JULIANA CHAMORRO RENGIFO

PARAGRYLLINI (ORTHOPTERA: GRYLLOIDEA: PHALANGOPSIDAE) BRASIL: DESCRIÇÕES DE NOVOS TÁXONS

Dissertação apresentada à Universidade Federal de Viçosa, como parte das exigências do Programa de Pós-Graduação em Entomologia, para obtenção do título de *Magister Scientiae*.

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APROVADA: 26 de Junho de 2009

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Prof. Carlos Frankl Sperber
(Orientador)

“Somos do tamanho dos nossos sonhos”
(Fernando Pessoa)

“Perder tempo em aprender coisas que não interessam,
priva-nos de descobrir coisas interessantes”.
(Carlos Drummond de Andrade)

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À minha família e amigos de longe, lá da Colômbia.

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RESUMO

CHAMORRO-RENGIFO, Juliana. M.Sc., Universidade Federal de Viçosa, junho de 2009. **Paragryllini (Orthoptera: Grylloidea: Phalangopsidae) Brasil: descrições de novos táxons.** Orientador: Carlos Frankl Sperber. Co-orientadores: Cristiano Lopes Andrade, Holger Braun e Karina Schimdt Furieri.

Paragryllini Desutter é uma tribo Neotropical com espécies distribuídas do sul do México até o Brasil. Atualmente são conhecidas 24 espécies subordinadas a 6 gêneros: *Benoistella* Uvarov, 1939; *Mexiacla* Gorochov, 2007; *Oaxacla* Gorochov, 2007; *Paragryllus* Guérin-Méneville, 1844; *Rumea* Desutter, 1988; e *Silvastella* Desutter-Grandcolas, 1992. Nesta dissertação são descritos novos táxons de Paragryllini da Amazônia Central brasileira. Faz-se o primeiro registro do gênero *Rumea* para esta área, com a descrição de três espécies novas: *R. zebra* sp. nov., *R. manauensis* sp. nov. e *R. tigris* sp. nov.. Também são descritos dois gêneros novos: *Marciela* gen. nov., que inclui *Marciela longipes* sp. Nov. do Brasil e *Marciela crybelos* (Nischk & Otte, 2000) comb. nov. do Equador; e *Sperberus* gen. nov. incluindo unicamente *Sperberus arboricola* sp. nov.. Para as espécies do gênero *Rumea*, discutem-se as características morfológicas da genitália dos machos e se propõe uma nova interpretação da dessa estrutura. Para ilustrar a genitália tanto dos machos quanto das fêmeas, desenvolveu-se uma técnica de fotografia: a estrutura era inmersa em glicerina e eran tiradas fotografias em diferentes níveis de foco. Para a construção da fotografia final usou-se o software livre CombineZM. Discutem-se alguns aspectos biogeográficos baseados na distribuição conhecida das espécies de Paragryllini. Este estudo proporciona um aporte para o conhecimento do grupo, já que se amplia sua dibribuiçao geográfica, e puede servir como um punto de partida para futuras pesquiças sobre os Paragryllini no Brasil.

ABSTRACT

CHAMORRO-RENGIFO, Juliana. M.Sc., Universidade Federal de Viçosa, june, 2009. **Paragryllini (Orthoptera: Grylloidea: Phalangopsidae) Brazil: descriptions of new taxa.** Advisor: Carlos Frankl Sperber. Co-Advisors: Cristiano Lopes Andrade, Holger Braun and Karina Schmidt Furieri.

Paragryllini Desutter is a Neotropical tribe of crickets with species distributed from southern Mexico to Brazil. Currently are known 24 species assigned to six genera: *Benoistella* Uvarov, 1939; *Mexiacla* Gorochov, 2007; *Oaxacla* Gorochov, 2007; *Paragryllus* Guérin-Méneville, 1844; *Rumea* Desutter, 1988; and *Silvastella* Desutter-Grandcolas, 1992. In this paper new taxa from the Brazilian Central Amazonia are described. The genus *Rumea* is reported for the first time from this region, represented by three new species from the Central Amazonian: *R. zebra* sp. nov., *R. manauensis* sp. nov. and *R. tigris* sp. nov. Also two new genera are described: *Marciela* gen. nov., including *M. longipes* sp. nov. from Brazil and *M. crybelos* (Nischk & Otte, 2000) comb. nov. from Ecuador; and *Sperberus* gen. nov. including only *S. arboricolus* sp. nov. The morphology of the male genitalia of the *Rumea* species is discussed and a new interpretation is proposed. For the illustration of the genitalia of males and females a photographic technique was used: the structure was immersed in glycerin and photographs were taken on different levels of focous. For the construction of the final images the free software CombineZM was used. The biogeography of the Paragryllini is discussed based on the known distribution of the species. This study contributes to the knowledge of the group, increases its geographical distribution, and may serve as a starting point for future research on the Paragryllini in Brazil.

1. INTRODUÇÃO GERAL

Grylloidea Laicharding 1781, o grupo dos chamados grilos verdadeiros, pertence à Subordem Ensifera, junto com sete superfamílias extintas (Elcanoidea Handlirsch 1906, Permoraphidioidea Tillyard 1932, Oedischioidea Handlirsch 1906, Triassomanteoidea Tillyard 1923, Xenopteroidea Riek 1955, Gryllavoidea Gorochov 1986, Phasmomimoidea Sharov 1968) e cinco superfamílias com representantes vivos atualmente: Hagloidea Handlirsch 1906, Rhaphidophoroidea Walker, F. 1871, Schizodactyloidea Blanchard 1845, Stenopelmatoidea Burmeister 1838 e Tettigonioidea Krauss 1902. Esta classificação foi disponibilizada por Orthoptera Species File (Eades & Otte, 2009), através de revisão e compilação da literatura.

Existem registros de Orthoptera desde o Carbonífero Superior, há aproximadamente 300 milhões de anos (Sharov, 1971). Para a América do Sul não se conhecem registros de Ensifera do Paleozóico e do Mesozóico Inferior. No Brasil e na Eurásia foram encontrados fósseis de Grylloidea identificados como pertencentes a três subfamílias da extinta família Baissogryllidae, e dois fósseis da subfamília dos Gryllinae. A evolução de Grylloidea é considerada mais lenta que a dos Tettigonioidea e Stenopelmatoidea. Possivelmente, a radiação adaptativa do Cenozóico deu como resultado a aparição das tribos atualmente reconhecidas (Gorochov, 2001).

As espécies de Grylloidea apresentam uma grande variação de tamanhos, formas e cores (Desutter, 1990). Caracterizam-se por terem três tarsômeros em todas as pernas, cercos longos e não especializados (contrario aos Tettigonioidea), com pêlos clavados na área interna. A placa subgenital da fêmea e do macho não têm estiletes e o ovipositor é usualmente comprido e fino, com valvas internas reduzidas (Desutter-Grandcolas, 1998). A genitália do macho é assimétrica dorso-ventralmente e, segundo a mais recente interpretação, é constituída por três camadas como nos demais Orthoptera: a camada mais externa, a epifálica; a do meio, a ectofálica; e a mais interna, a endofálica (Desutter, 1987).

Uma das características mais estudadas nos grilos é a emissão de som, produzido pela vibração das tégminas (asas anteriores). Esse mecanismo, também conhecido como estridulação tegminal, envolve duas estruturas: a fileira estridulatória (SF), ou *pars stridens* e o "raspador", *plectrum* ou *scraper* (Sales & Pye, 1974). A SF é a parte da veia A1 que sofreu desenvolvimento no lado interno da superfície da tégmina, formando uma série de dentes. O *plectrum* é formado pela projeção mais esclerotizada da região anal da tégmina e pode também corresponder à veia anal modificada (Montealegre *et al.,* 2009). O aparelho estridulador é atualmente considerado uma característica ancestral (Alexander, 1962; Otte, 1977, 1992). Supõe-se que o sistema de som apareceu nos Grylloidea e Tettigonioidea no final do Permiano. Os modelos evolutivos consideram a estridulação uma característica ancestral dos grilos e que foi perdida independentemente em diversos grupos (Otte, 1977, 1992; Walker & Masaki, 1989).

Grylloidea está amplamente distribuída no mundo, com uma alta diversidade nas regiões tropicais. Aproximadamente 3.000 espécies de grilos são conhecidas atualmente (Eades & Otte, 2009). Sobre a classificação do grupo, não existe consenso sobre qual classificação é a mais adequada. Bruner (1916) agrupou os grilos em 11 famílias, excluindo Gryllotalpidae. Chopard sugeriu 12 famílias em 1956 e 1965, logo no período entre 1967 e 1968 três famílias (Gryllotalpidae, Oecanthidae e Gryllidae) e dez subfamílias de Gryllidae (Gryllinae, Cacoplistinae, Eneopterinae, Mogoplistinae, Myrmecophilinae, Pentacentrinae, Phalangopsinae, Ptyeroplistinae, Scleropterinae e Trigonidiinae). E finalmente 12 famílias em 1969.

Vickery (1976) e Kevan (1982) sugeriram a separação de Gryllotalpidae em uma superfamília à parte, e a classificação de Grylloidea em 11 famílias e 16 subfamílias: Gryllidae (Brachytrupinae, Gryllinae e Nemobiinae), Pentacentridae (Pentacentrinae, Lissotrachelinae e Aphemogryllinae), Cacoplistidae, Pteroplistidae, Scleropteridae, Phalangopsidae (Luzarinae e Heterogryllinae), Oecanthidae, Mogoplistidae (Bothriophylacinae e Mogoplistinae), Trigonidiidae (Trigonidiinae e Phylloscirtinae), Eneopteridae (Eneopterinae, Itarinae, Podoscirtinae e Prognathogryllinae) e Myrmecophilidae. Alexander & Otte (1967) e Otte & Alexander (1983) consideraram apenas a família Gryllidae, com 14 subfamílias, incluindo entre elas Gryllotalpinae.

Desutter (1987, 1988) classificou os gêneros neotropicais de Grylloidea em três superfamílias e 13 famílias: Gryllotalpoidea (Gryllotalpidae), Myrmecophiloidea (Malgasiidae, Myrmecophilidae e Mogoplistidae), Grylloidea (Pteroplistidae, Oecanthidae, Neoaclidae, Paragryllidae, Phalangopsidae, Trigonidiidae, Podoscirtidae, Eneopteridae e Gryllidae) além de considerar dois grupos sem representantes na América do Sul: Pentacentridae e Scleropteridae.

Gorochov (1995a, b) propôs uma superfamília moderna (e outra extinta), com quatro famílias e 20 subfamílias: Gryllotalpidae, Myrmecophilidae (Malgasiinae, Bothriophylacinae e Myrmecophilinae), Gryllidae (Nemobiinae, Trigonidiinae, Pentacentrinae, Podoscirtinae, Euscyrtinae, Hemigryllinae, Eneopterinae, Phalangopsinae, Landrevinae, Gryllomiminae, Itarinae, Gryllomorphinae, Gryllinae, Phaloriinae, Cacoplistinae, Oecanthinae e Pteroplistinae) e Mogoplistidae. Mas Gorochov (2001) novamente sugeriu outra classificação, aparentemente sem nenhuma evidência conclusiva sobre as características que definiriam cada grupo. Ele dividiu a superfamília em cinco famílias: Trigonidiidae, Podoscirtidae, Eneopteridae, Gryllidae e Phalangopsidae.

Segundo Otte (1994) e Otte & Naskrecki (1997) há quatro famílias de Grylloidea: Gryllidae, Mogoplistidae, Myrmecophilidae e Gryllotalpidae. Gryllidae é dividido em 15 subfamílias: Gryllinae, Brachytrupinae, Nemobiinae, Trigonidiinae, Pentacentrinae, Sclerogryllinae, Phalangopsinae, Malgasiinae, Cacoplistinae, Itarinae, Eneopterinae, Euscyrtinae, Podoscirtinae, Pteroplistinae e Oecanthinae.

1.1. A genitália de Grylloidea

A genitália dos machos não é um órgão intromitente, mas tem duas funções: a formação do espermatóforo e a transferência dele para a genitália da fêmea. As estruturas envolvidas na formação do espermatóforo estão na metade ventral do complexo fálico genital (Randell, 1961). Já a estrutura envolvida na transferência do espermatóforo encontra-se na porção dorsal: o pseudepifalo (Chopard, 1920a), que tem como função pressionar a placa subgenital da fêmea e expor o poro genital. Por outro lado, Randell (1961) também sugeriu que a função dos parâmeros pseudepifálicos é a de servir de guia, suportando os escleritos endofálicos, os apódemas endofálicos (virga) e a dobra ectofálica durante a inserção do ducto do espermatóforo na fêmea.

As estruturas centrais mais internas, que estão entre os dois braços dorsais do pseudepifalo, são: os escleritos endofálicos, os apódemas endofálicos e a dobra ectofálica. Esta última poderia também estar envolvida na função de apertar ou agarrar o anel esclerotizado que rodeia o ducto da espermateca (Randell, 1961). Os escleritos ectofálicos são estruturas internas compridas, encontrando-se a cada lado do saco do espermatóforo, mostrando grande especialização para a inserção de dois pares de músculos (Randell, 1961).

A proposta mais recente sobre a estrutura da genitália do macho, mas não completamente aceita por todos os atuais taxônomos e sistematas, é a de Desutter (1987, modificada pela mesma autora em 2003). No geral, a interpretação é muito semelhante à de Chopard (1920), mas diferindo muito da de Ander (1939, 1956, 1970). Também Difere da de Snodgrass (1937) pela identificação do esclerito dorsal em Grylloidea e Gryllotalpoidea (ectofalo, pseudepifalo), e na maioria dos Rhaphidophoridae e Tettigoniidae (verdadeira esclerotização, par e um epifalo somente), e pela identificação das invaginações presentes na parte dorsal do complexo fálico (invaginação epi-ectofálica e ectofálica, cavidade endofálica) (Desutter-Grandcolas 2003).

A interpretação de Desutter-Grandcolas (2003) considera para os Ensifera três componentes maiores desenvolvidos e modificados em três diferentes clados:

1. Anel membranoso, rodeando o gonóporo (corresponderia ao ectofalo em Snodgrass (1937) e Ander (1956)). Subdividido em lóbulos ventral, dorsal e lateral. Pode estar usualmente diferenciado dorsalmente e muito conspícuo na genitália dos Ensifera, crescendo a partir de modificações do anel ectofálico. Dentre estas estruturas, a mais importante é o pseudepifalo (*sensu* Chopard 1920a), originando-se a partir de uma esclerotização e diferenciando-se a partir da porção mais dorsal do ectofalo; é uma invaginação em forma de T, que aparece na metade mais baixa da parte dorsal do ectofalo (invaginação ectofálica) (Desutter-Grandcolas, 2003).

2. Prega dorsal localizada entre o ectofalo e os paraproctos. Essa dobra é variavelmente prolongada lateralmente. Sua localização corresponde ao epifalo de Chopard (1920a) e Desutter-Grandcolas (2003).

3. Invaginação separando as duas estruturas anteriores, separando a dobra epifálica do anel ectofálico. Essa invaginação epi-ecto está sempre presente dorsalmente, é variavelmente desenvolvida e pode ser completamente circular ao redor do ectofalo, embora a parte ventral seja sempre estreita. Dorsalmente, ela pode ser comprida e plana, algumas vezes prolongada, como uma bolsa mediana tubular estreita, ou muito limitada (Desutter-Grandcolas, 2003).

Em muitos táxons, existe um espaço posterior e dorsal à abertura do ducto ejaculador. Este espaço, nomeado endofálico, usualmente está formando uma cavidade.

Em alguns grupos, além da cavidade, apresenta diversos escleritos e apódemas (cavidade endofálica, esclerito endofálico e apódema endofálico) (Desutter, 1987, 1990).

A genitália dos grilos tem algumas características semelhantes à dos Gryllotalpoidea: o epifalo é limitado a uma pequena dobra membranosa, a invaginação ectofálica é comprida e desenvolvida dorsalmente, e a parte superior do ectofalo é esclerotizada, formando um pseudepifalo. As autoapomorfias nos Grylloidea são justamente a forte assimetria dorsoventral e o complexo pseudepifalo (Desutter, 1987). Também, a invaginação ectofálica é fechada e forma dois apódemas, conectados mediante uma parte esclerotizada da invaginação, chamada arco ectofálico (Desutter, 1987), estrutura responsável pelo movimento de alguns elementos apicais do pseudepifalo (especialmente os escleritos localizado na parte baixa, mais reconhecidos como parâmeros) (Desutter-Grandcolas, 2003).

A seguinte sesão é um resumo das principais interpretações da morfologia da genitália de machos e a nomenclatura acerca da estrutura da genitália em Ensifera.

Chopard (1920 a, b)

A região genital compreende a placa subgenital, as quatro valvas genitais e o pseudepifalo. As valvas genitais são inferiores e membranosas; cada um dos costados do orifício do canal ejaculador apresenta uma membrana vertical dobrada, muito extensível, estas se amoldam sobre o espermatóforo. O pseudepifalo é a estrutura considerada homologa ao epifalo dos Phasgonuridae (atualmente subordinados a Tettigoniidae). O epifalo é uma camada adicional quitinosa, que pode estar presente entre os paraproctos e as valvas genitais, e pode ser simples (Rhaphidophoridae) ou estar em pares (titilador: Tettigoniidae).

Walker (1922)

O falo dos Ensifera é tipicamente coberto por um pseudesternito, que forma um tipo de arco lateralmente prolongado por escleritos alongados chamados rami; apresenta paredes membranosas e dobradas, com um ou dois lóbulos laterais, o que inclui um saco de espermatóforo, no qual o ducto ejaculatório se abre, e de cuja base e paredes crescem os parâmeros. O autor considera um pseudoesternito desenvolvido e esclerotizado somente em Gryllidae (para Walker igual a Grylloidea) e em alguns Rhaphidophoridae; em outros grupos, este tem a forma de uma dobra membranosa pequena.

Walker usou para exemplificar a estrutura dos Grylloidea o gênero *Gryllus*. Identificou um pseudoesternito muito semelhante ao do gênero *Ceuthophilus* (Rhaphidophoridae) que termina em três pontas, com a mesma função que os titiladores, e estão conectadas lateralmente com o rami. Identificou lóbulos ventrais longos e flexíveis que encerram a cavidade na qual a está o saco do espermatóforo. O saco é uma bolsa profunda e redonda, formada por uma só camada de quitina fina, curvada ao redor do final do saco e projetado sobre sua saída em um par de espinhas finas, localizadas juntas. Sobre o saco de espermatóforos e embaixo do pseudoesternito encontram-se duas barras, uma junto à outra na linha média, e continuando lateralmente com um par de barras, as quais aparecem na superfície interna do saco, perto da saída. Estas duas curvas formam uma evaginação do teto do saco de espermatóforos. Desde a conexão muscular, eles parecem representar a base dos parâmeros, e podem ser chamados endoparâmeros. Junto aos parâmeros podem também estar associadas as barras laterais anteriormente mencionadas. Talvez também possam estar associados aos dois lóbulos suportados pelo esclerito trirradiado, o qual está situado justo embaixo das prolongações laterais do pseudoesternito, e que está também em conexão estreita com as barras laterais (ectoparâmeros).

Snodgrass (1937)

A estrutura básica compreende lóbulos ventrais rodeando o gonóporo: um lóbulo ventral usualmente dividido em pequenos laterais, um lóbulo lateral em cada lado do gonóporo e um lóbulo dorsal. Esses lóbulos poderiam delimitar a cavidade endofálica, onde o ducto ejaculador se abre. O lóbulo dorsal caracteriza-se por suas margens bem diferenciadas, especialmente na margem superior chamada epifalo. O lóbulo dorsal é também modificado pela presença de uma depressão sobre a margem superior, que é membranosa ou esclerotizada, chamada cavidade dorsal, podem aparecer estruturas particulares, as quais com freqüência são evagináveis. Snodgrass (1937) sugiriu homologias de varias partes do órgão fálico para todo o grupo Ensifera (para Snodgrass:

Tettigonioidea). Concluiu que todos os Ensifera têm uma cavidade dorsal, e que nos grilos, converte-se numa bolsa interna e comprida onde o filamento do espermatóforo é formado (Desutter-Grandcolas, 2003).

Ander (1939, 1956 e 1970)

Este autor re-considerou a interpretação de Snodgrass (1937), para quem o falo consiste em vários lóbulos (um dorsal, um par ventral e um lateral facultativo), eventualmente subdivididos em lóbulos secundários. Na parede superior dos lóbulos dorsais, estão desenvolvidas bandas esclerotizadas ou distintamente esclerotizadas [= titiladores], freqüêntemente com projeções livres. Os titiladores são visíveis quando os lóbulos fálicos estão invertidos, e na posição de descanso e são mais o menos cobertos dentro da cavidade dorsal. Esta cavidade está situada embaixo dos lóbulos dorsais e desaparece quando o falo é evertido. Entretanto, Ander considerou que o esclerito dorsal, em Raphidophoridae. O que ele chamou de pseudesternito está localizado no tegumento, entre os paraproctos e os lóbulos fálicos dorsais, e assim não seria homologado com o esclerito presente nos grilos. Neste grupo, os lóbulos dorsais são muito especializados e formam um esclerito apical e dorsal, o pseudoepifalo com apódemas e pequenos escleritos adjacentes. Depois Ander (1970) reconsiderou sua hipótese e diferenciou uma “cavidade do titilador”, correspondente à cavidade dorsal de Snodgrass, e uma cavidade dorsal. Esta cavidade dorsal foi restrita ao saco de espermatóforos (Ander 1939, 1956, 1970 *apud* Desutter-Grandcolas, 2003).

Chopard (1961)

Esta interpretação é novamente baseada em uma publicação com informação para o gênero *Gryllus*. O autor considera que a genitália é formada por três partes maiores: a primeira é a inferior membranosa, com duas valvas que se acomodam sobre a espermateca depois de sua formação num órgão anterior, que constitui a segunda parte. Esse bolso chamado saco do espermatóforo, é membranoso e é sustentado por um estilete com ponta fina, esclerotizado. A terceira parte é fortemente esclerotizada e compreende uma grande estrutura superior e ímpar: o pseudepifalo, e na parte inferior do pseudepifalo um par de ectoparâmeros. Os endoparâmeros são articulados na base do pseudepifalo e dirigem-se para o interior do corpo, contribuindo para a sustentanção do saco de espermatóforos.

Randell (1964)

Randell realizou uma adaptação da terminologia usada por Chopard (1961), com algumas modificações e adições. Identificou o pseudepifalo como epifalo, e o par de parâmeros pseudepifálicos como parâmeros ectofálicos. Identificou os escleritos endofálicos e os parâmeros endofálicos como virga, os escleritos ectofálicos como endoparâmeros, e aparentemente o arco ectofálico como lóbulo médio, associado à articulação dos endoparâmeros (escleritos ectofálicos) e os ectoparâmeros (parâmeros pseudepifálicos), em alguns casos, aparece como um lóbulo pequeno e afilado, na margem média dos ectoparâmeros.

Mesa (1999 em Mesa & Garcia 1999)

A interpretação do autor está em desacordo com a nomenclatura proposta por Chopard (1961), Randell (1964) e Desutter (1987,1988, 2003). Mesa propôs uma nomenclatura simplificada, agrupando os escleritos em placas ectofálica e endofálica, cada uma delas dividida em áreas proximal e distal, unidas por um tecido conector. Cada um destes quatro escleritos básicos podem aparecer como uma peça simples ou dividida em dois escleritos simétricos. Os escleritos ectofálicos ocupam o campo dorsal e em algumas espécies também os lados laterais do lóbulo dorsal. O nome de cada esclerito e a nomenclatura é como se segue: 1) esclerito ectofálico proximal (PECS); 2) esclerito ectofálico distal (DECS), chamado de "epifalo" por Randell (1964) e "pseudepifalo" por Chopard (1961) e Desutter (2003); 3) esclerito endofálico proximal (PENS), que está acomodado dentro do lóbulo dorsal sustentado pela musculatura; 4) esclerito endofálico distal (DENS); e um quinto esclerito, longo, que ocupa a linha media ventral do lóbulo dorsal e possivelmente serve como suporte ao espermatóforo.

Gorochov (2007)

A terminologia usada por Gorochov encontra-se em suas publicações de 1995a,b e 2002. É uma modificação da terminologia usada por Randell (1964), com adições realizadas por outros autores (Alexander & Otte, 1967).

Gorochov (2002) defende a terminologia de Randell (1967) devido a seu fundamento funcional o que segundo o autor, permite fazer mais comparações com a terminologia de outros autores, e permite usar poucos termos para estruturas convergentes de origem mais ou menos similar. Assim o mesmo termo pode ser usado tanto para estruturas convergentes como para estruturas homólogas, o que é especialmente importante quando a origem e a homologia das estruturas estão mais ou menos confusas (situação usual em Grylloidea). Embora Gorochov use nomes iguais para algumas estruturas em grupos diferentes, ele reconhece que tem origens diferentes, e não como foi exposto por Dessuter-Grancolas (2003), onde ela afirma que Gorochov considera homologias entre Grylloidea, Tettigoniidae e Rhaphidophoridae, especialmente com o pseudepifalo (Gorochov 2007). Gorochov não rejeita a interpretação e nomenclatura de Desutter (2003), mas também não a usa em seus artigos.

Desutter-Grandcolas (2003)

Apóia a hipótese geral apresentada pelos autores anteriormente citados, e faz modificações para estabelecer homologias entre os Ensifera. Desutter 1987, 1988, 1990 analisou estruturas da genitália de machos e desafortunadamente (como ela mesma escreveu), cometeu o erro ao não identificar a verdadeira dobra epifálica. Depois interpretou incorretamente o pseudepifalo como um epifalo e a invaginação ectofálica como uma invaginação epi-ectofálica. Ao comparar a genitália de Grylloidea com outras genitálias de outros grupos de Ensifera, modificou os nomes das estruturas assim: pseudepifalo (em lugar de epifalo), parâmeros e apódemas pseudepifálicos (parâmeros e apódemas epifálicos), invaginação ectofálica (invaginação epi-ectofálica) e cavidade endofálica (cavidade dorsal).

1.2. A tribo Paragryllini Desutter

Paragryllidae foi inicialmente proposto por Desutter (1988), sendo um grupo separado na categoria de família, formado por Paragryllinae (Paragryllini + Benoistellini) e a subfamília monogenérica Rumeinae. Logo depois este táxon supra-genérico foi transferido e subordinado a Phalangopsidae (Desutter-Grandcolas, 1992), onde tanto Paragryllini como Benoistellini foram mantidos em seus *status*, e Rumeinae ganhou o *status* de tribo. No entanto, essas três tribos não foram designadas a nenhuma subfamília.

Gorochov (1995a,b *apud* Gorochov 2007) subordinou todos os gêneros a Paragryllini, dentro da subfamília Cacoplistinae. Posteriormente Gorochov (2007) re-avaliou a mudança anterior e incluiu Neoaclini em Paragryllini e transferiu a tribo completa para Phalangopsinae. Neste trabalho consideramos Phalangopsidae como uma família separada incluindo Paragryllini *sensu stricto* (não incluindo Neoaclini).

O caráter diagnóstico mais importante da tribo segundo Gorochov (2007) é a forma do ovipositor levemente afilada no ápice, com a área subapical das valvas conspicuamente alargada (em vista lateral).

Paragryllini encontra-se subordinado a Phalangopsidae pelas seguintes características compartilhadas**:** tamanho das pernas com relação ao corpo; forma da cabeça (embora seja um pouco mais globulosa); características gerais da tíbia posterior e dos tarsômeros médios; as asas truncadas no ápice e tégminas desenvolvidas; largura dos cerci; pequeno tamanho das tíbias posteriores, curvatura do ovipositor; redução dos palpos e do número de esporões dorsais da tíbia posterior (jamais superior a três sobre o lado interno e externo) (Desutter-Grandcolas 1992).

Paragryllini (Grylloidea: Phalangopsidae), como é usada nesta dissertação, inclui os seguintes gêneros:

Paragryllini Desutter-Grandcolas 1988

Paragryllus Guérin-Méneville, 1844	12 spp.
Mexiacla Gorochov, 2007	4 spp.
Oaxacla Gorochov, 2007	2 spp.
Beinostella Uvarov, 1939	1 sp.
Silvastella Desutter-Grandcolas, 1992	1 sp.

Rumea Desutter-Grandcolas, 1988 3 spp.

A classificação dos gêneros é baseada na morfologia externa e na genitália de machos e fêmeas, ou em um dos dois sexos, dependendo do grupo. À seguir são descritas as características principais dos gêneros:

***Paragryllus* Guérin-Méneville, 1844:** Este apresenta uma distribuição maior comparado com os outros cinco gêneros, encontrea-se registrado desde a parte Sur de Norte America até o Brasil. Se define pelos caracteres de machos e fêmeas. Os indivíduos apresentam fortes pernas anteriores e médias. Asas bem desenvolvidas, aparelho estridulador é grande e com um espelho igualmente desenvolvido, com numerosas nervuras arqueadas. Os machos apresentam o terceiro esporão apical interno da tíbia posterior inchado; provavelmente de natureza glandular e a placa supra-anal com ornamentações. Na genitália, o esclerito endofálico apresenta forma de "V" invertida, com dois apódemas terminais, a dobra endofálica é membranosa e mais ou menos comprida. Os apódemas ectofálicos, os rami, os parâmetros epifálicos e o epifalo são bem desenvolvidos. As fêmeas apresentam uma nervura separando a câmara dorsal da câmara lateral, a câmara dorsal com nervuras não regulares. A papila copulatória é comprida, mais ou menos retangular e geralmente curvada no ápice. O ápice pode ser reto ou tripartido (Desutter-Grandcolas 1992, Gorochov 2007).

***Benoistella* Uvarov, 1939:** O gênero é conhecido só para a Guyana Francesa. As espécies pertencentes a este gênero caracterizam-se por ter o fastígio comprido, sendo um pouco menor que o escapo. A tíbia posterior tem três esporões externos e um interno, os esporões apicais muito curtos. As tégminas apresentam duas nervuras transversas no espelho. O metanoto com uma área com características glandulares. A genitália do macho apresenta um esclerito pseudepifálico curto, com duas pregas membranosas, os parâmeros pseudepifálicos estão fortemente orientados posteriormente, o esclerito endofálico tem forma de duas barras compridas e esclerotizadas, com um pequeno apódema em forma de lamela. As fêmeas apresentam a papila copulatória esclerotizada, com forma cônica, com um ápice tubular mais o menos comprido. Na esclerotização, uma invaginação em forma de bolso achatado (Desutter-Grandcolas, 1992; Chopard, 1920b).

***Rumea* Desutter, 1988:** O gênero é conhecido para a Guyana Francesa e para o Perú. Os caracteres taxonômicos deste grupo encontram-se na genitália do macho: a dobra ectofálica é esclerotizada dorsalmente, e evidente hiper-desenvolvimento ventralmente, formando um canal membranoso ventral ou semelhando-se a dois escleritos compridos. Os apódemas ectofálicos são grossos e muito curtos; os parâmeros epifálicos, o pseudoepifalo e os rami são regredidos. As fêmeas apresentam a genitália completamente membranosa. Pela estrutura do complexo fálico, *Rumea* é o taxa mais derivado da tribo (Desutter, 1988; Desutter-Grandcolas, 1992).

***Silvastella* Desutter-Grandcolas, 1992:** Este grupo é conhecido unicamente pra a Guyana Francesa. Para este grupo somente são conhecidas as fêmeas. Compartilha algumas características com os *Beinostella*, como o tamanho do fastígio, o pronoto, as nervuras dos élitros, e os esporões das tíbias posteriores. A genitália apresenta uma papila copulatória comprida, pouco esclerotizada e com pregas em toda a superfície (Desutter-Grandcolas, 1992).

***Oaxacla* Gorochov, 2007:** Este gênero é conhecido unicamente para o México. Dentre as características mais importantes estão: as pernas anteriores sem tímpano, as tégminas tanto nos machos como nas fêmeas são muito curtas e sem aparelho estridulador. O abdômen dos machos tem dois tubérculos glandulares sobre o sétimo e oitavo tergito e numerosos pêlos na parte distal do sexto tergito. A genitália do macho apresenta a ponte pseudepifálica (epifálica para Gorochov) dividida em três partes e um par de fortes lóbulos posteriores laterais esclerotizados. Os escleritos e apódemas endofálicos são semi-membranosos (placa molde do espermatóforo para Gorochov), e os parâmeros pseudepifálicos (ectoparâmeros para Gorochov) não desenvolvidos (Gorochov, 2007).

***Mexiacla* Gorochov, 2007:** Este grupo, como o anterior é apenas conhecido para o México. Os indivíduos caracterizam-se por ter as pernas mais ou menos compridas e finas, mas o fêmur da perna posterior é largo. Cada tíbia da perna anterior tem um tímpano longo, presente unicamente na face externa. As tégminas curtas com aparelho estridulador mais ou menos desenvolvido. Não há asas posteriores estão ausentes nos dois sexos. Os machos apresentam tubérculos (de três a cinco) glandulares no abdômen. A genitália do macho tem a ponte pseudepifálica (epifálica para Gorochov) estreita na parte distal, é fortemente esclerotizada, e tem dois lóbulos laterais posteriores como espinhos. O braço pseudepifálico é grande (tanto em largura como em comprimento), pouco esclerotizado, tem forma de um lóbulo e a parte apical é estreita. Os parâmeros pseudepifálicos (ectoparâmeros de Gorochov) não são desenvolvidos, os escleritos endofálicos e apódemas endofálicos (molde do espermatóforo de Gorochov) estão rodeado por uma estrutura lateral membranosa ligada com os braços pseudepifálicos laterais (Gorochov, 2007).

Paragryllini é exclusivamente Neotropical. Duas espécies do gênero *Paragryllus* foram descritas com base em espécimes coletados na África (Chopard, 1968). Contudo, há dúvidas sobre a identificação e determinação dessas espécies. Acerca das características ecológicas, assim como para muitas espécies de grilos, ainda são pouco conhecidas. Por meio de observações fortuitas, sabe-se que os indivíduos deste grupo estão estreitamente relacionados com ramos, cascas e cavidades de árvores (Gorochov, 2007; Desutter-Grandcolas, 1992).

2. OBJETIVOS

O principal objetivo desta dissertação é contribuir com o conhecimento tanto taxonómico como da ampliação da distribuição geográfica dos gêneros da tribo Paragryllini. Também constitui objetivo desta dissertação utilizar uma nova técnica desenvolvida para a divulgação de imagens da genitália de grilos,. Aqui, esta técnica é proposta como uma forma complementar de ilustrar a genitália em publicações de taxonomia de Orthoptera.

3. MATERIAIS E MÉTODOS

3.1. Locais de coleta dos espécimes

Todos os espécimes foram coletados na Amazônia Central brasileira. Os indivíduos foram capturados em áreas próximas ao rio Tarumã Mirĭm (-60.15, -3.03)

(TM) e outra próxima ao Lago Janauarí (LJ) (-60.03, -3.21). Uma das áreas de estudo, a floresta inundável de água preta ("inundation-forest, Black-water" = "Igapó" (Sioli, 1956, *Apud* Adis, 1981)) está situada na área baixa do curso do rio TM, perto da nascente do Rio Negro, a uma distância de aproximadamente 20 km de Manaus rio-acima. O LJ se situa entre o Rio Negro e o Rio Solimões, sendo que a profundidade das águas desses dois últimos rios varia durante o ano todo, inundando anualmente as áreas vizinhas (Adis 1981).

3.2. Coleta dos espécimes

Os espécimes constituem parte do material coletado pelo pesquisador Joachim Adis, do Instituto Max-Planck (Alemanha), que realizou coletas sistemáticas na Amazônia Central entre os anos de 1974 e 1987. Com as coletas prestendiou-se realizar um inventário da fauna de artrópodes, com análises de dominância, fenologia e dinâmica da comunidade. Um dos objetivos específicos foi pesquisar sobre os efeitos das flutuações periódicas sobre esse grupo de animais.

Os grilos, assim como outros grupos de artrópodes, foram capturados com armadilhas "arboreal photo-eclectors". Este método detecta a migração de indivíduos sobre o tronco das árvores, tanto para animais que apresentam vôo, quanto para os que não, inclusive pode detectar o movimento de animais que se aproximem voando para o tronco (para mais detalhes consultar Adis, 1981).

Tem-se especimens coletados para as seguintes datas: fevereiro, março, agosto, setembro e dezembro de 1976; janeiro, abril de 1977, novembro de 1978 e setembro de 1987). O material foi depositado originalmente na coleção do Instituto Nacional de Pesquisas da Amazônia (INPA) Brasil. Logo depois foi emprestado por aproximadamente 20 anos ao Max Planck Institute of Limnology na Alemanha. Atualmente, encontra-se emprestado ao Laboratório de Orthopterologia (Universidade Federal de Viçosa, Brasil).

3.3. Procedimentos técnicos e taxonômicos

Todo o material foi conservado em solução alcoólica a 70%. As observações e descrições foram realizadas sob microscópio estereoscópio (lupa) Leica MZ16.

Para observar as características das asas posteriores, removeu-se a asa direita de alguns machos; do macho designado holótipo no caso onde só existia um macho, ou dos machos parátipos onde existiam mais de um macho. Para esticar as asas, estas foram colocadas em uma placa de Petri sobre papel filtro, pouco a pouco se adicionou solução alcoólica a 70%. A medida em que elas iam sendo esticadas com um pincel, se retirava o excesso de solução. Depois de ter a asa totalmente aberta, se colocavam junto com o papel filtro num lugar quente (uma caixa com uma lâmpada) por aproximadamente uma hora. Transcorrido esse tempo as asas foram transferidas para as lâminas histológicas. As láminas das asas foram fotografadas e incluídas nas pranchas.

As medidas das diferentes partes externas do corpo dos indivíduos foram realizadas usando um paquimetro digital, sob lupa. As seguintes medidas foram registradas (Figura 1):

a. Comprimento do corpo, medida dorsalmente desde o fastígio até a placa supra-anal;
b. Menor distância entre os olhos, medido dorsalmente;
c. Comprimento do pronoto ao longo da linha média;
d. Maior largura do pronoto, mensurada na margem posterior, ao nível da margem ventral dos lobos laterais;
e. Maior comprimento do fêmur posterior; mensurado pela face externa;
f. Maior comprimento da tíbia posterior, mensurado pela face externa;
g. Comprimento do ovipositor, medido lateralmente, desde a extremidade esclerozada, acima da placa subgenital até o ápice.

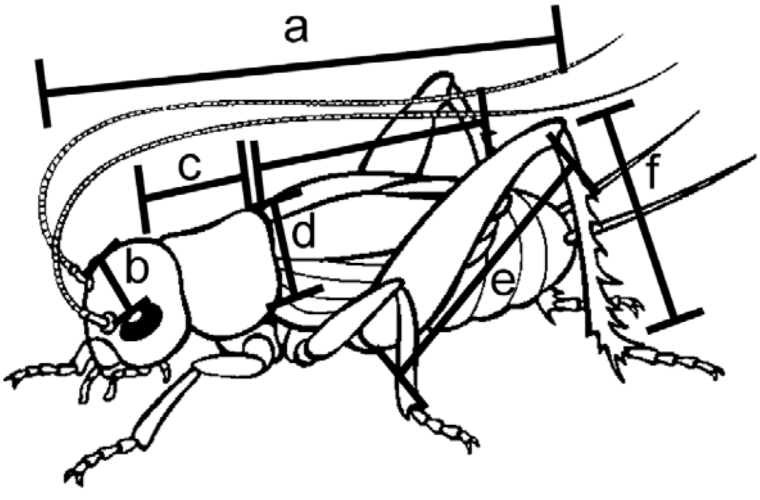

Figura 1. Medidas registradas a cada um dos individuos observados.

A contagem de estruturas como espinhos e esporões foi feita sob lupa. Todo o material foi etiquetado com o nome da nova espécie e o nome dos autores. Usaram-se etiquetas de cor vermelha para os holótipos e de cor azul para os alótipos e demais parátipos.

3.3.1. Dissecação da genitália

As genitálias dos machos foram dissecadas colocadas em solução aquosa de KOH 10% durante aproximadamente 48 horas. O tempo dependeu da ação da solução sobre os tecidos membranosos, segundo-se de lavajem em água. A genitália das fêmeas não foi submetida à solução aquosa de KOH, devido a ser de natureza membranosa. As genitálias foram guardadas em recipientes pequenos de plástico com glicerina, dentro dos vidros dos espécimes correspondentes.

3.4. Fotografias e ilustrações

As fotografias usadas tanto para as pranchas como para fazer os desenhos das partes do corpo, excetuando os da genitália, foi usado o método de superposição de imagens com diferentes planos de foco e unidas através do programa computacional livre (*freeware*) CombineZM (Hadley 2006). Este programa foi utilizado pela primeira vez em taxonomia por Lopes-Andrade (2007a,b) em estudos com coleópteros da família Ciidae, e nesta dissertação está sendo usado pela primeira vez para grilos. Há outros *softwares* disponíveis e mais comumente utilizados em taxonomia, mas que são pagos e de alto custo. Decidiu-se usar este procedimento já que embora os desenhos das genitálias transmitam muita informação sobre esta estrutura, são interpretações que dependem da pessoa que faz o desenho e podem não refletir a realidade (Dreisbach, 1952) além de muitos dos detalhes e a perspectiva tridimensional da estrutura serem perdidos.

Para tirar as fotos das genitálias foram feitos vários ensaios usando solução alcoólica a 70%, mas os resultados não foram satisfatorios. As imagens obtidas eram alteradas e não muito nítidas devido ao efeito da luz sobre o álcool. Finalmente, foi usada glicerina pura, que devido a sua viscosidade, pernute a obtenção de fotografias com menor distorção e de alta qualidade. Cada genitália foi colocada dentro de uma placa de Petri pequena e submersa até ficar totalmente coberta pela glicerina. Com a estrutura na posição desejada, e sem movimento, tirarou-se as fotografias. Utilizou-se uma câmara Canon S70 adaptada à lupa Leica MZ16 e duas lâmpadas halógenas de 150 Watts. As imagens finais do corpo e da genitália foram o resultado da união de 4 a 10 fotos. Os desenhos nas pranchas das outras partes do corpo foram realizados usando as fotografias e o programa CorelDraw X3. Os desenhos da genitália foram feitos através de uma câmara clara acoplada à lupa Leica MZ16.

3.5. Nomenclatura utilizada

A nomenclatura da genitália dos machos foi baseada em Desutter (1987, 1988), tendo em conta as modificações da mesma autora posteriormente (Desutter-Grandcolas, 2003). Entretanto, realizaram-se algumas modificações e novas interpretações depois de comparar as genitálias dos machos entre os diferentes gêneros de Paragryllini. A nomenclatura das tégminas foi baseada em Ragge (1955) e Sellier (1954), *apud* Desutter-Grandcolas (1995).

3.6. Glossário de termos

Para facilitar a compressão de alguns dos termos usados acerca das estruturas da genitália dos machos, se elaborou um glossário (Anexo 1), construído com diferentes fontes de informação, sobretudo tiveram-se em conta os principais autores consultados para a elaboração da introdução geral e os artigos.

3.7. Estrutura dos capítulos da dissertação

A dissertação foi dividida em dois capítulos, cada um em forma de artigo e seguindo as normas da revista onde se espera que seja publicado:

Capítulo 1: The first report of *Rumea* Desutter, 1988 (Orthoptera: Phalangopsidae: Paragryllini) from Brazil, with the description of three new Amazonian species.
Juliana Chamorro-Rengifo, Cristiano Lopes-Andrade & Carlos Frankl Sperber
Seguindo as normas da ***Zootaxa*.** http://www.mapress.com/zootaxa/
Artigo já submetido à Zootaxa.

Capítulo 2: *Marciela* and *Sperberus,* two new genera of Paragryllini crickets (Orthoptera: Phalangopsidae) from the Amazonian forest.
Juliana Chamorro-Rengifo, Cristiano Lopes-Andrade & Carlos Frankl Sperber
Seguindo as normas da ***Entomological Science***. http://www.wiley.com/bw/journal.asp?ref=1343-8786
Artigo ainda não submetido.

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5. ARTIGO 1:

The first report of *Rumea* Desutter, 1988 (Orthoptera: Phalangopsidae: Paragryllini) from Brazil, with the description of three new Amazonian species

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& CARLOS FRANKL SPERBER

The first report of *Rumea* Desutter, 1988 (Orthoptera: Phalangopsidae: Paragryllini) in Brazil, with the description of three new Amazonian species

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Abstract

We describe three new cricket species of *Rumea* Desutter collected at lowland rainforests in Central Amazonia, Brazil: *R. zebra* sp. nov., *R. manauensis* sp. nov. *R. tigris* sp. nov. We provide detailed descriptions of each species, together with measurements, drawings and photographs of external morphological features. We compared the male genitalia of the examined *Rumea* species with the ones of other Paragryllini, briefly discussing the gross morphology of this structure in the tribe. We also provide a brief discussion on the geographic distribution of the *Rumea* species.

Key words: Grylloidea, crickets, genitalia, Neotropical Region, Central Amazonia, Manaus, inundation forest, new photograph technique.

Resumen

Describimos tres nuevas especies de grillo de *Rumea* Desutter, colectadas en bosques lluviosos de tierras bajas en la Amazonia Central Brasilera: *R. zebra* sp. nov., *R. manauensis* sp. nov. y *R. tigris* sp. nov. Presentamos descripciones detalladas de cada especie, junto con las medidas de los individuos, dibujos y fotografías de las características morfológicas externas. Comparamos la genitalia de los machos de las especies de *Rumea* examinadas, con la genitalia de otros Paragryllini, discutimos brevemente la morfología general de esta estructura dentro de la tribu. Presentamos una discusión acerca de la distribución geográfica de las especies de *Rumea*.

Palabras clave: Grylloidea, grillos, genitalia, Región Neotropical, Amazonia Central, Manaus, bosque inundable, nueva tecnica de fotografía.

Introduction

Paragryllidae was originally proposed by Desutter (1988) as a separate family comprising Paragryllinae (Paragryllini + Benoistellini) and the monogereric subfamily Rumeinae. Subsequently, these suprageneric taxa were transferred to Phalangopsidae (Desutter-Grandcolas 1992), in which Paragryllini and Benoistellini were maintained with their status, and Rumeinae gained the status of tribe. However, these three tribes were not assigned to any subfamily by that time. Gorochov (1995, *apud* Gorochov 2007) joined all the genera of these tribes in a single tribe, Paragryllini, inside the subfamily Cacoplistinae. Gorochov (2007) re-evaluated his opinion, included the taxa of Neoaclini in Paragryllini and transferred the whole tribe to Phalangopsinae. Phalangopsidae has been treated either as a family (*e.g.* Desutter-Grandcolas 1992; Gorochov 2001) or a subfamily (*e.g.* Gorochov 2007) . Recent authors working on the taxonomy of the group have kept Phalangopsidae as a separate family (*e.g.* Sperber *et al.* 2003; Mews & Sperber 2008; Mews *et al.* 2008). Here, we consider Phalangopsidae as a separate family and Paragryllini (not including Neoaclini) as a tribe inside it, without considering any subfamily-level classification for the family. Our decision is arbitrary, with the sole intention of being practical. The suprageneric relationships within Grylloidea are far from being fully understood, and additional opinion on the matter without a phylogenetic framework or comparative studies of character sets will not improve the debate. Focuses of future works should be not merely on the taxonomic status of the group (family, subfamily or tribe), but on whether or not it constitutes a clade.

Paragryllini (Grylloidea: Phalangopsidae), as we use here, include the following six genera (with number of contained species in parentheses): *Benoistella* Uvarov, 1939 (1); *Mexiacla* Gorochov, 2007 (4); *Oaxacla* Gorochov, 2007 (2); *Paragryllus* Guérin-

Méneville, 1844 (12); *Rumea* Desutter, 1988 (3); and *Silvastella* Desutter-Grandcolas, 1992 (2).

The name "Paragryllidae" was first mentioned by Desutter (1987). However, the author has not provided either diagnostic characters or a type-genus for the group, making the name unavailable at that time. Shortly after, Desutter (1988) formally diagnosed the suprageneric taxon Paragryllidae, with the following combination of characters: palpi very short; external surface of the hindtibia with no more than three feeble spurs at the outer and three at the inner margins; hindwings always present; each hindwing with the apical area truncated, with the same length or barely exceeding the length of the tegmina; right tegmen with stridulatory apparatus complete and well developed, with numerous strong oblique veins, the veins being parallel to each other at the harp and forming concentric arcs at the mirror; base of each cercus thick; ovipositor usually curved. However, Gorochov (2007) gave tribal status for the group (Paragryllini), mentioning an outstanding feature: the shape of the distal part of the ovipositor, which is slightly thickened, acute at the apex, with distinctly widened (high) subapical part of upper valves and well exposed apical part of lower valves in lateral view. Desutter-Grandcolas (1992) considered Neoaclini and Paragryllini (as Paragryllidae) as separate taxa, while Gorochov (2007) includes the species of Neoaclini in Paragryllini.

Rumea is a Neotropical cricket genus and currently comprises three described species: *R. gaschei* Desutter, 1988 (type species, by monotypy); *R. guyanensis* Desutter-Grandcolas, 1992; and *R. micra* Desutter-Grandcolas, 1992. Specimens of *Rumea* are characterized by their small to median size (16.0 to 20.5mm), body usually brownish, legs bearing alternate light and dark incomplete rings, base of the antennal scape bearing a fringe of robust black bristles, each hindtibia with two internal and three external spurs, and the first tarsus of each hindtibia with two rows of spines (Desutter-Grandcolas 1992). The male genitalia of *Rumea* species are extremely different from the ones found in phalangopsid crickets of other genera, and the sclerites of the female genitalia are barely sclerotized (Desutter-Grandcolas 1992).

Rumea species are known from few localities in the French Guyana and Peru. It was supposed that *Rumea* crickets live in tree trunks, tree hollows and bushes in the forest (Desutter-Grandcolas 1992), possibly associated with the canopy.

In this work, we describe three new species of *Rumea* collected at seasonal inundation forests in the Central Amazonian Forest of Brazil: *R. zebra* sp. nov.; *R.*

manauensis sp. nov.; and *R. tigris* sp. nov. In addition, we briefly discuss the gross morphology of the male genitalia of Paragryllini and also the current biogeographic knowledge on the genus *Rumea*.

Material and methods

Specimens, examination and dissection

The examined specimens of *Rumea* were all collected by Joachim Adis during his ecological surveys on terrestrial arthropods at seasonal inundation forests in the Brazilian Central Amazonia. The crickets were captured with arboreal photo-eclectors (see Adis 1981) between 1974 and 1987. These specimens, all preserved in 70% ethanol solution, were originally deposited at the collection of the Instituto Nacional de Pesquisas da Amazônia (Brazil) and then held in trust for around twenty years at the Max Planck Institute of Limnology (Germany). Recently, these and other specimens from the same field collections were loaned to the Laboratório de Orthopterologia (Universidade Federal de Viçosa, Brazil) for identification. Besides the new species of *Rumea*, several other new cricket species were already recognized. They are already under description and will be presented in forthcoming articles by the authors or colleagues.

We examined three males and three females of *R. zebra* sp. nov., one male and two females of *R. manauensis* sp. nov., and one male of *R. tigris* sp. nov.

The examination and comparison of specimens, and the description of the new species, were made under a Leica MZ16 stereomicroscope. The new species of *Rumea* were compared with the descriptions and drawings of the known described species (Desutter 1988; Desutter-Grandcolas 1992). The six *Rumea* species are easily distinguished by the external morphological characters shown in Table 1. We do not provide an identification key to species, since the genus is possibly highly diversified, and any tentative identification key would not work well at the moment.

We extracted the right hindwing of one male paratype (*R. zebra* sp. nov. and *R. manauensis* sp. nov.) or the male holotype (only in the case of *R. tigris* sp. nov.). After extracting each hindwing, we put it on a filter paper and dropped 70% aqueous ethanol solution over it. We stretched the wing and took out the ethanol solution, so that it stayed stretched. Afterwards, we left the paper bearing the wing on a hot surface, then transferred and glued it on a grass slide with a cover slip. We use the nomenclature of

Ragge (1955) and Sellier (1954), *apud* Desutter-Grandcolas (1995), for the male forewings (tegmina).

We extracted the male genitalia, left it for 48h in 10% aqueous solution of KOH, and then washed it under running water. We extracted the female genitalia but did not leave it in KOH, since the structure was extremely membranous in the dissected specimens. Male and female genitalia were kept in vials with glycerine, inside the same bottle of the specimen. We used the nomenclature of Desutter (1987, 1988, 2003) for female and male genitalia, with few modifications. We compared the genitalia of the examined species of *Rumea* with the ones observed in other Paragryllini species. However, in the present work we provided photographs only of the genitalia of a *Rumea* and a *Paragryllus* not described species collected in Viçosa, Minas Gerais, Brazil (Fig. 1). We propose a new interpretation to the morphology of the male genitalia of *Rumea* species (see the Discussion section for an explanation).

Photographing and drawing

The genitalia of crickets, especially the male genitalia, are not easily photographed due to their great depth and consequent loss of focus. Slide mounting of the genitalia would permit an examination of details of the parts, but it would not be possible to photograph the entire structure mounted in such a way. Drawing the genitalia would also be an option, and that is extensively used in Orthoptera taxonomy. However, drawings are interpretations of what is seen under a microscope. If details were not correctly interpreted, the drawings would not provide accurate morphological information. We suggest that both drawings and photographs should be used in taxonomic works of Orthoptera. In an attempt to circumvent the problems in obtaining good images of the genitalia, we developed a new protocol for photographing genitalia of Orthoptera. We submerged the entire structure in pure glycerine, adjusted it to the desired position and waited for the liquid to stabilize. We took several digital photographs in different focus, under intense incident light (two 150 Watts halogen lamps), and processed them in an image stacking software. Due to the viscosity of the glycerine, the genitalia do not move in the medium while taking the photos. Consequently, the resulting final stacked image has a greater quality than that obtained with water or alcohol as immersion medium. The final image is a high resolution representation of the structure.

Digital photographs of the crickets and their extracted genitalia were taken with a Canon S70 mounted to a Leica MZ16 stereomicroscope. Final images of the body and the genitalia were the result of joining 4 to 10 photographs in different focus using the image stacking freeware CombineZM (Hadley 2006). This freeware was first used in taxonomy by Lopes-Andrade (2007a,b) in studies on ciid beetles. It is a non-cost alternative for other similar softwares, and is being used for the first time in taxonomic studies of crickets.

Drawings were made with a "camara lucida” adapted to the stereomicroscope, then digitalized and edited. Colour photographs of the specimens are available at the Orthoptera Species File (Eades & Otte 2008).

Abbreviations, labels and depositories

We use the following abbreviations for measurements (in mm) and counting of parts: TL, total body length; HF, length of the hindfemur; HT, length of the hindtibia; sHT, number of spines of the HT; sHts, number of spines of the first tarsomere of the hindtibia; PL, pronotal length at midline; PW, maximum pronotal width; EyeW, minimum eye width; TegL, maximum tegmina length; TegW, maximum tegmina width; SL, length of the stridulatory file of the male tegmen; NT, number of teeth in the stridulatory file of the male tegmen; OL, length of the ovipositor. We took all the measurements with an electronic digital calliper. We counted the number of spines (sHT and sHts) of the inner and outer margins of the left and right legs, providing the range of the variation found for either the holotype and allotype, and the range of variation observed for males and females of the whole type series.

Each specimen of the type series received an additional label containing the name of the species, authors and its status in the type series (holotype, allotype or paratype). We used red labels for holotypes and blue labels for paratypes, if any. We based the description of each species on the morphology of the male holotype and the female allotype, if any. We provided the observed variation, if any, in a separate section after each description.

Specimens have been deposited in or belong to the following institutional collections (with acronyms used in this paper):

INPA	Instituto Nacional de Pesquisas da Amazônia (Manaus, AM, Brazil)

Descriptions

Rumea zebra Chamorro-Rengifo, Lopes-Andrade & Sperber, sp. nov. (Figs 2–4)

Etymology. The specific epithet refers to the coloration pattern of the legs, which consists of alternating dark yellowish and dark brownish stripes, resembling the coloration pattern of a zebra.

Diagnosis. The body coloration of *R. zebra* sp. nov. is lighter than that of *R. manauensis* sp. nov. and *R. tigris* sp. nov., so the contrast between the brownish and yellowish stripes is comparatively more distinctive. This new species is also smaller than the latter two species. It can also be distinguished from the other described *Rumea* by the following combination of characters: (i) face with striped coloration, the brownish stripes being narrower than that of *R. manauensis* sp. nov.; (ii) pronotum with anterior and posterior sides broadly rounded; male genitalia with (iii) dorsal tip of the longitudinal midline of the pseudepiphallic arm with two small lobes (conspicuous in lateral view), (iv) one lateral lobe (of the pseudepiphallus) visible in dorsal view, (v) each lateral lobe of the pseudepiphallic arm directed outwards, and not laterally pronounced, (vii) ectophallic apodemes slightly curved inwards.

Description (holotype ♂ & allotype ♀). Holotype ♂: TL 16.01; HF 11.92; HT 9.68; sHT, inner margin 24–25, outer 22; sHts, inner margin 3–7, outer 8; PL 2.45; PW 3.41; EyeW 1.37; TegL 12.93; TegW 5.42; SL 3.78; NT 146. Allotype ♀: TL 16.87; HF 11.99; HT 9.32; sHT, inner margin 21–22, outer 18–20; sHts, inner margin 7, outer 7–8; PL 2.78; PW 3.52; EyeW 1.37; TegL 13.78; TegW 4.64; OV 12.16. General coloration consisting of dark brownish and dark yellowish areas (Fig. 2). **Head** with strong bristles on the vertex (Fig. 3A). Face coloration dark yellowish with brownish stripes. Frons with a brown stripe from the vertex to the frontoclypeal suture that narrows in the last third, and a yellowish oval area at eyes level; two oblique lateral stripes from the ventral margin of the antennal socket to the frontoclypeal suture, interrupted approximately at the first third above the frontoclypeal suture; each gena with two brownish stripes, one from the ventral margin of the eye to the ventral margin of the head, and the other bordering the ventral margin of the head and reaching the postgena. Clypeus almost completely brown, with three distinct yellowish oval areas, one in the center and one in either side of the longitudinal midline of the rostrum. Labrum greyish with two faint lateral stripes, none reaching the ventral margin. Mandibles yellowish with a few dark spots; cutting edge dark brownish. Maxillary and labial palpi with whitish bases and several distinctive dark spots at the base and tip of each palpus. Last palpomere of each maxillary palp dark brownish. Mouthparts in ventral view, excepting the appendages, yellowish with several black spots. Antennal scape light yellowish, with an irregular dark brownish spots; antennomeres light yellowish. Dorsal surface of the head (Fig. 3B) with four brownish longitudinal stripes: two stripes originating at the posterior margin and jointed at the eyes level, so that only one thick stripe reaches the anterior margin; two lateral stripes, one at each side, originating at the posterior margin and ending at the ventral margin of each eye. Additionally, there is one stripe, originating at the posterior base of each lateral stripe, which is bifurcated forming one stripe that reaches the inner margin of the eye and another faint stripe extending to the anterior ventral surface but disappearing, not reaching the face. Eyes dark brownish, with a whitish oval area at the dorsal inner surface; central ocellus oval, almost three times larger than the other two ocelli together, the latter being very small and inconspicuous. **Thorax** with the anterior and posterior pronotal angles rounded (Fig. 3C). Pronotum with disc mostly dark yellowish, bearing dark brownish marks; posterior area light yellowish; dark brownish lateral lobes and strong bristles at the anterior and lateral margins. Longitudinal midline of the pronotal disc with a small dark brownish triangular mark close to its anterior margin, and a distinctive triangular mark at each side of the midline, the outer mark being dark brownish and the inner mark dark yellowish; an indistinct dark yellowish oval mark on each side of the longitudinal midline, both marks being parallel to the posterior margin; and two oval dark yellowish marks at the midline, one large mark close to the posterior margin of the pronotum and the other above the first. Tegmina translucent, brownish; right tegmen (Fig. 3D) with the mirror bearing seven curved veins, the sixth vein from the anterior margin divided into two; harp with eight veins. Hindwings (Fig. 3E) translucent, brownish. Prosternum light yellowish, meso- and metasternum brownish, each with a small black mark near the base of the mid- and hindlegs. Fore- and midlegs (Fig. 3F) with similar coloration pattern, each as follows: coxa and trochanter yellowish and with indistinct dark spots like shadows; femur with the outer surface light yellowish, with one distinct brownish ring on the apex and another similar ring below it, the rings being separated from each other by a yellowish area, both rings interrupted at the lower surface; tibia with two brownish dark marks, one at the tip and the other at the middle. Each hindleg with the femur (Fig. 3G) bearing four distinct brownish areas intercalated with yellowish areas; hindtibia dark yellowish, with a dark brownish mark at the dorsal tip. First and second tarsomeres of fore- and midlegs darker than the third tarsomere and darker than the tarsus of the hindleg. Tarsus claws of all legs whitish, with black tips. **Abdomen** with the tergites light brownish, with irregular dark brownish spots like shadows. Sternites light brownish, the first and second ones lighter than the others. Penultimate tergite of the female (Fig. 3J) with a transversal division, with the anterior portion lifted up and leaving the posterior portion in low-relief (possibly a glandular area). Cerci dark yellowish. Posterior margin of the supra-anal plate broadly rounded (Figs 3H,J), larger in female (Fig. 3J) than in male (Fig. 3H), the plate in male being almost black, and in the female dark yellowish with irregular brownish spots like shadows. Subgenital plate of male (Fig. 3I.) with an indistinct emargination at the middle of the posterior margin (Fig. 3I); in female (Fig. 3K), this emargination is deep and broad, leading a V-shape cut of almost one-third the length of the plate at the longitudinal midline. Ovipositor (Fig. 3L) 0.72X the body length, with two little lobes at the ventral side before the apex. **Male genitalia** (Fig. 4) with the dorsal tip of the pseudepiphallic arm with two small lobes at the midline, visible in lateral view (Fig. 4B); pseudepiphallic arm with lateral lobes directed outwards (Fig. 4A,C), not projected in lateral view (Fig. 4B); each pseudepiphallic lateral lobe with only one projection, well developed, visible in dorsal view (Fig. 4A); ectophallic apodemes slightly curved inwards (Fig. 4A); both rami reduced, each one with a small undulation. **Female genitalia** (Fig. 4D) with a bell form; spermatheca tubular, broadly curved inwards, clockwise when seen from above, increasing in size from the basal to the apical portion.

Comments: Both antennas of the holotye are broken, the right one longer than the left one.

Variation. Measurements of males (n=3, including the holotype): TL 16.01–17.46; HF 11.92–13.00; HT 9.68–9.95; sHT, inner margin 22–25, outer 22–23; sHts, inner margin 3–8, outer 8–10; PL 2.45–2.78; PW 3.41–3.95; EyeW 1.37–1.94; TegL 12.93–14.46; TegW 5.42–6.13; SL 3.78–3.91; NT 146-176. Measurements of females (n=3, including the allotype): TL 16.87–18.51; HF 11.93–12.40; HT 8.29–9.32; sHT, inner margin 19–25, outer 18–23; sHts, inner margin 6–8, outer 7–9; PL 2.45–2.78; PW 3.41–3.66;

EyeW 1.37–1.52; TegL 13.39–14.07; TegW 4.64–4.97; OL 12.16–12.62. Right tegmen with six veins on the harp, and six to seven veins on the mirror; the last vein of the mirror being either ramified into two veins or unramified.

Type series. *Holotype* ♂ (INPA) labelled /Brazil, Manaus, Tarumã Mirim River. Joachim Adis [handwritten on white paper] / 47A TM BE. 22.3.1976 [handwritten on white paper] / *Rumea zebra* Chamorro-Rengifo, Lopes-Andrade & Sperber. 2009 [handwritten on red paper]/. *Allotype* ♀ (INPA), same locality data as the holotype but collected in /49A TM BE 22.3.76 [handwritten on white paper]/ and additionally labelled /*Rumea zebra* Chamorro-Rengifo, Lopes-Andrade & Sperber 2009 [handwritten on blue paper]/. *Paratypes*, same locality data as the holotype: 2♂♂ (1 INPA, 1 INPA) one collected in /48C TM BE 8.12.1976 [handwritten on translucent white paper]/ and the other in /49E TM BE 12-1-1976 [handwritten on white paper] /; 2♀♀ (1 INPA, 1 INPA) one collected in /47B TM BE 6.4.1977 [handwritten on white paper]/ and the other in /TM 48A TM BE 13.4.1977 [handwritten on white paper]/.

Rumea manauensis **Chamorro-Rengifo, Lopes-Andrade & Sperber, sp. nov. (Figs 5–7)**

Etymology. The specific epithet refers to Manaus, *terra typica* of this new species.

Diagnosis. The body coloration of this new species is darker than that of *R. zebra* sp. nov. This new species can be distinguished from the others *Rumea* by the following combination of characters: (i) face dark yellowish with brownish stripes, the brownish stripes being wider than those of *R. zebra* sp. nov.; (ii) whitish oval area at the inner margin of each eye larger than in *R. zebra* sp. nov. and *R. tigris* sp. nov.; (iii) either side of the anterior and posterior pronotal margins angulated, so that the pronotum has somewhat a square shape when seen from above; male genitalia with (iv) dorsal tip of the longitudinal midline of the pseudepiphallic arm bearing a small rounded lobe, (v) lateral lobes (of the pseudepiphallus) with a boomerang shape (two small lobes projected in opposite directions), visible in dorsal view, (vi) lateral lobes of the pseudepiphallic arm curved outwards, ventrally projected as seen in lateral view, (vii) ectophallic apodemes slightly directed inwards.

Description (holotype ♂ & allotype ♀). Holotype ♂: TL 20.45; HF 14.52; HT 11.82; sHT, inner margin 24–25, outer 23–25; sHts, inner margin 3–7, outer 8–9; PL 3.11; PW 3.88; EyeW 1.73; TegL 14.81; TegW 6.21; SL 3.68; NT 153. Allotype ♀: TL 21.09; HF 14.23; HT 11.29 (left hindleg lacking); sHT, inner margin 23, outer 22; sHts, inner margin 9, outer 9; PL 3.32; PW 3.97; EyeW 1.71; TegL 15.46; TegW 5.69; OL 17.97. General coloration consisting of dark brownish and dark yellowish areas (Fig. 5). **Head** with robust bristles on the vertex (Fig. 6A). Face with dark yellowish coloration, with brownish stripes. Frons with a broad brown stripe from the vertex to the frontoclypeal suture, narrowing from the dorsal to the ventral surface, with a yellowish oval area at the level of each eye; two oblique lateral stripes from below the antennal socket to the frontoclypeal suture, interrupted approximately in the first third above the frontoclypeal suture; each gena with two brownish stripes, one extending from below the eye to the ventral surface of the head, and the second stripe bordering the ventral surface of the head and reaching the postgena. Clypeus whitish, with two greyish lateral marks. Labrum whitish with two indistinct greyish lateral stripes (like shadows), not reaching the ventral margin. Mandibles yellowish, cutting edge dark brownish. Maxillary and labial palps light yellowish. Last palpomere of each maxillary palp dark brownish. Mouthparts in ventral view, excepting the appendages, light yellowish. Each antenna with scape dark yellowish, bearing an irregular dark brownish spot; antennomeres dark yellowish. Dorsal surface of head (Fig. 6B) with four brown longitudinal stripes: two stripes originating at the posterior margin and jointed at the eyes level, so that only one thick stripe reaches the anterior margin; two narrower and lighter lateral stripes, one at each side, originating at the posterior margin and ending at the ventral margin of each eye. Additionally, there is one stripe, originating at the posterior base of each lateral stripe, which is bifurcated forming one stripe that reaches the inner margin of the eye and another faint stripe extending to the anterior ventral surface but disappearing, not reaching the face. Surface close to the posterior margin of each antennal socket bearing a mark almost completely black. Eyes dark brownish with a whitish oval area at the posterior inner surface. Central ocellus oval, bigger than the others ocelli, the latter being almost indiscernible. **Thorax** of male with the pronotum almost square when seen from above (Fig. 6C), the female pronotum being comparatively more rounded. Pronotum mostly dark yellowish, with dark brownish areas; either lateral portions dark brownish; anterior and lateral margins with robust bristles; conspicuous triangular marks on each side of the longitudinal midline, near the very middle of the disc, the outermost marks being dark brownish and the innermost marks being yellowish; posterior portion with an indistinct dark yellowish oval mark on each side of the midline, both marks being parallel to the posterior margin, and a dark yellowish mark with a half oval shape at the midline; posterior portion with a dark yellowish border along the margin. Tegmina translucent, brownish; right tegmen (Fig. 6D) with the mirror bearing seven curved veins, the last vein of the anterior margin being divided into three; harp with six veins. Hindwings (Fig. 6E) translucently brown. Pro- and mesosternum dark yellowish, metasternum dark brownish. Fore- and midlegs (Fig. 6F) with the same coloration pattern, as follows: each coxa and trochanter dark brownish; dorsal area of each femur light brownish with a dark brownish mark near the apex; tibia with two inconspicuous dark areas, one at the tip and the other at the middle. Hindleg with femur (Fig. 6G) bearing four distinctive brownish areas, each one between yellowish stripes; hindtibia dark yellowish, with a dark brownish area at the dorsal tip. First and second tarsomeres of fore- and midlegs darker than the third, all darker than the tarsomeres of the hindleg. Tarsus claws of all legs whitish, with black tips. **Abdomen** with tergites dark brownish; ninth and tenth tergites with low-relief areas (possibly glandular) in either side (Fig. 6J), these areas being close to the posterior margin in the former and close to the anterior margin in the latter. Sternites dark brownish, lighter in female than in male. Cerci dark yellowish. Posterior margin of the supra-anal plate broadly rounded (Fig. 6H), mostly light brownish, bearing irregular dark brownish spots. Male subgenital plate (Fig. 6I) with two small apical lobes and a small central apical emargination; in female (Fig. 6K) with a deep rounded central emargination, near one third the length of the subgenital plate at midline. Ovipositor (Fig. 6L) near 0.85X the body length, with two small ventral lobes close to the apex. **Male genitalia (Fig. 7)** with the dorsal tip on the midline of the pseudepiphallic arm bearing a small rounded lobe visible in lateral view (Fig. 7B); lateral lobes of the pseudepiphallic arm curved ventrad-outwards (Fig. 7A and 7C), seen as ventrad projections in lateral view (Fig. 7B); each lateral lobe of the pseudepiphallic bridge with two projections, both well developed (compared with *R. micra* sp. nov.) and almost with the same size, visible in dorsal view (Fig. 7A); ectophallic apodemes directed outwards (Fig. 7A); rami not reduced, each ramus bearing two undulations. **Female genitalia (Fig. 7D)** narrowing from the dorsal to the ventral surface; spermatheca conspicuous, arranged on the left side of the genitalia, with two lateral ducts growing from the genital chamber.

Comments: Both antennas of the holotype are broken, the left one longer than the right one.

Variation. Measurements of males (n=2, including the holotype): TL 19.52–20.45; HF 14.52–15.11; HT 11.69–11.82; sHT, inner margin 24–25, outer 23–25; sHts, inner margin 3–8, outer 8–9; PL 3.11–3.20; PW 3.88–4.21; EyeW 1.70–1.73; TegL 14.81 (measured only in the holotype; paratype with incomplete tegmina); TegW 6.21–6.57; SL 3.68–4.01; NT 153–184. Females: besides the female allotype, no other female specimen was available. Right tegmen of the male paratype similar to that of the holotype, with six veins in the harp and eight in the mirror, without ramification.

Type series. *Holotype* ♂ (INPA) labelled /Brazil, Manaus, Tarumã Mirim River. 08-03-1976. Joachim Adis [handwritten in white paper] / 48A TM BE 8.3.76 [handwritten on white paper] / *Rumea manauensis* Chamorro-Rengifo, Lopes-Andrade & Sperber 2009 [handwritten on red paper]/. *Allotype* ♀ (INPA), same locality data as the holotype but collected in /47B TM BE 17.2.1976 [written on white paper]/ and additionally labelled /*Rumea manauensis* Chamorro-Rengifo, Lopes-Andrade & Sperber [handwritten on blue paper]/. *Paratype* ♂ (INPA), same locality data as the holotype but collected in /48D TM BE 06-01-1977 [handwritten on blue paper]/ and additionally labelled /*Rumea manauensis* Chamorro-Rengifo, Lopes-Andrade & Sperber [handwritten on blue paper]/.

Rumea tigris **Chamorro-Rengifo, Lopes-Andrade & Sperber, sp. nov. (Figs 8–10)**

Etymology. The specific epithet refers to the coloration pattern of the legs, which consists of alternating lines of light and dark brownish areas, similar to the colour pattern of a tiger.

Diagnosis. This species can be distinguished from the others species of *Rumea* by the following combination of characters: (i) body coloration darker than that of *R. zebra* sp. nov. and *R. manauensis* sp. nov.; (ii) face without striped coloration pattern; (iii) eyes dark brownish and more ventrally elongated than those of *R. zebra* sp. nov. and *R. manauensis* sp. nov., each eye bearing a whitish oval area at the dorsal inner surface that is smaller than those of *R. zebra* sp. nov. and *R. manauensis* sp. nov.; (iv) anterior and posterior pronotum edges broadly rounded, giving a suboval appearance to the pronotal surface when seem from above; male genitalia with (v) dorsal tip of the pseudepiphallic arm with a rounded small lobe on the midline, (vi) lateral lobes of the pseudepiphallic bridge with two projections, one being reduced and barely visible from above, (vii) lateral lobes of the pseudepiphallic arm curved ventrad-outwards, ventrad pronounced as seen in lateral view, (viii) ectophallic apodemes slightly curved inwards.

Description (holotype ♂; female unknown). Holotype ♂: TL 20.03; HF 15.28; HT 12.66; sHT, inner margin 25–30, outer 22–25; sHts, inner margin 6–8, outer 8–9; PL 3.43; PW 4.22; EyeW 1.84; TegL 16.05; TegW 7.04; SL 4.35; NT 124. General coloration consisting of dark brownish and dark yellowish areas (Fig. 8). **Head** bearing robust bristles at the vertex (Fig. 9A). Face with coloration dark brownish with small light brownish areas, without of striped pattern. Frons bearing an indistinct light yellowish oval mark on the longitudinal midline at eye level; two semi-rounded light yellowish oval areas at eye level, close to the antennal socket; two oblique light yellow stripes at the middle of each gena; a light yellow undefined areas above the subgenal suture. Clypeus greyish, with two distinct dark brownish marks at each side of the longitudinal midline, and a triangle-shaped mark at the midline. Labrum greyish with two darker lateral stripes, none of them reaching the ventral margin. Mandibles dark yellowish with a large dark brownish mark, cutting edge dark brownish. Maxillary palps light brownish. Last palpomere of each maxillary palp dark brownish. Labial palps whitish; second labial palpomere with several distinctive yellowish spots at the base, and light greyish spots at the ventral side. Mouthparts in ventral view, excepting the appendages, light yellowish. Antennal scape dark yellowish with small black spots at the tip and an oblique dark brownish line from the tip to the ventral margin; antennomeres dark yellowish. Head dorsal surface (Fig. 9B) with four brown longitudinal stripes: two stripes originating at the posterior margin and jointed at the eyes level, so that only one thick stripe reaches the anterior margin; two lateral stripes, one at each side, originating at the posterior margin and ending at the ventral margin of each eye. Additionally, there is one stripe, originating at the base of each lateral stripe, which is bifurcated forming one stripe that reaches the inner margin of the eye and another faint stripe extending to the anterior ventral surface but disappearing, not reaching the face. Eyes dark brownish, each with a whitish oval area at the dorsal inner surface; central ocellus oval, almost three times bigger than the two other ocelli, the latter been almost indiscernible. **Thorax** with the pronotal margins broadly rounded (Fig. 9C), giving a semicircular appearance to the pronotum when seen from above. Anterior and lateral margins bearing robust bristles; lateral surface dark brownish. Pronotum with disc dark yellowish and bearing dark brownish areas; anterior margin with dark brownish border along it, the border bearing a small subtriangular mark at the longitudinal midline; a distinctive triangular mark on each side of the midline, with one outer mark being dark brownish and the inner mark dark yellowish; posterior margin with two indistinct oval marks parallel to it, one mark at each side of the longitudinal midline; two ovals dark yellowish marks at the midline, one close to the posterior margin and the other above it; posterior portion with a light yellowish border along the margin. Tegmina translucent, brownish; right tegmen (Fig. 9D) with mirror bearing eight curved veins; harp with five veins. Hindwings (Fig. 9E) translucent, brownish. Sternum light yellowish. Metasternum darker than sternum. Fore- and midlegs (Fig. 9F) as follows: each coxa and trochanter yellowish with indistinct dark spots like shadows; femur light yellowish, with two conspicuous brownish rings, one near the apex and the other below it, being separated from each other by a yellowish space, the rings being incomplete at the lower surface; tibia with two brownish dark areas, one at the tip and the other at the middle. Hindlegs with femur (Fig. 9G) bearing four conspicuous brownish rings intercalated with yellowish stripes; hindtibia light brownish, with a dark brownish mark at the upper surface near the apex. Tarsomeres of fore- and midlegs light brownish, darker than the tarsomeres of the hindlegs. Tarsus claws of all legs whitish with black tips. **Abdomen** with the tergites and sternites dark yellowish, each with some irregular dark spots like shadows. Cerci dark yellowish. Posterior margin of the supra-anal plate broadly rounded (Fig. 9H), dark brownish with a light yellowish mark at the midline. Subgenital plate (Fig. 9G) light brownish at the anterior portion, with a dark brownish rounded mark near either posterior-lateral side; posterior area dark brownish; posterior margin with an emargination at middle and two feeble lateral lobes. **Male genitalia** (Fig. 10) with the dorsal tip of the pseudepiphallic arm bearing a small rounded lobe on the midline, that is visible in lateral view (Fig. 7B); pseudepiphallic lateral lobes curved ventrad-outwards (Fig. 10A and 10C), ventrad projecting in lateral view (Fig. 10B); lateral lobe with two projections, the dorsal one reduced, similar to a small lobe, being barely visible in dorsal view (Fig. 10A); each median lobe with a small projection (Fig. 10B); ectophallic apodemes directed outward (Fig. 10A); each ramus not reduced, bearing two undulations.

Comments: both antennas are broken, right one longer than the left one.

Type series. *Holotype* ♂ (INPA) labelled /Brazil, Manaus, Lago Janauari. Joachim Adis [handwritten on white paper] / BE 49C Lj 15.9.87 [handwritten on white paper] / *Rumea tigris* Chamorro-Rengifo, Lopes-Andrade & Sperber 2009 [handwritten on red paper]/.

Taxonomic key for the *Rumea* species

1. General coloration of the face without dark stripes…………………………………...2

1'. General coloration of the face with dark stripes ……………………………………..3

2. Genitalia of the male with the lateral lobes of the pseudepiphallic arm outward directed; lateral lobes of the pseudepiphallic arm not pronounced in lateral view…………………..***R. gaschei***

2'. Genitalia of the male with lateral lobes of the pseudepiphallic arm ventro-outward directed; lateral lobes of the pseudepiphallic arm pronounced in lateral view…..***R. tigris***

3. Two completed lateral lobes on the pseudepiphallic bridge…………………………..4

3'. Two lateral lobes on the pseudepiphallic bridge, but one completed and the other reduced…………………………………………………………………………..***R. micra***

4. Genitalia of the male with the lateral lobes of the pseudepiphallic arm outward directed...5

4'. Genitalia of the male with the lateral lobes of the pseudepiphallic arm ventro-outward directed……………………………………………………….....***R. manauensis***

5. Males with the tibia of the hind leg in average of 15 mm and tegminas > 15 mm...***R. guyanensis***

5'. Males with the tibia of the hind leg in average of 12.4 mm and tegminas 13.6 mm..***R. zebra***

Discussion

The male genitalia in Paragryllini

Besides the other external morphological characters, the genus *Rumea* is well characterized by the gross morphology of the male genitalia, which is drastically different from the ones found in other Paragryllini. For interpreting the gross morphology of the male genitalia in *Rumea*, we contrasted the male genitalia of the examined species and available drawings in the literature with the ones of other Paragryllini (see Fig. 1 for a comparison between a *Rumea* and a *Paragryllus* species). At first, we searched the fringe of bristles on the pseudepiphallic median lobes (in the pseudepiphallic bridge), so that we could locate the pseudepiphallic lateral lobes. In *R. guyanensis* and *R. manauensis* sp. nov., each pseudepiphallic lateral lobe is possibly modified into two lobes, and in the other *Rumea* species it is seen as a single structure (the fused lobe or one developed and one reduced lobe). The rami are reduced, either in lateral or in dorsal view. The ectophallic apodemes are larger than in species of other Paragryllini genera and oriented upwards and joined with the ventral posterior area of the pseudepiphallus. The ectophallic sclerites are reduced.

We suggest that the greater change in the structure is in the pseudepiphallic arm: the dorsal pseudoepiphallic arm remained fused on the longitudinal midline, forming one complete structure; the dorsal margin of the pseudepiphallic arm is closed and the pseudophiphallic ventral margin is open. The latter is a hyper-developed structure, barely sclerotized. The outer apical area of the pseudoepiphallic arm is protruding forming one ventro-outer lobe (Fig. 1, lateral lobe of the pseudepiphallic arm). The ectophallic fold, ectophallic arc and the endophallic sclerites are well differentiated and are exposed only in ventral view, concealed within the pseudepiphallic arm.

Biogeographic considerations

All the species of *Rumea* described until now, including the species described in this work, were collected at few localities in the Amazonian rainforests of Peru, French

Guyana and Brazil (Fig. 11). This suggests that the species of *Rumea* occurs only in the Amazonian subregion, being restricted to two biogeographic provinces (*sensu* Morrone 2006): the Humid Guyana province; and the Varzea province. It is unknown whether such restricted distribution of *Rumea* is a result of low sampling effort in other biogeographic provinces or a real distributional pattern for the taxon. In any case, Paragryllini species are not frequently collected in South America, the known range of the species are very narrow and they occur only in localities with relatively well preserved forests. Possibly, the distributions of most Paragryllini species constitute cases of microendemism.

The Humid Guyana comprises a portion of the eastern Venezuela, Guyana, Suriname, French Guyana and a northern portion of the state of Amapá (Brazil). Two species of *Rumea* are known only from this province: *R. guyanensis* and *R. micra*. The Varzea province is a long and narrow land stripe comprising the Solimões and Amazon rivers and part of their tributaries, and the lowland rainforests at their margins. Four species of *Rumea* occur at the Varzea province: *R. gaschei*; *R. manauensis* sp. nov.; *R. tigris* sp. nov.; and *R. zebra* sp. nov.. *Rumea gaschei* is known only from one locality in Peru, and the latter three species are known from Manaus (northern Brazil). Most of the lands of the Varzea province are periodically inundated by the water of rivers, and several arthropods occurring there are adapted to the constant forest disturbance caused by the river dynamics. There are two main types of seasonal inundation forests (Adis 2002): Igapó, which is flooded by black-water rivers; and Várzea, which is flooded by white-water rivers. *Rumea tigris* is known only from the surroundings of lake Janauari, a locality between the Negro and Solimões rivers. This locality is a mixture of Igapó and Várzea forests, and it possibly constitutes an ecotone (Adis 2002). *Rumea zebra* and *R. manauensis* are two sympatric species known from the Igapó forest of the Tarumã-Mirim tributary, a locality only 30 Km far from lake Janauari, but separate from it by the wide waters of the Negro river. The lowland Amazonian rainforests typically contain a high density of river tributaries, which may act as effective barriers to the dispersal of species and lead to events of allopatric speciation (Ayres & Clutton-Brock 1992). If the rivers and their tributaries repeatedly form new floodplains and abandon old ones, subsequent secondary contact of formerly separated forest patches and inundation areas may lead to a pattern of co-occurrence of close related species with narrow geographic range (Salo *et al.* 1986). Most phalangopsid crickets are non-volant or low dispersive organisms, so that allopatric speciation in expected to be a very important phenomena, mainly in such a geographic scenario. Therefore, the suprageneric and generic taxa of crickets of the Varzea province are expected to be highly diversified and bear a high number of endemic species. Consequently, the species of *Rumea* described here, along with several other phalangopsid taxa, are candidates for being included in lists of threatened taxa.

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TABLE 1. Comparison of the diagnostic morphological characters of the six known species of *Rumea* Desutter (*R. gaschei* Desutter; *R. guyanensis* Desutter-Grandcolas; *R. micra* Desutter-Grandcolas; *R. zebra* sp. nov.; *R. manauensis* sp. nov.; *R. tigris* sp. nov.). Abbreviations: HF, average of the length of the hind femur; TegL, length of the tegminas ;CPF, colouration pattern of the face; NLL, number of lateral lobes (on the pseudepiphallic bridge); DLLP, direction of the lateral lobes of the pseudepiphallic arm; LLP-LV, lateral lobes of the pseudepiphallic arm in lateral view; DEA, direction of the ectophallic apodemes.

Character	***R. gaschei***	***R. guyanensis***	***R. micra***	***R. zebra***	***R. manauensis***	***R. tigris***
HF	19.5	15	< 11.5	12.4	14.8	12.6
TegL	20.7	> 15	< 11	13.6	14.8	16.0
CPF	without stripe pattern	stripe pattern	stripe pattern	stripe pattern	stripe pattern	without stripe pattern
NLL	1	2	1 normal + 1 reduced	2	2	1 normal + 1 reduced
DLLP	outward	outward	outward	outward	ventro-outward	ventro-outward
LLP-LV	not pronounced	not pronounced	not pronounced	not pronounced	pronounced	pronounced
DEA	outwards	inwards	outwards	slightly inwards	outwards	outwards

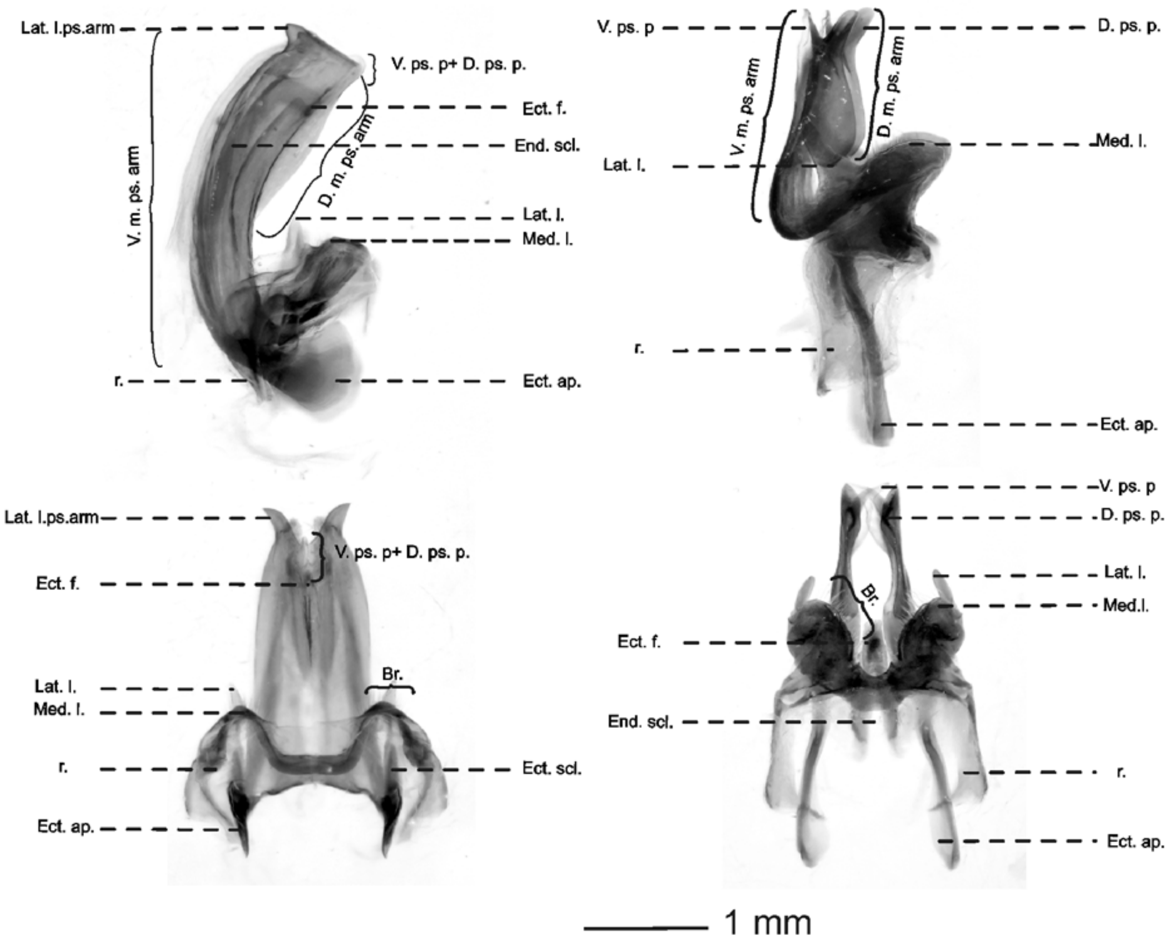

FIGURE 1. Comparison of the male genitalia of *Rumea manauensis* sp. nov. (**A** and **B**) and *Paragryllus* sp. (**C** and **D**; undescribed species). **A, C.** Lateral view. **B, D.** Dorsal view. Abbreviations: dorsal pseudepiphallic paramere (D.ps.p.), ventral pseudepiphallic paramere (V.ps.p), ventral margin of the pseudepiphallic arm (V.m.ps.arm.), dorsal margin of the pseudepiphallic arm (D.m.ps.arm), lateral lobe of the pseudepiphallic arm (Lat.l.ps.arm), lateral lobe (Lat.l.), median lobe (Med.l.), ramus (r), ectophallic fold (Ect.f.), ectophallic sclerites (Ect.scl.), ectophallic apodemes (Ect.ap.), endophallic sclerite (End.scl.), bristles (Br.).

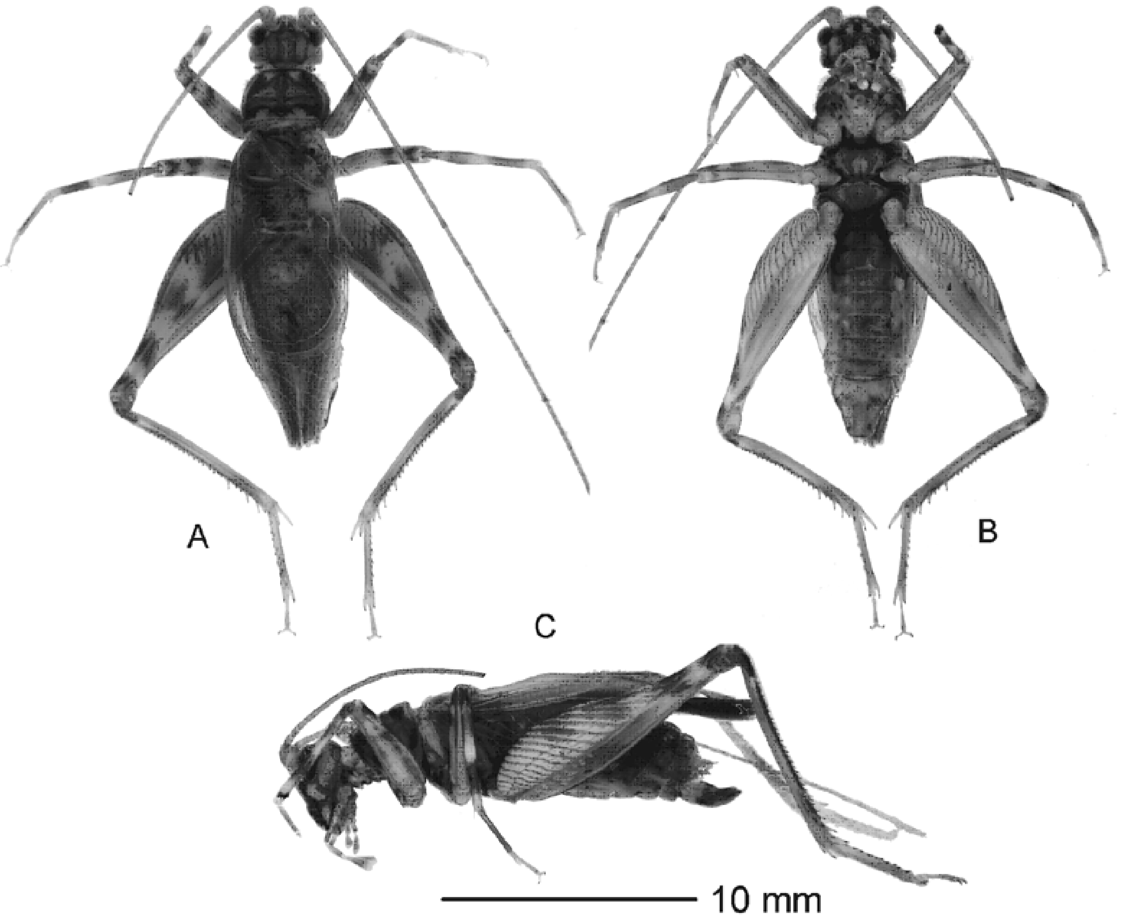

FIGURE 2. *Rumea zebra* sp. nov., male holotype. **A.** Dorsal view. **B.** Ventral view. **C.** Lateral view.

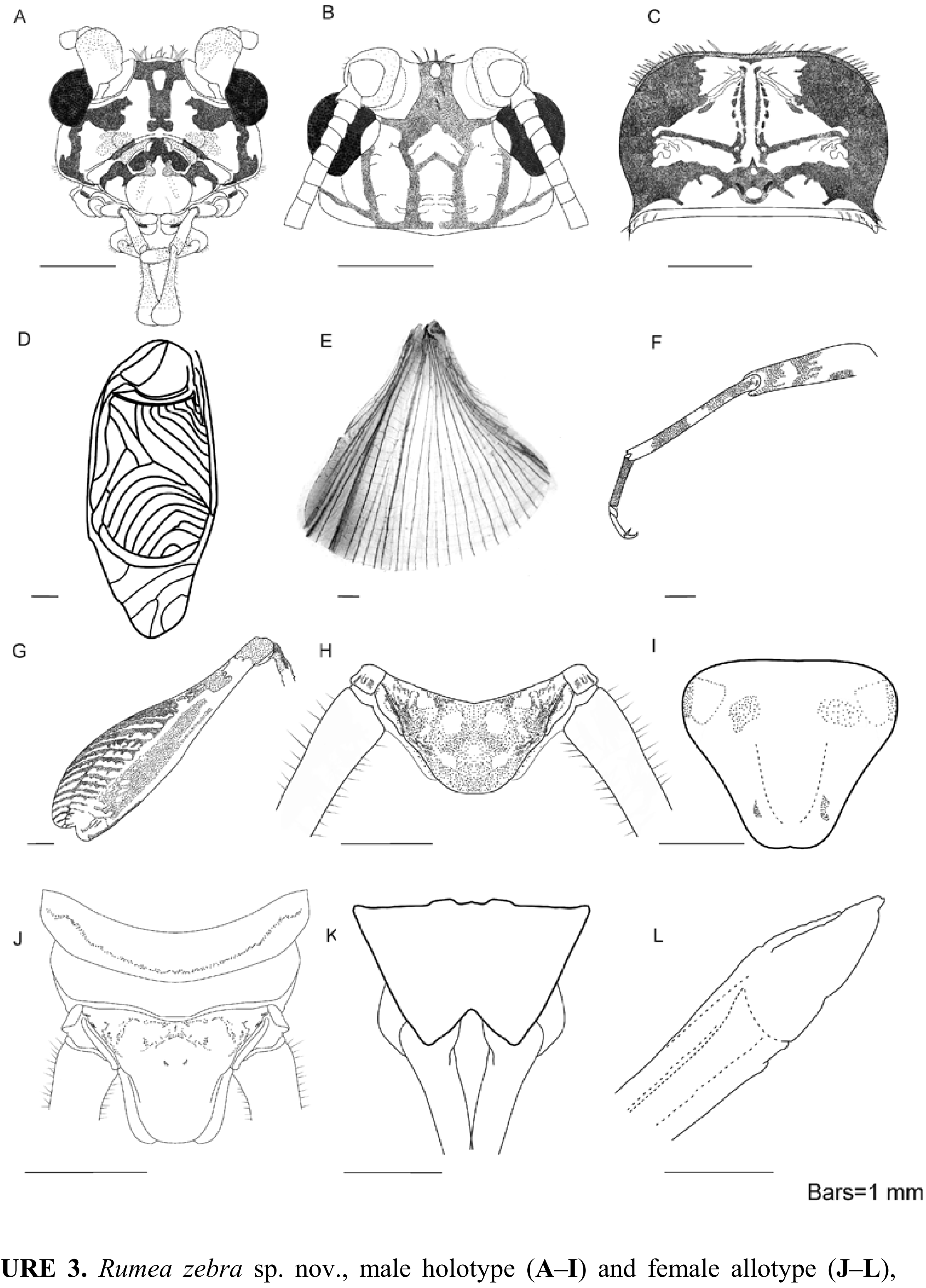

FIGURE 3. *Rumea zebra* sp. nov., male holotype (**A–I**) and female allotype (**J–L**), unless otherwise specified. **A.** Frontal view of the face. **B.** Dorsal view of the head. **C.** Dorsal view of the pronotum. **D.** Ventro-lateral view of the foreleg. **E.** Lateral view of the hindfemur. **F.** Ventral view of the right forewing of a paratype. **G.** Dorsal view of the right tegmen. **H.** Dorsal view of the supra-anal plate. **I.** Ventral view of the subgenital plate. **J.** Dorsal view of the supra-anal plate. **K.** Ventral view of the subgenital. **L.** Lateral view of the ovipositor apex.

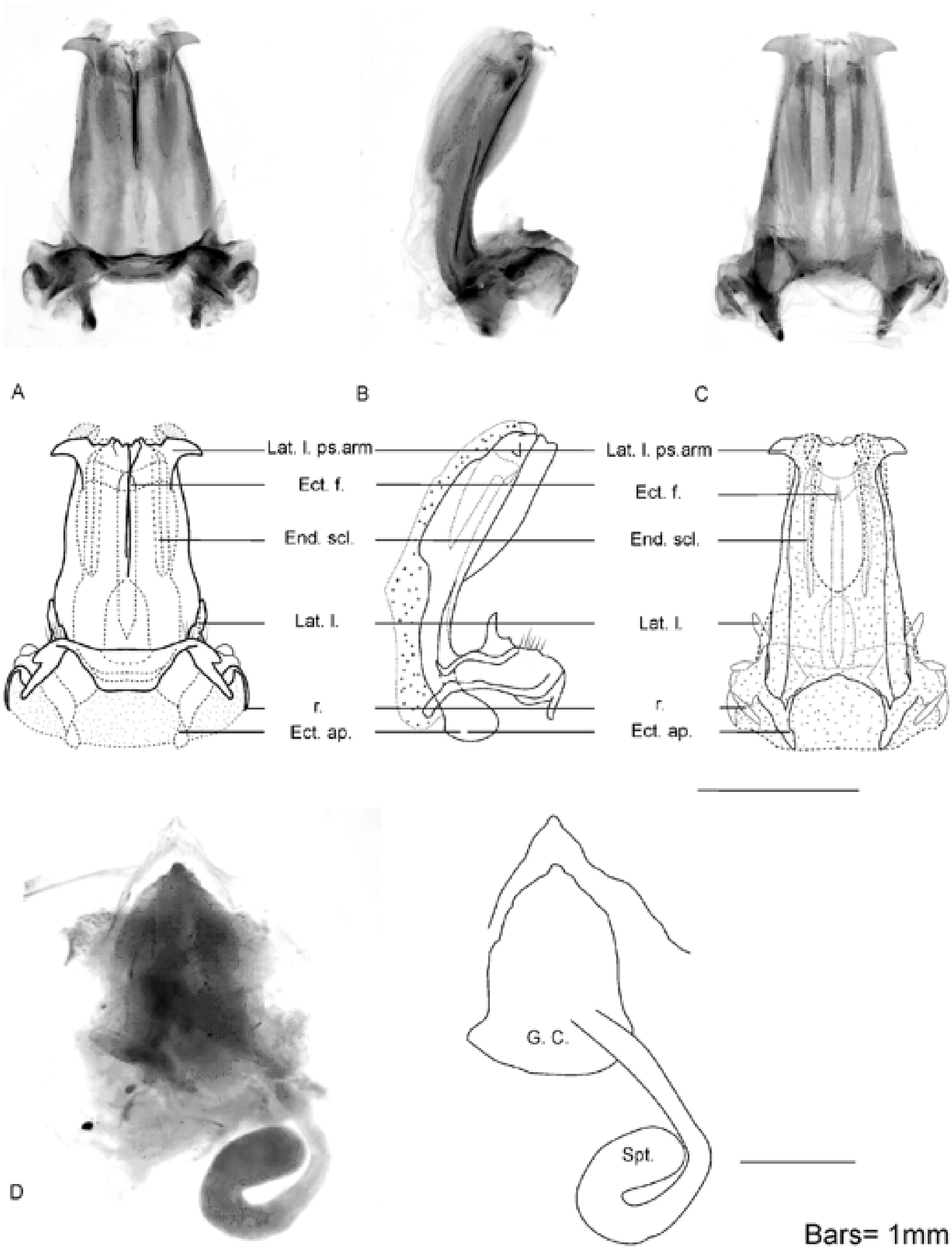

FIGURE 4. *Rumea zebra* sp. nov., genitalia of the male holotype (**A–C**) and female allotype (**D**). **A.** Dorsal view. **B.** Lateral view. **C.** Ventral view. **D.** Ventral view. Abbreviations: lateral lobe of the pseudepiphallic arm (Lat.l.ps.arm), ectophallic fold (Ect.f.), endophallic sclerite (End.scl.), lateral lobe (Lat. l.); ramus (r), ectophallic apodemes (Ect. ap.), genital chamber (G.C.), spermatheca (Spt.).

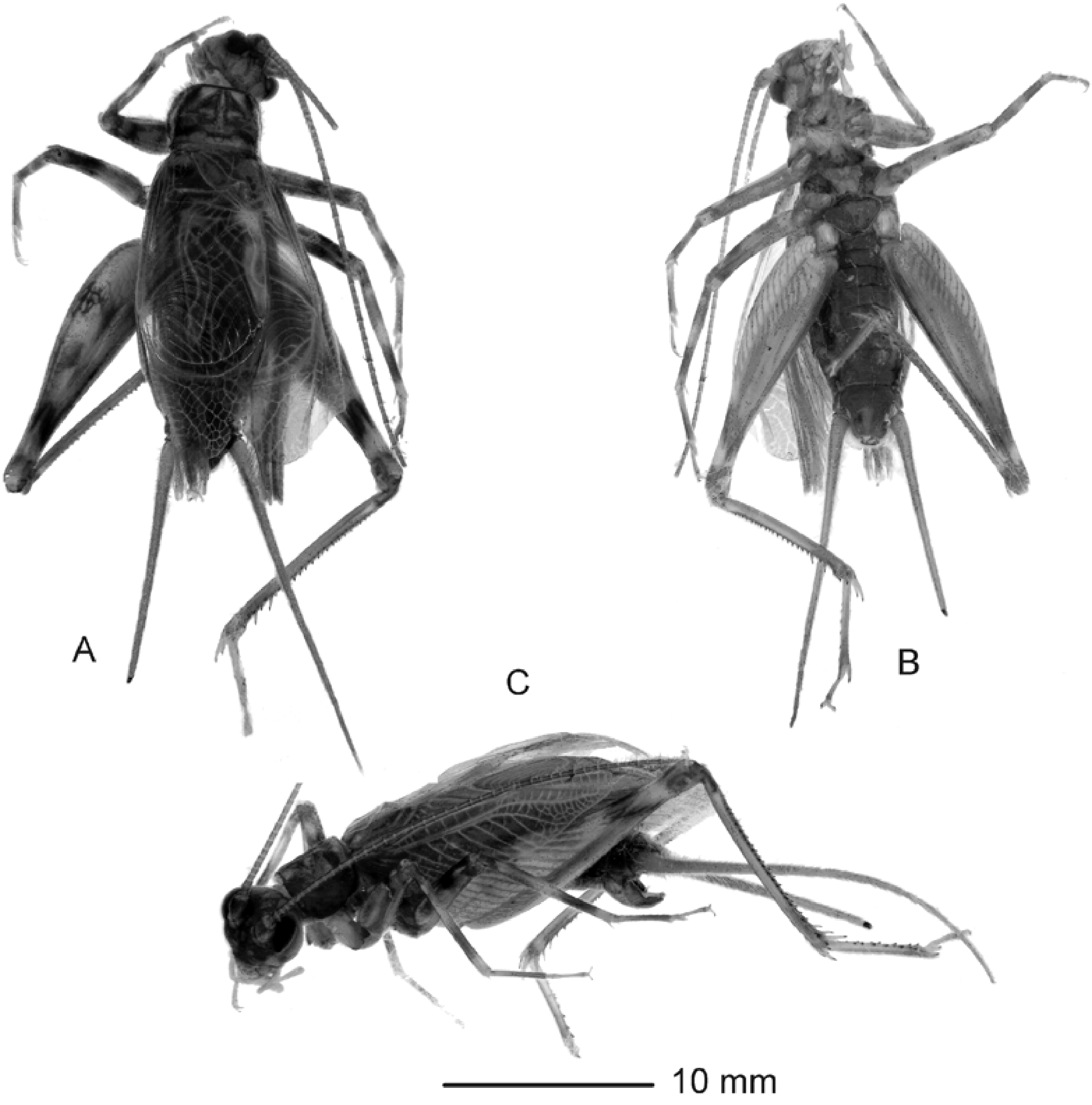

FIGURE 5. *Rumea manauensis* sp. nov., male holotype. **A.** Dorsal view. **B.** Ventral view. **C.** Lateral view.

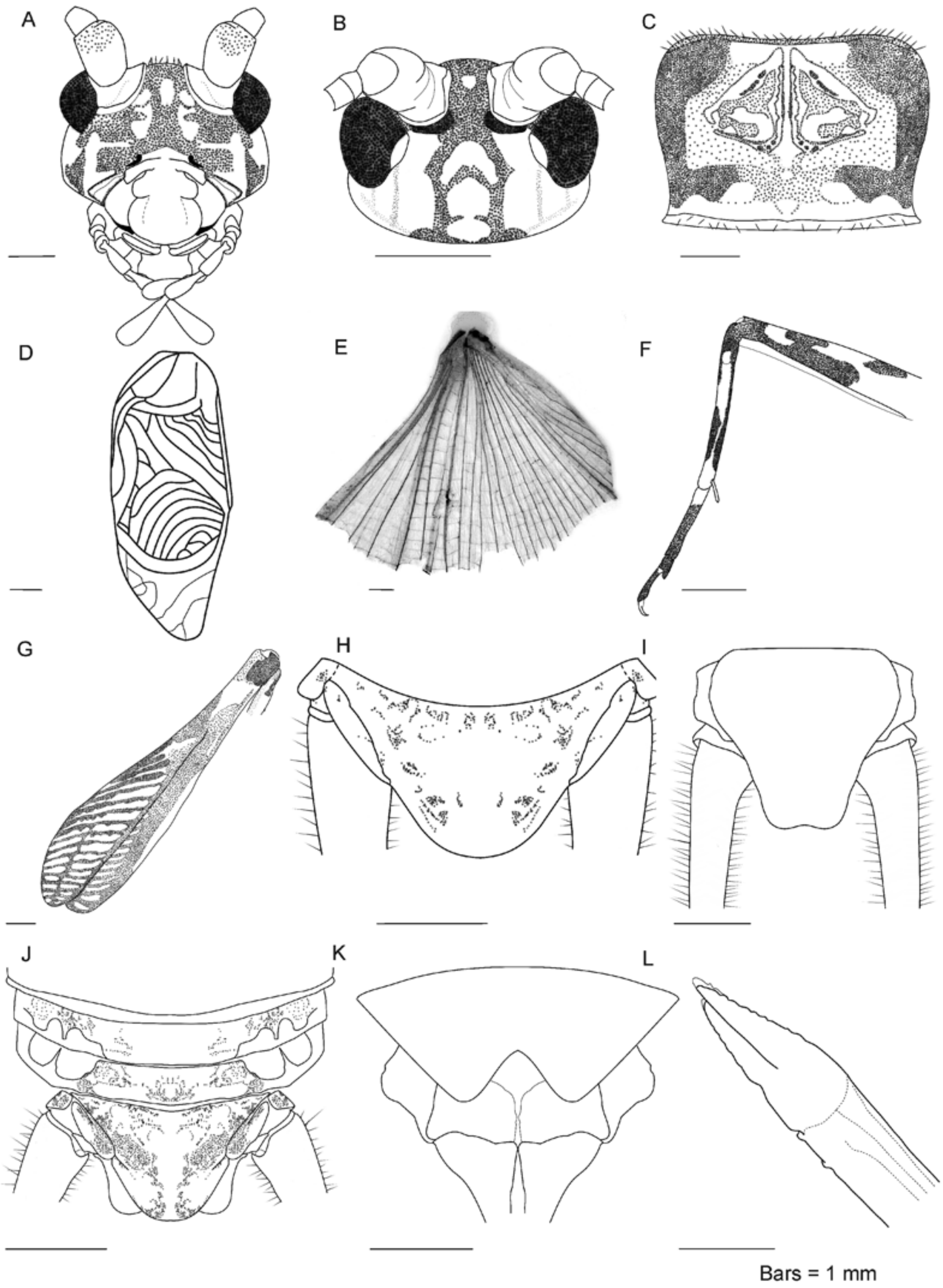

FIGURE 6. *Rumea manauensis* sp. nov., male holotype (**A–I**) and female allotype (**J–L**), unless otherwise specified. **A.** Frontal view of the face. **B.** Dorsal view of the head. **C.** Dorsal view of the pronotum. **D.** Ventro-lateral view of the foreleg. **E.** Lateral view of the hindfemur. **F.** Ventral view of the right forewing of a paratype. **G.** Dorsal view of the right tegmen. **H.** Dorsal view of the supra-anal plate. **I.** Ventral view of the subgenital plate. **J.** Dorsal view of part of the abdomen. **K.** Ventral view of the subgenital. **L.** Lateral view of the ovipositor apex.

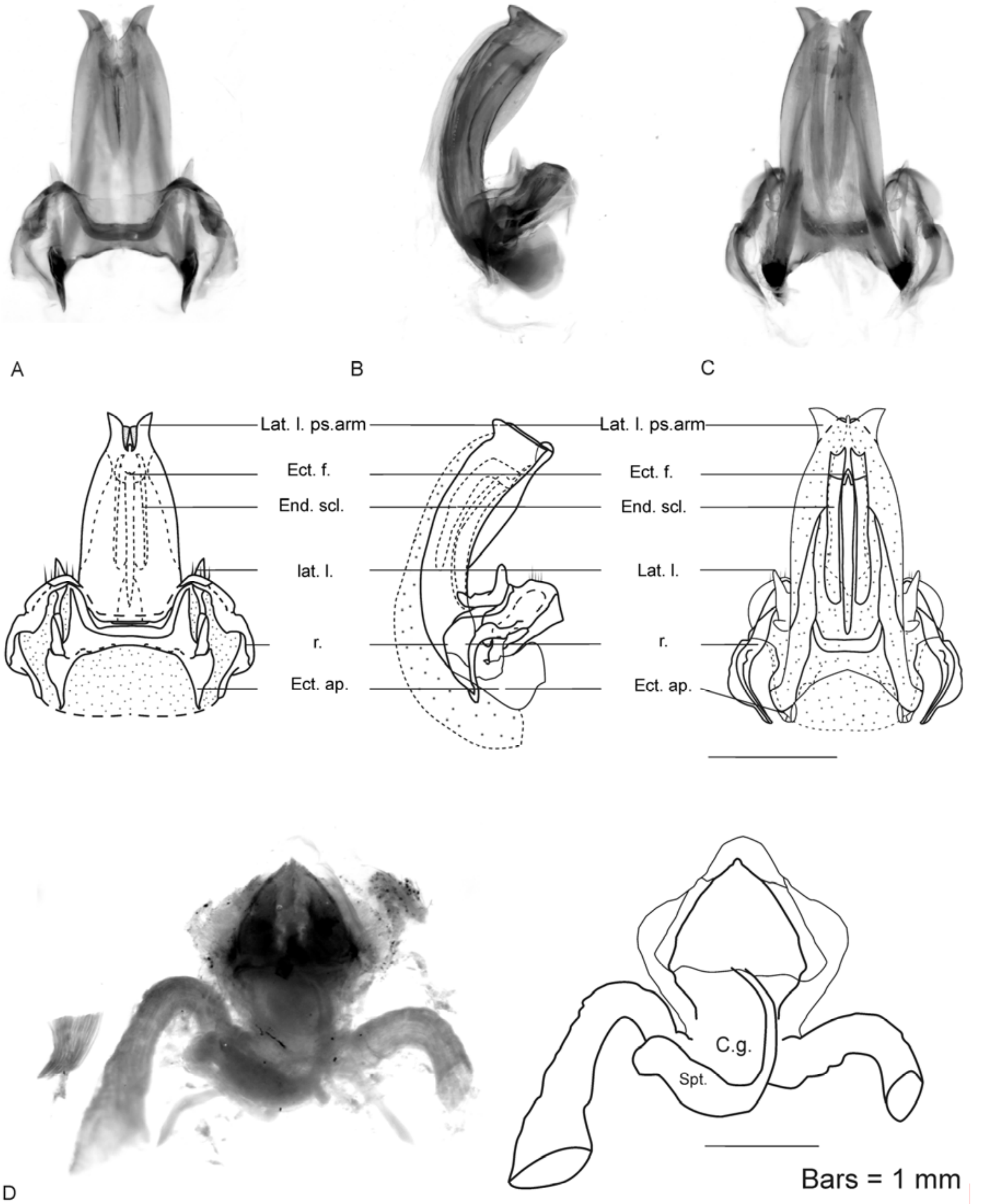

FIGURE 7. *Rumea manauensis* sp. nov., genitalia of the male holotype (**A–C**) and the female allotype (**D**). **A.** Dorsal view. **B.** Lateral view. **C.** Ventral view. **D.** Ventral view. Abbreviations: lateral lobe of the pseudepiphallic arm (Lat.l.ps.arm), ectophallic fold (Ect.f.), endophallic sclerite (End.scl.), lateral lobe (Lat. l.); ramus (r), ectophallic apodemes (Ect. ap.), genital chamber (G.C.), spermatheca (Spt.).

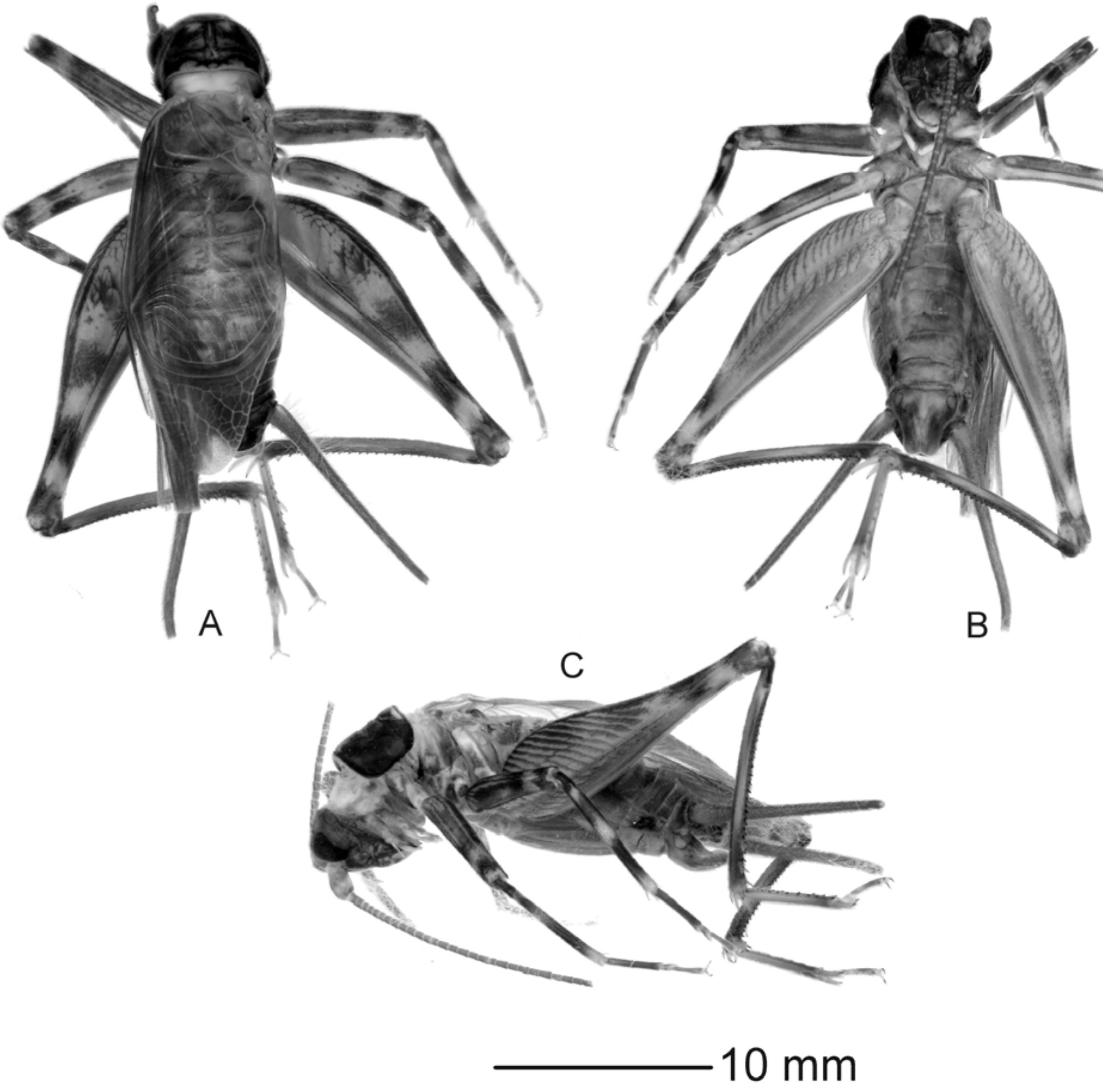

FIGURE 8. *Rumea tigris* sp. nov., male holotype. **A.** Dorsal view. **B.** Ventral view. **C.** Lateral view.

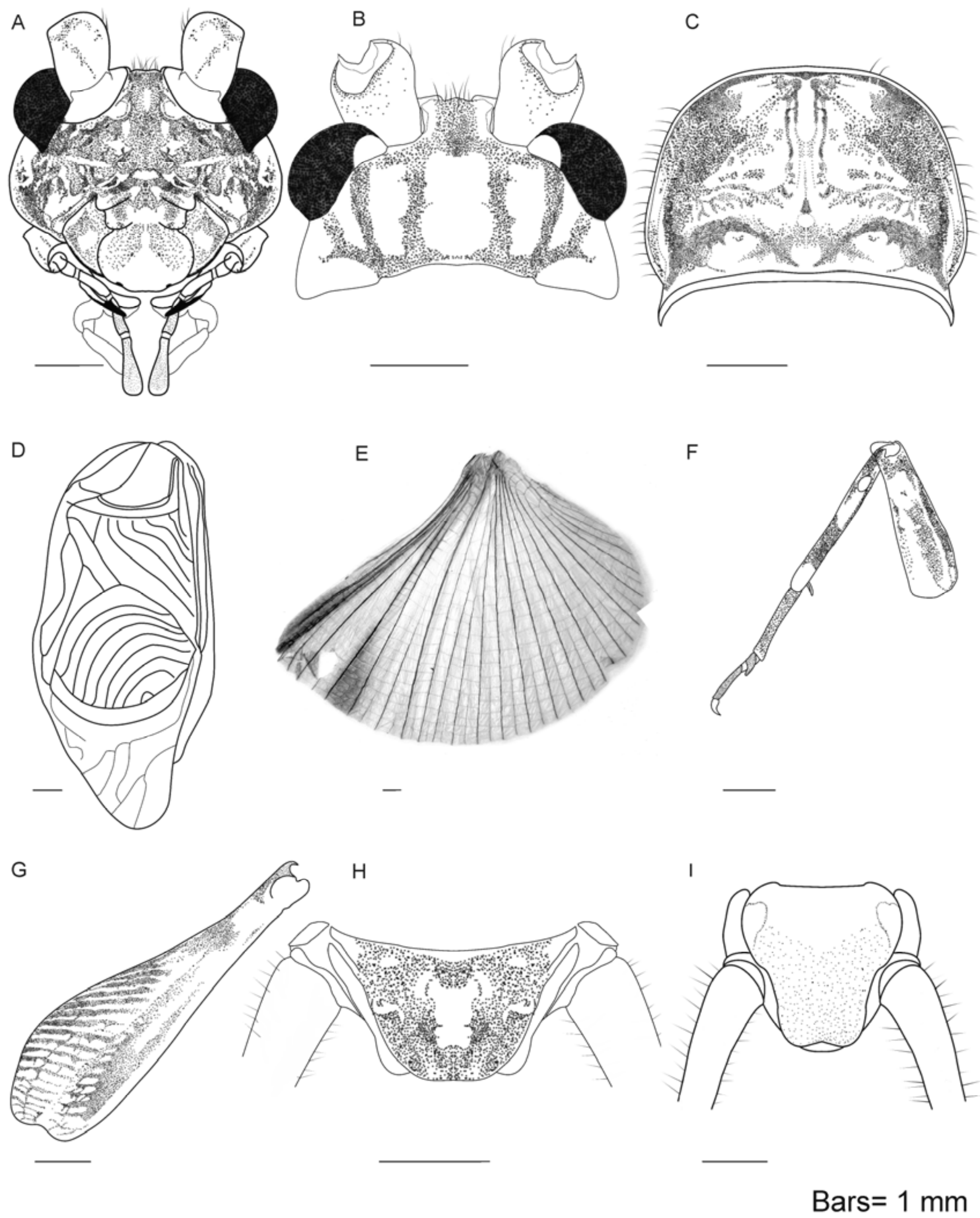

FIGURE 9. *Rumea tigris* sp. nov., male holotype: **A.** Frontal view of the face. **B.** Dorsal view of the head. **C.** Dorsal view of the pronotum. **D.** Dorsal view of the right tegmen. **E.** Ventral view of the right hindwing. **F.** Ventro-lateral view of the foreleg. **G.** Lateral view of the hindfemur. **H.** Dorsal view of the supra-anal plate. **I.** Ventral view of the subgenital plate.

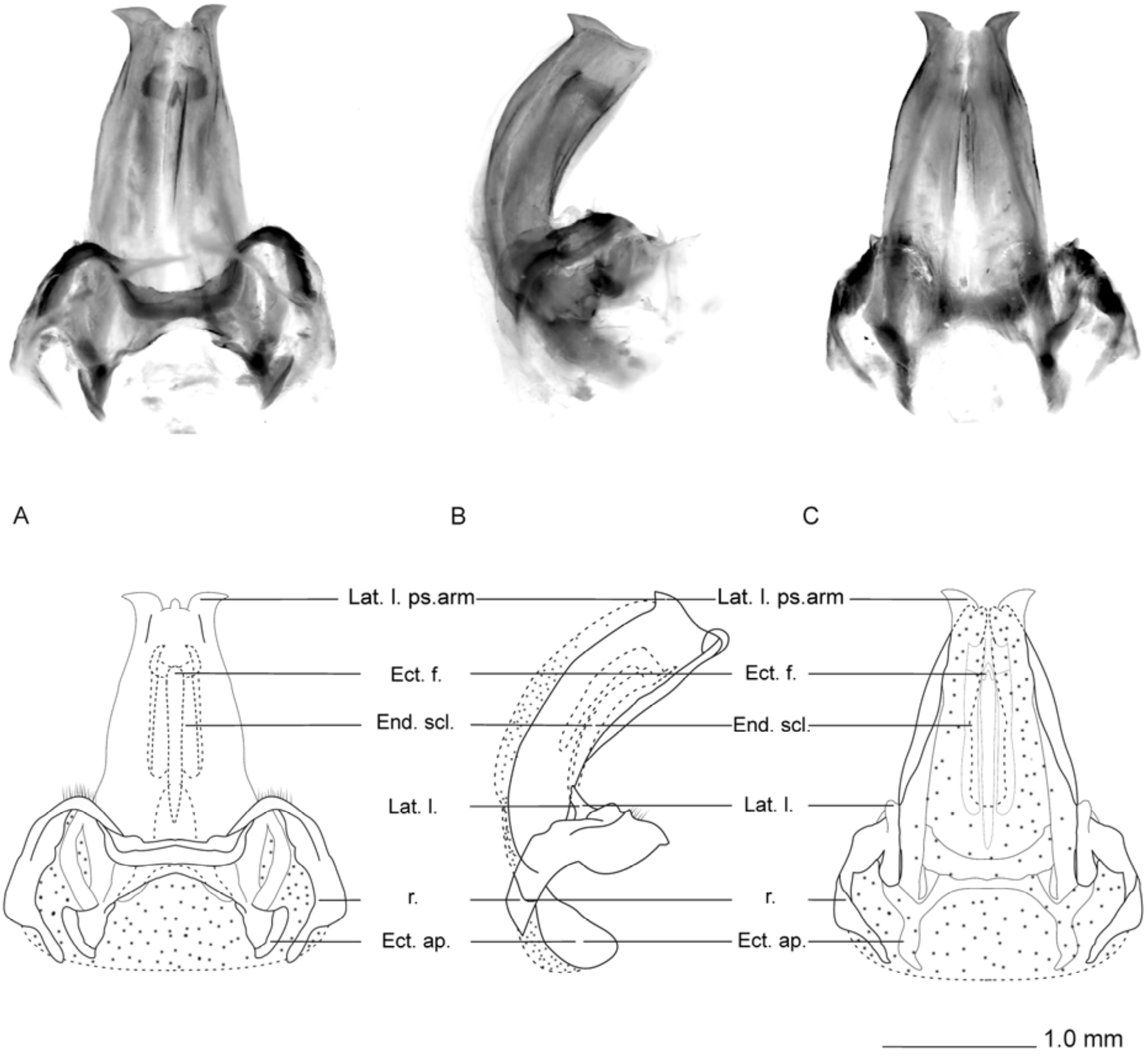

FIGURE 10. *Rumea tigris* sp. nov., genitalia of the male holotype. **A.** Dorsal view. **B.** Lateral view. **C.** Ventral view. Abbreviations: lateral lobe of the pseudepiphallic arm (Lat.l.ps.arm), ectophallic fold (Ect.f.), endophallic sclerite (End.scl.), lateral lobe (Lat. l.); ramus (r), ectophallic apodemes (Ect. ap.).

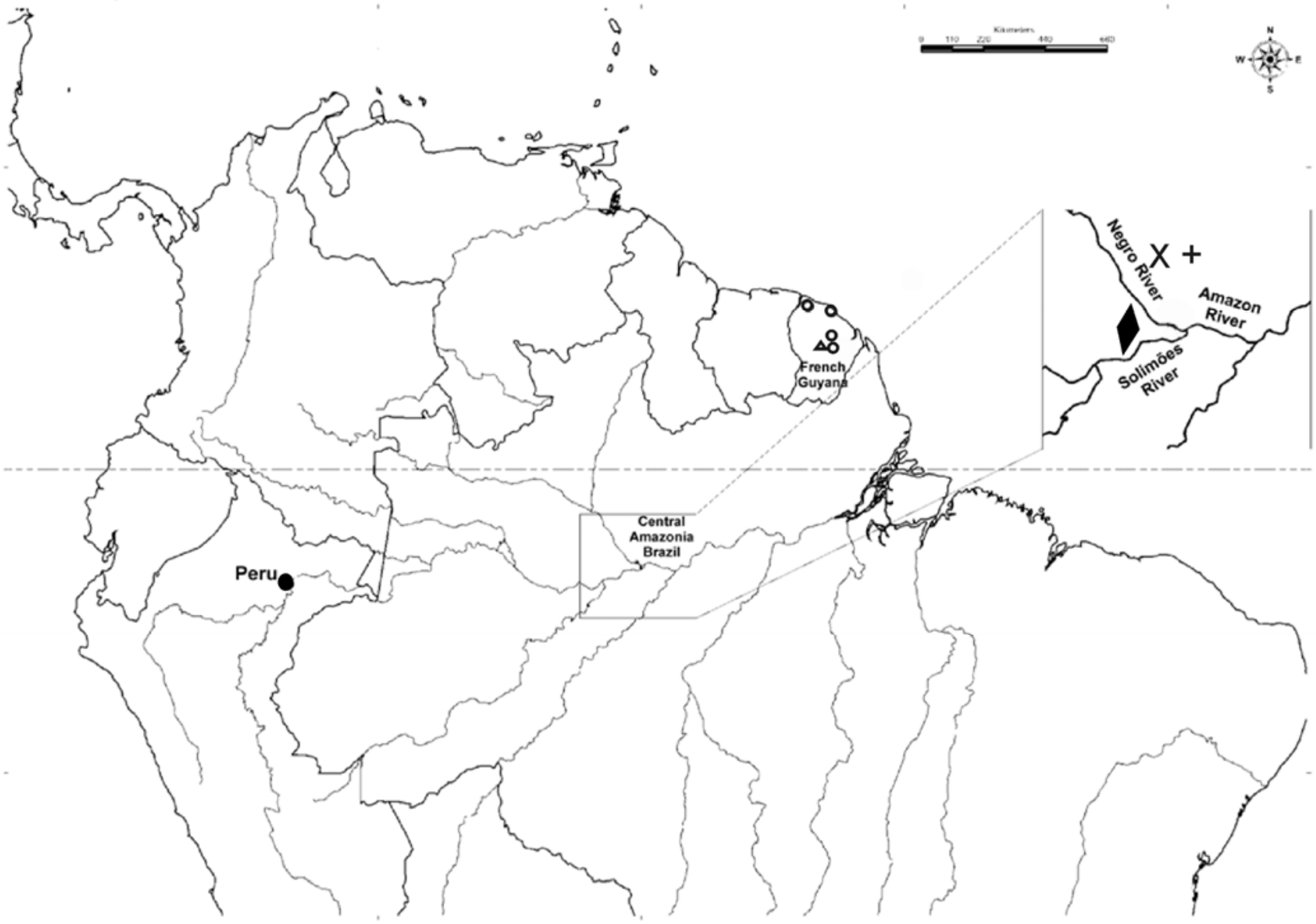

FIGURE 11. Distribution map for the species of *Rumea* Desutter, showing the distribution of *R. gaschei* Desutter (●), *R. guyanensis* Desutter-Grandcolas (○), *R. micra* Desutter-Grandcolas (▲), *R. manauensis* sp. nov (x), R. *tigris* sp. nov. (♦), and *R. zebra* sp. nov. (+). The map in detail (upper right) shows part of the Central Amazonia, at the confluence of the Negro and Solimões rivers, with the localities of the new species described in this work. Note that *R. manauensis* sp. nov. and *R. zebra* sp. nov. are sympatric species, and *R. tigris* sp. nov. is separated from them by the wide waters of the Negro River.

6. ARTIGO 2:

Marciela and *Sperberus*, two new genera of Paragryllini crickets (Orthoptera: Phalangopsidae) from the Brazilian Central Amazonia.

JULIANA CHAMORRO-RENGIFO , CRISTIANO LOPES-ANDRADE
& CARLOS FRANKL SPERBER

Marciela and *Sperberus*, two new genera of Paragryllini crickets (Orthoptera: Phalangopsidae) from the Amazonian forest.

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Abstract

We describe two new genera of Paragryllini from Central Amazonia, Brazil: *Marciela* gen. nov., and *Sperberus* gen. nov. The first one including *Marciela longipes* sp. nov. and *Marciela crybelos* (Nischk & Otte 2000) n. comb., the latter species from Ecuador and originally described as a *Paragryllus* Guérin-Méneville; and *Sperberus* gen. nov., known only from Central Amazonia and including the single species *Sperberus arboricolus* sp. nov. In the descriptions, we provide an extensive number of characteristics, mainly of the male genitalia, on which the diagnoses of new genera are based. We also provide photographs and drawings of the most important features of the new taxa.

Key words: Grylloidea, genitalia, Neotropical Region, Central Amazonian, Manaus, inundation forest, abdominal glands.

Resumen

Describimos dos nuevos géneros de Paragryllini de la Amazonía Central en Brasil: *Marciela* gen. nov., incluyendo *Marciela longipes,* sp. nov. y *Marciela crybelos* (Nischk & Otte, 2000) n. comb., esta última especie de Ecuador, originalmente descrita como un *Paragryllus* Guérin-Méneville; y *Sperberus* gen. nov., conocido solamente de la Amazonía Central e incluyendo una única especie, *Sperberus arboricolus* sp. nov.. En las descripciones proporcionamos un gran número de características, principalmente de la genitalia de los machos, en las cuales están basados los caracteres diagnósticos de los nuevos géneros. También proporcionamos imágenes e ilustraciones sobre casi todas las características importantes de los nuevos taxa.

Palabras clave: Grylloidea, genitalia, Región Neotropical, Amazonía Central, Manaus, bosque inundable, glándulas abdominales.

INTRODUCTION

Paragryllini was transferred to Phalangopsidae as a tribe by Gorochov (2007), after being formerly proposed as a family by Desutter (1988). It is a Neotropical group currently comprising six genera: *Benoistella* Uvarov, 1939; *Mexiacla* Gorochov, 2007; *Oaxacla* Gorochov, 2007; *Paragryllus* Guérin-Méneville, 1844; *Rumea* Desutter, 1988; and *Silvastella* Desutter-Grandcolas, 1992.

Paragryllus is the Paragryllini genus with the largest known distribution, from Central America to the Amazonian region. It includes also two African species (Chopard, 1968), but this information should be considered with care. *Oaxacla* and *Mexiacla* are known only from Mexico (Gorochov, 2007), and the known distribution of the remaining three Paragryllini genera are restricted to the French Guyana and the Amazonian subregion. The available information for this group is very limited, due to the lack of specialists on the Paragryllini, low collection effort, and particularly the cryptic habitat and behaviour of the insects which makes difficult to locate them in the field. One example of this problem is the genus *Silvastella* Desutter-Grandcolas, 1992 that is known only from females.

Paragryllus crybelos Nischk & Otte 2000, collected in Ecuador, also from the Amazonian subregion, was described in the genus *Paragryllus*, although the authors of the paper considered that it could belong to a new genus (Nischk & Otte, 2000). We concluded that it does constitute a distinct genus, together with a new species from Central Amazonia. In the present work, we describe two new genera: *Marciela* gen. nov., to accomodate *Marciela longipes* sp. nov., from Central Amazonia, and *P. crybelos*; and *Sperberus* gen. nov., including only *Sperberus arboricolus* sp. nov., also from Central Amazonia.

MATERIAL AND METHODS

Specimens, examination and dissection

The examined specimens were collected by Joachim Adis during his ecological surveys on terrestrial arthropods at seasonal inundation forests in Brazilian Central Amazon. The crickets were captured with arboreal photo-eclectors (see Adis 1981) between 1974 and 1987. These specimens, all preserved in 70% ethanol solution, were originally deposited at the collection of the Instituto Nacional de Pesquisas da Amazônia (Brazil) and then held in trust for around twenty years at the Max Planck Institute of Limnology (Germany). Recently, these and other specimens from the same field collections were loaned to the Laboratório de Orthopterologia (Universidade Federal de Viçosa, Brazil) for identification.

We examined one individual of Marciela longipes sp. nov. and one of *Sperberus arboricolus* sp. nov. The observations and comparison of specimens, and the description of the new genera and species, were made under a Leica MZ16 stereomicroscope. The new taxa, genera as well as species were compared with the descriptions and drawings of the known Paragryllini (Desutter 1988; Desutter-Grandcolas 1992, Nischk and Otte 2000, Gorochov 2007, Chopard 1920). The five genera (excluding *Silvastella*) are easily distinguished by the morphological characters shown in Table 1.

We extracted the right hindwing of each male holotype (*Marciela longipes* sp. nov. and *Sperberus arboricolus* sp. nov.). After extracting each hindwing, we put it on a filter paper and dropped 70% aqueous ethanol solution over it. We stretched the wing and took out the ethanol solution, so that it stayed stretched. Afterwards, we left the paper bearing the wing on a hot surface, then transferred and glued it on a grass slide with a cover slip. We use the nomenclature of Ragge (1955) and Sellier (1954), *apud* Desutter-Grandcolas (1995), for the male forewing.

We extracted the male genitalia, left them for 48h in 10% aqueous solution of KOH, and then washed them under running water. Male genitalia were kept in vials with glycerine, inside the same bottle of the specimen. We used the nomenclature of Desutter (1987, 1988, 2003) for male genitalia, with some modifications.

Photographing and drawing

For taking photographs we submerged the entire genitalia in pure glycerine, adjusted it to the desired position and waited for the liquid to stabilize. We took several digital photographs in different focus, under intense incident light (two 150 Watts halogen lamps), and processed them with an image stacking software.

Digital photographs of the crickets and their extracted genitalia were taken with a Canon S70 adapted to a Leica MZ16 stereomicroscope. Final images of the body and genitalia were the result of joining 4 to 10 photographs in different focus using the image stacking freeware CombineZM (Hadley 2006). Drawings were made with a "camara lucida" adapted to the stereomicroscope, then scanned and edited. Colour photographs of the specimens were made available at the Orthoptera Species File (Eades & Otte 2009).

Abbreviations, labels and depositories

We use the following abbreviations for measurements (in mm) and counting of body parts: TL, total body length; HF, length of the hindfemur; HT, length of the hindtibia; sHT, number of spines of the HT; sHts, number of spines of the first tarsomere of the hindtibia; PL, pronotal length at midline; PW, maximum pronotal width; EyeW, minimum eye width; TegL, maximum tegmina length; TegW, maximum tegmina width; SL, length of the stridulatory file of the male tegmen; NT, number of teeth in the stridulatory file of the male tegmen. We took all measurements with an digital calliper under the stereomicroscope.

Each holotype received an additional red label containing the name of the species, authors and its status. Specimens have been deposited at the entomological collection of INPA (Instituto Nacional de Pesquisas da Amazônia, Manaus, AM, Brazil).

RESULTS

Descriptions

Marciela **Chamorro-Rengifo, Lopes-Andrade & Sperber gen. nov.**

Type species. *Marciela longipes* Chamorro-Rengifo & Lopes-Andrade, sp. nov.

Etymology. This genus was named in honor of the Brazilian cricket taxonomist Carina Marciela Mews.

Diagnosis. *Marciela* could be distinguished from the other described Paragryllini genera by the following combination of characters: (i) pseudepiphallic arms dorsally separated at the midline, where the dorsal ectophallic sclerite is visible, (ii) pseudepiphallic arm not laterally differentiated in parameres, in lateral view it is a unique structure, (ii) but can be apically modified: dorsally it can be simple as in *Marciela crybelos* (Nischk & Otte, 2000) n. comb., or can be modified as in *Marciela longipes*, with one small lateral lobe (Lat.l.ps.arm), and a ventral one, that has a rounded format, (iii) the dorsal ectophallic sclerite is hyper-developed, and dorsally strongly projected, (iv) the lateral lobe of the pseudepiphallic median bridge, is a projection linked with the lateral one of the median pseudepiphallic bridge, this latter is continued laterally, (v) a sclerite forming a small projection on the apical inner face at the pseudepifallic arm, (vi) the ectophallic central arch obliquely oriented to the psedepiphallic arm .

Distribution. Ecuadorian and Brazilian Amazonian forest.

Marciela includes two species, *Marciela longipes* Chamorro-Rengifo, Lopes-Andrade & Sperber, sp. nov. and *Marciela crybelos* **(**Nischk & Otte, 2000) n. comb., originally described as *Paragryllus crybelos* Nischk & Otte, 2000. The male genitalic characteristics of the latter species do not correspond with the genitalia of the *Paragryllus* species, but they are very similar to the genitalic structure of *M. longipes* sp. nov.*,* For this reason we transfer *P. crybelos* to *Marciela.* The females of both species are unknown. The definition of the genus is based on the characteristics of male genitalia.

Marciela longipes **Chamorro-Rengifo, Lopes-Andrade & Sperber, sp. nov. (Figs 1–3).**

Etymology. The specific epithet refers to the long legs.

Diagnosis. This species can be distinguished from *Marciela crybelos* (Nischk & Otte, 2000) n. comb. by the coloration pattern of the legs and by the characteristics of the male genitalia: (i) pseudepiphallic arms straight, (ii) tip of the dorsal pseudepiphallic arm like a hook, directed inward, (iii) pseudepiphallic lateral lobes (of the median pseudepiphallic bridge) well developed, well distinguished from the rest of the pseudepiphallic structures, (iv) median pseudepiphallic bridge dorsally with two small lobes separated by a linear space, these two lobes are almost at the same distance of the two endophallic parameres combined, (v) median pseudepiphallic bridge laterally projected in a lobe similar in shape to the pseudepiphallic lateral lobe (vi) endophallic apodemes esclerotized.

Description. (holotype ♂): TL 28.45; PL 4.40; PW 5.95; EyeW 1.82; TegL 21.26; TegW 10.08; SL 7,02; NT 174. General coloration dark brownish, with little areas dark and light yellowish (Fig. 1). **Head** with strong bristles on the vertex (Fig 2A). face coloration dark brownish, with small dark yellowish areas. Frons dark brownish, with three dark yellowish areas between the antennal sockets: a long dark yellowish oval on the midline, and a semi-circular dark yellow area on each side of the longitudinal midline. On the center of the face, two dark yellowish and oblique and fine stripes, forming an inverted V. Surface above the frontoclypeal suture with a rectangular dark yellowish space between two dark little marks; each anterior tentorial arm also with a black mark. The first third of the area of the gena, under the ventral margin of the antennal sockets dark yellowish, the other two thirds dark brownish; postgena dark yellowish. Clypeus almost completely whitish, with a small distinct dark yellowish oblique oval one on each side of the longitudinal midline. Labrum almost completely whitish with a small dark yellowish oval mark on the longitudinal midline. Mandibles dark yellowish with lateral margin and cutting edge dark brownish. Maxillary palpi dark yellowish, the last three palpomeres darker than the others; tip of the last one grey. Labial palpi dark yellowish, the last palpomere grey. Maxilla tip dark brownish. Mouthparts ventrally dark yellowish. Antennal scape apparently very long, almost three times longer than wide; light yellowish with irregular dark brown marks. **Head dorsal area** (Fig. 2B) with four faint brownish longitudinal stripes: two stripes originating at the posterior margin and joined at eye level; two lateral stripes, one at each side, originating at the posterior margin and ending at the ventral margin of each eye. Additionally, there is one fainter stripe, originating at the posterior base of each lateral stripe, which is bifurcated forming one stripe that reaches the inner margin of the eye and another stripe extending to the anterior ventral surface but disappearing, not reaching the face. Eyes dark brownish, with a white oval area at the dorsal inner surface; central ocellus oval, conspicuous, even visible from the frontal view of the face, almost two times bigger than the two others; the latter also well visible. **Thorax** with the pronotal disc (Fig. 2C) and lateral surfaces mostly dark brownish, with strong bristles on the anterior and lateral margins. Center of the pronotal disc with two distinctive triangular darker brownish marks, one on each side of the longitudinal midline; posterior area with two indistinct oval marks, one on each side of the longitudinal midline, parallel to the posterior margin of the pronotum; longitudinal midline of the dorsal surface with a dark brownish oval mark; surface close to the dorsal margin light yellow. Tegmina (Fig. 2D) translucent, brownish, with some areas dark brownish; mirror with eight curved veins and harp with six ones. Hind wings (Fig. 2E) translucent, brownish. Sternites dark brownish. Legs, with the three pairs of coxae with different forms. The first pair larger than the others, bell-shaped, the anterior margin is curved, and the posterior margin wider, this latter margin with two undulations; inner posterior surface is protruding in a peak. Coxae of the midlegs rectangular, two times wider than long, with all margins rounded, dark brownish, darker than the others; coxae of the hind legs with rectangular shape, with all rounded margins, almost 0.5 times longer than wide. Fore- and mid legs very long, reaching almost the tip of the abdomen; femur of the foreleg dark brownish, with irregular darker marks, almost black; with robust appearance (Fig. 2F), the width of the femur increasing from the proximal end to the middle, then diminishing again to the distal end, the wider portion is almost twice as wide as the proximal end. Femur of the midlegs also with irregular marks, darker, almost black, but not with the same appearance of the femur of the forelegs. Tibia of the forelegs lighter than the femur; tibia of the midlegs dark yellowish, the middle portion wider, expanded, light yellowish. Tarsomeres of the fore- and mid legs with similar shape and coloration: first tarsomere dark yellowish, three times longer than the second one, and two times wider than the third one; second tarsomere dark brownish; third tarsomere dark yellowish; tarsal claws of all legs dark yellow. **Abdomen** with tergites dark yellowish on the central surface, laterally black. First tergite with a dark reddish inflated semi-rounded mark on the longitudinal midline; second tergite with an irregular reddish dark mark on the longitudinal midline (Fig. 2G) (possibly glandular). Supra-anal plate (Fig. 2H) dark brownish, with the posterior margin, central (midline), and lateral surface light yellowish, and surface close to the anterior margin on the longitudinal midline with a V-shaped black mark; anterior margin three times longer than the posterior one, this latter is almost plane. Sternites from the second to the sixth one almost completely dark brownish, almost black, first and eighth sternites only with the lateral surface dark, seventh tergite with the anterior and lateral margin black. Subgenital plate with the anterior surface expanded in two lateral lobes, posterior margin with an undulated emargination, forming two small lateral lobes (Fig. 2I). Cerci dark yellowish. **Male genitalia** (Fig. 3) with each lateral lobe of the pseudepiphallic arm rounded, outward dorsally directed (Fig. 3A and 3C), in lateral view is a small projection oriented dorsally (Fig. 3B); inner tip of the dorsal pseudepiphallic arm with the shape of a hook (Fig. 3A and 3C), inner tip of the ventral pseudepiphallic arm with the shape of a lobe, the two lobes are superimposed in a small area at the longitudinal midline (Fig. 3A, 3C and 3D); on each inner posterior area of pseudepiphallic arm, there is a protruding small lobe that is directed inward, this structure is only well visible in the dorsal view (Fig. 3A), but in dorsal view resembling a spine (Fig. 3D). Ectophallic dorsal sclerite strongly oriented dorsally (Fig. 3B); endophallic sclerites delicate at their base, and increasing in width gradually until a straight area, where the apodema originate (Fig. 3A and 3C); the outer lateral side with a fine membrane that reaches the apodema. Endophallic apodemes directed posteriorly, well defined, almost two times longer than wide (Fig. 3A and 3C). Ectophallic sclerites (Fig. 3A and 3C) with a distinctive protruding area almost in the first middle part (proximal to the pseudepiphallic bridge); ectophallic apodeme not strongly distinguished; pseudepiphallic central arch completely visible in upper-dorsal view (Fig. 3D) and partially in dorsal view (Fig. 3A). Median lobe with a minute fringe of bristles (Fig. 3A and 3D), and continuos with the lateral lobe that is distinguished because is more sclerotized than the median one; the lateral lobe is a long horizontal sclerite, oriented dorsally (Fig. 3B); median pseudepiphallic bridge (Fig. 3A and 3D) with two little lobes separated by a linear space, that is almost of the same length of as the two endophallic parameres together. Each ramus of the same size as the ectophallic parameres, the

anterior part is oriented posteriorly, and almost at the middle of the rami abruptly oriented obliquely ventrally (Fig. 3A and 3C).
For more details see pictures in OSF.

Comments: The holotype does not have the hind legs and the antennas.

Holotype. ♂ (INPA) labelled / *Marciela longipes* Chamorro-Rengifo, Lopes-Andrade & Sperber 2009 [handwritten on red paper] /Brazil, Manaus, Tarumã Mirĭm River. Joachim Adis [handwritten on white paper] / 47A TM BE. 16.9.76 [handwritten on white paper]/.

Marciela crybelos **(Nischk & Otte, 2000) n. comb.**

Nischk & Otte, 2000. Figs. 34-36.

Etymology. The species name is derived from the Greek translation of "hidden".

Justification of change of the name species: The male genitalia of this species are totally different from those of other known species of *Paragryllus*: namely, *P. temulentus* Saussure, *P. simplex* Chopard, and *P. elapsus* Desutter (Nischk & Otte, 2000).

Diagnosis. This species can be distinguished from *Marciela longipess* Chamorro-Rengifo, Lopes-Andrade & Sperber, sp. nov. by the coloration pattern of the legs with intercalated stripes dark and ligth and by the characteristics of the male genitalia: (i) pseudepiphallic arms not straight, (ii) tip of the dorsal pseudepiphallic arm simple with rounded angles, (iii) pseudepiphallic lateral lobes (of the median pseudepiphallic bridge) well developed, well distinguished from the rest of the pseudepiphallic structures, proutuding in dorsal and ventral view (iv) median pseudepiphallic bridge simples, linear.

Description. Harp with 8 veins; mirror with 7; stridulatory file with 153 ± 3 teeth.
Calling song. The calling song is made up of three to four-pulse chirps with a carrier

frequency of ca. 4 kHz and relatively long pulse length of up to 100 ms. **Habitat.** Found just once in a cacao plant. The species has however been identified in all the forested areas of San Pablo through its song.

Holotype. ♂ (Academy of Natural Sciences, Philadelphia). Ecuadro: San Pablo de Kantesiya, Província Sucumbíos (0° 15'S, 76° 27'W) X 1997 (F. Nischk collector).

***Sperberus* Chamorro-Rengifo, Lopes-Andrade & Sperber, gen. nov.**

Type species. *Sperberus arboricolus* Chamorro-Rengifo, Lopes-Andrade & Sperber gen. nov., sp. nov.

Etymology. This genus is named in honor of the German researcher Frank Nischk.

Diagnosis. This genus can be distinguished from the other Paragryllini genera by the following combination of characters: (i) pseudepiphallic arms ventrally separated at the midline, where the central ectophallic sclerite is visible, (ii) dorsal pseudepiphallic arm more developed than the ventral pseudepiphallic one, not differentiated laterally, only dorsally and ventrally, and each side can be differentiated in other small structures (iii) ectophallic dorsal sclerite in line with the other structures (in the same plane), between the pseudepiphallic arms, (iv) lateral lobe of the pseudepiphallic arm not developed, (v) median lobe only slightly, not strongly protruding, (v) endophallic sclerites well developed, ending in a delicated margin, (vi) endophallic apodemes membranous but broad and very long, projecting dorsally, (vii) pseudepiphallic central arch broad and perpendicular to the pseudepiphallic arm.

Distribution. The genus is monospecific and known only from the Central Amazonia in Brazil.

Sperberus arboricolus Chamorro-Rengifo, Lopes-Andrade & Sperber sp. nov. (Figs 4–6)

Etymology. The specific epithet refers to the arboricole lifestyle of the members of this tribe/the tribe Paragryllini

Description. (holotype ♂): TL 22.69 ; HF 12.07; HT 9.08 ; sHT, inner margin 17-16, outer 18-17; sHts 6-7; PL 3.73; PW 5.07; EyeW 1.54; TegL 16.68; TegW 8.49; SL 6.43; NT 266. General coloration dark brownish (Fig. 4). **Head** with the (Fig 4A) area between the antennal sockets broad. Face dark brownish, with some black marks; frons with two lateral stripes from the fastigium to the area between the antennal sockets; central area of the face with a curved blackish mark that diminishes from the ventral margin of the antennal sockets to the beginning of the pleurostoma; anterior tentorial arm with a black mark. Clypeus almost whitish, with the inner surface light brown, and a light brownish stripe on each lateral lobe of the clypeus. Labrum almost whitish, with three light brownish marks, one on the posterior surface at the longitudinal midline and two marks laterally on the ventral surface. Mandibles dark yellowish with lateral margin and cutting edge dark brownish. Maxillary palpi first and second palpomere with both apical surfaces whitish and middle portion light brownish; third and fourth palpomere light brownish; both terminal palpomeres lost; the third palpomere is almost twice as long as the fourth one. Labial palps whitish. Maxilla tip dark brown. Mouthparts ventrally whitish, with some dark brown marks, like shadows. Antennal scape and antennomeres dark brown. Dorsal surface of head (Fig. 5B) with four faint and fine brown longitudinal stripes: two stripes originating at the posterior margin and joined at eye level; two lateral stripes, one at each side, originating at the posterior margin and ending at the ventral margin of each eye. Additionally, there is one stripe, originating at the posterior base of each lateral stripe, which is bifurcated and forming one stripe that reaches the inner margin of the eye and another faint stripe extending to the anterior ventral surface but disappearing, not reaching the face. Eyes dark purple (probably different in live crickets), with a white oval area at the dorsal inner surface; central ocellus oval and dark brownish, conspicuous, even visible in frontal view of the face, almost twice as big as the two others combined, that are also well visible and whitish. **Thorax** with the pronotum (Fig. 5C) dark brownish; pronotal disc and lateral surface mostly dark brown, with strong bristles on the anterior and lateral margin; central surface of the pronotal disc almost in the middle with two distinctive triangular darker marks, one on each side of the midline; posterior surface with two indistinct oval mark, one on each side of the midline, parallel to the posterior margin of the pronotum. All sternites light brownish. Tegmina (Fig. 5D) mostly translucent, brownish, with some areas dark brown; mirror with nine curved veins, the last one more curved, almost like a semi-circle; and harp with six veins. Hind wings (Fig. 5E) translucent, brownish. Forelegs (Fig. 5F) with the coxae dark brownish, in mid and hind legs light yellowish, with dark brownish margins. Trochanters light brownish. Femura (Fig. 5G) of all legs dark brownish, without outstanding marks. Tibia of all legs dark brownish, with two inner and three outer spurs, the most anterior one slightly smaller than the most posterior. Tarsomeres and tarsal claws of all legs dark brown. **Abdomen** with the tergites light brownish with some irregular dark brown marks, like shadows; lateral areas dark brownish; first tergite with a protruding semi-circular dark brownish area on the midline, close to the dorsal margin. Supra-anal plate (Fig. 5H) mostly light brownish, with lateral and posterior surface dark brownish, and with two small oval cuticles, on the middle of the plate (probably glandular). Sternites light brownish. Subgenital plate dark brownish, with a slight apical emargination, forming two lateral lobes (Fig. 5I). Cerci dark brownish. **Male genitalia** (Fig. 6) dorsal pseudepiphallic arm strongly projected posteriorly (Fig. 6A and 6B), and in lateral view slightly oriented dorsally (Fig. 6A), at the second third with an internally projecting sclerite (Fig. 6A), with rounded margins; in lateral view this projection is protruding like a little pick, oriented posteriorly (Fig. 6B); ventral pseudepiphallic arm with a protruding inner sclerite almost at the same level as the dorsally projecting sclerite, with one inner projection like a little spine almost at the middle of the pseudepiphallic arm (Fig. 6C). Central pseudepiphallic arch broad, oriented perpendicularly to the pseudepiphallic arms. Pseudepiphallic median lobe with short bristles (Fig. 6A). Anterior tip of the ectophallic fold dorsally curved (Fig. 6B and 6D); ectophallic sclerites with one inner projection at the basal third (Fig. 6C).

For more details see pictures in OSF.

Comments: The holotype has the right antenna broken.

Holotype: ♂ (INPA) labelled / *Sperberus arboricolus* Chamorro-Rengifo, Lopes-Andrade & Sperber. 2009 [handwritten on red paper] /Brazil (AM) Manaus, Campus Universitario, 02.IX.1978, J.A. Rafael [handwritten on white paper] /.

Taxonomic key of the genera of Paragryllini

1. Tegminas reduced……………………………………………………………..2
1'. Tegminas completely developed……………………………………………...3

2. Tegminas of the male with intermediary (not completed) stridulatory file… ***Mexiacla***
2'. Tegminas of the male without stridulatory file…………………………........***Oaxacla***

3. Genitalia of the male with the pseudepiphallic lateral lobe linked with the pseudepiphallic median lobe; with an inner sclerite projected on the apical inner face at the pseudepifallic arm; and endophallic parameres small and sclerotized……………………………………………………………….***Marciela***
3'. Genitalia of the male without the pseudepiphallic lateral lobe linked with the pseudepiphallic median lobe; without an inner sclerite projected on the apical inner face at the pseudepifallic arm; and without endophallic parameres small and sclerotized……………………………………………………………………..4

4. Dorsal spurs on the tibia of the hind leg: three internal and three external; one wide (glandular) apical spur……………………………………………………..***Paragryllus***
4'. Dorsal spurs on the tibia of the hind leg: with less of three on the internal side and three on the external ……………………………………………………………….5

5. Dorsal spurs on the tibia of the hind leg: one on the internal side and three on the external…………………………………...………………………………***Benoistella***
5'. Dorsal spurs on the tibia of the hind leg: two on the internal side and three on the external……………………….……………………………………………………….6

6. Genitalia of the male with the pseudepiphallic arms link at the midline, forming one dorsal complete structure……………………………………………………….***Rumea***

6'. Genitalia of the male with the pseudepiphallic arms not link at the midline, forming two two arms…………………………...……………………………….***Sperberus***

DISCUSSION

Biogeographical considerations

It is difficult to trace an evolutionary scenario for Paragryllini without a phylogenetic framework. Among the known distribution patterns of the Paragryllini genera, *Paragryllus* has the largest distribution and the highest number of species. *Oaxacla* and *Mexiacla*, both reported only from Mexico, possibly constitute a separate group inside Paragryllini, in which the ancestor has early reached the northern neotropics, as is suggested by the reduction of their wings and the distributional gap of Paragryllini between Mexico and Ecuador. The apparent wide radiation of Paragryllini in Central Amazonia could be related to Pleistocenic refuges (Mayr & O'Hara, 1986), natural barriers of the rivers presented in Amazonia (Ayres & Clutton-Brock 1992, Salo *et al.* 1986), and the constant inundations that could temporarily separate populations (Adis, 1981). Paragryllini does constitute a very interesting group for biogeographic, phylogenetic and evolutionary studies.

Taxonomic considerations

The former characteristics proposed by Desutter (1988) for the definition of Paragryllini were re-valuated after the descriptions of *Oaxacla* Gorochov and *Mexiacla* Gorochov, mainly because they are the unique Paragryllini genera having reduced tegmina and stridulatory apparatus.

It is important to obtain more individuals of *Marciela longipes* sp. nov, because the unique available specimen lacks its posterior legs. Moreover, additional specimens would help us to evaluate the intraspecific variability of the species (an observation that also applies to *Sperberus arboricolus* sp. nov.). The inconvenience of working with few specimens leads to an important question: Is it important to describe new taxa, even though we know that the information we provide is rather incomplete? In this case, the answer for us was based on the time that the specimens were collected (1976 and 1978), the unique ecological features of their localities, and the opportunity to shed some light on the distribution of Paragryllini in the gap between the southern and northern Neotropics.

Species of *Marciela* gen. nov. and *Sperberus* gen. nov. have conspicuous structures at the first abdominal tergite, possibly glands. This feature was not observed in species of other Paragryllini genera, which also possess glands but in other parts of the body. The form of the pseudepiphallic arm are similar in *Sperberus* and *Benoistella* species and it could indicate either that both genera are closely related or that the appearance of the pseudepiphallic component occurred twice in the group. Considering other external morphological features, the differences between the latter two genera are remarkable: in *Benoistella* species, the tegmina have four veins at the harp and two veins at the mirror, the latter being in transverse position; while the species of *Sperberus* gen. nov. has the number of veins and their configuration similar to those observed in species of other Paragryllini genera, with six and nine veins respectively. In *Benoistella* only the ventral side of the pseudepiphallic arm is differentiated, while in *Sperberus* gen. nov. it is subdivided into small structures. In *Benoistella* the endophallic sclerite is modified into two long bars, both highly sclerotized, and the endophallic apodemes are small and lamellate. In *Sperberus* gen. nov., the endophallic apodemes are two bars with the anterior side finishing in a fine tip, and the endophallic apodemes are long, almost of the same length as the endophallic sclerite. Additionally there is a characteristic used by Desutter-Grandcolas (1992) for separating the "Paragryllidae" into tribes, the number of spurs at the inner side of the hind tibia: *Benoistella* has only one inner spur, like *Silvastella*; and *Sperberus* has two spurs, like in *Rumea*.

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Table 1 Comparison of the characterists of seven (except *Silvastella*) genera of Paragryllini Desutter (*Benoistella* Uvarov*, Mexiacla* Gorochov, 2007; *Oaxacla* Gorochov, 2007; *Paragryllus* Guérin-Méneville, 1844; *Rumea* Desutter, 1988, *Mariella* Chamorro-Rengifo, Lopes-Andrade & Sperber genus nov. and *Sperberus* Chamorro-Rengifo, Lopes-Andrade & Sperber genus nov.). Abbreviations: number of files of spines on the first tarsomere of the hind tibia (FsHts), number of spurs on the inner margin of the hind tibia (siHt), number of spines on the outer margin of the hind tibia (soHt), apical glandular spur on the hind tibia (agsHt), number of veins on the harp (vharp), number of veins on the mirror (Vmirror), Size of the tegmina (dT), stridulatory apparatus (SA), lateral side of the pseudepiphallic arm (lPsarm), dorsal side of the pseudepiphallic arms (dPsarm), lateral lobe of the pseudepiphallic arm (llPsarm), pseudepiphallic lateral lobe (Psll), inner sclerite projected on the apical inner face at the pseudepifallic arm (isPsarm), Endophallic parameres (Endp), glands on the thorax (gTx), processes on the anal plate (Panalp).

Character	***Paragryllus***	***Benoistella***	***Rumea***	***Marciela***	***Sperberus***	***Oaxacla***	***Mexiacla***
Distribution	Southern Mexico to Brazil, Africa?	French Guyana	French Guyana and Brazilian Amazon	Brazilian Amazon	Brazilian Amazon, Ecuadorian Amazon	Mexico	Mexico
FsHts	1	1	2	?	1	?	?
siHt	3	1	2	?	2	?	?
soHt	3	3	3	?	3	?	?
asHtg	yes	no	no	no	no	no	no
sT	complete	complete	complete	complete	complete	reduced	reduced
vharp	5-7	4	5 - 8	6	6	reduced	reduced
Vmirror	4-8	2	6 - 8	8	9	reduced	reduced
SA	complete	complete	complete	complete	complete	without	intermediate
lPsarm	differentiated (with two parameres ou lobes)	not differentiated	not differentiated	not differentiated	not differentiated	not differentiated	not differentiated
dPsarm	not linked at the midline	not linked at the midline	linked at the midline	not linked at the midline	not linked at the midline	not linked at the midline	not linked at the midline
llPsarm	without	without	outward or/and ventrally oriented	outward and dorsaly oriented	without	without	without
Psll	Free	Without lobe	Free	Linked with the pseudepiphallic median lobe	Without lobe	without	without
isPsarm	Without	Without	Without	With	Without	without	without
Endp	membranous, a rounded expantion	as small lamellas	without	small and sclerotized	two long membranous bares	large and expanded	large and expanded
Rami	complete	complete	reduced	complete	complete	complete?	variavel
gTx	not known	not known	a glandular cuticular modification on the penultimate tergite	one on the first tergite	one on the first tergite	gland consisting of two median tubercles (large one on 7th tergite and small one on 8th tergite)	abdominal gland consisting of 3-5 pairs of rounded tubercles connected with each other by more or less developed transverse keels
Tympanum	outer and inner	outer and inner	outer and inner	outer and inner	outer and inner	without	outer or absent
Panalp	yes	not	not	not	not	not	not

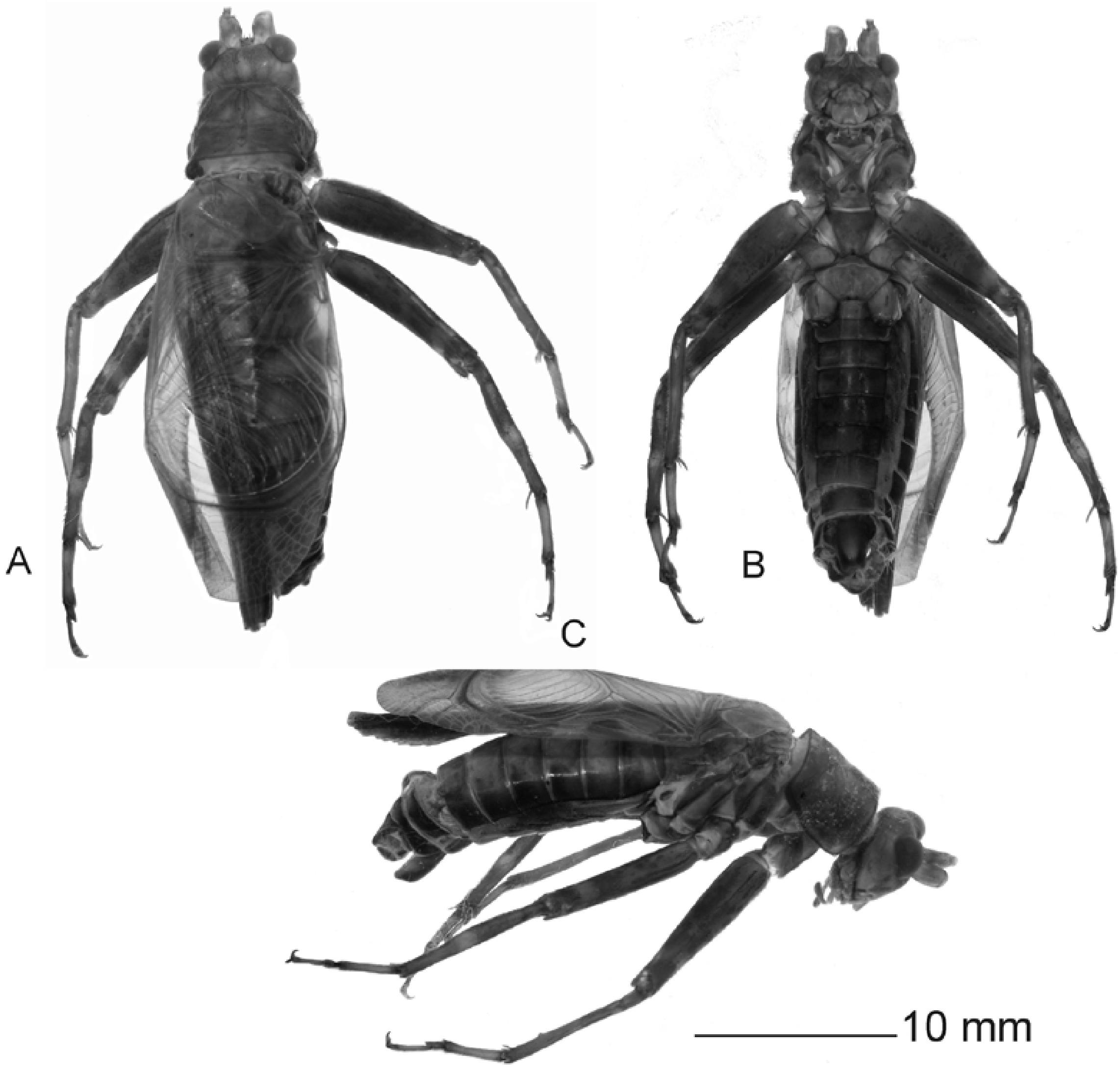

Figure 1 *Marciela longipes* **sp. nov.,** male holotype. **A.** Dorsal view. **B.** Ventral view. **C.** Lateral view.

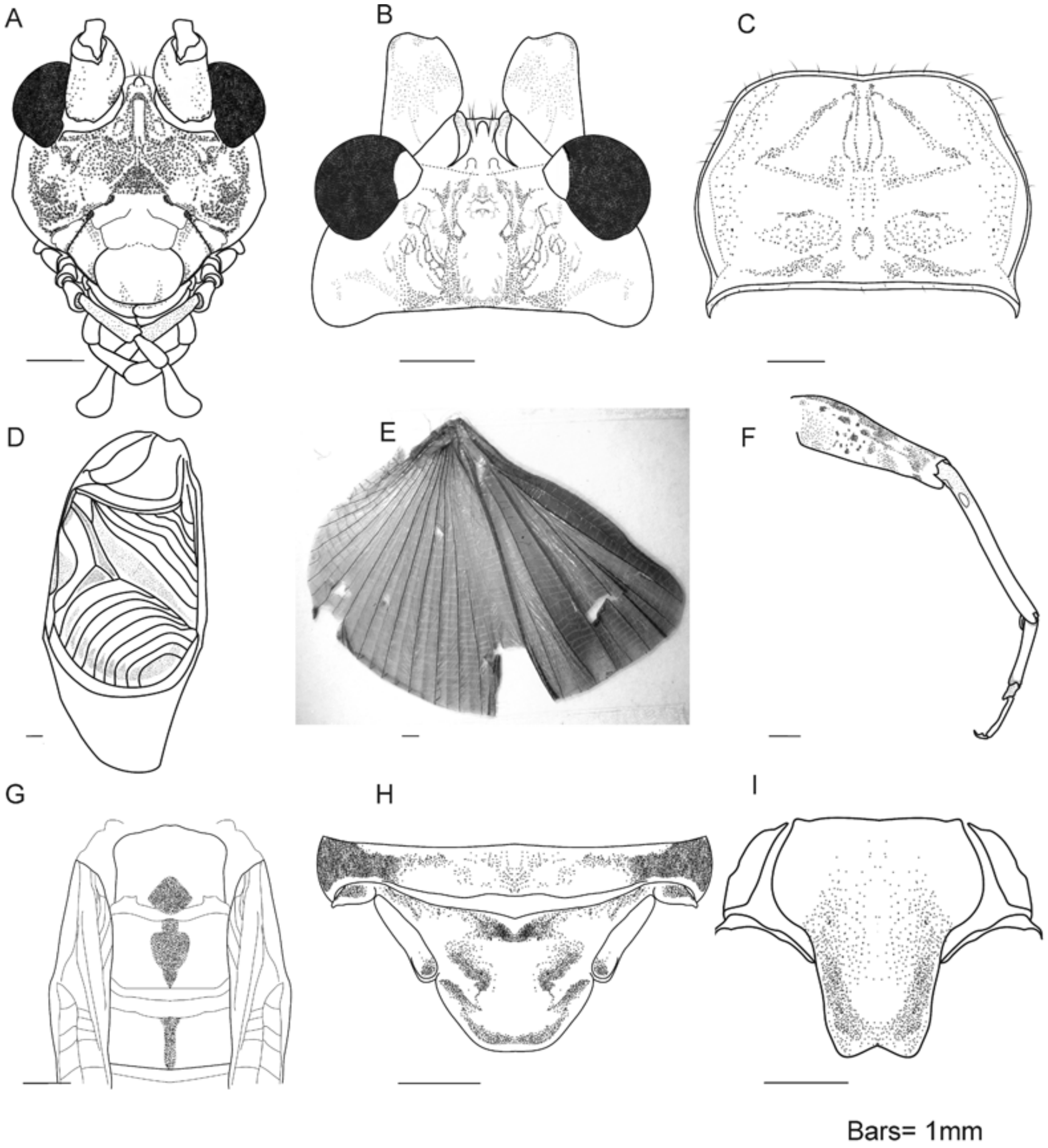

Figure 2 *Marciela longipes* **sp. nov.,** male holotype **A.** Frontal view of the face. **B.** Dorsal view of the head. **C.** Dorsal view of the pronotum. **D.** Dorsal view of the right tegmen. **E.** Ventral view of the right hindwing. **F.** Ventro-lateral view of the foreleg. **G.** Dorsal view of the first to third tergite. **H.** Dorsal view of the supra-anal plate. **I.** Ventral view of the subgenital plate.

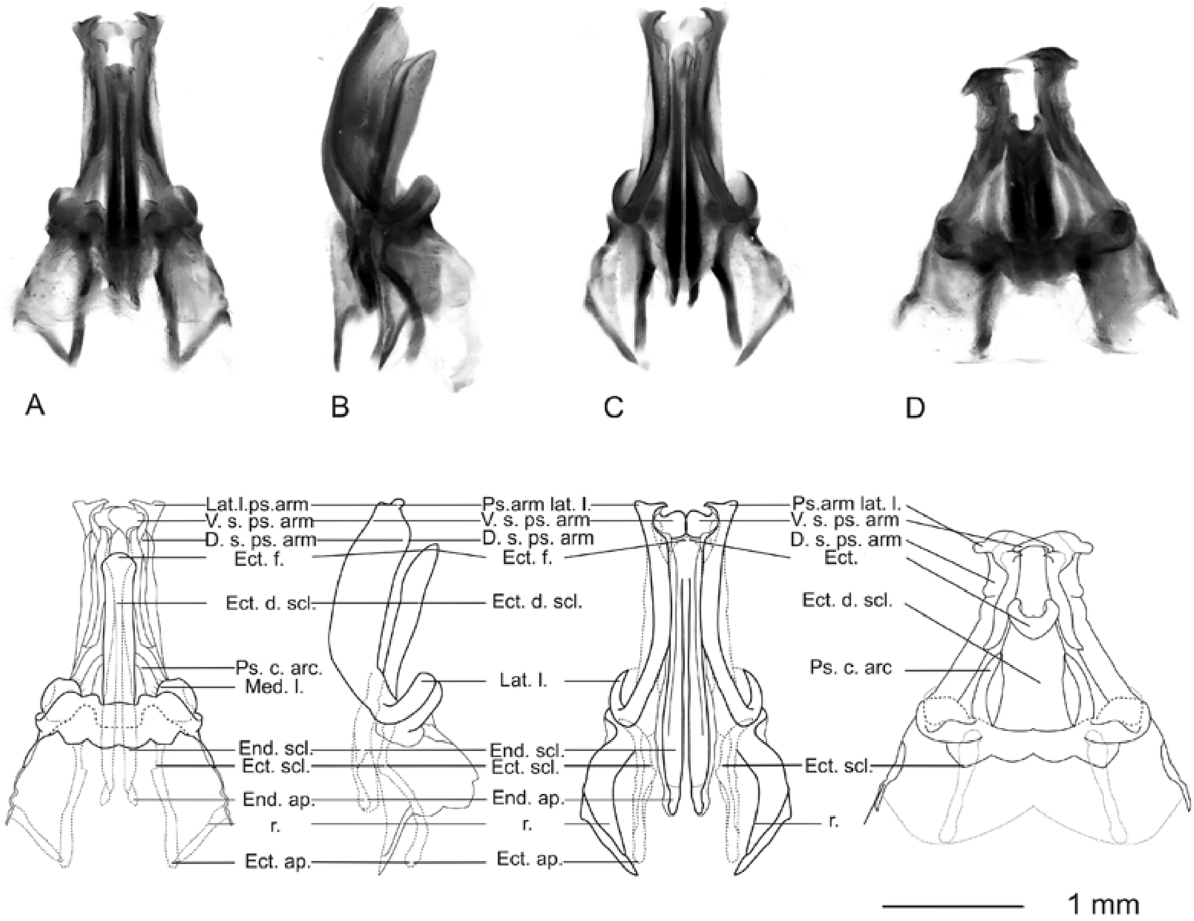

Figure 3 *Marciela longipes* **sp. nov.**, male genitalia. **A.** Dorsal view. **B.** Lateral view. **C.** Ventral view. **D.** Upper-dorsal view. Abbreviations: lateral lobe of the pseudepiphallic arm (Lat.l.ps.arm), dorsal side of the pseudepiphallic arm (D.s.ps.arm), ventral side of the pseudepiphallic arm (V.s.ps.arm), pseudepiphallic central sclerite (Ps.c.scl.), ectophallic fold (Ect.f.), ectophallic dorsal sclerite (Ect.d.scl.), median lobe (Med.l.), lateral lobe (Lat.l.), ectophalic sclerites (Ect.scl.), endophallic sclerite (End.scl.), ectophallic apodemes (Ect.ap.), endophallic apodemes (End.ap.), rami (r.).

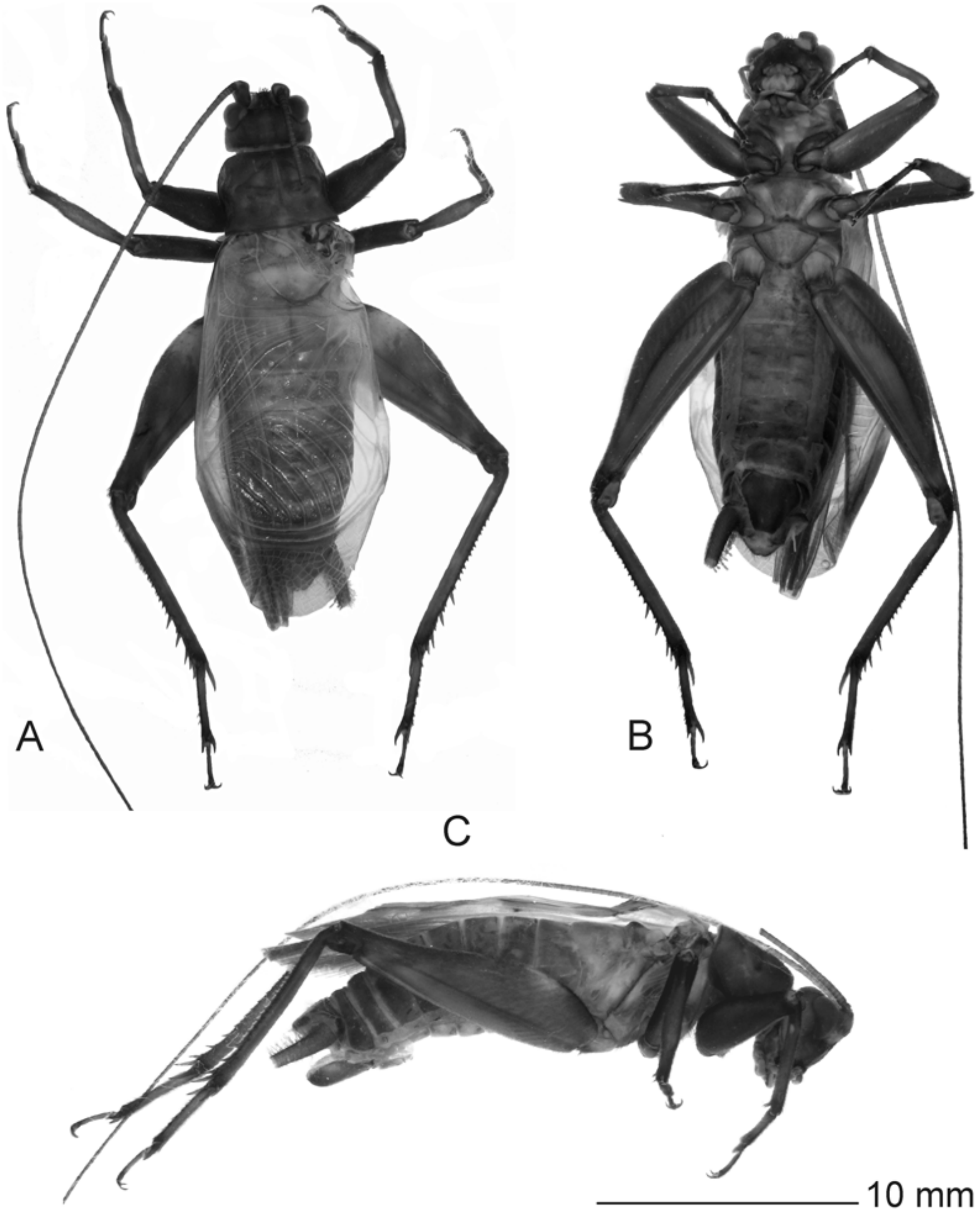

Figure 4 *Sperberus arboricolus* **sp. nov.,** male holotype. **A.** Dorsal view. **B.** Ventral view. **C.** Lateral view.

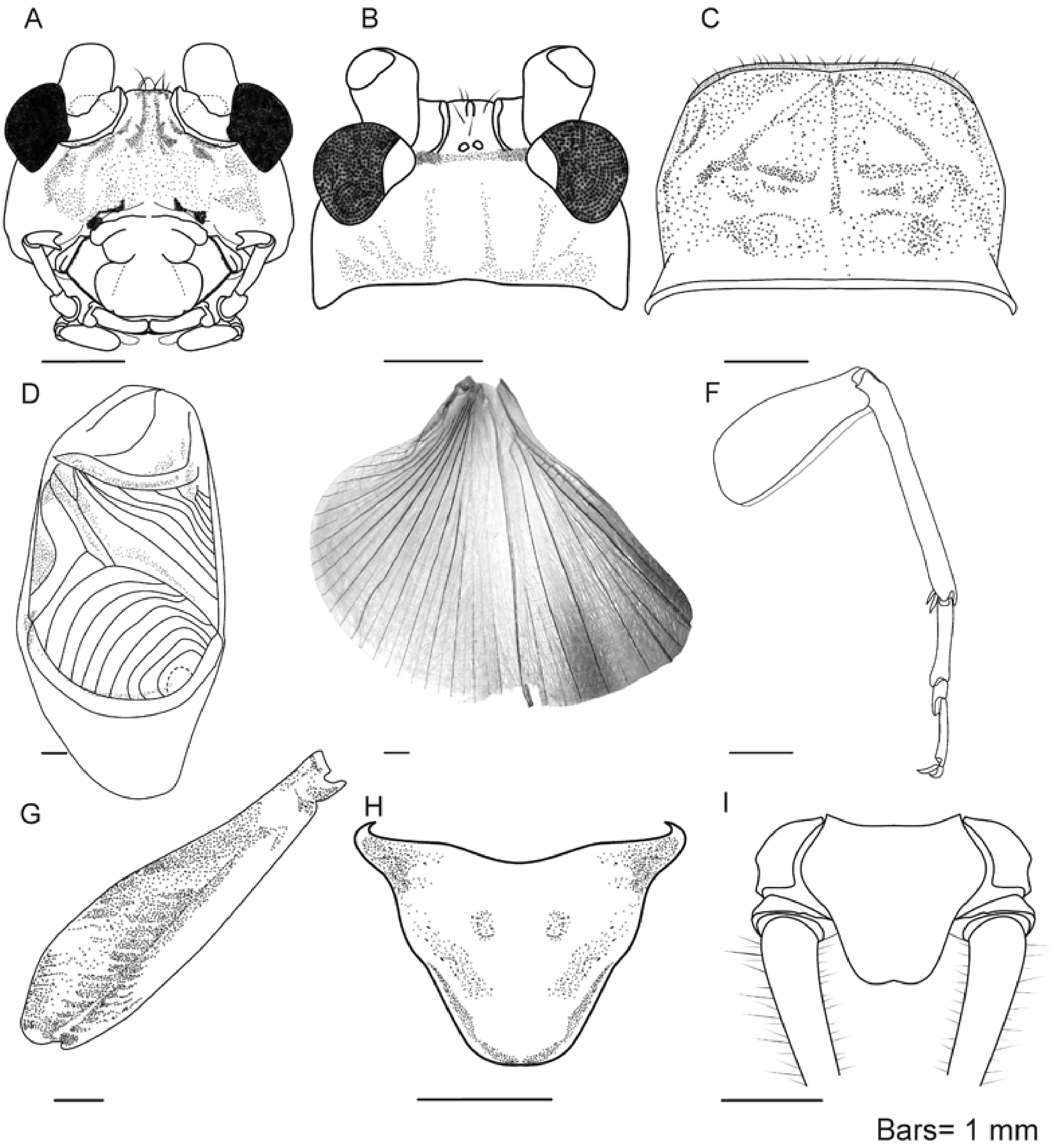

Figure 5 *Sperberus arboricolus* **sp. nov.,** male holotype **A.** Frontal view of the face. **B.** Dorsal view of the head. **C.** Dorsal view of the pronotum. **D.** Dorsal view of the left tegmen. **E.** Ventral view of the right hindwing. **F.** Ventro-lateral view of the foreleg. **G.** Lateral view of the hind femur. **H.** Dorsal view of the supra-anal plate. **I.** Ventral view of the subgenital plate.

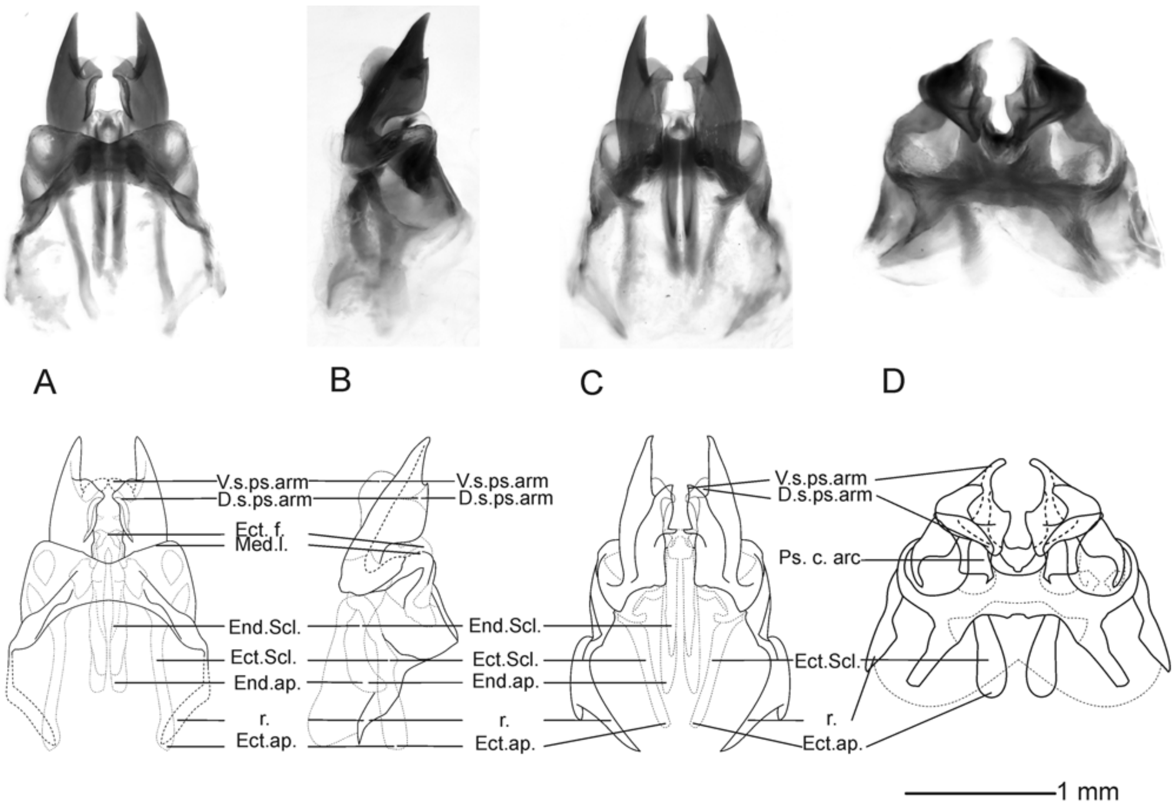

Figure 6 *Sperberus arboricolus* **sp. nov.,** male genitalia. **A.** Dorsal view. **B.** Lateral view. **C.** Ventral view. **D.** Upper-dorsal view. Abbreviations: lateral lobe of the pseudepiphallic arm (Lat.l.ps.arm), dorsal side of the pseudepiphallic arm (D.s.ps.arm), ventral side of the pseudepiphallic arm (V.s.ps.arm), pseudepiphallic central sclerite (Ps.c.scl.), ectophallic fold (Ect.f.), ectophallic dorsal sclerite (Ect.d.scl.), median lobe (Med.l.), lateral lobe (Lat.l.), ectophalic sclerites (Ect.scl.), endophallic sclerite (End. scl.), ectophallic apodemes (Ect.ap.), endophallic apodemes (End.ap.), rami (r.).

7. CONCLUSÕES

- Com esta dissertação realizou-se uma contribuição ao conhecimento do grupo Paragryllini, acrescentando-se o número de espécies conhecidas, em total 29 espécies (antes 24), e oito gêneros (antes seis).

- A genitália dos machos é uma estrutura significativa para a definição dos caracteres diagnósticos das espécies. Embora na prática se esteja trabalhando com o conceito morfológico de espécie, na teoria se tem em conta o conceito biológico, baseado nas barreiras reprodutivas entre indivíduos pertencentes a espécies diferentes. No caso da separação das espécies neste trabalho, se presume que a forma e a função estão intimamente relacionadas, embora se desconheça ainda a relação destas duas variáveis no momento do acasalamento dos indivíduos pertencentes à Paragryllini.

- As espécies do gênero *Rumea* possivelmente apresentam uma distribuição geográfica restrita, resultado das características geográficas e históricas da Amazônia Central e Guiana Francesa.

- A região da Amazônia Central parece ser um foco importante de estudo para os Paragryllini. Acredita-se que, aumentando o esforço de coleta nesta área, pode-se aumentar significativamente o conhecimento sobre os Paragryllini, e avançar no estudo do grupo com a condução de estudos biogeográficos e filogenéticos.

- O método de fotografar genitália utilizado nesta dissertação dá como resultado imagens de alta qualidade que podem transmitir informação importante e adicional, diferente da que é transmitida só por meio de desenhos. Igualmente, o uso desta técnica, para obter imagens de outras partes do corpo, otimiza o tempo do taxônomo.

ANEXO 1. Glossário:

A bibliografia usada para a construção deste glossário foi: Maggenti *et al.* 2005, Desutter 1987, Desutter-Grandcolas 2003 e Randell 1964.

Âncora: (Ancorae (a.)). Escleritos com forma de gancho, formados aproximadamente na base da camada pseudepifálica.

Apódema: n. (Gr. Apo, away; demas, body). Uma invaginação da cutícula que serve para unir músculos e para o estiramento das paredes do corpo (Maggenti *et al.,* 2005).

Apódemas ectofálicos: (Apodèmes ectophalliques (ap. ect.), Desutter, 1987).Apódemas formados a partir da invaginação ectofálica.

Apódema endofálico: (Apodème endophallique (ap. end.), Desutter, 1987). Invaginação ligada ao esclerito endofálico.

Arco ectofálico: (arc ectophallique (arc), Desutter, 1987). Esclerito formado sobre o fundo da invaginação ectofálica, se une entre os dois apódemas ectofálicos (Grylloidea).

Cavidade dorsal: (Cavité dorsale (cav.), Desutter, 1987). Cavidade formada pelo refinamento de uma membrana endofálica dorsal. Desutter-Grandolas (2007) mudou o nome para cavidade endofálica.

Cavidade endofálica: Novo nome usado por Desutter-Grandolas (2007) para a cavidade dorsal.

Dobra ectofalica: (Repli ectophallique (rep.), Desutter, 1987) lóbulo mediano dorsal da camada ectofalica membranosa ou diversamente diversificada. Stilete (Stylet, Chopard, 1961).

Ectofalo: Uma das camadas externas da genitália na ordem Orthoptera.

Epifalo: estrutura que se dispõe sobre o falo de alguns animais. Nos orthoptera é um esclerito que está na base da câmara genital. É limitado a uma pequena dobra membranoso nos Gryllotalpoidea e nos Grylloidea.

Escleritos endofálicos: (Sclérite endophallique (s.end). Esclerotização da membrana endofálica dorsal.

Invaginação epi-ectofálica: invaginação dorsal entre os paraproctos e a camada epifálica. Erroneamente identificada por Desutter (1987) como invaginação epifálica (Invagination epiphallique).

Lóbulo lateral posterior da ponte mediana do epifalo: hind lateral lobe of the median epiphallic bridge (ep. l.). Equivalente ao lophi lateral do pseudepifalo de Desutter (1987).

Lóbulo pseudepifálico ventral: (Lobe pseudepiphallique ventral (l.vent), Desutter, 1897). Evaginação apical ventral do pseudepifalo, no braço.

Lóbulo medial ventral: (Lobe mèdian ventral, (l.m.v. Desutter, 1987). lóbulo medial ventral da camada ectofalica. Só em Mogoplistoidea?.

Lophi: lopho-, loph-, lophio-, lophi-. Palavra do grego que significa crista (crest, tuft; by extension, hill top).

Lophi lateral. (Lophi latéraux (L.lat.), Desutter, 1987). Evaginações laterais do pseudepifalo, entre os lophi medianos e os parâmeros.

Lophi mediano: (Lophi médians (l. med.), Desutter, 1987). Evaginações apicais, esclerotizadas ou membranousas da camada pseudepifálica.

Lophus: singular de lophi.

Parâmero: [parameres n.pl. (Gr. Para, beside; meros, part)**]**. 1. A valva direita ou esquerda de um animal com simetria bilateral. 2. (arthro: Inseta) O par exterior dos falomeros que se desenvolveu nos apêndices de acasalamento dos machos; algumas vezes sinoniminizado com gonopofises. 3. (Echinod) o perradius com a metade dos interradius em cada lada. (Maggenti *et al.,* 2005).

Parâmeros pseudepifálicos: (Paramères pseudepiphalliques. p. eph.) evaginações laterais do pseudepifalo, com tendência a migrar sobre o pseudepifalo, e a se liberar.

Pseudepifalo: *sensu* Chopard, 1920. Origina-se desde uma esclerotização e se diferencia desde a parte mais dorsal do ectofalo, é uma invaginação em forma de T, e aparece na metade mais posterior da parte dorsal do ectofalo (invaginação ectofalica). Desutter (1987, 1988) confundiu o pseudepifalo dos Grylloidea com o epifalo.

Rami: (L. ramus, branch). Laminas esclerotizadas prolongadas lateralmente do pseudepifalo (Desutter, 1987). Uma rama ou prolongação de uma estrutura. O ramus, um par de escleritos concêntricos articulados dorsalmente, orientados antero-lateralmente, curvados ventralmente e em algumas ocasiões estão fundidos embaixo dos lóbulos ventrais. Em muitos gêneros, este rami não está articulado diretamente com o pseupifalo, mas sim com um par de escleritos compridos, chamados a placa ramal.

Valvas dorsais: (valves dorsales (v.d.), Desutter, 1987). Lóbulos laterais dorsais da camada ectofálica

Valvas ventrais: (Valves ventrais (v.v.)). Lóbulos laterais ventrais da camada ectofalica.

Virga: n. [L. virga, rod] (arthro: Inseta) Em dermaptera, uma extensão filiforme e esclerotizada do ducto ejaculador que guia a passagem do espermatóforo dentro da espermateca da fêmea.