

Programa de Pós-graduação em Diversidade Animal  
Universidade Federal da Bahia

Diogo França Dias Braulio Santos

**Taxonomia de *Macrostemum* Kolenati, 1859  
(Trichoptera: Hydropsychidae) da Região  
Neotropical**

Salvador

2012

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(Trichoptera: Hydropsychidae) da Região  
Neotropical**

Dissertação apresentada ao Instituto de Biologia da Universidade Federal da Bahia para a obtenção do Título de Mestre em Zoologia pelo Programa de Pós-graduação em Diversidade Animal.

Orientador: Adolfo Ricardo Calor  
Co-orientador: Henrique Paprocki

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1859 (Trichoptera: Hydropsychidae) da Região Neotropical**

Mestrando: Diogo França Dias Braulio Santos

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De acordo com o regimento geral da UFBA e com o regimento interno deste programa de pós-graduação, foram iniciados os trabalhos da Comissão Examinadora, composta pelos professores Dr. Adolfo Ricardo Calor (presidente), Dr. Freddy Ruben Bravo Quijano e Dra. Ana Maria Oliveira Pes às 14 horas do dia 04 de Maio de 2012.


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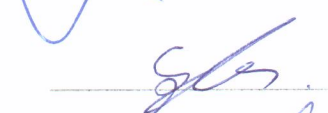
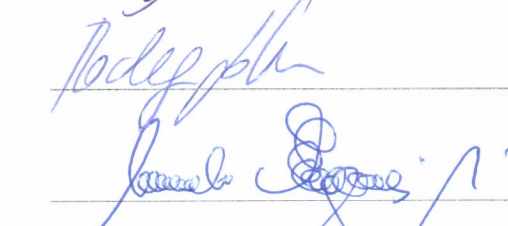

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# Dedicatória

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Dedico esta dissertação aos meus pais Glaycon e Vanessa,  
ao meu irmão Rodrigo e a minha vó Zilah

## Nota taxonômica

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Os nomes sugeridos para as espécies novas dessa dissertação são provisórios e não publicados dentro das regras do Código Internacional de Nomenclatura Zoológica (ICZN, 1999: Artigo 9). Os nomes e procedimentos nomenclaturais estabelecidos nesta dissertação não são válidos perante o Código e, portanto, não devem ser citados.

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## Resumo

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Trichoptera Kirby é uma ordem de insetos aquáticos holometábolos com ampla distribuição mundial, que exerce importante papel na dinâmica e cadeia trófica de ecossistemas aquáticos. Esses organismos estão presentes em todos os continentes, exceto Antártica, e possuem grande representatividade na biomassa de ambientes dulcícolas. Apesar de bons indicadores de integridade ambiental, sua utilização com esse propósito confronta com a escassez de estudos taxonômicos, sobretudo na Região Neotropical. Atualmente, são registradas 2.562 espécies nessa região distribuídas em 24 famílias. A família Hydropsychidae apresenta 355 espécies de distribuição neotropical, sendo 15 delas pertencentes ao gênero *Macrostemum*. Este gênero possui adultos geralmente reconhecidos pelo forte contraste de cores presentes nas asas anteriores e algumas de suas espécies estão entre as primeiras descritas para a Região Neotropical. Apesar disso, nenhuma espécie neotropical possui descrições que incluem caracteres de genitália masculina. Dessa forma, fazem parte do status taxonômico do gênero na região: espécies nominais válidas com descrições incompletas, espécies com séries-tipo perdidas, presença de novas espécies ainda não descritas, dados distribucionais das espécies desatualizados, ausência de chaves e manuais de identificação. Assim sendo, o presente trabalho objetivou caracterizar e ilustrar as espécies neotropicais, descrever duas novas espécies, atualizar dados de distribuição e produzir chave dicotômica para a identificação de machos.

## Introdução geral

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Trichoptera Kirby, 1813 é a uma ordem de insetos aquáticos holometábolos com adultos terrestres e estágios imaturos majoritariamente dulcícolas. As larvas utilizam seda para confeccionar redes de filtração ou construir abrigos e casas portáteis, para tanto, podem fazer uso de uma grande variedade de materiais orgânicos e inorgânicos (WIGGINS, 1996). Essa capacidade tem sido relacionada com altas taxas de especiação no grupo (MACKAY; WIGGINS, 1979), que se configura como a ordem mais diversa de insetos exclusivamente aquáticos (WIGGINS, 1996).

Adultos de Trichoptera são geralmente encontrados próximos à vegetação ripária de lagoas, córregos, rios e riachos. Geralmente, possuem hábito noturno, pequeno tamanho e ciclo de vida curto (MORSE, 2003). O aparelho bucal é pouco desenvolvido, utilizado apenas para sucção de líquidos (NEBOISS, 1991). Em contraposição às borboletas e mariposas, que possuem asas cobertas por escamas, as asas dos tricópteros são cobertas por cerdas, justificando o nome da ordem: do grego *trichos*, significa pelos, e *ptera*, asa (HOLZENTHAL *et al.*, 2007).

Os tricópteros estão presentes em todos os continentes, exceto Anatártica (DE MOOR; IVANOV, 2008). Com exceção de algumas espécies marinhas da família Chathamidae, encontradas na Nova Zelândia e Austrália, os tricópteros habitam a água doce (NEBOISS, 1991) e ambientes semi-terrestres (MUÑOZ-QUESADA; HOLZENTHAL, 1997). Assim como outros invertebrados aquáticos, uma grande diversidade de Trichoptera é encontrada em locais limpos, sendo que os riachos de regiões montanhosas comumente apresentam maior diversidade da ordem (WIGGINS, 1996).

Esses insetos exercem importante papel na dinâmica e cadeia trófica de ecossistemas lóticos (córregos, rios, corredeiras, cachoeiras) e lênticos (lagoas, pântanos, poças temporárias) (HYNES, 1970; VANNOTE *et al.*, 1980; ALLAN, 1995). Devido à estreita faixa de condições ecológicas toleradas pelas larvas de algumas espécies, os tricópteros demonstram grande potencial como indicadores de qualidade de água e contribuem no desenvolvimento de programas de monitoramento ambiental (ROSENBERG; RESH, 1996; DOHET, 2002). Apesar disso, a utilização desses organismos como ferramentas úteis para mensurar e identificar impactos ambientais ainda

confronta com a incipiência de estudos taxonômicos, sobretudo na Região Neotropical (BONADA *et al.*, 2006).

Atualmente, a ordem Trichoptera possui 13.574 espécies descritas (MORSE, 2011), em duas subordens, Annulipalpia Martynov, 1924 e Integripalpia Martynov, 1924 (HOLZENTHAL *et al.*, 2011), mas estimativas apontam para um número bem maior de espécies, cerca de 50.000 (SCHMID, 1984). A Região Neotropical registra 2.562 espécies e está entre as regiões com maior biodiversidade de Trichoptera (MORSE, 2011). Os trabalhos taxonômicos nessa região começaram em meados de 1830, com a descrição de *Macrostemum maculatum* (Perty, 1833) e em seguida de *Macronema lineatum* (Pictet, 1836), gêneros pertencentes à subordem Annulipalpia, família Hydropsychidae.

A subordem Annulipalpia apresenta larvas construtoras de abrigos fixos e redes de filtração (WIGGINS, 1996). O clado é composto por 13 famílias incluídas em três superfamílias. Philopotamoidea Stephens, 1829 com Philopotamidae Stephens, 1829 (25 gêneros e 1194 espécies) e Stenopsychidae Martynov, 1924 (3 gêneros, 95 espécies). Psychomyioidea Walker, 1852 com Dipseudopsidae Ulmer, 1904 (5 gêneros, 120 espécies), Dysoneuridae Sukatsheva, 1968 (3 gêneros, 6 espécies, todos fósseis), Ecnomidae Ulmer, 1903 (10 gêneros, 483 espécies), Electralbertidae Botosaneanu & Wichard, 1983 (1 gênero, 1 espécie fóssil), Kambaitipsychidae Malicky, 1992 (1 gênero, 2 espécies), Polycentropodidae Ulmer, 1903 (26 gêneros, 901 espécies), Pseudoneureclipsidae Ulmer, 1951 (2 gêneros, 120 espécies), Psychomyiidae Walker, 1852 (13 gêneros, 530 espécies) e Xiphocentronidae Ross, 1949 (7 gêneros, 173 espécies). Por fim, Hydropsychoidea Curtis, 1835 com a família Hydropsychidae Curtis, 1835 (39 gêneros, 1820 espécies) (HOLZENTHAL *et al.*, 2011).

A família Hidropsychidae detém o maior número de espécies entre os Annulipalpia (HOLZENTHAL *et al.*, 2011) e possui cinco subfamílias: Arctopsychinae, Diplectorinae, Hydropsychinae, Macronematinae, Smicrideinae (FLINT *et al.*, 1999; GERACI *et al.*, 2005; SCHEFTER, 1996, 2005). Dentre estas, quatro subfamílias ocorrem na Região Neotropical, sendo Macronematinae detentora de oito gêneros na região: *Synoestropsis* Ulmer, 1905 (tribo Polymorphanisini); *Blepharopus* Kolenati, 1859; *Centromacronema* Ulmer, 1905; *Leptonema* Guerin-Meneville, 1843; *Macronema* Pictet, 1836; *Macrostemum* Kolenati, 1859; *Plectromacronema* Ulmer, 1906 e *Pseudomacronema* Ulmer, 1905 (tribo Macronematini) (GERACI *et al.*, 2005).

O gênero *Macrostemum* é amplamente distribuído, exceto Europa e Antártica. Seus estágios imaturos são geralmente encontrados em rios e riachos de grande porte (WIGGINS, 1996). Os abrigos e redes de filtração larvais estão entre os mais especializados dentro de Hydropsychidae. Dessa forma, as larvas se mostram eficientes coletoras em ambientes lóticos, pois conseguem filtrar partículas finas de matéria orgânica, fitoplâncton e bactérias. (WALLACE; SHERBERGER, 1974). As larvas de *Macrostemum* são diagnosticadas pela seguinte combinação de caracteres morfológicos: cabeça achatada com carena em forma de “U”, um par de escleritos na base do labro, densa franja de cerdas nas tíbias e tarsos anteriores, proeminente processo na base do fêmur (WIGGINS, 1996).

Adultos de *Macrostemum* são geralmente reconhecidos pelo forte contraste de cores presentes nas asas anteriores (FLINT *et al.*, 1999). A conspicuidade promovida por esse padrão de cores pode ter contribuído para que as primeiras espécies dentro do gênero fossem descritas relativamente cedo após o estabelecimento da ordem Trichoptera. Antes do estabelecimento do gênero *Macrostemum*, três espécies foram descritas na Região Neotropical: *M. maculatum* como *Phryganea maculata*, *M. hyalinum* (Pictet, 1836) como *Hydropsyche hyalina*, e *M. arcuatum* (Erichson, 1848) como *Macronema arcuata*. As demais espécies neotropicais de *Macrostemum*, apesar de serem descritas após o estabelecimento do gênero, foram originalmente descritas como *Macronema*, gênero com adultos morfológicamente similares à *Macrostemum*, sendo elas: *M. braueri* (Banks, 1924), *M. digramma* (Mclachlan, 1871), *M. erichsoni* (Banks, 1920), *M. negrense* (Flint, 1978), *M. par* (Navás, 1930), *M. ramosum* (Navás, 1916), *M. santaeritae* (Ulmer, 1905), *M. subaequalis* (Banks, 1920), *M. surinamense* (Flint, 1974), *M. trigramma* (Navás, 1916), *M. triste* (Navás, 1916) e *M. ulmeri* (Banks, 1913).

O gênero *Macrostemum* foi estabelecido sem uma designação de espécie tipo e sinonimizado com *Macronema* por Ulmer (1907). Apesar da sinonimização, Ulmer (1907) reconheceu um grupo de espécies com distribuição restrita à América do Sul (atualmente em *Macronema*), caracterizado por asas anteriores com célula discoidal diminuta, grande célula medial, uma veia transversal entre as veias subcostal e costa e veia subcostal terminado na veia costa. O restante das espécies (que inclui espécies atualmente em *Macrostemum*) foi caracterizado por asas anteriores com célula discoidal média ou grande, pequena célula medial, ausência de veias transversais e veia subcostal se unindo a R<sub>1</sub> antes

da margem da asa. Dentre as espécies neotropicais foram posicionadas neste grupo: *M. digramma*, *M. hyalinum*, *M. maculatum* e *M. santaeritae*.

Ulmer (1957) designou *Macrostemum hyalinum* como espécie tipo de *Macrostemum*, porém ainda o considerou incluso em *Macronema*. Flint (1978) ressalva que espécies de *Macronema* (incluindo *Macrostemum*) podem possuir muitos problemas taxonômicos na Região Neotropical, devido às pequenas diferenças entre genitálias masculinas e a variação de cor presente nas asas de algumas espécies. Na chave dicotômica para adultos de *Macronema* apresentada pelo autor, todas as espécies, hoje consideradas *Macronema*, são separadas das demais (atualmente *Macrostemum*) no primeiro passo da chave: enquanto as espécies de *Macrostemum* são diagnosticadas pelo forte contraste de cores nas asas anteriores que não se restringe à região apical, as espécies de *Macronema* são caracterizadas pelo padrão de cores das asas anteriores formado por escamas e geralmente com metade basal de uma única cor. A identificação de dois agrupamentos em *Macronema* (ULMER, 1907; FLINT, 1978) foi refinada por Flint & Bueno-Soria (1979). Os autores dividem o gênero em dois grupos, observando padrões de coloração nas asas anteriores e a morfologia da genitália masculina. O grupo *hyalinum* apresenta as seguintes espécies neotropicais: *M. arcuatum*, *M. braueri*, *M. erichsoni*, *M. hyalinum*, *M. maculatum*, *M. negrense*, *M. santaeritae*, *M. surinamense* e *M. ulmeri*, todas hoje consideradas *Macrostemum*. Enquanto que outro grupo, *percitans*, é formado por espécies mantidas em *Macronema*.

Flint & Bueno-Soria (1982) reestabelecem o gênero *Macrostemum* com base, principalmente, em características morfológicas dos imaturos, mas também distinguem adultos de *Macrostemum* de *Macronema* pela seguinte combinação de caracteres: tibia anterior com um ou dois pequenos esporões apicais, veia subcostal da asa anterior se unindo a R<sub>1</sub> antes do ápice, asas anteriores com forte contraste de cores distribuído por toda a membrana da asa, genitália masculina com apêndice inferior distintamente segmentado, segmento X alongado e ápice do falo geralmente bulboso, sem estruturas acessórias especiais.

Apesar do estabelecimento de espécies em Trichoptera ser baseado na observação de caracteres da genitália masculina, todas as espécies neotropicais de *Macrostemum* foram descritas somente pelos padrões de cores das asas e corpo. Algumas espécies foram descritas somente com a observação de fêmeas ou o sexo não foi mencionado (*M.*

*negrense*, *M. par*, *M. ramosum*, *M. trigramma* e *M. triste*). Ainda, há espécies que não mais possuem série tipo (*M. hyalinum*, *M. ramosum*, *M. trigramma* e *M. triste*). Em síntese, nenhuma descrição das espécies neotropicais de *Macrostemum* possui qualquer menção aos caracteres de genitália masculina. Esses caracteres, apesar de algumas vezes mencionados em publicações posteriores, não foram descritos, apenas ilustrados.

O objetivo deste trabalho é estudar a taxonomia das espécies neotropicais de *Macrostemum*. Assim sendo, este trabalho fornece sinopses de todas as espécies neotropicais de *Macrostemum*, incluindo a análise de caracteres da genitália masculina, com caracterizações e ilustrações. Além disso, duas novas espécies são descritas, novas distribuições registradas e uma chave dicotômica para identificação de machos apresentada.

## Capítulo

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Este capítulo presenta o manuscrito intitulado “The genus *Macrostemum* Kolenati, 1859 (Trichoptera: Hydropsychidae) in Neotropical Region: description of two new species, taxonomic notes, distributional records and key to males” a ser submetido no periódico científico Zootaxa.



**The genus *Macrostemum* Kolenati, 1859 (Trichoptera:  
Hydropsychidae) in Neotropical Region: description of two new  
species, taxonomic notes, distributional records and key to males.**

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**Abstract**

The *Macrostemum* Kolenati contains 105 described species over the world, with 15 valid species from the Neotropical region. The adults can be recognized by the wing membranes strongly marked with dark and light colors. The Neotropical species of *Macrostemum* were described based on the wing colors patterns and general aspects of body. A few species were described based on females and others had no type series or the specimens were lost. In this paper we present a taxonomic study of the Neotropical

species, description of two new species from Brazil, distributional notes and dichotomous key to males.

**Keywords:** caddisflies, Macronematinae, new species, taxonomy.

## **Introduction**

The family Hydropsychidae Curtis is cosmopolitan and is divided into 5 subfamilies: Diplectroninae, Arctopsychinae, Hydropsychinae, Smicrideinae and Macronematinae (Flint *et al.*, 1999; Geraci *et al.*, 2005; Schefter, 1996, 2005). The subfamily

Macronematinae presents eight Neotropical genera: *Synoestropsis* Ulmer, *Blepharopus* Kolenati, *Centromacronema* Ulmer, *Leptonema* Guerin-Meneville, *Macronema* Pictet, *Macrostemum* Kolenati, *Plectromacronema* Ulmer, and *Pseudomacronema* Ulmer. All except *Synoestropsis* (Polymorphanisini) are of the Macronematini tribe.

*Macrostemum* Kolenati, 1859 is a conspicuous genus with adults generally recognized by wing membranes marked with strongly contrasting colors (Flint *et al.*, 1999). The larvae are rheophilus, building retreats and nets adapted to filter very small particles (Wallace & Sherberger, 1974). The genus is widespread over the world, except in Europe and Antarctica, most of northern Asia and West Indies, and contains 105 described species (Morse, 2012), with 15 valid species recorded from Neotropical Region: *M. arcuatum* (Erichson, 1848), *M. braueri* (Banks, 1924), *M. digramma* (McLachlan, 1871), *M. erichsoni* (Banks, 1920), *M. hyalinum* (Pictet, 1836), *M. maculatum* (Perty, 1833), *M. negrense* (Flint, 1978), *M. par* (Navás, 1930), *M. ramosum* (Navás, 1916), *M. santaeritae* (Ulmer, 1905a), *M. subaequalis* (Banks, 1920),

*M. surinamense* (Flint, 1974), *M. trigramma* (Navás, 1916), *M. triste* (Navás, 1916), *M. ulmeri* (Banks, 1913) (Flint *et al.*, 1999).

Kolenati (1859) proposed the genus *Macrostemum* for *Macrostemum hyalinum* and *Centromacronema auripenne* (Rambur, 1842). The genus was synonymized with *Macronema* (Pictet, 1836) by Ulmer (1907a) and resurrected by Flint & Bueno-Soria (1982). Despite 75 years as *Macronema*, several authors have proposed species group for *Macrostemum* species (Ulmer, 1907a; Flint, 1978; Flint & Bueno Soria, 1979). Some species have only females described or the gender was not defined in original descriptions (*M. negrense*, *M. par*, *M. ramosum*, *M. trigramma* and *M. triste*), others had the type series lost (*M. hyalinum*, *M. ramosum*, *M. trigramma* and *M. triste*). The original species descriptions do not contain neither descriptions nor the illustrations of the male genitalia. The male genitalia characters are presented in the following publications by means of the plates, without an accompanying description. Before this work, all the Neotropical species of *Macrostemum* were described exclusively based on the wing color patterns and general aspects of body.

This work presents the taxonomic synopsis of Neotropical species, description of two new species from Brazil, distributional notes and dichotomous keys to males.

## **Material and methods**

Specimens were collected and prepared following Blahnik & Holzenthal (2004).

Additional specimens were examined from Coleção Entomológica Prof. José Alfredo Pinheiro Dutra (DZRJ), Instituto Nacional de Pesquisas da Amazônia (INPA), Museu de Zoologia da Universidade Federal da Bahia (UFBA), Museu de Zoologia da Universidade de São Paulo (MZUSP). Specimens deposited in cited collections were

analyzed, mostly material from MZUSP and INPA identified by Dr. Oliver S. Flint. *Macrostemum par*, *M. ramosum*, *M. subaequalis*, *M. surinamense*, *M. trigramma* and *M. triste* were analyzed exclusively from the original descriptions.

The illustrations were made using a stereomicroscope and optical microscope, both equipped with camera lucida, the softwares Adobe® Illustrator® CS5 and Adobe® Photoshop® CS5. The photographs of the wings were taken using the digital camera Canon EOS Rebel T3 with a 60mm macro lens. Synopsis and key were made using DELTA system (Dallwitz *et al.*, 1993; 1995; 1999). The terminology used in the descriptions follows that Flint *et al.* (1987). Areas on the forewing were determined to facilitate the identification of color patterns: Basal area (the region from the origin of the wing to the imaginary perpendicular line near the first bifurcation of R<sub>1</sub>), Medial area (the region among basal and apical area), and Apical area (the region among the imaginary parallel line near the cross-vein of the discoidal cell and the apical border of the wing). Abbreviations for Brazilian States are as follow: Acre (AC), Amazonas (AM), Bahia (BA), Ceará (CE), Espírito Santo (ES), Mato Grosso (MT), Minas Gerais (MG), Pará (PA), Paraíba (PB), Paraná (PR), Pernambuco (PE), Rio de Janeiro (RJ), Rondônia (RO), Roraima (RR) and São Paulo (SP). The bold letter on distributional notes indicates new records of the species.

### **Taxonomy of *Macrostemum* Kolenati, 1859**

*Phryganea* Perty, 1833: 129 [description of *Macrostemum maculatum* as *Phryganea maculata*]

*Hydropsyche* Pictet, 1836: 402 [description of *Macrostemum hyalinum* as *Hydropsyche hyalina*]

*Macronemum* Burmeister, 1839: 916 [redefinition of *Macrostemum hyalinum* as *Macronemum hyalinum*]; Ross, 1944: 114 [characterization of *M. carolina*, *M. transversum*, *M. zebratum*].

*Macrostemum* Kolenati, 1859: 239 [designation of the genus; type species non defined]. Flint & Bueno-Soria, 1982: 358 [redefinition and validation of the genus]; Nimmo, 1987: 173 [characterization].

*Macronema* Ulmer, 1907a: 62 [synonymization and revision under *Macronema*]; Ulmer, 1957: 339 [designation of type species of *Macrostemum* as *M. hyalinum*, but under *Macronema*]. Flint, 1978: 386 [systematics]; Flint & Bueno-Soria, 1979: 524 [systematics].

The genus *Macrostemum* was erected by Kolenati (1859) to *Macrostemum hyalinum* (Pictet, 1836) and *Centromacronema auripenne* (Rambur, 1842), firstly *Hydropsyche hyalina* and *Macronema auripenne*, respectively. The genus was proposed based on the absence of apical spurs on fore tibia, but without designation of the genus type.

Kolenati (1859) did not observe a pair of very small apical spurs on fore tibia of *M. hyalinum*.

Ulmer (1907a) transferred the species of *Macrostemum* to *Macronema* (Pictet, 1836) and recognized one group of species of South American distribution (currently *Macronema*). These species group was characterized by a minute discoidal cell, a very large median cell, a distinct costal crossvein and the subcostal vein ending on the costa, and includes *M. argentilineatum* Ulmer, *M. bicolor* Ulmer, *M. fulvum* Ulmer, *M. lineatum* Pictet, *M. parvum* Ulmer, *M. percitans* Walker.

The remaining species were characterized by medium or large discoidal cell, smaller median cell, no costal crossveins, and subcostal vein united to R<sub>1</sub> just before the wing margin. The cosmopolitan species group, as related by Ulmer (1907a), included the following *Macrostemum* species: *M. alienum* (Ulmer), *M. capense* (Walker), *M. digramma* (McLachlan), *M. dohrni* (McLachlan), *M. distinguendum* (Ulmer), *M. fastosum* (Walker), *M. fenestratum* (Albarda), *M. hospitum* (McLachlan), *M. hyalinum*

(Pictet), *M. lautum* (McLachlan), *M. maculatum* (Perty), *M. multifarium* (Walker), *M. nebulosum* (Hagen), *M. opulentum* (Ulmer), *M. polygrammatum* (McLachlan), *M. pseudoneura* (Brauer), *M. radiatum* (McLachlan), *M. santaeritae* (Ulmer), *M. splendidum* (Hagen), *M. transversum* (Walker), *M. tuberosum* (Ulmer) and *M. zebratum* (Hagen). Ulmer (1957) determined *M. hyalinum* as the type species of cosmopolitan species group of the genus *Macronema* (all species currently placed in *Macrostemum*). Flint (1978) argues that the Neotropical species of *Macronema* (including *Macrostemum*) presents several systematic problems, probable related as the very small morphological differences in male genitalia and the variation of wing color patterns. The cosmopolitan group (currently *Macrostemum*) was identified from other (*Macronema* species) by differences in color patterns on forewings by means of the key proposed by Flint (1978). The cosmopolitan group has a forewing with strongly contrasting color pattern in the membrane, not basically limited to the apical area, and the other group (*Macronema sensu strictu*) has a forewing with color patterns due primarily to scales, basal half unicolorous (generally emerald green), and bordered outwardly by a distinct color pattern (Flint, 1978). Furthermore, to identify the species of cosmopolitan group, the author based exclusively on characters of forewings color patterns.

Flint & Bueno-Soria (1979) divided *Macronema* into two groups based on wing color patterns and the shape of male genitalia. The *hyalinum* group contains 10 species: *M. arcuatum* (Erichsoni), *M. braueri* (Banks), *M. erichsoni* (Banks), *M. hyalinum* (Pictet), *M. maculatum* (Perty), *M. negrense* (Flint), *M. santaeritae* (Ulmer), *M. surinamense* (Flint), *M. tuberosum* (Ulmer), *M. ulmeri* (Banks), all of these species currently placed in *Macrostemum*. The second, *percitans* group, includes 20 species: *M. amazonense* Flint, *M. argentineum* Ulmer, *M. bifidum* Flint, *M. burmeisteri* Banks, *M.*

*exophthalmum* Flint, *M. fragile* Banks, *M. fraternum* Banks, *M. gundlachi* Banks, *M. hageni* Banks, *M. lachlani* Banks, *M. luteipenne* Flint & Bueno, *M. matthewsi* Flint, *M. muelleri* Banks, *M. paliferum* Flint, *M. pennyi* Flint, *M. percitans* Walker, *M. pertyi* Banks, *M. picteli* Banks, *M. reinburgi* Navás, *M. variipenne* Flint & Bueno, all of these species currently placed in *Macronema*. All the species related above by Flint & Bueno-Soria (1979) were recorded from south of Mexico, Central America and Northern South America.

Flint & Bueno-Soria (1982) reerected *Macrostemum* including 19 species in New World (Nearctic and Neotropical Regions): *M. arcuatum*, *M. braueri*, *M. carolina*, *M. digramma*, *M. erichsoni*, *M. hyalinum*, *M. maculatum*, *M. negrense*, *M. par*, *M. ramosa*, *M. santaeritae*, *M. subequale*, *M. surinamense*, *M. transversum*, *M. trigramma*, *M. triste*, *M. tuberosum*, *M. ulmeri*, *M. zebratum*. This inference was based on larval and pupal morphology in: labrum, mandibles, gena, ventral ecdysal line, coxa, tibiae, tarsus, gills, anal prolegs, retreat, net, antennae, posterior hook plates, apical appendages, inner cocoon and cocoon ends.

Additionally, *Macrostemum* can be separated of *Macronema* by the following adult characters: foretibia with 1 or 2 small apical spurs; forewings with color due primarily to strongly contrasting colors of the membrane and the pattern is widespread over the wing; Sc of forewing fused with R<sub>1</sub> apically, or ending in a fork whose ventral arm is united to R<sub>1</sub> and is the stronger of the 2 arms; males with claspers distinctly 2-segmented, tenth tergum elongated and rather simple, and the tip of the aedeagus generally bulbous, without special structures (Flint & Bueno-Soria, 1982).

### **Neotropical species of *Macrostemum* Kolenati**

*Macrostemum* presents 15 described species from the Neotropics: *M. arcuatum* (Erichson), *M. braueri* (Banks), *M. digramma* (McLachlan), *M. erichsoni* (Banks), *M. hyalinum* (Pictet), *M. maculatum* (Perty), *M. negrense* (Flint), *M. par* (Navás), *M. ramosum* (Navás), *M. santaeritae* (Ulmer), *M. subaequalis* (Banks), *M. surinamense* (Flint), *M. trigramma* (Navás), *M. triste* (Navás), *M. ulmeri* (Banks) (Flint *et al.*, 1999). These species were described based on the wing color patterns and general aspects of body, characters that show some intraspecific variation. On the other hand, we proposed the shape of phallotremal sclerite (ventral view) as the most important structure to identify the Neotropical species of *Macrostemum*. Shapes of structures like dorsal keel of segment IX and warts on segment X, traditionally used in Trichoptera taxonomy, have shown some intraspecific variations in this genus. However, a combination of all of these characters have shown importance for the species diagnosis.

***Macrostemum nigrum* França, Paprocki & Calor, new species** (Fig. 1A – E)

This new species can be diagnosed from its congeners by two remarkable features: the presence of a protuberant wart on each lobe of X segment and one acuminate process on anterior margin of phallus, near the phallobase. Moreover, the phallotremal sclerite (ventral view) is similar that of *M. hyalinum*, but in this species the lateral extensions of the sclerite are longer than *M. hyalinum*. The acuminate apex of phallus of this new species is different from the truncate apex of *M. hyalinum*. The important diagnostic character that separate this species from all known Neotropical species is the presence of anterior wings entirely blackish.

**Description.** Adults in alcohol. Forewing length 9.3 mm (n=11). Head blackish with medial carina. Compound eyes blackish. Scape blackish with brown setae. Maxillary



palp brownish with brown and yellow setae. Prothorax blackish. Meso- and metathorax blackish. Legs yellow brownish. Tibial spur formula 2,4,4. Forewing entirely dark, without light spots. Discoidal cell present. Radial sector normal.

Male genitalia. Abdominal segment IX with a medial acuminate keel and long setae covered right and left sides (dorsal view); anterior margin sinuous; posterior margin sinuous, covered by setae and with one deep notch (lateral view). Segment X bilobed with a wart on rounded apex of each lobe (dorsal view); truncate, with spot of small setae on inferior region (lateral view). Inferior appendage uniformly wide and covered by small setae throughout its length; basal segment approximately the size of apical segment and with a small group of medium setae at the apex. Phallus acutely bent basally; apex acuminate (lateral view); phallosomal sclerite without dorsal process; anterior margin acutely concave and posterior margin bearing a pair of rounded prominences (ventral view); phallosoma rounded, concave, on anterior surface of apex of phallus.

**Material examined. Holotype: BRAZIL: Bahia:** Wenceslau Guimarães, Estação Ecológica Estadual Wenceslau Guimarães, Riacho Serra Grande, cachoeira em cima, 13°35'34.3''S, 39°42'51.8''W, 482m, 10.x.2010, luz/bandeja, equipe Programa de Pós-graduação em Diversidade Animal (PPGDA) *leg.*, 1 male (alcohol; UFBA). **Paratypes:** same data as holotype, 1 male (alcohol; MZUSP); Camacan, Reserva Particular do Patrimônio Natural Serra Bonita, riacho 1, trilha nova, 15°23'35.4''S, 39°33'50.1''W, 773m, 1.iv.2011, luz/bandeja, D. França, F. B. Quinteiro, H. Barreto *leg.*, 1 female (alcohol; UFBA); same data except Córrego Chuchuzeiro, 15°23'26.4''S, 39°33'52.2''W, 777m, ii.2009, Malaise 3, A. Calor *leg.*, 1 female (alcohol; UFBA); same data except iii.2009, 2 females (alcohol; UFBA); same data except iv.2009, 1

female (alcohol; UFBA); same data except v.2009, 1 female (alcohol; UFBA); same data except iii.2009, Malaise 2, 2 females (alcohol; UFBA); same data except 2<sup>o</sup>-riacho, 3.xi.2009, luz/lençol, F. B. Quinteiro *leg.*, 1 female (alcohol; UFBA).

**Etymology.** The species epithet, *nigrum*, from Latin, means black and it alludes to the color pattern of the forewings, which are completely blackish, singular in the genus.

**Distribution.** Brazil (BA).

***Macrostemum bravoii* França, Paprocki & Calor, new species** (Fig. 2A – E)

This new species has a distinctly medial prominence on anterior margin of its falciform phallotremal sclerite (ventral view). This species is similar to *M. erichsoni*, but the anterior margin of IX segment is rounded and the apex of phallus is truncate (lateral view). The forewings of the new species have a distinctive pattern of hyaline and brownish areas with blurry boundaries while all previously described species have very well defined dark spots. However the distribution and shape of the spots can resemble that of *M. erichsoni*.

**Description.** Adults in alcohol. Forewing length 11.9 mm (n=7). Head brown yellowish. Compound eyes blackish. Scape brownish on dorsal and yellowish on ventral surface. Maxillary palp yellowish with ferruginous and yellow setae. Prothorax yellow. Meso- and metathorax brown yellowish. Legs yellow brownish. Tibial spur formula 1,4,4. Forewing with dark and hyaline pattern colors, but no one spot clearly distinguishable. Discoidal cell present. Radial sector normal.

Male genitalia. Abdominal segment IX with a medial acuminate keel and long setae covered right and left sides (dorsal view); with anterior margin rounded; posterior margin sinuous, covered by setae and with one deep notch (lateral view). Segment X bilobed with a wart near from rounded apex of each lobe (dorsal view); acuminate, with a row of small setae on superior distal region and another on inferior region (lateral view). Inferior appendage covered by small setae throughout its length; basal segment approximately the same size of apical segment and narrow at the base. Phallus arched; apex truncate with a small rounded antero-ventral prominence (lateral view); phallotremal sclerite without dorsal process; falciform, with anterior margin with a medial prominence (ventral view); phallotrema rounded, concave, on anterior surface of apex of phallus.

**Material examined. Holotype: BRAZIL: Bahia:** Barreiras, APA Rio de Janeiro, Cachoeira Acaba Vida, 11°53'S, 45°36'W, 705m, 4.vi.2008, luz, F. Bravo, Menezes, Alvim, Silva-Neto *leg.*, 1 male (alcohol; UFBA). **Paratypes:** same data as holotype, 4 females (alcohol; UFBA); same data except Cachoeira Redondo, 11°53'S, 45°25'W, 573m, 5.vi.2008, luz, F. Bravo, Menezes, Alvim, Silva-Neto *leg.*, 1 female (alcohol; UFBA); **Mato Grosso:** Nova Xavantina, Córrego Ponte de Pedra, 14°57'51''S, 52°37'13''W, xii.2006, luz, A. Calor, S. Mateus, R. Silva *leg.*, 1 female (alcohol, UFBA).

**Etymology.** The species epithet of this species is in honor of Dr. Freddy Bravo, who collected this new species and contributes significantly for Trichoptera taxonomy.

**Distribution.** Brazil (BA).

***Macrostemum arcuatum* (Erichson, 1848)** (Fig. 3A – E)

Erichson, 1848: 586 [Type locality: by inference, “British-Guiana”; MCZ; ♂; as *Macronema arcuata*]; Ulmer, 1907a: 40, Plate 1 [wings; ♂; as *Pseudomacronema arcuatum*]; Mosely, 1931: 170 [distribution; as *Pseudomacronema arcuatum*]; Fischer, 1963: 163 [distribution]; Flint, 1974: 105, 106, Plate 1 [♂; distribution; wings; as *Macronema arcuatum*]; Flint, 1978: 388, 412, 416 [distribution; ♂; wings]; Flint, 1996: 412 [distribution]; Flint *et al.*, 1999: 68 [taxonomic notes; distribution]; Paprocki *et al.*, 2004: 8 [distribution]; Nogueira & Cabette, 2011: 349 [distribution].

*Macrostemum arcuatum* is a unique and unmistakable species. The characters that differentiate this species from all others include one quadrate-like wart on superior proximal region of the abdominal segment X and phallotremal sclerite bearing a pair of laminated dorsal process. In addition, a distinctly hyaline N-shaped patch on medial area of forewing may be used to aid its identification.

**Synopsis.** Adults pinned. Forewing length 9.9 mm (n=35). Head brownish with or not yellowish spot behind eyes. Compound eyes brownish. Scape golden with brown setae. Maxillary palp golden with golden setae. Prothorax golden. Meso- and metathorax dark brown with lateral light brown spots. Legs golden. Tibial spur formula 2,4,4. Forewing dark and hyaline, with a distinct hyaline N-shaped spot on medial area. Discoidal cell absent. Radial sector markedly expanded.

Male genitalia. Abdominal segment IX with a medial truncate keel and medium setae covered right and left sides (dorsal view); anterior margin sinuous; posterior margin sinuous, covered by setae and with one deep notch (lateral view). Segment X bilobed

with a wart on rounded apex of each lobe (dorsal view); acuminate with one quadrate-like wart on superior proximal region (lateral view). Inferior appendage uniformly wide and covered by small setae throughout its length; basal segment approximately two times the size of apical segment and with longer setae at the apex. Phallus acutely bent basally; apex truncate with acuminate antero-ventral prominence (lateral view); phallotremal sclerite bearing a pair of laminated dorsal process; slender, with medial portion straight and ends curved toward anterior region (ventral view); phallotrema rounded, concave, on anterior surface of apex of phallus.

**Material examined. BRAZIL: Amazonas:** Barcelos, Serrinha, Rio Aracá, 00°24'39,7''N, 63°23'12''W, 28.vii.2009, luz do barco, A. Pes *leg.*, 2 males (alcohol; INPA); **Mato Grosso:** Nova Olimpia, Fazenda Bandeirantes, Usinas Itamarati, Rio Bugres, 26.xii.2002, luz, A. R. Calor & C. T. Salgado *leg.*, 7 females (pinned; UFBA); Ribeirão Cascalheira, 1° córrego (estrada Fazenda Manaus), 2.xii.2006, luz, Calor & Silva *leg.*, 1 male (pinned; UFBA); same data, 19 females (pinned; UFBA); same data except, 1.xii.2006, 6 females (pinned; UFBA); same data except Córrego Represa, 27.xi.2006, luz, Calor, Silva, Mateus *leg.*, 1 female (pinned; UFBA); Tangará da Serra, Fazenda Calcário Tangará, Grupo Itamarati, Rio Sepotuba, 3.i.2003, puçá, A. R. Calor *leg.*, 1 female (pinned; UFBA) **Pará:** Rio Xingu, Camp (3°39'S, 52°22'W), ca 60km S. Altamira, x.1986, P. Spangler & O. Flint *leg.*, 2 males, 13 females (pinned; MZUSP); **(?) State:** estrada da colônia, Aripuanã, Y. T., 22.i.1975, L. P. Albuquerque & E. L. Antony *leg.*, 1 male (pinned; INPA); **SURINAM: Marowijne:** Benzdorp, Rio Lawa, xi.1963, B. Malkin *leg.*, 2 males (alcohol; MZUSP).

**Distribution.** Brazil (AM, MT, PA), Guyana, Peru, Surinam.

***Macrostemum braueri* (Banks, 1924)** (Fig. 4A – E)

Banks, 1924: 454, Plate 1 [Type locality: Brazil, Amazonas, Tefé; MCZ; ♀; wings; as *Macronema braueri*]; Fischer, 1963: 178 [distribution]; Flint, 1978: 390, 401, 416, 420, 421 [distribution; ♂; wings; as *Macronema braueri*]; Flint *et al.*, 1999: 68 [taxonomic notes; distribution]; Paprocki *et al.*, 2004: 8 [distribution].

*Macrostemum braueri* can be diagnosed by the long acuminate antero-ventral prominence of apex of phallus (lateral view), and by the M-shaped phallotremal sclerite (ventral view). The forewings of this species resembles that of *M. negrense* but in this species the dark spot on the apical area delimits only one boot-shaped hyaline area while in *M. negrense* the dark spot on the apical area delimits two boot-shaped hyaline areas.

**Synopsis.** Adults in alcohol. Forewing length 8.9 (n=3). Head yellowish with brown spot behind eyes. Compound eyes blackish. Scape yellow. Maxillary palp blackish at middle and pale at ends. Prothorax yellowish. Meso- and metathorax yellowish. Legs yellowish with foretibia brownish. Tibial spur formula 2,4,4. Forewing mostly hyaline, with one dark spot bordering the apical area and delimiting one boot-shaped hyaline area. Discoidal cell present. Radial sector normal.

Male genitalia. Abdominal segment IX with a medial rounded keel and long setae covered right and left sides (dorsal view); anterior margin rounded; posterior margin sinuous, covered by setae (lateral view). Segment X bilobed with a wart on rounded apex of each lobe (dorsal view); acuminate with one pronounced wart on proximal superior region, a row of setae on superior region and a spot of small setae on inferior region (lateral view). Inferior appendage covered by setae and uniformly wide throughout its

length; basal segment approximately 1.5 times the size of apical segment. Phallus arched; apex truncate with a long acuminate antero-ventral prominence (lateral view); phallotremal sclerite without dorsal process; M-shaped (ventral view); phallotrema on antero-dorsal surface of apex of phallus.

**Material examined. BRAZIL: Amazonas:** Manaus, Reserva Ducke, 24.ix.1976 (10-7), 1 male (pinned; INPA); Rio Preto da Eva, Ramal Baixo Rio, Estrada Poliana, Igarapé do Geladinho (#38), 2°46'48,2''S, 59°39'9,6''W, 24-27.ix.2008, armadilha luminosa (pensilvania), J. O. da Silva, C. Monteiro, C. Menezes *leg.*, 3 males (alcohol, UFBA).

**Distribution.** Brazil (AM).

*Macrostemum digramma* (McLachlan, 1871) (Fig. 5A – E)

McLachlan, 1871: 131 [Type locality: Brazil, Minas Gerais; BMNH; ♂; as *Macronema digramma*]; Ulmer, 1907a: 80 [wings♂]; Flint *et al.*, 1999: 68 [taxonomic notes; distribution]; Paprocki *et al.*, 2004: 8 [distribution]; Dumas *et al.*, 2009: 358 [distribution]; Calor, 2011: 321 [distribution].

The genitalia of this species is similar that of *Macrostemum maculatum* but may be diagnosable by the anterior margin of the abdominal segment X nearly straight (lateral view) and the phallotremal sclerite with anterior margin slightly concave (ventral view). Furthermore, the forewings of *M. digramma* are predominantly black with only two longitudinal hyaline narrow spots on medial area.

**Synopsis.** Adults in alcohol. Forewing length 12.7 mm (n=3). Head brownish with or not yellowish spot behind eyes. Compound eyes brownish. Scape brownish with ferruginous setae. Maxillary palp yellowish with ferruginous and yellow setae. Prothorax brownish with or not yellow spot on pleural region. Meso- and metathorax brownish or brown yellowish. Legs yellow brownish. Tibial spur formula 2,4,4. Forewing mostly dark, with only two longitudinal hyaline narrow spots on medial area. Discoidal cell present. Radial sector normal.

Male genitalia. Abdominal segment IX with a small medial truncate keel and medium setae covered right and left sides (dorsal view); anterior margin nearly straight; posterior margin sinuous, covered by setae and with one deep notch (lateral view). Segment X bilobed with a wart on rounded apex of each lobe (dorsal view); acuminate, with a row of small setae on superior distal region and a spot of small setae on inferior region (lateral view). Inferior appendage uniformly wide and covered by small setae throughout its length; basal segment approximately two times the size of apical segment. Phallus arched; apex slightly acuminate (lateral view); phallosomal sclerite bearing a pair of spine-like dorsal process; anterior margin slightly concave and posterior margin bearing a pair of rounded prominences (ventral view); phallosoma rounded, concave, on antero-dorsal surface of apex of phallus.

**Material examined. BRAZIL: São Paulo:** E. B. Paranapiacaba, 4.xi.1963 (35), 1 male (alcohol; MZUSP); Ubatuba, pé da Serra do Mar, Rio da Fazenda, 23° 20' 46.01''S, 44° 50' 59.61''W, 52m, 19.iv.2004, J. L. Nessimian & A. A. Huamantico *leg.*, 1 male (alcohol, DZRJ 1734); **Rio de Janeiro:** Cachoeiras de Macacu, Parque Estadual Três Picos, Mata do Jequitibá, riacho de 1ª ordem, 22°25'00.5''S, 42°36'28.2''W, 328m,



7.v.2006, A. P. M. Santos, L. L. Dumas, J. L. Nessimian *leg.*, 1 male (alcohol; DZRJ 3428); Rio de Janeiro, Parque Nacional da Tijuca, trilha ACM, 10.x.1992, L. F. M. Dorvillé *leg.*, 2 males (alcohol; DZRJ 1213); Teresópolis, rio Paquequer, represa, 22°26'41.3''S, 42°56'31.9''W, 13.x.1996, J. L. Nessimian *leg.*, 5 males (alcohol; DZRJ 1371); same data except, A. A. Huamantico *leg.*, 5 males (alcohol; DZRJ 1393); same data except, 23.xi.1991, J. L. Nessimian *leg.*, 7 males (alcohol; DZRJ 1395); same data except, 15.ii.1991, L. F. M. Dorvillé, E. R. Silva, J. L. Nessimian *leg.*, 1 male (alcohol, DZRJ 1396); same data except, 11.iv.1992, E. R. Callil *leg.*, 1 male (alcohol, DZRJ 1397); same data except, Venda Nova, 23.ix.1991, E. R. Silva & J. L. Nessimian *leg.*, 1 male (alcohol; DZRJ 1390); same data except, Vale da Revolta, 22°26'41.3''S, 42°56'31.9''W, 29.xii.1991, E. R. da Silva *leg.*, 1 male (alcohol; DZRJ 1391); same data except, 19.x.1991, M. E. Felix *leg.*, 2 males (alcohol; DZRJ 1392).

**Distribution.** Brazil (MG, RJ, SP).

***Macrostemum erichsoni* (Banks, 1920)** (Fig. 6A – E)

Banks, 1920: 356, Plate 5 [Type locality: French Guiana, Nouveau Chantier; MCZ; ♀; wings; as *Macronema erichsoni*]; Ulmer, 1913: 395 [wings; as *Macronema hyalinum* var.]; Mosely, 1931: 170 [distribution; as *Macronema erichsoni*]; Fischer, 1963: 184 [distribution]; Flint, 1967: 9, Plate 1 [holotype; wings]; Flint, 1974: 105, 108 [♂; distribution]; Flint, 1978: 389, 400, 413, 416 [distribution; ♂, wings]; Flint *et al.*, 1999: 68 [taxonomic notes; distribution]; Paprocki *et al.*, 2004: 8 [distribution].

The genitalia of *M. erichsoni* resembles that of *M. santaeritae*. In *M. erichsoni* the anterior margin of abdominal segment IX is sinuous (lateral view) and the phallotremal

sclerite is falciform with anterior margin deeply concave (ventral view). In addition, the forewing of this species has a distinct hyaline C-shaped spot on apical area.

**Synopsis.** Adults in alcohol. Forewing length 10.4 mm (n=54). Head blackish with yellow spot behind eyes. Compound eyes blackish. Scape blackish with brown setae. Maxillary palp yellowish with yellow setae. Prothorax yellow. Meso- and metathorax brownish with or not yellow spots. Legs yellow brownish. Tibial spur formula 1,4,4. Forewing dark and hyaline, with a distinct hyaline C-shaped spot on apical area. Discoidal cell present. Radial sector normal.

Male genitalia. Abdominal segment IX with a slight medial prominence and medium setae covered right and left sides (dorsal view); anterior margin sinuous; posterior margin sinuous, covered by setae and with one deep notch (lateral view). Segment X bilobed with a wart on rounded apex of each lobe (dorsal view); acuminate, with a row of small setae on superior distal region and a spot of small setae on inferior region (lateral view). Inferior appendage uniformly wide and covered by small setae throughout its length; basal segment approximately the same size of apical segment and with longer setae at the apex. Phallus arched; apex slightly acuminate (lateral view); phallotremal sclerite without dorsal process; falciform with posterior margin concave and anterior margin convex (ventral view); phallotrema rounded, concave, on antero-dorsal surface of apex of phallus.

**Material examined. BRAZIL: Acre:** Mâncio Lima, Parque Nacional Serra do Divisor, Pé da Serra, Base IBAMA, Igarapé Amor, 5.ix.2007, Malaise, A. R. Calor *leg.*, 46 males, 85 females (alcohol; UFBA); same data except 5.vi.2007, 28 males, 41 females (alcohol; UFBA); same data except 4.iv.2007, 21 males, 49 females (alcohol; UFBA);

same data except 5.xi.2007, 5 males, 28 females (alcohol; UFBA); same data except 5.vii.2007, 7 males (alcohol, UFBA); same data except 5.viii.2007, 29 males, 77 females (alcohol; UFBA); same data except 5.x.2007, 12 males, 46 females (alcohol; UFBA); same data except 10.iii.2006, luz, 1 female (alcohol; UFBA); **Amazonas:** Manaus, Reserva Ducke, 2.xi.1976, N. D. Penny *leg.*, 1 male (pinned; INPA); same data except BR 174Km 56 – ZF-02, sede, Ramal Km 38 – Trilha da torre, 1° Igarapé (#73); 2°35'50.9''S, 60°12'54.9''W, 9-12.xi.2008, armadilha Pensilvânia, U. G. Neiss, F. Salles, P. V. Cruz *leg.*, 2 males (alcohol; INPA); Presidente Figueiredo, igarapé do Ramal do Km 24, na prop. Seu José Souza, 2°1'7''S, 59°49'28''W, 4-5.xi.2000, armadilhas de luz, A. M. O. Pes *leg.*, 1 female (alcohol; INPA); **Bahia:** Wenceslau Guimarães, E.E.E. Wenceslau Guimarães, sede, Riacho Serra Grande, 13° 35' 42.9''S, 39° 43' 12.4''W, 561m, 10.x.2010, luz/bandeja, equipe PPGDA *leg.*, 1 female (alcohol; UFBA); **Pará:** stream at Caverna do Tatajuba, ca 22km SE Altamira, 6.x.1986, P. Spangler & O. Flint *leg.*, 1 male (pinned; MZUSP);(?) **state,** Cachoeira do Gigante, light, 3.vi.1961, E. J. Fittkau *leg.*, 1 male (alcohol; MZUSP).

**Distribution.** Brazil (AC, AM, BA, PA), French Guiana, Guyana, Surinam.

***Macrostemum hyalinum* (Pictet, 1836)** (Figs. 7, 8)

Pictet, 1836: 402, Plate [Type locality: Indes Orientales; type depository unknown; sex unknown; as *Hydropsyche hyalina*]; Burmeister, 1839: 916 [Type locality; distribution; as *Macronema hyalinum*]; Ulmer, 1905b: 67, 68, 69, Plate 2 [wings; ♂; as *Macronema hyalinum*]; Ulmer, 1907a: 75, 76, Plate 3 [♂; wings; as *Macronema hyalinum*]; Fischer, 1963: 188 [distribution]; Flint, 1978: 389, 413, 416 [distribution, ♂, wings; as *Macronema hyalinum*]; Flint, 1996: 412 [distribution]; Flint *et al.*, 1999: 68 [taxonomic

notes; distribution]; Marinoni & Almeida, 2000: 286 [distribution]; Paprocki *et al.*, 2004: 8 [distribution]; Hollier, 2007: 53 [Holotype situation]; Dumas *et al.*, 2009: 358 [distribution]; Calor, 2011: 321 [distribution]; Nogueira & Cabette, 2011: 351 [distribution].

*Macrostemum hyalinum* can be diagnosable by the two longitudinal rows of setae near from medial region of abdominal segment X. The abdominal segment X varies from acuminate to truncate (lateral view). The phallotremal sclerite resembles that of *M. digramma* but doesn't have a pair of dorsal processes. The color pattern on forewings is variable and the apical spot may extend to the edge of the wing.

**Synopsis.** Adults pinned. Forewing length 9.9 mm (n=63). Head with a small medial carina, could be entire blackish; blackish with yellow spots on pleural region and warts; or brownish on dorsal and yellowish on pleural surface. Compound eyes brownish. Scape blackish, brownish or yellowish with ferruginous and golden setae. Maxillary palp entire brownish, yellowish, or with both colors, covered by ferruginous and golden setae. Prothorax entire blackish or with yellow brownish spot on pleural surface. Meso- and metathorax blackish, brownish or with both colors. Legs yellow brownish. Tibial spur formula 2,4,4. Forewing dark and hyaline, with three distinct spots beginning near the middle of the posterior margin and follows towards apical area; the apical spot can extended around the apical area. Discoidal cell present. Radial sector markedly expanded.

Male genitalia. Abdominal segment IX with a medial acuminate keel and long setae covered right and left sides (dorsal view); anterior margin sinuous; posterior margin sinuous, covered by setae and with one deep notch (lateral view). Segment X bilobed

with a wart on rounded apex of each lobe (dorsal view); acuminate or truncate, with two longitudinal rows of setae near from medial region (lateral view). Inferior appendage uniformly wide, covered by small setae throughout its length and longer setae on dorsal surface; basal segment from two to three times the size of apical segment. Phallus arched; apex truncate (lateral view); phallotremal sclerite without dorsal process; anterior margin concave and posterior margin bearing a pair of large rounded prominences (ventral view); phallotrema rounded, concave, on anterior surface of apex of phallus.

**Material examined. BRAZIL: Acre:** Mâncio Lima, Parque Naional da Serra do Sidivisor, Pé da Serra, Base IBAMA, Igarapé Amor, 5.viii.2007, Malaise, A. R. Calor *leg.*, 3 males (alcohol; UFBA); same data except 4.iv.2007, 4 males (alcohol; UFBA); same data except 5.vi.2007, 5 males (alcohol; UFBA); **Bahia:** Camacan, RPPN Serra Bonita, Córrego Chuchuzeiro, 15°23'26.4''S, 39°33'52.2''W, 777m, ix.2009, Malaise 3, A. R. Calor *leg.*, 1 male (alcohol;UFBA); Palmeiras, Lavrinha, 12°35'3.97''S, 41°34'32.30''W, 944m, 15.vii.2011, Malaise, A. M. Silva-Neto, 1 female (alcohol; UFBA); Pindaí, Umburanas, barragem entre Fazenda Paraíso e Fazenda Cachoeira, 14°25'26''S, 42°33'45''W, 924m, 4.vi.2009, luz u.v./branca, A. R. Calor *et al. leg.*, 1 male (pinned; UFBA); Sauípe, mata da sede, 16.x.2007, luz, A. R. Calor *leg.*, 3 males (alcohol; UFBA); Wenceslau Guimarães, E.E.E. Wenceslau Guimarães, sede, Riacho Serra Grande, 13° 35' 43''S, 39° 43' 12''W, 7.x.2010, luz/bandeja, equipe PPGDA *leg.*, 2 males (alcohol; UFBA); same data except 8.x.2010, 1 male (alcohol; UFBA); same data except 10.x.2010, 4 males, 1 female (alcohol; UFBA); **Ceará:** Ubajara, Córrego Murimbeca, 3°49'16.7''S, 40°54'18.9''W, 29.x.2011, luz/bandeja16, Gomes & Duarte *leg.*, 1 male (alcohol; UFBA); **Espírito Santo:** Castelo, Parque Estadual do Forno

Grande, afluente do Rio Caxixe, cachoeira, 20°31'6.5''S, 41°5'11.8''W, 1133m, 30.iii.2011, L.L. Dumas, J. L. Nessimian *leg.*, 1 male (alcohol; DZRJ 3430); **Mato Grosso:** Utiariti, Rio Papagaio, viii.1961, K. Lenko *leg.*, 3 males (alcohol; MZUSP); **Pará:** Rio Xingu, camp (3°39'S, 52°22'W), ca 60km S. Altamira, x.1986, P. Spangler, O. Flint *leg.*, 13 males, 4 females (pinned; MZUSP); **Paraná:** Guaratuba, Estrada dos Castelhanos, ponte do Rio São João, 25°69'55''S, 48° 55'48''W, 280m, 16.iii.2010, R. Cavichioli, O. Evangelista *leg.*, 1 male (alcohol; DZRJ 3421); **Paraíba:** Mamanguape, Represa Caiana, 30.vii.2009, puçá, Calor & Lecci *leg.*, 4 males, 5 females (pinned; UFBA); same data except 29.vii.2009, luz, 4 males (pinned; UFBA); **Pernambuco:** Bonito, Cachoeira Véu de Noiva, 3.viii.2009, Puçá, A. R. Calor *leg.*, 1 male (pinned; UFBA); **Rio de Janeiro:** Angra dos Reis, Fazenda Japuhya, 8.ix.1945, luz, L. T. F. *leg.*, 6 males, 2 females (alcohol; MZUSP); same data except 31.viii.1945, 2 males, 1 female (alcohol; MZUSP); same data except 30.x.1945, 1 female (alcohol; MZUSP); same data except 6.xi.1945, 1 male, 4 females (alcohol; MZUSP); same data except 22.ix.1945, puçá diurno, 1 male (alcohol; MZUSP); same data except, Rio Bracuí, 22°54'28.1''S, 44°24'28.4''W, 10.v.2002, J. L. Nessimian *leg.*, 5 males (alcohol, DZRJ 1405); same data except, 3 males (alcohol; DZRJ 1410); Casemiro de Abreu, Aldeia Velha, RPPN Fazenda Bom Retiro, 22°27'11.6''S, 42°18'1.25''W, 6.viii.2009, D. M. Takiya *leg.*, 3 males, 1 female (alcohol; DZRJ 3425); Itatiaia, PN do Itatiaia, riacho de 1ª ordem ( próx. A Fabrica de Chocolate), 22°27'11.56''S, 44°36'15.01''W, 13.iv.2007, L. L. Dumas, A. P. M. Santos, J. L. Nessimian, N. Ferreira Jr. *leg.*, 1 male (alcohol; DZRJ 2098); Mangaratiba, Reserva Ecológica Rio das Pedras, Rio Grande, -22.992° , -44,105°, 17.viii.2002, J. L. Nessimian, N. Ferreira Jr. *leg.*, 1 male (alcohol; DZRJ 1263); Rio de Janeiro, Jacarepaguá, Parque Estadual Pedra Branca, (mata), 26.x.2001, J. L. Nessimian, N. Ferreira Jr. *leg.*, 1 male (alcohol; DZRJ 1211); **São Paulo:** Cananeia,

Córrego Gruta, ii.2003, F. O. Roque *leg.*, 1 male (alcohol; UFBA); Caraguatatuba, (Res. Flor. – 40mi), 2.iv.1962, Lenko & Reichardt *leg.*, 2 males (alcohol;vMZUSP); Jundiá, Serra do Japi, 20.xii.2007, puçá, A. R. Calor *leg.*, 8 males (pinned; UFBA); same data except córrego da Cachoeira Paraíso, 25.iv.2007, luz u.v./branca, L. Lecci, E. Nascimento *leg.*, 5 males (pinned; UFBA); same data except trilha da Cachoeira Paraíso, riacho após 2ª represa, 23°14'33''S, 46°57'3''W, 1050m, 12.iii.2008, luz u.v./branca, L. S. Lecci & E. A. Nascimento *leg.*, 1 female (alcohol; UFBA); same data except 23.ii.2007; puçá, 1 female (pinned; UFBA); Luiz Antônio, Estação Ecológica do Jataí, 19.ii.2003, puçá, A. R. Calor, C. M. D. Santos *leg.*, 1 male (pinned; UFBA); same data except x.2004, Malaise, E. A. Nascimento, G. A. Silveira, R. M. Silva *leg.*, 1 male (alcohol; UFBA); Salesópolis, Estação Biológica Boracéia, 24-28.iii.2011, Malaise 1, D. C. Ament, R. I. E. Falaschi, P. R. Riccardi *leg.*, 1 female (alcohol; UFBA); São Carlos, Córrego Canchim, 20.vii.2007, Malaise, F. O. Roque *leg.*, 10 males, 135 females (alcohol; UFBA); São Sebastião, Serra do Mar, Rio das Pedras, 28.x.2005, luz, Calor, Silva, Silveira, Pinho *leg.*, 1 male, 1 female (alcohol; UFBA).

**Remarks.** This species has no more type series (see Hollier, 2007) and the type locality may have been wrongly described. According to Pictet (1836) this species is from “Indes orientales” but several authors pointed this species to Brazil. Burmeister (1839) argues that the Brazil is the country origin of *M. hyalinum*, despite Pictet described it from East India. In addition, Ulmer (1905b, 1907a, 1913) pointed Brazil as locality of *M. hyalinum*. We didn't find any work that collected *M. hyalinum* in East India or mentioned this place as type locality. Thus, we state that *M. hyalinum* is from Brazil.

**Distribution.** Brazil (AC, BA, CE, ES, MT, PA, PB, PE, PR, RJ, SP), Colombia, Guyana, Peru, Venezuela.

***Macrostemum maculatum* (Perty, 1833)** (Figs. 9, 10)

Perty, 1833: 129 [Type locality: Brazil, inter St. Pauli civitatem et Villam riccam; ZSM; ♂; as *Phryganea maculata*]; Ulmer, 1907a: 79, Plate 3 [wings; ♀; as *Macronema maculatum*]; Ulmer, 1913: 395, 408 [♂; distribution; as *Macronema maculatum*]; Fischer, 1963: 190 [distribution; as *Macronema maculatum*]; Burmeister, 1983: 273 [Type situation; as *Macronema maculatum*]; Burmeister, 1989: 359-262 [Description of lectotype; ♂; as *Macronema maculatum*]; Flint *et al.*, 1999: 68 [taxonomic notes; distribution]; Paprocki *et al.*, 2004: 8 [distribution]; Calor, 2011: 321 [distribution].

- *Macronema tuberosum*: Ulmer, 1905a: 82, 83 [Type locality: Brazil, Bahia; NMW; ♂; wings]; Ulmer, 1907a: 78, 79, Plate 3 [♂; wings]; Ulmer, 1907b: 165 [distribution]; Flint, 1966: 7, 18, Plate 1 [Lectotype, male genitalia, wings]; Ulmer, 1913: 408 [distribution]; Fischer, 1963: 199 [distribution]; Burmeister, 1983: 273 [to synonymy].

*Macrostemum maculatum* has its genital apparatus similar to *M. digramma*, but has anterior margin of the abdominal segment X sinuous (lateral view). Furthermore, *M. maculatum* has a spot of small setae near from medial region of segment X, the apical segment of inferior appendage is curved with a pair of sclerotized small setae and the phallotremal sclerite has the anterior margin deeply concave (ventral view). The forewing of this species is extremely variable with 3 or 4 spot occurring on apical area.



**Synopsis.** Adults pinned. Forewing length 11.7 mm (n=34). Head blackish with medial carina. Compound eyes brownish. Scape blackish with brown setae. Maxillary palp yellow brownish with brown setae. Prothorax yellowish or blackish with yellow spots on pleural surface. Meso- and metathorax blackish with yellowish or brownish spots. Legs yellow brownish. Tibial spur formula 2,4,4. Forewing dark and hyaline, with 3 or 4 hyaline spots occurring on apical area; the most apical spot can be rounded or longitudinal. Discoidal cell present. Radial sector normal.

Male genitalia. Abdominal segment IX with a rounded medial keel and long setae covered right and left sides (dorsal view); anterior margin sinuous; posterior margin sinuous, covered by setae and with one deep notch (lateral view). Segment X bilobed with a wart near from acuminate apex of each lobe (dorsal view); acuminate, with a spot of small setae near from medial region (lateral view). Inferior appendage uniformly wide and covered by small setae throughout its length; basal segment approximately the size of apical segment and with a small group of long setae at the apex; apical segment curved with a pair of sclerotized small setae. Phallus arched; apex from truncate to acuminate (lateral view); phallosomal sclerite bearing a pair of spine-like dorsal process; anterior margin acutely concave and posterior margin bearing a pair of rounded prominences (ventral view); phallosoma rounded, concave, on anterior or antero-dorsal surface of apex of phallus.

**Material examined. BRAZIL: Bahia:** Camacan, RPPN Serra Bonita, i.2009, Malaise 2, A. R. Calor *leg.*, 1 female (alcohol; UFBA); same data except ii.2009, 1 male (alcohol; UFBA); same data except iii.2009, 2 males (alcohol; UFBA); same data except Córrego Chuchuzeiro, 15°23'26.4''S, 39°33'52.2''W, 777m, iii.2009, Malaise 3, 3 males, 1 female (alcohol; UFBA); same data except iv.2010, 1 male (alcohol; UFBA);

same data except ix.2009, 3 males (alcohol; UFBA); same data except viii.2009, 4 males (alcohol; UFBA); same data except ii.2009, 1 male (alcohol; UFBA); same data except xii.2009, 1 male (alcohol; UFBA); same data except xi.2009, 3 males (alcohol; UFBA); same data except Riacho 1, 15°23'39.5''S, 39°33'44.3''W, 724m, 31.iii.2011, luz/bandeja, França, Quinteiro, Barreto *leg.*, 1 male, 1 female (alcohol; UFBA); same data except Riacho 1 trilha nova, 15°23'35.4''S, 39°33'50.1''W, 773m, 1.iv.2011; 1 male (alcohol; UFBA); same data 2ª cachoeira trilha Bapeba, 2.xi.2009, luz/lençol, A. R. Calor *leg.*, 1 male (pinned UFBA); same data except 3.xi.2009, 1 male (pinned; UFBA); same data except 4.xi.2009, equipe PPGDA *leg.*, 1 male (pinned; UFBA); Santa Terezinha, Pedra Branca, Riacho das Torres, 12°51'00''S, 39°28'48''W, 678m, 4.xi.2010, luz/bandeja, Calor, França, Quinteiro, Costa, Mariano *leg.*, 1 male (alcohol; UFBA); same data except 6.xi.2010, 1 female (alcohol; UFBA); same data except, 7.viii.2009, A. R. Calor *leg.*, 1 male, 1 female (alcohol; UFBA); same data except 28-29.ix.2009, Calor & Cruz *leg.*, 2 males, 1 female (alcohol;UFBA); same data except 9.viii.2008, luz u.v./branca, Calor, Lecci, Pinho, Moretto *leg.*, 1 male (pinned; UFBA); same data except 9.vi.2010, Calor, França, Quinteiro *leg.*, 1 male, 1 female (pinned; UFBA); same data except 6.xi.2010, puçá, D. França *leg.*, 1 male (pinned; UFBA); same data except Área Gamba, 12°52'14.6''S, 39°28'33.7''W, 496m, 7.xi.2010, puçá, D. França *leg.*, 8 males (pinned; UFBA); same data except luz/lençol, A.R. Calor *et al. leg.*, 1 male (pinned; UFBA); Serra do Teimoso, 26.iv.2001, luz, Castro & Bravo *leg.*, 1 male (alcohol; UFBA); Wenceslau Guimarães, E.E.E. Wenceslau Guimarães, sede, Riacho Serra Grande, 13°35'43''S, 39°43'12''W, 531m, 7.x.2010, luz/bandeja, equipe PPGDA *leg.*, 1 male (alcohol; UFBA); **Rio de Janeiro:** Itatiaia, Parque Nacional do Itatiaia, trilha Véu da Noiva para Abrigo Rebouças, 22°25'46.21''S, 44°37'9.74''W, 1250m, ii.2009, M. L. Monné & M. A. Monné *leg.*, 1 male (alcohol, DZRJ 3423); **São**

**Paulo:** Jundiá, Serra do Japi, trilha Cachoera Paraíso, riacho, 23°14'S, 46°57'W, 1050m, 29.viii.2007, luz u.v./branca, Lecci, Moretto, Nascimento *leg.*, 2 males (pinned; UFBA); same data except puçá, 2 males (pinned UFBA); same data except 27.iii.2007, 1 female (pinned; UFBA); same data except 18.xii.2007, 1 male (pinned; UFBA); same data except 20.xii.2007, 1 male (pinned; UFBA); same data except v.2007, L. S. Lecci *leg.*, 1 male (pinned; UFBA); Salesópolis, Estação Biológica Boracéia, 24-28.iii.2011, Malaise 4, D. C. Ament, P. L. Falaschi, P. R. Richardi *leg.*, 1 male (alcohol; UFBA); same data except, Córrego Venerando, 9.xii.2005, armadilha luminosa, C. G. Froehlich *et al. leg.*, 2 males (alcohol; UFBA); same data except 23°39'5''S, 45°53'51''W, 1-4.xii.2008, Amorim, Falaschi, Miranda *leg.*, 2 males (pinned; UFBA); Ubatuba, pé da Serra do Mar, Picinguaba, Rio da Fazenda, 23°20'46.01''S, 44°50'61''W, 52m, 19.iv.2004, J. L. Nessimian, A. A. Huamantico *leg.*, 1 male (alcohol; DZRJ 1732).

**Remarks.** This species is variable both in color pattern of the wings and the form of the phallus. Despite the variation found in the phallus shape, the phallotremal sclerites, which has the same shape for all specimens, were used to group all identified morphotypes. Despite of grouping all specimens in a single species we suspect that this problem will only be solved through further collections, immature associations and use of molecular biology techniques.

**Distribution.** Brazil (BA, RJ, SP).

*Macrostemum negrense* (Flint, 1978) (Fig. 11A – E)

Flint, 1978: 390, 400, 416 [Type locality: Brazil, Amazonas, Rio Negro; AMNH; ♀; wings; as *Macronema negrense*]; Flint *et al.*, 1999: 68 [taxonomic notes; distribution]; Paprocki *et al.*, 2004: 8 [distribution].

*Macrostemum negrense* can be diagnosed by the medial dorsal prominence on the basal segment of inferior appendage. The phallotremal sclerite resembles that of *M. braueri* but has dorsal processes. The forewings are also similar that of *M. braueri* but in *M. negrense* the dark spot on the apical area delimits two boot-shaped hyaline areas.

**Description.** Adults pinned. Forewing length 7.3 mm (n=11). Head brownish on anterior and yellowish on posterior region. Compound eyes brownish. Scape yellowish with ferruginous and yellow setae. Maxillary palp brownish with yellow setae. Prothorax yellow. Meso- and metathorax yellowish. Legs yellow brownish. Tibial spur formula 2,4,4. Forewing mostly hyaline with one dark spot bordering the apical area and delimiting two boot-shaped hyaline areas. Discoidal cell present. Radial sector markedly expanded.

Male genitalia. Abdominal segment IX with a rounded medial keel and long setae covered right and left sides (dorsal view); anterior margin nearly straight; posterior margin sinuous, covered by setae and with one deep notch (lateral view). Segment X bilobed with a wart on rounded apex of each lobe (dorsal view); acuminate, with a row of small setae on superior distal region and another on inferior region (lateral view).

Inferior appendage covered by small setae throughout its length; basal segment approximately the same size of apical segment and with a medial dorsal prominence.

Phallus arched; apex rounded, slightly truncate (lateral view); phallotremal sclerite bearing a pair of spine-like dorsal process; anterior margin concave and posterior

margin bearing a pair of rounded prominences (ventral view); phallotrema rounded, concave, on antero-dorsal surface of apex of phallus.

**Material examined.** **BRAZIL: Amazonas:** 30Km E. de Tapuruquara, 17.i.1978, N. Penny *leg.*, 1 female (pinned; INPA); **Mato Grosso:** Ribeirão Cascalheira, Fazenda Campinha Verde, Rio Suiamissu, 12°48.6'S, 52°07'W, 10.x.2007, luz, Pinho, Mateus, Torati, Silva *leg.*, 4 males, 2 females (alcohol, UFBA); same data except Gleba Maria Tereza “Corgão”, 28.xi.2006, luz, A. R. Calor, R. Silva, S. Mateus *leg.*, 3 males, 10 females (alcohol; UFBA); same data except Córrego Represa, 27.xi.2006, 1 male (pinned; UFBA); same data except 1° córrego (estrada Fazenda Manaus), 2.xii.2006, luz, Calor & Silva *leg.*, 1 female (pinned; UFBA).

**Remarks.** This species was described only by females (Flint, 1978). This is the first time that the male of *M. negrense* is described and illustrated.

**Distribution.** Brazil (AM, MT, PA).

***Macrostemum par* (Navás, 1930)**

Navás, 1930: 74 [Type locality: Brazil, Ipiranga; DEI; ♀; as *Macronema par*]; Flint *et al.*, 1999: 68 [taxonomic notes; distribution]; Paprocki *et al.*, 2004: 8 [distribution].  
Calor, 2011: 321 [distribution].

The holotype of this species was not available for study and specimens were not examined. The information for this species is from Navás (1930).

**Synopsis.** Adults. Head testaceous, with a spot on vertex. Compound eyes blackish. Scape testaceous-yellowish. Maxillary palp testaceous. Prothorax testaceous. Meso- and metathorax dark near the base of wings. Legs yellowish. Forewing mostly hyaline with longitudinal dark patches. Discoidal cell present.

**Material examined.** None.

**Remarks.** According to Navás (1930) this species is similar to *M. santaeritae*. The illustration of the forewing provided by Navás suggest that *Macrostemum par* and *Macrostemum santaeritae* could be synonymous.

**Distribution.** Brazil (SP).

***Macrostemum ramosum* (Navás, 1916)**

Navás, 1916: 28 [Type locality: Brazil, Nueva Friburgo; collection Navás, now lost; sex unknown; as *Macronema tuberosum* Ulm. var. *ramosa*]; Flint *et al.*, 1999: 68 [taxonomic notes; distribution]; Paprocki *et al.*, 2004: 8 [distribution]; Dumas *et al.*, 2009: 359 [distribution].

The holotype of this species was not available for study and specimens were not examined. The information for this species is from Navás (1916).

**Synopsis.** Adults. Forewing with dark and hyaline pattern colors, extremely variable, the presence of three longitudinal patches at the base is the less variable pattern.

**Material examined.** None.

**Distribution.** Brazil (RJ).

*Macrostemum santaeritae* (Ulmer, 1905a) (Fig. 12A – E)

Ulmer, 1905a: 85 [Type locality: Brazil, Rio Preto, zwischen Boquerao und Sta. Rita; NMW; ♀; as “*Macronema Santae Ritae*”]; Ulmer, 1907a: 79, 80 [♀; wings; as “*Macronema Santae Ritae*”]; Ulmer, 1907b: 165 [distribution]; Ulmer, 1913: 397, 408, 412 [distribution]; Fischer, 1963: 196 [distribution]; Flint, 1966: 7, Plate 1 [♀; wings; as *Macronema santaeritae*]; Flint, 1978: 390, 400, 413, 416 [distribution; wings; male genitalia]; Flint *et al.*, 1999: 68 [taxonomic notes; distribution]; Paprocki *et al.*, 2004: 8 [distribution]; Nogueira & Cabette, 2011: 350 [distribution].

The genital apparatus of *M. santaeritae* resembles that of *M. erichsoni*, but in this species the anterior margin of abdominal segment IX is rounded (lateral view). The characters that make this species unique include a pair of dorsal processes on phallosomal sclerite and its trapezoidal shape (ventral view). Furthermore, the anterior wings of *M. santaeritae* are, in general, almost totally hyaline.

**Synopsis.** Adults pinned. Forewing length 10.2 mm (n=13). Head yellow brownish with dark spot on anterior region. Compound eyes brownish. Scape brownish on dorsal

surface, yellowish on ventral surface, with brown setae. Maxillary palp yellow brownish with yellow setae. Prothorax yellowish or blackish with yellow spots on pleural surface. Meso- and metathorax yellowish with brownish spots. Legs yellow brownish. Tibial spur formula 2,4,4. Forewing mostly hyaline with at least a little portion of one dark spot on apical area or with fingerlike-shaped dark patch bordering all apical area. Discoidal cell present. Radial sector normal.

Male genitalia. Abdominal segment IX rounded with long setae covering right and left sides (dorsal view); anterior margin rounded; posterior margin sinuous, covered by setae and with one deep notch (lateral view). Segment X bilobed with a wart on acuminate apex of each lobe (dorsal view); acuminate with a row of small setae on superior distal region and another on inferior region. Inferior appendage uniformly wide, covered by small setae throughout its length and longer setae on dorsal surface; basal segment approximately the same size of apical segment and with longer setae at the base. Phallus arched; apex acuminate (lateral view); phallotremal sclerite bearing a pair of dorsal process; trapezoidal, with anterior margin concave and posterior margin nearly straight (ventral view); phallotrema rounded, concave, on antero-dorsal surface of apex of phallus.

**Material examined. BRAZIL: Acre:** Mâncio Lima, Parque Nacional Serra do Divisor, Igarapé Ar Condicionado, 17.iii.2006, luz, A. R. Calor *leg.*, 1 male (alcohol; UFBA); **Amazonas:** Manaus, 60 Km N. A Res. Campina, 3.iii.1977, 1 male (pinned; INPA); Rio Preto da Eva, AM 010-Km 74, Instituto Adventista Agroindustrial, Igarapé II, próximo da barragem (#30); 2°41'41.3''S, 59°44'6.6''W, 13-16.iv.2008, C. A. S. Azevedo, M. Pepinelli, U. G. Neiss *leg.*, 1 female (alcohol; INPA); **Bahia:** Barreiras, Cachoeira Redondo, 11°53'S, 45°25'W, 573m, 5.vi.2008, luz, Bravo, Menezes, Alvim,



Silva-Neto *leg.*, 1 female (alcohol; UFBA); same data except Rio das Ondas, 12°08'33.4''S, 45°06'14''W, 492m, 15.x.2008, luz UV e branca, Calor, Mariano, Mateus *leg.*, 3 males, 4 females (pinned; UFBA); **Mato Grosso:** Ribeirão Cascalheira, Gleba Maria Tereza “Corgão”, 28.xi.2006, luz, A. R. Calor, R. Silva, S. Mateus *leg.*, 1 male, 1 female (alcohol; UFBA); **Pará:** Rio Xingu, camp (3°39'S, 52°22'W) ca 60 km S. Altamira, x.1986, P. Spangler & O. Flint *leg.*, 5 males, 17 females (pinned; MZUSP).

**Distribution.** Argentina, Brazil (AC, AM, BA, MT, PA).

***Macrostemum subaequalis* (Banks, 1920)** (Fig. 13A – C)

Banks, 1920: 355 [Type locality: Argentina, Misiones, Haut Parana, San Ignacio; MCZ; ♂; as *Macronema subaequalis*]; Fischer, 1963: 163 [distribution]; Flint 1967: 11, 32 [♂]; Flint *et al.*, 1999: 68 [taxonomic notes; distribution]; Paprocki *et al.*, 2004: 8 [distribution].

The holotype of this species was not available for study and specimens were not examined. The information for this species is from Banks (1920) and Flint (1967). The male genitalia illustration was redrawn from Flint (1967).

**Synopsis.** Adults. Forewing length 22 mm. Head golden, with golden setae and vertex black. Scape black. Maxillary palp black on base, pale beyond, the second, third, and fourth joints short, subequal. Prothorax blackish. Meso- and metathorax blackish. Legs yellowish, with tips of tarsi dark. Forewing dark brown, with two large, costal, yellowish spots, one beyond middle, other near stigmal region. Discoidal cell present.

Male genitalia. Abdominal segment IX with anterior margin sinuous; posterior margin sinuous, covered by setae and with one deep notch (lateral view). Segment X acuminate with apical setae (lateral view). Inferior appendage covered by setae and uniformly wide throughout its length; basal segment about three times the size of apical segment. Apex of phallus truncate (lateral view); phallotremal sclerite wing shaped (ventral view).

**Material examined.** None.

**Distribution.** Argentina.

*Macrostemum surinamense* (Flint, 1974) (Fig. 13D – G)

Flint, 1974: 108, Plate 2 [Type locality: Surinam, Coppename River, Bakhuis Mountains, camp III; RNH; ♀; wings; as *Macronema surinamense*]; Flint, 1978: 389, 413, 416 [distribution, wings, ♂, *Macronema near surinamense*]; Flint *et al.*, 1999: 69 [taxonomic notes; distribution]; Paprocki *et al.*, 2004: 8 [distribution].

The holotype of this species was not available for study and specimens were not examined. The information for this species is from Flint (1974) and Flint (1978). The male genitalia illustration was redrawn from Flint (1978).

**Synopsis.** Adults. Forewing length 13 mm. Head fuscous. Scape infusate. Prothorax yellow. Meso- and metathorax fuscous. Forewing brownish-black with pale golden-yellow markings.

Male genitalia. Abdominal segment IX with a medial acuminate keel and long setae covered right and left sides (dorsal view); anterior margin nearly straight; posterior margin sinuous, covered by setae (lateral view). Segment X bilobed with a wart on rounded apex of each lobe (dorsal view); acuminate, with a row of small setae on superior distal region and a spot of small setae on inferior region (lateral view). Inferior appendage uniformly wide throughout its length; basal segment about same size of apical segment. Phallus arched; apex truncate with acuminate antero-ventral prominence (lateral view).

**Material examined.** None.

**Distribution.** Brazil (AM), Surinam.

***Macrostemum trigramma* (Navás, 1916)**

Navás, 1916: 29 [Type locality: Brazil, Nueva Friburgo; collection Navás, now lost; ♀; as *Macronema trigramma*]; Flint *et al.*, 1999: 69 [taxonomic notes; distribution]; Paprocki *et al.*, 2004: 8 [distribution]; Dumas *et al.*, 2009: 359 [distribution]; - *pullatum* (Navás, 1932): 64, 65 [Type locality: Brazil, Rio de Janeiro, Barão Homem de Mello; DEI; ♀; as *Macronema pullatum*]; Flint & Bueno Soria, 1982: 369 [to synonymy].

The holotype of this species was not available for study and specimens were not examined. The information for this species is from Navás (1916).

**Synopsis.** Adult. Head blackish. Compound eyes brownish. Scape black. Maxillary palp with the first three articles testaceous-yellowish and the rest blackish. Prothorax blackish. Meso- and metathorax blackish. Legs brownish. Tibial spur formula 1,4,4. Forewing mostly dark with three longitudinal spots. Discoidal cell present.

**Material examined.** None.

**Distribution.** Brazil (RJ).

***Macrostemum triste* (Navás, 1916)**

Navás, 1916: 29, 30 [Type locality: Brazil, Nueva Friburgo; collection Navás, now lost; ♀; as *Macronema triste*]; Flint *et al.*, 1999: 69 [taxonomic notes; distribution]; Paprocki *et al.*, 2004: 8 [distribution]; Dumas *et al.*, 2009: 359 [distribution].

The holotype of this species was not available for study and specimens were not examined. The information for this species is from Navás (1916).

**Synopsis.** Adult. Head testaceous. Compound eyes brownish. Scape black. Maxillary palp with the first three articles testaceous and the rest blackish. Prothorax blackish. Meso- and metathorax blackish. Legs testaceous. Tibial spur formula 1,4,4. Forewing dark-ferruginous. Discoidal cell present.

**Material examined.** None.

**Distribution.** Brazil (RJ).

***Macrostemum ulmeri* (Banks, 1913)** (Figs. 7, 8)

Banks, 1913: 237, 238 [Type locality: Rio Negro, Colombia; MCZ; ♂; as *Macronema ulmeri*]; Ulmer, 1907a: 76, Plate 3 [wings, as *Macronema hyalinum* var.]; Fischer, 1963: 199 [distribution]; Flint 1967: 11, 32, Plate 1 [holotype wings; ♂]; Flint, 1974: 105, 107, Plate 1 [♂; wings; distribution]; Flint, 1978: 388, 400, 413, 416 [distribution; ♂; wings; as *Macronema ulmeri*]; Flint, 1991: 79, 108 [♂, wings, distribution]; Flint *et al.*, 1999: 69 [taxonomic notes; distribution]; Blahnik *et al.*, 2004: 4 [distribution]; Paprocki *et al.*, 2004: 8 [distribution]; Nogueira & Cabette, 2011: 350 [distribution].

- *siolii* (Marlier, 1964). Marlier, 1964: 136 – 140 [Type locality: unespecified, by inference Brazil, São Paulo de Olivença, Émissaire du source, Igarapé-Jaratuba; IRSNB; ♂; larva and pupa; as *Macronema siolii*]; Flint, 1978: 388 [to synonymy].

*Macrostemum ulmeri* can be diagnosable by the two longitudinal rows of setae near from medial region of abdominal segment X. The abdominal segment X varies from acuminate to truncate (lateral view). The phallotremal sclerite resembles that of *M. digramma* but doesn't have a pair of dorsal processes. The forewings color pattern is variable and the apical spot may extend to the edge of the wing.

**Synopsis.** Adults pinned. Forewing length 9.9 mm (n=63). Head with a small medial carina, could be entire blackish; blackish with yellow spots on pleural region and warts; or brownish on dorsal and yellowish on pleural surface. Compound eyes brownish. Scape blackish, brownish or yellowish with ferruginous and golden setae. Maxillary palp entire brownish, yellowish, or with both colors, covered by ferruginous and golden setae. Prothorax entire blackish or with yellow brownish spot on pleural surface. Meso- and metathorax blackish, brownish or with both colors. Legs yellow brownish. Tibial spur formula 2,4,4. Forewing dark and hyaline, with three distinct spots beginning near the middle of the posterior margin and follows towards apical area; the apical spot can extended around the apical area. Discoidal cell present. Radial sector markedly expanded.

Male genitalia. Abdominal segment IX with a medial acuminate keel and long setae covered right and left sides (dorsal view); anterior margin sinuous; posterior margin sinuous, covered by setae and with one deep notch (lateral view). Segment X bilobed with a wart on rounded apex of each lobe (dorsal view); acuminate or truncate, with two longitudinal rows of setae near from medial region (lateral view). Inferior appendage uniformly wide, covered by small setae throughout its length and longer setae on dorsal surface; basal segment from two to three times the size of apical segment. Phallus arched; apex truncate (lateral view); phallotremal sclerite without dorsal process; anterior margin concave and posterior margin bearing a pair of large rounded prominences (ventral view); phallotrema rounded, concave, on anterior surface of apex of phallus.

**Material examined. BRAZIL: Acre:** Mâncio Lima, Parque Nacional Serra do Divisor, Pé da Serra, Base IBAMA, Igarapé Amor, 5.ix.2007, Malaise, A. R. *Calor leg.*, 42

males, 54 females (alcohol; UFBA); same data except 5.x.2007, 13 males, 17 females (alcohol; UFBA); same data except 5.viii.2007, 42 males, 31 females (alcohol; UFBA); same data except 4.iv.2007, 33 males (alcohol; UFBA); same data except 5.vi.2007, 34 males, 24 females (alcohol; UFBA); same data except 5.xi.2007, 31 males, 10 females (alcohol; UFBA); same data except 5.vii.2007, 5 males (alcohol; UFBA); **Amazonas:** Manaus, Ponta Negra, 19.xi.1976, N. Penny *leg.*, 1 male (pinned; INPA); Rio Preto da Eva, Ramal Baixo Rio – Estrada Poliana, Igarapé do Geladinho (#38), 2°46'48.2''S, 59°39'9.6''W, 24-27.ix.2008, luz (pensilvania), J. O. da Silva, C. Monteiro, C. Menezes *leg.*, 2 males (alcohol; INPA); **Mato Grosso:** Ribeirão Cascalheira, Ribeirão Bonito, 12°52.6'S, 51°53''W, 12.ix.2007, luz, Pinho & Mateus *leg.*, 1 female (alcohol; UFBA); **Pará:** Rio Xingu, camp (3°39'S, 52°22'W) ca 60km S. Altamira, x.1986, P. Spangles, O. Flint *leg.*, 2 male (pinned.; MZUSP); Cachimbo, 12-16.iv.1956, L. Travassos & S. Medeiros *leg.*, 1 male (alcohol; MZUSP); **Rôndonia:** Porto Velho, Parque Natural Municipal Porto Velho, 2.ix.2005, P. V. Cruz *leg.*, 1 female (alcohol; MZUSP); **São Paulo:** Luiz Antônio, Estação Ecológica Jataí, 1-14.x.2004, Malaise, E. A. Nascimento, G. A. Silveira, R. M. Silva *leg.*, 2 females (alcohol; UFBA); same data except 10.iii.2006, 1 female (alcohol; UFBA); São Carlos, Córrego Canchim, 20.xii.2007, Malaise, F. O. Roque *leg.*, 2 females (alcohol; UFBA); **COSTA RICA: Heredia:** Est. Biol. La Selva, Rio Puerto Viejo, 10.440N, 84.012W, 30m, 3-13.vii.1986, M. M. Chavarria *leg.*, 1 male, 1 female (pinned; MZUSP); same data except 10.ix.1986, 1 female (pinned; MZUSP).

**Remarks.** *Macrostemum ulmeri* was described by Banks (1913). Although Ulmer (1907a) considers the wings color pattern of *M. ulmeri* a variation of *M. hyalinum* wings, Banks described *M. ulmeri* as a distinct species without examine genital

characters. We examine the male genital apparatus of this morphotype and concluded that *M. ulmeri* are synonymous of *M. hyalinum*. Therefore, the descriptions and illustrations presents in this work for *M. ulmeri* are the same of *M. hyalinum*.

**Distribution.** Brazil (AC, AM, MG, MT, PA, RO, RR, SP), Colombia, Costa Rica, Ecuador, Honduras, Panama, Peru, Surinam.

### Key to males of Neotropical *Macrostemum*

Herein are present a dichotomous key based on the male genitalia characters:

1. Basal segment of inferior appendage distinctly bigger than apical segment (Figs. 1B, 3B, 4B, 5B, 7A, 7B, 9A, 13A)..... 2  
     Basal segment of inferior appendage about same size of apical segment (Figs. 2B, 6B, 11B, 12B, 13D)..... 8
- 2(1). Abdominal segment IX, as viewed laterally, with anterior margin nearly straight (Fig. 5B)..... *Macrostemum digramma*  
     Abdominal segment IX, as viewed laterally, with anterior margin rounded or sinuous (Figs. 1B, 3B, 4B, 7A, 7B, 9A, 13A)..... 3
- 3(2). Apical segment of inferior appendage curved with a pair of sclerotized small setae (Fig. 9A). Phallotremal sclerite bearing a pair of spine-like dorsal processes (Fig. 9E)..... *Macrostemum maculatum*  
     Apical segment of inferior appendage not curved, without a pair of sclerotized small setae (Figs. 1B, 3B, 4B, 7A, 7B, 13A). Phallotremal sclerite not bearing a pair of spine-like dorsal processes (Figs. 1D, 3D, 4D, 7D, 13B)..... 4
- 4(3). Abdominal segment X with a distinctly pair of quadrate-like warts (Fig. 3B). Phallotremal sclerite bearing a pair of laminated dorsal processes (Fig. 3D)..... *Macrostemum arcuatum*  
     Abdominal segment X with warts and setae, but without a pair of quadrate-like warts (Figs. 1B, 4B, 7A, 7B, 13A). Phallotremal sclerite not bearing a pair of laminated processes (Figs. 1D, 4D, 7D, 13B)..... 5
- 5(4). Apex of phallus, as viewed laterally, truncate with basal prominence (Fig. 4C) or acuminate (Fig. 1C)..... 6  
     Apex of phallus, as viewed laterally, truncate, without prominences (Figs. 7C, 13C)..... 7



- 6(5). Abdominal seg. IX, as viewed laterally, with anterior margin sinuous.  
 Abdominal seg. X truncate (Fig. 1B). Apex of phallus acuminate (Fig. 1C)..... *Macrostemum nigrum*, n. sp.  
 Abdominal seg. IX, as viewed laterally, with anterior margin rounded.  
 Abdominal seg. X acuminate (Fig. 4B). Apex of phallus truncate with a long acuminate antero-ventral prominence (Fig. 4C)..... *Macrostemum braueri*
- 7(5). Abdominal seg. X, as viewed laterally, with a conspicuous wart on superior region (Fig. 13A)..... *Macrostemum subaequalis*  
 Abdominal seg. X, as viewed laterally, with two longitudinal rows of setae on medial region (Figs. 7A, 7B).... *Macrostemum hyalinum*; *Macrostemum ulmeri*
- 8(1). Abdominal segment IX, as viewed laterally, with anterior margin nearly straight (Figs. 11B, 13D)..... 9  
 Abdominal segment IX, as viewed laterally, with anterior margin rounded or sinuous (Figs. 2B, 6B, 12B)..... 10
- 9(8). Abdominal segment IX, as viewed laterally, with posterior margin sinuous (Fig. 13D). Apex of phallus, as viewed laterally, truncate, with acuminate antero-ventral prominence (Fig. 13F)..... *Macrostemum surinamense*  
 Abdominal segment IX, as viewed laterally, with posterior margin sinuous, with a deep notch (Fig. 11B). Apex of phallus, as viewed laterally, rounded, slightly truncate (Fig. 11C)..... *Macrostemum negrense*
- 10(8). Abdominal segment IX, as viewed laterally, with anterior margin rounded (Figs. 2B, 12B)..... 11  
 Abdominal segment IX, as viewed laterally, with anterior margin sinuous (Fig. 6B)..... *Macrostemum erichsoni*
- 11(10). Apex of phallus, as viewed laterally, truncate, with rounded antero-ventral prominence (Fig. 2C). Phallotremal sclerite without dorsal processes, with a medial prominence on anterior margin in ventral view (Fig. 2D).....  
*Macrostemum bravoii*, n. sp.  
 Apex of phallus, as viewed laterally, acuminate (Fig. 12C). Phallotremal sclerite bearing a pair of dorsal processes (Fig. 12D)..... *Macrostemum santaeritae*

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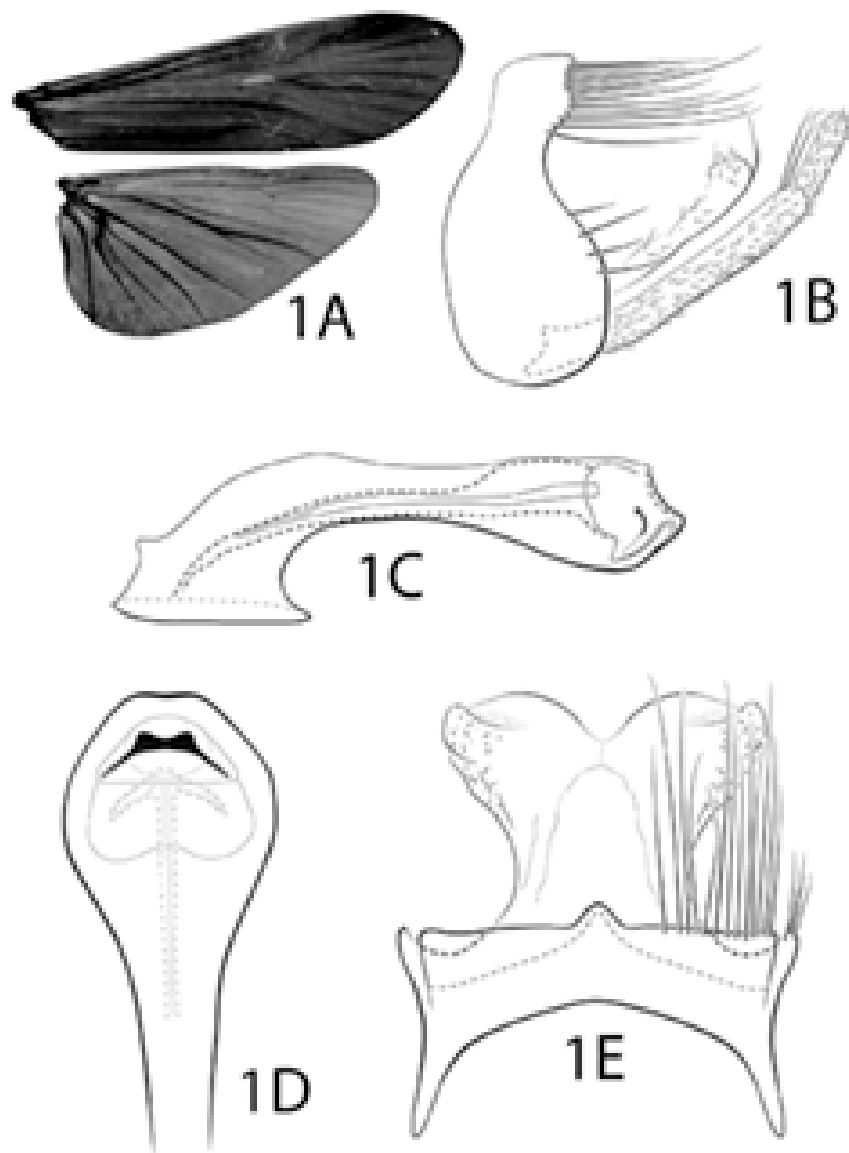
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**Figure 1:** *Macrostromus nigrus*, new species. A: right wings; B: male genitalia, lateral view; C: phallus, lateral view; D: apex of phallus, ventral view; E: male genitalia, dorsal view.

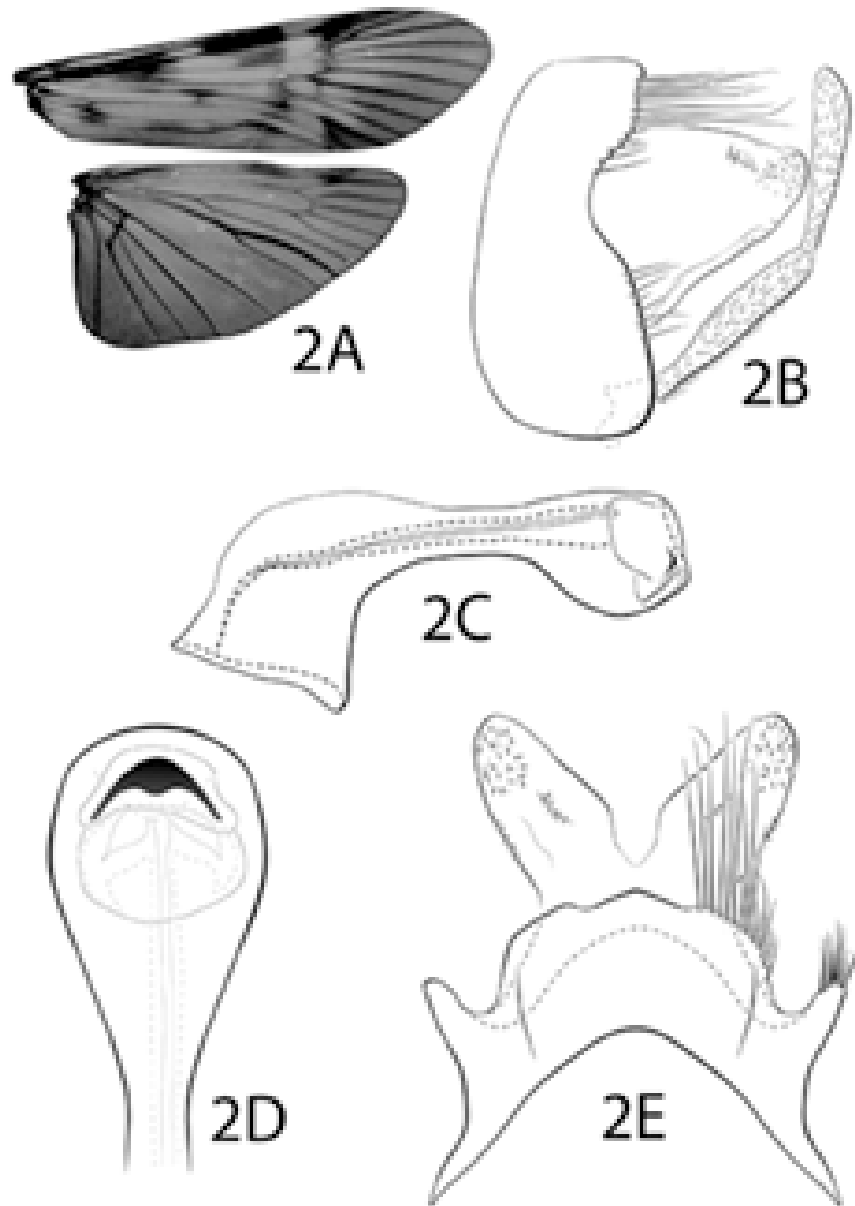


Figure 2: *Macrostenus bruxel*, new species. A: right wings; B: male genitalia, lateral view; C: phallus, lateral view; D: apex of phallus, ventral view; E: male genitalia, dorsal view.

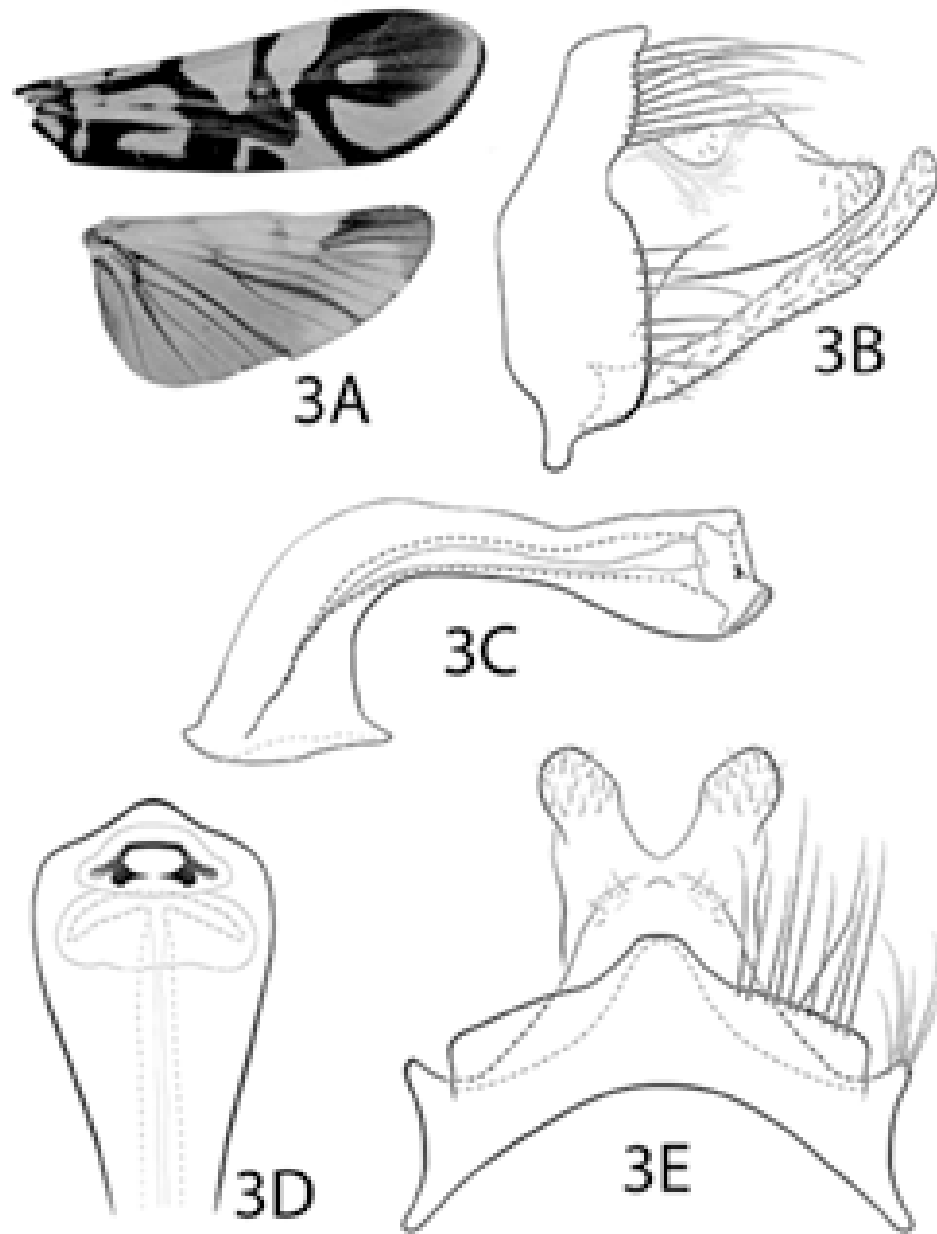


Figura 3: *Microstomum arcuatum*. A: right wings; B: male genitalia, lateral view; C: phallus, lateral view; D: apex of phallus, ventral view; E: male genitalia, dorsal view.

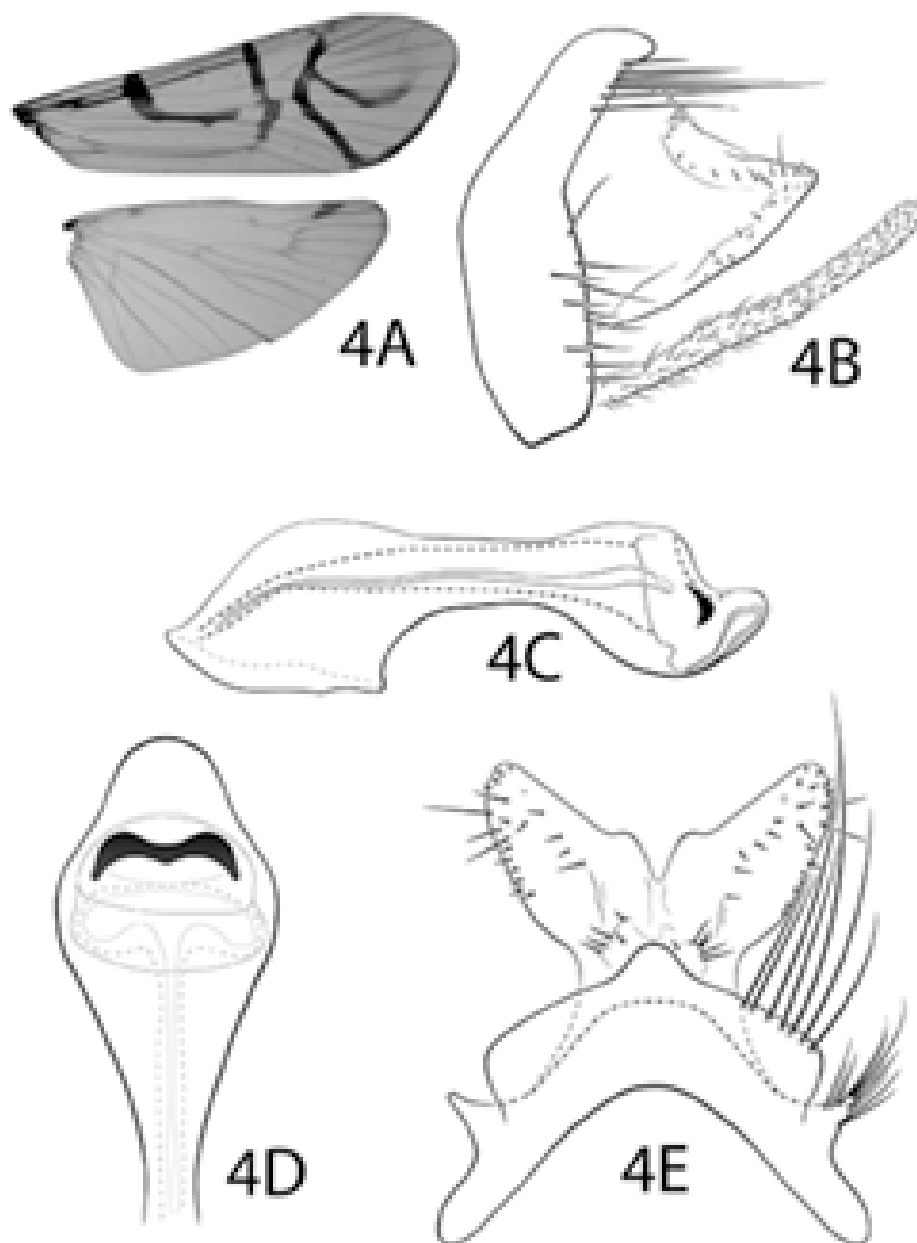


Figure 4: *Microstammus fraseri*. A: right wings; B: male genitalia, lateral view; C: phallus, lateral view; D: apex of phallus, ventral view; E: male genitalia, dorsal view.

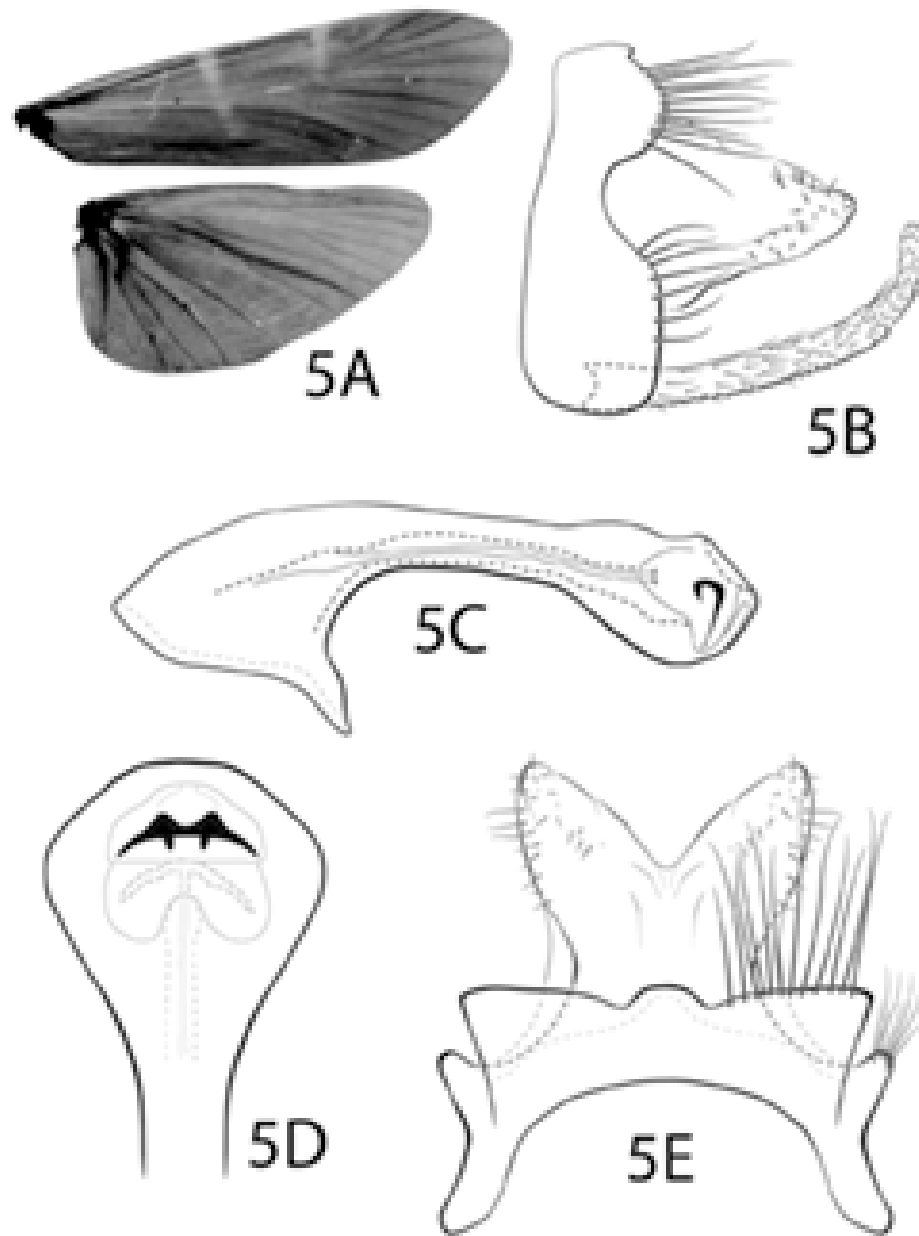


Figure 5: *Microstemon algramma*. A: right wings; B: male genitalia, lateral view; C: phallus, lateral view; D: apex of phallus, ventral view; E: male genitalia, dorsal view.

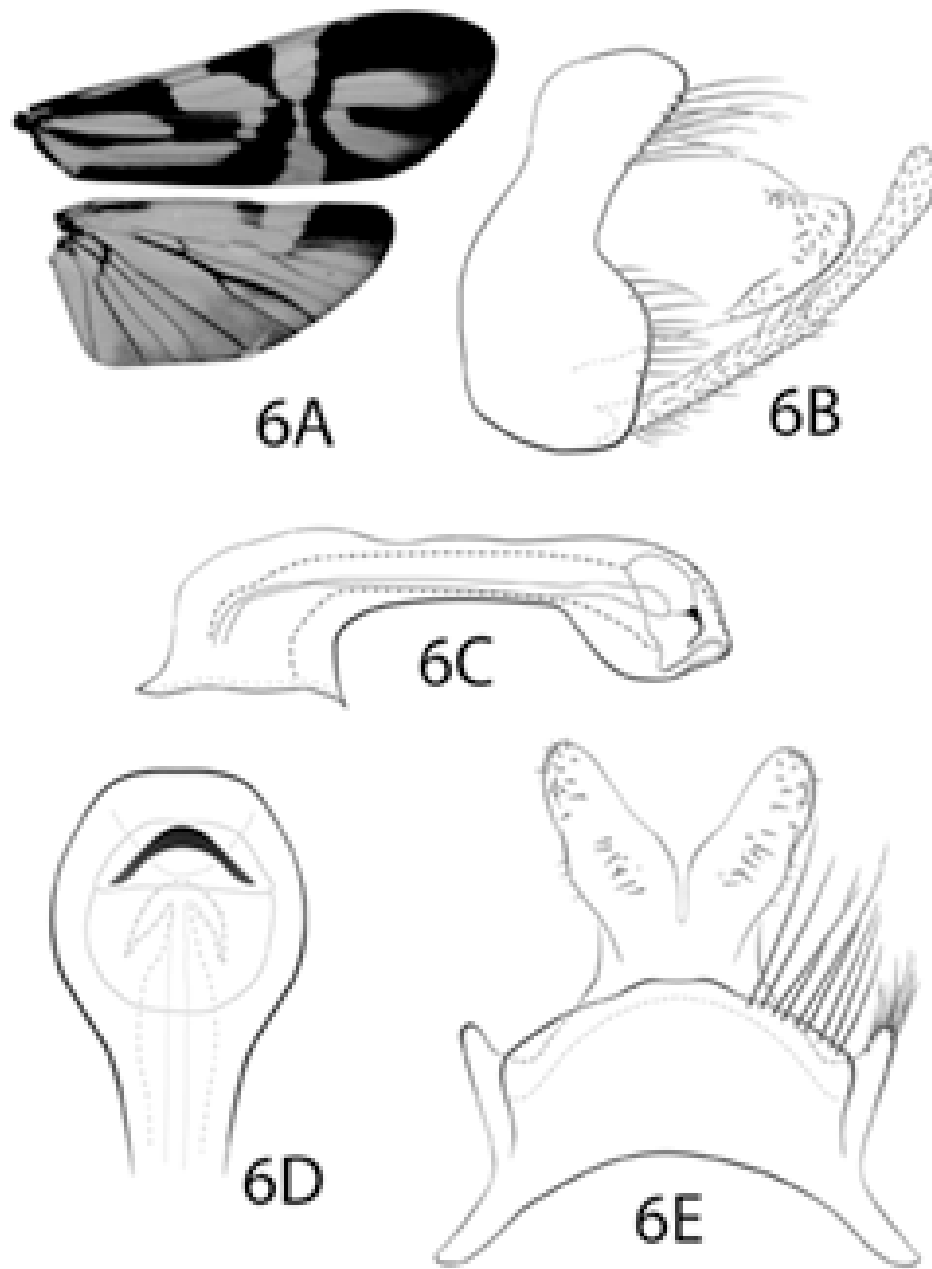


Figure 6: *Macrosetomus erichsoni*. A: right wings; B: male genitalia, lateral view; C: phallus, lateral view; D: apes of phallus, ventral view; E: male genitalia, dorsal view.

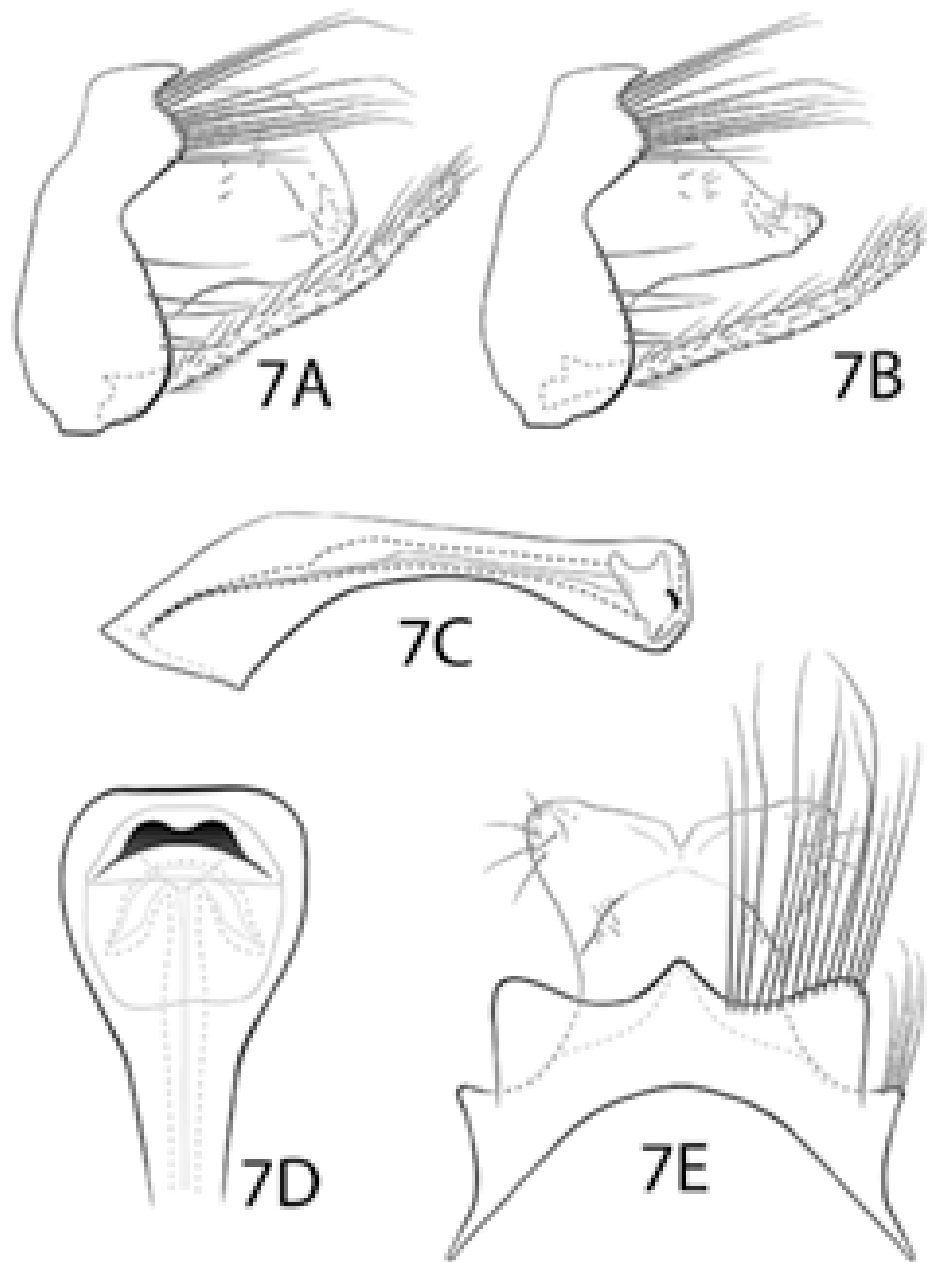


Figura 7: *Macrosetomus lyulinus*, *Macrosetomus almeri*. A, B: male genitalia, lateral view; C: phallus, lateral view; D: apex of phallus, ventral view; E: male genitalia, dorsal view.

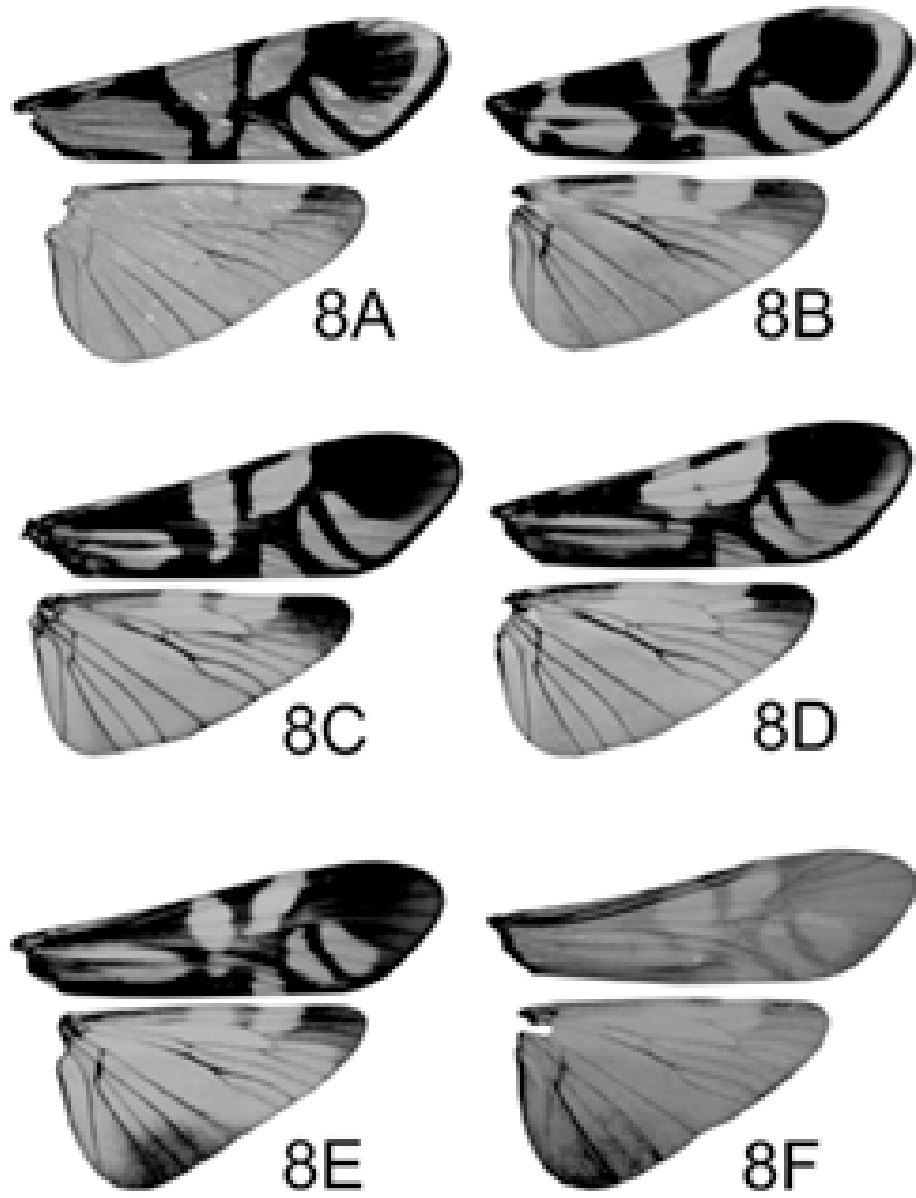


Figura 8: *Macrostomus hyalinus*, *Macrostomus alnevi*. A - F: tipos de wings.



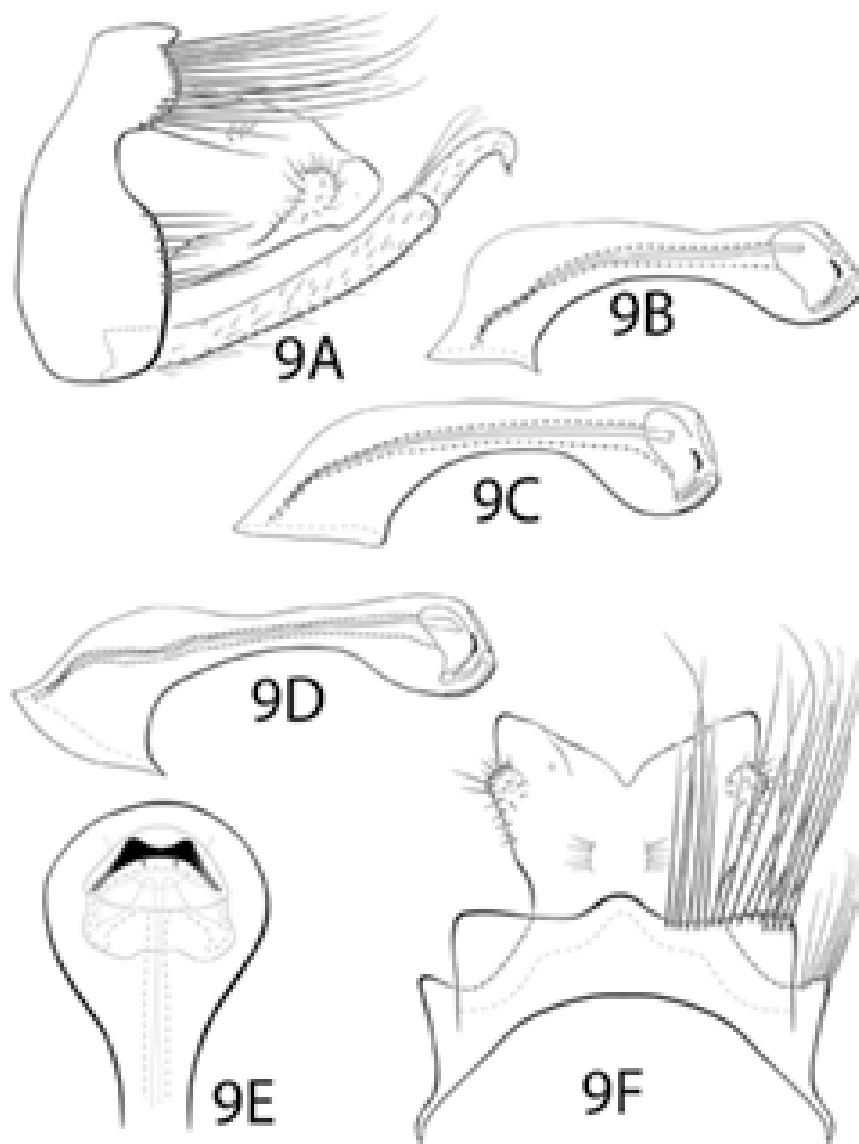


Figura 9: *Microstemon maculatum*. A: male genitalia, lateral view; B - D: types of phallus, lateral view; E: apex of phallus, ventral view; F: male genitalia, dorsal view.

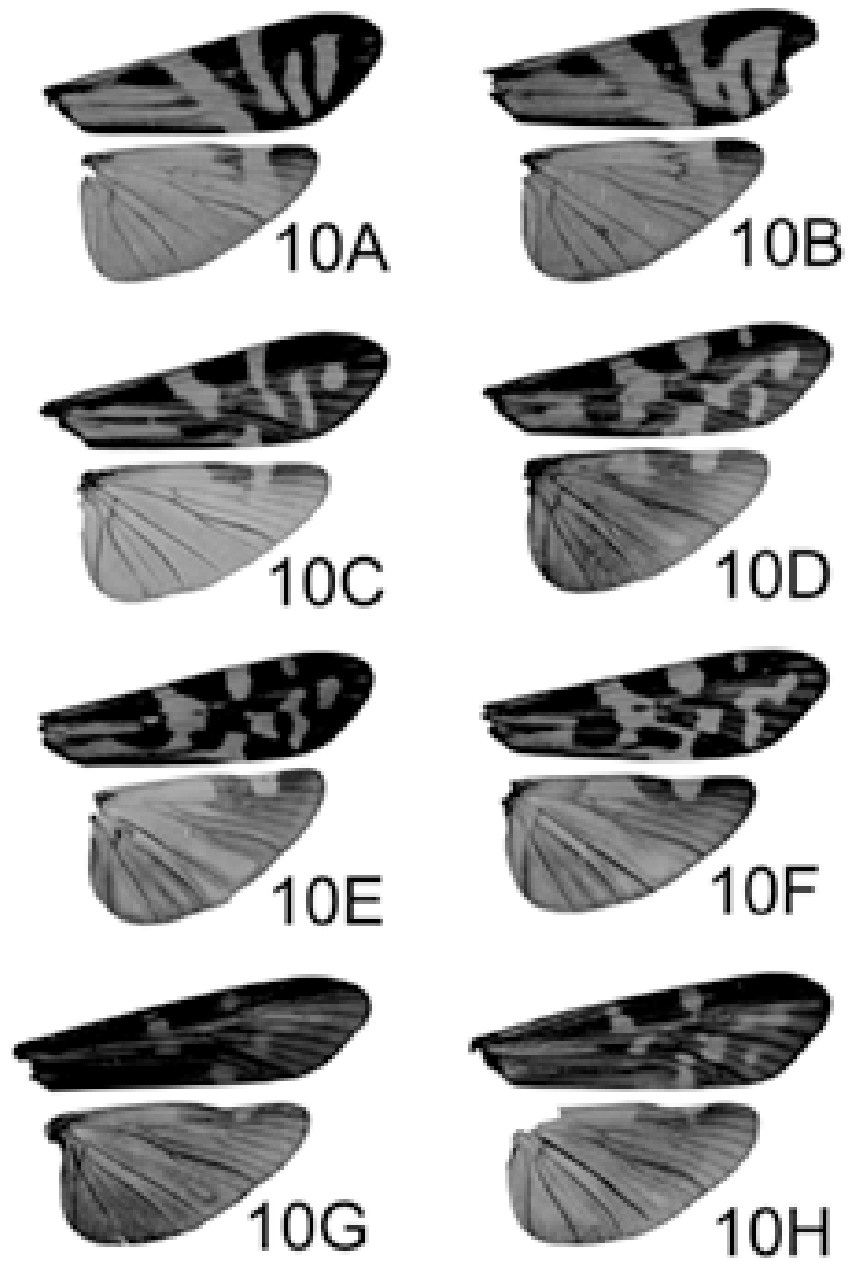
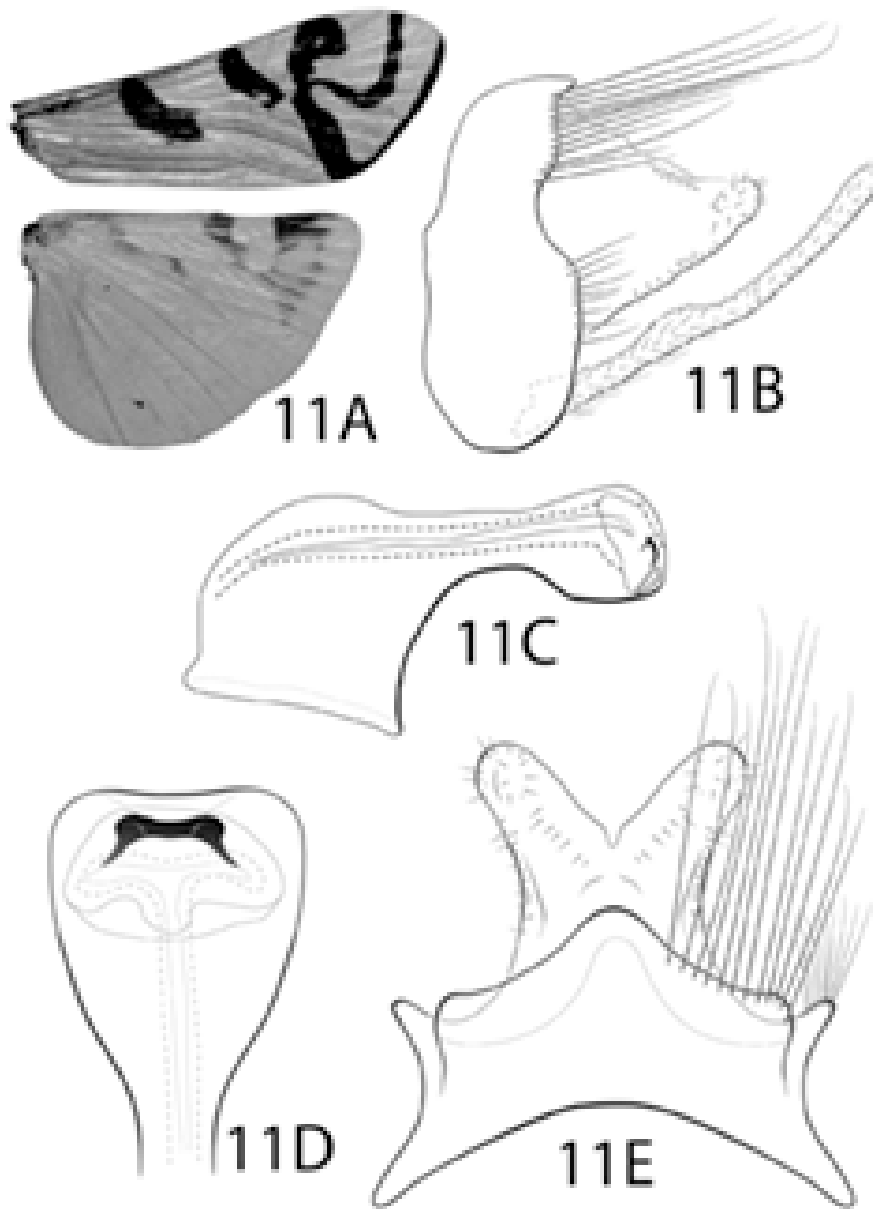
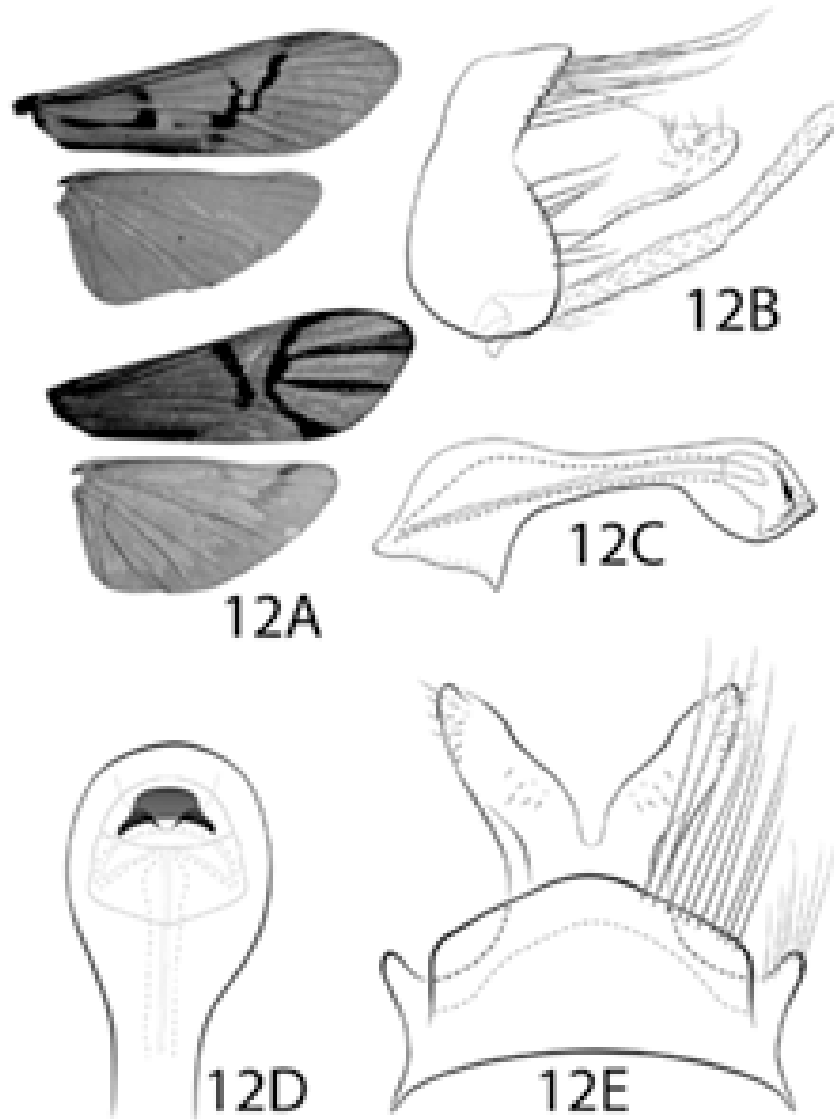


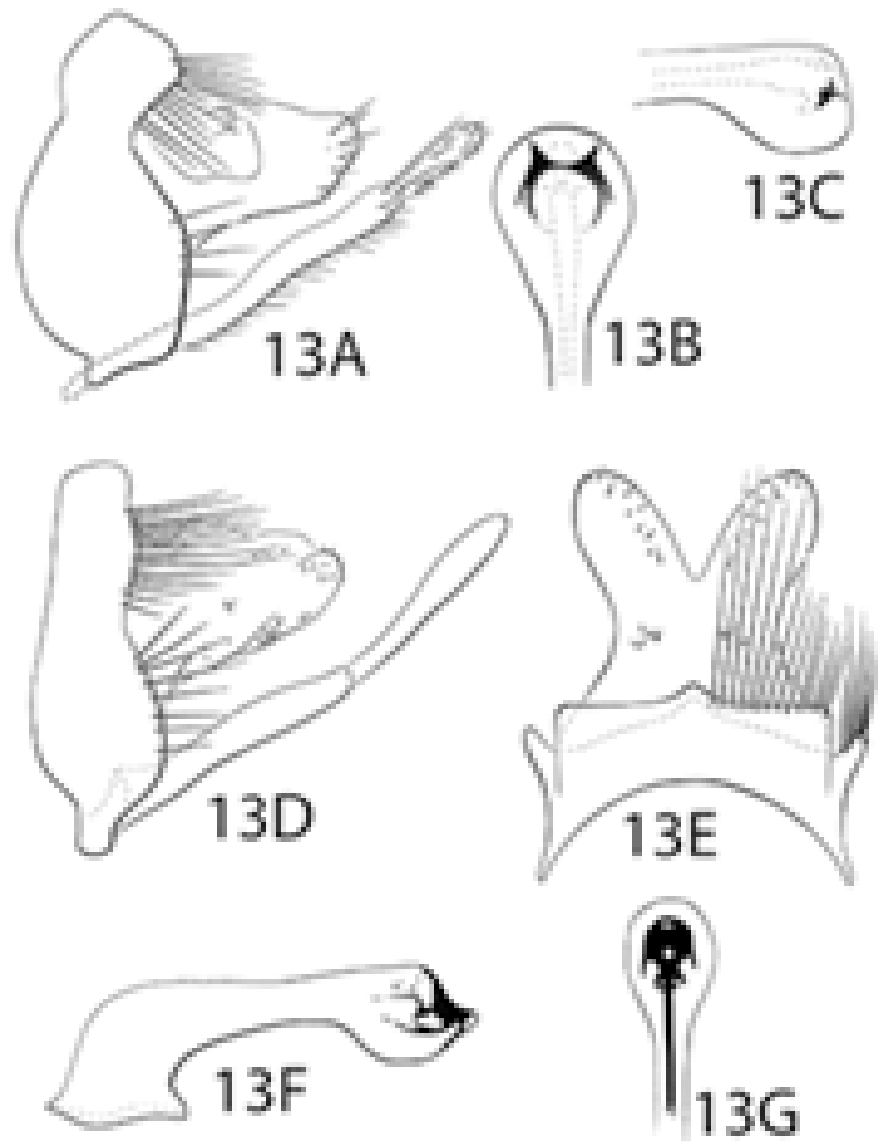
Figure 10: *Macrostomum maculatum*. A - H: types of wings.



**Figure 11:** *Macrostemum negressa*. A: right wings; B: male genitalia, lateral view; C: phallus, lateral view; D: apex of phallus, ventral view; E: male genitalia, dorsal view.



**Figure 12:** *Microstromum castaneipes*. A: right wings; B: male genitalia, lateral view; C: phallus, lateral view; D: apex of phallus, ventral view; E: male genitalia, dorsal view.



**Figure 13.** *Macrostromus subaeneus*. A) male genitalia, lateral view; B) apex of phallus, ventral view; C) apex of phallus, lateral view. *Macrostromus curvicauda*. D) male genitalia, lateral view; E) male genitalia, dorsal view; F) phallus, lateral view; G) apex of phallus, ventral view.

## Considerações finais

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A realização deste trabalho demonstrou que o padrão de cores, das asas anteriores das espécies neotropicais de *Macrostemum*, possui um elevado grau de variação intraespecífica. Essa observação concorda com trabalhos anteriormente publicados de pesquisadores como Oliver S. Flint Jr. e Georg Ulmer. Esse caráter deve ser considerado na descrição de espécies do gênero e auxilia na identificação das mesmas, porém não deve ser utilizado como único caráter diagnóstico.

A análise de uma grande série de espécimes, especialmente quando de distintas localidades, pode revelar padrões de variação fenotípica ainda não assinalados para espécies já descritas. Essas variações podem ocorrer tanto no padrão de cores do tórax, cabeça e asas, quanto na morfologia de algumas estruturas da genitália masculina como os segmentos IX e X. *M. maculatum* apresentou acentuadas variações no formato do falo, além de um elevado polimorfismo no padrão de cores das asas anteriores. Sendo assim, a possibilidade da espécie ser um complexo de espécies deve ser considerada e a observação de caracteres morfológicos de imaturos, comportamento e dados moleculares pode ser útil para uma melhor compreensão do grupo.

O caráter menos variável entre indivíduos de uma mesma espécie é a forma do esclerito falotremal em vista ventral. Apesar disso, recomenda-se a utilização de caracteres de toda genitália masculina na determinação de espécies de *Macrostemum*. A inclusão desses caracteres joga uma nova luz na taxonomia do gênero. Dessa forma, devem ser indispensáveis na descrição de novas espécies e caracterizados e ilustrados em publicações subsequentes. Através deste trabalho, foi possível caracterizar e ilustrar nove espécies neotropicais e identificar *M. ramosum*, *M. trigramma*, *M. triste*, como espécies com taxonomia problemática, devido à ausência de série tipo e descrições incompletas.

Atualmente, o gênero *Macrostemum* é conhecido para 15 estados brasileiros, com novos registros para Acre, Ceará, Espírito Santo, Paraíba, Pernambuco e Rondônia.

Apesar da ausência de registro em outros estados, o gênero possui potencial de distribuição por todo Brasil. A região Nordeste ainda não apresenta registros do gênero para o Sergipe, Alagoas, Rio Grande do Norte, Piau , Maranh o, no entanto acredita-se na sua distribui o por toda a regi o. A realiza o de invent rios pode revelar novos padr es de distribui o das esp cies, assim como novas esp cies.

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## Anexo I

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include the last date when you see that site, as it can be moved or deleted from that address in the future