

MARTÍN ET AL.: A NEW SPECIES OF OXYPETALUM FROM ARGENTINA

A New Species of *Oxypetalum* (Apocynaceae, Asclepiadoideae)

from Northern Argentina

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Abstract—*Oxypetalum* is the largest genus of Oxypetalinae (Apocynaceae-Asclepiadoideae) and presents its highest diversity in southern South America. A new species, *Oxypetalum globosum*, from montane environments of northern Argentina, is described, illustrated, and compared to similar species. Data on its habitat, distribution, ecology, and phenology are provided. This is an outstanding species within *Oxypetalum* due to its flowers with maroon, globose corollas, with patent, rounded corolla lobes, and a bright pink, exerted, hemispheric stilar-head appendage, which suggest fly-pollination. The difficulties in delimiting genera of Oxypetalinae are discussed. A key to the species of *Oxypetalum* from northern Argentina is included.

Keywords—flower morphology, montane grasslands, Oxypetalinae, stilar-head, taxonomy, Yungas.

Oxypetalum R. Br. is a large, taxonomically difficult, Neotropical genus of Apocynaceae-Asclepiadoideae with approximately 120 species, distributed from Mexico to central Argentina (Farinaccio and Mello Silva 2005; Farinaccio and Keller 2014; Farinaccio and Goyder 2016). It has an important center of diversity in southern South America, where it presents more than 80 species (Ezcurra et al. 2008). The genus is generally characterized by a combination of characters, which are, however, not all present in all its species. These features include showy flowers, corollas with lanceolate lacinia, corona of free lobes arising at the base of the corolla tube, rostrate stylar-head, well developed corpusculum (about the size of the pollinia or larger), and lateral teeth on the caudicles (Meyer 1944; Goyder 2004b; Farinaccio 2008; Rapini et al. 2011). It is mostly found in the Cerrado, Atlantic region and Pampas (sensu Cabrera and Willink 1973) of central and southern Brazil, Argentina and Uruguay (Meyer 1944; Farinaccio 2005; Rapini et al. 2010, 2011). Although several of its species grow in forest borders, most are common in open, sunny environments of savannas, “campos”, “cerrados”, and other tropical and subtropical grasslands.

Recently, molecular work on the phylogeny of the Asclepiadoideae MOOG clade (composed by Metastelmatinae Endl.ex Meisn., Orthosiinae Liede and Rapini, Oxypetalinae E. Fourn., and Gonolobinae G. Don ex Liede) has shed new light on taxonomic relationships among species in these groups (Rapini et al. 2003; Liede-Schumann et al. 2005; Rapini et al. 2006; Liede-Schumann and Meve 2015). Thus, information provided by phylogenetic studies within the Oxypetalinae have resulted in changes in generic circumscriptions and in species realignments that include the transfer of species previously described in e.g., *Schistogyne* Hook. et Arn., *Amblystigma* Benth., *Widgrenia* Malme and *Rhyssostelma* Decne., to *Oxypetalum* (e.g., Rapini et al. 2011;

Liede-Schumann and Meve 2015). As results, in the last years, numbers of *Oxypetalum* species have grown. In recent catalogues, approximately 96 species have been reported from Brazil (Rapini et al. 2010), 41 from Argentina (Farinaccio and Keller 2016), 31 from Paraguay (Fontella-Pereira et al 2010), 26 from Uruguay (Ezcurra et al. 2008), and 20 from Bolivia (Goyder et al. 2014).

Meyer (1943, 1944) performed the most important treatment of the genus, comprising an identification key, descriptions and illustrations of nearly all the species present in Argentina. Later, regional floras included revisions of several species groups (e.g., Fabris 1965; Meyer and Bacigalupo 1979; Pontiroli 1983; Fontella Pereira et al. 2004; Hechem and Ezcurra 2006). Recently, Farinaccio studied the numerous species from the State of Sao Paulo, Brazil (Farinaccio 2005), performed a detailed phylogenetic study of the genus (Farinaccio 2008), and published a synopsis of the species from Bolivia, in collaboration (Farinaccio and Goyder 2016). Also, several new species from Brazil, Argentina, and Bolivia have been discovered and described in the last years (e.g. Farinaccio and Mello-Silva 2006; Farinaccio and Keller 2014; Farinaccio and Goyder 2016).

The Yungas phytogeographical province extends along the Andes from Venezuela to northern Argentina from 500 to 2,500-3,500 m a.s.l., and includes diverse cloud forests, *Alnus acuminata* (Betulaceae) and *Podocarpus* (Podocarpaceae) forests, and species-rich montane grasslands (Cabrera and Willink 1973; Cabrera 1976). Recent floristic and biogeographic studies on montane grasslands of the Yungas of northern Argentina as part of the first author's doctoral dissertation work, resulted in the finding of a new species of *Oxypetalum*, which we here describe, illustrate, and compare to morphologically similar species. Data on its habitat, distribution, ecology and phenology are also provided. , We include a key to all the species of *Oxypetalum*

present in northern Argentina. We also discuss the difficulties in delimiting genera of Oxypetalinae based on floral characters.

MATERIALS AND METHODS

In addition to fieldwork in montane grasslands of northern Argentina, by the first author, our study also included analyses of Apocynaceae-Asclepiadoideae material from LIL and SI, as well as consideration of the relevant literature. Morphological observations and measurements on vegetative and floral characters were performed on live plants in the field, and by using a stereoscopic microscope with camera lucida on hydrated material from herbarium specimens.

TAXONOMIC TREATMENT

Oxypetalum globosum C. Ezcurra et C. M. Martín sp. nov. —TYPE: ARGENTINA.

Salta: Dep. Santa Victoria, Cerro Bravo, 22°13'60'' S, 64°46'09'' W, 2590 m, 04 Dec 2015, C. M. Martín 696 (holotype: SI, barcode 091773!; isotype: LIL!).

Species morphologically similar to *Oxypetalum urceolatum* Farinaccio et Goyder from Bolivia in the few-flowered inflorescences and basally inflated corollas. It differs in the deeply cordate (instead of nearly cuneate) leaves, the maroon and globose (instead of pale and urceolate) corolla tube, and the rounded, flat and patent (not triangular and suberect) corolla lobes (Figs. 1, D, E and 2, B). *Oxypetalum globosum* is also characterized by the dense, white hairs on the throat of the corolla, the caudicles without teeth, and the thick, bright pink, cylindrical and apically expanded stylar-head, forming an exerted hemispherical structure composed of multiple, connate, flat or fingerlike projections (Figs. 1, D, E and 2, C). In these characters it is somewhat similar

to *Oxypetalum dactylostelma* Goyder (= *Dactylostelma boliviense* Schltr.), but differs in the markedly cordate leaves and more globose flowers. It is also similar to species of *Oxypetalum* that have been described under the generic name *Calostigma* Decne.

(which means “beautiful stigma”) in the expanded styler-head appendix, such as *O. insigne* (Decne.) Malme (e.g., Farinaccio, 2005), but the species of this group generally differ from *O. globosum* because they are twining species with a laminar corpusculum longer than the pollinia, and they occur in Brazil.

Plant erect, 30–80 cm high, lactescent, unbranched. Stems terete, minutely and retrorsely puberulous towards the apex, the hairs less than 0.3 mm long, glabrous near the base, internodes 2.5–5(–8.5) cm, without interpetiolar colleters. Leaves opposite, petiole 0.9–2.2 cm long, puberulous, with hairs less than 0.4 mm long, blades ovate (the basalmost nearly orbiculate), 1.3–3.5 × 0.7–2 cm, adaxially and abaxially puberulous, ciliate, chartaceous, apex acute to acuminate, base deeply cordate, with 2 colleters near the insertion of the petiole on the adaxial face, venation brochidodromous. Inflorescence extra-axillary, alternate, umbelliform, 2–3(–4)-flowered, open flowers not pendant, peduncle 2–4 cm long, puberulous, bractlets linear, puberulous, pedicels 0.5–1.2 cm long, densely puberulous. Calyx divided almost to the base, lobes 1.5–2 × 0.8–1 mm, ovate-lanceolate, apex acute, pubescent abaxially and glabrous adaxially, with 4–5 colleters in clusters below sinus, when 5, the central is longer. Corolla dark maroon, tube globose, 3.8–4.1 mm long and diam., outside pubescent, inside introrsely barbellate on upper part, with long white hairs exerted on throat, lobes 2.5–3.5 × 2–2.6 mm, widely oblong-ovate, patent, not recurved or contorted, pubescent abaxially and glabrous adaxially, apex rounded. Corona coralline, the lobes free and arising at the base of the corolla tube, aprox. 2 × 1.5 mm, widely oblong-spatulate, apex rounded to emarginate. Gynostegial corona absent. Gynostegium sessile. Anthers 1.8–2 × 1–1.2

mm, rectangular, terminal appendage aprox. 0.5×0.8 mm, shortly and widely triangular-ovate. Corpusculum $0.38\text{--}0.43 \times 0.19\text{--}0.21$ mm, fistulose and with a frontal slit, elliptic to oblong, apex obtuse, caudicles $0.19\text{--}0.21$ mm long, horizontal, flattened, translucent, without teeth, pollinia $0.30\text{--}0.35 \times 0.24\text{--}0.25$ mm, ovoid. Styler-head extended in a bright pink thick cylinder $1.5\text{--}2$ mm beyond the anthers, expanded in its apex in an exerted hemispheric structure ca. 3 mm diam., formed by multiple connate, conspicuously fleshy, pink, flat or digitiform appendices. Follicles and seeds unknown. Figures 1 and 2.

Etymology—The name of this species refers to the markedly globose shape of the corolla tube of the flowers of this species (Figs. 1, E and 2, C), which are unusual in *Oxypetalum*.

Phenology— Flowering in November and December.

Distribution, Habitat and Ecology— *Oxypetalum globosum* is only known from Cerro Bravo, Dep. Santa Victoria, in the province of Salta, Argentina. Explorations of the region have resulted in a single collection of this species until now, Although its conservation status is unknown because of lack of data, it appears rare and therefore could be threatened. It has been found in montane grasslands, of the Yungas phytogeographical province (Cabrera and Willink 1973; Cabrera 1976), between 2,500 and 2,800 m a.s.l. (Fig. 2, A). The climate of this area is characterized by mean annual temperature of aprox. 11°C and annual precipitation that does not exceed 1,500 mm and falls mostly in summer. Supplementary water during the rest of the year is provided by mist (Hunzinger 1995; Arias and Bianchi 1996). These montane grasslands are very rich in species. During the wet summer season, many herbs with showy flowers bloom among the dominant grasses, whereas in winter all the vegetation looks yellow and dry (Cabrera 1976). The flora of these montane grasslands is biogeographically interesting,

as it presents endemic species, and several centered in Bolivia that extend to northern Argentina (Meyer 1957; Goyder 2004b). *Oxypetalum globosum* shares its habitat with species such as *Chuquiraga longiflora* (Griseb.) Hieron., *Hieracium argentinense* Zahn, *Hieracium neofurcatum* Sleumer, *Lucilia recurva* Wedd., *Onoseris hastata* Wedd., and *Senecio crepidifolius* DC. (Asteraceae); *Gaultheria erecta* Vent. and *Gaylussacia cardenasii* A.C. Sm. (Ericaceae); *Brachyotum microdon* (Naudin) Triana (Melastomataceae); *Cyclopogon oliganthus* (Hoehne) Hoehne & Schltr. and *Odontorrhynchus castillonii* Hauman (Orchidaceae); *Agalinis fiebrigii* (Diels) Darcy (Orobanchaceae); *Briza uniolae* (Nees) Nees ex Steud., *Cortaderia hieronymi* (Kuntze) N.P. Baker et H.P. Linder, *Danthonia secundiflora* J. Presl., *Elymus scabrillumis* (Hack.) Á. Löve, and *Jarava ichu* Ruiz et Pav. var *ichu* (Poaceae); *Thalictrum venturii* Boivin (Ranunculaceae); *Nierembergia rivularis* Miers (Solanaceae); *Barbaceniopsis boliviensis* (Baker) L.B. Sm. (Velloziaceae); *Viola micranthella* Wedd. and *Viola rodriguezii* W. Becker (Violaceae); among others.

The dark maroon corollas of the flowers of *Oxypetalum globosum* of the Oxypetalinae, with patent, flat lobes, and a short stylar-head expanded in an exerted, bright pink, hemispheric structure (Figs. 1, D, E and 2, C), is reminiscent of the myophilous flowers of many species of *Matelea* Aubl. of the Gonolobinae. Gonolobinae generally present open-access fly pollination (Ollerton and Liede 1997). Although a few species with pale, long-tubed corollas, probably with lepidopteran pollination, have been described in *Matelea* (e.g., *Matelea calchaquina* Ezcurra et Belgrano; *Matelea sartago-diaboli* Goyder), most *Matelea* species from northern Argentina present flat, rotate corollas and generally dull-colored, reddish, brownish, or greenish flowers, suggestive of fly pollination, i.e., myophily (Ezcurra and Belgrano 2007). On another hand, *Oxypetalum*, as the rest of the Asclepiadeae (i.e., excluding Gonolobinae),

generally present deeper, paler and more showy flowers pollinated by Hymenoptera and pollination ensembles of insects with strong Lepidoptera and lesser Diptera components (Ollerton and Liede 1997; Vieira and Shepherd 1999). Therefore, the evolution of morphological characteristics of the flowers *Oxypetalum globosum* within *Oxypetalum* could be a case of floral mimicry in relation to *Matelea* model species, which are currently frequent in forest and grassland environments of northern Argentina (10 species: Ezcurra and Belgrano 2007) and Bolivia (19 species: Goyder et al. 2014).

Taxonomic Considerations— The inclusion of this species in *Oxypetalum*, instead of within other genera of the taxonomically complex Oxypetalinae clade of Asclepiadoideae, could be a matter of discussion. The Oxypetalinae comprise the mostly South American *Araujia* Brot., *Funastrum* E. Fourn., *Morrenia* Lindl., *Oxypetalum* R. Br., *Philibertia* Kunth, and *Tweedia* Hook. et Arn. (Endress et al. 2014; Calviño et al. 2014; Liede-Schumann and Meve 2015). Morphological differences between genera of Oxypetalinae are sometimes not clear cut, which results in difficulties in genera delimitation (e.g., *Philibertia urceolata* Goyder was described as reminiscent of *Oxypetalum*: Goyder, 2008; *Morrenia* species have sometimes been included in *Araujia*: Rapini 2011). In fact, *Philibertia urceolata* Goyder recently described from Bolivia (Goyder 2008) is very similar to *Oxypetalum globosum*, although the former differs in the larger calyx, the yellow-green corolla with larger lobes, the position of the corona, and the white, narrowly cylindrical and apically entire stylar-head appendage. However, the combination of detailed morphological studies, molecular phylogenies, and information on geographic distribution, is starting to unravel the limits and relationships of these genera. Recently, a key has been published to the genera of Oxypetalinae to which *Oxypetalum* belongs (Calviño et al., 2014), that includes generic recircumscriptions recently accepted in Oxypetalinae (e.g., Rapini et al.

2003; Goyder 2004a, b; Liede-Schumann et al. 2005; Rapini et al. 2006; Rapini et al. 2011). This key allows the classification of *Oxypetalum globosum* within *Oxypetalum* without doubt, taking in account the erect habit, the coralline corona present and well developed, arising at the base of the corolla tube and composed of free lobes, and the absence of gynostegial corona.

Albeit, *O. globosum* is rare within *Oxypetalum* because it does not present lanceolate or triangular corolla lobes or lateral teeth on the caudicles, which are common diagnostic characters in *Oxypetalum* (e.g., Farinaccio 2008). Nevertheless, there are several species that fall well within the phylogeny of *Oxypetalum* (Rapini et al. 2003; Liede et al. 2005; Rapini et al. 2006) and also present ovate or elliptic corolla lobes and/or caudicles without teeth (e.g., *O. coccineum* Griseb.). Therefore, several species with these characteristics have been included in recent treatments of *Oxypetalum* (e.g., Farinaccio 2005; Rapini et al. 2011; Farinaccio and Goyder 2016). Thus, in addition to this morphological study, in the future it would be very useful to perform molecular phylogenetic studies that include *O. globosum* to confirm its taxonomic position within genera of Oxypetalinae.

We provide a key to *Oxypetalum* species in northern Argentina (provinces of Jujuy, Salta and Tucumán) that complements the one recently published for species of Bolivia (Farinaccio and Goyder, 2016).

KEY TO SPECIES OF *OXYPETALUM* IN NORTHERN ARGENTINA

- 1. Stems erect, not twining.....2
- 2. Caudicles enlarged in membranes and with a tooth on the top.....3

- 3. Style-head appendage up to 1.5 mm long., barely exerted beyond mouth of corolla tube.....*O. arnottianum* H. Buek
- 3. Style-head appendage 3–6 mm long., clearly exerted beyond mouth of corolla tube.....*O. capitatum* Mart.

- 2. Caudicles not enlarged in membranes and without teeth...4
 - 4. Red corolla with a cylindrical tube. Style-head appendage with two filiform branches.....*O. coccineum* Griseb.
 - 4. Dark maroon corolla with a globose tube. Style-head appendage expanded in its apex in an exerted hemispheric structure.....*O. globosum* C. Ezcurra et C. M. Martín

- 1. Stems twining, not erect.....5
 - 5. Style-head appendage with two filiform branches.....6
 - 6. Corona lobes barely visible beyond the mouth of corolla tube. Caudicles with teeth.....*O. balansae* Malme
 - 6. Corona lobes not visible beyond the mouth of corolla tube. Caudicles without teeth.....7
 - 7. Deltoid leaves, the base generally truncate. Corolla with a cylindrical tube and linear lobes. Style-head appendage filiform, up to 15 mm long., divided to almost the base, divergent at the apex.....*O. barberoanum* T. Mey.
 - 7'. Ovate-lanceolate leaves with cordate base. Corolla with a campanulate-urceolate tube and lanceolate lobes. Style-head appendage up to 4 mm long., divided to half its length, twisted at the apex.....*O. brachystemma* Malme

- 5'. Style-head appendage with 5–7 branches.....8
8. Style-head appendage branches short, not exerted beyond the mouth of the corolla tube. Corolla lobes triangular
.....*O. tucumanense* (T. Mey.) Goyder et Rapini
- 8'. Style-head appendage branches filiform, exerted beyond the mouth of the corolla tube. Corolla lobes sublinear.....9
9. Corona lobes without an appendage on inner face
.....*O. fiebrigii* (Malme) Goyder et Rapini
- 9'. Corona lobes with an appendage on inner face...10
10. Leathery leaves with wavy margins
.....*O. pubescens* (Malme) Goyder et Rapini
- 10'. Membranous leaves without wavy margins...
O. longipedunculatum (Malme) Goyder et Rapini

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FIG. 1. *Oxypetalum globosum*. A. Flowering stem. B. Detail of stem pubescence. C. Detail of leaf pubescence. D. Flower with exerted stylar-head apex. E. Flower, longitudinal section showing calyx, corolla, corona, and gynostegium with stamens and thick, apically expanded stylar-head. F. Corona appendix. G. Stamens. H. Pollinarium with corpusculum, caudicles, and pollinia. [Based on: *C. M. M.* 696 (holotype: SI)]

FIG. 2. *Oxypetalum globosum*. A. Habitat in montane grasslands of Salta, Argentina. B. Flowering stem. C. Mature flower with exerted stylar-head apex (Photographs C. M. M.).