

Two new species of *Euphorbia* sect. *Nummulariopsis* (Euphorbiaceae) from South America

by

Pablo Carrillo-Reyes & Victor W. Steinmann

Instituto de Ecología, A.C., Centro Regional del Bajío, Apartado Postal 386, 61600 Pátzcuaro, Michoacán, Mexico
 pcarreyes@gmail.com, victor.steinmann@inecol.edu.mx

Abstract

Carrillo-Reyes, P. & Steinmann, V.W. 2011. Two new species of *Euphorbia* sect. *Nummulariopsis* (Euphorbiaceae) from South America. *Anales Jard. Bot. Madrid* 68(2): 167-173.

Two new species of sect. *Nummulariopsis*, *Euphorbia guaraniorum* and *E. cordeiroae*, are described and illustrated. *Euphorbia guaraniorum* appears to be related to *E. portulacoides* and is distinguished by its densely arranged ensiform leaves. It is known only from the Yacyretá and Ybycui Islands in southern Paraguay. *Euphorbia cordeiroae*, occurs in the state of Goiás, Brazil, and is similar to *E. stenophylla*, from which it differs in its higher stature and very narrow and loosely arranged leaves.

Keywords: Brazil, *Euphorbia cordeiroae*, *E. guaraniorum*, Paraguay, *Portulacastrum*.

Introduction

Euphorbia L. sect. *Nummulariopsis* Boiss., as here circumscribed, contains approximately 30 species and has a disjunct distribution between the southeastern United States and South America. The section was initially proposed for *Euphorbia peperomioides* Boiss., a Brazilian endemic, but molecular phylogenetic results demonstrate that this species is nested within a clade that otherwise corresponds to *Euphorbia* sect. *Tithymalus* Boiss. subsect. *Inundatae* G.L. Webster (Steinmann & Porter, 2002). *Nummulariopsis* is the oldest legitimate name at the rank of section, and it is here adopted and expanded to include species previously treated with sect. *Tithymalus* subsect. *Inundatae*. As discussed by Webster (1967), the species in this group were first treated within *Euphorbia* sect. *Tithymalus* subsect. *Ipecacubanae* Boiss. (Boissier, 1862), but

Resumen

Carrillo-Reyes, P. & Steinmann, V.W. 2011. Dos nuevas especies de *Euphorbia* sect. *Nummulariopsis* (Euphorbiaceae) para Sudamérica. *Anales Jard. Bot. Madrid* 68(2): 167-173 (en inglés).

Dos nuevas especies de la sección *Nummulariopsis*, *Euphorbia guaraniorum* y *E. cordeiroae* son descritas e ilustradas. *Euphorbia guaraniorum* parece estar relacionada con *E. portulacoides*, de la que se distingue por sus hojas ensiformes densamente agrupadas y se conoce solo de las islas Yacyretá e Ybycui, en el sur de Paraguay; *E. cordeiroae*, conocida sólo del estado de Goiás, Brasil, se compara con *E. stenophylla*, de la que se diferencia por ser una planta más alta y por sus hojas extremadamente delgadas y con un arreglo laxo.

Palabras clave: Brasil, *Euphorbia cordeiroae*, *E. guaraniorum*, Paraguay, *Portulacastrum*.

they are not closely related to the type of this section, *Euphorbia ipecacubanae* L. It is worth noting that *E. peperomioides* differs vegetatively from the remainder of the species in the group by possessing a strictly prostrate habit with opposite leaves and stems rooting at the nodes. However, in terms of cyathial morphology, it is indistinguishable from the others. The distinctive feature of this section is the presence of perianth-like lobes that terminate the gynophore. This condition is very rare in *Euphorbia* and appears to represent a synapomorphy for sect. *Nummulariopsis*. Other characteristics of this section include the herbaceous habit, involucre glands lacking appendages, and ecarunculate seeds. According to molecular phylogenetic analyses (Steinmann & Porter, 2002), sect. *Nummulariopsis* is inferred to be the sister clade to *E. germanii* Phil. (sect. *Portulacastrum*) and belongs to *Euphorbia* subg. *Euphorbia*, sensu Bruyns & al. (2006).

During the course of revisionary studies on sect. *Nummulariopsis*, as part of the collaborative Planetary Biodiversity Inventory (PBI) *Euphorbia* project (Es-ser & al., 2009), two undescribed species were encountered. The purpose of this article is to formally propose them as new and provide comments on their distribution, ecology, and relationships.

Material y methods

Comparative morphological studies were conducted based on material from several herbaria (A, BCN, BM, CORD, CTES, GH, IEB, MA, MEXU, MO, MVFA, PY, SI, and SP). Protologues and type specimens of similar *Euphorbia* species were studied to clarify the delimitation of the new species. Standard morphological characters used by most previous taxonomic workers in *Euphorbia* were used and described. Information about habit, habitat, and distribution was obtained from specimen labels as well as from the literature. All measurements were taken from dry material, except those of the cyathia, which were rehydrated before being measured.

Results and discussion

Euphorbia guaraniorum P. Carrillo & V.W. Steinmann, **sp. nov.**

Type: Paraguay. Misiones: Isla Yacyretá, dunas de San Miguel, 27°27.341' S, 56°48.977' W, 28-X-2010, A. Bogado, M. Quintana & J. Molero 42102 (holotype, BCN; isotypes, PY, MA). Figs. 1, 2, and 3.

Herba erecta perennis. Radix napiformis usque ad 12 cm longa, 3 cm lata. Caules usque ad 25 cm longi, glabri. Folia caulina alternata, densi disposita, laminae lineares, 1.5-4.5 cm longae, 0.1-0.3 cm latae. Folia ad basim inflorescentia verticillatis, 1.2-3.3 cm longis, 0.3-0.5 cm latis. Cyathiis in pseudodichasiis, folia ad basim cyathorum opposita, ovatis, 5-6.2 mm longis, 2.2-2.6 cm latis. Involucra glabra, 1-1.5 mm longa, 2.5-5 mm lata, nectariis 5-7, reniformis. Lobis ad basim capsulae ca. 1 mm longis, linearis.

Ascending perennial herb from a thick napiform root to 12 cm long, 3 cm wide; stems numerous arising from near the base, to 25 cm high, glabrous, yellowish or reddish brown, with numerous foliar scars at the base, longitudinally striate when dry. Cauline leaves alternate, densely clustered along the stem, glabrous, stipules ca. 0.1 mm long, blade 1.5-4.5 cm long, 0.1-0.3 cm wide, ensiform, margins entire, apex acuminate or acute in some lower leaves, base truncate, venation parallel; leaves subtending the inflorescence verticillate, 1.2-3.3 cm long, 0.3-0.5 cm wide, elliptic;

leaves subtending cyathia opposite, 0.5-0.62 cm long, 0.22-0.26 cm wide, glabrous, ovate, margins entire, sometimes reddish to pinkish, acute at the apex. Cyathia in pseudopleiochasia, 5 or 6 on each branch; peduncle 1.8-5 mm long. Involucre 1-1.5(2) mm long, 1.6-2.5(3) mm wide below the glands, cupuliform, glabrous, lobes diffusely tripartite, marginally ciliate, to 0.4 mm long and wide; glands 5(7), broadly reniform to suborbicular, dark purple, 0.8(1) mm long (tangentially), 0.4-0.5 mm wide (radially), without appendages. Staminate flowers about 20 grouped in 4-5 clusters, pedicels 0.5-1 mm long, filament to 0.3 mm long, bracteoles numerous ca. 1.7 mm long, irregularly laciniate. Gynophore glabrous, elongating in fruit to 3 mm; perianth-like lobes linear, ca. 1 mm long; ovary subglobose, glabrous, 3-lobed; styles 3, ca. 0.8 mm long, fused at the base into a column for about two thirds of their length. Capsule 3-lobed, about 2 mm long, glabrous. Seeds 2.2-2.6 mm long, 1.6-1.7 mm diam, ovate in dorsal view, subrhombic in cross-section, blackish or whitish gray, smooth, ecarunculate.

Phenology, habitat and distribution

Euphorbia guaraniorum flowers from August to November. It is known from a few collections from Yacyretá and Ybycui Islands in southern Paraguay. The new species has been found on sandy hillocks at approximately 80 m elevation in the transition zone between mesophyllous forest and a community locally known as "pajonal", a mesophyllous grassland dominated by *Elyonurus muticus* (Sprengel) Kuntze (Fontana, 2008; 2010 pers. com.). Yacyretá Island was heavily impacted by the construction of the Yacyretá dam. More than two thirds of its original area was flooded, and some populations of *E. guaraniorum* have likely been destroyed. However, the type collection was made in the western portion of the island after the initial flooding, and this area now composes the Yacyretá Island Reserve, a compensatory natural protected area (Quintero, 2007). The presence of *Euphorbia guaraniorum* in fluvial sandy environments in adjacent Argentina (Corrientes and Misiones Provinces) is possible and should be explored.

Etymology. The specific epithet honors the Guaraní indigenous people, who inhabit the area where the new species occurs.

Paratypes

PARAGUAY. **Itapúa:** Isla Yacyretá, 27°27'18" S, 56°47'17" W, 25-X-2003 (fl), M. Peña-Chocarro, J. de Egea & T. Hostettler 1575 (CTES, BM); Isla Yacyretá, 14 Aug 1992 (fl), Pin et al. 198 (MO); Isla Ybycui, cerro Ybycui, 21-V-1993 (sterile), Quintana et al., 221

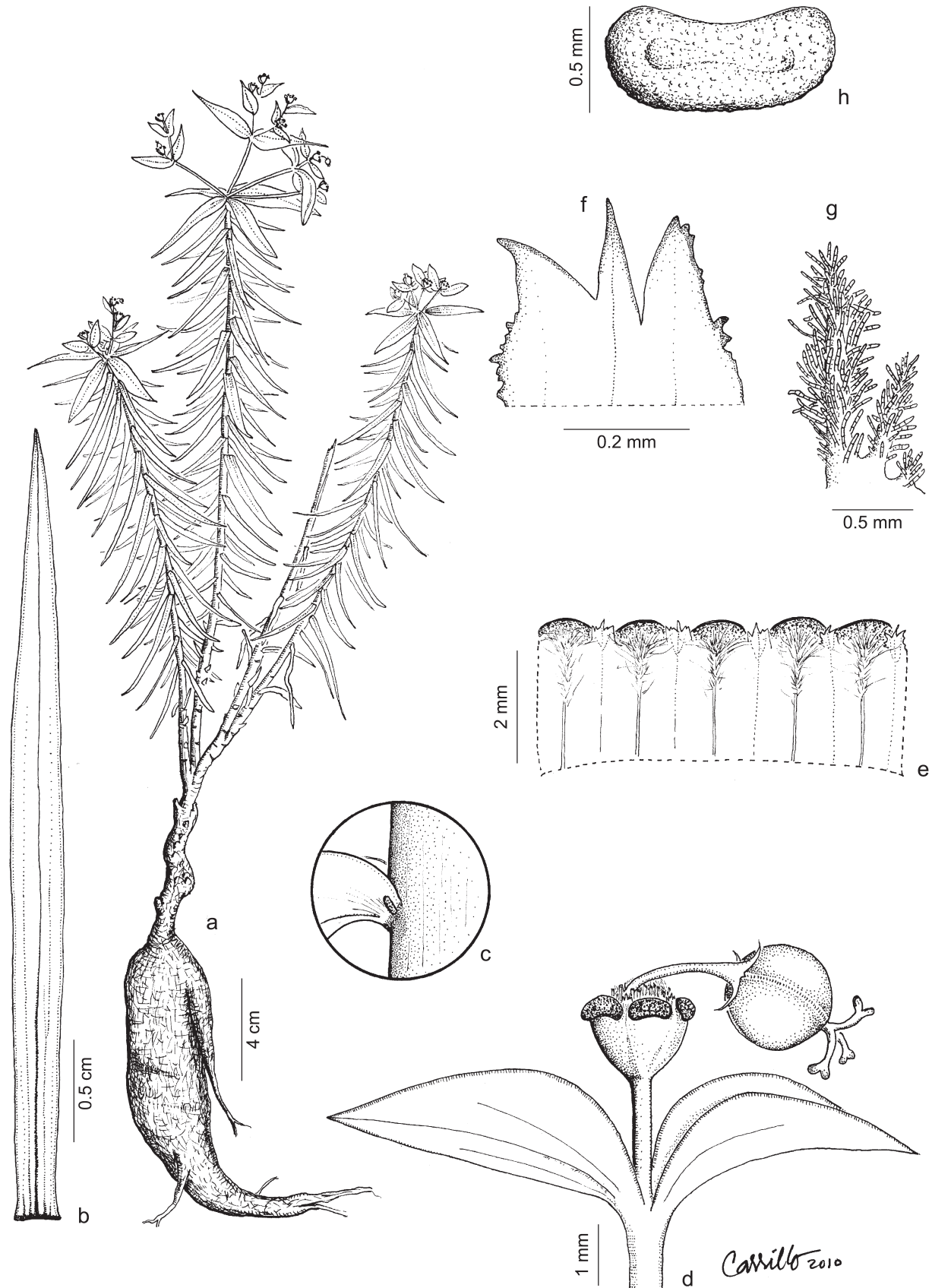


Fig. 1. *Euphorbia guaraniorum*: **a**, habit; **b**, cauline leaf; **c**, detail of the stipule at the base of the leaf; **d**, cyathium; **e**, involucre (split open); **f**, cyathial lobe; **g**, bracteole; **h**, cyathial gland. Based on Pin & al. 198 (MO).



Fig. 2. *E. guaraniorum*: **A**, detail of the inflorescence. The whitish pubescence shown here is not part of the plant, but some kind of insect or spider silk; **B**, habit. Photographs by J. Molero.

(PY). **Misiones:** Isla Yacyretá, pista hacia las dunas de San Miguel, 27°27.343' S, 56°48.284' W, 28-X-2010, A. Bogado, M. Quintana & J. Molero 42103 (BCN, MA, PY); Isla Yacyretá, duna de San Rafael, camino del vertedero de Añacua, 27°24.688' S, 56°41.708' W, 90 m, 28-X-2010, A. Bogado, M. Quintana & J. Molero 42106 (BCN, MA, PY).

Euphorbia guaraniorum is a distinctive species by virtue of its densely arranged ensiform leaves. Its closest relative seems to be *E. portulacoides* L., with which it shares cyathial features such as the campanulate involucre and the thick, broadly reniform, dark-red glands. However they can be separated by the disposition, shape and width of cauline leaves: *Euphorbia portulacoides* has loosely arranged, broadly elliptic cauline leaves that are 5-15 mm wide, whereas *E. guaraniorum* possesses densely arranged, ensiform cauline leaves less than 4.5 mm wide.

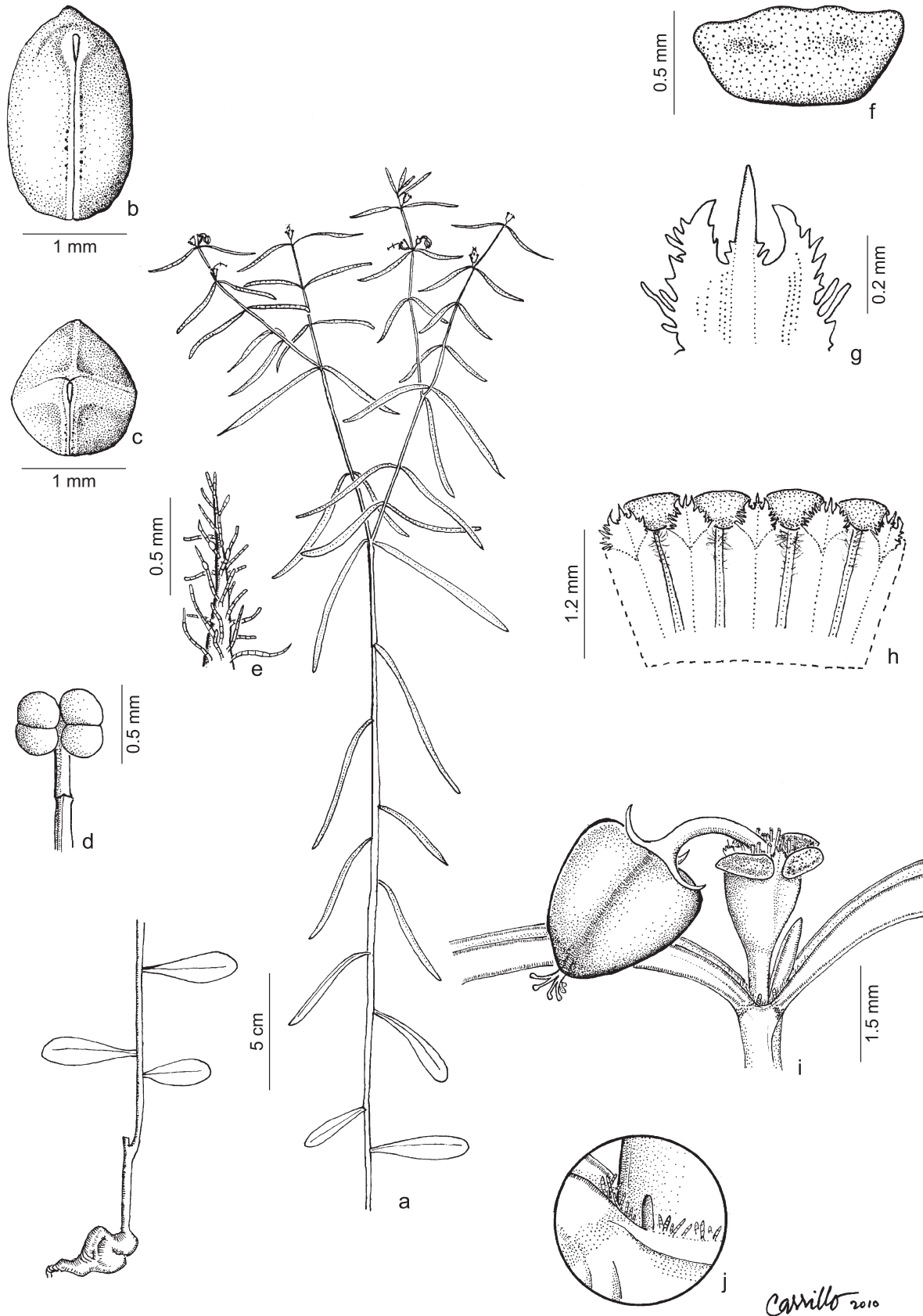
Euphorbia cordeiroae P. Carrillo & V.W. Steinmann, **sp. nov.**

Type: Brazil. Goiás, Alto Paraíso de Goiás, estrada para Colinas, a 1 km da entrada do Parque Nacional da Chapada dos Veadeiros, 20-XI-1987, I. Cordeiro & al. 388 (holotype, SP; isotype, IEB). (Fig. 3).

Herba erecta perennis usque ad 70 cm alta. Folia caulina alternata, glabris praeter pauci pili 0,1-0,2 mm longis ad adaxialis folii basim. Laminae 3-4,7 cm longae, 0,14-1,4 cm latae, ovatae ad caulibus basim, sursum lineatis. Folia ad basim inflorescentia opposita vel subternatis. Cyathiis in pseudopleiochasiis, folia ad

basim cyathorum opposita, linearis, 0,8-1,7 cm longis, 0,1-0,3 mm latis. Involucra campanulata, glabra, ca. 1,3 mm longa, 1 mm lata, nectariis 4, trapeziformis. Lobis ad basim capsulae ca. 0,5 mm longis, linearis. Semina ca. 2,1 mm longa, 1,2 mm diametro, nigricans, levia, ecarunculata.

Ascending perennial herb, to 70 cm tall, stems and leaves glabrous. Stems single, erect. Cauline leaves alternate, opposite or subternate below the inflorescences, glabrous, except for a few multicellular hairs 0.1-0.2 mm long concentrated near the base of the adaxial surface of the blade, stipules ca. 0.15 mm long, petioles ca. 0.5 mm long; blade 3-4.7 cm long, 0.15-1.4 cm wide, obovate in the basal leaves to linear on leaves along the medium and upper part of the plant, margins entire, often reddish; leaves subtending the inflorescence opposite or subternate, similar to cauline leaves; subcyathial leaves slightly smaller and sessile, opposite, linear, blade 0.8-1.7 cm long, 0.1-0.3 cm wide. Cyathia in pseudopleiochasia; peduncle 0.6-1.5 mm long. Involucre 1.3-1.5 mm long and ca. 1 mm wide below the glands, campanulate, glabrous, lobes diffusely tripartite, marginally ciliate, 0.4-0.5 mm long and ca. 0.4 mm wide, glands 4, ca. 0.5 mm long (radially), ca. 1 mm wide (tangentially), trapezoid, greenish brown to purple when dry, appendages absent. Staminate flowers ca. 12, ca. 0.6 mm long, pedicels 0.6-1.7 mm long, bracteoles numerous, ca. 1 mm long, laciniate. Gynophore glabrous, slender, elongating in fruit to 3.5 mm; peri-



Carrillo 2010

Fig. 3. *Euphorbia cordeiroae*: **a**, habit; **b**, seed (longitudinal view); **c**, seed (transverse view); **d**, staminate flower; **e**, bracteole; **f**, cyathial gland; **g**, cyathial lobe; **h**, involucre (split open); **i**, cyathium; **j**, stipule and detail of the pubescence at the base of the leaf. Based on Cordeiro & al. 388 (IEB).

anth-like lobes linear ca. 0.5 mm long; ovary subglobose, 3-lobed; styles 3, ca. 0.8 mm long, fused at the base into a column for about a fifth of their length. Capsule 3-lobed, ca. 3 mm long, 4 mm diam, subglobose to subconical, glabrous, smooth; columella 2.7-3 mm long. Seeds 2.1 mm long, 1.2 mm diam, elliptic in dorsal view, subrhombic in cross-section, grayish black, smooth, ecarunculate.

Phenology, habitat and distribution

Euphorbia cordeiroae flowers from October to March. It is a narrow endemic from the region of Chapada dos Veadeiros, in northeastern Goiás State, where it occurs between 1170 and 1250 m in elevation. According to Munhoz & Proença (1998), the vegetation of the area corresponds to cerrado *sensu stricto*, a savanna-like biome characterized by remarkable floristic diversity with a high concentration of endemic subshrubs and herbs.

Etymology. The specific epithet honors Dr. Inês Cordeiro, a Brazilian botanist from SP who collected the type specimen.

Paratypes

BRAZIL. **Goiás:** Chapada dos Veadeiros, ca. 20 km N of Alto Paraíso, 1250 m, 19-III-1971, *H.S. Irwin et al. 32232* (MO); 24 km NW of Veadeiros, road to Cavalcante, 1200 m, 22-X-1965, *H.S. Irwin et al. 9509* (MEXU).

Euphorbia cordeiroae is a remarkable species due to its tall, slender stem (to 70 cm tall), linear leaves with entire margins, and cyathia arranged in loose pseudopleiochasia. Apparently, its closest relative is *E. stenophylla* Boiss., another narrow-leaved species that also occurs in Brazil. However, *E. stenophylla* possesses shorter stems (to 30 cm tall) and ensiform leaves with denticulate margins. A comparison between these two species is provided in Table 1. Both species are also geographically separated, with *E. cordeiroae* occurring only in the Planalto area of central

Brazil (Goiás) at elevations of 1170-1250 m, and *E. stenophylla* is distributed in southern Brazil (Rio Grande do Sul and Paraná), Argentina, and Uruguay (Subils, 1977; Bacigalupo, 2005), at elevations of 200-1000 m.

Acknowledgements

We thank Julián Molero for locating and collecting additional material of *Euphorbia guaraniorum*, as well as for sharing his photographs with us, and to Ricarda Riina for her kind efforts to secure photographs and specimens. Paul Berry and Inês Cordeiro gave us invaluable comments on the manuscript. The following herbaria provided loans and/or granted permission to examine their collections: A, BCN, BM, CORD, CTES, GH, IEB, MEXU, MA, MO, MVFA, PY, SI, and SP. Mercedes Arbo, Norma Deginani, and Marcela Moré kindly sent us useful information and images of specimens housed in their herbaria. We are also grateful to Fernando Z. Vaz-de-Mello and José Luis Fontana for their assistance in obtaining literature. The latter also shared his knowledge on the vegetation of Yacretá Island. Support for this work was provided by the National Science Foundation Planetary Biodiversity Inventory Grant (DEB-0616533) and funds provide by the Instituto de Ecología, A.C. (account number 20006) and obtained from the Mexican Consejo Nacional de Ciencia y Tecnología (CONACyT) and from the Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO).

References

- Bacigalupo, N.M. 2005. *Euphorbia*. In: Burkart, A. & Bacigalupo, N.M. (eds.), *Flora Ilustrada de Entre Ríos (Argentina) IV: Dicotiledóneas Arquiclamídeas (Dialipétalas), B: Geraniales a Umbelliflorales*. Tomo 6. 109-128. *Colección Científica del INTA*. Buenos Aires.
- Boissier, E. 1862. Subordo Euphorbieae. In: De Candolle, *Prodrómus* 15(2): 3-188. Paris.
- Bruyns, P.V., Mapaya, R.J. & Bruyns, T.H. 2006. A new subgeneric classification for *Euphorbia* (Euphorbiaceae) in southern Africa based on ITS and *psbA-trnH* sequence data. *Taxon* 55: 397-420.
- Esser, H.-J., Berry, P.E. & Riina, R. 2009. EuphORBia: a global inventory of the spurges. *Blumea* 54: 11-12.
- Fontana, J.L. 2008. Vegetación y diversidad de ambientes en la

Table 1. Comparison of salient morphological features of *Euphorbia cordeiroae* and *E. stenophylla*.

| | <i>E. cordeiroae</i> | <i>E. stenophylla</i> |
|----------------|--|---|
| Height | to 70 cm | to 30 cm |
| Cauline leaves | 30-47 mm long, 1.5-14 mm wide | (18)30-40(45) mm long, 1.8-3 mm wide |
| Margins | Entire | Denticulate |
| Stipules | ca. 0.15 mm long | Inconspicuous or absent |
| Lobes | Diffusely tripartite, 0.4-0.5 mm long, ca. 0.4 mm wide | Trapezoid, ca. 0.2 mm long, ca. 0.3 mm wide |
| Distribution | Central Brazil (Goiás) | Southern Brazil (Paraná, Rio Grande do Sul), Uruguay, and Argentina |
| Altitude | 1170-1250 m | 200-1000 m |

- Reserva Natural Isla Apipé Grande, provincia de Corrientes, Argentina. In: Aceñolaza, F.G. (ed.), Temas de la Biodiversidad del Litoral III. INSUGEO, *Miscelanea* 17: 407-424.
- Munhoz, C.B.R. & Proença, C.E.B. 1998. Composição florística do município de Alto Paraíso de Goiás na Chapada dos Veadeiros. *Boletim do Herbario Ezechias Paulo Heringer* 3: 102-150.
- Quintero, J.D. 2007. *Mainstreaming conservation in infrastructure projects: case studies from Latin America*. The World Bank. Washington, D.C. 85 pp.
- Steinmann, V.W. & Porter, J.M. 2002. Phylogenetic relationships in Euphorbiae (Euphorbiaceae) based on ITS and *ndbF* sequence data. *Annals of the Missouri Botanical Garden* 89: 453-490.
- Subils, R. 1977. Las especies de *Euphorbia* de la República Argentina. *Kurtziana* 10: 83-248.
- Webster, G.L. 1967. The genera of Euphorbiaceae in the South-eastern United States. *Journal of the Arnold Arboretum*. 48: 303-430.

Associate Editor: R. Riina

Received: 14-I-2011

Accepted: 25-IV-2011