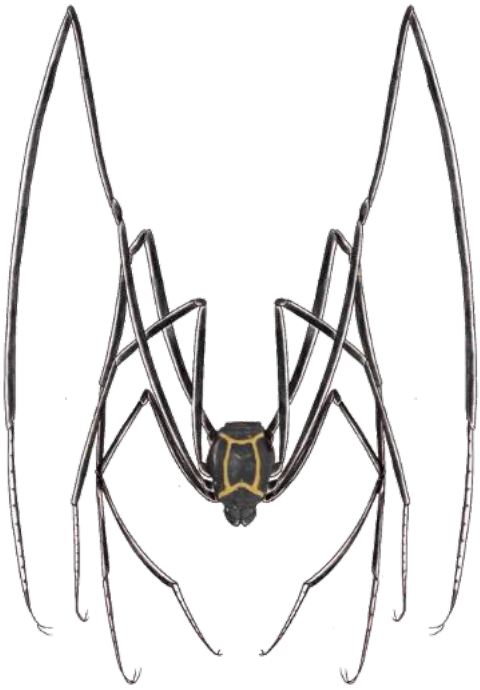
Universidade Federal do Rio de Janeiro

REVISÃO TAXONÔMICA E ANÁLISE FILOGENÉTICA DO COMPLEXO *Paecilaemella* ROEWER, 1925 E *Paecilaemana* ROEWER, 1928 (ARACHNIDA: OPILIONES: COSMETIDAE)



Laura Regina Caramori

2025

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Dissertação de Mestrado apresentada ao Programa de Pós-graduação em Ciências Biológicas (Zoologia), Museu Nacional, da Universidade Federal do Rio de Janeiro, como parte dos requisitos necessários à obtenção do título de Mestre em Ciências Biológicas (Zoologia).

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Aprovada por:

Presidente, Prof. Adriano Brilhante Kury

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RESUMO

REVISÃO TAXONÔMICA E ANÁLISE FILOGENÉTICA DO COMPLEXO *Paecilaemella* ROEWER, 1925 E *Paecilaemana* ROEWER, 1928 (ARACHNIDA: OPILIONES: COSMETIDAE)

Laura Regina Caramori

Orientador(es): Adriano Brilhante Kury; Miguel Medrano

Resumo da Dissertação de mestrado submetida ao Programa de Pós-graduação em Ciências Biológicas (Zoologia), Museu Nacional, da Universidade Federal do Rio de Janeiro - UFRJ, como parte dos requisitos necessários à obtenção do título de Mestre em Zoologia.

A família Cosmetidae, a mais diversa entre os opiliões no Neotrópico, tem sido foco de estudos que visam esclarecer suas relações internas e definir grupos infra-familiares. Apesar destes esforços, o grupo ainda precisa de mais estudos com enfoque em abordagens taxonômicas envolvendo análises filogenéticas que integrem diferentes tipos de dados, permitindo elucidar as relações entre os grupos dentro da família. Com o objetivo de elucidar as relações dentro de *Paecilaemella* Roewer, 1925 e *Paecilaemana* Roewer, 1928, gêneros pertencentes à subfamília *Flirteinae*, conduzimos uma análise cladística por meio da expansão da matriz morfológica utilizada em trabalhos anteriores. Os resultados mostram que *Paecilaemella* e *Paecilaemana* formam grupos monofiléticos e são separados principalmente pelo tipo de inchaço do basitarsômero da primeira perna em machos. Fornecemos uma nova diagnose para *Paecilaemella* e suas espécies são redescritas. Uma das espécies descritas em *Paecilaemella*, *Paecilaemella ornata* (Roewer, 1912), foi recuperada como parte de um gênero não descrito, em conjunto com uma espécie não descrita identificada no material examinado. Nosso estudo identificou um grande número de espécies não descritas para ambos os gêneros, evidenciando que estudos adicionais com o grupo são essenciais para o conhecimento de Flirteinae e da família Cosmetidae como um todo. Além disso, a distribuição conhecida dos táxons foi atualizada e observações taxonômicas foram feitas para as espécies de *Paecilaemana*. A coleta e estudo de espécimes machos, especialmente para *Paecilaemana*, se mostra essencial para o esclarecimento e compreensão das relações evolutivas entre o grupo.

Palavras-chave: Biodiversidade, Grassatores, Neotrópico, sistemática, taxonomia.

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ABSTRACT

TAXONOMIC REVIEW AND PHYLOGENETIC ANALYSIS OF THE COMPLEX *Paecilaemella* ROEWER, 1925 AND *Paecilaemana* ROEWER, 1928 (ARACHNIDA: OPILIONES: COSMETIDAE)

Laura Regina Caramori

Orientador(es): Adriano Brilhante Kury; Miguel Medrano

Abstract da Dissertação de mestrado submetida ao Programa de Pós-graduação em Ciências Biológicas (Zoologia), Museu Nacional, da Universidade Federal do Rio de Janeiro - UFRJ, como parte dos requisitos necessários à obtenção do título de Mestre em Zoologia.

The family Cosmetidae, the most diverse among harvestmen in the Neotropics, has been the focus of studies aiming to clarify its internal relationships and define infra-familial groups. Despite these efforts, the group still requires further research based on taxonomic approaches involving phylogenetic analyses that integrate different types of data to elucidate relationships within the family. Aiming to clarify the relationships within *Paecilaemella* Roewer, 1925 and *Paecilaemana* Roewer, 1928, genera belonging to the subfamily Flirteinae, we conducted a cladistic analysis by expanding the morphological matrix used in previous studies. The results show that *Paecilaemella* and *Paecilaemana* are monophyletic groups, mainly distinguished by the type of swelling on the basitarsomere of leg I in males. We provide a new diagnosis for *Paecilaemella*, and its species are redescribed. One species previously placed in *Paecilaemella*, *Paecilaemella ornata* (Roewer, 1912), was recovered as part of an undescribed genus, together with an undescribed species identified in the examined material. Our study identified a large number of undescribed species in both genera, highlighting that further research on this group is essential for advancing the knowledge of Flirteinae and the family Cosmetidae as a whole. Additionally, the known distribution of the taxa was updated, and taxonomic remarks were made for the species of *Paecilaemana*. The collection and study of male specimens, especially for *Paecilaemana*, is crucial for clarifying and understanding the evolutionary relationships within the group.

Key-words: Biodiversity, Grassatores, Neotrópico, systematics, taxonomy.

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INTRODUÇÃO GERAL

O estudo moderno dos aracnídeos teve início já no ponto de partida da nomenclatura binominal (ou binomial) com Linnaeus (1758). Em sua classe Insecta, na ordem Aptera, ele estabeleceu alguns gêneros que hoje são incluídos na classe Arachnida, como *Phalangium*, *Aranea* e *Scorpio*. Somente meio século após essa origem, Lamarck (1801) criou a classe Arachnida. Em seguida, começaram as subdivisões da classe Arachnida em ordens. Latreille (1829), por exemplo, já reconhecia algumas das ordens modernas, como Opiliones (que só adquiriu esse nome por Sundevall, 1833).

A ordem Opiliones, atualmente, inclui em torno de 6800 espécies válidas, dentre quatro subordens: Cyphophthalmi, Dyspnoi, Eupnoi e Laniatores (Kury et al., 2024). Uma quinta subordem, †Tetrophthalmi (proposta por Garwood et al., 2014), contém duas espécies fósseis do Devoniano e Carbonífero, mas esse grupo é atualmente considerado um *stem group* de Eupnoi (Gainett et al., 2024).

Com o trabalho do alemão C.L. Koch (1839), várias famílias de Opiliones foram introduzidas, incluindo Cosmetidae, a família objeto desta dissertação, alternativamente conhecida pelo nome vernacular inglês *Pied Harvestmen* (Medrano et al. 2021). Cosmetidae Koch, 1839, é a família mais diversa da subordem Laniatores e atualmente inclui 723 espécies, distribuídas no Neotrópico e Neártico (Kury, 2003; Kury et al., 2024). São caracterizados por apresentarem manchas brancas e/ou amarelas no escudo dorsal, além de pedipalpo característico, com fêmur comprimido e em forma de colher, que repousa sobre a quelícera formando um escudo (Simon, 1879).

Os opiliões podem ser encontrados em uma grande variedade de ecossistemas terrestres e são distribuídos por todos os continentes, exceto Antártica (Curtis & Machado, 2007). Os Cosmetídeos, por sua vez, são endêmicos do Novo Mundo e têm sua maior diversidade no norte da América do Sul e América Central (Pinto-da-Rocha & Giribet, 2007).

A primeira divisão de Cosmetidae em subfamílias ocorreu no início do século passado, quando Pickard-Cambridge (1904) propôs duas subfamílias, Cosmetinae e Discosomaticinae, baseadas na ausência ou presença de uma estrutura (garras pectinadas nos tarsos posteriores), configurando o paradigma pré-cladista de táxons definidos pelo estado apomórfico e plesiomórfico de um mesmo caráter.

Em contraste com a maioria dos outros táxons, cuja taxonomia foi desenvolvida por contribuições de um grande número de autores, a taxonomia de Opiliones foi fortemente influenciada por Carl-Friedrich Roewer (1881–1963), que descreveu sozinho mais de mil gêneros e duas mil espécies entre 1910 e 1963. Roewer criou o que hoje é chamado de "Sistema Roeweriano", um sistema de classificação que se baseava em caracteres superficiais e facilmente mensuráveis, e moldou por décadas a sistemática do grupo (Henriksen, 1932). Apesar de funcional à época, esse sistema resultou em agrupamentos artificiais, cuja revisão crítica só se intensificou no século XXI com o advento de abordagens filogenéticas e sistemática integrativa (p. ex. Wachter et al., 2015; Derkarabetian & Hedin, 2014; Arthofer et al., 2013). Entretanto, diferentemente de outra grande família do Neotrópico, Gonyleptidae, que apresenta uma profusão de caracteres morfológicos conspícuos, a taxonomia de Cosmetidae é caracterizada pela escassez de marcos anatômicos óbvios, o que demandou um esforço mais intenso e focalizado (veja García & Kury, 2017; Kury & Medrano, 2018).

Finalmente, Medrano et al. (2021), com base em um extenso levantamento de caracteres morfológicos, realizaram uma análise de parcimônia máxima (MP) e inferência Bayesiana que resultou em uma nova classificação supragenérica, na qual foram reconhecidas oito subfamílias. A subfamília Flirteinae Medrano, Kury & Mendes, 2021 originalmente incluía três gêneros e 32 espécies, sendo 25 delas concentradas em *Flirtea* Koch, 1839, e as outras sete distribuídas entre *Paecilaemella* Roewer, 1925, e *Paecilaemana* Roewer, 1928.

O gênero *Paecilaemella* foi descrito por Roewer (1925) em Cosmetinae como um gênero monotípico, tendo como espécie-tipo *Paecilaemella festae* Roewer, 1925, do Equador. O gênero foi sinonimizado com *Paecilaema* C.L. Koch, 1839, por Goodnight & Goodnight (1953) numa extensa sinonímia coletiva e revalidado por Kury & Medrano (2018). Posteriormente, Medrano, Ázara e Kury (2020) transferiram *Gonyleptes multimaculatus* Wood, 1869, para *Paecilaemella* como *Paecilaemella multimaculata*, ampliando a distribuição do gênero para o Brasil e Peru. Em 2021, Medrano et al. transferiram *Protus ornatus* Roewer, 1912 como *Paecilaemella ornata* (Roewer, 1912), espécie do Equador.

O gênero *Paecilaemana* foi descrito por Roewer (1928) também em Cosmetinae, contendo duas espécies do Equador, *Paecilaemana halonata* Roewer, 1928 e *Paecilaemana*

crux Roewer, 1928, sem designação de espécie-tipo. A espécie-tipo só foi fixada como *Paecilaemana halonata* décadas mais tarde, no catálogo de Kury (2003).

O elenco de espécies de *Paecilaemana* foi acrescido de mais duas espécies: *Paecilaemana reimoseri* Roewer, 1933, da Costa Rica, e *Paecilaemana quadripunctata* Goodnight & Goodnight, 1942, do Panamá. *Paecilaemana reimoseri* recentemente foi transferida para *Poecilaemula* Roewer, 1912 como sinônimo júnior de *Poecilaemula signata* (Banks, 1909) (Medrano et al., 2024).

Mais três espécies, *Paecilaemella andi* Medrano, Caramori & Kury, 2025, *Paecilaemella armasi* Medrano, Caramori & Kury, 2025 e *Paecilaemella geminorum* Medrano, Caramori & Kury, 2025 foram recentemente descritas como parte do projeto desta dissertação (Medrano et al., 2025; ver Apêndice II).

Dessa forma, previamente a este trabalho, *Paecilaemella* e *Paecilaemana* contavam em conjunto com nove espécies, sendo elas *Paecilaemella festae, Paecilaemella multimaculata, Paecilaemella ornata, Paecilaemella andi, Paecilaemella armasi* e *Paecilaemella geminorum* e *Paecilaemana crux*, *Paecilaemana halonata* e *Paecilaemana quadripunctata*.

A taxonomia da família Cosmetidae ainda está em fase inicial de revisão segundo padrões modernos, os quais envolvem análises filogenéticas integrando morfologia externa, morfologia genital e dados moleculares. Um exemplo desse esforço é a tese de doutorado de Damron (2020), que ainda não foi publicada, mas representa uma das primeiras tentativas abrangentes de revisar sistematicamente o grupo com base nesses critérios integrados. Muitas divisões entre unidades taxonômicas dentro da família ainda não foram revisadas e seguem a classificação proposta por Roewer durante as décadas de 1920 a 1940. Além disso, a morfologia genital da maioria das espécies de Cosmetidae permanece desconhecida, e caracteres genitais têm se mostrado cruciais em outras famílias de Opiliones, frequentemente levando a mudanças significativas nas hipóteses filogenéticas (p. ex. Kury, 2014). A inclusão desses caracteres pode esclarecer as relações entre os táxons e oferecer uma visão mais detalhada da evolução do grupo. Dessa forma, revisões genéricas integrativas são essenciais para a delimitação de unidades naturais e para a construção de uma classificação mais estável.

Embora Medrano et al. (2021) tenham fornecido uma diagnose para a subfamília Flirteinae, *Paecilaemana* não foi incluído como terminal em sua análise, e nenhum dos gêneros da subfamília passou por uma revisão taxonômica, deixando obscuras as relações

entre os táxons. Além disso, apenas a morfologia genital de *Flirtea* foi estudada por Kury & Garcia (2016), enquanto *Paecilaemella* e *Paecilaemana*, previamente à este trabalho, permaneciam conhecidas apenas por sua morfologia externa.

Com isso, o objetivo deste estudo é fornecer uma síntese do conhecimento taxonômico para as espécies de *Paecilaemella* e *Paecilaemana* por meio de uma revisão taxonômica e análise filogenética baseada em caracteres morfológicos. Com isso, pretende-se: (1) fornecer uma revisão taxonômica contendo diagnoses e caracterização das espécies dos gêneros; (2) investigar os limites taxonômicos entre *Paecilaemella* e *Paecilaemana*; (3) inferir sobre o relacionamento filogenético entre as espécies e (4) descrever novas espécies detectadas no material coletado e atualizar a distribuição conhecida dos táxons.

CONCLUSÃO GERAL

O gênero *Paecilaemella*, tal como circunscrito em trabalhos recentes — tanto no sentido de Medrano et al. (2020), que incluía *P. multimaculata*, quanto no sentido de Medrano et al. (2021), que posteriormente incorporou *P. ornata* — não é recuperado como monofilético em nossa análise. Tanto *P. multimaculata* quanto *P. ornata* são posicionadas fora do clado que contém a espécie-tipo *P. festae* e táxons relacionados. Este clado agora é composto por *P. festae*, três espécies recentemente descritas (*P. armasi*, *P. andi* e *P. geminorum*) e quatro espécies adicionais ainda não descritas. Portanto, propomos uma redefinição filogenética de *Paecilaemella* (sensu nov.) como o clado mais inclusivo que contém *P. festae*, mas não *P. halonata*.

De maneira semelhante, *Paecilaemana* é recuperado como monofilético, composto por sua espécie-tipo *P. halonata*, as espécies previamente descritas *P. crux* e *P. quadripunctata*, quatro espécies não descritas, além de *P. multimaculata*. Com base nesses resultados, redefinimos *Paecilaemana* (sensu nov.) como o clado mais inclusivo que contém *P. halonata*, mas não *P. festae*.

Apesar da similaridade externa entre *Paecilaemella* e *Paecilaemana*, as evidências atualmente disponíveis não sustentam a hipótese de sinonímia entre os dois gêneros. A hipótese de que se tratam de gêneros distintos permanece válida, embora durante o desenvolvimento deste estudo tenha surgido a suspeita, por parte da equipe, de que pudessem representar um único gênero. A espécie-tipo de *Paecilaemana* foi descrita com base em uma fêmea e não foi reencontrada em nenhum dos materiais examinados, seja por meio de

doações, empréstimos, visitas a coleções, ou nas expedições ao Equador. A morfologia genital, bem como a armadura das pernas e as quelíceras dos machos, será crucial para esclarecer definitivamente a identidade e os limites do gênero *Paecilaemana*.

Apesar de ambos os gêneros terem sido recuperados fora da subfamília Flirteinae, não dispomos de evidências suficientes para afirmar que pertencem a outra subfamília. Dessa forma, a classificação dos gêneros permanece conforme proposta por Medrano et al. (2021).

Além disso, *Paecilaemella ornata* não foi recuperada como pertencente a *Paecilaemella*, mas sim como parte de um "novo" gênero (Gênero C), diferenciado dos demais pela quelícera inflada. *Paecilaemella* e *Paecilaemana* podem ser diferenciados principalmente pelos basitarsômeros da perna I, que apresentam um inchaço nos machos: em *Paecilaemana*, os basitarsômeros têm tamanhos semelhantes entre si, enquanto em *Paecilaemella*, o primeiro basitarsômero é mais longo que os demais.

Para o melhor entendimento do grupo é essencial a coleta e estudo de espécimes machos, especialmente de *Paecilaemana*, de diferentes localidades e regiões. Além disso, estudos com análises filogenéticas envolvendo dados de morfologia externa, genital e molecular serão cruciais para a compreensão das relações evolutivas entre Cosmetidae.

As três novas espécies recentemente descritas de *Paecilaemella* fornecem novos dados morfológicos para refinar o diagnóstico do gênero e contribuem para o preenchimento da lacuna no conhecimento do grupo, servindo de apoio para futuros esforços taxonômicos.

APÊNDICE I: ARTIGO I (MANUSCRITO FINAL)

Revisiting *Paecilaemella* Roewer, 1925 and *Paecilaemana* Roewer, 1928 (Opiliones: Cosmetidae: Flirteinae) through a taxonomic review and phylogenetic analysis

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Abstract

The family Cosmetidae, the most diverse among Opiliones in the Neotropics, has been the focus of recent studies aimed at clarifying its internal relationships and defining infrageneric groups. To investigate the relationships within *Paecilaemella* Roewer, 1925, and *Paecilaemana* Roewer, 1928 — both genera of Flirteinae — we conducted a cladistic analysis by expanding the morphological dataset used in previous works. The results show that these two genera form distinct monophyletic units, differentiated primarily by the type of swelling in the basitarsomere of leg I in males. In addition, we provide a new diagnosis for *Paecilaemella*, redescriptions of its species, and taxonomic remarks on *Paecilaemana*. *Paecilaemella ornata* (Roewer, 1912) was recovered as part of an undescribed genus, and *Paecilaemella multimaculata* (Wood, 1869) as part of *Paecilaemana*. Our study also revealed a considerable number of undescribed species within the two genera, highlighting the need for further research on this group to improve our understanding of Flirteinae and Cosmetidae as a whole.

Key-words: Biodiversity, Grassatores, Neotrópico, systematics, taxonomy.

Introduction

Cosmetidae is the most diverse family within the suborder Laniatores, comprising approximately 720 valid species (Kury et al., 2024). Despite this richness, the group remained without a suprageneric framework for several decades. This situation changed with the comprehensive revision by Medrano et al. (2021), who proposed a new

classification recognizing eight subfamilies, including Flirteinae Medrano, Kury & Mendes, 2021.

Including 34 species, most of Flirteinae's diversity is concentrated in one of its three genera: *Flirtea*, with 25 species, and the remaining nine distributed between *Paecilaemella* Roewer, 1925, and *Paecilaemana* Roewer, 1928 (Kury et al., 2024).

Both *Paecilaemella* and *Paecilaemana*, described by Roewer in 1925 and 1928 respectively, comprise a small number of species and have a complex taxonomic history, including synonymies, revalidations, and recent transfers (Kury & Medrano, 2018; Medrano et al., 2020, 2021, 2024).

Paecilaemella was originally described as a monotypic genus based on *Paecilaemella festae* Roewer, 1925 from Ecuador. It was later synonymized with *Paecilaema* by Goodnight & Goodnight (1953) and revalidated by Kury & Medrano (2018). New combinations have expanded its composition and distribution, including *Paecilaemella multimaculata* (Wood, 1869) (Brazil and Peru) and *Paecilaemella ornata* (Roewer, 1912) (Ecuador) (Medrano et al., 2020, 2021). Three new species — *Paecilaemella andi* Medrano, Caramori & Kury, 2025, *Paecilaemella armasi* Medrano, Caramori & Kury, 2025, and *Paecilaemella geminorum* Medrano, Caramori & Kury, 2025 — were recently described by Medrano et al. (2025). *Paecilaemana*, on the other hand, was described with two species from Ecuador, with *Paecilaemana halonata* Roewer, 1928 later designated as the type species (Kury, 2003). The genus was later expanded to include *Paecilaemana reimoseri* Roewer, 1933 (Costa Rica) and *Paecilaemana quadripunctata* Goodnight & Goodnight, 1942 (Panama) (Roewer, 1933; Goodnight & Goodnight, 1942), although the former was recently transferred to *Poecilaemula* as a junior synonym (Medrano et al., 2024).

Previous to this work, *Paecilaemella* and *Paecilaemana* comprised the following species: *Paecilaemella festae*, *P. multimaculata*, *P. ornata*, *P. andi*, *P. armasi*, *P. geminorum*, and *Paecilaemana crux*, *P. halonata*, and *P. quadripunctata*.

The aim of this study is to provide a synthesis of the taxonomic knowledge of the species of *Paecilaemella* and *Paecilaemana* through a taxonomic revision and phylogenetic analysis based on morphological characters.

Material and Methods

The material examined in this study comprises 216 specimens of *P. festae*, *P. multimaculata*, and several potentially undescribed species, including representatives of two putative new genera, from Brazil, Colombia, Ecuador, and Peru. These specimens were obtained during expeditions carried out in 2019 and 2021, as well as through donations and loans from various institutions. In addition, iconographic material of the type series of *P. ornata*, *P. halonata*, and *P. crux* was analyzed. A specimen of *P. quadripunctata* housed at the Museum of Comparative Zoology, Harvard University (MCZ), was studied through photographs. Furthermore, several individuals lost in the 2018 fire at the Museu Nacional, Rio de Janeiro, were included in the comparative analysis based on available photographs and illustrations of external morphology.

The description of the exomorphology follows Kury & García (2016), terminology for chaetotaxy of the penis ventral plate follows Kury & Villarreal (2015) with the interpretation of macrosetae D1 as in Medrano & Kury (2016), terminology of dorsal scutum types follows Kury & Medrano (2016). Descriptions of colors use the standard names of the 267 Color Centroids of the NBS/IBCC Color System (online at http://people.csail.mit.edu/jaffer/Color/Dictionaries#nbs-iscc). Ecoregions mentioned in the distribution of the taxa follows Olson et al. (2001).

Tarsal formula: numbers of tarsomeres in tarsus I to IV, when an individual count is given; order is from left to right side (figures in parentheses denote the number of tarsomeres only in the distitarsus I–II). All measurements are in millimeters, unless otherwise specified.

Abbreviations of the repositories cited are (abbreviations follow the Global Registry of Scientific Collections at https://scientific-collections.gbif.org/institution/search): Instituto de Ciencias Naturales, Universidad Nacional de Colombia (ICN, Bogotá), Museo de Historia Natural, Universidad Nacional Mayor de San Marcos (MUSM, Lima), Museu Nacional/Universidade Federal do Rio de Janeiro (MNRJ, Rio de Janeiro), Museu Paraense Emílio Goeldi (MPEG, Belém), Museo de la Universidad Pontificia Javeriana (MPUJ, Bogotá), Museo de Zoología, Pontificia Universidad Católica del Ecuador (QCAZ, Quito), National Museum of Natural History, Smithsonian Institution (USNM, Washington DC). Other abbreviations are: Dorsal Scutum (DS); Macrosetae (MS); Ventral Plate (VP).

Abbreviations of taxonomic and nomenclatural acts in Latin as used here is: combīnātiō nova = comb. nov. (= new combination), species nova = sp. nov. (= new species); genus novum = gen. nov. (= new genus). This abbreviation is under quotation marks for its part of a gray literature for now and does not count as a nomenclatural act according to ICZN, 1999.

Iconographic material was produced using three methods: focus-stacked photomontage of the dorsal, ventral, and frontal aspects of the specimens using a Leica M205C stereoscope attached to a Leica DFC450 digital camera; illustrations of the dorsal and lateral aspects of the specimens, as well as legs I and IV, chelicerae, and pedipalps using a camera lucida attached to a stereomicroscope; and Scanning Electron Microscopy (SEM) of the genitalia. The illustrations were later vectorized using Inkscape v. 0.91. Specimen measurements were taken in the same manner as the illustrations and later processed using ImageJ.

For the SEM, specimen genitalia were dehydrated in a graded ethanol series, sputter-coated with gold and examined with a JEOL JSM-6390LV Scanning Electron Microscopy at the Rudolf Barth Electron Microscopy Platform of the Oswaldo Cruz Institute/FIOCRUZ.

Locality maps were created using QGIS (QGIS Development Team, 2016), compiling data from the literature, new data from the examined material, and records from the iNaturalist platform.

A cladistic parsimony-based phylogenetic analysis was carried out using the software MorphoBank (O'Leary & Kaufman, 2012) to expand a pre-existing character matrix used in previous studies by the team, such as Medrano & Kury (2018) and Medrano et al. (2021). Characters in this matrix were modified, and new characters were developed based on specimen examination. 78 characters were used in the analyses, 58 consisting of characters of the external morphology and 20 of genitalia. Of these 78, 10 were added for this work. 23 well-known genera from each Cosmetidae subfamily were selected as outgroup terminal taxa, along with members of *Flirtea*, the other representative of Flirteinae, The internal group also consists of 23 taxa, the six representatives of *Paecilaemella*, the three representatives of *Paecilaemana* and 14 potential new species.

The phylogenetic analyses followed the methodologies of Medrano et al., 2021 and Carvalho & Kury, 2024. Trees were searched using TNT (Goloboff et al., 2008a) using parsimony with the traditional search algorithm and tree bisection-reconnection branch-

swapping (TBR). Space was allocated for 100000 trees in memory. Heuristic searches consisted of 1000 replicates of random addition sequences (RAS) followed by TBR holding 100 trees per iteration. After that, TBR using trees from RAM was applied. The command 'collapse branches after search' was used to eliminate unsupported nodes.

A sensitivity approach using Implied Weighting (IW) was adopted using a script written by Salvador Arias, used to determine the optimal concavity constant (k) (see Goloboff et al., 2008b). This analysis resulted in a final value of k = 7.1875 and its strict consensus is illustrated in Figure 1. Analysis using different concavity values were also adopted (Goloboff, 1993; Goloboff et al., 2008a). Nine different concavity values (k = 1, 2, 3, 4, 5, 6, 10, 15, 20) were used following Carvalho & Kury, 2024.

The data were evaluated with relative Bremer support (Bremer, 1994) and Symmetrical resampling. A dash represented in Figure 1 for the symmetrical resampling indicates that there is as much evidence against as in favor of the existence of the clade. Clades obtained under Equal Weighting (EW) and IW with different K-values are shown using Navajo Rugs (or sensitivity plots) for comparison and discussion.

Results

Phylogenetic analyses

The equal weighting analysis resulted in 8012 most-parsimonious trees. Most of the analyses under implied weighting resulted in only one tree, except for the one with k = 6, which resulted in 12 trees and k = 15 and k = 20 which resulted in two trees each. The analysis using the Salvador Arias "setk" script resulted in two trees (419 steps). Its strict consensus was chosen to present and discuss the results (Fig. 1) and has a consistency index (CI) = 28 and retention index (RI) = 53.

Both *Paecilaemella* and *Paecilaemana* were retrieved as monophyletic, although outside of its current subfamily, Flirteinae and excluding two species of *Paecilaemella*. Three undescribed clades were also retrieved in the analysis as successive sister-groups of *Paecilaemella* + *Paecilaemana*. They should be treated as new genera, two of them monotypic, including undescribed species (Genus A and B) and other including *Paecilaemella ornata* and an undescribed species (Genus C). Some of the taxa defined by us as potentially undescribed *Paecilaemella* were retrieved as *Paecilaemana* and vice versa.

Paecilaemella multimaculata was retrieved as part of *Paecilaemana*, with the three described species of the genus, *P. halonata*, *P. crux* and *P. quadripunctata* and four undescribed species. As for *Paecilaemella*, only one species described before this study were retrieved within the genus, *P. festae* — the type-species, with the three recently described species, *P. andi*, *P. armasi* and *P. geminorum* and seven undescribed species.

Although most of the clades lack probabilistic support, some of them were retrieved in most of the analyses, as seen represented by the Navajo rugs. The clade we called Genus C shows relatively strong support and was recovered in all analyses. The same happens for some small clades such as *Paecilaemana crux* + *Paecilaemana* sp.1 and *Paecilaemella geminorum* + *Paecilaemella andi*.

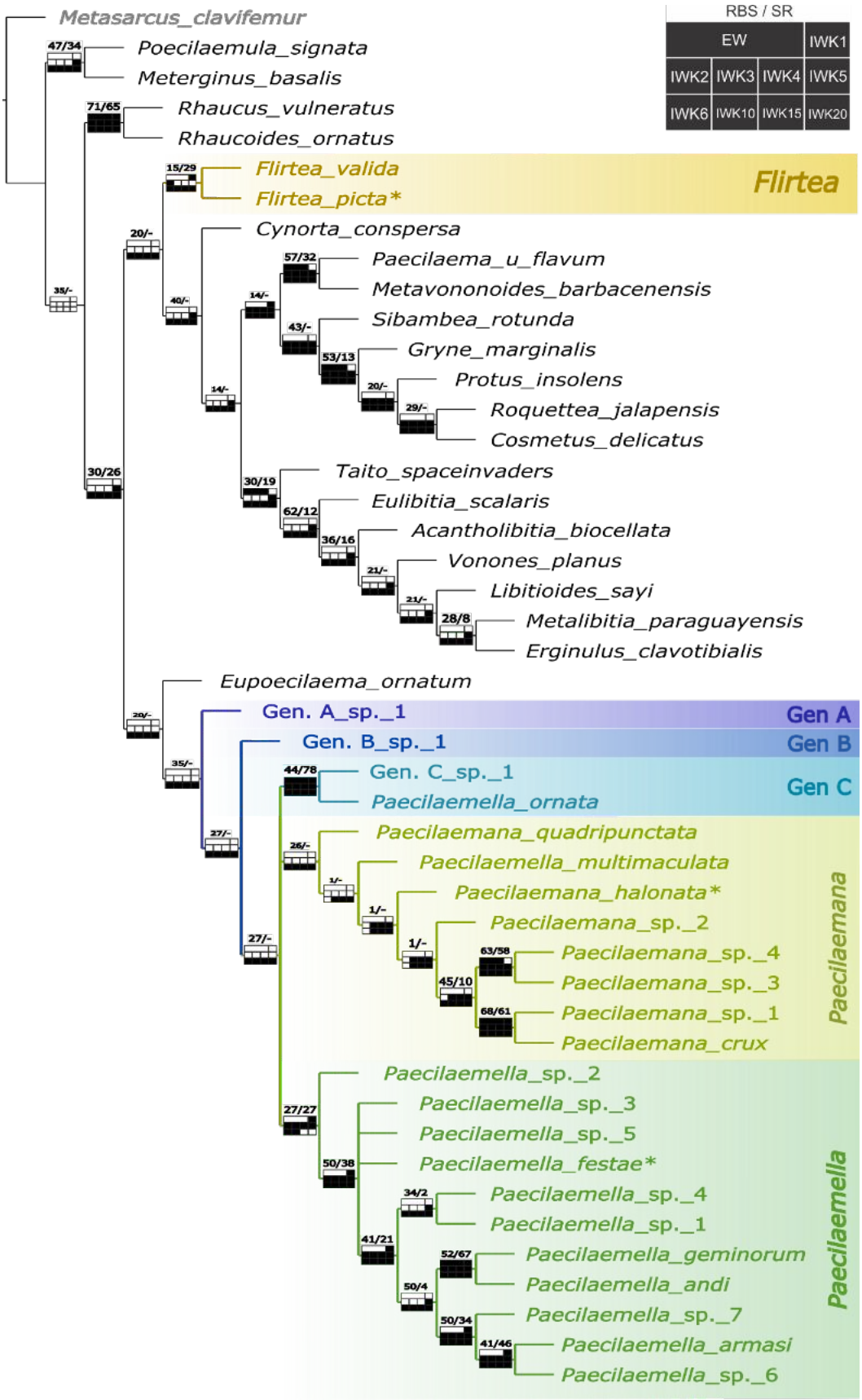

Figure 1. Strict consensus of trees obtained with k = 7.1875, indicating groups of interest. * indicates type species of the genera. Abbreviations: EW = equal weighting, IW = implied weighting, RBS = relative Bremer support, SR = symmetrical resampling

The clade that unites *Paecilaemella*, *Paecilaemana*, and the three undescribed genera has only one non-homoplastic synapomorphy: “Leg I, tarsomeres, sexual dimorphism [39 (1)]”, and was recovered as the sister group to *Eupoecilaema* (*incertae sedis* genus) (Fig. 2).

Paecilaemana, in turn, exhibits three homoplastic synapomorphies, all related to genital morphology, while *Paecilaemella* exhibits one homoplastic and one non-homoplastic synapomorphy, both related to tarsomeres of leg I: “Leg I, tarsomeres, Ta counts [41 (2,3)]” and “Leg I, tarsomeres, sexual dimorphism, type [40 (0)]”.

The clade *Paecilaemella*, *Paecilaemana* and Genus C exhibit six homoplastic synapomorphies, related to the dorsal scutum, legs and penis (characters 4, 7, 11, 43, 50. 73).

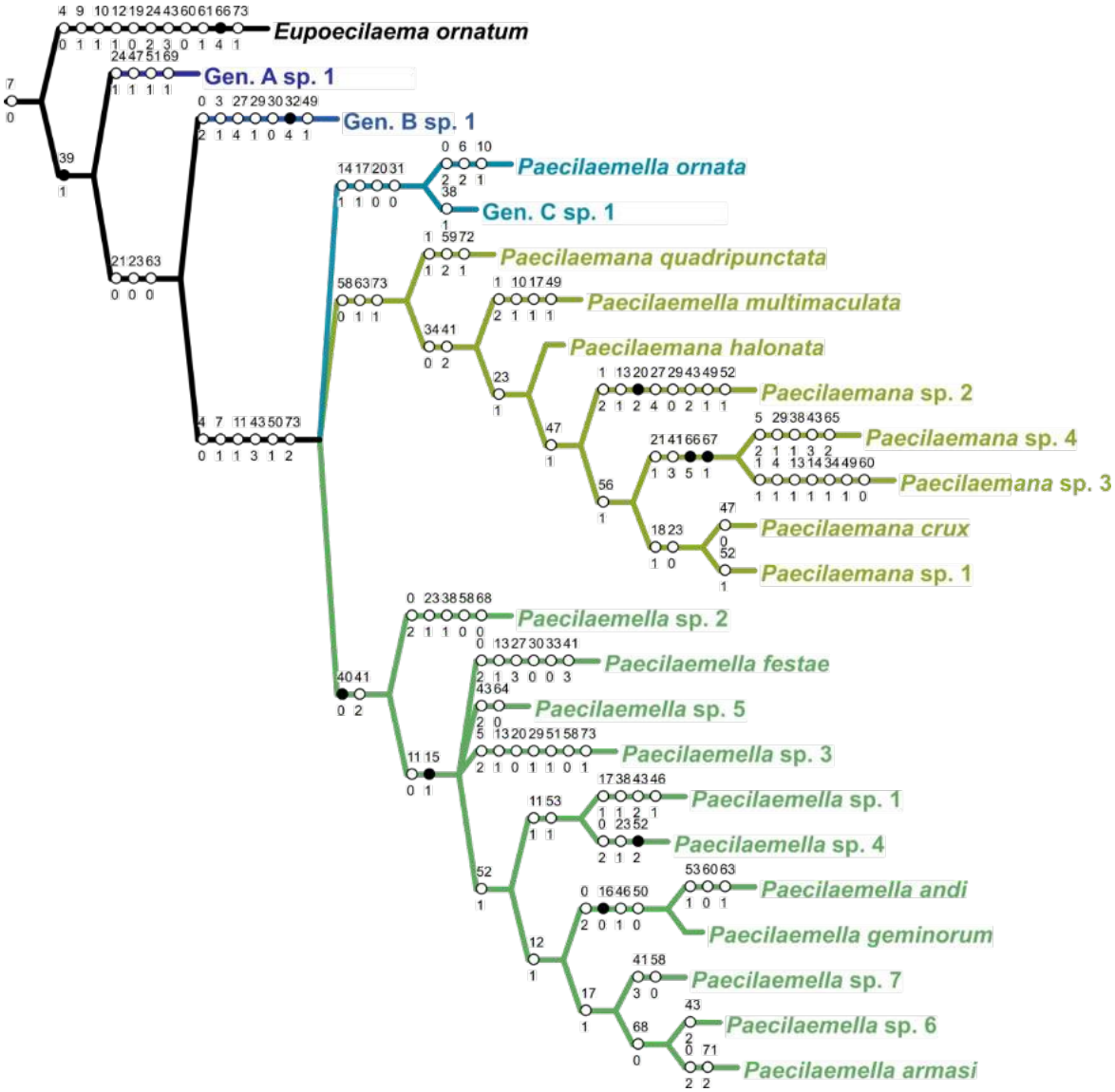

Figure 2. Cladogram representing the groups of interest, with synapomorphies for each clade mapped. The tree represents the topology retrieved by the analysis with k = 7.1875 tested using TNT. Black circles = non-homoplastic synapomorphies; white circles = homoplastic synapomorphies. Small numbers above symbols are the numbers of the characters. Small numbers under symbols are the numbers of the states.

Character matrix

Table 1. Matrix of character states for the cladistic analysis presented here (continued on next pages).

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Chacoikeontus clavifemur	1	1	2	0	1	2	2	1	-	-	-	-	0	0	0	0	-	0	0	1
Vonones planus	1	0	2	0	0	3	1	1	-	-	-	-	-	-	0	0	-	0	0	1
Erginulus clavotibialis	2	2	2	?	0	?	1	1	0	0	0	1	0	0	0	0	-	0	0	1
Meterginus basalis	2	1	1	0	1	2	2	1	0	1	1	1	1	0	0	0	-	0	0	1
Poecilaemula signata	1	1	1	0	0	?	2	1	1	0	0	1	0	0	0	0	-	0	0	1
Acantholibitia biocellata	0	2	2	1	0	2	0	1	0	0	0	0	0	0	0	0	-	0	0	0
Metalibitia paraguayensis	1	2	2	1	0	2	0	1	-	-	-	-	-	-	0	?	?	?	?	0
Paecilaemella festae	2	4	1	0	0	1	1	1	0	0	0	0	0	1	0	1	1	0	0	1
Paecilaemella ornata	2	4	1	?	0	1	2	1	0	0	1	1	0	0	1	0	-	1	0	1
Paecilaemella andi	2	4	1	0	0	1	1	1	0	0	1	0	1	0	0	1	0	0	0	1
Paecilaemella geminorum	2	4	1	0	0	1	1	1	0	0	1	0	1	0	0	1	0	0	0	1
Paecilaemella multimaculata	1	2	1	?	0	?	1	1	0	0	1	1	0	0	0	0	-	1	0	1
Eupoecilaema ornatum	1	4	1	0	0	1	1	0	0	1	1	0	1	0	0	0	-	0	0	0
Flirtea picta	1	4	1	0	1	1	1	1	0	1	1	1	0	0	1	0	-	0	1	1
Flirtea valida	1	4	1	0	1	1	1	1	0	0	1	?	0	0	0	0	-	0	?	1
Libitioides sayi	0	2	2	1	1	2	0	1	0	0	1	0	1	0	0	0	-	0	0	0
Taito spaceinvaders	1	6	1	1	0	0	1	1	0	0	0	0	0	0	1	0	-	0	0	1
Rhaucoides ornatus	1	1	1	0	1	2	2	2	0	0	0	1	0	0	1	?	?	?	?	1
Rhaucus vulneratus	2	0	2	0	1	2	2	2	0	0	0	0	0	0	0	0	-	0	0	2
Eulibitia scalaris	1	2	2	1	0	1	0	1	0	0	0	0	0	0	1	?	?	?	?	1
Cynorta conspersa	1	1	1	0	1	1	1	1	0	0	0	0	0	0	0	?	?	?	?	1
Cosmetus delicatus	1	1	1	0	1	1	0	0	1	0	1	1	0	0	0	0	-	0	0	0
Metavononoides barbacenensis	1	1	1	0	1	2	0	1	0	0	1	0	0	0	0	?	?	?	?	0
Paecilaema u-flavum	1	1	1	0	1	2	0	1	1	0	0	0	0	0	0	?	?	?	?	0
Sibambea rotunda	1	3	0	0	2	3	1	0	0	0	0	0	0	0	0	?	?	?	?	1
Protus insolens	1	1	1	0	2	2	1	0	0	0	0	0	0	0	0	?	?	?	?	1
Gryne marginalis	1	1	1	0	1	1	1	1	0	0	0	0	0	0	0	?	?	?	?	1
Roquettea jalapensis	1	1	1	0	1	1	1	1	0	0	0	0	0	1	0	?	?	?	?	1
Paecilaemana crux	?	4	1	?	0	?	1	?	0	0	0	0	0	0	0	0	-	0	1	1
Paecilaemana halonata	?	4	1	?	0	?	1	1	0	0	0	1	0	0	0	0	-	0	0	1
Paecilaemana quadripunctata	1	1	1	?	0	?	1	1	0	0	0	1	0	0	0	0	-	0	0	1
***Paecilaemella* sp. 5**	1	4	1	0	0	1	1	1	0	0	0	0	0	0	0	1	1	0	0	1
***Paecilaemella* sp. 2**	2	4	1	0	0	1	1	1	0	0	0	1	0	0	0	0	-	0	0	1
***Paecilaemella* sp. 3**	1	4	1	0	0	2	1	1	0	0	0	0	0	1	0	1	1	0	0	1
Gen. C sp. 1	1	4	1	0	0	1	1	1	0	0	0	1	0	0	1	0	-	1	0	1
***Paecilaemella* sp. 1**	1	4	1	0	0	1	1	1	0	0	0	1	0	0	0	1	1	1	0	1
***Paecilaemana* sp. 1**	2	4	1	1	0	1	1	1	0	0	0	1	0	0	0	0	-	0	1	1
***Paecilaemella* sp. 4**	2	4	1	0	0	1	1	1	0	0	1	1	0	0	0	1	1	0	0	1
Gen. A sp. 1	1	4	1	0	1	1	1	0	0	0	0	0	0	0	0	0	-	0	0	1
***Paecilaemana* sp. 2**	1	2	1	0	0	1	1	1	0	0	0	0	0	1	0	0	-	0	0	1
***Paecilaemana* sp. 3**	1	4	1	0	0	2	1	1	0	0	0	1	0	0	0	0	-	0	0	1

***Paecilaemella* sp. 6**	1	4	1	0	0	1	1	1	0	0	1	0	1	0	0	1	1	1	0	1
***Paecilaemella* sp. 7**	1	4	1	0	0	1	1	1	0	0	1	0	1	0	0	1	1	1	0	1
Paecilaemella armasi	2	4	1	0	0	1	1	1	0	0	1	0	1	0	0	1	1	1	0	1
Gen. B sp. 1	2	4	1	1	1	1	1	0	0	0	0	0	0	0	0	0	-	0	0	1
***Paecilaemana* sp. 4**	1	1	1	0	1	1	1	1	0	0	0	0	0	1	1	0	-	0	0	1

Table 1. (continued)

	20	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**
Chacoikeontus clavifemur	0	1	0	1	0	1	0	-	0	-	1	0	?	?	?	0	0	-	0	?
Vonones planus	1	1	1	1	0	0	1	0	?	?	1	2	?	?	?	1	0	?	0	?
Erginulus clavotibialis	?	0	0	0	-	-	1	4	?	?	1	1	2	0	1	1	1	2	?	?
Meterginus basalis	0	1	0	1	0	1	0	4	?	?	1	1	3	?	1	1	1	2	?	?
Poecilaemula signata	0	1	0	1	2	-	0	0	?	?	1	1	?	?	?	1	1	2	0	?
Acantholibitia biocellata	1	1	0	1	0	0	1	3	1	?	0	-	2	?	0	1	0	1	?	?
Metalibitia paraguayensis	3	1	1	1	2	-	1	0	1	0	0	-	2	?	0	1	0	1	?	?
Paecilaemella festae	1	0	0	0	-	-	0	3	1	2	0	-	2	0	1	1	0	1	0	1
Paecilaemella ornata	0	0	0	0	-	-	0	0	?	?	1	0	?	?	?	1	0	1	0	?
Paecilaemella andi	1	0	0	0	-	-	0	0	1	2	1	2	2	1	1	1	0	1	0	1
Paecilaemella geminorum	1	0	0	0	-	-	0	0	1	2	1	2	2	1	1	1	0	1	0	1
Paecilaemella multimaculata	1	0	0	0	-	-	0	?	?	?	1	?	?	1	0	1	0	1	0	1
Eupoecilaema ornatum	1	1	0	1	2	-	0	0	1	2	1	-	?	?	?	1	0	?	0	0
Flirtea picta	1	1	0	1	0	1	0	0	1	2	1	-	?	?	?	1	0	1	0	?
Flirtea valida	1	1	0	1	0	1	0	4	?	?	1	-	2	1	0	1	0	1	?	?
Libitioides sayi	1	1	0	1	2	0	1	0	?	?	0	-	2	0	0	1	0	1	0	0
Taito spaceinvaders	1	1	0	1	0	0	0	0	?	?	0	-	?	?	?	1	0	1	?	?
Rhaucoides ornatus	0	1	1	1	0	1	1	0	0	0	1	0	2	1	1	1	1	2	?	?
Rhaucus vulneratus	0	1	1	1	1	-	0	0	0	1	1	0	1	1	1	1	1	2	0	?
Eulibitia scalaris	1	1	0	1	2	-	0	0	?	?	0	-	2	1	0	1	0	1	?	?
Cynorta conspersa	1	1	0	1	0	1	0	-	?	1	1	2	?	?	?	1	0	1	?	?
Cosmetus delicatus	1	0	0	1	0	-	0	2	1	2	0	-	2	?	0	1	0	1	1	?
Metavononoides barbacenensis	1	1	0	1	0	1	0	2	?	?	0	-	2	1	0	1	0	1	?	?
Paecilaema u-flavum	1	0	0	1	0	1	0	2	?	?	0	-	2	1	0	1	0	1	?	?
Sibambea rotunda	1	0	0	0	-	-	0	1	?	?	0	-	0	0	0	1	0	1	?	?
Protus insolens	1	1	0	1	2	-	0	0	?	?	0	-	2	1	0	1	0	1	?	?
Gryne marginalis	1	1	0	1	0	1	0	4	?	?	0	-	2	1	0	1	0	1	?	?
Roquettea jalapensis	1	1	0	1	0	1	0	3	1	2	0	-	2	?	0	1	0	0	?	?
Paecilaemana crux	?	0	0	0	-	-	0	0	?	?	?	?	?	?	?	1	?	?	0	?
Paecilaemana halonata	1	0	0	1	0	0	0	0	?	?	?	?	?	?	?	1	?	?	0	1
Paecilaemana quadripunctata	1	0	0	0	-	-	0	0	1	2	1	?	2	1	1	1	?	?	0	1
***Paecilaemella* sp. 5**	1	0	0	0	-	-	0	0	1	2	1	2	2	1	1	1	0	1	0	1
***Paecilaemella* sp. 2**	1	0	0	1	0	1	0	0	1	2	1	2	2	1	1	1	0	1	1	1
***Paecilaemella* sp. 3**	0	0	0	0	-	-	0	0	1	1	?	?	2	1	1	1	0	1	?	1
Gen. C sp. 1	0	0	0	0	-	-	0	0	1	2	1	0	2	1	1	1	0	1	1	1
***Paecilaemella* sp. 1**	1	0	0	0	-	-	0	0	1	2	1	2	2	1	1	1	0	1	1	1
***Paecilaemana* sp. 1**	1	0	0	0	-	-	0	0	1	2	1	2	2	1	0	1	0	1	0	1

	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
***Paecilaemella* sp. 4**	1	0	0	1	?	?	0	0	1	2	?	?	2	1	1	1	0	1	0	1
Gen. A sp. 1	1	1	0	1	1	-	0	0	1	2	1	2	2	1	1	1	0	1	0	1
***Paecilaemana* sp. 2**	2	0	0	1	?	?	0	4	1	0	?	?	2	1	0	1	0	1	0	1
***Paecilaemana* sp. 3**	1	1	0	1	?	0	0	0	1	1	0	?	2	1	0	1	0	1	1	1
***Paecilaemella* sp. 6**	1	0	0	0	-	-	0	0	1	2	1	2	2	1	1	1	0	1	0	1
***Paecilaemella* sp. 7**	1	0	0	0	-	-	0	0	1	2	?	?	2	1	1	1	0	1	0	1
Paecilaemella armasi	1	0	0	0	-	-	0	0	1	2	1	2	2	1	1	1	0	1	0	1
Gen. B sp. 1	1	0	0	0	-	-	0	4	1	1	0	-	4	1	1	1	0	1	0	1
***Paecilaemana* sp. 4**	1	1	0	1	?	?	0	0	1	2	?	?	2	1	1	1	0	1	0	1

Table 1. (continued)

	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
Chacoikeontus clavifemur	?	3	?	2	1	0	0	0	0	0	0	1	0	0	0	0	0	1	1	1
Vonones planus	?	1	?	2	2	0	0	1	2	0	0	1	1	0	1	0	0	0	1	1
Erginulus clavotibialis	?	2	?	1	0	1	0	1	2	0	0	0	1	0	1	0	0	1	1	2
Meterginus basalis	?	3	?	2	1	0	0	0	1	0	0	1	0	0	0	0	0	0	?	2
Poecilaemula signata	?	3	?	2	1	0	0	0	0	0	2	2	0	0	0	0	0	0	1	2
Acantholibitia biocellata	?	1	?	0	0	0	0	1	1	0	0	1	0	0	0	1	0	1	0	1
Metalibitia paraguayensis	?	1	?	0	0	1	0	0	2	0	0	1	0	0	1	0	0	1	1	2
Paecilaemella festae	0	3	0	2&3	1	0	0	0	0	0	1	2	0	0	0	0	0	0	1	1
Paecilaemella ornata	?	3	?	3	1	0	0	0	0	0	1	2	0	0	0	?	0	0	?	?
Paecilaemella andi	0	2	0	3	1	0	1	0	0	0	0	2	1	1	0	0	0	0	?	1
Paecilaemella geminorum	0	2	0	3	1	0	1	0	0	0	0	2	1	0	0	0	0	0	1	1
Paecilaemella multimaculata	1	2	0	1	1	0	?	0	?	1	1	2	0	?	0	0	0	0	?	1
Eupoecilaema ornatum	-	3	?	3	1	0	0	0	0	0	0	2	0	0	0	0	0	0	?	2
Flirtea picta	?	3	?	1	0	0	0	0	0	0	1	2	0	0	0	0	0	0	1	2
Flirtea valida	?	2	?	1	1	0	0	0	0	0	1	2	0	0	0	0	0	0	1	1
Libitioides sayi	-	1	0	0	0	1	1	0	2	0	0	0	0	0	0	0	0	1	1	1
Taito spaceinvaders	?	2	?	1	1	1	1	1	1	0	0	1	0	1	1	0	1	1	1	1
Rhaucoides ornatus	?	1	?	1	1	0	0	0	0	0	0	1	1	0	0	0	0	0	1	1
Rhaucus vulneratus	?	2	?	2	1	0	0	1	0	0	0	0	1	0	1	0	0	0	1	2
Eulibitia scalaris	?	2	?	0&1	0	0	0	1	0	0	0	1	0	0	1	0	0	1	1	2
Cynorta conspersa	?	2	?	1	0&1	0	0	0	2	0	0	2	0	0	0	0	0	0	1	2
Cosmetus delicatus	?	3	?	?	?	0	0	0	2	0	0	2	0	0	0	0	0	0	1	1
Metavononoides barbacenensis	?	2	?	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	1
Paecilaema u-flavum	?	3	?	1	1	0	0	0	1	0	0	2	0	0	0	0	0	0	1	1
Sibambea rotunda	?	2	?	2	1	0	0	0	2	1	0	2	0	0	0	1	0	1	1	1
Protus insolens	?	3	?	2	1	0	0	0	2	0	0	2	0	0	0	1	0	0	1	1
Gryne marginalis	?	3	?	2&3	1	0	0	0	2	0	0	2	0	0	0	1	0	0	1	2
Roquettea jalapensis	?	3	?	2	1	0	0	0	2	0	0	2	0	0	0	1	0	0	1	2
Paecilaemana crux	?	?	?	?	?	0	?	0	?	0	?	1	0	0	0	?	1	0	?	?
Paecilaemana halonata	?	?	?	?	?	0	?	0	?	0	?	1	0	0	0	?	0	0	?	?
Paecilaemana quadripunctata	1	3	?	?	?	0	?	0	?	0	?	1	0	0	0	?	0	0	0	2

	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
***Paecilaemella* sp. 5**	0	2	0	2	1	0	0	0	0	0	1	2	0	0	0	0	0	0	1	1
***Paecilaemella* sp. 2**	0	2	0	3	1	0	0	0	0	0	1	2	0	0	0	0	0	0	0	1
***Paecilaemella* sp. 3**	0	?	0	?	?	0	0	0	0	0	1	1	0	0	0	?	0	0	0	1
Gen. C sp. 1	1	3	1	3	1	0	0	0	0	0	1	2	0	0	0	0	0	0	1	1
***Paecilaemella* sp. 1**	0	2	0	2	1	0	1	0	0	0	-	2	1	1	0	0	0	0	1	1
***Paecilaemana* sp. 1**	1	2	0	1	1	0	0	1	0	0	1	1	1	0	0	0	1	0	0	1
***Paecilaemella* sp. 4**	0	2	0	3	1	0	0	0	0	0	-	2	2	1	0	0	0	0	1	1
Gen. A sp. 1	1	3	0	2	1	0	0	1	0	0	0	1	0	0	0	0	0	0	1	1
***Paecilaemana* sp. 2**	1	2	0	2	1	0	0	1	0	1	1	1	1	0	0	0	0	0	0	1
***Paecilaemana* sp. 3**	1	3	0	3	1	0	0	1	0	0	1	1	0	0	0	0	1	0	0	1
***Paecilaemella* sp. 6**	0	2	0	2	1	0	0	0	0	0	1	2	1	0	0	0	0	0	1	1
***Paecilaemella* sp. 7**	0	3	0	3	1	0	0	0	0	0	1	2	1	0	0	0	0	0	0	1
Paecilaemella armasi	0	2	0	3	1	0	0	0	0	0	1	2	1	0	0	0	0	0	1	1
Gen. B sp. 1	1	3	0	2	1	0	0	0	0	1	0	2	0	0	0	0	0	0	1	1
***Paecilaemana* sp. 4**	1	3	0	1	?	0	0	1	0	1	1	1	0	0	0	0	1	0	0	1

Table 1. (continued)

	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77
Chacoikeontus clavifemur	1	1	1	0	0	0	0	-	-	0	0	-	-	-	-	0	1	1
Vonones planus	0	0	0	1	0	1	1	0	0	0	1	1	0	0	0	1	0	1
Erginulus clavotibialis	1	0	2	1	1	?	1	2	1	0	0	-	-	1	-	0	-	-
Meterginus basalis	1	0	0	1	1	1	1	0	?	0	1	?	2	0	0	1	0	1
Poecilaemula signata	0	0	0	1	0	0	1	0	?	0	1	?	1	1	-	1	0	1
Acantholibitia biocellata	1	0	0	0	1	1	1	0	1	1	1	2	1	0	1	1	0	0
Metalibitia paraguayensis	0	0	2	0	0	1	1	-	-	0	0	-	-	-	-	0	-	-
Paecilaemella festae	1	0	0	0	1	2	1	0	1	0	1	1	0	2	-	1	1	0
Paecilaemella ornata	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Paecilaemella andi	0	0	0	1	1	2	1	0	1	0	1	1	0	2	-	1	?	0
Paecilaemella geminorum	1	0	0	0	1	2	1	0	1	0	1	1	0	2	-	1	1	0
Paecilaemella multimaculata	0	0	0	1	1	2	1	0	1	0	1	1	?	1	-	1	?	?
Eupoecilaema ornatum	0	1	0	1	1	2	4	0	0	0	1	1	?	1	-	?	?	?
Flirtea picta	1	0	0	1	1	2	1	0	1	1	1	2	0	0	0	0	-	-
Flirtea valida	1	0	0	0	1	2	1	0	0	1	1	?	1	0	0	0	-	-
Libitioides sayi	0	0	0	1	1	?	1	0	0	0	1	1	1	1	-	1	0	1
Taito spaceinvaders	1	0	0	?	1	1	1	0	?	0	1	1	2	0	0	0	-	-
Rhaucoides ornatus	1	0	0	0	1	0	1	0	?	0	1	1	1	2	-	1	1	0
Rhaucus vulneratus	1	0	0	0	1	1	1	3	0	0	1	1	1	0	0	1	0	0
Eulibitia scalaris	1	0	0	1	1	0	1	0	0	0	1	1	0	0	0	1	0	0
Cynorta conspersa	0	1	0	1	1	1	1	0	0	0	1	1	1	?	0	0	-	-
Cosmetus delicatus	1	0	1	?	1	0	0	0	?	1	0	?	?	3	-	0	-	-
Metavononoides barbacenensis	0	0	0	1	0	1	1	0	0	0	1	?	1	0	0	0	-	-
Paecilaema u-flavum	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	-	-
Sibambea rotunda	1	0	0	1	1	1	1	0	0	0	1	0	0	1	-	1	1	0

	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77
Protus insolens	1	0	1	0	1	1	0	2	0	1	1	-	2	0	0	0	-	-
Gryne marginalis	1	1	0	0	1	0	0	?	0	1	1	?	0	0	1	0	-	-
Roquettea jalapensis	1	1	1	0	1	1	0	0	0	1	0	?	0	3	-	0	-	-
Paecilaemana crux	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Paecilaemana halonata	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Paecilaemana quadripunctata	0	0	0	1	1	2	1	0	1	0	1	1	1	1	1	?	?	0
***Paecilaemella* sp. 5**	1	0	0	0	0	2	1	0	1	0	1	1	0	2	-	1	1	0
***Paecilaemella* sp. 2**	1	0	0	?	?	2	1	0	0	0	1	?	?	2	-	1	1	0
***Paecilaemella* sp. 3**	1	0	0	0	1	2	1	0	1	0	1	?	0	1	-	1	1	0
Gen. C sp. 1	1	0	0	0	1	2	1	4	1	0	1	1	0	2	-	1	1	0
***Paecilaemella* sp. 1**	1	0	0	0	1	2	1	0	1	0	1	1	0	2	-	1	1	0
***Paecilaemana* sp. 1**	1	0	0	0	1	1	1	0	1	0	1	?	0	?	?	0	?	?
***Paecilaemella* sp. 4**	1	0	0	0	1	2	1	0	1	0	1	1	0	2	-	1	1	0
Gen. A sp. 1	1	0	0	1	1	2	1	0	?	1	1	?	0	0	1	1	1	0
***Paecilaemana* sp. 2**	1	0	0	1	1	1	1	0	1	0	1	?	0	?	?	?	?	?
***Paecilaemana* sp. 3**	1	0	0	1	1	2	5	1	1	0	1	?	0	1	-	0	-	-
***Paecilaemella* sp. 6**	1	0	0	0	1	2	1	0	0	0	1	1	0	2	-	1	1	0
***Paecilaemella* sp. 7**	1	0	0	0	1	2	1	0	1	0	1	?	0	2	-	1	1	0
Paecilaemella armasi	1	0	0	0	1	2	1	0	0	0	1	2	0	2	-	1	1	0
Gen. B sp. 1	1	0	0	0	1	2	1	0	1	0	1	?	?	0	1	?	?	?
***Paecilaemana* sp. 4**	0	0	0	1	1	1	5	1	1	0	1	?	?	1	-	0	-	-

Character list

{0 DS, length (mm); Small, <3; Medium, 4-6; Large >6;

{1 DS, outline shape, type (Kury & Medrano, 2016); Alpha; Beta; Lambda; Delta; Epsilon; gamma; beta elongate;

{2 DS, outline shape, constrictions C1 (Kury & Medrano, 2016); Not marked (*Sibambea*); Poorly marked (*Paecilaema*); Well marked (*Ambatoiella*);

{3 Dorsal scutum, lateral border in posterior view; following the general body curvature; clearly marked by a deep groove and raised breaking the outline of scutum;

{4 DS, shape in lateral view; Flat (carapace and abdomen), slight constrictions; Constriction of scutal groove well marked, carapace quasi flat, abdomen convex (*Cynorta*); Lenticular, strongly convex in lateral view, zero constrictions;

{5 Dorsal scutum, thickness in lateral view (measured at area II); thin, less than half the height of Cx IV; intermediate, about 0.8 height of Cx IV; thick, about as tall as Cx IV; extremely deep, about 1.5 times taller than Cx IV;

{6 DS, anterior border of carapace, width (compared to abdominal scutum); Narrow, maximum abdomen width three times that of carapace (*Acantholibitia*); Wide, maximum abdomen width aprox. 2.5 times that of carapace (Taito); Very wide, maximum abdomen width less two times that of carapace (*Meterginus*);

{7 DS, abdomen, posterior border; Without coda; Small coda, 1/3 of mid-bulge length; Large coda, almost as large as mid-bulge;
{8 DS, coloration, blots, shades of white (Kury & Medrano, 2018); One shade (solid or vivid); Two (solid and translucent or faint); One shade, faint;
{9 DS, coloration, color blots on scutum, backbone as a continuous line (not dots); absent; present;
{10 DS, coloration, color blots on scutum, v-part of chevron; absent; present;
{11 DS, coloration, blots, ears of chevron (Kury & Medrano, 2018); Absent; Present;
{12 DS, coloration, color blots on scutum, omega stripe; Absent; Present;
{13 DS, coloration, blots, numerous minuscule yellow-white dots covering denselly the DS; Absent; Present;
{14 DS, coloration, blots, area V, isolated posterior stripe; Absent; Present;
{15 DS, coloration, blots, suspender; Absent; Present;
{16 DS, coloration, blots, suspender, shape; Entire, two vertical lines forming suspenders on DS; Fragmented, two vertical rows of dots on DS;
{17 DS, coloration, blots, band on posterior border of carapace; Absent; Present (entire or fragmented);
{18 DS, coloration, blots, band invading area I; Absent; Present;
{19 Inter-ocular distance, proportion to carapace; Narrow (<1/4 of carapace width); Wide (1/3 of carapace width); Very wide (1/2 of carapace width);
{20 Carapace, guards of protoglyphs, shape; Reduced to a rounded lobe (*Rhaucus*); Triangular (*Eulibitia*); Square (*Libitia*); Bifurcate or multifurcate (*Metalibitia*);
{21 Abdominal scutum, mesotergal area I, armature; Without armature; Paramedian armature;
{22 Abdominal scutum, mesotergal area II, armature; Without armature; Paramedian armature;
{23 Abdominal scutum, mesotergal area III, armature; Absent; Present;
{24 Abdominal scutum, area III, armature, shape (in females if sexual dimorphism is present); Spines: paramedian acuminated high armature (longer than wide); Tubercules: paramedian acuminated thick tubercles (wider than long); Buttons: small rounded tubercles; Pseudo-columns: thick rounded and long spines;
{25 Abdominal scutum, area III, paramedian spines, size (in female if sexual dimorphism is present); Low spines, one third of the height of DS in lateral view; High spines, as high as DS in lateral view;
{26 Abdominal scutum, mesotergal area IV, armature; Absent; Paramedian armature;
{27 Free tergite I, yellow coloration; uncolored; Entirely colored; Paramedian granules colored; Dots equally spaced; Irregular coloration, not including granules;

{28 Leg I, coxa, proventral apophysis (element 3); absent; present, apophysis inserted ventro-apically, but projected dorsally, matching dorsal apophysis of same podomere (element 4);
{29 Leg I, coxa, posterior wall of the ditch (element 1); small granules; stout tubercles; rows of acuminate tubercles;
{30 Chelicerae, sexual dimorphism; Absent or imperceptible, basichelicerite and-or hand monomorphic; Present, basichelicerite and-or hand incrassate in males;
{31 Chelicera, cheliceral hand, sexual dimorphism, type; immensely inflated, projected dorsally, covering frontal part of the scutum in frontal view; immensely inflated, but not projected dorsally (*darko*); moderately inflated (*cynorta*);
{32 Chelicerae, hand, fixed finger, pectination; Absent, smooth; Serrated; Well-marked teeth; Keel; Well-marked teeth with a basal bifurcate one;
{33 Chelicera, hand, movable finger, distal teeth; Absent; Present;
{34 Chelicerae, hand, movable finger, basal triangular spine; Absent; Present;
{35 Pedipalp, general shape; Cylindrical; Femur compressed and tibia spoon-shaped, applied over the chelicerae;
{36 Pedipalpus, tibia, prolateral margin; Without prominent flap; With remarkable flap along inner side;
{37 Pedipalp, tibia, wider side; Apical, *Roquettea*-like; at 3/4 length-*Cynorta*-like; in mid length, *Rhaucus*-like;
{38 Legs, luminosity; Absent, trocanter and proximal part of femur the same color than DS; Present, trocanter and proximal part of femur lighter than DS;
{39 Leg I, tarsomeres, sexual dimorphism; Absent, all tarsomeres of same width in male and females; Present, one or more tarsomeres swollen in males;
{40 Leg I, tarsomeres, sexual dimorphism, type; Basitarsomere 2 to 3 times longer than the following ones; All basitarsomeres around the same size;
{41 Leg I, tarsomeres, Ta counts; four; five; six; seven to nine; 10 or more;
{42 Leg III, femur-tibia, ventral armature; Absent; Present;
{43 Leg III, tarsomeres, Ta counts; five to six; seven to eight; nine to ten; 11 to more;
{44 Leg IV, tarsomeres, Ta counts; five to eight; nine to 13; more than 13;
{45 Leg IV, coxa of male, prolateral distal armature; Unarmed or mostly reduced; Well marked apophyse;
{46 Leg IV, coxa and trochanter, orientation; Oblique; Cx IV of male entirely parallel to main body axis, so that Fe IV lies straight, while in females Cx is oblique and Fe in slanted;
{47 Leg IV, coxa, prodorsal basal armature; None; Groin warts;
{48 Leg IV, coxa, visibility in dorsal view; Entirely visible; Partially covered by DS (scutum outline touches or surpasses Cx outline); Entirely covered by DS (only posterior margin apparent);
{49 Leg IV, coxa, coloration; Uniform brown; White/yellow spots;

{50 Leg IV, coxa, outline of lateral border in dorsal view; Convex; Concave; Convex proximally and concave distally (C. compressicoxa);
{51 Leg IV, femur, length, proportion femur IV vs DS length ; Very short, less than 1x DS; Short, 1.5-2x DS; Long, 2.5x DS or more;
{52 Leg IV, femur, comb of pro-ventral armature in distal third; Absent; A comb a low independent tubercles increasing in size distally; A comb of tubercles sometimes fused in the base or forming a widening;
{53 Leg IV, femur, distal prolateral set of long hooks forming a comb; absent; present;
{54 Leg IV, femur, curvature (in dorsal view); Straight or substraight; Curved; curved in distal third;
{55 Legs III-IV, tarsal claws, pectination in inner side; Absent (smooth); Present (pectinate);
{56 Legs I-III, trochanters, basal retrolateral spine (*Taito*); Absent; Present, either in I, II, III or in I, II; present only in Tr III (*Prostygnus*);
{57 Leg IV of male, trochanter, retrolateral armature, distal part; unarmed; with retrolateral apical spur;
{58 Penis, VP, MS A1 position; extremely basal in VP (immediately distal to podium), contained in basal quarter of VP; contained in second proximal quarter of VP (from mid-length to proximal);
{59 Penis, VP, MS A, number; Extremely reduced, not detectable; One pair; Two pairs;
{60 Penis, VP, MS A1, length; Short, or very short, reduced; Long, as long as D1;
{61 Penis, VP, MS C3, presence; Absent; Present;
{62 Penis, VP, MS Cs, shape; Curved, flattened; Straight or sub-straight, cilindrical; Very short, straight;
{63 Penis, VP, MS Cs, tip, shape (dependent on the flattened shape); Acuminated; Truncated or rounded;
{64 Penis, VP, MS D1, size and stoutness; Small and thin; Long and stout, almost as a MS C;
{65 Penis, VP, MS D2, position; lateral, in the distal half; lateral, in the proximal half; dorso-lateral, at mid-length of VP;
{66 Penis, VP, basic shape; Rectangular, lateral margins sub-paralel (*Protus*-like); T-shape, distal border wider than basal, membranous region of MS C concave (*Rhaucus*-like); Inverted trapezium, basal portion of VP wider than distal portion (*Gryne leprosa*-like); pyriform (*Prostygnus*-like); asymmetrical hourglass; ovoid, with base narrower forming a neck;
{67 Dorsal process of glans, shape; Rounded, thumb-like; Very short, dome; Slender and accuminate; Short and cylindrical; Short and accuminate;
{68 Penis, glans, dorsal process, size; Short, half of stylus length; Long;
{69 Penis, VP, length; Short, approx. 1.5 times VP width; Long, length two times of VP width;
{70 Penis, VP, ventral surface, texture; Entirely glabrous; Some type of microsetae present;

{71 VP, microsetae, lateral patches of cteniform T4, proximal-distal expansion; restricted to corners of VP; expanding proximally to occupy the whole length of VP; lateral patches indistinct, extremely reduced;
{72 Penis, VP, basal section including truncus, texture; Microsetae not invading truncus; Microsetae gently invading the truncus; Microsetae clearly invading truncus;
{73 Penis, stylus, wattle, extension in ventral part; Going to the base of stylus (complete); From the middle to tip of stylus (as *Sibambea*); Restricted to distal part (as *Rhaucoides*); Almost absent (as *Roquettea*);
{74 Penis, stylus, wattle (when complete), shape; Triangular, wider in the middle (as in *Vonones*); Rectangular, same width in all extension (as in *Bodunius biocellatus*); Triangular, wider in the apice (as in *Libitia*);
{75 Penis, stylus, stylar barbs; Absent; Present;
{76 Penis, stylus, wattle, stylar barbs, disposition in ventral part; Not reaching the ventral margin of stylus+wattle; Reaching the ventral margin of stylus, forming ventral peak;
{77 Penis, stylus, wattle, stylar barbs, disposition in dorsal part; Not reaching the dorsal margin of stylus; Reaching the dorsal margin of stylus;

Systematic accounts

Cosmetidae Koch, 1839

Flirteinae Medrano, Kury & Mendes, 2021

Paecilaemana Roewer, 1928

• *Paecilaemana* Roewer 1928: 624. Type-species by subsequent designation, Kury (2003a: 80): *Paecilaemana halonata* Roewer, 1928.
Paecilaemana – Mello-Leitão 1932: 91; Roewer 1933: 289; Mello-Leitão 1933: 106; Kury 2003: 80; Kury & Alonso-Zarazaga 2011: 51.
• *Poecilaemana*: Mello-Leitão 1935: 113. Unjustified emendation of *Paecilaemana* Roewer, 1928, therefore nomenclaturally unavailable.

Etymology. From the pre-existing genus *Paecilaema* + random suffix *-ana*. Gender feminine.
Placement. Originally in Cosmetinae. Transferred to Flirteinae by Medrano, Kury & Mendes (2021: 33).
Included species. *Paecilaemana crux* Roewer, 1928 (type-species by subsequent designation), *Paecilaemana halonata* Roewer, 1928, *Paecilaemana multimaculata* "comb. nov." and *Paecilaemana quadripunctata* Goodnight & Goodnight, 1942.
Distribution. Western Ecuador moist forests and Isthmian-Atlantic moist forests of Panama (Fig. 9)

Paecilaemana crux Roewer, 1928

FIG 3

• *Paecilaemana crux* Roewer 1928: 625, fig. 49.
Paecilaemana crux – Kury 2003: 80.

Type data. ♀ holotype (SMF RII 182), from Ecuador, Guayas, Balzar (Examined by photograph).

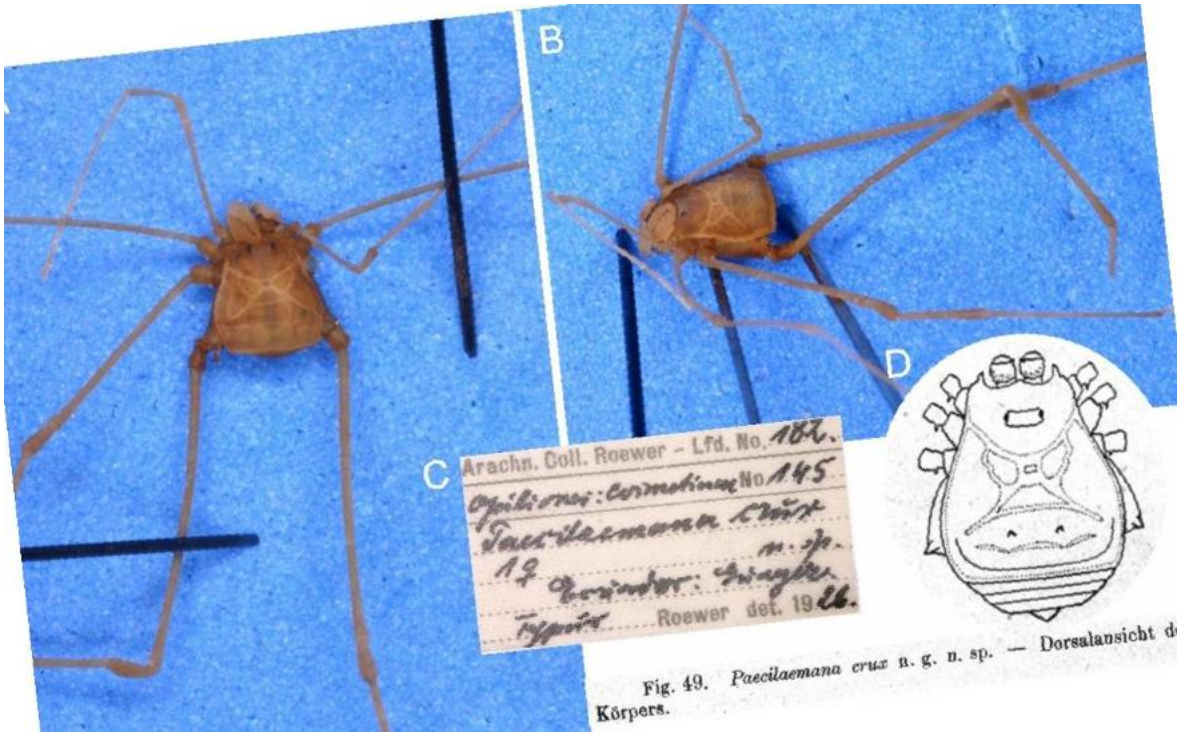

Figure 3. *Paecilaemana crux* Roewer, 1928: A–C. Female holotype (SMF 182); Photos courtesy Ricardo Pinto-da-Rocha: A. Habitus, dorsal view; B. Same, dorsolateral view; C. Original label. D. Original illustration (Roewer, 1928).

Distribution. Ecuador. Known only from its type locality (Fig. 9).

Remarks. This species of *Paecilaemana* correlates to *P. halonata* by having an epsilon-shaped dorsal scutum and with the other species of the genus by having long and thin but robust legs, growing thicker from I–IV, unarmed in females. It differentiates from the others by its blots of the dorsal scutum. Although there aren't any granules visible in the mesotergal areas in the photographs of the type specimen (Fig. 3), it is mentioned in its original description (Roewer, 1928) that the areas I–III of the dorsal scutum has a pair of median tubercles. Roewer also describes the blots of the dorsal scutum as it follows: "Scutum narrowly white-margined laterally and posteriorly, with a narrow white V-mark on the first scutal groove anteriorly, which transitions into a white, diagonally placed cross marking on areas I and II. This cross marking stands broadly medially on area I, where it is separated from the V-marking of the first scutal groove by a small median spot, while the distal parts of the femora are connected by a narrow white transverse band on the third scutal groove; fourth scutal groove with a narrow, white, weakly tripartite transverse band.".

***Paecilaemana halonata* Roewer, 1928**
FIG 4

• *Paecilaemana halonata* Roewer 1928: 625, fig. 48.
Paecilaemana halonata – Kury 2003: 80.

Type data. ♀ holotype (SMF RII 181), from Ecuador, Guayas, Balzar (Examined by photograph).

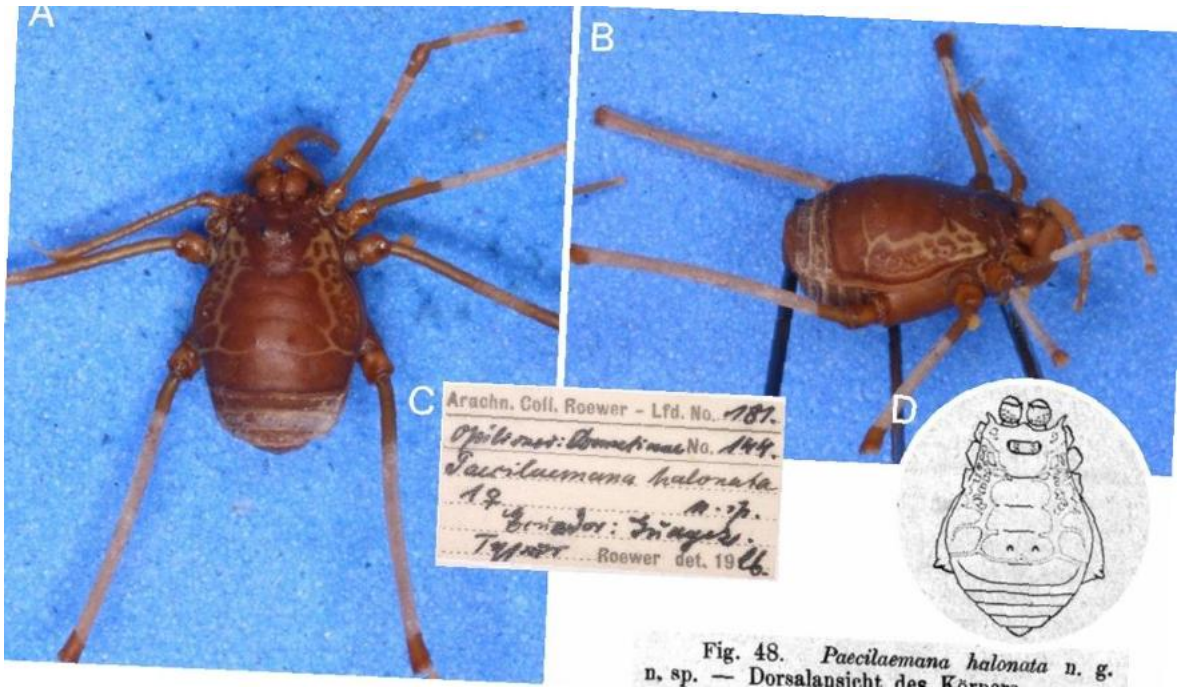

Figure 4. *Paecilaemana halonata* Roewer, 1928: A–C. Female holotype (SMF 181) Photos courtesy Ricardo Pinto-da-Rocha: A. Habitus, dorsal view; B. Same, dorsolateral view; C. Original label. D. Original illustration (Roewer, 1928).

Distribution. Ecuador. Known only from its type locality (Fig. 9).

Remarks. This species of *Paecilaemana* correlates to *P. crux* by having an epsilon-shaped dorsal scutum and with the other species of the genus by having long and thin but robust legs, growing thicker from I–IV, unarmed in females. It differentiates from the others by its blots of the dorsal scutum, and from *P. crux* by having a pair of tubercles on area III of the dorsal scutum. Roewer (1928) mentions granulations on various parts of the body, which are not visible on the photographs of the type specimen (Fig. 4). Roewer also describes the blots of the dorsal scutum as it follows: “Carapace anteriorly on each side with a small, isolated white comma-shaped spot; sides of the carapace and scutum up to area II with a broad, white, net-like pattern, with areas I and II of the scutum laterally each surrounded by a loop and from area III laterally a white hook line, as well as on the 4th

scutum transverse groove a band originates, which connects internally with a narrow double arch on the 4th scutum transverse groove. This double arch gives rise to a straight band towards the lateral side of the scutum and remains unbranched on both sides, forming the only median connection of the broad white lateral markings of the scutum."

***Paecilaemana multimaculata* (Wood, 1869) "comb. nov."**
FIGS 5, 6, 7

• *Gonyleptes multimaculatus* Wood 1869: 438, pl. 24, fig. 10. Subjective junior synonym of *Cosmetus cordatus* Gervais, 1844 by Butler (1873: 115); synonymy rejected by Medrano, Ázara & Kury (2020: 19).
Gonyleptes multimaculatus – Cokendolpher & Peek 1991: 95.
Cranaus multimaculatus: Simon 1879: 241.
Paecilaemella multimaculata: Medrano, Ázara & Kury 2020: 19, fig. 13 (revalid.).
• *Cynorta itacoaiensis* H. Soares 1970: 324, fig. 2. Subjective junior synonym of *Gonyleptes multimaculatus* Wood, 1869 by Medrano, Ázara & Kury (2020: 19).
Cynorta itacoaiensis – Kury 2003: 45.

Type data. *G. multimaculatus*: Type(s), whereabouts unknown, from "Napo and Marañon" [possibly the confluence of both rivers, near Iquitos, Loreto, Peru]. *Cynorta itacoaiensis*: ♂ holotype (MNRJ 5059), from Brazil, Amazonas, Upper Itaquaí River.
Records. Brazil, Acre, Cruzeiro do Sul, proximidades do Aeroporto Internacional de Cruzeiro do Sul, rodovia AC -405; (7.595972° S, 72.766528° W; 190 m) (Medrano, Ázara & Kury, 2020).
Doubtful records. Ecuador, Chimborazo, Sibambe (Roewer 1923). The Ecuadorian material (Roewer's record) is not surely referable to this species, because Sibambe is in a páramo around 3000 m, thus entailing a very unlikely species range from lowland Amazonia to Andean highlands.
Examined material. 1♂ (MNRJ 540) Colombia, Amazonas, San Martin de Amacayacu (-3.763333,-70.298611, alt.: 320 m); 2♀ (MNRJ 2953) Brazil, Acre, Cruzeiro do Sul, Banho do Cunha - Leste (-7.548372,-72.71505, alt.: 194 m), 8 Sep. 2021, AFA Lira leg.; 1♀ (QCAZ I 265317) Ecuador, Orellana, Francisco de Orellana, Est. Rio Huiririma (-0.6333, -75.4000, alt.: 220 m), C Carpio leg.; 1♂ (QCAZ I 265307) Ecuador, Napo, Bloque 31, Sub-baga (-0.99559, -77.81296, alt.: 204.85 m), 6 Nov. 1997, R Fonseca leg.; 1♀ (MPUJ_ENT 0064468) Colombia, Amazonas, Letícia, Monilla Amena, (-4.202099, -69.935935, alt.: 70 m), 30 Set. 2004; 1♀ (MUSM-ENT 0514512) Peru, Loreto, Maynas, Rio Napo (as "1°45'23.44"S, 3°4.43'22.93"W" in the original label but "-1.49452, -75.38675" considered as the correct coordinates, alt.: 210 m), 22 Dez. 2008, W Yawarcani leg.; 1♂ (MUSM-ENT 0512363) Peru, Loreto, Maynas, Rio Napo (as "1°45'23.44"S 3.4°43'22.93"W" in the original label but "-1.49452, -75.38675", considered as the correct coordinates alt.: 210 m), 22 Dez. 2008, W Yawarcani leg.; 1♀ (MUSM-ENT 0514090)

Peru, Loreto, Maynas, Napo, Gaseoducto Barret, (-1.49452, -75.38675, alt.: 178 m), 19 Fev. 2008, W Paredes leg.

iNaturalist records. Parque Nacional Yasuní, Orellana, Orellana, Ecuador (-0.572958 -76.550063) https://www.inaturalist.org/observations/131282462; Provincia de Sucumbíos, Ecuador (-0.47005 -76.457264) https://www.inaturalist.org/observations/27419747; Puesto de control MAE, Río Tiputini, PN Yasuní, Aguarico, Ecuador (-0.837389 -75.581747) https://www.inaturalist.org/observations/31795979; Alejandro Labaka, Ecuador (-0.44652 -76.527237) https://www.inaturalist.org/observations/58303361; Orellana Province, Ecuador (-0.67427 -76.397552) https://www.inaturalist.org/observations/6494119; Cuyabeno Wildlife Reserve ,Sucumbíos Province, Ecuador (-0.0692 -76.164903) https://www.inaturalist.org/observations/12596802; Puerto Nariño, Amazonas, Colombia (-3.771948 -70.377663) https://www.inaturalist.org/observations/178037791; Leticia, Amazonas, Colombia (-4.000446 -69.966933) https://www.inaturalist.org/observations/177749102; Maynas, Loreto, Peru (-3.562006 -73.123103) https://www.inaturalist.org/observations/102022425; Maynas Province, Peru (-3.965396 -73.419976) https://www.inaturalist.org/observations/126687276; Maynas, Loreto, Peru (-3.975063 -73.422326) https://www.inaturalist.org/observations/130898423; Cruzeiro do Sul, Acre, Brasil (-7.563346 -72.716006) https://www.inaturalist.org/observations/106408313; Cruzeiro do Sul, Acre, Brasil (-7.563516 -72.715544) https://www.inaturalist.org/observations/42098346.

Distribution. Southwest Amazon moist forests of Brazil, in Acre and Amazonas states. Solimões-Japurá moist forests of Colombia, in Amazonas department. Iquitos várzea and Napo moist forests of Peru and Ecuador, in Loreto department and Sucumbios and Napo provinces (Fig. 9).

Figure 5. *Paecilaemella multimaculata* (Wood, 1869): A. Live specimen from Cruzeiro do Sul. Photo courtesy Leonardo Carvalho. B–E. male from San Martin de Amacayacu, Amazonas, Colombia (MNRJ 540): B. Habitus, detail of the dorsal scutum in dorsal view; C. Same, ventral view; D. Same, frontal view; E. Same, dorsal view; Scale bars: B–D = 1 mm, E = 5 mm;

Diagnosis. *P. multimaculata* can be distinguished from other species within the genus by the pattern of coloration of the dorsal scutum and by having a lambda-shaped dorsal scutum. It correlates to *P. quadripunctata* by the swelling of the basitarsomeres of leg I in males, which is not noticeable in the other species for we only had access to females. It also correlates to the other species by having an armature on area III of the dorsal scutum, although *P. multimaculata* can present a large spine, while the others presents a tubercle.

Redescription. (Male). Measurements. Body length: 5.4. Maximum width of scutum: 4.6. Carapace length: 1.7, width 2.9. Interocular distance: 0.8. Legs: I: 19.32 (0.81, 5.02, 1.30, 3.37, 6.02, 2.80), II: 34.76 (0.74, 9.67, 1.26, 7.93, 9.68, 5.48), III: 31.39 (1.03, 7.20, 7.56, 4.35, 7.40, 3.85), IV: 34.61 (0.99, 9.44, 1.82, 6.33, 11.33, 4.70).

Dorsum. Medium sized cosmetid (dorsal scutum length approximately 5 mm). Dorsal scutum in dorsal view lambda-shaped with shallow cheliceral sockets (Figs. 5A, B, E; 6A). Dorsal scutum flat in lateral view (Fig. 6B), coxa IV entirely visible in dorsal view (Fig. 6A), thicker than scutum in lateral view. Ocularium low, narrow, with median depression. Scutal grooves poorly delimited (Fig. 5A, B). Scutum with pair of granules or spines in area III (Fig. 5B, D). Free tergites I–III and anal operculum unarmed.

Venter (Fig. 5C). Coxae I–III triangular, transverse to main body axis. Coxae II to IV connected by tubercle bridges. Ventral elements of coxa I: e1 and e2 forming a single row of ca 9 tubercles; e3 = 1 very large conical process, visible in dorsal view; e4 = one large bifid process; e5 = indistinct cluster of ca. nine cusps. The row of tubercles formed by e1 and e2 is continued in coxa II towards the genital operculum by a row of three tubercles. Coxa IV pentagonal, greatly developed, oriented obliquely, but almost parallel to the body axis. Stigmatic area T-shaped with stigmata large, unconcealed. Free sternites smooth and unarmed.

Chelicera (Fig. 6G). Neither basichelicerite nor hand thickened or swollen in males. Bulla short, rounded, bordered with rounded tubercles, eight to nine ectal and seven to nine posteriors. Movable finger without one basal triangular tubercle but with a row of smaller rounded tubercles. Fixed finger with a row of rounded tubercles, larger than those of the movable finger.

Pedipalpus (Fig. 6H, I). Femur strongly compressed, concave on mesal surface, borders armed with long tubercles. Tibia strongly depressed, with a weakly distinct groove on the mesal edge. Shape asymmetrical, with ectal side more pronounced, armed distally with a row of three short spines. Mesal side with a distal spine. Tarsus moderately elongated, with an irregular ventro-ectal row of short spines, a much sparser ventro-mesal row of short spines.

Legs. Elongate and moderately thick (growing thicker from I to IV). Males with basitarsomeres I thickened, first basitarsomere around the same size of the following ones (Fig. 6F). All femora straight. Femur IV armed with a row of scattered granules positioned retrolaterally in distal part and a row of three larger ventroprolateral tubercles (Fig. 6C–E). Tibia IV with scattered granules. Femur III unarmed. Tarsal claws unpectinate. Tarsal formula: 6(3)-6(3)/15(3)-14(3)/9-8/9-9.

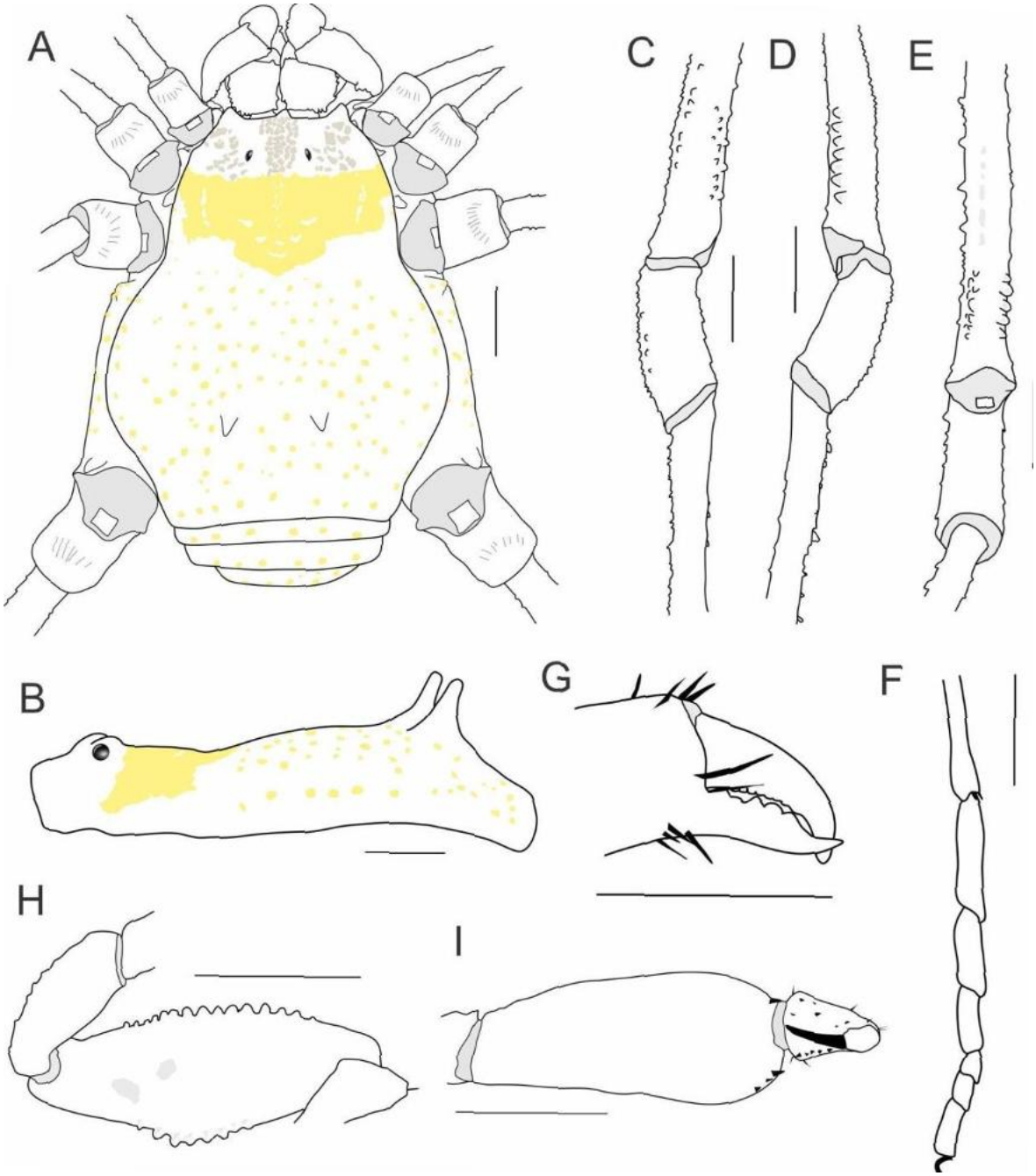

Figure 6. Schematics drawings of *P. multimaculata*, male. A–F: (MUSM-ENT 0512363). A. Body, dorsal view. B. Dorsal scutum, lateral view. C. Left leg IV: distal femur and trochanter: retrolateral view. D. Same, prolateral view. E. Same, ventral view. F. Left leg I, tarsomeres, lateral view. G–I: (MNRJ 540) G. Distal part of the cheliceral hand. H. Left pedipalp: patella, femur and trochanter, mesal view. I. Same, tibia and tarsus. Scale bars = 1 mm.

Color (Fig. 5). Background of body (dorsal and ventral) Brownish Black (65), dorsal scutum with lighter mottling Dark Grayish Brown (62) in carapace. Appendages, including pedipalps and chelicerae Brownish Black (65), pedipalps and chelicerae with lighter mottling Dark Grayish Brown (62). Blots Light Greenish Yellow (101). Band on the posterior border of carapace, with a central triangular posterior extension. Laterally in this

band it has discolored spots that appear to separate the ears of chevron, in addition to a group of discolored spots in the triangular extension. Small dots covering the rest of the dorsal scutum, free tergites and coxa IV. A few small dots also covering coxae II and III. Variation. Females with femur IV unarmed, basitarsomeres of leg I not thickened and not as long as those in males, chelicerae slightly smaller than in male. Area III variates by having from a small tubercle to a large spine. Blots on dorsal scutum with posterior extension varianting from being triangular to more rounded, in Acre specimens it appears to be straight. The small dots may start right after the band or have a gap between the band and the first scutum area.

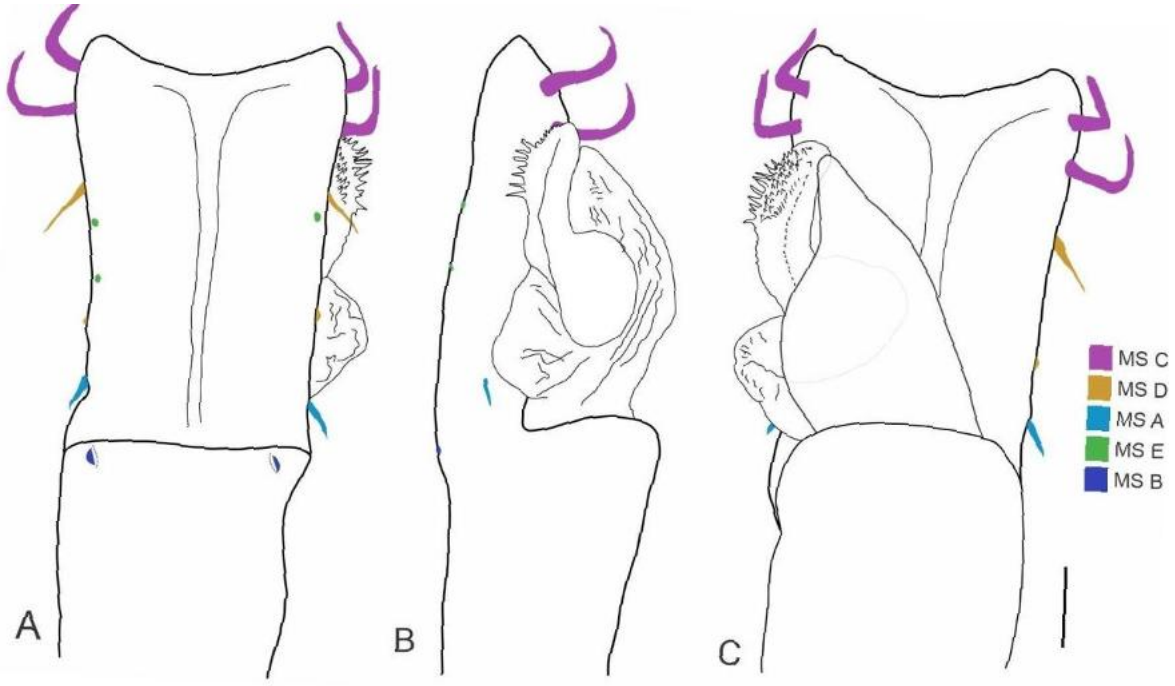

Figure 7. Schematic drawings of *Paecilaemella multimaculata* (QCAZ I 265312), distal part of penis. A. Ventral view; B. Lateral view; C. Dorsal view. MS = Macrosetae. Scale bar = 0.1 mm.

Genitalia (Fig. 7). VP of penis rectangular, widening distally. Lateral margins of the dorsal portion of VP (at MS C level) concave along their length, basal to MS C1–C2. Five pairs of larger macrosetae inserted on lateral margin of VP: Two pairs C1–C2 greatly developed, curved and flattened; the third pair of macrosetae, adjacent to C1–C2, robust, cylindrical and straight, is best interpreted as D1; D2 is reduced, acuminate and located basally, inserted in the dorsal part of the VP. The fifth pair of MS, here interpreted as A1, is straight and similar in shape to D1. A pair of small macrosetae B is located ventro-basally

on VP, while E1-E2, also reduced, are located ventrally and around the middle of the VP. Stylus strongly curved, cylindrical. Dorsal process of glans thumb-shaped.

***Paecilaemana quadripunctata* Goodnight & Goodnight, 1942**
FIG 8

• *Paecilaemana quadripunctata* Goodnight & Goodnight 1942: 9 fig.25.
Paecilaemana quadripunctata – Goodnight & Goodnight 1947: 9; Kury 2003: 80.
Paecilaemella quadripunctata: Eisner et al. 1977: 322.
Paecilaemella quadripunctata – Acosta et al. 1993: 27.

Type data. ♂ holotype, ♀ paratypes (AMNH), Panama, Canal Zone. Barro Colorado Island.
Records. Panama, Canal Zone. Madden Forest. Colón, Santa Rosa (Goodnight & Goodnight 1947).
Examined material. 1 ♂ (MCZ:IZ:38118) Panama, Canal Zone, Barro Colorado Island (9.15692500, -79.846683) N. Banks leg. (Examined by photograph).
Distribution. Panama, Isthmian-Atlantic moist forests (Fig. 9).

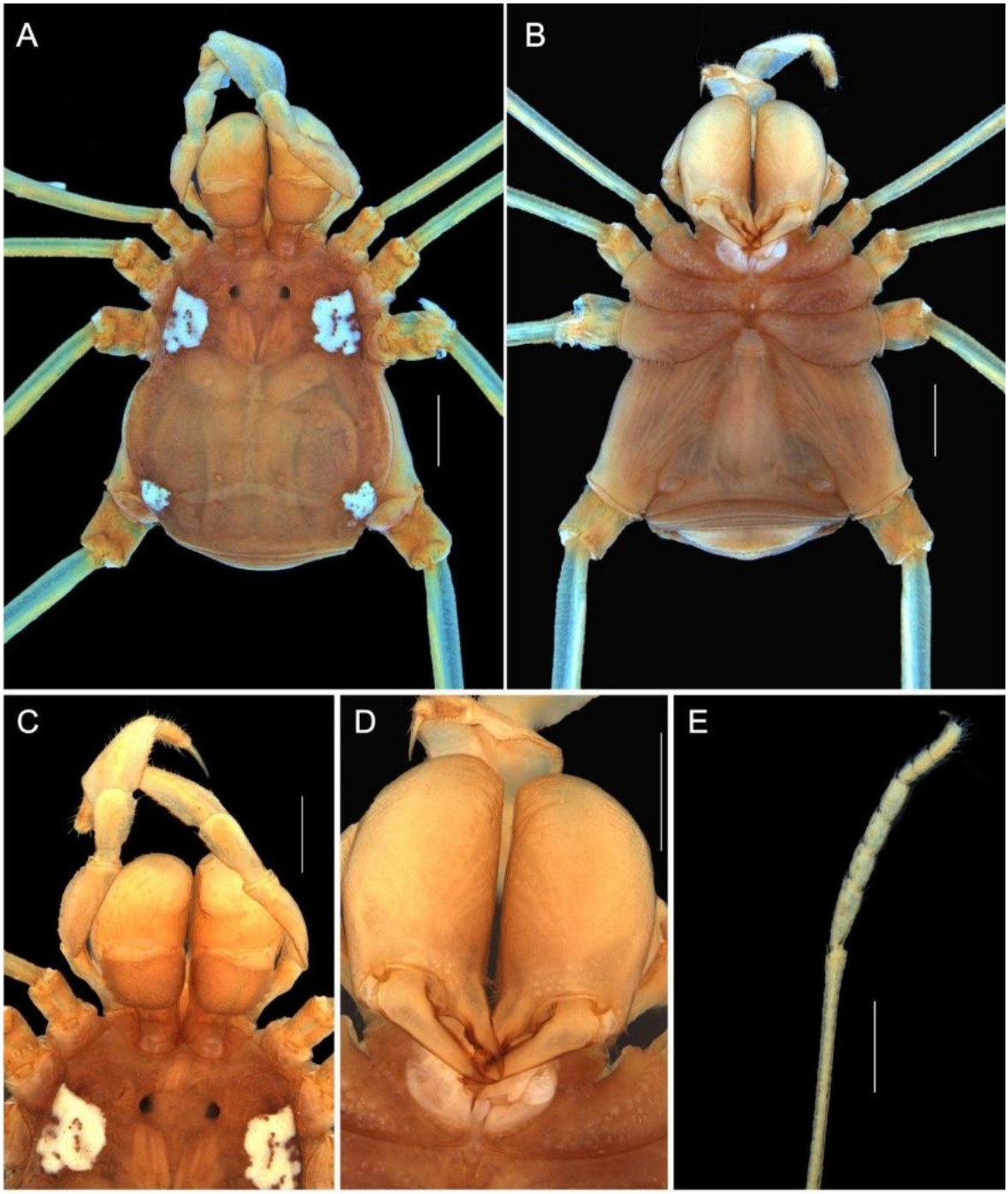

Figure 8. *Paecilaemana quadripunctata* Goodnight & Goodnight, 1942 (MCZ 38118): A. Habitus, dorsal view; B. Same, ventral view; C. Detail of pedipalpi and chelicerae; D. Detail of chelicerae; E. Leg I, distal part; Scale bars: A–B = 5 mm; C–E = 1 mm.

Remarks. This species of *Paecilaemana* correlates to the others by long and thin but robust legs, growing thicker from I–IV, unarmed. It differentiates from the others by having a beta-shaped dorsal scutum and by its blots of the dorsal scutum. It differentiates from *P. halonata* by not having a pair of tubercles on area III of the dorsal scutum. This species also presents an enlargement of the chelicerae in males and a swelling of the

basitarsomeres of leg I, which it's not visible in the other species of *Paecilaemana* (except *P. multimaculata*) for we have access only to females.

Goodnight & Goodnight (1942) mentions granulation and median tubercles on the third area, which isn't visible on the photographs that we had access (Fig. 8) and describes the blots of the dorsal scutum as it follows: "With four irregular splotches of white arranged as follows on the dorsal scute: anterior pair of spots on either side at the posterior portion of the cephalothorax and the anterior part of the abdomen; posterior pair of spots on the third and fourth areas; these spots are along the lateral margins; at the median line, the margin between the cephalothorax and the abdomen has a fleck of white varying in size in different individuals.".

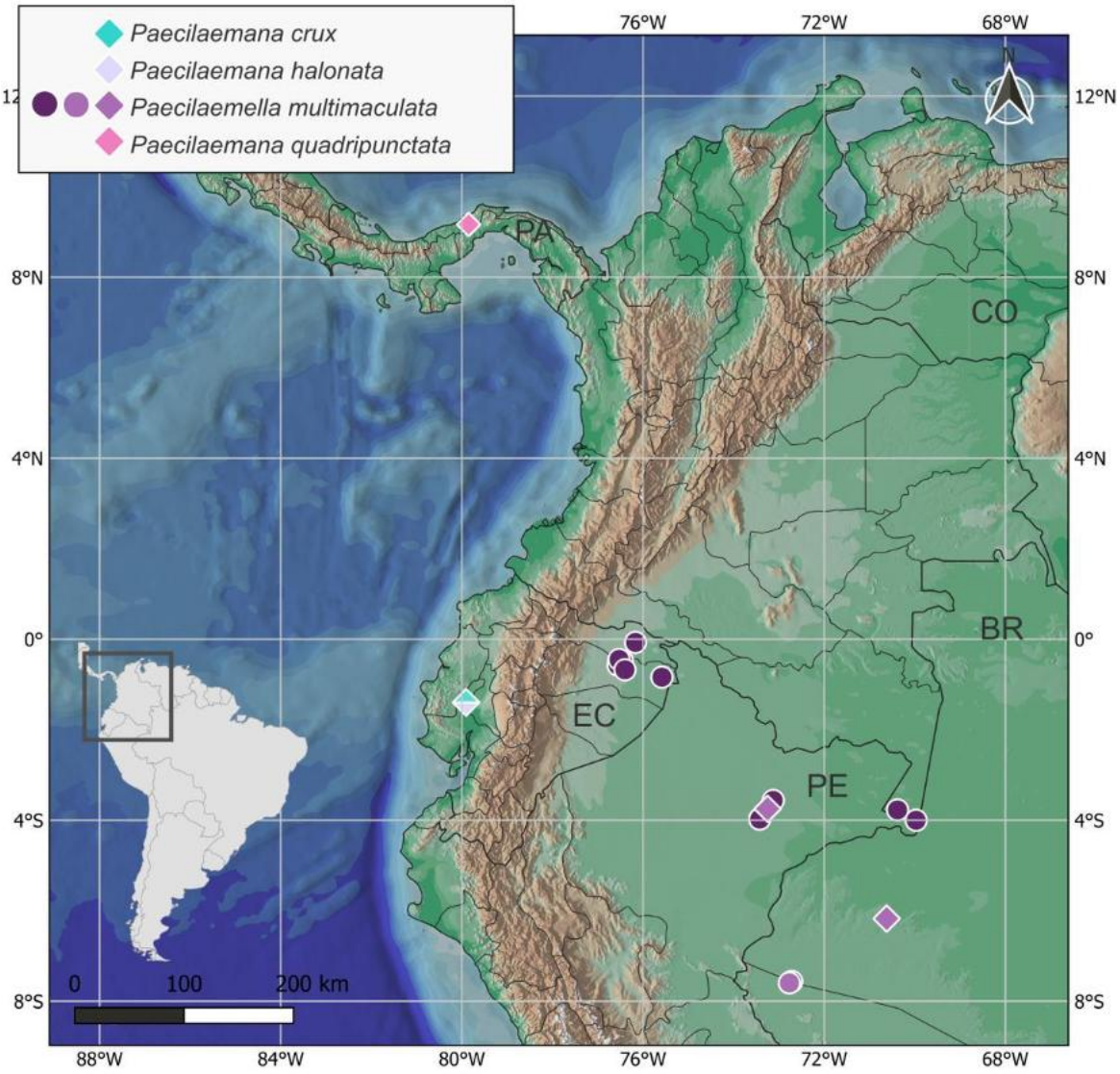

Figure 9. Known distribution of *Paecilaemana.* Rhombuses indicate the type locality for each species and darker circles indicate iNaturalist records.

***Paecilaemella* Roewer, 1925**

• *Paecilaemella* Roewer 1925: 13. Junior subjective synonym of *Meterginoides*, Roewer, 1912 by Goodnight & Goodnight (1942: 9); junior subjective synonym of *Paecilaema* C.L. Koch, 1839 by Goodnight & Goodnight (1953: 54); synonymy rejected by Kury & Medrano (2018: 210).
Paecilaemella – Roewer 1928: 626; Mello-Leitão 1932: 91; Roewer 1933: 290.
• *Poecilaemella* Mello-Leitão 1935: 113. Unjustified emendation.

Etymology. From the pre-existing genus *Paecilaema* + suffix *-ella*. Gender feminine.
Placement. Originally in Cosmetinae. Transferred to Flirteinae by Medrano, Kury & Mendes (2021: 33).
Included species. *Paecilaemella festae* Roewer, 1925 (type-species by monotypy), *Paecilaemella andi* Medrano, Caramori & Kury, 2025, *Paecilaemella armasi* Medrano, Caramori & Kury, 2025 and *Paecilaemella geminorum* Medrano, Caramori & Kury, 2025.
Distribution. Upper Amazonas basin of Brazil, Colombia, Ecuador and Peru. Only *P. ornata* is an exception, occurring on the Pacific slope of the Ecuadorian Andes, outside the typical range.
Diagnosis. Large cosmetids with dorsal scutum epsilon-type. Scutal areas without prominent ornamentation or with tubercles in area III. Basitarsomeres I thickened, first basitarsomere three to five times longer than the following ones. Coxa IV entirely visible and concave or almost straight in dorsal view. Femur IV unarmed or with a comb of pro-ventral armature in the distal third. Penis morphology with two apical curved MS C, two MS D (a long distal MS and a short basal one), and one long MS A. Dorsal process of glans thumb-shaped.

***Paecilaemella festae* Roewer, 1925**
FIGS 10, 11, 12

• *Paecilaemella festae* Roewer 1925: 13, fig. 11. Junior secondary homonym of *Paecilaema festae* Roewer, 1925.
Paecilaemella festae – Roewer 1928: 626, pl. 1, fig. 10; Kury & Medrano 2018: 210.
• *Paecilaema festiva* Kury 2003: 76. *Nomen novum* for *Paecilaemella festae* Roewer, 1925.
Paecilaema festivum: Kury & Alonso-Zarazaga 2011: 51.

Type data. holotype (MZTU); paratypes (SMF RII 120), Ecuador, Morona-Santiago, Santiago Valley.

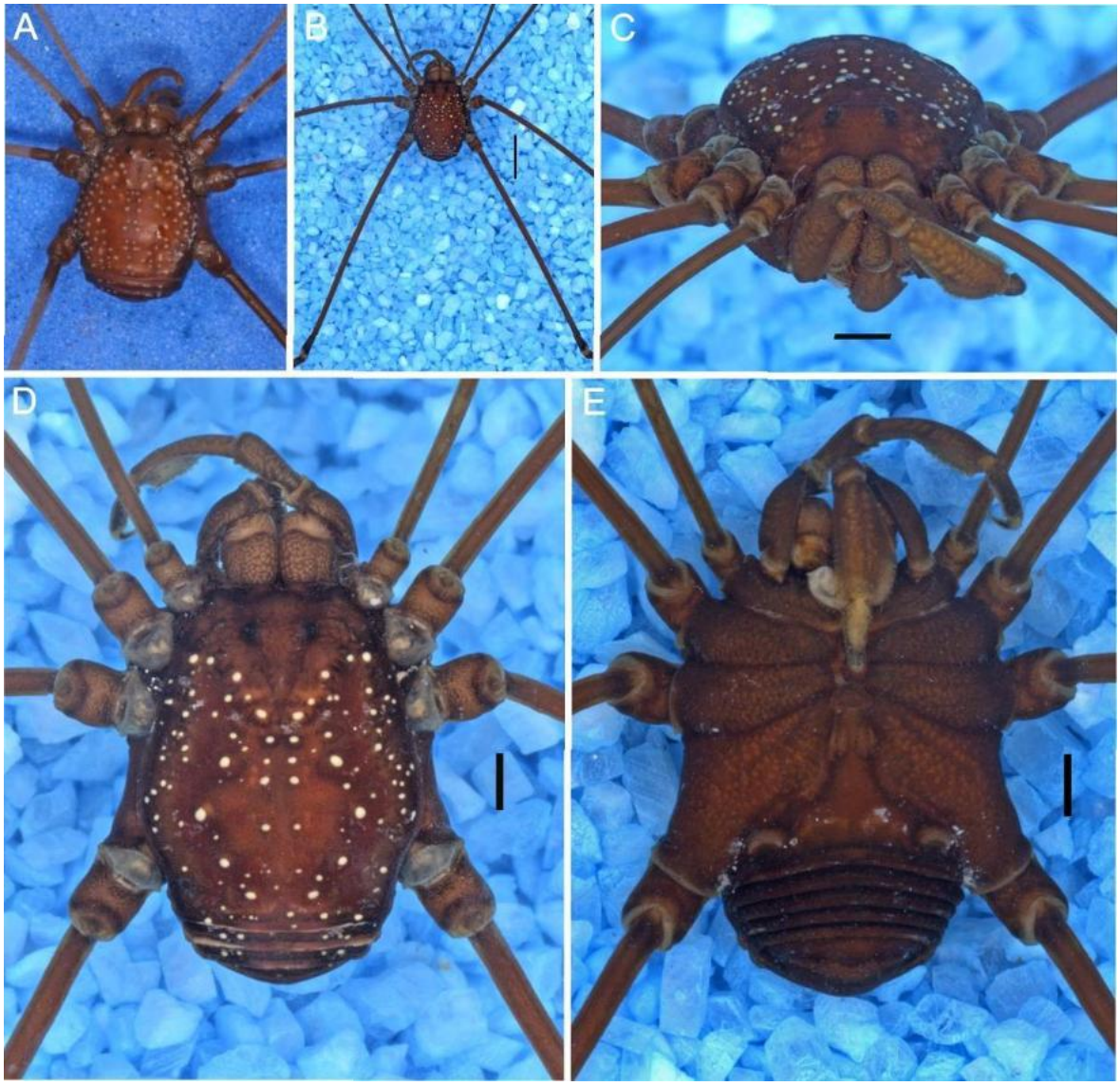

Figure 10. *Paecilaemella festae* Roewer, 1925: A. Female holotype (SMF 120); Photos courtesy Ricardo Pinto-da-Rocha; B–E. male from Rio Hollín, Napo, Equador (QCAZ I 265314): B. Habitus, dorsal view; C. Same, frontal view; D. Same, detail of the dorsal scutum in dorsal view; E. Same, ventral view; Scale bars: B = 5 mm; C–E = 1 mm.

Examined material. 2♀ (MNRJ 693) Ecuador, Pastaza, Puyo arredores de Puyo, El Triunfo, cascada y tarabita (-1.4336, -77.7925, alt.: 1060 m), 10 Dec. 2021, APL Giupponi, AA Granado, AB Kury, MA Medrano leg.; 1♂ (QCAZ I 265312) Ecuador, Napo, Rio Hollín (-0.9500, -77.7500, alt.: 1100 m), 08 Dec. 2001, L Salazar leg.; 1♀ (QCAZ I 265313) Ecuador, Napo, Via Loreto, Rio Hollín (-0.9500, -77.7500, alt.: 1100 m), 08 Dec. 2001, L Salazar leg.; 1♂ (QCAZ I 265314) Ecuador, Napo, Rio Hollín (-0.9500, -77.7500, alt.: 1100 m), 04 Dec. 1999, F Prieto leg.; 1♂ (QCAZ I 265315) Ecuador, Napo, Via Loreto, Rio Hollín (-0.6667, -77.6667, alt.: 1100 m), 06 Dec. 1997, P Barriga leg.; 1♀ (QCAZ I) Ecuador, Morona Santiago, Coangos, Cueva de los Tayos (-3.05164, -78.205411, alt.: 580 m), 14 Nov. 2018, F Romero leg.

Distribution. Ecuador, Napo moist forests and Eastern Cordillera real montane forests of Napo, Pastaza and Morona-Santiago provinces (Fig. 13).

Diagnosis. *P. festae* can be distinguished from other species within the genus by the pattern of coloration of the dorsal scutum and the absence of distal armature on the prolateral side of femur IV (Fig. 11C–E). It shares similarities with *P. andi* and *P. geminorum*, including a penis with MS D2 positioned more basally than MS A (Fig. 12). In contrast, it differs from *P. armasi* because the latter has both MS A and MS D2 aligned at the same height.

Redescription. (Male); Measurements. Body length: 5.6. Maximum width of scutum: 4.6. Carapace length: 2.3, width 3.4. Interocular distance: 1.0. Legs: I: 28.50 (0.76, 8.52, 1.59, 5.03, 7.60, 5.00), II: 59.51 (0.96, 18.23, 2.51, 14.28, 14.06, 9.47), III: 41.21 (1.09, 13.38, 2.28, 6.63, 11.16, 6.67), IV: 57.22 (1.23, 18.35, 2.62, 9.40, 17.26, 8.36).

Dorsum. Large sized cosmetid (dorsal scutum length approximately 6 mm). Dorsal scutum in dorsal view epsilon-shaped with shallow cheliceral sockets (Fig. 10A, B, D; 11A). Dorsal scutum flat in lateral view (Fig. 11B), coxa IV entirely visible in dorsal view (Fig. 10D; 11A), thicker than scutum in lateral view. Ocularium low, narrow, with median depression. Scutal grooves poorly delimited (Fig. 10D). Scutum entirely unarmed and without any granules but with dots in relief (Fig. 11B). Free tergites I–III and anal operculum unarmed.

Venter (Fig. 10E). Coxae I–III triangular, transverse to main body axis. Coxae II to IV connected by tubercle bridges. Ventral elements of coxa I: e1 and e2 forming a single row of ca 11 tubercles; e3 = 1 very large conical process, visible in dorsal view; e4 = one large bifid process; e5 = indistinct cluster of ca. seven cusps. The row of tubercles formed by e1 and e2 is continued in coxa II towards the genital operculum by a row of three tubercles. Coxa IV pentagonal, greatly developed, oriented obliquely, but almost parallel to the body axis. Stigmatic area T-shaped with stigmata large, unconcealed. Free sternites smooth and unarmed.

Chelicera (Fig. 11G). Neither basichelicerite nor hand thickened or swollen in males. Bulla short, rounded, bordered with rounded tubercles, six to eight ectal and five to six posteriors. Movable finger with one basal triangular tubercle and a row of smaller rounded tubercles distally. Fixed finger with a row of rounded tubercles, larger than those of the movable finger.

Pedipalpus (Figs. 11H, I). Trochanter with stout antero-dorsal protuberance. Femur strongly compressed, concave on mesal surface, borders armed with long tubercles. Tibia strongly depressed. Shape asymmetrical, with the ectal side more pronounced, armed

distally with a row of seven short spines. Mesal side with three proximal short setae and a distal spine. Tarsus moderately elongated, with an irregular ventro-ectal row of short spines, a much sparser ventro-mesal row of short spines, with two larger ones, one positioned at the middle of the tarsus, larger than the one located more distally.
Legs. Elongate and moderately thick (growing thicker from I to IV). Males with basitarsomeres I thickened, first basitarsomere three to five times longer than the following ones (Fig. 11F). All femora straight. Femur IV unarmed except by tiny scattered granules on the ventral distal part (Fig. 11C–E). Tibia IV with scattered granules. Femur III unarmed. Tarsal claws unpectinate. Tarsal formula: 6(3)-6(3)/?-19(3)/10-11/12-12.

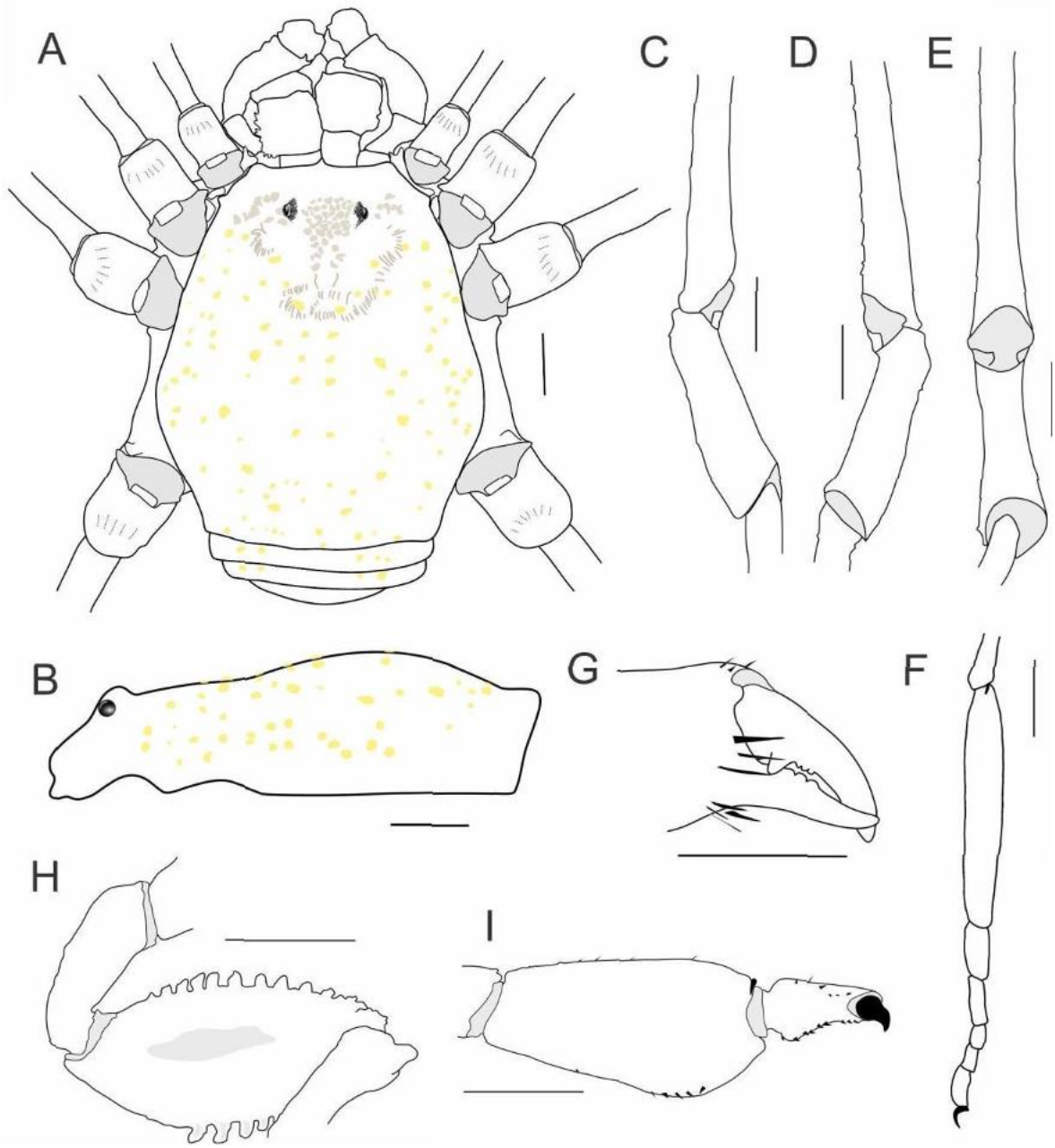

Figure 11. Schematics drawings of *P. festae*, male. A–E: (QCAZI 265314). A. Body, dorsal view. B. Dorsal scutum, lateral view. C. Left leg IV: distal femur and trochanter: retrolateral view. D. Same, prolateral view. E. Same, ventral view. F–I: (QCAZI 265312) F. Left leg I, tarsomeres, lateral view. G. Distal part of the cheliceral hand. H. Left pedipalp: patella, femur and trochanter, mesal view. I. Same, tibia and tarsus. Scale bars = 1 mm.

Color (Fig. 10). Background of body (dorsal and ventral) Deep Brown (56), dorsal scutum with lighter mottling Moderate Reddish Brown (43) in carapace. Appendages, including pedipalps and chelicerae Moderate Brown (58), pedipalps and chelicerae with lighter mottling Light Brown (57). Dorsal scutum covered with small Pale Yellow (89) dots, except for the anterior region and a V-shaped area on the posterior portion of the carapace. Additionally, the median regions of the scutal areas form an oval-shaped patch in the center of the scutum, surrounded by a suspender, with slightly larger dots than those elsewhere. The middle of this patch has dots arranged in paired rows.

Variation. Females with femur IV unarmed, basitarsomeres of leg I not thickened and not as long as those in males, chelicerae slightly smaller than in male. The observed blot pattern can be more or less defined.

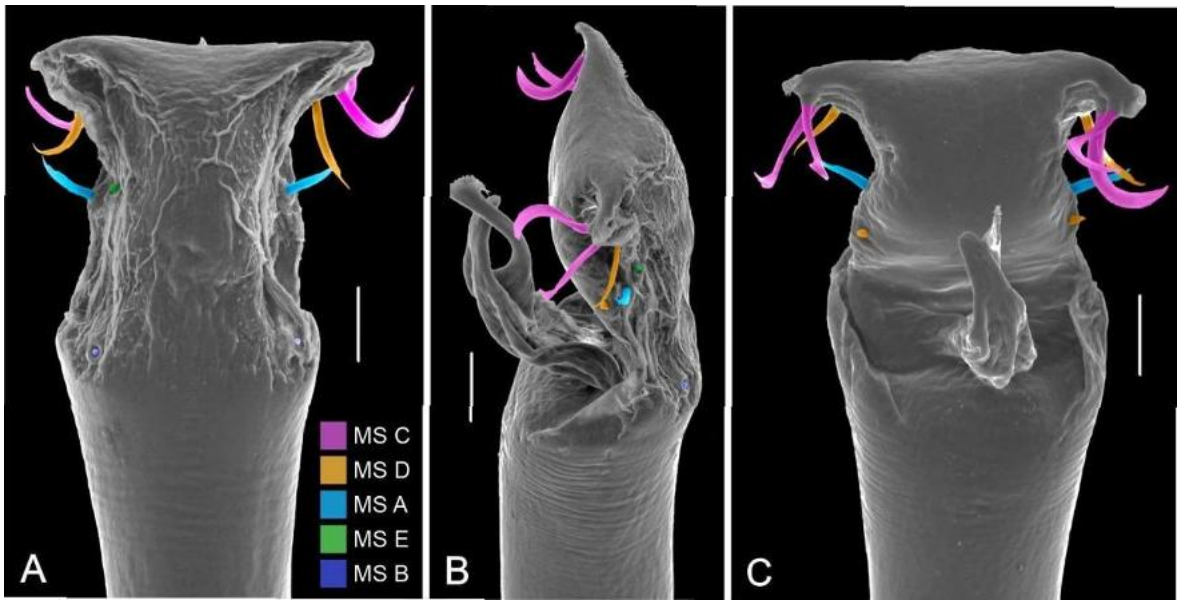

Figure 12. *Paecilaemella festae* Roewer, 1925 (QCAZ I 265312), penis distal part: A. Ventral view; B. Lateral view; C. Dorsal view. MS = Macrosetae. Scale bars: A–C = 0,05 mm.

Genitalia (Fig. 12). Ventral plate of penis rectangular, widening distally. Lateral margins of the dorsal portion of VP (at MS C level) concave along their length, basal to MS C1–C2. Five pairs of larger macrosetae inserted on lateral margin of VP: Two pairs C1–C2 greatly developed, curved and flattened; the third pair of macrosetae, adjacent to C1–C2, robust,

cylindrical and straight, is best interpreted as D1; D2 is reduced, acuminate and located basally, inserted in the dorsal part of the VP. The fifth pair of MS, here interpreted as A1, is straight and similar in shape to D1. A pair of small macrosetae B is located ventro-basally on VP, while E, also reduced, are located ventrally and around the middle of the VP. Microsetae type 4 covering the lateral margins of the VP, but absent in the middle. Stylus strongly curved, cylindrical, with small wattle and a well-developed ventral peak formed by barbels. Dorsal process of glans thumbshaped.

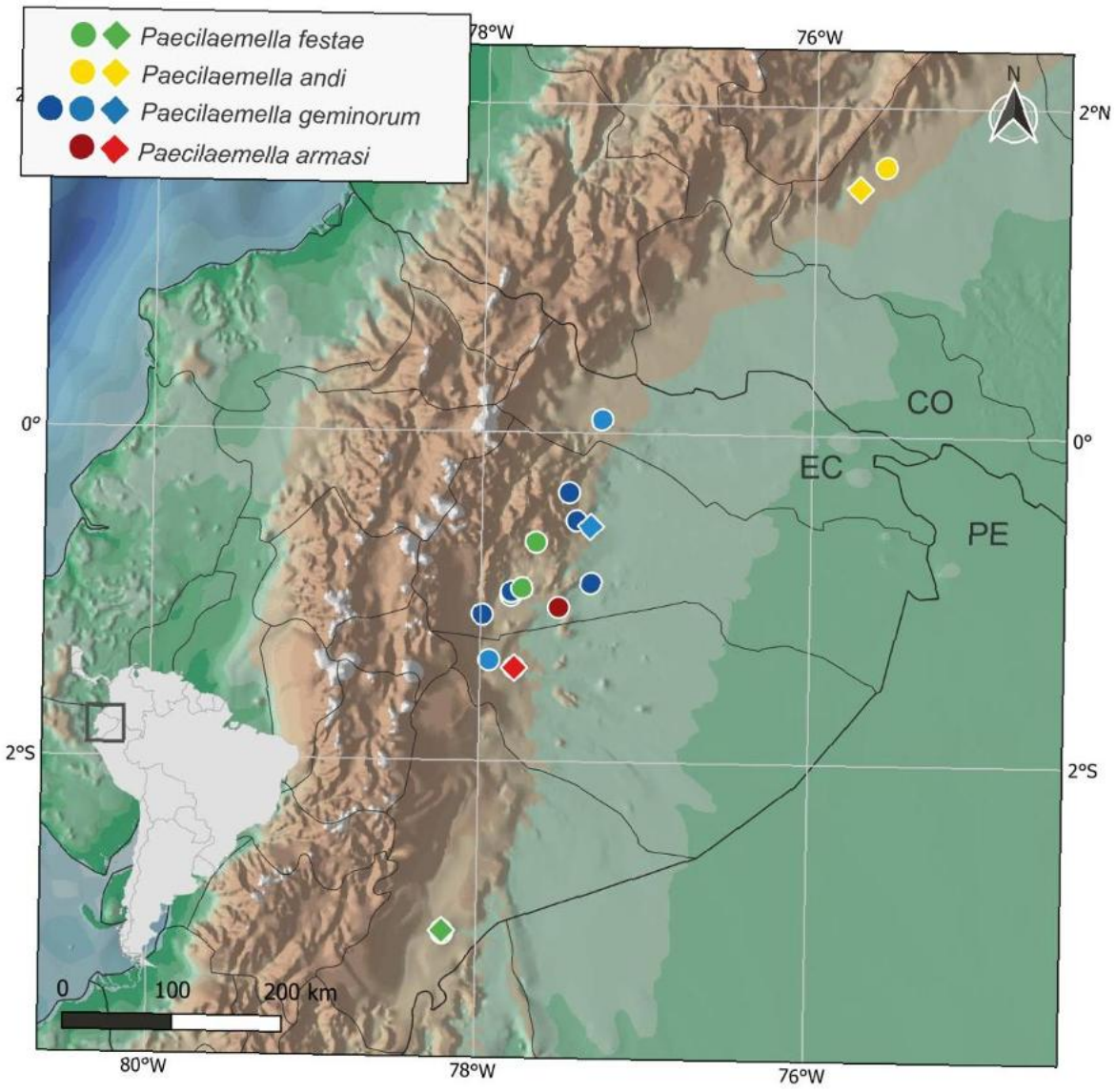

Figure 13. Known distribution of *Paecilaemella.* Rhombuses indicate the type locality for each species and darker circles indicate iNaturalist records.

Genus C "gen. nov."

Included species. Genus C sp. 1 (type-species) and Genus C *ornata* "comb. nov."

Distribution. Northwestern Andean montane forests of Ecuador and Colombia and Western Ecuador moist forests, Eastern Cordillera real montane forests and Ecuadorian dry forests of Ecuador.

Diagnosis. Medium to large cosmetids with dorsal scutum epsilon-type. Scutal areas without prominent ornamentation, Basitarsomeres I thickened, first basitarsomere around the same size of the following ones. Inflated chelicerae, projected dorsally, covering the frontal part of the scutum in alpha males (Fig. 14A, C). Femur IV unarmed. Penis morphology with two apical curved MS C, two MS D (a long distal MS and a short basal one), and one long MS A. Large glans with a dorsal process shot and accuminate (Fig. 15).

Genus C sp. 1 "sp. nov."
FIGS 14, 15

Type data. 1♂ (MNRJ 1181) Ecuador, Esmeraldas, Santo Domingo de Onzole, Tesoro Escondido, trilhas com cabruca (0.54128, -79.14464, alt.: 287 m), 15-16 Dec. 2021, APL Giupponi, AA Granado, AB Kury & MA Medrano leg.

Examined material. 3♂ 4♀ (MNRJ 2886) Ecuador, Pichincha, La Unión del Toachi, Centro de Educación Ambiental Otongachi, sede (-0.32142, -78.95159, alt.: 837 m), 13 Dec. 2021, APL Giupponi, AA Granado, AB Kury & MA Medrano leg.; 1♀ (MNRJ 58851) Ecuador, Pichincha, San Augusto, La Otonga, próx. La Union del Toachi (-0.321425, -78.951592, alt.: 834 m), 18 Jul.2019, A Chagas Jr & A Giupponi leg.; 1♀ (MNRJ 1182) Ecuador, Esmeraldas, Tundaloma ex-Lodge, próx Ricaurte (1.18189, -78.75175, alt.: 66 m), 12-13 Jul. 2019, A Chagas Jr & A Giupponi leg.; 1♂ (QCAZ I 265303) Ecuador, Cotopaxi, San Francisco de las Pampas (-0.4181, -78.9167, alt.: 1500 m), 01 Apr. 2007, G Onore leg.; 1♂ (QCAZ I 265304) Ecuador, Cotopaxi, San Francisco de las Pampas (-0.4181, -78.9167, alt.: 1500 m), 01 Apr. 2007, G Onore leg.; 1♂ (QCAZ I 265305) Ecuador, Cotopaxi, San Francisco de las Pampas (-0.4181, -78.9167, alt.: 1500 m), 01 Apr. 2007, G Onore leg.; 1♀ (QCAZ I 265318) Ecuador, Pichincha, Union del Toachi, (-0.3514, -78.9528, alt.: 980 m), 13 Jan. 2001, S Tellov leg.; 1♀ (ICN-AO-1754) Colombia, Nariño, Barbacoas, Altaquer, RN Río Ñambí (1.2700, -78.1200, alt.: 1380 m) 2-6 Jul. 2017, W Galvis leg.

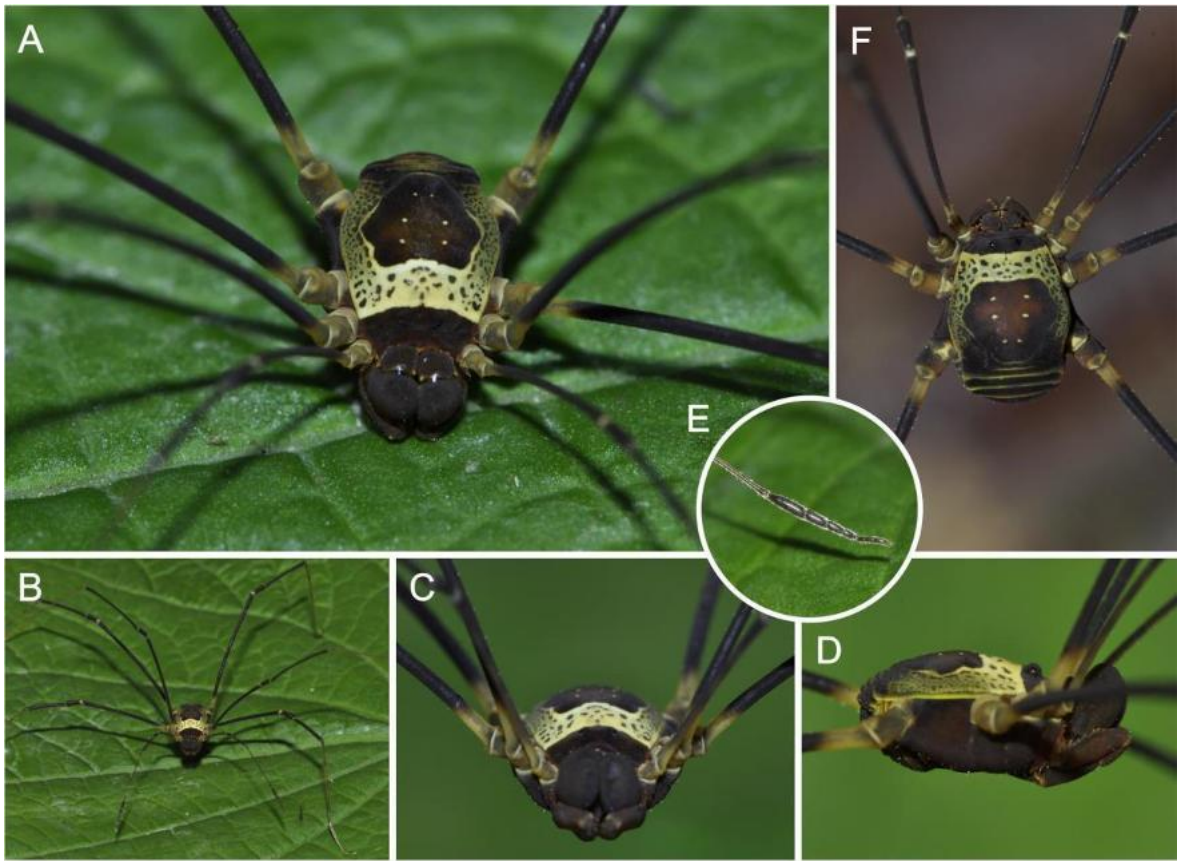

Figure 14. Genus C sp. 1, *habitus* in vivo. A–E. Male from La Otonga, San Augusto, Pichincha, Ecuador. A. Dorso-frontal view; B. Same; C. Same, frontal view; D. Same, lateral view; E. Same, detail of leg I; F. Male from Tesoro Escondido, Santo Domingo de Onzole, Esmeraldas, Ecuador, dorsal view.

Distribution. Ecuador and Colombia. Northwestern Andean montane forests at Cotopaxi, Pichincha and Esmeraldas province in Ecuador and Narino department in Colombia and Western Ecuador moist forests in Guayas and Chimborazo provinces in Ecuador.

Diagnosis. It correlates to the other species of the genus by having an epsilon-shaped dorsal scutum and an inflated chelicerae, projected dorsally, covering the frontal part of the scutum in alpha males. It also doesn't present an armature on area III of the dorsal scutum. It differentiates from the other species of the genus by its blots of the dorsal scutum and by having the trochanter and proximal part of femur of legs I-IV in a lighter color than the scutum and other portions of the legs.

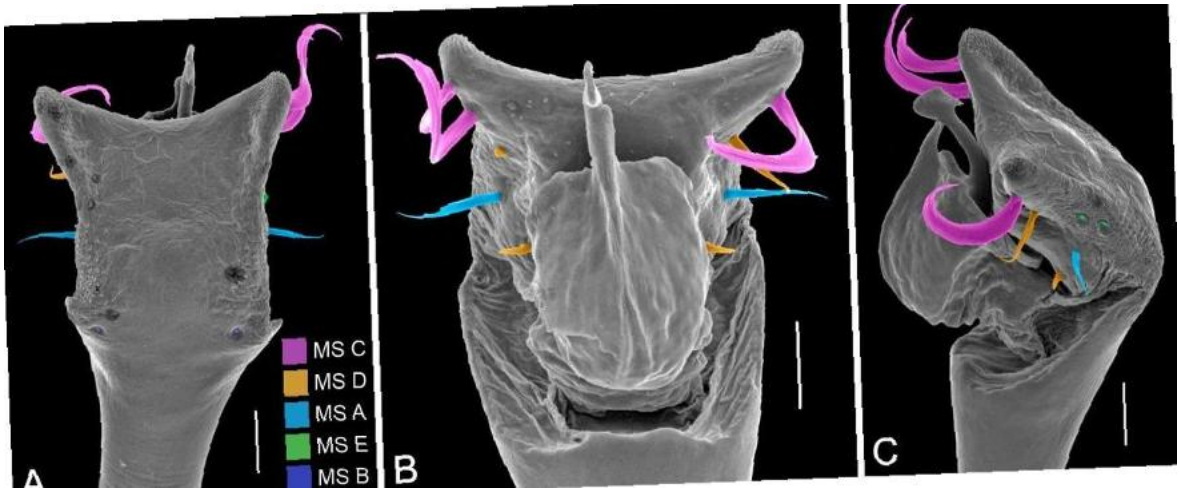

Figure 15. Genus sp. (MNRJ 2886), penis distal part: A. Ventral view; B. Dorsal view. C.Lateral view; MS = Macrosetae. Scale bars: A–C = 0,05 mm.

Genus C *ornata* "comb. nov."
FIG 16

• *Protus ornatus* Roewer 1912: 118, pl. 2, fig. 24.
Protus ornatus – Roewer 1923: 391, fig. 482; Mello-Leitão 1932: 93; Kury 2003: 89.
Paecilaemella ornata: Medrano et al. 2021: 618, fig. 22.
• *Paecilaemella albantica* Roewer 1947: 27 pl. 10, fig. 85. Junior subjective synonym of *Protus ornatus* Roewer, 1912) in Medrano, Kury & Mendes (2021: 618).
Paecilaema albantica: Goodnight & Goodnight 1953: 54; Kury 2003: 75.

Type data. *Protus ornatus*: ♂ holotype (SMF RI), Ecuador, Chimborazo, Riobamba, (-1.66482, -78.71318); *Paecilaemella albantica*: ♀ holotype (SMF RII 1472), Ecuador, Guayas, Naranjito, (-2.16687, -79.47997) (Examined by photograph).
Records. Ecuador. Santa Elena: La Rinconada (-1.71333, -80.79667, 100 m), S Aguilar leg., 11 Out. 2013, 2♂ 1♀ (QCAZ AK 389); (-1.70778, -80.79667, 200 m), A Calle leg., 12 Out. 2013, 1♂ 1♀ (QCAZ AK 390) (Medrano, Kury & Mendes 2021: 618).
Distribution. Ecuador. Eastern Cordillera real montane forests, Western Ecuador moist forests and Ecuadorian dry forests in the Chimborazo and Guayas provinces.

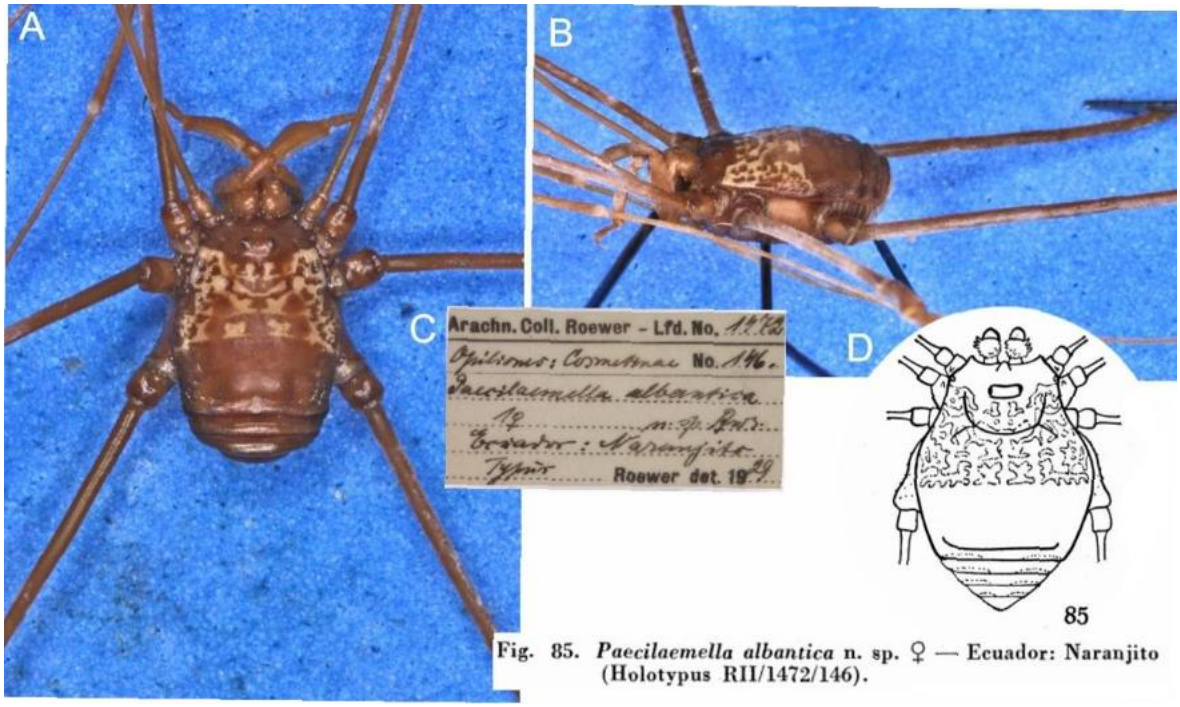

Figure 16. *Paecilaemella ornata* Roewer, 1925: A–C. Female holotype of *Paecilaemella albantica* (SMF 1472/146) Photos courtesy Ricardo Pinto-da-Rocha: A. Habitus, dorsal view; B. Same, dorsolateral view; C. Original label. D. Original illustration (Roewer, 1947).

Remarks. This species is no longer considered a *Paecilaemella* in this work, it was retrieved as part of an undescribed genus, referred here as Genus C (Fig. 16). It correlates to the other species of the genus by having an epsilon-shaped dorsal scutum and an inflated chelicerae, projected dorsally, covering the frontal part of the scutum (observed by Medrano et al, 2021), it also has long and thin but robust legs, growing thicker from I–IV. It differentiates from the other species of the genus by its blots of the dorsal scutum, described by Roewer (1912) as follows: “lateral margins of cephalothorax and abdominal scutum areas I and II with white spots and arch-like transverse stripe behind the eye mound, middle of cephalothorax behind the eye mound with two crescent-shaped transverse stripes of white; median part of body with darkened longitudinal band covering the middle third of the body, in the abdominal area I always a large white spot in the middle third of the band, which appears unpaired; on the lateral surfaces of the abdominal scutum areas II and III behind the median stripe, often a comma-shaped spot; in the middle between the median and lateral areas, a crescent-shaped white band; on each of the free dorsal abdominal segments, a narrow white line laterally; on the last dorsal segment of the abdomen, traces of white transverse rows of dots.”.

Discussion

In early Opiliones research, it was common for new species to be described based on female specimens—or even juveniles. A striking example is the family Palpinidae, which was established based on cosmetid juveniles (Pickard-Cambridge 1905). Today, it is well established that adult males possess more conspicuous and diagnostic morphological features, which enable more accurate species delimitation. From the mid-20th century onward, studies increasingly incorporated male genitalia in their analyses, recognizing its critical role in distinguishing harvestman species (e.g., Suzuki 1969). Consequently, species described solely from females have gradually fallen out of use.

Paecilaemana is one such case: most of its known species were originally described from females. Of these species, only *P. quadripunctata* was described based on a male specimen and was subsequently recorded by Goodnight & Goodnight, 1947. In the present study, all *Paecilaemana* species were accessed exclusively through photographs. For *P. crux* and *P. halonata*, images of the type series were analyzed; for *P. quadripunctata*, photographs of a male specimen housed at the MCZ and SEM images of the penis, used in Proud (2012), were examined. In the case of Genus C *ornata* "comb. nov.", Medrano et al., (2021) were able to study a male specimen before it was lost in the 2018 fire at the Museu Nacional. However, genital morphology was not examined at the time, and only photographs of the female type series were available for the current analysis. As a result, many morphological characters—both external and genital—could not be assessed for most species.

For *Paecilaemella*, we were able to examine most of the species in detail through specimens housed at MNRJ, whereas for *Paecilaemana*, it was only possible to study the material through photographs. This is reflected in the analysis, as the support values and clade recovery were high for *Paecilaemella* in most analyses, while for *Paecilaemana*, these values were low (Fig. 1).

This can explain the lack of probabilistic support and why *Paecilaemella* and *Paecilaemana* were not retrieved with *Flirtea* and therefore not as part of the subfamily Flirteinae. We also expected that *Paecilaemella* and *Paecilaemana* would not form mutually monophyletic units and would be nested within each other, due to the morphological similarity of the genera. In this way, we confirm Roewer's initial hypothesis (both genera forming two separate monophyletic units) but not for the same reason as he proposed, but for new characters.

The Roewerian diagnoses of both genera are unsatisfactory and do not reflect natural clades. Roewer (1928) separates *Paecilaemella* from *Paecilaemana* in an identification key through the presence of tubercles or spines in area III of the dorsal scutum. In our analysis, we did not observe any correlation to the presence of spines with the separation of the two genera, therefore, a new diagnosis for *Paecilaemella* is provided here, incorporating a broader set of characters, including genital morphology. With the analysis of additional material, it was possible to better understand the distribution patterns of *Paecilaemella* and detect a large number of undescribed species.

One of the characters that separates these two genera is precisely the swelling observed in the basitarsomeres of leg I in males. The clade recovered as *Paecilaemana* has basitarsomeres I around the same size, as do the taxa recovered as new genera, while the clade recovered as *Paecilaemella* has the first basitarsomere I longer than the following ones. This is one of the only non-homoplastic synapomorphy observed for these groups. Furthermore, this swelling (whether or not the basitarsomere is longer) is what unites *Paecilaemella*, *Paecilaemana* and the three taxa recovered as new genera.

However, there are only a few non-homoplastic synapomorphies supporting the clades retrieved in our analysis, showing that further studies amplifying the dataset specifically to *Paecilaemella* and *Paecilaemana* are essential. Furthermore, males of *P. halonata*, type species of *Paecilaemana*, are essential to assert whether or not the genus is related to *Paecilaemella* or they may even be considered synonyms.

Although our analysis did not recover *Paecilaemella* and *Paecilaemana* as part of Flirteinae, the lack of support prevents us from asserting that these genera do not belong to the subfamily. However, we can propose a new genus (Genus C), and thus, *Paecilaemella ornata* would no longer be nested within *Paecilaemella*. Both of the species nested within this new genera have its locality in the Pacific side of the Andean Cordillera and have the chelicerae inflated and projected dorsally, covering the frontal part of the scutum, as seen in Metergininae (sister-group to Flirteinae according to Medrano et al., 2021). They also present the same penis morphology as seen in *Paecilaemella* and *Paecilaemana*, except with a large glans with a dorsal process short and accuminate, while *Paecilaemella* and *Paecilaemana* present a dorsal process thumb-shaped. Two other monotypic undescribed genera were retrieved, referred here as Genus A and B, both including undescribed species, however, they lack support and were not retrieved in a sufficient number of analyses to support their proposal.

In Medrano et al., 2021 analysis, Flirteinae showed low probabilistic support, and was diagnosed as follows: “Large cosmetids with long, strong but entirely unarmed legs. Dorsal scutum beta-type with weakly marked constrictions. Scutal areas without prominent ornamentation (spines or tubercles) or with spines in area III. Some species with dimorphic chelicera (*P. ornata*). Coxa IV entirely visible and concave in dorsal view”. Examining the material we consider the dorsal scutum of *Paecilaemella* as epsilon-type, and some of them may have a comb of pro-ventral armature in the distal third of lev IV. *Paecilaemella* also may or may not have tubercles in area III and does not present dimorphic chelicera. Coxa IV is entirely visible and concave or almost straight in dorsal view.

For *P. multimaculata*, we observed a great variation in the armature of the third area of the dorsal scutum, however, this variation does not correlate to the distribution of the species. Some *P. multimaculata* with great spines in area III can occur in the same region as specimens with just a tubercle. This is also observed in the blots pattern of this species. This species also presents a lambda-type dorsal scutum and has shorter legs when compared to the other species of *Paecilaemana* and *Paecilaemella*. All these characteristics contributed to it being retrieved outside of *Paecilaemella*, although the differences between the dorsal scutum types are slight.

The *Paecilaemella* and *Paecilaemana* species are highly subsampled, most likely because of the lack of studies with this group, leaving gaps in its distribution. Especially in *Paecilamana*, we can observe a huge gap between Panama and Ecuador, since most of the species are still only known from their type-species. Therefore, more studies with this genera are extremely necessary to solve these gaps in the knowledge of the group, both in the sense of distribution and in the sense of the evolutionary relationships between the clades.

Conclusion

The genus *Paecilaemella*, as circumscribed in recent works — both sensu Medrano, et al., 2020, which included *P. multimaculata*, and sensu Medrano et al., 2021, which further incorporated *P. ornata* — is not recovered as monophyletic in our analysis. Both *P. multimaculata* and *P. ornata* are placed outside the clade containing the type species *P. festae* and allied taxa. This clade now comprises *P. festae*, three recently described species (*P. armasi*, *P. andi* and *P. geminorum*), and four additional undescribed

species. We therefore propose a phylogenetic redefinition of *Paecilaemella* (sensu nov.) as the most inclusive clade containing *P. festae*, but not *P. halonata*.

Similarly, *Paecilaemana* is recovered as monophyletic, comprising its type species *P. halonata*, the previously described *P. crux* and *P. quadripunctata*, four undescribed species, and also *P. multimaculata*. Based on these results, we redefine Paecilaemana (sensu nov.) as the most inclusive clade containing *P. halonata*, but not *P. festae*.

Despite their external similarity, current evidence does not support synonymizing the two genera. The identity of *Paecilaemana*, described from a female and not recollected in recent surveys, depends on features such as male genital morphology, leg armature, and cheliceral structure.

Although both genera were retrieved outside Flirteinae in our phylogenetic results, there is insufficient statistical support to confidently reassign them to another subfamily. Therefore, we maintain the classification proposed by Medrano et al. (2021).

Paecilaemella ornata was not recovered within *Paecilaemella*, but instead placed in a distinct genus (referred to here as Genus C), which is differentiated by its geographic distribution and its inflated chelicerae. *Paecilaemella* and *Paecilaemana* can be distinguished morphologically by the proportions of basitarsomeres on leg I: *Paecilaemella* possesses an elongated first basitarsomere, whereas in *Paecilaemana* the basitarsomeres are of similar length.

An updated diagnosis for *Paecilaemella* is provided. A large number of undescribed species was found among the examined material, highlighting how undersampled this group remains in terms of diversity. These findings underscore the importance of future studies for improving our understanding of the genera.

This work represents an important step toward clarifying the taxonomy of Flirteinae and contributes to a better understanding of the group's evolutionary relationships. Many species remain assigned to artificially defined genera, and future revisionary studies and broader morphological comparisons will be necessary to place them more accurately.

Moving forward, continued collection and study of specimens from diverse regions—especially male individuals—will be essential to fill existing knowledge gaps. Finally, integrative phylogenetic analyses combining morphological and molecular data will be crucial to achieving a more comprehensive view of evolutionary relationships within Cosmetidae.

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APÊNDICE II: ARTIGO II (PUBLICAÇÃO)

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Three new species of *Paecilaemella* (Cosmetidae: Flirteinae) from the upper Amazonian Basin

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Abstract

The recent revalidation of *Paecilaemella* Roewer, 1925 as a valid genus, along with the inclusion of *Gonyleptes multimaculatus* Wood, 1869, and *Protus ornatus* Roewer, 1912, in this previously monotypic genus, and its placement in the subfamily Flirteinae, represent significant advances in our understanding of this cosmetid genus and its subfamily. In this study, we further expand our knowledge by describing three new species of *Paecilaemella* from the Colombian (*Paecilaemella andi* **sp. nov.**) and Ecuadorian Amazon forest (*Paecilaemella armasi* **sp. nov.** and *Paecilaemella geminorum* **sp. nov.**). These three species are distinguishable from its congeners by a striking pattern of spots on the dorsal scutum, resembling the zodiac sign of Gemini. Males of these species share common characteristics, including non-hypertelic chelicerae, an armed distal region of femur IV, extremely elongated basitarsomeres in leg I, and a penis with a basal pair of MS A. Given the limited knowledge of other species in the genus, these characters will require further study to assess whether they represent synapomorphies of the genus.

Key words: Harvestmen, taxonomy, sexual dimorphism, morphology, new species

Introduction

Opiliones are incredibly diverse in humid areas (Kury & Pinto-da-Rocha, 2002). Members of Cosmetidae, the most diverse family of harvestmen in the Neotropics (Kury *et al*., 2023), are common habitants of the Amazonian forest. Amazonian cosmetids generally bear long and gracile legs, as in the tribe Discosomaticini, compared with cosmetids from the Andean Mountain range, which possess short and strong legs like those in the Libitiinae or Metergininae. This pattern may correspond with environmental demands, but its implications are still unknown mainly due to the systematic deficit in the family. Here, we detected a small group of long-legged cosmetids (Fig. 1) that fits in the genus *Paecilaemella* Roewer, 1925 (Flirteinae), from the Andean slope in Colombia and Ecuador (Fig. 8), a region that experienced the uplift of the Andes and is influenced by the adjacent Amazonian rainforest.

Following the phylogenetic analysis conducted by Medrano *et al.* (2021), Cosmetidae diversity can be categorized into eight subfamilies, a significant increase from the two subfamilies proposed by Pickard-Cambridge (1905). One of the better-supported subfamilies in the analysis was Flirteinae, which harbors three genera and 32 species. Although the subfamily has high stability under different weighting and analytical approaches (such as parsimony and Bayesian analyses), only five species from two genera are included in the tree and that some terminals in the matrix lack coding for genital morphology. Although a brief diagnosis of the subfamily was provided, the understanding of the morphology of its members, the delimitation of the genera, and the relationships among them remain in their early stages. A revision of most of the subfamilies is needed.

The most diverse genus in the Flirteinae, *Flirtea* Koch, 1839, was diagnosed by Kury & García (2016); however, the status of its 25 species was not evaluated and a comprehensive revision is still needed. In contrast, the other two genera, *Paecilaemella* and *Paecilaemana* Roewer, 1928, are known only by their external morphology. Kury &

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Medrano (2018) revalidated *Paecilaemella* and provided a diagnosis for the genus, which includes the type species *Paecilaemella festae* Roewer, 1925 and *Paecilaemella multimaculata* (Wood, 1869). Subsequently, Medrano *et al.* (2021) included the third species, *Paecilaemella ornata* (Roewer, 1912), based on a phylogenetic analysis. Here, we describe three new species of *Paecilaemella* from the upper Amazon basin, doubling the known diversity of the genus. As the genital morphology of the three previously known *Paecilaemella* species has not been described, we provide detailed genital descriptions for three new species which offers crucial information for future diagnoses.

Methods

The description of the exomorphology follows Kury & García (2016), terminology for chaetotaxy of the penis ventral plate follows Kury & Villarreal (2015) with the interpretation of macrosetae D1 as in Medrano & Kury (2016), terminology of dorsal scutum types follows Kury & Medrano (2016). Descriptions of colors use the standard names of the 267 Color Centroids of the NBS/IBCC Color System (online at http://people.csail.mit.edu/jaffer/Color/Dictionaries#nbs-iscc). Ecoregions mentioned in the distribution of the taxa follows Olson *et al.* (2001).

Tarsal formula: numbers of tarsomeres in tarsus I to IV, when an individual count is given; order is from left to right side (figures in parentheses denote the number of tarsomeres only in the distitarsus I–II). All measurements are in millimeters, unless otherwise specified.

Abbreviations of the repositories cited are: ICN (Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogotá, Colombia); MNRJ (Museu Nacional, Rio de Janeiro, Brazil); QCAZ (Museo de Zoología, Pontificia Universidad Católica de Quito, Quito, Ecuador). Other abbreviations: Dorsal Scutum (DS); Macrosetae (MS); Microsetae (ms); Ventral Plate (VP).

Specimen genitalia were dehydrated in a graded ethanol series, sputter-coated with gold and examined with a JEOL JSM-6390LV Scanning Electron Microscopy at the Rudolf Barth Electron Microscopy Platform of the Oswaldo Cruz Institute/FIOCRUZ and a ZEISS EVO 10 Scanning Electron Microscope at the multi-user laboratory in the MNRJ. The line drawings were made using a *camera lucida* attached to a stereomicroscope, later digitized and processed with the software Inkscape v. 0.91.

The term "*gemini mask*" is introduced here to denote the unique yellowish-white blot on the dorsal scutum of the three species described. This blot is named after the traditional symbol of the zodiacal constellation Gemini (The Twins). It roughly resembles Roman numeral II, with the upper bar represented by the chevron, the vertical bars by paramedian stripes along the backbone, and the lower bar by a modified omega stripe with backwards laterals.

Systematics

Cosmetidae Koch, 1839

Flirteinae Medrano, Kury & Mendes, 2021

Paecilaemella Roewer, 1925

Paecilaemella Roewer 1925: 13. Junior subjective synonym of *Metergmoides*, Roewer, 1912 by Goodnight & Goodnight (1942); junior subjective synonym of *Paecilaema* C.L. Koch, 1839 by Goodnight & Goodnight (1953: 54); synonymy rejected by Kury & Medrano (2018: 210).
Paecilaemella—Roewer 1928: 626; Mello-Leitão 1932: 91; Roewer 1933: 290; Goodnight & Goodnight, 1942: 9.
"*Poecilaemella*" [incorrect subsequent spelling]: Mello-Leitão 1935: 113.

Etymology. From the pre-existing genus *Paecilaema* + suffix *-ella*. Gender feminine.

Placement. Originally in Cosmetinae. Transferred to Flirteinae by Medrano, Kury & Mendes (2021: 33).

Included species. *Paecilaemella festae* Roewer, 1925 (type-species by monotypy), *Paecilaemella multimaculata* (Wood, 1869), *Paecilaemella ornata* (Roewer, 1912), *Paecilaemella andi* **sp. nov.**, *Paecilaemella armasi* **sp. nov.**, *Paecilaemella geminorum* **sp. nov.**

Distribution. Upper Amazonas basin of Brazil, Colombia, Ecuador and Peru. Only *P. ornata* is an exception, occurring on Pacific slope of the Ecuadorian Andes, outside the typical range.

***Paecilaemella andi* sp. nov.**
Figs 1A; 2; 3

Etymology. In honor of the late arachnologist and friend Andrés García (affectionately called Andi), who contributed significantly to the knowledge of the Opiliones diversity of Colombia, described the first harvestman of Caquetá department and collected the type material of the species. Noun in apposition.

Holotype. 1 ♂ (MNRJ 1183) Colombia, Caquetá, Florencia, camino a la Reserva Natural Ecoturística El Danubio (1.506098°,-75.732735°, alt.: 380 m), 17 Dec 2018, F Arcos, AF García & M Medrano leg.

Paratypes. 4 ♂ 3 ♀ (MNRJ 60294) Colombia, Caquetá, Florencia, El Manantial (1.63743°, -75.57410°, 500 m), 19 Dec 2018, F Arcos, AF García & M Medrano leg.; 1 ♂ 1 ♀ (ICN AO 1982), same data as previous; 1 ♂ 1 ♀ (MNRJ 60350), Colombia, Caquetá, Florencia, camino a la Reserva Natural Ecoturística El Danubio (1.506098°, -75.732735°, alt.: 380 m), 17 Dec 2018, F Arcos, AF García & M Medrano leg.

Distribution. Colombia, Napo moist forests in Caquetá department (Fig. 8).

Diagnosis. *Paecilaemella andi* can be distinguished from all its congeners by having two additional transversal continuous stripes separating the chevron and the two parallel longitudinal stripes in the gemini mask (Figs. 1A, 2A) (*P. armasi* bears fragmented spots that may be interpreted as homologous to these stripes). Differs from *P. armasi* by having a complete gemini mask without fragments, a ventral row of tubercles in the distal prolateral region of the femur IV (Fig. 2D–E) and by having lateroventral regions of the ventral plate covered with microsetae type 4 (Fig. 3E–F). Penis with MS D2 small but accuminate (Fig. 3A–B). The trochanter of leg IV has a smaller proximal tubercle in the dorsal region than *P. armasi* and *P. geminorum*.

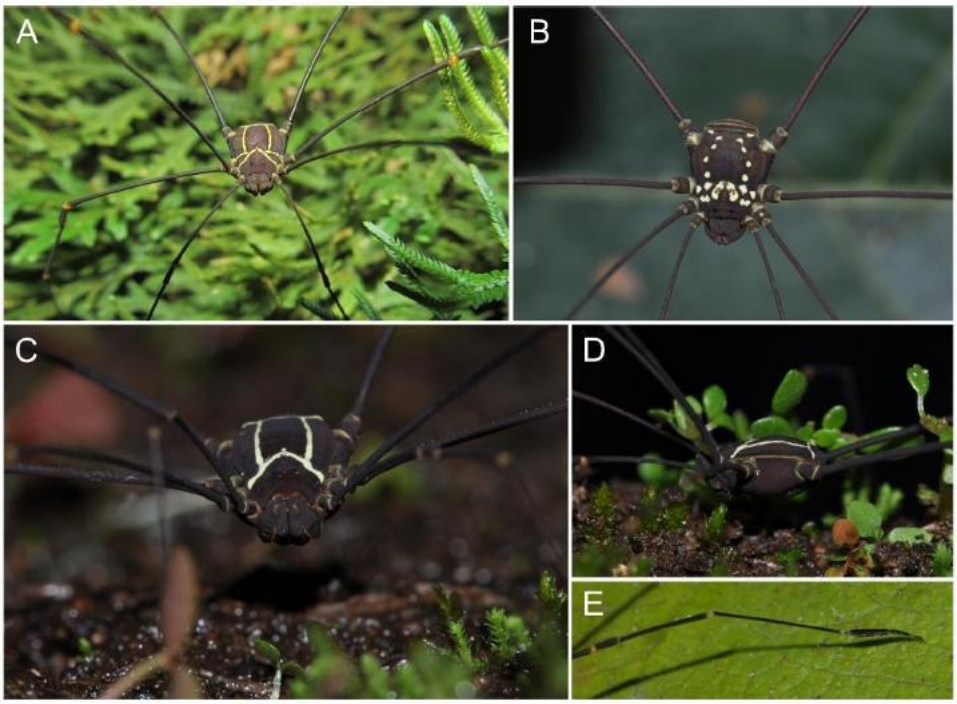

FIGURE 1. *Paecilaemella* spp. in vivo. A. *Paecilaemella andi* **sp. nov.**, from Caquetá, Colombia. B. *Paecilaemella armasi* **sp. nov.**, from Pastaza, Ecuador. C. *Paecilaemella geminorum* **sp. nov.**, from Sucumbíos, Ecuador. D. Same, lateral view. E. Same, detail of distal leg I. Photos by M. Medrano & A. Kury.

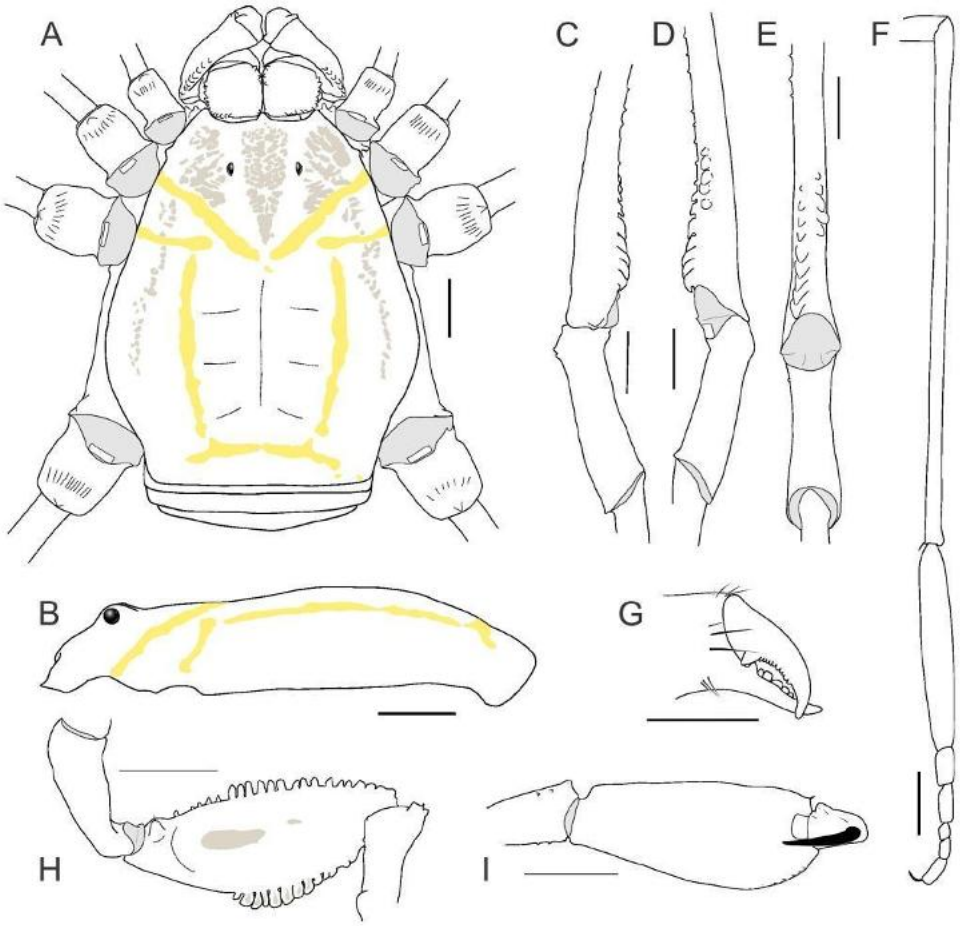

FIGURE 2. Schematic drawings of *Paecilaemella andi* **sp. nov.**, male holotype (MNRJ 1183). A. Body, dorsal view. B. Dorsal scutum, lateral view. C. Left leg IV, distal femur and trochanter, retrolateral view. D. Same, prolateral view. E. Same, ventral view. F. Left leg I, metatarsus and tarsomeres, lateral view. G. Distal part of the cheliceral hand. H. Left pedipalp, patella, femur and trochanter, mesal view. I. Same, tibia and tarsus. Scale bars: 1 mm.

Description. (Male holotype) (Fig. 2). Measurements. Body length: 6.1. Maximum width of scutum: 5.0. Carapace length: 2.4, width 3.4. Interocular distance: 1.0. Legs: I: 34.06 (0.86, 10.89, 1.54, 5.77, 9.07, 5.93), II: 79.0 (1.20, 23.39, 2.46, 17.01, 24.37, 10.57), III: 51.18 (1.25, 17.29, 2.11, 8.62, 14.87, 7.04), IV: 70.35 (1.44, 23.18, 3.12, 13.68, 20.53, 8.40).

Dorsum. Large sized cosmetid (dorsal scutum length approximately 6 mm). Dorsal scutum in dorsal view epsilon-shaped with shallow cheliceral sockets (Fig. 2A). Dorsal scutum flat in lateral view (Fig. 2B), coxa IV entirely visible in dorsal view (Fig. 2A), thicker than scutum in lateral view. Ocularium low, narrow, with median depression. Scutal grooves poorly delimited (Fig. 1A). Scutum entirely unarmed and without any granules (Figs 2A–B). Free tergites I–III and anal operculum smooth and unarmed (Fig. 2A).

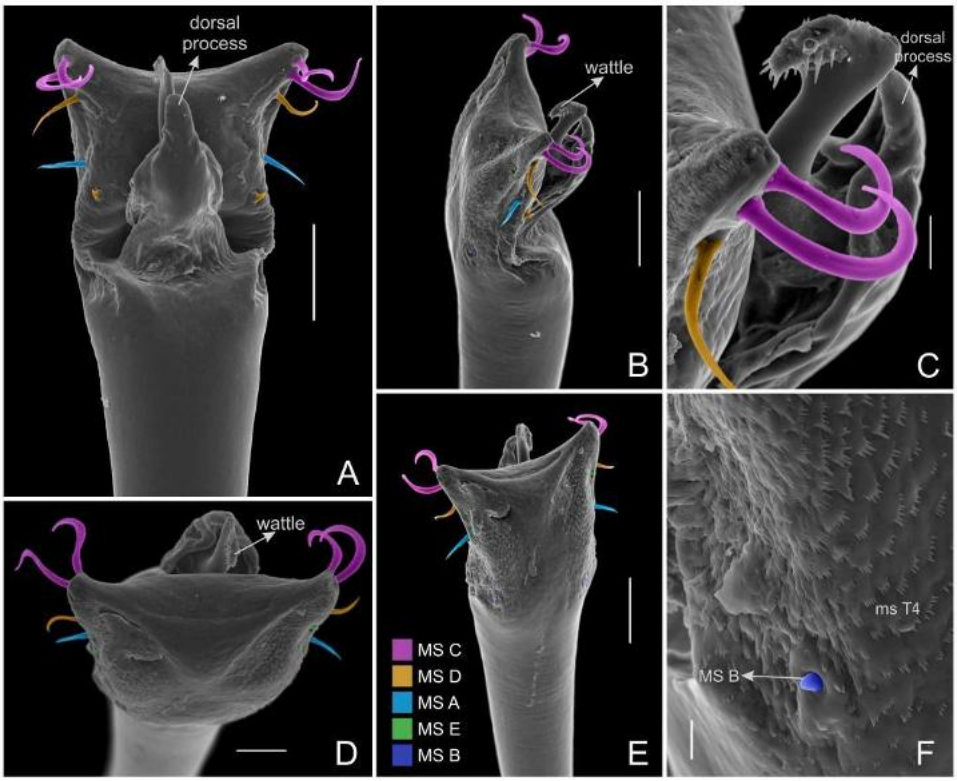

FIGURE 3. SEM images the penis of *Paecilaemella andi* **sp. nov.**, paratype (MNRJ 60294). A. Dorsal view. B. Lateroapical view. C. Same, detail of glans complex and MS C. D. Ventroapical view. E. Ventral view. F. Same, detail of ms and MS B. Scale bars: 100 μm (A, B, E), 50 μm (D), 20 μm (C), 10 μm (F).

Venter. Coxae I–III triangular, transverse to main body axis. Coxae II to IV connected by tubercle bridges. Ventral elements of coxa I: e1 and e2 forming a single row of ca 12 tubercles; e3 = 1 very large conical process, visible in dorsal view; e4 = one large bifid process; e5 = indistinct cluster of ca. five cusps. The row of tubercles formed by e1 and e2 is continued in coxa II towards the genital operculum by a row of 10 tubercles and in the coxa III by a cluster of four tubercles. Coxa IV pentagonal, greatly developed, oriented obliquely, but almost parallel to the body axis. Stigmatic area T-shaped with stigmata large, unconcealed. Free sternites smooth and unarmed.

Chelicera (Figs 2A, G). Neither basichelicerite nor hand thickened or swollen in males. Bulla short, rounded, bordered with rounded tubercles, six to eight ectal and five to six posteriors. Movable finger with one basal triangular tubercle and a row of smaller rounded tubercles distally. Fixed finger with a row of rounded tubercles, larger than those of the movable finger.

Pedipalpus (Figs 2H, I). Trochanter with stout antero-dorsal protuberance. Femur strongly compressed, concave on mesal surface, borders armed with long tubercles. Tibia strongly depressed, with a weakly distinct groove on the mesal edge. Shape asymmetrical, with ectal side more pronounced, armed distally with a row of seven short spines. Corresponding mesal side with a widely spaced row of seven short spines, increasing in size distally. Tarsus moderately elongated, with an irregular ventro-ectal row of short spines, a much sparser ventro-mesal row of short spines and a proximal mesal cluster of short spines.

Legs. Elongate and moderately thick (growing thicker from I to IV). Males with basitarsomeres I thickened, first basitarsomere five times longer than the following ones (Fig. 2F). All femora straight. Femur IV with a distal comb of eight retroventral tubercles and a subdistal comb of five pro-ventral tubercles (Figs 2C–E). Tibia IV with scattered granules. Femur III unarmed. Tarsal claws unpectinate. Tarsal formula: 6(3)-6(3)/17(3)-20(3)/11-11/12-12.

Color (Fig. 1A). Color pattern of the gemini mask as follows (Fig. 2A): Two continuous longitudinal parallel lines forming a suspender on DS, a non-fragmented chevron, two transversal lines between the chevron and the parallel lines. Omega stripe continuous. Background of body (dorsal and ventral) and appendages Dark Yellowish Brown (78), dorsal scutum with lighter mottling Light Brown (57) in carapace, laterals and anterior portion of the abdomen as depicted in Figure 2A. Pedipalps and chelicerae Dark Yellowish Brown (78) with lighter mottling Light Brown (57). Blots Brilliant Greenish Yellow (98). Distal portion of femur, tibia and patella of the legs Deep Orange Yellow (69). Patella and metatarsus Deep Orange Yellow (69) in the proximal portion.

Variation. Some males without tubercles on femur IV. Females with femur IV unarmed basitarsomeres of leg I not thickened and not as long as those in males, chelicerae slightly smaller than in male. The chevron may exhibit a median division or be divided into more portions, and the omega stripe may be entire or divided medially.

Genitalia (Fig. 3). VP of penis rectangular, widening slightly distally. Lateral margins of the dorsal portion of VP (at MS C level) concave along their length, basal to MS C1–C2. Five pairs of larger macrosetae inserted on lateral margin of VP: Two pairs C1–C2 greatly developed, curved and flattened; the third pair of macrosetae, adjacent to C1–C2, robust, cylindrical and straight, is best interpreted as D1; D2 is reduced, acuminate and located basally, inserted in the dorsal part of the VP. The fifth pair of MS, here interpreted as A1, is straight and similar in shape to D1. A pair of small macrosetae B is located ventro-basally on VP, while E1–E2 also reduced are located ventrally. Microsetae type 4 covering the lateral margins of the VP, but absent in the middle. Stylus strongly curved, cylindrical, with small wattle and a well-developed ventral peak formed by barbels. Dorsal process of glans thumb-shaped.

***Paecilaemella armasi* sp. nov.**

Figs 1B; 4; 5

Etymology. It is our pleasure to dedicate this species to the renowned Cuban arachnologist Luis de Armas in honor of his 80th birthday. Name in genitive case.

Holotype. 1 ♂ (QCAZI 278597) Ecuador, Pastaza, Diez de Agosto, Cascada El Triunfo (-1.434028°,-77.791444°, alt.: 1056 m), 22 Jul 2019, A Chagas Jr & A Giupponi leg.

Paratypes. 1 ♀ (QCAZI 278598) same data as the holotype; 17 ♂ 10 ♀ 2 juv. (MNRJ 58847) same data as the holotype; 2 ♂ 4 ♀ (MNRJ 984) Ecuador, Pastaza, Puyo arredores de Puyo, El Triunfo, cascada y tarabita (-1.4336°,-77.7925°, alt.: 1060 m), 10 Dec 2021, APL Giupponi, AA Granado, AB Kury, MA Medrano leg.;

Other examined material. 2 juv. (MNRJ 9532, burned) Ecuador, Pastaza, estrada de terra Puyo-Canelos (-1.601514°,-77.841967°, alt.: 950 m), 26 Jul 2018, A Giupponi, A Kury & M Medrano leg.

Distribution. Ecuador, Napo moist forests and Eastern Cordillera real montane forests of Pastaza province (Fig. 8).

Diagnosis. This species differs from its congeners by having a fragmented gemini mask (Fig. 1B, 4A) and from *P. andi* and *P. geminorum* by having 13 tarsomeres of leg IV while the other two species have 12. Furthermore, it has an almost glabrous ventral plate (Fig. 5B, D) (instead of having microsetae type 4 as in *P. andi* and *P. geminorum*). It shares similarities with *P. andi* by having two transversal spots between the chevron and the parallel lines (Fig. 1B, 4A), although in *P. andi* it forms a non-fragmented line.

Description. (Male holotype) (Fig. 4). Measurements. Body length: 5.7. Maximum width of scutum: 4.7. Carapace length: 2.6, width 3.2. Interocular distance: 1.2. Legs: I: 28.36 (0.74, 9.46, 1.40, 4.34, 7.57, 4.85), II: 69.98 (0.95, 20.30, 2.38, 15.97, 21.00, 9.38), III: 46.21 (1.10, 15.60, 2.30, 7.44, 12.71, 7.06), IV: 63.83 (1.13, 23.41, 2.69, 10.82, 18.26, 7.52).

Dorsum. Large sized cosmetid (dorsal scutum length approximately 6 mm). Dorsal scutum in dorsal view epsilon-shaped with shallow cheliceral sockets (Fig. 4A). Dorsal scutum flat in lateral view (Fig. 4B), coxa IV entirely visible in dorsal view (Fig. 4A), thicker than scutum in lateral view. Ocularium low, narrow, with median

depression. Scutal grooves poorly delimited. Scutum entirely unarmed and without any granules (Fig. 1B). Free tergites I–III and anal operculum smooth and unarmed (Fig. 4A).

Venter. Coxae I–III triangular, transverse to main body axis. Coxae II to IV connected by tubercle bridges. Ventral elements of coxa I: e1 and e2 forming a single row of ca 12 tubercles; e3 = 1 very large conical process, visible in dorsal view; e4 = 1 large bifid process; e5 = indistinct cluster of 6 cusps. The row of tubercles formed by e1 and e2 is continued in coxa II towards the genital operculum by a row of fused tubercles forming a keel.

Coxa IV pentagonal, greatly developed, oriented obliquely, but almost parallel to body axis. Stigmatic area T-shaped with stigmata large, unconcealed. Free sternites smooth and unarmed.

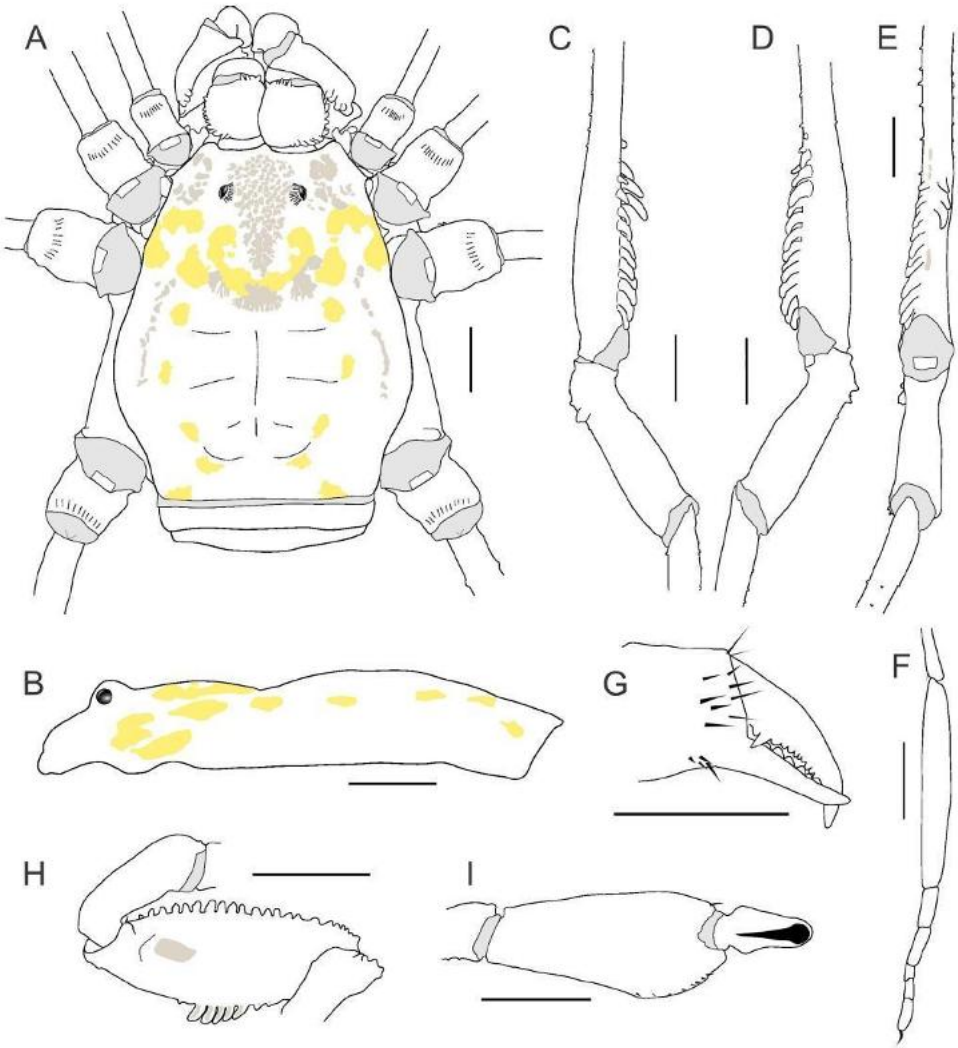

FIGURE 4. Schematic drawings of *Paecilaemella armasi* **sp. nov.**, male holotype (QCAZI 278597). A. Body, dorsal view. B. Dorsal scutum, lateral view. C. Left leg IV, distal femur and trochanter, retrolateral view. D. Same, prolateral view. E. Same, ventral view. F. Left leg I, metatarsus and tarsomeres, lateral view. G. Distal part of the cheliceral hand. H. Left pedipalp: patella, femur and trochanter, mesal view. I. Same, tibia and tarsus. Scale bars: 1 mm.

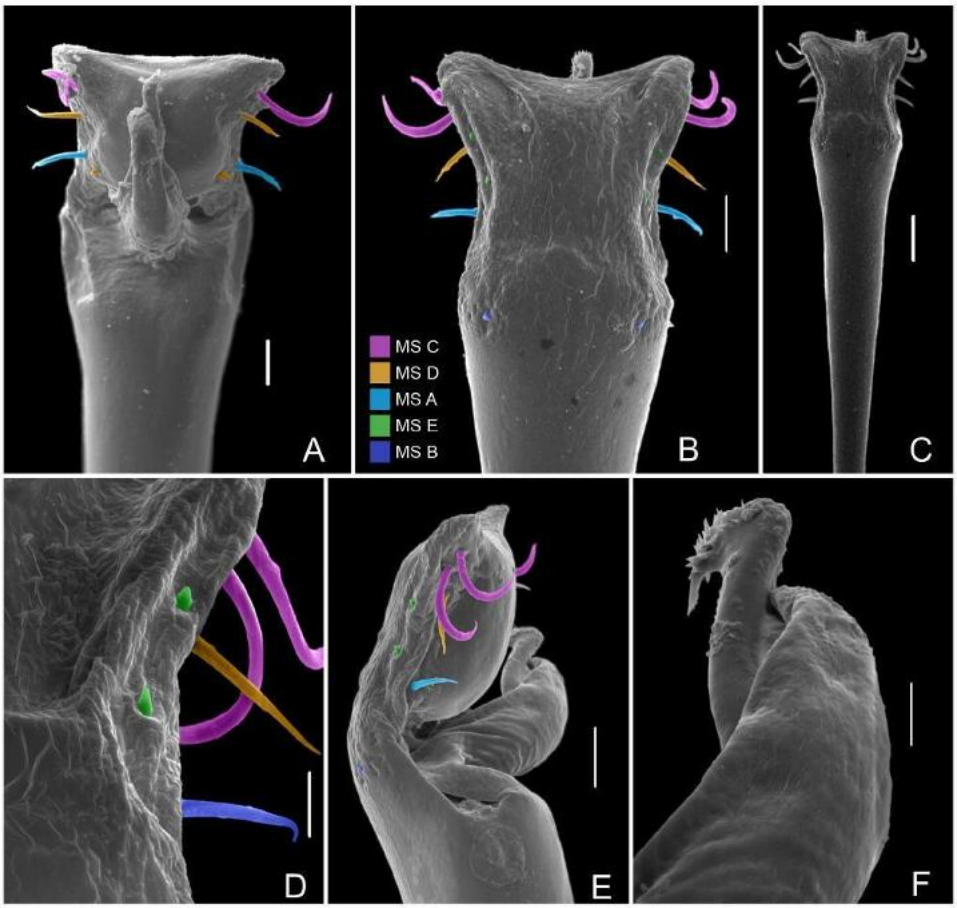

FIGURE 5. SEM images the penis of *Paecilaemella armasi* **sp. nov.** A. Paratype (MNRJ 58847), dorsal view. B. Same, ventral view. C. Same, panoramic ventral view. D. Paratype (MNRJ 984), detail of glabrous ventral plate and MS, ventral view. E. Same, lateral view. F. Same, detail of gland complex. Scale bars: 100 μm (C), 50 μm (B, E), 40 μm (A), 20 μm (D, F).

Chelicera (Figs 4A, G). Neither basichelicerite nor hand thickened or swollen in males. Bulla short, rounded, bordered with rounded tubercles, six ectal and four to six posterior. Movable finger with one basal triangular tubercle and a row of smaller rounded tubercles going distally. Fixed finger with a row of rounded tubercles, larger than those of the movable finger.

Pedipalpus (Figs 4H, I). Trochanter with stout antero-dorsal protuberance. Femur strongly compressed, concave on mesal surface, borders armed with long tubercles. Tibia strongly depressed, with a weakly distinct groove on the mesal edge. Shape asymmetrical, with ectal side more pronounced, armed distally with a row of eight short spines. Corresponding mesal side with a widely spaced row of seven short spines and a large apical spine. Tarsus moderately elongate, ventro-ectal side with two spines one medial and one apical and a row of small setae. A much sparser ventro-mesal tight row of short spines.

Legs. Elongate and moderately thick (growing thicker from I to IV). Males with basitarsomeres I thickened, first basitarsomere four times longer than the following ones. All femora straight. Femur IV with a distal comb of 11

retroventral tubercles and a subdistal comb of three pro-ventral tubercles (Figs 4C–E). Tibia with two ventral rows of granules. Tarsal claws unpectinate. Tarsal formula: 6(3)-6(3)/19(3)-19(3)/11-11/13-13.

Color (1B, 4A). Pattern color of the gemini mask as follows (Fig. 2A): Two longitudinal parallel rows of spots, with one spot per scutum area. Chevron fragmented into two lateral spots and a medial one forming the letter "v", two transversal spots between the chevron and the parallel lines. Omega stripe fragmented, formed by four spots: two on the posterior border of area IV and two on the postero-lateral border of DS. Background of body (dorsal and ventral) and appendages Reddish Black (24), dorsal scutum with lighter mottling Moderate Reddish Brown (43) in carapace, as in the pattern depicted in Figure 4A. Pedipalps and chelicerae Reddish Black (24) with lighter mottling Moderate Reddish Brown (43). Blots Yellowish White (92). Distal portion of femur, tibia and patella of the legs Deep Orange Yellow (69). Patella and metatarsus Deep Orange (51) in the proximal portion.

Variation. Size of the tubercles in distal femur IV may vary from remarkable to small and some males are unarmed (similar to females). Females with basitarsomeres not thickened in leg I and the first basitarsomere is not as long as in males, chelicerae slightly smaller than in male. The median part of the chevron may exhibit less extension, that is more fragmented in some specimens.

Genitalia (Fig. 5). VP of penis rectangular, widening slightly distally. Lateral margins of the dorsal portion of VP (at MS C level) concave along their length basal to MS C1-C2. Five pairs of larger macrosetae inserted on lateral margin of VP: Two pairs C1–C2 greatly developed, curved and flattened, the third pair of macrosetae, adjacent to C1-C2, robust, cylindrical and straight, is best interpreted as D1, while D2 is much reduced and located basally, inserted in the dorsal part of the VP. The fifth pair of MS, here interpreted as A1, is straight and similar in shape to D1. A pair of small macrosetae B is located ventro-basally on VP, while E1–E2 also reduced are located ventrally. Microsetae absent or extremely reduced. Stylus strongly curved, cylindrical, with small wattle and a well-developed ventral peak formed by barbels. Dorsal process of glans thumb-shaped.

***Paecilaemella geminorum* sp. nov.**
Figs 1C, D, E; 6; 7

Etymology. The species name derives from the Latin genitive plural of *geminus* (twin), referring to the dorsal blot, resembling the traditional symbol of the Gemini zodiac constellation.

Holotype. 1 ♂ (QCAZI 278596) Ecuador, Orellana, San José de Payamino Centro de Turismo Comunitario Petroglifos, Rio Tutapishco, Sr. Julio (-0.568364°,-77.33974°, alt.: 426 m), 6 Dec 2021, APL Giupponi, AA Granado, AB Kury, M Medrano leg.

Paratypes. 1 ♂ (MNRJ 264) same data as the holotype; 1 ♂ (MNRJ 691) Ecuador, Pastaza, Puyo, surroundings of Puyo, Teniente Hugo Ortiz (-1.38624°,-77.94437°, alt.: 1051 m), 10 Dec 2021. APL Giupponi, AA Granado, AB Kury, MA Medrano leg.; 1 ♂ 1 ♀ (MNRJ 640) Ecuador, Sucumbíos, Lumbaqui bridge in El Dorado de Cascale (0.082575°,-77.27911°, alt.: 430 m), 05 Dec 2021, APL Giupponi, AA Granado, AB Kury, M Medrano leg.

Other examined material. 3 ♂ 1 juv. (MNRJ 9523, burned) Ecuador, Sucumbíos, Lumbaqui, Cerro Lumbaqui, near the city (0.038461°,-77.316782°, alt.: 738 m), 23 Jul 2018. A Giupponi, A Kury & M Medrano leg.

Distribution. Ecuador, Napo moist forests and Eastern Cordillera real montane forests at Sucumbios, Pastaza and Orellana provinces (Fig. 8).

Diagnosis. *P. geminorum* can be distinguished from other species within the genus by its simple chevron (Fig. 1C, 6A) and the absence of distal armature on the prolateral side of femur IV (Fig. 6D–E). It shares similarities with *P. andi*, including a continuous gemini mask (Fig. 1C, 6A) and a penis with MS D2 positioned more basally than MS A (Fig. 7A, D). In contrast, it differs from *P. armasi* because the latter bears a discontinuous gemini mask (Fig. 1B, 4A) and has both MS A and MS D2 aligned at the same height (Fig. 5A, C).

Description. (Male holotype) (Fig. 6). Measurements. Body length: 6.8. Maximum width of scutum: 5.6. Carapace length: 2.7, width 3.8. Interocular distance: 1.0. Legs: I: 33.21 (1.07, 9.75, 1.56, 5.87, 9.28, 5.68), II: 66.54 (1.03, 18.03, 2.61, 15.18, 20.05, 9.64), III: 33.89 (1.05, 11.20, 1.67, 6.08, 9.09, 4.80), IV: 51.27 (0.95, 17.32, 2.82, 9.86, 14.02, 6.30).

Dorsum. Large sized cosmetid (dorsal scutum length approximately 7 mm). Dorsal scutum in dorsal view epsilon-shaped with shallow cheliceral sockets (Fig. 6A). Dorsal scutum flat in lateral view (Figs 1D, 6B), coxa IV entirely visible in dorsal view (Fig. 6A), thicker than scutum in lateral view (Fig. 1D). Ocularium low, narrow, with

median depression. Scutal grooves poorly delimited. Scutum entirely unarmed and without any granules (Figs 1C –D). Free tergites I–III and anal operculum smooth and unarmed (Fig. 6A).

Venter. Coxae I–III triangular, transverse to main body axis. Coxae II to IV connected by tubercle bridges. Ventral elements of coxa I: e1 = ca. 8 tubercles forming a row; e2 = 3 large tubercles clustered; e3 = 1 very large conical process; e4 = 1 huge bifid process; e5 = indistinct cluster of ca. 5 cusps. Coxa IV pentagonal, greatly developed, oriented obliquely, but almost parallel to the body axis. Stigmatic area T-shaped with stigmata large, unconcealed. Free sternites smooth and unarmed.

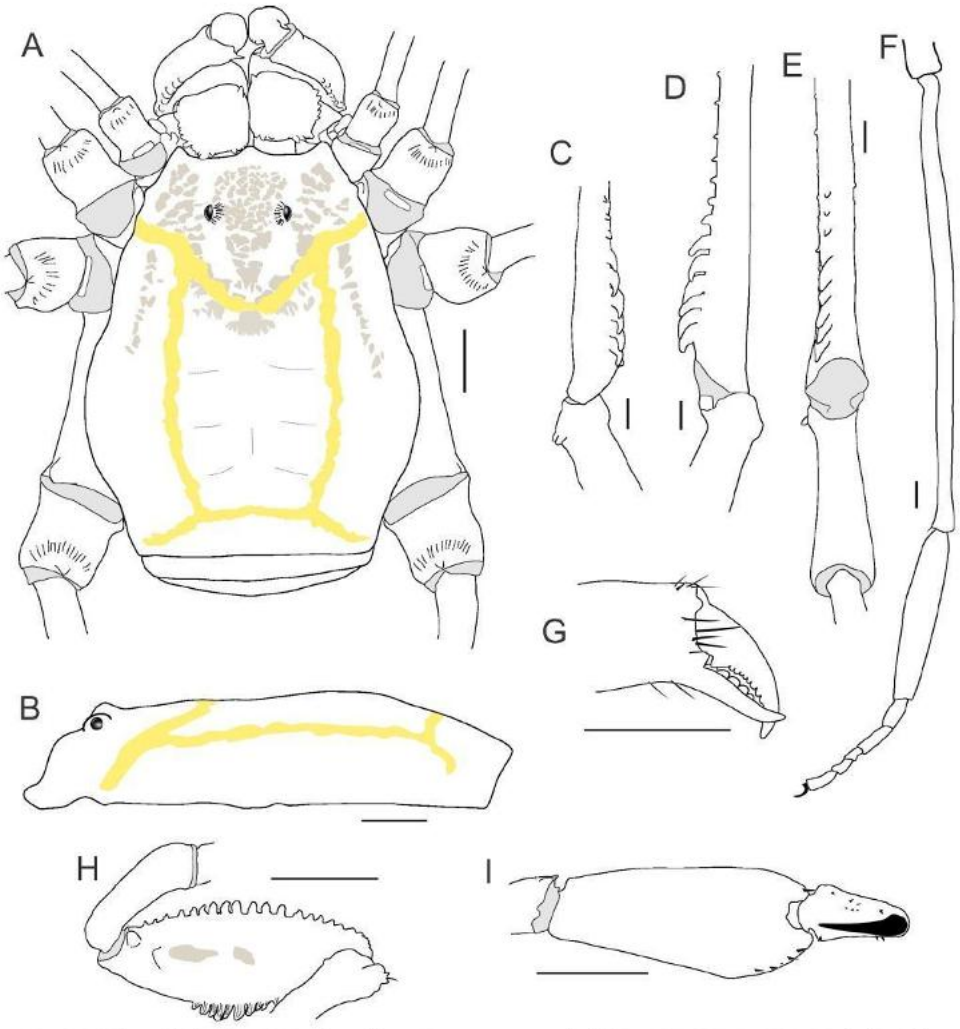

FIGURE 6. Schematic drawings of *Paecilaemella geminorum* **sp. nov.**, male holotype (QCAZI 278596). A. Body, dorsal view. B. Dorsal scutum, lateral view. C. Left leg IV, distal femur and trochanter, retrolateral view. D. Same, prolateral view. E. Same, ventral view. F. Left leg I, metatarsus and tarsomeres, lateral view. G. Distal part of the cheliceral hand. H. Left pedipalp, patella, femur and trochanter, mesal view. I. Same, tibia and tarsus. Scale bars: 1 mm.

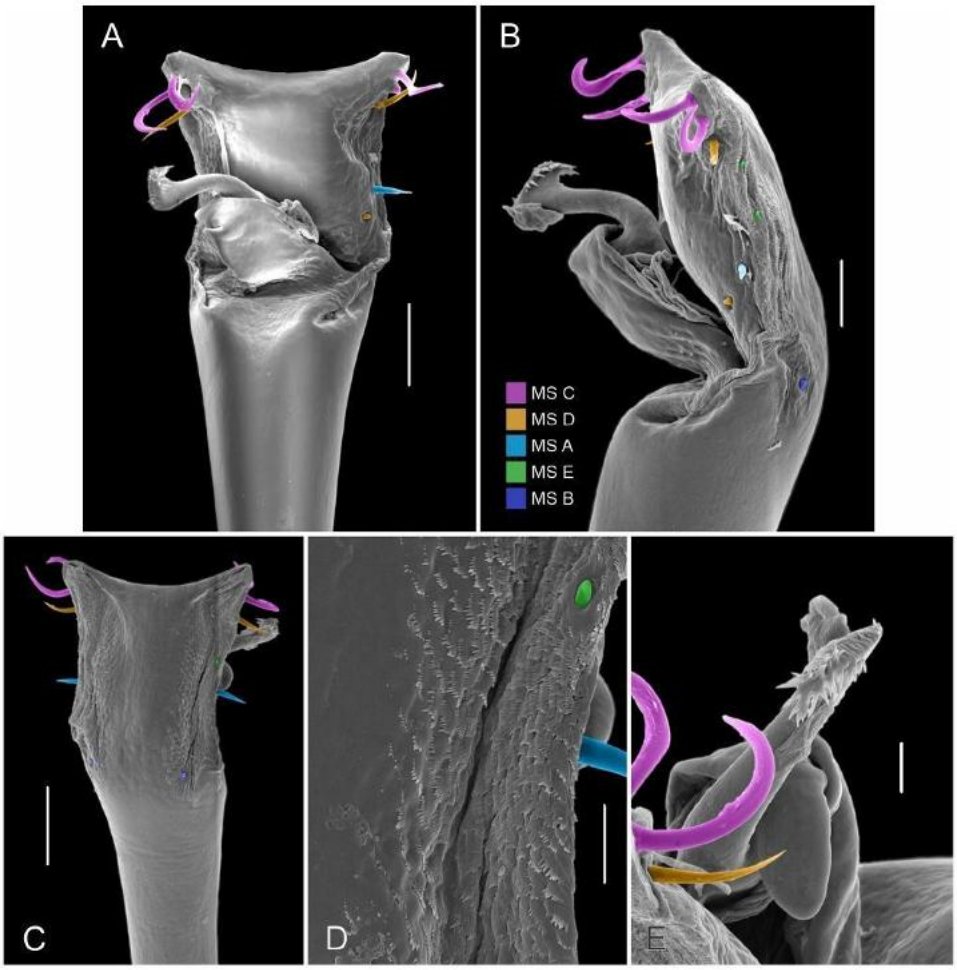

FIGURE 7. SEM images the penis of *Paecilaemella geminorum,* paratype (MNRJ 691). A. Dorsal view. B. Lateral view. C. Ventral view. D. Same, detail of microsetae on ventral plate E. Detail of gland complex. Scale bars: 100 µm (C), 80 µm (A), 50 µm (B), 20 µm (D, E).

Chelicera (Figs 6A, G). Neither basichelicerite nor hand thickened or swollen in males. Bulla short, rounded, bordered with rounded tubercles, eight ectal and 10 posterior. Movable finger with one basal triangular tubercle and a row of smaller rounded tubercles going distally. Fixed finger with a row of rounded tubercles, larger than those of the movable finger.

Pedipalpus (Figs 6H, I). Trochanter with stout antero-dorsal protuberance. Femur strongly compressed, concave on mesal surface, borders armed with long tubercles. Tibia strongly depressed, with a weakly distinct groove on the mesal edge. Shape asymmetrical, with ectal side more pronounced, armed distally with a row of seven short spines. Corresponding mesal side with a widely spaced row of seven short spines, increasing in size distally. Tarsus moderately elongate, with tight irregular ventro-ectal row of short spines, a much sparser ventro-mesal row of short spines and a proximal mesal cluster of short spines.

Legs. Elongate and moderately thick (growing thicker from I to IV). Males with basitarsomeres I thickened, first basitarsomere four to five times longer than the following ones. All femora straight. Femur IV with distal comb of retro-ventral spines. Tibia with two ventral rows of granules. Tarsal claws unpectinate. Tarsal formula: 6(3)-6(3)/?-18(3)/11-11/12-12.

Color (1C–E, 6A). Pattern color of the gemini mask as follows: Two continuous longitudinal parallel lines forming a suspender on DS, completed by two horizontal lines (chevron and omega stripe) forming the gemini sign. Background of body (dorsal and ventral) and appendages Reddish Black (24), dorsal scutum with lighter mottling Deep Yellowish Brown (75) in carapace, laterals and anterior portion of the abdomen as depicted in Figure 6A. Pedipalps and chelicerae Dark Grayish Red (20) with lighter mottling Deep Yellowish Brown (75). Blots Yellowish White (92). Distal portion of femur, tibia and patella of the legs Deep Orange Yellow (69). Patella and metatarsus Deep Orange Yellow (69) in the proximal portion.

Variation. Some males have reduced tubercles in the distal comb in femur IV. Females with basitarsomeres not thickened in leg I and not as long as those in males, chelicerae slightly smaller than in male. The chevron may exhibit a median division or be divided into more portions, while the omega stripe, whether entire or medianly divided.

Genitalia (Fig. 7). Ventral plate of penis rectangular, widening slightly distally. Lateral margins of the dorsal portion of VP (at MS C level) concave along their length, basal to MS C1-C2. Five pairs of larger macrosetae inserted on lateral margin of VP: Two pairs C1-C2 greatly developed, curved and flattened, the third pair of macrosetae, adjacent to C1-C2, robust, cylindrical and straight, is best interpreted as D1, while D2 is much reduced and located basally, inserted in the dorsal part of the VP. The fifth pair of MS, here interpreted as A1, is straight and similar in shape to D1. A pair of small macrosetae B is located ventro-basally on VP, while E1–E2 also reduced are located ventrally. Microsetae type 4 covering the lateral margins of the VP, but absent in the middle. Stylus strongly curved, cylindrical, with small wattle and a well-developed ventral peak formed by barbels. Dorsal process of glans thumb-shaped.

TABLE 1. Records of *Paecilaemella armasi* **sp. nov.** and *Paecilaemella geminorum* **sp. nov.** from iNaturalist in Ecuador.

Name	Locality	Latitude	Longitude	Source
Paecilaemella armasi	Napo, Ahuano	-1.063609	-77.526234	https://www.inaturalist.org/observations/99042125
Paecilaemella geminorum	Napo, Chontapunta	-0.912098	-77.332303	https://www.inaturalist.org/observations/99048906
Paecilaemella geminorum	Napo, Chontapunta	-0.912094	-77.332303	https://www.inaturalist.org/observations/99207278
Paecilaemella geminorum	Parque Nacional Napo-Sumaco Galeras	-0.365908	-77.470197	https://www.inaturalist.org/observations/41079038
Paecilaemella geminorum	Napo, El Capricho	-1.11	-77.99	https://www.inaturalist.org/observations/19625694
Paecilaemella geminorum	Napo, Tena	-0.994451	-77.816092	https://www.inaturalist.org/observations/23581172
Paecilaemella geminorum	Napo, Tena, Parque amazonico Isla del Amor	-0.993703	-77.815247	https://www.inaturalist.org/observations/24137301
Paecilaemella geminorum	Napo, Tena, Troncal Amazónica	-0.974597	-77.814278	https://www.inaturalist.org/observations/24341497
Paecilaemella geminorum	Napo, Tena, Calle Teniente Hugo Ortiz	-0.970788	-77.812012	https://www.inaturalist.org/observations/24572016
Paecilaemella geminorum	Orellana, Reserva Biológica Río Bigal	-0.536453	-77.424266	https://www.inaturalist.org/observations/140033194

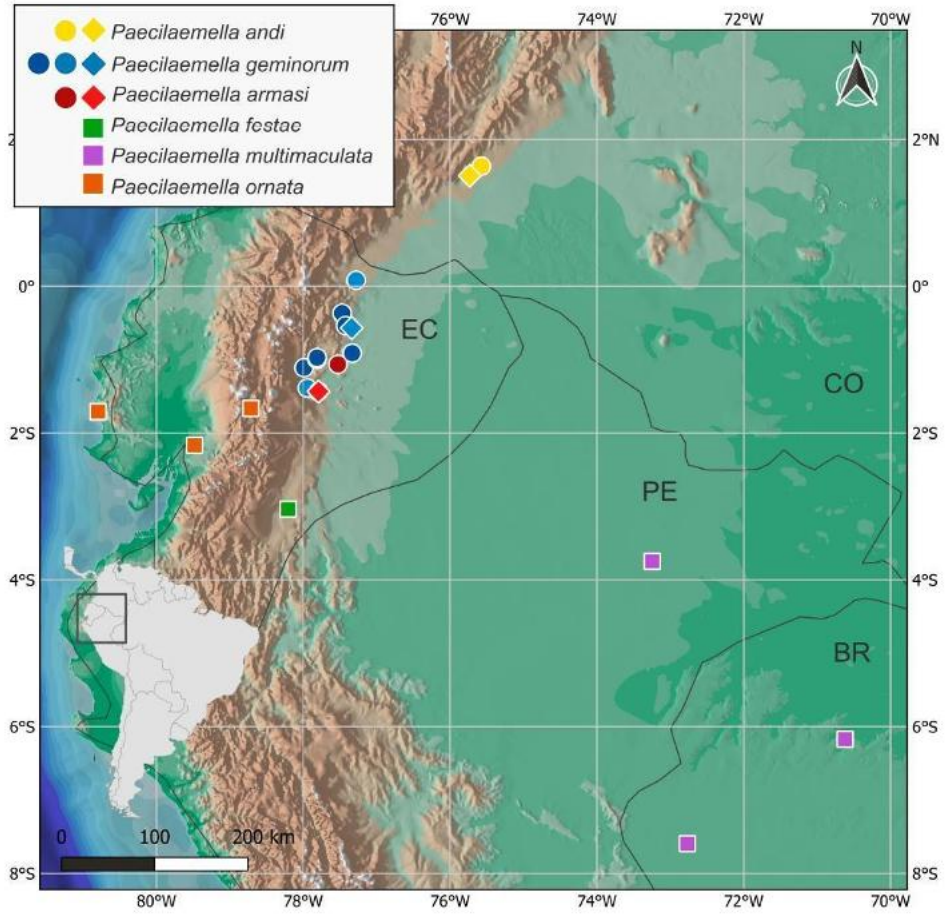

FIGURE 8. Known distribution of *Paecilaemella*. Rhombuses indicate the type locality for each species described here, and darker points indicate iNaturalist records (complete list in Table 1).

Discussion

The three species described here seem to form a monophylum within *Paecilaemella* based on their external and genital morphology. All three share a general spot pattern in the dorsal scutum; they have a well-defined chevron that is joined to a transverse stripe in area III by a pair of parallel stripes. The color pattern seems to be conservative within the species. We examined abundant material from the three species, including iNaturalist observations (Table 1), and the pattern remains almost unaltered among the individuals.

Males of the species described here exhibit an elongated first basitarsomere on leg I that is approximately four times longer than the second basitarsomere, the type specimen of *P. festae* is a female and in the other two species of *Paecilaemella* this character was not depicted or described. There is another genus in Cosmetidae, as far as we know, that possesses long basitarsomeres in legs I (first basitarsomere almost twice the size of the other tarsomeres): *Rhaucoides* Roewer, 1912. The presence of more than one gland pore in the elongated first

basitarsomere in *Rhaucoides* species, and the lack of subdivision led to it being treated as fused by Medrano *et al.* (2022). In *Paecilaemella* members, the number of tarsomeres remains consistent between sexes, suggesting that rather than a true fusion, the basitarsomere may have undergone elongation. Nevertheless, they do have multiple glands in the basitarsomere and a more comprehensive study is needed to assess the ubiquity of these glands across Cosmetidae.

The taxonomic knowledge of the genus is still incipient: two of the current species are known only by females, including the type species (*P. festae* and *P. multimaculata*), and the material depicted in Medrano *et al.* (2021) of the third species (*P. ornata*) was destroyed in the fire at the National Museum (Rio de Janeiro) in 2018 shortly after being photographed, thereby preventing the examination of its genital morphology. Morphology of the penis studied here shows a clear pattern of macrosetae arrangement: two apical curved MS C, two MS D (a long distal MS and a short basal one), and one long MS A. This pattern matches what we know about the subfamily, since *Flirtea* members bear the same quantity of MS (Kury & García, 2016). The genital morphology of *Paecilaemella* and *Flirtea* differs in two important ways: (1) the position of the MS D2 in *Paecilaemella* is more basal than in *Flirtea*, and this results in MS A being more basal than MS D in *Flirtea*, and (2) the size of the wattle in *Flirtea* occupies most of the stylus length, and in *Paecilaemella* the wattle is only apical, giving a cylindrical shape to the stylus. The shape and amount of barbels in *Paecilaemella* is much more similar to that of *Rhaucoides* and although the external morphology is remarkably different between both genera, the relative position of the MS D2 is the main character that differentiates their genital morphology.

Finally, some considerations must be made about the morphology of our new species and the diagnosis presented in Kury and Medrano (2018). First, the ornamentation of the legs IV may vary from one species to another, for example the three species described here exhibit ornamentation on the ventro-distal femora IV, both pro and retrolateral, not described by Kury & Medrano (2018). Second, sexual dimorphism is not remarkable in the three species described here. Males have slightly larger chelicerae and spines in distal femora IV, but none of these have hypertelic chelicerae, agreeing with diagnosis present in Kury and Medrano (2018), which contradicts the inclusion of *P. ornatum,* that has large kidney-shape chelicerae (Medrano *et al.*, 2021). Finally, the three species here described bear a white coloration in the distal region of the femora and tibiae I–IV, contrasting with the dark background of the rest of the podomere (Fig. 1E), but we do not know if this coloration pattern is present in the other three.

For now, the genus (including our three species) is supported by external morphology (Kury & Medrano, 2018), based on the shape of the dorsal scutum, unarmed abdomen and monomorphic chelicerae (except for *P. ornata),* and long and mostly unarmed femora IV (with only a distal comb of ventral tubercles).The three new species described here provide new morphological data for refining the diagnosis of the genus and contributes valuable insights that will support future taxonomic efforts. A revision of the genus is in progress and further examination of the valid species as well as undescribed ones will allow better delimitation and diagnosis of the genus and understanding of its relationships with other members of the subfamily.

Acknowledgements

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