

Studies on neotropical Phasmatodea XXII: Two new species of *Taraxippus* (Phasmatodea: Cladomorphinae: Hesperophasmatini) and the first record of the genus from Central America

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Abstract

Two new species of *Taraxippus* Moxey, 1971 are described and illustrated: *T. samarae* sp. nov. from Costa Rica and Panama and *T. perezgelaberti* sp. nov. from the Dominican Republic. Both sexes and the previously unknown eggs are described. The genus is recorded from Central America for the first time. A distribution map and a discussion of the distributional pattern of *Taraxippus* are provided.

Keywords

Costa Rica, Dominican Republic, Hispaniola, morphology, Panama, phasmids, stick insects, taxonomy

Introduction

Phasmatodea is one of the few insect orders that still lack a robust higher-level phylogeny. The relationships between many New World taxa in particular are still speculative. Numerous genera are only known from a few specimens and sometimes only from one sex. One of these seldom encountered genera is *Taraxippus* Moxey, 1971, a member of the predominantly Caribbean tribe Hesperophasmatini (subfamily Cladomorphinae). The intergeneric relationships and the definitions of some of the genera of this particular tribe are still insufficient, and further work is needed to clarify relationships within Hesperophasmatini.

This is the 22nd part of an on-going study of New World Phasmatodea and describes two new species of the very distinctive and stunning genus *Taraxippus* Moxey, 1971. Until now, this genus was known only from the type species, *Taraxippus paliurus* Moxey, 1971, which was only known from a unique female specimen from Haiti. A male described by Pérez-Gelabert (1999) from the Dominican Republic was proven to represent an unknown species that is here described as a new species. A further new species is described from Costa Rica and Panama and is the first record of this peculiar genus from outside the Caribbean. The eggs of *Taraxippus* are described and illustrated for the first time.

A survey of Hispaniolan orthopteroid insects was carried out by the Hispaniolan Orthopteroids Project from 2002 through 2004 in the Dominican Republic. Besides many interesting Orthoptera, a large number of Phasmatodea were collected that significantly increase the number of Phasmatodea species known from Hispaniola. Almost all regions and habitats of the island still harbor many undescribed taxa. In several previous papers, the authors have dealt with the material collected by the Hispaniolan Orthopteroids Project and described four new genera and 17 new species (Conle et al. 2006, 2008, 2014, Hennemann et al. 2016, in press).

Material and methods

The material for this study is exclusively dried and pinned. Insects and eggs were examined using an entomological lens with 4× magnification and a stereoscope (Zeiss Stemi SV 6). Eggs were examined at 10× magnification. Measurements were taken using a long ruler or a digital caliper and are given to 0.1 mm. Average measurements are given. Eggs were examined fully developed after they were laid. The terminology used for the descriptions of external and internal egg structures follows that of Sellick (1997). Photos were taken using either a Nikon D7100 camera with a AF-S Nikkor 60 mm f/2.8 G ED lens, or, for the eggs, a Sony A7RIII with a Tamron 90 mm f/2.8 DI VC USD MACRO and Raynox DCR-250. Lighting was produced with a Nikon SU-800 dual speed light system and background lighting provided by a 18W 6000K LED panel light plate. Depositories of specimens and type status are abbreviated as follows:

- INBIO Instituto Nacional de Biodiversidad, Costa Rica.
- USNM United States National Museum of Natural History, Smithsonian Institution, Washington, DC, USA.
- ZSMC Zoologische Staatssammlung München, Germany.
- FH Personal collection of Frank H. Hennemann, Bad Homburg, Germany.
- OC Personal collection of Oskar V. Conle, Duisburg, Germany.
- HT, PT holotype, paratype.

Results

Phasmatidae: Cladomorphinae: Hesperophasmatini

Taraxippus Moxey, 1971

Figs 1–8

Type-species.—*Taraxippus paliurus* Moxey, 1971: 67, by original designation.

Comments.—The genus comprises three species including the two new species described here. It is so far recorded from Hispaniola Island (Haiti and Dominican Republic), Costa Rica, and Panama.

Diagnosis of genus.—Medium to small member of the tribe Hesperophasmatini (body length ♀♀ including subgenital plate 39.8–71.1 mm, ♂♂ 38.2–54.2 mm), body prominently spinose and mesonotum with a prominent hump-like median swelling (more pronounced in females). Females apterous, males either winged or apterous. Body in both sexes all over armed with distinct spines, bulges, and/or irregular foliaceous lobes. Head with vertex strongly conically raised and armed with spines, higher than long; no ocelli. Antennae filiform; longer than head, pro-, and mesothorax combined. Antennomeres considerably longer than wide and gradually shortening in apical portion, more or less club-like in females. Scapus with spines on outer lateral margin. Mesothorax >2.5× longer than prothorax, strongly widened and deflexed medially; mesonotum prominently swollen and hump-like in central portion (females in particular). Metapleurae with a distinct multispinose supracoxal projection. Tegmina in males ovoid and with a fairly pointed central projection. Anal region of alae translucent greyish. Abdomen excluding median segment slightly longer than head and thorax combined. In females, segment VII longest segment, II quadrate, and II–VII wider than long; abdomen swollen and broadened medially. In males, all segments longer than wide and roughly uniform in width. Abdominal tergum VII in both sexes strongly deflexed laterally; III–VI and VIII occasionally with lateral lobes. Praeopercular organ on abdominal sternum VII of females distinct and positioned a considerable distance anterior to posterior margin. Epiproct of females scale-like and noticeably projecting over posterior margin of anal segment. Subgenital plate shovel-like and projecting notably beyond apex of abdomen; the apical portion more or less decidedly narrowed. Anal segment of males slightly convex and notched medially; the outer posterior angles set with a variable number of minute teeth ventrally. Vomer well developed, principally triangular in shape and with a single fairly acute terminal hook. Poculum (= subgenital plate) cup-shaped, strongly convex, and conical in center, and the posterior margin more or less labiate. Cerci laterally compressed in females, lancet-like, circular in cross-section in males, with tipped apex, projecting over the anal segment. All legs slender and bearing spines and/or variably sized and shaped foliaceous lobes; all femora shorter (females) or longer (males) than pro- and mesothorax combined. Profemora almost straight and just slightly compressed basally. Femora with medioventral carina almost obsolete and armed with a variable number of medium-sized spines. Tarsi elongated with basitarsus longer than following two tarsomeres combined.

Eggs: Capsule flattened laterally; the anterior, posterior, and lateral margins set with rows of long fringes. Lateral surfaces more or less flattened and rugulose. Micropylar plates less than half as long as capsule, spear-shaped, and roughly placed in center of dorsal capsule surface. Operculum oval, flat; outer margin with long setae or fringes.

Differentiation: This very distinctive genus is well differentiated from other members of the tribe Hesperophasmatini by the

extremely prominent body armature and almost straight profemora. Females further differ from all other known genera of the tribe by the strongly swollen and hump-like median portion of the mesonotum and males by having a very large pair of antler-like, median projections on the mesonotum. The eggs are very distinctive, being laterally flattened and somewhat angular and having the anterior, posterior, and lateral margins set with rows of long fringes.

Comments: This previously monotypic genus currently comprises three species including the two new species described herein. It is so far recorded from the Caribbean island of Hispaniola (Haiti and Dominican Republic) as well as Central America (Costa Rica and Panama). The disjunct distribution of *Taraxippus* is remarkable and may be subject to speculation on the mechanisms and reasons that led to the distributional pattern now seen. Very few phasmid genera are known to have representatives in both the Caribbean and in Central America; e.g., *Pterinoxylus* Serville, 1838 (Hennemann et al. 2016). But while *Pterinoxylus* is found throughout various altitudinal ranges including coastal lowland forests, *Taraxippus* seems to be confined to mountainous habitats. This would suggest a relict distribution for *Taraxippus*, meaning that the genus or its direct ancestors might once have had a considerably larger range but has subsequently become locally extinct in most areas.

Distribution.—Hispaniola, Costa Rica, and Panama.

Species included.—

Taraxippus paliurus Moxey, 1971: 70, figs 2, 5. [Hispaniola: Haiti]
Taraxippus perezgelaberti sp. nov. [Hispaniola: Dominican Republic]
Taraxippus samarae sp. nov. [Costa Rica and Panama]

Keys to species of *Taraxippus* Moxey, 1971

♂♂*

- 1 Apterous. Hispaniola..... *T. perezgelaberti* sp. nov.
- Winged. Costa Rica and Panama..... *T. samarae* sp. nov.

♀♀

- 1 Armature of head and mesonotum formed by acutely pointed spines or multispinose processes. Lateral lobes of abdominal tergum VII larger than all preceding. Sternum VII armed with at least six distinct spines. Hispaniola 2
- Armature of head and mesonotum with blunt apices. Lateral lobes of abdominal tergites V and VI largest. Sternum VII unarmed. Costa Rica and Panama *T. samarae* sp. nov.
- 2 Small (body length <52 mm). Mesonotum medially armed with a transverse row of four very large, laterad directed, multispinose, antler-like processes..... *T. perezgelaberti* sp. nov.
- Larger (body length 57 mm). Mesonotum very prominently raised and swollen medially and armed with several simple spines *T. paliurus*

Eggs**

- 1 Capsule roughly rectangular in cross-section with lateral surfaces flattened and distinctly rugulose; dull. Marginal fringes setae-like, long and slender, usually branched and free at apex. Micropylar plate surrounded by a row of fringes. Costa Rica and Panama..... *T. samarae* sp. nov.
- Capsule trapezoidal in cross-section with lateral surfaces gently convex and weakly coriaceous; glossy. Marginal fringes irregularly branched and net-like. Micropylar plate not surrounded by fringes. Hispaniola..... *T. perezgelaberti* sp. nov.

* Males of *Taraxippus paliurus* are unknown.

** Eggs of *Taraxippus paliurus* are unknown.

Taraxippus perezgelaberti sp. nov.

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Figs 1–3b, e, h, 4d–f

Taraxippus paliurus Pérez-Gelabert, 1999: 23, figs 1, 2.

Differentiation.—Females can easily be distinguished from the two other species in the genus by the armature of the mesonotum and the more elongate subgenital plate (ratio length/max. width >3; Fig. 3). Males are readily differentiated from those of *T. samarae* sp. nov. by the lack of wings (Fig. 1). Eggs differ from those of *T. samarae* sp. nov. by their triangular cross-section, gently concave lateral margins, glossy surface, and strongly branched, net-like marginal fringes (Fig. 4).

Type material and specimens examined.—

- HT**, ♂: DOMINICAN REPUBLIC, RD-043, on Trail Arroyazo to La Sal, Reserva Científica Ebano Verde (RCEV), La Vega Prov., on path between 19°02.374'N, 70°32.684'W, 1249 m and 19°02.021'N, 70°32.584'W, 1102 m, 10.vii.2002, D. E. Pérez-Gelabert (DEPG), B. Hierro (BH), R. Bastardo (RB) [USNM].
- PT**, ♀: DOMINICAN REPUBLIC, Parque Nacional Armando Bermúdez (PNAB), Los Tablones, La Vega Prov., 1250 m, 4.ix.1997, DEPG, K. Graseña (KG) [USNM].
- PT**, ♀: DOMINICAN REPUBLIC, La Sal, RCEV, La Vega Prov., 21.v.1992, S. Navarro [USNM].
- PT**, nymph ♀: DOMINICAN REPUBLIC, PNAB, Arroyo Gurabo, Santiago Prov., 13.iii.1999, A. del Monte [USNM].
- PT**, ♂: DOMINICAN REPUBLIC, PNAB, Los Tablones, La Vega Prov., 1250 m, 4.ix.1997, DEPG, KG [USNM].
- PT**, ♀: DOMINICAN REPUBLIC, PNAB, in bamboo forest approx. 400 m from park entrance, La Vega Prov., 9.i.1986, S. Larcher, DEPG [USNM].
- PT**, ♂: DOMINICAN REPUBLIC, PNAB, Jamamucito, dentro de yagua, Santiago Prov., 10.iv.1999, night, RB [USNM].
- PT**, 4 ♂♂, nymph ♂, nymph ♀: DOMINICAN REPUBLIC, RD-043, on Trail Arroyazo to La Sal, RCEV, La Vega Prov., on path between 19°02.374'N, 70°32.684'W, 1249 m and 19°02.021'N, 70°32.584'W, 1102 m, 10.vii.2002, DEPG, BH, RB [USNM].
- PT**, 3 ♂♂: DOMINICAN REPUBLIC, RD-042, Arroyazo, RCEV, La Vega Prov., 19°01.945'N, 70°32.593'W, 1066 m, 9–10.vii.2002, DEPG, BH, RB [USNM].
- PT**, 5 ♂♂, 3 ♀♀, nymph ♀: DOMINICAN REPUBLIC, RD-044, La Sal, RCEV, La Vega Prov., 19°04.101'N, 70°34.089'W, 1043 m, 11–12.vii.2002, DEPG, BG, RB [USNM].
- PT**, 2 ♂♂: DOMINICAN REPUBLIC, RD-128, PNAB, around caseta La Sierrecita, Santiago Prov., 19°14.889'N, 71°04.735'W, 752 m, 9.iv.2003, DEPG, BH, RB [USNM].
- PT**, ♂, ♀: DOMINICAN REPUBLIC, RD-149, Loma La Golondrina, RCEV, La Vega Prov., 19°03.498'N, 70°32.670'W, 11.vii.2003, day and night, DEPG, RB, BH, ex coll USNM [OC, No. 0535-2, 3].
- PT**, 2 ♀♀: DOMINICAN REPUBLIC, RD-043, on Trail Arroyazo to La Sal, RCEV, La Vega Prov., on path between 19°02.374'N, 70°32.684'W, 1249 m and 19°02.021'N, 70°32.584'W, 1102 m, 10.vii.2002, DEPG, BH, RB [USNM].
- PT**, 3 ♀♀: DOMINICAN REPUBLIC, RD-128, PNAB, around caseta La Sierrecita, Santiago Prov., 19°14.889'N, 71°04.735'W, 752 m, 9.iv.2003, DEPG, RB, BH [USNM].
- PT**, ♀: DOMINICAN REPUBLIC, RD-218, 1 km ESE Cortico, Barahona Prov., 18°06.520'N, 71°12.898'W, 1347 m, 9–10.iv.2004, day and night, DEPG, BH, RB [USNM].
- PT**, 2 ♂♂: DOMINICAN REPUBLIC, RD-157, PNAB, Los Tablones, La Vega Prov., 19°03.308'N, 70°53.049'W, 1270 m, 23.vii.2003, night, DEPG, RB, BH [USNM].
- PT**, ♀: DOMINICAN REPUBLIC, RD-148, ~100 m up from El Sitio del Agua, cloud forest, N Los Bolos, Sierra de Neiba, Independencia Prov., 18°39.339'N, 71°39.279'W, 1520 m, 9.vii.2003, day and night, DEPG, RB, BH [USNM].
- PT**, 4 ♂♂: DOMINICAN REPUBLIC, RD-023, Loma Casabito, RCEV, La Vega Prov., 340–522 m E 2106-146 m N, 1390 m, 31.i.2002, RB, BH, DEPG [USNM].
- PT**, 6 ♂♂, 2 ♀♀, 3 nymph ♀♀: DOMINICAN REPUBLIC, RD-022, La Sal, RCEV, La Vega Prov., 19°04.42'N, 70°34.18'W, 1010 m, 28–30.i.2002, RB, BH, DEPG [USNM].
- PT**, nymph ♂: DOMINICAN REPUBLIC, RD-021, Arroyazo, RCEV, La Vega Prov., 19°02.27'N, 70°32.64'W, 990 m, 26–27.i.2002, RB, BH, DEPG [USNM].
- PT**, ♂, ♀: DOMINICAN REPUBLIC, RD-025, Km 10 on Rd to Los Anones, S Ocoa, San José de Ocoa Prov., 347–605 m E 2052-511 m N, 1070 m, 1–2.ii.2002, RB, BH, DEPG [USNM].
- PT**, ♀: DOMINICAN REPUBLIC, near Los Tablones River, W La Ciénaga de Manabao, E Pico Duarte, Cordillera Central, La Vega Prov., ca. 1200 m asl, 28.vi.2012, C. Vogt [OC, No 0535-4].
- PT**, nymph ♀: DOMINICAN REPUBLIC, RD-043, on Trail Arroyazo to La Sal, RCEV, La Vega Prov., on path between 19°02.374'N, 70°32.684'W, 1249 m and 19°02.021'N, 70°32.584'W, 1102 m, 10.vii.2002, DEPG, BH, RB [USNM].
- PT**, nymph ♀: DOMINICAN REPUBLIC, RD-128, PNAB, around caseta La Sierrecita, Santiago Prov., 19°14.889'N, 71°04.735'W, 752 m, 9.iv.2003, DEPG, RB, BH [USNM].
- PT**, 4 eggs: DOMINICAN REPUBLIC, RD-149, Loma La Golondrina, RCEV, La Vega Prov., 19°03.498'N, 70°32.670'W, 11.vii.2003, day and night, DEPG, RB, BH [USNM].
- PT**, 2 eggs: DOMINICAN REPUBLIC, RD-149, Loma La Golondrina, RCEV, La Vega Prov., 19°03.498'N, 70°32.670'W, 11.vii.2003, day and night, DEPG, RB, BH, ex coll USNM [OC, No 0535-1].
- PT**, ♀: DOMINICAN REPUBLIC, RD-151, La Sal, RCEV, La Vega Prov., 19°04.101'N, 70°34.089'W, 1043 m, 12.vii.2003, night, DEPG, RB, BH, ex coll USNM [FH, No 1220-1].
- PT**, ♂: DOMINICAN REPUBLIC, RD-149, Loma La Golondrina, RCEV, La Vega Prov., 19°03.498'N, 70°32.670'W, 11.vii.2003, day and night, DEPG, RB, BH, ex coll USNM [FH, No 1220-2].
- PT**, egg: DOMINICAN REPUBLIC, RD-14, Loma La Golondrina, RCEV, La Vega Prov., 19°03.498'N, 70°32.670'W, 11.vii.2003, day and night DEPG, RB, BH, ex coll USNM [FH, No 1220-E].

Distribution.—So far only known from the provinces of La Vega, Santiago, Barahona, Independencia, and San José de Ocoa in Dominican Republic (Fig. 9).

Etymology.—This species is dedicated to Dr. Daniel E. Pérez-Gelabert (USNM) who collected the type specimens and provided specimens for the present study.

Description.—♀♀ (Figs 2, 3b, e, h). Small for the genus (body length 39.8–50.5 mm). Apterous. General color variable and more or less lichenose to moss-like; various shades of brown and green. Eyes dark brown with a yellowish-green reticulate pattern.

Head: Slightly longer than wide, broadest at the eyes and slightly narrowed towards the posterior. Vertex strongly raised, rounded, convex, and armed with a crown-like ornamentation formed by six prominent and acute spines and four dentate foliaceous projections.



Fig. 1. Male (HT) of *Taraxippus perezgelaberti* sp. nov. Habitus: a. Dorsal; b. Lateral; c. Ventral. Head and thorax: d. Dorsal; e. Lateral; f. Ventral. End of the abdomen: g. Dorsal; h. Lateral; i. Ventral.



Fig. 2. Female (PT) of *Taraxippus perezgelaberti* sp. nov. Habitus: a. Dorsal; b. Lateral; c. Ventral. Head and thorax: d. Dorsal; e. Lateral; f. Ventral. End of the abdomen: g. Dorsal; h. Lateral; i. Ventral.

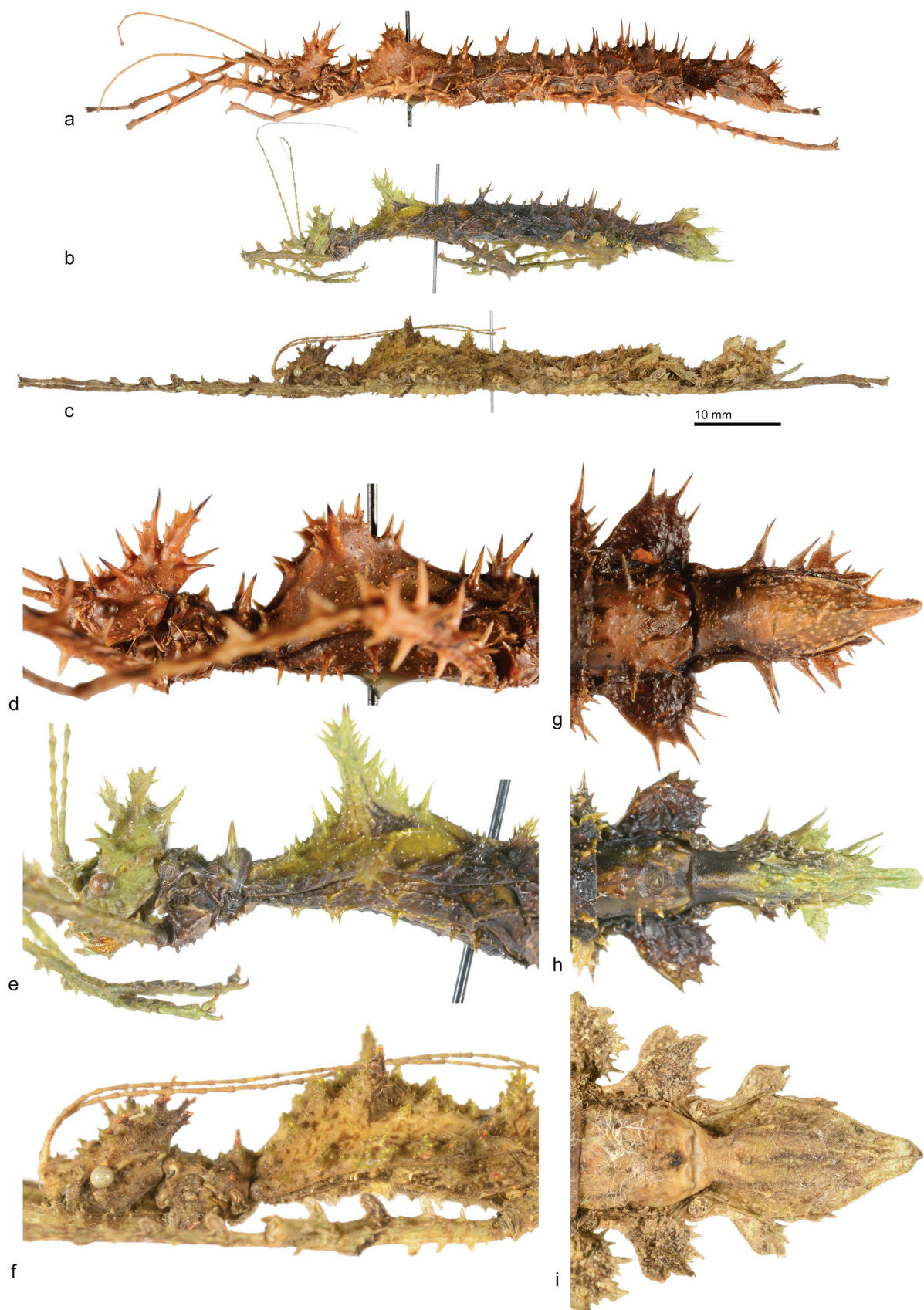


Fig. 3. Comparison of females of *Taraxippus*. Note: (d–i) not in scale. Habitus in lateral view: a. *Taraxippus paliurus* Moxey, 1971; b. *Taraxippus perezgelaberti* sp. nov.; c. *Taraxippus samarae* sp. nov. Head, pro-, and mesothorax in lateral view: d. *Taraxippus paliurus* Moxey, 1971; e. *Taraxippus perezgelaberti* sp. nov.; f. *Taraxippus samarae* sp. nov. End of the abdomen in ventral view: g. *Taraxippus paliurus* Moxey, 1971; h. *Taraxippus perezgelaberti* sp. nov.; i. *Taraxippus samarae* sp. nov.

Genae usually with a pale cream longitudinal postocular line. Eyes prominent, almost spherical and their length about 2× that of genae. Antennae filiform, reaching to abdominal segment IV. Scapus slightly compressed dorsoventrally, constricted at base, about 2× longer than wide and with a distinct dorsal spine towards apex. Pedicellus cylindrical and somewhat constricted towards apex.

Thorax: Pronotum slightly wider than long and the transverse median sulcus distinctly impressed; entire surface irregularly granulated. Four enlarged spines in posterior half, two towards the lateral and two towards the dorsolateral. Mesonotum 3.7× longer than pronotum; distinctly swollen premedially, densely granulate and with irregular spines; at widest area with four dorsal distinctly outward-directed, multispinose processes, two towards the lateral and two dorsolateral, larger, and somewhat pointing towards the anterior; two dorsal, smaller ones close to the posterior margin. Mesosternum rough, with small spines along the lateral margins. Metanotum widened towards the posterior; sculptured with two distinct, dorsal, multispinose projections medially, slightly pointing towards the posterior; 0.5× longer than mesonotum. Metapleurae with large supracoxal multispinose projection near the base, supplied with several shorter spines.

Abdomen: Median segment almost half the length of metanotum. Abdomen excluding median segment almost as long as head and thorax combined. Segments III–IV slightly increasing in width, V widest segment (2× wider than long), VI–VII tapered towards the posterior. Terga III–VIII with the lateral margins posteriorly expanded into a small dentate and dorsally carinate lobe; the smallest in tergum III, larger and almost equal in size in terga IV–VI, which projects laterally by less than one-third the width of segment; the largest in tergum VII, which projects laterally by more than half the width of segment. All abdominal terga with two irregular and sub-parallel longitudinal median carinae; along each of them, with one medium to large multispinose process per segment (II–VI); very small in VII. In VIII–IX, with expanded dentate lobes pointing towards the posterior, the biggest in VIII. Praeopercular organ formed by several concentric circular carinae, surrounded by eight small spines. Anal segment 0.7× longer than tergum IX, tectiform, broadened basally with expanded dentate lobes pointing towards the posterior; posterior margin with acute spines. Supraanal plate weakly developed, tectiform, triangular, and pointed at apex; slightly projecting over the anal segment and never reaching the end of the subgenital plate. Cerci usually green, long, and flattened, projecting over the anal segment. Subgenital plate slightly convex, shovel-like, widened medially, and strongly compressed towards the posterior third; granulated, with a median keel; ratio length/max. width ≈ 3×, posterior margin rounded at apex.

Legs: Profemora slightly compressed basally. Dorsal and ventral carinae of all femora, as well as dorsal carinae of all tibiae, armed with some irregular dentate foliaceous lobes. Tarsi elongated and slender.

♂♂ (Fig. 1). Small for the genus (body length 38.2–45.0 mm). Apterous. Generally similar to female but much more slender. Color similar to female except for the yellowish green markings along the lateral margins of pro-, meso-, and metathorax as well as abdominal terga II–VI.

Head: Similar to female except for the narrowed and more acute dorso-laterally directed and multispinose antler-like projections. Antennae filiform, long, slightly longer than the entire body.

Thorax: Meso- and metasternum with irregular spines. Pronotum similar to female. Mesonotum 3.7× longer than pronotum; slightly swollen premedially, densely granulate and with irregular spines; at widest area with two small spines towards the lateral

and two dorsal distinctly outward-directed, multispinose processes (composed of less spines than in females); two dorsal, small spines close to the posterior margin. Mesosternum rough, with small spines. Metanotum 0.6× longer than mesonotum, roundly constricted medially and widened towards the posterior; sculptured with two distinct, dorsal, multispinose projections medially, slightly pointing towards the posterior. Metapleurae with large supracoxal spine near the base, supplied with several shorter spines.

Abdomen: Median segment almost half the length of metanotum, with two small spines close to the posterior margin. Abdomen excluding median segment slightly longer than head and thorax combined. Segments II–VI almost equal in length. Sterna II–VI armed with two ventral small spines medially and two tiny spines close to the posterior margin. Terga II–IV (sometimes even V) armed with two dorsal pairs of spines close to the posterior margin and joined at base; each pair of spines consists of a small one pointing towards the anterior and a larger one (at least 2× in length) pointing towards the posterior. VI only with a pair of spines close to the posterior margin. The size of the spines on the terga decreases towards the posterior. Tergum VII with the lateral margins deflexed into a prominent, irregularly denticulate lobe, which laterally projects by more than one-third the width of segment. Anal segment 1.4× longer than tergum IX, tectiform, broadened basally, strongly narrowed medially, with a rounded incision at apex. Cerci brown, long, and narrowed towards the apex, projecting over the anal segment. Vomer triangular, widened at base, and acute at apex. Poculum strongly convex, the posterior portion granulated, with an irregular median keel; posterior margin rounded.

Legs: Profemora slightly compressed basally. Dorsal and ventral carinae of all femora, as well as dorsal carinae of all tibiae, armed with some irregular dentate foliaceous lobes. Tarsi elongated and slender.

Measurements (in mm).—♂, HT: Body 42.5, head 4.2, pronotum 2.1, mesonotum 9.7, metanotum 5.6, median segment 1.5, profemora 14.0, mesofemora 10.9, metafemora 14.2, protibia 14.7, mesotibia 12.2, metatibia 16.3, antennae >40.0.

♂♂, PT: Body 38.2–45.0, head 4.3–4.5, pronotum 2.3–2.5, mesonotum 8.3–10.6, metanotum 5.2–6.0, median segment 1.6–2.3, profemora 12.1–14.8, mesofemora 9.9–11.9, metafemora 12.8–15.2, protibia 12.7–16.2, mesotibia 10.9–13.2, metatibia 13.8–18.2, antennae >28.8.

♀♀, PT: Body 39.8–50.5, head 5.2–6.4, pronotum 2.8–3.0, mesonotum 8.7–10.9, metanotum 5.6–6.8, median segment 2.3–3.3, profemora 9.5–11.6, mesofemora 7.3–9.7, metafemora 9.9–13.3, protibia 9.1–12.0, mesotibia 9.0–10.7, metatibia 11.4–15.1, antennae >29.0.

Egg: (Fig. 4d–f) General color various shades of brown. Capsule 2× longer than wide and 1.6× longer than high. General shape of capsule triangular prism, with the lateral surfaces slightly convex and the dorsal surface almost flat. Lateral longitudinal carinae set with a net-like structure of branched and tangled fringes, without free standing apices. Lateral surfaces wavy and glossy. Dorsal surface of egg without a longitudinal median row of hairy structures. Micropylar plate positioned in the anterior half in the dorsal egg surface and roughly half the length of capsule; shape spearhead-like pointing towards anterior; surface unarmed and outer margin set with moderately long hairy structures. Micropylar cup placed almost in posterior margin of plate. Median line pale brown, not reaching the posterior pole. Operculum oval, slightly convex; surface variable from smooth to rough, with a raised concentric central plateau from whose

margin a network of fringes is born and connects with that of the lateral margins of the capsule, intertwining with each other; between the central plateau and the margin of the operculum a crown-like ornamentation is present, formed by sets of multispinose processes.

Measurements (in mm).—Egg, PT: length 3.1, width 1.4, height 2.0, length of micropylar plate 1.4.

Comments.—The male of this new species was mistaken for *T. paliurus* Moxey, 1971 by Pérez-Gelabert (1999), who provided a description and illustrations of the terminalia.

***Taraxippus samarae* sp. nov.**

<http://zoobank.org/400FD424-309B-41D6-ADF5-8A2FF0C37B08>

Figs 3c, f, i, 4a–c, 5–8

Differentiation.—Males are readily differentiated from those of *T. perezgelaberti* sp. nov. by being winged. Furthermore, they differ from that species by bearing distinct lateral foliaceous projections on abdominal segments V–VII and having the apex of the antler-like mesonotal processes bifurcate (Figs 5, 6). Females differ from the other two known species of the genus by the broadened subgenital plate, apically bifurcate antler-like processes of the mesonotum, and unarmed abdominal sternum VI (at best tiny granules) and terga (Fig. 3). Eggs readily differ from those of *T. perezgelaberti* sp. nov. by their rectangular cross-section, flattened lateral surfaces, setae-like long, slender marginal fringes that usually are free at the apex, as well as having fringes along the outer margin of the micropylar plate (Fig. 4).

Type material and specimens examined.—

HT, ♂: COSTA RICA, Siquirres, Limón Prov., 10°03'17.1"N, 83°33'05.6"W, 610 m, iii.2018, J. Sommerhalder [ZSMC].

PT, ♀: COSTA RICA, Siquirres, Limón Prov., 10°03'17.1"N, 83°33'05.6"W, 610 m, iii.2018, J. Sommerhalder [ZSMC].

PT, 2 ♂♂, 2 ♀♀, ♀ nymph: COSTA RICA, Siquirres, Limón Prov., 10°03'17.1"N, 83°33'05.6"W, 610 m, iii.2018, J. Sommerhalder [OC, No. 0536-(3–7)].

PT, ♀: COSTA RICA, Pocaá, Finca INBio, Bosque Lluvioso, Limón Prov., 200–300 m, 22.ix.2004, night, J. Mata, Colecta Libre, L_N_241740_S51770, #95228; INB0004179712, INBIOCRI COSTA RICA; DNA Barcoding E. Ulate, CCDB-15936 D04 [INBIO].

PT, ♀, 15 eggs: PANAMA, Parque Nacional General de División Omar Torrijos Herrera, Coclé Prov., 8°40'5.53"N, 80°35'33.48"W, vii.2019, O. Conle, P. Valero [OC, No. 0536-1, 2].

PT, 11 ♂♂, 10 ♀♀, 12 eggs: COSTA RICA, Siquirres, Limón Prov., iii.2018, J. Sommerhalder, Ex Zucht B.Kneubühler 2019, F1 [OC, No. 0536-(8–29)].

PT, ♂, ♀, egg: COSTA RICA, Siquirres, Limón Prov., iii.2018, J. Sommerhalder, Ex Zucht B. Kneubühler 2019, F1 [FH, No. 1200-1, 2 and E].

Distribution.—So far only known from Costa Rica (Limón Province: Siquirres and Pocaá) and Panama (Coclé Province, Parque Nacional General de División Omar Torrijos Herrera) (Fig. 9).

Etymology.—This stunning new species is named after Samara, the daughter of Jürg Sommerhalder (Switzerland), who found the holotype and several paratypes in March 2018 in Costa Rica.

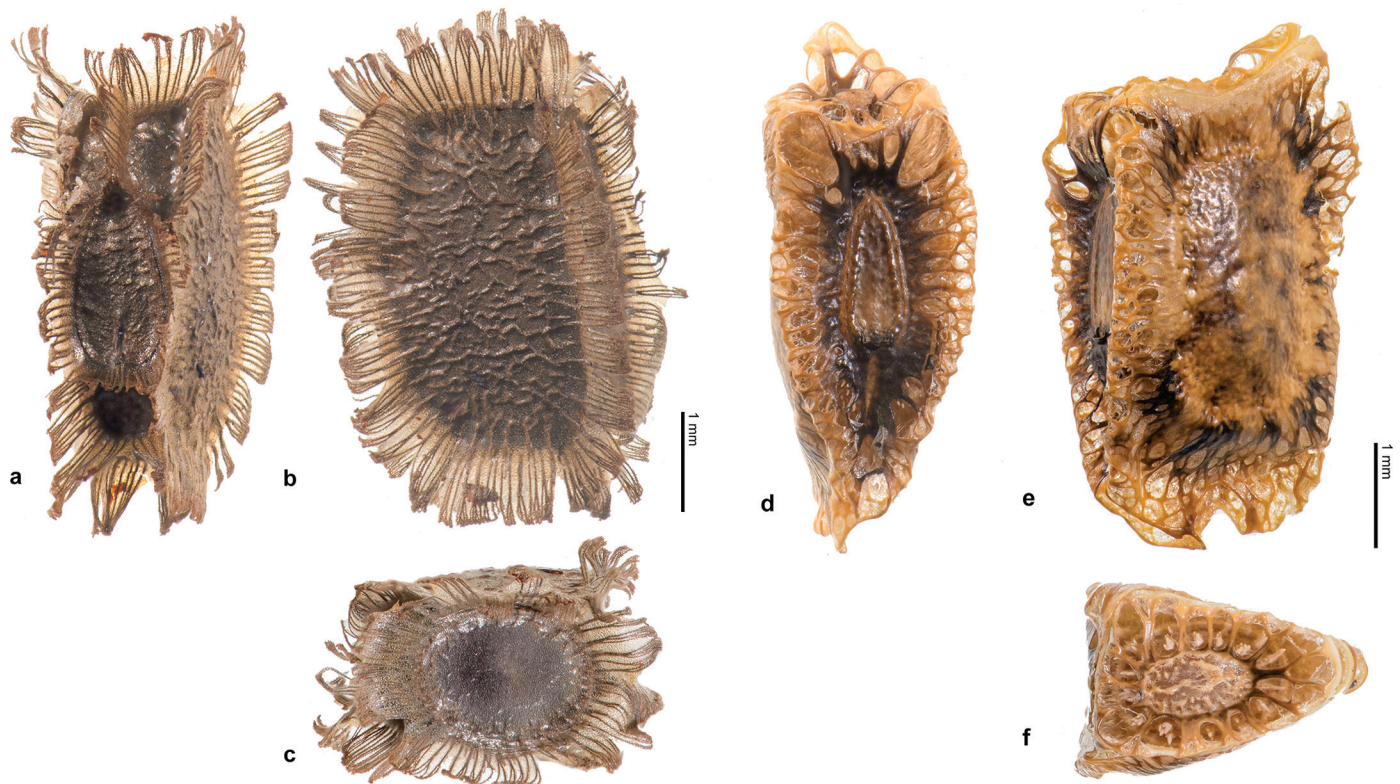


Fig. 4. Comparison of eggs: *Taraxippus samarae* sp. nov.: a. Dorsal; b. Lateral; c. Frontal. *Taraxippus perezgelaberti* sp. nov.: d. Dorsal; e. Lateral; f. Frontal.



Fig. 5. Male (HT) of *Taraxippus samarae* sp. nov. Habitus: a. Lateral; b. Dorsal.



Fig. 6. Male (PT) of *Taraxippus samarae* sp. nov. Habitus: a. Dorsal; b. Lateral; c. Ventral. Head and thorax: d. Dorsal; e. Lateral; f. Ventral. End of the abdomen: g. Dorsal; h. Lateral; i. Ventral.

Description.—In this species, all spines and multispinose processes have blunt apices.

♀ (Figs 3c, f, i, 7, 8a–c). Medium to large for the genus (body length 54.7–71.1 mm). Apterous. General color various shades of brown, usually with green markings (especially in foliaceous projections) and a dorsal longitudinal pale cream stripe from the head to the end of the abdomen. Eyes dark brown with a yellowish-green reticulate pattern. Entire body (including antennae) setose.

Head: Slightly longer than wide, broadest at the eyes and slightly narrowed towards the posterior. Vertex slightly raised, rounded, convex, and armed with a crown-like ornamentation formed by eight prominent antler-like projections, with reddish brown and blunt apex. Genae with a pale cream longitudinal postocular carina that ends in a small spiniform tubercle. Eyes prominent, almost spherical, and their length about 2× that of genae. Antennae filiform, reaching to median segment. Scapus compressed dorsoventrally, about 2× longer than wide and with two exterior foliaceous projections towards apex. Pedicellus cylindrical and somewhat constricted towards apex.

Thorax: Pronotum slightly wider than long and the transverse median sulcus distinctly impressed, expanding over the entire width of segment; entire surface irregularly granulated. Four enlarged, spiniform tubercles in posterior half, two towards the lateral and two towards the dorsal. Mesonotum 3.2× longer than pronotum; distinctly swollen premedially, densely granulose and with irregular spiniform tubercles; at widest area with two dorsal distinctly outward-directed, multispinose processes bifurcated at apex; two smaller dorsal multispinose projections towards the posterior margin; lateral margins bearing multispinose projections, increasing in size towards the widest area. Mesosternum rough, with small spiniform tubercles along the lateral margins. Metanotum widened towards the posterior, roundly constricted medially; sculptured with four dorsal small multispinose projections, two medially and two close to the posterior margin; 0.5× longer than mesonotum. Meso- and metapleurae granulated and with a marginal row of small spiniform tubercles.

Abdomen: Median segment almost half the length of metanotum, usually with two dorsal multispinose projections towards the posterior, variable in size. Abdomen excluding median segment almost equal in length to head and thorax combined. Segments III–IV strongly increasing in width, V widest segment (2.5× wider than long), VI–VII narrowing towards the posterior. Terga II–VIII with the lateral margins posteriorly expanded into a dentate and foliaceous projection; this strongly increasing in size from II–VI and decreasing in size towards VII. All terga with two irregular and sub-parallel longitudinal median carinae, usually with expanded foliaceous projections, distinctly large in VIII–IX. Praeopercular organ formed by a small dark blunt tubercle close to the posterior margin of sternum VII. Anal segment 0.8× longer than tergum IX, tectiform, broadened basally; posterior margin rounded. Supraanal plate well developed, tectiform, slightly longer than wide, projecting over the anal segment and almost reaching the end of the subgenital plate to form a beak-like structure. Cerci green, long, laterally compressed, with tipped apex, projecting over the anal segment. Subgenital plate slightly convex, shovel-like, with a median keel, ratio length/max. width $\approx 1.8\times$, posterior margin narrowed but not acute and usually not projecting over the anal segment.

Legs: Profemora slightly compressed basally. Dorsal and ventral carinae of all femora, as well as dorsal carinae of all tibiae, armed with some irregular dentate lobes. Tarsi elongated and slender.

♂♂ (Figs 5, 6, 8d). Medium to large for the genus (body length 45.8–54.2 mm) and fully winged. General color various shades

of brown, usually with irregular green markings (especially in foliaceous projections and tegmina). Anal area of the wings greyish brown, translucent. Eyes dark brown with a yellowish-green reticulate pattern. Entire body (including antennae) setose.

Head: Slightly longer than wide, broadest at the eyes and slightly narrowed towards the posterior. Vertex slightly raised, rounded, convex, and armed with a crown-like ornamentation formed by eight prominent antler-like projections, with reddish brown and blunt apex. Genae with a longitudinal postocular carina that ends in a small spiniform tubercle. Eyes prominent, almost spherical and their length about 2× that of genae. Antennae reaching to abdominal segment V. Scapus compressed dorsoventrally, about 2× longer than wide and with two exterior foliaceous projections towards apex. Pedicellus cylindrical and somewhat constricted towards apex.

Thorax: Pronotum slightly wider than long and the transverse median sulcus distinctly impressed, expanding over the entire width of segment; entire surface irregularly granulated. Four enlarged, spiniform tubercles in posterior half, two towards the lateral and two towards the dorsal. Mesonotum 2.8× longer than pronotum; swollen premedially, densely granulose and with irregular spiniform tubercles; at widest area with two dorsal distinctly outward-directed, multispinose processes bifurcated at apex; two smaller dorsal multispinose projections towards the posterior margin; lateral margins bearing spines, increasing in size towards the widest area. Mesosternum rough, with small, spiniform, pale cream tubercles along the lateral margins. Metanotum slightly widened towards the posterior; 0.7× longer than mesonotum. Meso- and metapleurae granulated and with a marginal row of small spiniform tubercles. Tegmina not reaching the posterior margin of metanotum and with a fairly acute central spine; the basal portion notably narrowed and the posterior margin rounded. Alae reaching to abdominal segment VII.

Abdomen: Unarmed. Median segment about one-quarter the length of metanotum. Abdomen excluding median segment slightly longer than head and thorax combined. Segments II–VII almost equal in length and width. Terga III–IV with the lateral margins deflexed into a tiny irregularly foliaceous projection. Terga V–VIII with the lateral margins deflexed into a prominent irregularly foliaceous projection, which projects laterally by more than two-thirds the width of segment in V–VII and one-third in VIII. Anal segment 0.7× longer than tergum IX, tectiform, broadened basally; posterior margin rounded. Cerci green, long, and almost cylindrical, projecting over the anal segment. Vomer triangular, widened at base, and acute at apex. Poculum strongly convex, the posterior portion granulated, with an irregular median keel; posterior margin rounded.

Legs: Profemora slightly compressed basally. Dorsal and ventral carinae of all femora, as well as dorsal carinae of all tibiae, armed with some irregular dentate lobes. Tarsi elongated and slender.

Measurements (in mm).—♂, HT: Body 47.3, head 3.6, pronotum 2.3, mesonotum 7.8, metanotum 7.2, median segment 1.8, profemora 11.4, mesofemora 9.1, metafemora 10.7, protibia 10.2, mesotibia 10.3, metatibia 12.8, tegmina 6.4, alae 30.1, antennae >27.0.

♂♂, PT: Body 45.8–54.2, head 3.8–4.5, pronotum 1.9–3.0, mesonotum 7.3–7.9, metanotum 6.4–7.9, median segment 1.5–1.9, profemora 10.3–12.3, mesofemora 9.1–10.7, metafemora 11.4–12.7, protibia 10.2–12.2, mesotibia 10.2–11.4, metatibia 12.2–15.2, tegmina 6.4–7.1, alae 27.5–31.1, antennae >30.0.

♀♀, PT: Body 54.7–71.1, head 6.6–7.8, pronotum 3.7–4.7, mesonotum 11.5–14.8, metanotum 6.3–8.5, median segment



Fig. 7. Female (PT) of *Taraxippus samarae* sp. nov. Habitus: a. Dorsal; b. Lateral; c. Ventral. Head and thorax: d. Dorsal; e. Lateral; f. Ventral. End of the abdomen: g. Dorsal; h. Lateral; i. Ventral.



Fig. 8. Living specimens of *Taraxippus samarae* sp. nov. a. Adult female from Cope, Panama, in its natural habitat; b, c. Adult females from Siquirres, Costa Rica, showing intraspecific variability in the coloration; d. Adult male from Siquirres, Costa Rica.

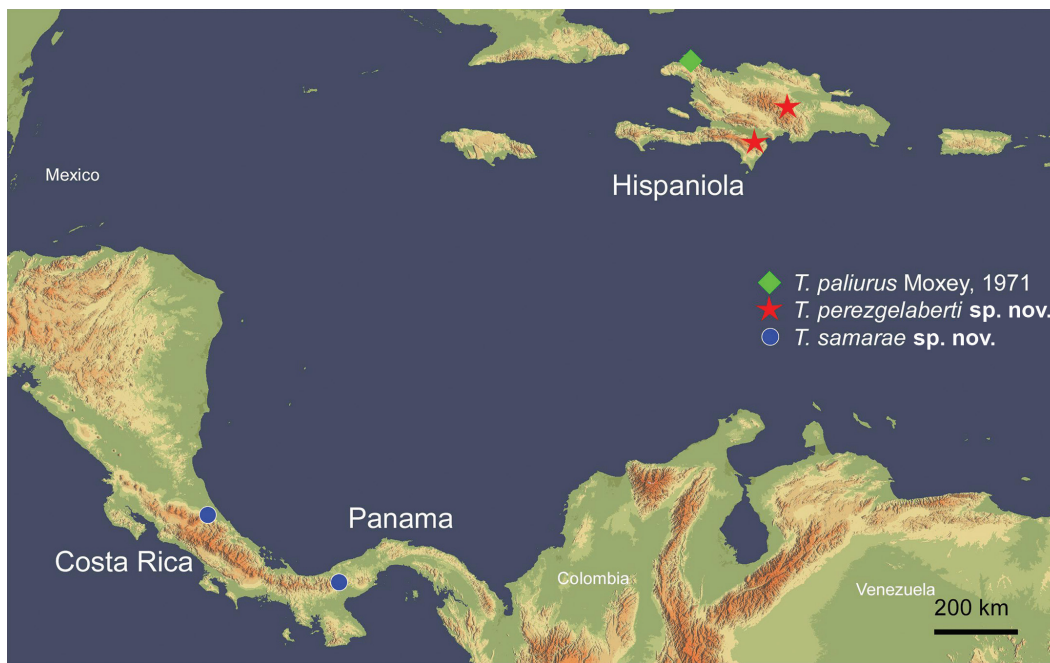


Fig. 9. Distribution map of all known *Taraxippus* species.

2.2–2.7, profemora 11.4–14.9, mesofemora 9.7–13.2, metafemora 11.5–16.0, protibia 11.3–15.2, mesotibia 11.1–14.4, metatibia 14.4–18.6, antennae >26.0.

Egg (Fig. 4a–c): General color chestnut brown. Capsule $2.6\times$ longer than wide and $1.6\times$ longer than high. General shape of capsule cuboid, with the lateral surfaces flattened and almost parallel and the dorsal surface slightly convex. In lateral aspect, slightly widened medially. Lateral longitudinal carinae set with a row of long and slender fringes, usually branched and somewhat connected laterally by a kind of brownish translucent membrane. Lateral surfaces with a reticulate pattern of carinae. Dorsal and ventral surfaces of egg each with a longitudinal median row of hairy structures. Micropylar plate positioned medially on the dorsal egg surface and roughly half the length of capsule; shape spearhead-like and pointed towards anterior; surface unarmed and outer margin set with moderately long hairy structures. Micropylar cup small and placed in posterior one-quarter of plate. Operculum oval, flat, and with the outer margin set with a row of the same long feather-like fringes seen along the longitudinal outer carinae of the egg-capsule; no capitulum.

Measurements (in mm).—Egg, PT: length 3.6, width 1.2, height 2.3, length of micropylar plate 1.9.

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