

Does *Tamarix dalmatica* (Tamaricaceae) occur in Spain?

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Abstract

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The presence of *Tamarix dalmatica* in the Iberian Peninsula, and its confusion in Spain with the native species *T. boveana* and *T. africana*, is discussed. A morphological comparison between these three species, and a critical study of the causes for the confusion between them, is presented. This includes an analysis of the variability in some morphological characters used for the identification of these species, together with clarifications of some discrepancies between the original descriptions and our observations of the type material. As a conclusion, *T. dalmatica* is excluded from the Iberian and Balearic floras.

Keywords: *Tamarix dalmatica*, *Tamarix boveana*, *Tamarix africana*, morphological characters, taxonomy, systematics, Iberian Peninsula.

Resumen

Villar, J.L., Alonso, M.A., Juan, A. & Crespo, M.B. 2012. ¿Es *Tamarix dalmatica* (Tamaricaceae) una planta española? *Anales Jard. Bot. Madrid* 69(2): 253-258 (en inglés).

Se discute la presencia de *Tamarix dalmatica* en la Península Ibérica e Islas Baleares. Se pone de manifiesto la frecuente confusión de esta especie, en el territorio peninsular, con las nativas *T. boveana* y *T. africana*. Se realiza una comparación morfológica entre las tres especies y un estudio crítico de las causas que han provocado dicha confusión. Así mismo, se discute la variabilidad existente en algunos caracteres morfológicos utilizados para la identificación de estas especies, así como algunas discrepancias entre las descripciones originales publicadas y el material tipo. Como conclusión se descarta la presencia de *T. dalmatica* en la flora ibero-balear.

Palabras clave: *Tamarix dalmatica*, *Tamarix boveana*, *Tamarix africana*, caracteres morfológicos, taxonomía, sistemática, Península Ibérica.

INTRODUCTION

The genus *Tamarix* (Tamaricaceae) includes, according to different authors, between 65 and 90 species (Baum, 1978; Liu Shu, 2007) that are native to Asia, Africa and Europe. Many *Tamarix* species grow in xeric environments with some degree of salinity, and species are common in deserts, coastal sand dunes, salt marshes and ravines, although some species are also able to occur in freshwater habitats such as river banks. The complex taxonomy of this genus has been reported several times since the XIX century (Bunge, 1852; Baum, 1978; Zohary, 1987). Some of the characters that have been used for species separation are in fact variable in individuals of the same species, or even in a single individual (Jahandiez & Maire, 1932; Quézel & Santa, 1963). Of the 14 species included in Flora Europaea (Baum, 1990), four were cited for the Iberian Peninsula and the Balearic Islands: *T. africana* Poir., *T. gallica* L., *T. canariensis* Willd. and *T. boveana* Bunge. Since then, additional species have been reported: *T. parviflora* DC. (Baum, 1978), *T. dalmatica* Baum (Cirujano, 1993; Gil & al., 1996; Pérez Badia, 1997; Lendínez & al., 2009; Mota & al., 2009), *T. mascatensis* Bunge (De Martis & al., 1985; Gil & al., 1996), *T. arborea* (Sieb. ex Ehrenb.) Bunge (Gil & al., 1996; Gardano & al., 2009), and *T. meyeri* (Venturella & al., 2012).

In Spain, *T. dalmatica* was first reported in the Flora iberica (Cirujano, 1993) for the provinces of Alicante, Murcia and Majorca. Subsequently, some additional localities have been published: Majorca (Gil & al., 1996); La Marina Alta (Alicante) (Pérez Badia, 1997; Bolòs & al., 2005; Serra, 2009); Almería (Lendínez & al., 2009; Mota & al., 2009). And other species have been used in gardens as ornamentals, and have become naturalized (e.g. *T. parviflora* DC., *T. chinensis* Lour. and *T. ramosissima* Ledeb.).

Tamarix dalmatica was described by Baum (1978) based on specimens collected in the XIX and early XX centuries. It is mainly distributed in the eastern Adriatic and north-eastern Ionian coastland (Albania, Bosnia and Herzegovina, Croatia, and Montenegro). Baum also reported the species from the north-western coast of Italy and Sicily. It was also cited for Sicily by Pignatti (1982), but it recently was not found to occur in that island, as reported in a comprehensive revision on the Sicilian taxa of *Tamarix* (Venturella & al., 2007). It has also been recorded in Sardinia (De Martis & al., 1984) and southern Calabria (Venturella & al., 2008). The morphological similarities between *T. dalmatica* and *T. boveana*, and also *T. africana*, have been reflected in the different identification keys which have attempted to distinguish these taxa for the Iberian Peninsula and the Balearics (e.g., Cirujano, 1993; Bolòs & al., 2005; Mateo & Crespo, 2009; Salazar & Quesada, 2010). The present study is aimed to clarify the relationships between these species.

MATERIAL AND METHODS

For this study around 170 herbarium specimens of *T. africana*, *T. boveana* and *T. dalmatica* from ABH, HUAL, G, JAEN, K, MA, MPU, PR, PRC, UIB, VAL and W (acronyms according to Thiers, 2011) were examined. These included the holotype (PRC) and two isotypes (W and PR) of *T. dalmatica*, and also isotypes of *T. boveana* (W and G). Some field populations reported as *T. dalmatica* in the Iberian Peninsula were visited, and collections of *T. dalmatica* were made in the spring of 2011 in Albania, Montenegro and Croatia, where the species is widely distributed (deposited at ABH). Furthermore, collections of *T. boveana* were made at the type locality (La Macta, Algeria), and these are also currently conserved at ABH.

The morphological characters of the studied materials of *T. boveana* and *T. dalmatica* were compared with the original descriptions and with morphological data taken from other studies (Bunge, 1852; Baum, 1978; Cirujano, 1993). For species identification various monographs were used (Bunge, 1852; Baum, 1978; Cirujano, 1993). Author abbreviations follow Brummitt and Powell (1992), and have been updated according to the IPNI (2011). Detailed photographs of *T. africana*, *T. boveana* and *T. dalmatica* were made using a binocular microscope (Olympus SZX12) with adapted camera.

RESULTS

Our study of the herbarium specimens (Appendix 1) identified as *T. dalmatica* in Spain in various reports revealed that most of them correspond in fact to *T. boveana*, and some to *T. africana*, but none was found to correspond to *T. dalmatica*. The reports of *T. dalmatica* in Majorca could not be checked because no vouchers were found in the herbaria consulted. However, since no specimen resembling *T. dalmatica* has been found among the Balearic collections studied, or was collected during the last years of our research, its presence in the Balearic Islands is very unlikely. *Tamarix boveana* and *T. africana* are the two species in the Iberian Peninsula that most resemble *T. dalmatica*. The latter species has often been confused with *T. boveana* due to some similarities in floral morphology, although in the field *T. africana* looks much closer to *T. dalmatica*.

Despite their general similarity, some differences can be highlighted: *T. dalmatica* and *T. africana* have similar leaves, although those of *T. africana* are markedly auriculate, but in both species the longest leaves are shorter than 4 mm, whereas those of *T. boveana* can reach up to 7 mm. The racemes (Fig. 1) of *T. boveana* are longer and wider (up to 12 cm long and 13 mm wide) than those of *T. dalmatica* (up to 6 cm long and 7 mm wide) and *T. africana* (up to 6.5 cm long and 7 mm wide).

Bracts are also quite similar in *T. africana* and *T. dalmatica*,

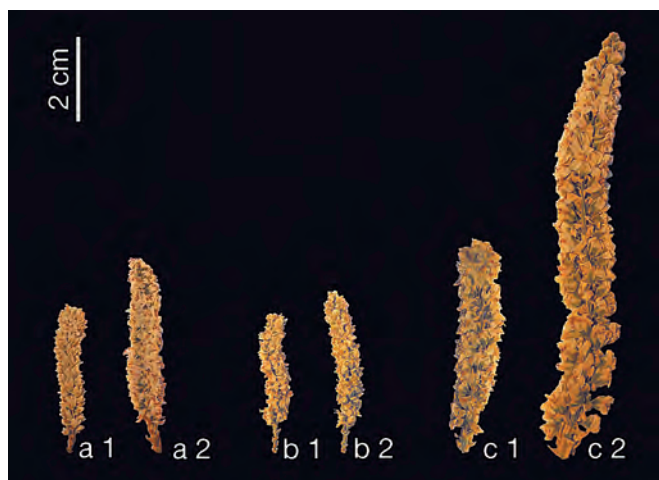


Fig. 1. Racemes of: **a1**, *Tamarix africana* (ABH55366, Valencia, Spain); **a2**, *T. africana* (ABH57862, Alicante, Spain); **b1**, **b2**, *T. dalmatica* (ABH57836, Central Dalmatia, Croatia); **c1**, *T. boveana* (ABH58159, Alicante, Spain); **c2**, *T. boveana* (ABH57853, Alicante, Spain).

being typically broadly triangular to oblong, obtuse, and usually shorter than 3 mm, almost equalling the calyx or slightly overtopping it. Those in *T. boveana* are also oblong and obtuse, but they are much longer, clearly overtopping the calyx, and frequently reaching 5–6 mm in length (Fig. 2). The flowers of *T. africana* are usually pentamerous, whilst those of *T. boveana* and *T. dalmatica* are usually tetramerous. Although all three species show exceptions, *T. dalmatica* is the most variable in the number of pieces in the floral whorls. The size of the sepals can overlap in all three species, but whilst those in *T. boveana* can reach 3.5(4) mm in some cases, in *T. dalmatica* and *T. africana* they are usually smaller (Fig. 2). Petals are elliptic-oblong to obovate unguiculate in *T. boveana*, whereas they are ovate to elliptical (or oblong-cuneate in var. *fluminensis* Maire) in *T. africana*, and oblong elliptical with a cuneate base in *T. dalmatica* (Fig. 2). The ovary of *T. africana* bears 3 styles, whereas in *T. boveana* it usually has 4 styles (rarely 3). Similarly, *T. dalmatica* usually has 4 styles, but 3-styled ovaries are not uncommon and this species is the most variable of the three with regard to this character.

Some differences can also be found in the habitat requirement. *T. boveana* is hyper-halophilous, whereas *T. dalmatica* and *T. africana* are halo-tolerant, and able to grow near freshwater environments. More complete descriptions of the three species are given below.

DISCUSSION

The confusion that led to several erroneous reports of *T. dalmatica* in the Iberian Peninsula was probably due to a number of factors. A widely used character to distinguish between species or groups of species in *Tamarix* is the nectariferous disc (Baum, 1978; De Martis & al., 1984; Cirujano, 1993). Baum (1978) established three types of nectariferous disc according to the fusion of the stamen filaments to the disc: synlophic, paralophic, and hololophic.

Although this is a very useful character, it can be problematic since differences between synlophic and paralophic discs are often very weak. Distinction between paralophic and hololophic discs can also be unclear, particularly when the lobes are not well developed and the disc is circular in shape. Some authors have questioned the reliability of the nectariferous disc shape for some species (Zohary 1987), and in the Flora of China (Liu Shu, 2007), only two types are distinguished: those in which the staminal filaments are inserted on top of the disc lobes, and those in which the filaments are inserted between the lobes. According to the observed variability, the option of using only two types of nectariferous disc seems to work better in the species with marked morphological plasticity. Disc type may have been a reason for some misidentifications. The disc of *T. dalmatica* has been defined as paralophic in several works, whilst *T. africana* and *T. boveana* discs were defined as synlophic (Baum, 1978; Cirujano, 1993). However, this character is especially variable in *T. boveana* (see species description below), and clear assignment to any of those disc types is sometimes extremely difficult.

The number of petals and sepals is an important character to note. *T. boveana* and *T. africana* have been considered quite stable in the number of sepals and petals (tetramerous

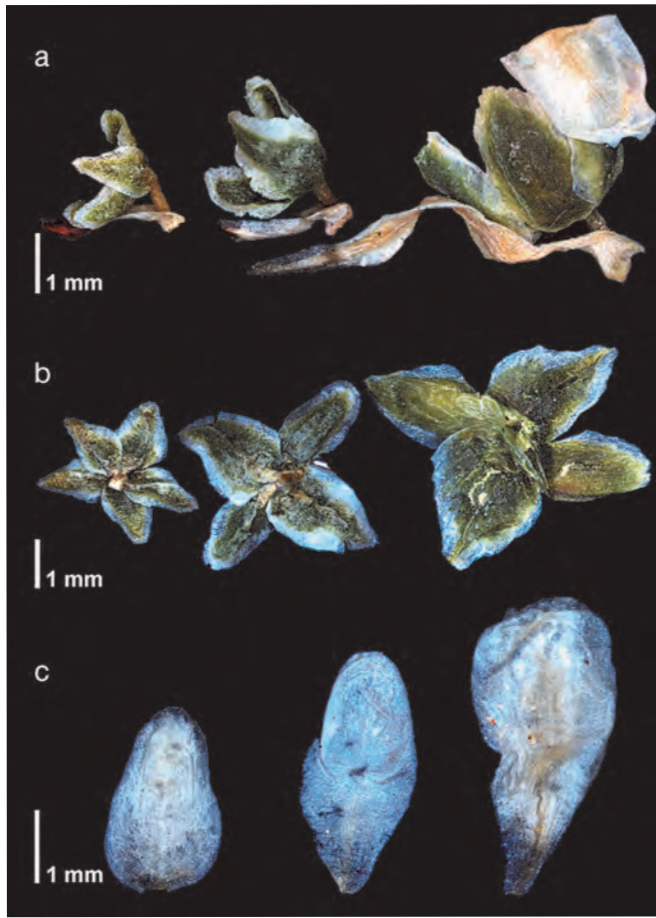


Fig. 2. *Tamarix africana* (left column; ABH55366, Valencia, Spain), *T. dalmatica* (central column; ABH57836, Central Dalmatia, Croatia); *T. boveana* (right column; ABH57853, Alicante, Spain). **a**, bracts and calyx; **b**, outer view of calyx; **c**, petals.

and pentamerous, respectively), whereas *T. dalmatica* was described as a tetra-pentamerous species. This can cause misidentification of *T. dalmatica* with *T. boveana* or *T. africana* in specimens of the latter two species that show flowers with a different sepal number in the racemes. In fact, in most species some flowers can be found that show abnormal features or even morphological aberrations, such as a reduction in the number of sepals (sometimes due to fusion); extra petals or extra sepals (flowers were found with eight well-developed petals and sepals in *T. hampeana* Boiss. & Heldr.); extra bracts located on pedicels, reported by Baum (1978) for *T. rosea* Bunge, but also observed in other species such as *T. boveana* Bunge, *T. chinensis* Lour., *T. hampeana* or *T. hohenerkeri* Bunge; extra staminal filaments or stamens, well-developed or not; or intermediate shaped pieces between the sepals and petals. The shape of sepals and their margin are another source of potential confusion. In recent works (Baum, 1978; Cirujano, 1993; Salazar & Quesada, 2010), the two internal sepals of *T. boveana* have been described with a denticulate margin at the apex, whereas the sepal margin in *T. dalmatica* was said to be entire in the original description (Baum, 1978). In the protologue of *T. boveana* (Bunge, 1852), sepals (including the outer ones) were described as having a finely serrulate margin, but according to our own observations, in

T. boveana the margin of inner and outer sepals can vary from entire to finely serrulate or irregularly denticulate. Surprisingly, despite Baum's original description, no individuals of *T. dalmatica* with entire sepals have been found, including the holotype and two isotypes.

The relative length of bracts with respect to calyx has been another source of confusion. According to the protologue, the bracts in *T. dalmatica* are longer than calyx, but no quantitative measurements were given. In fact, bracts longer than calyces were rare in most specimens of *T. dalmatica* studied by us (including the type material). However, *T. boveana* bracts are almost always longer than the calyx, and clearly larger in size than those of *T. dalmatica*, as emphasized in the descriptions below. It is important to note the convenience of measuring the bract size, even though it is variable in some species. This is because in some cases (e.g. *T. polystachya* Ledeb.) the pedicels continue to elongate after the flowers are open, whereas bracts remain the same size. In such cases, the bracts can be slightly shorter than the calyx when flowers first open, and much shorter than pedicels at fruiting time.

Another confusing character is the size of racemes. According to the original descriptions, *T. dalmatica* and *T. boveana* have racemes that are similar in size. However, *T. boveana* racemes are significantly longer and wider than those in *T. dalmatica*. Yet another source of confusion is the papillosity of the raceme rachis. In *T. boveana* the rachis has been described as papillose, whereas it is glabrous in *T. dalmatica* (Baum, 1978; Cirujano, 1993; Salazar & Quesada, 2010). Whilst most specimens of *T. boveana* show appreciable papillosity all over the rachis, a number of individuals occur in which the raceme rachis appears to be glabrous or only papillose around the insertion of bracts. Moreover, it is necessary to be cautious when using this as a diagnostic character for species segregation. Baum (1978) regarded it as variable in some species, e.g. *T. nilotica*, *T. macrocarpa*, *T. arborea*, and *T. passerinoides*, with *T. hispida* Willd. the most extreme example. Two varieties are accepted in the latter: var. *hispida*, with the raceme densely covered with hair-like papillae, and var. *karelinii* (Bunge) Baum, with the raceme almost glabrous, although intermediate forms are common between both extremes.

According to our observations, the presence of *T. dalmatica* in the Iberian Peninsula and the Balearics should be disregarded. And since the variability of morphological characters used for identification is high, it is necessary to use a combination of most of them to ensure accurate identifications.

KEY TO THE STUDIED SPECIES

1. All flowers in the racemes pentamerous, or exceptionally with only a few tetramerous ***T. africana***
1. All flowers in the racemes tetramerous, or tetramerous and pentamerous intermixed in similar proportions **2**
2. Racemes 4-12(15) cm long and 7-13 mm wide. Bracts 4-6(7.5) mm long, clearly longer than the calyx ***T. boveana***
2. Racemes 2-4(6) cm long and 4.5-5.5(7) mm wide. Bracts 1.25-2.25(3) mm long, usually slightly shorter than the calyx ***T. dalmatica***

The following descriptions are included to facilitate further identification of taxa. They are based on our observations of many specimens of the three species, including type materials of both *T. dalmatica* and *T. boveana*:

Tamarix dalmatica Baum

Leaves 1.5-3(4) mm long, narrowly triangular, acute, with narrow decurrent base, the larger slightly auriculate. Inflorescence composed of racemes arranged in unbranched spike-like panicles. Racemes 20-40(60) × 4.5-5.5(7) mm, with a short peduncle (2-3 mm) covered by scarious bracts. Rachis glabrous. Bracts 1.25-2.25(3) mm long, shorter to equalling the calyx, rarely longer, broadly triangular to oblong, patent, slightly concave, with the apex sometimes scarious and incurved, base decurrent and narrow. Pedicels ca. 0.5 mm. Sepals 4 (sometimes 5), 1.2-1.7(2) × 1-1.4 mm, broadly ovate to elliptic, with a hyaline irregular and finely denticulate margin; the 2 external from obtuse to acute, sometimes with prominent central nerve, the 2(3) internal ones obtuse. Petals 4 (sometimes 5), 2.5-3.25(3.5) × 1.2-1.5 mm, oblong-elliptical with a cuneate base to slightly obovate, recurved. Filaments 4(5), inserted on the top of disc lobes, the lobes short and filament insertion truncate (abrupt). Anthers not apiculate. Ovary with 4 styles, rarely 3.

Tamarix boveana Bunge

Leaves 2-4(7) mm long, narrowly lanceolate acute, the larger long triangular with wide base at flowering time, markedly auriculate in late summer and autumn shoots. Inflorescence composed of racemes arranged in unbranched spike-like panicles. Racemes 40-120(150) × 7-13 mm, very large, with a peduncle up to 1 cm long, with some long and wide oblong bracts. Rachis from papillose to almost glabrous. Bracts 4-6(7.5) × 0.5-1 mm, oblong-obtuse, sometimes with scarious incurved apex, base decurrent, divaricate to recurved at fruit stage, with papillose margin and surface, longer to much longer than calyx; exceptionally 1-3 extra bracts* can be found on the pedicels of flowers at the base of racemes, these bracts being triangular linear and usually shorter than 2 mm. Pedicels 0.5-1 mm, sometimes slightly recurved. Sepals 4 (rarely 5, exceptionally 6), (1.8)2-3.5(4) × 1.25-2.5 mm, ovate-elliptical, with a hyaline margin that is entire or finely and irregularly denticulate, the 2 internal obtuse, the 2 external slightly larger, commonly acute (rarely obtuse) to acuminate; when acuminate, the central nerve is strongly developed and the sepals may appear keeled. Petals 4 (rarely 5), 2.5-4(6) × 1.25-2.5 mm, elliptical-obovate to obovate-ungiculate. Filaments 4 (rarely 5, very rarely 6-7), inserted on the top of disc lobes, the lobes short and filament insertion usually cuneate (progressive), sometimes truncate; sometimes the stigmatic disc is very thin and circular, with no clear lobes, and then the insertion of filaments is cuneate. Anthers not apiculate. Ovary with 4 styles, very rarely 3.

*In some specimens these bracts are very close to calyx, and they adopt the shape of a sepal, and so maybe the possible origin of some flowers with a hexamerous calyx.

Tamarix africana Poir.

Leaves 1.5-3(4) mm long, ovate-triangular, acute, auriculate with narrow base. Inflorescence composed of racemes arranged in unbranched spike-like panicles. Racemes 20-50(65) × (5)5.5-7 mm, with a short peduncle (<5 mm) covered by scarious bracts. Rachis usually papillose. Bracts 1.5-3(4)* mm

long, sub-equalling to slightly longer than calyx, broadly triangular to oblong, sometimes with scarious incurved apex, usually obtuse, with papillose margin, base narrow decurrent to calcarate, sometimes with 2 small auricles that are also decurrent. Pedicels ca. 0.5 mm. Sepals 5 (rarely 4, exceptionally 6), broadly ovate to oblong, obtuse, with a narrow hyaline margin entire or finely denticulate; the 2 external (1)1.25-2(2.5) mm long, mostly with prominent central nerve, the 2 internal 0.8-1.5 mm long. Petals 5 (rarely 4, exceptionally 6), 2-3(4)* × 0.9-1.5(2) mm, ovate to elliptic (or oblong-cuneate to oblong-ungiculate)**. Filaments 5 (rarely 6-8, and exceptionally 4), inserted on the top of the disc lobes, the insertion cuneate (when extra filaments are present, inserted between lobes). Anthers mostly not apiculate. Ovary always with 3 styles.

*In var. *fluminensis* Maire the bracts, sepals and petals have the largest values for the species.

**Only in var. *fluminensis* Maire.

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APPENDIX 1

Studied specimens

Tamarix boveana

- ALGERIA. Pres de La Macta. IV-1830. Bové. (Isotypes of *Tamarix boveana* Bunge, (G (2 vouchers), W). Bords du Chott el Chergui, près de Khrider, cercle de Saïda, 30-V-1852, *Balansa* (isotypus of *Tamarix bouanopoea* J. Gay, W1889-66855). Orán, La Macta, saladar con dunas, 30S YE 6064, 1 m, 13-VI-2010, A. Juan (ABH56326, ABH56327). M Sila, Chellal, 31S FV 2531, 460 m, A. Juan (ABH56332, ABH56333). MOROCCO. Prov. Goulimine, Oued Noun, 13 Km SW of Goulimine on P41 to Tan-Tan, D. Podelch (MO-6050185). Saladar próximo a Barrage Mohamed, 30SVD9823, 235 m, 20-IV-2009, M.A. Alonso, M.B. Crespo, A. Juan, J.L. Villar & al. (ABH54181, ABH54183, ABH54185). SPAIN. **Alicante:** Jijona, Monnegre, Barranco salinas, 30SYH1663, 260 m, 03-V-2007, P. Rico, J.C. Cristobal, A. Vicente, A. Guilló & J.L. Villar (ABH51546). Alicante, campos próximos a Sierra de los Tajos 30SYH0957, 210 m, 20-IV-1998, E. Camuñas & J.C. Cristobal. (ABH39056). Elche, Próximo a Sierra de Sancho, 30SYH1142, 90 m, 09-III-1999, E. Camuñas (ABH41460). Jijona, Monnegre, Barranco salinas, 30SYH1663, 275 m, 22-IV-1997, J.C. Cristobal (ABH33919). Alicante, Cabo Huertas, 30SYH2448, 1 m, 04-V-1997, E. Camuñas & M.B. Crespo (ABH34309). Jijona, Monnegre, Barranco Salinas, 30SYH1563, 300 m, 26-IV-1997, J.C. Cristobal (ABH34012). Denia, Les Deveses, 30SYJ5807, 1 m, 15-III-1997, M. Signes & J.X. Soler (MA590335). Elche, Playa del Carabassí, 30SYH174350, 1 m, 26-V-2010, J.L. Villar (ABH55442). Cabo de las Huertas, parque arriba de Cala Cantalar, 30SYH253484, 30 m, 13-III-2011, J.L. Villar & E. Martínez (ABH57853). Playa de San Juan, junto a edificio Suiza, 30SYH 255492, J.L. Villar & R.M. García (ABH57856). Santa Pola, salinas, junto a la torre, 30SYH089289, 1 m, 21-III-2011, J.L. Villar & I. Aragoneses (ABH58156). Santa Pola, salinas, 30S YH1029, 1 m, 21-III-2011, J.L. Villar & I. Aragoneses (ABH58157, ABH57159). Guardamar del Segura, Desembocadura del Segura, 30SYH053195, 1 m, 21-III-2011, J.L. Villar & I. Aragoneses (ABH57854). **Almería:** Cabo de Gata, 3-IV-1876, E. Hackel (W). Río Chico, Berja, 30SWF0071, 76 m, 18-III-2006, M.L. Lendinez, J. Quesada & F.M. Marchal (JAEN 700428). Pilar de Jaravía, Pulpi, 30SXG1639, 80 m, 18-III-2006, A. Lahora (HUAL 22092). Pilar de Jaravía, Pulpi, 30SXG1639, 79 m, 18-III-2006, J.F. Mota, F.J. Pérez-García & A. Lahora (HUAL 18130). Vera, Salar de los Carros, 30SXG056203, 3 m, 8-V-2010, J.L. Villar & E. Martínez (ABH55342, ABH55343, ABH55344). Salinas de Cabo de Gata, 30SWF684706, 8-V-2010, J.L. Villar & E. Martínez (ABH55351). **Granada:** Cúllar, Salado del Margen, 30SWG365672, 840m, 9-V-2010, J.L. Villar & E. Martínez (ABH55341, ABH55339). Cúllar, Salado del Margen, 30SWG365664, 840 m, 9-V-2010, J.L. Villar & E. Martínez (ABH55340). **Mallorca:** Puerto de Pollensa le long de la routed Alcudia, abords du pré salé, dunes littorales, 2-IV-1977, J. Duvigneaud (G159953). **Murcia:** Fortu-

na, rambla Salada. 100 m, 4-IV-1979, A. Molina (G169033). Alhama de Murcia, Los Ventorillos, 30SHG48, 150 m, 28-III-2006, M. Cano (ABH50682). **Tarragona:** Delta del Ebro, frente a Isla del Buda, 31TCF1806, 1 m, 7-V-2009, J.L. Villar, M.A. Alonso, J.C. Agulló & H. Alvarado (ABH54332). **Zaragoza:** La salada de Alcañiz, La Sabrosa de Chiprana, 2-V-1887, Loscos (G6990/1257). Laguna salada de Chiprana, 30TYL3669, 136 m, 7-V-2009, J.L. Villar, M.A. Alonso, J.C. Agulló & H. Alvarado (ABH54330).

Tamarix africana

- ALGERIA. Union agricole du Sig, provincé Oran, 1850, *Dulando* (W). Bords de l'Oued Biskra, à Biskra, *Balansa* 991 (W1889-80151, W1889-320236). Alger, bas-fonds humides au pied des collines du Shael, aus sud de Koléa, 23-III-1960, A. Dubois & L. Faurel (W1977-05063). Tizi-Ouzou, El Jecmae, 31SFA1141, 400m, 20-VI-2010, A. Juan (ABH56325). FRANCE. Bords de la mer a St.Tropez, 13-4-1861, *Bourgeau* (W). Insula Corsica, in sabulosis maritimis, Ile Rousse, 14-IV.1918, *Mary F. Spencer* (W2009-00736). ITALY. **Sardinia:** Hügel und Küsten s. Alghero, 12.IV-1963, *Krendl* (W1977-19646). Oristano, saladar en Putzultzu, 32TMK489327, 3 m, 20-VI-2009, J.L. Villar, M.A. Alonso, A. Juan, J.C. Agulló & A. Guilló (ABH54423). Oristano, Cabras, 32SMK589189, 3m, 21-VI-2009, J.L. Villar, M.A. Alonso, A. Juan, J.C. Agulló & A. Guilló (ABH54431, ABH54432). Cagliari, Quartu Santa Elena, 32SNJ1441, 4 m, 24-VI-2009, J.L. Villar, M.A. Alonso, A. Juan, J.C. Agulló & A. Guilló (ABH54465, ABH54312, ABH54463). Cagliari, playa en is Canaleddu, 32SNJ312366, 5 m, 24-VI-2009, J.L. Villar, M.A. Alonso, A. Juan, J.C. Agulló & A. Guilló (ABH54370). Cagliari, Solanas, 32SNJ377320, 10 m, 24-VI-2009, J.L. Villar, M.A. Alonso, A. Juan, J.C. Agulló & A. Guilló (ABH54441, ABH54442). Cagliari, Laguna de Sestu, 32SNJ077536, 55 m, 25-VI-2009, J.L. Villar, M.A. Alonso, A. Juan, J.C. Agulló & A. Guilló (ABH55417, ABH56711). Golfo di Cagliari, playa, 32SNJ019337, 2 m, 25-VI-2009, J.L. Villar, M.A. Alonso, A. Juan, J.C. Agulló & A. Guilló (ABH55416). Cagliari, rio Chia, 32SMJ899060, 2 m, 25-VI-2009, J.L. Villar, M.A. Alonso, A. Juan, J.C. Agulló & A. Guilló (ABH54444). Cagliari, rio Chia, 32SMJ907079, 17 m, 25-VI-2009, J.L. Villar, M.A. Alonso, A. Juan, J.C. Agulló & A. Guilló (ABH55360). Cagliari, laguna de Chia, 32SMJ892050, 2 m, 25-VI-2009, J.L. Villar, M.A. Alonso, A. Juan, J.C. Agulló & A. Guilló (ABH54443). Cagliari, Sant Antioco, 32SMJ543234, 3 m, 25-VI-2009, J.L. Villar, M.A. Alonso, A. Juan, J.C. Agulló & A. Guilló (ABH54366). Oristano, saladar de Santa Giusta, 32SMK645100, 1 m, 26-VI-2009, J.L. Villar, M.A. Alonso, A. Juan, J.C. Agulló & A. Guilló (ABH55430, ABH56712). Sassari, Estintino, 32TML356245, 24 m, 26-VI-2009, J.L. Villar, M.A. Alonso, A. Juan, J.C. Agulló & A. Guilló (ABH54439). Sassari, Argentera, 32TML2811, 26-VI-2009, J.L. Villar, M.A. Alonso, A. Juan, J.C. Agulló & A. Guilló (ABH54437, ABH54438). Sassari, Lago Baratz, 32TML346032, 26-VI-2009, J.L. Villar, M.A. Alonso, A. Juan, J.C. Agulló & A. Guilló (ABH54371). **Sicily:** Plantae siculae, in arenosis Mondello propè Panormo, 26-III-1835, *Huet du Pavillon* (W1889-67485). Selinunte, feuchtestellen un weit der Tempel, 14-IV-1955, *Höppflinger* (W1968-1364). MOROCCO. Beni-Tuzin, bords du rio Kert, 6-V-1934, *Sennen* & Mauricio (W1935-5317, isotypus of *Tamarix mauritii* Sennen). Beni-Tuzin, termas de Rastafat, 9-V-1934, *Sennen* & Mauricio (W). Or, Oujda-Taourirt (Oued Jfrei), 30SVD198231, 325 m, 20-IV-2009, M.A. Alonso, M.B. Crespo, A. Juan, J.L. Villar & al. (ABH54445). Proximidades de Debdou, 30SWC-006675, 784 m, 20-IV-2009, M.A. Alonso, M.B. Crespo, A. Juan, J.L. Villar & al. (ABH54207, ABH54205). TH, carretera de Taza hacia Aknoul, 30SVD533949, 848 m, 21-IV-2009, M.A. Alonso, M.B. Crespo, A. Juan, J.L. Villar & al. (ABH54123). TH, Aknoul, 30SVD202307, 925m, 21-IV-2009, M.A. Alonso, M.B. Crespo, A. Juan, J.L. Villar & al. (ABH54121). TH, Taza-Guercif, 30SVC328915, 500m, 22-IV-2009, M.A. Alonso, M.B. Crespo, A. Juan, J.L. Villar & al. (ABH54191, ABH54192). Carretera costera entre Nador y Al Hoceima, 30SVD876992, 34 m, 23-IV-2009, M.A. Alonso, M.B. Crespo, A. Juan, J.L. Villar & al. (ABH54190). Carretera costera entre Nador y Al Hoceima, 30SVD8397, 12 m, 23-IV-2009, M.A. Alonso, M.B. Crespo, A. Juan, J.L. Villar & al. (ABH54193, ABH54203). Al Hoceima, 30SVD-268951, 25 m, 23-IV-2009, M.A. Alonso, M.B. Crespo, A. Juan, J.L. Villar & al. (ABH54193). SPAIN. **Albacete:** In einer sumpfwiese nahe E Alcaraz, ca. 700 m, truppweise, 24-VI-1975, *Polatschek*, (W1976-04119). **Alicante:** Orihuela, Rambla del Trujillao, Río Nacimiento, 30SXG9598, 45 m, 13-III-2008, P. Rico, M. A. Alonso & al. (ABH55137). Tibi, entre Xirau y Maigmo, estrete roig, junto a carretera de servicio, 30SYH092627, 535 m, 4-V-2009, J.C. Cristobal (ABH54301). Alicante, Sierra de los Tajos, Les esmo-

ladores, 30SYH0955, 240 m, 23-III-2007, *L. Serra, J.M. Mondéjar & P. Mateo* (MA784516). San Juan de Alicante, 30SYH22525297, 50 m, 29-III-2011, *J.L. Villar, J.C. Agulló, & E. Martínez* (ABH57862). **Almería:** El Ejido, Balerna, 30SWF097653, 4 m, 9-V-2010, *J.L. Villar & E. Martínez* (ABH55348). **Castellón:** Segorbe, en la rambla seca, V-1918, *Pau* 3629 (W1922-15352). **Girona:** Port de la Selva, Cala Tamariua, 31TEG1788, 5 m, 10-IV-2010, *M.B. Crespo & E. Camuñas* (ABH55078). **Granada:** Sierra Nevada zw. Orgiva und Caratauna, 600-700 m, 3-V-1965, *Greuter* (W1966-16337). **Murcia:** Mazarrón, las Chapas, Cañada de Gallego, 30SXG437552, 4 m, 8-V-2010, *J.L. Villar & E. Martínez* (ABH55352). Águilas, Rambla de Minglano, 30SXG213438, 109 m, 8-V-2010, *J.L. Villar & E. Martínez* (ABH55355). **La Rioja:** Logroño, Recajo, sables de I Ebre, 10-V-1923, *Sennen & Elías* (W1926-23534, isotypus of *Tamarix celtiberica* Sennen & Mauricio). **Tarragona:** Cambrils, torrent de Janer, 8-VI-1917, *Sennen* 3066 (W1922-15231, isotypus of *Tamarix uncinatifolia* Sennen). **Toledo:** Laguna grande de Villacañas, 30SVJ7285, 650 m, 9-V-2010, *M.D. Vargas & J. Alonso* (ABH55361, ABH55362). **Valencia:** Regn. Valentinum, in arenosis proximis sec. Viam quae ducit ad Cabo S. Anton, 27-IV-1891, *Porta & Kigoiter* (W1892-6724). Villargordo del Cabriel, junto a la carretera, 30SXJ323786, 740 m, 17-V-2010, *J.L. Villar, M.B. Crespo, F. Martínez-Flores & C. Pena* (ABH55366). PORTUGAL. Alto tras os Montes, Mogadouro, Embalse Bemposta, río Douro Internacional, 29TQF1074, 340 m, 14-VI-2010, *M.B. Crespo* (ABH55436). TUNISIA. Tunisien, Oued el Hathob, SW Kairouan, 18-IV-1962, *K. Fitz* (W1979-09956).

Tamarix dalmatica

BOSNIA and HERZEGOVINA. An der Narenta bei Caplijina, V/1892, *F. Fiala* (holotypus PRC 422665, isotypus W 1929-20413, PR). CROATIA. St Stefano pr. Spalato, VI-1872, *Pilcher* (G, 2 vouchers; PR). Dalmacia central, Mündungsebene der Neretva (Posrednica), am linken Neretva-Ufer gegenüber von Rogotin (Zwischen Opuzen und Ploče) nahe Strassenbrücke, 2m, 20-IV-1979, *E. Vitek* (W2003-02919). Dalmacia Central, Slano, 33TYH364407, 16 m, 29-IV-2011, *J.L. Villar & E. Martínez* (ABH58191, ABH58192). Dalmacia central, Omis, 33TXJ376129, 18 m, 30-IV-2011, *J.L. Villar & E. Martínez* (ABH57840). Dalmacia central, Podstrana, 33TXJ283136, 8 m, 30-IV-2011, *J.L. Villar & E. Martínez* (ABH57836). Dalmacia del norte, Sukosan, paseo junto al mar, 33TWJ248777, 1 m, 30-IV-2011, *J.L. Villar & E. Martínez* (ABH58187). MONTENEGRO. Bar, V-1903, *Rohlena* (PR). Bar, al sur de Bar, junto a ctra a Ulcinj, 34TCM432618, 26 m, 27-IV-2011, *J.L. Villar & E. Martínez* (ABH57843). Kotor, Lavsta, Junto a ctra. Budva-Kotor, en llanura aluvial, 34TCM170883, 22m, 27-IV-2011, *J.L. Villar & E. Martínez* (ABH57844, ABH57845). Hercej-Novi, Morinj, desembocadura de río al sur del pueblo, junto al mar, 34TCN070066, 15 m, 28-IV-2011, *J.L. Villar & E. Martínez* (ABH58169, ABH58168).

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