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TAXONOMIA DE *Persis* STÅL, 1862
(HEMIPTERA: AUCHENORRHYNCHA: FULGOROMORPHA: DERBIDAE) NA
REGIÃO NEOTROPICAL

INEZITA CANTANHEDE LIMA NETA

Manaus, Amazonas

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REGIÃO NEOTROPICAL**

ORIENTADORA: DRA. ROSALY ALE-ROCHA

COORIENTADORA: DRA. EDUARDA FERNANDA GOMES VIEGAS

Dissertação apresentada à Coordenação do Programa de Pós-Graduação em Entomologia do INPA, como parte dos requisitos para obtenção do título de Mestre em Ciências Biológicas, área de concentração em Entomologia.

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Dra. Jeane Marcelle C. do Nascimento

Universidade Federal do Pará (UFPA)

Dr. Alexandre Cruz Domahovski

Universidade Federal do Rio de Janeiro (UFRJ)

Dr. Rafael Aquino Heleodoro

Universidade Federal do Amazonas (UFAM)

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Sinopse:

Foi realizado um estudo taxonômico com *Persis* Stål da região Neotropical, com ênfase para o Brasil. Seis espécies foram identificadas, três delas foram revisadas, com adição de novos registros de ocorrência e mais três espécies novas foram descritas no gênero. Além disso, foram elaboradas chaves ilustradas para os subgêneros e para as espécies de cada grupo, com mapas de distribuição atualizados.

Palavras-chave: Cigarrinhas, espécies novas, Fulgoroidea, taxonomia

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*Que a força do medo que tenho
não me impeça de ver o que anseio
que a morte de tudo em que acredito
não me tape os ouvidos e a boca
pois metade de mim é o que eu grito
a outra metade é silêncio*

*Que a música que ouço ao longe
seja linda ainda que tristeza
que o homem que amo seja pra sempre amado
mesmo que distante
pois metade de mim é partida
a outra metade é saudade.*

*Que as palavras que falo
não sejam ouvidas como prece nem repetidas com fervor
apenas respeitadas como a única coisa
que resta a uma mulher inundada de sentimentos
pois metade de mim é o que ouço
a outra metade é o que calo*

*Que a minha vontade de ir embora
se transforme na calma e paz que mereço
que a tensão que me corrói por dentro
seja um dia recompensada
porque metade de mim é o que penso
a outra metade um vulcão*

*Que o medo da solidão se afaste
e o convívio comigo mesmo se torne ao menos suportável
que o espelho reflita meu rosto num doce sorriso
que me lembro ter dado na infância
pois metade de mim é a lembrança do que fui
a outra metade não sei*

*Que não seja preciso mais do que uma simples alegria
pra me fazer aquietar o espírito
e que o seu silêncio me fale cada vez mais
pois metade de mim é abrigo
a outra metade é cansaço*

[...]

RESUMO

Persis Stål é um gênero do Novo Mundo, que possui atualmente 12 espécies válidas distribuídas em três subgêneros: *Persis* (*Anapersis*) (seis spp.), *Persis* (*Persis*) (cinco spp.), e *Persis* (*Eritalaena*) (monotípico). Tanto *Persis* (*Persis*), quanto *Persis* (*Eritalaena*) possuem registros apenas para a região Neotropical. O último trabalho realizado que contribuiu com espécies novas para o grupo foi em 1986 por O'Brien. O objetivo deste trabalho foi realizar um estudo taxonômico das espécies de *Persis* Stål (Hemiptera, Derbidae) que ocorrem na Região Neotropical. Os espécimes estudados foram obtidos a partir de Coleções Zoológicas Nacionais e fotografias fornecidas por algumas coleções estrangeiras. Neste estudo foram fornecidas chaves de identificação ilustradas, mapas com registros geográficos, descrições e redescrições de espécies. Durante as análises, foram identificadas seis espécies: *Persis* (*Persis*) *pugnax* Stål, *Persis* (*Persis*) *stali* Muir, *Persis* (*Eritalaena*) *fuscinervis* Muir, *Persis* (*Anapersis*) *takiyae* **sp. nov.**, *Persis* (*Persis*) *gaianii* **sp. nov.**, e *Persis* (*Persis*) *limeirai* **sp. nov.**. As espécies conhecidas foram revisadas, com novos registros de distribuição para a Região Neotropical: *Persis* (*Persis*) *pugnax* Stål anteriormente conhecida somente no Brasil, agora também registrada para o Peru; *Persis* (*Persis*) *stali* Muir com registros prévios para Guiana e Suriname, agora registrada no Brasil e na Venezuela; e *Persis* (*Eritalaena*) *fuscinervis* Muir com registros conhecidos para Guiana e Panamá, com novos registros para o Brasil e Costa Rica. O número de espécies para o gênero foi ampliado de 12 para 15. Assim, os resultados evidenciam que o grupo está amplamente distribuído pela região Neotropical.

Palavras-chaves: Cigarrinhas, espécies novas, Fulgoroidea, taxonomia.

ABSTRACT

Persis Stål is a genus from the New World, which currently has 12 valid species, distributed in three subgenera: *Persis* (*Anapersis*) (six spp.), *Persis* (*Persis*) (five spp.), e *Persis* (*Eritalaena*) (monotypic). Both *Persis* (*Persis*) and *Persis* (*Eritalaena*) have records only for the Neotropical region. The last work carried out that contributed new species to the group was in 1986 by O'Brien. The objective of this work was to carry out a taxonomic study of the species of *Persis* Stål (Hemiptera, Derbidae) that occur in the Neotropical Region. The specimens studied were obtained from National Zoological Collections and photographs provided by some foreign collections. Illustrated identification keys, maps with geographic records, species specifics and redescriptions were provided. During the analyses, six species were identified: *Persis* (*Persis*) *pugnax* Stål, *Persis* (*Persis*) *stali* Muir, *Persis* (*Eritalaena*) *fuscinervis* Muir, *Persis* (*Anapersis*) *takiyae* **sp. nov.**, *Persis* (*Persis*) *gaianii* **sp. nov.**, e *Persis* (*Persis*) *limeirai* **sp. nov.**. The known species were revised, with new distribution records for the Neotropical region: *Persis* (*Persis*) *pugnax* Stål, formerly known only from Brazil, now also recorded from Peru; *Persis* (*Persis*) *stali* Muir with previous records from Guyana and Suriname, now recorded in Brazil and Venezuela; and *Persis* (*Eritalaena*) *fuscinervis* Muir with known records from Guyana and Panama, with new records from Brazil and Costa Rica. The number of species for the genus increases from 12 to 15. The results demonstrate that the group is widely distributed throughout the Neotropical region.

Keywords: Planthoppers, new species, Fulgoroidea, taxonomy.

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LISTA DE ABREVIATURAS

et.al. – et alii (e outros);

comun. pessoal – comunicação pessoal;

Fig. – Figura;

mm – milímetros;

sp. – espécie;

spp. – espécies;

sp. nov. – espécie nova;

PREFÁCIO

Esta dissertação não deve ser considerada como uma publicação válida para os fins de nomenclatura zoológica, como estabelecido no capítulo 3, Artigos 7–9, do Código Internacional de Nomenclatura Zoológica (ICZN, 1999). Assim, não deve ser considerada, em quaisquer circunstâncias, para qualquer ato de nomenclatura relacionado. As decisões aqui assumidas tornam-se inválidas ou indisponíveis. Esta renúncia segue o indicado pelos Artigos 8.2 e 8.3 do ICZN (1999).

PREFACE

This work should not be regarded as a valid publication for the purposes of zoological nomenclature as stipulated in Chapter 3, Articles 7–9 of the International Code of Zoological Nomenclature (ICZN, 1999). Under no circumstances should it be considered as having any nomenclatural implications. The decisions made herein are rendered null and void. This disclaimer is in accordance with the provisions outlined in Articles 8.2 and 8.3 of the ICZN (1999).

1. INTRODUÇÃO

1.1 Hemiptera Linnaeus, 1758

Hemiptera é uma das cinco ordens megadiversas, com aproximadamente 106.000 espécies conhecidas (Grimaldi e Engel 2005; Grazia *et al.* 2024). Dentre os caracteres que distinguem os hemípteros, destaca-se seu aparelho bucal do tipo picador-sugador, onde o lábio é modificado em forma de rostro, geralmente segmentado, que tem a função de abrigar as mandíbulas e maxilas em forma de estiletos (Grazia *et al.* 2024).

Os hemípteros são insetos hemimetábolos, passam por três estágios em seu desenvolvimento: ovo, ninfa e adultos. Geralmente as ninfas são semelhantes aos adultos, com asas ausentes ou reduzidas, passando por diversas mudas até a fase adulta (Triplehorn e Johnson 2011). Além disso, os membros dessa ordem são encontrados em uma variedade de ambientes, incluindo terrestres, aquáticos e semiaquáticos (Grazia *et al.* 2024). Grande parte dos representantes desse grupo são conhecidos popularmente por cigarras, cigarrinhas, percevejos, barbeiros, baratas d'água, pulgões, cochonilhas e moscas brancas (Triplehorn e Johnson 2011).

Atualmente, Hemiptera é dividida em quatro subordens: Auchenorrhyncha Duméril, Coleorrhyncha Myers & China, (sem ocorrência no Brasil), Heteroptera Linnaeus e Sternorrhyncha Amyot & Serville (Grazia *et al.* 2024).

Os Auchenorrhyncha, popularmente conhecidos por cigarras, cigarrinhas de pastagens, cigarrinhas e soldadinhos, englobam insetos terrestres, que variam em forma e comprimento, podendo variar de 3 a 100mm. As principais características diagnósticas destes hemípteros são: antenas curtas e setáceas, tarso com três segmentos e o rostro originando-se na parte posterior da cabeça (Grazia *et al.* 2024). Quanto ao hábito alimentar, eles são fitófagos e alimentam-se de seiva vegetal, floema e xilema, ou do mesófilo (Grazia *et al.* 2024). Essa subordem está dividida em duas infraordens e cinco superfamílias: Cicadomorpha (superfamília Cicadoidea Latreille, Cercopoidea Leach, Membracoidea Rafinesque); e Fulgoromorpha Evans (superfamília Delphacoidea Leach e Fulgoroidea Latreille) (Bucher *et al.* 2023; Grazia *et al.* 2024).

1.2. Fulgoromorpha Evans, 1946

Os representantes de Fulgoromorpha possuem distribuição cosmopolita e incluem aproximadamente 10.000 espécies descritas em 37 famílias, das quais, 15 são representadas por fósseis (Bourgoin 2024). Essa infraordem é notável pela sua diversidade em formas, colorações,

tamanhos e características singulares para cada família. Seus representantes podem ser distinguidos das demais superfamílias de Auchenorrhyncha pelo seguinte conjunto de caracteres: antenas localizadas abaixo dos olhos compostos, pedicelo dilatado e alongado com sensilas conspícuas em forma de verruga, cabeça muitas vezes com projeções, veias anais formando um “Y” na região do clavo e a tégula geralmente presente na asa anterior (Gallo *et al.* 2002; Grazia *et al.* 2024).

Os Fulgoromorpha são popularmente conhecidos por cigarrinhas e um gênero de Fulgoridae em particular, *Fulgora* Linnaeus, faz parte do folclore nacional sendo conhecida popularmente por jequitiranaboia ou “cobra voadora”. Dentro de Fulgoroidea há grupos que são importantes pragas agrícolas devido ao hábito alimentar das espécies, que podem atingir altas densidades populacionais prejudicando muitas culturas como arroz, milho, batata, beterraba-sacarina, cana-de-açúcar, etc. Esses insetos também podem ser vetores de patógenos bacterianos, fitoplasmáticos ou virais, acarretando sérios prejuízos aos agricultores (Wilson 2005).

As cigarrinhas podem apresentar especificidade por um único hospedeiro, como a espécie *Perkinsiella saccharicida* Kirkaldy (Delphacidae) que tem a cana-de-açúcar como sua fonte principal de alimento, e a espécie *Diostrombus mkurangai* Wilson (Derbidae), que tem o coqueiro como planta hospedeira. Enquanto outras são polífagas, isto é, se alimentam de diversas culturas, como *Hyalesthes obsoletus* Signoret (Cixiidae), que se alimenta das artemísias (*Artemisia* sp.), alfafa (*Medicago sativa* L.) e urtiga (*Urtica dioica* L.) (Wilson 2005).

Como mencionado anteriormente, essa infraordem está dividida em duas superfamílias, conforme descrito a seguir: Delphacoidea, composta pelas famílias Cixiidae e Delphacidae; e Fulgoroidea composta por Acanaloniidae, Achilidae, Achilixiidae, Caliscelidae, Derbidae, Dictyopharidae, Lophopidae, Eurybrachidae, Flatidae, Fulgoridae, Issidae, Kinnaridae, Meenoplidae, Ricaniidae, Tettigometridae e Tropiduchidae (Bucher *et al.* 2023).

1.3. Derbidae Spinola, 1839

Os representantes de Derbidae têm uma coloração multivariada, se caracterizam por possuir o articulo apical do rostró tão largo quanto longo, metatarso com uma fileira de espinhos, asas que se estendem muito além do ápice do abdome, fusão do tergito IX com o tubo anal (tergito X) nos machos e poros de ceras no abdome (Bartlett *et al.* 2014; Emeljanov e Shcherbakov 2020; Grazia *et al.* 2024).

Diferentemente dos outros grupos de Fulgoroidea, as ninfas de Derbidae se alimentam de fungos e podem ser encontradas em troncos apodrecidos e em matéria orgânica em decomposição (Howard *et al.* 2001; Bartlett *et al.* 2014; Grazia *et al.* 2024). Os adultos possuem importância econômica sendo vetores de alguns fitopatógenos, como por exemplo o fitoplasma da mancha amarela e murcha-de-fitomonas (Wilson 2005). Eles se alimentam principalmente de palmeiras (monocotiledôneas) e dicotiledôneas lenhosas (Wilson *et al.* 1994). Além da alimentação, os Derbidae utilizam as plantas como local para oviposição e proteção. Geralmente os adultos se reúnem sob folhas largas, um comportamento de proteção para as asas, já que as mesmas são frágeis (Bartlett *et al.* 2014).

Registros fósseis de Derbidae são conhecidos em seis tribos: Cedusini Emeljanov, Cenchreini Muir, Derbini Spinola, Otiocerini Muir, e Zoraidini Muir, os quais são da Era Cenozoica (65 Ma – vida recente), registrados a partir de âmbares bálticos e rochas sedimentares. Os registros de Derbachilini Emeljanov & Shcherbakov são datados da Era Mesozoica (250 a 65 Ma), registrados a partir de âmbar birmanês do Cretáceo (90 Ma) (Emeljanov 1994, 2002, 2008; Emeljanov e Shcherbakov 2000; Stroiński e Szwedo 2002; Szwedo 2004, 2005, 2006; Emeljanov e Shcherbakov 2020).

Atualmente, não existem estudos filogenéticos específicos para Derbidae, sendo apenas incluída em estudos mais abrangentes da superfamília. Na filogenia de Ashe (1987), que se baseou em caracteres morfológicos do adulto, especialmente nos caracteres da genitália da fêmea, a posição de Derbidae dentro de Fulgoroidea não foi estabelecida, uma vez recuperado em uma politomia. Bourgoïn (1993), com base na morfologia das genitálias das fêmeas, obteve um resultado diferente de Ashe, onde Derbidae foi recuperada como grupo-irmão de Achilidae + Achilixiidae.

As relações filogenéticas obtidas por Urban e Cryan (2007), a partir da análise de parcimônia e inferência Bayesiana com dados moleculares (18S rDNA, 28S rDNA, H3-Histone subunit 3 e Wg-Wingless), posiciona *Amblycratus* sp. (Achilidae) como irmão de *Derbe* sp. dentro de Derbidae, sugerindo uma investigação mais detalhada sobre esse relacionamento. Além disso, no cladograma resultante da inferência Bayesiana deste trabalho, foi observada uma proximidade entre o único representante de Achilixiidae e as espécies de Derbidae.

Song e Liang (2013), utilizaram os mesmos marcadores de Urban e Cryan (2007) e adicionaram mais marcadores moleculares, como sequências nucleares (18S e 28S rDNA) e mitocondriais (16S rDNA e cytb), entretanto a hipótese de relacionamento entre Derbidae e Achilidae não foi recuperada. No cladograma resultante da análise de máxima verossimilhança,

Derbidae foi recuperada como grupo-irmão de um clado formado em parte Nogodinidae (*Paravarcia* sp.) e Achilixiidae (*Bebaiotes* sp.). Porém, na árvore resultante da inferência Bayesiana, Derbidae foi recuperada como grupo-irmão do gênero *Paravarcia* sp. de “Nogodinidae”.

Recentemente, em Bucher *et al.* (2023), sobre a filogenia de Fulgoromorpha com base em dados moleculares (18S, 28S D3-D5, 28S D6-D10, Wg, COI, Cytb), o cladograma gerado pela análise da máxima verossimilhança recuperou Derbidae como um grupo monofilético e grupo-irmão de Achilidae.

1.3.1. Distribuição de Derbidae

Os derbídeos estão presentes em todas as regiões biogeográficas, exceto a Antártida, e possuem a maior riqueza em espécies entre os Fulgoroidea, com aproximadamente 1.700 espécies em 166 gêneros e 21 tribos, divididos em três subfamílias: Derbinae Spinola, Breddiniolinae Fennah e Otiocerinae Muir, além de dois gêneros que não estão inseridos em nenhuma das subfamílias citadas: *Diprora* Williams e *Nesorhamma* Fennah (Bourgoin 2024; Grazia *et al.* 2024). Na região Neotropical são conhecidas 410 espécies e 41 gêneros (Bourgoin, 2024; Grazia *et al.* 2024). Para o Brasil foram registrados 114 espécies e 17 gêneros (Bartlett *et al.* 2023). A região brasileira que contém o maior número de espécies contabilizadas é o Norte (65 spp.), seguida do Sudeste (13 spp.), Centro Oeste (sete spp.) e o Nordeste (três espécies) (Bartlett *et al.* 2023).

As três subfamílias de Derbidae possuem registros no Brasil, e, dentre elas, Derbinae é a subfamília que possui o maior número de espécies conhecidas.

1.4. Derbinae Spinola, 1839

Os representantes dessa subfamília são facilmente reconhecidos pela cabeça com fossas sensoriais no vértice e na frente, asa anterior (tégmina) longa, com pústulas sensoriais no clavo ao longo da veia Pcu, e asa posterior com venação pouco reduzida (Metcalf 1938; Emeljanov 1995).

Essa subfamília tem distribuição cosmopolita e possui a segunda maior riqueza de espécies de Derbidae, atrás apenas de Otiocerinae. Os Derbinae possuem 410 espécies conhecidas, 40 gêneros, e cinco tribos para o mundo: Cedochreini Emeljanov, Cenchreini Muir, Dawnarioidini Emeljanov, Derbini Spinola, e Nicertini Emeljanov (Bourgoin 2024).

Para Região Neotropical foram registradas aproximadamente 263 espécies, e 26 gêneros em quatro tribos, com exceção de Nicertini (Bourgoin 2023). Para o Brasil foram catalogadas 96 espécies e 14 gêneros em três tribos: Dawnarioidini, Derbini e Cenchreini (Bartlett *et al.* 2023).

1.5. Cenchreini Muir, 1913

As características estabelecidas por Fennah (1952) para a identificação dos Cenchreini foram: fronte moderadamente estreita, raramente larga, fortemente comprimida lateralmente formando carenas; asa anterior com proporções variáveis, pelo menos 2,8 vezes mais longa que larga, margem apical arredondada, moderadamente curta, raramente estendida e oblíqua; veia MP e CuA com menos de oito ramos na margem e clavo fechado, raramente aberto, estendendo-se por pelo menos metade do comprimento total da tégmina; veia CuA₂ alcançando a margem posterior diretamente, ou encontrando-se com as veias transversais.

Cenchreini é cosmopolita, com 204 espécies e 25 gêneros (Bourgoin 2024). Na região Neotropical são registradas 59 espécies e 11 gêneros. No Brasil são conhecidos seis espécies e três gêneros: *Herpis* Stål, 1862 (*Herpis fuscovittata* Stål, 1862 e *Herpis vittata* (Fabricius, 1803)), *Persis* Stål, 1862 (*Persis (Anapervis) pallidovenosa* (Stål, 1862) e *Persis (Persis) pugnax* Stål, 1862) e *Phaciocephalus* Kirkaldy, 1906 (*Phaciocephalus fimbriolatus* (Stål, 1862) e *Phaciocephalus orbus* (Stål, 1862)) (Bartlett *et al.* 2023).

1.6. *Persis* Stål, 1862

Persis contém registro apenas para o Novo Mundo, e inclui 12 espécies válidas, 10 delas com ocorrência na Região Neotropical, e duas no Brasil: *Persis (Persis) pugnax* Stål, 1862 (Rio de Janeiro e Roraima) e *Persis (Anapervis) pallidovenosa* (Stål, 1862) (Rio de Janeiro) (Figura 1; Tabela 1) (Bartlett *et al.* 2023; Bourgoin 2024).

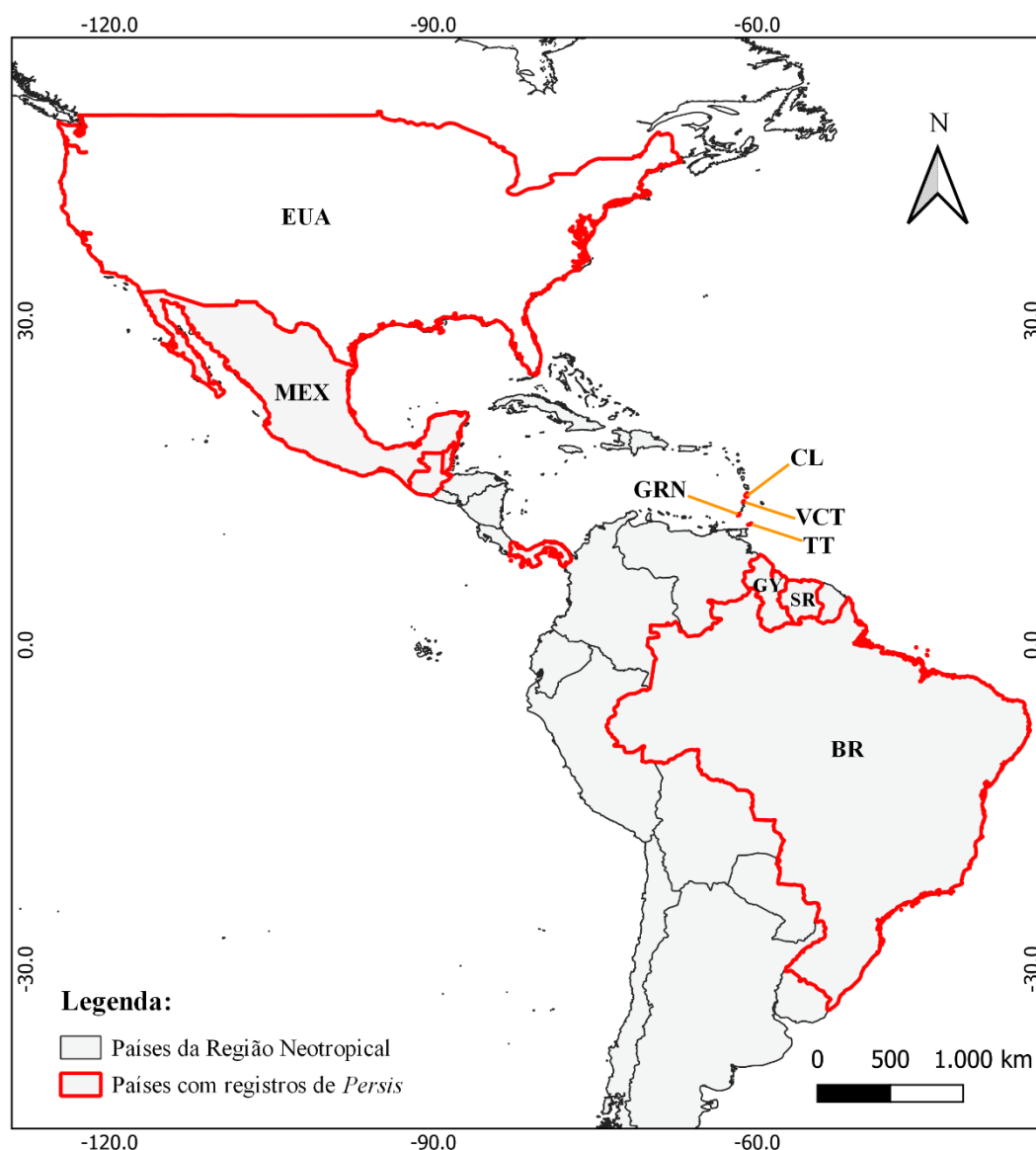


Figura 1. Mapa de distribuição de *Persis* Stål no Novo Mundo. Abreviações dos países: BR, Brasil; EUA, Estados Unidos da América; GRN, Granada; GY, Guiana; LC, Santa Lucia MEX, México, PA, Panamá; SR, Suriname; TT, Trindade e Tobago; VCT, São Vicente.

Persis foi descrito por Stål (1862), que diagnosticou o gênero com base nos seguintes caracteres: cabeça comprimida entre os olhos (Figura 2A-B); vértice longo, estreito, bordas altas, côncavo, pontiagudo em direção ao ápice (Figura 2D); fronte longa, estreita, com lados subparalelos, bordas elevadas; clipeo tricarenado; gena grande (Figura 2C); pronoto curto, angulado, expandido em ambos os lados (Figura 2A-B, D) e asas anteriores longas, paralelas, com veias longitudinais bifurcadas, todas próximas ao ápice (Figura 2A).

Stål designou *Persis pugnax* Stål, 1862 como espécie-tipo do gênero, a qual foi coletada no Brasil, especificamente no estado do Rio de Janeiro. A descrição da espécie é sucinta, feita em apenas duas linhas, e a sua caracterização é constituída de detalhes gerais da morfologia

externa, e não há ilustrações das mesmas. Posteriormente, Stål (1869), transferiu *Cicada lineata* Fabricius, 1803 para o gênero *Persis*, e estabeleceu uma nova combinação, *Persis lineata* (Fabricius, 1803).

Após quase 50 anos sem estudos com o grupo, Muir (1918) acrescentou duas espécies ao gênero: *Persis stali* Muir, 1918 e *Persis fuscineris* Muir, 1918, ambas da Guiana Inglesa. McAtee (1924) transferiu *Persis lineata* para *Cenchrea* Westwood, 1840. Metcalf (1938) não concordou com a mudança taxonômica feita por McAtee (1924) e transferiu *Cenchrea lineata* novamente para o gênero *Persis* e mudou o nome da espécie para *Persis fabriciana* Metcalf, 1938 (América do Sul) por identificar que o nome dado à espécie por Fabricius (1803) tratava-se de um nome preocupado. Nesse mesmo trabalho, Metcalf (1938) forneceu a descrição e ilustração da genitália do macho de *P. fuscineris*, que até aquele momento não era conhecida.

Caldwell (1944) descreve *Persis foveatis* Caldwell, 1944 (México) e ilustra apenas a genitália do macho. Posteriormente, Fennah (1952) revisou os grupos de Derbidae e subdividiu *Persis* em três subgêneros (Figura 3 A-C):

1) *Persis (Persis)* Stål, 1862 (Figura 3 A): agrupa os espécimes que possuem a cabeça com projeção 2,7 vezes mais longa do que a largura dos olhos, em vista lateral; processo paranotal raso, não formando fôveas profundas; e, pigóforo com um processo medioventral amplamente triangular. Esse subgênero incluiu as espécies *P. pugnax* (designada espécie-tipo do subgênero), *P. stali*, *P. fabriciana* e *P. foveatis*, e descreve a espécie *Persis (Persis) novacula* Fennah, 1952 (Trinidad).

2) *Persis (Anapersis)* Fennah, 1952 (Figura 3 B): cabeça com projeção 2.0 vezes menor que a largura dos olhos, vista lateral; processo paranotal proeminente, formando fôveas profundas; e, pigóforo com processo medioventral bem desenvolvido. A espécie-tipo designada para esse subgênero é *Persis qregaria* (Fennah, 1945), originalmente descrita em *Neocenchrea* Metcalf, 1923.

3) *Persis (Eritalaena)* Fennah 1952 (Figura 3 C): cabeça projetada entre os olhos com um comprimento similar a largura à largura dos olhos, em vista lateral; pronoto com fôveas obsoletas; pigóforo com processo medioventral triangular curto; e, esternito VII (pré-genital) com a região ventral da margem posterior alongada. É um subgênero monotípico incluindo a espécie *Persis (Eritalaena) fuscineris*.

Fennah (1952) transferiu *Neocenchrea pallescens* Metcalf, 1938 (Panamá) e *Mysidia ? spreata* Fowler, 1900 (México) para *Persis (Anapersis)*, por possuírem a cabeça com uma carena

entre o vértice e a fronte, pronoto com fóveas na margem dorsal fortemente desenvolvidas, mesonoto relativamente mais largo, presença de um processo medioventral no pigóforo e pelo padrão dos gonóstilos. Essas espécies foram designadas com as combinações: *Persis (Anapersis) pallescens* (Metcalf, 1938) (Panamá) e *Persis (Anapersis) spreta* (Fowler, 1900) (México). Além disso, nesse trabalho foi elaborada a primeira chave de identificação para os gêneros e subgêneros de Cenchreini.

O'Brien (1986) descreveu mais duas espécies: *Persis (Anapersis) ferox* O'Brien, 1986 e *Persis (Anapersis) arizonensis* O'Brien, 1986, ambas com registro para o Arizona (Estados Unidos). A autora também forneceu uma chave para as quatro espécies de *Persis* identificadas no seu trabalho que ocorrem no Estados Unidos e México, são elas: *P. (Anapersis) arizonensis*, *P. (Anapersis) ferox*, *P. (Anapersis) spreta* e *P. (Persis) foveatis*.

Na revisão dos Fulgoroidea dos Estados Unidos de Bartlett *et al.* (2014) foi disponibilizada uma chave atualizada de Metcalf (1923) para todos os gêneros de Derbidae que ocorrem no México, incluindo *Persis*. Nesta chave, as características para identificação dos representantes de *Persis* engloba caracteres dos três subgêneros.

Recentemente Bahder (2021) transferiu *Phaciocephalus pallidovenosus* (Stål, 1862) (Brasil) para *Persis (Anapersis)*, por possuir a cabeça moderadamente larga e não projetada anteriormente, vértice côncavo com pústulas laterais e fronte côncava. Nesse contexto, foi feita a combinação: *Persis (Anapersis) pallidovenosa* (Stål, 1862).

Atualmente, não existem estudos filogenéticos para *Persis* e isso gera uma lacuna no conhecimento sobre sua relação com outros grupos, e também impede o reconhecimento das relações de parentesco entre os seus subgêneros. Além disso, a divisão de *Persis* em três subgêneros ocasiona muitas dúvidas, e existem suspeitas de que, na verdade, trata-se de gêneros diferentes (Charles Bartlett, comun. pessoal).

A realização do presente estudo foi motivada pela grande lacuna do conhecimento sobre a fauna brasileira de Fulgoromorpha nos mais variados grupos, e para Derbidae esse conhecimento é ainda mais escasso. Esse estudo teve como objetivo principal, a identificação das espécies de *Persis*, e dessa forma incrementar o conhecimento a respeito do grupo, e da biodiversidade de Fulgoromorpha para Região Neotropical e para o Brasil.

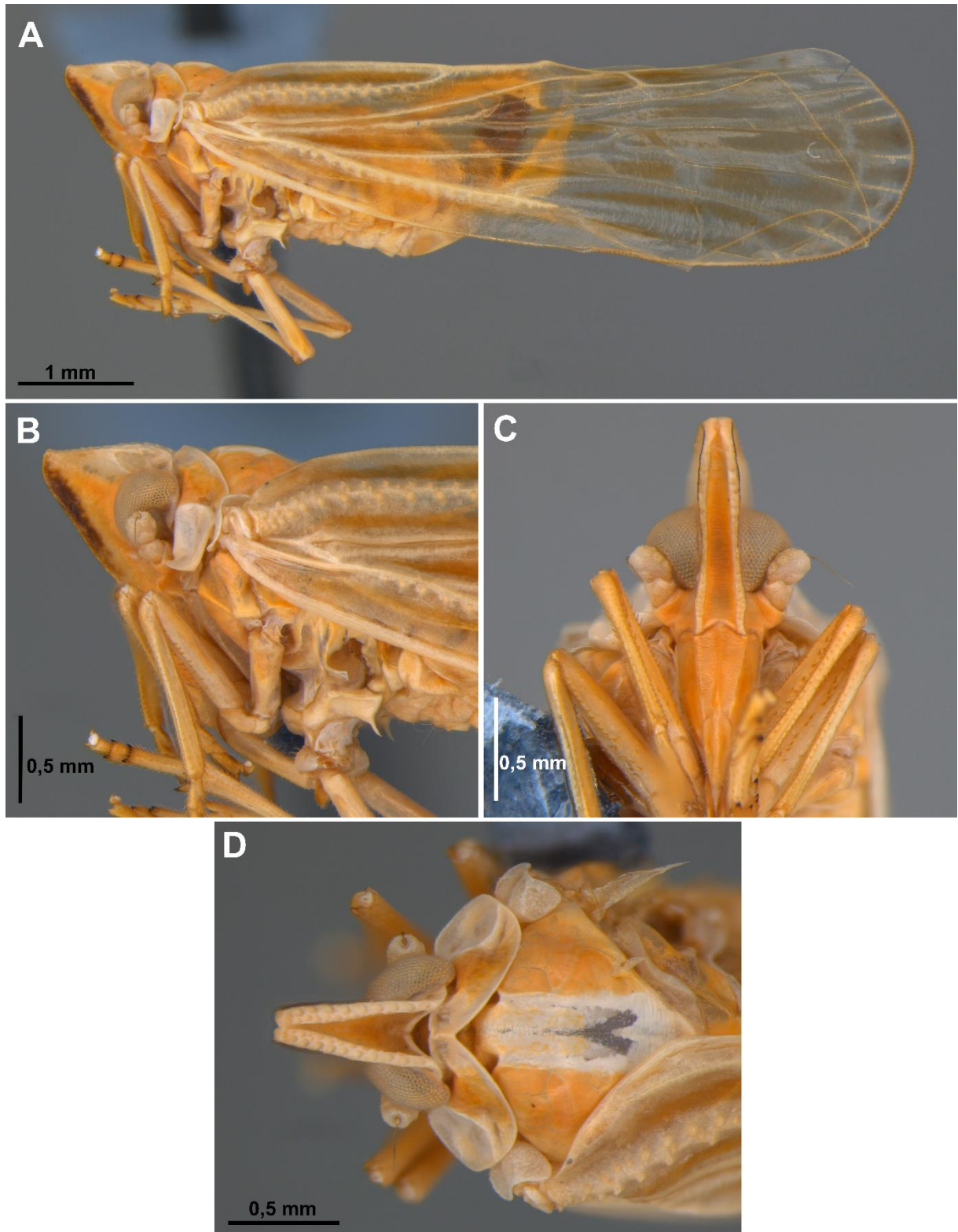


Figura 2 A-D. *Persis (Persis) stali* Muir: **A.** *Habitus*, vista lateral; **B.** Cabeça e tórax, vista lateral; **C.** Cabeça, vista anterior; **D.** Cabeça e tórax, vista dorsal.

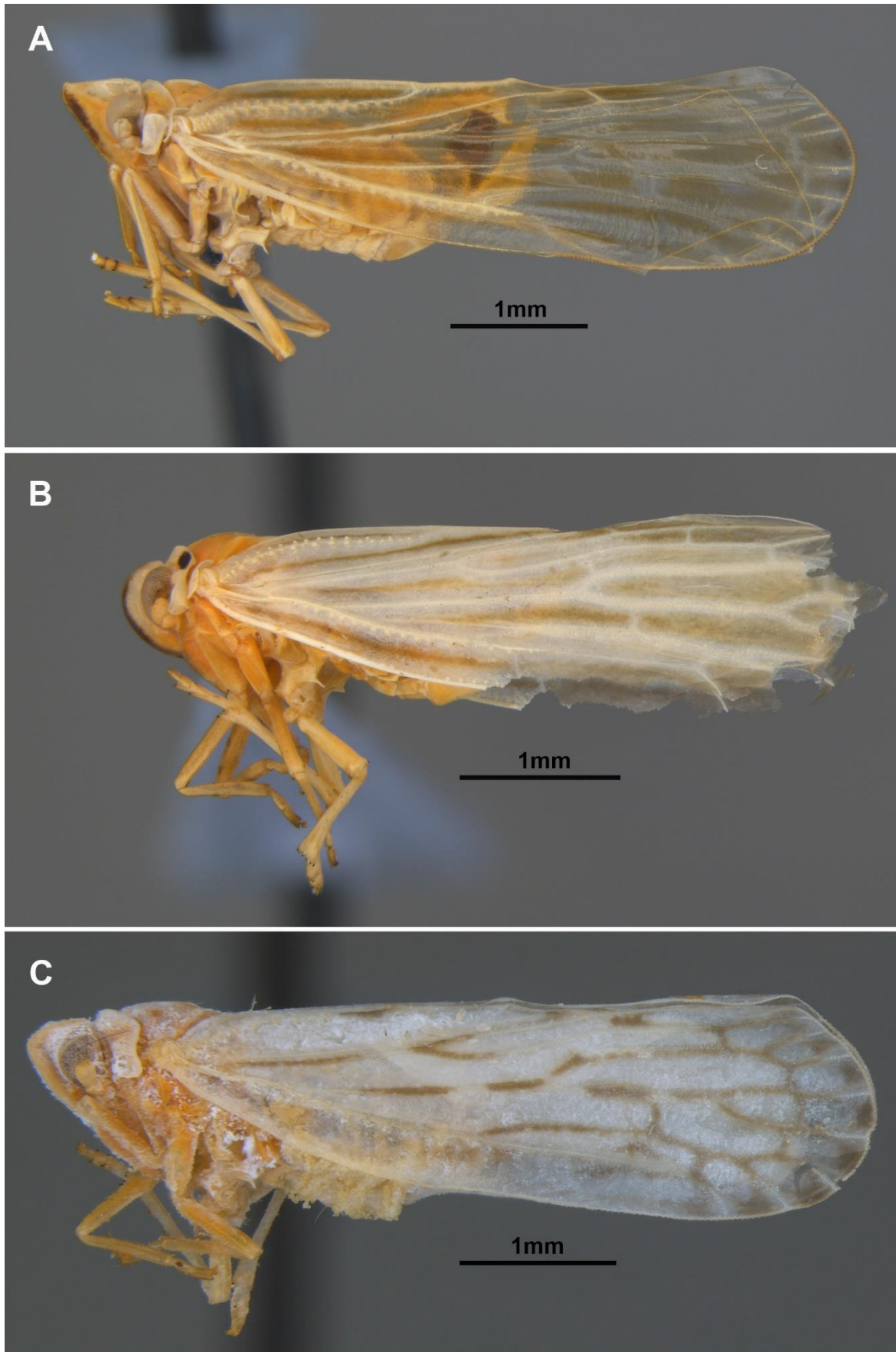


Figura 3 A-C. *Habitus* dos subgêneros de *Persis*: **A.** *Persis (Persis) stali* Muir, vista lateral; **B.** *Persis (Anaparsis) takiyae* sp. nov., vista lateral; e **C.** *Persis (Eritalaena) fuscinervis* Muir, vista lateral.

Tabela 1. Subgêneros e espécies de *Persis* Stål com respectivo sexos, distribuição e local de depósito do material tipo.

Subgêneros	Espécies	Sexos	Distribuição	Dep. de Material Tipo
<i>Persis (Persis) Stål</i>				
	<i>P. (P.) pugnax</i> Stål*	♂, ♀	Brasil (Rio de Janeiro e Roraima)	NHRS
	<i>P. (P.) novacula</i> Fennah	♂, ♀	Trinidade e Tobago	NHM
	<i>P. (P.) fabriciana</i> Metcalf	♀	São Vicente	NHMD
	<i>P. (P.) stali</i> Muir	♂, ♀	Suriname e Guiana	AMNH
	<i>Persis foveatis</i> Caldwell	♂, ♀	México; Belize; El Salvador; Honduras; Costa Rica e Panamá	USNM
<i>Persis (Eritalaena) Fennah</i>				
	<i>P. (E.) fuscinervis</i> Muir*	♂, ♀	Guiana e Panamá	OSUC
<i>Persis (Anapersis) Fennah</i>				
	<i>P. (A.) arizonensis</i> O'Brien	♂, ♀	Estados Unidos da América; México	CAS
	<i>P. (A.) ferox</i> O'Brien	♂, ♀	Estados Unidos da América; México	CAS
	<i>P. (A.) gregaria</i> (Fennah)*	♂, ♀	Granada, Santa Lúcia, São Vicente, Granadinas, Trinidad e Tobago	USNM
	<i>P. (A.) pallescens</i> (Metcalf)	♀	Panamá	MCZ
	<i>P. (A.) pallidovenosa</i> (Stål)	♂, ♀	Brasil (Rio de Janeiro)	NHRS
	<i>P. (A.) spreta</i> Fowler	-	México	Não localizado

*Espécie-tipo de cada subgênero. Acrônimos das instituições: AMNH - American Museum of Natural History; CAS – California Academy of Sciences; MCZ - Museum Comparative of Zoology; NHRS - Museum of Natural History, Stockholm; NHMD - Natural History Museum of Denmark; NHM- The Natural History Museum, London; OSUC - C.A. Triplehorn Insect Collection, USNM - Smithsonian Institution, Museum National of Natural History.

2. OBJETIVOS

2.1. Geral

Realizar um estudo taxonômico dos espécimes de *Persis* Stål (Hemiptera, Derbidae) da região Neotropical, com ênfase para o Brasil.

2.2. Específicos

- ✓ Identificar os espécimes que ocorrem na região Neotropical;
- ✓ Redescrever as espécies encontradas que ocorrem na região Neotropical;
- ✓ Descrever e ilustrar eventuais táxons novos;
- ✓ Elaborar uma chave dicotômica ilustrada para identificação dos subgêneros e das espécies;
- ✓ Elaborar mapas de distribuição para as espécies.

3. MATERIAL & MÉTODOS

3.1. Origem do material

O presente estudo foi baseado em exemplares adultos provenientes principalmente do acervo do INPA - Coleção de Invertebrados do Instituto Nacional de Pesquisas da Amazônia, Manaus, AM e demais materiais disponíveis de coletas mais recentes oriundos dos projetos “Biodiversidade de Insecta na Amazônia– rede BIA” (Financiamento: MCTI, CNPq e FNDCT”) e “Entomologia na Amazônia: Diversidade de Insetos” (Financiamento: MCTI), ambos coordenados pelo Dr. José Albertino Rafael.

Foram contactadas diversas instituições científicas nacionais a fim de obter mais material para esse estudo. As coleções que disponibilizaram material, estão listadas abaixo com seus respectivos acrônimos:

CZMA – Coleção Zoológica do Maranhão, Universidade Estadual do Maranhão, Caxias, MA, Brasil;

DZUP – Coleção Entomológica Pe. Jesus Santiago Moure, Universidade Federal do Paraná, Curitiba, PR, Brasil;

DZRJ – Coleção Entomológica Professor José Alfredo Pinheiro Dutra, Universidade Federal do Rio de Janeiro, Rio de Janeiro, RJ, Brasil;

MZSP – Museu de Zoologia da Universidade de São Paulo, São Paulo, SP, Brasil.

Além do material examinado das coleções supracitadas, foram contactadas algumas instituições estrangeiras que mantêm o material-tipo. O objetivo foi ter acesso ao material-tipo e/ou exemplares identificados das espécies previamente conhecidas, entretanto, como não foi viável o envio do material para o Brasil, foram solicitadas fotografias desse material. As coleções internacionais que disponibilizaram fotografias do material-tipo estão listadas abaixo com seus respectivos acrônimos, localidade e as espécies que estão depositadas nas mesmas (Tabela 2).

Tabela 2. Coleções internacionais com seus acrônimos, localidades e as espécies fotografadas.

Acrônimo	Localidade	Espécies obtidas	Material tipo (Sexo)	Autores
AMNH	New York, USA	<i>Persis (Persis) stali</i>	HT/M	Ruth Salas
NHMD	Copenhagen, DK	<i>Persis (Persis) fabriciana</i>	ST/F	Sree Gayathree Selvantharan
CAS	San Francisco, USA	<i>Persis (Anaparsis) arizonensis</i>	HT/M	Charles Bartlett
		<i>Persis (Anaparsis) ferox</i>	HT/M	Charles Bartlett
MCZ	Cambridge, USA	<i>Persis (Anaparsis) pallescens</i>	HT/F	Site da MCZ
USNM	Washington D.C., USA	<i>Persis (Persis) foveatis</i>	HT/M	Solomon Hendrix
NHRS	Stockholm, SE	<i>Persis (Persis) pugnax</i>	ST/ F	Gunvi Lindberg
		<i>Persis (Anaparsis) pallidovenosa</i>	ST/ F	Gunvi Lindberg
OSUC	Ohio, USA	<i>Persis (Eritalaena) fuscinervis</i>	HT/F	Charles Bartlett

Acrônimos das instituições: AMNH- American Museum of Natural History; CAS – California Academy of Sciences; MCZ: Museum Comparative of Zoology; USNM- Smithsonian Institution, Museum National of Natural History; NHMD - Natural History Museum of Denmark; NHRS - Museum of Natural History, Stockholm; OSUC - C.A. Triplehorn Insect Collection. Siglas do material tipo: HT, Holótipo, ST, Síntipo. Siglas do sexo: F, Fêmea, M, Macho.

Todo o material obtido por empréstimo encontra-se provisoriamente depositado no Laboratório de Sistemática de Díptera (LabDip) do INPA e, posteriormente, será devolvido às suas respectivas instituições, devidamente identificado e etiquetado. Os espécimes-tipo dos novos táxons serão depositados nas instituições de origem. Em relação aos parátipos será solicitada a instituição de empréstimo, permissão para o depósito dos mesmos em outras coleções nacionais.

3.2. Preparação do material

Foram estudados espécimes conservados em via úmida e seca. Os espécimes conservados a seco, montados em alfinetes entomológicos por via direta ou por dupla montagem (colados em triângulos de papel cartão), foram submetidos diretamente aos procedimentos de morfotipagem. O material conservado em álcool 70% foi preparado através de um processo de desidratação, no qual os espécimes passaram por diferentes concentrações de álcool, 80%, 90% e absoluto, sendo mantidos nas duas primeiras concentrações por 30 min cada e no álcool absoluto por 24h. Posteriormente, foram postos em um papel toalha para

retirada do excesso de álcool e, logo após imersos no acetato de etila, onde permaneceram por 15 minutos. Os espécimes foram montados em montagem dupla, e transferidos para estufa, para secagem. Por fim, o material foi etiquetado e organizado em caixas nas gavetas entomológicas.

3.3. Identificação e terminologia

As chaves e descrições originais utilizadas na identificação dos espécimes foram: Bartlett *et al.* (2014), Muir (1918), Caldwell (1944), Fennah (1945; 1952), O'Brien (1986), Stål (1862) e Bahder *et al.* (2021).

A terminologia adotada para caracteres morfológicos externos da cabeça e do tórax seguiu O'Brien e Wilson (1985) (Figura 4 A-C), para estruturas como a asa anterior, seguiu Bourgoïn *et al.* (2015) (Figura 5), e para asa posterior Dworakowska (1988) (Figura 6). Para a terminália do macho, Bourgoïn (1988) juntamente com Bourgoïn e Huang (1990) (Figura 7 A-B), e para a terminália da fêmea, Bourgoïn (1993) (Figura 8 A-F).

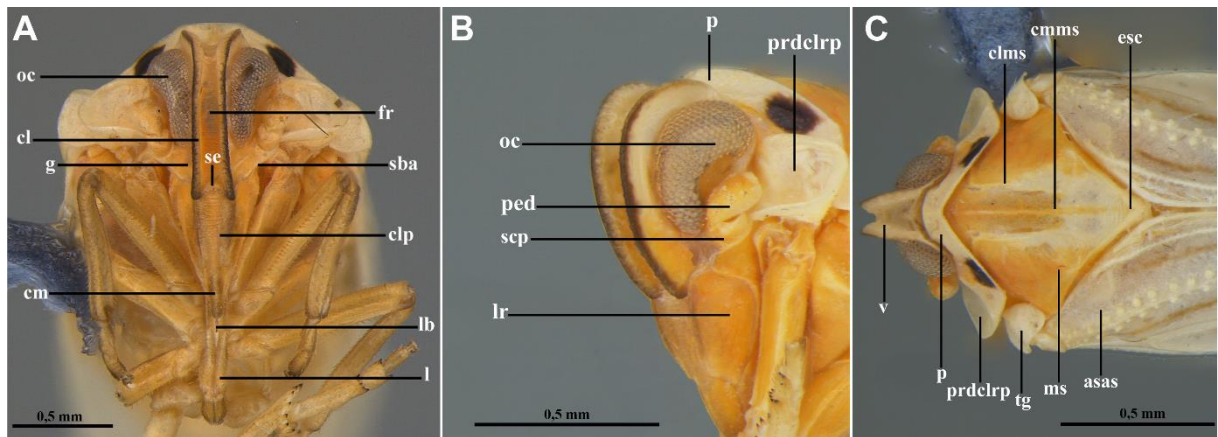


Figura 4 A-C. Terminologia externa da cabeça e tórax de *Persis (Anapersis) takiyae* sp. nov. **A.** Cabeça, vista frontal; **B.** Cabeça, vista anterolateral; **C.** Cabeça e tórax, vista dorsal. Abreviações: *Cabeça.* cl: carena lateral; cm: carena mediana; clp: clípeo; fr: fronte; g: gena; l: lábio; lb: labro; lr: lora; oc: olho composto; ped: pedicelo; se: sulco epistomal; sba: sulco sub-antenal; scp: escapo; v: vértice. *Tórax.* Clms: carena lateral do mesonoto; cmms: carena mediana do mesonoto; esc: escutelo; ms: mesonoto; p: pronoto; prdclrp: região pronotal paradiscal; tg: tégula.

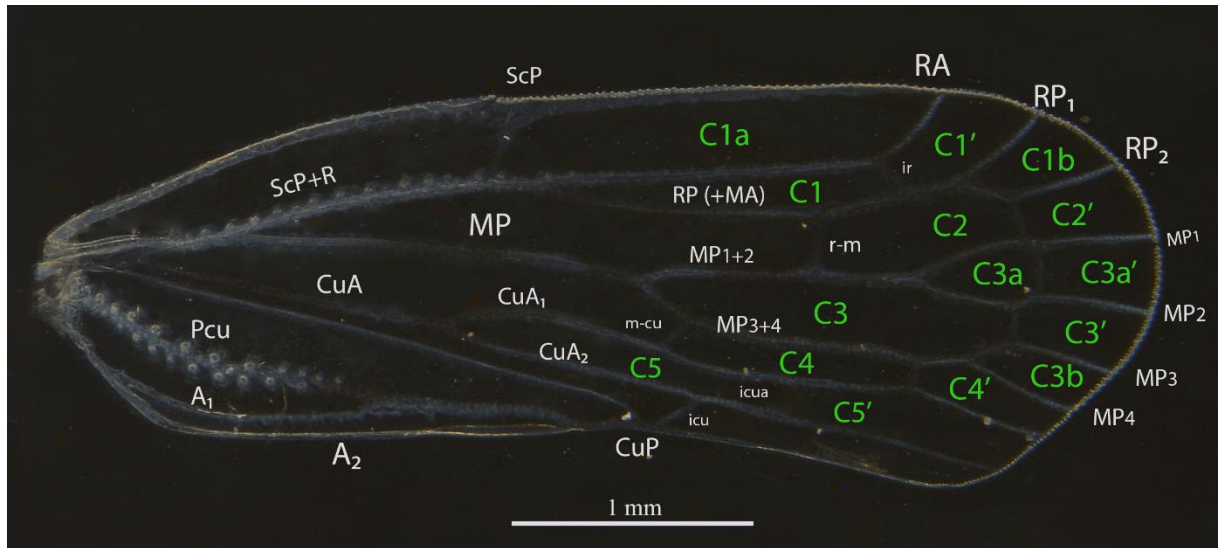


Figura 5. Terminologia da asa anterior de *Persis (Eritalaena) fuscinervis* Muir. Abreviações: *Venação horizontal*. A1, A2: primeiro e segundo ramo da veia anal, respectivamente; CuA: veia cubital anterior; CuA1, CuA2: primeiro e segundo ramo anterior da veia cubital, respectivamente; CuP: veia cubital posterior; MP: veia medial posterior; MP₁₊₂, primeiro ramo da veia medial posterior; MP₃₊₄, segundo ramo da veia medial posterior; MP₁, MP₂, MP₃, MP₄, MP₅: primeiro, segundo, terceiro, quarto e quinto ramo da veia medial posterior, respectivamente; Pcu: veia poscubital; RA: veia radial anterior; RP (+MA), veia radial posterior (+ veia medial anterior); veia ScP + R, veia subcostal + veia radial; veia ScP: veia subcostal. *Venação transversal*. icu, entre as veias cubital; icua, entre as veias cubitais anterior; ir, entre radiais; r-m, rádio-mediana. *Células*. C1: célula 1; C1': célula 1'; C1a: célula 1a; C1b: célula 1b; C2: célula 2; C2': célula 2'; C3: célula 3; C3': célula 3'; C3a: célula 3a; C3a': célula 3a'; C3b: célula 3b; C4: célula 4; C4': célula 4'; C5: célula 5; C5': célula 5'.

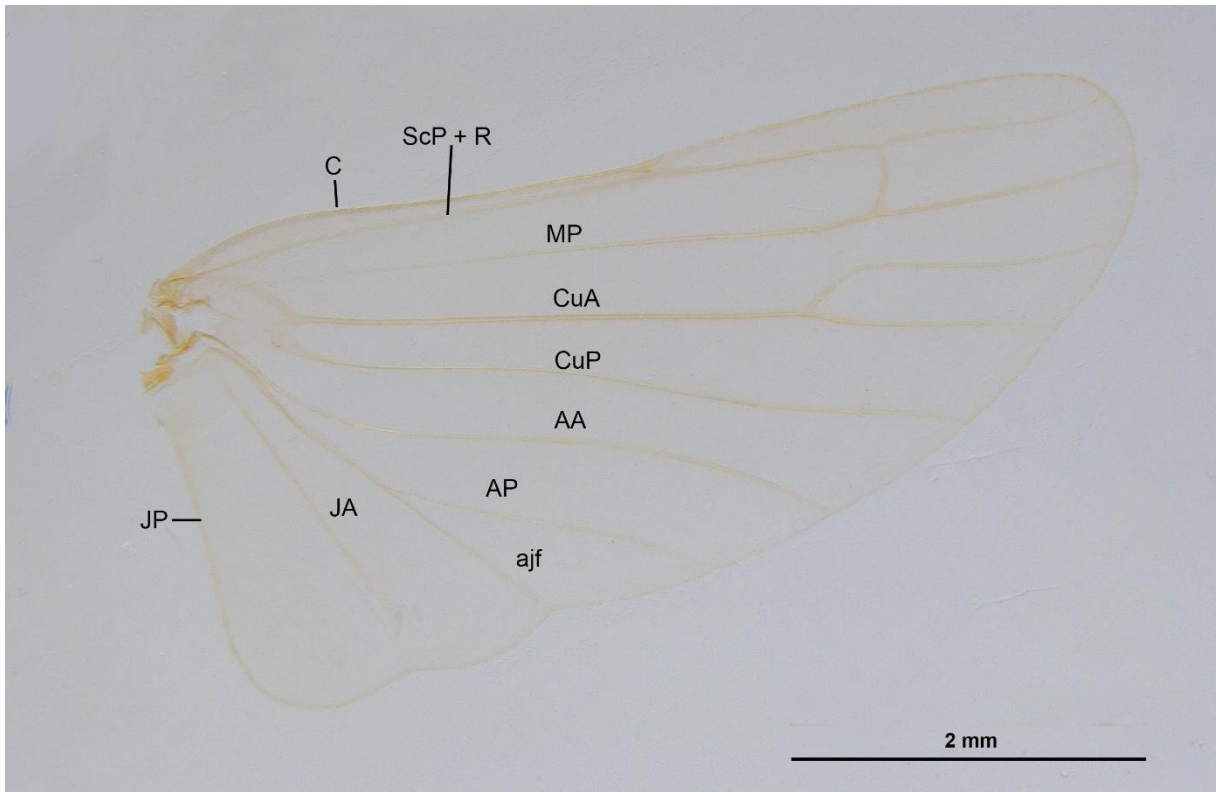


Figura 6. Terminologia da asa posterior de *Persis (Persis) stali* Muir. Abreviações: *Venação horizontal*. AA: veia anal anterior; ajf: dobra anojugal; AP: veia anal posterior; C: veia costal; CuA: veia cubital anterior; CuP, veia cubital posterior; JA: veia jugal anterior; JP: veia jugal posterior; MA: veia medial anterior; MP: veia medial posterior; R: veia radial; ScP: veia subcostal.

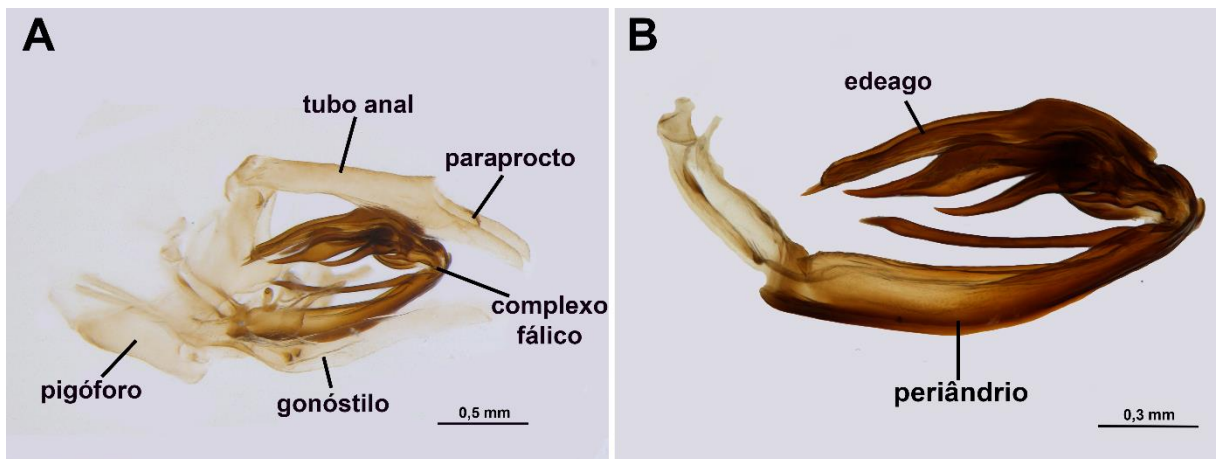


Figura 7 A-B. Terminologia da genitália do macho de *Persis (Persis) limeirai* sp. nov.. **A.** Pigóforo, gonóstilo, complexo fálico, tubo anal e paraprocto, vista lateral; **B.** Complexo fálico: periândrio e edeago, vista lateral.

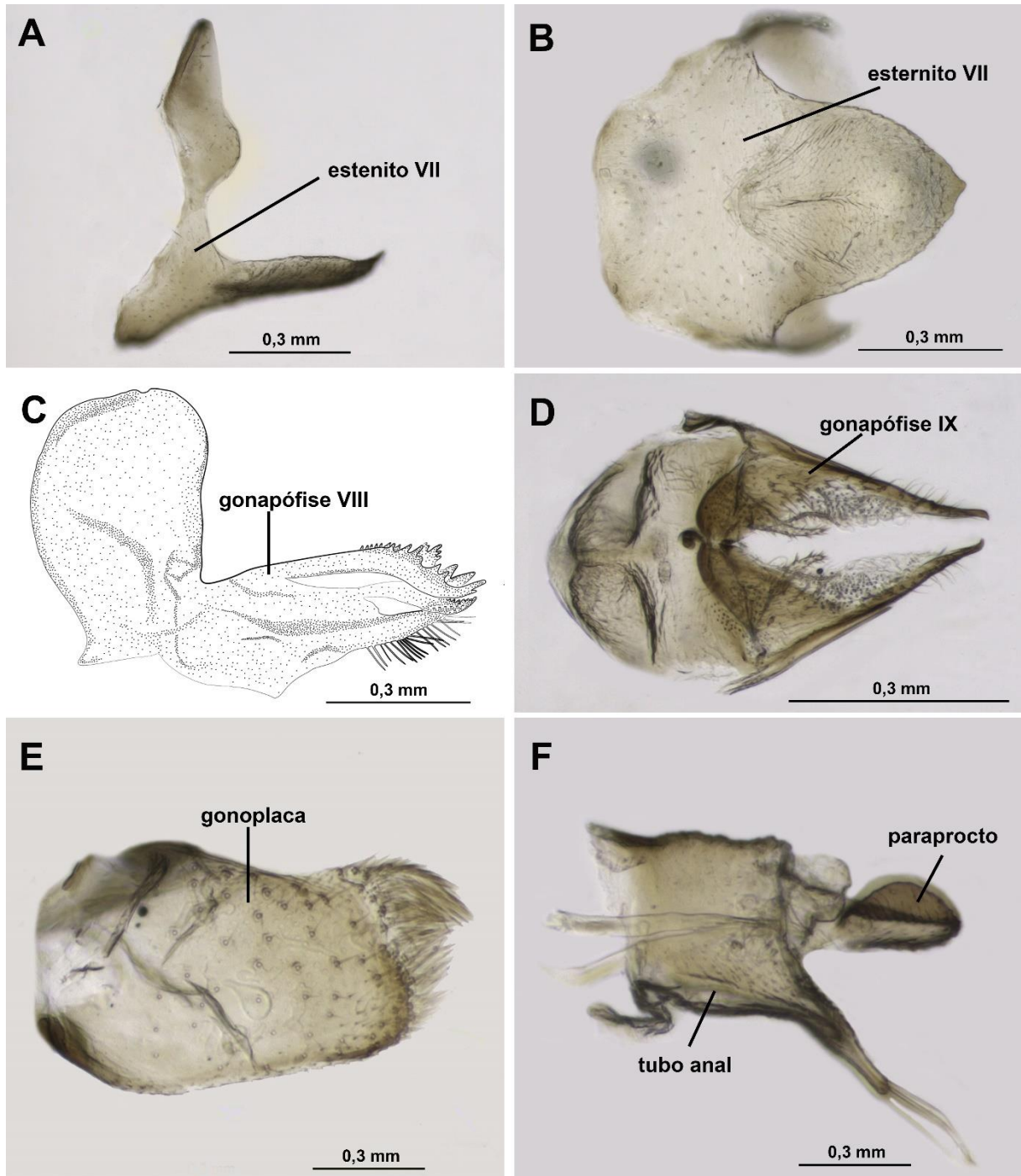


Figura 8 A-F. Terminologia da genitália da fêmea de *Persis (Eritalaena) fuscinervis* Muir. **A.** Esternito VII, vista lateral; **B.** Esternito VII, vista ventral; **C.** Gonapófise VIII, vista lateral; **D.** Gonapófise IX, vista dorsal; **E.** Gonoplaca, vista lateral; **F.** Tubo anal e paraprocto, vista lateral.

3.4. Preparação das genitálias e asas

Para análise das estruturas genitais, o abdome foi separado do tórax, macerado em ácido láctico 85% quente, por tempo variável de acordo com o grau de esclerosação do abdômen, de 15–30 minutos, utilizando o protocolo de Cumming (1992); posteriormente, foi imerso em

glicerina para visualização no estereomicroscópio Leica® M165C. Depois de estudada, a genitália foi acondicionada em microtubos de plásticos preenchidos com glicerina e este montado em alfinete entomológico juntamente com o espécime correspondente.

Para a montagem da asa anterior de um espécime, a mesma foi destacada, limpa por um banho curto de xilol e montada entre lamínulas com uso de Euparal. Após a secagem, foi colado na margem do conjunto (lamínula) um pequeno pedaço de papel cartão para que este fosse fixado no mesmo alfinete do espécime correspondente.

3.5. Fotografias e desenhos

Foram feitas ilustrações e/ou fotografias de todas as características importantes para a identificação das espécies estudadas, como *habitus* lateral, dorsal e frontal, antena, tórax, asa anterior e posterior, abdômen e, principalmente, dos caracteres da genitália.

Para obtenção das fotografias utilizou-se dois equipamentos: para a morfologia externa (cabeça, tórax, asa e abdômen) utilizou-se o microscópio estereoscópico Leica® MZ205, com uma câmera digital Leica®DFC500 acoplada, do Laboratório de Díptera; e para obtenção das imagens da genitália (macho e fêmea) foi utilizado o estereomicroscópio Leica M205A com uma câmera Leica DMC4500 acoplada, da Coleção de Invertebrados do INPA. Ambos os equipamentos estão conectados a um computador com o software Leica Suíte Aplicativos, que inclui um módulo de Auto-Montage (software Syncroscopy) (<http://www.syncroscopy.com/syncroscopy/>) que produzem uma montagem de várias camadas de fotografias. O tratamento das imagens e confecção das pranchas de cada espécie foram realizadas no programa Adobe Photoshop CS versão 8.0.1.

Para melhor visualização das estruturas que compõem as genitálias do macho e da fêmea de difícil visualização nas fotografias, utilizou-se o Microscópio Estereoscópico, juntamente com o software Adobe Illustrator® CS6, para confecção dos desenhos.

3.6. Mapas de distribuição

Os mapas da distribuição geográfica das espécies foram confeccionados através do programa QGIS 3.16 (https://www.qgis.org/pt_BR/site/forusers/download.html), a partir das coordenadas geográficas do ponto de coleta contidas nos dados da etiqueta dos espécimes. Para os espécimes que não possuem na etiqueta as coordenadas geográficas do ponto de coleta, utilizou-se a plataforma GoogleEarth® para obtenção das coordenadas aproximadas do local.

3.7. Descrição e redescrição das espécies

As redescrções foram realizadas a partir das fotografias obtidas do material-tipo, além do material adicional.

Nas descrições e redescrções das espécies foram disponibilizadas as informações abaixo, com alterações conforme as normas das revistas para as quais os artigos forem submetidos:

- Lista sinonímica (para redescrções);
- Tipo de material examinado;
- Condição do tipo;
- Parátipos (quando disponível);
- Material adicional (presente apenas nas redescrções);
- Medidas;
- Diagnose;
- (Re) descrição (machos e fêmeas): coloração, cabeça, tórax, pernas, asa, abdômen, terminália masculina e feminina;
- Etimologia (para as espécies novas);
- Distribuição;
- Variação (quando observada);
- Comentários taxonômicos.

3.8. Medidas

As medidas utilizadas nesse trabalho foram: Comprimento do corpo (cc), feita da região mediana da frente ao ápice do segmento anal, na lateral (Figura 9 A); comprimento do corpo incluindo as asas (cca), feita da região mediana da frente até o ápice da asa (Figura 9 A); largura mediana da frente (lmfr), medida feita na altura dos olhos compostos (Figura 9 B); comprimento mediano do clipeo (cmclp), feita da sutura epistomal até o ápice do clipeo (Figura 9 B); largura máxima do clipeo, (lmaxclp) feita próximo a sutura epistomal (Figura 9 B); largura da projeção da cabeça (lpc), feita do ápice até a primeira margem do olho composto (Figura 9 C); largura mediana do olho composto (lmoc), feita na porção mediana do olho (Figura 9 C); comprimento mediano do vértice (cmv), feito da base do vértice até o seu ápice (Figura 9D); largura máxima do vértice (lmaxv), feita na base do vértice (Figura 9 D).

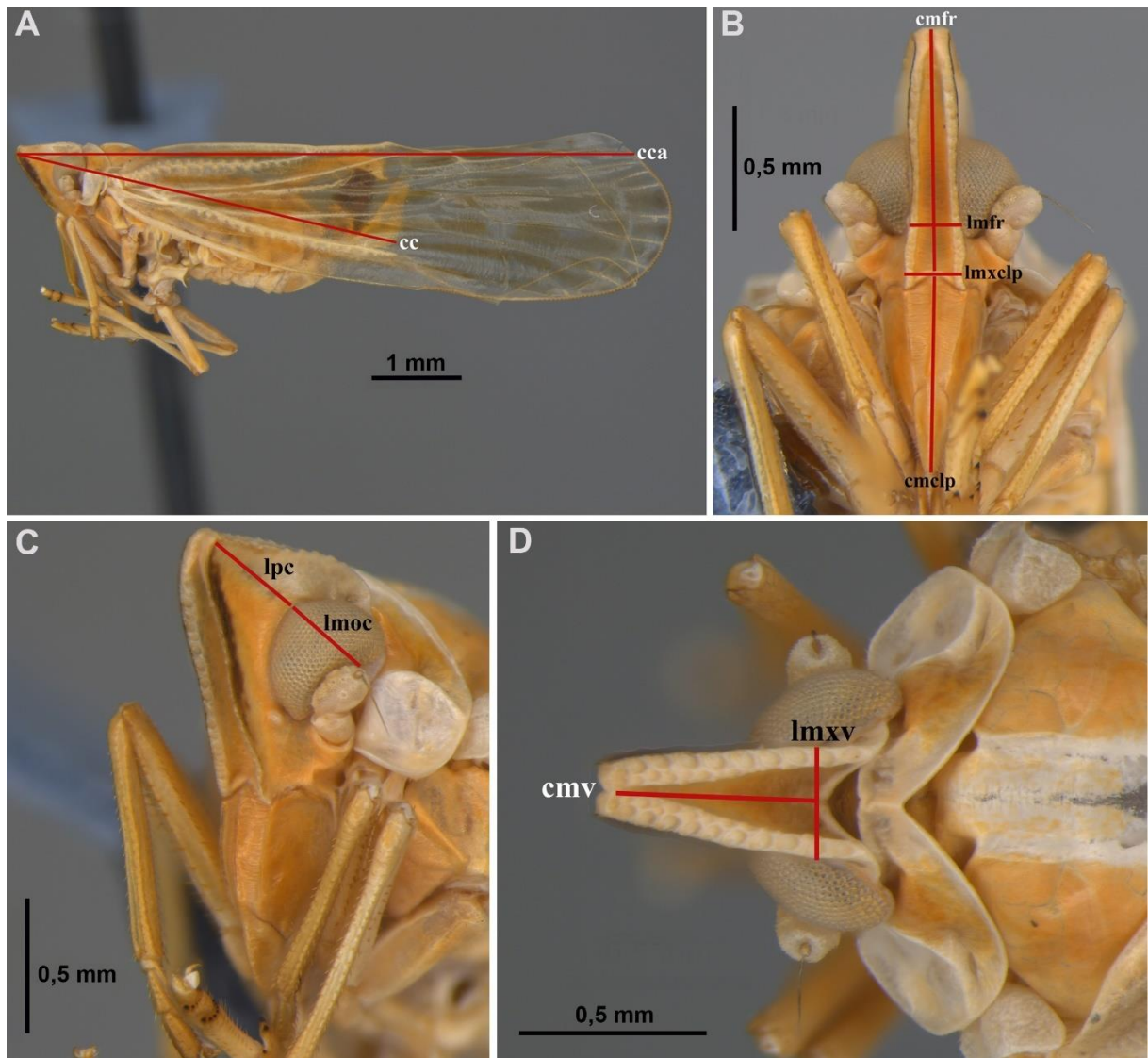


Figura 9 A-D. Morfometria de *Persis (Persis) stali* Muir. **A.** *Habitus*, vista lateral; **B.** Cabeça, vista anterior; **C.** Cabeça, vista anterolateral; **D.** Cabeça e tórax, vista dorsal. Abreviações: *Habitus*: cc: comprimento do corpo; cca: comprimento do corpo incluindo as asas. *Cabeça*. cmcl: comprimento mediano do clipeo; lmfr: largura mediana da frente; lmxcl: largura máxima do clipeo; lmoc: largura mediana dos olhos compostos; lpc: largura da projeção da cabeça. *Tórax*. cmv, comprimento mediano do vértice; lmxv: largura máxima do vértice.

3.9. Chave dicotômica ilustrada

A chave dicotômica foi elaborada com base na análise dos espécimes, foram usados caracteres morfológicos diagnósticos, comparações de caracteres com suas respectivas fotografias e desenhos.

3. 10. Organização da dissertação

Esta dissertação está estruturada no formato de artigos, abrangendo três capítulos de taxonomia referente a cada um dos subgêneros de *Persis*. O primeiro capítulo, intitulado “*Persis*

(*Anapersis*) Fennah, 1952 from Brazil (Hemiptera: Fulgoroidea: Derbidae) and identification key to the New World species”, teve como objetivo descrever, ilustrar e propor um novo táxon para o subgênero encontrado durante o desenvolvimento do trabalho.

O segundo capítulo intitulado “Taxonomic study of *Persis* (*Persis*) Stål from South America: redescription of two species and description of two new species (Hemiptera: Fulgoroidea: Derbidae) teve como objetivo a redescrição de *Persis* (*Persis*) *pugnax* e *Persis* (*Persis*) *stali*, propor novos táxons que foram encontrados durante o desenvolvimento do trabalho como um todo, além de ampliar a distribuição do subgênero.

O terceiro, intitulado “Redescription of the subgenus *Persis* (*Eritalaena*) Fennah, and new records from Neotropical Region (Hemiptera: Fulgoromorpha: Derbidae) conta com a redescrição de *Persis* (*Eritalaena*) *fuscinervis*, juntamente com seu primeiro registro para dois países.

Ao final, é apresentada uma síntese dos resultados, visando estabelecer a relação entre os capítulos desta dissertação. Os capítulos foram formatados de acordo com a norma da revista científica de interesse.

4. CAPÍTULO I

**Cantanhede, I.; Viegas, E. F. G. & Ale-
Rocha, R. *Persis* (*Anapersis*) Fennah,
1952 from Brazil (Hemiptera:
Fulgoroidea: Derbidae) and
identification key to the New World
species**

Manuscrito formatado para *Zootaxa*¹

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1 ***Persis (Anapersis) Fennah, 1952 from Brazil (Hemiptera: Fulgoroidea: Derbidae) and***
2 **identification key to the New World species**

3 INEZITA CANTANHEDE^{1,*}, EDUARDA FERNANDA GOMES VIEGAS² & ROSALY
4 ALE-ROCHA³

5 ¹Graduate Program in Entomology, Instituto Nacional de Pesquisas da Amazônia, Av. André
6 Araújo, Petrópolis, 2936, Manaus, 69067–375, Amazonas, Brazil. [https://orcid.org/0000-](https://orcid.org/0000-0002-1747-4742)
7 0002–1747–4742

8 ²Scholarship DTI–A, CNPq, Instituto Nacional de Pesquisas da Amazônia, Manaus, Av. André
9 Araújo, Petrópolis, 2936, Manaus, 69067–375, Amazonas, Brazil.

10 Email, edwviegasgomes@gmail.com; <https://orcid.org/0000-0003-3349-5639>

11 ³Biodiversity Coordination, Instituto Nacional de Pesquisas da Amazônia, Caixa Postal 2223,
12 Manaus, 69080–971, Amazonas, Brazil. Fellowship PQ/CNPq. Email, rosalyale@gmail.com;
13 <https://orcid.org/0000-0001-9874-9770>

14 *Corresponding author. E-mail: inezitacneta@gmail.com

15

16 **4.1. Abstract:**

17 We report for the first time the occurrence of the subgenus *Persis (Anapersis)* in Brazil, in the
18 Amazon and Cerrado biomes, through the description of *P. (Anapersis) takiyae* **sp. nov.** A key
19 to the subgenera of *Persis* and for six *Persis (Anapersis)* species is provided.

20

21 **Key words:** biodiversity, Fulgoromorpha, planthoppers, taxonomy.

22

23 **4.2. Introduction**

24 *Persis* Stål, 1862 is a genus restricted to the New World which belongs to the tribe Cenchreini
25 Muir, 1913 and comprise 12 known species (Bourgoin 2024; Bartlett *et al.* 2024). The division

26 of *Persis* into subgenera, *Persis (Anapersis)* Fennah, *Persis (Persis)* Stål and *Persis*
27 (*Eritalaena*) Fennah, was proposed by Fennah (1952) after he reviewed the groups of Derbidae.

28 According to Fennah (1952), members of *Persis (Anapersis)* are characterized by the head
29 in profile with projection twice smaller than the width of the eyes, pronotum with paradiscal
30 region deep, developed antennal fovea and pygofer with medioventral process well-developed.
31 Based on this set of characteristics, he transferred to this subgenus the species *Neocenchrea*
32 *gregaria* Fennah, 1945 (Trinidad, St. Vincent, Grenada and St. Lucia) designated as the type
33 specie, *Neocenchrea pallescens* Metcalf, 1938 (Panama) and *Mysidia ? spreta* Fowler, 1900
34 (Mexico), with the following combinations: *Persis (Anapersis) pallescens* (Metcalf, 1938) and
35 *Persis (Anapersis) spreta* (Fowler, 1900). In that work, the first identification key for the genera
36 and subgenera of Cenchreini was also provided.

37 The first species described for the subgenus *Persis (Anapersis)* were provided by O'Brien
38 (1986), *Persis (Anapersis) ferox*, and *Persis (Anapersis) arizonensis*, both from United States
39 of America and Mexico. Recently, Bahder (2021) transferred *Phaciocephalus pallidovenosus*
40 (Stål, 1862) (Brazil), to *Persis (Anapersis)*, with the combination *Persis (Anapersis)*
41 *pallidovenosa* (Stål, 1862).

42 There are no studies on the phylogenetic relationships between species and between
43 subgenera of *Persis*, and between *Persis* and other genera in Cenchreini, thus, sister group
44 relationships are unknown. However, Fennah (1952), when proposing the subgenera, noted that
45 the paradiscal region of the pronotum of *Persis (Anapersis)* and *Persis (Persis)* forms a fovea
46 behind the eyes that surrounds the antenna, indicating a possible close relationship between
47 these subgenera. While in *Persis (Eritalaena)* this region was described by Fennah (1952) as
48 "no antennal fovea developed".

49 In this paper, we describe and illustrate a species of *Persis (Anapersis)* from Brazil, *P.*
50 (*Anapersis*) *takiyae* **sp. nov.**. In addition, we provide an identification key for *P. (Anapersis)*,

51 with the exception of *P. (Anapersis) spreata* (Fowler, 1900). *Persis (Anapersis) spreata* that was
52 not included because we did not have access to the type material or photographs, and its
53 description is very superficial, lacking characters that delimit this species. We also provide an
54 updated distribution map of the subgenus for Brazil.

55

56 **4.3. Material and methods**

57 Studied specimens in this paper belong to the in following collections:

58 CZMA = Coleção Zoológica do Maranhão, Caxias, Maranhão, Brazil;

59 DZRJ = Coleção Entomológica Professor José Alfredo Pinheiro Dutra, Universidade Federal
60 do Rio de Janeiro, Rio de Janeiro, Brazil;

61 DZUP = Coleção Entomológica Pe. Jesus Santiago Moure, Universidade Federal do Paraná,
62 Curitiba, Brazil;

63 INPA = Coleção de Invertebrados do Instituto Nacional de Pesquisas da Amazônia, Manaus,
64 Brazil.

65

66 For the study of the genital structures, the abdomen was detached from the thorax,
67 macerated into 85% hot lactic acid, examined under a Leica M165C stereomicroscope, and
68 illustrated immersed in glycerin jelly. Afterward, genitalia were stored in plastic microvials
69 with glycerin and pinned with the specimen. Forewing of a specimen was detached, cleaned by
70 a short xylol bath, and mounted between cover glasses with Euparal for photography. After
71 drying, sides of cover slides were glued to a small piece of cardboard and pinned below the
72 specimen. Digital photographs were taken with a Leica MC 170 HD camera attached to a
73 stereomicroscope and combined into expanded focus images by Leica Application Suite
74 software.

75 Terminology of the head characters mostly follows O'Brien & Wilson (1985), for
76 forewing venation follows Bourgoïn *et al.* (2015), for male genitalia mostly follows Bourgoïn
77 (1988) and Bourgoïn & Huang (1990), and for female genitalia it follows Bourgoïn (1993).

78 The measurements were taken as follows: body length (from the tip of head to the tip of
79 anal tube) and body length including forewings (from the tip of head to the tip of forewing),
80 both measurements were taken in lateral view; head projection width (from the apex of the head
81 to the nearest eye margin) and eyes width (in the medial region of the eye), both measurements
82 were taken in lateral view; vertex length (from the base of the transverse carina of the transition
83 front to the vertex), this measurement was taken in dorsal view; maximum vertex width (in the
84 basal region of the vertex between the carina) and minimum vertex width (in the apical region
85 of the vertex between the carina), both measurement were taken in dorsal view; frons length
86 (close to the transverse carina to the epistomal suture) and width (in the lowest height region of
87 the compound eyes), both measurements were taken in anterior view; clypeus length (from the
88 epistomal suture to the apex of the clypeus) and width (near to suture epistomal), both
89 measurements were taken in anterior view.

90 The distribution map was created with QGIS 3.20
91 (https://www.qgis.org/pt_BR/site/forusers/download.html), using geographical coordinates
92 from specimen labels. We used Google Earth® to locate approximated collecting sites for
93 specimens without geographical coordinates. Label information of examined specimens is
94 provided verbatim with square brackets indicating comments or extrapolated information.

95 **4.4. Results**

96 **Taxonomy**

97 **Hemiptera Linnaeus, 1758**

98 **Fulgoromorpha Evans, 1946**

99 **Fulgoroidea Latreille, 1807**

100 **Derbidae Spinola, 1839**

101 **Cenchreini Muir, 1918**

102 ***Persis* Stål, 1862**

103 Type species: *Persis pugnax* Stål, 1862; by original designation.

104 *Persis* Stål, 1862: 7; 1866: 193 (key); 1869: 99 (citation); Muir, 1913: 32 (key); 1918a: 416
 105 (notes); 1918b: 231 (key): 243 (citation); Metcalf, 1938: 326 (key, notes); 1945: 90
 106 (catalogue); Caldwell, 1944: 105 (notes), 106 (description), 108 Figs Plate I, 7A–C
 107 (genitalia); Fennah 1952: 127 (key), 138–142 (subgenera); O’Brien 1982: 319
 108 (catalogue); Bartlett *et al.* 2014: 25 (key), 152 (citation).

109 **Subgenus *Persis*** Stål, 1862: 7 (as genus) (type species *Persis pugnax* Stål, 1862, by original
 110 designation)

111 **Subgenus *Anapersis*** Fennah, 1952: 140 (type species *Neocenchrea gregaria* Fennah 1945 by
 112 original designation)

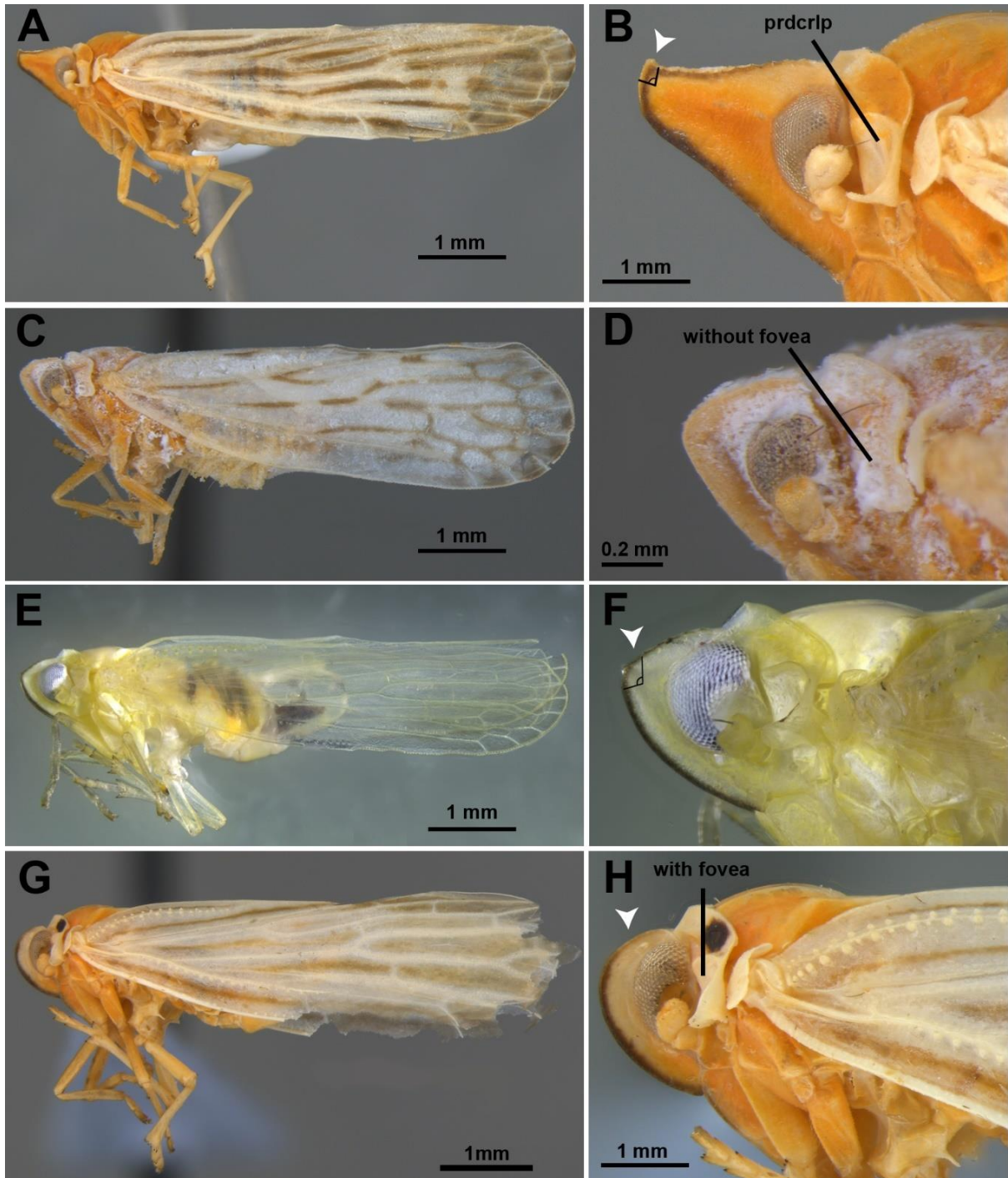
113 **Subgenus *Eritalaena*** Fennah, 1952: 142 (Type species: *Persis fuscinervis* Muir, 1918: 417 (by
 114 original designation and monotypy).

115

116 **Diagnosis.** Head produced beyond the eyes (Figs 1A–H); vertex and frons concave,
 117 compressed, with raised lateral carinae bearing a row of pits, median carina absent (Figs 2A–
 118 F). Transverse carina between vertex and frons present (Figs 2E, 3E, 4B). Antennae short,
 119 pedicel spheroid, about as long as wide (Figs 1B, D, F, H). Pronotum short, narrow, concave
 120 posteriorly (Figs 2B, D, F, 5E). Forewing elongated, exceeding the abdomen apex (Figs 1A,
 121 C, E, G, 3A, D, 4A, D, 5A, B) with pustules in ScP+R and Pcu veins, clavus closed (Fig. 5F).
 122 Males with medioventral process on pygofer present (Figs 6A–C). Female with medioventral
 123 process on sternite VII present (Figs 8A–C).

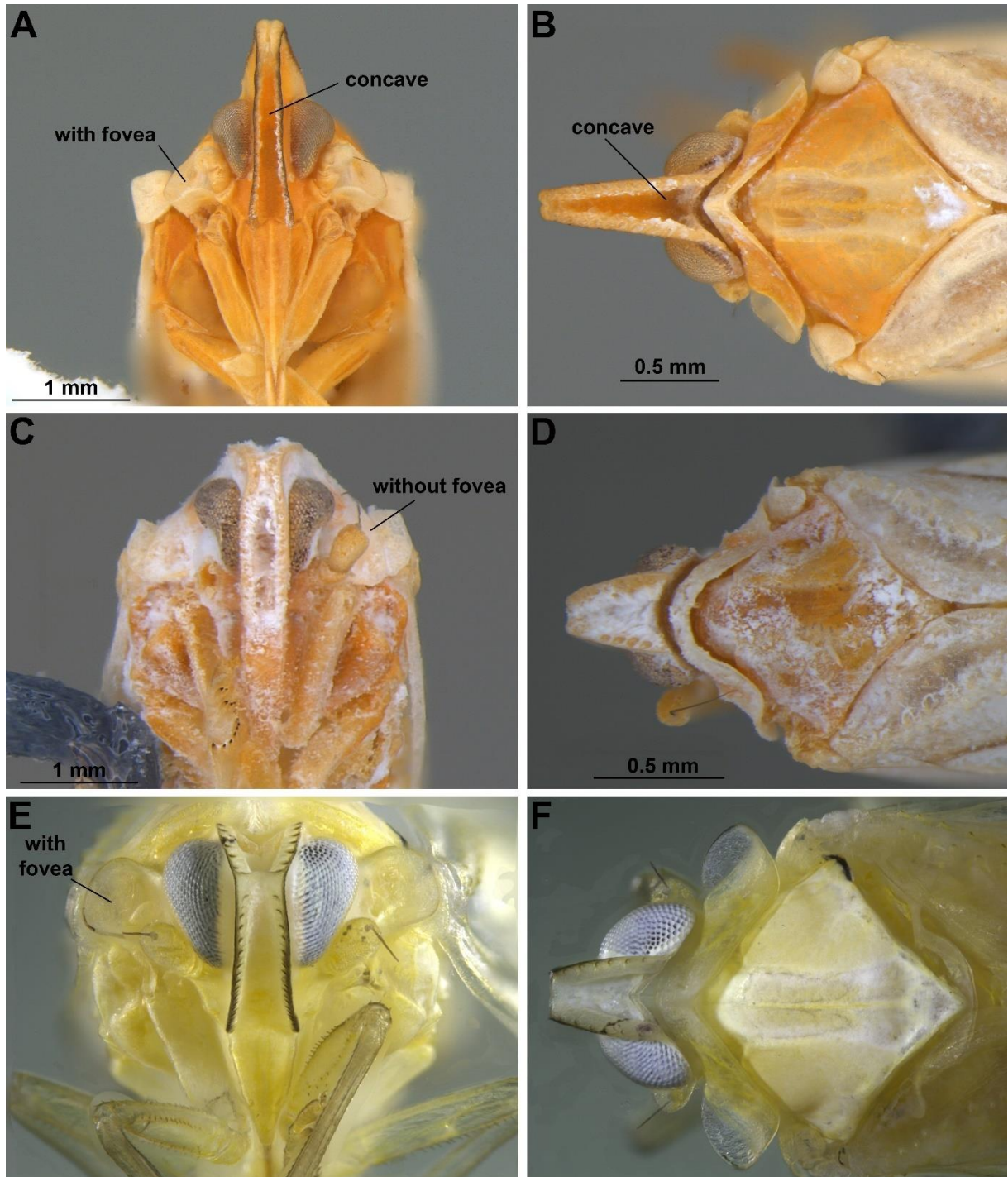
- 124 **Key to subgenera of *Persis* and species of *Persis* (*Anapersis*) Fennah (except *Persis***
 125 ***(Anapersis) spreta* (Fowler))**
- 126 1 Paradiscal region of pronotum greatly foliate forming antennal foveae behind eyes (Figs
 127 1B, F, H, 2A, E) ... 2
- 128 - Paradiscal region of pronotum not greatly foliate, not forming antennal fovea behind eyes
 129 (Figs 1D, 2C) ... *Persis (Eritalaena)* Fennah
- 130 2 Head produced beyond the eyes for distance greater than eye width, acutely angulate in
 131 profile (Fig. 1B) ... *Persis (Persis)* Stål
- 132 - Head produced beyond the eyes for distance no greater than eye width, obtusely angular
 133 (Fig. 1F) or rounded in profile (Fig. 1H) *Persis (Anapersis)* Fennah ... 3
- 134 3 Transverse carina between vertex and frons not forming an obtuse angle in profile (Fig.
 135 1H) ...4
- 136 - Transverse carina between vertex and frons forming an obtuse angle in profile (Fig. 1F)
 137 ... 5
- 138 4 Black band covering the lateral carinae of the vertex and frons (Figs 5C, D); pronotum
 139 with two black spots (Figs 5A–E) ... *Persis (Anapersis) takiyae* **sp. nov.**
- 140 - Black band absent at the vertex and at the frons (Figs 4D, E); pronotum without black
 141 spots (Fig. 4D) ... *Persis (Anapersis) pallidovenosa* (Stål)
- 142 5 Pronotum with four black spots (Fig. 3A) ... *Persis (Anapersis) ferox* O' Brien
- 143 - Pronotum without black spots (Figs 3D, 4A, D) ... 6
- 144 6 Forewing bicolor (Fig. 4A) ... *Persis (Anapersis) arizonensis* O' Brien
- 145 - Forewing unicolor (Figs 1E, 3D) ... 7
- 146 7 Lateral carina divergent towards the clypeus (Fig. 2E); female pregenital sternite (Sternite
 147 VII) with medioventral process semicircular ... *Persis (Anapersis) gregaria* (Fennah)

- 148 - Lateral carina subparallel towards the clypeus (Fig. 3E); female pregenital sternite
149 (Sternite VII) with medioventral process triangular ... *Persis (Anapersis) pallescens*
150 Metcalf



151

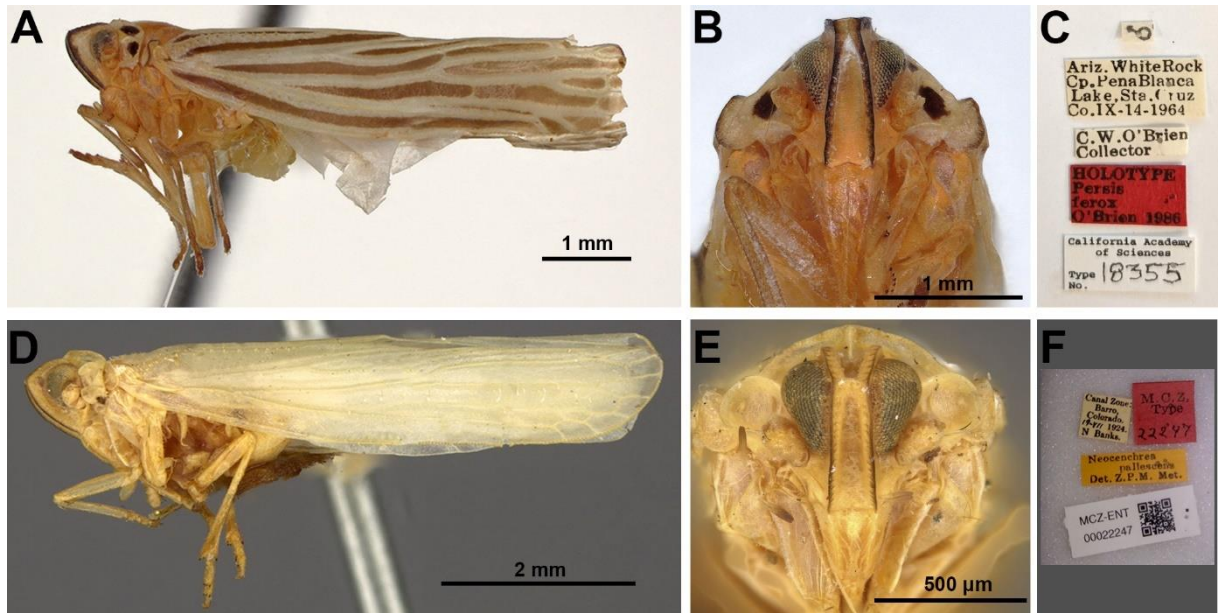
152 **FIGURE 1 A–H.** *Persis* species. **A–B.** *Persis (Persis) pugnax* Stål, female. **A.** Habitus, lateral
 153 view; **B.** Head, lateral view. **C–D.** *Persis (Eritalaena) fuscinervis* Muir, female. **C.** Habitus,
 154 lateral view; **D.** Head, lateral view; **E–F.** *Persis (Anapersis) gregaria* Fennah, male. **E.** Habitus,
 155 lateral view; **F.** Head, lateral view; **G–H.** *Persis (Anapersis) takiyae* **sp. nov.** male habitus. **G.**
 156 Habitus, lateral view; **H.** Head, lateral view. Photographs: E, F Dr. Charles Bartlett (UF/IFAS).



157

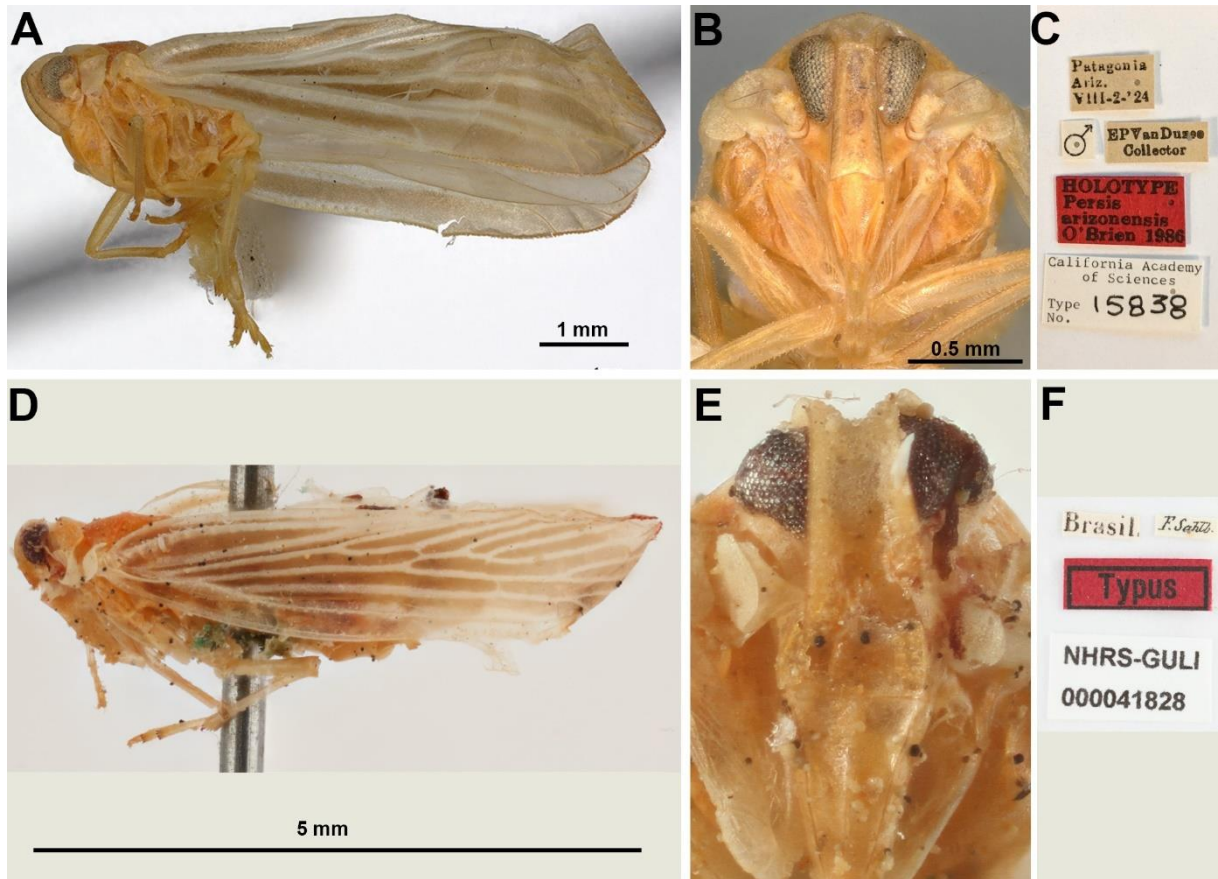
158 **FIGURE 2** A–F. Subgenera of *Persis* Stål A–B. *Persis (Persis) pugnax* Stål, female. A. Head,
 159 anterior view; B. Head and thorax, dorsal view. C–D. *Persis (Eritalaena) fuscinervis* Muir,
 160 female. C. Head, anterior view; D. Head and thorax, dorsal view. E–F. *Persis (Anapersis)*
 161 *gregaria* Fennah, male. E. Head, anterior view; F. Head and thorax, dorsal view. Photographs:
 162 E, F Dr. Charles Bartlett (UF/IFAS).

163



164

165 **FIGURE 3 A–F.** Holotypes of *Persis* (*Anapersis*) Fennah species. **A–C.** Holotype male *Persis*
 166 (*Anapersis*) *ferox* O'Brien, CAS/8355. **A.** Habitus, lateral view; **B.** Head, anterior view; **C.**
 167 Labels. **D–F.** Holotype female *Persis* (*Anapersis*) *pallescens* Metcalf, MCZ/22247. **D.** Habitus,
 168 lateral view; **E.** Head, anterior view; **F.** Labels. Photographs: A–C. Dr. Charles Bartlett
 169 (UF/IFAS); D–F. image from the website of the Museum of Comparative Zoology (MCZ,
 170 Harvard University, Cambridge MA; ©President and Fellows of Harvard College, used by
 171 permission) <http://mczbase.mcz.harvard.edu/guid/MCZ:Ent:22247>.



172

173 **FIGURE 4 A–F.** Holotypes of *Persis* (*Anapersis*) Fennah species. **A–C.** Holotype male *Persis*
 174 (*Anapersis*) *arizonensis* O'Brien, CAS/15838, **A.** Habitus, lateral view; **B.** Head, anterior view;
 175 **C.** Labels. **D–F.** Syntype female *Persis* (*Anapersis*) *pallidovenosa* Stål, NHRS-GULI/
 176 000041828. **D.** Habitus, lateral view; **E.** Head, anterior view; **F.** Labels. Photographs: A–C. Dr.
 177 Charles Bartlett (UF/IFAS); D–F. Dr. Gunvi Lindberg (SMNH).

178

179 *Persis* (*Anapersis*) Fennah

180 (Figs 1E, F, G, H; 2E, F; 3 A–F, 4 A–F, 5A–F)

181 Type species: *Persis* (*Anapersis*) *gregaria* Fennah, 1952; by original designation.

182 *Persis* (*Anapersis*) Fennah, 1952: 140; O'Brien 1982:308 (key), 319 (catalogue); O'Brien 1986:
 183 70–72, Figs 7, 8, 9, 10–12, 15, 18 (head, thorax, and male terminalia) (description and
 184 key); Bartlett *et al.* 2014: 152 (citation); Bahder *et al.* 2021: 126, Fig.6 (habitus, head,
 185 labels), 128 (new combinations).

186 **Amended diagnosis.** Medium sized *Persis* (*Anapersis*): body length 4.5–9.9 mm in males, 3.0–
 187 7.2 mm in females. Head projecting beyond the eyes 2 times smaller than the width of the
 188 compound eye in lateral view (Figs 1E, F, G, H, 3A, D, 4A, D, 5A, B, D); projection of the
 189 head between the eyes variable, obtusely angular (Figs 1E, F, 3A, D, 4A) or roundend in profile
 190 (Figs 1G, H, 4D). Pronotum with paradiscal regions deep, forming cup-shaped foliated foveae
 191 that partially circumscribe the antennae (Figs 1F, H, 2E); median carina present, but weakly
 192 marked (Figs 2F, 5E); lateral carinae strongly diverging towards the tegula in dorsal view (Figs
 193 2F, 5E); posterior margin acutely concave (Figs 2F, 5E). Mesonotum with median carina
 194 present, strongly marked; lateral carinae present, weakly marked (Figs 2F, 5E). Forewing (Fig.
 195 5F): ScP+R vein long, finishing at the level of clavus apex; RA vein with apex strongly curved
 196 anteriorly; RP vein arising after ScP+R vein; RP vein with three cells (C1, C1', C1b, C1b');
 197 MP vein with four branches; first forking of MP vein arising after apex of clavus; forking of
 198 CuA vein arising after Pcu+A₁ vein. Hindwing: unbranched RP vein, unbranched MP vein,
 199 CuA vein with two branches. Legs: metatibia without lateral spines (Figs 5A, B).

200 **Etymology.** In the original description (Fennah 1952) the etymology of *Persis*
 201 (*Anapersis*) was not stated. However, Dmitriev (2022) provides the etymology and unknown
 202 grammatical gender of several genera, including for *Persis*. *Persis* is a name given referring to
 203 a country, Persia (currently known as Iran), and is feminine in gender. Therefore, the subgenus
 204 *Anapersis* is also feminine, and the prefix “*Ana*” (Greek: ἀνά) means another + “*Persis*” (Greek:
 205 Περσίς).

206 **Remarks.** *Persis* (*Anapersis*) differs from the species of *Persis* (*Persis*) by the projection
 207 of the head that is twice smaller than the width of the compound eye and the paradiscal region
 208 forms a deep fovea, while in *Persis* (*Persis*) species the projection of the head is 2.0 times
 209 greater than the width compound eye and the paradiscal region forms a shallow fovea (Figs 1A,
 210 B). *Persis* (*Anapersis*) species differs from the species of *Persis* (*Eritalaena*) by the presence

211 of the tricrenate clypeus, forewing with long ScP+R vein, RA vein with the apex strongly
212 curved anteriorly and RP vein with five cells (C1, C1', C1a, C1b, C1b'), while in *Persis*
213 (*Eritalaena*) species there is no median carina in the clypeus, forewing with short ScP+R vein,
214 RA vein with the apex strongly curved anteriorly and RP vein with four cells (C1, C1', C1a,
215 C1b). To date *Persis* (*Anapersis*) species have been recorded in North, Central, and South
216 America, while *Persis* (*Persis*) and *Persis* (*Eritalaena*) species have records restricted to
217 Central and South America.

218 Although we did not find works that specifically address the biology of *Persis*, some
219 information can be extracted both from studies focused on larger groups such as families, tribes,
220 etc., and from labels (location, collection method, seasonality). Using these means, we raised
221 small topics about the biology of *Persis*.

222 From the records contained in the literature it is known that in Brazil *Persis* (*Anapersis*)
223 is registered for the state of Rio de Janeiro (Bourgoin 2024), in the Atlantic Forest biome, the
224 second largest tropical forest in Brazil. The Atlantic Forest extends along the entire Brazilian
225 coast, covering about 1.1 million km² and three regions, Northeast, Southeast and South
226 (Tanizaki & Moulton 2000). Based on this information, we can assume that *Persis* (*Anapersis*)
227 is probably widespread in more Brazilian states covered by the Atlantic Forest biome.
228 Specimen's labels suggest that they can be found in the understory and canopy of trees. The
229 specimens of *Persis* (*Anapersis*) analyzed in this study were collected in the months of January,
230 February, March, May and December. The largest number of specimens collected were during
231 the months of December and February, the rainy season in Brazil. Both nymphs and adults of
232 Derbidae prefer humid places (Howard 2001), so their populations can be influenced by water
233 availability. In the work of Silva *et al.* (2018) with leafhoppers from the state of Sergipe (Brazil)
234 it was observed that the diversity and number of individuals of the suborder Auchenorrhyncha
235 are influenced by seasonal variation and climatic conditions. One of their conclusions is that

236 the composition and abundance of the Cenchreini representatives increase during the rainy
 237 season. Besides that, based on information from labels of specimens and literature data,
 238 specimens have been collected using Malaise trap and sweep.

239 **Records.** Neotropical Region: Brazil (Rio de Janeiro), Panama, Grenada, Saint Lucia,
 240 Saint Vicent and the Grenadines, and Trinidad–Tobago (Bourgoin 2024). Nearctic Region:
 241 Mexico (Sonora), United States of America (Arizona) (Bourgoin 2024).

242 *New records: Brazil (Amazonas, Goiás, Maranhão, Mato Grosso do Sul, Minas Gerais,
 243 Paraná, São Paulo).

244

245 *Persis (Anaparsis) takiyae* sp. nov.

246 (Figs 5A–F; 6A–E; 7A–E, 8A–E; 9A–D, 10)

247 **Type material.** Holotype male (INPA). BRA [Brasil], **SP [São Paulo]**, Rio Restinga, 20°43'
 248 31"S–47°30' 60"W, 21.iii. 2008, coleta manual, 650m, J.A. Rafael, F. F. Xavier, D.S. Amorim.

249 **Condition of the holotype:** Forewing with torn edges along of the apical margin (Fig. 4A).

250 **Paratypes.** [BRASIL] **Amazonas**, Manaus, Est. Aleixo, Pomar, 29.v.1968, E. V. Silva col.
 251 (1f#, INPA 2840); **SP [São Paulo]**, Rio Restinga, 20°43'31"S–47°30'60"W, 21.iii. 2008, coleta

252 manual, 650m, J.A. Rafael, F. F. Xavier, D.S. Amorim (1 m#, 2 f#, INPA); *idem*, Araras,

253 Campus da UFSCar, 02.v.1999, D. M. Takiya (1f#, DZRJ); *idem*, Bairro José Ometto,

254 28.i.1993, G. Mejdalani (1f#, DZRJ); **Goiás**, Goiânia, 9.ii.1977, Norman Penny (3 m#, 1f#,

255 INPA). **MA [Maranhão]**, Mirador, Parque Est[adual] Mirador, Base da Geraldina, 419m,

256 06°37'25"S–45°52'08"W, Armadilha Luminosa, 08-13.iii.2008, F. Limeira-de-Oliveira; J. C.

257 Silva (1f#, DZRJ); **MS [Mato Grosso do Sul]**, Reserva Florestal Faz[enda] Coqueiro,

258 22°12'34"S–54°54'46"W, 18.ii.2009, A. Paladini leg. (1 f#, DZUP 578994); **MG [Minas**

259 **Gerais]**, Carmo do Rio Claro, 20°55'19.3"S–46°08'00.8"W, 24.xii.2020–28.ii.2021, Armadilha

260 Malaise, D. G. Pádua leg. (3 m#, 3 f#, INPA); **PR [Paraná]**, Eng[enheiro] Beltrão, xii.[19]83,

261 Rafael leg. (1 m#, DZUP 399203); *idem*, (1 m#, DZUP 399204); *idem*, (1 m#, DZUP 399205);
262 *idem*, (1 m#, DZUP 399206); *idem*, (1 m#, DZUP 399208); *idem*, (1 m#, DZUP 399207).

263 **Measurements:** Body length: male 2.7–4.7 mm (5.7–9.9 mm including wings) (N=12); female:
264 3.0–3.6 mm (6.1–7.6 mm including wings) (N=9).

265 **Diagnosis.** Pronotum with two oval lateral black spots near lateral region (Figs 5A–E). Pygofer
266 with a pair of long digitiform projections on posterodorsal margin (Figs 6A, B).

267 **Description.** Coloration. General body color orange with pale yellow to white regions (Figs
268 5A–E). Vertex, lateral region of the frons above lateral ocelli, tegula, pronotum, epimeron,
269 episternum and scutellum pale yellow or white. Narrow black band covering the lateral carinae
270 of the vertex and frons (Figs 5C, D). Pronotum with two oval black spots near lateral margin
271 (Figs 5C–E). Mesonotum orange, with a yellow stripe covering the lateral carina (Fig. 5E).
272 Forewing semi hyaline, pale yellow, with pale brown cells: brown, long and narrow horizontal
273 stripe inside postcostal, medial, CPcu+A1, CPcu+A1' cells; C1a, C1', C1b', C2, C2', C3' C3a,
274 C3a', C3b, C4' cells predominantly brown; wide brown horizontal stripe on the apical half of
275 the radial cell (Fig. 5F). Hind wing semi hyaline, white. Legs predominantly pale yellow (Fig.
276 5A). Abdomen yellowish-orange, except all tergites brown, pygofer, gonostylus and anal tube
277 (segment X) pale yellow (Fig. 6A).

278 *Head:* Frons approximately 4 times as long as wide (Fig. 5C); projection of the head
279 beyond the eyes without angulation in profile (Figs 1G, H, 5A, B, D); lateral carina of frons
280 parallel, in anterior view (Fig. 5C); vertex trapezoidal in dorsal view, with rounded posterior
281 margin and minimum vertex width greater than $\frac{1}{4}$ of its maximum width (Fig. 5E); epistomal
282 suture triangular medially (Fig. 5C); clypeus approximately 4 times as long as wide (Fig. 5C);
283 median carina absent (Figs 5C, D). *Thorax:* pronotum with anterior margin truncate (Fig. 5E);
284 mesonotum with lateral carina parallel (Fig. 5E). Forewing: ScP+R vein long, finishing at the
285 level claval apex; RA vein with the apex slightly curved anteriorly; RP vein arising before the

286 ScP vein; RP vein with four cells (C1, C1', C1b, C1b'); forking of MP₁₊₂ vein arising after the
287 ir cross-vein (Fig. 5F).

288 *Male terminalia* (Figs 6A–E, 7A–E): Pygofer symmetrical, subrectangular, narrowest
289 dorsally, with digitiform projection on posterodorsal margin in lateral view (Figs 6A–C);
290 projection digitiform elongated and robust, extending beyond the middle of the anal tube,
291 rounded apex in lateral view (Figs 6A, B); medioventral process small, slightly produced in
292 lateral view and subtriangular, forming an obtuse angle at the apex in ventral view (Fig. 6C).
293 Gonostyli symmetrical, spatulate, apex rounded in lateral view, the same length of than anal
294 tube (Figs 6A, D); dorsal margin with two process near the apex, and a row of setae up to the
295 base of the first process. P1: first process, bifid, lobes with unequal size, a sclerosed spiniform
296 lobe and a robust lobe with a rounded apex; P2: subtriangular process, with a few setae at the
297 apex (Figs 6D, E); ventral margin sinuous, with one sclerosed subtriangular process, located
298 halfway along its length, apex of process curved ventrally (Figs 6D, E). Phallic complex
299 symmetrical (Figs 7A, B): perianthrium slightly sclerotized, without spiniform projections.
300 Aedeagus with one process long, laterally compressed, widened in the basal two third and
301 slender in the apical third, in lateral view, narrow and convergent in dorsal view (S1); one bifid
302 process of unequal size (S2): one short, slender and curved spine (S2a); one long, slender,
303 sinuous spine (S2b); one falciform spine, curved ventrally in the apical half (S3) and one
304 shorter, slender, straight apical spine inserted at apex (S4). Anal tube (segment X) robust and
305 expanded distally; dorsal margin almost straight; ventral margin sinuous with a short reentrance
306 at the apex, occupying less than 1/4 apical of the total length of the anal tube, forming two lobes
307 in ventral view (Fig. 7E); lobe almost straight, robust, with rounded apex in dorsal view (Figs
308 7C–E). Paraproct, subquadrangular, with truncate apex, almost the same length as the lobe of
309 the anal tube in dorsal view (Fig. 7D).

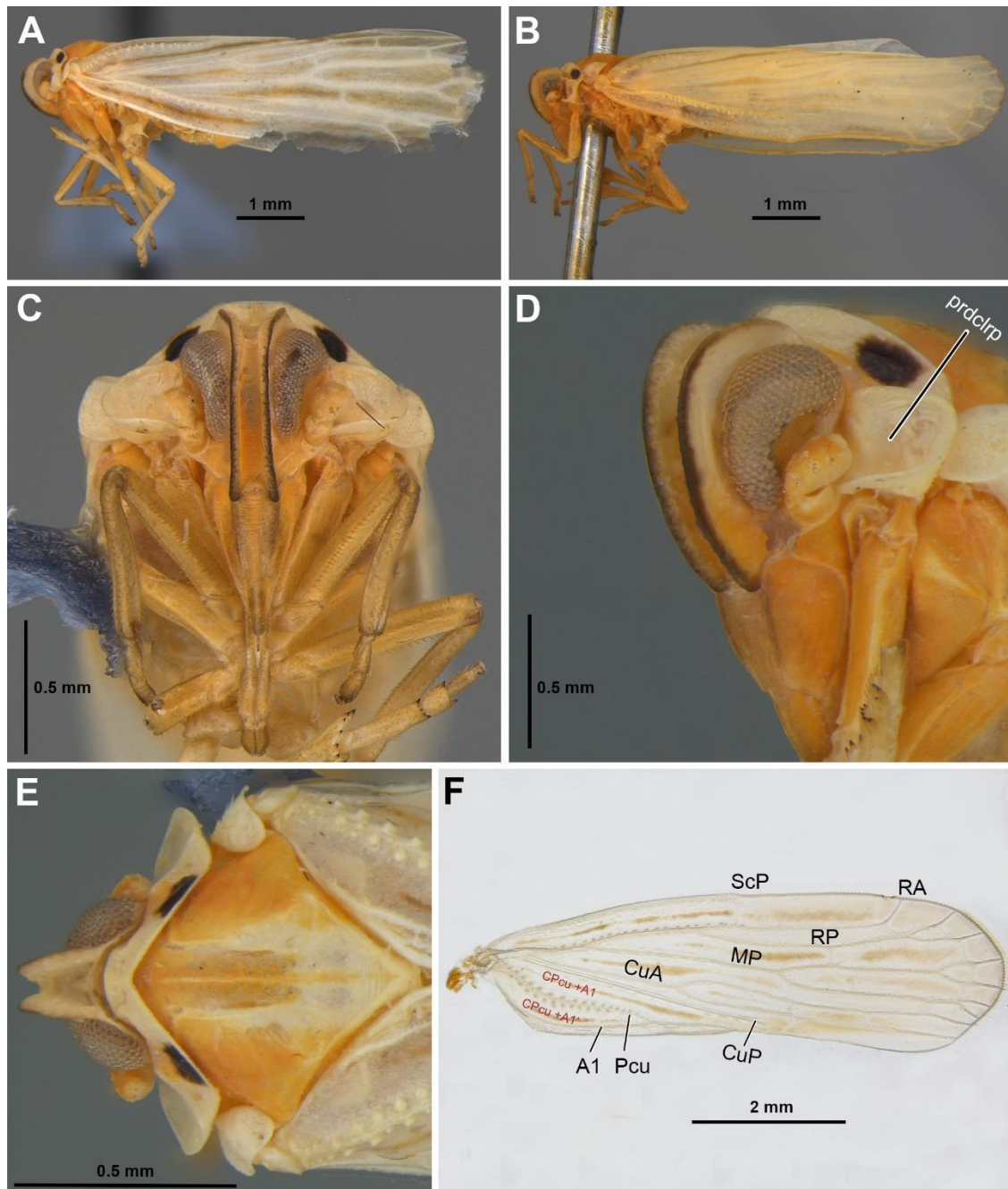
310 Female similar to male (Fig. 5B). *Female terminalia* (Figs 8A–E, 9A–D): Pregenital
311 sternite (Sternite VII), semicircular, with subrounded apex of the medioventral process, in
312 ventral view (Fig. 8B). Sternite VIII subtriangular, with rounded apex, in lateral view (Fig. 8A).
313 Gonapophysis VIII (first valvula) with one long and slender projection on dorsoapical margin,
314 with elevated irregular teeth in lateral view, forming a concavity in dorsal view; a shorter,
315 upwardly curved lateroapical projection with toothed dorsal margin in lateral view (Fig. 8D).
316 Bursa copulatrix bifid, with apically filamentous lobes narrowing towards the apex, with
317 rounded apexes, covered by small spiniform projections on apical half in lateral view (Fig. 8D).
318 Gonapophysis IX (second valvula) robust, wider basally, bifid at apical 3/4, lobes with pointed
319 and bifid apexes, straight posteriorly; ventral region of lobes with fine and small setae on apical
320 3/4; basal half of the Gonapophysis IX with spiniform projections in ventral region (Fig. 8E);
321 basal plate of Gonapophysis IX 2.8 times longer than wide; anterior margin with projected
322 median region; apex of projection truncated (Fig. 8E). Gonoplac (third valvula) subrectangular,
323 apex truncated, with smooth indentation, and bearing numerous setae apically in lateral view
324 (Fig. 9A). Anal tube (segment X), short, subquadrate in dorsal view (Fig. 9C); ventral margin
325 of the anal tube reentrant, with elongated slender digitiform lobe, bearing three long apical
326 spiniform setae, approximately half the length of the lobe (Figs 9B, D). Paraproct, subcircular,
327 with prominent apical region in dorsal view (Fig. 9C).

328 **Variations.** In some female specimens, the medioventral process of sternite VII presents
329 an indentation at the apex of the posterior margin, in ventral view (Fig. 8C). Furthermore, it
330 was observed that the number of setae at the apex of the lobe of the anal tube can vary from
331 three to four.

332 **Etymology.** The species is named to honor Dra. Daniela Maeda Takiya from the Federal
333 University of Rio de Janeiro–UFRJ, for her important contribution to the knowledge of the
334 Brazilian hemipteran fauna.

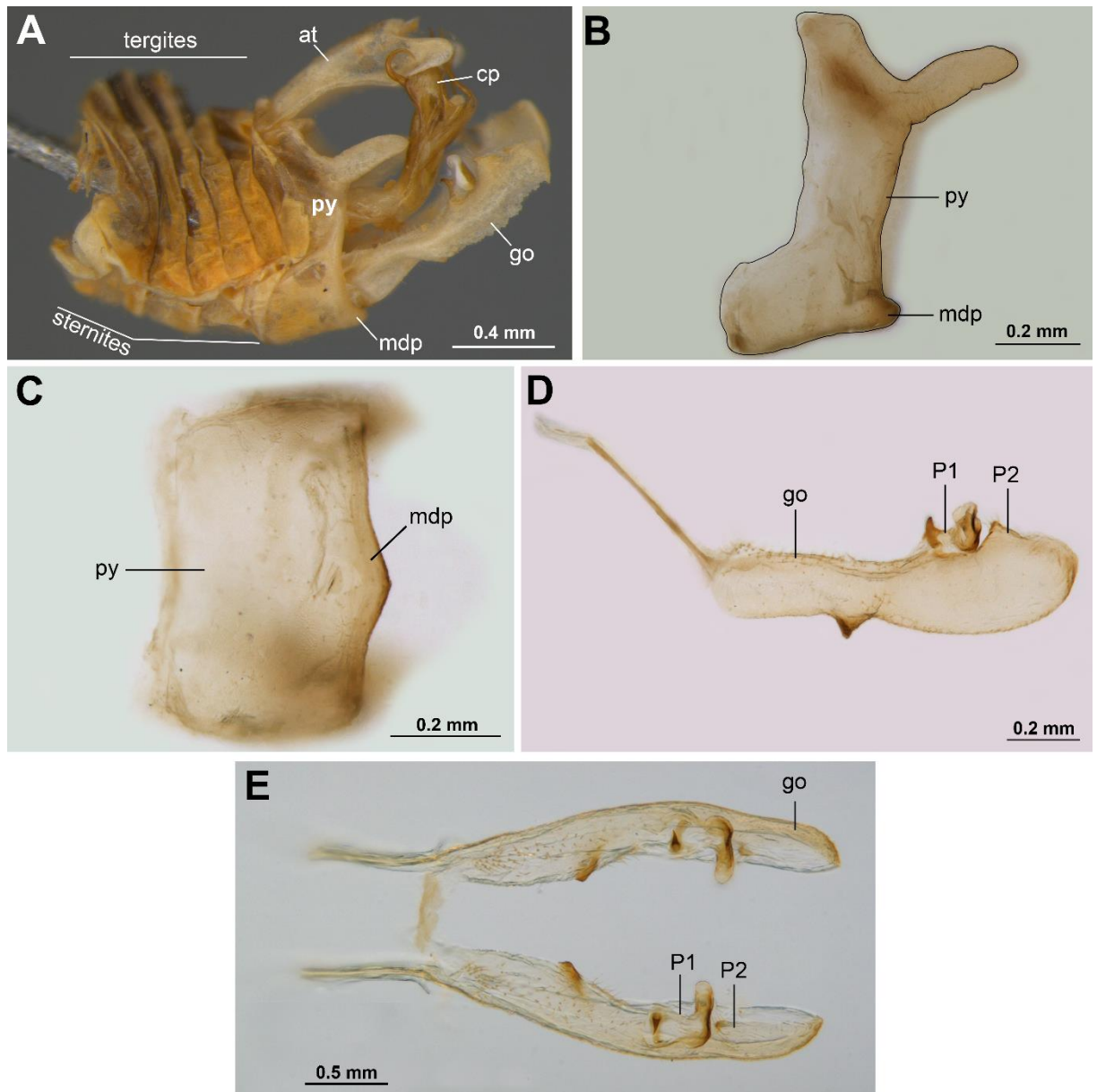
335 **Distribution.** Brazil (Amazonas, Goiás, Maranhão, Mato Grosso do Sul, Minas Gerais, Paraná
336 and São Paulo) (Fig. 10).

337 **Taxonomic notes.** *Persis (Anaparsis) takiyae* **sp. nov.** is most similar to *P. (Anaparsis) ferox*
338 in having a small medioventral process of the pygofer, and black spots on the pronotum.
339 However, *Persis (Anaparsis) takiyae* **sp. nov.** differs from the latter and all other species of the
340 genus (except *Persis (Anaparsis) pallidovenosa*) in that the vertex and frons do not form an
341 obtuse angle in lateral view. Although *Persis (Anaparsis) takiyae* **sp. nov.** and *Persis*
342 *(Anaparsis) pallidovenosa* share a rounded head shape in lateral view, in *Persis (Anaparsis)*
343 *pallidovenosa* the pronotum has no spots and the wings are pale yellow with white veins, unlike
344 what we can observe in *Persis (Anaparsis) takiyae* **sp. nov.**.



345

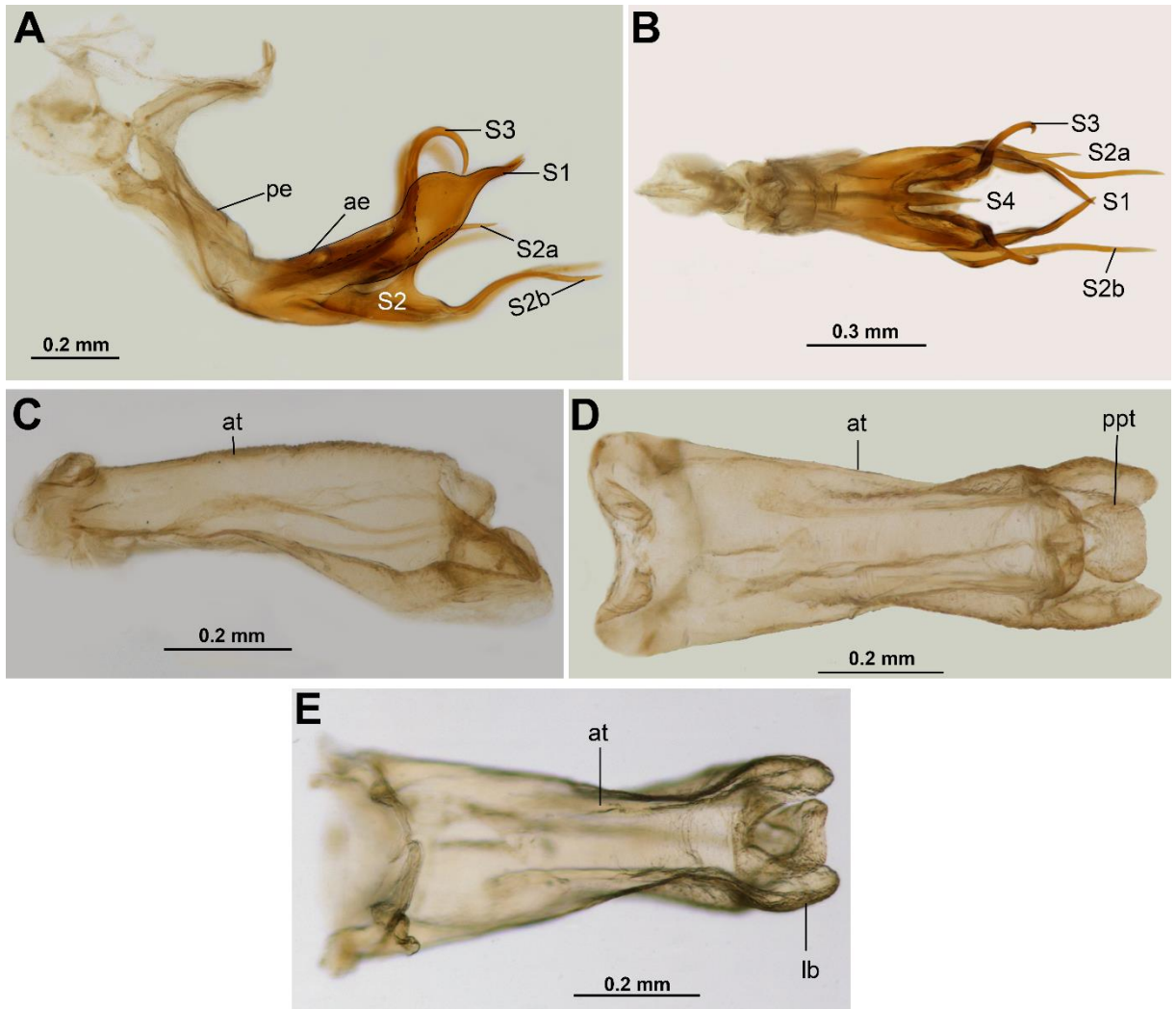
346 **FIGURE 5 A–F.** *Persis (Anapersis) takiyae* **sp. nov.** **A.** Male habitus, lateral view; **B.** Female
 347 habitus, lateral view; **C.** Male head, anterior view; **D.** Male head and pronotum, anterolateral
 348 view; **E.** Male head and thorax, dorsal view; **F.** Right forewing of paratype. Abbreviations:
 349 Thorax: prdc/r, paradiscal region of pronotum; Forewings: CuA, anterior cubitus; CuP,
 350 posterior cubitus; MP, media posterior; Pcu, postcubitus; RA, radius anterior branch; RP,
 351 radius posterior branch; ScP, Subcosta posterior. Cells: CPcu+A1, Pcu+A1 cell; CPcu+A1', CPcu+A1
 352 cell.



353

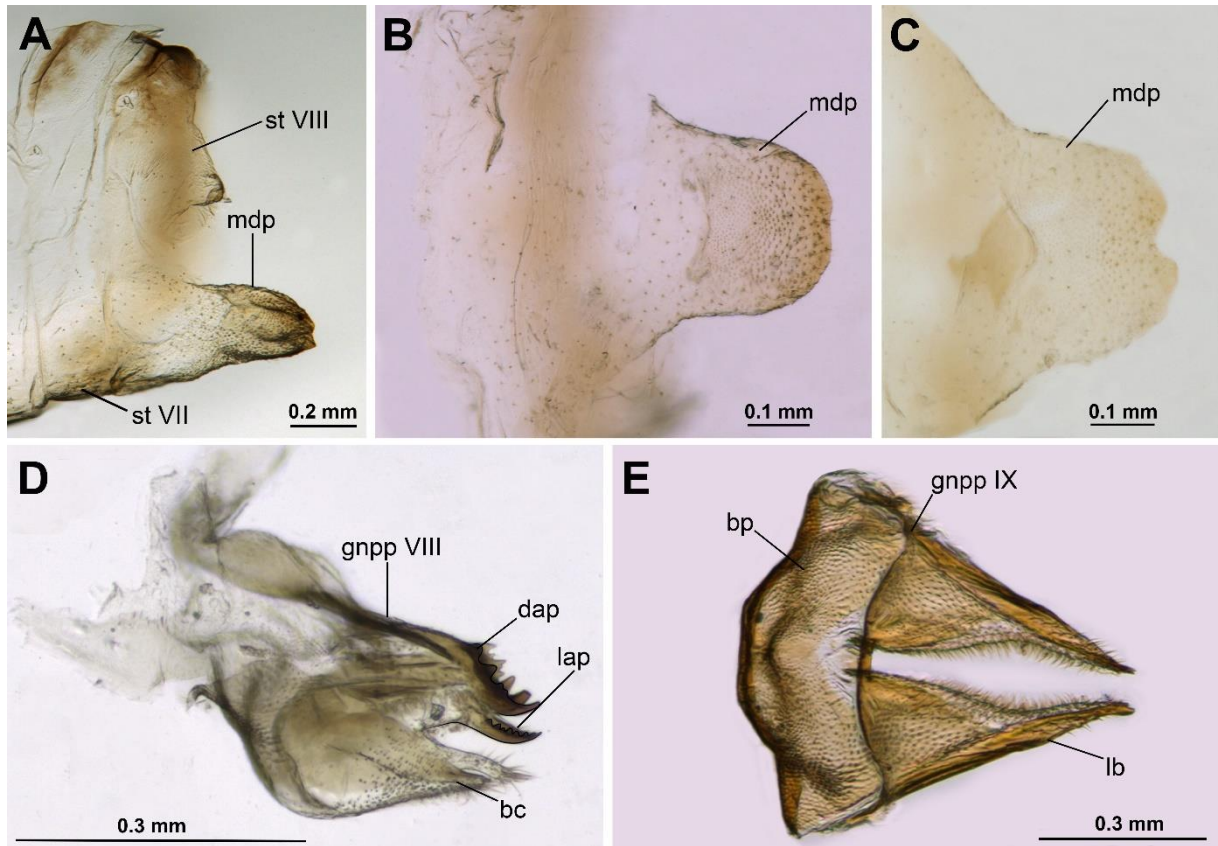
354 **FIGURE 6 A–E.** *Persis (Anapersis) takiyae* **sp. nov.**, male terminalia: **A.** Abdomen and genital
 355 capsule, lateral view; **B.** Pygofer, lateral view; **C.** Pygofer, ventral view; **D.** Gonostylus, lateral
 356 view; **E.** Gonostyli, dorsal view. Abbreviations: at, anal tube; cp, phallic complex; go,
 357 gonostylus; mdp, medioventral process; p, process; py, pygofer.

358



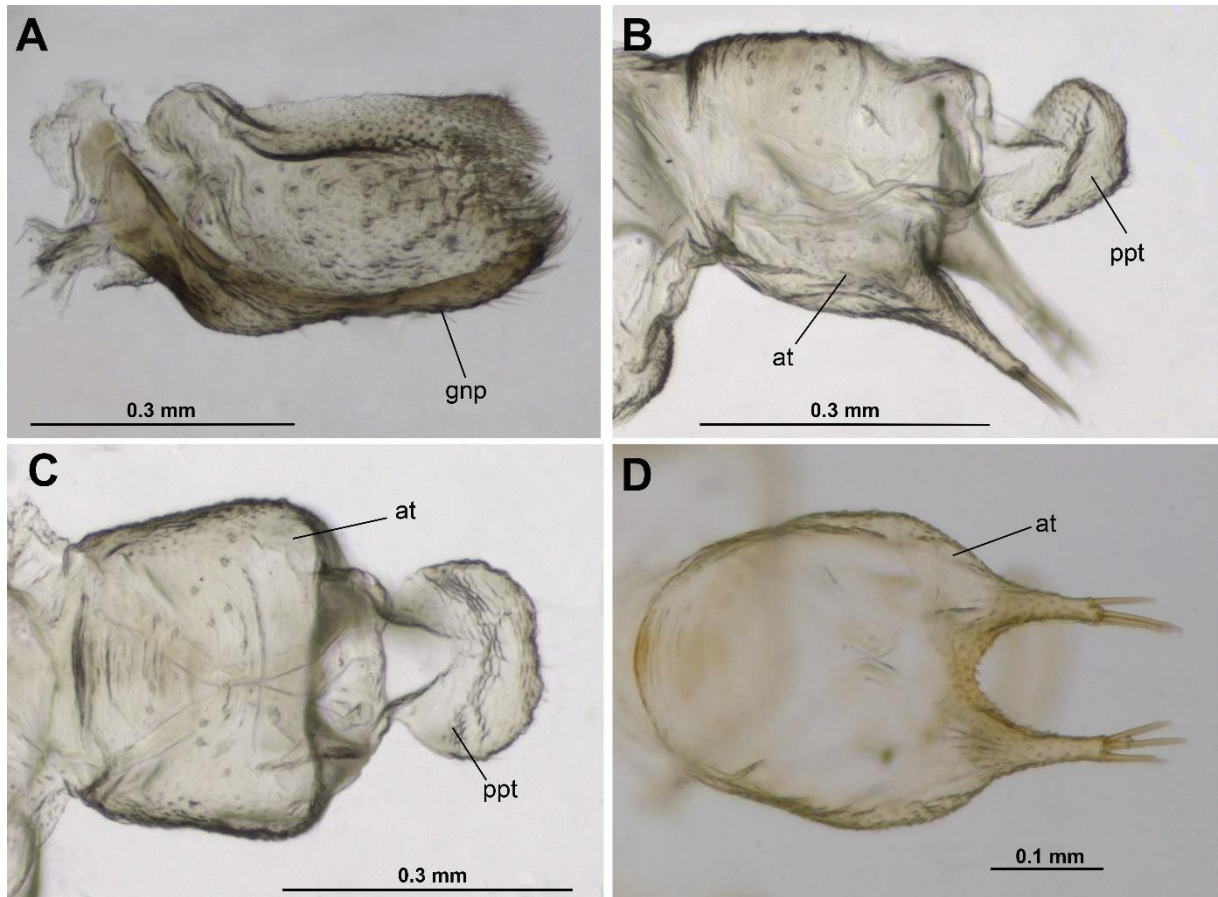
359

360 **FIGURE 7 A–E.** *Persis (Anapersis) takiyae* **sp. nov.**, male terminalia: **A.** Phallic complex,
 361 lateral view; **B.** Phallic complex, dorsal view; **C.** Anal tube (segment X), lateral view; **D.** Anal
 362 tube (segment X) and paraproct, dorsal view; **E.** Anal tube (segment X), ventral view.
 363 Abbreviations: ae: aedeagus; at, anal tube; pe, periandrium; ppt, paraproct; s, spines.



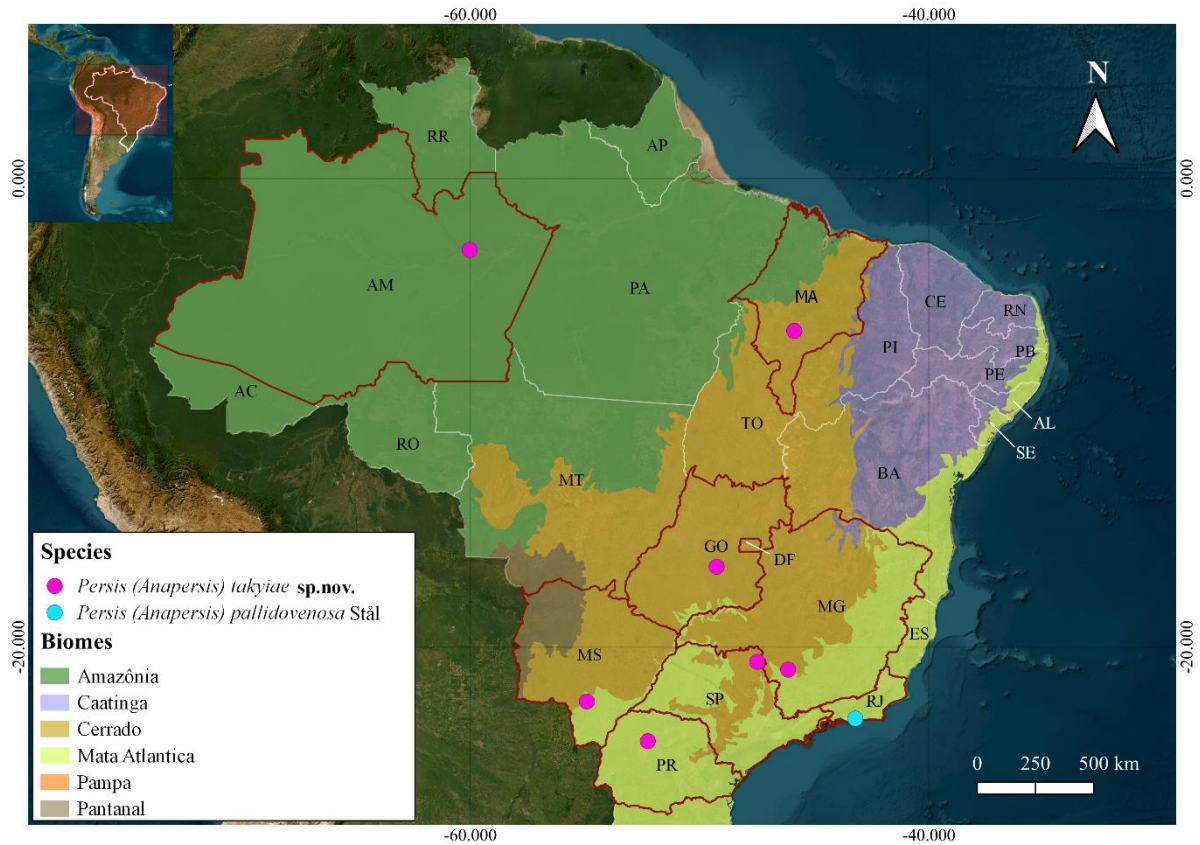
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365 **FIGURE 8 A–E.** *Persis (Anapersis) takiyae* sp. nov., female genitalia: **A.** Sternite VII and
 366 Sternite VIII, lateral view; **B.** Sternite VII, ventral view; **C.** Sternite VII, ventral view; **D.**
 367 Gonapophysis VIII (first valvula) and bursa copulatrix, lateral view; **E.** Gonapophysis IX
 368 (second valvula), dorsal view. Abbreviations: bc, bursa copulatrix; bp, basal plate; dap,
 369 dorsoapical process; gnpp, gonapophysis; lb, lobe; lap, lateroapical process; mdp, medioventral
 370 process; st, sternite.



371

372 **FIGURE 9 A–D.** *Persis (Anapersis) takiyae* sp. nov., female genitalia: **A.** Gonoplac (third
 373 valvula), lateral view; **B.** Anal tube (segment X) and paraproct, lateral view; **C.** Anal tube
 374 (segment X) and paraproct, dorsal view; **D.** Anal tube (segment X), ventral view.
 375 Abbreviations: at, anal tube; gnp, gonoplac; ppt, paraproct.



376

377 **FIGURE 10.** Distribution of *Persis (Anapersis)* Fennah in Brazil. Previous known distribution
 378 of *Persis (Anapersis)* Fennah in blue circle. Distribution of the new species *Persis (Anapersis)*
 379 *takiyae sp. nov.* in the pink circles.

380

381 4.5. Discussion

382 **Variable structures:** two observations about the structures of the terminalia were made:

383 1) in the description of the subgenus *Persis (Anapersis)*, Fennah (1952) describes the
 384 medioventral process of the male pygofer specimens as “well-developed”. However, we found
 385 that in both species *Persis (Anapersis) takiyae sp. nov.* and *Persis (Anapersis) ferox* O’Brien,
 386 this process is slightly produced, that is, it is not “well-developed” (Fig. 15 in O’Brien 1986),
 387 demonstrating that this character within the subgenus can vary, no longer being a characteristic
 388 used to diagnose this subgenus; 2) one of the few structures sometimes used to separate females,
 389 the pregenital sternite (Sternite VII) (Metcalf 1938; Fennah 1945), may contain variation within

390 the same species, as occurs in *Persis (Anapersis) takiyae* **sp. nov.** (Figs 8B, C). This shows that
391 the shape of the sternite VII alone is not enough to separate species, and highlights the
392 importance of describing all structures of the female terminalia/genitalia. In view of this, we
393 studied, described and illustrated for the first time all the structures of the female terminalia of
394 *Persis (Anapersis)*.

395 **Distribution:** In Brazil *Persis (Anapersis)* was only recorded in the state of Rio de Janeiro
396 (Atlantic Forest biome). With the new species described here, it is observed that the subgenus
397 has a wide distribution, being recorded in two other biomes, Amazon and Cerrado, with new
398 occurrence records for all Brazilian regions: North, Northeast, Central-West, South and
399 Southeast (Fig. 10). Probably this wide distribution may be related to the association of these
400 individuals with the host plant. Recently, in Brazil, the species *Persis (Persis) pugnax* Stål,
401 1862 was found associated with coconut trees (Dollet *et al.* 2020).

402 According to Dollet *et al.* (2020), based on data analyzed from the FLOW website
403 (Bourgoin 2024), representatives of Derbidae are more associated with Arecaceae plants (palm
404 trees) than with any other family. It is possible that all representatives of *Persis* have palm trees
405 as their host plant. Arecaceae plants occur in all five Brazilian regions (this corroborates the
406 new distribution records), and in the following phylogeographic domains: Amazon Forest,
407 Caatinga, Cerrado, Atlantic Forest, Pampa and Pantanal (Flora e Funga do Brasil 2024). Thus,
408 it is probable that *Persis* occurs in all these domains. Furthermore, many of the specimens
409 studied in this work were collected a long time ago, being stored in unidentified collections or
410 belonging to completely different groups. Therefore, it is evident that not only does *Persis* have
411 a large knowledge gap, but the family Derbidae as whole has been neglected. The lack of
412 specialists contributes to this lack of knowledge about hemipteran biodiversity in Brazil.

413

414

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433

434 4.7. References

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5. CAPÍTULO II

Cantanhede, I.; Viegas, E. F. G. & Ale-Rocha, R. Taxonomic study of *Persis* (*Persis*) Stål from South America: redescription of two species and description of two new species from Brazil (Hemiptera: Fulgoroidea: Derbidae)

Manuscrito formatado para *Zootaxa*¹

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1 **Taxonomic study of *Persis (Persis)* Stål from South America: redescription of two**
2 **species and description of two new species from Brazil (Hemiptera: Fulgoroidea:**
3 **Derbidae)**

4 INEZITA CANTANHEDE^{1,*}, EDUARDA FERNANDA GOMES VIEGAS² &
5 ROSALY ALE-ROCHA³

6 ¹Graduate Program in Entomology, Instituto Nacional de Pesquisas da Amazônia, Av.
7 André Araújo, Petrópolis, 2936, Manaus, 69067-375, Amazonas, Brazil.
8 <https://orcid.org/0000-0002-1747-4742>

9 ²Scholarship DTI-A, CNPq, Instituto Nacional de Pesquisas da Amazônia, Manaus, Av.
10 André Araújo, Petrópolis, 2936, Manaus, 69067-375, Amazonas, Brazil.

11 Email, edwviegasgomes@gmail.com; <https://orcid.org/0000-0003-3349-5639>

12 ³Biodiversity Coordination, Instituto Nacional de Pesquisas da Amazônia, Caixa Postal
13 2223, Manaus, 69080-971, Amazonas, Brazil. Fellowship PQ/CNPq. Email,
14 rosalyale@gmail.com; <https://orcid.org/0000-0001-9874-9770>

15 *Corresponding author. E-mail: inezitacneta@gmail.com

16

17 **5.1. Abstract:**

18 *Persis (Persis) pugnax* Stål is redescribed with description and illustrations of the male
19 and female genitalia provided for the first time. The new species is newly recorded from
20 Peru. *Persis (Persis) stali* Muir, is also redescribed and illustrated and recorded for the
21 first time from Brazil and Venezuela. Two new species are described and illustrated:
22 *Persis (Persis) gaianii* **sp. nov.** (Brazil and Venezuela) and *Persis (Persis) limeirai* **sp.**
23 **nov.** (Brazil). Additionally, an illustrated key to the species of the *Persis (Persis)* is
24 provided.

25 **Key words:** biodiversity, Fulgoromorpha, planthoppers, Neotropical region, taxonomy.

26 5.2. Introduction

27 *Persis* (Cenchreini Muir, 1913) was originally a monotypic genus described by Stål in
28 1862, with the type species *Persis pugnax* Stål, 1862 collected in the state of Rio de
29 Janeiro, Brazil. Currently, the genus contains 13 valid species, distributed in three
30 subgenera, restricted to the Americas: *Persis (Persis)* Stål, *Persis (Anapersis)* Fennah,
31 1952 and *Persis (Eritalaena)* Fennah, 1952 (Cantanhede *et al.* in prep.). Among the
32 genera of Cenchreini, *Persis* is recognized based on the head strongly compressed
33 between the eyes, vertex and frons long, narrow, and concave; pronotum narrow with
34 angled posterior margin; forewings elongated (exceeding the abdomen) and parallel (Stål
35 1862).

36 The nominotypical subgenus, *Persis (Persis)* Stål, was proposed by Fennah (1952),
37 in the review of the Derbidae groups, together with *Persis (Anapersis)* Fennah and *Persis*
38 (*Eritalaena*) Fennah.

39 This subgenus, restricted to the Neotropical region, is composed of five valid
40 species: *Persis (Persis) pugnax* Stål, 1862 (Brazil), *Persis (Persis) stali* Muir, 1918
41 (Guyana, Suriname), *Persis (Persis) fabriciana* Metcalf, 1938 (South America), *Persis*
42 (*Persis*) *foveatis* Caldwell, 1944 (Mexico), and *Persis (Persis) novacula* Fennah, 1952
43 (Trinidad). *Persis (Persis)* are recognized by projection of the head acutely angled at the
44 apex in lateral view; pronotum with shallow paradiscal region, not forming a deep fovea;
45 pygofer with triangular medioventral process (Fennah 1952).

46 Until now, there are no phylogenetic studies for the genus. The brief historical of
47 *Persis* involves only incomplete alpha-level taxonomic descriptions, checklists, and
48 catalogues (e.g., Fowler 1900; Metcalf 1938, 1945; Caldwell 1944; Fennah 1945, 1952;
49 O'Brien 1982, 1986).

50 In this paper, we redescribe, illustrate, and extend the records of two species from
51 South America, *Persis (Persis) pugnax* and *Persis (Persis) stali* and after a gap of 72
52 years, we describe and illustrate two new species, *Persis (Persis) galianii* **sp. nov.** and
53 *Persis (Persis) limeirai* **sp. nov.** from Brazil. In addition, an identification key to species
54 of the subgenus and an updated distribution map are provided.

55 **5.3. Material and methods**

56 Specimens studied herein are deposited in the following collections: CZMA = Coleção
57 Zoológica do Maranhão, Caxias, Maranhão, Brazil (Curator: Francisco Limeira-de-
58 Oliveira); DZRJ = Coleção Entomológica Professor José Alfredo Pinheiro Dutra, Rio de
59 Janeiro, Brazil (Curator: Dra. Daniela Maeda Takiya); DZUP = Coleção Entomológica
60 Padre Jesus Santiago Moure, Curitiba, Paraná, Brazil (Curator: Dra. Andressa Paladini);
61 INPA = Coleção de Invertebrados do Instituto Nacional de Pesquisas da Amazônia,
62 Manaus, Amazonas, Brazil (Curator: Dr. Marcio Luiz de Oliveira) and MZUSP = Museu
63 de Zoologia da Universidade de São Paulo, São Paulo, Brazil (Curator: Dra. Talita Roell).

64 For redescrptions we used photographs of the type material together with
65 additional material examined. The type material analyzed belongs to the following
66 collections: AMNH= American Museum of Natural History, New York, USA – *Persis*
67 (*Persis*) *stali* Muir (photographed by Ruth Salas); NHRS= Museum of Natural History,
68 Stockholm, SE – *Persis (Persis) pugnax* Stål (photographed by Gunvi Lindberg).

69 For examination of the genital structures, the abdomen was detached from the
70 thorax, macerated into 85% hot lactic acid, studied under a Leica M165C
71 stereomicroscope, and illustrated immersed in glycerin jelly. Afterward, genitalia were
72 stored in plastic microvials with glycerin and pinned with the specimen. A forewing of a
73 specimen was detached, cleaned by a short xylol bath, and mounted between cover glasses

74 with Euparal for photography. After drying, sides of the cover slides were glued to a small
75 piece of cardboard and pinned with the specimen. Digital photographs were taken with a
76 Leica MC 170 HD camera attached to a stereomicroscope and combined into expanded
77 focus images by Leica Application Suite software.

78 Terminology of head characters follows O'Brien & Wilson (1985), except for
79 forewing venation follows Bourgoïn *et al.* (2015), for male genitalia follows Bourgoïn
80 (1988) and Bourgoïn & Huang (1990), and for female genitalia it follows Bourgoïn
81 (1993).

82 The measurements taken in this study were body length (with or without wings)
83 and head (projection of the head, vertex, eyes, frons and clypeus). The measurement were
84 taken as follows: body length (from the tip of head to the tip of anal tube) and body length
85 including forewings (from the tip of head to the tip of forewing), both measurements were
86 taken in lateral view; head projection length (from the apex of the head to the nearest eye
87 margin) and eyes width (in the medial region of the eye), both measurements were taken
88 in lateral view; vertex length (from the base of the transverse carina of the transition frons
89 to the vertex), this measurement was taken in dorsal view; maximum vertex width (in the
90 basal region of the vertex between the carina) and minimum vertex width (in the apical
91 region of the vertex between the carina), both measurement were taken in dorsal view;
92 frons length (close to the transverse carina to the epistomal suture) and width (in the
93 lowest height region of the compound eyes), both measurements were taken in anterior
94 view; clypeus length (from the epistomal suture to the apex of the clypeus) and width
95 (near to suture epistomal), both measurements were taken in anterior view.

96 The distribution map was created with QGIS 3.20
97 (https://www.qgis.org/pt_BR/site/forusers/download.html), using geographical
98 coordinates from specimen labels. We used Google Earth® to locate approximated

99 collecting sites for specimens without geographical coordinates. Label information of
 100 examined specimens is provided verbatim with square brackets indicating comments or
 101 extrapolated information.

102 **5.4. Results**

103 **Taxonomy**

104 **Hemiptera Linnaeus, 1758**

105 **Fulgoromorpha Evans, 1946**

106 **Fulgoroidea Latreille, 1807**

107 **Derbidae Spinola, 1839**

108 **Cenchreini Muir, 1918**

109

110 ***Persis* Stål, 1862**

111 Type species: *Persis pugnax* Stål, 1862:7; by original designation.

112 *Persis* Stål, 1862: 7; 1866: 193 (key); 1869: 99 (citation); Muir, 1913: 32 (key); 1918a:
 113 416 (notes); 1918b: 231 (key): 243 (citation); Metcalf, 1938: 326 (key, notes);
 114 1945: 90 (catalogue); Caldwell, 1944: 105 (notes), 106 (description), 108 Figs Plate
 115 I, 7A–C (genitalia); Fennah 1952: 127 (key), 138–142 (creation of subgenera);
 116 O'Brien 1982: 319 (catalogue); Bartlett *et al.* 2014: 25 (key), 152 (citation);
 117 Cantanhede *et al.* (in prep.).

118 **Subgenus *Persis* Stål, 1862: 7 (as genus) (type species *Persis pugnax* Stål, 1862, by
 119 original designation).**

120 **Subgenus *Eritalaena* Fennah, 1952: 142 (Type species: *Persis fuscinervis* Muir, 1918:
 121 417 by original designation and monotypy).**

122 **Subgenus *Anapersis* Fennah, 1952: 140 (type species *Neocenchrea gregaria* Fennah
 123 1945 by original designation).**

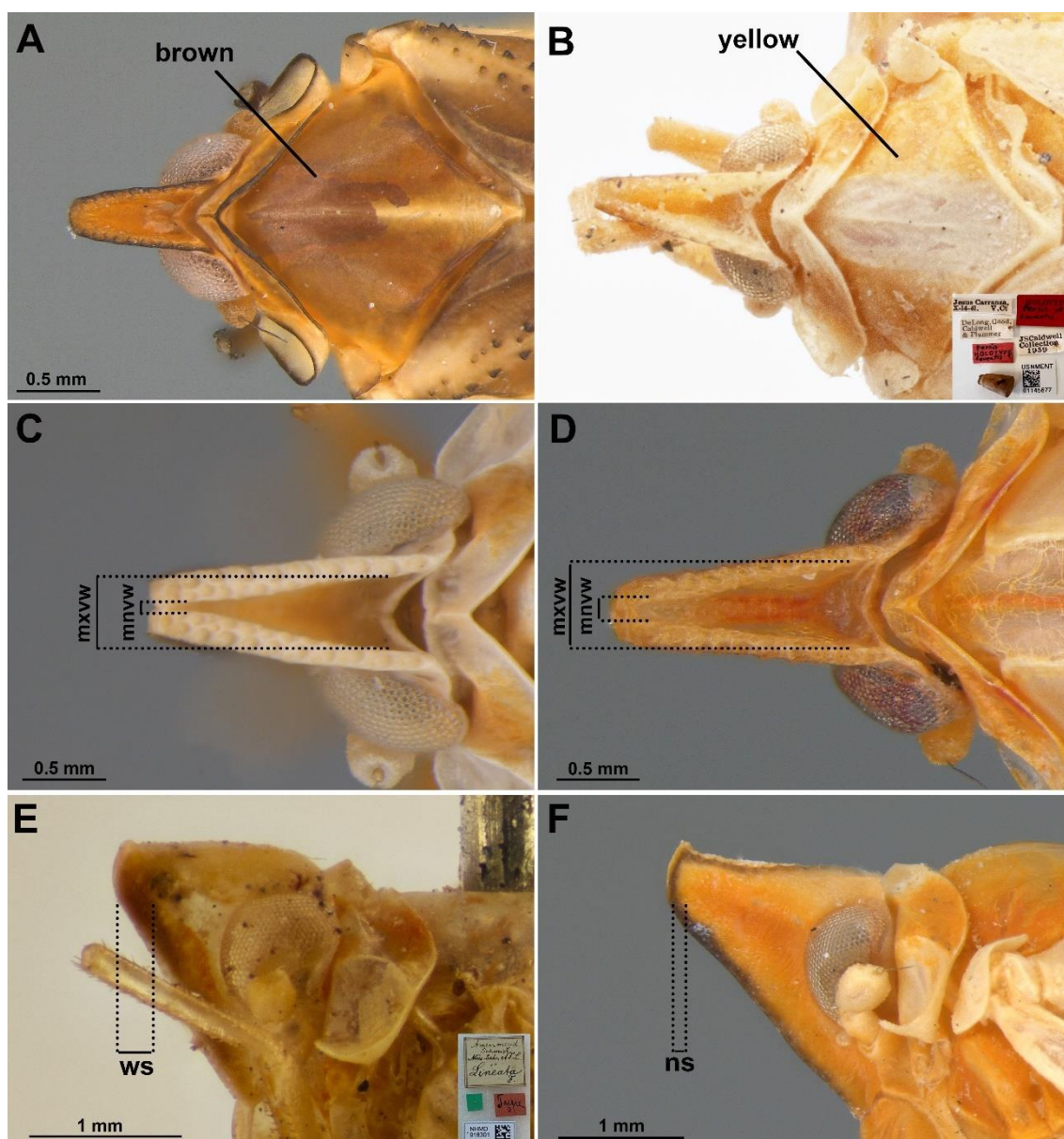
124 **Diagnosis.** Head produced beyond the eyes (Figs 1 A–F, 2 A–B, 4 A–D, 5A, B, 6A, B,
 125 D, E, 11A, B, 12A, B, D, E, 16A, C, D, 19A, B, 20A, B, D, E); vertex and frons concave
 126 and compressed; lateral carinae of vertex and frons bearing a row of pits (Figs 1 A–D,
 127 2A, B, 5B, C, 6C, E, 11B, 12C, E, 16B, D, 20C, E); median carina of frons absent (Figs
 128 5C, 6C, 12C, 16B, 20C); transverse carina between the vertex and the frons present (Figs
 129 4B, 6D, 12D, 16C, 20D). Antennae short; pedicle spheroid, about as long as wide (Figs
 130 1E, F, 4A, B, D, 5A, C, 6 A–D, 11A, 12 A–D, 19A, B, 20 A–D). Pronotum narrow,
 131 posteriorly concave (Figs 1 A–D, 2A, B, 5B, 6E, 11B, 12E, 16D, 20E). Mesonotum
 132 tricarinate (Figs 1 A–D, 2A, B, 5B, 6E, 11B, 12E, 16D, 20E). Forewing elongated,
 133 exceeding the abdomen, with a row of pustules along of ScP+R vein and and two row of
 134 pustules along of Pcu vein, closed clavus (Figs 4A, D, 5A, B, 6A, B, 11A, B, 12A, B,
 135 16A, 19A, B, 20A, B, 24 A–D). Male terminalia: pygofer symmetrical; medioventral
 136 process present (Figs 7A, B, 13A, B, 19C, 21A, B). Female: Sternite VII with
 137 medioventral process (Figs 9A, B, 14A, B, 17A, B, 22A, B); anal tube (segment X)
 138 cylindrical, ventral margin reentrant, forming two long finger-shaped lateral lobes (Figs
 139 10E, 15E, 18E, 23E) with spiniform apical setae (Figs 10E, 15E, 18E, 23E).

140

141 **Key illustrated to species of *Persis* (*Persis*) Stål**

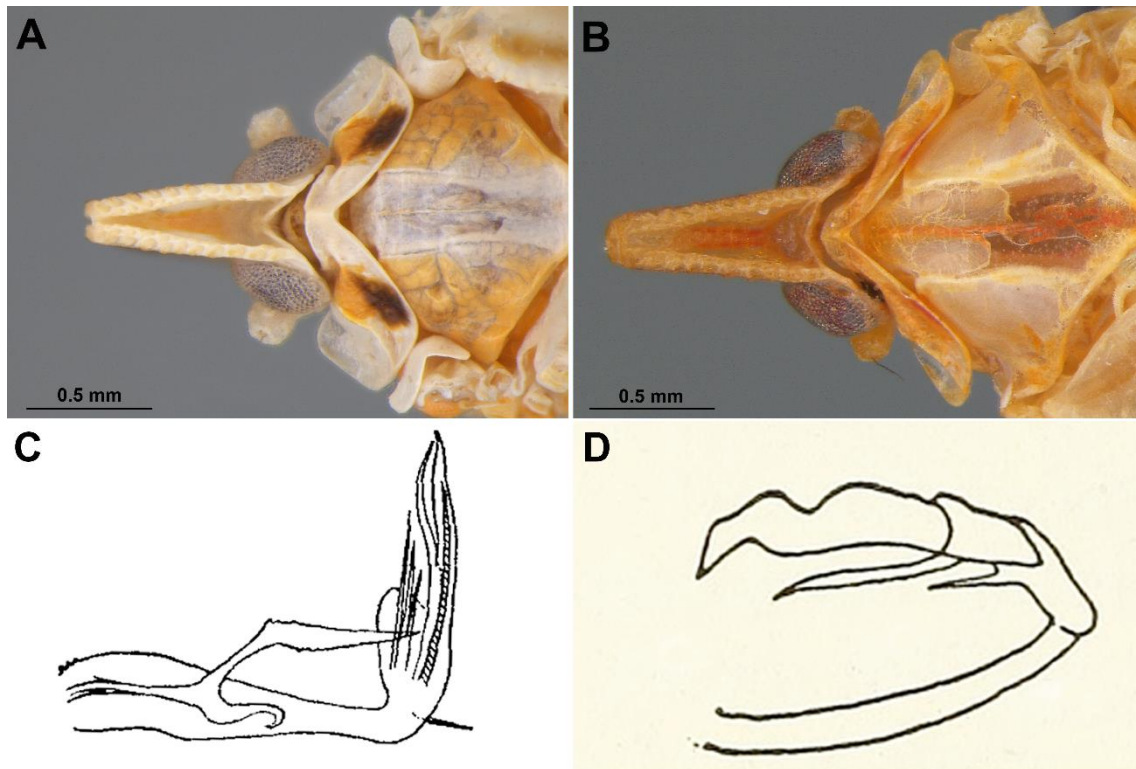
- 142 1. Mesonotum predominantly brown (Fig. 1A) ... *P. (P.) limeirai* **sp. nov.**
 143 - Mesonotum orange yellow (Fig. 1B) ...2
- 144 2. Pronotum with black spots (Fig. 2A) ... *P. (P.) gaianii* **sp. nov.**
 145 - Pronotum without black spots (Fig. 2B) ...3
- 146 3. Minimum vertex width less than $\frac{1}{4}$ than its maximum width (Fig. 1C) ...*P. (P.) stali*
 147 Muir
- 148 - Minimum vertex width greater than $\frac{1}{4}$ than its maximum width (Fig. 1D) ... 4

- 149 4. Frons with wide black lateral stripe in lateral view (Figs 1E, 4A) ... *P. (P.) fabriciana*
150 Metcalf
- 151 - Frons with narrow black lateral stripe in lateral view (Fig. 1F) ... 5
- 152 5. Phallic complex: periandrium with a bifurcated laterobasal process (Fig. 2C)
153 ...*Persis (Persis) novacula* Fennah
- 154 - Phallic complex: periandrium without bifurcated laterobasal process (Fig. 2D) ... 6
- 155 6. Gonostylus with upwardly curved apex (Fig. 3A); periandrium without projections
156 on the ventral margin (Fig. 2D) ... *P. (P.) foveatis* Caldwell
- 157 - Gonostylus with apex almost straight posteriorly (Fig. 3B); periandrium with
158 projections on the ventral margin (Fig. 3C) ... *P. (P.) pugnax* Stål



159

160 **FIGURE 1 A–F.** *Persis (Persis)* Stål species. **A.** *Persis (Persis) limeirai* **sp. nov.** male,
 161 head and thorax, dorsal view; **B.** *Persis (Persis) foveatis* Caldwell, holotype male, head
 162 and thorax, dorsal view; **C.** *Persis (Persis) stali* Muir, male, head, dorsal view; **D.** *Persis*
 163 (*Persis*) *pugnax* Stål, female, head, dorsal view; **E.** *Persis (Persis) fabriciana* Metcalf,
 164 syntype female NHMD, head, lateral view; **F.** *Persis (Persis) pugnax*, female, head,
 165 lateral view. Abbreviations: mnvw, minimum vertex width; mxvw, maximum vertex
 166 width; ns, narrow stripe; ws, wide stripe. Photographs: B, Solomon Hendrix (University
 167 of Delaware); E, Lars Vilhelmsen and Sree Gayathree Selvantharan (USNMENT).

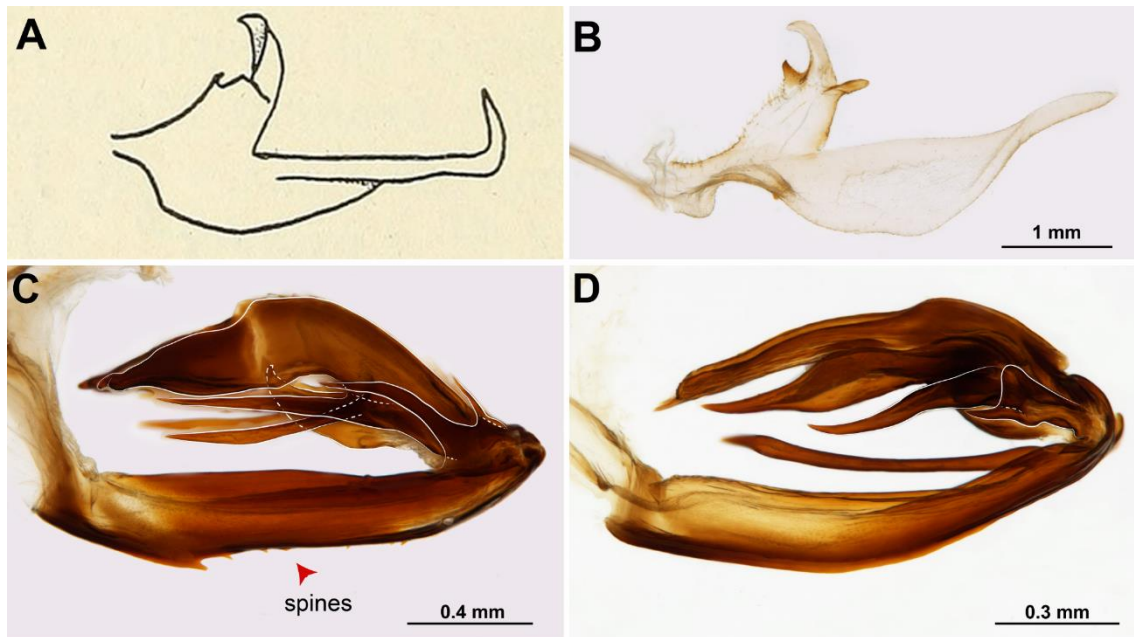


168

169 **FIGURE 2 A–D.** *Persis (Persis)* Stål species. **A.** *Persis (Persis) gaianii* **sp. nov.**, female,
 170 head and thorax, dorsal view; **B.** *Persis (Persis) pugnax* Stål, female, head and thorax,
 171 dorsal view; **C.** *Persis (Persis) novacula* Fennah, male, phallic complex, lateral view; **D.**
 172 *Persis (Persis) foveatis* Caldwell, phallic complex, lateral view. Illustrations: C, Fennah
 173 1952 (Fig. 15F); D, Caldwell 1944 (Fig. 7A).

174

175



176

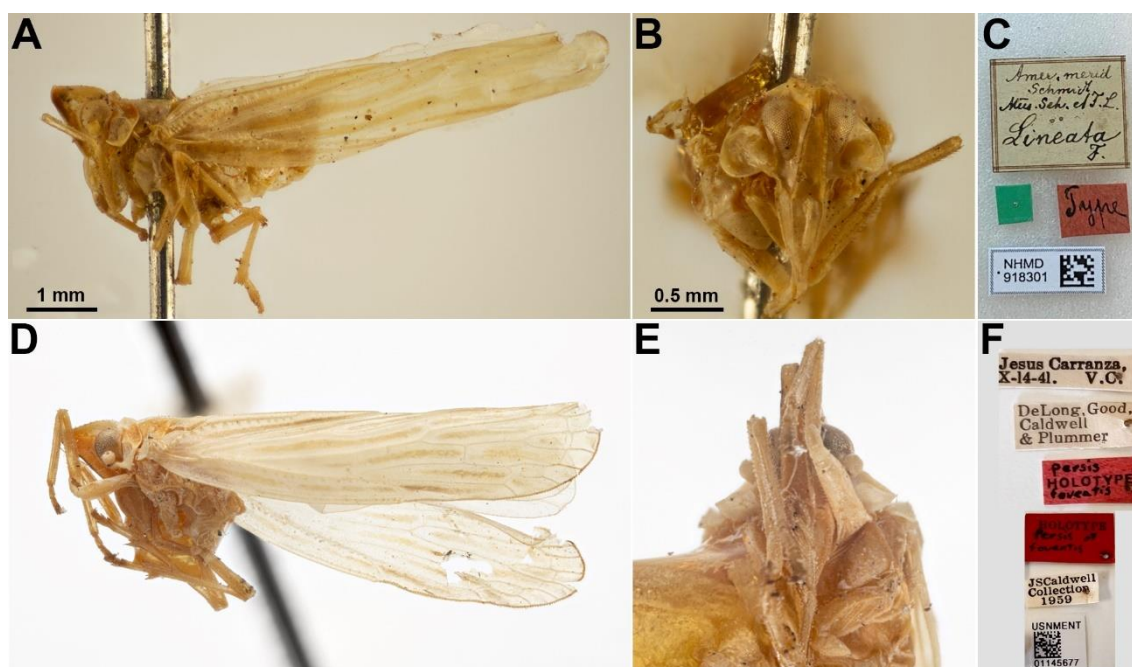
177 **FIGURE 3 A–D.** Terminalia of *Persis (Persis)* Stål males. **A–B.** Gonostylus. **A.** *Persis*
 178 (*Persis*) *foveatis* Caldwell, lateral view; **B.** *Persis (Persis) pugnax* Stål, lateral view; **C–**
 179 **D.** Phallic complex. **C.** *Persis (Persis) pugnax* Stål, lateral view; **D.** *Persis (Persis)*
 180 *limeirai* sp. nov., lateral view. Illustrations: A, Caldwell 1944 (Fig. 7B).

181

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185

186 **FIGURE 4 A–F.** Type material of the species *Persis (Persis)* Stål. **A–C.** *Persis (Persis)*
 187 *fabriciana* Metcalf, female syntype. **A.** Habitus, lateral view; **B.** Frons, anterior view; **C.**
 188 Labels; **D–F.** *Persis (Persis) foveatis* Caldwell, male holotype. **D.** Habitus, lateral view;
 189 **E.** Frons, anterior view; **F.** Labels. Photographs: A–C, Lars Vilhelmsen and Sree
 190 Gayathree Selvantharan (USNMENT); D–F, Solomon Hendrix (University of Delaware).

191

192 *Persis (Persis)* Stål

193 (Figs 1 A–F; 2 A–D; 3 A–D; 4 A–F; 5 A–D; 6 A–E; 7 A–E; 8 A–D; 9 A–C; 10 A–E; 11
 194 A–D; 12 A–E; 13 A–I; 14 A–C; 15 A–E; 16 A–D; 17 A–C; 18 A–E; 19 A–C; 20
 195 A–E; 21 A–I; 22 A–C; 23 A–E; 24 A–D; 25)

196 *Persis (Persis)* Stål, 1862: 7; Fennah 1952: 138. Type species: *Persis pugnax* Stål, 1862:
 197 138 (original designation); O’Brien 1982:308 (key), 319 (catalogue); Bartlett *et al.*
 198 2014: 152 (citation); Dollet *et al.* 2020: 5, Fig. 2C (habitus, citation).

199 **Amended diagnosis.** Medium sized *Persis (Persis)*: body length 3.3–10.8 mm in males,
 200 3.2–9.6 mm in females. Head projecting beyond the eyes, approximately 1.3 times the

201 width of the compound eye in lateral view (Figs 1 A–F, 2 A–B, 4 A–D, 5A, B, 6A, B, D,
202 E, 11A, B, 12A, B, D, E, 16A, C, D, 19A, B, 20A, B, D, E) and acutely angulate in lateral
203 view (Figs 1E, F, 4A, D, 5A, 6A, B, 11A, 12A, B, 16A, 19A, B, 20A, B); vertex concave,
204 triangular (Figs 1 A–D, 2A, B, 5B, 6E, 11B, 12E, 16D, 20E); lateral carina of the frons
205 keeled, subparallel; median carina of clypeus present (Figs 5C, 6C, 12C, 16B, 20C).
206 Pronotum with paradiscal regions variable, shallow (Figs 1E, F, 4A, D, 5A, 6D, 11A,
207 12D, 16C, 19B) or deep (Fig. 20D), forming a cup-shaped foliated fovea that partially
208 circumscribe the antennae; median longitudinal carina present, strongly marked; lateral
209 carina strongly diverging towards the tegula in dorsal view. Mesonotum with median
210 carina present, strongly marked and lateral carinae of mesonotum present, but sometimes
211 weakly marked (Figs 1 A–D, 2A, B, 5B, 6E, 11B, 12E, 16D, 20E). Forewing (Figs 24 A–
212 D): ScP+R vein long, finishing at the level of the apex of the clavus; RA vein with apex
213 strongly curved anteriorly; RP vein arising after ScP+RA vein; RP vein with four cells
214 (C1, C1', C1b, C1b'); MP vein with four branches; first forking of MP vein arising after
215 the apex of clavus; forking of CuA vein arising after Pcu+A₁ claval veins, with two veins
216 reaching apical margin. Hind wing with RP vein simple to apex, MP vein simple, CuA
217 vein with two branches. Legs: metatibia without lateral spines (Figs 4A, D, 5A, 6A, B,
218 11A, C, 12A, B, 19B, 20A, B, C).

219 **Remarks.** *Persis* (*Persis*) is distinguished from the other subgenera of *Persis* by the
220 more elongated extension of the head and the acute angle formed at the transition between
221 the vertex and frons. However, we have observed that some species of *Persis* (*Persis*) and
222 *Persis* (*Anapersis*) have overlapping characters. Based on the year the genus was
223 established (Stål, 1862), the current classification of the genus (Fennah, 1952), and the
224 species descriptions, there is a clear need for a more in-depth study (Fennah 1952;
225 O'Brien 1982; Cantanhede *et al.* 2024 in prep.) Many aspects within the genus remain

226 "unclear," such as the rationale for the creation of subgenera within *Persis*, which was
227 not clearly justified in Fennah (1952). Therefore, the delimitation of each subgenus needs
228 to be better defined, or even tested, however, this is a future work that requires an
229 integrative taxonomic review. Although there is no phylogeny for the group, for a better
230 understanding of the relationships between subgenera, was observed through the
231 diagnosis of each subgenus (Fennah 1952) and in the study carried out with the material
232 we have in the laboratory, that *Persis (Persis)* and *Persis (Anaparsis)* appears to be more
233 basal to by the presence of an antennal fovea in the paradiscal region of the pronotum,
234 than *Persis (Eritalaena)* whose expansion in the pronotum region is small, not forming a
235 fovea. This difference in the paradiscal region of the pronotum raises the hypothesis that
236 the antennal fovea may be a plesiomorphic character within Cenchreini, while its
237 reduction would be an apomorphy of *Persis (Eritalaena)*.

238 Information about the biology of *Persis* is scarce. However, a recent study by Dollet
239 *et al.* (2020) with derbids associated with coconut and oil palm, identified the presence
240 of *Persis (Persis) pugnax* among the species found. Association of the *Persis* with palm
241 trees was expected, since 36% of the records of the association of derbids with plants
242 compiled by Wilson *et al.* (1994) showed that Derbidae are related to palms trees.
243 Furthermore, Dollet *et al.* (2020) report that according to the Fulgoromorpha website
244 (FLOW), 16.7% of the plant associations recorded for Derbidae involve the Arecaceae
245 family, representing the highest percentage compared to other plant families. However,
246 this association of *Persis* with palm trees may present risks to agriculture, Teodoro *et al.*
247 (2020) report that in Mexico, phytoplasmas causing lethal yellowing (LY) were found in
248 *Persis*.

249 In this study, 80 specimens of *Persis (Persis)* were analyzed and the data on their
250 labels indicate that the individuals were collected in all months of the year. Also based

251 on information from the labels and literature data, specimens were collected using light
 252 trap, Malaise, and sweeping. Sweeping was the method that collected the most specimens
 253 (72%), followed by light traps (15%).

254 **Records.** Neotropical Region: Mexico (Veracruz, Chiapas, Oaxaca), Trinidad,
 255 Saint Vincent, Brazil (Rio de Janeiro, Roraima), Guyana (Bartica), Suriname
 256 (Paramaribo) (Bourgoin 2024).

257 *New records: Brazil (Alagoas, Amapá, Bahia, Espírito Santo, Maranhão, Mato
 258 Grosso, Mato Grosso do Sul, Pará, Paraná, Rondônia, São Paulo); Peru (Madre de Dios);
 259 Venezuela (Bolívar).

260

261 ***Persis (Persis) pugnax* Stål**

262 (Figs 5 A–D; 6 A–E; 7 A–E; 8 A–D; 9A–C; 10 A–E; 24A; 25)

263 *Persis pugnax* Stål, 1862: 8

264 *Persis (Persis) pugnax*; Fennah 1952: 139 (subgeneric combination); Dollet *et al.* 2020:
 265 5 (illustration of habitus).

266 **Type material.** Syntype female (NHRS–GULI000040281) Rio Jan [state of Rio de
 267 Janeiro], Stål (Figs 5 A–D). Syntype unknown sex (NHRS–GULI000040282) Brazil, F.
 268 Sahlberg [lost abdomen].

269 **Condition of the syntype:** Syntype (NHRS- GULI 000040281) with broken left antenna,
 270 protibia, protarsus, mesotibia and mesotarsus; Syntype (NHRS–GULI000040282)
 271 without antennae, only the right metathoracic leg intact, and without abdomen.

272 **Additional material examined.** **Brasil, Alagoas,** Quebrangulo, Reserva Biológica de
 273 Pedra Talhada, trilha para Riacho Cafuringa, 9°15'15.2"S, 36°25'7.9"W, 20.vi.2014,
 274 sweep, D.M. Takiya & A.C. Domahovski leg. (2 m#, 1 f# DZRJ). **(MA) [Maranhão],**
 275 REBIO–Res. Biol. [Reserva Biológica] Gurupi Armad.[Armadilha] Luminosa Base, 01–

276 05.i.2011, M. M. Abreu, E.A. S. Barbosa & A. A. Santos, cols. (6 m#, 1f#, CZMA); *idem*,
277 Caxias, Bode, 24.ix–5.x.1996, Arm.[Armadilha] Malaise, F. L. Oliveira Col. (1 m#,
278 CZMA); *idem*, Morro do Alecrim, Coleta incidental, 02–11.v.2011, E.S. Lima, E. S.
279 Martins & T. S. Bacelar, cols. (1 m#, CZMA). **Roraima**, Boa vista, UFRR, Campus
280 Paricarama, matinha – Cbio, 04.vi. 2018, Malaise, R. Boldrini (1 f #, INPA); *idem*, Rio
281 Uraricoera, Ilha de Maraca, 18–28.viii. 1987, Luz, J. A. Rafael, L.S. Aquino, J. F. Vidal,
282 E. Binda (1 m#, 1 f#, INPA). **MT [Mato Grosso]**, Itaium (Dourados), III–1974, M.
283 Alvarenga Leg (1 m#, DZUP 399181); *idem*, (1 f#, DZUP 399182); *idem*, (1 m#, DZUP
284 399183); *idem*, (1 m#, DZUP 399184); *idem*, (1 f#, DZUP 399185); *idem*, (1 m#, DZUP
285 399186); *idem*, (1 m#, DZUP 399187); *idem*, (1 m#, DZUP 399188); *idem*, (1 m#, DZUP
286 399189); *idem*, (1 f#, DZUP 399190); *idem*, (1 f#, DZUP 399191); *idem*, (1 f#, DZUP
287 399192); *idem*, (1 m#, DZUP 399193); *idem*, (1 m#, DZUP 399194); *idem*, (1 m#, DZUP
288 399214); Jacara–P. N. [Parque Nacional] Xingu, XI–1961, Alvarenga Wagner (1 m#,
289 DZUP 399201); *idem*, P. N. [Parque Nacional] Chapada dos Guimarães, 14. i. 2013,
290 sweep M. Savaris & S. Lampert leg. (1 m#, DZUP 399447); *idem* (1 m#, DZUP 399448
291 [terminalia dissected]); *idem*, (1 f#, DZUP 399449); *idem*, (1 f#, DZUP 399450); *idem* (1
292 f#, DZUP 399451); *idem*, (1 f#, DZUP 399452). **MS [Mato Grosso do Sul]**, Dourados,
293 Reserva Florestal Faz.[enda] Coqueiro 22°12'34"S–54°54'46"W, 18.ii.2009. A. Paladini
294 leg. (1 m#, DZUP 578995 [terminalia dissected]); *idem*, (1 f#, DZUP 578996); *idem*, (1
295 m#, DZUP 578997); *idem*, (1 f#, DZUP 578998). **PR [Paraná]**, Altamira do Paraná, Est.
296 [Estrada] da Bota, 21–24/III/2011 Grossi & Weiss leg (1 m#, DZUP 399413); *idem*,
297 Guaratuba, 25°49'54"S–48°46'00"W, (300 a 800m), 12-15/I/2010, R. R. Cavichioli (1 f#,
298 DZUP 399410). **SP [São Paulo]**, Picinguaba, Ubatuba, 4/VII/1994, G. Mejdalani (1 m#,
299 1 f#, DZRJ). **PERU**, M. de Dios, Parque Manu, Pakitza 340m, 11°55'48"S–71°15'18"W,
300 16. Oct [x]. 1991, Leg. M. Casagrande (1 f#, DZUP 399211).

301 **Measurements:** Body length: male 3.9–4.5 mm (8.2–10 mm including wings) (N=30);
 302 female: 3.8–5.0 mm (7.4–9.6 mm including wings) (N=17).

303 **Diagnosis.** Vertex and frons with a narrow lateral stripe, in anterolateral view (Figs 6A,
 304 B, D). Anal tube (segment X) with apex almost straight (Figs 7A, 8C, D). Sternite VIII
 305 in females, subtriangular, with pointed and cylindrical apex (Fig. 9A).

306 **Redescription (male and female).** Coloration. General body color orange with pale
 307 yellow regions (Figs 5 A–D, 6 A–E). Narrow black stripe covering the lateral carina of
 308 frons in anterior view (Fig. 6C). Carina of vertex, scape, pedicel, paradiscal region of the
 309 pronotum, tegula, epimeron, episternum and scutellum pale yellow (Figs 6D, E). Vertex
 310 and frons with a narrow black lateral stripe, in anterolateral view (Fig. 6D). Pronotum and
 311 mesonotum with yellow pale median region (Figs 5B, 6E). Forewing semi hyaline, pale
 312 yellow, with brown cells: postcostal, C1a, CPcu+A1 cells with brown, long and wide
 313 horizontal stripe; radial cell with brown horizontal stripe broken almost in half; C1', C1b,
 314 C1b', C2, C2', C3, C3', C3a, C3a', C4, C4', C5, median cells predominantly brown;
 315 cubital cell with brown, long and narrow horizontal stripe arising before the bifurcation
 316 of CuA; CPcu+A1' cell with narrow, brown horizontal band (Fig. 24A). Hind wing
 317 semihyaline, pale yellow. Legs pale yellow (Figs 5A, 6A, B). Abdomen yellowish-
 318 orange, except all brown tergites, anal tube (segment X), gonostylus and pygofer pale
 319 yellow.

320 *Head:* Frons approximately 6 times as long as wide (Figs 5C, 6C); projection of
 321 head 1.6 times wider than eye width, in lateral view (Figs 5A, 6A, B, D); lateral carina of
 322 frons divergent towards the clypeus in anterior view (Figs 5C, 6C); vertex with rounded
 323 posterior margin and minimum vertex width greater than $\frac{1}{4}$ of its maximum width (Fig.
 324 6E); epistomal suture slightly triangular medially (Figs 5C, 6C); clypeus approximately
 325 3.4 times as long as wide (Figs 5C, 6C). *Thorax:* pronotum anterior margin tapering (Figs

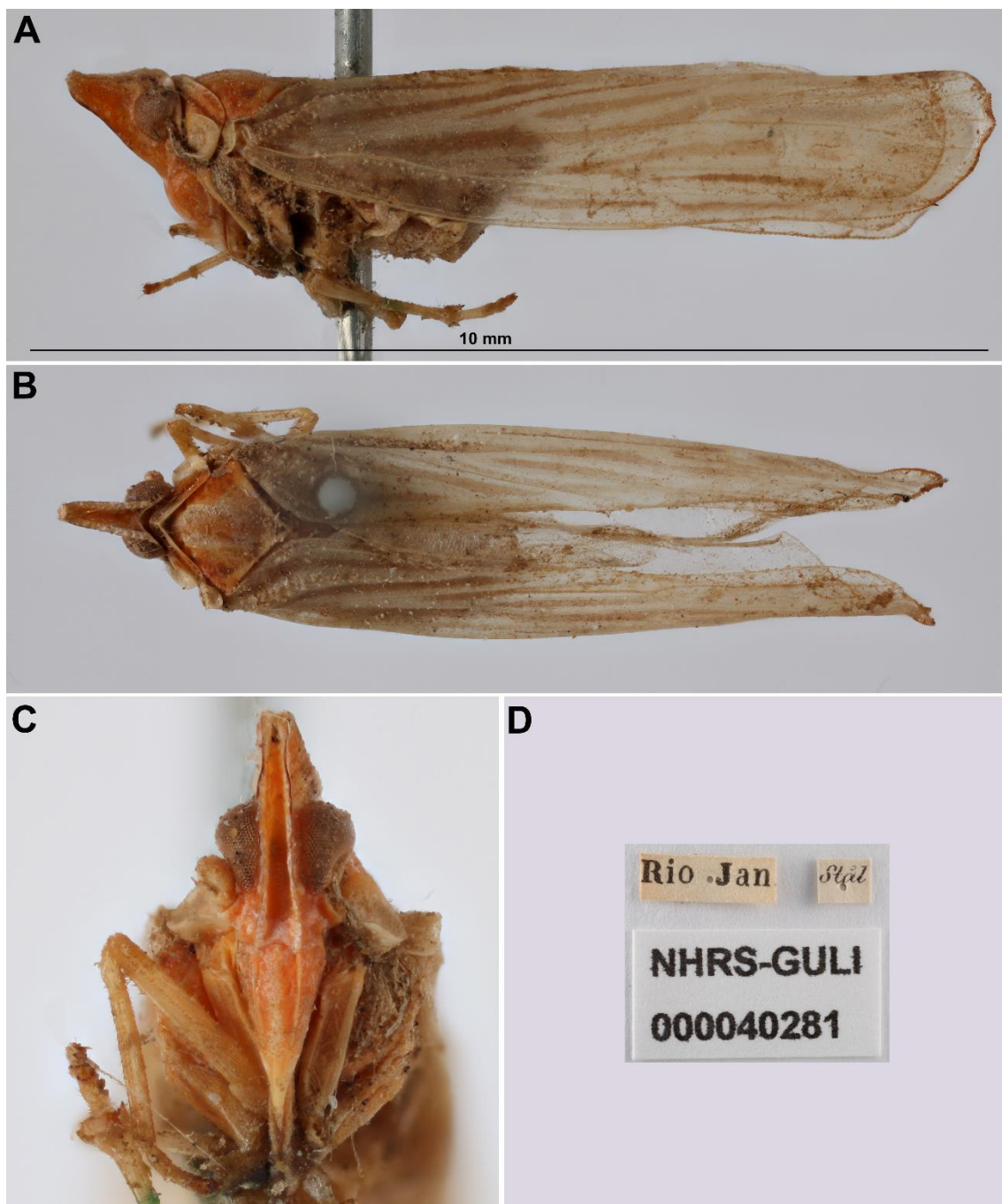
326 5B, 6E); shallow paradiscal regions (Figs 5A, 6D). Forewing approximately 4 times
327 longer than it is wide; CuA vein forking at level of Pcu+A1 vein (Fig. 24A).

328 *Male terminalia:* Pygofer symmetrical, subrectangular, narrowest dorsally, with
329 subrounded protuberance on posterodorsal margins (Figs 7A, B); medioventral process
330 subtriangular, with rounded apex in ventral view (Fig. 7C). Gonostyli symmetrical, short,
331 approximately 2 times shorter than the anal tube, with cylindrical and pointed apex;
332 dilated median region, with the central portion laterally compressed; dorsal margin with
333 a process close to base and a row of setae in the base of process (P) (Fig. 7D); process
334 subrectangular, trifid, with lobes of unequal sizes (P): a sclerosed spiniform lobe, with a
335 pointed apex and convergent, a long lobe, wider basally, with an anteriorly recurved
336 falciform apex, and a lobe short, sclerosed, straight posteriorly, with rounded apex (Fig.
337 7D); ventral margin sinuous, with a rounded projection near base, and a sclerosed
338 spiniform projection at the level of the process of dorsal margin bearing an anteriorly
339 curved apex (Figs 7D, E). Phallic complex symmetrical, anteriorly curved (Figs 8A, B):
340 periandrium with a row of small spiniform projections on ventral margin (Fig. 8A).
341 Aedeagus with a bifid process, with unequal size spines (S1): a short, slender, slightly
342 curved anteriorly spine in lateral view, apex divergent in dorsal view (S1a); a long,
343 slender, sinuous spine, apex convergent in dorsal view (S1b); a process long, bifid with
344 unequal size and shape (S2): a robust, laterally compressed process, narrowing at apex,
345 sickle-shaped, externally curved in dorsal view, apex divergent in dorsal view (S2a); a
346 long, slender, almost straight spiniform process in lateral view, apex divergent in dorsal
347 view (S2b); a long, slender, sinuous spine, apex divergent in dorsal view (S3); and a short,
348 robust process, with a dorsally curved apex in lateral view (S4) (Figs 8A, B). Anal tube
349 (segment X) slender, almost straight dorsal margin and sinuous ventral margin (Fig. 8C);
350 apex with a long indentation occupying almost the apical 2/4 of the total length of the

351 anal tube, forming two lobes in ventral view (Fig. 8D); straight and slender lobes, with
352 pointed apex, slightly curved ventrally in lateral view (Fig. 8D). Paraproct subcircular
353 (Fig. 8D).

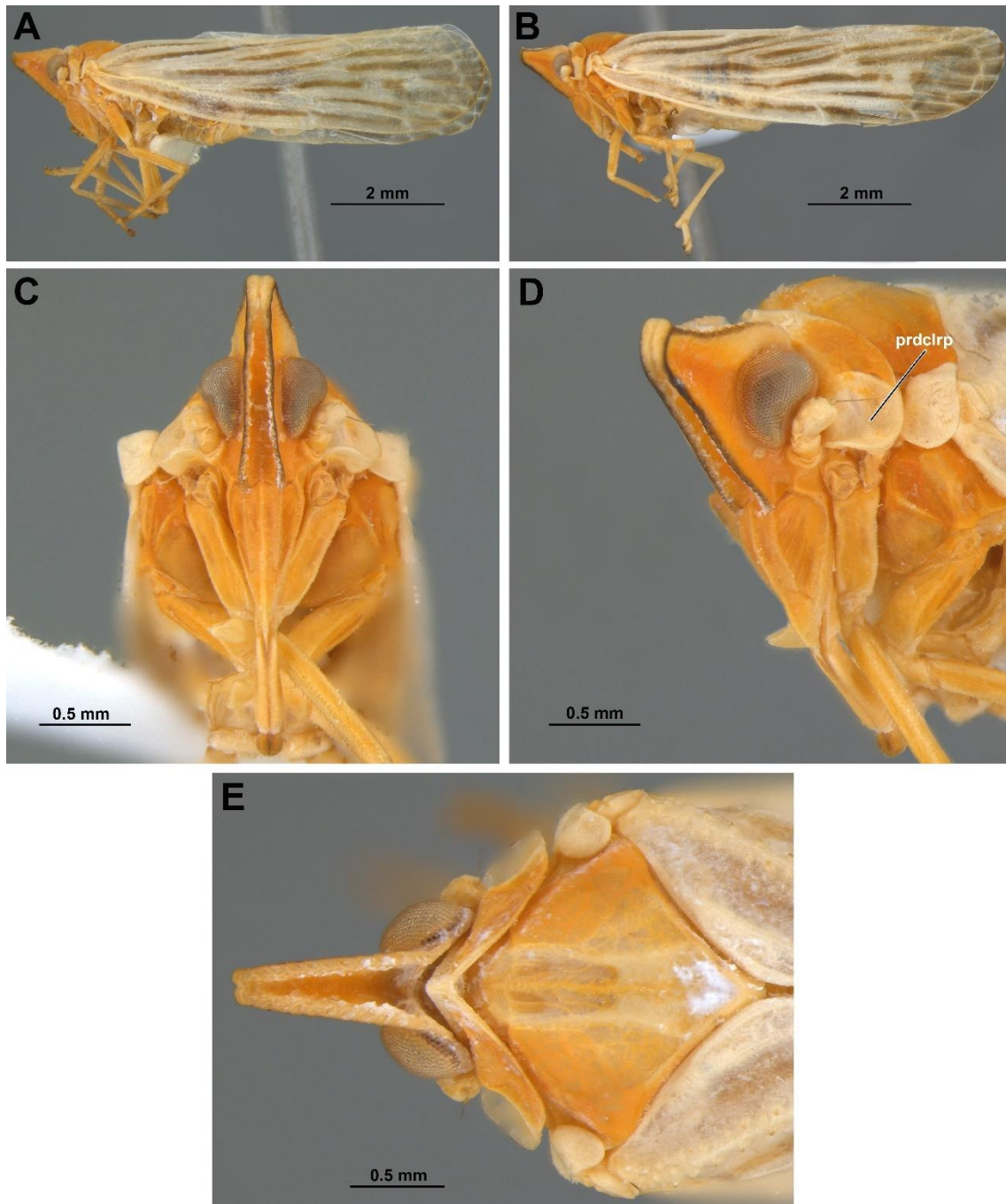
354 Female similar to male (Fig. 6B). *Female terminalia*: Pregenital sternite (Sternite
355 VII) with apex of medioventral process truncate in ventral view (Fig. 9B). Sternite VIII
356 subtriangular, with pointed and cylindrical apex, in lateral view (Fig. 9A). Gonapophysis
357 VIII (first valvula) with a long and slender projection on dorsoapical margin (dap) bearing
358 elevated irregular teeth, forming concavity in dorsal view, and with two small spines close
359 to base of projection (Fig. 9C); one lateroapical projection with 10 teeth on apical margin,
360 with upwardly curved apex (Fig. 9C). Bursa copulatrix slightly filamentous at apex, apex
361 acute and straight posteriorly, covered by small spiniform projections on apical half in
362 lateral view (Fig. 9C). Gonapophysis IX (second valvula) robust, wider basally, bifid at
363 apical 3/4 with lobes pointed and convergent apically (Fig. 10A); fine and small setae
364 present on apical 3/4 of lobes in dorsal region; basal half of Gonapophysis IX (second
365 valvula) with spiniform projections in ventral region (Fig. 10A); basal plate (bp) of
366 Gonapophysis IX (second valvula) 2 times longer than wide; rounded anterior margin
367 (Fig. 10A). Gonoplac (third valvula) subquadrate, apex truncated, with smooth
368 indentation, and bearing numerous setae apically in lateral view (Fig. 10B). Anal tube
369 (segment X) short, cylindrical (Fig. 10C); ventral margin of anal tube reentrant, with
370 elongated robust digitiform lobe bearing three apical spiniform setae of different sizes
371 (Fig. 10E). Paraproct subcircular (Fig. 10D).

372 **Distribution.** Brazil (Alagoas, Bahia, Maranhão, Mato Grosso, Mato Grosso do Sul,
373 Paraná, Rio de Janeiro, Roraima, São Paulo). Peru (Madre de Dios) (Fig. 25).



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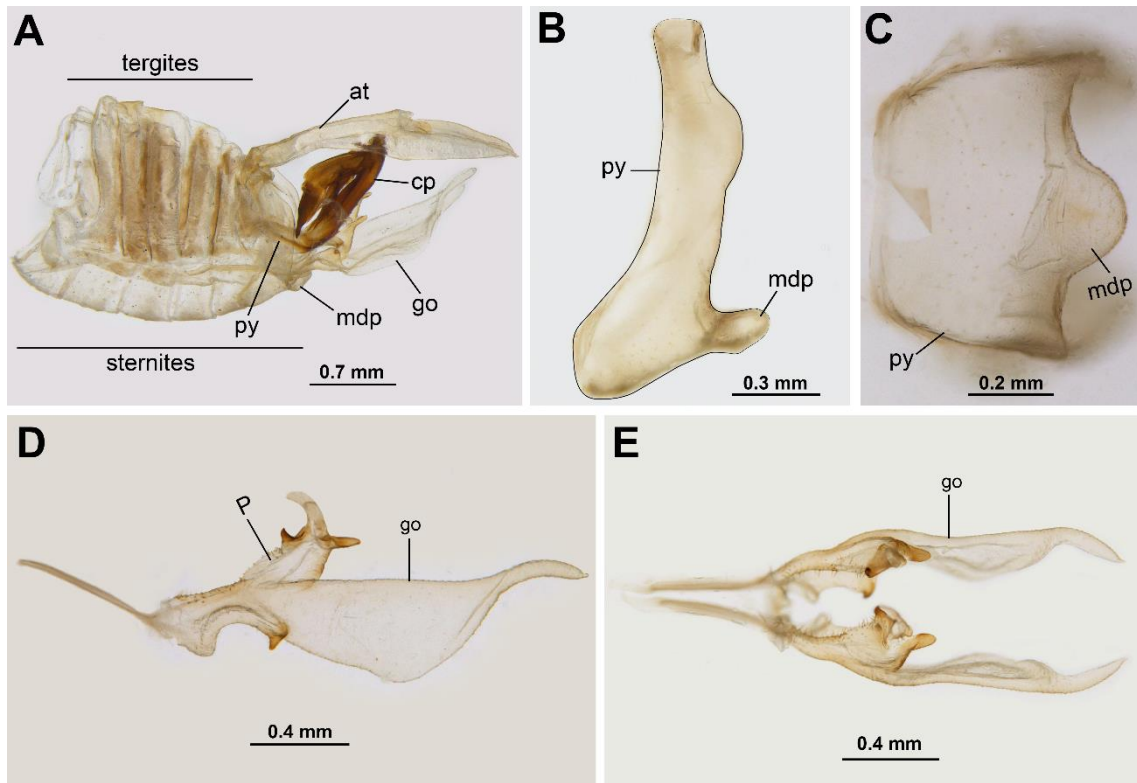
375 **FIGURE 5 A–D.** *Persis (Persis) pugnax* Stål, syntype female 000040281. **A.** Habitus,
 376 lateral view; **B.** Habitus, dorsal view; **C.** Frons, anterior view; **D.** Labels. Photographs:
 377 Gunvi Lindberg (Swedish Museum of Natural History).



378

379 **FIGURE 6 A–E.** *Persis (Persis) pugnax* Stål. **A–B.** Habitus. **A.** male, lateral view; **B.**
 380 female, lateral view; **C.** Frons, anterior view; **D.** Frons and thorax, anterolateral view; **E.**
 381 Head and thorax, dorsal view.

382

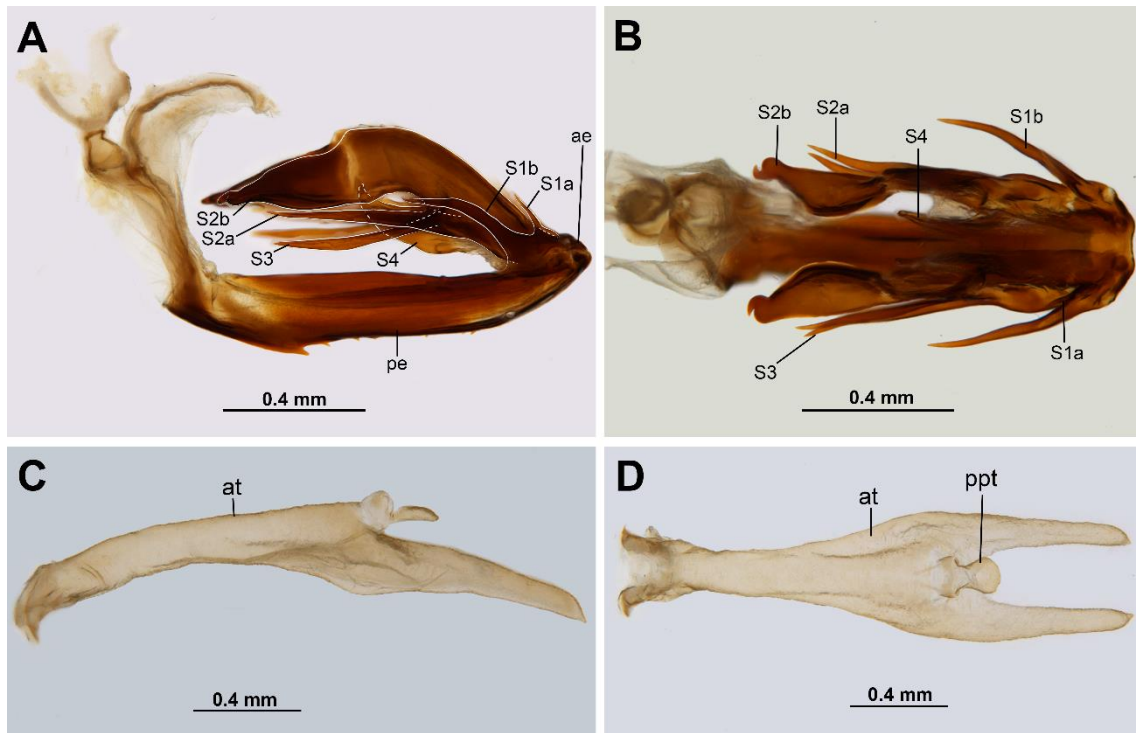


383

384 **FIGURE 7 A–E.** *Persis (Persis) pugnax* Stål, male terminalia. **A.** Abdomen and genital
 385 capsule, lateral view; **B.** Pygofer, lateral view; **C.** Pygofer, ventral view; **D.** Gonostylus,
 386 lateral view; **E.** Gonostyli, dorsal view. Abbreviations: at, anal tube; cp, phallic complex;
 387 go, gonostylus; mdp, medioventral process; p, process; py, pygofer.

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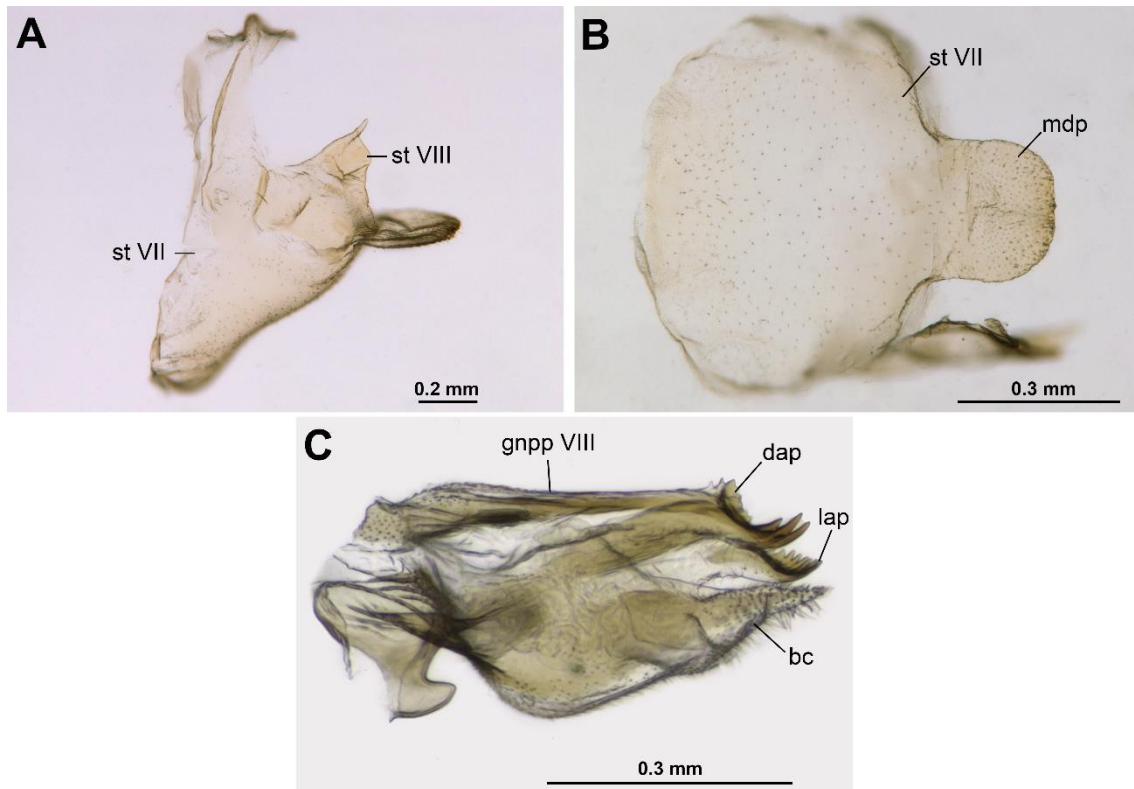
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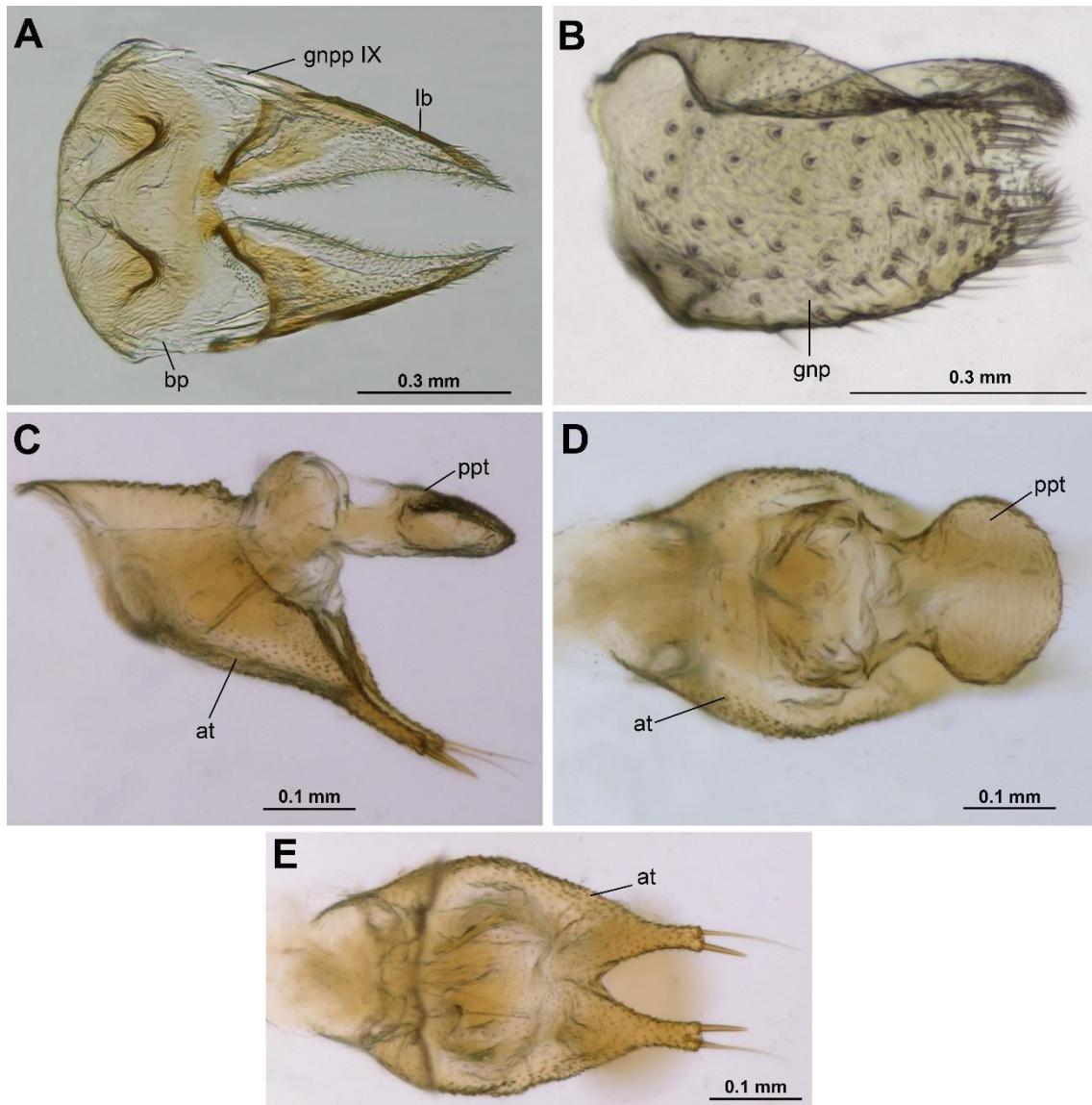
391 **FIGURE 8 A–D.** *Persis (Persis) pugnax* Stål, male terminalia. **A.** Phallic complex,
 392 lateral view; **B.** Phallic complex, dorsal view; **C.** Anal tube (segment X), lateral view; **D.**
 393 Anal tube (segment X) and paraproct, dorsal view. Abbreviations: ae: aedeagus; at, anal
 394 tube; pe, periandrium; ppt, paraproct; s, spines.

395



396

397 **FIGURE 9 A–C.** *Persis (Persis) pugnax* Stål, female genitalia. **A.** Sternite VII and VIII,
 398 lateral view; **B.** Sternite VII and medioventral process, ventral view; **C.** Gonapophysis
 399 VIII (first valvula) and bursa copulatrix, lateral view. Abbreviations: bc, bursa copulatrix;
 400 dap, dorsoapical process; gnpp, gonapophysis; lb, lobe; lap, lateroapical process; mdp,
 401 medioventral process; st, sternite.



402

403 **FIGURE 10 A–E.** *Persis (Persis) pugnax* Stål, female genitalia. **A.** Gonapophysis IX
 404 (second valvula), dorsal view; **B.** Gonoplac (third valvula), lateral view; **C.** Anal tube
 405 (segment X) and paraproct, lateral view; **D.** Anal tube (segment X) and paraproct, dorsal
 406 view; **E.** Anal tube (segment X), ventral view. Abbreviations: at, anal tube; bp, basal
 407 plate; gnp, gonoplac; gnpp, gonapophysis; lb, lobe; ppt, paraproct.

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413 ***Persis (Persis) stali* Muir**

414 (Figs 11 A–D; 12 A–E; 13 A–I; 14 A–C; 15 A–E; 24B; 25)

415 *Persis stali* Muir416 *Persis (Persis) stali*; Fennah 1952: 139 (subgeneric combination).417 **Type material.** Holotype male (AMNH) Paramaribo, D[utch] G[uiana] [old name for
418 country Suriname]. August, 1911 (examined through photographs) (Figs 11 A–D).419 **Condition of the holotype:** torn hind wing [terminalia not dissected].420 **Additional material examined. [Brasil], AM [Amazonas],** 2493, Nova Olinda, 15/2/63,421 Col – Cerqueira Eduardo (1 m#, INPA); *idem*, 27/5/63, Col-Cerqueira Antonio (1 f#,422 INPA); **AP [Amapá]** [currently a municipality in Amazonas], Fonte Boa, ix. 1975, F. M.423 Oliveira col. (1 f#, DZUP 399213); *idem*, (1 f#, DZUP 399199); *idem*, (1 f#, DZUP424 399197 [terminalia dissected]); *idem*, (1 f#, DZUP 399517); *idem*, (1 f#, DZUP 399198);425 *idem*, (1 m#, DZUP 399196 [terminalia terminalia dissected]); *idem*, Serra do Navio,

426 Estrada Lagoa Azul, -51°52'52"N–51°50'49"W, 15.iv.2014, varredura, J. T. Câmara, A.

427 Plant, J. A. Rafael, cols. (1 m#, INPA); *idem*, 18.iv.2014 (4 m#, INPA). **MA [Maranhão],**

428 C. [Cândido] Mendes, Fazenda 7 Irmãos, 01°52'06"S–45°45'59.7"W, Armadilha Malaise,

429 01–15.viii.2019, F. Limeira–de–Oliveira, D. Limeira & J. S. Brito, cols (1 f#, CZMA).

430 **Pará,** Belo Monte, Rio Xingu, Rodovia Transamazônica, 03°05'52"S–51°41'31"W,431 07.iv.2008, coleta manual, J. A. Rafael & F. F. Xavier F° (1 f#, INPA). **RO [Rondônia],**

432 Faz. [Fazenda] Rancho Grande, Cacaúlândia, Ariquemes, 18–XI–1991, Mielke leg. (1 f#,

433 1 m# DZUP 399442). **Roraima,** Alto Alegre, ESEC Maracá, 03°21'59"S–61°26'04"W,

434 1–15.xii. 2016, Malaise grande, R. Boldrini & J. A. Rafael – Rede BIA (1 m#, INPA);

435 *idem*, Mucajai, 02°22'45"N–61°21'03"W, Corcova, 27.ix.2021, Lençol iluminado, F. F.436 Xavier Filho, S. Lima, I. Oliveira (1 f#, INPA); *idem*, 29.ix.2021, coleta ativa,437 750/1000m, F. F. Xavier Filho, S. Lima, I. Oliveira (1 f#, INPA). **Venezuela,** Bolivar, El

438 Bochinche Res. Forestal Imataca, 200m, 6-13.xii.74, Em Trampa Malaise. Expedicion
439 Instituto Zoologia Agricola, Fac Agronomia. U.C.V (1 m#, MIZA).

440 **Measurements:** Body length: male 3.3–5.6 mm (6.0–10.8 mm including wings) (N=10);
441 female: 3.2–4.2 mm (7.0–7.6 mm including wings) (N=11).

442 **Diagnosis.** Frons with a large black lateral stripe, in lateral view (Figs 11A, 12A). Anal
443 tube with apex abruptly folded ventrally (Figs 13A, H). Sternite VIII in females, with
444 finger-shaped apex (Fig. 14A).

445 **Redescription (male and female).** Coloration. General body color orange with pale
446 yellow regions (Figs 11A, B, 12A, B). Vertex and frons carinae, scape, pedicel, paradiscal
447 region of the pronotum, tegula, epimeron, episternum and scutellum pale yellow (Figs 11
448 A, B, 12 A–E). Frons with a large black lateral band, in lateral view (Figs 11A, 12A).
449 Pronotum and mesonotum with yellow pale median region (Figs 11B, 12E). Forewing
450 semi hyaline, pale yellow, with dark yellow cells: dark yellow, long and narrow horizontal
451 stripe inside postcostal, C1a, CPcu+A1 cells; radial cell with continuous dark yellow
452 horizontal stripe; C1', C1b, C1b', C2, C2', C3, C3', C3a, C3a', C4, C4', C5, median cells
453 predominantly dark yellow; cell C5' with narrow horizontal stripe broken in the apical
454 half; cubital cell brown, long and narrow with horizontal stripe arising at the level of the
455 CuA bifurcation; wide, brown horizontal stripe inside CPcu+ A1' cell (Fig. 24B). Hind
456 wing semi hyaline, pale yellow. Legs pale yellow (Fig. 11A, C, 12A, B). Abdomen
457 yellowish-orange, except all brown tergites, anal tube (segment X), gonostylus and
458 pygofer pale yellow.

459 *Head:* Frons approximately 5.2 times as long as wide (Fig. 12C); projection of head
460 1.3 times wider than eye width, in lateral view (Figs 11A, 12A, B, D); lateral carina of
461 frons subparallel towards the clypeus, in anterior view (Fig. 12C); vertex with rounded
462 posterior margin and minimum vertex width less than $\frac{1}{4}$ of its maximum width (Fig. 12E);

463 epistomal suture strongly triangular medially (Fig. 12C); clypeus approximately 3.5 times
464 as long as wide (Fig. 12C). *Thorax*: pronotum anterior margin truncated (Fig. 12E);
465 shallow paradiscal regions (Figs 11A, 12A, B, D). Forewing approximately 3.6 times
466 longer than wide; CuA vein forking at the level of Pcu+A1 vein (Fig. 24B).

467 *Male terminalia* (Figs 13A–I): Pygofer symmetrical, subrectangular, narrowest
468 dorsally, with truncate protuberance on posterodorsal margins (Figs 13A, B);
469 medioventral process subtriangular, with slightly pointed apex in ventral view (Fig. 13C).
470 Gonostyli symmetrical, long, approximately 1.7 times longer than the anal tube, with
471 cylindrical and pointed apex (Fig. 13E); dilated median region, with the central portion
472 laterally compressed in dorsal view (Fig. 13E); dorsal margin with a process close to base
473 (P) and a row of setae to the base of process (Fig. 13D); process subrectangular, trifid,
474 with lobes of unequal sizes (P) (Fig. 13D): a sclerosed spiniform lobe, with a pointed
475 apex, externally curved, a lobe long, large, with rounded apex anteriorly curved, and a
476 short, sclerosed lobe, straight posteriorly, with truncate apex (Fig. 13D); ventral margin
477 sinuous, with a rounded projection near base, and a sclerosed spiniform projection at the
478 level of the process of the dorsal margin (Fig. 13D), with an anteriorly curved apex (Fig.
479 13E). Phallic complex, symmetrical, anteriorly curved (Figs 13F, G): periandrium
480 without projections (Fig. 13F). Aedeagus with a bifid process, with unequal size spines
481 (S1): short, slender, sinuous spine, apex convergent in dorsal view (S1a); a long, slender,
482 sinuous spine, apex convergent in dorsal view (S1b); a bifid process of unequal size and
483 shape spines (S2): a long, slender, sinuous spine, apex convergent in dorsal view (S2a);
484 a long, sinuous process, dorsoventrally compressed, widened in the basal 2/3, slender in
485 the apical third, apex convergent in dorsal view (S2b); a short, broad, subtriangular
486 process with rounded apex, directed upwards in lateral view (S3); and a long, almost
487 straight process, with a bifid, divergent apex, boot-shaped (S4) (Fig. 13G). Anal tube

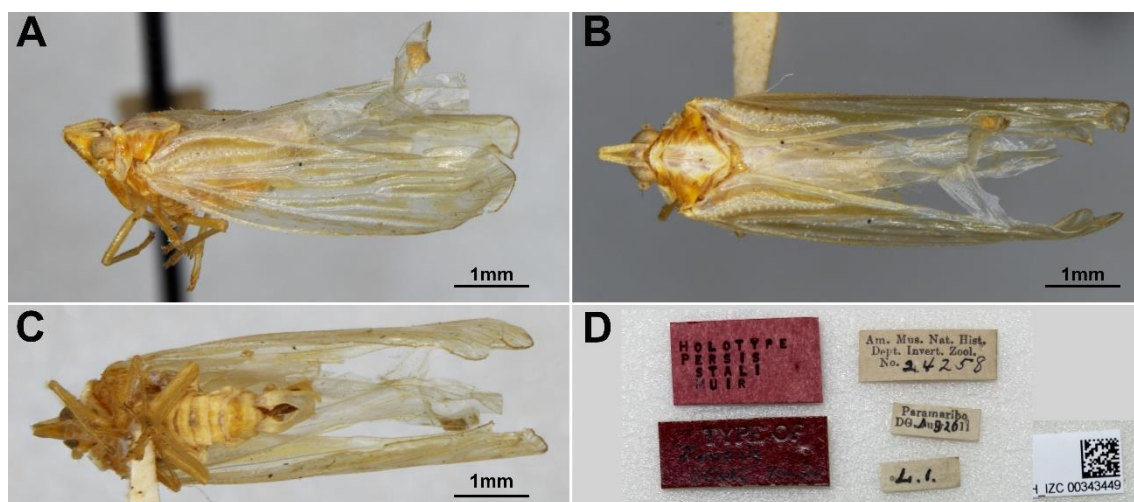
488 (segment X) robust, with dorsal margin almost straight and ventral margin sinuous (Fig.
489 13H); apex with a short reentrant, occupying 1/4 apical of the total length of anal tube,
490 forming two lobes (Fig. 13I); robust lobes, abruptly curved ventrally (Fig. 13H), with
491 pointed and cylindrical apex directed posteriorly in dorsal view (Fig. 13I). Paraproct
492 subcircular (Fig. 13I).

493 Female similar to male (Fig. 12B). *Female terminalia* (Figs 14 A–C, 15 A–E):
494 Pregenital sternite (Sternite VII) with apex of medioventral process slightly indented in
495 the middle, in ventral view (Fig. 14B). Sternite VIII finger-shaped, with sinuous dorsal
496 margin and ventral margin towards the apex in lateral view (Fig. 14A), with subrounded
497 apex (Fig. 14A). Gonapophysis VIII (first valvula) with a long and slender projection on
498 dorsoapical margin (dap) bearing elevated irregular teeth, forming a concavity in dorsal
499 view, and without spines close to base of projection (Fig. 14C); one lateroapical
500 projection (lap) with nine teeth on apical margin, with upwardly curved apex (Fig. 14C).
501 Bursa copulatrix (bc) slightly filamentous towards the apex, apex acute and straight
502 posteriorly, covered by small spiniform projections on apical half, in lateral view (Fig.
503 14C). Gonapophysis IX (second valvula) robust, wider basally, bifid at apical 3/4, with
504 lobes pointed and convergent apically (Fig. 15A); fine and small setae present on the
505 apical 3/4 of the lobes in the dorsal region; basal half of the Gonapophysis IX (second
506 valvula) with spiniform projections in ventral region (Fig. 15A); basal plate (bp) of
507 Gonapophysis IX 2.2 times longer than wide; subtriangular anterior margin (Fig. 15A).
508 Gonoplac (third valvula) subquadrate, apex truncated, with smooth indentation, and
509 bearing numerous setae apically in lateral view (Fig. 15B). Anal tube (segment X) short,
510 cylindrical (Fig. 15C); ventral margin of the anal tube reentrant, with elongated robust
511 digitiform lobes bearing three apical spiniform setae of different size (Figs 15D, E).
512 Paraproct subcircular (Fig. 15D).

513 **Distribution.** Neotropical Region: Guyana, Suriname, Venezuela and Brazil (Amazonas,
514 Amapá, Maranhão, Pará, Rondônia, Roraima) (Fig. 25).

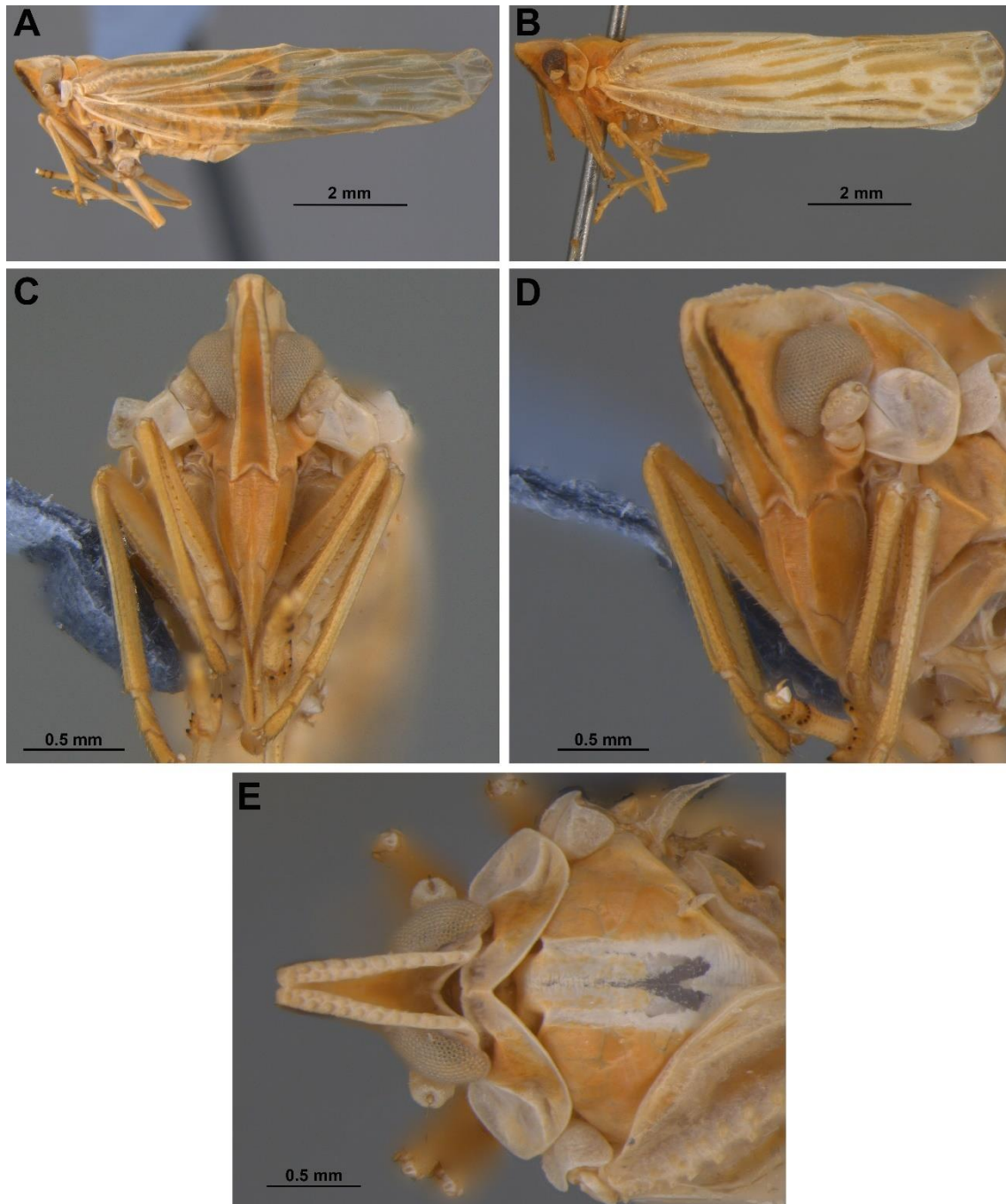
515 **Taxonomic notes.** The coloring is very similar to *Persis (Persis) pugnax*, but the two
516 species can be differentiated by the length of the head projection in lateral view. In *P.*
517 (*Persis*) *pugnax*, this projection is 1.6 times larger than the width of the compound eyes,
518 while in *Persis (Persis) stali* it is 1.3 times larger. Furthermore, *P. (Persis) stali* has a
519 wide black stripe that appears only on the frons in lateral view, while in *P. (Persis)*
520 *pugnax*, the stripe is narrow and extends both on the vertex and frons.

521



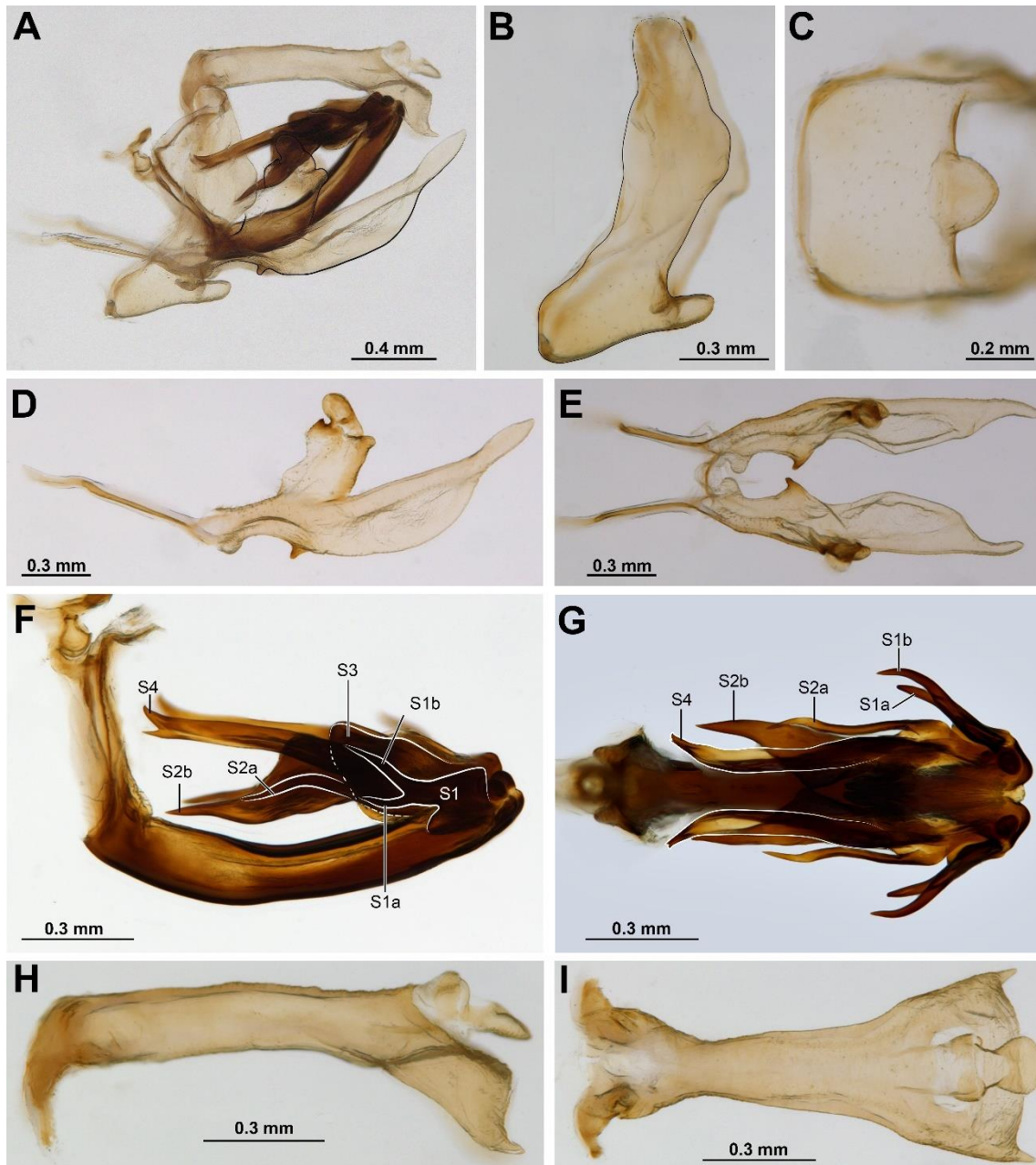
522

523 **FIGURE 11 A–D.** *Persis (Persis) stali* Muir, holotype male. **A.** Habitus, lateral view; **B.**
524 Habitus, dorsal view; **C.** Habitus, ventral view; **D.** Labels. Photographs: Ruth Salas
525 (AMNH).



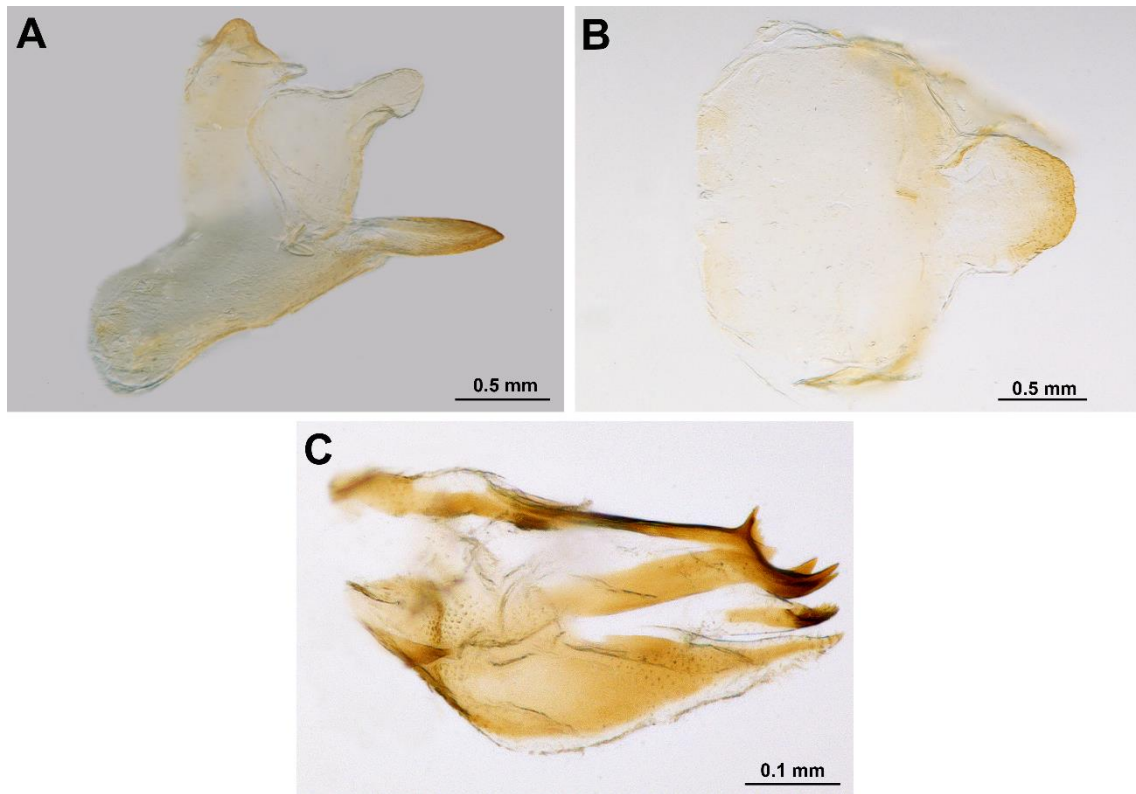
526

527 **FIGURE 12 A–E.** *Persis (Persis) stali* Muir. **A–B.** Habitus. **A.** male, lateral view; **B.**
 528 female, lateral view; **C.** Frons, anterior view; **D.** Frons and thorax, anterolateral view; **E.**
 529 Head and thorax, dorsal view.



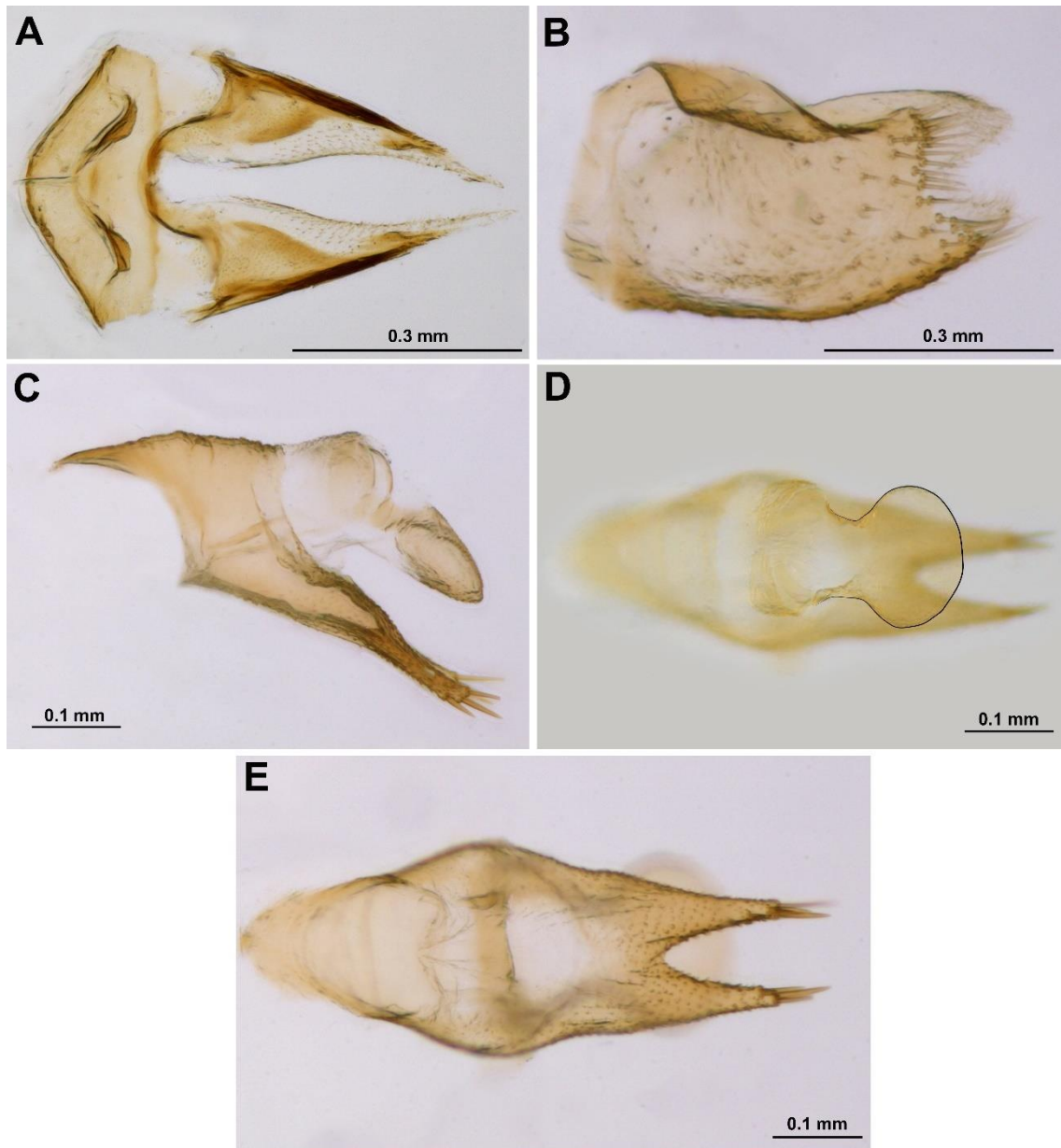
530

531 **FIGURE 13 A–I.** *Persis (Persis) stali* Muir, male terminalia. **A.** Genital capsule, lateral
 532 view; **B.** Pygofer, lateral view; **C.** Pygofer, in ventral view; **D.** Gonostylus, lateral view;
 533 **E.** Gonostyli, dorsal view; **F.** Phallic complex, lateral view; **G.** Phallic complex, dorsal
 534 view; **H.** Anal tube (segment X), lateral view; **I.** Anal tube (segment X) and paraproct,
 535 dorsal view. Abbreviations: s, spines.



536

537 **FIGURE 14 A–C.** *Persis (Persis) stali* Muir, female terminalia. **A.** Sternite VII and VIII,
538 lateral view; **B.** Sternite VII, ventral view; **C.** Gonapophysis VIII (first valvula) and bursa
539 copulatrix, lateral view.



540

541 **FIGURE 15 A–E.** *Persis (Persis) stali* Muir, female genitalia. **A.** Gonapophysis IX
 542 (second valvula), dorsal view; **B.** Gonoplac (third valvula), lateral view; **C.** Anal tube
 543 (segment X) and paraproct, lateral view; **D.** Anal tube (segment X) and paraproct, dorsal
 544 view; **E.** Anal tube (segment X), ventral view.

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550 *Persis (Persis) gaianii* sp. nov.

551 (Figs 16 A–D; 17 A–C; 18 A–E; 19 A–C; 24C; 25)

552 **Type material.** Holotype female (INPA). Brasil, **Roraima**, Alto Alegre, ESEC Maracá,
553 03°21'59"N–61°26'04"W, 11.XI.2016, 1–15.x.2016, Malaise grande, R. Boldrini & J.A.
554 Rafael – Rede BIA (terminalia dissected) (Figs 16 A–D).

555 **Condition of the holotype:** prothoracic legs, right mesothoracic and left metathoracic
556 broken; left wing assembled, abdomen dissected.

557 **Measurements:** Body length: female: 4.8 mm (7.7 mm including wings) (N=1).

558 **Diagnosis.** Frons with a narrow black lateral stripe (Figs 16 A, C); Pronotum with two
559 oval lateral black spots near lateral region (Figs 16A, C, D, 19A, B).

560 **Description.** Coloration. General body color orange with white regions (Figs 16A, 19A,
561 B). Vertex, carinae of frons, scape, pedicel, paradiscal region of the pronotum, tegula,
562 and scutellum white (Figs 16 A–D, 19A). Frons with a narrow black lateral stripe, in
563 lateral view (Fig. 16A). Pronotum with two oval black spots near lateral margins (Fig.
564 16A, C, D, 19A, B). Pronotum and mesonotum with white median region (Fig. 16D).
565 Forewing semi hyaline, pale yellow, with brown cells: brown, long and narrow horizontal
566 stripe inside postcostal, C1a, CPcu+A1 cells; C1', C1b, C1b', C2, C2', C3, C3', C3a, C3a',
567 C4, C4', C5, median cells predominantly dark yellow; cubital cell with short, narrow
568 brown horizontal band arising after the bicurcation of CuA; wide brown horizontal stripe
569 inside CPcu+ A1' cell. Hind wing semihyaline, pale yellow (Fig. 24C). Legs yellowish-
570 orange. Abdomen with tergites yellowish-orange and sternites pale yellow.

571 *Head:* Frons, approximately 4.1 times as long as wide (Fig. 16B); projection of the
572 head 2 times wider than eye width, in lateral view (Figs 16A, 19A, B); lateral carina of
573 frons subparallel towards the clypeus, in anterior view (Fig. 16B); vertex with triangular
574 posterior margin and minimum vertex width less than $\frac{1}{4}$ of its maximum width (Fig.

575 16D); epistomal suture smoothly triangular medially (Figs 16B, C); clypeus
576 approximately 3.4 times as long as wide (Fig. 16B). *Thorax*: pronotum with truncated
577 anterior margin (Fig. 16D); shallow paradiscal regions (Figs 16A, C, 19A, B). Forewing
578 approximately 4 times longer than wide; CuA vein forking at level of Pcu+A1 vein. (Fig.
579 24C).

580 *Male terminalia* (Fig. 19C): Pygofer symmetrical, subrectangular, narrowest
581 dorsally, with sinuous protuberance on posterodorsal margins (Fig. 19C); medioventral
582 process subtriangular, with rounded apex in ventral view. Gonostyli symmetrical, short,
583 approximately 1.5 times shorter than the anal tube, with cylindrical and acute apices;
584 dilated median region with the central portion laterally compressed; dorsal margin with a
585 process close to base and a row of setae to the base of process; process subquadrate, trifid,
586 with unequal size lobes: a sclerosed spiniform lobe, with a pointed apex, posteriorly
587 curved, a lobe long, robust, with rounded apex, and a short, triangular lobe (Fig. 19C).
588 Phallic complex symmetrical, anteriorly curved (Fig. 19C): periandrium with a
589 lateroapical bifid process, with similar size spines (P): spines short, slender and sinuous
590 (S1a, S1b). Aedeagus with a lateral spine at basal half, long, slender and slightly sinuous
591 at apex (S1); a lateral spine at apical half long, robust, with divergent curved apex (S2);
592 a lateral spine at apical half long, robust, with straight apex (S3) (Fig. 19C). Anal tube
593 (segment X) robust, with almost straight dorsal margin, sinuous ventral margin in lateral
594 view; ventral margin with a long indentation at apex, occupying almost the apical 1/4 of
595 the total length of the anal tube, forming two lobes; lobes robust, abruptly folded
596 ventrally, with a pointed apex slightly curved ventrally (Fig. 19C). Paraproct non-visual.

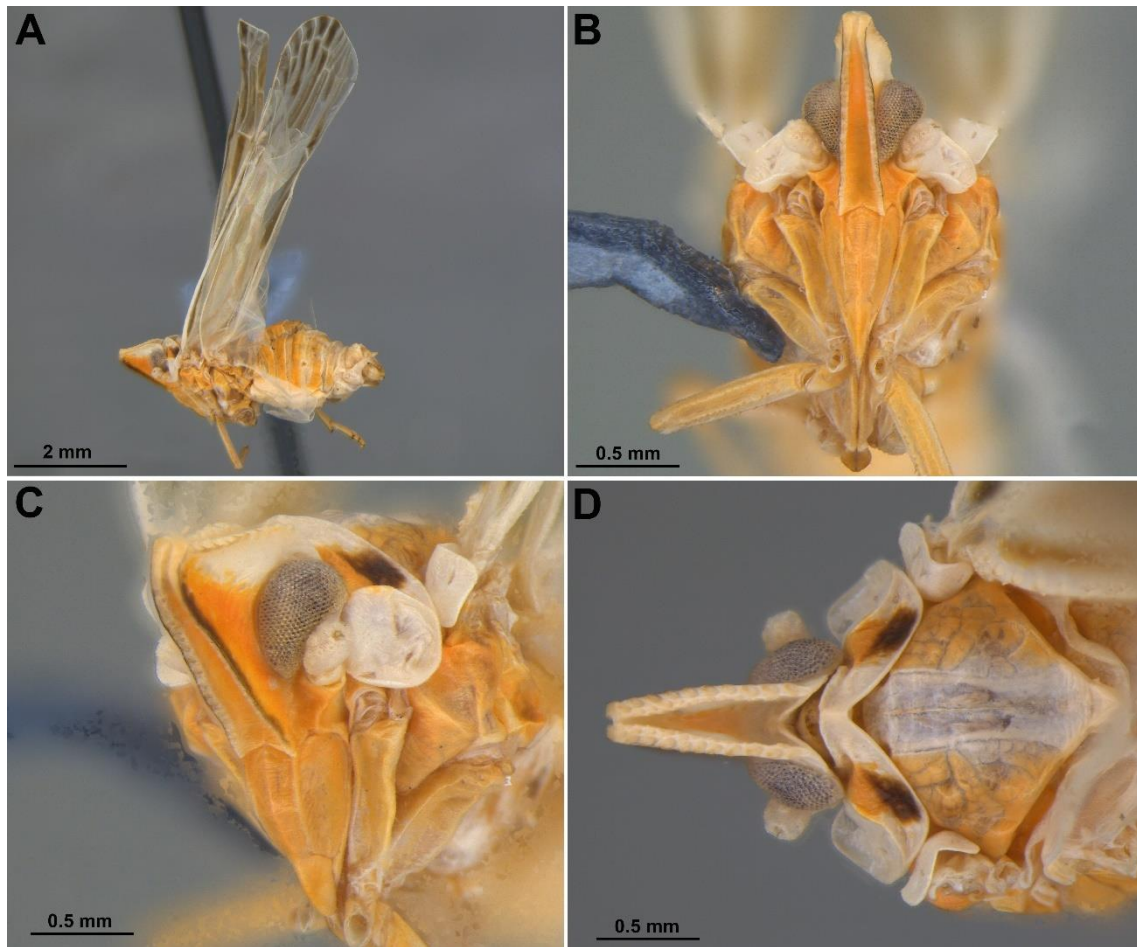
597 *Female* similar to male (Fig. 16A). *Female terminalia*: Pregenital sternite (Sternite
598 VII) with subtriangular medioventral process (Fig. 17B). Sternite VIII finger-shaped,
599 with straight dorsal margin and straight ventral margin towards the apex in lateral view,

600 with pointed apex (Fig. 17A). Gonapophysis VIII (first valvula) with a long and slender
601 projection on dorsoapical margin (dap) with irregular slightly elevated teeth, forming a
602 concavity in dorsal view, and without spines close to base of projection (Fig. 17C); one
603 lateroapical projection (lap) with 12 teeth at apical margin, with upwardly curved apex
604 (Fig. 17C). Bursa copulatrix (bc) slightly filamentous at apex, apex acute and curved
605 upwards, covered by small spiniform projections at apical half in lateral view (Fig. 17C).
606 Gonapophysis IX (second valvula) robust, wider basally, bifid at 3/4 apical, lobes with
607 pointed and convergent apices (Fig. 18A); fine and small setae at 3/4 of the lobes in
608 dorsal region; basal half of Gonapophysis IX (second valvula) with spiniform projections
609 in ventral region (Fig. 18A); basal plate (bp) of Gonapophysis IX 1.6 times longer than it
610 is wide; roundend anterior margin (Fig. 18A). Gonoplac (third valvula) subquadrate, apex
611 truncated, with smooth indentation, and bearing numerous setae apically in lateral view
612 (Fig. 18B). Anal tube (segment X) short, cylindrical (Fig. 18C); ventral margin of anal
613 tube reentrant, with elongated slender digitiform lobes bearing three apical spiniform
614 setae of different size (Figs 18D, E). Paraproct subcircular (Fig. 18D).

615 **Etymology.** This species is named in honor of Dr. Marco Gaiani, former curator of the
616 Museum of the Institute of Agricultural Zoology, Central University of Venezuela), the
617 largest collection of Arthropods in Venezuela, as a form of gratitude for his contribution
618 in making the material available and for all assistance provided to describe this species.

619 **Distribution.** Venezuela, Brazil (Roraima) (Fig. 25).

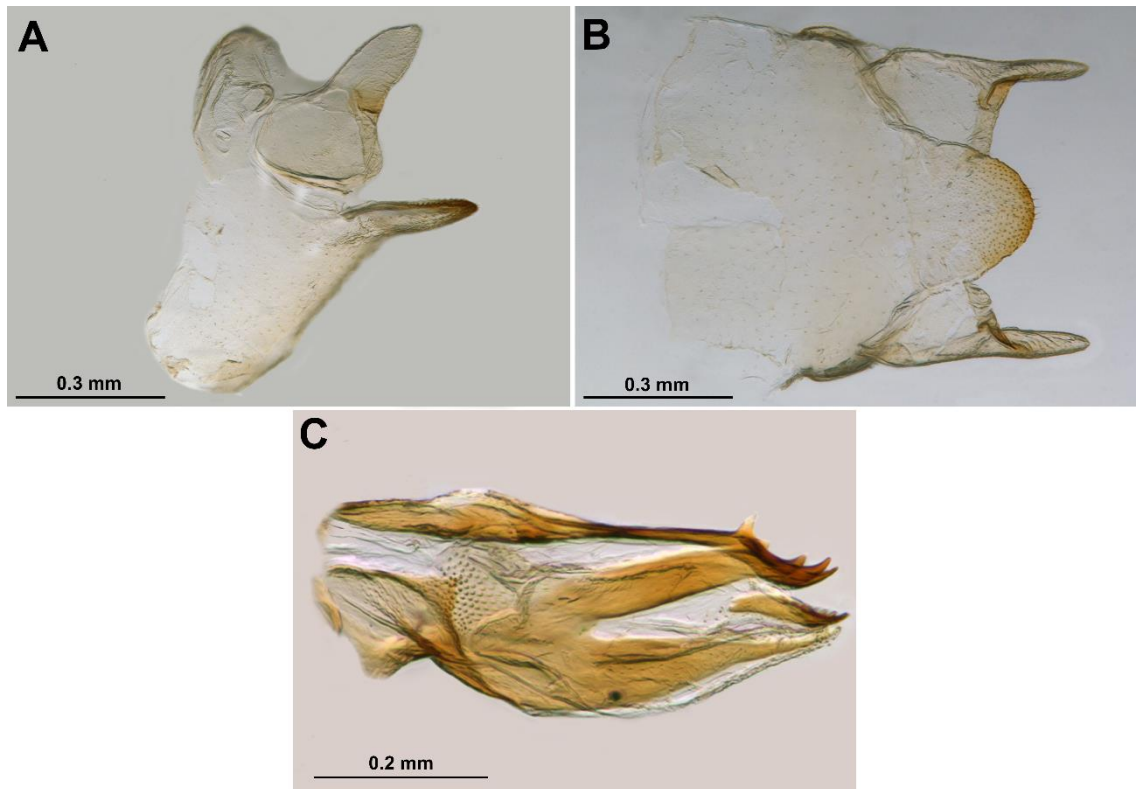
620 **Taxonomic notes.** This species differs from all others in this subgenus by the presence
621 of two oval black spots on the side of the pronotum.



622

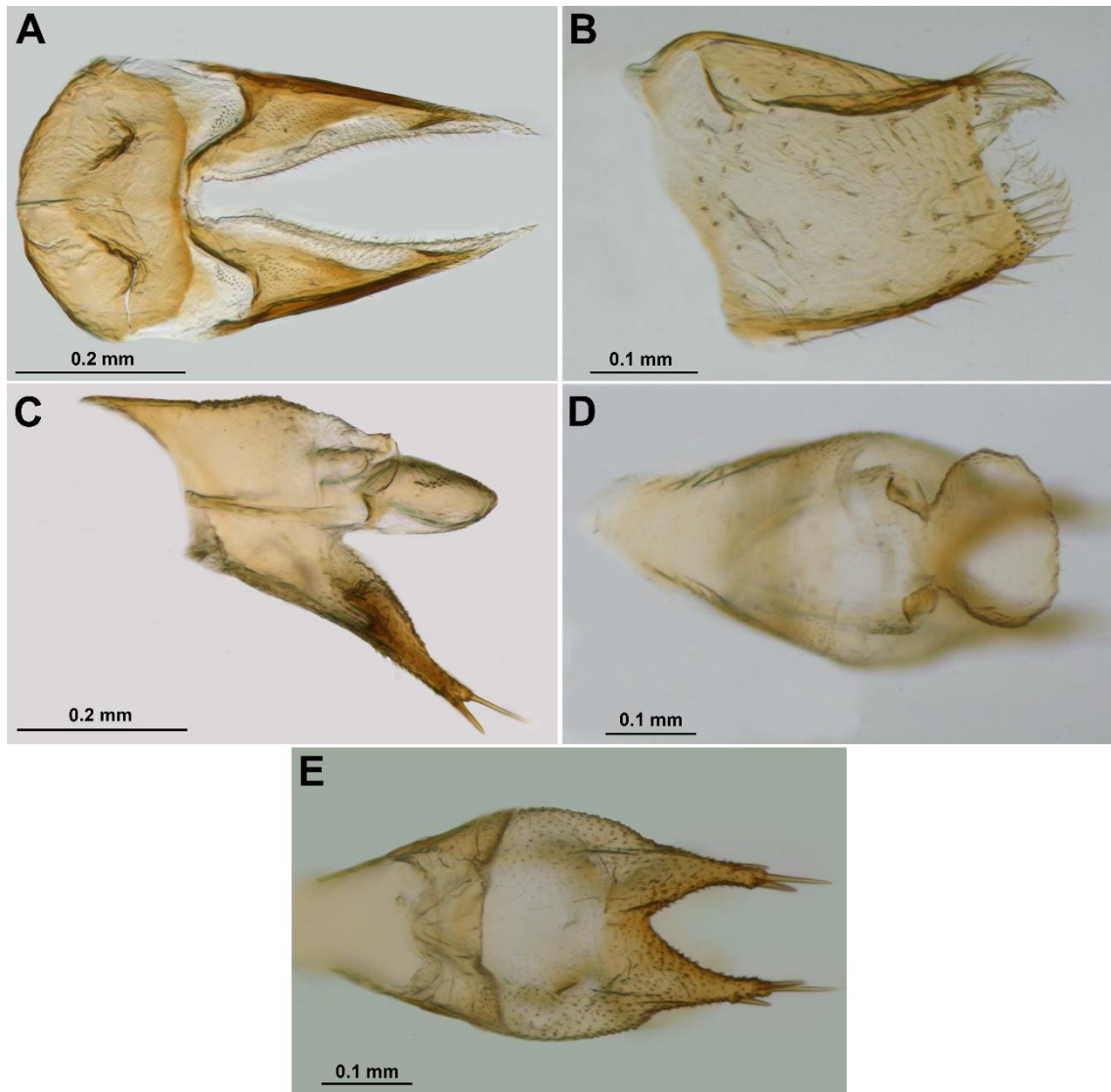
623 **FIGURE 16 A–D.** *Persis (Persis) gaianii* sp. nov., female. **A.** Habitus, lateral view; **B.**624 Frons, anterior view; **C.** Frons and thorax, anterolateral view; **D.** Head and thorax, dorsal

625 view.



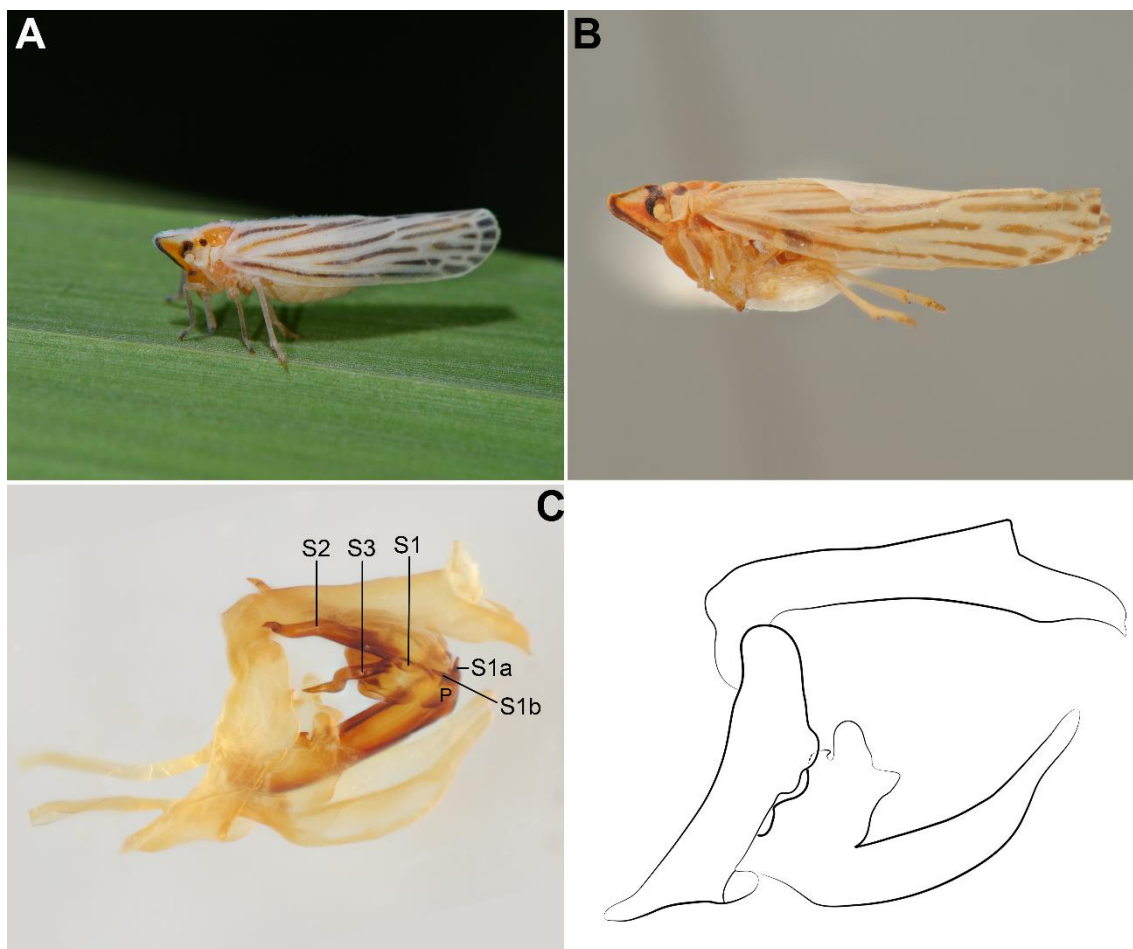
626

627 **FIGURE 17 A–C.** *Persis (Persis) gaianii* **sp. nov.**, female terminalia. **A.** Sternite VII and
 628 VIII, lateral view; **B.** Sternite VII, ventral view; **C.** Gonapophysis VIII (first valvula) and
 629 bursa copulatrix, lateral view. Abbreviations: p, process; s, spines.



630

631 **FIGURE 18 A–E.** *Persis (Persis) gaianii* **sp. nov.**, female genitalia. **A.** Gonapophysis
 632 IX (second valvula), dorsal view; **B.** Gonoplac (third valvula), lateral view; **C.** Anal tube
 633 (segment X) and paraproct, lateral view; **D.** Anal tube (segment X) and paraproct, dorsal
 634 view; **E.** Anal tube (segment X), ventral view.



635

636 **FIGURE 19 A–C.** *Persis (Persis) gaianii* **sp. nov.**, male. **A.** Habitus (in nature), lateral
 637 view; **B.** Habitus, lateral view; **C.** Genital capsule, lateral view.

638

639 *Persis (Persis) limeirai* **sp. nov.**

640 (Figs 20 A–E; 21 A–I; 22A–C; 23 A–E; 24D; 25)

641 **Type material.** Holotype male (DZUP 579000). Brasil, **Paraná**, Morretes, Estrada da
 642 Inhanha [Anhaia], 25°34'38"S–48°52'12"W, 11.XI.2016, Sweep, A. C. Domahovski & R.
 643 R. Cavichioli leg (Figs 20A–E, 21 A–I).

644 **Condition of the holotype:** in perfect condition (terminalia not dissected).

645 **Paratypes.** Same data as holotype (1 m#, DZUP 577899, terminalia dissected); *idem*, (1
 646 f#, DZUP 579001); *idem*, (1 f#, DZUP 579002); *idem*, (1 f#, DZUP 579003). **ES**
 647 **[Espírito Santo]**, Santa Teresa, 4/6[vi]/1967, C. & C. T. Elias (1 f#, DZUP 399200);
 648 *idem*, Racho Dantas, Brejetuba, 07/03[iii]/ 2000, M. Felix col. (2 f#, DZRJ). **R[io] de**
 649 **J[aneiro]**, Itatiaia, P. N. [Parque Nacional] do Itatiaia, Cachoeira do Maromba,
 650 06.xii.2015, sweep, J. S. Prando (1 f#, DZRJ [terminalia dissected]).

651 **Measurements:** Body length: male 4.1 mm (7.9 mm including wings) (N=2); female:
 652 3.7–4.7 mm (7.0–9.5 mm including wings) (N=7).

653 **Diagnosis.** Mesonotum predominantly brown, with pale yellow median stripe (Fig. 20E).
 654 Forewing with yellow upper half, lower half and apical cells brown (Fig. 24D).

655 **Description.** Coloration. General body color orange, with pale yellow and brown regions
 656 (Figs 20A, B). Apical articulation of the rostrum brown and brown mesonotum (Figs 20C,
 657 E). Paradiscal regions of the pronotum, tegula, epimeron, episternum and scutellum pale
 658 yellow (Figs 20A, B). Margins of the paradiscal region of the pronotum brown (Figs 20C–
 659 E). Tegula and pronotum with posterior margin brown (Fig. 20D). Pronotum with median
 660 carina and lateral region of posterior margin brown (Fig. 20E). Mesonotum with pale
 661 yellow median stripe covering the median carina (Fig. 20E). Forewing semi hyaline, with
 662 yellow upper half, brown lower half and apical cells, and yellow veins (Fig 24D). Hind
 663 wing semi hyaline, pale yellow. Legs: profemur, protibia, protarsus, mesofemur,
 664 mesotibia and mesotarsus predominantly brown; metathoracic leg pale yellow, with
 665 apical region of the metafemur, metatibia, and metatarsus brown (Figs 20 A–C).
 666 Abdomen yellowish-orange, except for brown tergites, anal tube (segment X), gonostylus
 667 and pygofer pale yellow.

668 *Head:* Frons approximately 5.6 times as long as wide (Fig. 20C); projection of head
 669 1.3 times wider than eye width, in lateral view (Figs 20A, B, D); lateral carina of frons

670 divergent towards the clypeus (Fig. 20C); vertex with triangular posterior margin and
671 minimum vertex width greater than $\frac{1}{4}$ of its maximum width (Fig. 20E); epistomal suture
672 almost straight (Fig. 20C); clypeus approximately 4.1 times as long as wide (Fig. 20C).
673 *Thorax*: pronotum anterior margin tapering (Fig. 20E); deep paradiscal region (Figs 20
674 C–E). Forewing approximately 4.2 times longer than wide; CuA vein forking before
675 Pcu+A1 vein union. (Fig. 24D).

676 *Male terminalia* (Figs 21 A–I): Pygofer symmetrical, subrectangular, narrowest
677 dorsally, with triangular process on posterodorsal margins (Figs 21A, B); subtriangular
678 curved upward process, slightly longer than the medioventral process, acute apex in
679 lateral view (Fig. 21B); medioventral process subtriangular, with subrounded apex, in
680 ventral view (Fig. 21C). Gonostyli symmetrical, long, approximately 1.3 times longer
681 than anal tube, with a flat, robust and pointed apexes; dorsal margin with a process close
682 to base and a row of setae to base of process (Figs 21D, E); trifold process with lobes of
683 unequal sizes (Fig. 21D): a sclerosed spiniform lobe, with pointed apex, externally curved
684 downwards, a robust and rounded lobe, and a long, pointed and straight lobe posteriorly;
685 ventral margin sinuous, with a sclerosed spiniform projection at the level of process of
686 the dorsal margin in ventral view (Figs 21D, E), bearing anteriorly curved apex (Fig.
687 21E). Phallic complex symmetrical, anteriorly curved (Figs 21F, G): periandrium without
688 spiniform projections on ventral margin, and dorsal margin with one cylindrical spiniform
689 projection near the base (Fig. 21F); projection spiniform slender, long, occupying $\frac{3}{4}$ of
690 the length of periandrium, almost straight and slightly sinuous at apex, bearing acute apex,
691 directed outwards (Fig. 21F). Aedeagus with one short, slender, sinuous spine, apex
692 convergent in dorsal view (S1); a short process, longer than wide, narrower basally, with
693 straight dorsal half, laterally compressed and apically rounded, and with sinuous ventral
694 half, laterally compressed, and apically pointed and cylindrical in lateral view (S2); a

695 long, cylindrical, sinuous spine, apex convergent in dorsal view (S3); a long process,
696 laterally compressed, with median region widened, apically slender and pointed (S4); a
697 long process, sinuous, with rounded apex of the inner lateral half and with apex of outer
698 lateral half pointed and cylindrical (S5) (Figs 21F, G). Anal tube (segment X) robust, with
699 almost straight dorsal margin and sinuous ventral margin (Fig. 21H); ventral margin with
700 a long indentation at apex, occupying almost the apical 2/4 of the total length of the anal
701 tube, forming two lobes (Fig. 21I); robust lobes with pointed apex, slightly curved
702 ventrally (Fig. 21I). Paraproct subcircular (Fig. 21I).

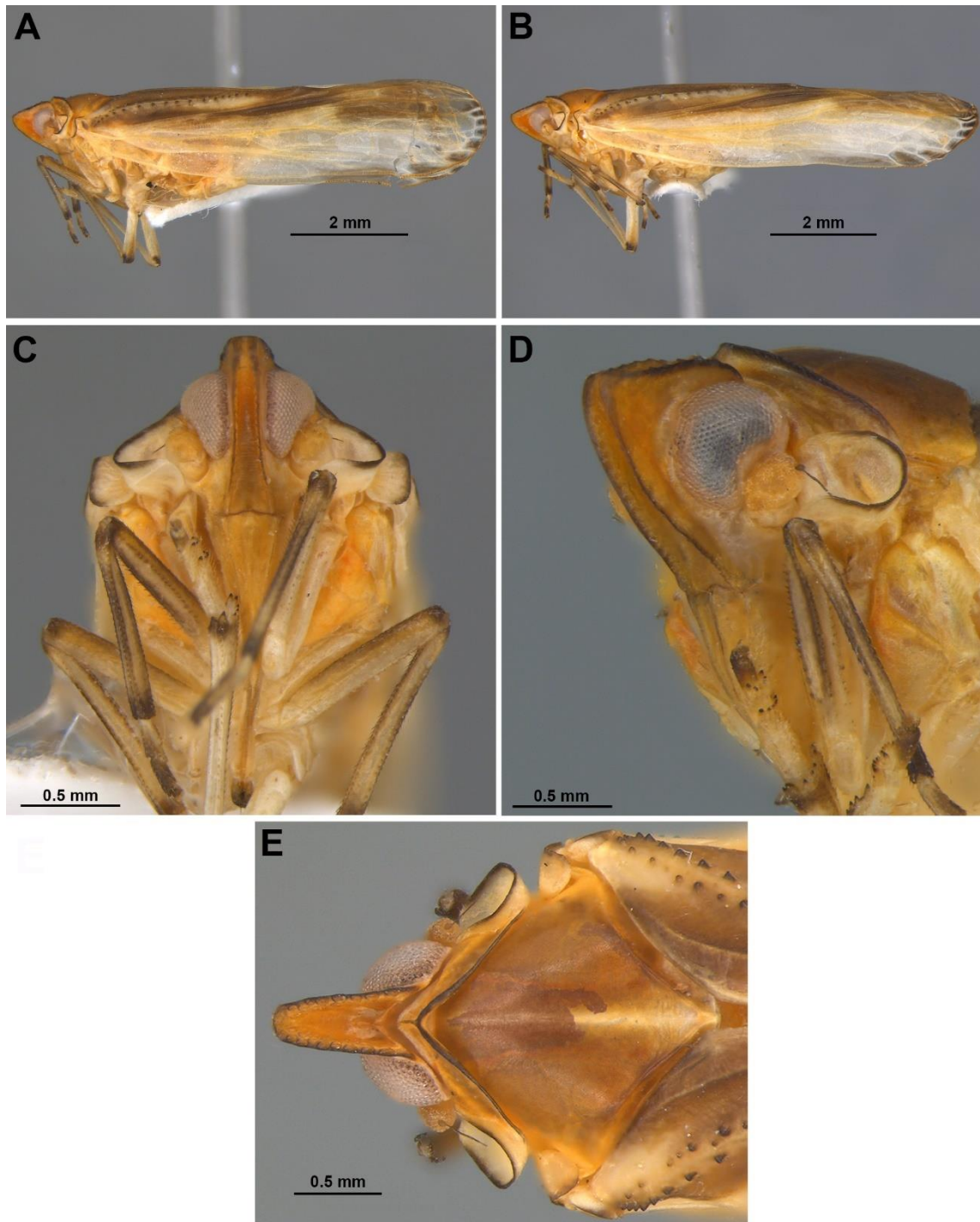
703 Female similar to male (Fig. 20B). *Female terminalia* (Figs 22 A–C, 23 A–E):
704 Pregenital sternite (Sternite VII) with triangular medioventral process in ventral view
705 (Fig. 22A). Sternite VIII finger-shaped, with straight dorsal margin and straight ventral
706 margin towards the apex, with subrounded apex (Fig. 22B). Gonapophysis VIII (first
707 valvula) with a long and slender projection on dorsoapical margin (dap) bearing elevated
708 irregular teeth, forming a concavity, and without spines close to base of projection (Fig.
709 22C); a shorter, upwardly curved lateroapical projection (lap), with nine teeth on apical
710 margin (Fig. 22C). Bursa copulatrix (bc) slightly filamentous at the apex, apex sclerotic
711 and pointed, curved upwards (Fig. 22C). Gonapophysis IX (second valvula) robust, wider
712 basally, bifid at apical $\frac{3}{4}$ with lobes pointed and bifid apex, straight posteriorly (Fig. 23A);
713 fine and small setae present at apical $\frac{3}{4}$ of the lobes in the dorsal region; basal half of the
714 Gonapophysis IX (second valvula) with spiniform projections in ventral region (Fig.
715 23A); basal plate (bp) of Gonapophysis IX subtriangular, 1.5 longer than wide; triangular
716 anterior margin (Fig. 23A). Gonoplac (third valvula) subrectangular, apex truncated, with
717 smooth indentation, and bearing numerous setae apically (Fig. 23B). Anal tube (segment
718 X) short, cylindrical (Fig. 23C); ventral margin of the anal tube reentrant, with elongated

719 slender digitiform lobes bearing four apical spiniform setae of different size (Fig. 23E).
720 Paraproct subcircular (Fig. 23D).

721 **Etymology.** This species is named in honor of Dr. Francisco Limeira de Oliveira, curator
722 of the Coleção Zoológica do Maranhão–CZMA at the Universidade Estadual do
723 Maranhão–UEMA, as a way of thanking you for your contribution in making the material
724 available and for all your efforts in collecting material in neglected areas (Northeast of
725 Brazil).

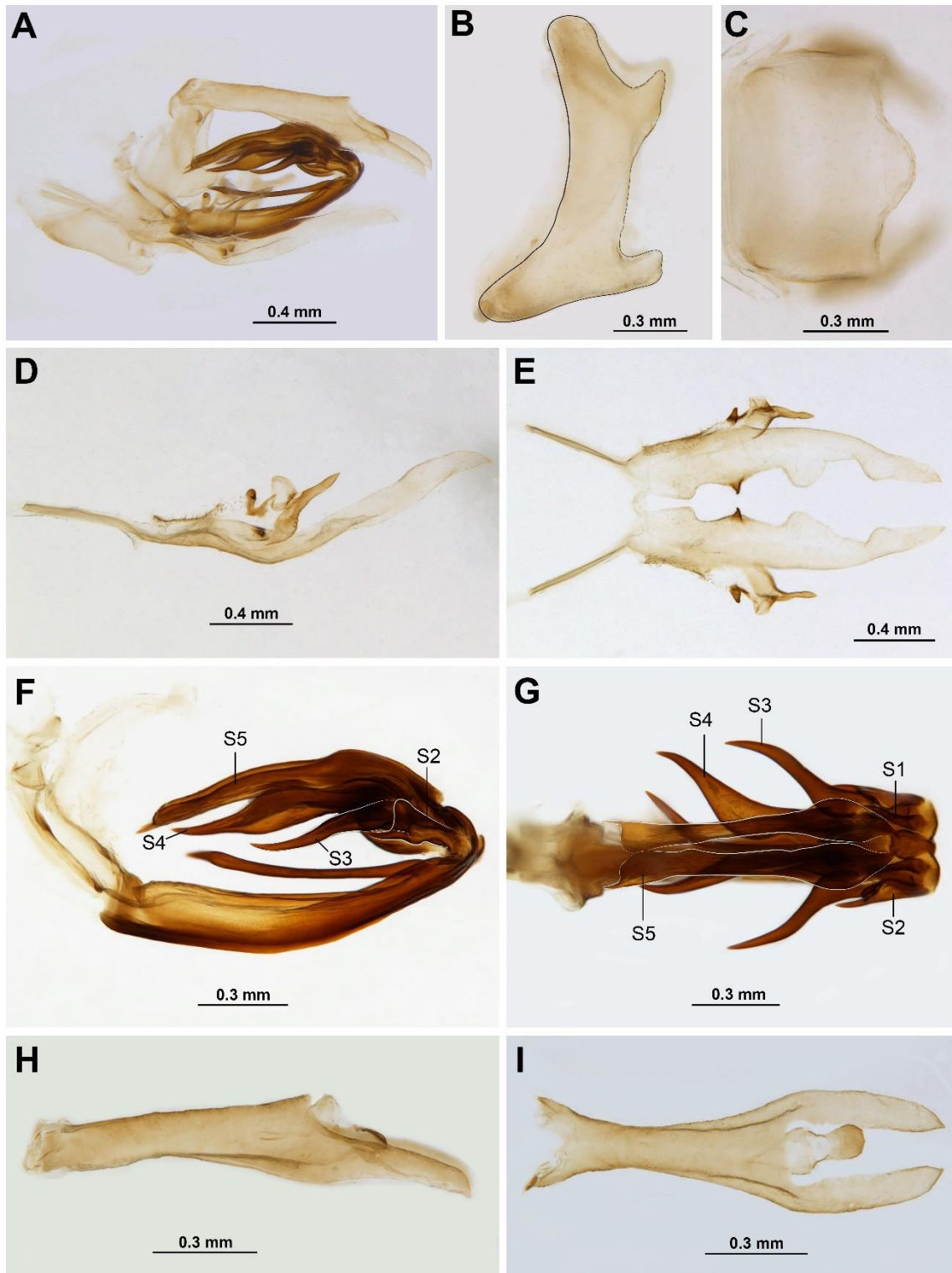
726 **Distribution.** Brazil (Espírito Santo, Paraná and Rio de Janeiro) (Fig. 25).

727 **Taxonomic notes.** *Persis (Persis) limeirai* **sp. nov.** differs from all other species of the
728 subgenus by the deep paradiscal region of the pronotum and by having a brown thorax
729 and brown lower half of the forewing.



730

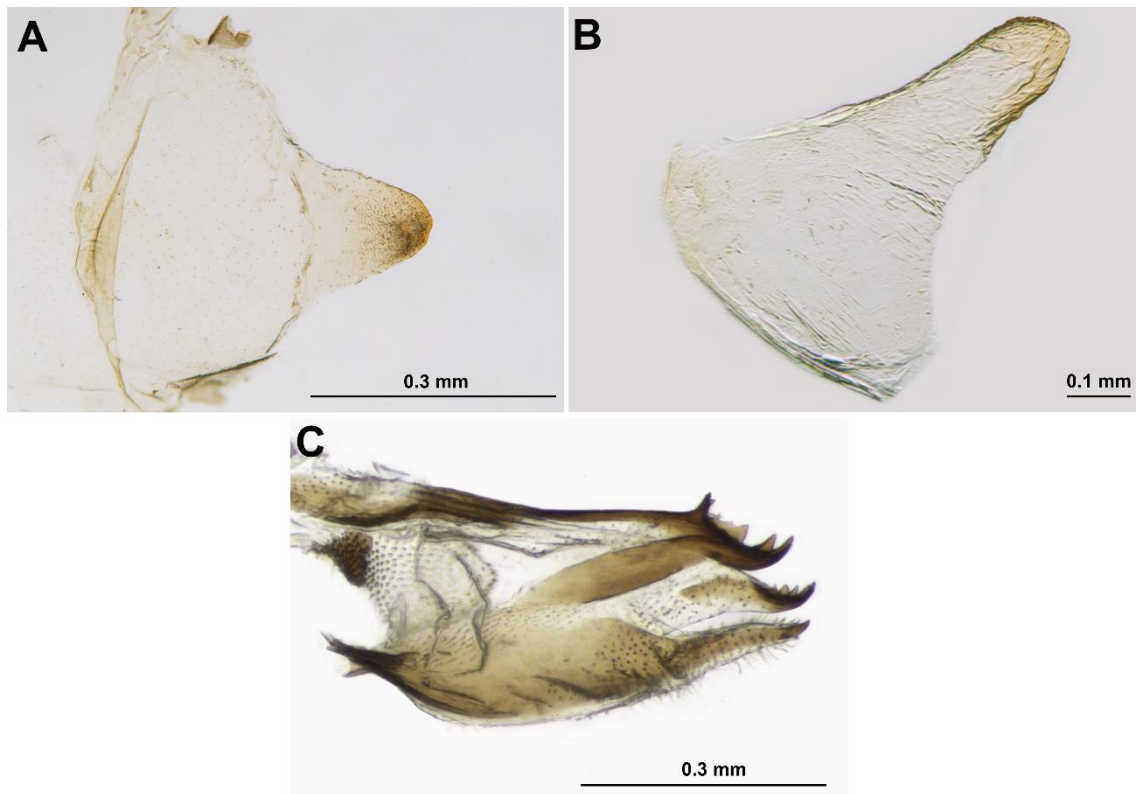
731 **FIGURE 20 A–E.** *Persis (Persis) limeirai* sp. nov.. **A–B.** Habitus. **A.** male, lateral view;732 **B.** female, lateral view; **C.** Frons, anterior view; **D.** Frons and thorax, anterolateral view;733 **E.** Head and thorax, dorsal view.



734

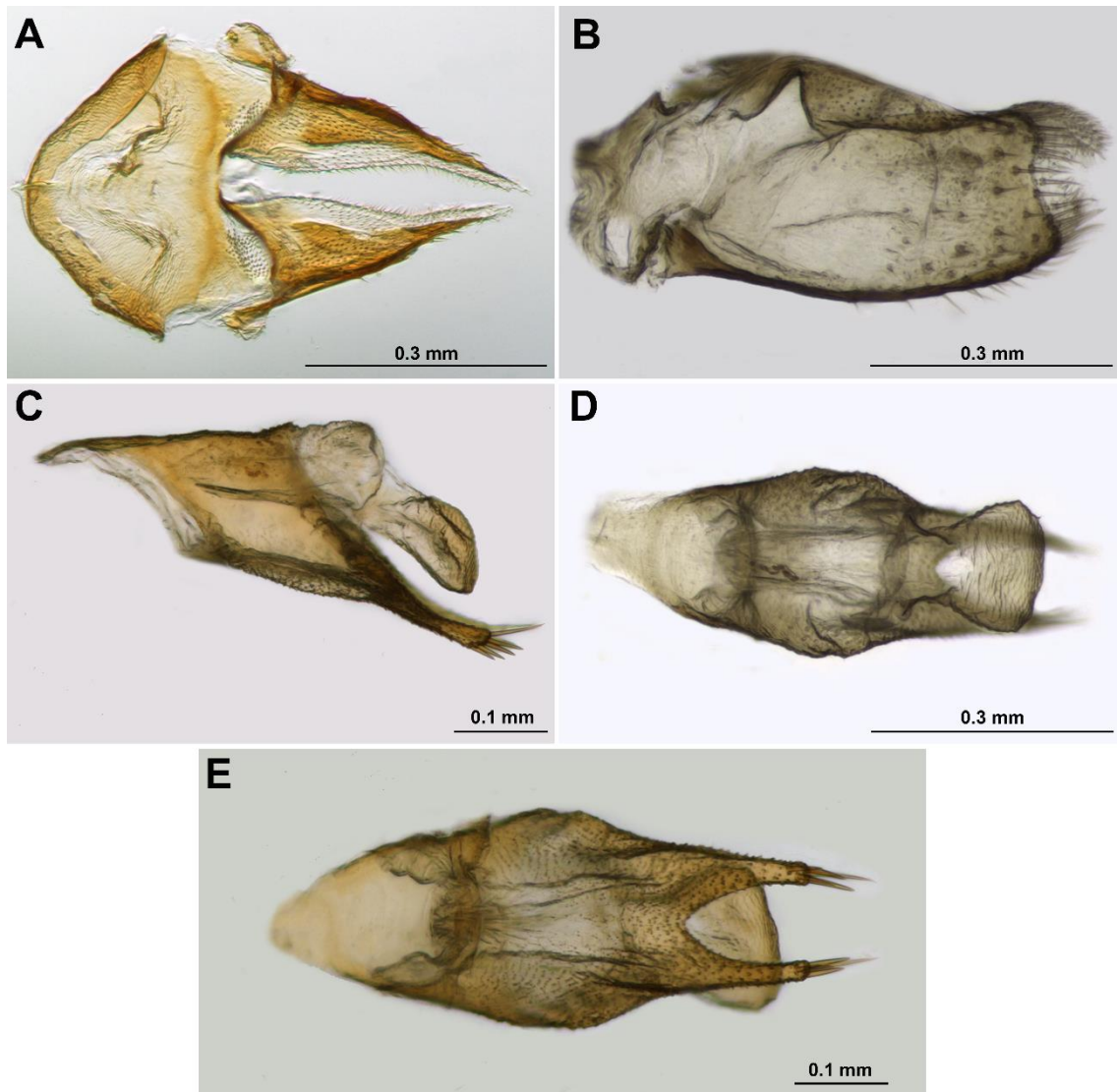
735 **FIGURE 21 A–I.** *Persis (Persis) limeirai* **sp. nov.**, male terminalia. **A.** Genital capsule,
 736 lateral view; **B.** Pygofer, lateral view; **C.** Pygofer, ventral view; **D.** Gonostylus, lateral
 737 view; **E.** Gonostyli, dorsal view; **F.** Phallic complex, lateral view; **G.** Phallic complex,

738 dorsal view; **H.** Anal tube (segment X), lateral view; **I.** Anal tube (segment X) and
739 paraproct, dorsal view. Abbreviations: s, spines.



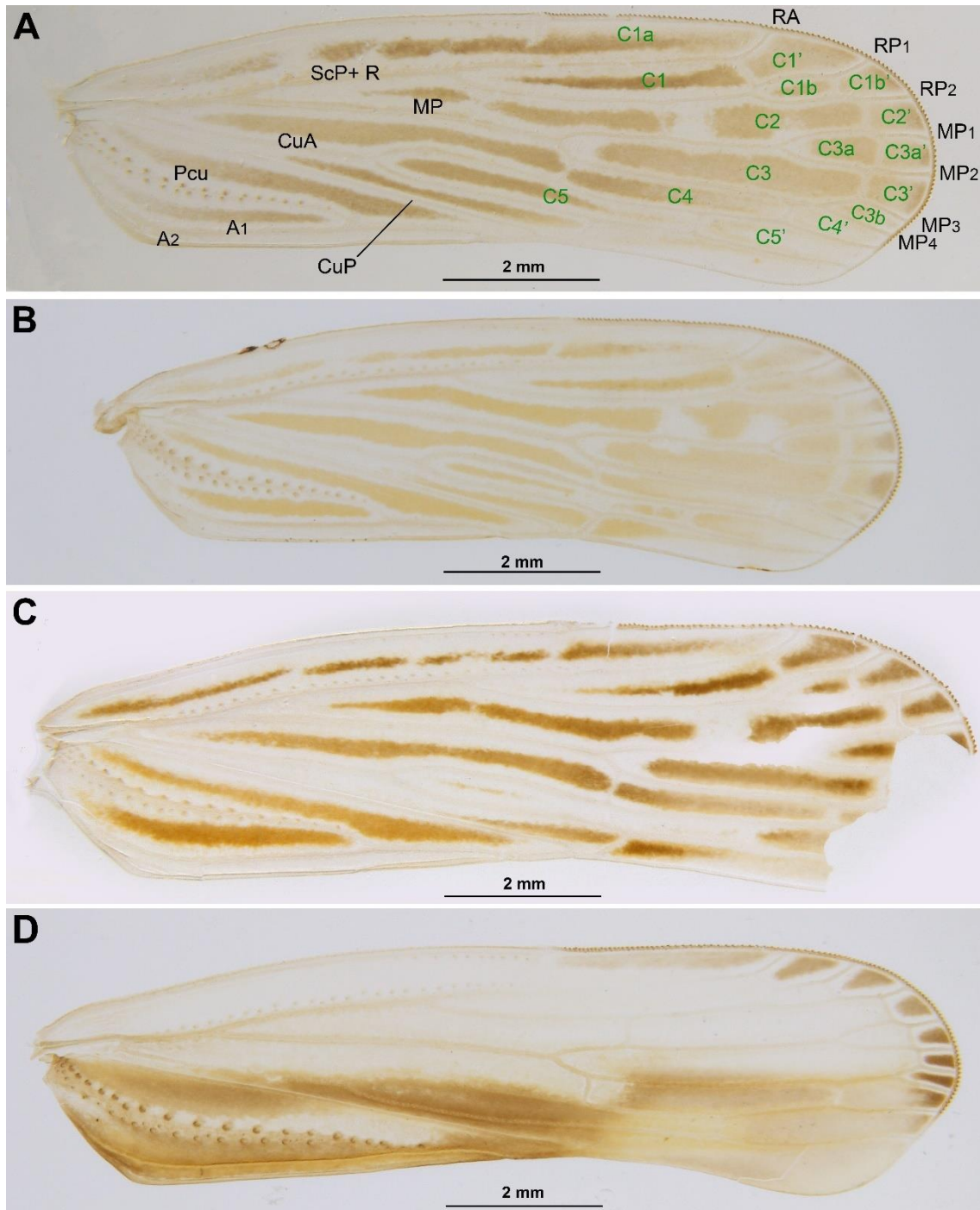
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741 **FIGURE 22 A–C.** *Persis (Persis) limeirai* sp. nov., female terminalia. **A.** Sternite VII,
742 ventral; **B.** Sternite VIII, lateral view; **C.** Gonapophysis VIII (first valvula) and bursa
743 copulatrix, lateral view.



744

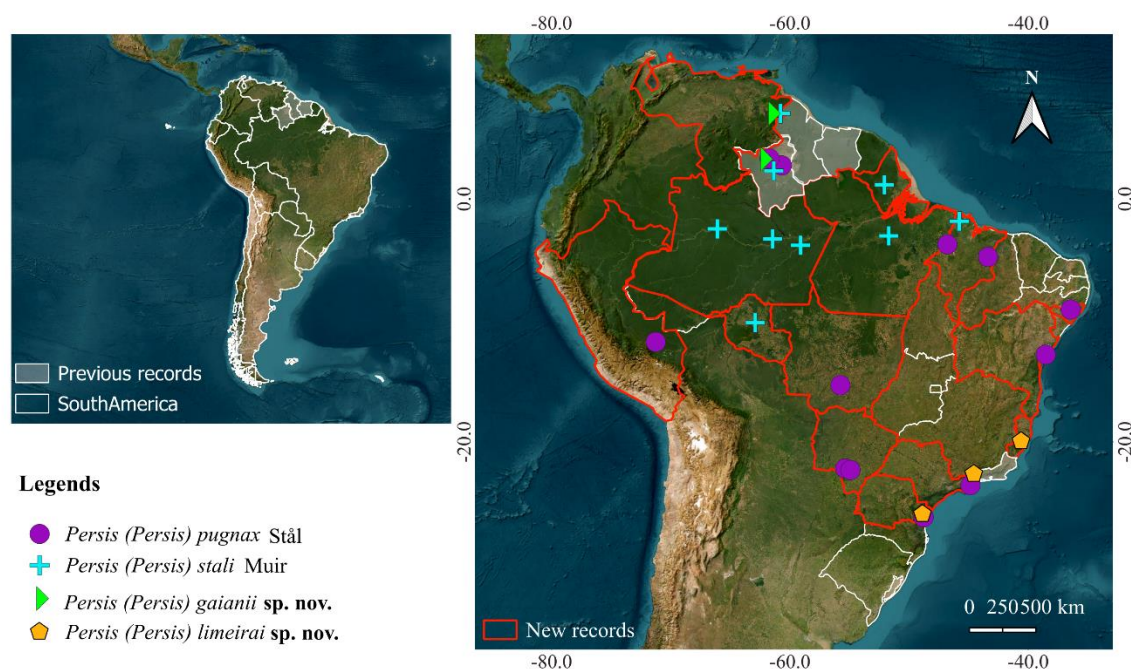
745 **FIGURE 23 A–E.** *Persis (Persis) limeirai* sp. nov., female terminalia. **A.** Gonapophysis
 746 IX (second valvula), dorsal view; **B.** Gonoplac (third valvula), lateral view; **C.** Anal tube
 747 (segment X) and paraproct, lateral view; **D.** Anal tube (segment X) and paraproct, dorsal
 748 view; **E.** Anal tube (segment X), ventral view.



749

750 **FIGURE 24 A–D.** Right forewing of the species *Persis (Persis)* Stål. **A.** *Persis (Persis)*751 *pugnax* Stål; **B.** *Persis (Persis) stali* Muir; **C.** *Persis (Persis) galianii* sp. nov.; **D.** *Persis*752 *(Persis) limeirai* sp. nov.. Forewing information : black, vein; green, cell.

753



754

755 **FIGURE 25.** Map for *Persis (Persis)* Stål species of South America.

756

757 5.5. Discussion

758 With the description of *Persis (Persis) gaianii* **sp. nov.** and *Persis (Persis) limeirai* **sp.**
 759 **nov.**, there are now seven species in *Persis (Persis)*, and consequently 15 species for
 760 *Persis* (Cantanhede *et al.* in prep), however, the status of *Persis (Persis) fabriciana*
 761 Metcalf needs to be examined by checking the type material. Through the photos we
 762 received from the syntypical series of *Persis (Persis) fabriciana* Metcalf, we assimilate
 763 this species with the female of *Persis (Persis) stali* Muir through the following
 764 characteristics: by the width of the projection of the head compared to that of the eyes,
 765 the wide band on the side of the head present only on the frons, and because both sternites
 766 VII have a subquadrate medioventral process, with a slightly indentation apex in the
 767 middle.

768 The discovery and description of two new species for the genus, together with the
769 update of the distribution of this group in South America, further highlights the gap in
770 leafhopper biodiversity on the South American continent.

771 **Economic importance.** Lethal yellowing (LY) is a highly destructive disease that
772 affects palm trees, especially the coconut tree, causing significant economic losses in
773 cultivated areas (Marinho *et al.* 2002). This disease is caused by phytoplasma *Candidatus*
774 *Phytoplasma palmae*, present only in the phloem, the disease interferes with the transport
775 of nutrients, resulting in the death of palm trees (Dollet *et al.* 2009).

776 In the New World, this disease occurs in North and Central America and the
777 Caribbean (Marinho *et al.* 2002). There are still no records of it in Brazil (Dollet &
778 Talamini 2018). As Brazil is the fourth largest coconut producer, finding *Persis* in the
779 country and knowing its potential as a vector of this phytoplasma can generate concerns
780 for farmers (Teodoro *et al.* 2020; IBGE 2023). The main coconut-producing areas in the
781 country are in the North region, especially in the state of Pará, where the occurrence of
782 *Persis (Persis) stali* Muir was recorded, and in the Northeast region, with emphasis on
783 the states of Alagoas, Bahia, Ceará, Rio Grande do Norte and Sergipe, where *Persis*
784 (*Persis*) *pugnax* was recorded in Alagoas, Bahia and Maranhão (IBGE 2023) (Fig. 25).

785

786 **5.6. Acknowledgements**

787 We thank the curators Dr. Marcio Luiz de Oliveira (INPA), Dr. Francisco Limeira-de-
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795 History Museum of Denmark) for images of syntypes series of *Persis (Persis) fabriciana*.
796 We thank Dr. Gunvi Lindberg (Museum of Natural History, Stockholm) for images of
797 syntypes series of *Persis (Persis) pugnax*. We thank Ruth Salas and Jessica Ware,
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804 study was financed in part by the Fundação de Apoio à Pesquisa do Estado do Amazonas
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806

807 **5.7. References**

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6. CAPÍTULO III

**Cantanhede, I.; Viegas, E. F. G.;
Bahder, B. W.; Bartlett, C. R. &
Ale-Rocha, R. Redescription of
subgenus *Persis* (*Eritalaena*)
Fennah, and new records from
Neotropical region (Hemiptera:
Fulgoromorpha: Derbidae)**

Manuscrito formatado para *Zootaxa*¹

CR-2022 / Fator de impacto:1.026; Qualis biodiversidade: A4

1 **Redescription of subgenus *Persis* (*Eritalaena*) Fennah, and new records from**
2 **Neotropical region (Hemiptera: Fulgoromorpha: Derbidae)**

3 INEZITA CANTANHEDE^{1, *}, EDUARDA FERNANDA GOMES VIEGAS², BRIAN
4 W. BAHDER³, CHARLES R. BARTLETT⁴ & ROSALY ALE-ROCHA⁵

5 ¹Graduate Program in Entomology, Instituto Nacional de Pesquisas da Amazônia, Av.
6 André Araújo, Petrópolis, 2936, Manaus, 69067–375, Amazonas, Brazil.
7 <https://orcid.org/0000-0002-1747-4742>

8 ²Scholarship DTI–A, CNPq, Instituto Nacional de Pesquisas da Amazônia, Manaus, Av.
9 André Araújo, Petrópolis, 2936, Manaus, 69067–375, Amazonas, Brazil. Email,
10 edwiegasgomes@gmail.com; <https://orcid.org/0000-0003-3349-5639>

11 ³ University of Florida, Department of Entomology and Nematology – Fort Lauderdale
12 Research and Education Center; 3205 College Ave., Davie, FL 33314–7719, USA. Email,
13 bbahder@ufl.edu; <https://orcid.org/0000-0002-1118-4832>

14 ⁴University of Delaware, Department of Entomology and Wildlife Ecology, 250
15 Townsend Hall, Newark, DE 19716–2160, USA. Email, bartlett@udel.edu;
16 <https://orcid.org/0000-0001-9428-7337>

17 ⁵Biodiversity Coordination, Instituto Nacional de Pesquisas da Amazônia, Caixa Postal
18 2223, Manaus, 69080–971, Amazonas, Brazil. Fellowship PQ/CNPq. Email,
19 rosalyale@gmail.com; <https://orcid.org/0000-0001-9874-9770>

20 *Corresponding author. E-mail: inezitacneta@gmail.com

21

22 **6.1. Abstract:**

23 *Persis* (*Eritalaena*) *fuscinervis* Muir, 1918, originally described in Guyana (South
24 America), was redescribed based on studies of male and female genitalia and external

25 morphology, with new occurrence records for Central America (Costa Rica) and South
26 America (Brazil).

27

28 **Key words:** Amazonia, planthopper, taxonomy.

29

30 **6.2. Introduction**

31 The representatives of *Persis* Stål, 1862 (type species *Persis pugnax* Stål, from Brazil)
32 (Derbidae: Derbinae: Cenchreini) are recognized by pale coloration, head projected
33 anteriorly to a varying degree, frons bearing pustules, not strongly compressed, with
34 lateral margins subparallel and raised, pronotum short, forewing with pustules along
35 ScP+R and Pcu vein, clavus closed and pygofer with medioventral process (Stål 1862,
36 Fennah 1952, O'Brien 1982).

37 Currently, the genus contains 15 valid species recorded in the New World, grouped
38 into three subgenera: *Persis* (*Persis*) Stål, with seven species, *Persis* (*Anapersis*) Fennah,
39 1952 with seven species, and *Persis* (*Eritalaena*) Fennah with one specie. In the
40 Neotropical region, 13 species are known (except *Persis* (*Anapersis*) *ferox* O'Brien, 1986
41 and *Persis* (*Anapersis*) *arizonensis* O'Brien, 1986) distributed among the three subgenera
42 (Cantanhede *et al.* in prep.).

43 There are no phylogenetic studies on *Persis*. Published work involving *Persis* are
44 mainly checklists, catalogs, species descriptions, and diagnostic works (e.g., Fowler
45 1900, Metcalf 1938, 1945; Caldwell 1944, Fennah 1945, 1952; O'Brien 1982, 1986;
46 Cantanhede *et al.* in prep.). The paucity of recent study creates several knowledge gaps.
47 This includes incomplete alpha-level taxonomic diagnoses and the lack of phylogenetic
48 hypotheses. The relationships among *Persis* species, among subgenera, and between
49 *Persis* and other genera in the Cenchreini have not been investigated. The monophyly of

50 the subgenera has not been tested with phylogenetics and may prove invalid or
51 alternatively could support status as full genera (at least for *Eritalaena*, which is the most
52 diagnostically different). It has been observed that the size of paradiscal region of the
53 pronotum are not equal among subgenera. *Persis* (*Persis*) and *Persis* (*Anapersis*) have a
54 deep paradiscal region of the pronotum indicating a possible close relationship between
55 these subgenera. In *Persis* (*Eritalaena*), the paradiscal region of the pronotum is shallow,
56 so that it has been characterized as ‘not foliately raised’ or absent (i.e., Metcalf 1938,
57 Fennah 1952, O’Brien 1982).

58 Until now, *Persis* (*Eritalaena*) was a monotypic subgenus, with the type species
59 *Persis* (*Eritalaena*) *fuscinervis* Muir, 1918 recorded from Guyana (type locality) and
60 Panama (Muir 1918, Metcalf 1938, Bourgoïn 2024). The subgenus is characterized by
61 head projecting in front of the eyes for distance similar to the width of eyes and the
62 paradiscal region of the pronotum with a shallow antennal fovea (Fennah 1952).

63 In this paper, we provide the re-description of *Persis* (*Eritalaena*) *fuscinervis*,
64 including the description of the female genitalia, provide the first record of *P.* (*Eritalaena*)
65 for Brazil and an identification key for the subgenera of *Persis*.

66

67 **6.3. Material and methods**

68 The studied material belongs to the Invertebrate Collection of the National Institute for
69 Amazonian Research (INPA). A single specimen of the subgenus referred to in this work
70 was studied, collected in the Adolpho Ducke Reserve, on the banks of Igarapé Tinga, in
71 the municipality of Manaus, northeast of the state of Amazonas, Brazil.

72 For examination of genital structures, the abdomen was detached from the thorax,
73 macerated into 85% hot lactic acid, studied under a Leica M165C stereomicroscope, and
74 illustrated immersed in glycerin jelly. Afterward, genitalia were stored in plastic

75 microvials with glycerin and pinned with the specimen. The right forewing of the
76 specimen was detached, cleaned by a short xylol bath, and mounted between coverslips
77 with Euparal. After drying, the coverslips were glued to a small piece of cardboard and
78 pinned with the specimen. Digital photographs were taken with a Leica MC 170 HD
79 camera attached to a stereomicroscope and combined into expanded focus images by
80 Leica Application Suite software.

81 Terminology of the head characters mostly follows O'Brien & Wilson (1985), for
82 forewing venation follows Bourgoïn *et al.* (2015), for male genitalia mostly follows
83 Bourgoïn (1988) and Bourgoïn & Huang (1990), and for female genitalia it follows
84 Bourgoïn (1993).

85 The measurement were taken as follows: body length (from the tip of head to the
86 tip of anal tube) and body length including forewings (from the tip of head to the tip of
87 forewing), both measurements were taken in lateral view; head projection width (from
88 the apex of the head to the nearest eye margin) and eyes width (in the medial region of
89 the eye), both measurements were taken in lateral view; vertex length (from the base of
90 the transverse carina of the transition front to the vertex), this measurement was taken in
91 dorsal view; maximum vertex width (in the basal region of the vertex between the carina)
92 and minimum vertex width (in the apical region of the vertex between the carina), both
93 measurement were taken in dorsal view; frons length (close to the transverse carina to the
94 epistomal suture) and width (in the lowest height region of the compound eyes), both
95 measurements were taken in anterior view; clypeus length (from the epistomal suture to
96 the apex of the clypeus) and width (near to suture epistomal), both measurements were
97 taken in anterior view.

98 The distribution map was created with QGIS 3.20
99 (https://www.qgis.org/pt_BR/site/forusers/download.html), using geographical

100 coordinates from specimen labels. We used Google Earth® to locate approximated
 101 collecting sites for specimens without geographical coordinates. Label information of
 102 examined specimens is provided verbatim with square brackets indicating comments or
 103 extrapolated information.

104 **6.4. Results**

105 **Taxonomy**

106 **Hemiptera Linnaeus, 1758**

107 **Fulgoromorpha Evans, 1946**

108 **Fulgoroidea Latreille, 1807**

109 **Derbidae Spinola, 1839**

110 **Cenchreini Muir, 1918**

111

112 ***Persis* Stål, 1862**

113 Type species: *Persis pugnax* Stål, 1862; by original designation.

114 *Persis* Stål, 1862: 7; 1866: 193 (key); 1869: 99 (citation); Muir, 1913: 32 (key); 1918a:
 115 416 (notes); 1918b: 231 (key): 243 (citation); Metcalf, 1938: 326 (key, notes);
 116 1945: 90 (catalogue); Caldwell, 1944: 105 (notes), 106 (description), 108 Figs Plate
 117 I, 7A–C (genitalia); Fennah, 1952: 127 (key), 138–142 (creation of subgenera);
 118 O’Brien, 1982: 319 (catalogue); Bartlett *et al.* 2014: 25 (key), 152 (citation);
 119 Cantanhede *et al.* in prep. (description, key).

120 **Subgenus *Persis* Stål, 1862: 7 (as genus) (type species *Persis pugnax* Stål, 1862, by
 121 original designation)**

122 **Subgenus *Anapersis* Fennah, 1952: 140 (type species *Neocenchrea gregaria* Fennah,
 123 1945 by original designation)**

124 **Subgenus *Eritalaena*** Fennah, 1952: 142 (Type species: *Persis fuscinervis* Muir, 1918:
125 417 (by original designation and monotypy).

126

127 **Key to subgenera of *Persis* Stål**

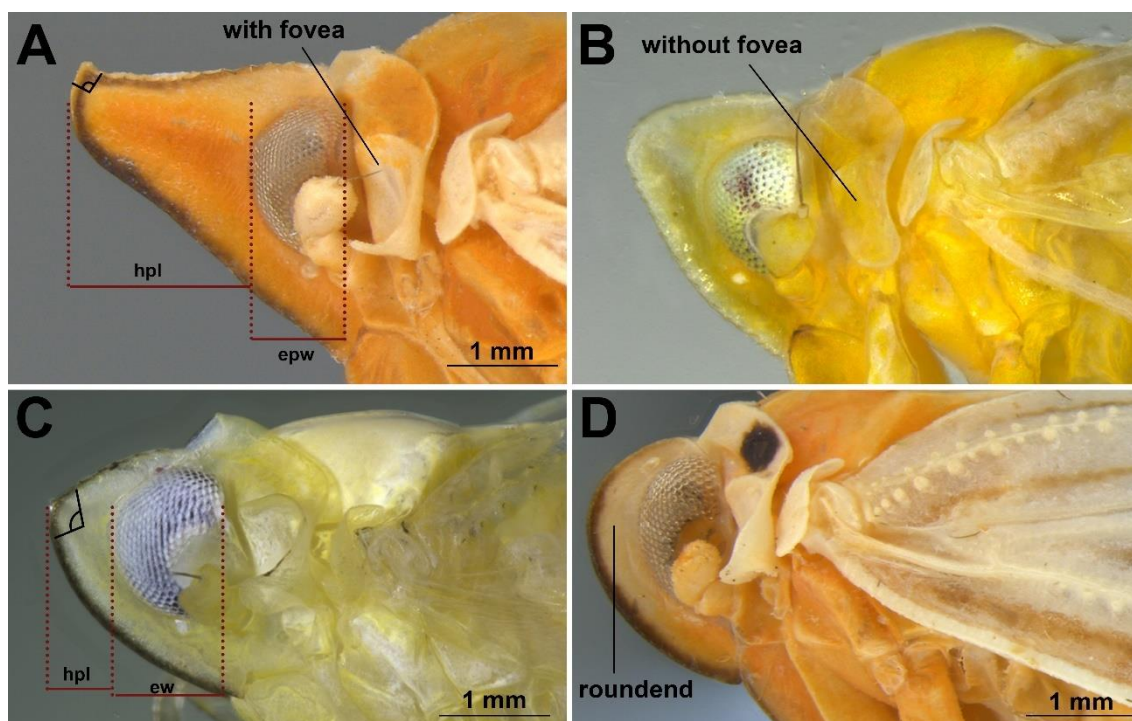
128 1. Paradiscal region of pronotum greatly foliate forming antennal foveae behind eyes
129 (Fig.1A).....2

130 – Paradiscal region of pronotum not greatly foliate and not forming antennal fovea behind
131 eyes (Fig. 2B).....*Persis (Eritalaena)* Fennah

132 2. Head produced beyond the eyes for distance greater than eye width, acutely angulate
133 in profile (Fig. 1A)*Persis (Persis)* Stål

134 – Head produced beyond the eyes for distance no greater than eye width, obtusely angular
135 (Fig. 1C), or rounded in profile (Fig. 1D)*Persis (Anapersis)* Fennah

136



137

138 **FIGURE 1 A–D.** Subgenera of *Persis* Stål. **A.** *Persis (Persis) pugnax* Stål, female, lateral
139 view; **B.** *Persis (Eritalaena) fuscinervis* Muir, female, lateral view; **C.** *Persis (Anapersis)*
140 *gregaria* Fennah, male, in lateral view; **D.** *Persis (Anapersis) takiyae* Cantanhede, Viegas

141 & Rosaly (in prep.), male, lateral view. Abbreviations: ew, eyes width; hpl, head
142 projection length.

143 **Species checklist of *Persis* Stål**

144 Subgenus *Persis* Stål 1862: 7

145 *Persis (Persis) fabriciana* Metcalf, 1938: 326 (replacement name for *Cicada lineata*
146 Fabricius, 1803: 66) – South America.

147 = *Cicada lineata* Fabricius, 1803:66, original combination.

148 = *Persis lineata* (Fabricius, 1803) by Stål 1869:99 (St. Vicent)

149 = *Cenchrea lineata* (Fabricius, 1803) by McAtee, 1924: 178.

150 = *Persis fabriciana* Metcalf, 1938: 326

151 *Persis (Persis) foveatis* Caldwell, 1944: 106 – Mexico (Veracruz, Chiapas, Oaxaca).

152 = *Persis foveatis* Caldwell, 1944 original combination.

153 = *Persis foveata* O'Brien, 1986: 70, 72 unjustified amendment.

154 *Persis (Persis) novacula* Fennah, 1952: 140 – Trinidad.

155 *Persis (Persis) pugnax* Stål, 1862: 8 – Brazil (Rio de Janeiro, Roraima).

156 *Persis (Persis) stali* Muir, 1918: 417 – Guyana (Bartica), Suriname (Paramaribo).

157 *Persis (Persis) gaianii* Cantanhede, Viegas & Rosaly (in prep.) – Brazil (Amazonas),
158 Venezuela

159 *Persis (Persis) limeirai* Cantanhede, Viegas & Rosaly (in prep.) – Brazil (Espírito Santo,
160 Paraná, Rio de Janeiro)

161 Subgenus *Anapersis* Fennah, 1952: 140

162 *Persis (Anapersis) arizonensis* O'Brien, 1986: 72 – United States (Arizona); Mexico
163 (Sonora)

164 *Persis (Anapersis) ferox* O'Brien, 1986: 70 – United States (Arizona); Mexico (Sonora)

165 *Persis (Anapersis) gregaria* (Fennah, 1945) – Trinidad; Saint Vincent; Grenada; Saint
166 Lucia.

167 = *Neocenchrea gregaria* Fennah, 1945: 443, original combination.

168 = *Persis (Anapersis) gregaria* (Fennah, 1945), comb. by Fennah 1952: 141.

169 *Persis (Anapersis) pallescens* (Metcalf, 1938: 332) – Panama

170 *Persis (Anapersis) pallidovenosa* (Stål, 1862) – Brazil (Rio de Janeiro)

171 = *Herpis pallido-venosa* Stål, 1862: 8, original combination.

172 = *Lamelia pallidovenosa* (Stål, 1862) by Kilkardy, 1906: 403.

173 = *Phaciocephalus pallidovenosus* (Stål, 1862) by Muir, 1924: 16.

- 174 = *Persis (Anaparsis) pallidovenosa* (Stål, 1862), comb. by Bahder *et al.* 2021: 128.
- 175 *Persis (Anaparsis) spreta* (Fowler, 1900) – Mexico (Tabasco)
- 176 = *Mysidia ? spreta* Fowler, 1900: 74, original combination.
- 177 = *Basileocephalus spreta* (Fowler, 1900) by Muir 1918: 230.
- 178 = *Neocenchrea spreta* (Fowler, 1900) by Metcalf 1938: 331.
- 179 = *Persis (Anaparsis) spreta* (Fowler, 1900) by Fennah 1952: 141.
- 180 *Persis (Anaparsis) takiyae* Cantanhede, Viegas & Rosaly (in prep) – Brazil (Amazonas,
- 181 Goiás, Maranhão, Mato Grosso do Sul, Minas Gerais, Paraná and São Paulo)
- 182 Subgenus *Eritalaena* Fennah, 1952: 142
- 183 *Persis (Eritalaena) fuscinervis* Muir, 1918: 417 – Guyana (Bartica), Panama (Ancon),
- 184 Brazil (Amazonas), Costa Rica (Osa Peninsula).
- 185
- 186 ***Persis (Eritalaena) Fennah***
- 187 *Persis (Eritalaena)* Fennah, 1952: 142. Type species: *Persis fuscinervis* Muir, 1918: 417
- 188 (original designation).
- 189 **Amended description.** Medium sized *Persis (Eritalaena)*: body length 3.9 mm in males,
- 190 2.8 mm in females. Head projected beyond at a distance similar to the width of eyes (Figs
- 191 3A, D, 6A, D); vertex trapezoidal in dorsal view (Figs 2B, 3E, 6E). Pronotum with
- 192 paradiscal pronotal regions shallow, not forming a cup-shaped foliated fossa that partially
- 193 circumscribes the antenna (Figs 2C, 3D, 6D); posterior margin concave (Figs 2B, 3E, 6E).
- 194 Mesonotum with median and lateral carina present, but sometimes weakly marked (Figs
- 195 2B, 3E, 6E). Forewings with ScP+R vein short, finishing at the bifurcation of the CuA
- 196 vein; RA vein with the apex strongly curved anteriorly; RP vein arising after ScP+RA
- 197 vein; RP vein with three cells (C1, C1', C1b); MP₁₊₂ vein arising at the level of the cross-
- 198 vein (Figs 3F, 6F). Metatibia with lateral spines (Fig. 6A). Male terminalia: pygofer with
- 199 medioventral process of pygofer slightly produced (Fig. 6C). Phallic complex:
- 200 periandrium without spiniform projections (Figs 8 A–B). Female terminalia: Pregenital
- 201 sternite (sternite VII) with medioventral process (Figs 4A, B).

202 **Remarks.** *Persis (Eritalaena)* is easily distinguished from the others subgenera of
 203 *Persis*, by head projecting beyond the eyes for distance similar to the width of eyes (in
 204 *Persis (Persis)* the projection of the head is 2.7 times wider than the compound eye, and
 205 2.0 times smaller than the width of the compound eye in *Persis (Anaparsis)*); median
 206 carina of clypeus absent (present in *Persis (Persis)* and *Persis (Anaparsis)*); pronotum
 207 with paradiscal regions shallow, not forming cup-shaped foliated fossa that partially
 208 circumscribe the antenna (in *Persis (Persis)* the paradiscal region forms a shallow fossa
 209 and the fossa of the paradiscal region is deep in *Persis (Anaparsis)*); forewing with short
 210 ScP+R vein, ending at the bifurcation of the CuA vein (forewing with long ScP+R vein,
 211 ending at the level of the apex of the clavus, in *Persis (Persis)* and *Persis (Anaparsis)*).

212 In the original description of *Persis (Eritalaena) fuscinervis* Muir, the author
 213 reports the presence of an opaque white waxy impression on the wings of the specimen,
 214 coincidentally the material we analyzed here also presents this waxy substance
 215 throughout the body, perhaps a characteristic of these representatives.

216 **Records.** Guyana (Bartica), Panama (Ancon) (Bourgoin 2024).

217 *New records: South America (Brazil: Amazonas), Central America (Costa Rica:
 218 Osa Peninsula).

219

220 *Persis (Eritalaena) fuscinervis* Muir, 1918

221 (Figs 1B; 2 A–E; 3 A–F; 4 A–D; 5 A–C; 6 A–F; 7 A–C; 8 A–B; 9)

222 *Persis fuscinervis* Muir, 1918:417; Metcalf, 1938: 327 (description, illustration), Pls. I,

223 V, XVIII, XIX (habitus, head, male terminalia and female pregenital sternite).

224 *Persis (Eritalaena) fuscinervis* Fennah, 1952: 142 (subgeneric combination).

225

226 **Type material.** Holotype female (OSUC): British Guiana, Bartica, May 1901, H. S.
227 Parish collector, Herbert Osborn Collection (examined through photographs) (Figs 2A–
228 E).

229 **Condition of the holotype:** Left antenna with pedicel and flagellum lost; left tegula lost;
230 only a remnant of the left hind wing present. All tibiae missing (Figs 2 A–E).

231 **Additional material examined. Brasil,** AM[azonas], Manaus, Reserva Ducke, Ig[arapé]
232 Tinga, ii. 2004, Arm[adilha] Suspensa, 25m, A. Henriques et al. (1 f#, INPA). **Costa**
233 **Rica,** Cotinga Biological Station, 8.621825N, -83.478819W (2 m#).

234 **Measurements:** Body length: male 3.9 mm (5.8 mm including wings) (N=2); female:
235 2.77 mm (5.6 mm including wings) (N=1).

236 **Diagnosis.** Clypeus without median carina (Figs 3C, D, 6C); scutellum with two
237 laterobasal spines (Fig. 6E); metatibiae with four lateral spines (Fig. 6A).

238 **Redescription.** Coloration. General body yellow to orange, with pale yellow regions
239 (Figs 3A, B, 6A, B). Vertex and lateral carina of the frons, scape, pedicel, first joint of
240 the rostrum, median region of the pronotum, paranotal process, tegula, epimeron, and
241 episternum pale yellow (Figs 3D, E, 6C, D, E). Orange mesonotum, with a yellow stripe
242 covering the lateral carina (Figs 3E, 6E). Scutellum with pale yellow apex (Figs 3E, 6E).
243 Forewing hyaline with brown regions: small brown rectangular band in the apical portion
244 of the postcostal cell extending to the base of the C1a cell; diffuse brown spot in the
245 medial portion of cell C1a; subrectangular brown spot in the apical portion of cell C1;
246 rectangular brown spot in the apical portion of cell C5; small brown quadrangular spots
247 in the apical region of cells C1a, C1', C2', C3a, C3', C3b; diffuse brown spot at the apex
248 of the clavus (Fig. 3F). Yellow veins with brown-tinged regions: RP and MP
249 predominantly brown; basal third and initial portion of the CuA vein bifurcation; apical
250 portion of the Pcu vein; and transverse veins ir, r–m, im, m–cu, icua, icu (Figs 2D, 3F).

251 Hind wing white. Prothoracic leg orange, except for medial region of the coxa and
252 protrochanter, basal and medial portion of profemur, protibia and first segment of
253 protarsus pale yellow; mesothoracic leg orange, except for medial region of coxa and
254 mesotrochanter, basal and medial portion of mesofemur, mesotibia and first segment of
255 mesotarsus pale yellow; metathoracic leg predominantly pale yellow (Figs 3A, 6A).
256 Abdomen yellow, except brown tergites; anal tube and pygofer yellow (Figs 2A, 7A–C).

257 *Head:* Frons approximately 2.5 times as long as wide (Figs 2C, 6C); lateral carina
258 of frons subparallel towards the clypeus in anterior view (Figs 3C, 6C); vertex with
259 truncated posterior margin and minimum vertex width greater than $\frac{1}{4}$ of its maximum
260 width (Fig. 6E). Scape short, pedicel subcylindrical, as long as wide (Figs 2C, D, 6C, D).
261 Clypeus approximately 4 times as long as wide; median carina absent (Figs 2C, 6C).
262 *Thorax:* Pronotum with anterior margin rounded; posterior margin roundly concave (Figs
263 2B, 3E, 6E). Mesonotum with median and lateral carina present, but sometimes weakly
264 marked (Figs 2B, 3E, 6E); scutellum with a laterobasal spine on each side (Fig. 6E).
265 Forewing with ScP+R vein short, finishing at the bifurcation of the CuA vein; RA vein
266 with apex strongly curved anteriorly; RP vein arising after ScP+RA vein; RP vein with
267 three cells (C1, C1', C1b); MP₁₊₂ vein arising at the level of the ir cross-vein (Figs 3F,
268 6F). Legs: metatibia with four lateral spines (Fig. 3A, 6A).

269 *Male terminalia* (Figs 7A–C, 8A–B): Pygofer symmetrical, subrectangular,
270 narrowest dorsally, with subtriangular projection with rounded apex on posterodorsal
271 margin in lateral view (Fig. 7A); medioventral process small, slightly produced in lateral
272 view (Fig. 7A) and subtriangular, forming an obtuse angle at the apex in ventral view
273 (Fig. 7C). Gonostyli symmetrical, subrectangular, short, approximately 1.5 times shorter
274 than anal tube, with apex convergent indentation, forming two lobes: outer dorsoapical
275 lobe with pointed apex curved inward in ventral view (L1), and inner ventroapical lobe

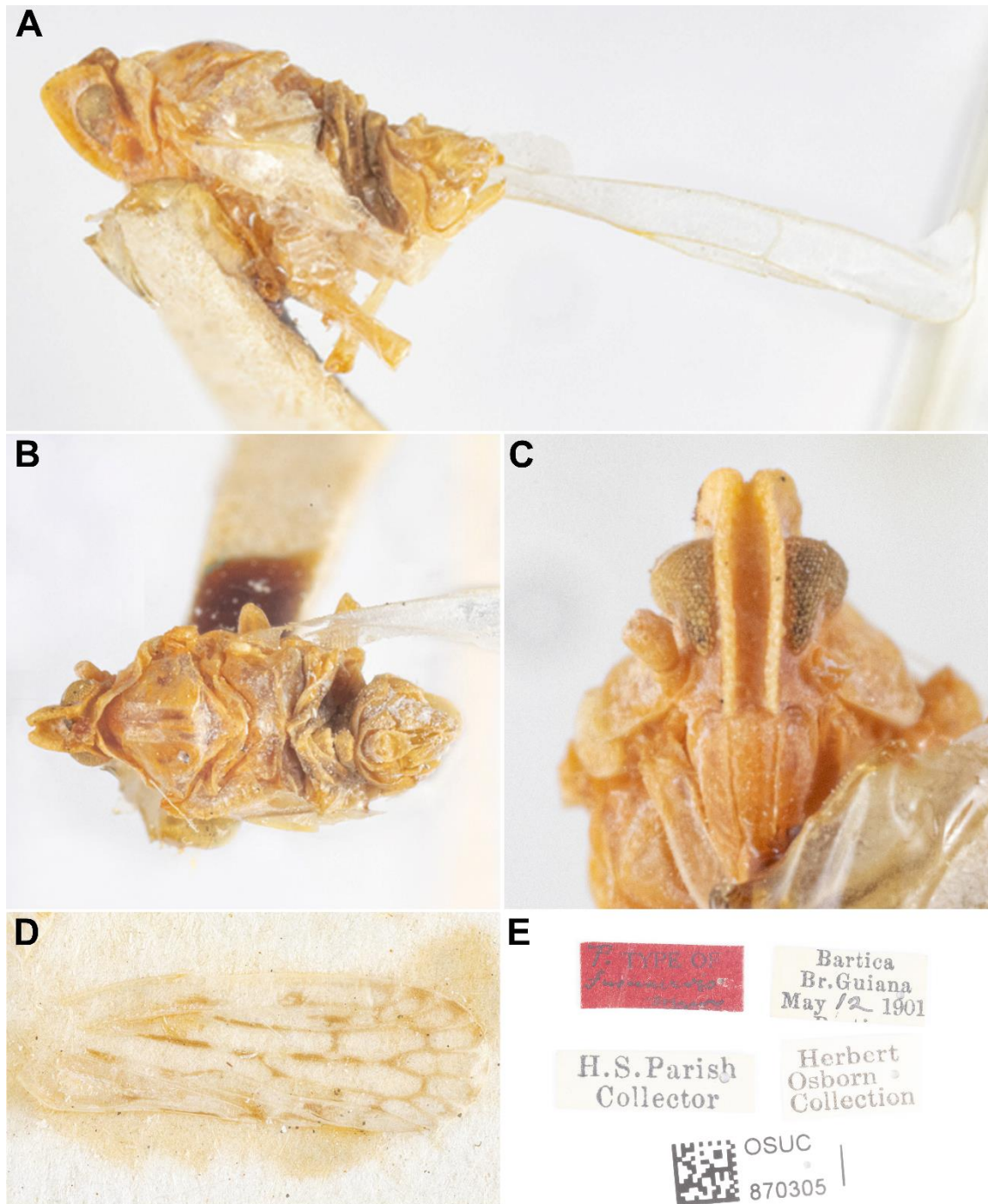
276 with rounded apex in ventral view (L2) (Fig. 7C); dorsal margin with three spiniform
277 projections in the apical 2/3: one subbasal elongated, slender and straight spine (S1); one
278 shorter, robust spine, with a divergent sickle-shaped apex in the middle (S2); and one
279 apical, shorter, robust, and anteriorly curved spine (S3) (Fig. 7A). Phallic complex
280 symmetrical, anteriorly curved: periandrium sclerotized, without spiniform projections
281 (Figs 8A–B). Aedeagus with one dorsobasal spine, short, slender and sinuous, with
282 divergent apex (S1); one long, slender, and sinuous laterobasal spine (S2); and one long,
283 almost straight, laterodorsal spine, with wide and membranous basal half, and sclerotized
284 and pointed apical half (S3) (Figs 8A–B). Anal tube (segment X) elongate, with dorsal
285 margin almost straight and ventral sinuous; ventral margin with a short indentation at the
286 apex, occupying less than 1/4 apical of the total length of the anal tube, forming two lobes
287 (Fig. 7A); lobes ventrally curved, with pointed apex in lateral view (Fig. 7A). Paraproct
288 subcircular (Fig. 7B).

289 Female similar to male. *Female terminalia* (Figs 4A–D, 5A–C): Pregenital sternite
290 (sternite VII) ring-shaped with apex of the medioventral process triangular in ventral
291 view, and curved dorsally in lateral view (Figs 4A, B). Gonapophysis VIII (first valvula)
292 with a long and slender projection on the dorsoapical margin bearing elevated irregular
293 teeth, forming a concavity, and with a row of small spines in the apical 1/3 to the base of
294 the projection (Fig. 4C); a shorter, upwardly curved lateroapical projection with toothed
295 dorsal margin in lateral view (Fig. 4C). Bursa copulatrix slightly filamentous at the apex,
296 apex pointed and straight, in lateral view (Fig. 4C). Gonapophysis IX (second valvula)
297 robust, wider basally, bifid at apical 3/4 with lobes slender apically and with convergent
298 pointed apices (Fig. 4D); ventral region of lobes with fine and small setae on apical 3/4
299 (Fig. 4D); basal half of the Gonapophysis IX with spiniform projections in ventral region
300 (Fig. 4D); basal plate of the Gonapophysis IX elongated, 1.5 times longer than wide;

301 anterior margin subtriangular (Fig. 4D). Gonoplac (third valvula) subrectangular in lateral
302 view, apex truncated, with smooth indentation, and bearing numerous setae apically in
303 lateral view (Fig. 5A). Anal tube (segment X) short, cylindrical; ventral margin of the
304 anal tube reentrant (Fig. 5C), with elongated slender digitiform lobes, bearing three long
305 apical spiniform setae approximately half the length of the lobes (Fig. 5B). Paraproct
306 concave (Fig. 5B), subcircular, with small indentation on the median apical margin in
307 dorsal view (Fig. 5C).

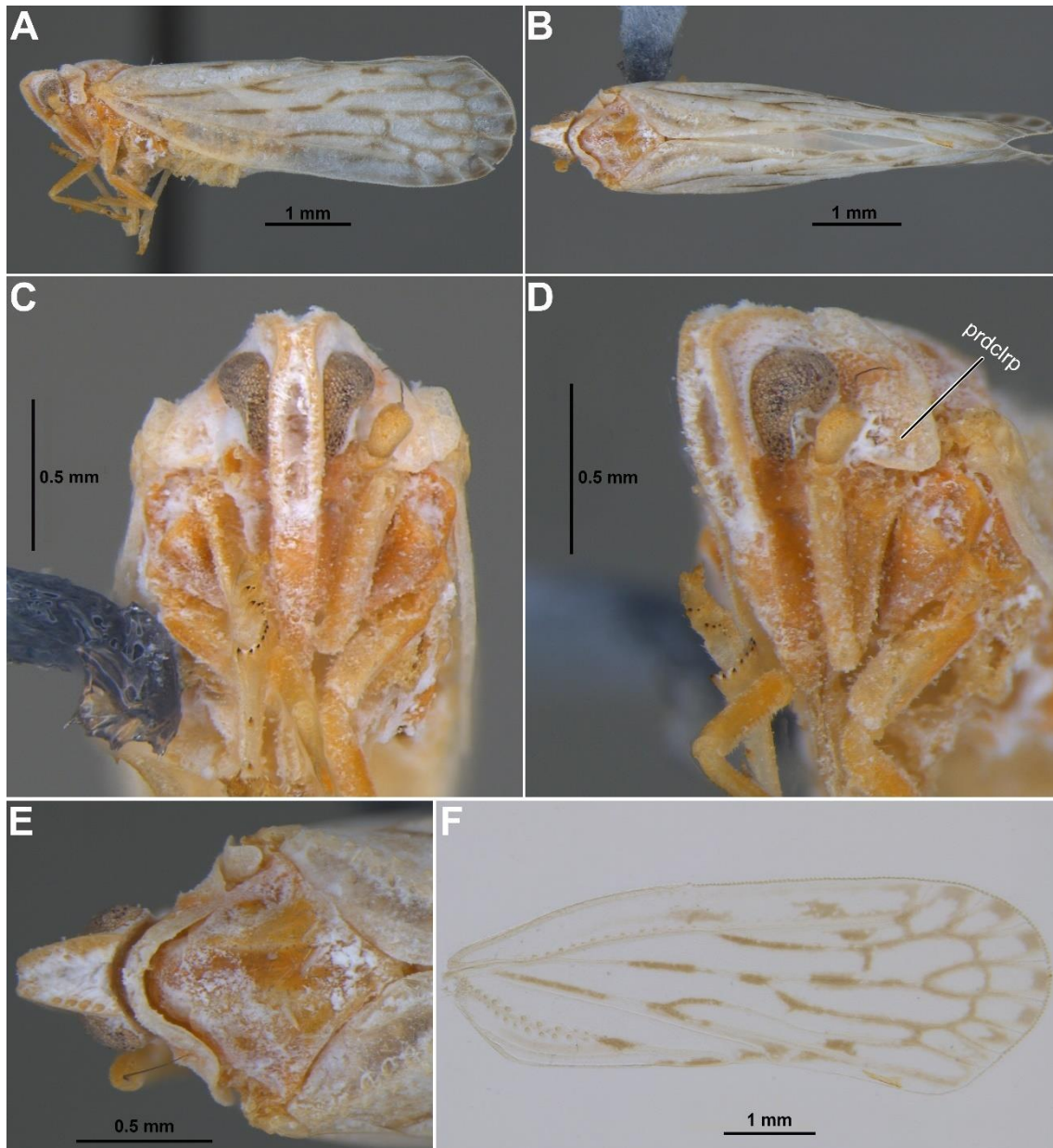
308 **Distribution.** Costa Rica, Panama (Ancon), Guyana (Bartica), Brazil (Amazonas)
309 (Fig. 9).

310



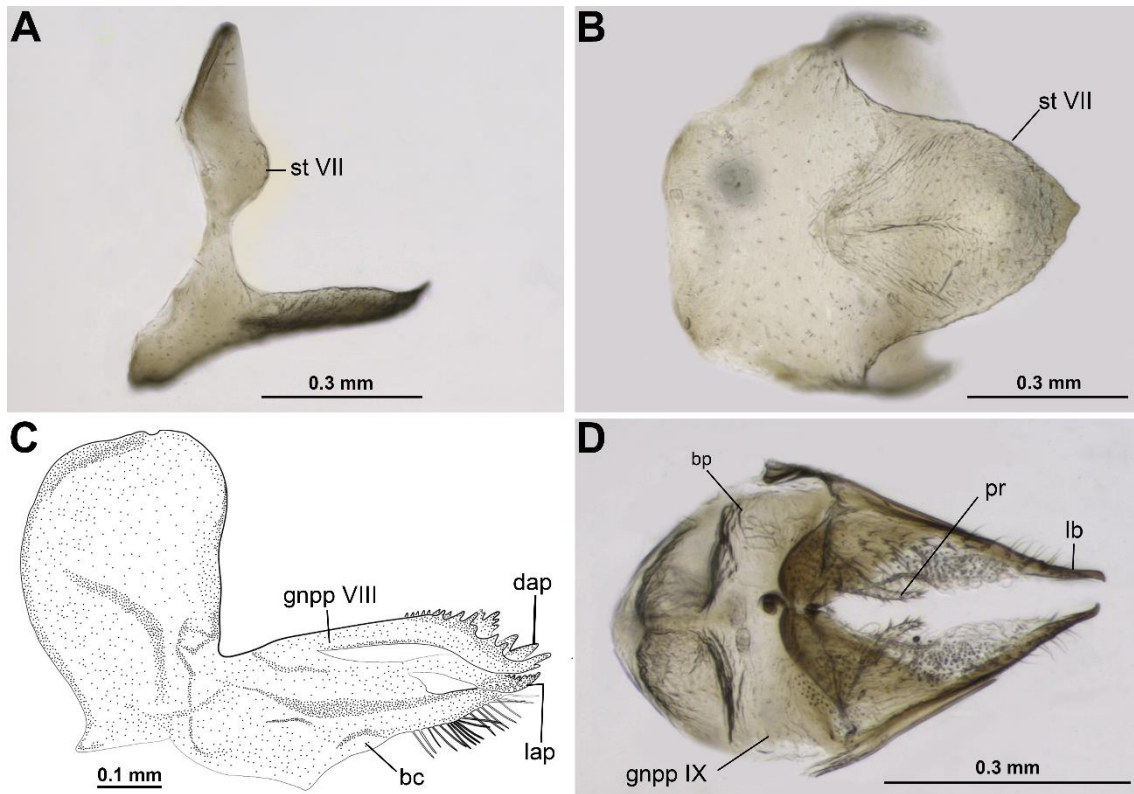
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312 **FIGURE 2 A–E.** *Persis (Eritalaena) fuscinervis* Muir, 1918, holotype female. **A.**
 313 **Habitus, lateral view; B.** Body, dorsal view; **C.** Head, anterior view; **D.** Forewing; **E.**
 314 **Labels.**



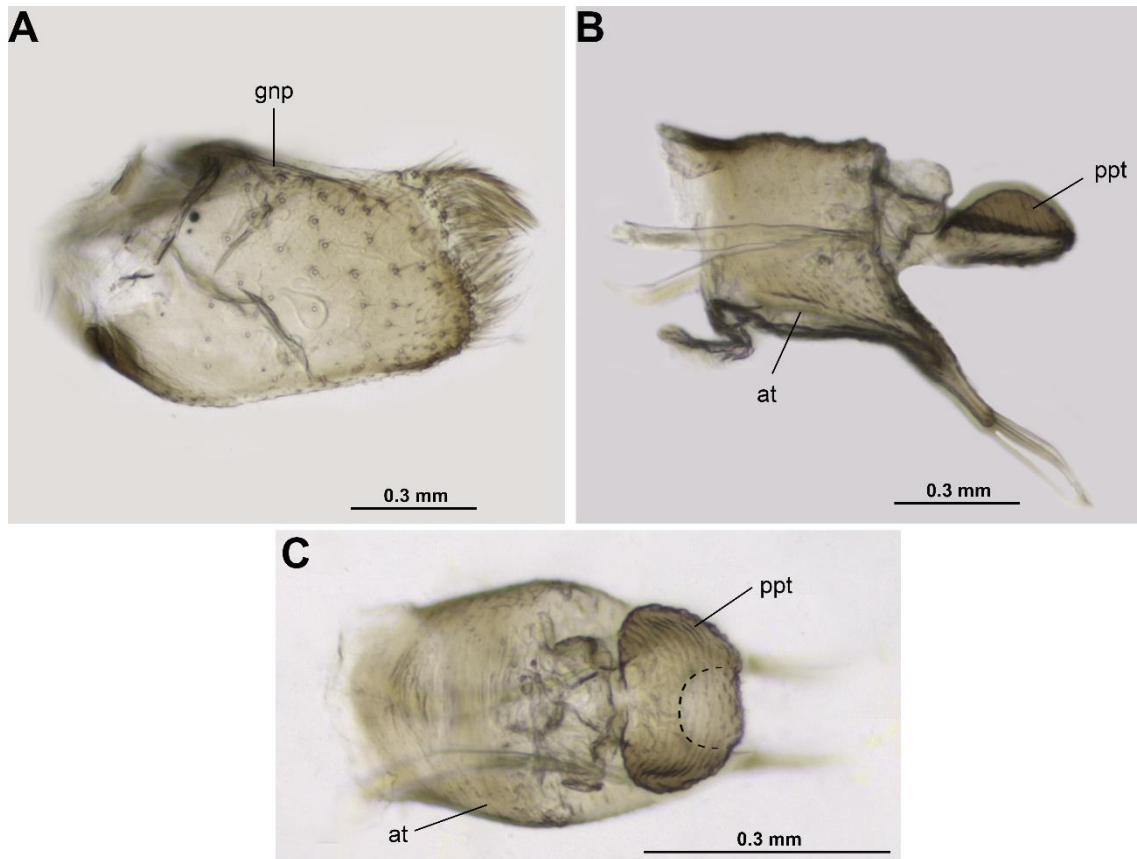
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316 **FIGURE 3 A–F.** *Persis (Eritalaena) fuscinervis* Muir, female. **A.** Habitus, lateral view;
 317 **B.** Body, dorsal view; **C.** Head, anterior view; **D.** Head, parafrontal view; **E.** Head and
 318 thorax, dorsal view, **F.** Right forewing. Abbreviations: Thorax: prdcirp, paradiscal region
 319 of pronotum.



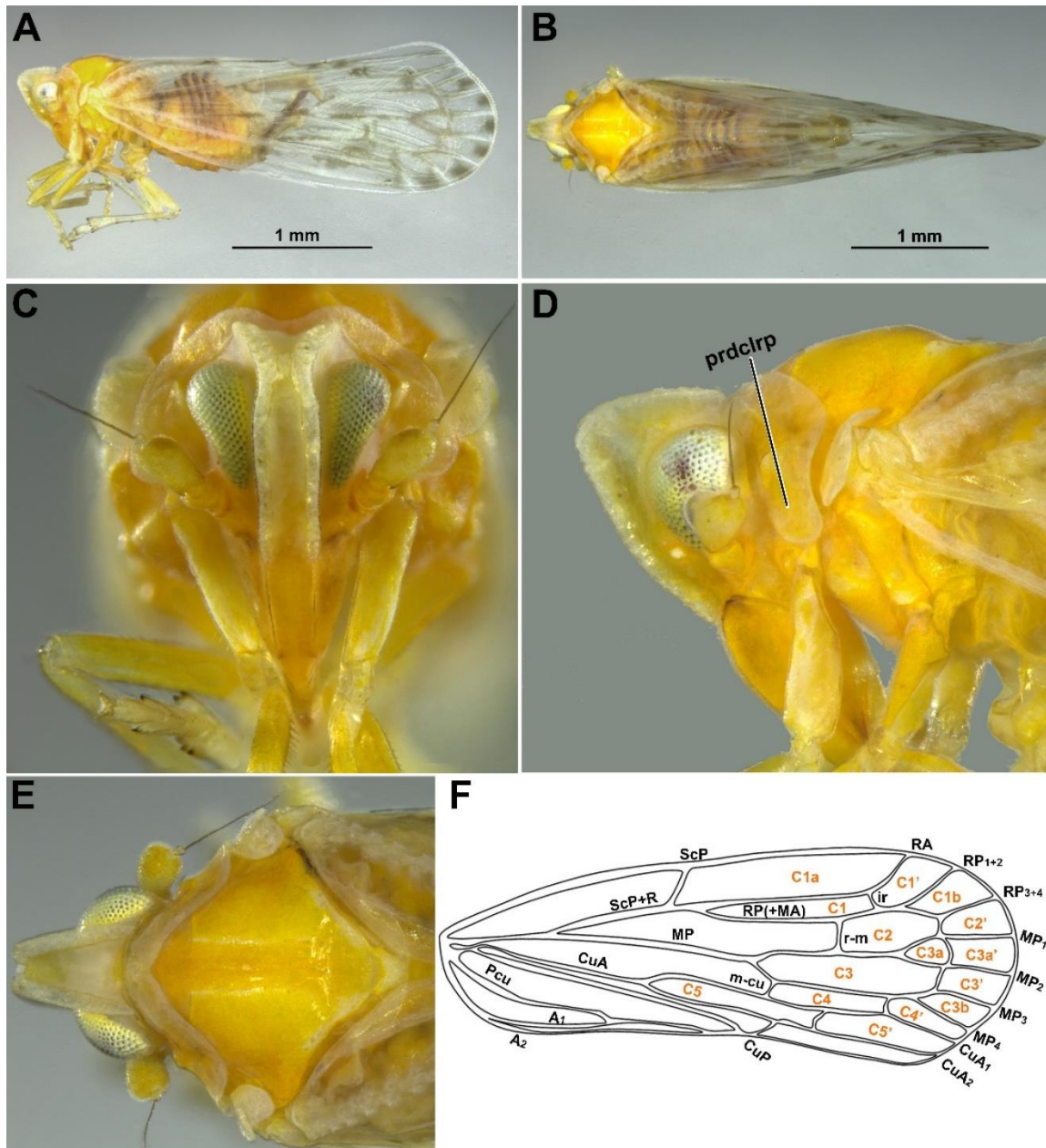
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321 **FIGURE 4 A–D.** *Persis (Eritalaena) fuscinervis* Muir, female genitalia. **A.** Sternite VII,
 322 lateral view; **B.** Sternite VII, ventral view; **C.** Gonapophysis VIII (first valvula) and bursa
 323 copulatrix, lateral view; **D.** Gonapophysis IX (second valvula), dorsal view.
 324 Abbreviations: bc, bursa copulatrix; bp, basal plate; dap, dorsoapical projection; gnpp,
 325 gonapophysis; lap, lateroapical projection; lb, lobe; pr, processes; rs, row of spines; st,
 326 sternite.



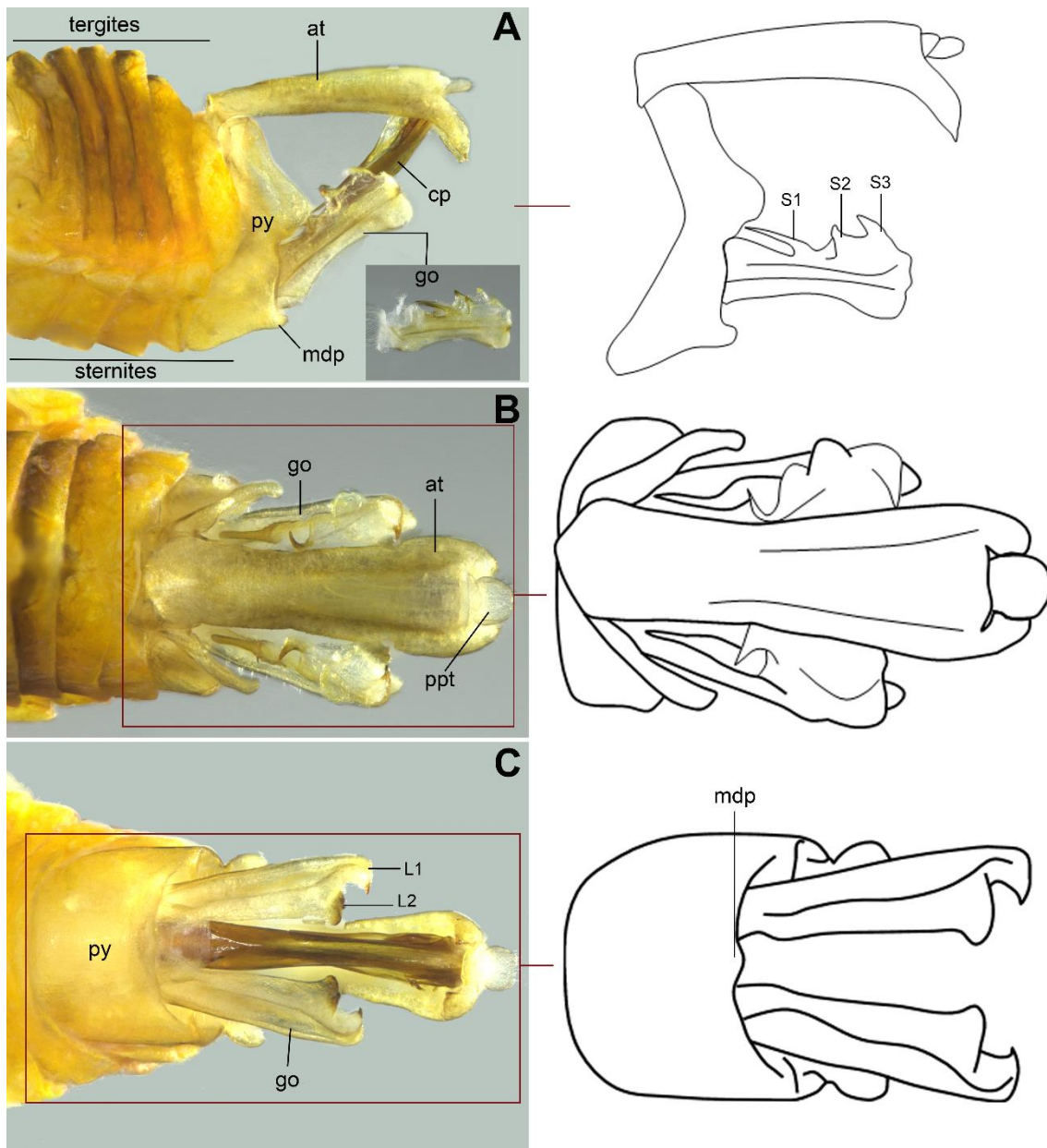
327

328 **FIGURE 5 A–C.** *Persis (Eritalaena) fuscinervis* Muir, female genitalia. **A.** Gonoplac
 329 (third valvula), lateral view; **B.** Anal tube (segment X), lateral view; **C.** Paraproct, dorsal
 330 view. Abbreviations: at, anal tube; gnp, gonoplac; ppt, paraproct.



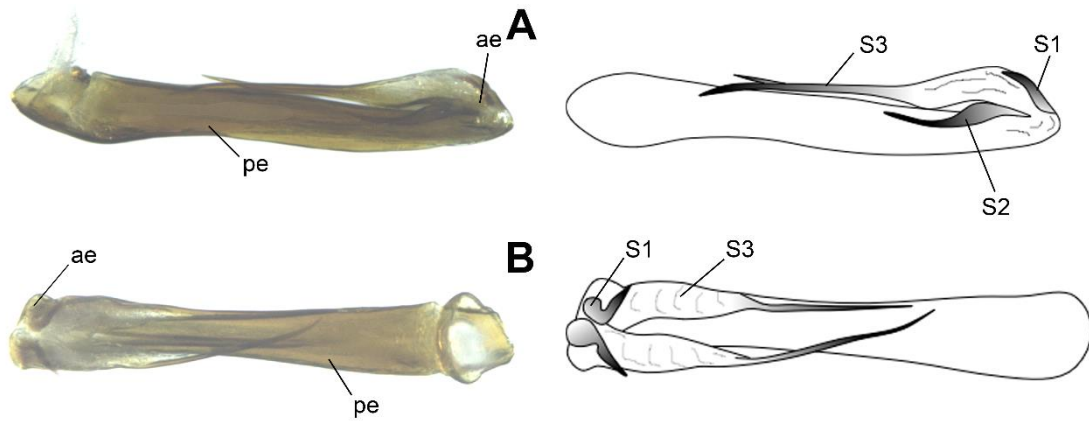
331

332 **FIGURE 6 A–F.** *Persis (Eritalaena) fuscinervis* Muir, male. **A.** Habitus, lateral view; **B.**
 333 Body, dorsal view; **C.** Head, anterior view; **D.** Head and thorax, lateral view; **E.** Head and
 334 thorax, dorsal view; **F.** Forewing venation, black (vein) and orange (cells). Abbreviations:
 335 Thorax: prdclr, paradiscal region of pronotum.



336

337 **FIGURE 7 A–C.** *Persis (Eritalaena) fuscinervis* Muir, male terminalia. **A.** Abdomen and
 338 genital capsule, lateral view; **B.** Abdomen and genital capsule, dorsal view; **C.** Abdomen
 339 and genital capsule, ventral view. Abbreviations: at, anal tube; cp, phallic complex; go,
 340 gonostylus; l, lobe; mdp, medioventral process; p, process; pe, periandrium; ppt,
 341 paraproct; py, pygofer; s, spines.



342

343 **FIGURE 8 A–B.** *Persis (Eritalaena) fuscinervis* Muir, aedeagus male. **A.** Left lateral
 344 view; **B.** Dorsal view. Abbreviations: ae: aedeagus; pe, periandrium; s, spines.

345



346

347 **FIGURE 9.** Map of the *Persis (Eritalaena) fuscinervis* Muir of the Neotropical Region.

348

349 6.5. Discussion

350 *Persis* is a New World genus and, except for *Persis (Anaparsis) arizonensis* O'Brien and

351 *Persis (Anaparsis) ferox* O'Brien, which also have records from Arizona/EUA (O'Brien

1986), all remaining species are recorded only from the Neotropics, especially from Central America (Cantanhede *et al.* in prep.), and this includes the species that is the focus of this work (Fig. 9).

Although the occurrence of *Persis (Eritalaena) fuscinervis* in Brazil is new information for science, it was expected if we carefully analyzed its short distribution history. Initially, *Persis (Eritalaena) fuscinervis* was recorded for Guyana (formerly British Guiana), a country with 97% of its territory occupied by the Amazon biome (Pereira *et al.* 2023), and which shares borders Brazil, through the states of Roraima and Pará, territories that are also covered by the Amazon biome. The Amazonas, the state where we are recording *Persis (Eritalaena) fuscinervis* for the first time in Brazil, borders Roraima, one of the Brazilian states where *Persis (Persis) pugnax* was recently found (Dollet *et al.* 2020). From this point of view, this species is possibly associated with the Amazon Rainforest, and is probably distributed in other countries in South America (International Amazon), as well as in other Brazilian states (Legal Amazon).

Although its occurrence was expected, since two of the three subgenera of *Persis* already have records for Brazil, providing this record 84 year after the last one (Metcalf 1938), highlights how much Cenchreini (Derbidae) is undersampled in the country. Of the 59 species and 11 genera that occur in the Neotropical Region (Bourgoin, 2024; Grazia *et al.* 2024), only 10 species and three genera are recorded in Brazil: *Herpis* Stål, 1862 (*Herpis fuscovittata* Stål, 1862 and *Herpis vittata* (Fabricius, 1803)), *Persis* Stål, 1862 (*Persis (Anapersis) pallidovenosa* (Stål, 1862), *Persis (Anapersis) takiyae* Cantanhede, Viegas & Ale-Rocha (in prep.), *Persis (Persis) pugnax* Stål, 1862, *Persis (Persis) stali* Muir, 1918, *Persis (Persis) gaianii* Cantanhede, Viegas & Ale-Rocha (in prep.) and *Persis (Persis) limeirai* Cantanhede, Viegas & Ale-Rocha (in prep.)) and

376 *Phaciocephalus* Kirkaldy, 1906 (*Phaciocephalus fimbriolatus* (Stål, 1862) and
377 *Phaciocephalus orbis* (Stål, 1862)) (Cantanhede *et al.* in prep.).

378

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386

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7. SÍNTESE

Com a realização desse trabalho foi possível ampliar o conhecimento sobre a diversidade de *Persis* para a região Neotropical, com a descrição de três novas espécies: *Persis (Persis) gaianii* **sp. nov.**, *Persis (Persis) limeirai* **sp. nov.** e *Persis (Anapersis) takiyae* **sp. nov.**. Além disso, três espécies foram redescritas, *Persis (Persis) pugnax* Stål, *Persis (Persis) stali* Muir (Cap. I) e *Persis (Eritalaena) fuscinervis* Muir (Cap. III), explorando-se novos caracteres que possibilitam a sua identificação utilizando a terminologia adotada nas descrições de Fulgoromorpha. Dessa maneira foi possível se aprofundar no conhecimento sobre a morfologia do gênero, permitindo assim, conhecer todas as estruturas que compõe a terminália da fêmea (Sternito VIII, Gonapófise VIII, Bursa copulatrix, Gonapófise IX, Gonoplaca, Tubo anal e Paraprocto), que em muitos trabalhos é negligenciada. Juntamente com as descrições e redescritões, ampliamos os registros geográficos de *Persis* para a região Neotropical, registrando-o pela primeira vez na Costa Rica, Venezuela e Peru.

Apesar desse grupo ter sido descrito a partir de uma espécie brasileira (Rio de Janeiro), os seus registros no Brasil limitavam-se a apenas dois estados bastante distantes, com biomas e clima diferentes, Rio de Janeiro e Roraima. A partir do empréstimo de material das coleções nacionais, esse trabalho pode ampliar a distribuição do grupo no Brasil com novos registros para 10 estados: Amazonas, Alagoas, Bahia, Maranhão, Goiás, Minas Gerais, São Paulo, Mato Grosso, Mato Grosso do Sul e Paraná, mostrando que muito provavelmente ainda há muitos dados desconhecidos pela ciência nos acervos depositados em coleções científicas.

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