A NEW SERIES OF THE GENUS *OPUNTIA* MILL. (OPUNTIEAE, OPUNTIOIDEAE, CACTACEAE) FROM AUSTRAL SOUTH AMERICA

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Abstract: *Opuntia* Ser. *Chacopuntiae* Oakley & R. Kiesling *nov. ser*., a new series of the genus *Opuntia* Mill. (Opuntieae, Opuntioideae, Cactaceae) from austral South America (Argentina, Bolivia and Paraguay) is described here. The type species is *Opuntia quimilo* K. Schum. The relation with another *Opuntia* s. str. species and another genus of the Opuntioideae it is mentioned.

Keywords: Cactaceae, Opuntioideae, *Chacopuntiae*, *Opuntia quimilo*

Resumen: Se describe una nueva serie dentro del género *Opuntia* Mill. (Opuntieae, Opuntioideae, Cactaceae) de Sudamérica Austral (Argentina, Bolivia y Paraguay): *Opuntia* Ser. *Chacopuntiae* Oakley & R. Kiesling *nov. ser*. La especie tipo es *Opuntia quimilo* K. Schum. Se mencionan las relaciones de esta última con otras especies de *Opuntia* s. str. y otros géneros de Opuntioideae.

Palabras clave: Cactaceae, Opuntioideae, *Chacopuntiae, Opuntia quimilo.*

INTRODUCTION

Among the *Opuntia* s. str. species of austral South America, *Opuntia quimilo* K. Schum. is clearly different from the others with respect to several characters (Britton & Rose 1919, Kiesling et al. 2011). The species grows at the western part of the Chaco Region in Argentina, Paraguay (Castellanos & Lelong 1943, Ritter 1980, Degen & Mereles 1996, Pin & Simón 2004, Kiesling et al. 2008) and Bolivia (Cardenas 1953, Ritter, 1980, Navarro 1996, Kiesling et al. 2014). It is plausible that it also grows in similar environments in Mato Grosso do Sul, Brazil (Eggli 2002).

This species was described in 1898 by Karl Schumann from material collected by Otto Kuntze from Santiago del Estero province (Argentina). In his monographic work Schumann (1899) placed it in *Opuntia* Subg. ("Untergattung") Platyopuntia Engl. Ser. ("Reihe") Armatae K. Schum. — using geographical criteria — related with *O. microdisca* F.C.A. Weber, *O. aurantiaca* Lindl., *O. sulphurea* Gillies ex Salm-Dyck and *O. monacantha* Haw. Later, Britton & Rose (1919) placed it within the Ser. Streptacanthae Britton & Rose, related with 11 species — most of them natives from North America — such as *Opuntia lasiacantha* Pfeiffer, *O. spinulifera* Salm-Dyck, *O. megacantha* Salm-Dyck, *O. streptacantha* Lem. and *O. amyclaea* Tenore. In the same book they described *Opuntia distans* Britton & Rose, based on material collected by J. A. Shafer from Andalgalá (Catamarca, Argentina) as part of Ser. Elatiores, and they raised their possible affinity with species of series Streptacanthae and Ficus-indicae. Castellanos (1957) proposed a new classification system in the subgenus Platyopuntia and placed *O. distans* and *O. quimilo* within the Section Euplatyopuntia A. Cast. — *nom. illeg.* — but in different subsections, following Britton & Rose criteria [Elatiores (Britton & Rose) A. Cast. and Streptacantha (Britton & Rose) A. Cast., respectively]. Backeberg (1958) placed *O. distans* and *O. quimilo* within the Ser. ("Reihe") Oligacanthae Backeb., related with the most of the shrubb species native to southern South America (*O. salagria* A Cast., *O. chakensis* Speg., etc.). Currently *O. distans* is considered a synonym of *O. quimilo* by most authors (Kiesling 1999, Anderson 2001).

The uniqueness of *Opuntia quimilo* had been discussed with Alberto Areces-Mallea (pers. comm. to RK ca. 1981) during a visit of this Cuban botanist to Argentina, who pointed out that some of the characters we mentioned in regard to *O. quimilo* correspond also to the Caribbean genus *Consolea* Lem., suggesting its affinity.

For this reason it was hypothesized that *Opuntia quimilo* would be more related with the species of the genus *Consolea* than the rest of *Opuntia* s. str. To verify the validity of this hypothesis a comparative study was made between *O. quimilo* with diverse species of *Consolea*, and other genera of Tribe Opuntieae (with flattened branches, 'Platyopuntias'), such as *Brasiliopuntia* A. Berger, *Nopalea* Salm-Dyck and

Figure 1. Specimen of *Opuntia quimilo* about 6 meters tall (photo P. Demaio). Locality: Santiago del Estero, Dpto. Ibarra.

Tacinga Britton & Rose.

MATERIALS AND METHODS

Accessions from the following herbaria have been studied: AS, BA, BAB, CORD, CTES, FCQ, G, LIL, LP, MCNS, MERL, MO, PY, K, NY and SI. In addition, specimen images available on the web (JSTOR Global Plants, http://plants.jstor.org/) were observed. Field observations of native populations were done on vegetative and reproductive characters in Argentina and Paraguay. Features used by various authors who worked with the groups of different 'Platyopuntias' were compared.

RESULTS

In the following, we compare the characters of *Opuntia quimilo* that differentiate it from the rest of the species of *Opuntia* s. str. and the other genera of Tribe Opuntieae.

1) **Habit**: *Opuntia quimilo* has a tendency to develop a definite trunk, circular or slightly ovate in transverse section, segmented, with most branches near the top, i.e., it has an arborescent habit (Fig. 1); the lower branches are deciduous, particularly if the plant is growing in the shade of the xerophytic forest. Both the growth of the principal trunk and the ramifications are sympodial, they are initially segmented. Plants of *Consolea* and *Brasiliopuntia* also have cylindrical trunks of circular cross section and

Figure 2. Young pads of *Opuntia quimilo* with buds, note the very short tepals. Spines on this young pad are partially absent (photo P. Demaio). Same locality as Fig. 1.

Figure 3. Flower and immature fruits of *Opuntia quimilo*, showing the short, fleshy tepals. At the type locality.

well defined treetops, but the growth of their trunks is indeterminate (monopodial), for that reason they are not segmented. The development of their branches is sympodial (Areces-Mallea 2001, Stuppy 2002, Taylor & Zappy 2004). The height of *O. quimilo* had been mentioned as being up to 4 meters, but there are specimens up to 6 meters at undisturbed areas. A few Opuntioids reach that height, possibly only *Brasiliopuntia* (to at least 10 m, sensu Stuppy 2002), *Consolea* (Areces-Mallea 2001), and some species of *Opuntia* from the Galapagos Islands that also have segmented trunks as *O. quimilo* (Britton & Rose 1919, Anderson & Walkington 1971).

2) **Stem segments**: *Opuntia quimilo* has very glaucous cladodes, covered with wax when young, later green-blue, dull; young cladodes without spines (Fig. 2); some mature cladodes with only a few

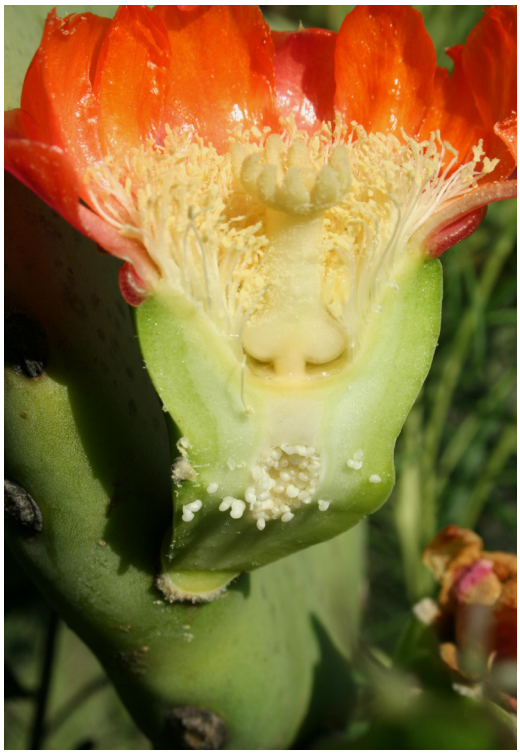

Figure 4. Longitudinal section of an *Opuntia quimilo* flower showing the enlarged diameter of the style. From the type locality.

spines, these of extraordinary length (up to 20 cm!); but some mature cladodes with all the areoles spiny. On the other hand, in *Consolea* only *C. moniliformis* A. Berger has similar coloration and the same variation in the distribution of spines (Areces-Mallea 2001). A few *Consolea* species have bullate cells at the epidermis, which is unique in Cactaceae.

3) **Flowers**: a) **Tepals**: The inner perianth of *Opuntia quimilo* consists of thick, fleshy, short, bright orange tepals (Fig. 3). This color is frequently associated with pollination by hummingbirds (Díaz & Cocucci 2003), and also exists in *O. quitensis* F.C.A. Weber (Madsen 1989), *O. stenopetala* Engelm. (Bravo 1978, Orozco-Arroyo et al. 2012), and all the species of *Consolea* (tepals of equal length to those of *O. quimilo* or shorter, bright red) and *Nopalea*. On the other hand, in *Opuntia* s. str., *Brasiliopuntia* and *Tacinga* generally, the tepals are yellow, orange or white, and not thick (Stuppy 2002; Taylor & Zappi 2004). b) **Style**: In *O. quimilo* (Fig. 4) as in *Consolea* (Fig. 5) and *Nopalea*, the style has a thin base that becomes abruptly enlarged, with an annular border, sometimes with short lobes erect. This character is absent in the species of *Brasiliopuntia*, *Tacinga* and *Opuntia* s. str. (Stuppy 2002), except in *O. quitensis* (Madsen 1989). This thick part of the style has been said to have nectaries (Natero & Malerba 2011), but it also has the function of promoting closer contact between pollinators and stamens. c) **Nectar Chamber**: One of the characters that clearly differentiates

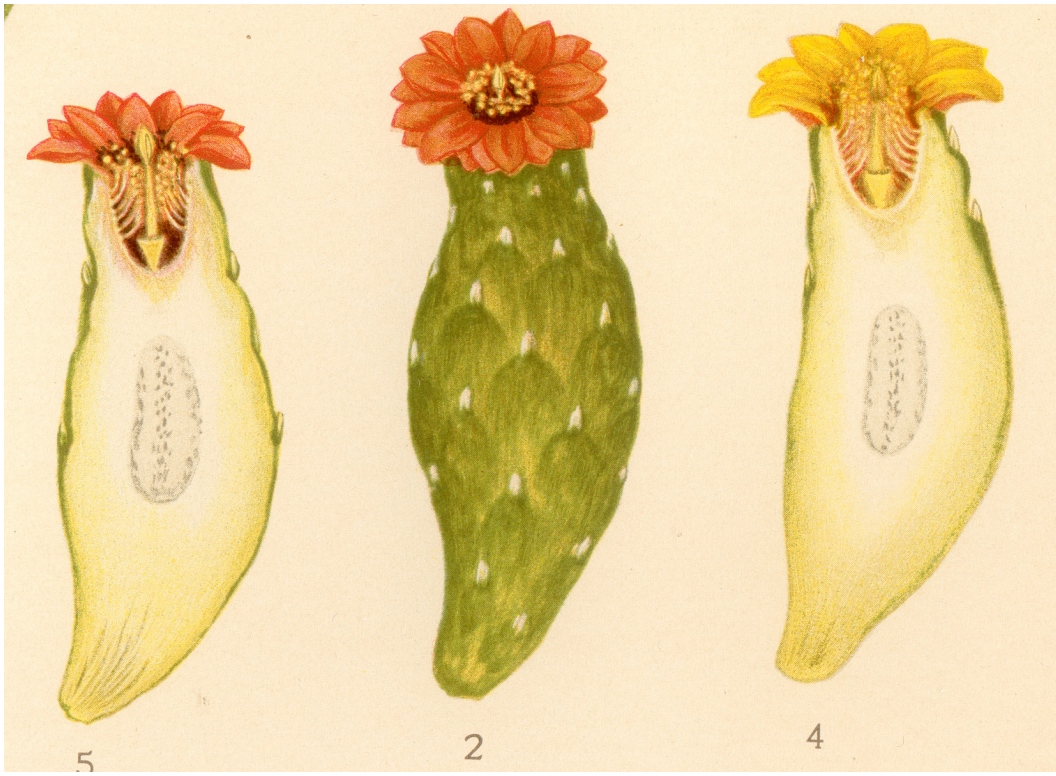

Figure 5. Excerpt from Britton and Rose (1919), Plate XXXVI, showing at the two flower sections, the enlarged diameter of the style of *Opuntia spinosissima*, now *Consolea spinosissima.*

Figure 6 (a) above: An extended ligneous vascular tissue of the fruit. Original color is yellowish; the dark part of this specimen had been under fungal attack. From Kiesling & Oakley 10426. **(b) below**: Subepidermal ligneous vascular tissue of the fruit, cleaned of mucilage. From Kiesling & Oakley 10426.

O. quimilo from most species of *Opuntia* s. str. is the presence of a nectar chamber that has been registered very few times in the genus (Fuentes-Pérez et al. 2009). On the other hand, the nectar chamber is very characteristic of *Consolea*, *Nopalea* (Stuppy 2002) and *Tacinga* (Barthlott & Hunt 1993). d) **Staminal thigmonasty**: *O. quimilo* does not exhibit staminal sensitivity (Díaz & Cocucci 2003), as species of *Brasiliopuntia*, *Consolea*, *Nopalea* and *Tacinga* (Stuppy 2002; Taylor & Zappi 2004). In contrast, thigmonasty is very common in *Opuntia* s. str. species, except in *O. stenopetala* (Bravo 1978) and *O. quitensis* (Madsen 1989).

4) **Floral biology**: The occurrence of trioecy was reported in *Opuntia quimilo* (Díaz & Coccuci 2003) and also in *O. robusta* (del Castillo & Trujillo Argueta 2009). On the other hand, the species of the genus *Consolea* and *O. stenopetala* were reported to be dioecious (Parfitt 1985, Strittmatter 2006, Strittmatter et al. 2008, Orozco-Arroyo et al. 2012). The dioecy in the Strittmatter et al. (2008) paper also has a third possibility: "inconstant/leaky males", meaning that it could be called trioecy as well. The Díaz and Cocucci paper (2003) is interesting for research on the flower sexuality of *O. quimilo* and also because it compares the characters of *O. quimilo* with characters of *Consolea*, *Nopalea* and *Tacinga*; and also mentions the series Stenopetala section Micranthae (*Opuntia* s. str.), from México, which species have nectaries and red tepals, similar to the ones of *O. quimilo*. A paper about *O. quimilo* (Natero & Malerba 2011) adds further information to that of Díaz & Cocucci (2003).

5) **Fruits**: *Opuntia quimilo* has vascular tissue forming a strong ligneous net on the pericarpel (Figs. 6a & 6b) (Buxbaum 1953, Kiesling et al. 2011). This hard tissue is absent in any other species of *Opuntia* s. str. (Bravo 1978, Anderson 2001; Hunt et al. 2006), and it is not reported in *Brasiliopuntia*, *Consolea* (Strittmatter pers. comm.), *Nopalea* or *Tacinga* (Taylor & Zappi 2004, Hunt et al. 2006). All the Cactaceae have comparable tissue on the pericarpel, but it is soft, not ligneous.

Figure 7. Fruit of *Opuntia quimilo* on soil surface in situ, showing two brown areas, presumably attacked by fungi.

6) **Fruit phenology**: At the end of winter, fruits of *Opuntia quimilo* drop from the plant and apparently complete their maturation on the soil, turning from green to yellow and disintegrating, perhaps due to fungal attack, or becoming dry (Fig. 7). They are eaten by wild animals such as the wild pig *Catagonus wagneri* and wild birds (Trevisson & Perea 2009),

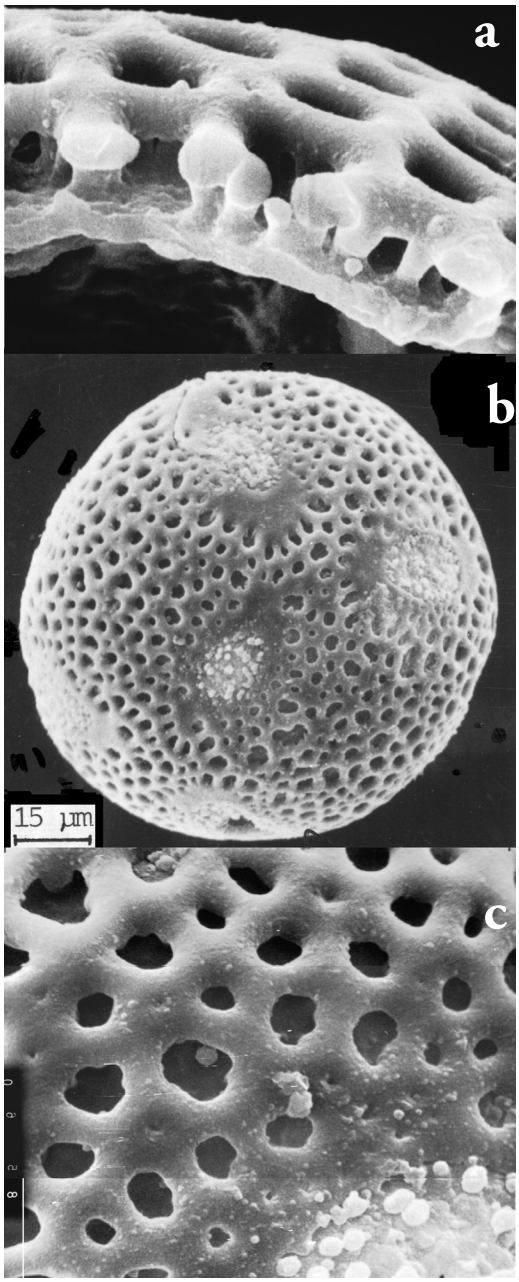

Figure 8. Photo of *Opuntia quimilo* pollen (from Kiesling, 1984), from the herbarium specimen Cabrera 16071 (LP). **(a):** *section of the pollen;* **(b):** aspect of the tectum; **(c)** general view of the grain with the elongate (oval) pores, non-spiny tectum, and non-areolate perforations; free columellas are none or scarce.

and domestic animals such as cows (Ochoa et al. 2010). The fruits of *O. quimilo* do not seem capable of vegetative reproduction as are the fruits of many opuntioid genera; our experimental attempts to generate plants by such vegetative reproduction have failed, and such vegetative reproduction has not been observed in the field.

7) **Pollen**: The pollen of *Opuntia quimilo* has a tectum with big elongated perforations, surrounded by a thickening of the exine (Fig. 8), for that it has a semi-cross linked aspect (Kiesling 1984, Garralla & Cuadrado 2007). According our observations the pollen surface is semi-reticulate, free columellas are none or scarce, different from the other species of *Opuntia* s. str. and also to the Opuntioideae with cylindrical trunks. According to Leuenberger (1976), it is similar to that of *Consolea*, and in lesser degree to that of *Nopalea* and *Tacinga*.

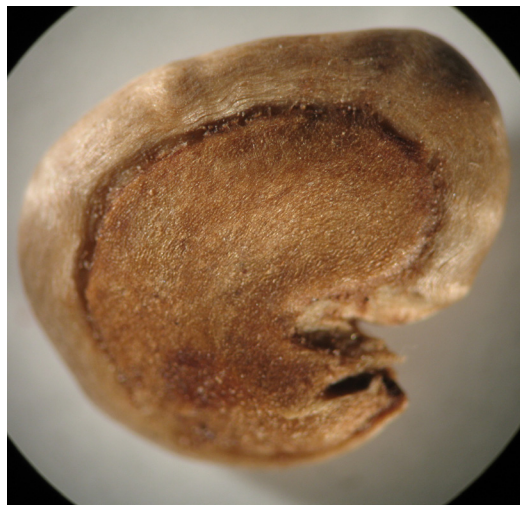

Figure 9. View of the funicular envelope of *Opuntia quimilo*, showing the developed girdle.

8) **Seeds**: Like other Opuntioideae the seeds of *Opuntia quimilo* are completely covered by a funicular envelope, or aril, surrounded by a funicular girdle (Stuppy, 2002). According to personal observations, the aril is very hard, whitish to yellowish, flattened laterally, glabrous, and has a well-developed funicular girdle, clearer or slightly yellowish (Fig. 9). Its diameter is near 6 × 8 mm, in agreement with the diameter reported by Areces-Mallea (1996) for a *Consolea* species. In his treatment of the seeds of Opuntioideae, Stuppy (2002) describes for the *Opuntia* s. str., *Nopalea* and *Tacinga* that the funicular girdle appears as a protruding strip, ridge or bulge encircling the seed and, for *Consolea* the funicular girdle protrudes strongly, surrounding the seeds as a yellow bugle. For *Consolea* he also mentioned the presence of the dense cover of unicellular trichomes on the funicular envelope. According our observations the funicular girdle in *O. quimilo* is like that of *Consolea* but there are no trichomes (Fig. 10).

9) Molecular systematics: The first phylogenetic studies of the Opuntioideae were made by Wallace & Dickie (2002) and Griffith & Porter (2009), both concluded that tribe Opuntieae ('platyopuntioids') is a well-supported group. According to the results of Griffith & Porter (2009) *Tacinga* and *Brasiliopuntia* are defined groups, while *Nopalea* and *Consolea* are within *Opuntia*. In these studies, *O. quimilo* is not included. Another phylogeny of Cactaceae was published later (Barcenas et al. 2011) in which *O. quimilo* is noticeably separated from the other species of

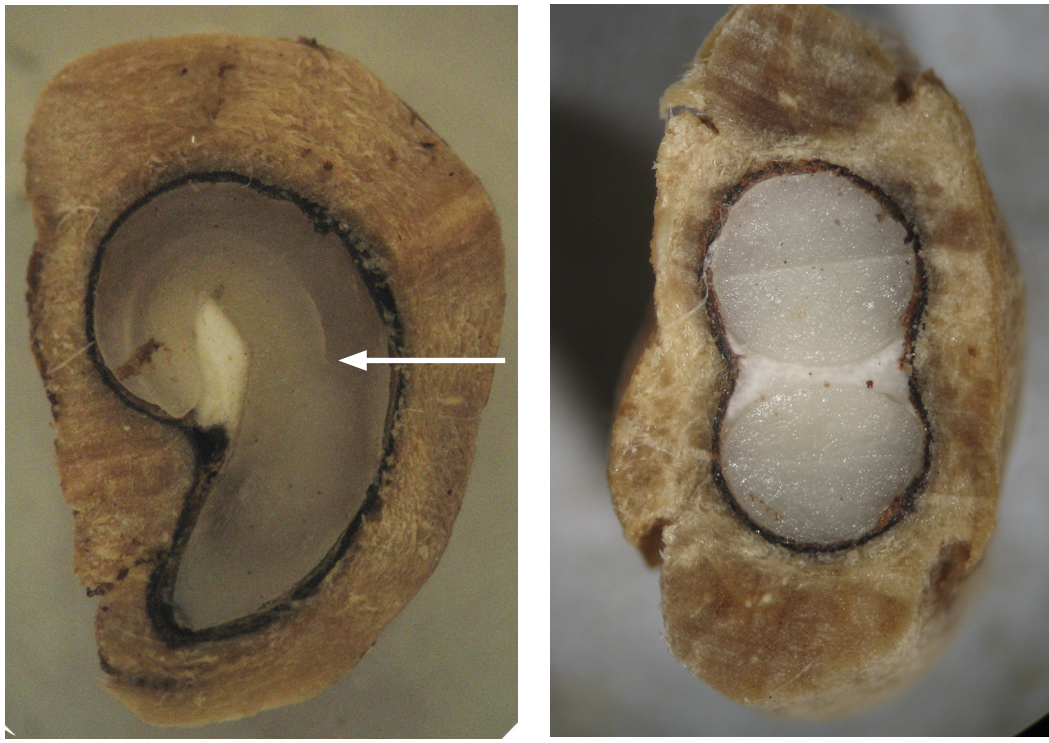

Figure 10. Left: Longitudinal section of an *Opuntia quimilo* seed showing the external funicular envelope and the true seed inside. Testa dark brown; embryo yellowish; perisperm inside white. The arrow is showing the base of the cotyledons. Right: transverse section, where the girdle can be seen protruding strongly.

Opuntia s. str., but only one species of South America was included in the analysis. Furthermore these authors used only one region of the chloroplast genome (trnK-matK) and only Bayesian methods, resulting in a lower support of their conclusions. On the other hand, Majure et al. (2012 a) also analyzed the phylogeny of *Opuntia* s. str. and other genera of the Tribe Opuntieae. This analysis was carried out with both chloroplast and nuclear genes, in addition to nuclear ribosomal internal transcribed spacers (ITS); in the phylogenetic analysis they used maximum parsimony, maximum likelihood and Bayesian methods. The results of this paper show that the genera *Consolea*, *Tacinga* and *Brasiliopuntia* form defined and separated groups of *Opuntia* s. str., while *Nopalea* is in the same clade. Another result of this paper is the high affinity of *O. quimilo* with three species of southern South America: *O. arechavaletae* Speg., *O. retrorsa* Speg. and *O. elata* Salm-Dyck. Recently, a study of phylogenetic relationships of the species of *Opuntia* s. str. from southern South America has obtained similar results (Realini et al. 2014a).

10) **Chromosomes**: Most chromosome counts in *Opuntia quimilo* resulted diploid: 2n = 22 (Majure et al. 2012b; Realini et al. 2014b, Las Peñas, ined.). *Brasiliopuntia brasiliensis* (Willd.) A. Berger and most species of *Nopalea* are also diploids (Majure et al. 2012b). On the other hand, the different species of *Consolea* have 2n = 66 or 88: they are hexaploids and octoploids (Negrón-Ortiz 2007). The one *Tacinga* is tetraploid with 2n = 44 (Majure et al. 2012b).

According to all these points, *Opuntia quimilo* has no clear affinity with *Consolea* species or the other genera of 'Platyopuntias', so the hypothesis of close relationship is dubious. On the other hand, it has certain unique characters that differentiate it from most species of *Opuntia* s. str., and so should be placed in a separate series within the genus.

TAXONOMIC TREATMENT

Opuntia Mill. Ser. ***Chacopuntiae*** Oakley & R. Kiesling *nov. ser.*

Tree-like plants with determinate and segmented trunks. Flowers with thick fleshy tepals, red-orange, style with the base thin, abruptly enlarged above and sometimes with an annular border at its middle or lower part. Fruits with a very strong ligneous subepidermal net of vascular tissue. Seeds with funicular girdle conspicuously differentiated from the flanks.

Etymology: The series name derives from a combination of the Chaco biogeographic province (because the species type is endemic of there) where it grows, and *Opuntia*.

Type species: *Opuntia quimilo* K. Schum., *Gesamtbeschr. Kakt*. 746. 1898.

Type: "Argentinian, in dem Staat Santiago bei La Banda: Otto Kuntze. Blühend und fruchtend im Oktober. Quimilo, der Name in Argentinian". Specimen not found.

The mentioned type collection is not at the B herbarium, where Schumann had worked (Leuenberger 1999). There is no doubt that the complete description of Schumann had been—at least in part—provided by the collector, Otto Kuntze, a German botanist who had been contracted by the Argentinean Academy of Sciences, and worked at Córdoba (Argentina), at which herbarium no isotype exists.

Therefore, a **Neotype** is here designated:

Argentina, Santiago del Estero, Departament Loreto, 'entre Loreto y Santo Domingo', 28º 44.125' S, 64º 02.688' W, 25/XII/2011. Planta arbórea 3 m alto, flores rojo-naranja brillante, sin frutos. Kiesling & Oakley 10425 (Neotype, MERL, here designated).

Platyopuntia quimilo (K. Schum.) F. Ritter, *Kakteen Südamerika* 2: 404. 1980. (*nom. illeg.*, Art. 52.1).

Opuntia distans Britton & Rose, *The Cactaceae* 1: 155, fig. 195. 1919. Type: Sandy places, Andalgalá, Catamarca, Argentina, J. A. Shafer 7, December 15, 1916 (Holotype: US -seen at the virtual herbaria-; isotypes: NY!, G, K!, MO!).

Shrubs or more frequently tree-like plants, 2–4(–6) m high, very branched. Segments discoid, elliptical or ovate, sometimes sub-rhombic, narrower at the base, large: 20–50 cm long, and 15–30 cm wide, thick, blue-green or greyish. Areoles very separate, prominent, only 12–20 at each side. Spines absent or 1–5(8), the central bigger than the others, 15–17(–25) cm long, the others -if exist- mostly short, up to 2 cm.

Flowers when open 4–8 cm diameter, with thick fleshy tepals, red-orange; pericarpel 3–4 cm long; style thin with thin base, abruptly enlarged above and sometimes with an annular border at its middle or lower part; stigma ca. 8-lobed, white, thick. Fruits obpiriform, 5–7 cm long, greyish-green, but becoming yellow when ripe, with a very strong ligneous subepidermal net of vascular tissue. Envelope of the seeds ca. 8 mm diam., 1–2 mm thick, whitish or yellowish, with funicular girdle clearly distinguished from the flanks. Embryo hooked, cotyledons about 50 % of its length.

Note: For differences between hermaphroditic and male flowers, see Díaz & Cocucci (2003). They find the main differences are: the hermaphroditic flowers weigh twice as much as the females; the females have more ovules than the hermaphroditic; stamens of male flowers are twice as long as those of the females and are more numerous; the stamens of the female flowers have no pollen, but spherical crystals.

The species occurs in the occidental district of the Chaco biogeographic province in Bolivia, W Paraguay and in Argentina from the North of Córdoba to Formosa, Salta and Jujuy, and can indicate saline or alkaline soils. It is very frequent in disturbed areas.

The vernacular name, Quimil or its variations ("Quimilo", "Quimilí", or less frequently "Quimir") is very well known, giving origin to several toponyms, including Quimilar, Quimilí, Quimil Pozo and Quimilloj.

SPECIMENS EXAMINED

ARGENTINA: *Catamarca*. Department Chumbicha, without locality, 1972, Cantino 386 (CORD); a 15 Km de Ruta Nac. 60, 31/X/1977, Biurrun & Agüero 1191 (SI). Department Paclín, Cuesta del Totoral, 16/XII/1953, Cuezzo & Legname 4987 (LIL). *Chaco*. Department Alte. Brown, 8 Km al S de Río Muerto, 8/VI/1977, Bordón 228 (CTES). Department Gral. Güemes, El Impenetrable, XI/1969, Schulz 9930 (CTES); 19 km de Fuerte Esperanza hacia Salta; 20/XI/1990, Fortunato 1501 (BAB). *Córdoba*, Department Cruz del Eje, 1995, Leuenberger et al. 4489 (CORD). *Formosa*. Department Bermejo, Cruce Ruta 39 y Cañada El Rosillo, 15/X/1982, Molina, Cabral & Roig 664 (BAB); S Pozo de Maza, 25/III/1999, Scarpa 393 (BA). *Jujuy*. Department San Pedro, 15 km SE San Pedro, 30/IX/1938, Eyerdam & Beetle (BA 41419); 2 km SW Santa Rita, 3/X/1971, Arnow 3500 (MO). Department Santa Bárbara, de Palma Sola a El Piquete, 16/X/1964, Cabrera 16071 (LP). *La Rioja*. Department Gral. Belgrano, de Chañar a Castro Barros, 7/IV/1988, Biurrun & Leguiza 12 (CORD). *Salta.* Department Anta, El Quebrachal, 20/VII/1930, Castellanos s.n. (BA 30/783); Ruta 16, 7 Km al SE de El Quebrachal, 8/XI/1979, Schinini 20046 (CTES, SI). Department Capital, al S de San Bernardo y El Portezuelo, 1250–1300 m s.m., 28/I/2008, Novara & Seo 13089 (MCNS). Department Chicoana, ruta 68, 3–4 km al N de El Carril, 1200 m s.m, 19/XI/1994, Novara & Tolaba s.n. (MCNS 1082). Department Gral. Güemes, entre Güemes y El Zapallar, 5/XI/1965, Meyer 22492 (LIL, CTES); from Salta to Cabeza de Buey, 25/VIII/1985, Gentry, Neumann & Palací 51828 (MO). Department Metán, Río Piedras, 4/I/1917, Shafer 34 (MO, NY -ID 484746- in glass). Department Rivadavia, Ruta 81, 45 Km SE de Cnel. Solá, 10/XII/1980, Schinini 19582 (CTES, SI). Department San Martín, Pozo El Milagro, ruta 81, 15 Km al O de Hickmann, 10/XII/1972, Maruñak, Quarin & Schinini 570 (CTES, LIL, SI). *Santa Fe*. Department Nueve de Julio, Bajos Submeridionales, 10 km E Tostado, Ruta 98, 24/III/1989, Williams, Krapovickas & Vanni 922 (BA, CTES). *Santiago del Estero*. Department Alberdi, Pampa de los Guanacos, VIII/1938, Meyer 2483 (BA 22296). Department Loreto, entre Loreto y Santo Domingo, 28º 44.125' S, 64º 02.688' W, 25/XII/2011, 'frutos sobre el suelo, sin flores', Kiesling & Oakley 10426 (MERL). Department Ojo de Agua, 29º 30' S, 63º 40' W, 25/XI/1995, Fortunato & Micheli 5049 (BAB, K. MO, NY, US). *Tucumán.* Department Trancas, Vipos, 9/XI/1921, Schreiter 1702 (LIL).

PARAGUAY: Department *Boquerón*; Fortín Nueva Asunción, 24/III/1986, Brunner 1665 (G, MO, PY); La Cumbreña, 10/X/1987, Spichiger 2222 (G); Cerca Nueva Asunción, 20/XI/1992, Mereles & Degen 4959 (FCQ, MO); Tyto. Mariscal Estigarribia-Tte. Picco, en bosque xerófito, 20/XI/1992, Mereles & Degen 4962

(FCQ); Misión Santa Rosa, 15/VIII/1993, Gragson 184 (MO); Picada Siracuas, 12/XII/1993, Mereles & Degen 5504 (FCQ); Base Aérea Pratt Gill, 16/X/1996, Mereles 6475 (FCQ); Park Medanos del Chaco, 20° 54' 8" S, 61° 50' 34" W, 13/XII/1998, Zardini & Duarte 49764 (MO, AS, SI); Cañada Lamadrid, sitio histórico, 22º 59' 49,4" S, 61º 50' 44,2" W, 200 m s.m., 13/XI/2011, Vera 3121 (FCQ); Ruta Transchaco, entre límite NW Parque Enciso y Nueva Asunción, 20º 53,245' S, 61º51,139'W, 14/XII/2011, Vera et al. 3222 (FCQ). Department *Concepción*, Prope Concepción. 1901–1902, Hassler 7583 (G).

Additional information: **BOLIVIA**: Mentioned by Cárdenas (1953) for Camiri (Department Santa Cruz), Mizque and from Sucre to Cochabamba (Department Cochabamba) and observed by us at Villa Montes (Department of Tarija). Also is mentioned for Cochabamba by Taylor (2007) and for Department Chuquisaca by Serrano & Terán (1998) and Kiesling et al. (2014).

DISCUSSION

The newly described Series *Chacopuntiae* is placed — according phylogenetic studies — with species of Ser. Armatae K. Schum. and Ser. Aurantiacae Britton & Rose (Majure et al. 2012a, Realini et al. 2014a), a curious coincidence with the proposal made by Backeberg (1958). However, according our observations these species are morphologically very different to *O. quimilo.*

The series is monotypical, but its only species — *Opuntia quimilo* — closely resembles *O. quitensis* which occurs in Peru, basically for the characters of floral biology, tepal color, style form and absence of staminal thigmonasty. *Opuntia quitensis* and *O. quimilo* are closely related in the consensus tree of phylogeny obtained with maximum likelihood (Majure et al. 2012a). However, the two species may be readily distinguished by habit, pollen morphology, fruits and seeds characters. More studies for determining relationships among the two species are necessary.

ACKNOWLEDGEMENTS

To the curators of the cited herbaria for the access to examine the specimens. To Alberto Areces-Mallea for sharing his first-hand knowledge about *Consolea* characters. To Lara Strittmatter for the bibliography sent and her comments about the *Consolea* morphology. To Laura Las Peñas for bibliographic searches about *O. quimilo* cytology and other aspects of the work. To Pablo Demaio for his comments and nice photos provided. To Marta Bianchi and Darién Prado for their help with English translation. To Cecilia Grierson for her help with corrections

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