

Further naturalised Cactaceae in northeastern Iberian Peninsula

by

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Abstract

During the floristic work carried out in 2004 in the Baix Camp region of Tarragona (NE Spain) we found four new species of alien naturalised Cactaceae. Of these, three are reported for the second time from Europe and the other is new to Catalonia region. Southern Catalonia, with eleven species of Cactaceae, harbours the highest diversity of the family in Europe. Our results demonstrate that this diversity is even higher than previously believed. The introduction of these exotic taxa is, once again, due to the development of gardening based exclusively on foreign elements, to the unscrupulous and uncontrolled dumping of their remains in the natural environment, and to the existence of a favourable climate.

Keywords: alien plants, Cactaceae, Catalonia, exotic, invaders, Spain, xenophyte.

Resumen

Durante la campaña de prospección florística llevada a cabo en 2004 por la comarca del Baix Camp (Tarragona, NE de España) hemos encontrado cuatro especies de cactáceas alóctonas naturalizadas. De ellas, tres se citan por segunda vez de Europa y la otra es nueva para Cataluña. Nuestros resultados aumentan aún más la diversidad de cactáceas del sur de Cataluña que, con once especies, es la mayor de toda Europa. La introducción de estos táxones exóticos que ahora damos a conocer se debe, una vez más, al desarrollo de una jardinería basada casi exclusivamente en elementos foráneos, en el vertido desaprensivo e incontrolado de sus restos en el medio natural y en la existencia de una climatología muy favorable.

Palabras clave: Cactaceae, Cataluña, España, plantas invasoras, xenófitas.

Introduction

In the summer of 2004 the systematic prospecting for alien plants in the southern coast of Tarragona was completed (Sobrino & al., 2002). The area is particularly rich in Cactaceae, as we already showed in a previous paper (Sanz-Elorza & al., 2004). With these new findings, the number of species of this family in northeastern Iberian Peninsula reaches eleven. This is a strikingly high number, as except for the American regions from where these species are native, no other place in the world is known to have such a diversity of Cactaceae.

The botanical exploration for this study was designed by the Group of Alien Plant Species of the Spanish Society of Weed Science (Sobrino & al., 1999) to report the presence and distribution of alien

species in Spain, and has been carried out during the last five years. With this study, the floristic prospecting of the dry river beds in the coastal areas of Tarragona between Cambrils and the estuary of the Ebro river has been completed. The study has been focused in Cactaceae because of its abundance and marked invasive character of several of its species (Richardson & al., 2000). With respect to the demography, we basically follow the methodology proposed by Iriondo (2001), while for the characterisation of the natural environment we follow Sanz-Elorza & al. (2004).

Account of the species found

Cylindropuntia imbricata (Haw.) F.M. Knuth. in Backeb. & F.M. Knuth, *Kaktus-ABC*: 125. 1935 (Fig. 1a, d)

SPAIN. **Tarragona**: Cambrils, naturalised on the south facing bank and side of the L'Alforja dry river bed, 41°05'14"N, 1°02'43"E, (31TCF3550), 30 m, 20-VIII-2004, *M. Sanz-Elorza* (MA 720829).

Shrub, arborescent, or small tree, usually to 3 m high, often with short trunks; branches much longer. Stem segments cylindrical to somewhat club-shaped, greyish-green, 8-25 long, 1.5-4 cm in diameter, with very prominent and spaced tubercles (few compared with *C. spinosior*), very sharply raised, 3-4 rows visible laterally, 2-3.5 cm long, 4.5-9 mm wide. Areoles with yellow to tan wool, elliptical. Glochids pale yellow, 0.5-3 mm long. Spines on most areoles, red or pink, about 5-30 per areole, stout, rounded or sometimes flattened in cross section basally, spreading in all directions, straight or curved, the longest 1.2-3 cm long, sheaths dull tan, papery, persistent about 1 year, silver to yellow. Flowers dark pink to magenta or reddish-purple. Sepaloids cuneate to cuneate-oblong, 5-20 mm long, 5-15 mm wide, truncate to somewhat rounded. Petaloids narrowly obovate, 25-40 mm long, 12-20 mm wide, apically rounded. Filaments purplish-green, anthers yellow. Style green and purple. Stigmas 7-8, rather slender. Fruits obovoid, fleshy, yellow, strongly tuberculate, spineless, 2.4-4.5 cm long, 2-4 cm wide, umbilicus deep and cup-like. Seeds light tan, irregularly lenticular, 3 mm diameter, 1.5 mm thick. Flowers from May to July.

The species is native from the central part of southern USA (Arizona, Colorado, Kansas, New Mexico, Oklahoma, and Texas, cf. Benson, 1982: 314-318; Pinkava, 2003: 112-113), and the high plateaus of northern Mexico (Chihuahua, Coahuila, Durango, Guanajuato, Hidalgo, México, Querétaro, Tamaulipas, and Zacatecas, cf. Bravo-Hollis, 1978: 205-209). Two varieties have been recognised: var. *imbricata*, to which the Spanish plants belong, and var. *argentea* (M.S. Anthony) Backeb., endemic to the Big Bend region in Texas (Pinkava, 2003). In its native area it is one of the species that characterize the desert landscape (Bravo-Hollis, 1978). *Cylindropuntia imbricata* is considered to be an invasive species in arid areas of Australia (Randall, 2002: 213), New Zealand, Zimbabwe, and South Africa (Henderson, 1995: 44). This is the first report of the species for Catalonia, although it has been previously found in the provinces of Alicante (Berthet, 1990) and Valencia (Mateo & Crespo, 1995; Guillot & Van Der Meer, 2001: 40-41).

Demography: The population consists of three individual adults forming a complex tangle of vegetation and at least ten young plants established from loose joints. The population occupies an area of 20 m² on

the left bank of L'Alforja river, facing south, near to the place where the A7 motorway bridge crosses the river. In the same area other Cactaceae (*Austrocylindropuntia subulata*, *Opuntia engelmannii*, *O. ficus-indica*, *O. lindheimeri*, and *O. monacantha*) cohabit with native elements like *Hyparrhenia hirta*, *Pinus halepensis*, *Piptatherum miliaceum*, *Pistacia lentiscus*, *Ulex parviflorus*, etc.

Opuntia lindheimeri var. **linguiformis** (Griffiths) L. Benson, Cact. Succ. J. Amer. 46: 80. 1974 (Fig. 1b)

SPAIN. **Tarragona**: Cambrils, naturalised on the south facing bank and side of the L'Alforja dry river bed, 41°05'14"N, 1°02'43"E, (31TCF3550), 30 m, 20-VIII-2004, *M. Sanz-Elorza* (MA 720828).

Large suberect to sprawling shrubs, 1-3 m high, trunk, if present, very short. Joints elongate, oblong to ovate-oblong or lanceolate, 20-40 cm long or even more, often several times longer than wide, pale green and slightly glaucous, basally enlarged. Leaves 3-9 mm long, narrowly conical. Areoles filled with brown wool, elliptic, about 4.5 mm long, 3 mm wide, typically 2.5-4 cm apart. Glochids yellow or turning brown with age, 3-6 mm long. Spines scarce, 1-2 per areole, about 16 mm long, yellow or sometimes whitish-yellow, very slender and narrowly elliptic in section, terete or nearly so. Flowers yellow, 5-7.5(10.5) cm in diameter, 5-8 cm long. Sepaloids greenish-yellow or greenish-red, obovate, 6-35 mm long, 6-15(25) mm wide, mucronate to acuminate. Petaloids yellow or rarely red, cuneate-obovate, 30-40(45) mm long, 10-25(40) mm wide, mucronate, undulate. Filaments white or greenish at base, 6-15 mm long. Anthers 2 mm long. Style greenish-yellow, 12-20 mm long, 3-6 mm in diameter. Stigmas 6-9, green, slender to fairly thick. Ovary bearing numerous glochids in upper areoles, unarmed at anthesis. Fruit reddish-purple, fleshy at maturity, not persistent, obovate or elongate, areoles and glochids small, 3-7 cm long, 2.5-3.8 cm in diameter, umbilicus shallow. Seeds tan, 3-4 mm long, 2.5-3 mm wide, acute on the back, asymmetrically elliptic.

Flowering time in Spain for this species is unknown, as there is not enough phenological information, although during our visit (August) there were some flowers open. It is an extremely stenocorous taxon, only known as a dubious native plant near San Antonio (Texas, USA), where it may even have become extinct (Benson, 1982: 495; Anderson, 2001: 498), and Bexar County, also in Texas (Weniger, 1984; Pinkava, 2003: 136). In 1908 Griffiths introduced its cultivation and since then it is one of the "Chollas" most used in gardening because of its curious long

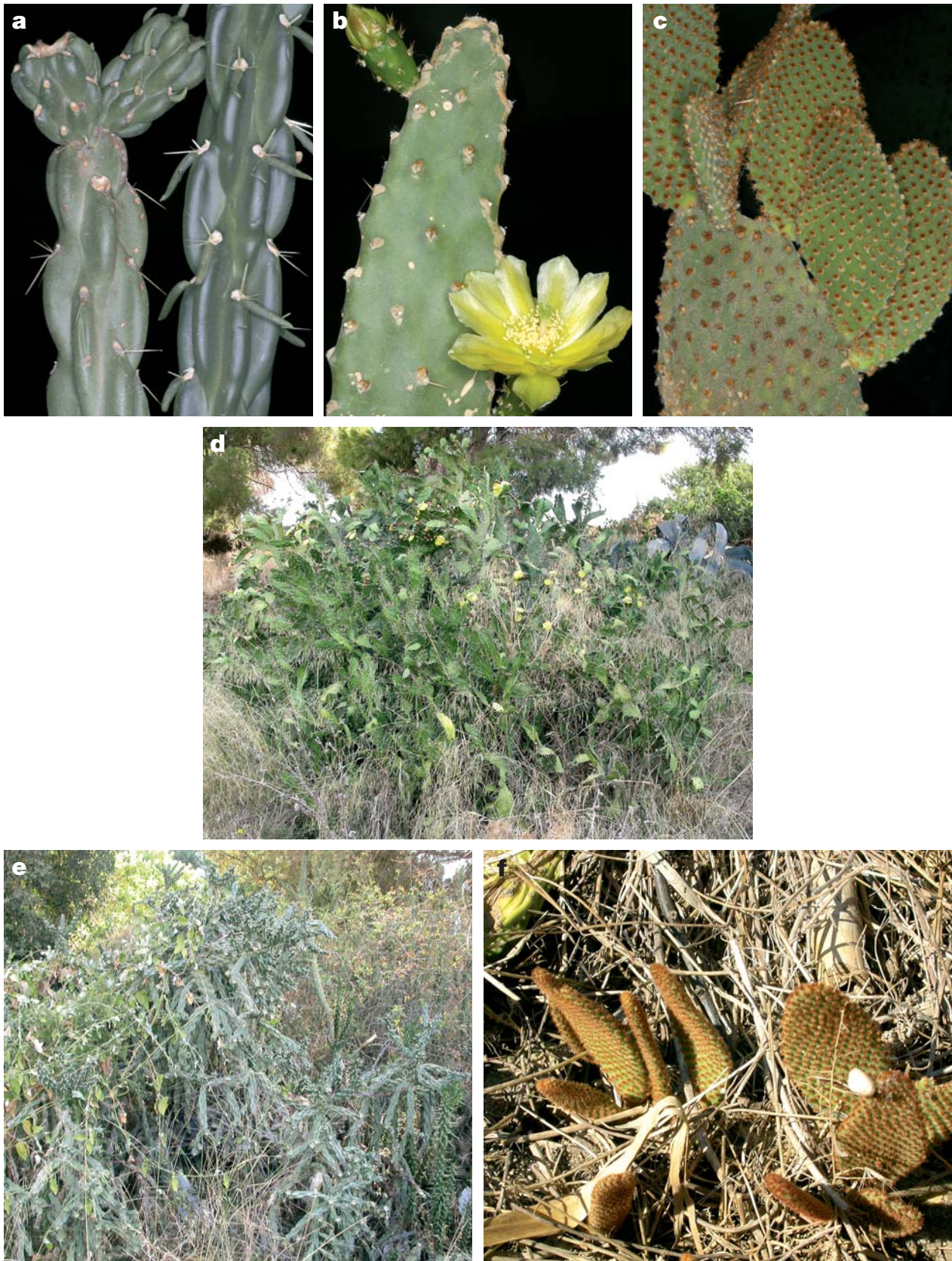


Fig. 1: Species of naturalised cacti in riera de l'Alforja, Baix Camp (Tarragona): **a**, *Cylindropuntia imbricata*; **b**, *Opuntia lindheimeri* var. *linguiformis*; **c**, *Opuntia microdasys* var. *microdasys*; **d**, *Opuntia monacantha*, adult specimen; **e**, *Cylindropuntia imbricata*, adult specimen; **f**, *Opuntia microdasys* var. *microdasys*, seedlings and young specimen.

blades (Benson, 1982). It is also relatively common as naturalised in different places in USA and Mexico (Pinkava, 2003). The systematic position of this taxon has been subject to some controversy: authors like Britton & Rose (1919: 164) and Backeberg (1977: 366) consider it an independent species, whilst others (e.g., Bravo-Hollis, 1978: 286-289; Benson, 1982: 495-496) treated it as a variety of *O. lindheimeri* Engelm. Anderson (2001: 497) and Pinkava (2003: 135-136) included *O. lindheimeri* under *O. engelmannii* Salm-Dyck ex Engelm., and then its correct name at the varietal rank would be *O. engelmannii* var. *linguiformis* (Griffiths) B.D. Parffit & Pinkava. Finally, Gibson & Nobel (1990: 231-232) consider it closely related to *Opuntia phaeacantha* Engelm. within a taxonomic complex that includes at least seven microspecies generated by hybridation and polyploidy. This is the first record of the taxon for Catalonia and the second for Europe, being known previously only from Godella and Olocau (Valencia province, E Spain, cf. Guillot, 2003: 10), although this author did not report voucher specimens or demographic status.

Demography: The population consists of two individual adults growing very close to each other and six young plants developed from loose joints. The population occupies a total area of 60 m² on the left bank of the L'Alforja river, facing south, near the place where the A7 motorway bridge crosses the river. They cohabit with other Cactaceae (*Austrocylindropuntia subulata*, *Opuntia engelmannii*, *O. ficus-indica*, *O. lindheimeri*, and *O. monacantha*) in a *Hyparrhenia hirta*, *Pinus halepensis*, *Piptatherum miliaceum*, *Pistacia lentiscus*, *Ulex parviflorus*, etc. formation.

Opuntia monacantha (Willd.) Haw., Suppl. Pl. Succ.: 81. 1819 (Fig. 1 d)

SPAIN. **Tarragona**: Cambrils, naturalised on the south facing bank and side of the L'Alforja dry river bed, 41°05'14"N, 1°02'43"E, (31TCF3550), 36 m, 20-VIII-2004, M. Sanz-Elorza (MA 720827).

The variegated form of this species has been recently reported from the Baix Camp (Sanz-Elorza & al., 2004). Now this species has been found again in its typical form in other site of the "riera de l'Alforja", four kilometers away of the previous population, which confirms the stable presence of the species in southern Catalonia. The presence of both expressions (typical and variegated) and the large size of the specimens suggest that they are the result of old and independent introductions.

Demography: The population consists of a young individual 2.5 m high branched almost from the base

and four young plants growing from loose joints. The population occupies an area of 40 m² on the left bank of the l'Alforja river, facing south, near the place where the A7 motorway bridge crosses the river. It grows with several species of Cactaceae (*Austrocylindropuntia subulata*, *Cylindropuntia imbricata*, *Opuntia engelmannii*, *O. ficus-indica*, and *O. lindheimeri*) and other alien species (*Agave americana*, and *Araujia sericifera*) in a *Hyparrhenia hirta*, *Pinus halepensis*, *Piptatherum miliaceum*, *Pistacia lentiscus*, *Ulex parviflorus*, etc. formation.

Opuntia microdasys (Lehm.) Pfeiff., Enum. Diagn. Cact.: 154. 1837 var. **microdasys** (Fig. 1 c, f)

SPAIN. **Tarragona**: Cambrils, naturalised on the south facing bank and side of the L'Alforja dry river bed, 41°05'05"N, 1°02'48"E, (31TCF3550), 30 m, 20-VIII-2004, M. Sanz-Elorza (MA 720826).

Shrubby, erect to sprawling, much branched, to 1 m, forming low clumps. Stem segments circular to elliptic-obovate, pubescent, low tuberculate, nor disarticulating, bright or pale green, flattened, 5-15 cm long. Areoles conspicuous, 9-16 per diagonal row across midstem segment, rounded, closely arranged, 2-5 mm diameter. Glochids numerous, usually yellow (var. *pallida*), brownish (var. *microdasys*), or whitish (var. *albispina*), nearly filling the areole. Spines usually lacking, rarely one. Flowers with inner tepals bright yellow throughout, sometimes with a reddish hue tint, 25-30(40) mm in diameter. Filaments and style white. Anthers yellowish. Stigmatic lobes dark green. Fruits globose or ovoid, to 25 mm long, dark red, with many areoles bearing dense glochids, spineless, pubescent. Seeds tan, nearly spherical, slightly flattened, 1-1.2 mm in diameter.

The native area of this taxon includes the deserts of northern Mexico (Chihuahua, Coahuila, Durango, Nuevo León, San Luis Potosí, and Zacatecas), south to the state of Hidalgo (Bravo-Hollis, 1978: 243; Anderson, 2001: 508), and it has been introduced in Arizona (Pinkava, 2003: 142). Several varieties have been described based on the shape and size of the joints and the colour of the glochids. It is a very decorative plant, easy to cultivate and popular in gardening. This is the first record of the plant in Catalonia. Previously, both var. *albispina* Fobé and var. *microdasys* had been reported from Valencia (Guillot & Van der Meer, 2001: 41; Guillot, 2003: 11) and Castellón (Guillot, 2003) provinces.

Demography: The population consists of an undetermined number of young individuals coming from gardening remains dumped and partially buried in the

river l'Alforja. It occupies an area of 10 m² on the left bank of l'Alforja river, facing south, near the junction of the A7 motorway. It grows close to several very large plants of *Austrocylindropuntia subulata* and *Opuntia ficus-indica*, as well as other alien species (*Agave americana*, *Araujia sericifera*, and *Senecio angulatus*).

Discussion

Just along one of the dry river beds of the Tarragona province (NE Spain) we have found four different species of Cactaceae, which, with the eight already known (Sanz-Elorza & al., 2004), represent the highest diversity of Cactaceae on a local scale recorded so far for all Catalonia, Iberian Peninsula, and even Europe.

Once again, the combination of xerogardening based on exotic species, intense human pressure on the territory with the resulting destruction or degradation of the pre-existing vegetation and the particularly benign climatic conditions have favored the introduction and establishment of several Cactaceae in an area where alien elements are particularly dominant in the flora.

As it has been already pointed out (Sanz-Elorza & al., 2004), the process of invasion of the southern coast of Catalonia by exotic vascular plants is an unstoppable process. This invasion processes should be explicitly included in the design of biodiversity conservation strategies in those regions which are especially sensitive and vulnerable (Dana & al., 2003: 1009).

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References

- Anderson, E.F. 2001. *The Cactus Family*. Timber Press. Portland, Oregon.
- Backeberg, C. 1977. *Cactus Lexicon*. Blandford Press. Poole, Dorset.
- Benson, L. 1982. *The Cacti of the United States and Canada*. Stanford University Press. USA.
- Berthet, P. 1990. *Opuntia* Miller. In: Castroviejo, S. & al. (eds.), *Flora iberica* 2: 62-70. Real Jardín Botánico, CSIC. Madrid.
- Bravo-Hollis, H. 1978. *Las Cactáceas de México* I. Universidad Nacional Autónoma de México. México.
- Britton, N.L. & Rose, J.N. 1919. *The Cactaceae* I. The Carnegie Institution of Washington. USA.
- Dana, E.D., Sobrino, E. & Sanz-Elorza, M. 2003. Plantas invasoras en España: un nuevo problema en las estrategias de conservación. In: Bañares, A., Blanca, G., Güemes, J., Moreno, J.C. & Ortiz, S. (eds.), *Atlas y Libro Rojo de la Flora Vasculosa Amenazada de España: 1009-1027*. Dirección General de Conservación de la Naturaleza. Madrid.
- Gibson, A.C. & Nobel, P.S. 1990. *The Cactus Primer*. Harvard University Press. Cambridge, Massachusetts.
- Guillot, D. 2003. Sobre la presencia de 17 táxones de la familia Cactaceae en la Comunidad Valenciana. *Flora Montiberica* 24: 6-13.
- Guillot, D. & Van der Meer, P. 2001. Siete táxones nuevos del género *Opuntia* Mill. en la provincia de Valencia: aspectos históricos, ecológicos y reproductivos. *Flora Montiberica* 19: 37-44.
- Henderson, L. 1995. *Plant Invaders of Southern Africa*. Plant Protection Research Institute. Pretoria.
- Iriondo, J.M. 2001. *Atlas de Flora Amenazada. Manual de metodología de trabajo corológico y demográfico*. TRAGSA. Madrid.
- Mateo, G. & Crespo, M.B. 1995. *Flora abreviada de la Comunidad Valenciana*. Editorial Gamma. Valencia.
- Pinkava, D.J. 2003. Cactaceae Jussieu subfam. Opuntioideae Burnett. In: Flora of North America Editorial Committee (eds.), *Flora of North America* 4: 102-150. Oxford University Press. New York.
- Randall, R.P. 2002. *A Global Compendium of Weeds*. R.G. & F.J. Richardson. Melbourne.
- Richardson, D.M., Pysek, P., Rejmánek, M., Barbour, M.G., Panetta, F.D. & West, C.J. 2000. Naturalization and invasion of alien plants: concepts and definitions. *Diversity and Distributions* 6: 93-107.
- Sanz-Elorza, M., Dana, E.D. & Sobrino, E. 2004. Sobre la presencia de cactáceas naturalizadas en la costa meridional de Cataluña. *Anales del Jardín Botánico de Madrid* 61(1): 27-33.
- Sobrino, E., Sanz-Elorza, M., Dana, E.D. & Zaragoza, C. 1999. *La Flora Alóctona Española: Banco de Datos. Actas Congreso SEMb*: 39-46. Logroño.
- Sobrino, E., Sanz-Elorza, M., Dana, E.D. & González, A. 2002. Invasibility of a coastal strip in NE Spain by alien plants. *Journal of Vegetation Science* 13: 585-594.
- Weniger, D. 1984. *Cacti of Texas and Neighbouring States: A field guide*. Austin, Texas.

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