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On the occurrence of *Salix appendiculata* (*Salicaceae*) in Greece

Abstract

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Salix appendiculata is a typical Central European willow species. Its geographical distribution in the Balkan Peninsula is scattered and its occurrence in some Balkan countries is not yet clarified. The occurrence of the taxon in Greece is confirmed in this study. Leaf morphology of the Greek populations shows that they belong to *S. appendiculata* var. *latifolia* (A. Kerner) Rech. f. Finally, the ecological preferences of the taxon at the easternmost extent of its distribution are described with reference to bibliographic data.

Additional key words: geographical distribution, Rhodope, Balkan Peninsula, ecology, morphology

Introduction

Salix appendiculata Vill. (= *S. grandifolia* Ser., *S. aurita* var. *grandiflora* (Ser.) Fiori) is a medium-sized or tall shrub or a small tree. It is usually found on rocky soils, taluses, moist slopes and banks of streams in the mountain forest and subalpine zone. Although mostly found on limestone substrate, it has also been encountered on peaty and siliceous bedrocks (Skvortsov 1999). It is a subalpine taxon (Oberdorfer 1990) with a geographical distribution extending from the Czech Republic and S Germany to the Pyrenees, S Italy and W Bulgaria (Fig. 1) (Jalas & Suominen 1976; Rechinger 1993). Martini & Paiero (1988) mentioned that under favourable climatic conditions the taxon may also occur at lower altitudes near sea-level. *Salix appendiculata* hybridizes freely with *S. caprea* L., giving the hybrid species *S.* ×*macrophylla* Kerner (Rechinger 1993). It also hybridizes with *S. aurita* L. and *S. cinerea* L. (Pignatti 1982).

According to Atlas florae europaeae (Jalas & Suominen 1976) the occurrence of *Salix appendiculata* in the Mediterranean region is quite scattered. There are only two reports of its occurrence in the S Balkan Peninsula, one from S former Yugoslavia and one from SW Bulgaria. These two sites are isolated from the main European distributional centre of the taxon. In Prodromus florae peninsulae balcanicae, Hayek (1927) reported that *S. appendiculata* was present in the N Yugoslavian Republic, Bulgaria and Albania. Rechinger did not take this report into consideration and thus these countries were not included in the distribution of the taxon published in Flora europaea (Rechinger 1964). Jordanov & Kužmanov (1966) referred to *S. appendiculata* as a native species of the Bulgarian flora, as did Jalas & Suominen (1976), Rechinger (1993) and Assyov & al. (2006). The occurrence of the taxon in Albania was reported again by Demiri (1983), but Rechinger (1993) questioned its occurrence in that country. This problematic situation led Rechinger

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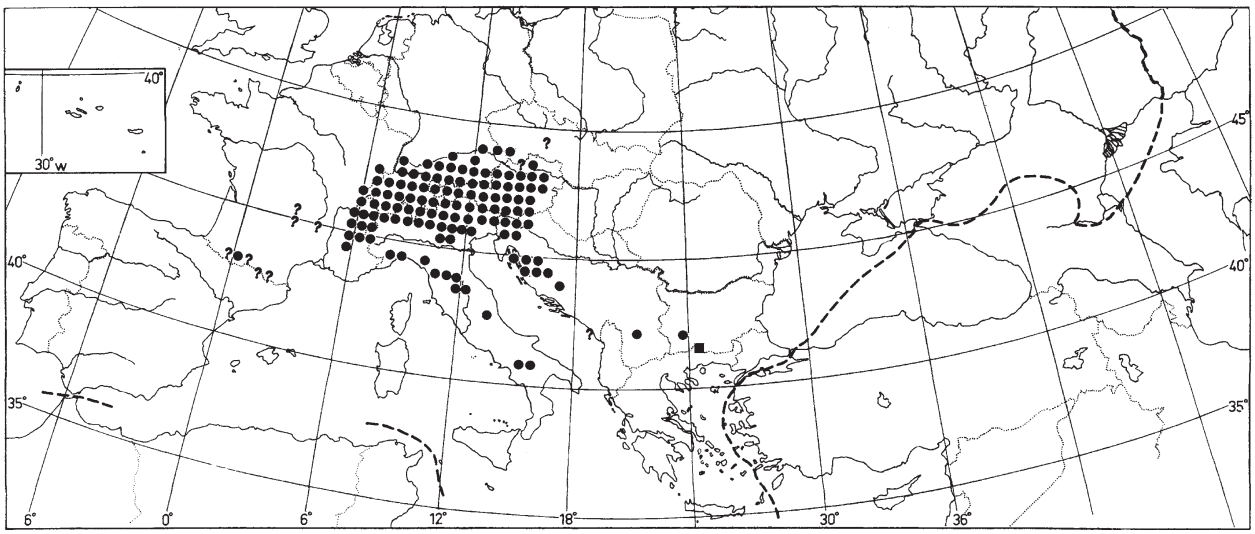

Fig. 1. Geographical distribution of *Salix appendiculata* in Europe – The Greek localities are marked with a square (■). – Map based on Jalas & Suominen (1976).

(1992) to pose the question "…how far does the distribution of *S. appendiculata* stretch beyond the Alps into the northwestern Balkan Peninsula?"

Christensen (1997) mentioned the taxon in Flora hellenica, based on the determination of a Greek specimen (*Eleftheriadou 2612*, TAUF, confirmed by Christensen) from NE Greece, but did not include it in the identification key.

The aim of this research is to confirm the occurrence of *Salix appendiculata* in Greece and to specify its geographical distribution and abundance in the study area. This study area was chosen based on the collection site of the above-mentioned specimen: by the Rema Symvallontos in the Frakto Virgin Forest of Drama Prefecture.

Material and methods

The study area is situated in the NE part of Drama Prefecture, in the NW part of the Greek Rhodope Mountains, and covers an area of 850 ha. Forty sampling plots each of 100 m^2 (10 × 10 m), were selected in either roadsides or clearings in forest close to or along the banks of the Rema Symvallontos, Gouras Rema and Rema Lykolakkas where *Salix* species occurred (Fig. 2). Sampling took place in August 2009, and for each sampling plot one individual of every *Salix* taxon was collected and recorded, along with the other woody taxa that occurred in the plot (including species in the *Fabaceae*, *Fagaceae*, *Pinaceae* and *Rosaceae*). Furthermore, the following parameters were recorded per plot: geographical coordinates (WGS 84 international coordinate system), locality (name of closest stream, except for Elatia area), altitude, exposure and slope, total number of plants in each plot and their % coverage, maximum height and ecological form, the soil skeletal material (%), soil texture, soil pH, the surface stoniness (%) of the soil, drainage conditions, dominant woody vegetation in the surrounding area and other woody vegetation in the sample plot.

All specimens were deposited in TAUF. Additionally, herbarium specimens from the wider area (also in TAUF) were examined so as to recognize any unidentified or misidentified material among the specimens collected.

Soil samples collected from each plot were analysed in the laboratory for pH, soil texture and drainage conditions. Surface stoniness and soil skeletal material were estimated in the field.

Specimen identification was made mainly with the help of Flora hellenica (Strid & Tan 1997) and Flora europaea (Tutin & al. 1968, 1993). For taxa of the genus *Salix,* other monographs were also used, such as Meikle (1984), Newsholme (1992) and Skvortsov (1999). Nomenclature of the taxa follows the above-mentioned literature.

For *Salix* identification, morphological characters of each sample were measured from five leaves growing between the third and fifth node of the shoots (Kehl & al. 2008). Some characters with high diagnostic value (Newsholme 1992; Christensen 1997; Skvortsov 1999; Hardig & al. 2000; Kehl & al. 2008) were selected to examine whether differences in leaf morphology between the Greek and other populations occur. These characters were: lamina width, lamina length, lamina length/width and petiole length. In addition, the following characters where measured and described: twig and shoot hairiness, striation of the decorticated wood, bud position on the shoot, bud hairiness, leaf arrangement on the shoots, position at which the lamina reaches its maximum width, lamina shape, hairiness of both upper and lower leaf surface of the young and fully developed leaves, leaf tip and base shape, petiole hairiness, presence of glands and presence and morphology of stipules.

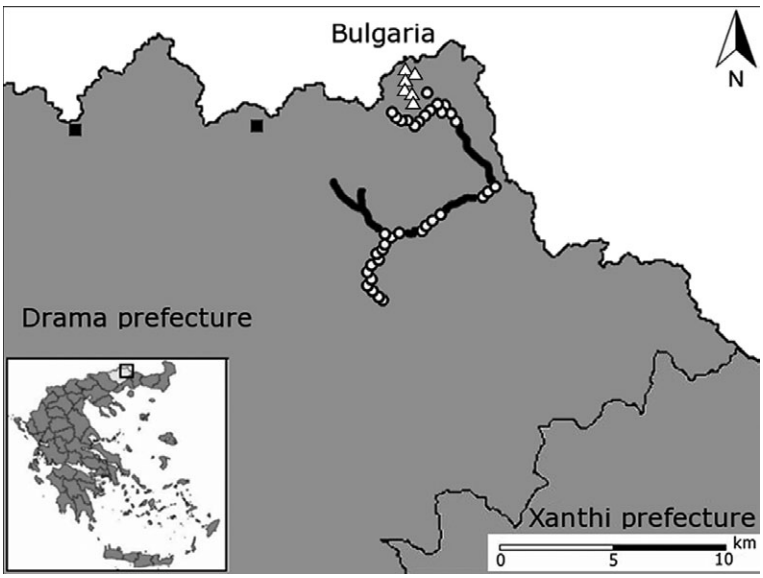

Fig. 2. Sampling and distribution of *Salix appendiculata* in Greece – △ sampling plots with *S. appendiculata*; ○ sampling plots without *S. appendiculata*; ■ records of *S. appendiculata* based on herbarium material; ▬ areas without records of *Salix* species.

Results

A total of 82 *Salix* specimens was collected among the 40 sampling plots. Six of the specimens in six of the plots were identified as *S. appendiculata*, as were two additional specimens in the TAUF herbarium collected prior to this study (Table 1). Among the latter two, *Eleftheriadou 2612* was used by Christensen (1997) for his record of *S. appendiculata* in Flora hellenica, and *Eleftheriadou 1991* was incorrectly determined as *S. caprea* L. × *S. pedicellata* Desf. by Eleftheriadou (1992).

Salix appendiculata was represented in each sampling plot by one or two individuals and only once did the species occur in a stand of five individuals. All the individuals of *S. appendiculata* were shrubs, the tallest of which (*Kailis 106*) reached a height of 5 m. The willow shrubs covered 5–30 % of the area of each plot, depending on the number of individuals present and their height. In all plots, *S. appendiculata* grew together with *S. caprea*. The latter taxon is also the dominant willow species of the surrounding area, occasionally growing with *Picea abies* (L.) H. Karst., *Fagus sylvatica* L. s.l., *Pinus sylvestris* L. or *Chamaecytisus absinthioides* (Janka) Kuzmanov subsp. *absinthioides*. The dominant woody vegetation of the study area consists mainly of *Picea abies* and *Fagus sylvatica*, while in sites at lower altitudes (sample plot 6) *Fagus sylvatica* was replaced by *Pinus sylvestris*.

Site slopes ranged from 4–9 %. Exposure varied for almost every plot, being western, northwestern, southwestern, northeastern and in two cases, southeastern.

All the collected plants of *Salix appendiculata* grew on well-drained, fine, sandy, acidic (mean pH = 5.2) soils with low organic matter content. The surface stoniness and skeletal material of the soil ranged from 50–90 % in all sites.

Both the older herbarium specimens (*Eleftheriadou 1991* and *Eleftheriadou 2612*) had been collected near stream banks.

The results of the lamina measurements showed that all the samples collected belonged to the taxon *Salix appendiculata*. Furthermore, leaf variation (Fig. 3) indicates that these samples belong to *S. appendiculata* var. *latifolia* (A. Kerner) Rech. f. (Wagenitz 1981). The measured lamina length ranged from 47.5 mm to 100 mm (mean length 76 mm, n = 6), the width from 19.5 mm to 44.5 mm (mean width 32.5 mm, n = 6), and the lamina length/width ratio was 1.6:1 to 3.6:1 (mean value 2.4:1, n = 6) for all the leaves measured. The petiole length ranged from 6.5 mm to 18.5 mm (mean petiole length 10 mm, n = 6).

Discussion

In N Greece, *Salix appendiculata* appears to have a restricted distribution in mountainous clearings (at altitudes over 1500 m) near the Greek-Bulgarian border. The taxon frequently grows together with *S. caprea,* and both species have very similar morphology. This similarity may explain why the occurrence of *S. appendiculata* in Greece was not reported earlier. However, the species can be distinguished from the related *S. caprea* and *S. cinerea* because of the only slightly ridged decorticated wood (i.e. with a few, sometimes indistinct, elevated ridges), the usually obovate to oblanceolate lamina persistently ± sparsely pubescent beneath, the well-developed and ± persistent stipules and the shorter and narrower catkins (Table 2) (Rechinger 1993; Christensen 1997).

The confirmed occurrence of *Salix appendiculata* in Greece sets a new south-easternmost point in its geographical distribution and thus helps to answer Rechinger's (1992) question concerning its distribution in the Balkan Peninsula. The distributional centre of the taxon lies in the mountains of Central Europe (Jalas & Suominen 1976; Pignatti 1982; Martini & Paiero 1988; Newsholme 1992; Rechinger 1993; Skvortsov 1999). However, attempting to define the width of the distribution of the taxon beyond this centre is problematic. Westward, its distribution becomes scarcer as it reaches the French Pyrenees, where it is rather rare (Bonnier 1934), while its occurrence in Spain requires confirmation (Castroviejo & al. 1993). Southward, according to Pignatti (1982), *S. appendiculata* occurs from N Italy to the S Apennines in the region of Basilicata. On the other hand, Martini & Paiero (1988) restricted its occurrence to N Italy, thus making Greece the southernmost point of

Table 1. Collection data of investigated material of *Salix appendiculata*.

Sampling plot	Locality	Latitude Longitude	Altitude [m]	Number of individuals	Date	Voucher specimen in TAUF
1	Rema Lykolakkas	41°32'27"N 24°29'09"E	1650	3	10 Aug 2009	*Kailis 104*
2	Rema Lykolakkas	41°32'43"N 24°29'07"E	1630	4	10 Aug 2009	*Kailis 106*
3	Rema Lykolakkas	41°33'02"N 24°29'04"E	1700	7	10 Aug 2009	*Kailis 108*
4	Rema Lykolakkas	41°32'16"N 24°28'57"E	1610	6	10 Aug 2009	*Kailis 110*
5	Rema Lykolakkas	41°32'02"N 24°29'11"E	1710	6	10 Aug 2009	*Kailis 112*
6	Gouras Rema	41°31'48"N 24°29'18"E	1620	4	10 Aug 2009	*Kailis 114*
*	Rema Symvallontos	41°32'30"N 24°29'03"E	1650	–	8 Oct 1993	*Eleftheriadou 2612*
*	Elatia area	41°30'16"N 24°18'57"E	1500	–	9 Jun 1988	*Eleftheriadou 1991*

*Specimens from the TAUF Herbarium collected prior to this study. Latitude and longitude are approximate, and there is no information on the number of individuals.

occurrence of the taxon. Eastward, its distribution is scattered from N former Yugoslavia to W Bulgaria, reaching the Greek-Bulgarian border in the southeast and probably Albania in the southwest (Jalas & Suominen 1976, Assyov & al. 2006). However, the occurrence of *S. appendiculata* in Greece should not be surprising, since there are some other boreal or Central European species that have their only Greek occurrences in the Rhodope Mountains (e.g. *Alnus incana* (L.) Moench and *Picea abies* subsp. *abies*) or in the northern parts of the country (e.g. *Betula pendula* Roth, *Pinus sylvestris*, *Sorbus aucuparia* L. and *Vaccinium vitis-idaea* L.).

In Greece, *Salix appendiculata* prefers habitats of mountain forest clearings near streams, comparable to those mentioned in the literature. However, the soil conditions differentiate the habitats of the current research. According to Oberdorfer (1990), *S. appendiculata* occurs on base-rich soils, whereas in Greece the species grows in acidic soils very poor in humus. Skvortsov (1999) mentioned that many *Salix* species "do not exhibit any particular preferences to the substrate acidity" and Kuzovkina-Eischen (2003) concluded that many *Salix* species are pH adaptable. Martini & Paiero (1988) characterized *S. appendiculata* as an "indifferent species" with regard to the acidity of the soil. As far as humus content is concerned, Martini & Paiero (1988) and Oberdorfer (1990) referred to *S. appendiculata* as a taxon of humus-rich and stable soils. The soil samples from the plots showed that the soils are sandy and poor in humus. Being pioneers, the taxa of the genus *Salix* have the ability to grow on nutrient-poor soils (Raven 1992), where they survive by forming mycorrhizae (Kuzovkina-Eischen 2003).

Leaf morphology (i.e. lamina length, width, length/width ratio and petiole length) of the Greek populations of *Salix appendiculata* was found to be within the ranges given in most bibliographical descriptions from neigh-

Table 2. Main diagnostic characters of *Salix appendiculata* and similar species.

Salix appendiculata	***Salix caprea***	***Salix cinerea***
Decorticated wood with few, sometimes indistinct, elevated ridges	decorticated wood without ridges, sometimes weakly ridged	decorticated wood with many, prominent ridges
Lamina usually obovate to oblanceolate, persistently ± sparsely pubescent beneath, ± glabrescent above	lamina usually broadly ovate to ovate-oblong, persistently softly and densely grey tomentose beneath, finally almost glabrous above	lamina obovate, oblanceolate or elliptic, ± densely glaucous or greyish green tomentose beneath, sparsely and persistently tomentose above
Stipules well developed, 10–20 cm, ± persistent	stipules usually large, to 20 mm, caducous or ± persistent	stipules to 14 mm, ± persistent
Catkins to 3 × 1 cm, lax-flowered	catkins to 4 × 3 cm (male) or 8 × 3 cm (female)	catkins to 4.5 × 2.5 cm (male) or 8.5 × 2 cm (female)

bouring countries (Jordanov & Kužmanov 1966; Pignatti 1982; Demiri 1983; Martini & Paiero 1988), although the taxon is notorious for its variability in leaf size and shape. In its western distribution, *S. appendiculata* appears to have longer leaves (100–150 mm) than those in its Balkan distribution (Zángheri 1976; Castroviejo & al. 1993).

A thorough study is needed to clarify the geographical distribution of *Salix appendiculata* in the Balkan Peninsula and W Europe, so as to determine whether its scarce distribution in some areas is due to a lack of available data or to prevailing ecological factors.

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References

Assyov B., Petrova A., Dimitrov D. & Vassilev R. 2006: Conspectus of the Bulgarian vascular flora. – Sofia: Bulgarian Biodiversity Foundation.

Bonnier G. 1934: Flore complète illustrée en couleurs de France, Suisse et Belgique **10.** – Paris: Librairie Générale de l'Enseignement.

Castroviejo S., Aedo C., Cirujano S., Laínz M., Montserrat P., Morales R., Muñoz Garmendia F., Navarro C., Paiva J. & Soriano C. (ed.) 1993: Flora iberica: plantas vasculares de la Península Ibérica e Islas Baleares. **3.** *Plumbaginaceae* (partim)–*Capparaceae*. – Madrid: Real Jardín Botánico, C.S.I.C.

Christensen K. I. 1997: *Salix* L. – Pp. 27–33 in: Strid A. & Tan K. (ed.), Flora hellenica **1.** – Königstein: Koeltz Scientific Books.

Demiri M. 1983: Flora ekskursioniste e Shqipërisë. – Tiranë: Shtëpia Botuese e Librit Shkollor.

Eleftheriadou E. 1992: Die Flora der kaltliebenden Laub- und Koniferenwälder und der hohen extrawaldland von Elatia Dramas. – Thessaloniki: Ph.D. thesis, Faculty of Forestry and Natural Environment, Aristotle University of Thessaloniki [in Greek with German summary].

Hardig T. M., Brunsfeld S. J., Fritz R. S., Morgan M. & Orians C. M. 2000: Morphological and molecular evidence for hybridization and introgression in a willow (*Salix*) hybrid zone. – Molec. Ecol. **9:** 9–24.

Hayek A. von 1927: Prodromus florae peninsulae balcanicae 1. – Repert. Spec. Nov. Regni Veg. Beih. **30(1).**

Jalas J. & Suominen J. (ed.) 1976: Atlas florae europaeae **3.** – Helsinki: The Committee for Mapping the Flora of Europe & Societas Biologica Fennica Vanamo.

Jordanov D. & Kužmanov B. 1966: Flora reipublicae popularis bulgaricae **3.** Serdicae: in Aedibus Academiae Scientarum Bulgaricae.

Kehl A., Aas G. & Rambold G. 2008: Genotypical and multiple phenotypical traits discriminate *Salix* ×*rubens* Schrank clearly from its parent species. – Pl. Syst. Evol. **275:** 169–179.

Kuzovkina-Eischen Y. A. 2003: Stress tolerance and horticultural evaluation of the genus *Salix*. – Columbus: Ph.D. thesis, Ohio State University.

Martini F. & Paiero P. 1988: I Salici d' Italia: guida al riconoscimento e all' utilizzazione pratica, ed. 2. – Trieste: Lint.

Meikle R. D. 1984: Willows and poplars of Great Britain and Ireland. – London: Botanical Society of the British Isles.

Newsholme C. 1992: Willows: the genus *Salix*. – London: B. T. Batsford Ltd.

Oberdorfer E. 1990: Pflanzensoziologische Exkursionsflora. – Stuttgart: Ulmer.

Pignatti S. 1982: Flora d' Italia **1.** – Bologna: Edagricole.

Raven J. A. 1992: The physiology of *Salix*. – Proc. Roy. Soc. Edinburgh, B, Biol. Sci. **98:** 49–62.

Rechinger K. H. 1964: *Salix* L. – Pp. 43–54 in: Tutin T. G., Heywood V. H., Burges N. A., Valentine D. H., Walters S. M. & Webb D. A. (ed.), Flora europaea **1.** – Cambridge: University Press.

Rechinger K. H. 1992: *Salix* taxonomy in Europe – problems, interpretations, observations. – Proc. Roy. Soc. Edinburgh, B, Biol. Sci. **98:** 1–12.

Rechinger K. H., revised by Akeroyd J. R. 1993: *Salix* L. – Pp. 53–64 in: Tutin T. G., Burges N. A., Chater A. O., Edmondson J. R., Heywood V. H., Moore D. M., Valentine D. H., Walters S. M. & Webb D. A. (ed.), Flora europaea, ed. 2, **1.** – Cambridge: University Press.

Skvortsov A. K. 1999: Willows of Russia and adjacent countries: taxonomical and geographical revision. – Joensuu: University of Joensuu [translated from: Skvortsov A. K. 1968: Willows of the USSR. Taxonomic and geographic revision. – Moscow: Nauka].

Strid A. & Tan K. (ed.) 1997: Flora hellenica **1.** – Königstein: Koeltz Scientific Books.

Tutin T. G., Heywood V. H., Burges N. A., Moore D. M., Valentine D. H., Walters S. M. & Webb D. A. (ed.) 1968: Flora europaea **2.** – Cambridge: University Press.

Tutin T. G., Burges N. A., Chater A. O., Edmondson J. R., Heywood V. H., Moore D. M., Valentine D. H., Walters S. M. & Webb D. A. (ed.) 1993: Flora europaea, ed. 2, **1.** – Cambridge: University Press.

Wagenitz G. 1981: *Salix* L. – Pp. 44–135 in: Hegi G. (ed.), Illustrierte Flora von Mitteleuropa, ed. 3, **3(1).** – Berlin: Parey.

Zángheri P. 1976: Flora italica **1.** – Padova: Cedam.