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Two new species of *Polyptychus* Hübner, [1819] (Lepidoptera: Sphingidae: Smerinthinae) from West Africa

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Received 21 October 2021 | Accepted by V. Pešić: 3 November 2021 | Published online 5 November 2021.

Abstract

Two new species of *Polyptychus*, *Polyptychus smithi* sp. nov. and *Polyptychus lucindae* sp. nov., are described from West Africa. A comparison is made with their closest congeners, *Polyptychus coryndoni* Rothschild & Jordan, 1903 and *Polyptychus lagnelae* Pierre, 2014 respectively from which they differ in features of the wing pattern, genitalia and the COI-5P region of the mitochondrial DNA. Diagnoses are provided together with illustrations of the habitus and male genital morphology.

Key words: Taxonomy, DNA barcode, biogeography.

Introduction

The Old-World hawkmoth genus *Polyptychus* Hübner, [1819] currently contains 56 species, which are distributed in Sub-Saharan Africa and southern Asia as far as Indonesia in the east, with the majority, 47 species, being found in Africa (Kitching 2021). The recent increase in the number of species is partly due to the synonymy of several genera based on morphology (*Acanthosphinx* Aurivillius, 1891, *Avinoffia* Clark, 1929, *Lycosphingia* Rothschild & Jordan, 1903, *Polyptychopsis* Carcasson, 1968 and *Polyptychoides* Carcasson, 1968), as well as the descriptions of new species with the aid of molecular DNA barcode data (e.g., Bouyer 2016; Melichar & Řezáč 2018). In the process of identifying the Sphingidae material recently collected as part of expeditions to West Africa organised by the African Natural History Research Trust, comparisons with material from further east on the continent suggested that the populations currently identified at *Polyptychus coryndoni* Rothschild & Jordan, 1903 and *P. lagnelae* Pierre, 2014 in West Africa may represent separate species. Detailed morphological study together with DNA barcode analysis confirmed the original hypotheses and thus two new species are described herein.

Material and methods

Preparation of genitalia followed Lafontaine & Mikkola (1987), the phalluses were stained with Eosin red and the dissected genitalia stored in glycerol. Genitalia were photographed using a Canon EOS 700D camera

mounted on a Wild M3Z stereo microscope. Adults were photographed using a Nikon D90 with a Nikkor AF Micro 60 mm lens or a Nikon D500 with a Sigma 105mm Macro lens. All images were edited in Adobe Photoshop. DNA barcodes were obtained by removing tarsal segments from adult specimens before being submitted to the Canadian Centre for DNA Barcoding (CCDB, Biodiversity Institute of Ontario, University of Guelph). Sequences were obtained using Single Molecule Real-Time sequencing through the Sequel (PacBio) pipeline at CCDB (Hebert *et al.* 2018). The resulting sequences were aligned using MUSCLE in MEGA version X (Kumar *et al.* 2018) and genetic distances were calculated using Kimura's two-parameter model (Kimura 1980). Primary label data have been transcribed verbatim with “//” denoting a different label and “/” denoting a line break.

Abbreviations:

ANHRT African Natural History Research Trust, Leominster, UK
NHMUK Natural History Museum, London, UK

Description of new species

Polyptychus smithi sp. nov.

<http://zoobank.org/urn:lsid:zoobank.org:act:27148C60-936C-4ABE-A7A1-F51A9A268D4A>
(Figs. 1–4)

Holotype ♂ (ANHRT):

“TOGO 415m / Fazao-Malfakassa NP., / Point de vue campsite / (Sudanian savannah) / 08°48'50"N, 0°49'3.2"E / 16-23.viii.2018 MV Light Trap / Aristophanous, M., Geiser, M., / Moretto, P., Sanbena, B. leg. / ANHRT:2018.31 // ANHRTUK / 00190231”.

Paratypes (13♂♂, 2♀♀):

BURKINA FASO: Bobo-Dioulasso, 20.ii.1985, Cadiou coll. (1♂ NHMUK); **CAMEROON:** Wack (La Falaise), 900m, 07°40'17"N, 13°33'18"E, 2-21.x.2018, General Collection, leg. S. Safian & G. Simonics (2♂♂ ANHRT); **IVORY COAST:** Comoe, iv.1998, Cadiou coll. (1♂ NHMUK); Comoe, v.2001, Cadiou coll. (1♂ NHMUK); Denguele Classified Forest, 479m, 09°30'01"N, 07°40'51"W, 6-14.vi.2018, LepiLED Light Trap, leg. M. Aristophanous, W. Miles, P. Moretto & Y. Outtara (1♂ ANHRT); Gbando Village, 417m, 09°34'17"N, 06°41'01"W, 15-22.vi.2018, MV Light Trap, leg. M. Aristophanous, W. Miles, P. Moretto & Y. Outtara (1♂ ANHRT); Kakpin Village, 259m, 08°39'07"N, 03°46'59"W, 27.vi-22.vii.2015, Light Trap, leg. M. Aristophanous, P. Moretto & E. Ruzzier (1♀ ANHRT); **NIGERIA:** Zaria, 29.xii.1961, K. Harris (1♀ NHMUK); **SIERRA LEONE:** [no precise locality], viii.1991, Cadiou coll. (1♂ NHMUK); **TOGO:** identical data to holotype (5♂♂ ANHRT).

Description

Forewing length: holotype: 32 mm; paratype males: 29–34 mm; paratype female: 34 mm.

Upperside. Ground colour of head, thorax and abdomen grey. Vertex with a slight crest. Antenna thick, strongly fasciculate, with grey-white scaling along its entire length. Abdominal segments 3-8 with white scales along posterior margin and dark scales more distally, giving the abdomen a banded appearance. Forewing triangular, broadly pointed at apex; outer margin sinuate, sub-apically falcate, the remainder convex. Ground colour whitish-grey with several dark grey bands; basal band, indicated by three small, poorly-developed, circular dark grey spots aligned transversely. Antemedial line sinuate; medial band well-developed, gently curved and sharply kinked at vein Rs3, inner edges with diffuse dark grey scaling; both antemedial and medial bands converge towards the ventral margin. Postmedial band well-developed, straight, kinked outwardly at vein CuA2. Submarginal and subterminal bands weakly-developed, sinuate; diffuse patch of dark grey scales in submarginal region between M2 and CuA1 reaching outer margin. Tonal marking short with a small spot positioned dorsad. Fringe white with dark grey vein spots. Hindwing brick red except for grey tonal region. Anal fold with a short, dark grey stripe. Wing margin dark grey with dark grey scales encroaching along veins in submarginal region; two small dark grey spots near ends of CuA2 and anal fold. Fringe white.



Figures 1–4. *Polyptychus smithi* sp. nov.: 1 – holotype ♂, upperside; 2 – paratype ♀, upperside; 3 – holotype ♂, genital capsule; 4 – *idem.*, phallus. **Figures 5–8.** *Polyptychus coryndoni* Rothschild & Jordan, 1903: 5 – ♂, Zambia, Kapishya Hot Springs [ANHRTUK00021480], upperside; 6 – ♀, Zambia, Lukwakwa, W. Lunga National Park [ANHRTUK00149927], upperside; 7 – *idem.* ♂, genital capsule; 8 – *idem.*, phallus. Scale bar equals 10 mm for the adults and 1 mm for the genitalia.

Underside. Ground colour of head, thorax and abdomen beige with a pinkish undertone. Labial palps and legs whitish-grey, the legs with a pinkish undertone. Forewing ground colour brown, with light, pinkish scaling along costal region; basal, antemedial and medial bands absent. Postmedial band well-developed, dark brown. Submarginal and subterminal bands weakly-developed, dark brown. Region beyond postmedial band with diffuse grey scaling. Subterminal region with a triangular, dark brown patch, the dorsal edge, straight and well-defined approximating the apex, and just reaching the subterminal band; proximal edge reaching outer margin at vein CuA1. Hindwing beige with a pinkish undertone; basal half (as far as the medial band) and tornal region slightly paler. Medial line straight, well-developed and dark brown, terminating in anal fold. Postmedial band indistinct and submarginal band more strongly developed, both curved and running parallel to each other.

Male genitalia. Uncus broadly triangular, obtusely angled at apex, apically bluntly pointed. Gnathos poorly-developed as a triangular process. Vinculum elongate, Y-shaped. Juxta cup-shaped with a triangular, apically-pointed medio-distal process on each side. Valve ovaline in shape, truncate apically; sacculus short, gently arcuate dorsally, straight ventrally; harpe bilobed, medio-distally covered in dense setae; the dorsal lobe is digitate and rounded at apex, the ventral lobe somewhat triangular, bluntly pointed at apex; the section between the two lobes evenly arcuate. Valve costa, short, well-sclerotised, its margin concave. Ventral margin of valve with a weakly-sclerotised ventrally directed digitate costal process. Phallus well-sclerotised, dorsally slightly concave, apically slightly expanded and produced into a gently recurved carinal hook with an ovaline expansion basally; caecum short and anteriorly rounded. Vesica expanded basally into a spherical sac.

Female. Antenna thinner than in male. Upperside markings similar to the male but ground colour of forewing brownish, basal half (as far as the antemedial band) and section between medial and postmedial bands slightly paler and more grey. Underside markings similar to male but ground colour generally darker.

Diagnosis

Polyptychus smithi (Figs. 1–2) is similar in appearance to *P. coryndoni* (Figs. 5–6) but is on average a smaller moth, with more strongly falcate forewings and more contrasting forewing markings and lighter undersides. The male genitalia of *P. coryndoni* (Figs. 7–8) are similar to *P. smithi* (Figs. 3–4) but differ in the following characters: the vinculum is shorter and more robust; the process of the juxta more elongate; the harpe is shorter, the digitate distal lobe wider and the proximal lobe less protruding; the digitate process of the ventral margin of the valve slightly longer and thinner; the carinal apical hook of the phallus unevenly arcuate and straight medially; the base of the apical hook with strongly developed crenulations dorsally. As these two species are distributed allopatrically (see Distribution below), there is unlikely to be any confusion in specimens with good provenance.

Polyptychus smithi is not dissimilar to *P. andosa* (Walker, 1856) but the latter is generally smaller in size, the antennae are slenderer, the forewing postmedial band is clearly sinuate, the subterminal band is indicated by black spots on the veins and the tornal marking is larger and more triangular in shape. The dark scaling along the hindwing veins extend further towards the base. These two taxa are not sympatric, *P. smithi* being found in savanna habitats and *P. andosa* in forested environments.

DNA divergences

The new species has been assigned the Barcode Index Number (BIN) BOLD:AAC2743. Intraspecific pairwise distances (PWD) were 0.0% (n=3) and interspecific PWD between the new species and *P. coryndoni* were 4.1–4.6%.

Derivatio nominis

It is with great pleasure that this species is dedicated to Richard Smith, Director of the African Natural History Research Trust, in admiration of his continued contribution to the field of systematic entomology in Africa.

Distribution

This species is distributed across the Sudanian Savanna belt from Gambia on the Atlantic coast (Goff 2009) through to Cameroon. Based on the allopatric or parapatric distributions of species such as *Pseudoclanis molitor* (Rothschild & Jordan, 1912) and other insect groups (e.g., the dung beetle genus *Catharsius*, Takano in prep), it is difficult to state with certainty whether specimens from east of Cameroon, such as those

recorded from Central African Republic by Basquin & Pierre (2005), are conspecific with *P. smithi*. Previously published records of the new species include an example from Banfora in Burkina Faso (Prost 1986) and Wango Fitini in Ivory Coast (Vuattoux *et al.* 1989).

***Polyptychus lucindae* sp. nov.**

<http://zoobank.org/urn:lsid:zoobank.org:act:F56C4442-DFEE-4547-A90A-36A5ABAD697E>

(Figs. 9–11)

Holotype ♂ (ANHRT):

“IVORY COAST, 174m / Tai NP, Tai Research Station (SRET) / 05°50'00"N, 07°20'32.0"W, / 25.III – 17.IV.2017, MV Light, / Aristophanous, A., Aristophanous, M., / Geiser, M., Moretto, P., leg. / ANHRT:2017.25 // ANHRTUK / 00007316”.

Paratypes (2♂♂):

IVORY COAST: identical data to holotype (1♂ ANHRT); **LIBERIA:** Grassfield, Nimba Mts., ix-x.1968, A. Forbes-Watson (1♂ NHMUK).

Description

Forewing length: holotype: 27 mm; paratypes: 27 mm.

Upperside. Ground colour of head, thorax and abdomen purplish-brown. Vertex with a slight crest. Antenna strongly fasciculate, with brown scaling along its entire length and white scaling basally. Patagia with a patch of blueish-grey scales medially on posterior margin. Tegulae with outer anterior margin white. Posterior margin of thorax and abdominal segments 1-2 with blueish-grey markings medially. Forewing triangular, produced and broadly pointed at apex; outer margin falcate. Ground colour reddish-brown, darker in the submarginal region; a large dark greenish-brown spot at base with lighter cream scales on its outer edge, bisected laterally partially or completely. Basal two-thirds (up to the postmedial line) with silvery-mauve diffuse patches separated by bands of the ground colour; double antemedial band sinuate, very pale, the outermost stronger and wider, and a transverse band arising nearly halfway along the costa and terminating at the postmedial band, following the rough outline of vein M1. Discal spot cream, well-developed. Postmedial band dark brown, straight but kinked at a right angle at vein M1 with a line of silvery-mauve scales on the outer edge of the postmedial line, more prominent basally. Submarginal band dark greenish-brown linking triangular apical marking with triangular tornal marking. Apical marking with olive scaling along the inner margin; tornal marking with olive scaling markings on both inner and outer margins. Hindwing margin falcate, becoming more pronounced towards the tornus; ground colour brick red, darker in the submarginal area. Anal fold with a small narrow black marking towards the tornus. Tornal patch between vein CuA2 and the anal fold consists of an elongate olive marking, internally emarginate medially on vein CuP, with two further lines on its inner margin, one dark greenish-brown, the other grey, following the outline of the patch.

Underside: Ground colour of head, thorax and abdomen bright orangey-red. Labial palps the same ground colour except for their greyish-mauve apices. Legs brown, pro- and metafemurs with heavy silvery-mauve scaling, metatibia with a white circular marking basally. Forewing ground colour rusty-brown becoming darker beyond two dark brown postmedial lines. Apex of wing with a trapezoidal white marking not reaching the outer margin. Hindwing slightly lighter in tone, with a well-developed dark brown, sinuate postmedial line.

Male genitalia. Uncus long, narrow and gently arcuate, truncate and rounded at apex. Gnathos developed as a pair of well-sclerotised rounded lobes; distal margin slightly serrate. Vinculum v-shaped and well-developed. Juxta conical, strongly produced, emarginate apically in ventral view, arcuate in lateral view with a sharp projection medially at basal third; apical half with serrations proximally. Valve ovaline in shape; sacculus straight ventrally, dorsally gently arcuate; harpe bilobed, the dorsal lobe trapezoid, rounded at angles and strongly sclerotised along its dorsal margin, proximal lobe quadrangular, slightly hooked distally at apex. Valve costa very short. Phallus well-sclerotised apically slightly expanded and produced into a carinal hook with an excavation on its dorsal margin basally; caecum short and anteriorly rounded. Vesica expanded basally into a spherical sac.

Female unknown.

TWO NEW SPECIES OF POLYPTYCHUS



Figures 9–11. *Polyptychus lucindae* sp. nov.: 9 – holotype ♂, upperside; 10 – *idem.*, genital capsule; 11 – *idem.*, phallus. **Figures 12–14.** *Polyptychus lagnelae* Pierre, 2014: 12 – ♂, Gabon, Dilo ANPN camp, Ivindo [ANHRTUK00073409], upperside; 13 – *idem.*, genital capsule; 14 – *idem.*, phallus. Scale bar equals 10 mm for the adults and 1 mm for the genitalia.

Diagnosis

Polyptychus lucindae (Fig. 9) is similar in appearance to *P. lagnelae* (Fig. 12) but is on average a smaller moth with less contrasting forewing markings. On the forewing, the subterminal region in the latter is of a darker brown colouration, the apical patch and tornal patch is not linked by a submarginal line and the apical patch is more longitudinally elongate with a clear pale olive stripe bisecting it. The forewing underside is darker towards the outer margin. In the male genitalia, the juxta in *P. lagnelae* (Fig. 13) is nearly twice as long as in *P. lucindae* (Fig. 10) and lacks apical serrations, the dorsal distal lobe of the harpe is arcuate distally and the ventral lobe is more digitate. The phallus in *P. lagnelae* (Fig. 14) is narrower, longer, and the basal expansion of the vesica is larger compared to that of *P. lucindae* (Fig. 11).

DNA divergences

The new species has been assigned the BIN BOLD:AEK2399. Intraspecific PWD were 0.0% (n=2) and interspecific PWD between the new species and *P. lagnelae* were 4.8–5.0%.

Derivatio nominis

It is with great pleasure that this exquisite new species is dedicated to Lucinda Sharp-Smith, who like her father, shares a great passion for natural history and Africa.

Distribution

Polyptychus lucindae is found in the lowland forests of the Upper Guinean Forest. The two specimens from Tai were caught in a clearing within intact closed-canopy lowland rainforest (M. Aristophanous 2017, pers. comm.) and although only three specimens are known, it is probable that this new species is more widely distributed in suitable habitats in Guinea and Sierra Leone.

Discussion

Both new species of *Polyptychus* have phenotypically similar allopatric vicariants inhabiting different regions of Africa. In the case of *P. smithi* and *P. coryndoni*, these two species are widely distributed in open woodland habitats, the former in the Sudanian domain and the latter in the Zambezian domain (as defined in Assédé *et al.* 2020). *Polyptychus lucindae* and *P. lagnelae* on the other hand are species distributed in the wet forests of Upper Guinea and Lower Guinea respectively, separated by the savannas of the Dahomey Gap. Such geographic circumscriptions are mirrored in many species of terrestrial vertebrates and invertebrates (e.g., Fuchs *et al.* 2017).

Acknowledgements

My thanks go to Ian Kitching (NHMUK) for providing label data from NHMUK specimens and for helpful taxonomic discussions and critical review of the manuscript that greatly improved the final version. I am grateful to Gyula Laszlo (ANHRT) for his high-quality dissections and photography of the genital capsules. Research in Côte d'Ivoire was authorised by the Ministère de l'Enseignement Supérieur et de la Recherche Scientifique. The Office Ivoirien des Parcs et Réserves (OIPR) and the Société de Développement des Forêts (SODEFOR) are thanked for authorising access to protected forests and providing export permits. Research in Togo was authorised by Monsieur André Kouassi Ablom Johnson, Ministre de l'Environnement et des ressources forestières du Togo, who kindly granted access to Parc National de Fazao-Malfakassa. Professors Yaovi Nuto and Komina Amevoin from the Université de Lomé and Lieutenant Mawunya Komi Gbemou, conservateur du P. N. de Fazao-Malfakassa are thanked for their support.

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