



***Lerneca inalata beripocone* subsp. nov. (Orthoptera: Phalangopsidae; Luzarinae): a new taxon for the northern Pantanal of Brazil**

RAYSA MARTINS LIMA¹, LUCIANO DE PINHO MARTINS², MARCELO RIBEIRO PEREIRA^{3,10},
TODOR D. GANCHEV^{4,5}, OLAF JAHN^{5,6}, MARCOS GONÇALVES LHANO¹,
MARINÊZ ISAAC MARQUES^{5,7,8} & KARL-L SCHUCHMANN^{5,6,8,9}

¹Universidade Federal do Recôncavo da Bahia, Centro de Ciências Agrárias, Ambientais e Biológicas, Laboratório de Ecologia e Taxonomia de Insetos. Programa de Pós-Graduação em Ciências Agrárias, 44380-000, Cruz das Almas, BA, Brazil.

E-mail: raysa.ml@hotmail.com, entomology@gmail.com

²Instituto Nacional de Pesquisas da Amazônia, Coordenação de Biodiversidade, Av. André Araújo, 2936, 69060-001, Manaus, AM, Brazil. E-mail: lucianodpm@gmail.com

³Centro de Ciências Agrárias, Departamento de Biologia, Universidade Federal do Espírito Santo – Campus de Alegre, 29.500-000, Alegre, ES, Brazil. E-mail: marcelo.ribeiropereira@gmail.com

⁴Department of Electronics, Technical University of Varna, 9010, Varna, Bulgaria. E-mail: tganchev@tu-varna.bg

⁵National Institute for Science and Technology in Wetlands, Science without Borders Program (CsF), Federal University of Mato Grosso, Av. Fernando Corrêa da Costa 2367, Cuiabá, MT, Brazil

⁶Zoological Research Museum A. Koenig, Adenauerallee 160, 53113 Bonn, Germany.

E-mail: klschuchmann@googlemail.com, o.jahn@zfmk.de

⁷Universidade Federal de Mato Grosso, Programa de Pós-Graduação em Ecologia e Conservação da Biodiversidade, 78060-900, Cuiabá, MT, Brazil

⁸Universidade Federal de Mato Grosso, Programa de Pós-Graduação em Zoologia, 78060-900, Cuiabá, MT, Brazil.

E-mail: marinez513@gmail.com

⁹University of Bonn, 53113, Bonn, Germany.

¹⁰Current address: Instituto de Ciências Biológicas e da Saúde, Universidade Federal de Viçosa (UFV) – Campus Rio Paranaíba, 38810-000, Rio Paranaíba, MG, Brazil

Abstract

The first record of the Orthoptera species *Lerneca inalata* for Brazil is presented here. The taxon is represented by a new subspecies *Lerneca inalata beripocone* subsp. nov. (Phalangopsidae, Luzarinae), collected in the Pantanal of Poconé, Mato Grosso, Brazil. This work includes morphological and morphometric data as well as descriptions of female genitalia and calling song. The new subspecies has as diagnostic features the male genitalia with six ventral spines on the B sclerite, the first spine having a subtle bifurcation; the mid-region of the strongly sclerotized pseudepiphallus; inclination of C sclerite with slightly concave curvature; tegmina-length ratio and the speculum (syn. mirror) width approximately three times the length of the apical area. The description of the female genitalia and the calling song is presented for the first time for the species *Lerneca inalata*. A distribution map covers the local occurrence of its subspecies.

Key words: Grylloidea, new subspecies, first record for Brazil, bioacoustics, genitalia

Introduction

The taxa of the subfamily Luzarinae, Orthoptera (Phalangopsidae) which occur in the Neotropics were classified in groups of genera, denominated as A, B, and C (*sensu* Desutter 1990), based on differences in genitalia structure. Group C has the largest number of genera (*Lerneca* Walker, 1869; *Gryllosoma* Hebard, 1928; *Tairona* Hebard, 1928; *Eidmanacris* Chopard, 1956; *Strinatia* Chopard, 1970; *Prosthacusta* Saussure, 1874; *Cophella* Hebard, 1928; *Smicrotes* Desutter-Grandcolas, 1991; *Aracamby* de Mello, 1992; *Cacruzia* de Mello, 1992; *Koilenoma* Desutter-Grandcolas, 1993; *Microlerneca* de Mello, 1995; *Endophallusia* de Mello, 1990; *Lernecopsis* de Mello,

1995; *Izecksohniella* de Mello, 1992; *Guabamima* de Mello, 1992; *Ottedana* de Mello & Andrade, 2003; *Adenopygus* Bolfarini & de Mello, 2012; *Bambuina* de Mello, Horta & Bolfarini, 2013; *Joadis* Mews & Sperber, 2009; *Marcgraviella* Souza-Dias & Desutter-Grandcolas, 2014; *Lernecopsis* de Mello, 1995; *Marliella* Mews & Mól 2009; *Mellopsis* Mews & Sperber, 2010; *Pizacris* Souza-Dias & Desutter-Grandcolas 2015).

The genus *Lerneca* Walker, 1869 is distributed over a wide area of the Neotropics and has as its type species, *L. varipes* Walker, 1869, and junior synonyms *Diplacusta* Saussure, 1874 and *Diplacustes* Saussure, 1878 (Eades *et al.* 2015). Eight valid species are recognized for *Lerneca*: *L. digrediens* (Otte, 2006), with records from Costa Rica; *L. funebris* Hebard, 1928, Colombia, Peru, and Bolivia (Aguilar 1973); *L. occidentalis* Gorochov, 2007, Mexico; *L. ornata* Desutter-Grandcolas, 1992, French Guiana and Ecuador (Desutter-Grandcolas 1992; Gorochov 2014a); *L. sylvestris* Gorochov, 2014, Bolivia (Gorochov 2014a); *L. fuscipennis* (Saussure, 1874), Brazil (Saussure 1874); *L. varipes* Walker, 1869, Panama, Colombia, Trinidad, Suriname, Bolivia, and Brazil (Desutter-Grandcolas 1992), and *L. inalata* (Saussure, 1874) occurring in Mexico, Suriname, Bolivia, Paraguay (Desutter-Grandcolas 1992; Gorochov 2007, 2014a), and Brazil (first record presented here).

The characteristics directly related to the reproductive process, including the production of acoustic signals, as well as the form and arrangement of phallic sclerites, are among the most important for cricket taxonomy (Valdecasas 2011; Gorochov 2014b). However for *L. varipes* and *L. funebris* there is information only about color and external morphology (Saussure 1874, 1878; Hebard 1928; Desutter-Grandcolas 1992). Description of species-specific calling songs exist only for *L. fuscipennis* (Desutter-Grandcolas 1992).

Lerneca inalata (Saussure, 1874) comprises four recognized subspecies: *L. i. amboro* Gorochov, 2014 (Bolivia), *L. i. inalata* (Saussure, 1874) (Suriname), *L. i. mexicana* Gorochov, 2007 (Mexico), and *L. i. pantanal* Gorochov, 2014 (Paraguay) (Eades *et al.* 2015). In this study we describe a new subspecies of *L. inalata*, which is also the first record for Brazil. In addition, we present the previously unknown calling song as well as the morphology of the female genitalia of *L. inalata* (Fig. 1).

Material and methods

Our study was carried out in two areas in the Pantanal of Poconé, Mato Grosso, Brazil: (a) in the vicinity of the Advanced Pantanal Research Base (BAPP) of the Federal University of Mato Grosso (UFMT), located in the SESC Baía das Pedras Ecological Resort, SESC Pantanal (-16.500947°, -56.413267°) and (b) at Pouso Alegre farm (-16,50303°, -56,74533°). The specimens and audio recordings were collected at SESC in July 2013 and at Pouso Alegre between September and November 2013. Both areas are subject to geological, climatic, and ecological influences from the Cuiabá and Bento Gomes rivers (Junk *et al.* 2006).

Cricket calling songs were recorded in the field using a Zoom H4N and a Sony PCM-D50 portable digital recorder. All recordings are stored at the INAU Pantanal BioData Center – IPBC / LETA / UFMT. After documenting their sounds, specimens were collected for identification and anatomical studies. Analysis of calling songs were carried out using Avisoft SasLab Lite software by selecting a 10 s portion of each sound for the analysis of the frequency range, dominant frequency, number of chirps, number of pulses per second, number of pulses per chirp, pulse and chirp durations, and inter-pulse and inter-chirp intervals. The sound analyses are expressed as: mean ± standard deviation (amplitude variation, sample size). Temporal measurements are given in ms and frequencies in kHz.

The right tegmina of 16 male specimens were removed and fixed between a slide and a cover slip to count the teeth of the stridulatory file under high magnification. Measurements were carried out with a Zeiss SteREO Discovery V20 stereomicroscope, equipped with AxioCam MRc digital camera and Axio Vision 4.8 image-processing software. The following abbreviations were used: BL = body length; PL = pronotum length; PW = pronotum width; IOD = inter-ocular distance; RTL = right tegmen length; RTW = right tegmen width; PFL = posterior femur length; PTL = posterior tibia length; OL = ovipositor length.

The genitalia of nine male specimens were extracted, treated with a KOH solution to remove musculature according to the methodology of Desutter-Grandcolas (2014), and photographed. Three female genitalia were also extracted, analyzed, and photographed. The photographs of the genitalia were taken with the structures immersed in lubricant *K-Y*® gel to stabilize the structure and photograph the dorsal, ventral, and lateral views. An additional layer of 80% alcohol was placed over the gel to reduce reflection.

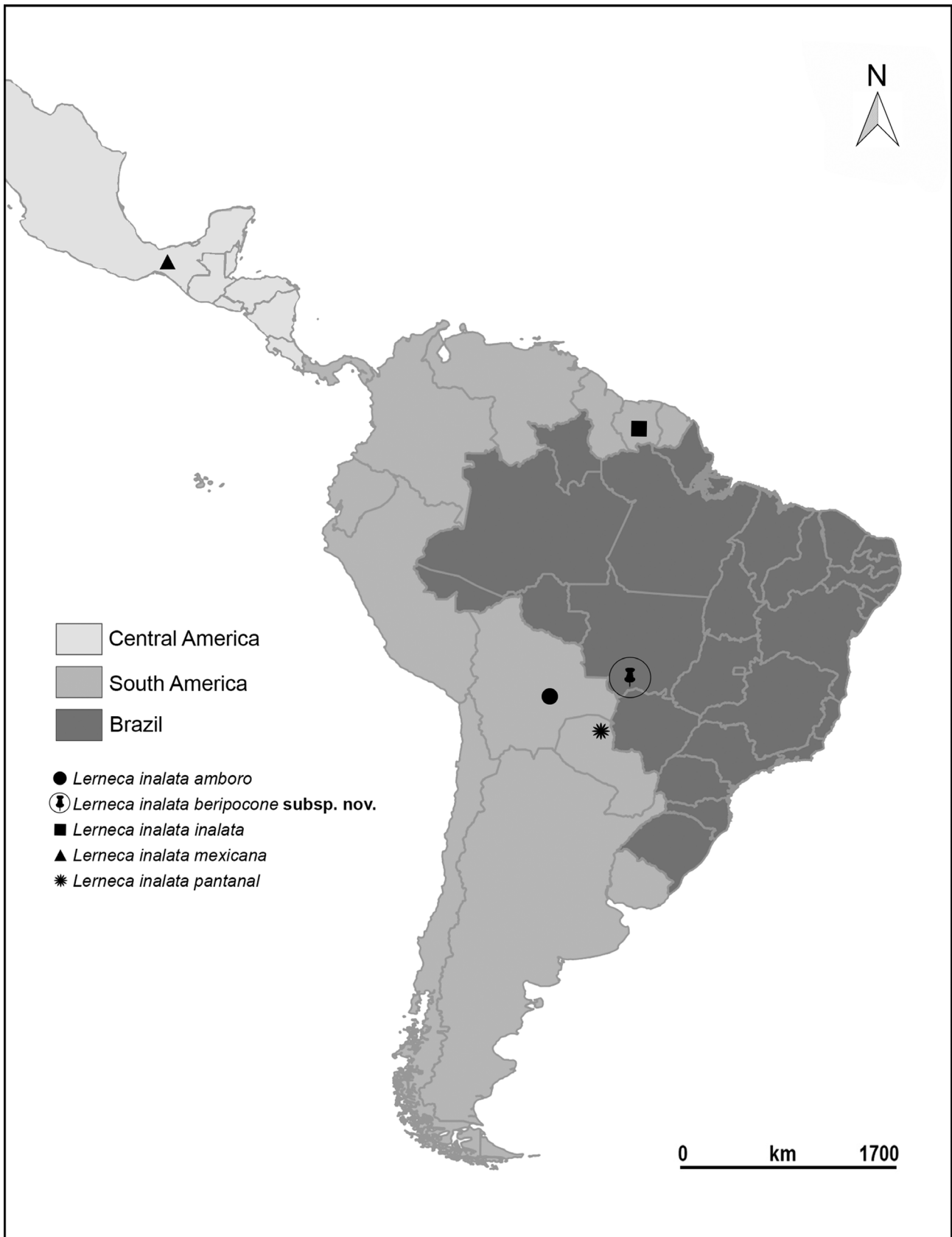


FIGURE 1. Occurrence of *Lerneca inalata* subspecies in Central and South America.

All images were obtained with a Zeiss V20 stereomicroscope equipped with an AxioCam MRc camera. The final image was the result of a combination of 35 photographs obtained at different foci using the Zeiss Axio Vision 4.8 image-processing program.

The terminology applied in this study is as follows: male and female genitalia as proposed by Desutter (1987), with modifications from Desutter-Grandcolas (2003) and tegminal venation according to Ragge (1965), and audio description after Martins *et al.* (2014). All genitalia descriptions are based on paratypes, avoiding holotype dissection.

The male holotype, five female paratypes, and ten male paratypes were deposited at the Zoological Collection of the Federal University of Mato Grosso (UFMT / CEMT). The audio recordings of the collected specimens are stored at the sound archive of the INAU Pantanal BioData Center (IPBC) and available on the CO.BRA website (Computational Bioacoustics Research Unit: <http://cobra.ic.ufmt.br/archive/publication/datasets>).

Results

Lerneca inalata beripocone Lima, Martins & Lhano, subsp. nov.

(Fig. 2)

<http://lsid.speciesfile.org/urn:lsid:Orthoptera.speciesfile.org:TaxonName:492155>

Type locality. Brazil, Mato Grosso State, Poconé municipality, Fazenda Pouso Alegre: -16.50824°, -56.75050°.

Type material. HOLOTYPE (male): CEMT 52041; BRAZIL, MT, Poconé, Fazenda Pouso Alegre, Pantanal (FPAP), -16,50824°, -56,75050°, 29.x.2013, active collection, Lima, R.M. coll., *Lerneca inalata beripocone* Lima, Martins & Lhano det.. ALLOTYPE (female): CEMT 52042; BRAZIL, MT, Poconé, Fazenda Pouso Alegre, Pantanal (FPAP), -16,50893°, -56,75367°, 25.ix.2013, active collection, Lima, R.M. coll., *Lerneca inalata beripocone* Lima, Martins & Lhano det..

Other material examined. PARATYPES: 6 females CEMT 52043, 52044, 52045, 52046, 52047, 52048; BRAZIL, MT, Poconé, Fazenda Pouso Alegre, Pantanal, -16,50303°, -56,74533°, 19–29.x.2013, active collection, R.M. Lima coll.; 7 males: 1 male, CEMT 52049; BRAZIL, MT, Poconé, Fazenda Pouso Alegre, Pantanal, -16.50384°, -56.73959°, 19.x.2013, active collection, R.M. Lima coll., *Lerneca inalata beripocone* Lima, R.M., Pereira, M.R., Martins, L.P., Lhano, M.G. det.; 1 male, CEMT 52050; BRAZIL, MT, Poconé, Fazenda Pouso Alegre, Pantanal, -16.50303°, -56.74533°, 01.xi.2013, active collection, Lima, R.M. coll., *Lerneca inalata beripocone* Lima, R.M. Pereira, M.R., Martins, L.P., Lhano, M.G. det.; 1 male, CEMT 52051; BRAZIL, MT, Poconé, Fazenda Pouso Alegre, Pantanal, -16.50252°, -56.74226°, 07.x.2013, active collection, R.M. Lima coll., *Lerneca inalata beripocone* Lima, R.M., Pereira, M.R., Martins, L.P., Lhano, M.G. det.; 1 male, CEMT 52052; BRAZIL, MT, Poconé, Fazenda Pouso Alegre, Pantanal, -16.50824°, -56.75050°, 15.x.2013, active collection, R.M. Lima coll., *Lerneca inalata beripocone* Lima, R.M., Pereira, M.R., Martins, L.P., Lhano, M.G. det.; 1 male, CEMT 52053; BRAZIL, MT, Poconé, Fazenda Pouso Alegre, Pantanal, 23.x.2013, active collection, Lima, R.M. coll., *Lerneca inalata beripocone* Lima, R.M., Pereira, M.R., Martins, L.P., Lhano, M.G. det.; 1 male, CEMT 52054; BRAZIL, MT, Poconé, Fazenda Pouso Alegre, Pantanal, -16.50824°, -56.75050°, 15.x.2013, active collection, Lima, R.M. coll., *Lerneca inalata beripocone* Lima, R.M., Pereira, M.R., Martins, L.P., Lhano, M.G. det.; 1 male, CEMT 52055; BRAZIL, MT, Poconé, Fazenda Pouso Alegre, Pantanal, -16.50893°, -56.75367°, 25.ix.2013, active collection, Lima, R.M. coll., *Lerneca inalata beripocone* Lima, R.M., Pereira, M.R., Martins, L.P., Lhano, M.G. det.; 1 male, CEMT 52056; BRAZIL, MT, Advanced Pantanal Research Base (BAPP) of the Federal University of Mato Grosso, -16.500947°, -56.413267°, 28.vii.2013, active collection, R.M. Lima & L.P. Martins coll., *Lerneca inalata beripocone* Lima, R.M., Pereira, M.R., Martins, L.P., Lhano, M.G. det..

Etymology. In honor of the indigenous tribe ‘Beri-Poconé’ (Bororo ethnic group) which inhabited the region where the subspecies is present and from which originated the name of the municipality of Poconé, Mato Grosso state.

Diagnosis. This subspecies is distinguished by the combination of the following characters: (i) male genitalia with six spines on the ventral region of sclerite B, with the first spine on the anterior portion having a subtle bifurcation (Fig. 3A); (ii) sclerite C with slightly concave curvature in the direction of the dorsal region of the genitalia (Fig. 3C); (iii) tegmina: ratio between speculum length and apical area length *c.* 2.9, and ratio between width and apical area length *c.* 3.16 (Fig. 4A, B).

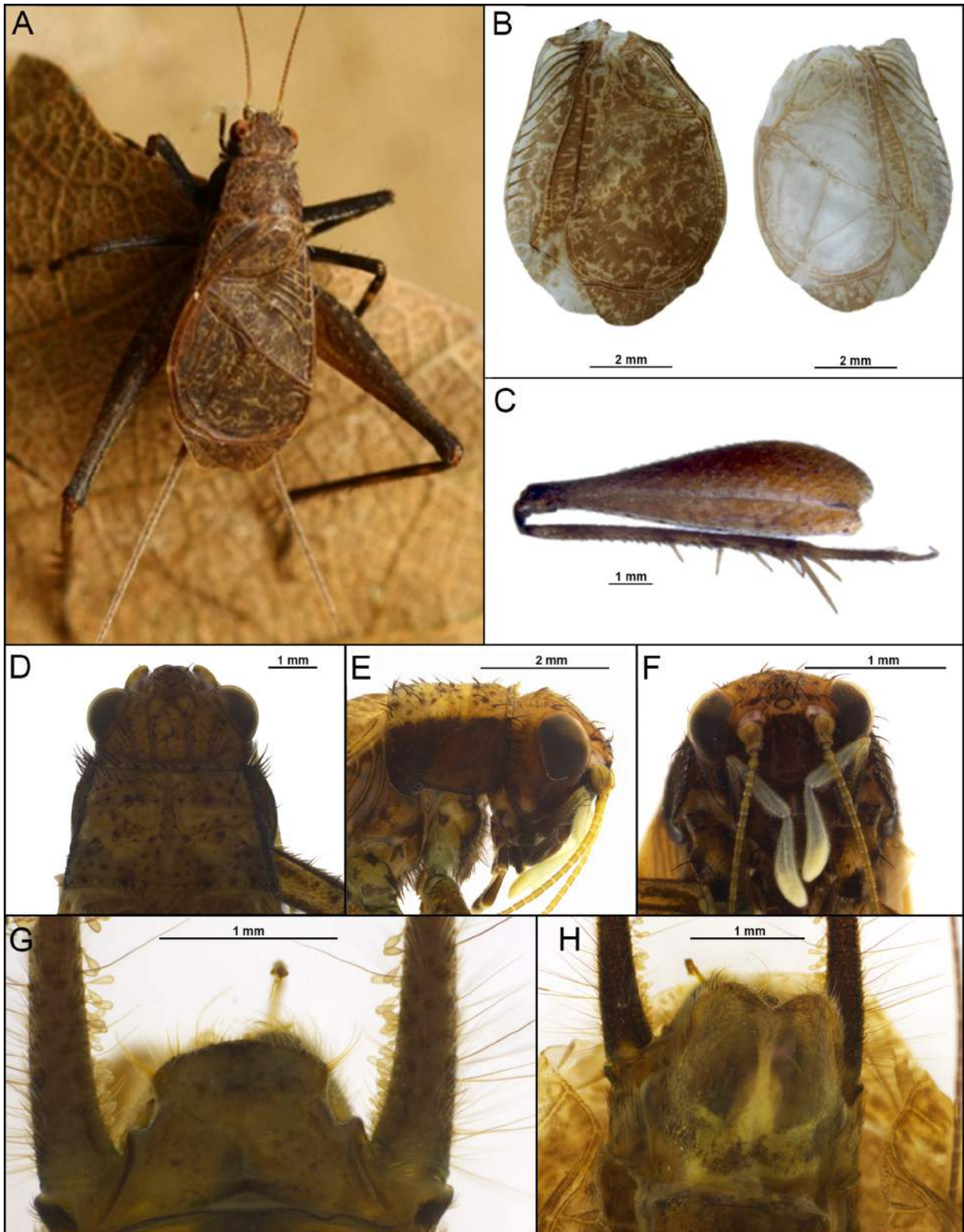


FIGURE 2. *Lerneca inalata beripocone* **subsp. nov.** (Male holotype). A. Dorsal view; B. Right tegmen, dorsal (left) and ventral view (right); C. The right hind leg, outer surface; D. Head and pronotum, dorsal view; E. Head and pronotum, lateral view; F. Head, front view; G. Supranal plate; H. Subgenital plate.

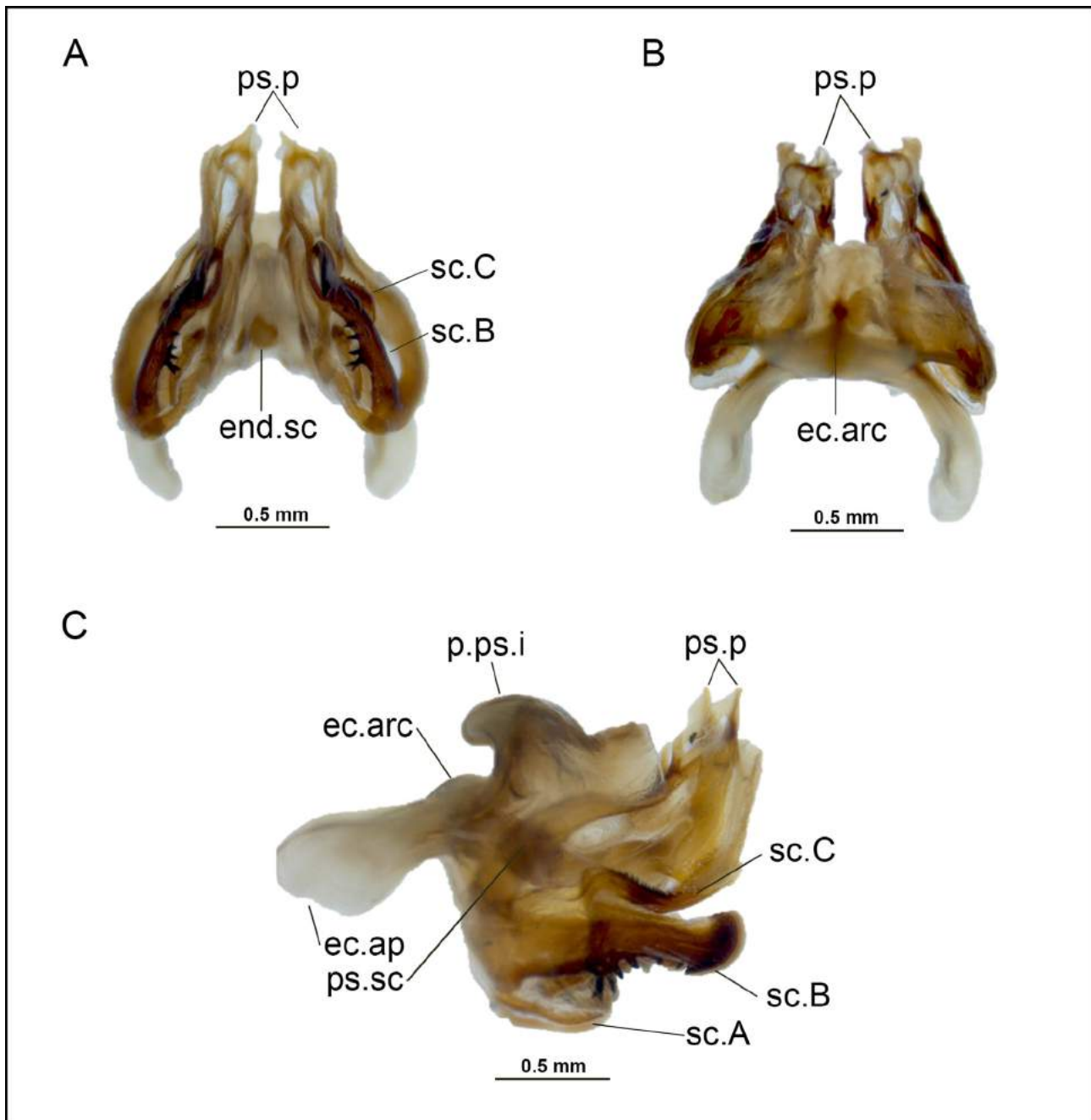


FIGURE 3. Male genitalia of *Lerneca inalata beripocone* **subsp. nov.** (paratype). A. Ventral; B. Dorsal; C. Lateral views. Abbreviations: ec.arc—ectophallic arc; ec.ap—ectophallic apodeme; end.sc—endophallic sclerite; ps.s—pseudepiphallic sclerite; p.ps.i—proximal pseudepiphallic invagination; sc.A—sclerite A of pseudepiphallic part; sc.B—sclerite B of pseudepiphallic part; sc.C—sclerite C of pseudepiphallic part; ps.p—pseudepiphallic parameres.

Description. Head: Dark brown with 4 light brown longitudinal stripes, short bristles over full extent and long black bristles on the frons (Fig. 2D). Antenna dark brown with scape, pedicel and antennomere whitened in the proximal region. Frons, gena, clypeus, labrum, and mandibles dark brown. White maxillary palpus, with 3 rounded segments and bristles over its entire length (Fig. 2F). First segment darker on base, and last segment wider and flatter than the others. Labial palpus smaller and darker than maxillary palpus. **Thorax and abdomen:** Dorsal disc of pronotum with small dark spots, pubescent, with larger and darker bristles on the anterior and posterior margins. Lateral lobe of pronotum dark brown. Metanotum with two drop-shaped stains. The ventral region of the thorax and abdomen light brown, with longitudinal rounded spots that extend all over the abdomen. Prothorax tergites and abdomen dark brown. Metanotal glands like a pair of small dilatations. Tibia and tarsus I, II, and III and femur I

and II dark brown, marked with light spots. Tibia I tympanum present on both sides, oval and subequal in size. Femur III darker in the distal half, with dark brown spots, with the inner surface brighter than the outer (Fig. 2C). Trapezoidal supranal plate light brown, with apex rounded and narrower than the base (Fig. 2G). Subgenital plate light brown with dark dots, apex with invagination in the middle portion with sclerite B spines (Fig. 2H). Cerci light brown.

Observations of Paratypes.

Genitalia. Sclerite B with rounded apex and 6 ventral spines, the anterior 4 being more developed than the posterior 2 (Fig. 3A, C). The first spine in the basal portion of sclerite B with slight bifurcation (Fig. 3A). Sclerite C dorsally projected, concave, with denticles all over the dorsal surface (Fig. 3A). Mid-region of pseudepiphallus strongly sclerotized, with basal area larger than the apex (Figs. 3A, B). Sclerotized proximal pseudepiphallus invagination bent and projected towards the ectophallic apodeme (Fig. 3C). Pseudepiphallic paramere membranous in more than 50% of its area slightly longer and curved to the medio-anterior portion of the dorsal face (Fig. 3C).

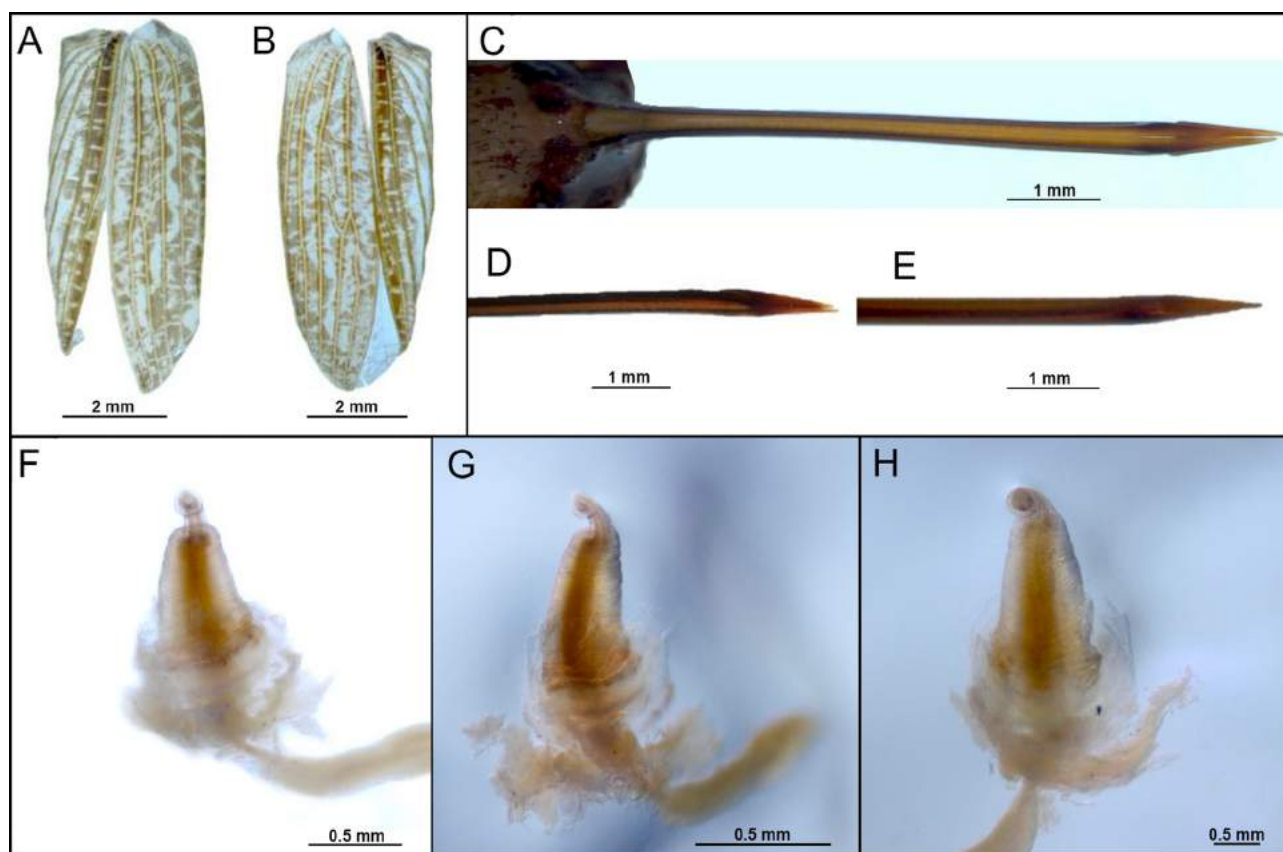


FIGURE 4. *Lerneca inalata beripocone* subsp. nov. (Female paratype). Tegmina, upper left, dorsal view: A. Left side; B. Right side. Subgenital plate and ovipositor, upper right: C. Ventral view; D. Ovipositor apex, dorsal view; E. Ovipositor apex, side view. Lower row, copulatory papilla: F. Ventral view; G. Side view; H. Dorsal view.

Left tegmen. Brown with light yellow stains, lighter colored veins, speculum length 2.92 ± 0.13 mm ($n=16$), speculum width 3.19 ± 0.14 mm ($n=16$); length of apical area 1.01 ± 0.1 mm ($n=16$). Speculum length-apical area length ratio is 2.95 ($2.92 \times 1.01 = 2.95$) and speculum width-apical area length ratio is 3.22 ($3.19 \times 1.01 = 3.22$). Stridulatory row with 145 ± 11.54 teeth (129–168, $n=15$). Right tegmen smaller and lighter than left (Fig. 2).

Calling songs. (Fig. 5, $n=3$, BIINORPHLEINBE-45IPBC, 28°C, 7:24 pm, 18.09.2013; BIINORPHLEINBE-22IPBC, 23°C, 06:00 pm, 28.07.2013; BIINORPHLEINBE-90IPBC, 28°C, 06:30 pm, 15.10.2013). Chirps with 29 to 40 pulses, frequency band between 4.0 and 5.7 kHz; dominant frequency 4.5 kHz, each chirp preceded by a single pulse with lower frequency and duration. Pulse frequencies and durations increase gradually over the whole chirp, chirp duration of 253 ± 29.38 ms ($n=15$), interval between chirps of 707 ± 216.62 ms ($n=15$), pulse duration of 4.35 ± 0.63 ms, inter-pulse interval of 3.91 ± 0.41 ms ($n=157$), pulse period of 8.35 ± 0.78 ms ($n=157$), pulses with 17.77 ± 5.28 sound cycles ($n=9$), calling song activities during twilight and nocturnal periods, and during the day (one observation at 09:00 am, 27°C, BIINORPHLEINBE-89IPBC).

Female. Similar to male. Larger in size (Table 1). Differs from male by tegmina with parallel longitudinal veins. Very small subgenital plate, truncated apex, concave margin, 2 drop-shaped dark brown spots (Fig. 4A). Ovipositor dorso-ventrally flattened, valve apex slightly acuminate, smooth edge (Fig. 4C–E).

TABLE 1. Body measurements of *L. inalata* males and females, measurements (mm), with max., min., mean, and standard deviation values. Abbreviations: BL = body length; PL = pronotum length; PW = pronotum width; IOD = interocular distance; RTL = right tegmen length; RTW = right tegmen width; PFL = posterior femur length; PTL = posterior tibia length; OL = ovipositor length.

		BL	PL	PW	IOD	RTL	RTW	PLF	PTL	OL
<i>L. i. beripocone</i> subsp. nov. Males n=16	Max.	11	2.2	2.9	1.3	9	5.7	8.3	7.7	-
	Min.	9.7	1.6	2.1	1	7.4	4.1	7.7	7.4	-
	Mean	10	1.8	2.5	1.2	8.5	5.3	7.9	7.45	-
	SD	0.54	0.19	0.23	0.15	0.5	0.44	0.2	0.2	-
Females n=4	Max.	12	2.2	3	1.6	7.6	4.3	9	8.4	8.5
	Min.	11	1.9	2.6	1.3	6.7	3.8	8.5	7.8	7.8
	Mean	11.9	2	2.8	1.5	7	4.1	7.65	8.15	8.3
	SD	0.47	0.12	0.18	0.12	0.45	0.25	0.21	0.27	0.29
<i>L. i. mexicana</i> Gorochov, 2007 *Male	Max.	10	1.9	-	-	8.5	-	8.6	-	-
	Min.	9.5	1.7	-	-	8	-	8.4	-	-
*Female	Max.	11	2.3	-	-	7.5	-	9.5	-	7.3
	Min.	10	2.1	-	-	7.2	-	9	-	7
<i>L. i. amboro</i> Gorochov, 2014 *Male	Max.	9.5	1.7	-	-	8	-	8	-	-
	Min.	8	1.5	-	-	7	-	7	-	-
*Female	Mean	10	1.9	-	-	7	-	8	-	6.8
<i>L. i. pantanal</i> Gorochov, 2014 *Male	Max.	10	1.8	-	-	8.5	-	8.5	-	-
	Min.	8	1.6	-	-	7	-	7.5	-	-
*Female	Max.	11	2.2	-	-	8	-	8	-	7
	Min.	9	1.8	-	-	7	-	7.5	-	-

*Numbers of studied individuals not provided.

Female genitalia. Copulatory papilla elongated, tapered apex with transverse folds (Figs. 4F–H). Basal portion covered by membranes that separate the papilla from the elongated channel that extends to the small rounded spermatheca.

Occurrence. Known only from the municipality of Poconé, Mato Grosso, Brazil (Fig. 1). Individuals of this subspecies were frequently observed on leaf litter inside the deciduous and semi-deciduous forests, or near the border areas between forest and pasture.

Discussion

The polytypic status of *L. inalata* was proposed by Gorochov (2007). Accordingly, subspecies differ as follows: *L. i. mexicana* Gorochov, 2007 has a dark brown head with light narrow stripes on the dorsal area, the first and second pair of femora and dark tibiae are dark, male genitalia with average posterior invagination distinctly shallower, sclerite B (posterolateral arm of epiphallus, *sensu* Gorochov) a little shorter than in nominate subspecies and with long teeth on the ventral edge. *Lerneca i. inalata* (Saussure, 1874) has the dorsal area of the head a light brown color with stains and small brown spots, first and second pair of femora and tibiae with varied spots. Desutter-Grandcolas (1992) has added new data to this description, together with male genitalia schemes and copulatory

papilla of female. Subsequently, two new subspecies were described by Gorochov (2014a), highlighting the differences as to the male genitalia and tegmina measurements: *L. i. amboro* with slightly narrower tegmina, smaller speculum, and ventral spines distinctly longer in the median region of sclerite B (posterolateral arms of epiphallus, *sensu* Gorochov; (Gorochov 2014a), Fig. XIV-10); and *L. i. pantanal* with pseudepiphallic parameres (ectoparameres, *sensu* Gorochov) a little longer and directed more backward than upward (Gorochov 2014a).

Gorochov (2014a) used the ratio of speculum length and the tegmina apical area length to differentiate *L. i. amboro* from *L. i. pantanal*. In *L. i. amboro* the ratio is from 2.1 to 2.4, whereas for *L. i. pantanal* it is approximately 3.5. Gorochov (2007) did not consider the ratio of these characters for *L. i. mexicana*, but just gave the width of the speculum as 3.4 mm. In *L. i. beripocone* **subsp. nov.**, the ratio of speculum length to the dorsal field apical area is c. 2.9, while that of speculum width to apical area length is c. 3.1. However the range of variation in these ratios is within the averages found in the three subspecies cited herein, so does not allow diagnosis based on this structure.

With the description of *L. i. beripocone* **subsp. nov.** a fifth subspecies of *L. inalata* is added. This is the only record of the species in Brazil (Fig. 1). Thus, the number of *Lerneca* species records for Brazil increases to three: *L. varipes* (Desutter-Grandcolas 1992), *L. fuscipennis* (Saussure 1874), and *L. inalata* as described in this study.

Lerneca i. beripocone **subsp. nov.** exhibits the same pattern of copulatory papilla morphology described by Desutter-Grandcolas (1992) for *L. fuscipennis* and *L. ornata*, with a narrow elongated shape with transverse folds and a base surrounded by membranes (Fig. 4F–H) which extend into the elongated channel connected to a spermatheca.

In the description of *L. i. inalata* male genitalia provided by Desutter-Grandcolas (1992), the sclerite B has 5 ventral spines in the middle region, with the first being bifurcated, as in *L. i. mexicana* (Gorochov, 2007), *L. i. amboro*, and *L. i. pantanal* (Gorochov, 2014a). However, *L. i. beripocone* **subsp. nov.** has 6 spines, the first spine having a bifurcation which is much less prominent. As for sclerite C in *L. i. beripocone* **subsp. nov.** it is dorsally more curved than that found in both *L. i. mexicana* and *L. i. pantanal*, but less curved when compared with *L. i. amboro* and *L. i. inalata*. The pseudepiphallic invagination is rounded in *L. i. amboro*, *L. i. pantanal*, *L. i. inalata*, and *L. i. beripocone* **subsp. nov.**, while in *L. i. mexicana* this invagination presents an almost triangular shape.

The calling song of *L. fuscipennis* is uncharacteristic for crickets, because the pulses are issued without spacing between them, forming a continuous sound (Desutter-Grandcolas 1992). Furthermore, the rhythm has three distinct sequences: I) 3 to 10 pulses issued briefly and in a regular manner; II) a very short passage, characterized by modulation at quite high frequency; and III) a trill, with pulses issued continuously for about 20 s (Desutter-Grandcolas 1992). The calling song of *L. i. beripocone* **subsp. nov.** differ from this, being standardized in chirps with 29 to 40 pulses, corresponding to the first record of the calling song described for the species (*L. inalata*) (Fig. 5).

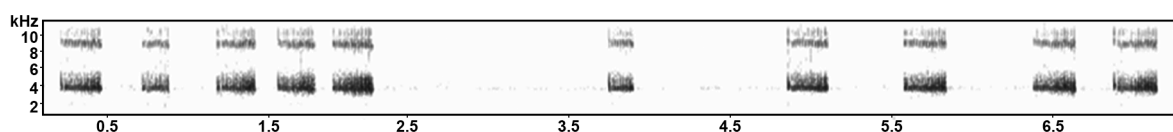


FIGURE 5. Spectrogram of *Lerneca inalata beripocone* **subsp. nov.** (22IPBC, 06:00 pm, 23°C, 28.07.2013) calling songs.

Even though there is information as to the number of teeth in the stridulatory row in *L. i. inalata* (200 teeth), only one individual was evaluated (Desutter-Grandcolas 1992), making more conclusive comparisons with *L. i. beripocone* **subsp. nov.** impossible, because in an analysis of fifteen individuals a considerable variation was found (129–168, 23%).

Lerneca inalata (Fig. 1) was originally described only for Suriname, since its exact geographic occurrence was not defined by Saussure (1874). Gorochov (2007) included the distribution of this species (*L. i. mexicana*, Fig. 1) for the southern tip of Mexico with type locality in Chiapas, a region with a predominance of tropical and pine forests (Enciclopedia de Los Municipios y Delegaciones de México-Estado de Chiapas 2010).

Lerneca i. amboro (Fig. 1) occurs in the Amboro National Park, Departamento de Santa Cruz, Bolivia, which comprises several eco-regions, such as the Amazon Forest, Chaco, Yungas, and dry forests at higher elevations (Olson *et al.* 2001). *Lerneca i. pantanal* (Fig. 1), was collected in the Reserva Pantanal Paraguayo, Estación Biológica de los Tres Gigantes, Paraguay, on the banks of the Rio Negro on the border with Bolivia, a Chaco –

Pantanal transition zone known as the Matogrossense Region (Hayes 1995). *Lerneca i. beripocone* **subsp. nov.** (Fig. 1) has its occurrence confirmed only for its type locality, municipality of Poconé, in the floodplain of the Pantanal of Poconé, Mato Grosso, Brazil.

Comparing the north-south latitudinal distribution of the *Lerneca inalata* subspecies, it can be seen that only *L. i. mexicana* is a taxon with a geographical distribution more distant from the Equator than all other *Lerneca inalata* subspecies. *L. i. inalata* inhabits tropical rainforest that besides its proximity to the Equator is characterized by a seasonal tropical climate with pronounced wet and dry seasons. The other subspecies, *L. i. amboro*, *L. i. pantanal*, and *L. i. beripocone* **subsp. nov.**, occur in regions that are located south of the tropical equatorial belt but within the Southern Tropical Conversion Zone with similar climatic and vegetation conditions, as well as strong stochastic hydrological impacts (Swarts 2000).

Acknowledgments

Special thanks go to Adolfo Abel Pereira for his excellent help during the fieldwork; Professor Dr. Edison Zefa for discussions on specific taxonomic and morphological terms; Luiz Vicente da Silva Campos Filho, Fazenda Pouso Alegre, and Waldir Valutky, Supervisor of the SESC Pantanal Ecological Resort, Baía das Pedras, for allowing us to carry out this study in the respective areas; Daniela Santos for suggestions and ms. discussions, and Herval Nunes for his help with the software *ArcGis*. Dr. Ana Silvia Tissiani, UFMT, helped with the configuration adaptations of the morphological figures and the text. This research received financial and logistical support from the Graduate Program in Agricultural Sciences of the Federal University of Reconcavo of Bahia; from the National Institute of Science and Technology in Wetlands (INAU/UFMT/CNPq/MCT), from the Brehm Foundation for International Bird Conservation, Germany, for technical equipment support, and from the project “Biota de Orthoptera do Brasil, SISBIOTA/Brazil” (issue MCT/CNPq/MMA/MEC/CAPES/FNDCT and FAPEMIG—Transversal Action/FAPs n° 47/2010, Proc. 563360/2010-0), from FAPES (TO n° 0834/2015), and PROTAX/CNPq (Proc. n° 440664/2015–2). Authorization for collection activities for scientific purposes (MMA/ICMBio/SISBIO) n° 29890-2.

References

- Aguilar, P.G. (1973) Especies de grillos registrados para el Perú. *Revista de Entomología*, 16, 122.
- Desutter, L. (1987) Structure et évolution du complexe phallique des Gryllidae (Orthoptères) et classification des genres Néotropicaux de Grylloidea. Première partie. *Annales de la Société Entomologique de France*, 23 (3), 213–239.
- Desutter, L. (1990) *Etude phylogénétique, biogéographique et écologique des Grylloidea néotropicaux (Insectes, Orthoptères)*. Tese. Université de Paris-Sud, Centre d’Orsay, Paris 347 pp.
- Desutter-Grandcolas, L. (1992) Les Phalangopsidae de Guyane Française (Orthoptères, Grylloidea): systématique, éléments de phylogénie et de biologie. *Bulletin du Muséum National d’Histoire Naturelle, Paris, 4^{ème} sér., 14, section A*, 1, 93–177.
- Desutter-Grandcolas, L. (2003) Phylogeny and the evolution of acoustic communication in extant Ensifera (Insecta, Orthoptera). *Zoologica Scripta*, 32 (6), 525–561.
<http://dx.doi.org/10.1046/j.1463-6409.2003.00142.x>
- Desutter-Grandcolas, L. (2014). New taxa and data for Neotropical Phalangopsidae (Orthoptera, Grylloidea). *Zootaxa*, 3866 (3), 398–420.
<http://dx.doi.org/10.11646/zootaxa.3866.3.5>
- Eades, D.C., Otte, D., Cigliano, M.M. & Braun, H. (2015) Orthoptera Species File, Online Version 5.0/5.0. Available from: <http://orthoptera.speciesfile.org> (accessed 13 January 2015)
- Enciclopedia de los Municipios y Delegaciones de México-estado de Chiapas (2010) Mexico: INAFED Instituto para el Federalismo y el Desarrollo Municipal. SEGOB Secretaría de Gobernación. Available from: <http://www.inafed.gob.mx/work/enciclopedia/EMM07chiapas/> (accessed 17 September 2015)
- Gorochoy, A.V. (2007) Taxonomic study of Mexican Phalangopsinae (Orthoptera: Gryllidae). *Zoosystematica Rossica*, 16 (2), 177–200.
- Gorochoy, A.V. (2014a) Classification of the Phalangopsinae subfamily group, and new taxa from the subfamilies Phalangopsinae and Phaloriinae (Orthoptera: Gryllidae). *Zoosystematica Rossica*, 23 (1), 7–88.
- Gorochoy, A.V. (2014b) Evolution and taxonomic significance of the copulatory apparatus in Ensifera (Orthoptera). Part 1: General concepts and origin. *Zoosystematica Rossica*, 23 (2), 197–209.
- Hayes, F.E. (1995) *Status, distribution and biogeography of the birds of Paraguay*. American Birding Association. Monographs

in Field Ornithology, American Birding Association, Colorado, 224 pp.

- Hebard, M. (1928) The group Luzarae (Orthoptera: Gryllidae). *Transactions of the American Entomological Society*, 54 (1), 1–56.
- Junk, W.J., Da Cunha, C.N., Wantzen, K.M., Petermann, P., Strüssmann, C., Marques, M.I. & Adis, J. (2006) Biodiversity and its conservation in the Pantanal of Mato Grosso, Brazil. *Aquatic Sciences*, 68 (3), 278–309.
<http://dx.doi.org/10.1007/s00027-006-0851-4>
- Martins, L.P., Pereira, M.R., Henriques, A.L. & Zefa, E. (2014) Two new species of *Hygronemobius* Hebard, 1913 (Orthoptera, Grylloidea, Nemobiinae) from Brazilian Amazon. *Zootaxa*, 3794 (3), 469–480.
<http://dx.doi.org/10.11646/zootaxa.3794.3.8>
- Olson, D.M., Dinerstein, E., Wikramanayake, E.D., Burgess, N.D., Powell, G.V.N., Underwood, E.C., D'amico, J.A., Itoua, I., Strand, H.E., Morrison, J.C., Loucks, C.J., Allnutt, T.F., Ricketts, T.H., Kura, Y., Lamoreux, J.F., Wettengel, W.W., Hedao, P. & Kassem, K.R. (2001) Terrestrial ecoregions of the world: a new map of life on Earth. *Bioscience*, 51 (11), 933–938.
[http://dx.doi.org/10.1641/0006-3568\(2001\)051\[0933:TEOTWA\]2.0.CO;2](http://dx.doi.org/10.1641/0006-3568(2001)051[0933:TEOTWA]2.0.CO;2)
- Otte, D. (2006) Eighty-four new cricket species (Orthoptera: Grylloidea) from La Selva, Costa Rica. *Transactions of the American Entomological Society*, 132 (3/4), 299–418.
- Ragge, D.R. (1965) *Grasshoppers, crickets and cockroaches of the British Isles*. Frederick Warne & Co. LTD., London, 331 pp.
- Saussure, H. (1874) *Mission scientifique au Mexique et dans l'Amérique Centrale. Sixième partie: Études sur les Myriapodes et les Insectes*. Imprimerie imperial, Paris, 531 pp.
- Saussure, H. (1878) Mélanges Orthoptérologiques. VIème fascicule. Gryllides (2ème partie). *Mémoires de la Société de physique et d'histoire naturelle de Genève*, 25, 369–702.
- Swarts, F.A. (2000) *The Pantanal of Brazil, Bolivia and Paraguay: selected discourses on the world's largest remaining wetland system*. Hudson MacArthur Publishers, Gouldsboro PA, 287 pp.
- Valdecasas, A.G. (2011) Una disciplina científica en la encrucijada: la Taxonomía. *Memorias de la Real Sociedad Española de Historia Natural*, Segunda Época, 9, 9–17.