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Freya ambigua (Araneae: Salticidae) introduced to the continental United States, with new synonyms

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Abstract. *Euophrys ambigua* C.L. Koch 1846 is again transferred, becoming *Freya ambigua*, COMBINATION RESTORED. This jumping spider species, native to northern South America, has been found in North America in the southern parts of two of the states of the USA: Florida (Broward, Hillsborough, Manatee, Miami-Dade, and Pinellas counties) and Texas (Cameron and Hidalgo counties). Previously known from Colombia, Suriname, Trinidad and Tobago, and Venezuela, it is now also recorded from Brazil and French Guiana. Two other names are reported as NEW SYNONYMS: *Menemerus fannae* Peckham & Peckham 1896 and *Freya perelegans* Simon 1902. A lectotype is designated for *Menemerus fannae*. The female of *F. ambigua* is described for the first time.

Keywords: Florida, jumping spider, South America, systematics, Texas

Freya ambigua (C.L. Koch 1846) is a medium-sized jumping spider that was originally described from Suriname. Another species from the same greater geographic area, *Freya perelegans* Simon 1902, was originally described from Venezuela. The latter species was also reported from Trinidad and Tobago (Cutler & Edwards 2002). Comparing our respective research endeavors on these two species, we have discovered that the two names represent one more widely distributed species. Subsequently, a third species, *Plexippus* (*sub Menemerus*) *fannae* (Peckham & Peckham 1896) from Colombia, has been found to be another synonym, further widening the geographic range of this species. The female apparently has not been described previously under any of these names, although it would not be surprising to find it has been described under yet another old name.

Starting a little more than a decade ago, there have been three records (Dixon & Coile 1999, 2000; Dixon & Anderson 2010) of females of this species reported from Florida. Since the female was neither described nor could these specimens be conclusively matched with a known male, a species name was not applied to this introduction, and it was known as *Freya* sp. Species identification awaited the collection of a male, which was only recently forthcoming. In the meantime, records from Texas indicated possible multiple exports of *F. ambigua* from its native range. A review of *F. ambigu*a was initiated to establish a better understanding of its natural range and to clarify its nomenclature.

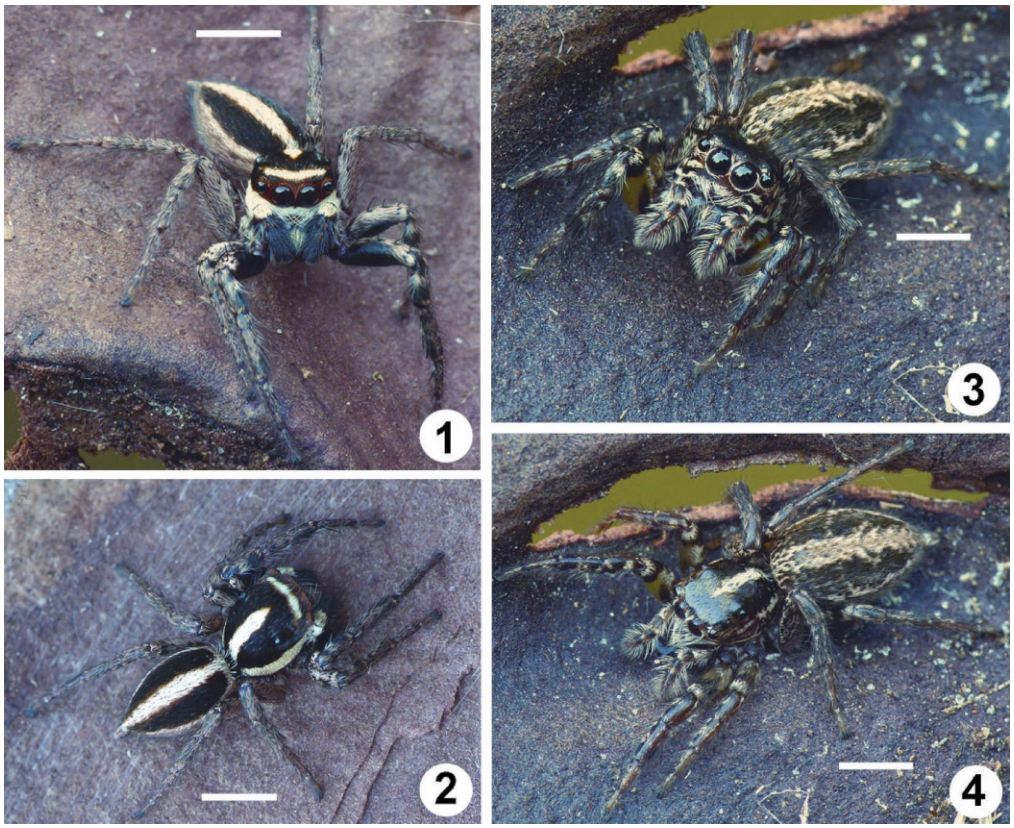
METHODS

Records identified by GBE from Florida were originally obtained by Florida Department of Agriculture and Consumer Services, Division of Plant Industry (DPI), Bureau of Plant and Apiary Inspection personnel, and published in the DPI technical report, Tri-ology. These were supplemented with subsequent surveys by GBE with Lyn and Brooks Atherton. All DPI records are in the Florida State Collection of Arthropods (FSCA), along with further records from arthropod surveys of various Neotropical areas. Texas records were from the Texas A & M University Insect Collection (TAMUIC), and photographic records from this state were obtained through the courtesy of Dick Walton. Records from Brazil were identified by GRSR from the Museu Paraense Emílio Goeldi (MPEG), Belém and Instituto Butantan (IBSP), São Paulo. Records from the Brazilian states of Amazonia and Roraima were based on examination of photographs of specimens collected by Thierry Gasnier and Bruno R.S. Machado; these specimens should be deposited in the Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, but have not been located by the staff. Additional material was examined from the United States National Museum of Natural History (USNM), Smithsonian Institution, Washington, D.C. GRSR provided the drawings and examined some types.

The lectotype of *F. perelegans* is located in the Muséum National d'Histoire Naturelle (MNHN), Paris, France. It was previously selected from the syntype series, redescribed, and illustrated by Galiano (1963). Other type specimens were provided for examination by the following institutions: Museum of Comparative Zoology (MCZ), Cambridge, Massachusetts; Museum für Naturkunde (ZMB), Berlin, Germany; and Naturhistorisches Museum Basel (NMB), Switzerland.

Specimens preserved in 70% ethanol were examined with a Leica MZ16A stereomicroscope. Male left palps were dissected at the coxa-trochanter joint and examined under high magnification for evaluation of details on the embolus and RTA. Epigynes were examined and illustrated in situ in ventral view. For details of inner structures, the epigynal plate was dissected and immersed in clove oil, cleared, and illustrated. Illustrations were done with the aid of a camera lucida on 'eggshell' paper with pen and pencil. Dissected parts were placed in microvials in the same vial with the specimen from which they were removed.

Abbreviations are used for the following morphological structures: AER = anterior eye row, AEW = anterior eye row width, ALE = anterior lateral eye, AME = anterior median eye, BL = body length, AOB = anterior ocular band, CH = carapace height, CL = carapace length, CW = carapace width, EFL = eye field length, I-II-III-IV = leg pair number starting from the anterior, PEW = posterior eye row width,



Figures 1–4.—*Freya ambigua*, living specimens from Tierra Verde, Florida. 1, 2. male; 3, 4. female. Scale = 2.0 mm.

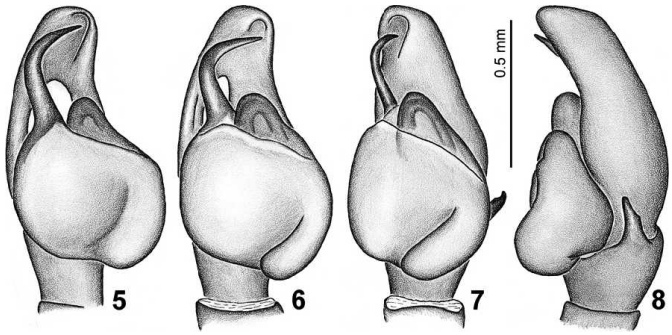
PLE = posterior lateral eye, PME = posterior median eye, RTA = retrolateral tibial apophysis (male left palp always illustrated). Measurements (in mm) were made of five specimens of each sex and are given as a range: minimum (mean) maximum. Nomenclature follows Platnick (2012). Exclamation marks with citations indicate type(s) were examined. Some specimens collected as juveniles were reared to adult (as indicated).

TAXONOMY

Order Araneae
Family Salticidae
Genus *Freya* C.L. Koch 1850

Relationships and diagnosis of *Freya*.—This genus belongs to an as yet informally defined neotropical group, the 'freyines' (Maddison et al. 2008), which is presently under study (G.B. Edwards in prep.). Although many putative genera in this group appear to have conspicuous colors and markings (e.g., *Nycerella* Galiano 1982, *Phiale* C.L. Koch 1846), *Freya* is one of a smaller number of genera that primarily have a cryptic color pattern, especially in females (e.g., Figs. 3, 4). A cryptic pattern in this context is considered to be a dorsal opisthosoma with a pale median stripe (sometimes modified with spots or chevrons) bordered laterally by a broad dark stripe on each side, usually brown (sometimes black or dull red, often with small pale markings), and with a venter consisting of numerous dark speckles on a pale background. Other genera that also have a cryptic pattern include *Kalcerrytus* Galiano 2000, *Sumampattus* Galiano 1983 and *Trydarssus* Galiano 1995.

Freya and similar genera are medium-sized jumping spiders (5–8 mm body length). The species of *Freya* can be characterized by a moderately slender, usually unmodified embolus originating on the prolateral side of the bulb (or if distal, without a bifurcate tip), lacking a conductor, usually with a lamella (fused or lost in a few species, but present in close relatives of those species where it is lost), and a robust simple RTA. The epigynal copulatory openings of *Freya* species are anterolateral or anterior without atria (or with a hooded atrium), and the copulatory ducts are short and broad. Of the other cryptic genera, *Freya* seems more closely related to *Kalcerrytus*, which also has the embolus originating prolaterally, but the latter genus is very dark in color (lacking pale carapace markings present in the other genera) with an incomplete median opisthosomal stripe, the RTA is frequently complex, and the epigynal copulatory openings are situated in atria that are not modified to cover the openings, but also have broad if somewhat more elongate ducts. *Sumampattus* and *Trydarssus* have the palpal embolus originating distally. *Sumampattus* has an embolus that is flared out and/or notched along its length, and lacks a lamella with the embolus, but has a prominent ventral membranous conductor and a robust simple RTA. *Trydarssus* has a lamella and lacks a conductor, but in addition the distinctive conical embolus is bifurcate at the tip, and the RTA is strongly bifurcate. Both genera have their epigynal copulatory openings anteromedial within larger exposed atria, and the copulatory ducts are moderately elongate and narrow.



Figures 5–8.—*Freya ambigua*, male left palp (from left to right): 5. holotype of *F. ambigua*, ventral view; 6. holotype of *Phiale albovittata*, ventral view; 7. same, retroventral view matching Galiano's (1963) illustration of *Freya perelegans*; 8. same, retrolateral view.

Type species.—*Freya* (*sub Euophrys*) *decorata* (C.L. Koch 1846)

Freya ambigua (C.L. Koch 1846), COMBINATION RESTORED
Figs. 1–13

Euophrys ambigua C.L. Koch 1846:206, f. 1253 (Dm)! *Freya a.*: C.L. Koch 1850:66.

Menemerus fannae Peckham & Peckham 1896:74, pl. 6, f. 6 (Dm)! NEW SYNONYMY. Lectotype male designated (male with both palps attached), second male is paralectotype (palps detached).

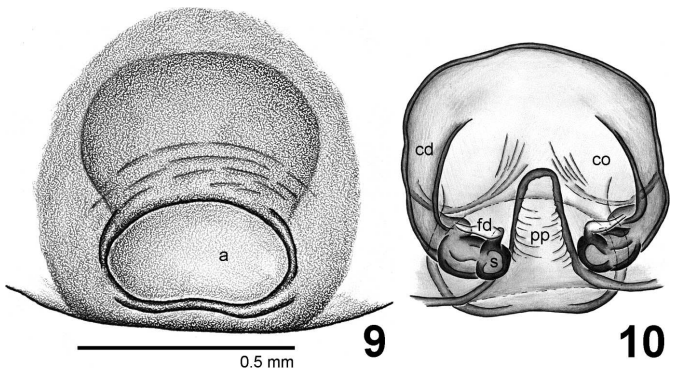
Thotmes f.: F.O.P.-Cambridge, 1901:241, pl. 20, f. 22 (m). *Freya perelegans* Simon 1902:414 (Dm). NEW SYNONYMY.

Plexippus f.: Petrunkevitch 1911:695. *Phiale albovittata* Schenkel 1953:51, f. 45a-b (Dm)! *E. a.*: Roewer 1955:1179.

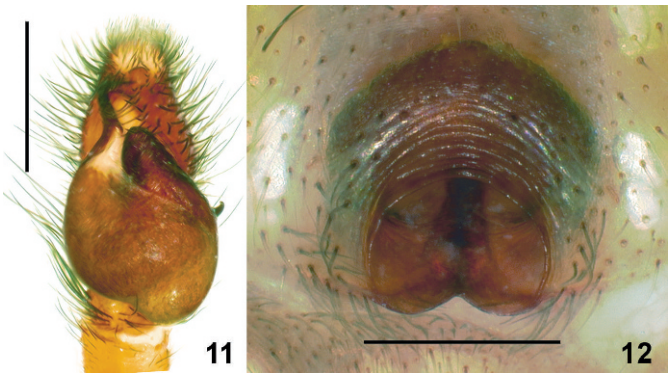
F. p.: Galiano 1963:359, pl. XX, f. 8-9 (m).

F. p.: Cutler & Edwards 2002:42. *F. p.*: Ruiz & Brescovit 2007:648 (S) [synonymized *P. albovittata* with *F. perelegans*].

Type material.—Holotype male *Euophrys ambigua*, SURINAME: no other locality data (Cordua, ZMB 1799); 3 syntype male *Freya perelegans*. VENEZUELA: *Distrito Capital*: Caracas (E. Simon, MNHN) [lectotype designated by Galiano (1963)]; holotype male *Phiale albovittata*. VENEZUELA: *Falcón*: Distrito Acosta, El Pozón, October 1924–January 1925 (K. Widenmeyer, NMB 2254); 2 syntype male



Figures 9–10.—*Freya ambigua*, epigyne of female from Pará (Brazil): 9. ventral view; 10. dorsal view, cleared. Abbreviations: a) atrium, cd) copulatory duct, co) copulatory opening, fd) fertilization duct, pp) posterior pocket, s) spermatheca.



Figures 11–12.—*Freya ambigua,* photos of specimens from Ruskin, Florida: 11. male palp, ventral view; 12. female epigyne, ventral view. Scale = 0.5 mm.

Menemerus fannae. COLOMBIA (NEW GRENADA): ex. Keyserling coll. (Peckham coll. 445, MCZ), lectotype designated herein.

Other material examined.—*Previous records* [Florida records from Tri-ology; Trinidad and Tobago locality records were briefly reported by Cutler and Edwards (2002) without other data, included here]: TRINIDAD AND TOBAGO: *Trinidad*: Caroni Co., Chaguanas Ward, Madame Espagnole River, Caroni Swamp, N of Cacandee Settlement, on mangrove, 20 August 1986, 1M (G.B. Edwards, FSCA); St. Andrew Co., Manzanilla Ward, Aripo Savannah, 23 August 1986, 1M, 1F (G.B. Edwards, FSCA); same location, 24 August 1988, 1F (C. Chaboo, FSCA); St. George Co., Northern Range, Arima to Blanchiseusse Rd., roadside at 300 m asl. on south side of range, 29 June 1999, 1F (G.B. Edwards, FSCA); San Rafael Ward, Arena Forest Preserve, vegetation in sandpit and old Caribbean pine plantation understory, 1 July 1999, 2M, 1F (B. Cutler, FSCA); same location and date, 1M, 2F (G.B. Edwards, FSCA); same location, 7 July 1999, 3M, 5F (G.B. Edwards, FSCA); Tunapuna, Mt. St. Benedict, secondary rainforest and pine forest, 4 July 1999, 1M (D.B. Richman, FSCA); same location, 8–9 July 1999, 1F (G.B. Edwards, FSCA); St. Patrick Co., Erin Ward, savannah vegetation, 2 July 1999, 1F (B. Cutler, FSCA); La Brea, Pitch Lake, weeds and grass near edge of pitch, 2 July 1999, 1M (G.B. Edwards, FSCA). USA: *Florida*: Manatee Co., Parrish, on Chinese water spinach (*Ipomoea aquatica* Forssk.), 7 October 1999, 1F (K. L. Etchells, FSCA); same location, at nursery, 15 November 2000, 1F (M.L. Runnals, FSCA); Miami-Dade Co., Medley, on mango (*Mangifera indica* L.), 15 December 2010, 1F (J.F. Revuelta, FSCA).

New Records: BRAZIL: *Amapá*: Oiapoque, Igarapé do Campo, 3.842°N, 51.855°W, 12 April 2005, 1M (Monteiro-Santos, MPEG 4996). *Amazonas*: Solimões River, between Coari and Manaus, 1F (T. Gasnier & B.R.S. Machado photographs of specimen collected by F.N. Rego & B.R.S. Machado, INPA, photos examined by GRSR). *Ceará*: Pentecoste, Fazenda experimental da UFC, 3.8°S, 39.35°W, pitfall traps in preserved Caatinga, August 2008–August 2009, 2M (R. Azevedo, IBSP 162857-162858). *Pará*: Juruti, Piranha, 2.210028°S, 56.122417°W, 14 May 2010–22 February 2011, 3M, 3F (N.A. dos Santos, B.V.B. Rodrigues & N.F. Lo Man

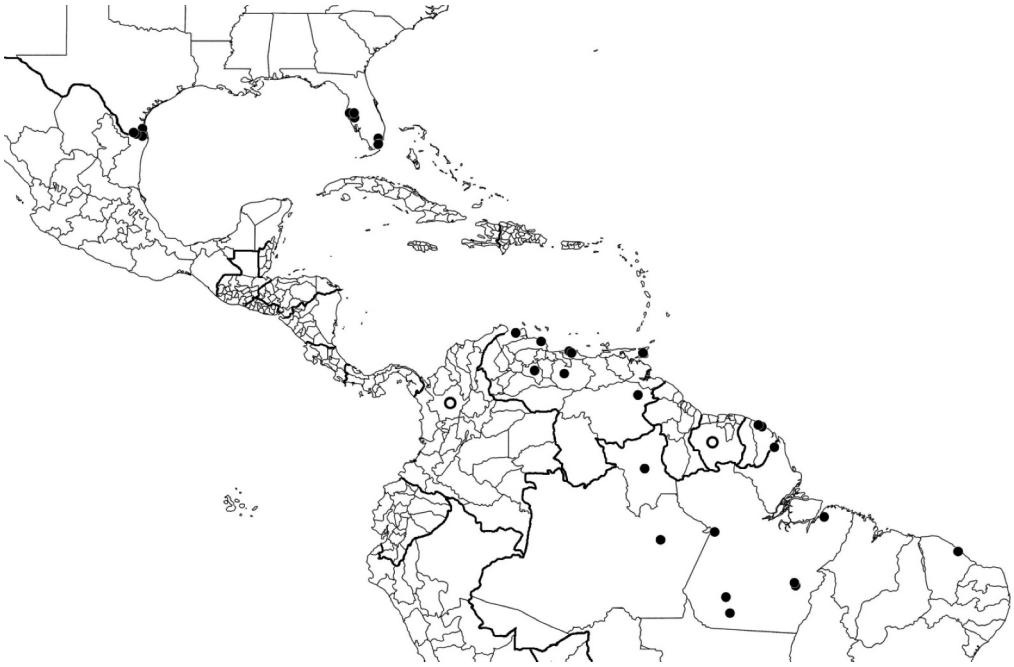


Figure 13.—Distribution map for *Freya ambigua*. Dots are records; circles in Colombia and Suriname represent records from those countries with no further data and are approximate.

Hung, MPEG 19195-19200); Belém, Campus de Pesquisa do Museu Paraense Emílio Goeldi, April 2012, 1M (G.R.S. Ruiz, MPEG 19201); Carajás, Serra Norte, Mina do Sossego, 6.445°S, 50.066°W, 23 February–6 March 2004, 1M (D.R. Santos-Souza, MPEG 4091); same location, 6.435°S, 50.069°W, 1F (E. Wanzeler, MPEG 4079); Altamira, Novo Progresso, 7.129°S, 55.425°W, 19–26 November 2005, 2M, 2F (D.R. Santos-Souza, MPEG 2676, 2679, 4395, 4396); same location, 19–24 November 2005, 2M, 2F (J.O. Dias, MPEG 2675, 2677, 4397, 4398); same location and date, 1M (D.F. Candiani, MPEG 2678); Castelo dos Sonhos, 8.217°S, 55.015°W, 16 November 2005, 1F (A.L. Nunes, MPEG 4394); same location and date, 2F (D.R. Santos-Souza, MPEG 4399); same location, 8.214°S, 55.020°W, 13 November 2005, 1M (A.L. Nunes, MPEG 2680); same location, 16 November 2005, 1M (A.A. Pinheiro, MPEG 2681). *Roraima*: Maracá, 1M (INPA, T. Gasnier & B.R.S. Machado photographs examined by GRSR). FRENCH GUIANA: *Kourou*: Montagne de Singes, disturbed primary forest, 17 May 2009, 1M (V. Vedel, FSCA); Route D13, near Guatemala, 13 April 1999, roadside savannah, 2F (G.B. Edwards, FSCA); *Roura*: junction Route N2 and Route de Bélizon, 3 April 1999, roadside, 1F (G.B. Edwards, FSCA); *Sinnamary*: near Malmanoury, 13 April 1999, roadside savannah, 1M (G.B. Edwards, FSCA). USA: *Florida*: Broward Co.: Dania Beach, John Lloyd State Park, Interdiction and Maritime Services survey, on sticky board, 8 October 2012, 1F (M.A. DaCosta & J. Garcia, FSCA); Hillsborough Co., Ruskin, beating salt grass [*Distichlis spicata* (L.) Greene], 6 April 2012, 1M, 2 subadults, 5 smaller juveniles (1M, 2F reared) (G.B. Edwards, L. & B. Atherton, FSCA); Miami-Dade Co., Miami, sticky trap on seagrape [*Coccoloba uvifera* (L.) L.], 18 June 2012, 1F (C. Pelegrin, FSCA); Pinellas Co., Tierra Verde, north shore of S. Duck Pond, 16 November 2011, 3M, 2F, 9 subadults (3M reared) (G.B. Edwards, L. & B. Atherton, FSCA); Ft. DeSoto Park, mulberry area in dense grass (1M on sapling persimmon), 16 November 2011, 2M, 1F, 2 subadults (1F reared) (G.B. Edwards, L. & B. Atherton, FSCA); same location and date, Soldier's Hole, on recumbent salt marsh aster, 1 subadult M (G.B. Edwards, L. & B. Atherton, FSCA). *Texas*: Cameron Co., Laguna Atascosa National Wildlife Refuge, 26.22375°N, 97.35454°W, 16–29 October 2008, FIT-ground, dense coastal brush, 1m (J. King & E. Riley 300, TAMUIC); Sabal Palm Grove Refuge, 25.84799°N, 97.41881°W, 18–31 October 2009, FIT-ground, palm forest, 1F (J. King & E. Riley 1433, TAMUIC); same location and trap type (Site 2), 25.84851°N, 97.41794°W, 31 October 2008–6 February 2009, 1M (J. King & E. Riley 435, TAMUIC); San Benito, 28 December 2011, 1 subadult M (T. Fuller photograph); Hidalgo Co.: pitfall trap in grass survey, 13–19 March 1981, 1F (FSCA); Bentsen Rio Grande Valley State Park, 26.17830°N, 98.38577°W, 4–17 October 2008, FIT-ground, cedar elm forest, 1M (J. King & E. Riley 280, TAMUIC); Estero Lano Grande State Park, 21 November 2011, 1M (R.K. Walton photograph); Lower Rio Grande Valley National Wildlife Refuge (LRGVNWR), La Coma (Site 1), 26.05302°N, 98.04665°W, 20 September–3 October 2008, pitfall trap, re-vegetated site, 1M (J. King & E. Riley 141, TAMUIC); same location and trap, 13–26 March 2009, 2M (J. King & E. Riley 618-621, TAMUIC); same location and trap, 24 April–7 May 2009, 1F (J. King & E. Riley 896-899, TAMUIC); same location and trap, 8–22 May 2009, 2M (J. King & E. Riley 976-979, TAMUIC); same location and trap type (Site 2), 26.05611°N, 98.03635°W, 4–17 October 2008, 1F (J. King & E. Riley 236-239, TAMUIC); LRGVNWR, McManus Unit, 26.05380°N, 98.04987°W,

2–17 November 2009, FIT-ground, ebony-guayacan association, 1F (J. King & E. Riley 1516, TAMUIC); Santa Ana Refuge, 18 May 1984, 1M (D.A. Dean, FSCA). VENEZUELA: *Bolivar*: 7.6 km SE Guasipati, 22 March 1982, 1M, 1F (G.F. & J.F. Hevel, USNM). *Guárico*: 44 km S. Calabozo Hato Masaguaral, 10 February 1986, 1F (R.B. Miller & L.A. Stange, FSCA). *Portuguesa*: Agua Blanca, rice field, 8 December 1982, 1M (J.M. Osorio, FSCA). *Vargas*: Tanaguarena, 26 December 1970, coastal building and garden, 1M (W. B. Peck, FSCA).

Range.—Northern South America from Colombia to French Guiana and northern Brazil. Introduced to the southernmost parts of the USA in Florida and Texas (Fig. 13).

Remarks.—Koch (1850) described *Freya* and correctly (based on knowledge available at that time) transferred his own species, *E. ambigua*, from *Euophrys* to *Freya*; however, Roewer (1955) reversed the transfer, thereby obscuring its relationship, since this caused the species to be associated with the wrong subfamily (Euophryinae). This species actually belongs to the ''freyine'' group of genera (Maddison et al. 2008).

There were three loose palps in the type vial of *Menemerus fannae*, even though only two males from ''New Grenada'' are indicated in the description. A matching pair of palps, which are very similar to the intact palps of the lectotype, has been placed with the paralectotype. The extra left palp matches the remaining right palp of a third specimen, noted in the original description from Guatemala. This palp was most likely misplaced during the original description, and it was returned to that vial. The Guatemalan specimen belongs to the related *Freya longispina* (F.O. P.-Cambridge 1901), originally described from Guatemala. As no records of *M. fannae* intermediate between the two localities exist, the distribution reported for this species, Guatemala to Colombia (Platnick 2012), is not supported. By inference (since *M. fannae* is a synonym), *F. ambigua* therefore is not known from Central America.

Since one of the three specimens in the original description of *M. fannae* is a different species, it is necessary to designate a lectotype, done above. This species was illustrated as having a red dorsum in Cambridge (1901), and reddish scales are still apparent on the dorsum of the two specimens from this locality; however, this may be due to severe fading or other preservation artifacts, as all other specimens from other localities have a mostly black dorsum, and the only reddish scales, if present, are around the eyes and the edges of some white markings on the carapace.

A few of the records reported from Trinidad and Tobago (Cutler and Edwards 2002) (the two Tobago localities and the Trinidad specimen from Mt. Zion) are either *Freya longispina*, previously cited only from Guatemala and Panama (Platnick 2012), or more likely a related species with an elongate RTA. These specimens are similar to, but do not quite match, the *P. fannae* specimen from Guatemala, or the description and illustrations of *F. longispina* in F.O.P-Cambridge (1901). This species will be referred to as *F. cf. longispina* in the Diagnosis. The records will be reported in detail elsewhere (Edwards in prep.).

Diagnosis.—*Euophrys ambigua* is transferred to *Freya* based on its cryptic color pattern as defined previously, the male having a simple hooked embolus originating prolaterally, lacking a lamella [although its close Central American relative *Freya bifurcata* (F.O.P.-Cambridge 1901), has a lamella], lacking a membranous conductor, and having a robust, simple RTA. The epigynal copulatory openings are anterolateral, and the copulatory ducts are broad and relatively short. In addition, the black dorsum with white stripes and bands of male *F. ambigua* (and its closest relatives) is quite similar to the black and white pattern of male *F. decorata*, the type species of the genus. The main difference between them is the pattern on the anterior dorsum of the carapace, which in *F. decorata* has three short stripes rather than a transverse band.

From its closest relatives, males of *F. ambigua* differ from males of the sympatric *F. cf. longispina* in that the palp of *F. ambigua* has a narrower, more curved embolus, and with the RTA about 3/4 the length of that of *F. cf. longispina*. These two differ from similar Central American species, except true *F. longispina*, by lacking a sharply pointed sclerotized lamella accompanying the embolus near its tip. In addition, the male face of *F. ambigua* has an unbroken white clypeal band (Fig. 1), while in *F. cf. longispina*, the clypeal band is missing medially from the middle of each AME inward. Males of *F. longispina* are like *F. cf. longispina* in having a less curved embolus and more elongate RTA, but like *F. ambigua* in having an unbroken white clypeal band.

Females of *F. ambigua* have the anterior ridged part of the epigyne equal to or longer than the atrial opening. The posterior pocket is incorporated into the floor of the atrium (Fig. 10) and reaches a little past and between the copulatory openings. In *F. cf. longispina*, the anterior ridged area is shorter than the atrial opening (which is larger than in *F. ambigua*), and the posterior pocket extends very near the anterior end of the atrium, corresponding to the longer RTA of the male. The carapace color pattern of females also differs: *F. ambigua* usually has a distinct, narrow, white submarginal band on each side with roughly parallel margins (Fig. 4), whereas in *F. cf. longispina*, the submarginal band is indistinct with a noticeably jagged lower edge. The female of *F. longispina* is not described, at least not under this name, but *Phiale laticava* (F.O.P.-Cambridge 1901) and *Phiale mediocava* (F.O.P.-Cambridge 1901) are apparently related species from Guatemala described only from females.

Description.—*Male* (n = 5): BL 5.05 (6.07) 8.10, CL 2.55 (3.06) 3.85, EFL 1.35 (1.55) 1.90, CW 1.90 (2.26) 3.00, AEW 1.60 (1.88) 2.30, PEW 1.60 (1.88) 2.30, CH 1.20 (1.37) 1.80. Carapace integument black (cephalic) and orange (thoracic), mostly densely covered with elongate black setae adpressed to integument, with most erect setae around eyes. White elongate scale-like setae (scales) make broad marginal band on each side (submarginal at posterolateral corners), broad median stripe from posterior edge of carapace to middle of eye field that comes to sharp point, transverse anterior ocular band just behind AER and complete clypeal band contiguous with marginal bands (Figs. 1, 2). Rust red scales surround AME, ALE, and PME, are dorsal to PLE, and edge AOB and point of median stripe. Chelicerae reddish brown with dense cover of elongate white setae (that also form an elongate fringe on clypeus); promargin with two contiguous teeth, of which outer is larger and about same size as single opposing retromarginal tooth. Endites and labium reddish brown; sternum yellow.

Dorsally palp covered with elongate white setae on femur and patella, elongate black setae on tibia and cymbium. RTA moderately long, bent outward near base, straight or slightly angled ventrally in lateral view, with small inner concavity at tip (Figs. 7, 8). Embolus arising in distal prolateral position, appearing as elongated hook that starts toward the prolateral side before turning back to oblique embolar groove on cymbium angled toward retrolateral side (Fig. 6). Bulb broad with proximal retrolateral lobe that varies in shape, size, and amount of indentation separating lobe from rest of bulb. Legs yellow but extensively marked with black, and femur and tibia I may be mostly black. Leg I ventral macrosetae: metatarsus with two pair (distal, subproximal), tibia with three pair (distal, medial, subproximal). Leg formula I-IV-III-II. Abdomen dorsally with two broad paramedial black stripes, broad median white stripe, and lateral white stripes, respectively covered with same types of black and white setae as carapace. White stripes meet in front to form short basal band. Sides and venter gray, separated by narrow white stripes, and venter sparsely speckled with black.

Female (n = 5): BL 6.00 (7.08) 8.10, CL 2.60 (3.09) 3.40, EFL 1.40 (1.59) 1.70, CW 1.95 (2.29) 2.50, AEW 1.65 (1.92) 2.10, PEW 1.60 (1.91) 2.10, CH 1.30 (1.45) 1.70. Carapace integument reddish brown (cephalic) and orange (thoracic), with median white stripe like male, but narrow white submarginal bands. Dark thoracic areas covered with black setae, but dorsal eye field covered with clear iridescent scales. White submarginal cheek bands, not contiguous with submarginal lateral bands, occur under ALE. Clypeus with long white fringe, but no band. Chelicerae, endites, labium reddish brown; sternum yellow. Cheliceral teeth like male. Palps yellow with dorsal black basal patches on patella, tibia, and tarsus. Legs with less black than males, tending to form distal rings on segments and dorsal femoral stripes, especially femora III and IV; macrosetae as in male. Leg formula IV-III-I-II. Abdomen generally like male dorsally, except dark stripes brown with white speckles, white stripes with brown speckles, and median stripe covered with tan scales; faint chevrons usually present in posterior half of median stripe. Sides dark gray and striated, venter pale with numerous dark gray speckles. Spinnerets brown dorsally, yellowish brown ventrally. Epigyne a low mound with series of parallel transverse ridges along the anterior face, posteriorly with large kidney-shaped atrium that measured along midline is on average slightly shorter than anterior part. Inside atrium is pair of copulatory openings, one each side, that have a rim on posterior edges. Posterior pocket heavily sclerotized, aligned medially, elongate to about half way between the copulatory openings and anterior end of atrium, and has circular opening under (in ventral view) edge of atrium where latter is indented. Copulatory ducts extend posteriorly from anterolateral copulatory openings inside the deep atrium, become slightly sinuous, and lead to small spermathecae located near the posterior edge of the atrium; fertilization ducts emerge from the anterior face of the spermathecae, curving dorsally to the sides. With exception of one Texas male, females noticeably larger than males.

Biology.—In almost all cases with known habitat data, specimens were taken from sunny open dense patches of grass or herbaceous plants with a few small bushes or tree saplings intermixed. This is true in all locations reported here. The spiders were primarily on the grass and herbs, although of the Florida records, one male was taken on a sapling persimmon tree, and a female was taken on a mango tree, about 100 m from a canal that had mixed vegetation along its banks. Habitats included open patches of vegetation in woodland and along trails, as well as vegetation along bodies of water such as fresh water ponds and near saltwater shoreline.

Introduction history.—The first two Florida records (Dixon and Coile 1999, 2000) were from Manatee Co. in the mid-western part of the peninsula. A more recent record (Dixon and Anderson 2010) was from Miami-Dade Co. across the state in the extreme southeast, which might represent either a separate introduction or indicate that the species is now widespread in south Florida. As this paper was being submitted, a new record from this part of the state was found at Dania Beach in Broward Co. Other recent records were the result of surveys in southern Pinellas and Hillsborough counties that were instigated by a photograph of a penultimate male specimen sent to GBE by Lyn Atherton of Tierra Verde. Specimens collected at Tierra Verde and at Ft. DeSoto Park in Pinellas Co., and at Ruskin in Hillsborough Co., along with the Broward Co. specimen, represent new county records for the state. Some of the juveniles from these collections were reared to maturity.

Texas records from Cameron and Hidalgo counties as early as 1981 were found in the TAMUIC collection. Photographic records of a male from Hidalgo Co., Estero Lano Grande State Park, were made by Dick Walton on 21 November 2011, and an apparent penultimate male (based on its distinctive color pattern) was photographed by Terry Fuller in Cameron Co., San Benito, on 28 December 2011 (forwarded by Dick Walton). Although these are the first reports of this species from south Texas, it appears that the species has been established here for over three decades.

Introduction pathway.—Since this species is an inhabitant of moderately low herbaceous vegetation and small shrubs, it is possible that it could have been introduced through the ornamental or florist industries, either with plants intended as yard ornamentals, or with cut flower shipments. There is considerable cut flower traffic from Colombia through the port of Miami (T. Skarlinsky personal communication 2011). Also, *F. ambigua* tends to be found near aquatic environments, and the first Florida record was on Chinese water spinach, *Ipomoea aquatica* Forsskal, an aquatic vine that has become established in Hillsborough, Manatee, and Pinellas counties (Wunderlin and Hansen 2011). This invasive plant is on the USA federal noxious weed list and the Florida prohibited aquatic plant list. Smuggling of this edible plant could have contributed to the presence of *F. ambigua* in Florida. How it became established in Texas is open to speculation.

DISCUSSION

Available evidence suggests that this species is introduced into North America. Despite intensive collecting in the state by several arachnologists throughout much of the 20th century, no previous records were found in Florida, indicating this is a recent introduction. No freyine jumping spiders are known to be native to the Caribbean area except for two species of *Eustiromastix* from St. Vincent in the Lesser Antilles

(Peckham & Peckham 1893), so it seems unlikely that *F. ambigua* naturally dispersed by that route. Texas might be considered more plausible to be in the native range of *F. ambigua* due to its continuous continental connection with the Neotropics. However, the presence of closely related species in Central America, such as *Freya bifurcata* and *Freya longispina*, which are thought to be ecological equivalents, appears to prevent establishment by dispersal northward of *F. ambigua* from northern South America.

Miscellaneous records from various museums have extended the known natural range of *F. ambigua* in South America. Brazil and French Guiana are added to Colombia, Suriname, Trinidad and Tobago, and Venezuela as countries that contain native populations of *F. ambigua*. Thus, the species appears to be widespread in northern South America. It would be predicted to occur at least in Guyana in addition to the countries presently recorded.

Significance.—As a predator, *F. ambigua* is not considered a pest of agricultural significance. However, its potential role as an invasive of natural ecosystems is unknown. It appears that it can occur in high densities in shoreline habitats, both in coastal habitats associated with saltwater and around fresh water ponds. Its potential effect on native salticids that occur in the same habitats, such as the common *Marpissa pikei* (Peckham & Peckham 1888) or the uncommon *Paramaevia hobbsae* (Barnes 1955), remains to be assessed. It is thought at this time that *F. ambigua* will not be able to migrate northward into more temperate climates, and that whatever environmental effects it does have will be restricted to the subtropical zones of south Florida and south Texas.

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