

TRANSFER OF PARAGUAYAN *EUPATORIUM AMAMBAYENSE* TO *CHROMOLAENA* (ASTERACEAE, EUPATORIEAE) WITH TAXONOMICAL NOTES

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Abstract. Salgado, V. G.; M. A. Grossi & D. G. Gutiérrez. 2023. Transfer of Paraguayan *Eupatorium amambayense* to *Chromolaena* (Asteraceae, Eupatorieae) with taxonomical notes. *Darwiniana*, nueva serie 11(1): 92-100.

Eupatorium amambayense, an endemism of Paraguay, was originally described within *Eupatorium* sect. *Cylindrocephalum*. Nowadays, genus *Eupatorium* is restricted to species from North America and Eurasia, and section *Cylindrocephalum* is a synonym of *Chromolaena* (Praxelinae). The objective of the work is to determine the current taxonomic identity of *E. amambayense*. Detailed comparative analyses of morphological traits, the protologue and type materials have revealed that the species belongs to *Chromolaena* and can be differentiated from the other genera of Praxelinae, especially *Praxelis*. As result the transfer of *Eupatorium amambayense* as *Chromolaena amambayensis* is proposed.

Keywords. *Chromolaena*; *Eupatorium*; Paraguay; Praxelinae.

Resumen. Salgado, V. G.; M. A. Grossi & D. G. Gutiérrez. 2023. Transferencia de *Eupatorium amambayense* de Paraguay al género *Chromolaena* (Asteraceae, Eupatorieae) con notas taxonómicas. *Darwiniana*, nueva serie 11(1): 92-100.

Eupatorium amambayense, un endemismo de Paraguay, fue descrita originalmente en *Eupatorium* sect. *Cylindrocephalum*. Actualmente, el género *Eupatorium* se restringe a especies de América del Norte y Eurasia, y la sección *Cylindrocephalum* es un sinónimo de *Chromolaena* (Praxelinae). El objetivo de este trabajo es determinar la identidad taxonómica actual de *E. amambayense*. Análisis detallados comparativos de rasgos morfológicos, el protólogo y los materiales tipo han revelado que la especie pertenece a *Chromolaena* y puede diferenciarse de los otros géneros de Praxelinae, especialmente *Praxelis*. Como resultado se propone la transferencia de *Eupatorium amambayense* como *Chromolaena amambayensis*.

Palabras clave. *Chromolaena*; *Eupatorium*; Paraguay; Praxelinae.

INTRODUCTION

Chromolaena DC. belongs to the subtribe Praxelinae R.M. King & H. Rob. of Eupatorieae Cass. (Hind & Robinson, 2007; Robinson et al., 2009; Rodríguez Cabeza et al., 2014; Rivera et al., 2016), one of the most recently derived lineages of Asteraceae (Mandel et al., 2017, 2019; Susanna et al., 2020). This genus includes herbs or shrubs with opposite leaves and lilac, blue or white corollas.

The genus is morphologically circumscribed by a cylindrical involucre composed of 4-6 series of imbricated phyllaries, flat to scarcely convex receptacle, obpyramidal cypselae, distinct carpodium and pappus of numerous capillary bristles (King & Robinson, 1987; Bremer, 1994; Grossi et al., 2020). *Chromolaena* includes ca. 166 species (King & Robinson, 1987; Hind & Robinson, 2007) distributed in warm and temperate-warm regions of the Neotropics, from southern United

States, through Central America up to southern South America in Argentinian Pampas (King & Robinson, 1987; Freire, 2008; Rodríguez Cabeza et al., 2014; Avila et al., 2022). The genus is most diverse in the Cerrado region of Brazil, and the Andes.

Chromolaena was first described by Candolle in 1836 with *C. horminoides* DC. as type species. In 1873, Benthams included it into the large genus *Eupatorium* L. For a long time, this was the accepted taxonomic viewpoint for many botanists, especially in the Neotropics (e.g. Baker, 1876; Robinson, 1918; Cabrera et al., 1996).

In 1987, King and Robinson published a detailed systematic survey of Eupatorieae, which is considered a new taxonomic starting point for this tribe. In this work, the genus *Eupatorium* was restricted to ca. 40 species from North America and Eurasia, and the remaining species were included into ca. 100 new or reinstated genera. The separation of the genus *Eupatorium* was made based on morphological characters, and has been supported by molecular evidence (Schilling et al., 1999; Schmidt & Schilling, 2000). *Eupatorium* is defined by campanulate

involucres, phyllaries subimbricated arranged in 3-4 series, cypselae almost exclusively glanduliferous, anthers collars lacking annular thickenings in the cells, and no distinct carpodium (King & Robinson, 1970; Bremer, 1994; Hind & Robinson, 2007).

King & Robinson (1970; 1987) recognized *Chromolaena* at genus level, including species of *Eupatorium* sect. *Chromolaena* (DC.) Benth. ex Baker, *Osmia* Schultz-Bip., and *Eupatorium* sect. *Cylindrocephala* DC. Although this is currently the accepted taxonomic criteria (Hind & Robinson, 2007; Freire & Ariza Espinar, 2014; Christ & Rebouças, 2020), some South American botanists in the 1990's and early 2000 did not follow this classification; such was the case of the Flora of Paraguay (Cabrera, 1996), and the Catalogue of the Southern Cone (Freire, 2008). While maintaining *Eupatorium*'s broad concept, Cabrera (1993) described *Eupatorium amambayense* Cabrera within *Eupatorium* sect. *Cylindrocephum* DC. considering this section a synonym of *Chromolaena* (Cabrera & Klein, 1991). The current number of *Chromolaena* species for Paraguay is 19 (Table 1).

Table 1. Species of *Chromolaena* and *Eupatorium amambayense* in Paraguay. Abbreviations A: Alto Paraguay, AP: Alto Paraná, AM: Amambay, B: Boquerón, C: Caaguazú, CA: Caazapá, CN: Canindeyu, CE: Central, CO: Concepción, CR: Cordillera, G: Guairá, I: Itapúa, M: Misiones, Ñ: Ñembecú, PA: Paraguari, PR: Presidente Hayes, S: San Pedro.

	A	AP	AM	B	C	CA	CN	CE	CO	CR	G	I	M	Ñ	PA	PR	S
<i>Eupatorium amambayense</i>			X														
<i>Chromolaena asperrima</i>			X														
<i>Chromolaena barbaccensis</i>	X		X														
<i>Chromolaena caaguazuensis</i>			X		X	X			X	X	X				X		X
<i>Chromolaena christieana</i>	X					X		X	X	X			X		X	X	X
<i>Chromolaena elliptica</i>					X	X	X			X		X			X		
<i>Chromolaena ferruginea</i>	X								X								
<i>Chromolaena hirsuta</i>	X		X		X	X			X	X	X	X	X	X	X	X	X
<i>Chromolaena ivifolia</i>	X	X	X		X	X	X	X	X	X	X	X			X	X	X
<i>Chromolaena laevigata</i>		X	X		X		X	X	X	X	X				X	X	X
<i>Chromolaena margaritensis</i>			X					X	X	X					X		
<i>Chromolaena odorata</i>		X	X		X	X		X		X	X		X		X	X	X
<i>Chromolaena orbignyana</i>	X		X			X		X	X	X	X			X	X	X	X
<i>Chromolaena oxylepis</i>			X														
<i>Chromolaena pedunculosa</i>					X		X	X		X	X	X			X		
<i>Chromolaena rhinanthacea</i>							X										
<i>Chromolaena rojasii</i>			X														
<i>Chromolaena squarroso-ramosa</i>	X							X	X		X				X	X	X
<i>Chromolaena squarrolosa</i>		X	X		X		X		X	X	X		X	X	X		X
<i>Chromolaena verbenacea</i>			X		X		X		X	X	X		X		X		X
TOTAL	7	4	14	0	9	7	7	8	11	12	10	4	5	3	13	7	10

As part of an ongoing revision of southern South American *Chromolaena*, our main objective is to establish the taxonomic identity of *Eupatorium amambayense* and transfer it to *Chromolaena*, based on a detailed morphological analysis.

MATERIALS AND METHODS

Specimens and high-resolution images from the following herbaria BA, BM, G, L, LP, MICH, MPU, P, SI, and US (Thiers, 2022) were examined. Dichotomous keys from general studies were used to differentiate genera (King & Robinson, 1970; Hind & Robinson, 2007; Christ & Ritter, 2019) and local keys were used to differentiate species (Cabrera et al., 1996). We follow Harris & Harris (1994) for general terminology and Grossi et al. (2020) for involucre and floral features. Characters of taxonomic importance within Praxelinae (King & Robinson, 1987; Hind, 2014; Grossi, 2020) were analysed and cross-checked with information from protologues and type specimens. Morphological features of *Chromolaena* and *Praxelis* Cass. (King & Robinson, 1987; Hind, 2014; Grossi, 2020) were analysed using a Zeiss Discovery.V20 stereo microscope, images were taken using a Axiocam 512 camera and stack using ZEN 2 Software. The following specimens were analysed:

Chromolaena hirsuta (Hook. & Arn.) R.M. King & H. Rob.: ARGENTINA, **Santa Fe**, General Obligado, 5-III-2022, *Gutiérrez* 1790 (BA). PARAGUAY, **Alto Paraguay**, Estancia Roma, III-1917, *Rojas* 2948 (LP). **Misiones**, San Fernando, 5-V-1945, *Rojas* 12634a (LP). **Paraguarí**, Calixtro, II-1919, *Rojas* 3453 (LP).

Chromolaena laevigata (Lam.) R.M. King & H. Rob.: PARAGUAY, **Central**, Fernando de la Mora, 15-IV-1961, *Pedersen* 5908 (LP). **Paraguarí**, Camino de Ipacaray a Pirayú, 12-III-1972, *Schinini* 4284 (LP).

Chromolaena squarrolosa (Hook. & Arn.) R.M. King & H. Rob.: PARAGUAY, **Guairá**, Yegua-porá, 6-X-1952, *Montes* 16570 (LP).

Praxelis clematidea R.M. King & H. Rob. ARGENTINA, **Catamarca**, Ambato, camino a El Rodeo, 23-IV-2022, *Salgado* 5 (BA). PARAGUAY, **San Pedro**, Colonia Primavera, 23-III-1956, *Woolston* 114a (SI).

Praxelis kleinioides (Kunth) Sch. Bip.: PARAGUAY, **Amambay**, San Luis, III-1908/1909, *Fiebrig* 5160 (L).

Praxelis ostenii (B.L. Rob.) R.M. King & H. Rob.: PARAGUAY, **Concepción**, Itapucumí, III-1917, *Rojas* 2952 (LP, SI).

RESULTS AND DISCUSSION

Currently, *Eupatorium* is restricted to North America and Eurasia and includes species without distinct carpopodium or imbricated phyllaries (King & Robinson, 1970; Bremer, 1994; Hind & Robinson, 2007), both characteristics present in *Eupatorium amambayensis*. This species can be included in Praxelinae by its deciduous involucre (phyllaries falling when reaching maturity) which differentiate it from other related subtribes of Eupatorieae like Hebecliniinae, Critoniinae, Fleischmanniinae, and Ageratinae (Rivera et al., 2016; Grossi, 2020).

Praxelinae includes seven genera: *Chromolaena* DC., *Eitenia* R.M. King & H. Rob., *Eupatoriopsis* Hieron., *Lomatozonia* Baker, *Osmiopsis* R.M. King & H. Rob., *Praxeliopsis* G.M. Barroso, and *Praxelis* Cass. (Table 2).

Praxeliopsis, *Eupatoriopsis*, *Eitenia*, and *Lomatozonia* are endemic to Brazil (King & Robinson, 1987). With the exception of *Lomatozonia*, all of these genera have conical or columnar receptacles (Barroso, 1949; King & Robinson, 1979; 1987) that differ from the flat to slightly convex receptacle of *E. amambayense*. *Lomatozonia* has filiform style branches and poorly developed carpopodium (King & Robinson, 1979), unlike *E. amambayense*, that has slightly broadened in distal half style branches and distinct carpopodium.

The genus *Osmiopsis* is endemic to Haiti. It has opposite leaves that contrast with the alternate leaves of *E. amambayense* and is the only genus of the tribe that has style branches with broadened tips (King & Robinson, 1975), which are absent in the species of our study.

Table 2. Comparison among the genera of Praxelinae and *Eupatorium amambayense*. In bold, shared characteristics between *E. amambayense* and the genera of Praxelinae.

Characters and distribution	<i>Eupatorium amambayense</i>	<i>Chromolaena</i> DC.	<i>Eitenia</i> R.M. King & H. Rob.	<i>Eupatoriopsis</i> Hieron.	<i>Lomatozona</i> Baker	<i>Osmiopsis</i> R.M. King & H. Rob.	<i>Praxeliopsis</i> G.M. Barroso	<i>Praxelis</i> Cass.
Phyllotaxis	alternate	opposite, rarely alternate	opposite	opposite	opposite	opposite	alternate	opposite
Capitulescence	corymbose	corymbose, rarely solitary	laxly cymose	laxly cymose	laxly cymose	corymbose	laxly cymose	solitary or corymbose
Involucre shape	cylindrical	cylindrical	campanulate	campanulate	cylindrical	cylindrical	cylindrical	campanulate or cylindrical
Involucre phyllaries	imbricated	imbricated	imbricated	subimbricated	imbricated	imbricated	imbricated	imbricated
Phyllaries	deciduous	usually deciduous	deciduous	outer somewhat persistent	deciduous	deciduous	deciduous	deciduous
Receptacle	flat to slightly convex	flat to slightly convex	conical	conical to columnar	slightly convex	flat to slightly convex	conical	conical
Style branches	narrowly linear, slightly broadened in distal half	narrowly linear to slightly broadened in distal half	filiform	narrowly linear, broadened in distal half	filiform	narrowly linear, with broadened tips	filiform	narrowly linear, broadened in distal half
Carpopodium	distinct, symmetrical	distinct, symmetrical	distinct, asymmetrical	distinct, strongly asymmetrical	poorly developed, symmetrical	distinct, symmetrical	distinct, symmetrical	distinct, strongly asymmetrical
Cypsela shape	prismatic	prismatic	obcompressed	obcompressed	prismatic	prismatic	prismatic	obcompressed
Cypsela ribs	5	5 (rarely 3)	2 (rarely 3)	2	5	5	5	3 to 5
Pappus bristles	ca. 25, scabrid	20 to 40, scabrid	2 to 8, scabrid	18 to 20, barbellate	15 to 22, scabrid	25 to 30, scabrid	5, scabrid	20 to 40, scabrid
Distribution	endemic to Paraguay	from south eastern United States and Mexico to central Argentina	endemic to Brazil	endemic to Brazil	endemic to Brazil	endemic to Haiti	endemic to Brazil	from Peru, Bolivia and central Brazil to central Argentina



Fig. 1. Characters of taxonomic importance for Praxelinae in Paraguay. *Chromolaena*: **A**, cylindrical involucre with imbricated phyllaries. **C**, flat to slightly convex receptacle. **E**, obovate cypselae. *Praxelis*: **B**, campanulate involucre with subimbricated phyllaries. **D**, conical receptacle. **F**, obovate cypselae. Abbreviations: **r**, receptacle; **c**, cypselae. Color version at <http://www.ojs.darwin.edu.ar/index.php/darwiniana/article/view/1077/1287>

TAXONOMIC TREATMENT

Chromolaena amambayensis (Cabrera)

Grossi, V.G. Salgado & D.G. Gut., **comb. nov.** *Eupatorium amambayense* Cabrera, *Candollea* 48: 237. 1993, not *Eupatorium amambayense* Hassler. TYPE: Paraguay, Amambay department, “altaplanitie et declivibus Sierra de Amambay”, January 1907-1908, *T. Rojas* & *E. Hassler 10089* (holotype G G00381699 [photo!]; isotypes G 00381698 [photo!], G 0381977 [photo!], BM 000096285 [photo!], MICH 1107346 [photo!], MPU 015582 [photo!], P 00742281 [photo!]).

Shrubs 0.3-0.6 m tall, xylopodium present. Stems erect, internodes 5-10 mm long, densely leafy up to capitulescence, striated, densely lanuginose. Leaves alternate, sessile or shortly petiolate, petioles 0.5-1 mm long, lamina 2.5-5 × 1.5-2.5 cm, ovate, base cordate, stem-clasping, apex acute, margin serrate, slightly recurved, with large teeth at the base, gradually smaller towards the apex, 5-veined, veins abaxially prominent, minor veins forming a fine reticulum, coriaceous, glabrous and shiny adaxially, glabrous or glabrescent with a slight pubescence, mainly on the veins abaxially. Capitulescences corymbiform, capitula sessile or shortly pedunculate. Involucres 5.5 mm × 2.5 mm, cylindrical, phyllaries 18-20, imbricate, arranged in 4-5 series, inner gradually longer than outer, broadly oblong, 1.1-2 mm wide, apex acute and briefly mucronate. Florets 9-10, corollas 3.5-4 mm long, tubular-funnelform, lilac. Cypselae 3 mm long, obpyramidal, 5-costate, Pappus of capillary bristles, ca. 3.5 mm long, white.

Iconography. Cabrera 1993: 238-239, figs. 1, 2; 1996: 26, fig. 4.

Common name. “mbói contra” (Guarani language mbói = snake).

Distribution and habitat. *Chromolaena amambayensis* is known only from the Sierra de Amambay, a low range of mountains along part of the Brazil-Paraguay border, where it inhabits elevated fields.

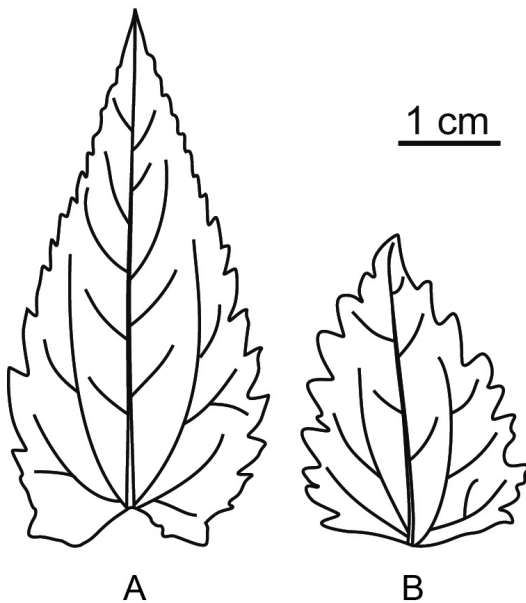


Fig. 2. A, leaf of *C. amambayensis*. B, leaf of *C. hirsuta*. (A, adapted from Cabrera 1993: 238; B, specimen US 01668847). Drawings by V.G. Salgado.

The two genera of Praxelinae present in Paraguay are *Praxelis* and *Chromolaena* (King & Robinson, 1987; Salgado et al., 2020). *Praxelis* has campanulate involucre, subimbricated phyllaries and obovate cypselae laterally inserted in a conical receptacle; whereas *Chromolaena* has cylindrical involucre, imbricated phyllaries and (most species) obpyramidal cypselae with basal insertion to a flat to slightly convex involucre (King & Robinson, 1987; Hind, 2014; Grossi et al., 2020) (Fig. 1). *Eupatorium amambayense* has imbricate phyllaries, cylindrical involucre and obpyramidal cypselae which fit it accurately within *Chromolaena*.

Nineteen species of *Chromolaena* are currently described for Paraguay; only one species, *C. hirsuta* (Hook. & Arn.) R.M. King & H. Rob. has phyllaries with differentiated apex and alternate ascendant (not pendular) leaves like *Eupatorium amambayense*. As stated in the protologue, *E. amambayense* can be recognized by its glabrous or glabrescent laminae with cordate bases in opposition to *C. hirsuta*'s loosely hirsute laminae with rounded bases (Cabrera, 1993; Cabrera et al., 1996) (Fig. 2).

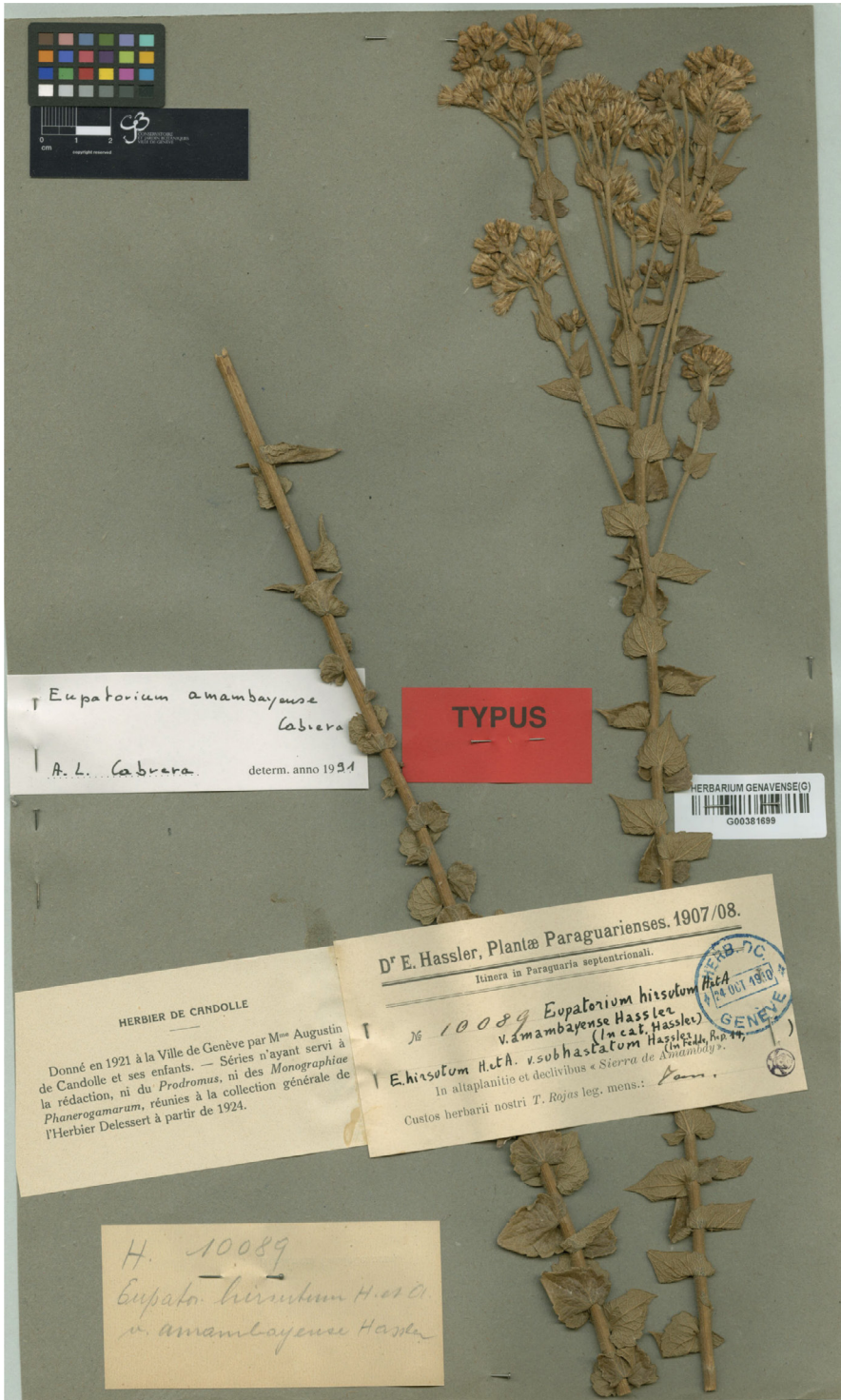


Fig. 3. The holotype of *Eupatorium amambayense* Cabrera, deposited in G (Catalogue des herbiers de Genève (CHG). Conservatoire & Jardin botaniques de la Ville de Genève. 17-08-2022 (<http://www.ville-ge.ch/musinfo/bd/cjb/chg>). Color version at <http://www.ojs.darwin.edu.ar/index.php/darwiniana/article/view/1077/1287>

Phenology. Flowering in summer.

Additional specimens examined

PARAGUAY, **Amambay**, Sierra de Amambay, December 1907-1908, *Rojas & Hassler 9762* (MPU, BM, paratypes).

Cabrera (1993) cites as holotype material in G with locality “altaplanitie et declivibus Sierra de Amambay”, collected by T. Rojas & E. Hassler with number 10089 (Fig. 3). Although there are three specimens in G (i.e. G00381698, G00381700, G00381699) that match the protologue information, there is an image of G00381699 in the protologue indicating it as the holotype. There is one specimen (G00381977) with matching collector and number but different location information: “campis pr. [prope] Estrella” probably referring to Colonia Estrella in the Amambay region. Cabrera also mentions in the protologue that the holotype and a gathering from the same locality by T. Rojas & E. Hassler with number 9762 (MPU 015581, G) have handwritten annotations with the name “amambayensis”, which he chose to use as the species name.

The transfer of *Eupatorium amambayense* as *Chromolaena amambayensis* totals 20 species of *Chromolaena* for Paraguay (Table 1). This species and three others of the genus (*C. asperrima* (Sch. Bip. ex Baker) R.M. King & H. Rob.; *C. oxylepis* (DC.) R.M. King & H. Rob. and *C. rojasii* (Hassl.) R.M. King & H. Rob.) are endemic to the Amambay department, a highly diverse region and endemism hotspot (Peña Chocarro & De Gea, 2018).

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