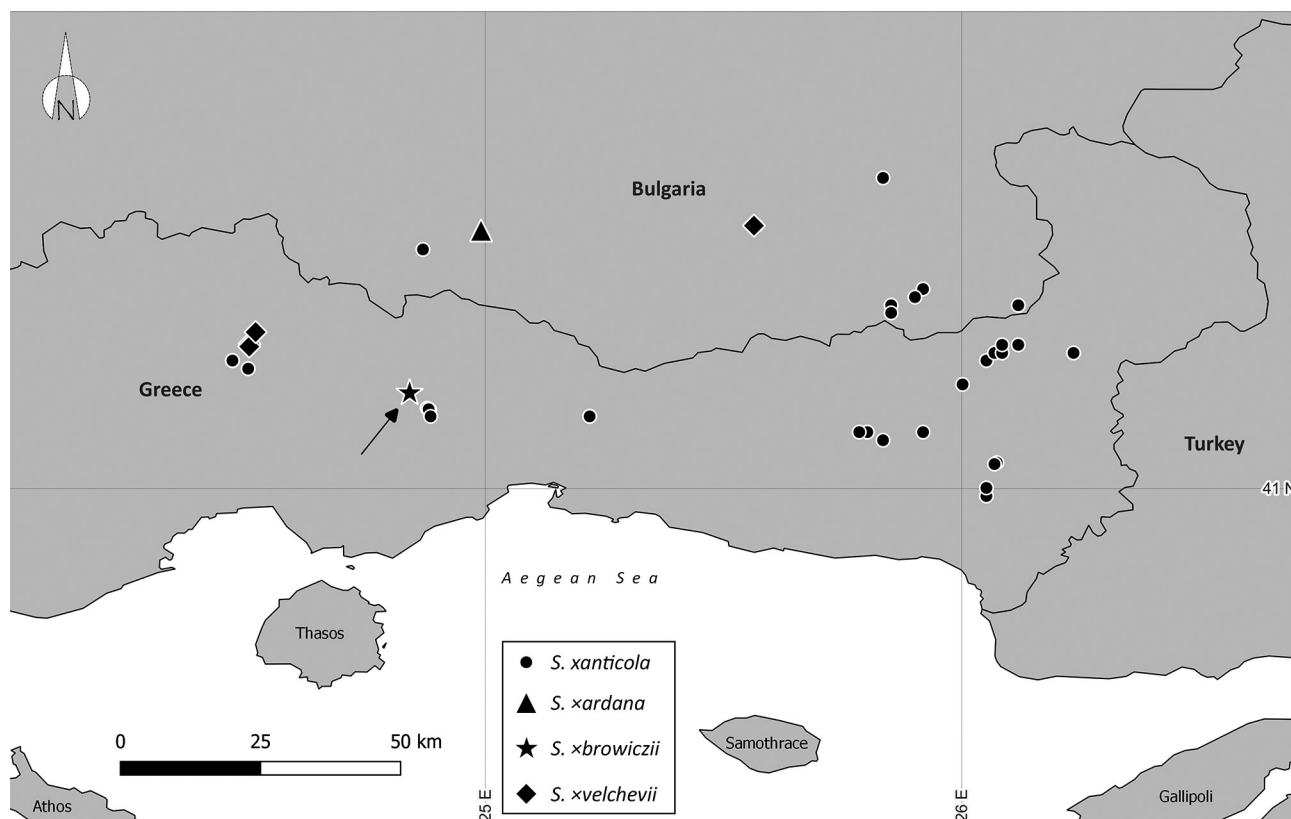


Fig. 1. Distribution of *Salix xanthicola* and its hybrids; based on data from Christensen (1991, 1997), Christensen et al. (2006), Zieliński et al. (2006), Kailis & Eleftheriadou (2011)

more information emerged regarding the occurrence of the latter hybrid, *S. x velchevii* Ziel. & Pancheva, in Greece (Kailis & Eleftheriadou, 2011) (Fig. 1).

The description of this hybrid species is based on a single herbarium specimen, collected in mid-summer, after flowering had already occurred, hence the lack of flowers and fruits on it. Nonetheless, it stands out well among other willows, even in its vegetative form. It is assumed that in the future, a set of diagnostic features for this species will be supplemented by botanists conducting research in the area of its potential occurrence.

Material and methods

To compare the hybrid specimen with the parent species, we used the entire herbarium collection at KOR (herbarium codes following Thiers, 2023+): 95 herbarium sheets of *S. triandra*, 25 of *S. xanthicola*, and one of the hybrid specimen. As we only had a herbarium specimen without flowers and fruits at our disposal, we have expanded our observations to include the micro-morphology of the abaxial surface of the lamina. For the scanning electron microscope (SEM) images, a Hitachi S3000N was used (equipped with a secondary electron detector). Plant fragments from herbarium specimens (*S. triandra*: KOR 27181,

41158, 42253, 42288; *S. xanthicola*: KOR 27173; hybrid: KOR 27179) were mounted on aluminium stubs using double-sided adhesive carbon discs and coated with gold and palladium. The accelerating voltage used was 15 kV.

Results and discussion

Taxonomic treatment

Salix x browiczii Ziel., D.Tomasz. & Kosiński, **nothosp. nov.**

(*S. triandra* L. × *S. xanthicola* K.I.Chr.)

LSID: urn:lsid:ipni.org:names: 77319699-1

Fig. 2–4, 4B, 4E, S1–S4

Holotype: Greece. Province Xanthi. E of Gerakas, W of the road between Xanthi and Echinós, close to the road to Stavroupoli, 41°11'43"N, 24°50'40"E. Thickets on the slope above the Kosynthos River. 24.06.1979, leg. A. Boratyński, K. Browicz, & J. Zieliński (KOR 27179) (<https://rcin.org.pl/dlibra/publication/274369>).

Description

Shrub ca 2 m tall. Stems erect. Decorticated wood is smooth (with some indistinct ridges and



Fig. 2. Holotype of *Salix ×browiczii* (KOR 27179)

wood imperfections) (Fig. S1). Annual stems \pm densely grey-tomentose (Fig. S3). Buds tomentose, slightly flattened, adpressed to the shoot in their

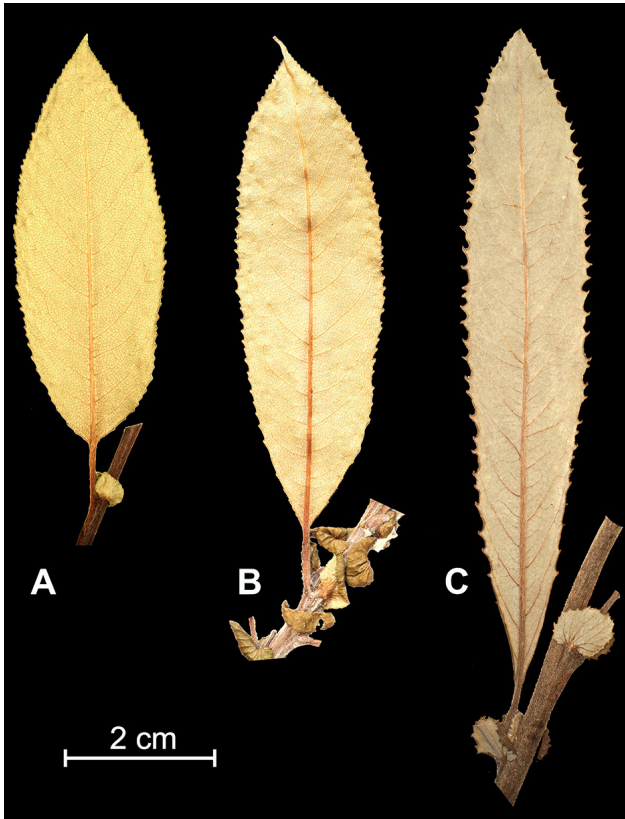


Fig. 3. Leaves (with stem fragments) of *Salix triandra* subsp. *triandra* (A) (KOR 44294), *S. x browiczii* (B) (KOR 27179), and *S. xanthicola* (C) (KOR 27170) (photo by P. Kosiński)

lower part and declined from it in their upper part (Fig. 3B). Older stems glabrous. Leaves up to 10 cm long and 2.5 cm wide, narrowly oblong to narrowly oblanceolate, acute to shortly acuminate, densely serrate-dentate, with slightly irregularly curved teeth (Fig. 3B, S2). Petioles 5–10 mm long, with several sessile to short-stipitate glands just below the leaf blade. Stipules large, broad, coarsely dentate, with scattered glands above, persistent (Fig. S4). Young leaves shortly puberulent on both sides, adult ones subglabrous, dark green above, and grey-green, covered with \pm smooth wax layer beneath (Fig. 4B, 4E). Flowers and fruits unknown.

Diagnosis

Generally, *Salix x browiczii*, by having a smooth wax layer (i.e. without conicoids or other structures) on the abaxial side of leaves (Fig. 4B, 4E), resembles *S. triandra* subsp. *triandra*, which also grows in this region (Fig. 4A, 4D). The question arises as to why these structures do not exhibit an intermediate character between the parental species. A study by Szafranek et al. (2008) on *Salix* demonstrates that the hybrid taxa within this group do not consistently occupy an intermediate position in terms of chemistry or micromorphology but tend to resemble one of their parents. The absence of wax structures can be explained by assuming that it is a dominantly inherited trait.

Furthermore, *Salix x browiczii* differs from *S. triandra* by distinctly grey tomentose young twigs and buds, \pm pubescent young leaves and a more deeply

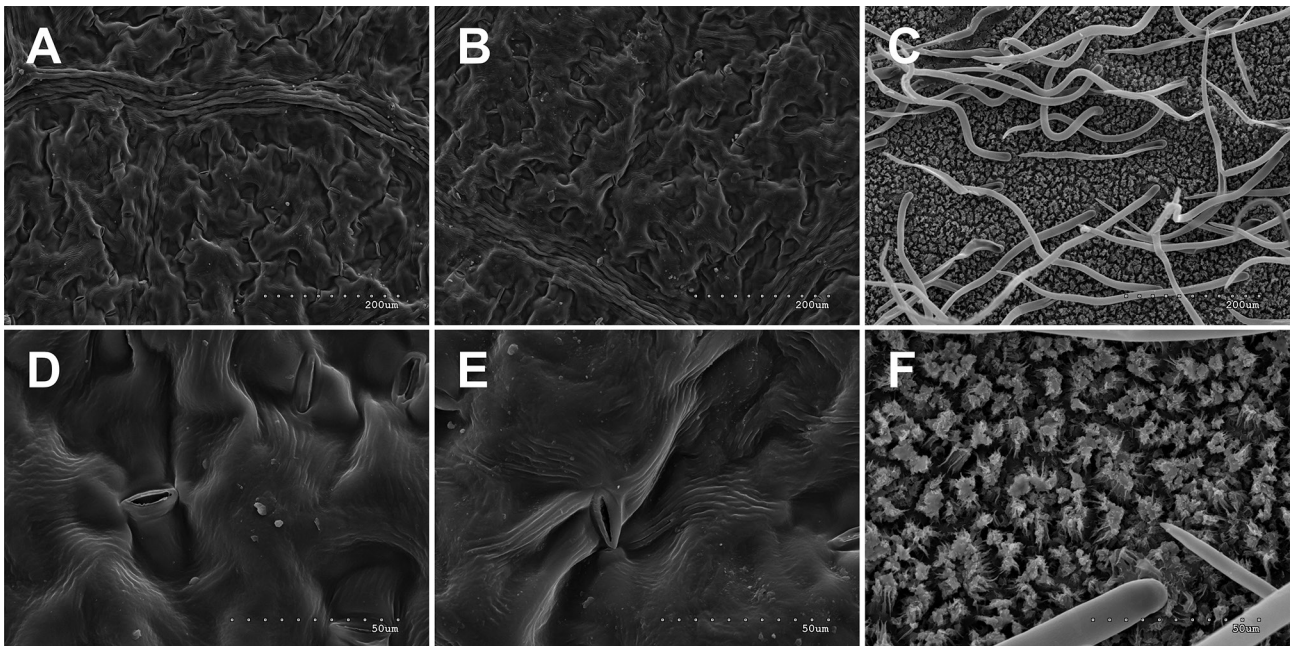


Fig. 4. Surface of the abaxial side of the leaf blade of *Salix triandra* subsp. *triandra* (A, D) (KOR 27181), *S. x browiczii* (B, E) (KOR 27179), and *S. xanthicola* (C, F) (KOR 27173); surface distortions result from material drying (photos by D. Tomaszewski)

serrate leaf margin (Fig. 3, S3). The above features clearly indicate that the second parent species is *S. xanthicola* which grows nearby. However, in the latter species, the leaves are permanently hairy on both sides and, contrary to the wax structure of *S. triandra* occurring in this region, the lower surface of its leaves is always covered with wax, which forms concoids (Fig. 5C, 5F).

From *S. xanthicola*, the hybrid is distinguished by the weaker indumentum of all organs, green abaxial leaf surface, type of wax layer and the presence of glands in the upper part of the petioles (Fig. 3).

Eponymy

The epithet “browiczii” commemorates Kazimierz Browicz (1925–2009), a Polish botanist and biogeographer, an outstanding expert in the woody flora of SW Asia and the Eastern Mediterranean, who organized and participated in the expedition to Greece mentioned above.

Acknowledgements

We are very grateful to Dr Kit Tan, Copenhagen, for her valuable comments.

References

- Argus GW (1974) An experimental study of hybridization and pollination in *Salix* (willow). *Canadian Journal of Botany* 52: 1613–1619. doi:10.1139/b74-212.
- Argus GW, Eckenwalder JE & Kiger RW (2010) Salicaceae: Flora of North America, vol. 7 (ed. by Flora of North America Editorial Committee). Oxford University Press, New York, US, pp. 3–164.
- Belyaeva IV (2020) Challenges in identification and naming: Salicaceae sensu stricto. *Skvortsovia*: 5(3): 83–104.
- Christensen KI (1991) *Salix xanthicola* (Salicaceae), a new species from northeastern Greece. *Willdenowia* 21: 105–111.
- Christensen KI (1997) *Salix* L.: Flora Hellenica, vol. 1 (ed. by A Strid & K Tan) Koelz Scientific Books, Königstein, Germany, pp. 27–33 + maps 33–38.
- Christensen KI, Zieliński J & Petrova A (2006) Notes on the geographic distribution and ecology of *Salix xanthicola* (Salicaceae). *Phytologia Balcanica* 12: 209–213.
- Kailis N & Eleftheriadou E (2011) Contribution to the description and distribution of *Salix ×velchevii* (Salicaceae). *Phytologia Balcanica* 17, 3: 279–282.
- Rechinger KH (1964) *Salix* L.: Flora Europaea, vol. 1 (ed. by TG Tutin, VH Heywood, NA Burges, DH Valentine, SM Walters, DA Webb), Cambridge University Press, London, United Kingdom, pp. 43–54.
- Rechinger KH (1992) *Salix* taxonomy in Europe – problems, interpretations, observations. Proceedings of the Royal Society of Edinburgh, Section B: Biological Sciences 98: 1–12. doi:10.1017/S0269727000007417.
- Rechinger KH & Akeroyd JR (1993) Salicaceae: Flora Europaea, vol. 1 (ed. by TG Tutin, NA Burges, AO Chater, JR Edmondson, VH Heywood, DM Moore, DH Valentine, SM Walters, & DA Webb), Cambridge University Press, Cambridge, UK, pp. 53–66.
- Skvortsov AK (1968) Ivy SSSR. *Sistemicheskiy i geograficheskiy obzor* [Willows of the USSR. Taxonomic and geographic revision]. Nauka, Moskva, USSR.
- Skvortsov AK (1999) Willows of Russia and adjacent countries. Taxonomical and geographical revision. University of Joensuu, Joensuu, Finland, Faculty of Mathematics and Natural Sciences Report Series 39: 1–307.
- Szafranek B, Tomaszewski D, Pokrzywińska K, Gołębiowski M (2008) Microstructure and chemical composition of leaf cuticular waxes in two *Salix* species and their hybrid. *Acta Biologica Cracoviensia Series Botanica* 50:49–54.
- Thiers BM ed. (2023+) [Continuously updated] Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden’s Virtual Herbarium. Available from: <http://sweetgum.nybg.org/science/ih/> (Accessed 22 April 2023).
- Zieliński J, Petrova A & Pancheva Zh (2006) *Salix ×velchevii* and *S. ×ardana* (Salicaceae) – two new willow hybrids from the Bulgarian Rhodope Mts. *Acta Societatis Botanicorum Poloniae* 75: 145–148.