

## *Exostigma*, a New Genus of Astereae (Compositae) from Southern South America

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**Abstract**—*Conyza notobellidiastrum* and *C. rivularis* are two South American species that recently were transferred to *Podocoma*, based mainly on corolla, style, and cypselae characters. Following evidence obtained from comparative morphological and molecular studies developed in *Podocoma*, Podocominae, and Astereae in general, *Conyza notobellidiastrum* and *C. rivularis* were excluded from *Podocoma*. A new genus, *Exostigma*, is described to include these two species: *Exostigma notobellidiastrum* and *E. rivulare*. Moreover, *C. notobellidiastrum* var. *oblongifolia* is placed in synonymy with *C. primulifolia*, lectotypes are designated for the names *Conyza notobellidiastrum* and *C. rivularis*, and the appropriate new combinations are made.

**Keywords**—Asteraceae, Astereae, *Podocoma*, taxonomy.

*Exostigma* is a new genus from southern South America (Argentina, Bolivia, Brazil, Paraguay, and Uruguay) that includes two species originally treated in *Conyza* Less., *Conyza notobellidiastrum* Griseb. and *C. rivularis* Gardner (Grisebach 1879; Gardner 1845). *Exostigma* is characterized by an herbaceous habit, leaves congested at the base, corymbose arrays of heterogamous, disciform capitula, 2–3-seriate ray florets with exerted styles, nearly filiform white ray corollas with short, distally entire, lobate or bifid limbs, disc florets with linear-elliptic style branches and distally subobtusate sterile appendages, compressed, marginally weakly ribbed and distally attenuate cypselae, and usually a ~~one-seriate~~ pappus of setae.

After their original description, *Conyza notobellidiastrum* and *C. rivularis* were first transferred to *Erigeron* L. (Blake 1917; Cabrera 1937) mainly based on their ray corollas with minute but present limbs. By that time, the distinction between both genera mainly relied on ray limb features (the limbs developed in *Erigeron* vs. reduced or undeveloped in *Conyza*; Bentham 1873) although the boundaries of the two genera were not always clear. Later, *C. notobellidiastrum* and *C. rivularis* were transferred to *Baccharidastrum* Cabrera by Herter (1939) without comments about his decision. More recently, the two species were placed into *Podocoma* Cass. by Nesom and Zanowiak (1994), mainly based on the disc corolla tube ca. 2/3 the total corolla length and opening into an indurate throat, distally subobtusate sterile style appendages of the disc florets, and cypselae distally attenuate or constricted into a neck or beak (vs. disc corolla tube ca. 1/3–1/4 the total corolla length and opening into an indurate throat, distally deltate sterile style appendages of the disc florets, and “truncate” cypselae not constricted distally into a neck or beak in *Conyza*).

Nesom (1994) and Nesom and Robinson (2006 [2007]) placed *Podocoma*, including *P. notobellidiastrum* (Griseb.) G. L. Nesom and *P. rivularis* (Gardner) G. L. Nesom, in the subtribe Podocominae G. L. Nesom (1994) because of its perennial herbaceous habit, 2–3-seriate ray florets, linear-elliptic sterile style appendages of the disc florets, compressed and marginally ribbed cypselae often with a neck or beak (rostrum), and (1-)2–3-seriate pappus bristles, occasionally with a much shorter outer series. However, recent studies show that this subtribe is not monophyletic and indicate that its limits apparently deserve significant re-evaluation (Sancho and Karaman-Castro 2008; Brouillet et al. 2009).

Comparative morphological studies on subtribe Podocominae and molecular analyses of the Podocominae and Astereae

Cass. (Sancho and Karaman-Castro 2008; Brouillet et al. 2009) support the exclusion of *P. notobellidiastrum* and *P. rivularis* from *Podocoma* (Sancho et al. 2010). A new genus of Astereae, *Exostigma* Sancho, is described below to include these two species. Because of its 2–3-seriate ray florets, linear-elliptic sterile style appendages of the disc florets, and compressed, marginally weakly ribbed cypselae, the new genus *Exostigma* is provisionally included in Podocominae (sensu Nesom 1994) until a re-evaluation of the subtribe is carried out.

### MATERIALS AND METHODS

Data were derived from the study of ca. 430 herbarium specimens from CTES, GH, K, LP, MO, MVFA, NY, P, SI, and US, and from field observations. For light microscopy examination, floral and vegetative parts were re-hydrated in water and stained in 2% safranin. For anatomical observations, freehand transverse sections were done. Whenever possible, data from live specimens were added (e.g. involucre shape, corolla and pappus color).

Drawings were made by the author using a Nikon SMZ1000 stereomicroscope and a Nikon Eclipse E200 light microscope with a camera lucida. Terminology follows Freire et al. (2005), Harris and Harris (1994), Hess (1938), Ramayya (1962), and Stearn (1992).

### TAXONOMIC TREATMENT

***Exostigma* Sancho, gen. nov.**—TYPE SPECIES: *Conyza rivularis* Gardner  $\equiv$  *Baccharidastrum rivulare* (Gardner) Herter  $\equiv$  *Podocoma rivularis* (Gardner) G. L. Nesom.

Herbae perennes; caules simplices. Folia subrosulata, alterna, sessilia; laminae simplices, anguste ellipticae vel anguste obovatae vel late obovatae ad suborbiculares; folia distalia reducta. Capitula heterogama disciformia dimorpha pedunculata in capitulescentiis corymbosis congestis terminalibus disposita; involucrum fere cylindricum, phyllariis pauciseriatis gradatim; receptaculum subconvexum alveolatum epaleaceum. Flores radii (2-)3-seriati pistillati; corolla alba fere filiformis, limbo valde brevi, apice integra vel lobata vel bifida; stylus exsertus ramis linearibus. Flores disci hermaphroditi; corolla luteola, breviter 5-lobata, limbo infundibuliformi; antherae thecae basi subauriculatae ad rotundatae, appendice apicali ovata subobtusata; stylus bifidus ramis lineari-ellipticis subacutis in dimidio distali dorsaliter pilosis et in dimidio proximali dorsaliter glabris, superficie stigmatica in duabus lineis marginalibus, appendice sterili 1/3 styli rami, subobtusata. Cypselae compressae costatae ellipticae ad partem distalem

TABLE 1. Comparison of diagnostic morphological characters in *Exostigma*. (Fig. 1).

	<i>Exostigma</i>	<i>Conyza</i> s. l.	<i>Podocoma</i>
Ray floret series	Two or three	Three (two) to several	Two to four
Ray corolla	Nearly filiform, sub-rayed or with dentate or lobate short limbs	Filiform, typical true ray, subrayed or with dentate or lobate short limbs	Typical true ray
Style of ray florets	Exserted	Exserted or included	Included
Disc corolla limbs	Funnelform	Campanulate	Funnelform
Disc floret style sterile appendages	Subobtuse distally	Deltate distally	Subobtuse distally
Cypsela	Attenuate distally	With slightly confluent margins distally	Rostrate
Cypsela (ribs)	Weakly two-ribbed	Weakly two-ribbed	Strongly two-ribbed
Pappus series	One (occasionally two)	One	Two or three

attenuatae; pappi setae 1(–2)-seriate subaequales vel inaequales scabridae albae.

Perennial glabrate to glabrous, somewhat rhizomatous herbs, the roots fibrous; stems single, distally almost leafless, erect, striate. Leaves congested at the base, alternate, sessile; blades simple, herbaceous, narrowly elliptic to narrowly obovate, obovate or broadly obovate to suborbicular, the primary vein medial, single, the margins distally crenate or denticulate; distal leaves reduced, clasping, commonly subauriculate proximally, acute distally. Capitula in terminal, congested corymbose arrays, heterogamous, disciform, dimorphic, shortly pedunculate; involucre nearly cylindrical when live, the phyllaries few-seriate, gradate, the outer linear-ovate, the mid and inner linear-elliptic; receptacle subconvex, epaleate, alveolate. Ray florets (2–)3-seriate, pistillate, the corolla white, nearly filiform, the limb short (1/6 of corolla length), distally entire, lobate, or bifid; style exserted, the branches linear, dorsally glabrous. Disc florets hermaphroditic, the corolla yellowish, the limb funnelform, shortly 5-lobed; anther collar present, the thecae proximally subauriculate to rounded, the apical appendage ovate, subobtuse; style bifid, the branches linear-elliptic, the proximal half dorsally glabrate, the distal half dorsally papillose, the stigmatic surface in two marginal lines, the sterile appendage one third of style branches, apically subobtuse. Cypselae elliptic, compressed, the margins weakly 2-ribbed, distally attenuate, villous to laxly villous, erostrate; pappus of 1(–2) series of setae, the setae subequal or unequal, scabrid, the apex tapering, white when live and whitish when dry, occasionally with few short outer setae.

**Etymology**—The name refers to the exserted style of the pistillate ray florets.

**Distribution**—The genus is known from southern South America, in Argentina, Brazil, Bolivia, Paraguay, and Uruguay.

**Generic Relationships**—In the past, the species of *Exostigma* were variously treated as both *Conyza* and *Podocoma*. Recent molecular studies failed to show close relationships between *Exostigma* and *Podocoma* or *Conyza* (e.g. Brouillet et al. 2009). Selected morphological differences among the three genera are shown in Table 1 and Fig. 1. For comparison purposes, a broad concept of *Conyza* was used (sensu Nesom and Robinson 2006 [2007]), keeping in mind its doubtful generic limits and polyphyletic origin (e.g. Noyes and Rieseberg 1999; Nesom 2008; Brouillet et al. 2009).

The closest generic relationships of *Exostigma* are still uncertain. For instance, based on molecular evidence (nrDNA ITS), *Exostigma* was recovered within a large polytomy including genera distributed around the world and belonging to various subtribes of Astereae (Cross et al. 2002; Brouillet et al. 2009). Other molecular-based studies (nrDNA ITS; Sancho and Karaman-Castro 2008; Karaman-Castro and Urbatsch 2009) showed a closer relationship of *Exostigma* to American genera belonging to various subtribes of Astereae. For instance, *Exostigma* was recovered in a polytomy including *Laenmezia* Cass. and *Podocoma* of Podocominae, *Archibaccharis* Heering and *Baccharis* L. of Baccharidinae, and *Floscaldasia* Cuatrec. and *Parastrephia* Nutt. of Hinterhuberinae. Since the above evidence did not show Podocominae to be monophyletic, *Exostigma* is provisionally placed in this subtribe until its limits are re-evaluated.

#### KEY TO THE SPECIES OF *EXOSTIGMA*

1. Leaf blades broadly obovate to suborbicular ..... 1. *E. notobellidiastrum*  
 1. Leaf blades narrowly elliptic, narrowly obovate, or obovate ..... 2. *E. rivulare*

1. ***Exostigma notobellidiastrum*** (Griseb.) Sancho, comb. nov. *Conyza notobellidiastrum* Griseb., Abh. Königl. Ges. Wiss. Göttingen 24: 177. 1879. *Marsea notobellidiastrum* (Griseb.) Kuntze, Revis. Gen. Pl. 3 (3): 546. 1898. *Erigeron notobellidiastrum* (Griseb.) S. F. Blake, Contr. Gray Herb. 52: 31. 1917. *Baccharidastrum notobellidiastrum* Herter, Revista Sudamer. Bot. 6: 104. 1939. *Podocoma notobellidiastrum* (Griseb.) G. L. Nesom, Phytologia 76 (2): 112. 1994.—TYPE: ARGENTINA. "Tucuman pr. La Cruz," P. G. Lorentz & G. Hieronymus 98 (lectotype, here designated: GOET, photo <https://gwdu64.gwdg.de/pls/herbar/>; isolectotypes: CORD-2 sheets, photo LP!).

Herbs 10–75 cm tall. Proximal leaf blades broadly obovate to suborbicular, abruptly narrowed into a pseudopetiole, 6–20 × 2–7 cm, the base attenuate to cuneate, clasping, the

apex acute to subobtuse, distally crenate-denticulate or crenate-mucronate, glabrous or glabrate; distal leaves reduced, few (1 or 2), oblong, 1.5–9 × 0.5–4 cm. Capitula 4–35 per array, the peduncles 0.5–3 cm long, pubescent, the trichomes minute; involucre 6–8 mm high; phyllaries 3–5-seriate, acute, the margins scarious, whitish when live, pale when dry, dorsally green when live, centrally dark when dry, distally slightly glandular and pubescent (simple biseriate glandular trichomes and few flagellate filiform trichomes), the outer phyllaries 2–2.8 × ca. 0.3 mm, the margins sparsely pilose (relatively long conical trichomes), the mid and inner phyllaries 4.8–5 × ca. 0.5 mm, the margins distally fimbriate. Ray floret corollas 5–5.2 mm long, hairy (simple biseriate glandular trichomes on limb and tube), the limb 0.8–1 mm, distally entire, bilobate, trilobate or bifid, variable within the same capitulum; style branches 0.8–1 mm long. Disc

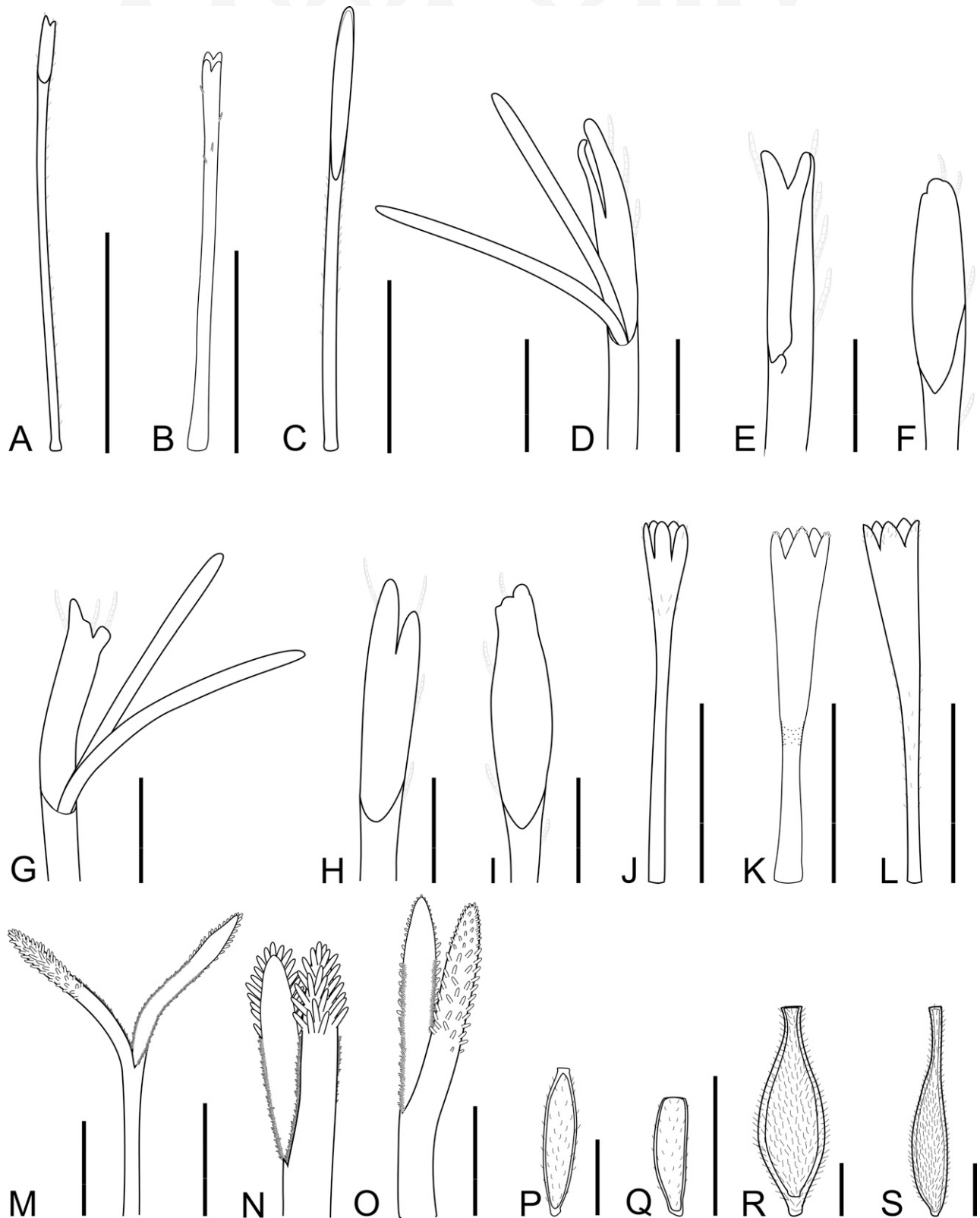


FIG. 1. Comparison of diagnostic morphological characters of *Exostigma*. A-C. Ray corollas. A. *Exostigma notobellidiastrum* (Montes 4021, LP) B. *Conyza sumatrensis* var. *leiotheca* (S. F. Blake) Pruski & Sancho (Cabrera & Frangi 20594, LP). C. *Podocoma hirsuta* (Hook. & Arn.) (Sancho & Bonifacino 73, LP). D. Pistillate ray floret, *Exostigma notobellidiastrum* (Grüner 861, LP). E, F. Limbs of ray corollas of *Exostigma notobellidiastrum* (Montes 4021, LP). G. Pistillate ray floret, *Exostigma rivulare* (Reitz & Klein 7504, NY). H, I. Limbs of ray corollas of *Exostigma rivulare* (Reitz & Klein 7504, NY). J-L. Disc corollas. J. *Exostigma rivulare* (Reitz & Klein 7504, NY). K. *Conyza sumatrensis* var. *leiotheca* (Cabrera & Frangi 20594, LP). L. *Podocoma spegazzini* Cabrera (Sancho & Bonifacino 93, LP). M-O. Styles of disc florets. M. *Exostigma notobellidiastrum* (Rodrigo 2020, LP). N. *Conyza bonariensis* (L.) Cronquist (Pochettino 2, LP). O. *Podocoma hieracifolia* (Poir.) Cass. (Cabrera 10275, LP). P-S. Cypselsae. P. *Exostigma notobellidiastrum* (Montes 4021, LP). Q. *Conyza bonariensis* (Pochettino 2, LP). R. *Podocoma bellidifolia* Baker (Dusén s. n., S). S. *Podocoma hieracifolia* (Schulz 256, LP). Scale bars: A = 2.5 mm; B, C, K = 2 mm; D-I, O = 0.5 mm; J = 2.5 mm; L = 4 mm; M = 0.6; N = 0.25 mm; P-S = 1.5 mm.

floret corollas 5.5–6 mm long, hairy (simple biseriate glandular trichomes on tube and lobes), the lobes 0.4–0.5 mm long; anthers 0.8–1 mm long; style branches 1–1.2 mm long, the sterile appendages 0.3–0.4 mm long. Cypselae 2–3 mm long, sparsely villous (typical twin hairs); pappus 6–8 mm long, the setae subequal; short outer setae, when present, 0.2–0.3 mm. Figure 2.

[E2]

**Leaf Anatomy**—The specimens studied have amphistomatic blades. The cuticle is relatively thin and striate. The epidermis consists of a single layer of large polygonal cells. The mesophyll is dorsiventral with one or two palisade layers. The palisade cells are short and compact, more or less strongly stained, and distinct from the spongy tissue, which has more irregular, laxly arranged larger cells. Medial vascular bundles are without sclereids. Secretory cavities have been observed associated with the vascular bundles (Fig. 3A). Each secretory cavity is an intercellular space surrounded by epithelial cells, as described in other Compositae (e.g. Curtis and Lersten 1986; Simón et al. 2002; Andreucci et al. 2008; Sancho et al. 2010). Short conical trichomes and small flagellate filiform trichomes (with short distal cells), when present, are scattered on both faces (Fig. 2B and C).

[E3]

**Phenology**—Flowering throughout the year.

**Chromosome Number**— $n = 9$  (Hunziker et al. 1989, sub nom. *Conyza notobellidiastrum*).

**Distribution and Habitat**—Northern Argentina, south-central Bolivia, southeastern Brazil, eastern Paraguay, and Uruguay (Fig. 4); 0–2,000 m, in semi-shade of forest margins, in shade of forest understory, or on river banks among rocks in wet soil. It is apparently common.

[E4]

**Notes**—After analyzing the type specimen of *Conyza notobellidiastrum* var. *oblongifolia* Griseb. (*P. G. Lorentz & G. Hieronymus* 1026, GOET, photo at <https://gwdu64.gwdg.de/pls/herbar/>) it is clear that it does not belong to *Conyza notobellidiastrum* but to *Conyza primulifolia* (Lam.) Cuatrec. & Lourteig.

There are three well preserved syntypes of *Conyza notobellidiastrum* at GOET; the syntype *P. G. Lorentz & G. Hieronymus* 98 is chosen here as the lectotype as it is the most complete specimen. There are two sheets of *P. G. Lorentz & G. Hieronymus* 98 at CORD. The label of one of them indicates “22/28. XII 1872, Tusca y Taruca-Pampa cerca de La Cruz; Prov. de Tucuman.” The label information of the second duplicate is identical but differs in date (“22/28 XII 1878”), which was overwritten on the label changing an 8 into a 2.

The other two syntypes of *Conyza notobellidiastrum* are *P. G. Lorentz & G. Hieronymus* 646 from Bolivia (GOET, photo <https://gwdu64.gwdg.de/pls/herbar/>, Tarija, “cuesta S<sup>a</sup> Luisina bei S<sup>n</sup> Luis, 12.VI.73”; isosyntypes: CORD-2 sheets, photos LP) and *Balansa* 804a from Paraguay (GOET, photo at <https://gwdu64.gwdg.de/pls/herbar/>, “Luque, dans le bois, 20 août 1876”; isosyntype: P.) label of *P. G. Lorentz & G. Hieronymus* 646 at CORD indicates “Cuesta entre San Luis y S<sup>n</sup> Diego; Prov. de las Salinas/ 12.VI.1873.”

The specimens *Balansa* 804 kept at, for instance, K or P are not regarded here as type material. The protologue clearly indicates “*Balansa* 804a” as the type. Indeed, both specimens, i.e. *Balansa* 804 and 804a have different collecting places and dates.

**Representative Specimens Examined**—ARGENTINA. Catamarca: Paclín, 16 Aug 1942, *Rodrigo* 3180 (LP). Chaco: Sargento Cabral, 15 Nov 1998, *Delucchi* 1973 (LP); Las Palmas, Oct 1917, *Jørgensen* 2033 (SI, US); cerca del Tirol, 4 May 1931, *Meyer* 493 (SI); Colonia Benítez, Oct 1930, *Schulz* 75

(CTES, LP, MO); Margarita Belén, Aug 1967, *Schulz* 16002 (CTES). Corrientes: Curuzú Cuatiá, 19 Oct 1977, *Ahumada* et al. 519 (CTES, LP); Bella Vista, 16 Jun 1970, *Carnevali* 2181 (CTES); San Cosme, 18 Feb 1972, *Carnevali* 2858 (CTES); Berón de Astrada, 28 Aug 1982, *Carnevali* 5798 (CTES); Capital, 15 Aug 1974, *Cristóbal* et al. 1133 (LP); Estancia San Francisco, 2 Dec 1970, *Krapovickas* et al. 16870 (LP); Santo Tomé, 20 Sep 1974, *Krapovickas* et al. 25905 (CTES); Mburucuyá, 6 Sep 1949, *Pedersen* 421 (K, LP, NY, P, US); Empedrado, 14 Aug 1954, *Pedersen* 2770 (CTES, K, LP, MO, P, US); Itatí, 21 Apr 1960, *Pedersen* 5526 (K, LP, P, US); San Luis del Palmar, 26 Sep 1946, *Quarín & Tressens* 1412 (LP); Riachuelo, 13 Feb 2004, *Sancho* 68 (LP); Lomas de Vallejos, 29 Aug 1973, *Schinini & Quarín* 6991 (CTES); Mercedes, 17–24 Oct 1975, *Schinini* et al. 11882 (CTES). Formosa: Guayculec, Jan 1919, *Jørgensen* 3146 (MO, SI); Pilcomayo, Estancia Riacho Negro, 17 Oct 1947, *Morel* 3924 (LP). Jujuy: Ledesma, 3 Nov 1999, *Ahumada & Agüero* 8542 (CTES); Quebrada de Yala, 25 Jul 1963, *Cabrera* 15900 (LP); Abra de los Morteros, 26 Oct 1974, *Cabrera* et al. 25568 (LP); road to Valle Grande, 13 Sep 1976, *Cabrera* 27836 (K, SI); Santa Bárbara, 14 Dec 1962, *de la Sota* 3045 (LP); Ledesma, 21 Sept 1997, *Dematteis & Seijo* 825 (CTES); Capital, 5 Oct 1938, *Eyerdam & Beetle* 22461 (K); El Cármen, 28 Dec 1962, *Fabris & Tello* 3692 (LP); Serranía de Calilegua, 16 Oct 1963, *Fabris* 4458 (LP); Abra de Cañas, 8 Nov 1974, *Krapovickas* et al. 26613 (CTES); camino de Lozano a Tiraxi, 3 Nov 1974, *Schinini* et al. 10219 (CTES, LP, SI). Misiones: Monte Loreto, Aug 1927, *Burkart* 1356 (SI); Mburucuyá, 11 Oct 1954, *Burkart* 19443 (SI); Apóstoles, 25 Aug 1978, *Cabrera* et al. 29493 (SI); Posadas, 27 Dec 1907, *Ekman* 1083 (LP); Candelaria, Loreto, 23 Oct 1932, *Grüner* 861 (LP); San Pedro, 5 Jun 2002, *Keller* 1873 (CTES); General Belgrano, 5 Jan 1968, *Krapovickas & Cristóbal* 13722 (CTES, LP); Caá-Guazú, Oct 1940, *Mangieri* 2 (LP); Caniguás, Puerto Rico, 27 May 1949, *Montes* 4021 (LP); Iguazú, 28 Oct 1950, *Montes* 10286 (LP); El Dorado, 9 Jul 1972, *Schinini* 4913 (CTES); San Ignacio, 4 Sep 1946, *Schwarz* 3317 (K); Guaraní, 2 Sep 1999, *Tressens* et al. 6388 (GH); Libertador General San Martín, 28 Jul 1987, *Vanni* et al. 925 (K, CTES); Iguazú, Salto Uruguay, 12 May 1979, *Zuloaga* et al. 800 (SI). Salta: Santa Victoria, 27 Sep 1998, *Ahumada & Agüero* 8170 (CTES); Coronel Moldes, 14 Nov 1942, *Burkart* 13283 (LP, SI); Capital, San Lorenzo, 28 May 1933, *Cabrera* 3074 (LP); Metán, 2 Jun 1933, *Cabrera* 3088 (LP); Orán, 15 Jul 1937, *Cabrera* 4216 (LP); Cerros del Río Itaú, 29 Oct 1938, *Eyerdam & Beetle* 22754 (K, MO); Salazuti, 4 Jul 1944, *Huidobro* s. n. (NY); El Piquete, Jul 1934, *Ragonese* 163 (LP); Orán, 1 Nov 1997, *Schinini* et al. 33094 (CTES); Tartagal, 1944, *Schulz* 5290 (CTES); Los Yacones, 22 Sep 1980, *Zardini* 1201 (LP, MO). Santa Fé: General Obligado, 19 Oct 1987, *Blanchoud* 2373 (CTES); Lanteri, 1 Feb 1936, *Job* 1239 (LP); Villa Guillermina, 21 Sep 1939, *Meyer* 2249 (LP). Tucumán: Tafí, 22 Jan 1933, *Burkart* 5206 (LP); Monteros, 17 Nov 1997, *Dematteis & Seijo* 737 (CTES); Chilingasta, 14 Oct 1966, *Fabris* 6556 (LP); Horco Molle, 10 Oct 1966, *Gautier* 7708 (LP); Sierra del Ascocchinga, 18 Oct 1948, *Humbert* 20932 (P, US); Burruyacú, Dec 1916, *Jørgensen* 50 (MO, SI); Garabatal, 30 Nov 1944, *Olea* 32 (NY); Parque Aconquija, 4 Nov 1952, *Petersen & Hjerting* 558 (MO, NY); Tafí, Sierra de San Javier, 10 Dec 1938, *Rodrigo* 2020 (LP); road Tucumán-Catamarca, 14 Jan 1962, *Solbrig* 3372 (NY); cumbre a Taficillo, 13 Mar 1928, *Venturi* 5917 (SI, US).

BOLIVIA. Chuquisaca: Tomina, 9 Mar 1998, *Wood* et al. 13313 (K). Santa Cruz: Cordillera, 8 Jan 1982, *de Michel* 116 (LP); Florida, 21 Dec 1991, *Nee* 42230 (NY). Tarija: O'Connor, 2–3 Oct 1983, *Solomon* 11014 (MO, NY, SI); Arce, 14–16 Oct 1983, *Solomon* 11283 (CTES, MO, NY); between Emboruzú and La Mamora, 19 Oct 1980, *Zuloaga* et al. 1076 (LP).

BRAZIL. Paraná: José dos Pinhães, 25 Sep 1952, *Hatschbach* 2827 (SI); Palmas, 19 Sep 2001, *Hatschbach* et al. 72388 (CTES); Ypiranga, 2 Nov 1934, *Reiss* 119 (NY); “Nord-Paraná”, 24 Mar 1937, *Tessman* 6129 (K). Rio de Janeiro: Serra da Estrela, without collector (Herb. Glaziou 2621a, P). Rio Grande do Sul: São Leopoldo, Jun 1940, *Eugenio* 320 (NY); Canoas, 16 Feb 1949, *Irmão Ligorio Alfonso* 30 (K, LP, MO, P); Nova Prata, 26 Jul 1998, *Molon* et al. UCS 12623 (NY); Pareci, 26 Nov 1950, *Rambo* 49238 (K, P); Passo do Socorro, 26 Dec 1951, *Rambo* 51520 (NY); Montenegro, 8 Sep 1949, *Selmen* 3797 (CTES); Caçapava do sul, 20 Sep 1986, *Wasum* et al. 1945 (NY); Flores da Cunha, 9 Oct 1989, *Wasum* 6264 (NY); São Francisco de Paula, 29 Oct 1994, *Wasum* et al. 10280 (NY). Santa Catarina: Brusque, 27 Oct 1947, *Klein* C 1908 (LP); Lebon Regis, 19 Sep 1962, *Klein* 3121 (LP); Curitiba, 17 Sep 1962, *Klein* 3139 (LP); Bom Retiro, 25 Oct 1962, *Reitz & Klein* 5447 (LP); Novo Horizonte, 20 Mar 1959, *Reitz & Klein* 8709 (LP); Santa Cecilia, 25 Oct 1962, *Reitz & Klein* 13454 (LP); Lajes, 30 Oct 1962, *Reitz & Klein* 13928 (LP); Campos Novos, 12 Sep 1963, *Reitz & Klein* 16165 (LP); Abelardo Luz, 23 Oct 1964, *Smith & Klein* 12827 (LP); Agua Doce, 4 Dec 1964, *Smith & Klein* 13506 (LP, NY). São Paulo: without locality, 1816–1821, *Voyage d'Auguste de Saint-Hilaire* 1107 *Catal.* C2 1229 (P). Without precise locality: South Brazil, without date, *Sello* s. n. (K).

PARAGUAY. Alto Paraná: Reserva Biológica Itabo, 9 Oct 1990, *Schinini & Marmorini* 26986 (CTES). Amambay: Parque Nacional Cerro



FIG. 2. *Exostigma notobellidiastrum* (Griseb.) Sancho. A. Plant. B, C. Leaf trichomes. B. Conical trichome. C. Flagellate filiform trichome. D. Capitulum. E. Outer phyllary. F. Inner phyllary. G-I. Phyllary trichomes. G. Flagellate filiform trichome. H. Conical trichome. I. Simple biseriolate glandular trichome. J. Ray corolla. K. Simple biseriolate glandular trichome of ray corolla. L. Style of ray floret. M. Disc corolla. N. Simple biseriolate glandular trichome of disc corolla. O. Stamen of disc floret. P. Style of disc floret. Q. Cypsela with pappus. R. Twin hair of cypsela. S, T. Pappus setae. S. Seta base. T. Seta apex [A-J, L-N, P, Q, *Montes 4021* (LP); K, O, R-T, *Montes 4021* (LP)]. Scale bars: A = 25 mm; B = 60  $\mu$ m; C = 30  $\mu$ m; D-F, J, M, Q = 2.5 mm; G, H = 65  $\mu$ m; I, N = 30  $\mu$ m; K = 64  $\mu$ m; L = 0.8 mm; O = 0.5 mm; P = 1 mm; R = 80  $\mu$ m; S, T = 75  $\mu$ m.

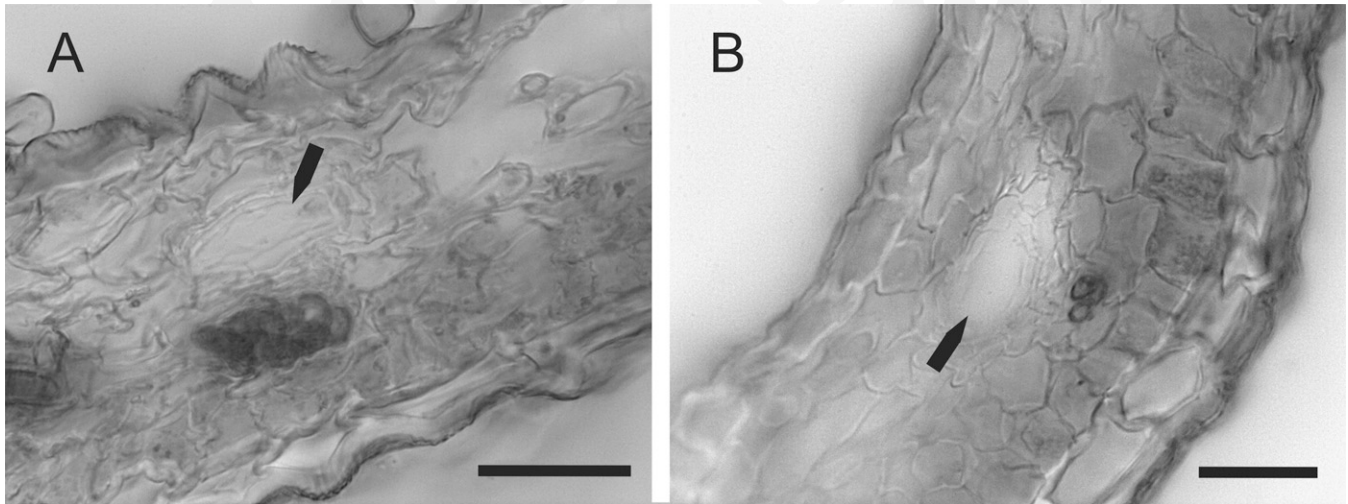


FIG. 3. Leaf anatomy of *Exostigma*. Cross section showing secretory cavities at the base of vascular bundle. A. *E. notobellidiastrum*. B. *E. rivulare*. (A. Cristobal et al. 1133, LP. B. Smith & Klein 7504, LP). Scale bars: A = 22  $\mu$ m; B = 20  $\mu$ m.

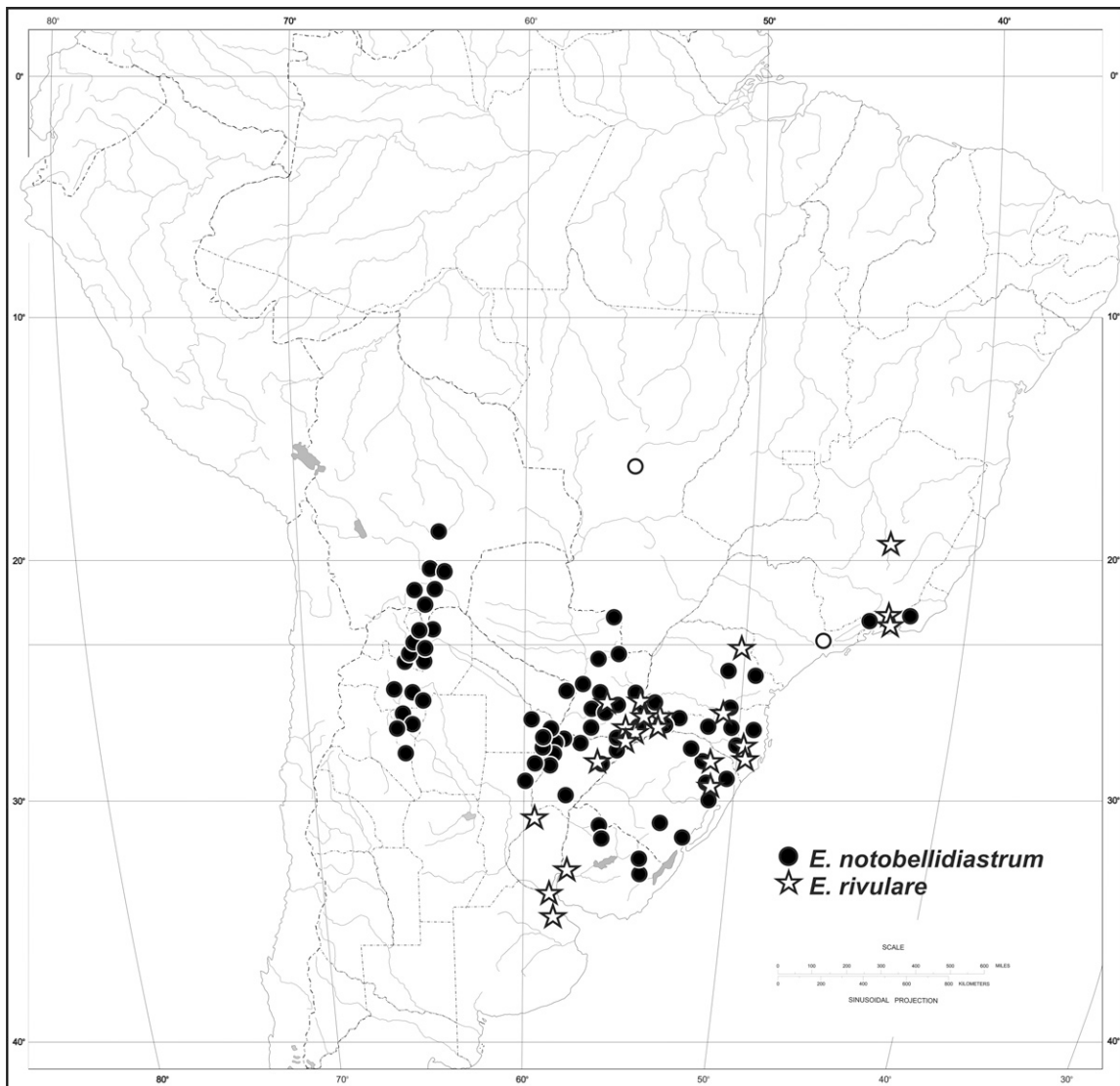


FIG. 4. Map of distribution of *Exostigma*. White circle: *E. notobellidiastrum* imprecise locality [i.e. Mato Grosso (specimen not seen; state cited in Teles and Borges 2010), São Paulo (*Voyage d'Auguste de Saint-Hilaire 1107 Catal. C2 1229, P*)].



FIG. 5. *Exostigma rivulare* (Gardner) Sancho. A. Plant. B, C. Leaf trichomes. B. Flagellate filiform trichome. C. Conical trichome. D. Capitulum. E. Outer phyllary. F. Inner phyllary. G, H. Phyllary trichomes. G. Flagellate filiform trichome. H. Simple biseriata glandular trichome. I. Ray corolla. J. Glandular biseriata trichome of ray corolla. K. Style of ray floret. L. Disc corolla. M. Simple biseriata glandular trichome of disc corolla. N. Stamen of disc floret. O. Style of disc floret. P. Cypsela with pappus. Q, R. Twin hairs of cypsela. S, T. Pappus setae. S. Seta base. T. Seta apex [A, D, *Martinelli & Maas* 3296 (NY); B, C, E-T, *Reitz & Klein* 7404 (LP)]. Scale bars: A = 25 mm; B, H, M = 40  $\mu$ m; C = 100  $\mu$ m; D, E, F, I, L, P = 2.5 mm; G = 60  $\mu$ m; J = 50  $\mu$ m; K, N, O = 0.8 mm; Q, R = 45  $\mu$ m; S, T = 140  $\mu$ m.

Corá, 7 Jan 1988, *Zardini et al.* 4152 (NY). Caazapá: Yuty, Tres de Mayo, 10 Sep 1987, *Zardini et al.* 3009 (MO). Canindeyú: Colonia Fortuna, 8 May 1974, *Arenas* 696 (CTES). Central: Luque, 1876, *Balansa* 804a (P); Lago Ypacaray, 1913, *Hassler* 11882 (K, NY); Jardín Botánico, Aug 1942, *Paretti & Rojas* 9771 (LP). Cordillera: Compañía Río Negro, 7 Jul 1990, *Zardini & Velázquez* 21742 (MO). Guaira: "à l'Est de la cordillère de Villa-Rica," 21 Sep 1874, *Balansa* 804 (K, P); Villarica, without date, *Jørgensen* 3488 (LP, NY, US); Iturbe, 22 Aug 1952, *Montes* 12512 (LP); Cordillera de Ybytyruzú, 14 Jul 1989, *Zardini & Velázquez* 13527 (MO). Neembucú: Humaitá, 9 Nov 1978, *Bernardi* 18465 (MO, NY). Paraguari: Parque Nacional Ybycuí, 15 Sep 1980, *Fernández Casas & Molero* 3633 (MO, NY); Macizo Acahay, 30 Jun 1988, *Zardini & Florentin* 7072 (MO, NY, US). San Pedro: San Pedro, 14 Jul 1955, *Woolston* 538 (NY); Linea Caraguatay, 3 Oct 1987, *Zardini & Benitez* 3381 (NY). Without precise locality: cordillera Centralis, Dec 1900, *Hassler* 6600 (K, LP, P); without locality, Sep 1892, *Kuntze s. n.* (NY).

URUGUAY. Cerro Largo: Gruta de la Gotera, 2 Mar 1972, *del Puerto & Marchesi* 11119 (LP). Rivera: Arroyo Lunarejo, 19 Feb 2004, *San Bonifacio* 89 (LP); same locality and date, *del Puerto & Marchesi* 9 MVFA; Tacuarembó: Gruta de los Cuervos, without date, *Chebaroff* 8999 (LP). Treinta y Tres: Quebrada de los Cuervos, 12 Nov 1965, *del Puerto & Marchesi* 5479 (LP).

2. *Exostigma rivulare* (Gardner) Sancho, comb. nov. *Conyza rivularis* Gardner, in *London J. Bot.* 4: 124. 1845. *Baccharidastrum rivulare* (Gardner) Herter, in *Revista Sudamer. Bot.* 6: 104. 1939. *Podocoma rivularis* (Gardner) G. L. Nesom, *Phytologia* 76 (2): 112. 1994.—TYPE: BRAZIL. Rio de Janeiro: On rocks in the bed of the Rio Paquequer in the Organ Mountains, fl. March. [1837], *G. Gardner* 520 [sub 377— see following note] (lectotype, BM, here designated; isolectotypes: K!, NY!, P!).

*Erigeron gardneri* Cabrera, *Notas Mus. La Plata, Bot.* 16, 2: 177. 1937, non *E. rivulare* Sw., *Prodr. Veg. Ind. Occ.*: 113. 1788, nec Spreng, ex DC., *Prodr.* 5: 288. 1836.

Herbs 10 to ca. 40 cm tall. Proximal leaf blades narrowly elliptic, narrowly obovate to obovate, proximally gradually narrowed, 5–15 × 1–3 cm, the base attenuate, clasping, the apex acute, distally denticulate, glabrous or glabrate; distal leaves reduced, few (1 or 2), oblong, ca. 1.5 × 0.4–1.8 cm. Capitula 4–30 per array, the peduncles 0.5–2 cm long, pubescent, the trichomes minute; involucre 6–7 mm high; phyllaries 3–4-seriate, acute, the margins scarios, whitish when live, pale when dry, dorsally green when live, centrally dark when dry, distally slightly glandular and pubescent (simple biseriate glandular trichomes and few flagellate filiform trichomes), the outer phyllaries ca. 3 × 0.5 mm, the margins sparsely pilose (relatively long conical trichomes), the mid and inner phyllaries 5–5.2 × ca. 0.3 mm, the margins distally fimbriate. Ray floret corollas 4–4.5 mm long, densely hairy (simple biseriate glandular trichomes on limb and tube), the limb ca. 0.6 mm, distally entire, bilobate, trilobate, or bifid, variable within the same capitulum; style branches 0.6–0.7 mm long. Disc floret corollas 4.5–5 mm long, hairy (simple biseriate glandular trichomes on throat and lobes), the lobes 0.3–0.5 mm long; anthers ca. 0.7 mm long; style branches 0.7–0.8 mm long, the sterile apical appendages 0.2–0.3 mm long. Cypselae 2.5–3 mm long, villous (typical twin hairs and septate twin hairs); pappus 4.5–5 mm long, the setae subequal; short outer setae, when present, 0.2–0.3 mm. Figure 5.

**Leaf Anatomy**—The studied specimens have hypostomatic blades. The anatomical features of leaves of *Exostigma rivulare* are similar to those of *E. notobellidiastrum* (Fig. 3B). Short conical and flagellate filiform trichomes are scattered on both faces (Fig. 5B and C).

**Phenology**—The species has been collected flowering throughout the year.

**Distribution and Habitat**—The species is known from northeastern Argentina, east-central to southeastern Brazil, eastern Paraguay, and Uruguay; 0–1,200 m, in shade, in forest understorey, or on riverbanks on rocks and wet soils. It has been indicated as common.

**Notes**—Gardner's collection number indicated in the original publication is 377. However, in Gardner's "Catalogue of Brazilian Plants" (unpublished manuscript that numbers his collections to just over 6,100) three specimens are referred to by that number (D. J. N. Hind, pers. comm.); two of them belong to Melastomataceae and one to Compositae. In another unpublished manuscript catalogue of Gardner's Brazilian collections (by Hiern, at BM), the number 377 refers to the two specimens of Melastomataceae. In the original publication (Gardner 1845) there is a note by the editor (Bentham) indicating that the plant described by Gardner has collection number "502" in his set. This is, without a doubt, either Bentham's error or a typographical error since, in Gardner's 'Catalogue ...', the number 502 is for an *Adenostemma* (Compositae), a taxon different from *Conyza*. It is clear that Gardner's description of *Conyza rivularis* belongs to a composite that coincides with his collection number 520. Because of the problems highlighted above, lectotypification of Gardner's name is required for nomenclatural clarity of this species.

The labels of the specimens of *Gardner* 520 vary with respect to the collection date. There are two type specimens at K, one indicates "Jany. 1837" and the other seemingly "1838"; the specimen at P has no collection date whereas the NY specimen indicates "1837." However, according to Gardner (1849), the collections from the Organ Mountains were undertaken mainly during first half of 1837 and briefly in 1841.

*Exostigma rivulare* and *E. notobellidiastrum* are similar species and differ only by leaf blade shape. Indeed, intermediates between the two blade shapes are commonly observed (e.g. some specimens from Paraná, Brazil, from Caazapá, Paraguay, and from Tacuarembó, Uruguay). When the type specimens are studied, the differences in leaf shape of both species are evident, but this becomes less clear when analyzing additional material (Fig. 6). Broad leaves have been observed in Argentine (particularly in those from Punta Lara, Buenos Aires), Uruguayan [e.g. *Arechavaleta* 4025 (K) and

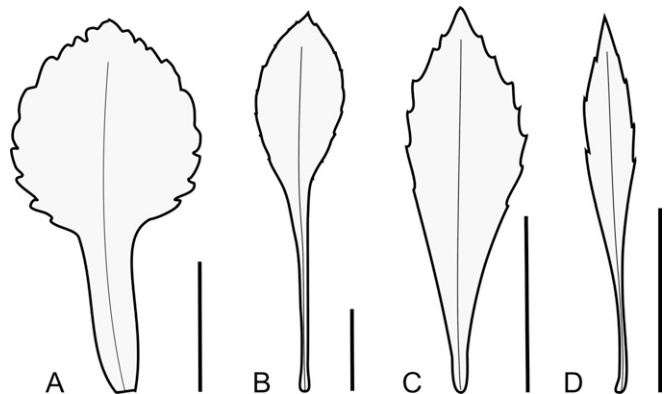


FIG. 6. Variation in leaf blade. A, B. *E. notobellidiastrum*. C, D. *Exostigma rivulare*. Scale bar: 3 cm.



*Fruchard s. n.* (P), both from Fray Bentos] as well as on some Brazilian specimens of *E. rivulare*, casting doubt upon identification of the specimens. Among the studied collections, narrower leaves were found in specimens from Rio de Janeiro and Santa Catarina states in Brazil. Given the weak differences between the two species, it could be possible to regard them as a single species, but the traditional usage of them as distinct is followed here.

**Representative Specimens Examined**—ARGENTINA. Buenos Aires: Punta Lara, Nov 1937, *Abbiatti s. n.* (LP 050420); Punta Lara, 10 Feb 1929, *Burkart 3184* (SI); Paraná de las Palmas, 10 Feb 1932, *Burkart 7120* (SI); Punta Lara, 8 Dec 1927, *Cabrera 131* (LP); Paraná de las Palmas, 18 Jan 1931, *Cabrera 1617* (LP); Punta Lara, Sep 1947, *Cabrera 10392* (SI); Paraná de las Palmas, 26 Nov 1938, *Eyerdam & Beetle 23262* (K); Reserva Provincial Punta Lara, 29 Nov 2003, *Sancho 64* (LP). Corrientes: Santo Tomé, 8 Feb 1972, *Krapovickas et al. 21378* (CTES). Entre Ríos: La Paz, 8 Dec 1986, *Guaglianone et al. 322* (SI). Misiones: El Dorado, 10 Dec 1943, *Burkart 14657* (LP, SI); Loreto, 5 Sep 1931, *Grüner 979* (LP); Parque Nacional Iguazú, 5 Jan 2004, *Iharlegui 3* (LP); Guaraní, 31 Aug 1999, *Tressens et al. 6053* (NY); Guaraní, 31 Aug 1999, *Tressens et al. 6339* (GH, NY); Cainguás, 12 Oct 1975, *Zardini et al. 778* (LP, SI).

BRASIL. Minas Gerais: 1816–1821, *Voyage d'Auguste de Saint-Hilaire s. n. Catal. B1 1083* (P); *Voyage d'Auguste de Saint-Hilaire s. n. Catal. B1 1753* (P). Parana: Jaguariáiva, 23 Oct 1910, *Dusén 10744* (US). Rio de Janeiro: Serra do Frade, without date, *Carauta 1200* (US); Terezópolis, 20 Oct 1977, *Martinelli & Maas 3296* (K, NY). Rio Grande do Sul: Caxias do Sul, 5 Mar 2000, *Kegler 744* (MO, NY). Santa Catarina: Salto do Rio Vacariano, 9 Nov 2001, *Hatschbach et al. 72523* (CTES); Valões, 15 Sep 1962, *Klein 3043* (LP); Novo Horizonte, 24 Oct 1958, *Reitz & Klein 7504* (LP, NY, US); São Miguel d' Oeste, Peperi, 21 Oct 1964, *Smith & Reitz 12792* (LP, MO, P). Without precise locality: 1844, *Weddell 70bis?* (P 109).

PARAGUAY. Alto Paraná: Estancia Río Bonito, 30 Aug 1994, *Zardini & Vera 40801* (MO). Caazapá: Tavai, 29 Oct 1988, *Soria 2410* (CTES). Guairá: Cordillera Ybytyruzú, 28 May 1989, *Zardini & Velázquez 12362* (MO).

URUGUAY. Río Negro: Fray Bentos, Feb 1877, *Arechavaleta 4025* (K); 16 Feb 1877, *Fruchard s. n.* (P).

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#### LITERATURE CITED

- Andreucci, A. C., D. Ciccarelli, I. Desideri, and A. M. Pagni. 2008. Glandular hairs and secretory ducts in *Matricaria chamomilla* (Asteraceae): morphology and histochemistry. *Annales Botanici Fennici* 45: 11–18.
- Benthham, G. 1873. Compositae. Pp. 163–533 in *Genera plantarum* vol. 2, eds. G. Benthham and J. D. Hooker. London: Lovell Reeve and Co.
- Blake, S. F. 1917. New and noteworthy Compositae, chiefly Mexican. *Contributions from the Gray Herbarium of Harvard University ser. 2* 52: 16–59.
- Brouillet, L., T. K. Lowrey, L. Urbatsch, V. Karaman-Castro, G. Sancho, S. J. Wagstaff, and J. C. Semple. 2009. Phylogeny and evolution of the Astereae (Asteraceae). Pp. 589–629 in *Systematics, evolution, and biogeography of the Compositae*, eds. Funk V. A., A. Susanna, T. F. Stuessy, and R. J. Bayer. Vienna: IAPT.
- Cabrera, A. L. 1937. Compuestas nuevas o interesantes. *Notas del Museo de La Plata, Botánica* 16 2: 171–204.
- Cross, E. W., C. J. Quinn, and S. J. Wagstaff. 2002. Molecular evidence for the polyphyly of *Olearia* (Asteraceae: Asteraceae). *Plant Systematics and Evolution* 235: 99–120.
- Curtis, J. D. and N. R. Lersten. 1986. Developmental of bicellular foliar secretory cavities in white snakeroot, *Eupatorium rugosum* (Asteraceae). *American Journal of Botany* 73: 79–86.
- Freire, S. E., A. M. Arambarri, N. D. Bayón, G. Sancho, E. Urtubey, C. Monti, C. Novoa, and M. N. Colares. 2005. Epidermal characteristics of toxic plants for cattle from the Salado River Basin (Buenos Aires, Argentina). *Boletín de la Sociedad Argentina de Botánica* 40: 241–281.
- Gardner, G. 1845. Contributions towards a Flora of Brazil, being the distinctive characters of a century of new species of plants from the Organ Mountains. (Continued from p. 355 of vol. II). *The London Journal of Botany* 4: 97–136.
- Gardner, G. 1849. *Travels in the interior of Brazil principally through the northern provinces and the gold and diamonds districts during the years 1836–1941*. London: Reeve, Benham and Reeve.
- Grisebach, A. 1879. *Symbolae ad Floram argentinam. Zweite Bearbeitung argentinischer Pflanzen*. Göttingen: Dieterich'sche Verlags-Buchhandlung.
- Harris, J. G. and M. W. Harris. 1994. *Plant identification terminology. An illustrated glossary*. Spring Lake, Utah: Spring Lake Publishing.
- Herter, W. G. 1939. (Montevideo y Berlin-Dahlem). Plantas uruguayenses novae vel criticae II. *Revista Sudamericana de Botánica* 6: 69–128.
- Hess, R. 1938. Vergleichende Untersuchungen über die Zwillingshaare der Compositen. *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie* 68: 435–496.
- Hunziker, J. H., A. Wulff, C. C. Xifreda, and A. Escobar. 1989. Estudios cariológicos en Compositae V. *Darwiniana* 29: 25–39.
- Karaman-Castro, V. and L. E. Urbatsch. 2009. Phylogeny of Hinterhubera group and related genera (Hinterhuberinae: Astereae) based on the nrDNA ITS and ETS sequences. *Systematic Botany* 34: 805–817.
- Nesom, G. L. 1994. Subtribal classification of the Astereae (Asteraceae). *Phytologia* 76: 193–274.
- Nesom, G. L. 2008. Classification of subtribe Conyzinae (Asteraceae: Astereae). *Lundelia* 11: 8–38.
- Nesom, G. L. and D. Zanowiak. 1994. Taxonomic overview of *Podocoma* (Asteraceae, Astereae), with the incorporation of two species from *Conyza*. *Phytologia* 76: 106–114.
- Nesom, G. L. and H. Robinson. [2006] 2007. Astereae. Pp. 284–342 in *The families and genera of vascular plants* vol. 8, series ed. K. Kubitzki, vol. eds. J. W. Kadereit, C. Jeffrey, *Flowering Plants-Eudicots-Asterales*. Berlin, Heidelberg, New York: Springer-Verlag.
- Noyes, R. D. and L. H. Rieseberg. 1999. ITS sequence data support a single origin for North American Astereae (Asteraceae) and reflect deep geographic division in *Aster s. l.* *American Journal of Botany* 86: 398–412.
- Ramayya, N. 1962. Studies on the trichomes of some Compositae I. General structure. *Bulletin of the Botanical Survey of India* 4: 177–188.
- Sancho, G. and V. Karaman-Castro. 2008. A phylogenetic analysis in the subtribe Podocomininae (Astereae, Asteraceae) inferred from nrITS and plasmid *trnL-F* DNA sequences. *Systematic Botany* 33: 762–775.
- Sancho, G., D. J. N. Hind, and J. F. Pruski. 2010. Systematics of *Podocoma* Cass. (Asteraceae: Astereae): a generic reassessment. *Botanical Journal of the Linnean Society* 163: 486–513.
- Simón, P. M., L. Katinas, and A. M. Arambarri. 2002. Secretory structures in *Tagetes minuta* (Asteraceae, Helenieae). *Boletín de la Sociedad Argentina de Botánica* 37: 181–191.
- Stearn, W. T. 1992. *Botanical Latin: history, grammar, syntax, terminology and vocabulary*. Ed. 4. Portland: Timber Press.
- Teles, A. M. and R. A. X. Borges. 2010. *Podocoma*. Pp. 732 in *Catálogo de plantas e fungos do Brasil* vol. 1, orgs. Forzza R. C., P. M. Leitman, A. F. Costa, A. A. Carvalho Jr., A. L. Peixoto, B. M. T. Walter, C. Bicudo, D. Zappi, D. P. Costa, E. Lleras, G. Martinelli, H. C. Lima, J. Prado, J. R. Stehmann, J. F. A. Baumgratz, J. R. Pirani, L. Sylvestre, and L. C. Maia. Rio de Janeiro: Instituto de Pesquisas Jardim Botânico do Rio de Janeiro.