

NEW RECORDS OF CACTACEAE FROM GRAN CANARIA (CANARY ISLANDS, SPAIN)

FILIP VERLOOVE

Botanic Garden of Meise,
Nieuwelaan 38,
B-1860 Meise, Belgium.
email: filip.verloove@botanicgardenmeise.be

ÁGUEDO MARRERO RODRÍGUEZ

Jardín Botánico Canario Viera y Clavijo,
Unidad Asociada al CSIC,
c/ El Palmeral nº 15,
Tafira Baja, E-35017.
Las Palmas de Gran Canaria,
Gran Canaria-Canary Islands, Spain
email: agmarrero@grancanaria.com

MARCOS SALAS-PASCUAL

Instituto de Estudios Ambientales y Recursos Naturales (i-UNAT),
Campus Universitario de Tafira,
Universidad de las Palmas de Gran Canaria, E-35017.
Las Palmas de Gran Canaria,
Gran Canaria, Canary Islands, Spain
email: marcossalaspascual@gmail.com

ALESSANDRO GUIGGI

DISTAV, Polo Botanico,
Università degli Studi di Genova,
International Cactaceae Research Center (ICRC),
Corso Dogali,
1M - 16136 Genova, Italy.
email: alex.guiggi@libero.it

Abstract: Recent field work in Gran Canaria (Canary Islands, Spain), mostly in March and April 2017, yielded first records of 10 species of Cactaceae, all originally introduced as ornamentals. *Cylindropuntia bigelovii*, *C. imbricata*, *C. prolifera*, *Disocactus speciosus*, *Opuntia lindheimeri* and *O. microdasys* are locally naturalized or likely to become so, whereas *Ferocactus berrerae*, *Harrisia tetraacantha*, *Lophocereus schottii* and *Trichocereus spachianus* are considered casuals. All these species are illustrated, georeferenced localities provided and other useful information, especially with regard to their identification and invasion status (in Gran Canaria as well as elsewhere in the world) are also presented. The presence of two further species, *Opuntia monacantha* and *O. robusta*, both often considered doubtful in the Canary Islands, is confirmed from Gran Canaria. New data are also provided for *Opuntia leucotricha* and *O. pilifera*, two species that were recently recorded for the first time for Gran Canaria, that seem to have increased.

Keywords: Cactaceae, Canary Islands, Gran Canaria, invasive species, naturalization.

INTRODUCTION

The Cactaceae family accommodates about 2,000 species (Hunt et al., 2006) that nearly exclusively grow in warm and arid regions of the New World. A large number of species in this family are of importance, either economically, ethnobotanically or horticulturally or are significant weeds (e.g. Novoa et al., 2015). A majority of the species is cultivated for ornament, either out-of-doors (in favorable climatic circumstances, e.g. in the Mediterranean region or in Macaronesia) or indoors elsewhere. However, if grown outdoors, many of these ornamentals easily escape or establish themselves from discarded garden

waste, even in the absence of pollinators (vegetative reproduction). They spread rapidly and many have invaded the warm-temperate and xeric regions of the world, including parts of southern Europe (e.g. Essl & Kobler, 2008). In the Canary Islands, three species are considered invasive (Acebes Ginovés et al., 2010) and two of them, *Opuntia dillenii* (Ker Gawl.) Haw. and *O. ficus-indica* (L.) Mill. even are among the most noxious invaders there. Both these species and the entire genus *Cylindropuntia* (Engelm.) F.M. Knuth are included in the National Catalogue of Invasive Exotic Species and their cultivation and propagation are strictly regulated (Royal Decree 630/2013, of August 2, regulating the Spanish Cat-

alogue of Invasive Alien Species, “BOE” (Boletín Oficial del Estado) no. 185, of 08/08/2013, available at <https://www.boe.es/buscar/pdf/2013/BOE-A-2013-8565-consolidado.pdf>).

Many genera of the Cactaceae are notoriously difficult in terms of identification, taxonomy and/or nomenclature. As a result, the exact identity of many species, also of those found outside their native range, often is uncertain. Yet, taxonomic resources are essential for the effective management of invasive plants and incorrect identifications can impede ecological studies (Pyšek et al., 2013).

Although the Canary Islands climatologically are among the most suitable places in the world for cacti, the family is very badly understood there. According to a recent checklist (Acebes-Ginovés et al., 2010) only nine species are known to be present in the Canary Islands: *Austrocylindropuntia cylindrica* (Lam.) Backeb., *A. exaltata* (Berg) Backeb., *Hylocereus undatus* (Haw.) Britton & Rose, *Opuntia dillenii*, *O. maxima* Mill., *O. robusta* H.L. Wendland, *O. tomentosa* Salm-Dyck, *O. tuna* (L.) Mill., and *O. vulgaris* Mill. Of these, *O. maxima* auct. and *O. vulgaris* auct. non Mill. are now referred to *O. ficus-indica* [although the binomial *O. vulgaris* has also been associated with *O. monacantha* (Willd.) Haw., also in the Canary Islands; see later]. Two others, *O. tuna* and *Austrocylindropuntia cylindrica*, probably refer to respectively misidentifications, or are only very locally naturalized species. Recent surveys in Tenerife and (to a lesser extent) Gran Canaria demonstrated that several members of the family are quite invasive but not known as such. Thirty taxa were observed that had not previously been recorded in the Canary Islands (Verloove, 2016; Verloove et al., 2017). Out of these, 20 taxa are at least locally naturalized or already show signs of an incipient invasion.

As a continuation of this research, the first author conducted field work in Gran Canaria between 29 March and 12 April 2017, assisted and subsequently continued by two of the other authors (Águedo Marrero Rodríguez and Marcos Salas Pascual). The identity of some of the critical taxa recorded on this occasion was assessed in close collaboration with the fourth author (Alessandro Guiggi). In this paper some preliminary results are presented. Assessing the identity of some additional taxa — some of them obvious or possible hybrids of complex parentage — will require further study.

MATERIALS AND METHODS

Since all species of cacti are difficult to preserve as dried specimens for deposition in a herbarium, all of the records here reported are only documented with photographs.

The presence or absence on the island of Gran Canaria was each time compared with data provided by Acebes Ginovés et al. (2010), as well as other, more recent literature sources. The paper is divided into three major parts in each of which the taxa are arranged in alphabetical sequence. Naturalized and/



Figure 1. *Cylindropuntia bigelovii*, La Aldea de San Nicolás (Tocodomán), Barranco de Tocodomán, March 2017, F. Verloove.

or potentially invasive taxa are dealt with in the first part; as a rule, these are treated in more detail than the taxa recorded as casuals in the second part. In the third part miscellaneous notes are provided for some additional taxa that are of interest. Each entry includes: [1.] the scientific name of the taxon (accompanied by one or more synonyms, if deemed desirable); [2.] list of localities; [3.] distribution of the taxon (native as well as introduced area); [4.] ecology and habitat; and [5.] additional useful comments, usually about its invasiveness (for definitions, see Richardson et al. 2000), identification and/or nomenclatural or taxonomic issues. All species that are reported for the first time from Gran Canaria are illustrated.

Nomenclature of the taxa presented is mostly in accordance with recent insights, often based on molecular phylogenetic studies. Authorities of plant names usually follow Tropicos (<http://www.tropicos.org>).

RESULTS

NEWLY RECORDED NATURALIZED OR NATURALIZING SPECIES

Cylindropuntia bigelovii (Engelm.) F.M. Knuth, Kaktus-ABC 125. 1935. (Figure 1).
 ≡ *Opuntia bigelovii* Engelm., Proc. Amer. Acad. Arts 3: 307. 1856.

NEW RECORDS

SPAIN, Gran Canaria: La Aldea de San Nicolás (Tocodomán), between 27°57'28.00" N, 15°46'46.15" W and 27°57'24.41" N, 15°46'48.83" W, 271–293 m.a.s.l., Barranco de Tocodomán, on the slopes of the Cactualdea Cactus Park, two clones,



Figure 2. *Cylindropuntia imbricata*, Santa Lucía, sobre La Sorrueda, July 2016, Á. Marrero Rodríguez (a: habit, b: flower details).

31.03.2017, F. Verloove; Firgas, Camino Los Dolores, between its junction with GC-300 and Casablanca reservoir, 28°07'41.38", 15°33'03.42" W, 242 m.a.s.l., stony slope, ca. 10–15 individuals, 10.04.2017, F. Verloove.

Distribution: native to the Mojave and Sonoran deserts of California, Arizona and Nevada, and Baja California and Sonora in Mexico. Planted outdoors as an ornamental in climatologically suitable areas, for instance in Spain (Sánchez de Lorenzo Cáceres, 2000). In 2016 *Cylindropuntia bigelovii* was recorded in Tenerife, Canary Islands, probably for the first time in the wild outside of its native distribution range (Verloove et al., 2017). Some populations of *C. pallida* in Spain, for instance in the surroundings of Lliria in Valencia, may also pertain to this species (Deltoro et al., 2014).

Ecology: in its native area *Cylindropuntia bigelovii* occurs on sandy flats, gravelly to rocky washes, bajadas, and hillsides from 300 to 900 m elevation (Pinkava, 2003a). In the Canary Islands it has been recorded on dry, sun-exposed stony slopes and roadsides.

Discussion: *Cylindropuntia bigelovii* was recorded in two widely separate localities in Gran Canaria. In Tocodomán few plants grow on a slope of a ravine adjacent to the Cactualdea Cactus Park from where it evidently escaped. Its segments easily detach and subsequently root in any suitable habitat. In Firgas it was more numerous and obviously established from discarded garden waste, along with several other cacti. A future naturalization is likely although, up to present, it only occurs in the immediate surroundings of localities where it has been introduced on purpose. *C. bigelovii* is not known as an invasive



species (Novoa et al., 2015), although it certainly has the potential to become so.

This species probably has been confused with *C. pallida* in Spain (Deltoro et al., 2014). Compared with the latter it has a distinct, erect main stem and its inner petals are pale green to whitish (vs. pink).

Cylindropuntia imbricata (Haw.) F.M. Knuth, Kaktus-ABC 125. 1935. (Figures 2 a, b).
 ≡ *Opuntia imbricata* (Haw.) DC., Prodr. 3: 471. 1828.
 ≡ *Cereus imbricatus* Haw., Suppl. Pl. Succ. 70. 1819.

NEW RECORD

SPAIN, Gran Canaria: Santa Lucía de Tirajana, sobre La Sorrueda, 27°53'32" N, 15°32'07" W, 540–550 m.a.s.l., rocky slopes in abandoned crops and human settlements, 23.07.2016 and 29.04.2017, Á. Marrero Rodríguez.



Figure 3. *Cylindropuntia prolifera*, (a: habit) La Aldea de San Nicolás (Tocodomán), Cañada de Bartolo, March 2017, F. Verloove and (b: flower details) Firgas, Camino Los Dolores, May 2017, M. Salas Pascual.

Distribution: native to northern Mexico (Rio Grande catchment, Chihuahuan desert) and the south-central U.S.A. (Pinkava, 2003a). Commonly cultivated as an ornamental in climatologically suitable regions (Hunt, 1989; Sánchez de Lorenzo Cáceres, 2000). Readily escaping and naturalizing subsequently, for instance in Australia (Chinnock, 2015), South Africa (Walters et al., 2011), Namibia (Klaassen & Kwembeya, 2013) and North Africa (Véla, 2013). In Europe it has been reported from France, Spain and Switzerland (e.g., Sanz-Elorza et al., 2006; Desfayes, 2008; Tison & de Foucault, 2014), while claims from Italy require confirmation. It was not previously reported from the Canary Islands (Verloove et al., 2017).

Ecology: in its native area *Cylindropuntia imbricata* grows in deserts, grasslands, pinyon-juniper woodlands, hills and plains, ranging in altitude between (800-) 1,100–1,800 (–2,200) m (Pinkava, 2003a). In Gran Canaria it was initially introduced on purpose between 1967 and 1977 in Günther Kunkel's finca in Santa Lucía de Tirajana (Marrero Rodríguez, in preparation). The area is now completely abandoned and this species, along with some other cacti and other succulents (e.g. *Austrocylindropuntia subulata*, *Opuntia ficus-indica*, *O. leucotricha*, *O. microdasys*, *O. monacantha* and *O. tomentosa*), can be considered naturalized. In this locality *C. imbricata* is reproducing both from seed and vegetatively.

Discussion: *Cylindropuntia imbricata* has become a noxious invader in many of the areas where it was



once introduced. According to Novoa et al. (2015) it is the sixth most invasive cactus species worldwide. However, in Gran Canaria, at present it is merely naturalized, without signs of invasive behavior.

Cylindropuntia prolifera (Engelm.) F.M. Knuth, Kaktus-ABC 126. 1935. (Figure 3 a, b).
 ≡ *Opuntia prolifera* Engelm., Amer. J. Sci. Arts, ser. 2 14(42): 338. 1852.

NEW RECORDS

SPAIN, Gran Canaria: La Aldea de San Nicolás (Tocodomán), between 27°57'28.00" N, 15°46'46.15" W and 27°57'24.41" N, 15°46'48.83" W, 271–293 m.a.s.l., Barranco de Tocodomán, on the slopes of a ravine, below the Cactualdea Cactus Park, several dozens, 31.03.2017, F. Verloove;

La Aldea de San Nicolás (Tocodomán), between 27°57'28.73" N, 15°46'45.94" W and 27°57'31.14" N, 15°46'43.24" W, 268–254 m.a.s.l., Barranco de Tocodomán, on the slopes of a ravine, close to the Cactualdea Cactus Park, scattered individuals, 31.03.2017, F. Verloove; La Aldea de San Nicolás (Tocodomán), between 27°57'32.99" N, 15°46'58.50" W and 27°57'28.48" N, 15°47'08.46" W, 310–378 m.a.s.l., Cañada de Bartolo, slope of ravine close to the Cactualdea Cactus Park, at least 100 individuals, 31.03.2017, F. Verloove; Firgas, Camino Los Dolores, between its junction with GC-300 and Casablanca reservoir, 28°07'41.38" N, 15°33'03.42" W, 242 m.a.s.l., stony slope, frequent, 10.04.2017, F. Verloove.

Distribution: native to the U.S.A. (California) and Mexico (Baja California) (Pinkava, 2003a). Outside its native area it is planted as an ornamental, although perhaps not widely so; for instance, it is not mentioned by Sánchez de Lorenzo Cáceres (2000), nor by Hunt (1989). In the wild it has been recorded in Australia (Chinnock, 2015) and since 2010 it has been found in several places in Tenerife, Canary Islands, as well (Verloove et al., 2017). In continental Europe it was recently reported for the first time from Spain (Laguna Lumbreras et al., 2015).

Ecology: in its native area *Cylindropuntia prolifera* is found in ocean bluffs, inland coastal sage flats, and hills, up to 300 m. In Gran Canaria (as well as in Tenerife) it grows in stony, sun-exposed habitats, often slopes of ravines.

Discussion: of the newly recorded species in this paper, *Cylindropuntia prolifera* is by far the species with the highest potential as an invasive species. Although not mentioned as an invasive species by Novoa et al. (2015), it is known as such, at least in southern Australia where it is quite widespread (Chinnock, 2015). In Tocodomán it is very well established already and a future spread to neighboring valuable habitats is predictable. Its stem segments very easily detach and are further dispersed by, for instance, goats and sheep. In Firgas it occurs in similar circumstances but in a less natural environment and thus with a lower risk of adverse impacts.

This species, a hybrid of two Mexican species, *C. alcahes* (F.A.C. Weber) F.M. Knuth and *C. cholla* (F.A.C. Weber) F.M. Knuth, is reminiscent of *C. spinosior* (Engelm.) F.M. Knuth, and the two species may have been confused. The latter is distinguished by its white spines and yellow to orange fruits, as opposed to the brownish spines and green fruits of *C. prolifera*.

Disocactus speciosus (Cav.) Barthlott, Bradleya 9: 87. 1991. (Figure 4)
 ≡ *Heliocereus speciosus* (Cav.) Britton & Rose, Contr. U.S. Natl. Herb. 12(10): 434. 1909.

NEW RECORD

SPAIN, Gran Canaria: Valleseco, Carpinteras, 28°03'42" N, 15°34'56" W, 865 m.a.s.l., subspontaneous in remains of anthropized laurel forest, climb-



Figure 4. *Disocactus speciosus*, Valleseco, Carpinteras, June 2017, Á. Marrero Rodríguez.

ing in trunks of *Laurus novocanariensis*) and non-native trees such as *Ulmus minor*, 02.07.1993 and 16.04.2017, Á. Marrero Rodríguez.

Distribution: this species has a very wide range and is abundant in Central America (Guatemala, Honduras, Mexico, Nicaragua and El Salvador). Although widely available in the horticultural trade, also in Spain (e.g. Sánchez de Lorenzo Cáceres, 2000), *Disocactus speciosus* has, to our knowledge, not yet been recorded in the wild outside of its native area.

Ecology: in its native range, *Disocactus speciosus* grows in moist montane forest, mostly in oak and pine woodland. It is found in a similar habitat (montane forest) in Gran Canaria. It has invaded endemic (but degraded) laurel forest dominated by *Laurus novocanariensis* Rivas-Mart. et al. and introduced trees like *Ulmus minor* Mill.

Discussion: *Disocactus speciosus* was discovered in its single locality in Gran Canaria almost 25 years ago. Although up to present only vegetative reproduction has been observed, the species is slowly but surely expanding and can be considered locally naturalized.

The exact placement within Hyllocereae of this species long remained controversial and it has been moved back and forth. For instance, Hunt et al. (2006) accepted it as a species of *Disocactus* Lindl., whereas Lodé (2015) placed it in *Hylocereus* (A. Berger) Britton & Rose. However, recent molecular



Figure 5. *Opuntia lindheimeri*, (a: flower details) Firgas, Camino Los Dolores, May 2017, M. Salas Pascual and (b: detail of bicolored spines), idem, March 2017, F. Verloove.

studies confirm that it is best accommodated in *Disocactus* (Cruz et al., 2016).

Opuntia lindheimeri Engelm., Boston J. Nat. Hist. 6(2): 207. 1850. (Figure 5 a, b)

≡ *O. engelmannii* Salm-Dyck ex Engelm. var. *lindheimeri* (Engelm.) B.D. Parfitt & Pinkava, Madroño 35(4): 346–347. 1988[1989].

NEW RECORD

SPAIN, Gran Canaria: Firgas, Camino Los Dolores, between its junction with GC-300 and Casablanca reservoir, 28°07'41.38" N, 15°33'03.42" W, 242 m.a.s.l., stony slope, frequent, 10.04.2017, F. Verloove.

Distribution: native to the southern U.S.A. (Arizona, Louisiana, New Mexico, Texas) and adjacent parts of Mexico (Pinkava, 2003b). This species and the closely similar (according to some authors conspecific) *Opuntia engelmannii* are widely cultivated as ornamentals in climatologically suitable areas, also in Spain (Sánchez de Lorenzo Cáceres, 2000). As escapes from cultivation, they were able to naturalize in many parts of the world, for instance in South Africa (Walters et al., 2011), Australia (Potter & Rutherford, 2013), Namibia (Klaassen & Kwembeya, 2013) and – in Europe – in Italy (Guiggi, 2014) and Spain (Sanz-Elorza et al., 2006; Essl & Kobler, 2008; Aymerich, 2015). It had not been reported before from the Canary Islands.

Ecology: in its native area *Opuntia lindheimeri* occurs in plains to woodlands and chaparral, on sandy to gravelly or rocky soils, from sea level up to 1900 m (Pinkava, 2003b). In Gran Canaria it was found in a similar habitat: on a stony, sun-exposed slope.

Discussion: in its single locality in Firgas several dozens of individuals of *Opuntia lindheimeri*



are found and the species looks firmly established. It grows along with other escaped cacti, including *O. dillenii*, a species that is superficially similar. Compared with the latter the Canarian plants differ in having stem segments that are bluish green with spines yellow with distinct red or red-brown extreme bases, aging blackish. Although *O. lindheimeri* and *O. engelmannii* are sometimes considered conspecific (e.g. Hunt et al., 2006; Lodé, 2015), they are here treated as distinct entities, following Britton & Rose (1919–1923). They are easily distinguished when grown side-by-side and do not overlap in their natural ranges. These species and *O. phaeacantha* Engelm., as well as other species from this complex, often hybridize or intergrade, considerably blurring species boundaries. Also in the invaded range, populations are sometimes difficult to assign (Walters et al., 2011).

Opuntia lindheimeri (usually as *O. engelmannii* s.l.) is often considered an invasive species (e.g. Essl & Kobler, 2008; Walters et al., 2011; Potter & Ruth-



Figure 6. *Opuntia microdasys*, (a: typical variety) Santa Lucía, sobre La Sorrueda, July 2016, Á. Marrero Rodríguez and (b: cultivar 'Rufida') La Aldea de San Nicolás (Tocodomán), Barranco de Tocodomán, March 2017, F. Verloove.

erford, 2013; Novoa et al., 2015).

Opuntia microdasys (Lehm.) Pfeiff., Enum.

Diagn. Cact. 154. 1837. (Figure 6 a, b).

≡ *Cactus microdasys* Lehm., Index sem. (Hamburg) 16. 1827.

NEW RECORDS

SPAIN, Gran Canaria: Santa Lucía de Tirajana, sobre La Sorrueda, 27°53'32"-33" N, 15°32'12"-13" W, 540–560 m.a.s.l., rocky slopes in abandoned crops and human settlements, 23.07.2016 and 29.04.2017, Á. Marrero Rodríguez; Santa Lucía de Tirajana, sobre La Sorrueda, 27°53'32" N, 15°32'06"-08" W, 540–550 m.a.s.l., rocky slopes in abandoned crops and human settlements, 23.07.2016 and 29.04.2017, Á. Marrero Rodríguez; La Aldea de San Nicolás (Tocodomán), between 27°57'28.73" N, 15°46'45.94" W and 27°57'31.14" N, 15°46'43.24" W, 268–254 m.a.s.l., Barranco de Tocodomán, on the slopes of a ravine, close to the Cactaldea Cactus Park, two clones, 31.03.2017, F. Verloove; San Bartolomé de Tirajana (El Salobre), Calle Archipiélago Canario (GC-604), 27°47'09.60" N, 15°37'54.62" W, 243 m.a.s.l., dry roadside, two individuals (planted in abundance on the other side of the road), 02.04.2017, F. Verloove.

Distribution: native in Mexico (Coahuila, Durango, Nuevo León, San Luis Potosí, Zacatecas) (Pinkava, 2003b) but widely planted as an ornamental elsewhere, also in Europe (Hunt, 1989; Sánchez de Lorenzo Cáceres, 2000). Readily escaping and naturalizing in many areas with a suitable climate, for instance in South Africa (Smith et al., 2011), the southern U.S.A. (Pinkava, l.c.) and Australia (Potter & Rutherford, 2013). In continental Europe *Opuntia microdasys* has been reported from France, Italy, Portugal and Spain (Guillot & Van der Meer, 2001;



Guillot, 2003; Sanz-Elorza et al., 2006; Essl & Koblner, 2008; Guiggi, 2014; Novoa et al., 2015), while in the Canary Islands it was known already from Fuerteventura (Verloove & Guiggi, 2013), La Palma (Salas-Pascual, 2010) and Tenerife (Verloove et al., 2017).

Ecology: in its native area in Mexico *Opuntia microdasys* is found in desert hills, uplands and sandy to loamy calcareous soils; it ranges between 1700–2100 m (Pinkava, 2003b). In its introduced range it grows in similar dry, sunny and gravelly habitats, often on the edges of ravines.

Discussion: *Opuntia microdasys* is a variable species. The nominal taxon has yellowish glochids, as seen in the population discovered in Santa Lucía de Tirajana. In the other localities mentioned above plants have reddish brown glochids, a characteristic feature of the cultivar 'Rufida'. This has been confused with *O. rufida* Engelm., a similar but distinct species. All these taxa, as well as *O. basilaris* Engelm. & J.M. Bigelow, seem to intergrade in cultivation (see also discussion in Verloove et al., 2017).

Opuntia microdasys is an increasing weed problem



Figure 7. *Ferocactus herrerae*, Arucas (San Andrés), 2010, M. Salas Pascual.

in almost all areas where it was once introduced as an ornamental, for instance in South Africa (Smith et al., 2011) and Australia (Essl & Kobler, 2008; Novoa et al., 2015).

In Gran Canaria this species reproduces both from seed and vegetatively.

NEWLY RECORDED CASUAL SPECIES

Ferocactus herrerae J.G. Ortega, México For-est. 5: 53 1927. (Figure 7). \equiv *Ferocactus wislizeni* (Engelm.) Britton & Rose subsp. *herrerae* (J.G. Ortega) Pilbeam & Bowdery, *Ferocactus* 103. 2005.

\equiv *Ferocactus wislizeni* (Engelm.) Britton & Rose var. *herrerae* (J.G. Ortega) N.P. Taylor, *Bradleya* 2: 34 1984.

NEW RECORD

SPAIN, Gran Canaria: Arucas (San Andrés), 28°08'37.7" N, 15°33'36.5" W, 49 m.a.s.l., stony slope, a single individual, 09.04.2017, M. Salas Pascual & F. Verloove 12815 (BR).

Distribution: native to Mexico (Sinaloa, Sonora and Durango) (Hunt et al., 2006) but widely cultivated as an ornamental, also in Spain (Hunt, 1989; Sánchez de Lorenzo Cáceres, 2000; often as *F. wislizeni*). To our knowledge it has not been recorded in the wild outside of its native range.

Ecology: *Ferocactus herrerae* is confined to coastal plains in its native area where it is found on sand and gravel. In Gran Canaria it grows on a gravelly, sun-exposed slope, close to the sea.

Discussion: in Gran Canaria *Ferocactus herrerae* is known from a single locality where one individual persists since 2010. It suffered from landslides lately and a future naturalization is unlikely. The plant grows in a relatively remote, not easily accessed locality, without gardens nearby. Its vector of introduc-



Figure 8. *Harrisia tetraacantha*, La Aldea de San Nicolás (Tocodomán), Barranco de Tocodomán, March 2017, F. Verloove.

tion is unclear.

Harrisia tetraacantha (Labour.) D.R. Hunt, *Bradleya* 5: 92. 1987. (Figure 8)

\equiv *Eriocereus tetraacanthus* (Labour.) Riccob., *Boll. Reale Orto Bot. Giardino Colon. Palermo* 8: 244. 1909.

\equiv *Cereus tetraacanthus* Labour., *Rev. Hort.* 4: 25. 1855.

NEW RECORD

SPAIN, Gran Canaria: La Aldea de San Nicolás (Tocodomán), between 27°57'28.00" N, 15°46'46.15" W and 27°57'24.41" N, 15°46'48.83" W, 271–293 m.a.s.l., Barranco de Tocodomán, on the slopes of a ravine, below the Cactualdea Cactus Park, a single clone, 31.03.2017, F. Verloove.

Distribution: a common endemic species of the East Andes in Bolivia (Chuquisaca, Cochabamba and Santa Cruz) (Franck, 2012; Franck, 2016). It is widely cultivated as an ornamental, also in Europe (Hunt, 1989; Sánchez de Lorenzo Cáceres, 2000). To our knowledge *Harrisia tetraacantha* has not been recorded in the wild outside of its native range. Several other species of this genus, however, are reputed invasive species: *H. balansae* (K. Schum.) N.P. Taylor & Zappi, *H. pomanensis* (F.A.C. Weber ex K. Schum.) Britton & Rose, *H. tortuosa* (J. Forbes ex Otto & A. Dietr.) Britton & Rose and *H. martinii* (Labour.) Britton, especially in South Africa, Namibia and Australia (Parsons & Cuthbertson, 2001; Walters et al., 2011; Klaassen & Kwembeya, 2013; Novoa et al., 2015).

Ecology: in its native area *Harrisia tetraacantha* grows in seasonally dry scrub forest of inter-Andean valleys, at altitudes ranging between 1,200 and 2,600 m (Franck, 2016). In Gran Canaria it was found on



Figure 9. *Lophocereus schottii*, (a: typical form), Agüimes (Arinaga), Barranco del Polvo, March 2017, F. Verloove and (b: atypical form), La Aldea de San Nicolás (Tocodomán), Cañada de Bartolo, March 2017, F. Verloove.

a rocky, sun-exposed slope of a ravine.

Discussion: this species was long known as *Eriocereus tetraacantha*. Molecular studies, however, confirm that it is part of the genus *Harrisia* (Franck, 2012; Franck et al., 2013).

Harrisia tetraacantha is easily separated from congeneric species that are currently known as noxious invaders in possessing stiffly erect stems (vs. stems curvaceous and arching, scrambling, clambering or prostrate). It also has much thicker stems than the other species of *Harrisia*.

Species of *Harrisia* produce large quantities of seed that is highly viable and easily spread by birds and other animals. In addition, the invasive species have long trailing branches that bend and take root wherever they touch the ground. Any broken-off portions root and grow. It is also well-adapted to disturbance (Franck, 2016).

Lophocereus schottii (Engelm.) Britton & Rose, Contr. U.S. Natl. Herb. 12(10): 427. 1909. (Figure 9 a, b).

≡ *Pachycereus schottii* (Engelm.) D.R. Hunt, Bradleya 5: 93. 1987.

≡ *Cereus schottii* Engelm., Proc. Amer. Acad. Arts 3: 288. 1856.

NEW RECORDS

SPAIN, Gran Canaria: Agüimes (Arinaga), 27°51'04.70" N, 15°24'31.49" W, 5 m.a.s.l., north side of Barranco del Polvo, close to the sea, between basalt blocks, a single clone, 16.11.2015 and 30.03.2017, F. Verloove; La Aldea de San Nicolás (Tocodomán), between 27°57'32.99" N,

15°46'58.50" W and 27°57'28.48" N, 15°47'08.46" W, 310–378 m.a.s.l., Cañada de Bartolo, slope of ravine close to the Cactualdea Cactus Park, three clones, 31.03.2017, F. Verloove.

Distribution: native to northwestern Mexico (Baja California, Baja California Sur, Sinaloa, Sonora), extending to Arizona in the U.S.A. (Gibson, 2003). Although widely cultivated as an ornamental (e.g. Hunt, 1989; Sánchez de Lorenzo Cáceres, 2000) this species probably has not been reported yet in the wild outside of its native range.

Ecology: in its native area, *Lophocereus schottii* grows around washes, on sandy or gravelly soils, ranging in altitude between 400 and 500 m. In Gran Canaria it was found on a sunny gravelly slope and between basalt blocks bordering a riverbed, in the latter locality probably from washed-up rhizomes or stem fragments.

Discussion: the individuals of *Lophocereus schottii* recently found in two localities in Gran Canaria express the morphological variety of this species. The plant known from Arinaga is very characteristic in having flowering portions of adult stems with numerous long, grayish bristles. The clones from Tocodomán, in contrast, belong to a spineless variant that much resembles *Pachycereus marginatus* (DC.) Britton & Rose, a morphologically, anatomically and genetically very closely related species (Gibson, 2003) that also is frequently cultivated and has been recorded as an escape, for instance in Spain (Guillot Ortiz et al., 2009). In the latter species, however, areoles are adjacent to confluent, while they are distinct in *L. schottii*.

Lophocereus (Berger) Britton & Rose is sometimes included in a broadly circumscribed genus *Pachycer-*

eus (Berger) Britton & Rose. However, the genus represents a lineage within the subtribe Pachycereinae but is not directly related to *Pachycereus* s.str. (Arias & Terrazas, 2009).

Trichocereus spachianus (Lem.) Riccob., Boll. Reale Orto Bot. Giardino Colon. Palermo 8: 237. 1909. (Figure 10).

≡ *Echinopsis spachiana* (Lem.) Friedrich & G.D. Rowley, Int. Organ. Succ. Pl. Study Bull. 3(3): 98. 1974.

≡ *Cereus spachianus* Lem., Hort. Universel 1: 225. 1839.

NEW RECORD

SPAIN, Gran Canaria: La Aldea de San Nicolás (Tocodomán), between 27°57'28.00" N, 15°46'46.15" W and 27°57'24.41" N, 15°46'48.83" W, 271–293 m.a.s.l., Barranco de Tocodomán, on the slopes of a ravine, below the Cactualdea Cactus Park, two clones, 31.03.2017, F. Verloove.

Distribution: a native species of Argentina (surroundings of Icaño, province of Santiago del Estero; Lambert, 2010), *Trichocereus spachianus* is commonly cultivated as an ornamental, also in Spain (e.g. Hunt, 1989; Sánchez de Lorenzo Cáceres, 2000). In recent years it is increasingly reported as an escape from cultivation in Europe, for instance in Italy (Guiggi, 2010; Guiggi, 2014) and Spain (Gómez et al., 2013; Aymereich, 2015). It has also been known from South Africa and Australia (Brodie & Reynolds, 2012; Cheek & Crouch, 2015).

Ecology: in its native area *Trichocereus spachianus* and related species grow on stony slopes, often at higher altitudes. In Gran Canaria it was found on a sunny slope of a ravine.

Discussion: of the species that are at present considered casuals in Gran Canaria, *Trichocereus spachianus* doubtlessly is the species with the highest probability of becoming invasive. It is a declared invader and transformer species in, among others, South Africa and Australia (Walters et al., 2011; Brodie & Reynolds, 2012; Cheek & Crouch, 2015; Novoa et al., 2015). In South Africa its spread could take on similar proportions to those of *Opuntia ficus-indica* in the early twentieth century. Its succulent fruits are eagerly consumed and distributed by both mammals and birds (Henderson, 2015).

There is some doubt about the application of the name *Trichocereus spachianus*. According to Hunt et al. (2006) it is an ambiguous and untypifiable name. As a consequence, South African populations formerly referred to that species are now called *Echinopsis schickendantzii* F.A.C. Weber (syn.: *Trichocereus schickendantzii* (F.A.C. Weber) Britton & Rose) (Walters et al., 2011). Molecular studies by Schlumberger & Renner (2012) suggest including *Trichocereus* (A. Berger) Riccob. in *Echinopsis* Zucc. However, *T. spachianus* was not included in their study and a more conservative taxonomy is retained here, pending further research.

Trichocereus spachianus is easily recognized by the clumps of densely golden spiny columnar stems.



Figure 10. *Trichocereus spachianus*, La Aldea de San Nicolás (Tocodomán), Barranco de Tocodomán, March 2017, F. Verloove.

MISCELLANEOUS NOTES

CONFIRMATION OF THE PRESENCE OF *OPUNTIA*

ROBUSTA IN GRAN CANARIA

This Mexican species was already claimed from the Canary Islands in the 1970s (Eriksson et al., 1979). However, many of the early claims certainly were referable to forms of the very variable *O. ficus-indica* (Verloove et al., 2017). Especially f. *amyklaea* (Ten.) Schelle of the latter (syn.: *O. megacantha* Salm-Dyck), characterized by large, often nearly orbicular, glaucous and very spiny cladodes, somehow resembles *O. robusta*, which may have added to the confusion. The presence of the latter was recently confirmed from Tenerife (Verloove et al., l.c.) and it was now shown to be naturalized in Gran Canaria as well:

SPAIN, Gran Canaria: Mogán (Las Casillas), 27°52'03.14" N, 15°44'14.01" W, 169 m.a.s.l., roadside slope of GC-200, monospecific stand of ca. 15–20 m² with some smaller satellite clones nearby, 31.03.2017, F. Verloove; Mogán (Veneguera), 27°54'21.00" N, 15°43'40.78" W, 313 m.a.s.l., at crossing of GC-200 and GC-206, steep roadside slope, escaped from plantation, two individuals, 31.03.2017, F. Verloove; La Aldea de San Nicolás (Tocodomán), between 27°57'28.00" N, 15°46'46.15" W and 27°57'24.41" N, 15°46'48.83" W, 271–293 m.a.s.l., Barranco de Tocodomán, on the slopes of a ravine, below the Cactualdea Cactus Park, highly invasive, 31.03.2017, F. Verloove; La Aldea de San Nicolás (Tocodomán), between 27°57'28.73" N, 15°46'45.94" W and 27°57'31.14"

N, 15°46'43.24" W, 268–254 m.a.s.l., Barranco de Tocodomán, on the slopes of a ravine, close to the Cactualdea Cactus Park, scattered individuals, 31.03.2017, F. Verloove; La Aldea de San Nicolás (Tocodomán), between 27°57'32.99" N, 15°46'58.50" W and 27°57'28.48" N, 15°47'08.46" W, 310–378 m.a.s.l., Cañada de Bartolo, slope of ravine close to the Cactualdea Cactus Park, frequent, 31.03.2017, F. Verloove; San Bartolomé de Tirajana, Barranco de Chamoriscán S of Palmitos Park, 27°49'48.43" N, 15°37'05.16" W, 362 m.a.s.l., dry gravelly riverbed, a single clone, 02.04.2017, F. Verloove; Firgas, Camino Los Dolores, between its junction with GC-300 and Casablanca reservoir, 28°07'41.20" N, 15°33'02.75" W, 245 m.a.s.l., roadside, a single clone, 10.04.2017, F. Verloove.

At least in Tocodomán *Opuntia robusta* can be considered an invasive species and similar behavior is predictable in most of the other places where it has been recorded. It is known as such in many areas where it has escaped from cultivation, for instance in South Africa and Australia (Novoa et al., 2015).

NEW RECORDS OF TWO RECENTLY REPORTED SPECIES OF *OPUNTIA*

Opuntia leucotricha DC. and *O. pilifera* F.A.C. Weber are recent newcomers in the Gran Canaria flora, known respectively since 2012 and 2015 (Verloove, 2013; Verloove et al., 2017). Especially the former is a reputed invasive species, for instance in South Africa (Walters et al., 2011), and both were recently recorded in several new localities in Gran Canaria. A future, wider naturalization is likely.

Opuntia leucotricha

SPAIN, Gran Canaria: Las Palmas de Gran Canaria, Tafira Baja, 28°04'01" N, 15°27'11" W, 380 m.a.s.l., in mixed *Olea europaea*-*Pistacia lentiscus* shrubland, in recovery phase, 02.11.2015, Águedo Marrero Rodríguez; Santa Lucía de Tirajana, sobre La Sorrueda, 27°53'32" N, 15°32'07" W, 540–550 m.a.s.l., rocky slopes in abandoned crops and human settlements, 23.07.2016 and 29.04.2017, Á. Marrero Rodríguez; Mogán (Las Casillas), 27°52'02.61" N, 15°44'15.48" W, 165 m.a.s.l., steep slope of ravine, a single clone, 31.03.2017, F. Verloove; Mogán (Veneguera), 27°54'21.00" N, 15°43'40.78" W, 313 m.a.s.l., at crossing of GC-200 and GC-206, steep roadside slope, escaped from plantation, two individuals, 31.03.2017, F. Verloove; La Aldea de San Nicolás (Tocodomán), 27°57'31.14" N, 15°46'43.24" W, 254 m.a.s.l., Barranco de Tocodomán, on the slopes of a ravine, close to the Cactualdea Cactus Park, a single clone, 31.03.2017, F. Verloove; La Aldea de San Nicolás (Tocodomán), between 27°57'32.99" N, 15°46'58.50" W and 27°57'28.48" N, 15°47'08.46" W, 310–378 m.a.s.l., Cañada de Bartolo, slope of ravine close to the Cactualdea Cactus Park, 31.03.2017, F. Verloove; Las Palmas de Gran Canaria (Tafira Alta-Monte Luz), 28°03'31.67" N, 15°27'32.73" W, 359 m.a.s.l., roadside slope of GC-110, three clones (mass-planted nearby),

06.04.2017, F. Verloove; Las Palmas de Gran Canaria (El Secadero), 28°05'11.88" N, 15°26'07.79" W, 177 m.a.s.l., foot of rocks next to GC-5 motorway, small population, 09.04.2017, M. Salas Pascual & F. Verloove; Las Palmas de Gran Canaria, cruce de La Calzada, GC-310, 28°03'33" N, 15°27'56" W, 300 m.a.s.l., basaltic rocks with anthropic vegetation, in scrubland with *Euphorbia regis-jubae* Webb & Berthel., *Bosea yervamora* L. and *Rubia fruticosa* Aiton, 23.04.2017, Águedo Marrero Rodríguez; Arucas, slopes next to highway of Cardones, borders of old cultures, small stand in anthropized zone, with several detached clones, 28°07'22" N, 15°30'54" W, 245 m.a.s.l., 06.05.2017, 16.06.2017, Águedo Marrero Rodríguez.

This species was also confirmed in barranco de las Madres in Firgas where it was discovered in 2012 (Verloove, 2013) and it has also been known to one of us since some years from a roadside near Finca de Osorio in Teror (Salas-Pascual, 2012). Both sexual and clonal reproduction has been observed.

Opuntia pilifera

SPAIN, Gran Canaria: San Bartolomé de Tirajana (Juan Grande), calle Juan Grande, 27°48'52.94" N, 15°28'16.79" W, 48 m.a.s.l., dry disturbed slope of small ravine close to houses, five individuals, 30.03.2017, F. Verloove; San Bartolomé de Tirajana (Juan Grande), next to Ermita de Nuestra Señora de Guadalupe, 27°48'27.22" N, 15°28'12.13" W, 32 m.a.s.l., two clones, 30.03.2017, F. Verloove; San Bartolomé de Tirajana, Barranco de Chamoriscán S of Palmitos Park, 27°49'48.43" N, 15°37'05.16" W, 362 m.a.s.l., dry gravelly riverbed, a single clone, 02.04.2017, F. Verloove; Firgas, Camino Los Dolores, between its junction with GC-300 and Casablanca reservoir, 28°07'41.38" N, 15°33'03.42" W, 242 m.a.s.l., stony slope, a single clone, 10.04.2017, F. Verloove.

This species was also confirmed in San Agustín and Bahía Feliz (San Bartolomé de Tirajana) where it was discovered in 2015 (Verloove et al., 2017).

"*OPUNTIA VULGARIS*" IN GRAN CANARIA

In the latest version of the checklist of vascular plants in the Canary Islands (Acebes Ginovés et al., 2010) this species is reported from La Gomera, Gran Canaria, Fuerteventura and Lanzarote. It is, however, an ambiguous name that has been associated with several other species, including *O. ficus-indica* (Verloove et al., 2017). Its correct name is *O. monacantha* (Willd.) Haw. and its presence in Gran Canaria was confirmed during our field work. It was seen on several occasions but usually in relatively small numbers and often in the immediate vicinity of houses. It is much less aggressive than the other species of *Opuntia* that were already introduced a long time ago.

SPAIN, Gran Canaria: San Bartolomé de Tirajana (Maspalomas), Avenida Touroperador Tui, Palmal, 27°45'41.64" N, 15°35'08.38" W, 31 m.a.s.l.,

slope in front of bus station, a single clone (amidst dense stands of *O. dillenii*), 02.04.2017, F. Verloove; San Bartolomé de Tirajana (Cercados de Espino, El Horno), Barranco de Arguineguín, 27°50'44.36" N, 15°39'37.27" W, 151 m.a.s.l., on the verge of dry river bed, a single clone, 03.04.2017, F. Verloove; Las Palmas de Gran Canaria (Santa Brígida, El Tejar), 28° 2'50.77" N, 15°29'37.93" W, by track, 09.04.2017, M. Salas Pascual & F. Verloove; Las Palmas de Gran Canaria (Tafira Alta), Camino Los Lirios (GC-801), 28°02'51.73" N, 15°27'41.71" W, 330 m.a.s.l., roadside, scattered individuals, 11.04.2017, F. Verloove; Valleseco, GC-305 39, Barranco de la Virgen, 28°03'47.11" N, 15°35'15.19" W, 695 m.a.s.l., dry riverbed, in several subpopulations, 12.04.2017, Á. Marrero Rodríguez & F. Verloove; Valleseco (Carpinteras), GC-305 42, 28°03'35.54" N, 15°35'02.64" W, 945 m.a.s.l., dry slope, in several subpopulations, 12.04.2017, Á. Marrero Rodríguez & F. Verloove; Firgas, GC-30, La Roca, 28°06'06" N, 15°33'33" W, 550 m.a.s.l., basaltic rocks near settlements and traditional crops, 20.05.2017, Águedo Marrero Rodríguez; Firgas, Lomo de la Cruz, 28°05'49" N, 15°33'22" W, 550 m.a.s.l., alongside track, 03.06.2017, Águedo Marrero Rodríguez.

DISCUSSION AND CONCLUSION

The Canary Islands experience a climate that is typified by extremely dry summer months with warm temperatures and mild winters with more rainfall, particularly in the northern parts of the islands. In this respect there is a broad-scale climatic matching between these islands and major distribution areas of a large number of cactus species. Sure enough, many have been introduced in the Canary Islands, for various purposes (e.g. as ornamentals or forage, for their edible fruit). Although some of the early introductions (*Opuntia dillenii*, *O. ficus-indica*) readily escaped from cultivation and became troublesome invasive species, an increasing number of others are available in the horticultural trade. Also, for the sake of tourism, several local parks present important collections of cactus species, including many that are reputed invaders. Recent field work by the authors has demonstrated that especially in the surroundings of such localities many species escape and naturalize locally. In a worst case scenario these events constitute a first step towards another incipient invasion process. Taking into account that for the most part species are concerned that have been reported as invasive in other parts of the world and that the Canary Islands are bioclimatically equivalent to main native distribution centers for cacti, the results of our field work appear to be very alarming. Therefore it is advisable to set up eradication programs, especially in vulnerable areas that are located near to areas where huge amounts of cactus species have been introduced.

ACKNOWLEDGEMENTS

Field work by the first author in March and April 2017 was granted by COST Action TD 1209.

REFERENCES

- Acebes Ginovés JR, León Arencibia MC, Rodríguez Navarro ML et al. (2010) Pteridophyta, Spermatophyta. *II* Arechavaleta M, Rodríguez S, Zurita N and García A (eds.), *Lista de especies silvestres de Canarias (hongos, plantas y animales terrestres)*. (2nd ed.). Pp. 119–172. Gobierno de Canarias, La Laguna.
- Arias S & Terrazas T (2009) Taxonomic revision of *Pachycereus* (Cactaceae). *Systematic Botany* 34: 68–83.
- Aymerich P (2015) Contribución al conocimiento de las cactáceas en Cataluña. *Bouteloua* 22: 76–98.
- Britton NL & Rose JN (1919–23) *The Cactaceae*, vols. 1–4. Carnegie Inst. Publ. 248.
- Brodie CJ & Reynolds TM (2012) *Review of recent plant naturalisations in South Australia and initial screening for weed risk*. DENR Technical Report 2012/02, South Australian Department of Environment and Natural Resources, Adelaide.
- Cheek MD & Crouch NR (2015) Assessment of the invasive status of newly recorded cactus species in the central Tugela River basin. *Bothalia* 45(1): 1–8.
- Chinnock RJ (2015) Feral opuntoid cacti in Australia: Part I. Cylindrical-stemmed genera: *Austrocylindropuntia*, *Cylindropuntia* and *Corynopuntia*. *Journal of the Adelaide Botanic Gardens Supplement* 3: 1–69.
- Cruz MÁ, Arias S & Terrazas T (2016) Molecular phylogeny and taxonomy of the genus *Disocactus* (Cactaceae), based on the DNA sequences of six chloroplast markers. *Willdenowia* 46: 145–164.
- Deltoro Torró V, Gómez-Serrano MA, Laguna Lumbres E & Novoa Pérez A (2014) *Bases para el control del cactus invasor Cylindropuntia pallida*. Colección Manuales Técnicos de Biodiversidad, 5. Conselleria d'Infraestructures, Territori i Medi Ambient. Generalitat Valenciana. Valencia.
- Desfayes M (2008) Les opuntias du Valais, un problème épineux: espèces et nomenclature. *Bulletin de la Murithienne* 125: 29–39.
- Eriksson O, Hansen A & Sunding P (1979). *Flora of Macaronesia: checklist of vascular plants* (2nd ed.). Botanical Garden and Museum, University of Oslo, Oslo.
- Essl F & Kobler J (2008) Spiny invaders – Patterns and determinants of cacti invasion in Europe. *Flora - Morphology Distribution Functional Ecology of Plants* 204(7): 485–494.
- Franck AR (2012) Synopsis of *Harrisia* including a newly described species, several typifications, new synonyms, and a key to species. *Haseltonia* 18: 95–104.
- Franck AR (2016) Monograph of *Harrisia* (Cactaceae). *Phytoneuron* 2016–85: 1–159. Part 1, 1–52; Part 2, 53–68; Part 3, 69–101; Part 4, 102–134; Part 5, 135–159.
- Franck AR, Cochrane BJ, Garey JR (2013) Phylogeny, biogeography, and infrageneric classification of *Harrisia* (Cactaceae). *Systematic Botany* 38(1): 210–223.

- Gibson AC (2003) *Pachycereus*. In: Flora of North America Editorial Committee (ed.), *Flora of North America north of Mexico*, vol. 4. Oxford University Press, Oxford.
- Gómez JA, Laguna E, Roselló R & Guillot D (2013) *Echinopsis spachiana* (Lemaire) H. Friedrich & G.D. Rowley, primera cita como alóctona en la Península Ibérica. *Bouteloua* 15: 93–97.
- Guiggi A (2010) Aggiunte e correzioni al Catalogo delle Cactaceae naturalizzate in Italia. *Rivista piemontese di Storia naturale* 31: 35–54.
- Guiggi A (2014) Repertorium Cactorum Italicum. *Repertorium Cactorum Italicum* 4: 4–20.
- Guillot D (2003) Sobre la presencia de 17 táxones de la familia Cactaceae en la Comunidad Valenciana. *Flora Montiberica* 24: 6–13.
- Guillot Ortiz D, Laguna Lumbreras E & Roselló Picornell JA (2009) Flora alóctona valenciana: Familia Cactaceae. *Monografías de la revista Bouteloua* 5: 148 pp.
- 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 (2015) Karoo invasion: Is history being repeated? *SAPIA News* 35: 1–5.
- Hunt DR (1989) *Opuntia*. In: Walters SM et al. (eds.), *The European Garden Flora*, vol. 3. Pp. 297–300. Cambridge University Press, Cambridge.
- Hunt DR, Taylor N & Charles G (eds.) (2006) *The New Cactus Lexicon*. dh books, Milborne Port, England.
- Klaassen ES & Kwembeya EG (eds.) (2013) *A Checklist of Namibian Indigenous and Naturalised Plants*. Occasional Contributions No. 5, National Botanical Research Institute, Windhoek, Namibia.
- Laguna Lumbreras E, Deltoro Torró V & Ferrer-Gallego PP (2015) Primera cita europea y mediterránea de la especie invasora *Cylindropuntia prolifera* (Engelm.) F. M. Knuth (Cactaceae). *Bouteloua* 21: 105–110.
- Lambert JG (2010) *Cacti of Argentina* (2nd ed., revised and supplemented). Concordia, Roeselare (Belgium).
- Lodé J (2015) *Taxonomy of the Cactaceae: A new classification of cacti based on molecular research and fully explained*. Cactus-Adventures.
- Novoa A, Le Roux JJ, Robertson MP, Wilson JR & Richardson DM (2015). Introduced and invasive cactus species: a global review. *AoB PLANTS* 7: <https://doi.org/10.1093/aobpla/plu078>.
- Parsons WT & Cuthbertson EG (2001) *Noxious Weeds of Australia* (2nd ed.). CSIRO publishing, Collingwood.
- Pinkava DJ (2003a) *Cylindropuntia*. In: Flora of North America Editorial Committee (Ed.), *Flora of North America north of Mexico*, vol. 4. Oxford University Press, Oxford.
- Pinkava DJ (2003b) *Opuntia*. In: Flora of North America Editorial Committee (Ed.), *Flora of North America north of Mexico*, vol. 4. Oxford University Press, Oxford.
- Potter S & Rutherford H (2013) *Field Identification Guide – Austrocylindropuntia, Cylindropuntia and Opuntia species*. Biosecurity South Australia: 64 pp.
- Pyšek P, Hulme PE, Meyerson LA, Smith GF, Boatwright JS, Crouch NR, Figueiredo E, Foxcroft LC, Jarošík V, Richardson DM, Suda J & Wilson JR (2013) Hitting the right target: taxonomic challenges for, and of, plant invasions. *AoB PLANTS* 5: <http://dx.doi.org/10.1093/aobpla/plt042>.
- Richardson DM, Pyšek P, Rejmánek M, Barbour MG, Panetta FD & West CJ (2000) Naturalization and invasion of alien plants: concepts and definitions. *Diversity & Distributions* 6: 93–107.
- Salas-Pascual M (2010) *Donde menos se espera, salta la invasora*. *Opuntia cf. microdasys en La Palma*. [accessed at: <http://invasionesbiologicas.blogspot.be/search/label/Opuntia%20microdasys>; 28 April 2017].
- Salas-Pascual M (2012) *Tuneras «raras» en Gran Canaria, o por qué no es bueno determinar «de oído»*. [accessed at: <https://invasionesbiologicas.blogspot.be/search/label/Opuntia%20streptacantha>; 02 May 2017].
- Sánchez de Lorenzo Cáceres JM (2000) Cactaceae. In: Sánchez de Lorenzo Cáceres JM (ed.), *Flora Ornamental Española*, vol. II Cactaceae-Cucurbitaceae. Mundi-Prensa, Madrid.
- Sanz-Elorza M, Dana Sánchez ED, Sobrino Vesperinas E (2006) Further naturalised Cactaceae in northeastern Iberian Peninsula. *Anales del Jardín Botánico de Madrid* 63(1):7–11.
- Schlumpberger BO & Renner SS (2012) Molecular phylogenetics of *Echinopsis* (Cactaceae): Polyphyly at all levels and convergent evolution of pollination modes and growth forms. *American Journal of Botany* 99(8): 1335–1349.
- Smith GF, Figueiredo E, Boatwright JS & Crouch NR (2011) South Africa's ongoing *Opuntia* Mill. (Cactaceae) problem: the case of *O. microdasys* (Lehm.) Pfeiff. *Bradleya* 29: 73–78.
- Tison J-M & de Foucault B (coord.) (2014) *Flora Gallica. Flore de France*. Editions Biotope, Mèze.
- Véla E (2013) Notes sur les cactus du genre *Opuntia* s.l. en Algérie et Tunisie. Addenda — Notes Xénophytes. In: Dobignard A & Chatelain C (eds.), *Index synonymique de la flore d'Afrique du Nord*: 376–379.
- Verloove F (2013) New xenophytes from Gran Canaria (Canary Islands, Spain), with emphasis on naturalized and (potentially) invasive species. *Collectanea Botanica* 32: 59–82.
- Verloove F (2016) A naturalised population of *Epostoa melanostele* (Cactaceae: Cactoideae) on Tenerife (Canary Islands). *Cactus Explorer* 17: 19–22.
- Verloove F & Guiggi A (2013). Some new xenophytes from Fuerteventura (Canary Islands, Spain). *Bouteloua* 13: 38–42.
- Verloove F, Ojeda-Land E, Smith GF, Guiggi A, Reyes-Betancort JA, Samarín C, González Hernández A & Barone R (2017) New records of naturalised and invasive cacti (Cactaceae) from Gran Canaria and Tenerife, Canary Islands, Spain. *Bradleya* 35: 58–79.
- Walters M, Figueiredo E, Crouch NR, Winter PJD, Smith GF, Zimmermann HG & Mashope BK (2011) *Naturalised and invasive succulents of southern Africa*. ABC Taxa 11.