New cactus records from Gran Canaria with a key to the opuntioid species now established in the Canary Islands (Spain)

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Abstract: Further field work in Gran Canaria (Canary Islands, Spain) yielded new records of escaped cacti. *Opuntia elatior*, *O. engelmannii*, *O. phaeacantha*, *O. stricta*, *Oreocereus pseudofossulatus*, *Pilosocereus polygonus*, *Trichocereus cuzcoensis* and *T. pachanoi* are reported for the first time from Gran Canaria. A spontaneous hybrid between two invasive species (*O. ficus-indica* and *O. robusta*) was recorded in two localities. Several of these taxa appear to be firmly established while others are considered casuals, at least at present. *Austrocylindropuntia cylindrica* – a species formerly considered doubtful in the Canary Islands – is confirmed from Gran Canaria. New records are presented for three recently detected, naturalized or invasive species: *Cylindropuntia bigelovii*, *C. prolifera* and *Opuntia lindheimeri*. All newly detected taxa are illustrated and a key for the identification of the opuntioid species reliably recorded so far in the Canary Islands is presented.

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

INTRODUCTION

Cacti form a distinct taxonomic group that mostly share similar physiological traits and habitat preferences that can result in dispersal with negative impacts (Novoa et al. 2015, Novoa et al. 2016, Kaplan et al. 2017). In tropical and subtropical climates they are among the most widespread and dominant groups of invasive plants. This also applies to the Canary Islands where they have a long history of introduction for agriculture and ornamental horticulture. For quite a long time only a few alien species were involved. In the recent past, however, much progress has been made with respect to the knowledge of cacti that have established themselves as alien in the Canary Islands. While the most recent checklist of the flora of the Canary Islands (Acebes Ginovés et al. 2010) only cites nine species (*Austrocylindropuntia cylindrica* (Lam.) Backeb., *A. exaltata* (Berg) Backeb., *Hylocereus undatus* (Haw.) Britton & Rose, *Opuntia dillenii* (Ker-Gawl.) Haw., *O. maxima* Mill., *O. robusta* H.L.Wendland, *O. tomentosa* Salm-Dyck, *O. tuna* (L.) Mill. and *O. vulgaris* Mill., several of these claims being doubtful or even erroneous), rather numerous additional species have been reported recently, especially from Gran Canaria and Tenerife (Verloove & Guiggi 2013, Verloove 2016, Verloove et al. 2017a, Verloove et al. 2017b). As a matter of fact, the Canary Islands (and more precisely the lowland areas) offer ideal circumstances for the naturalization of cacti. The use of predominantly exotic species in gardening and intense human pressure resulting in the destruction or degradation of pre-existing vegetation, combined with particularly benign climatic conditions, have favored the introduction and settlement of a high number of allochthonous species in general and of cacti in particular.

In this paper we present records of eight species and a putative hybrid that were observed for the first time from Gran Canaria (most of them are reported for the first time from the Canary Islands as a whole). Assessing the naturalization status for each individual species is not straightforward and will only become evident in the longer term. Most species, however, constitute nuclei that we consider viable in the medium term and from which some expansion by vegetative multiplication can be expected. Nevertheless, almost all of these populations are located in very anthropogenic (rural or suburban) environments and in many cases only a few meters from the houses and gardens from which they escaped. It is not exceptional that several species are found together in a single locality, often obviously establishing themselves from discarded garden debris.

In addition to the newly detected species, miscellaneous notes on other species are presented here. The presence of one of the species that were considered doubtful in the Canary Islands (*Austrocylindropuntia cylindrica*) is confirmed from Gran Canaria, whereas new records are provided for several recently discovered species. At least two of them (*Cylindropuntia bigelovii* and *C. prolifera*, both with very easily detached stem segments) expand with some ease beyond their anthropic habitats, although at present they can only qualify as invasive in a few localities.

The identification of opuntioid species in the Canary Islands is problematic but they are considered to be the most relevant in terms of invasion ecology. Therefore, a tentative key for the identification of these cacti in the Canary Islands is proposed. It includes 24 species for which the presence in the study area has been confirmed.

MATERIAL AND METHODS

The records presented in this paper are mostly the result of fieldwork by the first three authors between December 2017 and May 2018. The fourth author assisted with the identification of some of the critical taxa. Since all species of cacti are difficult to preserve as dried specimens for deposition in a herbarium, all 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 several parts in each of which the taxa are arranged in alphabetical sequence. The newly detected taxa are dealt with in the first part and these are treated in more detail than the taxa recorded in the other parts. Each entry includes: [1] the scientific name of the taxon (accompanied by one or more synonyms, if useful); [2] list of localities (including geographical coordinates which enable local governments to eradicate plants or populations, if deemed desirable); [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 DETECTED TAXA

Opuntia elatior Mill., Gard. Dict. (ed. 8) no.3. 1768. (Fig. 1)

= *Opuntia bergeriana* F.A.C. Weber, Gard. Chron., ser. 3 35: 34. 1904. [red-flowered form]

=? *Opuntia schumannii* F.A.C. Weber, Gard. Chron., ser. 3 35: 34. 1904. [red-flowered form]

Figure 1. *Opuntia elatior*. La Aldea de San Nicolás (Tocodomán), rocky slope, April 2018, F. Verloove.

GRAN CANARIA: La Aldea de San Nicolás (Tocodomán), 27° 57' 33.26" N,

15° 47' 0.02" W, 320 m.a.s.l., Cañada de Bartolo, rocky slope close to the Cactualdea Cactus Park, scattered individuals, 25 April 2018, F. Verloove.

A native of Central and South America (Colombia, Costa Rica, Panama, Venezuela) and the Netherlands Antilles, this species is commonly grown as an ornamental shrub. It easily runs wild and was already quite common on the Italian Riviera at the beginning of the 20th century (Britton & Rose 1919–1923). In the Mediterranean it is also known from Morocco (Véla 2013). It is a declared invasive species in, for instance, Australia (Novoa et al. 2015) and Kenya (Githae 2018).

The usual plant in cultivation has slightly glaucous stem segments and was formerly segregated as *O. bergeriana*. This and several of the other representatives of series *Elatiores* Britton & Rose (Britton & Rose 1919–1923) are all similar and here subsumed under *O. elatior*, the earliest available name for the species. This possibly also applies to *O. schumannii* F.A.C. Weber, another member of the series (characterized by stouter, subulate spines and more shiny cladodes; Britton & Rose 1919–1923) that has been reported as an escape from Spain (Guillot Ortiz & van der Meer 2006, Guillot Ortiz et al. 2008). *O. elatior* in a strict sense has rather greenish pads with dark brown to blackish spines and red streaked or red-tipped muddy yellow flowers; it thus differs considerably from *O. bergeriana*, which is a clear red-flowered species. Lodé (2015) accepted both entities as distinct species and plants recently found in the wild in Ibiza (Balearic Islands) were assigned to *O. bergeriana* (Serapio et al. 2016). The plants found in the Canary Islands have glaucous-green pads with yellowish spines and red flowers and thus clearly correspond with what was formerly segregated as *O. bergeriana*. The deep red flowers differentiate it from most other species of *Opuntia* currently found in the study area.

Opuntia elatior is here reported for the first time from Gran Canaria where a small population was found on a rocky, sun-exposed slope in La Aldea de San Nicolás. It grows along with other escaped

Figure 2. *Opuntia engelmannii*. La Aldea de San Nicolás (Tocodomán), on the slopes of a ravine, April 2018, F. Verloove.

Figure 3. *Opuntia ficus-indica* × *O. robusta*. Agüimes (Los Corralillos), ruderal roadside of GC-104 road, April 2017, F. Verloove.

opuntias such as *O. leucotricha*, *O. microdasys* and *O. robusta*. In the Canary Islands it was previously reported from a single locality in Tenerife (Verloove et al. 2017b).

The concept of *O. elatior* is not uncontested and the earlier name *O. tuna* (L.) Mill. may apply to it. The latter was lectotypified by Crook & Mottram (2004). [For notes on its typification, see also Mottram 2013]. It is a poorly understood species and its name is often misapplied to other species. In the sense in which it was lectotypified it is indeed hard to distinguish from *O. elatior*. However, we refrain from using this binomial here, especially because this name has also been erroneously applied in the area under study for a quite different species. Re-introducing this obscure name for yet another species of *Opuntia* would only add to the confusion.

Opuntia engelmannii Salm-Dyck ex Engelm., Boston J. Nat. Hist. 6(2): 207–208. 1850. (Fig. 2)
var. ***engelmanii***

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, scattered individuals, 09 December 2017 and 25 April 2018, F. Verloove.

Opuntia engelmannii is native to the southern United States (Arizona, California, Nevada, New Mexico, Texas and Utah) and Mexico. It is commonly grown as an ornamental in climatologically suitable areas, for instance in the Mediterranean. Korotkova & Raab-Straube (2017) report it, for example, from Abkhazia, Armenia, Bulgaria and Crimea. It easily escapes, naturalizes or even becomes invasive, for instance in Australia, Namibia, South Africa and Spain (Novoa et al. 2015), Kenya (Githae 2018) or Italy (Guiggi 2008, Guiggi 2014).

Opuntia engelmannii is part of a species complex in which hybridization frequently occurs and species boundaries are often obscure (Walters et al. 2011). The group includes, among others, *O. lindheimeri*. Compared with the latter, *O. engelmannii* has spines that are chalky white rather than yellow, often with dark red-brown extreme bases (Pinkava 2003). *O. lindheimeri* was recently reported for the first time from the Canary Islands (Gran Canaria; Verloove et al. 2017a, this paper), whereas *O. engelmannii* had not been recorded before.

The separation of these two species is sometimes problematic and some plants my represent hybrids, also with related species like *O. phaeacantha* Engelm. Moreover, several authors have questioned the taxonomic value of *O. lindheimeri*. According to Crook & Mottram (1999) Engelmann described it solely based on a fruit and soon abandoned the name when he found out it was the same plant as *O. engelmannii*. Britton & Rose (1919) and Benson (1982), however, continued to use the name typified with a plant from New Braunfels. However, Benson's published illustrations are in fact *O. engelmannii* (comm. R. Mottram). Hunt et al. (2006) also equate *O. lindheimeri* with *O. engelmannii*. When both taxa are considered synonymous, *O. engelmannii* has priority (Crook & Mottram 1999). Other contemporary taxonomists accept both taxa, though *O. lindheimeri* often at a lower taxonomic rank (e.g. Pinkava 2003).

Opuntia ficus-indica (L.) Mill. × ***O. robusta*** H.L.Wendl. ex Pfeiff. (Fig. 3)
= *O. robusta* 'L'Horta Nova' (Guillot Ortiz et al. 2014)

GRAN CANARIA: Agüimes (Los Corralillos), 27° 53' 56.81" N, 15° 28' 14.91" W, 283 m.a.s.l., ruderal roadside of GC-104 road, close to its junction with GC-551, scattered individuals in the vicinity of the putative parents, 5 April 2017 and 21 April 2018, 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, scattered individuals in the vicinity of the putative parents, 25 April 2018, F. Verloove.

In two localities in Gran Canaria where *Opuntia ficus-indica* and *O. robusta* grow in close proximity putative hybrid plants have been recorded that are intermediate in morphology. They are reminiscent

Figure 4. *Opuntia phaeacantha*. San Bartolomé de Tirajana (San Agustín), fallow land, April 2018, F. Verloove.

of the latter but stem segments are longer than wide, less glaucous and flatter. Also, compared with the plants of *O. robusta* usually seen in Gran Canaria (var. *longiglochidiata* Backeb.?), spines on areoles are much less numerous (often single and deflexed parallel to the surface) and much shorter.

Identical plants have been recorded in the wild in several localities in the province of Valencia in Spain (Guillot Ortiz et al. 2014) where they have been assigned to a new cultivar of *O. robusta* 'L'Horta Nova'. These authors also suppose a hybrid origin of these plants, *O. ficus-indica* × *O. robusta*. Although no fully flowering plants were seen so far, flower color probably corresponds well with that observed in Spain: the outer petals are purple-red before opening, then turn to light orange when they open, shading to intense orange.

Opuntia phaeacantha Engelm., Mem. Amer. Acad. Arts, n.s. 4(1): 51–52. 1849. (Fig. 4)

GRAN CANARIA: San Bartolomé de Tirajana (San Agustín), 27° 46' 13.25" N, 15° 33' 4.44" W, 56 m.a.s.l., fallow land adjacent to Calle Colegio Arenas, a single clone, 30 March and 21 December 2017, 19 April 2018, F. Verloove; Las Palmas de Gran Canaria, Lomo de la Cruz, 28° 05' 27.2" N, 15° 26' 52.5" W, 200 m m.a.s.l., slopes of GC-23 motorway, at the roundabout Lomo de la Cruz, 24 May 2018, Á. Marrero Rodríguez.

Opuntia phaeacantha naturally grows in deserts, plains, chaparral and surrounding mountains, on sandy to rocky soils (Pinkava 2003). It is wide-ranging in the southern United States (primarily Arizona and Texas, but also California, Colorado, Kansas, Nevada, New Mexico, Oklahoma and Utah) wandering into Coahuila in Mexico.

This species is very variable and constitutes one of the most problematic cacti in terms of classification and taxonomy (Bravo-Hollis 1978). The species name refers to the dark bases of the spines. It is quite an interesting species, having almost consistently throughout its distribution the rather unusual chromosome number of 2n=66. It is most probably an allopolyploid of two other species with 2n=22 plus 2n=44, which then behaves like a normal true-breeding species. It is quite cold-hardy and grows robustly in open spaces (comm. R. Mottram, June 2018). Compared with similar opuntias that are known to occur in Gran Canaria (*O. engelmannii* and *O. lindheimeri*), *O. phaeacantha* usually has more roundish cladodes, spines with very dark bases and smaller fruits.

Figure 5. *Opuntia stricta*. La Aldea de San Nicolás (Tocodomán), on the slopes of a ravine, April 2018, F. Verloove.

These plants are sometimes erroneously labelled as *Opuntia rastrera* F.A.C. Weber in European cultivation. However, genuine *O. rastrera* differs in habit of growth, forming long chains of cladodes marching along the ground. It is a native of central Mexico. The similar *O. arizonica* Griffiths was recently reported from Spain (Gómez-Serrano et al. 2015). It probably is nothing else than a spinier and smaller form of *O. engelmannii* although it also has been synonymized with *O. phaeacantha* (var. *major* Engelm.; Bravo-Hollis 1978).

Opuntia phaeacantha is an invasive weed, for instance in the Karadag Nature Reserve in Crimea (Fateryga & Bagrikova 2017). Novoa et al. (2015) further cite it from Austria, Spain and Italy (see also Gavilán & Molina Maruenda 1992, Guiggi 2007, Guiggi 2008, Sánchez Gullón et al. 2014, Aymerich 2015, etc.). Although a rare alien in Europe, *O. phaeacantha* is able to withstand successfully the rather strong Central European winter and produces abundant viable seeds (Essl 2007, Desfayes 2008, Essl & Kobler 2008). Korotkova & Raab-Straube (2017) report it, among others, from Abkhazia, Armenia, Austria, Caucasus, Crimea, Czech Republic, France, Georgia, Germany and Ukraine.

Opuntia stricta (Haw.) Haw., Syn. Pl. Succ. 191. 1812. (Fig. 5)

Figure 6. *Oreocereus pseudofossulatus*. San Bartolomé de Tirajana (Caserio Monte León), rocky slope, December 2017, F. Verloove.

GRAN CANARIA: La Aldea de San Nicolás (Tocodomán), 27° 57' 29.51" N, 15° 46' 45.55" W, 263 m.a.s.l., Barranco de Tocodomán, on the slopes of a ravine close to the Cactualdea Cactus Park, a single clone, 25 April 2018, F. Verloove.

A native of the southern United States (Florida to southern Texas) and Cuba, *Opuntia stricta* is often cultivated and considered the second most invasive cactus worldwide. It is reported as such from at least 20 countries (Novoa et al. 2015). Although very widespread and invasive, *O. stricta* had not been recorded so far from the Canary Islands.

This species is sometimes considered conspecific with *O. dillenii*, one of the highly invasive cactus species in the Canary Islands. Its joints, however, are spineless or only have 1 or 2 short and terete (not flattened) spines at some of the areoles.

Oreocereus pseudofossulatus D.R. Hunt, Bradleya 9: 89. 1991. (Fig. 6)

≡ *Cleistocactus fossulatus* Mottram, Chileans 12(42): 138. 1983.

≡ *Oreocereus fossulatus* (Labour.) Backeb., Kaktus-ABC 186. 1936.

GRAN CANARIA: San Bartolomé de Tirajana (Caserio Monte León), 27° 48' 49.78" N, 15° 37' 0.86" W, 382 m.a.s.l., rocky slope, 22 December 2017 and 19 April 2018, F. Verloove.

A naturalized population of this species from Bolivia was recently reported from Tenerife in the Canary Islands (Verloove et al. 2017b). It is here reported for the first time from Gran Canaria. A small population with a few individuals grows on the verge of a rocky slope in Caserio Monte León, along

Figure 7. *Pilosocereus polygonus* (habitus). Las Palmas de Gran Canaria, Almatriche, rough ground with various kind of debris, April 2018, F. Verloove, Á. Marrero Rodríguez & M. Salas Pascual.

Figure 8. *Pilosocereus polygonus* (flower details). Las Palmas de Gran Canaria, Almatriche, rough ground with various kind of debris, April 2018, F. Verloove, Á. Marrero Rodríguez & M. Salas Pascual.

with several different other cacti and succulents (e.g. *Agave angustifolia*, *Cylindropuntia bigelovii*, *C. prolifera*, *Opuntia microdasys*, *O. pilifera*, *O. robusta*, etc.). All these species were able to establish themselves from discarded garden waste and several are obviously well-established.

Pilosocereus polygonus (Lam.) Byles & G.D. Rowley, Cact. Succ. J. Gr. Brit. 19(3): 67. 1957. (Figs. 7, 8).

GRAN CANARIA: Las Palmas de Gran Canaria, Almatriche, Lomo de la Herradura, 28° 5' 24.07" N, 15° 27' 53.57" W, 252 m.a.s.l., rough ground with

Figure 9. *Trichocereus cuzcoensis*. Las Palmas de Gran Canaria, Tafira Baja, on top of slope of barranco de Guiniguada, April 2018, F. Verloove, Á. Marrero Rodríguez & M. Salas Pascual.

various kind of debris, three small colonies, 18 and 24 April 2018, F. Verloove, Á. Marrero Rodríguez & M. Salas Pascual.

The taxonomic history of this and related species is chaotic and confused. *Pilosocereus polygonus* is the oldest typifiable name for this complex (Zappi 1994). In a broad sense it includes a series of names of species described for each different island from the Florida Keys to the Bahamas, Cuba and Hispaniola. Anderson (2001) treated all of those named variants and others as merely insular forms of *P. polygonus* and this taxonomy is adopted in most recent checklists (for instance Hunt et al. 2006, Lodé 2015) and here as well. Other authors, however, still accept several of the segregates as distinct species, the most notable being *P. robinii* (Lem.) Byles & G.D. Rowley from Florida Keys (Lima & Adams 1996, Parfitt & Gibson 2003).

The plants found in a single locality in Gran Canaria are up to 3 m tall, have dark green (not glaucous) stems with 5–13 ribs, long and slender acicular spines and flowering areoles with long, white woolly hairs. To our knowledge, this species has not been reported so far in the wild outside of its native area. The congeneric *Pilosocereus pachycladus* F. Ritter is known from one locality in Tenerife (Verloove et al. 2017b).

Trichocereus cuzcoensis Britton & Rose, Cact. 2: 136. 1920. (Fig. 9)

≡ *Echinopsis cuzcoensis* (Britton & Rose) Friedrich & G.D. Rowley, Int. Organ. Succ. Pl. Study Bull. 3(3): 95. 1974.

GRAN CANARIA: Las Palmas de Gran Canaria, Tafira Baja, Campus Universitario de Tafira ULPGC, 28° 4' 14.44" N, 15° 27' 27.65" W and 28° 4' 14.77" N, 15° 27' 27.94" W, 310–315 m.a.s.l., on top of slope of barranco de Guiniguada, two small populations, 24 April 2018, F. Verloove, Á. Marrero Rodríguez & M. Salas Pascual.

This species from Peru is similar to *Trichocereus peruvianus* Britton & Rose, a species that was previously reported from a single locality in Tenerife (Verloove et al. 2017b). Compared with the latter it has a columnar growth form and has distinctly swollen spine bases (Britton & Rose 1919–1923), whereas *T. peruvianus* leans and is often prostrate. In Gran Canaria *Trichocereus cuzcoensis* was found in two nearby localities in Tafira Baja where it obviously established itself from discarded garden waste. To our knowledge, this species has not been recorded before as an escape outside of its area of origin.

Figure 10. *Trichocereus pachanoi* (habitus). San Bartolomé de Tirajana, Monte León, rocky slope, April 2018, F. Verloove.

Trichocereus pachanoi Britton & Rose, Cact. 2: 134–135, f. 196. 1920. (Figs. 10, 11)

≡ *Echinopsis pachanoi* (Britton & Rose) Friedrich & G.D. Rowley, Int. Organ. Succ. Pl. Study Bull. 3(3): 96. 1974.

=? *Trichocereus macrogonus* (Salm-Dyck) Riccob., Boll. Reale Orto Bot. Giardino Colon. Palermo 8: 236. 1909.

≡ *Echinopsis macrogona* (Salm-Dyck) Friedrich & G.D. Rowley, Int. Organ. Succ. Pl. Study Bull. 3(3): 96. 1974.

GRAN CANARIA: San Bartolomé de Tirajana, Monte León, Calle Chopin, 27° 49' 8.23" N, 15° 36' 55.49" W, 492 m.a.s.l., rocky slope, 19 April 2018, F. Verloove.

A species from the High Andes in Peru (in Bolivia and Ecuador probably mostly cultivated, not genuinely wild), *Trichocereus pachanoi* is widely grown as an ornamental (Hunt 1989), also in Spain (as *Echinopsis macrogona*; Sánchez de Lorenzo Cáceres 2000). It is characterized by its pericarpel and tube with conspicuous black hairs.

This species is often synonymized with *Trichocereus macrogonus*, an older name but of uncertain

Figure 11. *Trichocereus pachanoi* (flower details). San Bartolomé de Tirajana, Monte León, rocky slope, April 2018, F. Verloove.

application. It was described based on cultivated, non-flowering plants in Berlin of unknown origin. Contemporary descriptions were long thought to deviate from the original and the name may have been widely misapplied (Hunt 1989). However, Albesiano & Kiesling (2012) thoroughly studied the identity of and neotypified *T. macrogonus*. Mostly based on the different number and size of spines, they accepted *T. pachanoi* as a variety of *T. macrogonus*, var. *pachanoi* (Britton & Rose) S. Albesiano & R. Kiesling. Spines of the older areoles are often absent or few: 3–7, all similar and ca. 1–2 cm long (vs. spines of the older areoles 18–20, 3–4 of them prominent, longer, stronger and more robust, ca. 5 cm long). The single clone encountered in Gran Canaria clearly corresponds with *T. pachanoi* and is here maintained as a distinct species.

To our knowledge, this species has not been recorded so far as an escape outside of its area of origin.

CONFIRMATION FROM GRAN CANARIA

Austrocylindropuntia cylindrica (Lam.) Backeb., Cactaceae Handb. Kakteen. Pereskioideae Opuntioideae 2: 12. 1941. (Fig. 12)

≡ *Cylindropuntia cylindrica* (Lam.) F.M. Knuth, Kaktus-ABC 120. 1935.

≡ *Opuntia cylindrica* (Lam.) DC., Prodr. 3: 471. 1828.

GRAN CANARIA: Santa Brígida (La Atalaya, Los Veroles), 28° 1' 55.69"N, 15° 29' 5.03" W, 547 m.a.s.l., roadside, 5 December 2017 and 17 April 2018, F. Verloove; Las Palmas de Gran Canaria, GC-802 road, W slope of Pico de Bandama, 28° 2' 27.17" N, 15 °27' 32.46" W, 414 m.a.s.l., on top of stone wall, 17 April 2018, F. Verloove; La Aldea de San Nicolás (Tocodomán), 27° 57' 33.26" N, 15° 47' 0.02" W, 320 m.a.s.l., Cañada de Bartolo, rocky slope, a single individual, 25 April 2018, F. Verloove.

Austrocylindropuntia cylindrica, a native of parts of western South America (Ecuador and Peru) is claimed by Acebes Ginovés et al. (2010) from Fuerteventura, Gran Canaria, La Palma and Lanzarote in the Canary Islands. However, these claims require confirmation since this species and *A. subulata* have widely been confused in this area, the latter being the usual garden plant and escape (Verloove et al. 2017b). Genuine *A. cylindrica*, however, was recently confirmed from Gran Canaria where it was seen in three different localities. This species occurs in small populations and is much less aggressive than *A. subulata*.

Figure 12. *Austrocylindropuntia cylindrica*. Las Palmas de Gran Canaria, GC-802 road, W slope of Pico de Bandama, on top of stone wall, April 2018, F. Verloove.

NEW RECORDS OF SOME RECENTLY DETECTED SPECIES

In past years rather numerous new localities were discovered in Gran Canaria for cacti that had been only recently reported for the first time, for instance *O. leucotricha*, *O. microdasys*, *O. pilifera* and *O. robusta*. These species can now be considered fully naturalized. Three further interesting species – two of which have easily detaching stem segments and thus a high incidence of invasive behavior – were found in additional localities:

Cylindropuntia bigelovii (Engelm.) F.M. Knuth, Kaktus-ABC 125. 1935.

GRAN CANARIA: San Bartolomé de Tirajana (Caserio Monte León), 27° 48' 49.78" N, 15° 37' 0.86" W, 382 m.a.s.l., rocky slope, dozens of individuals, obviously well-established, 22 December 2017 and 19 April 2018, F. Verloove.

Cylindropuntia prolifera (Engelm.) F.M. Knuth, Kaktus-ABC 126. 1935.

GRAN CANARIA: San Bartolomé de Tirajana

(Caserio Monte León), 27° 48' 49.78" N, 15° 37' 0.86" W, 382 m.a.s.l., rocky slope, scattered individuals, 22 December 2017 and 19 April 2018, F. Verloove; Las Palmas de Gran Canaria, Tamaraceite, 28° 6' 3.28"N, 15° 29' 3.92" W, 199 m.a.s.l, edge of Barranco de Jacomar, escaping from ornamental plantation, few individuals, 20 April 2018, F. Verloove.

This is by far the most invasive species of the cacti recently naturalized in the wild in the Canary Islands. A large population on a rocky slope in Cañada de Bartolo in La Aldea de San Nicolás (Tocodomán) in Gran Canaria, detected in 2017, was eradicated by the local government in 2018, based on our previous findings (Verloove et al. 2017a).

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

GRAN CANARIA: La Aldea de San Nicolás (Tocodomán), 27° 57' 30.57" N, 15° 46' 45.30" W, 261 m.a.s.l., Barranco de Tocodomán, on the slopes of a ravine close to the Cactualdea Cactus Park, a well-established population, 25 April 2018, F. Verloove.

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Key To the opuntioid cacti of the Canary Islands

Only forms and races of each species that are present in the study area are included here. These represent only part of the variation of each species. The key is based on field observations in the study area, as well as on literature sources (viz Britton & Rose 1919–1923, Bravo-Hollis 1978, Backeberg 1982, Pinkava 2003, Chinnock 2015). For each species the known distribution in the Canary Islands is shown in brackets (abbreviations: H=El Hierro; P=La Palma; G=La Gomera; T=Tenerife; C=Gran Canaria; F=Fuerteventura; L=Lanzarote). Several hybrids have been observed in the past (for instance between *Opuntia ficus-indica* and *O. tomentosa* or *O. ficus-indica* and *O. robusta*; Verloove et al. 2017b, this paper). These are more or less intermediate between the parent species and not included in this key. The same applies to infraspecific taxa of limited taxonomic value.

1 Stem segments all terete, cylindric to globose, never flattened or compressed, often easily detached 2
Stem segments flat or compressed, pad-like, not at all or not easily detached (*Opuntia* s.str.) 10
2 Branches and stem segments few, short and clustered. Spines (when present) flat and papery (*Tephrocactus*) ..... ***Tephrocactus articulatus*** (T)
Branches many-jointed, numerous. Spines never flat and papery 3
3 Spines without papery sheaths (*Austrocylindropuntia*) 4
Spines with papery sheaths (*Cylindropuntia*) 5
4 Leaves long-persisting, up to 12 cm long. Spines to 8 cm long, yellowish ..... ***A. subulata*** (C, F, G, L, P, T)
Leaves early deciduous, up to 1.5 cm long. Spines to 1.5 cm long, usually paler ..... ***A. cylindrica*** (C, ?F, ?L, ?P)
5 Fruits smooth to shallowly tuberculate, usually forming chains. Stem segments always very easily detached, with low and broad tubercles. Flowers rose to magenta 6
Fruits strongly tuberculate, solitary, not proliferating. Stem segments either hard to detach or easily detached, with high and narrow tubercles. Flowers yellow-green or rose to magenta 7
6 Stem segments appearing spineless or nearly so from afar, exposing strongly mamillate tubercles. Fruits numerous, forming long, branching, pendent chains ..... ***C. fulgida*** (f. ***mamillata***) (T)
Stem segments with 6–12 spines per areole, the longest to 2 cm, tubercles prominent, broadly oval, but not strongly mamillate. Fruits proliferating into short erect chains of 2–5 fruits ..... ***C. prolifera*** (C, F, L, T)

7 Stem segments firmly attached with spines not or little obscuring stem. Flowers rose to magenta. Large shrub to small tree, up to 4 m tall ..... ***C. imbricata*** (C)
Stem segments easily detached with spines obscuring stem. Flowers pale green to yellow (sometimes edged reddish purple or aging bronze to reddish brown) or rose-magenta. Small much-branched shrubs, rarely exceeding 1 m 8
8 Spine sheaths very tightly attached, obscure. Arborescent with distinct main stem. Flowers greenish-white ..... ***C. bigelovii*** (C, T)
Spine sheaths very loosely attached, distinct. Shrublike with uniform branches, without obvious main stem. Flowers rose-magenta or greenish-yellow 9
9 Flowers rose-magenta. Spines whitish ..... ***C. pallida*** (T)
Flowers greenish-yellow. Spines pinkish in new growth ..... ***C. tunicata*** (T)
10 Prostrate plants up to 50 cm tall. Spines always absent. Areoles small (1–2 mm across), not elevated and usually close together 11
Shrubs or trees, often much exceeding 50 cm. Spines absent or present. Areoles usually larger and more distant 12
11 Flowers pink to magenta. Fruit dry at maturity ..... ***Opuntia basilaris*** (T)
Flowers yellow. Fruit fleshy at maturity ..... ***O. microdasys*** (C, F, P, T)
12 Epidermis of stem segments and fruits puberulent 13
Epidermis of stem segments and fruits glabrous 14
13 Spines usually absent. Plant tree-like. Flowers orange. Fruit red ..... ***O. tomentosa*** (C, F, G, H, L, P, T)
Spines present. Plant usually smaller. Flowers yellow. Fruit usually white to pale yellow, rarely red to purple ..... ***O. leucotricha*** (C, P, T)
14 Spines (if present) entirely whitish or greyish 15
Spines yellow, brown or even darker, at least at base 18
15 Areoles with long soft hairs. Flowers pink or purple ..... ***O. pilifera*** (C, T)
Areoles without long white hairs. Flowers yellow or orange 16
16 Stem segments nearly orbicular, often 30 cm or more wide at maturity, very glaucous ..... ***O. robusta*** (C, T)
Stem segments obovate, often narrower, green to slightly glaucous 17
17 Stem segments thick, dull and pruinose, greenish to slightly glaucous. Spines absent or 1–2(-6) per areole. Flowers yellow or rarely orange ..... ***O. ficus-indica*** (C, G, F, H, L, P, T)
Stem segments thin, shiny and green, not pruinose. Spine usually solitary. Flowers yellow, often tinged red ..... ***O. monacantha*** (C, F, G, L, T)
18 Flowers deep red ..... ***O. elatior*** (C, T)
Flowers yellow, sometimes tinged red 19
19 Stem segments purplish (particularly under stress) ..... ***O. macrocentra*** (T)
Stem segments never purplish 20
20 Spines not conspicuously darker at base. Stem segments green to slightly glaucous 21
Spines conspicuously darker at base. Stem segments slightly to distinctly glaucous 22
21 Spines few, 1–2 (sometimes absent), and only at some areoles, short, terete in section, grayish yellow ..... ***O. stricta*** (C)
Spines long and stout, several at most areoles, golden yellow with brownish bands, more or less flattened ..... ***O. dillenii*** (C, F, G, H, L, P, T)
22 Stem segments nearly orbicular, rounded at base. Spines dark red to brown at base. Low shrub ***O. phaeacantha*** (C)
Stem segments obviously longer than wide, cuneate at base. Spines chalky white to pale yellow with darker base. Often taller shrub 23
23 Plants usually erect, more than 1 m tall. Areoles up to 60 mm apart. Spines 1–8, intense yellow with a reddish base, aciculate, 40 mm or more long, not arranged as a bird's foot ..... ***O. lindheimeri*** (C)
Plants usually sub-erect or creeping, less than 1 m tall. Areoles up to 25 mm apart. Spines 1–3, subulate, pale yellow with a red tinged base, 20–30 mm long, arranged as a bird's foot ..... ***O. engelmannii*** (C)