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Article

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Two new species close to *Pachyna satanas* from the Congolian forests (Lepidoptera, Lasiocampidae, Lasiocampinae)

ALEXEY M. PROZOROV[1*], AIDAS SALDAITIS[2], JULIA S. VOLKOVA[3], TATIANA A. PROZOROVA[4], EDITA E. REVAY[5], ROMAN V. YAKOVLEV[6,6a,6b], HARALD SULAK[7], GERGELY PETRÁNYI[8] & GÜNTER C. MÜLLER[9,9a]

[1]*University of Sciences, Techniques and Technology of Bamako, BP 1805 Bamako, Mali.*
[2]*Nature Research Centre, Akademijos str. 2, 08412 Vilnius-21, Lithuania.*
E-mail: saldrasa@gmail.com; https://orcid.org/0000-0003-0999-3996
[3]*Ulyanovsk State University, Universitetskaya Naberezhnaya Ulitsa, 1, RUS-432063 Ulyanovsk, Russia.*
E-mail: beeme7@mail.ru; https://orcid.org/0000-0002-4014-3140
[4]*Karl Marx st. 41, RUS-432001 Ulyanovsk, Russia.*
E-mail: tatianaaprozorova@gmail.com; https://orcid.org/0000-0003-3466-5249
[5]*University of Sciences, Techniques and Technology of Bamako, BP 1805 Bamako, Mali.*
E-mail: erevay@gmail.com; https://orcid.org/0000-0003-0512-0303
[6]*Altai State University, pr. Lenina 61, RUS-656049 Barnaul, Russia.*
E-mail: yakovlev_asu@mail.ru; https://orcid.org/0000-0001-9512-8709
[6a]*Tomsk State University, Laboratory of Biodiversity and Ecology, Lenina pr. 36, RUS-634050 Tomsk, Russia.*
[6b]*Samarkand State University, University blv. 15, 140104 Samarkand, Uzbekistan.*
[7]*Museum Witt, Max-Reger-Str. 18, 92637 Weiden in der Oberpfalz, Germany.*
E-mail: sciensese@yahoo.com; https://orcid.org/0000-0002-8138-3538
[8]*University of Sciences, Techniques and Technology of Bamako, BP 1805, Bamako, Mali.*
E-mail: pertu.g@gmail.com; https://orcid.org/0000-0001-8897-6240
[9]*University of Sciences, Techniques and Technology of Bamako, BP 1805 Bamako, Mali.*
E-mail: guntercmuller@hotmail.com; https://orcid.org/0000-0002-7024-0179
[9a]*Kuvin Center for the Study of Infectious and Tropical Diseases, Hadassah Medical School, The Hebrew University, Kalman Ya'akov Man St., 91120 Jerusalem, Israel.*
**Corresponding author. E-mail: alexeymprozorov@gmail.com; https://orcid.org/0000-0002-5668-0741*

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Abstract
Two new species of the genus *Pachyna* Weymer, 1892 close to *Pachyna satanas* Zolotuhin & Gurkovich, 2009 are described from the Congolian lowland forests: *Pachyna arienne* **sp. n.** and *Cheligium stella* **sp. n.** Adult males and their genitalia with a distribution map are illustrated.

Key words: Afrotropical realm, biodiversity, Democratic Republic of the Congo, Gabon, lappet moth.

Introduction

The family Lasiocampidae Harris, 1841 is a sole member of the superfamily Lasiocampoidea (Minet, 1994; Regier *et al*., 2009; Zwick *et al*., 2011; Hamilton *et al*., 2019). The last discovery in the suprageneric system of the family was done by Zolotuhin with co-authors (2012a, 2012b) based on the nucleotide sequence of the gene elongation factor-1 alpha. The family resulted in containing five subfamilies and 14 tribes, among which Argudini Zolotuhin, 2012 was established new and briefly described for eleven Indomalayan and one African genera.

Lasiocampidae occur worldwide, except in New Zealand. According to Zolotuhin (2015), among the eight biogeographic realms on Earth, the most diverse fauna of the family Lasiocampidae is in the Afrotropical realm. The fauna is represented by more than 700 species in 115 genera, while about 100 species and 20 genera are yet to be discovered. The Afrotropical fauna shares the genus *Bombycopsis* Felder & Felder, 1874 with the Palearctic realm (see Joannou & Krüger, 2009); and *Estigena* Moore, 1860; *Trabala* Walker, 1856 and *Streblote* Hübner, 1820 with the Indomalayan realm (see Prozorov, 2011; Prozorov *et al*., 2022).

Zolotuhin and Gurkovich (2009) reviewed the relationship between the Palearctic genus *Pachypasa* Walker, 1855 and closely related lineages, and ended up with 12 new genera, 2 new subgenera and 28 new species. One of the lineages was *Pachyna* Weymer, 1892 with the type species *Pachyna trapezina* Weymer, 1892 (junior subjective synonym of *Pachyna subfascia* (Walker, 1855)). *Pachyna* contains four species: *P. subfacia* with the characteristic dentated external margin of hindwings (Fig. 1); externally similar *Pachyna bogema* Zolotuhin & Gurkovich, 2009 (Fig. 2) and *Pachyna crabik* Zolotuhin & Gurkovich, 2009 (Fig. 3), both brown with smooth convex external margin of hindwings; and an outlying dark-colored *Pachyna satanas* Zolotuhin & Gurkovich, 2009 with concave margin of hindwings (Figs 4–5). Externally similar and nearly sympatric Cameroonian *P. bogema* and Nigerian *P. crabik* (though the HT originates from an unknown location) have stable differences in the distal half of sacculus: narrow in *P. bogema* (Fig. 12) but expanded and claw-like in *P. crabik* (Fig. 11). All four species have very small (Figs 11–13) to barely pronounced (Fig. 10) ventroapical spur in aedeagus, long basal apodemes of aedeagus, and more (Figs 10–11) or less (Figs 12–13) fused lobes of cubile. The present article is devoted to two new species very close externally to the dark-colored *P. satanas* but having significant differences in male genitalia. New species were collected during a one-year-long stationary expedition to the buffer zone of the Salonga National Park, from where 11 new lasiocampid species have been recently described (Prozorov *et al*., 2021a, 2021b, 2023a, 2023b). Additional material from other locations was also used.

Abbreviations of the depositories used:

CGM – collection of Günter Müller (Freising, Germany);
MfNB – Museum für Naturkunde (Berlin, Germany);
MNHN – Muséum national d'Histoire naturelle (Paris, France);
NHML – Natural History Museum (London, UK);
RMCA – Royal Museum for Central Africa (Tervuren, Belgium);
USTTB – l'Université des Sciences, des Techniques et des Technologies de Bamako (Bamako, Mali).

Other abbreviations used:

DRC – the Democratic Republic of the Congo;
GS – genitalia slide;
HT – holotype;
PT – paratype.

Material and Methods

Some adults were collected near the Ekongo camp (2.75613S, 20.31538E), Mai-Ndombe, DRC using a traditional white screen lit with a Sylvania Mini-Lynx Blacklight BL368 and a chain of locally made auto-traps with similar bulbs. A Honda EU 20i generator provided the electricity for the screen and the traps.

Genitalia preparations were made generally following Hardwick (1950). Distal one third of the abdomen of each specimen was put into a separate 50 ml Falcon tube with 10 ml of 13% solution of

potassium hydroxide (KOH). Several tubes with abdomens and KOH were put together into a small pot with hot water for 20 minutes. The tubes thereafter were taken out from the pot and the abdomens were rinsed with water, once or twice, to wash off any remaining scales and soft tissue. Cleaned abdomens were then transferred into separate cells of the Corning Costar 96 Well Cell Culture Cluster with a small quantity of water to keep them moist during preparation. One after another, abdomens were cleaned with a soft brush and dissected using Dumont Tweezers Style 5 and "no name" micro scissors in a Petri dish under the microscope. Aedeagus was extracted and vesica everted with an insulin syringe and a 32G or 33G needle for mesotherapy. Male's vesica was stained with the Evans blue. The dissected genitalia were rinsed in 50, 70 and 96% ethanol and then mounted on a microscope slide in Euparal and covered with a cover slip. Slides then photographed using an Olympus C-750 UZ and a Leica MC170 HD.

Adults were photographed with an Olympus C-750 UZ, a Nikon D3300, a Nikon 40mm f/2.8G and a Nikon R1C1. Slides were photographed using an Olympus C-750 UZ and a Leica MC170 HD. All images were processed with Photoshop CS6 and InDesign CS6 (Adobe, 2012).

Morphological terminology follows Zolotuhin (2015) and Prozorov *et al.* (2023c) with additions (the term *cubile* follows de Lajonquière, 1968). Distribution map was made with Google My Maps service (https://www.google.com/maps/). Altitude for collecting sites was taken from Google Earth Pro if missing from labels. Ecoregions listed in the Distribution section of the species follow Dinerstein *et al.*, 2017.

Taxonomical part

***Pachyna arienne* sp. n.**
https://zoobank.org/urn:lsid:zoobank.org:act:4C95E6F8-E859-4C1A-9137-384C7B8180E5
(Figs 6–7, 14, 17–18)

Holotype: ♂, DRC, Congo River, 10 km SE Kisangani, Mbiye Island, 0.45674 N, 25.28209 E, 420 m, 24.II.2008, leg. A. Gurkovich & V. Zolotuhin, GS 0185 (CGM/USTTB). **Paratypes, DRC**: 11♂, DRC, Mai-Ndombe, Ekongo camp, 2.75613S, 20.31538E, 350 m, XII.2017, leg. A. Prozorov, T. Prozorova *et al*., GS 0871 (CGM/USTTB); ♂, DRC, Kongo Central, Mayumbe, Luki Nature Reserve, 5.45 S, 13.08333 E, 250 m, 29.XI.2008, leg. J. & W. de Prins, GS 000005056 (RMCA).

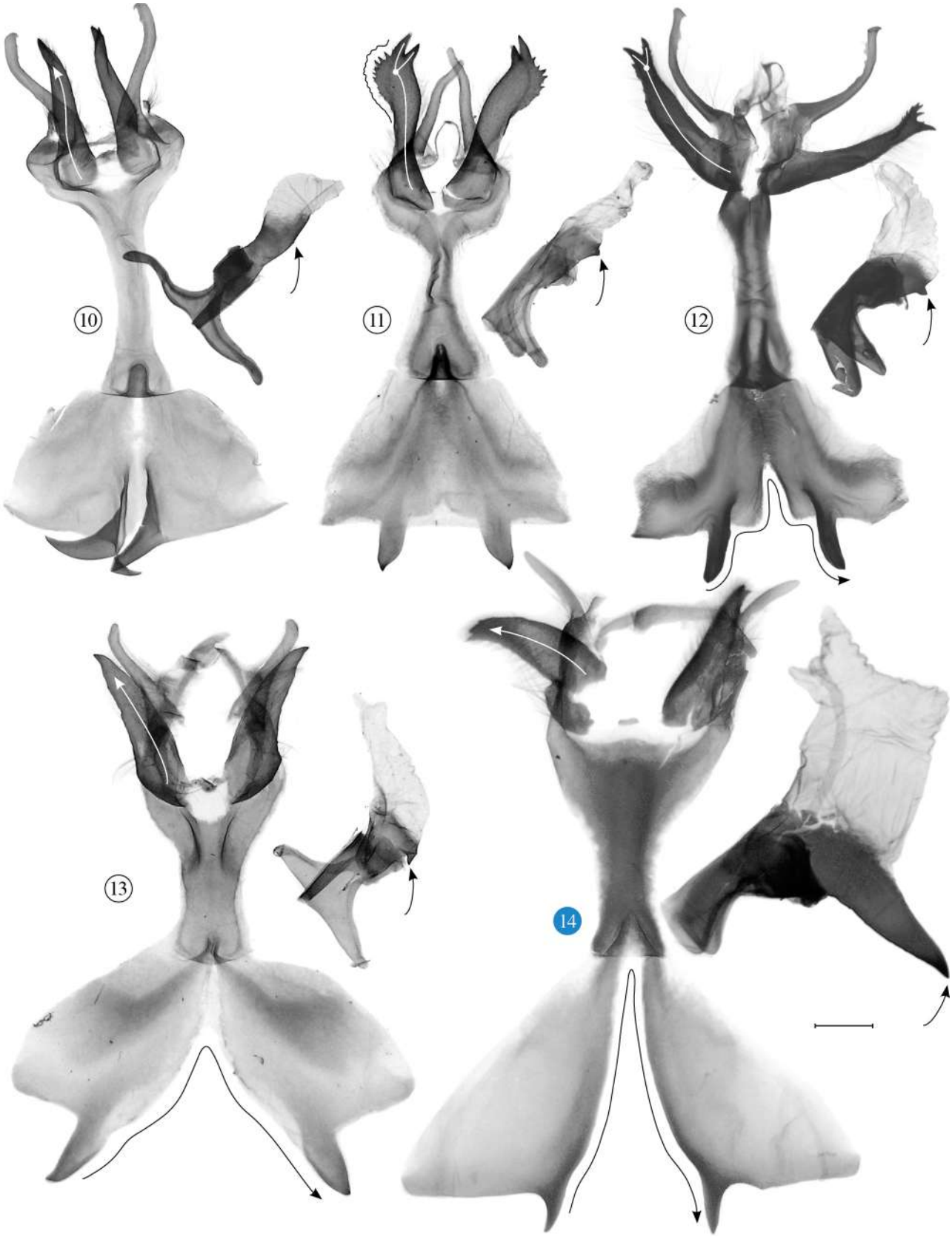
Description. **Male** (Figs 6–7). Flagellum covered with speckled brown and dark brown scales. Head, thorax and abdomen dark brown. *Forewing*. Forewing length: 24–26 mm. Long, semilanceolate with bunt apex. Background color dark brown. Pattern consists of diagonal contrasting lines. Fringe dark brown. *Hindwing*. Somewhat tapezoid with concave outer margin. Background color and fringe dark brown. *Genitalia* (Figs 14, 17). Vinculum a narrow band slightly widening medially. Socii papilla-shaped, sclerotized and covered with setae. Cucullus elongated, finger-shaped with blunt apex, covered with setae. Sacculus elongated, slightly longer than cucullus, c-shaped, densely covered with setae, apically bears small dents. Juxta nearly reduced, medioventrally fused with aedeagus. Aedeagus c-shaped with large ventroapical spur. Vesica large, trapezoid, dorsally has two short extensions. Vinculum ventrally elongated, bears cubile. Cubile clearly divided medially into a pair of somewhat triangle processes with mediodistal spur. **Female** remains unknown.

Diagnosis. Adult males of *P. arienne* **sp. n.** are very dark brown with concave external margin of hindwings (Figs 6–7), have large vesica, large ventroapical spur in aedeagus, and fully split lobes of cubile (Figs 14, 17), while adult males of *P. subfascia* are brown with convex dentated external margin of hindwings (Fig. 1), have small vesica, brely pronounced spur in aedeagus, and fused lobes of cubile (Fig. 10).

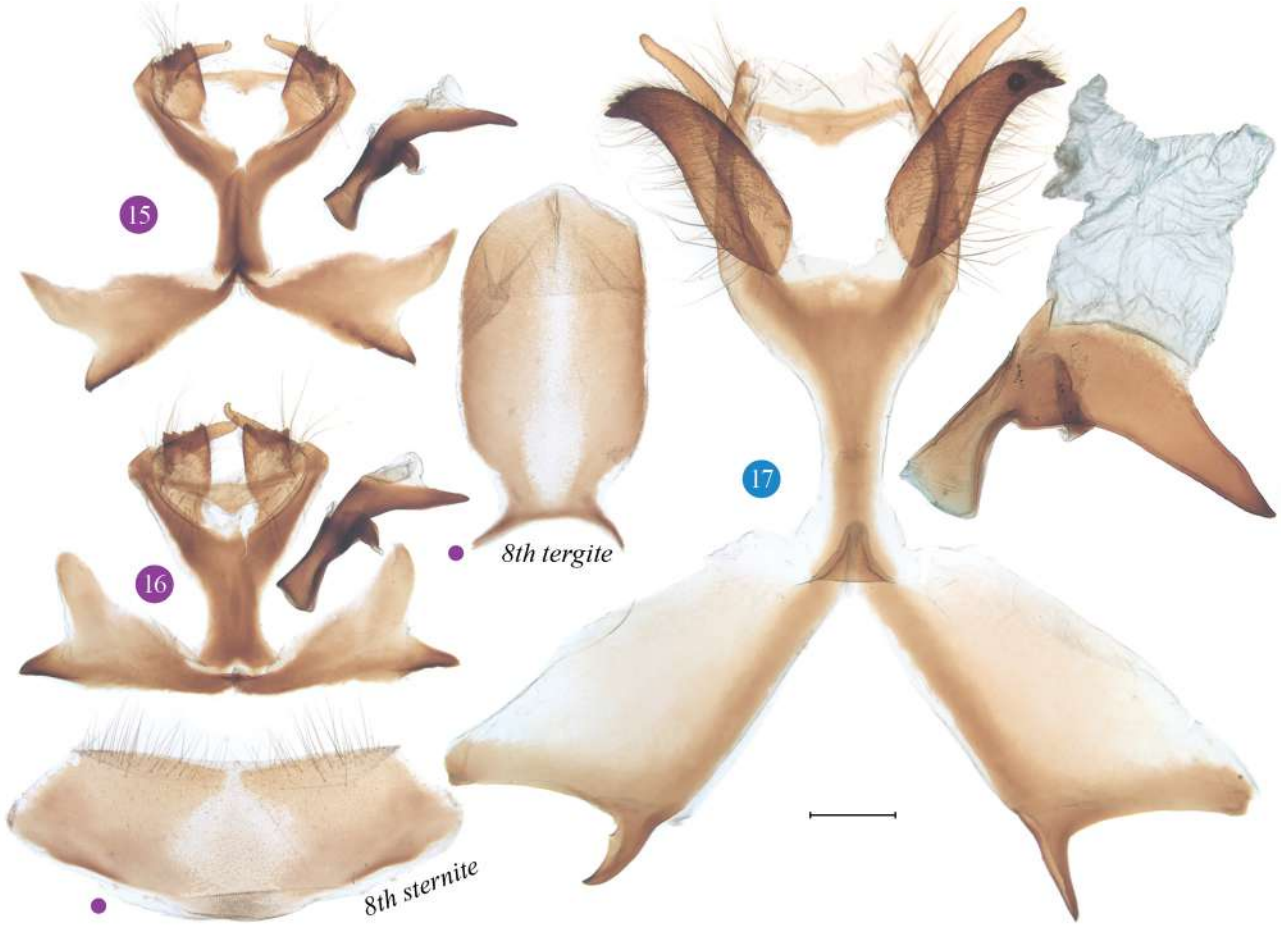
Adult males of *P. arienne* **sp. n.** are very dark brown with concave external margin of hindwings (Figs 6–7), have large vesica, large ventroapical spur in aedeagus, and fully split lobes of cubile (Figs 14, 17), while adult males of *P. bogema* are brown with convex external margin of hindwings (Fig. 2), have small vesica, small ventroapical spur in aedeagus, and half-fused lobes of cubile (Fig. 12).

Adult males of *P. arienne* **sp. n.** are very dark brown with concave external margin of hindwings (Figs 6–7), have large vesica, large ventroapical spur in aedeagus, and fully split lobes of cubile (Figs 14, 17), while adult males of *P. ckabik* are brown with convex dentated external margin of hindwings (Fig. 3), have small vesica, small ventroapical spur in aedeagus, and fused lobes of cubile (Figs 15–16).

Figures 1–9. Adult ♂ of *Pachyna* spp. 1. *P. subfascia*, Equatorial Guinea, Mbini (MfNB). 2. *P. bogema*, HT, Cameroon, Ebogo, GS 2006-25 (RMCA). 3. *P. crabik*, HT, unknown location (NHML). 4–5. *P. satanas*, DRC, Isiro (RMCA). 4. HT, GS 2006-46. 5. PT. 6–7. *P. stella* **sp. n.**, DRC. 6. HT, island Mbiye, GS 0185 (CGM/USTTB). 7. PT, Luki Nature Reserve, GS 000005056 (RMCA). 8–9. *P. arienne* **sp. n.**, DRC, Ekongo camp (CGM/USTTB). 8. HT, GS 0794. 9. PT, GS 0795. Scale bar – 1 cm.



Figures 10–14. ♂ genitalia of *Pachyna* spp. 10. *P. subfascia*, Burundi, Gitega, GS 2006-70 (RMCA). 11. *P. crabik*, HT, unknown location, GS 1408 (NHMUK). 12. *P. bogema*, Cameroon, Nkolmetet, GS 2013-087 (ZSM). 13. *P. satanas*, HT, GS 2006-46 (RMCA). 14. *P. stella* **sp. n.**, DRC, Luki Nature Reserve, GS 000005056 (RMCA). Scale bar – 1 mm.



Figures 15–17. ♂ genitalia of *Pachyna* spp., DRC (USTTB). 15–16. *P. arienne* **sp. n.**, Ekongo camp. 14. HT, GS 0794. 15. PT, GS 0795. 17. *P. stella* **sp. n.**, island Mbiye, GS 0185. Scale bar – 1 mm.

Adult males of *P. arienne* **sp. n.** have large vesica, large ventroapical spur in aedeagus, and fully split lobes of cubile (Figs 14, 17), while adult males of *P. satanas* have small vesica, small ventroapical spur in aedeagus, and partly fused lobes of cubile (Fig. 13).

Adult males of *P. arienne* **sp. n.** have overall larger genitalia, straight apex of cucullus, long sacculus, large vesica, and large ventroapical spur in aedeagus (Figs 14, 17), while adult males of *P. stella* **sp. n.** have overall smaller genitalia, bent apex of cucullus, short sacculus, small vesica, and proportional spur in aedeagus (Figs 15–16).

Distribution (Fig. 18). Congolian coastal forests, Central Congolian lowland forests and Eastern Congolian swamp forests in DRC.

Biology. Adults were collected in February and November from an altitude of 350–420 meters a.s.l. Preimaginal stages unknown.

Etymology. The species is named in honor of Arienne Taormina (Nesconset, USA).

***Pachyna stella* sp. n.**
https://zoobank.org/urn:lsid:zoobank.org:act:3DD9BD75-20DB-48CF-A9E5-3986C61ABBB3
(Figs 8–9, 15–16, 17)

Holotype: ♂, DRC, Mai-Ndombe, Ekongo camp, 2.75613S, 20.31538E, 350 m, I.2018, leg. A. Prozorov, T. Prozorova *et al*., GS 0794 (CGM/USTTB). **Paratypes**. **DRC**: 10♂, same data as holotype, GS 0795 (CGM/USTTB). **Gabon**: ♂, Ogooué-Ivindo Province, Lastoursville, 0.81832 S, 12.725 E, 300 m, leg. P. Rougeot (MNHN).

Description. **Male** (Figs 7–8). Flagellum covered with speckled brown and dark brown scales. Head, thorax and abdomen dark brown. *Forewing*. Forewing length: 24–26 mm. Long, semilanceolate with bunt apex. Background color dark brown. Pattern consists of diagonal contrasting lines. Fringe dark brown. *Hindwing*. Somewhat trapezoid with concave outer margin. Background color and fringe dark brown. *Genitalia* (Figs 14–15). Vinculum a narrow band slightly widening medially. Socii papilla-shaped, sclerotized and covered with setae. Cucullus finger-like, c-shaped, with bent and blunt apex, covered with setae. Sacculus about the same length with cucullus, trapezoid, densely covered with setae, apically bears small dents. Juxta very small, medioventrally fused with aedeagus. Aedeagus c-shaped with ventroapical spur. Vesica small, semispherical. Vinculum ventrally elongated, bears cubile. Cubile clearly divided medially into a pair of somewhat triangle processes with mediodistal spur. Eighth sternite somewhat pentagonal with distal margin covered with setae. Eight tergite somewhat heptagonal, elongated with elongated basal apodemes. **Female** remains unknown.

Diagnosis. Adult males of *P. stella* **sp. n.** are very dark brown with concave external margin of hindwings (Figs 6–7), have overall small genitalia, short cucullus and sacculus, fully split lobes of cubile, very small vesica, proportional ventroapical spur of aedeagus (Figs 14–15), while adult males of *P. subfascia* are brown with convex dentated external margin of hindwings (Fig. 1), have overall large genitalia, long cucullus and sacculus, fused lobes of cubile, proportional vesica, barely pronounced ventroapical spur of aedeagus (Fig. 10).

Adult males of *P. stella* **sp. n.** are very dark brown with concave external margin of hindwings (Figs 6–7), have overall small genitalia, short cucullus and sacculus, fully split lobes of cubile, very small vesica, proportional ventroapical spur of aedeagus (Figs 14–15), while adult males of *P. bogema* are brown with convex external margin of hindwings (Fig. 2), have overall large genitalia, long cucullus and sacculus, half-fused lobes of cubile, proportional vesica, and very small ventroapical spur of aedeagus (Fig. 12).

Adult males of *P. stella* **sp. n.** are very dark brown with concave external margin of hindwings (Figs 6–7), have overall small genitalia, short cucullus and sacculus, fully split lobes of cubile, very small vesica, proportional ventroapical spur of aedeagus (Figs 14–15), while adult males of *P. crabik* are brown with convex external margin of hindwings (Fig. 3), have overall large genitalia, long cucullus and sacculus, fused lobes of cubile, proportional vesica, and very small ventroapical spur of aedeagus (Fig. 11).

Adult males of *P. stella* **sp. n.** have overall small genitalia, short cucullus and sacculus, fully split lobes of cubile, very small vesica, proportional ventroapical spur of aedeagus (Figs 14–15), while adult males of *P. satanas* have overall large genitalia, long cucullus and sacculus, nearly split lobes of cubile, proportional vesica, and very small ventroapical spur of aedeagus (Fig. 11).

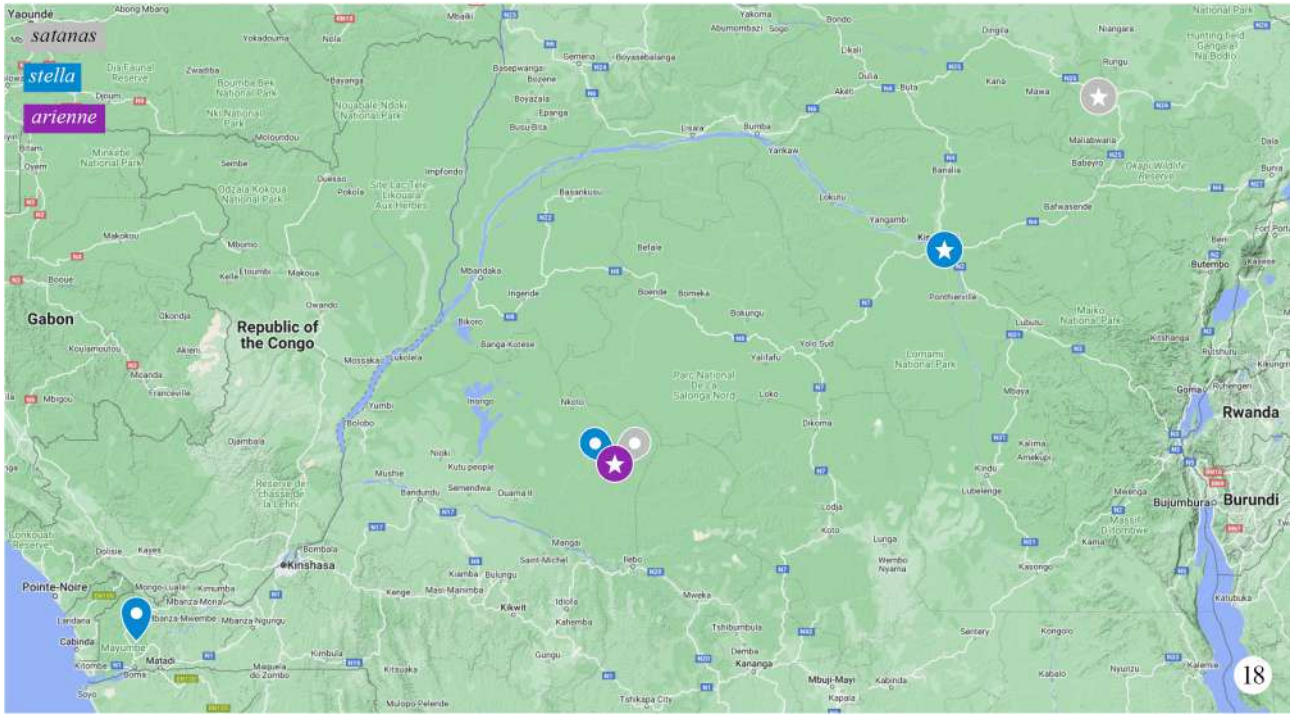


Figure 18. Collecting sites of *Pachyna* spp. Circle with star is for the HT, other tags are PT.

Adult males of *P. stella* **sp. n.** have overall smaller genitalia, bent apex of cucullus, short sacculus, small vesica, and proportional spur in aedeagus (Figs 15–16), while adult males of *P. arienne* **sp. n.** have overall larger genitalia, straight apex of cucullus, long sacculus, large vesica, and large ventroapical spur in aedeagus (Figs 14, 17).

Distribution (Fig. 17). Central Congolian lowland forests in DRC and Northwest Congolian lowland forests in Gabon.

Biology. Adults were collected in January from an altitude of 350 meters a.s.l. Preimaginal stages unknown.

Etymology. The species is named in honor of Stella Margiotta (Nesconset, USA).

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