Historia naturalis bulgarica
— monthly online journal of natural history

ISSN 2603-3186

Volume **48** · Issue **10**
Publication date [online]: 1 October 2026

NATURA ET SCIENTIA

Contents

Yeison Vega, Zunilda Escalante-Arteaga, Karla Fiallos-Yanez, Geoffrey Gallice
Immature stages and natural host plant of the Neotropical skipper *Pheraeus pulcher* Grishin, 2023 (Lepidoptera: Hesperiidae: Moncina) in the Peruvian Amazon 285

Ayane Suênia-Bastos, Suianne Cajé, Daniela Cubillos, Joshua Pablo Cavalcanti, Jefferson Duarte-de-Mélo, Mirna Martins Casagrande
A new record of Hesperiinae (Lepidoptera: Hesperiidae) parasitoidism by Tachinidae (Diptera) in Brazil 297

Dilian Georgiev, Ognyan Todorov
New records of Psocodea (Insecta) from Vietnam 307

National Museum of Natural History — Bulgarian Academy of Sciences

Historia naturalis bulgarica
https://www.nmnhs.com/historia-naturalis-bulgarica/
Editorial office e-mail: hnb@nmnhs.com

Publisher: National Museum of Natural History, Bulgarian Academy of Sciences, 1 Tsar Osvoboditel Blvd, 1000 Sofia, Bulgaria

Editorial board

Editor-in-chief
Stanislav Abadjiev

Subject editors
Ilya Fabian Acosta, Zsolt Bálint, Christo Deltshev, Snejana Grozeva, Kal Ivanov, Larissa Ivanova, Peter Jäger, Mihail Kechev, Fedor V. Konstantinov, Yurii V. Kornilev, Yordan Koshev, Mario Langourov, Georgi N. Markov, Boris Nikolov, Jozef Oboňa, Teddy German Angarita Sierra, Nikolay Simov, Giancarlo Statti, Rossen Tzonev, Dimitar Uzunov

OPEN ACCESS

Distributed under the Creative Commons Attribution 4.0 International License (CC BY 4.0)

Historia naturalis bulgarica 48 (10): 285–295
ISSN 2603-3186 (online) | ISSN 0205-3640 (print) · nmnhs.com/historia-naturalis-bulgarica
https://doi.org/10.48027/hnb.48.101
Publication date [online]: 1 October 2026

Research article

Immature stages and natural host plant of the Neotropical skipper *Pheraeus pulcher* Grishin, 2023 (Lepidoptera: Hesperiidae: Moncina) in the Peruvian Amazon

Yeison Vega[1], Zunilda Escalante-Arteaga[2], Karla Fiallos-Yanez[3], Geoffrey Gallice[4, 5, 6]

(1) [Corresponding author] Alianza para una Amazonía Sostenible Perú, Las Piedras, Madre de Dios, Perú, yeison.vega@sustainableamazon.org; https://orcid.org/0000-0002-2492-6866
(2) Alianza para una Amazonía Sostenible Perú, Las Piedras, Madre de Dios, Perú, zunilda.escalante@sustainableamazon.org; https://orcid.org/0000-0002-4266-9592
(3) Alianza para una Amazonía Sostenible Perú, Las Piedras, Madre de Dios, Perú, karla.fiallos@sustainableamazon.org; https://orcid.org/0009-0007-8940-9919
(4) Pontificia Universidad Católica del Perú, Lima, Perú, ggallice@pucp.edu.pe, geoff.gallice@gmail.com; https://orcid.org/0000-0003-4381-4437
(5) Alliance for a Sustainable Amazon, Potomac, MD 20854, USA
(6) Department of Natural History, Florida Museum of Natural History, University of Florida, Gainesville, FL 32611, USA

Abstract: Skippers (Lepidoptera: Hesperiidae) are an extremely diverse group of butterflies in the Neotropics. However, basic biological information is still lacking for the vast majority of species, hindering studies of the group's evolutionary relationships, diversification, and species interactions. Here, we describe the immature stages, natural host plant, and larval shelter construction of *Pheraeus pulcher*, a recently described species in the particularly diverse subtribe Moncina from southeastern Peru. The life cycle, based on an individual reared from the egg, lasted 61 days and included six larval instars. The host plant is *Guadua weberbaueri*, a widespread bamboo species that forms dense stands throughout the study region. Our findings represent a significant improvement in our knowledge of this highly diverse yet poorly studied group of skippers in one of the world's most important biodiversity hotspots.

Keywords: bamboo, butterfly, larvae, larval biology, plant-insect interaction, Poaceae

Introduction

The skippers (Lepidoptera: Hesperiidae) are an extremely diverse group of butterflies, especially in the Neotropics, where approximately 2,700–2,800 species have been described to date (e.g., Mielke, 2004; Zhang et al., 2022, 2023, 2025). Although detailed studies remain scarce overall, improved molecular evidence has contributed to major changes in our understanding of skipper taxonomy and systematics in recent decades, (including multiple new phylogenetic hypotheses (e.g., Warren et al., 2009; Zhang et al., 2019a, 2023, 2024; Xiao et al., 2025) and the description of multiple new species and clades (e.g., Zhang et al., 2019b, 2023). While studies of the immature stages and host plant associations are limited or non-existent for most Neotropical species and groups (Duerr et al., 2022), when these data have been incorporated they have proven useful in supporting genetics-based taxonomic hypotheses (e.g., Janzen et al., 2005), the recognition of cryptic species (Hebert et al., 2004), the inference of macroevolutionary histories (Sahoo et al., 2017), and even the clarification of diversity patterns in complex groups

Received: 29 June 2026; accepted: 28 August 2026 · Editor: Stanislav Abadjiev

(Hernández-Roldan et al., 2012; Bächtold et al., 2017). Life and natural history characteristics may become even more critical in highly diverse and complex groups in which adult morphology exhibits convergence, causing commonly-used derived characters to be poorly informative for supporting classifications (Li et al., 2019).

The largely Neotropical skipper subtribe Moncina currently comprises more than 800 recognised species (Warren et al., 2026), making it one of the most diverse lineages within Hesperiidae. Moncina species are highly abundant throughout the Neotropics and most species are usually small, typically brown (Zhang et al., 2023), causing them to be extremely difficult to identify based on adult morphology. This lineage has consistently been recovered as a natural group in phylogenetic studies (Warren et al., 2009; Zhang et al., 2023), although no morphological diagnosis has yet been established that encompasses all species (Saraiva et al., 2020). In this context, characters derived from the immature stages could represent an additional source of evidence for comparative approaches aimed at improving our understanding of taxonomy, phylogenetic relationships, evolutionary patterns, and the remarkable diversification of this group.

The genus *Pheraeus* currently includes 13 species, which are widely distributed throughout the Neotropics (Steinhauser, 1991; Saraiva et al., 2020). The most recent descriptions have been made during the last decade, with the description of *P. guandu* Saraiva, Carneiro, O. Mielke & Casagrande, 2020 from Espírito Santo, Brazil (Saraiva et al., 2020), based on adult morphological characters, and *P. pulcher* Grishin, 2023 from the upper Amazonian region (Zhang et al., 2023), where the species was delimited primarily by genetic differences and only subsequently compared phenotypically with *P. honta* Evans, 1955 and its relatives. Despite the above-mentioned limited advances in the taxonomy and phylogenetic placement of *Pheraeus*, no information is currently available on the genus' basic biology and the immature stages of all species remain unknown. To address this important knowledge gap, in this study we present detailed descriptions of the immature stages, including larval shelter structures and head capsules, of *P. pulcher* and document the species' host plant in the southeastern Peruvian Amazon. This is the first study to document and describe the larval biology of any species of the genus *Pheraeus* and adds to a small but growing body of knowledge (e.g., Raby et al., 2024; Medeiros et al., 2025; Suênia-Bastos et al., 2026) on the natural history of Neotropical Hesperiidae.

Methods

Study site

This study was conducted at the Finca Las Piedras (FLP) field station located in the department of Madre de Dios (12°13′40″ S, 69°6′40″ W; 240 m a.s.l.) in southeastern Peru. FLP is covered mostly in upland or terra firme forest where Brazil nut (*Bertholletia excelsa* Bonpl.) is a dominant canopy species, although the site also borders areas of active agricultural fields and regenerating secondary forest, as well as swamps dominated by *Mauritia flexuosa* (Arecaceae). FLP is characterised by a tropical monsoon climate with a strong dry season from May to September, during which fewer than 100 mm of precipitation occur per month, and a wet season from approximately November to March with >200 mm of precipitation per month (for more information about the climate and tree species composition at FLP, see Fortier et al., 2025). This project is part of the Alliance for a Sustainable Amazon's long-term Lepidoptera Diversity and Biology Project in southeastern Peru.

Rearing

An egg of *P. pulcher* was found on August 27, 2025 during a regular search for immature Lepidoptera in one of several patches of *Guadua weberbaueri* Pigl. and subsequently brought to the FLP field laboratory for rearing and documentation under controlled conditions. Rearing was conducted following the protocol established at FLP (e.g., Baine et al., 2019), in which immatures are kept individually in 1L containers supplied with fresh host plant leaves kept hydrated using floral water tubes. The individual was photographed every two to three days using a Nikon D7100 digital SLR camera equipped with a Nikon AF-S VR Micro-Nikkor 105mm f/2.8G IF-ED lens. The eclosed adult was mounted and deposited in the Lepidoptera collection of the Alliance for a

Sustainable Amazon (ASA) in Puerto Maldonado, Peru.

Morphology

Measurements included the maximum diameter of the egg and length of the larvae and pupa taken in lateral view from the anterior portion of the head to posterior margin of the tenth abdominal segment. Examination and photography of head capsules were carried out using a Leica S9D stereomicroscope with a View 4K HD Camera. Measurements for all life stages, except for the cephalic capsule of the first instar, were made by counting pixels calibrated to scale in high resolution digital photographs using ImageJ 1.54d (Schneider et al., 2012). The description of the egg and larval instars followed the terminology in Minno (1994), except for the terms frontoclypeus and epicraneal notch, which are in accordance with Stehr (1987); the description of the pupa was based on nomenclature proposed by Mosher (1915). Because the first-instar head capsule was lost, the nomenclature of setae and pores was established based on the second-instar head capsule, following the terminology proposed by Stehr (1987). The classification of shelter groups and types follows the scheme proposed by Greeney (2009).

Identification

Because the colouration, number, and shape of the spots on the ventral hindwing (VHW) are diagnostic for species identification in *Pheraeus* (Saraiva et al., 2020), we compared our specimen with the type material illustrated in Warren et al. (2024). Since the two most recently described species, *P. pulcher* and *P. guandu*, were not included in that study, we also compared our material directly with the holotypes figured in Saraiva et al. (2020) and Zhang et al. (2023), respectively. To discriminate between *P. honta* and *P. pulcher*, we primarily followed the diagnostic characters proposed by Zhang et al. (2023), who demonstrated that populations previously identified as *P. honta* from Ecuador and Peru correspond to *P. pulcher*, and we verified the presence of a tuft of long orange scales tinged with brown near the apex and inner margin of the dorsal hindwing (DHW), a diagnostic feature of *P. pulcher*.

Results

Description of immature stages

Pheraeus pulcher Grishin, 2023
Voucher: 2025-FLP-IMM-0228

Egg (Fig. 1A–C): Diameter 1.1 mm. Semi-spherical shape, similar to a dome or cup. Pale yellow; base whitish. Chorion with multiple longitudinal stripes; micropylar region slightly concave. Laid on abaxial side of mature leaves. Duration: Unknown, hatched 6 days (n=1) after collection.

First instar (Fig. 1D–E): Head capsule black; shiny; pitted sculpting; vertex rounded; insignificant epicranial notch (Fig. 3A). Body yellowish, slightly green dorsally due to feeding, creamy in subspiracular region. Black prothoracic shield present. Whitish tracheal system. Short translucent setae scattered across body, longer and thicker on anal plate. Anal plate not differentiated from the integument. Body length: 4.80 mm. Duration: 5 days (n=1).

Second instar (Fig. 1F–G): Head capsule (Fig. 2) width 0.46 mm; light brown; pitted sculpting; vertex rounded; insignificant epicranial notch; stemmata black throughout the instar (Fig. 3B). Setae F1, AF2, P1, P2, A3, S1, S2. Clypeus with six setae on each side. Body similar to preceding instar, but yellow, turning dark green after feeding. Body length: 6.70 mm. Duration: 7 days (n=1).

Third instar (Fig. 1H–I): Head capsule width 0.60 mm, similar in colour and shape to preceding instar, but surface irregularly reticulate; secondary translucent setae more abundant; light brown line on each side, parallel to epicranial suture; adfrontal area light brown; median brown vertical line on frontoclypeus (Fig. 3C). Body similar to preceding instar, but green dorsal line more conspicuous; intersegmental lines dark green; body yellow from A8 to A10, slightly orange around the spiracle of A8. Body length: 8.70 mm. Duration: 4 days (n=1).

Fourth instar (Fig. 1J–K): Head capsule width 1 mm, similar in colour and shape to preceding instar, but light brown markings more evident; light brown spot starting from adfrontal area extending to stemmata region; light brown frontoclypeus; vertex slightly concave, bearing small pointed protuberances (Fig. 3D). Body similar to preceding instar, but T1-T3 and A7-A10 slightly yellow-orangish; dorsal region slightly whitish with small

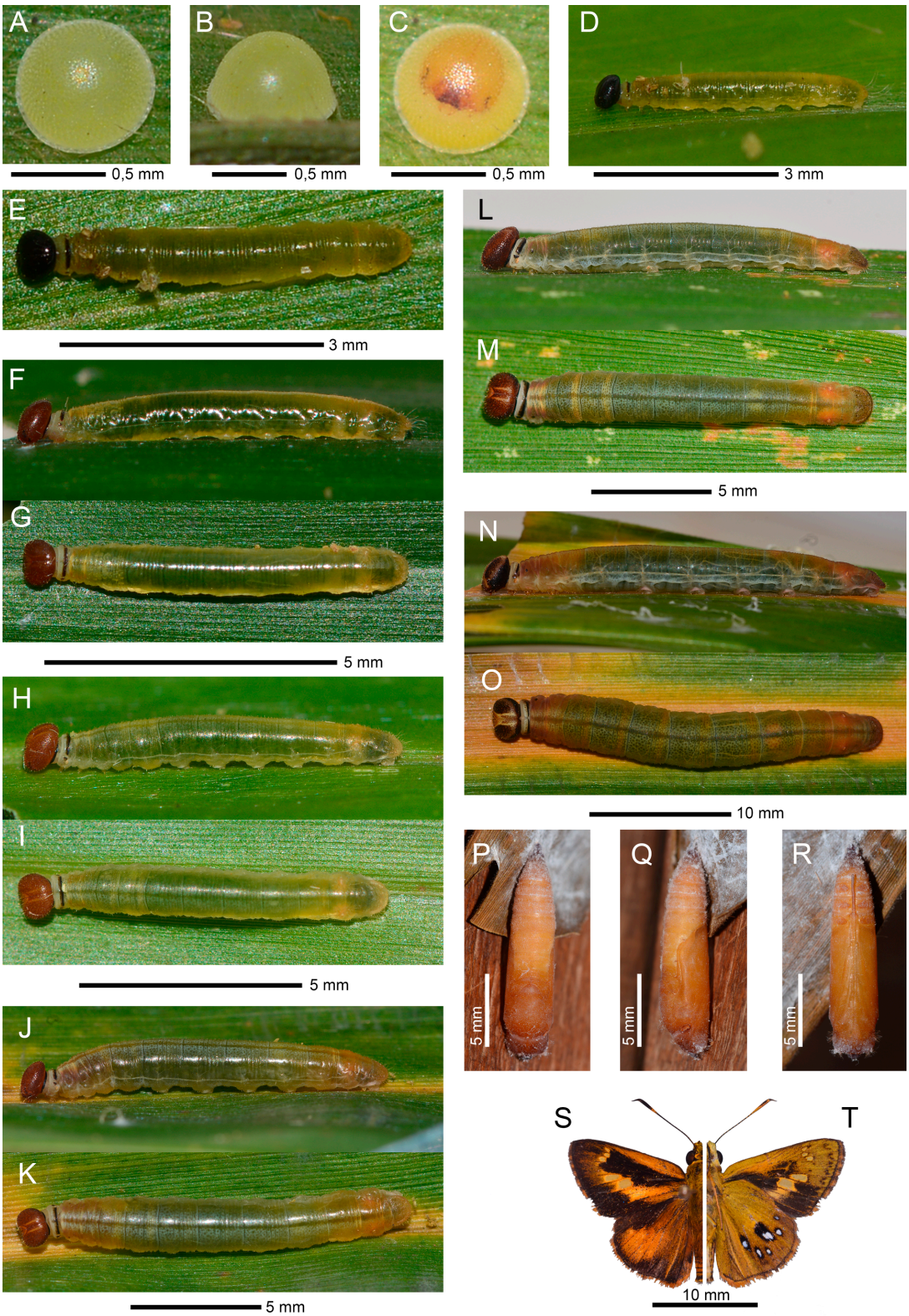


Fig. 1. Life stages of *Pheraeus pulcher* (voucher: 2025-FLP-IMM-0228): (A–B) egg in dorsal view and lateral view; (C) egg with head capsule visible (dorsal view); (D–E) first instar in lateral and dorsal views; (F–G) second instar in lateral and dorsal views; (H–I) third instar in lateral and dorsal views; (J–K) fourth instar in lateral and dorsal views; (L–M) fifth instar in lateral and dorsal views; (N–O) sixth instar in lateral and dorsal view; (P–R) pupa in dorsal, lateral, and ventral views; (S–T) adult in dorsal and ventral views.

dark green circular spots. Body length: 15.20 mm. Duration: 5 days (n=1).

Fifth instar (Fig. 1L–M): Head capsule width 1.34 mm, similar in colour and shape to preceding instar, but light brown markings paler and more conspicuous; vertex slightly more concave; epicranial notch V-shaped (Fig. 3E). Body similar to preceding instar, but T1–T2 slightly pinkish dorsally and matte; transverse yellow bands on A1–A2; area around spiracle of A8 more orange; anal plate ochre-yellow to brown, with black punctuations. Body length: 18.50 mm. Duration: 7 days (n=1).

Sixth instar (Fig. 1N–O): Head capsule width 1.90 mm, similar in colour and shape to preceding instar, but light brown markings becoming cream-coloured; creamy lateral band extending from the vertex to stemmata 1-4; vertex concave; epicranial notch V-shaped, deeper than in preceding instar (Fig. 3F). Body similar to preceding instar, but mid-dorsal line darker; thoracic and posterior abdominal segments slightly purplish; posterior margin of each segment with a yellowish transverse band. In prepupa, body becomes pale yellow; wax present ventrally between segments A3–A9. Body length: 29 mm. Duration: 14 days (n=1).

Pupa (Fig. 1P–R): Body elongated and fusiform. Head, thorax, and wing cases ochre. Galea of the maxilla extending to A7. Head with small dark brown trapezoidal process. Translucent setae present in ocular and supraocular regions, thorax dorsally, and abdomen. Mesothorax anteriorly with a pair of ochre eye-pieces. Abdominal segments pale yellow. Triangular cremaster reddish-brown. As development progresses, head and thorax become darker; pupal eyes become dark brown to black. Body length: 17.50 mm. Duration: 13 days (n=1).

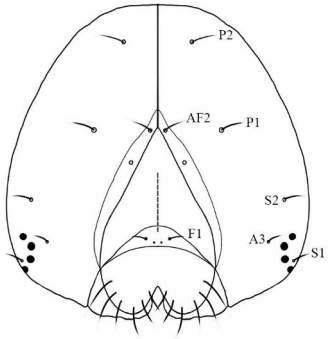


Fig. 2. Chaetotaxy of the head capsule of the second larval instar of *Pheraeus pulcher*.

Host plant, behaviour and shelter structure

The host plant was identified as *G. weberbaueri* (Poaceae: Bambusoideae: Bambuseae) that had been identified by previous studies at the site (Corahua-

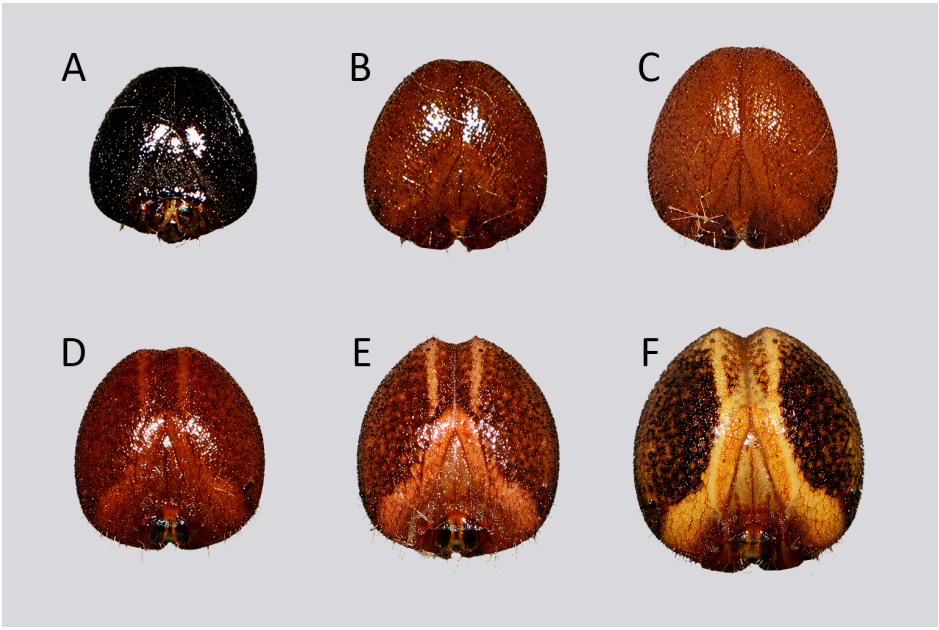


Fig. 3. Head capsules of *Pheraeus pulcher* (all in frontal view): (A) first instar; (B) second instar; (C) third instar; (D) fourth instar; (E) fifth instar; (F) sixth instar.



Fig. 4. Habitat of *Pheraeus pulcher* at Finca Las Piedras in southeastern Peru: (A) bamboo patch, *Guadua weberbaueri*, at forest edge; (B) view inside of *Guadua weberbaueri* patch.

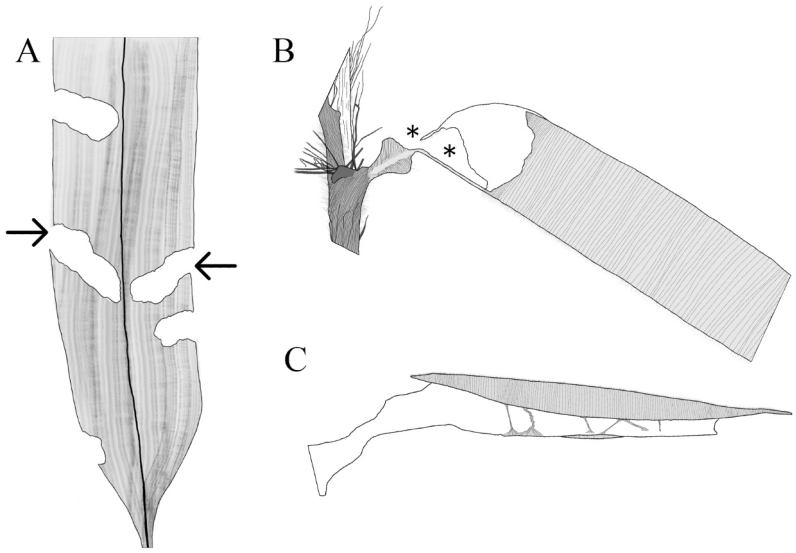


Fig. 5. Shelter structure of *Pheraeus pulcher*: (A) leaf damage caused by larval feeding; arrows indicate the initial cuts made to construct the shelter; (B) shelter in lateral view, note that the leaf damage (indicated by *) is located at the base of the leaf; (C) shelter in dorsal view. The shaded area represents the underside of the leaf in all drawings.

Espinosa et al., 2022). This species is a common bamboo widely distributed throughout the Amazon Basin that can reach up to 10–20 m in height and can form extensive patches in disturbed areas or within forested habitats (Londoño & Peterson, 1991; Tovar, 1993). The egg of *P. pulcher* was collected from a plant growing in a patch located at the forest edge, adjacent to a deforested area dominated by a *Urochloa* P.Beauv. species (Poaceae; Fig. 4). The egg was found 2.5–4 m above the ground on the abaxial surface of the leaf, near the base and close to the leaf margin.

In all instars, the larva initially fed perpendicular to the leaf midrib, producing a narrow, elongated feeding scar (Fig. 5). The leaf midrib was never consumed. Subsequent feeding occurred around this initial damaged area. The larva preferentially consumed the basal portion of the leaf, leaving the remainder of the leaf blade attached only by the midrib (Fig. 5A).

Shelter construction was not observed during the first instar or early second instar. From the late second instar to last instar, the shelter was tubular and was constructed by making two initial cuts on opposite

sides of the leaf blade, followed by folding the leaf margins together with silk and suspending the structure from the midrib in late instars (Fig. 5). This type of shelter belongs to Type 5, according to the classification by Greeney (2009).

Discussion

The descriptions of the immature stages of *P. pulcher* provided in this study constitute the first detailed information regarding the immature stages, as well as the first host plant record, for the genus *Pheraeus*. The morphology of the larval stages and pupa is consistent with that of other Moncina species (e.g., Greeney & Warren, 2011; Duerr et al., 2022; Raby et al., 2024; Medeiros et al., 2025), notably the tubular body, the presence of a prothoracic shield, the progressive development of markings and a more pronounced epicranial notch on the head capsule throughout the larval instars, and a fusiform pupa. Larvae with tubular bodies and fusiform pupae have been recorded in other Hesperiidae that use grasses or bamboos as host plants, regardless of their taxonomic position (Greeney & Warren, 2009a; Duerr et al., 2022; Vega et al., 2025; Suênia-Bastos et al., 2026), suggesting that these shared characteristics probably reflect adaptations to the structural traits of the host plant leaves, as has been proposed for other Hesperiidae that feed on other monocotyledons (e.g., Freitas, 2018; Freitas, 2020; Raby et al., 2024).

On the other hand, we consider that characters of the head capsule and the shape of the pupal head process may be potentially informative for distinguishing among groups or even species of Hesperiidae. The markings on the head capsule of Hesperiidae larvae in the later instars vary in position, colouration, and complexity, but in Moncina they are typically located along the adfrontal area, the epicranial suture, and the lateral regions of the head capsule. In *P. pulcher*, the pattern of markings (Fig. 3), particularly in the final instar, differ from those reported for other Moncina larvae (e.g., Greeney & Warren, 2009a; Cock, 2013; Medeiros et al., 2025), where the spot surrounding the epicranial suture is particularly broader and extends toward the stemmatal region, in addition to the development of an epicranial notch that is much more pronounced than in other species of the subtribe (e.g., Greeney & Warren, 2009a, 2009b; Ccahuana et al., 2021; Duerr et al., 2022; Medeiros et al., 2025). Regarding the head process of the pupa, *P. pulcher* exhibits a trapezoidal shape, differing from the long and pointed process reported in other species (Cock, 2013; Freitas, 2020; Ccahuana et al., 2021; Duerr et al., 2022), the short and conical form (Duerr et al., 2022; Vega et al., 2025), the short and triangular form (Greeney & Warren, 2011), or the complete absence of this structure (Cock, 2013; Raby et al., 2024; Medeiros et al., 2025) observed in other Neotropical skippers.

The record of *G. weberbaueri* as the host plant of *P. pulcher* is consistent with the association of most Moncina species with Poaceae (e.g., Beccaloni et al., 2008; Janzen & Hallwachs, 2018). This association has been suggested as one of the factors underlying the high diversification rates observed in skippers, especially in Hesperiinae (Sahoo et al., 2017), given the diversity of this plant family. In addition, our field observations suggest that patches of *G. weberbaueri* in the region constitute an important resource for several other lepidopteran species. We have observed multiple skipper genera belonging to different tribes (e.g., *Xeniades* Godman, 1900, *Metron* Godman, 1900, *Eutocus* Godman, 1901, *Dubia* (Bell, 1932), and *Perichares* Scudder, 1872), as well as multiple Euptychiina (Nymphalidae: Satyrinae: Satyrini) (e.g., *Pseudodebis valentina* (Cramer, 1779), Corahua-Espinoza et al., 2022 and *Harjesia blanda* (Möschler, 1877), Nakahara et al., 2026; some species of *Argentaria* Huertas & Willmott and *Caeruleuptychia* Forster, 1964) and a few tiger moths (Erebidae: Arctinae) feeding on this plant as larvae.

Larval shelters constructed of folded leaves held together with silk are a common feature among many lepidopteran families, with shelter form and ontogeny often varying characteristically across taxa (Greeney & Jones, 2003; Lill et al., 2007). Skipper shelters can generally be divided into five different types that are defined by the number of leaves used, whether they are cut, and how many cuts are involved in construction (Greeney, 2009; Greeney & Jones, 2003). In general, skipper larvae construct shelters of two types during different stages of their larval development, with Type 1 (no-cut fold, tubular, formed using only one leaf) and Type 4 (one-cut fold, conical or tubular, constructed using only one major cut) shelters being the most common among Moncina (e.g., Greeney & Warren, 2009b; Greeney & Warren, 2011; Cock, 2013; Ccahuana et al., 2021). The shelter type observed in *P. pulcher* remained unchanged

throughout its development and contrasts with the shelter types typically reported for grass-feeding skippers. From the second instar onward, larvae constructed a Type 5 (two-cut fold on opposite sides of the leaf midvein) shelter (Fig. 5), a shelter type that appears to be relatively uncommon among documented Moncina. To our knowledge, this shelter type has been reported within Moncina only for fourth instar larvae of *Corra coryna* (Hewitson, 1866) (Greeney & Warren, 2009a), although it is likely that this shelter type also occurs in other taxa of the subtribe, as it has also been documented in other grass-feeding hesperiines (Greeney & Jones, 2003).

We consider that the morphological characteristics of the immature stages of *P. pulcher* reported herein, together with its shelter-building behaviour and association with *G. weberbaueri*, may provide a starting point for refining the taxonomy and phylogenetic placement of the genus by incorporating potentially valuable characters that have not been commonly considered previously (Warren et al., 2009). These characteristics may also facilitate macroecological studies at infraspecific levels aimed at revealing processes of speciation and adaptation (e.g., Allio et al., 2021). It is evident that our knowledge of the immature stages of Neotropical butterflies remains severely limited, as studies of this kind require detailed long-term monitoring and considerable effort, which is compounded by the immense species richness of the region. Nevertheless, such basic biological studies provide valuable information across multiple disciplines, helping to elucidate patterns of diversification and contributing to the conservation of biodiversity in the Neotropics at a time when human impacts on natural ecosystems are increasing at an unprecedented rate.

Acknowledgements

We greatly thank Johana Reyes of the Alianza para una Amazonía Sostenible Perú for administrative support of the Lepidoptera Diversity and Biology Project. We also thank Wild Green Future for partial funding of the Alliance for a Sustainable Amazon's Lepidoptera Diversity and Biology Project at Finca Las Piedras. Peru's Servicio Nacional Forestal y de Fauna Silvestre – SERFOR granted permission to conduct field and laboratory research at FLP (permit number D000443-2021-MIDAGRI-DGGDPFFS).

Conflicts of interest

No potential conflict of interest has been reported by the authors, reviewers, or subject editor.

Author' contributions

(using CrediT)

Yeison Vega: conceptualisation, data curation, formal analysis, investigation, methodology, resources, software, validation, visualisation, writing—original draft, writing—review and editing; Zunilda Escalante-Arteaga: conceptualisation, data curation, formal analysis, investigation, methodology, resources, software, validation, visualisation, writing—original draft, writing—review and editing; Karla Fiallos-Yanez: data curation, investigation, methodology, validation, writing—review and editing; Geoffrey Gallice: funding acquisition, project administration, writing—review and editing.

References

Allio R., Nabholz B., Wanke S., Chomicki G., Pérez-Escobar O.A., Cotton A.M., Clamens A.L., Kergoat G.J., Sperling F.A.H., Condamine F.L. 2021 Genome-wide macroevolutionary signatures of key innovations in butterflies colonizing new host plants. Nature Communication 12 (354). https://doi.org/10.1038/s41467-020-20507-3

Bächtold A., Kaminski L.A., Magaldi L.M., Oliveira P.S., Del-Claro K., Janzen D.H., Burns J.M., Grishin N., Hajibabaei M., Hallwachs W., Freitas A.V.L. 2017 Integrative data helps the assessment of a butterfly within the *Udranomia kikkawai* species complex (Lepidoptera: Hesperiidae): immature stages, natural history, and molecular evidence. Zoologischer Anzeiger 266: 169–176. https://doi.org/10.1016/j.jcz.2016.11.009

Baine Q., Polo-Espinoza G., Nakahara S., Gallice G. 2019 Immature stages and new host record of *Taygetis rufomarginata* Staudinger, 1888 (Lepidoptera: Nymphalidae: Satyrinae). Tropical Lepidoptera Research 29: 79–86.

Beccaloni G.W., Viloria A.L., Hall S.K., Robinson G.S. 2008 Catalogue of the hostplants of the Neotropical butterflies. m3m-Monografias Tercer Milenio, Volume 8. Zaragoza (Spain): Sociedad

Entomológica Aragonesa (SEA)/Red Iberoamericana de Biogeografía y Entomología Sistemática (RIBES)/Ciencia y Tecnología para el Desarrollo (CYTED)/Natural History Museum, London, U. K. (NHM)/Instituto Venezolano de Investigaciones Científicas, Venezuela (IVIC), 536 pp.

Ccahuana R., Tejeira R., Hurtado T., Nakahara S., Rodríguez-Melgarejo M., Gott R.J., See J., Gallice G. 2021 Immature stages of *Ebusus ebusus ebusus* (Cramer, 1780) in the Peruvian Amazon (Lepidoptera: Hesperiidae: Hesperiinae). Tropical Lepidoptera Research 31 (2): 90–95.

Cock M.J.W. 2013 The Skipper Butterflies (Hesperiidae) of Trinidad. Part 19. Hesperiinae, Moncini: the Remaining Genera with Pale Spots: *Cymaenes, Cobalopsis, Arita, Lerema, Morysand, Tigasis*. Living World, Journal of The Trinidad and Tobago Field Naturalists' Club, 20–40.

Corahua-Espinosa T., Nakahara S., Baine Q., Kabir J., Rodríguez-Melgarejo M., Tejeira R., Ccahuana R., See J., Soto-Quispe Y., Wood H., Escalante-Arteaga Z., Gallice G. 2022 Immature Stages and New Host Plant Records for Three Species in the "*Taygetis* Clade" of Euptychiina in Southeastern Peru (Lepidoptera: Nymphalidae: Satyrinae). Neotropical Entomology 52: 67–80. https://doi.org/10.1007/s13744-022-00998-z

Duerr N., Corahua-Espinoza T., Baine Q., Tejeira R., Ccahuana R., del Castillo Espinosa M.M., Perlett E., Cervantes-Martínez N., Santillana A.L., See J., Soto-Quispe Y.S., Wood H., Escalante-Arteaga Z., Gallice G. 2022 Immature stages, new host plant records and shelter structures of *Troyus phyllides* (Röber, 1925) and *Thoon ponka* Evans, 1955 in the Peruvian Amazon (Lepidoptera: Hesperiidae: Hesperiinae: Hesperiini). Zootaxa 5200 (4): 372–390. https://doi.org/10.11646/zootaxa.5200.4.6

Freitas A.V.L. 2018 Immature stages of the Neotropical skipper *Lychnuchoides ozias ozias* (Hewitson, 1878) (Lepidoptera: Hesperiidae). Tropical Lepidoptera Research 28 (1): 25–28.

Freitas A.V.L. 2020 Immature stages of the Neotropical skipper *Saliana longirostris* (Sepp, [1840]) (Lepidoptera: Hesperiidae). Tropical Lepidoptera Research 30 (2): 81–85.

Fortier R.P., Corahua-Espinoza T., Swamy V., Feeley K.J., Gallice G.R. 2025 Insights from a new 1-ha permanent forest plot reveal differences between habitat type and similarities between forest type in the southwestern Amazon. Ecology and Evolution 15: e71476. https://doi.org/10.1002/ece3.71476

Greeney H.F. 2009 A revised classification scheme for larval hesperiid shelters, with comments on shelter diversity in the Pyrginae. Journal of Research on the Lepidoptera 41: 53–59. https://doi.org/10.5962/p.266528

Greeney H.F., Jones M.T. 2003 Shelter building in the Hesperiidae: A classification scheme for larval shelters. Journal of Research on the Lepidoptera 37: 27–36. https://doi.org/10.5962/p.266551

Greeney H.F., Warren A.D. 2009a The life history and shelter building behavior of *Vettius coryna coryna* Hewitson, 1866 in Eastern Ecuador (Lepidoptera: Hesperiidae: Hesperiinae). Journal of Insect Science 9 (32): 1–9. https://doi.org/10.1673/031.009.3201

Greeney H.F., Warren A.D. 2009b The immature stages and shelter building behavior of *Falga jeconia ombra* in eastern Ecuador (Lepidoptera: Hesperiidae: Hesperiinae). Journal of Insect Science 9 (33): 1–10. https://doi.org/10.1673/031.009.3301

Greeney H.F., Warren A.D. 2011 The Natural History, Immature Stages, and Shelter Building Behavior of *Dion carmenta* (Lepidoptera: Hesperiidae: Hesperiinae) in Eastern Ecuador. Annals of the Entomological Society of America 104 (6): 1128–1134. https://doi.org/10.1603/AN10063

Hebert P.D.N., Penton E.H., Burns J.M., Janzen D.H., Hallwachs W. 2004 Ten species in one: DNA barcoding reveals cryptic species in the Neotropical skipper butterfly *Astraptes fulgerator*. Proceedings of the National Academy of Sciences 101 (41): 14812–14817. https://doi.org/10.1073/pnas.0406166101

Hernández-Roldán J.L., Munguira M.L., Wagner W., Vila R. 2012 Comparative analysis and taxonomic use of morphology of immature stages and natural history traits in European species of *Pyrgus* Hübner (Lepidoptera: Hesperiidae, Pyrgidae). Zootaxa 3470: 1–70. https://doi.org/10.11646/zootaxa.3470.1.1

Janzen D.H., Hajibabaei M., Burns J.M., Hallwachs W., Remigio E., Hebert P.D.N. 2005 Wedding biodiversity inventory of a large and complex

Lepidoptera fauna with DNA barcoding. Philosophical Transactions of the Royal Society B: Biological Sciences 360 (1462): 1835–1845. https://doi.org/10.1098/rstb.2005.1715

Janzen D.H., Hallwachs W. 2018 Dynamic database for an inventory of the macrocaterpillar fauna, and its food plants and parasitoids, of Area de Conservación Guanacaste (ACG), northwestern Costa Rica (nn-SRNP-nnnnn voucher codes).

Lepesqueur C., Neis M., Silva N.A.P., Pereira T., Rodrigues H.P.A., Trindade T., Diniz I.R. 2017 *Elbella luteizona* (Mabille, 1877) (Lepidoptera, Hesperiidae: Pyrginae) in Brazilian Cerrado: larval morphology, diet, and shelter architecture. Revista Brasileira de Entomologia 61: 282–289. https://doi.org/10.1016/j.rbe.2017.08.004

Li W., Cong Q., Shen J., Zhang J., Hallwachs W., Janzen D.H., Grishin N.V. 2019 Genomes of skipper butterflies reveal extensive convergence of wing patterns. Proceedings of the National Academy of Sciences 116 (13): 6232–6237. https://doi.org/10.1073/pnas.1821304116

Lill J.T., Marquis R.J., Cuddington K., Byers J.E., Wilson W.G., Hastings A. 2007 Microhabitat manipulation: ecosystem engineering by shelter-building insects. Ecosystem engineers: plants to protists, 107–138. https://doi.org/10.1016/S1875-306X(07)80008-6

Londoño X., Peterson P.M. 1991 *Guadua sarcocarpa* (Poaceae: Bambuseae), a new species of Amazonian Bamboo with Fleshy Fruits. Systematic Botany 16 (4): 630–638. https://doi.org/10.2307/2418866

Medeiros A.M., Medeiros A.D., Kerpel S.M. 2025 Immature stages of *Callimormus saturnus* (Herrich-Schäffer, 1869) (Lepidoptera: Hesperiidae, Hesperiinae, Hesperiini, Moncina): biology, morphology and behaviour. Historia naturalis bulgarica 47 (6): 145–156. https://doi.org/10.48027/hnb.47.063

Mielke O.H.H. 2004 Hesperiidae. In: Lamas G. (ed.) Atlas of Neotropical Lepidoptera/Checklist: Part 4A Hesperioidea-Papilionoidea. Scientific Publishers, 25–86.

Minno M.C. 1994 Immature stages of the skipper butterflies (Lepidoptera: Hesperiidae) of the United States: Biology, morphology, and descriptions [Doctoral dissertation]. University of Florida.

Mosher E. 1915 A classification of the Lepidoptera based on characters of the pupa [Doctoral dissertation]. University of Illinois. https://doi.org/10.5962/bhl.title.70830

Nakahara S., Vega Y., Corahua-Espinoza T.H.A., Kabir J., Maclure C., Duerr N., Baine Q. 2026 Immature stages and new host plant records for eight euptychiine butterflies in southeastern Peru (Lepidoptera: Nymphalidae: Satyrinae: Satyrini). Zootaxa 5748 (2): 151–192. https://doi.org/10.11646/zootaxa.5748.2.1

Raby R., Siewert R.R., Freitas A.V.L. 2024 Immature stages of *Rhinthon bajula* (Schaus, 1902) (Hesperiidae: Hesperiinae). Tropical Lepidoptera Research 34 (2): 118–121.

Sahoo R.K., Warren A.D., Collins S.C., Kodandaramaiah U. 2017 Hostplant change and paleoclimatic events explain diversification shifts in skipper butterflies (Family: Hesperiidae). BMC Evolutionary Biology 17 (174). https://doi.org/10.1186/s12862-017-1016-x

Saraiva I.M., Carneiro E., Casagrande M.M., Mielke O.H.H. 2020 A new species of *Pheraeus* Godman, 1900 (Hesperiidae, Hesperiini, Moncina) restricted to Rio Doce Valley, Brazil. Zootaxa 4859 (2): 285–292. https://doi.org/10.11646/zootaxa.4859.2.7

Schneider C., Rasband W., Eliceiri, K. 2012 NIH Image to ImageJ: 25 years of image analysis. Nature Methods 9: 671–675. https://doi.org/10.1038/nmeth.2089

Stehr F.W. 1987 Order Lepidoptera. In: Stehr F.W. (ed.) Immature Insects, Vol. I. Kendall/Hunt Publishing, Dubuque, 293–294.

Steinhauser S.R. 1991 Taxonomic notes and descriptions of new taxa in the Neotropical Hesperiidae Part II, Heteropterinae and Hesperiinae, *Vinius* Group. Bulletin of the Allyn Museum 132: 1–79.

Suênia-Bastos A., Cajé S., Medeiros A.D., Pereira E., Duarte-de-Mélo J., Cavalcanti J.P., Mielke O.H.H. 2026 First description of the later immature stages of *Orthos hyalinus* (Bell,1930) (Hesperiinae: Hesperiini: Carystina). Tropical Lepidoptera Research 35 (2): 117–121.

Tovar O. 1993 Las Gramíneas (Poaceae) del Perú (Vol. 13). Editorial CSIC-CSIC Press.

Vega Y., Flores-Bacayan C., Cordova-Velazco A., Escalante-Arteaga Z., Gallice G., Nakahara S. 2025 Immature stages and biology of the

Neotropical skipper *Artines angelica* Medeiros, 2019 (Hesperiidae: Hesperiinae: Hesperiini: Moncina). Acta Amazonica 55: e55bc24162. https://doi.org/10.1590/1809-4392202401621

Warren A.D., Ogawa J.R., Brower A.V. 2009 Revised classification of the family Hesperiidae (Lepidoptera: Hesperioidea) based on combined molecular and morphological data. Systematic Entomology 34 (3): 467–523. https://doi.org/10.1111/j.1365-3113.2008.00463.x

Warren A.D., Davis K.J., Stangeland E.M., Willmott K.R., Grishin N.V. 2026 Illustrated Lists of American Butterflies. http://www.butterfliesofamerica.com/.

Xiao J., Hao X., Chiba H., Li Y., Yuan X. 2025 Comparative Analysis of Mitogenomic and Nuclear Gene Data Reveals Phylogenetic Implications, Divergence Times, and Historical Biogeography in the Subfamily Pyrginae (Lepidoptera: Hesperiidae). Ecology and Evolution 15 (7): e71757. https://doi.org/10.1002/ece3.71757

Zhang J., Cong Q., Shen J., Brockmann E., Grishin N.V. 2019a Genomes reveal drastic and recurrent divergence in firetip skipper butterflies (Hesperiidae: Pyrrhopyginae). Proceedings of the Royal Society B: Biological Sciences 286 (1903): 20190609. https://doi.org/10.1098/rspb.2019.0609

Zhang J., Cong Q., Shen J., Brockmann E., Grishin N.V. 2019b Three new subfamilies of skipper butterflies (Lepidoptera, Hesperiidae). ZooKeys 861: 91–105. https://doi.org/10.3897/zookeys.861.34686

Zhang J., Cong Q., Shen J., Song L., Gott R.J., Boyer P., Guppy C.S., Kohler S., Lamas G., Opler P.A., Grishin N.V. 2022 Taxonomic discoveries enabled by genomic analysis of butterflies. The taxonomic report of the International Lepidoptera Survey 10 (7): 1–59. https://doi.org/10.5281/zenodo.7160429

Zhang J., Cong Q., Grishin N.V. 2023 Descriptions of one hundred new species of Hesperiidae. Insecta mundi 1026: 1–135.

Zhang J., Cong Q., Shen J., Song L., Grishin N.V. 2024 Genomics-based taxonomic rearrangement of Achlyodini and Carcharodini (Lepidoptera: Hesperiidae: Pyrginae). Insecta mundi 1016: 135027.

Zhang J., Cong Q., Shen J., Song L., Grishin N.V. 2025 Descriptions of three hundred new species of Hesperiidae (Lepidoptera). Insecta Mundi 1148. https://doi.org/10.64338/im.1148.2704t

Historia naturalis bulgarica 48 (10): 297–305
ISSN 2603-3186 (online) | ISSN 0205-3640 (print) · nmnhs.com/historia-naturalis-bulgarica
https://doi.org/10.48027/hnb.48.102
Publication date [online]: 1 October 2026

Research article

A new record of Hesperiinae (Lepidoptera: Hesperiidae) parasitoidism by Tachinidae (Diptera) in Brazil

Ayane Suênia-Bastos[1], Suianne Cajé[2], Daniela Cubillos[3, 4], Joshua Pablo Cavalcanti[5], Jefferson Duarte-de-Mélo[6], Mirna Martins Casagrande[7]

(1) [Corresponding author] Laboratório de Estudos de Lepidoptera Neotropical, Universidade Federal do Paraná, Departamento de Zoologia, Curitiba, Paraná, Brazil, P.O.Box 19.020, 81531-980, sueniaayane@gmail.com, ayanebastos8@gmail.com; https://orcid.org/0000-0002-3443-745X
(2) Laboratório de Estudos de Lepidoptera Neotropical, Universidade Federal do Paraná, Departamento de Zoologia, Curitiba, Paraná, Brazil, P.O.Box 19.020, 81531-980, suiannecaje@yahoo.com; https://orcid.org/0000-0002-4558-4551
(3) Laboratório de Biossistemática de Formigas, Universidade Federal do Paraná, Departamento de Zoologia, Curitiba, Paraná, Brazil, P.O.Box 19.020, 81531-980, danielaccc55@gmail.com; https://orcid.org/0009-0000-2123-6926
(4) Grupo Sistemática de Insectos Agronomía SAI, Museo Entomológico UNAB, Facultad de Ciencias Agrarias, Universidad Nacional de Colombia, Bogotá, Colombia
(5) Laboratório de Biossistemática de Formigas, Universidade Federal do Paraná, Departamento de Zoologia, Curitiba, Paraná, Brazil, P.O.Box 19.020, 81531-980, Joshuapablo2015@gmail.com; https://orcid.org/0000-0002-1285-0745
(6) Laboratório de Sistemática e Bioecologia de Coleoptera, Universidade Federal do Paraná, Departamento de Zoologia, Curitiba, Paraná, Brazil, P.O.Box 19.020, 81531-980, jeffersonduartedemelo@gmail.com; https://orcid.org/0000-0003-0268-279X
(7) Laboratório de Estudos de Lepidoptera Neotropical, Universidade Federal do Paraná, Departamento de Zoologia, Curitiba, Paraná, Brazil, P.O.Box 19.020, 81531-980, mibras@ufpr.br; https://orcid.org/0000-0002-6076-8463

Abstract: Plants, herbivores and natural enemies are intrinsically connected in a relationship regarded as tritrophic interactions. Among the natural enemies, Tachinidae (Diptera) is a group of parasitoids that contains 9,748 species described around the world, with the Neotropical Region leading the ranking of richness. Their larvae parasite several hosts of Lepidoptera, including Hesperiidae larvae. The objective of this study is to report a *Chrysotachina* Brauer & Bergenstamm, 1889 species (Tachininae: Polideini) as the parasitoid of a *Perichares* Scudder, 1872 species (Hesperiinae: Pericharini, Pericharina) in Brazil. Two immatures were collected during February, 2025 in Joinville, Santa Catarina, Brazil, and one died. The single larva exhibited characteristics of two *Perichares* spp., and an individual of *Chrysotachina* sp. was reared from it, potentially represent a new species. This exemplifies the first report of a relationship between a Tachinidae and a Hesperiinae larva in Brazil. Additionally, it is the first to report *Chrysotachina* sp. on *Perichares* spp. in South America, once known only in Central America.

Keywords: immature stages, natural enemies, Papilionoidea, skippers, tritrophic interactions

Introduction

The relationship between plants and lepidopteran larvae is one of the most studied topics since the last century to nowadays (Ehrlich & Raven, 1964; Zalucki et al., 2002). Female lepidopterans need to choose a suitable food plant for laying their eggs, and after the establishment on a particular plant, the cycle restarts again after the immature reaches the adult stage (Scoble, 1992; Zalucki et al., 2002). Morphological features as well as the releasing of chemical compounds are between the defence mechanisms of

Received: 6 July 2026; accepted: 28 August 2026 · Editor: Stanislav Abadjiev

which plants evolved to deal with herbivores (War et al., 2012; Gong & Zhang, 2014). As soon as the larva hatches from its egg, the immature has to deal with many barriers in order to continue its development. The first barrier may be the external morphology of the leaves that involves the presence of structures on the surface (e.g.: trichomes, waxes, leaf endurance), or also the presence of chemicals that impacts directly on the larval nutrition (Zalucki et al., 2002). However, it is also through chemical volatiles (indirect defence) that one of the most interesting defence mechanisms is triggered (War et al., 2012; Gong & Zhang, 2013): the calling for natural enemies. This interaction mechanism among plants, herbivores, and natural enemies is a relationship of three trophic levels (Price et al., 1980). Tritrophic relationships are apparently specific because plants release distinct volatile compounds in response to herbivory, which allow parasitoids to discriminate and find appropriate hosts (De Moraes et al., 1998).

Hymenoptera and Diptera are the main parasitoids known for the lepidopteran larvae (Eggleton & Belshaw, 1992). Within the dipterans, Tachinidae comprises 9,748 species classified into four subfamilies distributed worldwide, with the richness of species concentrated in the Neotropical Region (O'Hara et al., 2020). These flies parasite several lepidopteran, including Hesperiidae larvae (Papilionoidea) (Guimarães, 1977; Arnaud, 1978; Alam, 1987; Fleming et al., 2015; Quicke et al., 2025). Hesperiidae is a group of butterflies with more than 4,000 species distributed in all major biogeographic realms (Warren et al., 2009; Mielke, 2026). Their immatures are easily to be recognised due to the presence of a constricted area between the head and the body (= "neck") (Ackery et al., 1998), and due to the behaviour of building shelters with leaves and silk (Greeney, 2009). Even building shelters to protect themselves, parasitoids are still able to lay their eggs on these hosts. Several gaps of knowledge of the organisms exists, and the consequences may be reflected in studies focusing on taxonomic or evolutionary hypotheses. Therefore, in order to reduce gaps of knowledge, the focus of this study is to reveal, for the first time in Brazil, a tachinid parasitoid on a Hesperiinae species, and summarise the records found in the literature on interactions between Hesperiinae and Tachinidae.

Material and methods

During a field trip, two larvae were collected on an unidentified Poaceae shrub in February, 2025 in Joinville (26°18′38.7″S, 48°58′09.4″W, 52 m), Santa Catarina, Brazil, and taken to the Laboratório de Estudos de Lepidoptera Neotropical, Departamento de Zoologia, Universidade Federal do Paraná (UFPR), Curitiba, Paraná, Brazil, for further investigations. These individuals were placed into a plastic container and fed with a bamboo species identified as *Phyllostachys aurea* Carrière ex Rivière & C. Rivière (UPCB 108434, available in https://jabot.jbrj.gov.br/) (Poaceae) collected around the *Campus* Botânico (UFPR), Curitiba, until the butterfly emergence or parasitoid egression. Photographs of the hesperiid larva were taken using the equipment of self-assembly Leica M205 C equipped with a digital camera (Leica DMC4500), and a digital camera. Stehr (1987) was used for lepidopteran larval terminology.

One larva died, and a single male Tachinidae parasitoid egressed from the other larva. This tachinid was prepared and also photographed; the abdomen was disattached from the body and then boiled in 10% potassium hydroxide (KOH) during less than five minutes to extract the terminalia and subsequently fixed in a tube containing glycerine. This specimen is deposited in the Entomological Collection Padre Jesus Santiago Moure (DZUP) (DZ 76.358) in the Lepidoptera section.

In relation to this dipteran parasitoid, the identification was made by the Tachinidae specialist Dr Perilla López from Wright State University, Ohio, USA, and the terminology employed, when necessary, for general adult morphology follows Cumming & Wood (2017), and for puparium follows Perilla López & Stireman III (2021).

Results

This Hesperiinae larva contained some characteristics during earlier and late instars that were similar to larvae of *Perichares* Scudder, 1872 (Pericharini: Pericharina) (Fig. 1). Due to the impossibility of species identification, this record will be treated here as *Perichares*. The larva spent eight days during the penultimate instar. During the last instar (Fig. 1C–E), this single larva showed signals of parasitism (Fig.

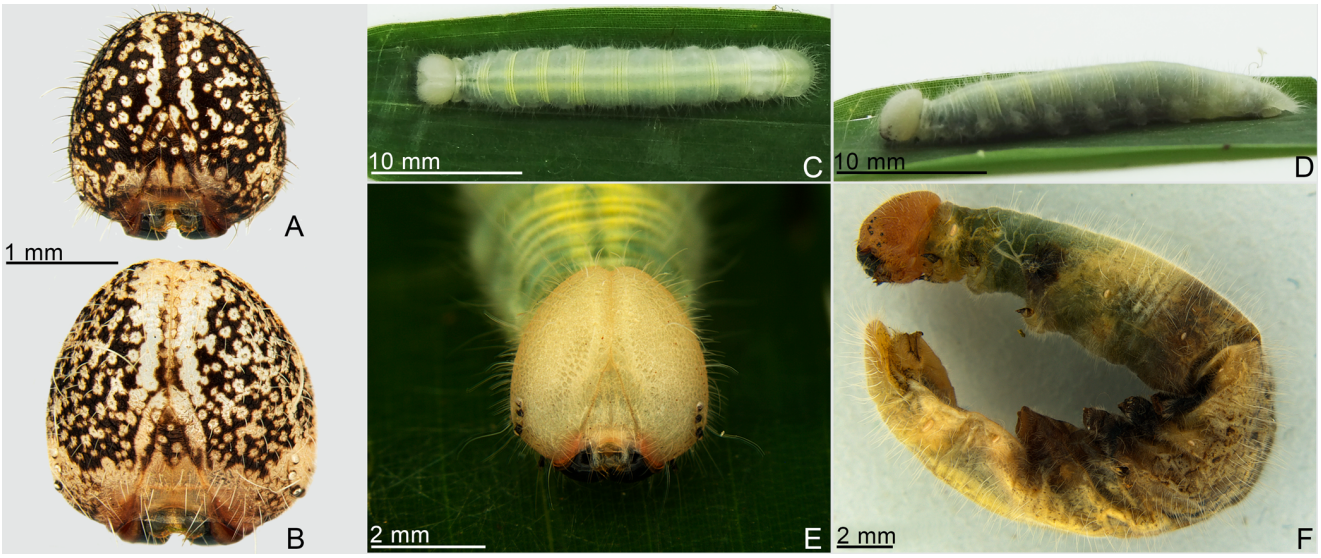


Fig. 1. *Perichares* Scudder, 1872 (Hesperiinae: Pericharini, Pericharina) immature aspects. A–B. Early instars head capsule. C–D. Last instar larva in dorsal and lateral views. E. Last instar larva, frontal view of capsule of the head. F. Last instar larva after the egression of the specimen identified as *Chrysotachina* Brauer & Bergenstamm, 1889 (Tachininae: Polideini).

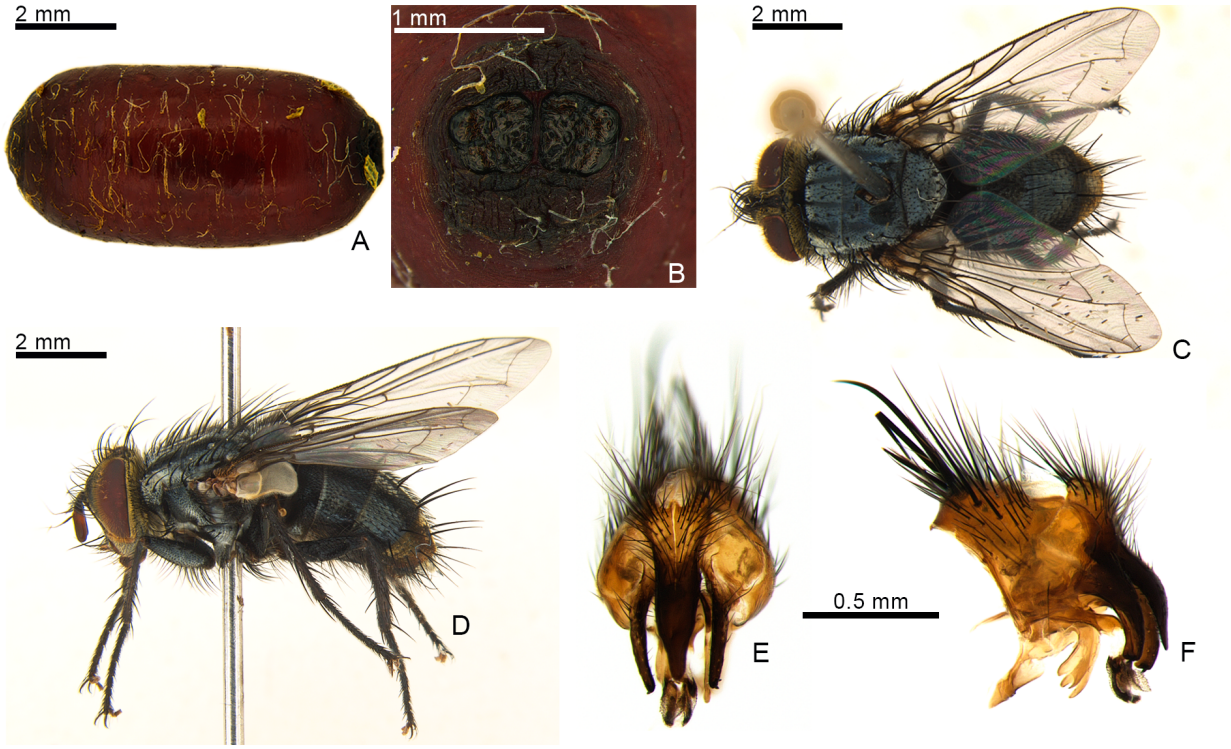


Fig. 2. *Chrysotachina* Brauer & Bergenstamm, 1889 (Tachininae: Polideini), puparium and male adult. A. Puparium. B. Posterior spiracle discs. C–D. Male adult in dorsal and lateral views. E–F. Male terminalia in posterior and lateral views.

1F), and the parasitoid egressed on 17 March 2025 and emerged on 31 March 2025 (15 days). The single reared specimen in this study (Fig. 2C–F) represents one of the new species of *Chrysotachina* Brauer & Bergenstamm, 1889 (Tachininae: Polideini) from Santa Catarina that will be described in the future (Perilla López, pers. comm.). Its puparium (Fig. 2–B) is cylindrical and dark reddish, and surrounding the

spiracles the cuticle is strongly wrinkled with convoluted and long spiracular slits.

Discussion

Hesperiinae is the largest subfamily within Hesperiidae (Lepidoptera), recognised by the majority of its species feeding on monocotyledons during the larval stage (Ackery et al., 1998; Warren et al., 2009). Despite more species being described each year (see Mielke, 2026), information on the immature stages and their interactions with other insects or plants remains scarce. In general, there are no synapomorphies during the larval stage, but the larvae exhibit their body elongate (MacNeill, 1975; Stehr, 1987), and the head capsule is relatively narrow, which may be subconical at the vertex (Stehr, 1987).

Perichares is composed of 30 species distributed along the Neotropical Region (Zhang et al., 2023, 2025; Suênia-Bastos et al., 2025a), which despite do not present a morphological diagnosis (Suênia-Bastos et al., 2025b), the adults can be recognised from other Pericharina through the patterns of the ventral hindwing, either with lilac markings (with or without orange colour in the anal angle) or lacking those markings and having longitudinal or transversal stripes (Suênia-Bastos et al., 2025a).

With a few knowledge regarding the juveniles, the immatures of some *Perichares* species feed on an array of Cannaceae, Cyperaceae, Poaceae, and Arecaceae (all monocotyledons) (Panton, 1898; Kaye, 1926; Moss, 1949; Ellwood & Harvey 1990; Cock, 2005; Burns et al., 2008; Nishida et al., 2009; Murillo-Hiller et al., 2019; Orlandin et al., 2020), including native and introduced species. The morphological characteristics presented by the immatures still remain incomplete and it is beyond the scope of this study, but such characteristics will be briefly mentioned based on the study of some immature's aspects of *Perichares lotus* (Butler, 1870) in comparison to other *Perichares* spp. larvae (Suênia-Bastos, pers. comm.). The examination of the head capsule of early instars revealed a similarity with *Perichares lotus* (Fig. 1A–B), except in the last instar when the head capsule does not exhibit the blackish band in the stemmata region (Suênia-Bastos, pers. comm.), instead it is entirely creamish (Fig. 1D–E), resembling more the last instar larva of *Perichares aurina* Evans, 1955 (Orlandin et al., 2020). Both species are distributed together in southern Brazil, including Joinville. Five *Perichares* species and other Hesperiidae had already been reported as hosts for species of this genus fly in North, Central and South America, as given in the Supplementary material 01.

Chrysotachina currently is composed of 29 species distributed in the New World, with great part of the known species and plenty of undescribed species from the Neotropical Region (Perilla López & Stireman III, 2021). The host association (Hesperiidae, Mimallonidae, Nymphalidae and Riodinidae as the main hosts) and the characteristics presented in the posterior spiracle discs of the puparium both represent useful information to trace the likely relationship among the species (Perilla López & Stireman III, 2021). Considering that the knowledge regarding the host association is only known mostly for Costa Rica and Ecuador (Perilla López & Stireman III, 2021; Supplementary material 01), much more still need to be understood about this genus, especially the characteristics of the puparium, considered extremely valuable for systematics purposes (Perilla López & Stireman III, 2021). The puparium (Fig. 2A–B) of the species illustrated here is consistent with a provisional classification of Perilla López & Stireman III (2021) found in species of *Chrysotachina*, which have large and medially sunken posterior spiracular plates.

In relation to the interactions between *Perichares* spp. and parasitoids, there are records in Área de Conservación Guanacaste, Guanacaste, Costa Rica, all those hymenopterans associated: 1) *Apanteles andreacalvoae* Fernández-Triana, 2014 (Braconidae: Microgastrinae) associated with *Perichares geonomaphaga* Burns, 2008, *Perichares prestoeaphaga* Burns, 2008, and *Perichares poaceaphaga* Burns, 2008 (Fernández-Triana et al., 2014); (2) *Creagrura rogerblancoi* Sääksjärvi, 2022 (Ichneumonidae: Cremastrinae) associated with six species not mentioned by the author (Sääksjärvi et al., 2022); (3) *Creagrura nigripes* Townes, 1971 associated with *P. prestoaephaga* (Quicke et al., 2024); (4) *Alphomelon sergioriosi* Fernandez-Triana & Shimbori, 2023 (Braconidae: Microgastrinae) associated with *Perichares adela* (Hewitson, 1867) (Fernandez-Triana et al., 2023) and *Perichares deceptus deceptus* (Butler & H. Druce, 1872) (Quicke et al., 2024); (5) *Yelicones markmetzi* Sharkey, 2021 (Braconidae: Rogadinae) associated with *P. lotus* (Quicke et al., 2024).

Loads of studies mention hymenopteran parasitoids, either larvae or pupae, as the main natural

enemies of Hesperiidae in the American continent (Santis, 1941; Costa Lima, 1949; Janzen et al., 1998; Zitani et al., 1998; Burns & Janzen 2001; Resende et al., 2009; Fernández-Triana et al., 2014; Lepesqueur et al., 2017; Quicke et al., 2020, 2024; Lill et al., 2021; Silva et al., 2021; Sharkey et al., 2023; Suênia-Bastos et al., 2024a, b). In contrast, records that bring Tachinidae as parasitoids of Hesperiidae are mostly known from North and Central America (Arnaud, 1978; Alam, 1987; Maes, 1989; Herrera & Rodríguez, 1999; Burns & Janzen, 2001, 2005; Santos-Murgas, 2008; Fleming et al., 2015; Lill et al., 2021; Quicke et al., 2025).

Across the South America several Tachinidae species were recognised as parasitoids of some Hesperiidae in Trinidad and Tobago, Ecuador, and Brazil. Aldrich (1932) described *Exoristoides urichi* Aldrich, 1932 (now placed in *Chrysotachina* Brauer & Berganstamm, 1889) (Polideini) and *Achaetoneura nigripalpis* Aldrich, 1932 (now placed in *Lespesia* Robineau-Desvoidy, 1863) (Exoristinae: Eryciini), mentioning that these organisms were reared from pupae of *Calpodes ethlius* (Stoll, 1782) (Hesperiinae) in Trinidad. Additionally, Cock (2005) recorded the egression of tachinid flies from *Orses cynisca* (Swainson, 1821), *Talides sergestus* (Cramer, 1775) and *Talides sinois* Hübner, [1819], all Hesperiinae; however, only the fly egressed from *T. sinois* successfully emerged. In Ecuador, representatives of *Hyphantrophaga* Townsend, 1892, *Patelloa* Townsend, 1916 (Exoristinae: Goniini), *Chlorohystricia* Townsend, 1927 and *Chrysotachina* (Polideini) were recorded on an unidentified Hesperiidae, whereas *Winthemia* Robineau-Desvoidy, 1830 sp. (Exoristinae: Winthemiini) was reported parasitising *Pyrrhopyge papius papius* Hopffer, 1874 (Pyrrhopyginae) (Stireman III et al., 2009). More specifically in Brazil, information on these flies attacking hesperiid larvae is scarce, with only two records: *Pyrrhopyge* Hübner, [1819] species as host for *Winthemia* sp. in Campinas, São Paulo (Sauer, 1946); and *Urbanus proteus proteus* (Linnaeus, 1758) (Eudaminae) as host for *Lespesia affinis* (Townsend 1927) in Paraná (Guimarães, 1983). A photograph of a tachinid on the host plant where the immatures of *Udranomia spitzi* (Hayward, 1942) (Eudaminae) were feeding was also documented in Uberlândia (Minas Gerais), however, no evidence of parasitisation was revealed (Bächtold et al., 2012).

The result of this work confirms the very first record of a Tachinidae parasitisation of Hesperiinae larva for Brazil. Also, the interaction between *Chrysotachina* sp. and *Perichares* sp. becomes the first one in South America, once known for five *Perichares* spp. in Central America. To conclude, further investigation of these relationships in South America is needed, where plenty of organism's interactions are still unknown, ready to be explored, especially when details could be included in taxonomic studies to assist the classification, and also to elucidate the evolutionary associations between hosts and their natural enemies.

Acknowledgments

We are extremely grateful to Juan Manuel Perilla López from Wright State University, Ohio, USA, for the identification of the Tachinidae specimen, and Javier O. Martínez-Alava from Grupo Infecciones y Salud en el Trópico, Colombia, for sending us instructions for the process of dissection. Also, we thank Regina Tomoko Shirasuna by *Phyllostachys aurea* identification. Still, we are also grateful to O. H. H. Mielke for the free access of his own library, and Adalberto Dantas de Medeiros for helping and sharing the moment when the immatures were collected in Joinville. We are also grateful to Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) for the fellowship of ASB (88887.949958/2024-00), SC (88887.931876/2024-00), JPC (88887.132404/2025-00), JDM (88887.931875/2024-00), and Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) for the fellowship of DC (142556/2025-4) and MMC (310227/2021-3).

Conflicts of interest

No potential conflict of interest has been reported by the authors, reviewers, or subject editor.

Author' contributions
(using CrediT)

Ayane Suênia-Bastos: conceptualisation, data curation, investigation, writing—original draft, writing—review and editing; Suianne Cajé: investigation, writing—review and editing; Daniela Cubillos: investiga-

tion, writing—review and editing; Joshua Pablo Cavalcanti: investigation, writing—review and editing; Jefferson Duarte-de-Mélo: investigation, writing—review and editing; Mirna Martins Casagrande: supervision, writing—review and editing.

References

Ackery P.R., de Jong R., Vane-Wright R.I. 1998 16. The butterflies: Hedyloidea, Hesperioidea and Papilionoidea. In: Kristensen N.P. (ed.) Lepidoptera, Moths and Butterflies. Volume 1: Evolution, Systematics, and Biogeography. Handbuch der Zoologie 4 (35): i–x+1–487.

Alam M.M. 1987 Arrowroot leaf-roller- a serious pest of arrowroot in St. Vincent. Caribbean Food Crops Society, 23 Annual Meeting 23: 197–202.

Aldrich J.M. 1932 New Diptera, or two-winged flies, from America, Asia, and Java, with additional notes. Proceedings of the United States National Museum 81 (9): 1–28.

Arnaud P.H. 1978 A host-parasite catalogue of North American Tachinidae (Diptera). Dept. of Agriculture, Science and Education Administration, Washington DC, 860 pp.

Bächtold A., Del-Claro K., Kaminski L.A., Freitas A.V.L., Oliveira P.S. 2012 Natural history of an ant-plant-butterfly interaction in a Neotropical savanna. Journal of Natural History 46 (15–16): 943–954. https://doi.org/10.1080/00222933.2011.651649

Burns J.M., Janzen D.H. 2001 Biodiversity of Pyrrhopyginae skipper butterflies (Hesperiidae) in the Area de Conservación Guanacaste, Costa Rica. Journal of the Lepidopterists' Society 55 (1): 15–43.

Burns J.M., Janzen D.H. 2005 Pan-Neotropical genus *Venada* (Hesperiidae: Pyrginae) is not monotypic: four new species occur on one volcano in the Área de Conservación Guanacaste, Costa Rica. Journal of the Lepidopterists' Society 59 (1): 19–34.

Burns J.M., Janzen D.H., Hajibabaei M., Hallwachs W., Hebert P.D. 2008 DNA barcodes and cryptic species of skipper butterflies in the genus *Perichares* in Área de Conservacion Guanacaste, Costa Rica. Proceedings of the National Academy of Sciences 105 (17): 6350–6355. https://doi.org/10.1073/pnas.0712181105

Cock M.J.W. 2005 The Skipper Butterflies (Hesperiidae) of Trinidad e Tobago. Part 13, Hesperiinae, Genera Group K. Living World, Journal of The Trinidad e Tobago and Tobago Field Naturalists' Club, 23–47.

Costa Lima A. 1949 Entomofagos sul Americanos (parasitos e predadores) de insetos nocivos a agricultura. Boletim-Sociedade Brasileira de Agronomia, Rio de Janeiro 11 (1): 1–32.

Cumming J.M., Wood D.M. 2017 Adult morphology and terminology. Adult morphology and terminology. In: Kirk-Spriggs A.K., Sinclair B.J. (eds) Manual of Afrotropical Diptera. Vol 1. South African National Biodiversity Institute, Pretoria, 89–133.

De Moraes C.M., Lewis W.J., Paré P.W., Alborn H.T., Tumlinson J.H. 1998 Herbivore-infested plants selectively attract parasitoids. Nature 393: 570–573. https://doi.org/10.1038/31219

Ehrlich P.R., Raven P.H. 1964 Butterflies and plants: a study in coevolution. Evolution 18 (4): 586–608. https://doi.org/10.1111/j.1558-5646.1964.tb01674.x

Eggleton P., Belshaw R. 1992 Insect parasitoids: an evolutionary overview. Philosophical Transactions of the Royal Society of London 337: 1–20.

Ellwood C.V., Harvey M.V. 1990 The Lady Blake Collection: catalogue of Lady Edith Blake's Collection of drawings of Jamaican Lepidoptera and plants. Bulletin of the British Museum (Natural History) Historical Series 18 (2): 145–202. https://doi.org/10.5962/p.236341

Fernández-Triana J.L., Whitfield J.B., Rodriguez J.J., Smith M.A., Janzen D.H., Hallwachs W.D., Hajibabaei M., Burns D.H., Solis M.A., Brown J., Cardinal S., Goulet H., Hebert P.D.N. 2014 Review of *Apanteles* sensu stricto (Hymenoptera, Braconidae, Microgastrinae) from Area de Conservación Guanacaste, Northwestern Costa Rica, with Keys to all described species from Mesoamerica. Zookeys 383: 1–565. https://doi.org/10.3897/zookeys.383.6418

Fernandez-Triana J.L., Shimbori E.M., Whitfield J.B., Penteado-Dias A.M., Shaw S.R., Boudreault C., Sones J., Perez K., Brown A., Manjunath R., Burns J.M., Hebert P.D.N., Smith M.A., Hallwachs W., Janzen D.H. 2023 A revision of the parasitoid wasp genus *Alphomelon* Mason with

the description with of 30 new species (Hymenoptera, Braconidae). Zookeys 1175: 5–162. https://doi.org/10.3897/zookeys.1175.105068

Fleming A.J., Wood M.D., Janzen D., Hallwachs W., Smith M.A. 2015 Seven new species of *Spathidexia* Townsend (Diptera: Tachinidae) reared from caterpillars in Área de Conservación Guanacaste, Costa Rica. Biodiversity Data Journal 3: e4597. https://doi.org/10.3897/BDJ.3.e4597

Gong B., Zhang G. 2014 Interactions between plants and herbivores: a review of plant defense. Acta Ecologica Sinica 34: 325–336. https://doi.org/10.1016/j.chnaes.2013.07.010

Greeney H.F. 2009 A revised classification scheme for larval hesperiid shelters, with comments on shelter diversity in the Pyrginae. Journal of Research on the Lepidoptera 41: 53–59.

Guimarães J.H. 1977 Host-parasite and parasite-host catalogue of South American Tachinidae (Diptera). Arquivos de Zoologia 28 (3): 1–131. https://doi.org/10.11606/issn.2176-7793.v28i3p1-131

Guimarães J.H. 1983 Taxonomy of Brazilian flies of the genus *Lespesia* Robineae-Desvoidy (Diptera, Tachinidae). Papéis Avulsos de Zoologia 35 (2): 11–30. https://doi.org/10.11606/0031-1049.1983.35.p11-30

Herrera A.G., Rodríguez G.S. 1999 Bombyliidae y Tachinidae (Diptera) parasitoides de Lepidoptera en Costa Rica. Revista de Biología Tropical 46 (4): 1147–1148.

Janzen D.H., Sharkey M.J., Burns J.M. 1998 Parasitization biology of a new species of Braconidae (Hymenoptera) feeding on larvae of Costa Rican dry forest skippers (Lepidoptera: Hesperiidae: Pyrginae). Tropical Lepidoptera Research 9 (2): 33–41.

Kaye W.J. 1926 The butterflies of Jamaica. Transactions of the entomological Society of London 1925 (3/4): 455–504.

Lill J.T., Weiss M.R., Block C., Kula R.R. 2021 Larval parasitism of the silver-spotted skipper, *Epargyreus clarus* (Cramer) (Lepidoptera: Hesperiidae), in the Washington, DC area. Proceedings of the Entomological Society of Washington 123 (1): 120–135. https://doi.org/10.4289/0013-8797.123.1.120

Lepesqueur C., Neis M., Silva N.A.P., Pereira T.; Rodrigues H.P.A., Trindade T., Diniz I.R. 2017 *Elbella luteizona* (Mabille, 1877) (Lepidoptera, Hesperiidae: Pyrginae) in Brazilian Cerrado: larval morphology, diet and shelter architecture. Revista Brasileira de Entomologia 61: 282–289. https://doi.org/10.1016/j.rbe.2017.08.004

MacNeill C.D. 1975 Family Hesperiidae, The skippers. In: Howe W.H. (ed.) The Butterflies of North America. Doubleday & Company, Garden, New York, 423–578.

Maes J.-M. 1989 Catálogo de los insectos controladores biológicos en Nicaragua. Volume III. Insectos parasitoides. Revista Nicaraguense de Entomologia 10: 1–38.

Mielke O.H.H. 2026 Checklist of the American Hesperiidae. Version April 6, 2026. https://sites.google.com/site/lablepneo/publica%C3%A7%C3%B5es/livros.

Moss A.M. 1949 Biological notes on some Hesperiidae of Para and the Amazon. Acta Zoologica Lilloana 7: 27–29.

Murillo-Hiller L.R., Segura-Bermúdez O.A., Barquero J.D., Bolaños F. 2019 The skipper butterflies (Lepidoptera: Hesperiidae) of the Reserva Ecológica Leonelo Oviedo, San José, Costa Rica. Revista de Biología Tropical 67 (2): 228–248. https://doi.org/10.15517/rbt.v67i2SUPL.37236

Nishida K., Nakamura I., Morales C.O. 2009 Plants and butterflies of a small urban preserve in the Central Valley of Costa Rica. Revista de Biología Tropical 57 (1): 31–67.

O'Hara J.E., Henderson S.J., Wood D.M. 2020 Preliminary checklist of the Tachinidae (Diptera) of the world. Version 2,1, 2020. http://www.nadsdiptera.org/Tach/WorldTachs/Checklist/Tachchlist_ver2.1.pdf.

Orlandin E., Piovesan M., Carneiro E. 2020 Borboletas do Meio-Oeste de Santa Catarina: história natural e guia de identificação. Clube dos Autores, Joaçaba, 400 pp.

Panton S. 1898 The life history of some Jamaica Hesperiidae. Journal of the Institute of Jamaica 2: 435–441.

Perilla López J.M., Stireman J.O. 2021 What is *Chrysotachina* B. & B. (Diptera: Tachinidae)? The Tachinidae Times 34: 33–41.

Price P.W., Bouton C.E., Gross P., McPheron B.A., Thompson J.N., Wies A.E. 1980 Interactions

among three trophic levels: influence of plants on interactions between insect herbivores and natural enemies. Annual Review of Ecology and Systematics 11: 41–65.

Quicke D.L.J., Sharkey M.J., Janzen D., Hallwachs W., Hebert P.D.N., Butcher B.A. 2020 A new genus and species of Neotropical gregarious braconine parasitoid (Hymenoptera: Braconidae) of a caterpillar (Lepidoptera: Hesperiidae). Zootaxa 4816 (3): 370–376. https://doi.org/10.11646/zootaxa.4816.3.7

Quicke D.L.J., Janzen D.H., Hallwachs W., Sharkey M.J., Hebert P.D.N., Butcher B.A. 2024 Forty-five years of caterpillar rearing in Area de Conservación Guanacaste (ACG) Northwestern Costa Rica: DNA barcodes, BINs, and a first description of plant-caterpillar-Ichneumonidae interactions detected. Diversity 16 (683): 1–41. https://doi.org/10.3390/d16110683

Quicke D.L.J., Fleming A.J., Wood D.M., Woodley N.E., Manjunath R., Naik S., Smith M.A., Sharkey M.J., Hallwachs W., Janzen D.H., Fernández-Triana J., Whitfield J.B., Hebert P.D.N., Butcher B.A. 2025 Tachinid flies (Diptera), caterpillar hosts (Lepidoptera) and their food plants, reared in Área de Conservación Guanacaste (ACG), northwestern Costa Rica: documenting community structure with the aid of DNA barcodes. Diversity 17 (9): 658 (1–34). https://doi.org/10.3390/d17090658

Resende A.L.S., Aguiar-Menezes E.L., Guerra J.G.M., Tavares M.T., Menezes E.B. 2009 Ocorrência de *Astraptes talus* (Cramer, 1777) (Lepidoptera: Hesperiidae) em associação com *Mucuna pruriens* (L.) De Candolle, 1825 (Fabaceae) e seus parasitóides (Hymenoptera) em Seropédica, Rio de Janeiro, Brasil. Entomotropica 24 (2): 89–94.

Sääksjärvi I.E., Kaunisto K.M., Sharkey M., Stedenfeld S., Smith M.A., Hallwachs W., Janzen D. 2022 Cryptic Biodiversity of tropical hesperiid caterpillar-attacking parasitoid wasps: three new species of *Creagrura* Townes (Hymenoptera, Icheunomidae, Cremastinae) from Costa Rica and Perú. Biodiversity Data Journal 10: e91486 (1–18). https://doi.org/10.3897/BDJ.10.e91486

Santis L. 1941 Lista de Himenopteros parasitos y predatores de los insectos de la república Argentina. Boletim da Sociedade brasileira de Agronomia, Rio de Janeiro 4 (1): 1–66.

Santos-Murgas A. 2008 Especifidad parasítica de *Prosierola obliqua* Evans, 1964 (Hymenoptera: Bethylidae) sobre larvas de Hesperiidae (Lepidoptera) dobladoras de hojas. Tecnociencia 10 (2): 81–93.

Sauer H.F.G. 1946 Constatação de himenópteros e dípteros entomófagos no estado de São Paulo. Boletím Fitossanitário 3 (1): 7–23.

Scoble M.J. 1992 The Lepidoptera: form, function and diversity. Oxford University Press, New York, 404 pp.

Silva A.M., Medeiros A.D., Kerpel S.M. 2021 Immature stages of *Nisoniades macarius* (Hesperiidae: Pyrginae: Carcharodini): biology, morphology and behavior. Iheringia, Série Zoologia 111: e2021027 (1–7). https://doi.org/10.1590/1678-4766e2021027

Sharkey M.J., Baker A., McCluskey K., Smith A., Naik S., Ratnasingham S., Manjunath R., Perez K., Sones J., D'Souza M., St. Jacques B., Hajibabaei M., Whitfield J., Arias D., Solis A., Metz M., Burns J., Zuñiga R., Phillips-Rodriguez E., Espinoza B., Chacon I., Hebert P., Hallwachs W., Janzen D. 2023 Minimalist revision of *Mesochorus* Gravenhorst, 1829 (Hymenoptera: Ichneumonidae: Mesochorinae) from Área de Conservación Guanacaste, Costa Rica, with 158 new species and host records for 129 species. Revista De Biología Tropical 71 (S2): e56316. https://doi.org/10.15517/rev.biol.trop.v71iS2.56316

Stehr F.W. 1985 Order Lepidoptera. In: Stehr F.W. (ed.) Immatures Insects. Kendall/Hunt Publishing Company, Dubuque, 288–596.

Stireman III J.O., Greeney H.F., Dyer L.A. 2009 Species richness and host associations of Lepidoptera – attacking Tachinidae in the northeast Ecuadorian Andes. Journal of Insect Science 9 (39): 39 (1–19). https://doi.org/10.1673/031.009.3901

Suênia-Bastos A., Cajé S., Duarte-de-Mélo J., Cavalcanti J.P. 2024a The food in on *Urbanus proteus proteus* (Linnaeus, 1758): First report of its Apanteles sp. Parasitoids in Alagoas, Brazil. Spixiana 41 (1): 93–94.

Suênia-Bastos A., Cajé S., Duarte-de-Mélo J., Lima I.M.M., Mielke O.H.H. 2024b Bioecological aspects of *Cynea* (*Cynea*) *diluta* (Herrich-Schäffer, 1869) (Lepidoptera: Hesperiidae:

Hesperiinae). Revista Chilena de Entomología 50 (1): 53–74. https://doi.org/10.35249/rche.50.1.24.09

Suênia-Bastos A., Medeiros A.D., Cajé S., Gualberto E.P., Mielke O.H.H., Casagrande M.M. 2025a A new *Perichares* from the Cosñipata Valley, Cusco, Peru, and the revalidation of *Perichares lindigiana* stat. rev. (Lepidoptera: Hesperiidae). Acta Entomologica Musei Nationalis Pragae 65 (1): 197–205. https://doi.org/10.37520/aemnp.2025.015

Suênia-Bastos A., Mielke O.H.H., Casagrande M.M. 2025b What does the morphology tell us about it? Completing the reverse taxonomy of Pericharini Grishin, 2019 (Hesperiinae). Zootaxa 5604 (2): 101–117. https://doi.org/10.11646/zootaxa.5604.2.1

War A.R., Paulraj M. G., Ahmad T., Buhroo A.A., Hussain B., Ignacimuthu S., Sharma H.C. 2012 Mechanisms of plant defense against insect herbivores. Plant Signaling & Behavior 7 (10): 1306–1320. https://doi.org/10.4161/psb.21663

Warren A.D., Ogawa J.R., Brower A.V.Z. 2009 Revised classification of the family Hesperiidae (Lepidoptera: Hesperioidea) based on combined molecular and morphological data. Systematic Entomology 34 (3): 467–523. https://doi.org/10.1111/j.1365-3113.2008.00463.x

Zalucki M.P., Clarke A.R., Malcolm S.B. 2002 Ecology and behavior of first instar larval Lepidoptera. Annual Review of Entomology 47: 361–393. https://doi.org/10.1146/annurev.ento.47.091201.145220

Zitani N.M., Shaw S.R., Janzen D.H. 1998 Systematics of Costa Rican *Meteorus* (Hymenoptera: Braconidae: Meterorinae) species lacking a dorsope. Journal of Hymenoptera Research 7 (2): 182–208.

Zhang J., Cong Q., Grishin N.V. 2023 Descriptions of one hundred new species of Hesperiidae. Insecta Mundi 1026: 1–115.

Zhang J., Cong Q., Shen J., Song L., Grishin N.V. 2025 New butterfly taxa and findings from genomic analyses. The Taxonomic Report of the International Lepidoptera Survey 12 (8): 1–154.

Supplementary materials

01
Document title: Table 1. List of Hesperiidae hosts and their respective *Chrysotachina* Brauer & Berganstamm, 1889 species available in the literature, followed by the record location and reference
Kind of document: Microsoft Word (OpenXML)
MIME type: application/vnd.openxmlformats-officedocument.wordprocessingml.document
Document name: 000636000482026-01.docx
https://doi.org/10.48027/hnb.48.102/01

Historia naturalis bulgarica 48 (10): 307–310
ISSN 2603-3186 (online) | ISSN 0205-3640 (print) · nmnhs.com/historia-naturalis-bulgarica
https://doi.org/10.48027/hnb.48.103
Publication date [online]: 1 October 2026

Research article

New records of Psocodea (Insecta) from Vietnam

Dilian Georgiev[1, 2], Ognyan Todorov[3, 4]

(1) Department of General Animal Husbandry, Section Ecology and zoology, Faculty of Veterinary Medicine, Trakia University – Stara Zagora, 6000 Stara Zagora, Bulgaria, dilyan.georgiev@trakia-uni.bg
(2) Department of Ecology and Environmental Conservation, University of Plovdiv, 24 Tsar Assen Street, 4000 Plovdiv, Bulgaria, diliangeorgiev@uni-plovdiv.bg; https://orcid.org/0000-0003-2885-4895
(3) Regional Natural History Museum – Plovdiv Hristo G. Danov Street 34 4000 Plovdiv, Bulgaria, ogi.lion@gmail.com
(4) Department of Botany and biological education, University of Plovdiv, 24 Tsar Assen Street, 4000 Plovdiv, Bulgaria, ognian_todorov@uni-plovdiv.bg

Abstract: In this study, we contribute to the knowledge of the psocid fauna of Vietnam by reporting four species for the first time for the territory of the country: *Amphipsocus unitoides* New & Thornton, 1976, *Isophanes capeneri* Smithers, 1956, *Peripsocus medimacularis* Li, 1995, and *Sigmatoneura kolbei* (Enderlein, 1906). Additionally, we provide four new distribution localities for *Caecilius fuscopterus* (Latreille, 1799), a species first recorded in Vietnam as a smaller variety by Enderlein (1903). All specimens were collected from various habitats in northern Vietnam during October 2025.

Keywords: biodiversity, equatorial, habitats, insects, SE Asia

Introduction

The study of the Psocoptera fauna in Vietnam dates back to the beginning of the 20th century with the works of Enderlein (1903) and Navas (1924). Despite this early start, taxonomic research in the region remained sporadic for a long period. By 2016, the checklist of species known to the country included only 26 taxa, with subsequent studies adding only a few more records (Lienhard, 2016; Liang et al., 2013, 2017; Ning et al., 2020). Given the exceptional biodiversity of tropical ecosystems in Indochina, these figures remain relatively small and reflect a poorly known fauna. Significant progress in documenting this species richness was recently published by Georgiev et al. (2024), who reported 19 new species for Vietnam, primarily collected from the Tam Dao National Park. This publication highlighted the presence of species previously unknown not only to the country but also to the Indochina Peninsula and continental Asia, underscoring the vital need for continued entomological exploration.

In this article, we further contribute to the knowledge of the regional psocid fauna by reporting an additional four species for the first time for the territory of Vietnam.

Material and methods

Barkflies were collected between 11.10.2025 and 17.10.2025 from Vietnam in open habitats – grasses and shrubs at a forest edge (Fig. 1). All specimens were collected by Ognyan Todorov by sweep netting then preserved in 96% ethanol. All material was deposited at the Regional Natural History Museum – Plovdiv. Identification was based on the original descriptions or identification keys provided by Enderlein (1906), Smithers (1956), New & Thornton (1976), Lienhard (1998), Li (2002), and New & Lienhard (2007). Distributional data follows Lienhard (2016).

Results and discussion

A total of five species were identified, from which four were new country records for Vietnam, as follows:

Received: 23 February 2026; accepted: 4 September 2026 · Editor: Stanislav Abadjiev



Fig. 1. Some of the Psocodea habitats surveyed during present study: A – locality of *I. capeneri*, B – locality of *A. unitoides*, C – locality of *P. medimacularis*, D – locality of *S. kolbei*. Photos: O. Todorov.

Amphipsocidae

Amphipsocus unitoides New & Thornton, 1976 Material examined: 16.10.2025, Mường Phăng, Điện Biên Phủ District, 21°25′56.9″N 103°06′03.9″E, 958 m a. s. l., 1 ♀. Remark: This species was known only from its type locality in Singapore (New & Thornton, 1976). New record for Vietnam.

Caeciliusidae

Caecilius fuscopterus (Latreille, 1799) Material examined: 10.10.2025, Sa Pa District, Lào Cai Province, Phan Xi Păng/Fansipan Summit, 22°18′19.4″N 103°46′31.6″E, 3020 m a. s. l., 1 ♂; 11.10.2025, Tam Đường District, Lai Châu, 22°21′13.0″N 103°46′19.9″E, 1965 m a. s. l., 1 ♀; 13.10.2025, Séo Mý Tỷ, Tả Van, Sa Pa, Lào Cai, Hoàng Liên National Park, 22°16′07.0″N 103°53′15.2″E, 1719 m a. s. l., 1 ♀; 19.10.2025, Mường Phăng, h. Điện Biên, 21°24′03.8″N 103°05′19.3″E, 961 m a. s. l., 1 ♀. Remark: This species is widely distributed across Europe and Asia (Lienhard, 2016). In Vietnam, it was first reported by Enderlein (1903) under the name *C. fuscopterus* var. *tonkinensis*, based on a single female specimen collected by Hans Fruhstorfer from the Mau Son Mountains (Mauson-Gebirge) in Tonkin. Enderlein noted that the Vietnamese specimen aligned perfectly with European individuals in its microscopic structure and leg pubescence, differing only in its smaller size (forewing length of 2.5 mm vs. the 3 mm minimum typical for European females). The four localities recorded in our study represent new distribution data for the species within Vietnam.

Isophanes capeneri Smithers, 1956 Material examined: 13.10.2025, Séo Mý Tỷ, Tả Van, Sa Pa, Lào Cai, Hoàng Liên National Park, 22°16′07.0″N 103°53′15.2″E, 1719 m a. s. l., 1 ♂ (Fig. 2). Remark: This species was originally described from South Africa based on a male specimen (Smithers, 1956).

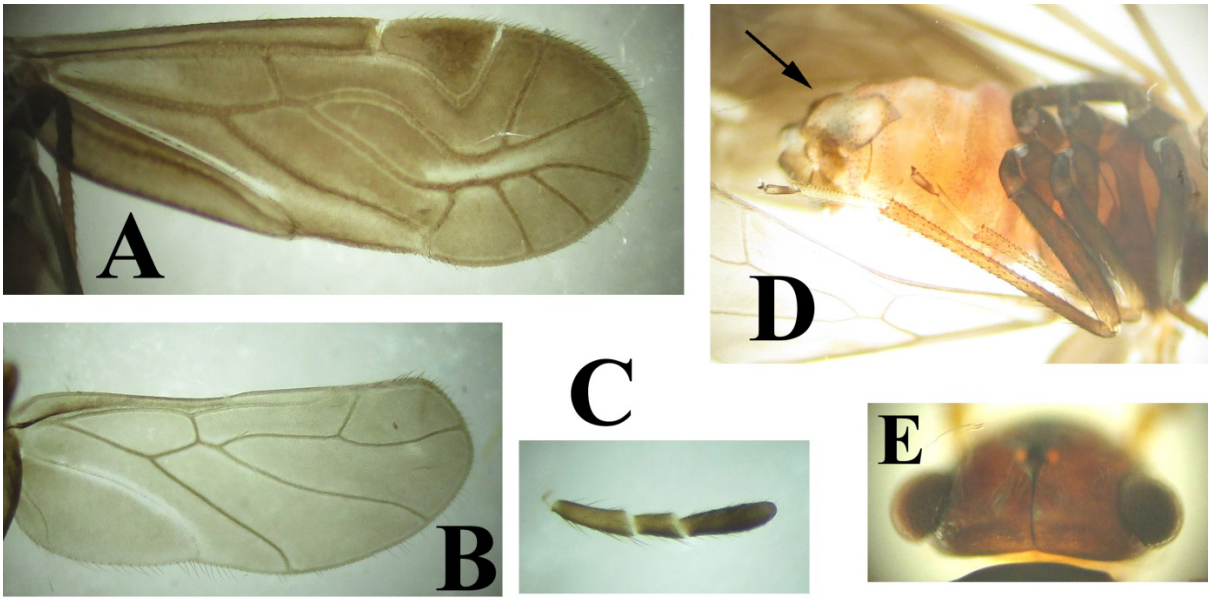


Fig. 2. *Isophanes capeneri* from Vietnam, male: A – forewing, B – hind wing, C – palpus, D – ventral side of the abdomen with legs (specific male genitalia is pointed by an arrow), E – head. FW length 2.02 mm, scale also to B and D; C and E not to scale. Photos: D. Georgiev.

Although Vietnam is geographically distant from the type locality, such distribution patterns are not uncommon, similar cases have been documented for several species previously considered Asian but subsequently found in Africa. While the exact origin of these species remains unclear, they were likely dispersed through the historical maritime transport of fruits and plants (Georgiev, 2021, 2022, 2024). New record for Vietnam.

Peripsocidae

Peripsocus medimacularis Li, 1995 Material examined: 16.10.2025, Mường Phăng, Điện Biên Phủ District, 21°25′56.9″N 103°06′03.9″E, 958 m a. s. l., 1 ♀. Remark: The species was known only from China (Lienhard, 2016). New record for Vietnam.

Psocidae

Sigmatoneura kolbei (Enderlein, 1906) Material examined: 17.10.2025, Mường Phăng, h. Điện Biên, 21°26′29.5″N 103°06′59.5″E, 960 m a. s. l., 1 ♂. Remark: The species was known from Japan (type locality), Taiwan and China (Lienhard, 2016). New record for Vietnam.

Acknowledgements

This study was financed by project "Insect biodiversity in Bach Ma National Park (Central Vietnam) – new approaches and methods for field research" (ICVT/03/2026-2027) under the bilateral cooperation between the Bulgarian Academy of Sciences and the Vietnam Academy of Science and Technology. Authors are grateful to Todor Mishev for the literature sources provided and to Kristian Vladov for the help during field work.

Conflicts of interest

No potential conflict of interest has been reported by the authors, reviewers, or subject editor.

Author' contributions
(using CrediT)

Dilian Georgiev: conceptualisation, data curation, formal analysis, investigation, methodology, resources, visualisation, writing—original draft, writing—review and editing; Ognyan Todorov: funding acquisition, investigation, writing—review and editing.

References

Georgiev D. 2021 On the fauna of Psocoptera of Unguja (Zanzibar) Island (Tanzania, East Africa). Historia naturalis bulgarica 42: 35–42.

Georgiev D. 2022 New records of Psocoptera from East Sub-Saharan Africa. ZooNotes Supplement 12: 1–36.

Georgiev D. 2024 One more "Asian" psocid (Insecta: Psocodea) found in Africa? ZooNotes 231: 1–4.

Li F. 2002 Psocoptera of China. National Natural Science Foundation of China, 1976 pp.

Lienhard C. 1998 Psocoptères euro-méditerranées. Faune de France 83, Fédération Francaise des Sociétés de Sciences Naturelles, Paris, 517 pp.

Lienhard C. 2016 Country checklists of the Psocoptera species of the World, extracted from Lienhard C., Smithers C. 2002 Psocoptera (Insecta) – World Catalogue and Bibliography. Psocid News, Special Issue I: 1–123.

New T., Lienhard C. 2007 The Psocoptera of tropical South East Asia. Fauna Malesiana Handbooks, Volume 6, 290 pp.

New T., Thornton I. 1976 Psocomorpha (Psocoptera) from the Malayan Peninsula, including collections from forest canopy. Oriental Insects 9 (4): 375–418.

Smithers C. 1956 A new species of *Isophanes* (Caeciliidae, Psocoptera). Journal of the Entomological Society of Southern Africa 19: 9–32.