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Notes on *Streblote* (Lepidoptera, Lasiocampidae, Lasiocampinae) from the Malay Archipelago with two new species description

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Abstract

The article updates the status of the three valid taxa of the genus *Streblote* Hübner, 1820 from the Malay Archipelago. The species *Streblote castanea* (Swinhoe, 1892) was described from an unstated location in the Philippines. Presently this species is recorded from 8 major Philippine islands: Cebu, Luzon, Mindanao, Mindoro, Negros, Palawan, Panay, and Samar. The three populations from Luzon, Mindoro, and Negros have pairwise distances ranging from 2.45 to 3.92%. Genetic distance together with geographic isolation is enough to treat the populations as separate species, but

the description of new Philippine taxa is not possible until the island of the origin of *S. castanea* is designated. To locate the species origin and to understand relationships to other populations, the type specimen has to be barcoded. The species *Streblote dorsalis* (Walker, 1866) from Borneo is similar morphologically to *S. castanea*. It has to be sequenced as well to understand its relationship with the Philippine species and with geographically and morphologically close populations from the islands Belitung and Sulawesi. The taxon *Streblote pallida* (Rothschild, 1915) from Java and Bali was earlier attributed as a subspecies to *S. castanea* and then to *S. dorsalis*. It is raised here to a **bona species** because of its wing pattern distinct from the two species, it has an average pairwise distance of 5.15% from *S. castanea*. Two populations from the neighboring Sumatra, Flores and Sumba are described as new species *Streblote gerry* **sp. n.** and *Streblote jacquie* **sp. n.** *Streblote pallida* and *S. jacquie* **sp. n.** have a pairwise distance of up to 2.45%.

Key words: Greater Sunda Island, Indomalayan fauna, island endemism, Lesser Sunda Islands, the Philippines, *Streblote castanea*, *Streblote dorsalis*.

Introduction

This article continues a series of publications devoted to the new Lasiocampidae species recently collected from the Lesser Sunda Archipelago (Bolotov *et al.*, 2018; Spitsyn *et al.*, 2019; Spitsyn & Potapov, 2020; Spitsyn *et al.*, 2021).

The Lasiocampidae fauna of the Malay Archipelago was so far not summarized. There are publications devoted to the island of Borneo (Holloway, 1987), the Philippines (Zolotuhin *et al.*, 1997), Indonesia (Zolotuhin & Witt, 2005), and the island Sulawesi (Zolotuhin & Holloway, 2006), some island species and subspecies were described recently (Sergeev & Zolotuhin, 2010; Zolotuhin & Perekrasnov, 2010; Spitsyn *et al.*, 2019; Spitsyn & Potapov, 2020; Spitsyn *et al.*, 2021). According to the publications, there are 26 genera and 143 species and subspecies of Lasiocampidae. Most taxa have been described based on morphologic characters and geographic isolation.

The genus *Streblote* (type-species Iberian and North African *Streblote panda* Hübner, 1820) is spread from southern Africa northwards to southwest Europe and eastwards through southern continental Asia to the Malay Archipelago. Altogether it may include about 60 species, some Afrotropic and Indomalayan taxa have yet to be described (Zolotuhin, 2015). In this paper, we focus on the Malay Archipelago known for its high endemism (Zolotuhin, 2009). All in all, three valid taxa of *Streblote* were recognized until now (given in the original combinations): *Ticera castanea* Swinhoe, 1892 described from the Philippines; *Megasoma dorsalis* Walker, 1866 from Borneo; and *Taragama castanea pallida* Rothschild, 1915 from Bali.

Swinhoe (1892) described the monotypic genus *Ticera* with *Ticera castanea* and unfortunately did not specify the island of its origin. The two males mentioned in the article are only labeled “Philippines” (holotype is kept in OUMHN, Fig. 1; and paratype – in NHML). The species was transferred to *Streblote* by Zolotuhin *et al.* (1997), its distribution included: “Luzon, Mindoro, Negros, Panay, Cebu, Samar, Palawan.” The authors noted that “males [...] occur in two color forms: black-brown and red-brown,” but no additional morphologic differences have been found and no distribution pattern behind the color variations has been revealed.

Walker (1866) described *Megasoma dorsalis* in the genus *Megasoma* Boisduval, 1833, the holotype female was collected in Borneo (Fig. 8; type specimen is kept in NHML). Hampson (1892), and later Grünberg (1911, 1922; for correct years of publication see Griffin, 1936), regarded the species within the genus *Taragama* Moore, 1860 as a senior synonym of four other dark-colored species (given in the original combination): *Taragama igniflua* Moore, 1883 described from Sri-Lanka; *Taragama intensa* Moore, 1883 and *Taragama hyperantherae* Moore, 1883 from West Bengal, E India; and *Taragama castanoptera* Moore, 1888 from the Kangra Valley, NW India. Thus, the distribution area of *dorsalis* was regarded to be from the West Himalayas to the Malay Archipelago. Hampson (1892) noticed that “the Javan race is very pale in both sexes.” Later, Grünberg (1922) wrote that “specimens from the Sunda Islands are lighter,” but he did not mention the third taxon *Taragama castanea pallida* Rothschild, 1915 from Bali. Rothschild (1915) shortly described it as “♀. Much paler than *c. castanea* Swinh.”

Zolotuhin (1998) regarded *dorsalis* and *pallida* to be within the genus *Streblote* without formal change of the generic combination. First, he synonymized *Streblote helpsi* Holloway, 1987 with *S. dorsalis*, both were described from Borneo. Second, he reattributed subspecies *pallida* from *S. castanea* to the

geographically closer *S. dorsalis* from Borneo and synonymized *Nadiasa callipaida* Tams, 1935 with *S. dorsalis pallida*, both described from Bali. Later, Zolotuhin & Witt (2000) stated that “the occurrence of *Streblote dorsalis* from the continent [suggested by Hampson (1892) and Grünberg (1911, 1922)] is less possible” and recorded it only for the islands: Borneo, Bali, Sumatra, and Java. They did not mention *S. dorsalis pallida* at all.

Zolotuhin with co-authors planned to describe two more island species: one from Flores (Zolotuhin & Witt, 2005), and another from Sulawesi (Zolotuhin & Holloway, 2006). The first is described here as *S. jacquie* **sp. n.**, the latter we still leave undescribed due to lack of genetic data (see below under *S. dorsalis*).

Material and methods

Adults were photographed with Olympus C-750 UZ, a set of Nikon D3300 with a Nikon 40mm f/2.8G, and a Nikon R1C1 and a set of Canon 7D with a Canon 100 mm f/2.8. Morphologic preparations were photographed using Fujifilm X-T10 with Motic SMZ-161-TLED. All images were processed in Photoshop CS6 (Adobe, 2012).

Specimens from the following collections were examined:

CGM	collection of Günter Müller (Freising, Germany);
MfNB	Museum für Naturkunde (Berlin, Germany);
MWM	Museum Witt Munich (Munich, Germany);
NBCL	Naturalis Biodiversity Center (Leiden, Netherland);
NHML	Natural History Museum (London, UK);
NHMV	Natural History Museum (Vienna, Austria);
NSMT	National Museum of Nature and Science (Tsukuba, Japan);
OUMNH	Oxford University Museum of Natural History (Oxford, UK);
RBINS	Royal Belgian Institute of Natural Sciences (Brussels, Belgium);
RMBH	Russian Museum of Biodiversity Hotspots (Arkhangelsk, Russia);
SMNH	Swedish Museum of Natural History (Stockholm, Sweden)
SMNS	State Museum of Natural History (Stuttgart, Germany);
SNHM	Senckenberg Natural History Museum (Frankfurt, Germany);
ZSM	Bavarian State Collection of Zoology (Munich, Germany).

Molecular Analysis

Sampling and Collection of Data

Sequences of eight *Streblote* specimens from the Malay Archipelago were obtained for this study. The samples were collected from Indonesia and the Philippines and stored in MWM/ZSM (Table 1). One leg from each individual was used for analysis. Legs were stored in tubes with 96% ethanol. The sequences were obtained at the Biodiversity Institute of Ontario, Canada. DNA isolation, PCR amplification, and DNA sequencing followed standard protocols (Hebert *et al.*, 2003; deWaard *et al.*, 2008). The sequences are released publicly in the dataset DS-STREB1 (dx.doi.org/10.5883/DS-STREB1) on BOLD (Ratnasingham & Hebert, 2007, 2013).

Sequence Analysis

Sequence alignment and calculation of pairwise distances were done in MEGA 11 software (Tamura *et al.*, 2021). Bootstrap analysis (1000 replicates) and the neighbor-joining tree of the COI sequences (the Kimura 2-parameter was used) were also built in MEGA 11. We used as the out-group a sequence of *Pachygastrina editae* Speidel *et al.*, 2015 (Lepidoptera: Lasiocampidae).

Only three sequences of *Streblote* spp. out of eight are of a 658 bp length, others range between 408 and 630 bp (Table 1).

Table 1. Information on the barcodes stored in the public dataset DS-STREB1 on BOLD and specimens from MWM/ZSM collections used in phylogenetic analysis.

Taxon	BOLD Sample ID	COI bp	Sex	Collection data
<i>P. editae</i>	GWORC2521-13	658	♂	Morocco, High Atlas, Marrakech, Oukaimeden, 31.1927 N, 7.8838 W, 2150 m, 20.VIII.2012
<i>S. castanea</i> spp.	LBEOA419-11	630	♂	the Philippines, Negros, Negros Occidental, Mt Kanlaon, route via Mambucal, 600 m, 19.VII.1996
	LBEOA420-11	577	♂	the Philippines, Negros, Negros Occidental, Mt Kanlaon, route via Mambucal, 600–800 m, II.1998
	LBEOA421-11	599	♀	the Philippines, Mindoro, Oriental Mindoro, Mt Halcon, 1000 m, V.2001
	LBEOA422-11	408	♀	the Philippines, Mindoro, Oriental Mindoro, Mt Halcon, 2000 m, 6–18.III.2000
	LBEOA1358-11	658	♂	the Philippines, Luzon, Panasai, Benguet Province, 19.III.2009
<i>S. pallida</i>	GWOTL634-13	658	♂	Indonesia, Java, West Java, Mt Salak, 6.42 S, 106.44 E, 1000–1500 m, VII.1996
<i>S. jacquie</i>	GWOTL636-13	658	♂	Indonesia, Sumba, East Nusa Tenggara, Luku Melolo, 500 m, 10 S, 120.10 E, V.2006
	LBEOA425-11	454	♂	Indonesia, Flores, East Nusa Tenggara, Ruteng, Mt Ranaka, 3 km S Mano, 8.36 S, 120.3 E, 1270 m, 17–21.IV.1996

Results

Lasiocampidae, Lasiocampinae, Lasiocampini

Streblote castanea (Swinhoe, 1892)

(Figs 1–7, 25, 32, 38–40)

Ticerca castanea Swinhoe, 1892, *Catalogue of eastern and Australian Lepidoptera Heterocera in the collection of the Oxford University Museum*, 1, 269. Type locality: “Philippine Islands.” Holotype male (OUMNH).

Taxonomic note. 1. The origin of the holotype is unknown, which makes further taxonomic studies impossible. A 130 years old holotype male from OUMNH (Fig. 1) has to be barcoded using a modern sequencing approach (e.g., Prosser *et al.*, 2015) and then compared with specimens from other Philippine islands. So far, five specimens from Luzon, Mindoro, and Negros have been barcoded (*p*-distance ranges between 2.45 and 3.92%, Figs 38–40) but the species was recorded also from Panay, Cebu, Samar, and Palawan (Zolotuhin *et al.*, 1997), additionally, we know few specimens from Mindanao (NBCL, NSMT, MWM/ZSM). A detailed study of the external variability of males and females mentioned by Zolotuhin *et al.* (1997) is also necessary.

2. The species resembles very much *S. dorsalis* from Borneo, a genetic study is necessary to check their relationship due to the lack of significant morphologic differences.

Streblote dorsalis (Walker, 1866)

(Figs 8–10, 26, 38–40)

Megasoma dorsalis Walker, 1866, *List of the specimens of lepidopterous insects in the collection of the British Museum*, 35, 1947. Type locality: Borneo. Holotype female (NHML), not male as stated by Walker.

= *Streblote helpsi* Holloway, 1987, *Moths of Borneo*, 3, 25. Type locality: [Borneo] Brunei, Sungai Selanjak. Holotype male (NHML).



Figures 1–13. Adults of *Streblote* spp. 1–7. *S. castanea* sensu lato, the Philippines. 1. Male, holotype (OUMNH). 2. Female, Luzon (NBCL). 3. Female, Palawan (SMNS). 2. Male, Luzon (SMNS). 5. Male, Palawan, genitalia slide 220629 (SMNS). 6. Male, Luzon (SMNS). 7. Male, Negros (SMNS). 8–10. *S. dorsalis*, Greater Sunda Islands, Borneo. 8. Female, holotype (NHML). 9. Male, holotype of *S. helpsi* (NHML). 10. Male (SNHM). 11–12. *Streblote* sp., Belitung. 11. Female (SMNH). 12. Male (SMNH). 13. *Streblote* sp., Sulawesi (NBCL). Scale bar – 1 cm.

Taxonomic note. 1. The “male” mentioned in the original description is an error. Walker described a female which is evident from the coloration, the size of the body, and the wings of the specimen.

2. The taxon is known to us from 4 adults originating from Borneo: holotype female (Fig. 8), holotype male of *S. helpsi* (Fig. 9), and a pair from SNHM (male on Fig. 10). Here we suppose that specimens from Belitung (a pair from SMNH, Figs 11–12, and one female from NBCL) and Sulawesi (two females from NBCL, Fig. 13; earlier mentioned by Zolotuhin & Holloway, 2006) may represent two new species externally resembling and genetically close to *S. dorsalis*. Barcoding and detailed morphologic study are necessary.

3. The species resembles very much *S. castanea* from the Philippines, a genetic study is necessary to check their relationship due to the lack of significant morphologic differences.

***Streblote pallida* (Rothschild, 1915), stat rev. as bona sp.**

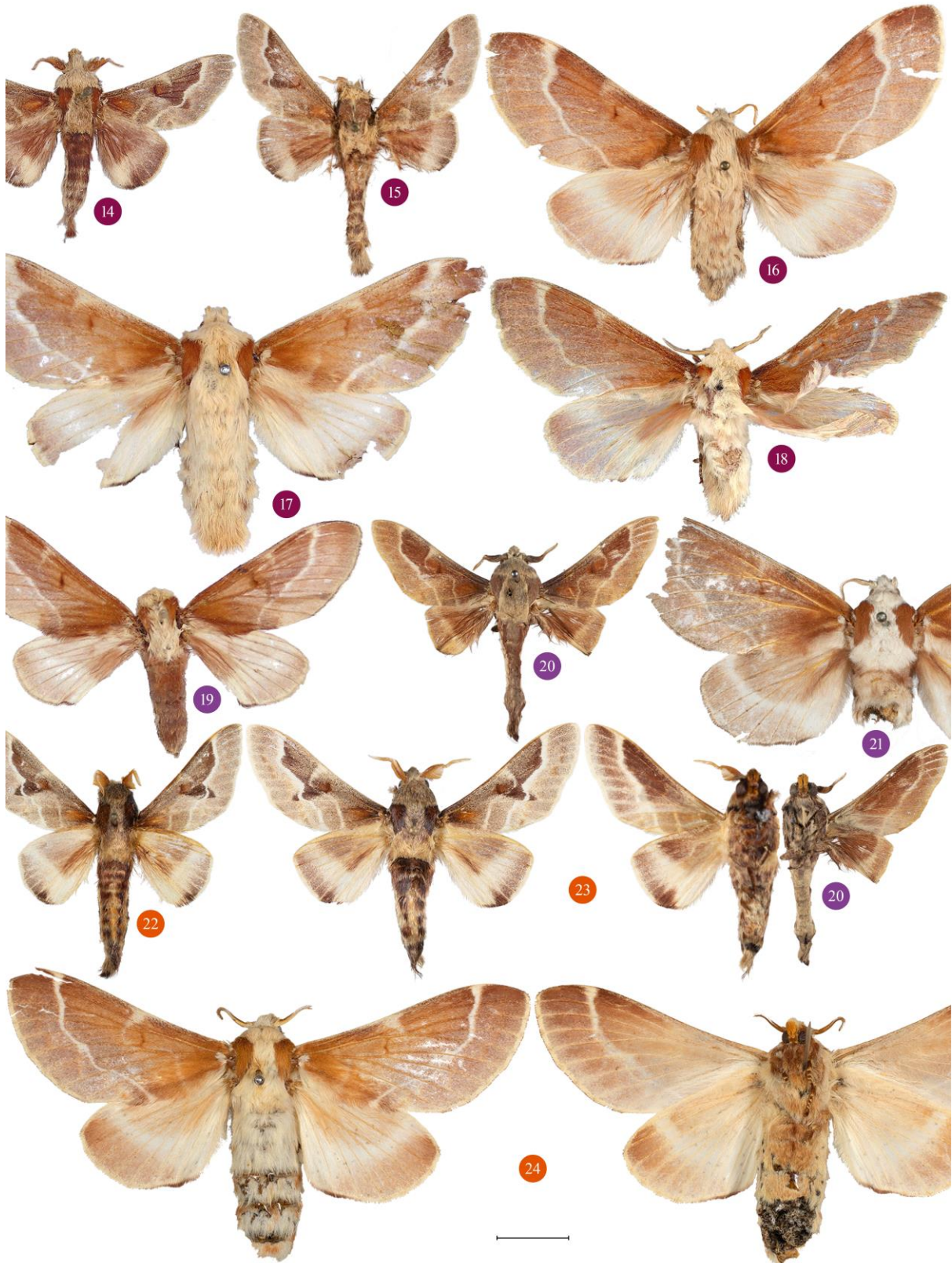
(Figs 14–18, 28–29, 35–40)

Taragama castanea pallida Rothschild, 1915, *Novitates Zoologicae*, 22, 222. Type locality: Bali. Holotype female (NHML).

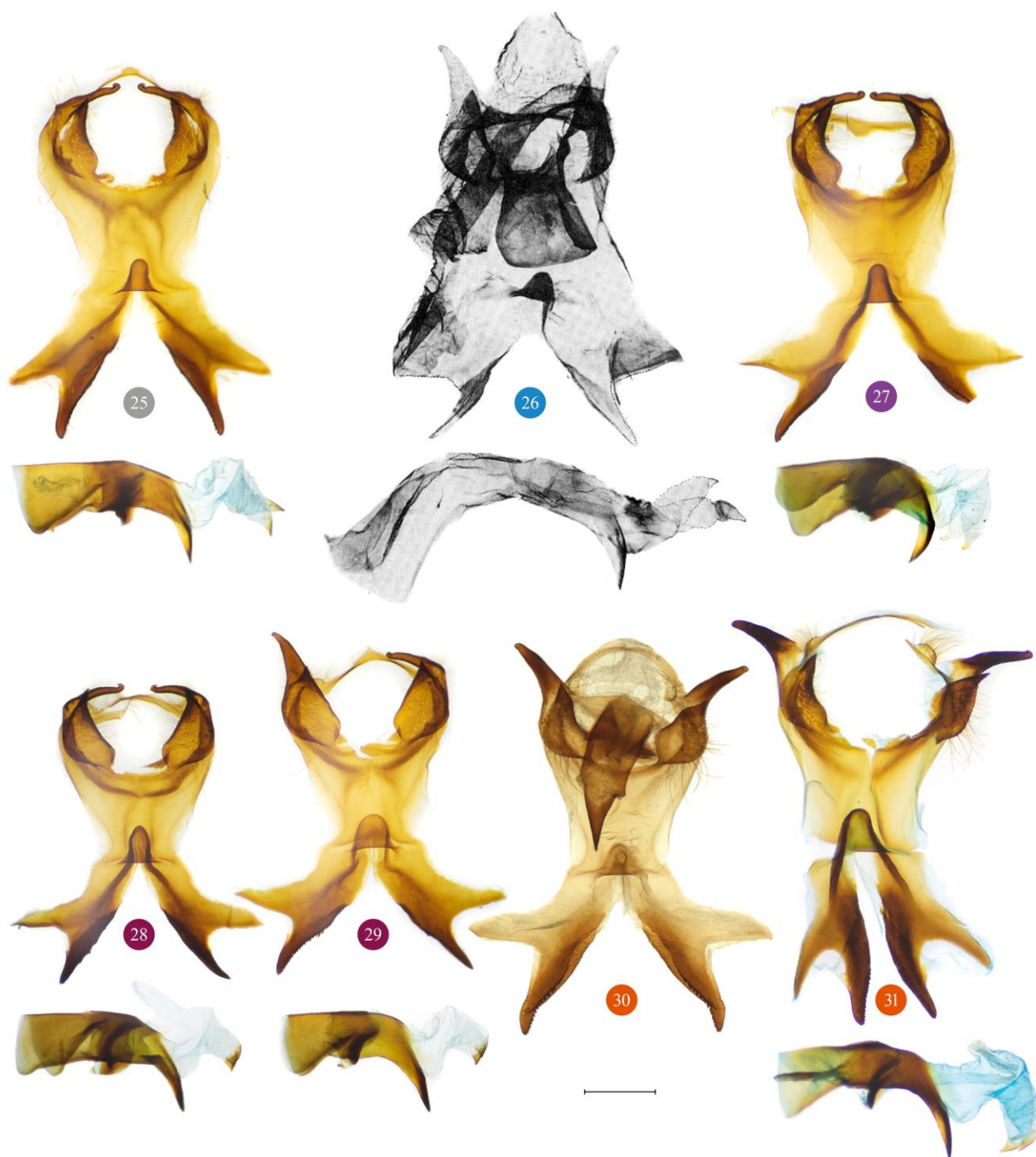
= *Nadisa callipaida* Tams, 1935, *Mémoires du Musée royal d'histoire naturelle de Belgique* 4(12), 45–46. Type locality: Bali, Denpasar. Holotype female (RBINS).

The original description is short and based on one female, we would like to redescribe the taxon here.

Redescription. Male (Figs 14–15). Antenna creamy or orangish, flagellum covered with creamy speckled scales. Palpi orangish. Eyes dark brown, naked. Head and thorax mesially creamy with dark speckles, tegulae orangish or reddish brown. Abdomen from reddish brown basally to creamy apically with more or less pronounced reddish-brown stripes along it. Epiphysis on the fore leg absent. *Forewing*. Forewing length: 25–26 mm; wingspan: 41–56 mm. Triangular, apex acute, outer margin slightly waved. Background color reddish brown. Pattern consists of orangish basal spot, two pale wavy medial lines, orangish eye-like spot in medial field with dark R-Cu vein, dark brown drop-like spot growing from it between M_3 and CuA_1 towards external field and faded orangish fragmented external line. Cilia creamy. *Hindwing*. Trapezoid. Background color reddish brown with more or less pronounced creamy medial band, external field with darker anal spot. Cilia creamy, gets darker on anal angle. *Genitalia* (Figs 28–29, 35–36). Tegumen a narrow band, triangle-shaped mesially, bears pair of knob-like socii covered with chaetae. Cucullus elongated finger-like, c-shaped, slightly curved apically; sacculus short tubercle-shaped with pointed apex, body covered with chaetae. Vinculum distally expands and bears cubile, each arm bifurcates, medial outgrowth more sclerotized, slightly c-shaped with serrated outer edge. Juxta medially fused with aedaeagus. Aedaeagus c-shaped, hardly sclerotized; caulis short; phallobase apically elongated, claw-like. Vesica compact elongated, basally slightly widens, then bifurcates, each outgrowth apically bears small claw-like cornutus. Eighth sternite trapezoid, caudal laterally gets membranous; eighth tergite somewhat pentagonal with somewhat romboid medial membranous field. **Female** (Figs 16–18). Bigger, little paler and less contrasty than male. Antenna creamy or orangish, flagellum covered with creamy scales. Palpi orangish. Eyes dark brown, naked. Head and thorax mesially creamy with dark speckles, tegulae orangish or reddish brown. Abdomen creamy, may be reddish basally. Epiphysis on the fore leg absent. *Forewing*. Forewing length: 40–45 mm; wingspan: 82–94 mm. Oval-shaped, apex blunt, outer margin slightly wavy. Background color reddish or orangish brown. Pattern consists of orangish basal spot, two pale wavy medial lines, medial orangish eye-like spot and faded orangish fragmented external line. Cilia creamy. *Hindwing*. Egg-shaped. Background color reddish or orangish brown with more or less pronounced creamy medial line which may become a large field (Fig. 17). Cilia creamy, gets darker near anal angle. *Genitalia* (Fig. 37). Papillae analis elongated, densely covered with chaetae. Posterior apophyses slightly shorter than anterior ones. Lamella antevaginalis a sclerotized shield-like formation with lateral trenches for cubile arms and medial indentation for apex of phallobase, lamella postvaginalis a narrow medially membranous plate. Ductus bursae short, wrinkled. Corpus bursae spherical, medium-sized, dorsally bears tiny horizontally elongated signum.



Figures 14–24. Adults of *Streblote* ssp. 14–18. *S. pallida*. 14. Male, Greater Sunda Islands, Java (RBINS). 15. Male, Greater Sunda Islands, Java, genitalia slide 2022-0096, DNA GWOTL634-13 (MWM/ZSM). 16. Female, Greater Sunda Islands, Java, genitalia slide 2022-0098 (NBCL). 17. Female, holotype of *Nadiasa callipaida*, Lesser Sunda Islands, Bali (RBINS). 18. Female, holotype of *S. castanea pallida*, Lesser Sunda Islands, Bali (NHML). 19–21. *S. gerry*, Greater Sunda Islands, Sumatra. 19. Female (MWM/ZSM). 20. Male, genitalia slide 2022-0094 (NBCL). 21. Female (NBCL). 22–24. *S. jacquie*, Lesser Sunda Islands. 22. Male, paratype, Sumba (CGM). 23. Male, holotype, Flores, genitalia slide ZSM-60 (MWM/ZSM). 24. Female, paratype, Flores (NBCL). Scale bar – 1 cm.



Figures 25–31. Male genitalia of *Streblote* spp. 25. *S. castanea*, the Philippines, Palawan, genitalia slide 220630 (SMNS). 26. *S. dorsalis*, paratype of *S. helpsi* after Holloway (1987), Greater Sunda Islands, Borneo (NHML). 27. *S. gerry*, holotype, Greater Sunda Islands, Sumatra (NBCL). 28–29. *S. pallida*, Greater Sunda Islands, Java. 28. Genitalia slide 2022 0096 (MWM/ZSM). 29. Genitalia slide 2022 0097 (NBCL). 30–31. *S. jacquie*, Lesser Sunda Islands. 30. Paratype, Flores (RMBH). 31. Holotype, Flores (MWM/ZSM). Scale bar – 1 mm.

Variability. Coloration of wings and abdomen of male may be more or less dark (Figs 14–15). Medial lines on fore wing of female may be dull and thin (Fig. 18) or brighter, wider and more curved (Fig. 17). Medial band on hind wing of male and female may be more (Figs 15, 17) or less pronounced (Figs 14, 18). In male genitalia apex of cucullus may be more (Fig. 28) or less curved (Fig. 29), apex of sacculus may be short (Fig. 29) or elongated (Fig. 28), cubile arms with more (Fig. 29) or less developed denticles (Fig. 28) along the outer edge, size and shape of the eighth sternum and tergum slightly varies (Figs 35–36).

Diagnosis. Reddish-brown species with contrasting light pattern that never occurs in *S. dorsalis* from Borneo or *S. castanea* from the Philippines. It occurs on Java and Bali only. Male is of intermediate coloration between *S. gerry* sp. n. from Sumatra and *S. jacquie* sp. n. from Flores and Sumba. No clear difference in male genitalia is found between *S. pallida*, *S. jacquie* sp. n., *S. gerry* sp. n., *S. dorsalis*, and *S. castanea*. The species has up to 2.45% difference in COI from *S. jacquie* sp. n., and 4.90–5.39% from *S. castanea* (Fig. 32).

Distribution (Fig. 30). Java and Bali.

Ecology. Adults were collected in April, July–August, and December from the altitudes between 6 (Besuki) to 2909 m (Mt Merapi) within the following ecoregions: Western Java lowland and montane rain forests, Eastern Java-Bali lowland and montane rain forests (Dinerstein *et al.*, 2017). According to the collection data, the species is likely multivoltine.

Taxonomic note. Zolotuhin (1998) changed the original combination of *Taragama castanea pallida* Rothschild, 1915 to *Streblote dorsalis pallida* (Rothschild, 1915) actualizing the traditional point of view that the lighter *dorsalis* population is spread over some of the Sunda Islands (Hampson, 1892: 405; Grünberg, 1911: 177; Grünberg, 1922: 393). Although, adults of *S. dorsalis* from Borneo (Figs 9–10) are much darker than *S. pallida* and they resemble rather the dark form of *S. castanea* from the Philippines (Figs 1, 4) as Holloway (1987) noted. We raise *S. pallida* to a specific rank as **bona species** considering that *S. pallida* differs externally from both *S. castanea* and *S. dorsalis*, never occurs sympatrically with the two and has an average pairwise distance of 5.15% from *S. castanea*.

Material examined. Indonesia, Bali: Holotype ♀, 1912, leg. E. Stresemann (NHML); ♀, holotype of *Nadiasa callipaida*, Denpasar, 1932, leg. Prince Léopold (RBINS). **Indonesia, Java:** ♀ (MfNB); ♂, Mt Salak, 6.42 S, 106.44 E, 1000–1500 m, VII.1996, slide 2022 0096, DNA LBEOA423-11 (MWM/ZSM); ♂, Surabaya, 24.VII.1912, slide 2022 0097 (NBCL); ♀, Rajamandala, VII.1934, leg. [?] Toxopeus, slide 2022 0098 (NBCL); ♀, Ambarawa, leg. Ludeking (NBCL); ♂, Mt Merapi, 26.XII.1995 (NSMT); ♂, Besuki, 900 m, VII.1932, leg. S. Wilis (RBINS); ♀, Situbondo, 4.IV.1926 (RBINS).

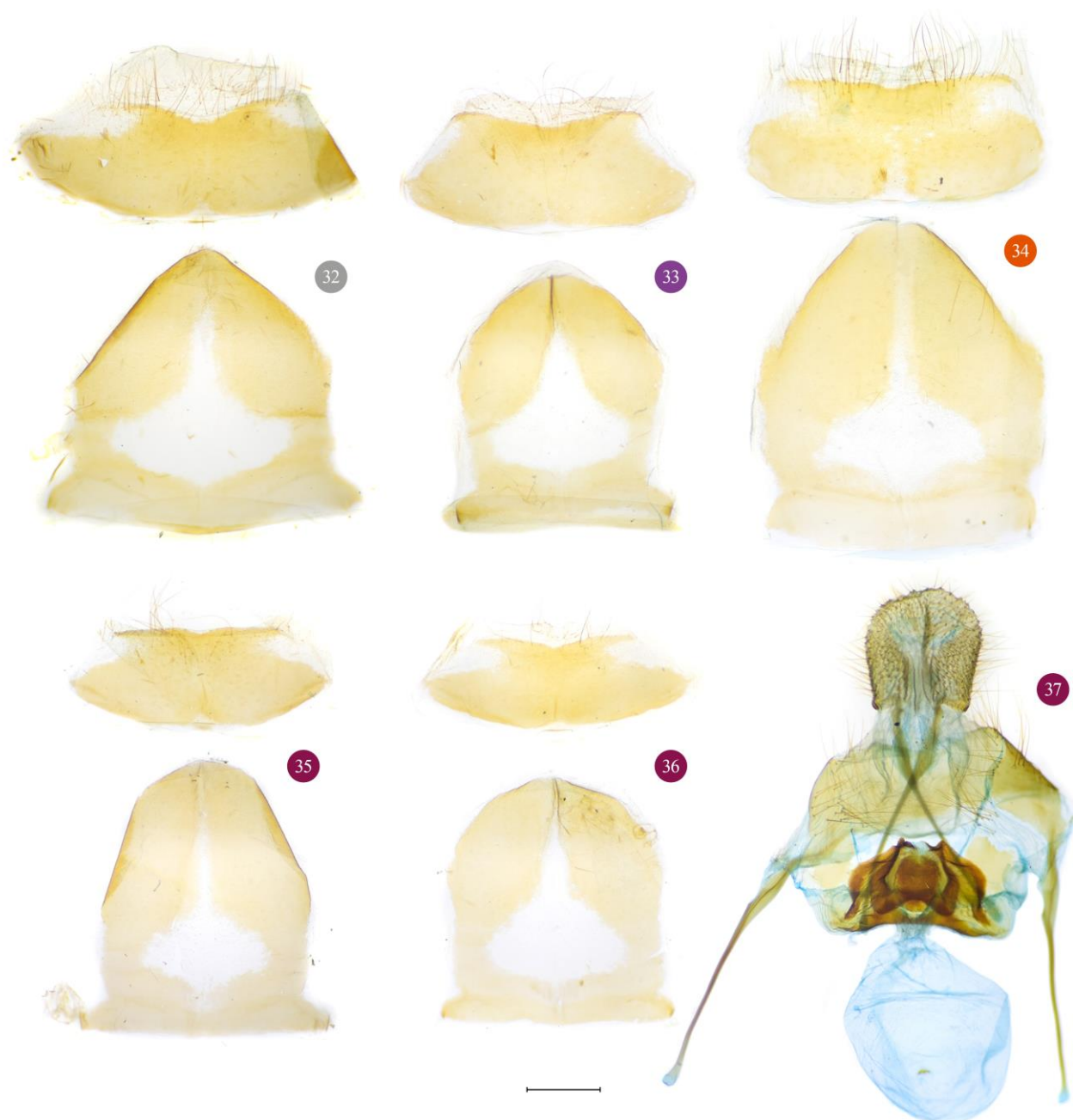
***Streblote gerry* sp. n.**

<http://zoobank.org/urn:lsid:zoobank.org:act:EC58D7FE-3F94-465F-B66C-A114DAB8EFA9>

(Figs 19–21, 27, 33, 38–40)

Type material. Holotype ♂, **Indonesia, Sumatra**, Aceh Province, 1916, leg. G. Herman, slide 2022 0094 (NBCL). **Paratypes** (2♀ total). **Indonesia, Sumatra:** ♀, Medan Deli, leg. Fulmek (NBCL); ♀, North Sumatra Province, Parapat, 19.VIII.1979, leg. E. Diehl (ZSM).

Description. Male (Fig. 20). Antenna orangish, flagellum covered with creamy speckled scales. Palpi orange. Eyes dark brown, naked. Head and thorax mesially creamy with dark dense speckles, tegulae reddish brown. Abdomen from reddish brown. Epiphysis on the fore leg absent. *Forewing.* Forewing length: 25 mm; wingspan: 51 mm. Triangular, apex acute, outer margin slightly waved. Background color reddish brown. Pattern consists of orangish basal spot, two pale wavy medial lines, orangish eye-like spot in medial field with dark R-Cu vein and faded orangish fragmented external line. Cilia yellowish creamy. *Hindwing.* Trapezoid. Background color reddish brown with faded yellowish creamy medial line. Cilia creamy, gets darker on anal angle. *Genitalia* (Figs 27, 33). Similar to *S. pallida* (see above). **Female** (Figs 19, 21). Bigger, little paler and less contrasty than male. Antenna orangish, flagellum covered with creamy scales. Palpi orange. Eyes dark brown, naked. Head and thorax mesially creamy, tegulae orangish or reddish brown. Abdomen creamy or reddish brown. *Forewing.* Forewing length: 36–45 mm; wingspan: 70–90 mm. Oval-shaped, apex blunt, outer margin slightly wavy. Background color reddish or orangish brown. Pattern consists of weakly pronounced orangish basal spot, two pale wavy medial lines, weakly pronounced medial orangish eye-like spot and faded orangish fragmented external line. Cilia brownish. *Hindwing.* Egg-shaped. Background color reddish or orangish brown with more or less pronounced creamy medial line. Cilia brownish. *Genitalia* is not studied (both known females have broken abdomens, genitalia slides are not found).



Figures 32–37. Eight sternites (top) and tergites (bottom) of male and female genitalia of *Streblote* spp. 32. *S. castanea*, the Philippines, Palawan, genitalia slide 220630 (SMNS). 33. *S. gerry*, holotype, Greater Sunda Islands, Sumatra (NBCL). 34. *S. jacquie*, holotype, Lesser Sunda Islands, Flores (MWM/ZSM). 35–37. *S. pallida*, Greater Sunda Islands, Java. 35. Genitalia slide 2022 0096 (MWM/ZSM). 36. Genitalia slide 2022 0097 (NBCL). 37. Genitalia slide 2022 0098 (NBCL). Scale bar – 1 mm.

Variability. Medial line on hind wing of female may be narrow (Fig. 21) or wider (Fig. 19), abdomen reddish brown (Fig. 19) or creamy (Fig. 21).

Diagnosis. The species is endemic to Sumatra. Male is darker than *S. pallida* from Java and Bali, and *S. jacquie* sp. n. from Flores and Sumba. No clear difference in male genitalia is found between *S. pallida*, *S. jacquie* sp. n., *S. gerry* sp. n., *S. dorsalis*, and *S. castanea*.

Distribution (Fig. 38). Sumatra.

Ecology. Adults were collected in August from the altitudes between 9 (Medan Deli) and 945 m (Parapat) within Sumatran lowland and montane rainforest ecoregions (Dinerstein *et al.*, 2017).

Etymology. The species is named after Gerald “Gerry” Malcolm Durrell, a well-known naturalist and writer who inspires lots of people through decades to devote their lives to studying biology.

Taxonomic note. The species is not barcoded like *S. pallida* and *S. jacquie* **sp. n.**, but darker coloration, isolated distribution on Sumatra within distinct ecoregions, and 2.45% distance between *S. pallida* and *S. jacquie* **sp. n.** let us suggest that the Sumatran population is also a separate species.

***Streblote jacquie* sp. n.**

<http://zoobank.org/urn:lsid:zoobank.org:act:45779F85-2AFD-4AFB-9354-D0D92AD13F20>

(Figs 22–24, 30–31, 34, 38–40)

Type material. **Holotype** ♂, **Indonesia, Flores**, Prov. East Nusa Tenggara, Gunung Ranakah, 3 km S Mano, 18 km E Ruteng, primary forest, 1270 m, 17–21.IV.1996, leg. R. Brechlin, slide ZSM-60 (ZSM). **Paratypes** (6♂, 1♀ total). **Indonesia, Flores:** ♂, Beanio, 400 m, VII.1953 (NBCL); ♂, Sukutukang, 350 m, 29.XII.1953 (NBCL); ♂, Waling, 750 m, 31.VII.1953 (NBCL); ♂, Flores, I.1912 (NBCL); ♂, East Nusa Tenggara Islands, Flores Island, Bajawa, Wolokoro Ecolodge, heavily disturbed monsoon forests and eucalyptus plantings, 08°49’02” S, 120°56’03” E, 1009 m, 28–31.I.2020, leg. V. Spitsyn & E. Spitsyna (RMBH). **Indonesia, Sumba:** ♂, East Nusa Tenggara Islands, E Sumba Island, Luku Melolo, 10°S, 120°10’E, 500 m, V.2006, leg. Jakl (CGM); ♂, Sumba, (NHMV).

Description. Male (Figs 22–23). Antennae orangish, basally speckled creamy and brown. Palpi orangish brown. Eyes dark brown, naked. Head and thorax mesially creamy with brown speckles, tegulae reddish or orangish brown. Abdomen from creamy to brown with more or less pronounced dorsal transversal brown stripes. *Forewing.* Forewing length: 26–30 mm; wingspan: 44–60 mm. Triangular, apex acute, outer margin slightly waved. Background color brown with creamy speckles. Pattern consists of orangish to reddish brown spot, two white to creamy wavy medial lines, orangish to reddish brown eye-like spot in medial field with dark R-Cu vein, dark brown drop-like spot growing from it between M₃ and CuA₁ towards external field and faded fragmented orangish external line. *Hindwing.* Trapezoid. Background color brown with creamy medial line, external field with darker anal spot. Cilia creamy, gets darker on anal angle. *Genitalia* (Figs 30–31, 34). Similar to *S. pallida* (see above). **Female** (Fig. 24). Bigger, darker and less contrasty than male. Antenna brownish, flagellum covered with creamy scales. Palpi orange. Eyes dark brown, naked. Head and thorax mesially creamy, tegulae orangish brown. Abdomen creamy with reddish patches. *Forewing.* Forewing length: 44 mm; wingspan: 94 mm. Oval-shaped, apex blunt, outer margin slightly wavy. Background color orangish brown. Pattern consists of weakly pronounced orangish basal spot, two pale wavy medial lines, weakly pronounced medial orangish eye-like spot and faded orangish fragmented external line. Cilia creamy with brownish tips. *Hindwing.* Egg-shaped. Background color orangish brown with creamy medial line. Cilia creamy, gets darker on anal angle. *Genitalia* is not studied (female has broken abdomen, genitalia slide is not found).

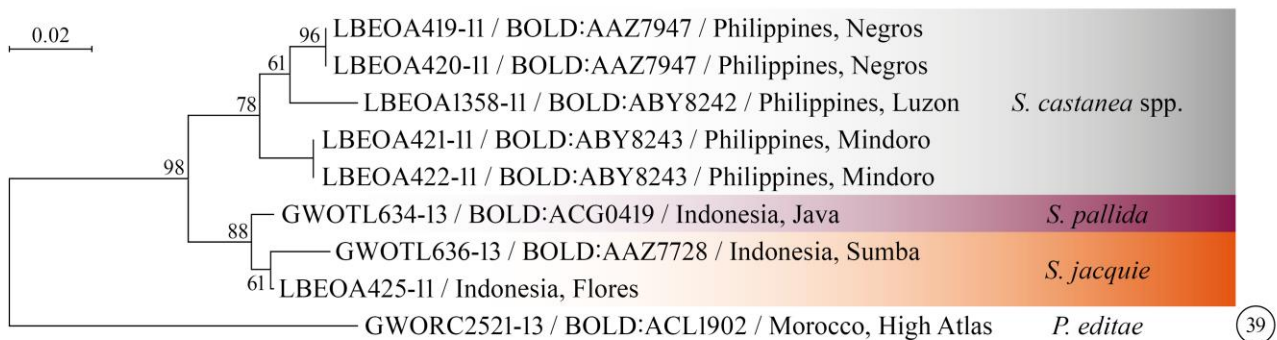
Variability. Dark elements of the wing pattern on male wings may get slightly paler than of the ones that figured (Figs 22–23).

Diagnosis. The species is endemic to Flores and Sumba, male is paler than both: *S. pallida* from Java and Bali and *S. gerry* **sp. n.** from Sumatra. No clear difference in male genitalia is found between *S. pallida*, *S. jacquie* **sp. n.**, *S. gerry* **sp. n.**, *S. dorsalis*, and *S. castanea*. The species has up to 2.45% of pairwise distance from *S. pallida*, and 6.37–6.86% from *S. castanea* (Fig. 40).

Distribution (Fig. 38). Flores and Sumba.

Ecology. Adults were collected in December–January, April–May, and July–August from the altitudes between 5 (Luku Melolo, Sumba) to 1372 m (Ranaka, Flores) within the following ecoregions: Lesser Sundas and Sumba deciduous forests (Dinerstein *et al.*, 2017).

Etymology. The species is named in honor of Jacqueline “Jacquie” Sonia Durrell, the first wife and admirable companion of Gerald Durrell on numerous expeditions, a book writer, and a manager of the Jersey Zoo.



1	2	3	4	5	6	7	8	9	Nº	BOLD ID	bp	Locality
	0.000	2.451	2.451	2.451	4.902	6.373	4.902	15.196	1	LBEOA419-11	630	Negros
		2.451	2.451	2.451	4.902	6.373	4.902	15.196	2	LBEOA420-11	577	Negros
			3.922	3.922	5.392	6.863	5.392	14.706	3	LBEOA1358-11	658	Luzon
				0.000	5.392	6.863	5.392	13.725	4	LBEOA421-11	599	Mindoro
					5.392	6.863	5.392	13.725	5	LBEOA422-11	408	Mindoro
						2.451	0.980	13.725	6	GWOTL634-13	658	Java
							1.471	13.725	7	GWOTL636-13	658	Sumba
								13.725	8	LBEOA425-11	454	Flores
									9	GWORC2521-13	658	Morocco

Figures 38–40. Principal differences between *S. castanea* from the Philippines (gray), *S. dorsalis* from Borneo (blue), *Streblote* sp. from Belitung (yellow), *Streblote* sp. from Sulawesi (green), *S. geraldii* (purple), *S. pallida* (vinous) and *S. jacquie* (orange): 38. Distribution map (for details visit bit.ly/3qq4WRz). 39. Phylogenetic tree (NJ, Kimura-2, 1000 replicates). 40. Pairwise distances (%).

Conclusion

Streblothe castanea was regarded until recently as a species widely distributed in the Philippine islands, namely Luzon, Mindoro, Negros, Panay, Cebu, Samar, Palawan and Mindanao (Fig. 38). Barcoding of five specimens from Luzon, Mindoro, and Negros revealed that the externally similar specimens are genetically as far from each other as different species (Fig. 39). Though the percentage ranges between 2.45 and 3.92 (Fig. 40) more sequences are needed because only one of them has the full length of 658 bp (LBEOA1358-11). Populations from other islands have yet to be sequenced too, best, both males and females. Males have two “colour forms: black-brown and red-brown” and females are even more “variable in colour, size and wing pattern” (Zolotuhin *et al.*, 1997). The most important task is to get the DNA of the species holotype to define its origin in comparison with populations from all the major Philippine islands.

Adults of *S. dorsalis* are very similar to dark specimens of *S. castanea*, the two are divided by a 100 km strait between Borneo and Palawan. Holloway (1987) mentioned in the original description of *S. helpsi* (junior synonym of *S. dorsalis*) that “The [two] males are dark brown as in the Philippines species *castanea* Swinhoe, but larger, with the hindwing distal margin straight to convex rather than slightly concave.” We are aware of one male of *S. dorsalis* from SNHM, it has a wingspan comparable to *S. castanea* and the hindwing distal margin is slightly concave (Fig. 10), accordingly, size, pattern, and wing shape seem to be no reliable characters to determine the few adults known in collections. The relationship between *S. dorsalis* and *S. castanea* can finally only be defined by DNA analysis. The same is the case for the few known specimens from Belitung and Sulawesi.

Streblothe pallida was originally described in one short sentence after a single female. The collection material is poor even after 100 years since its description – we redescribed the species after 10 specimens. The populations from the neighboring islands are described as two new species: *S. geraldii* **sp. n.** from Sumatra and *S. jacquie* **sp. n.** from Flores and Sumba. *Streblothe pallida* and *S. jacquie* **sp. n.** have 2.45% pairwise distance and all three species are slightly different externally.

As a result, the number of the *Streblothe* taxa from the Malay Archipelago is raised from two species and one subspecies to five valid species. *Streblothe pallida* and *S. jacquie* **sp. n.** are described according to the modern integrative approach (Wheeler *et al.*, 2004; Dayrat, 2005; DeSalle *et al.*, 2005; Zamani *et al.*, 2022). About nine more species from the Philippines are expected to be described. The species externally form two lineages: 1) dark-colored males and paler females with weakly developed pale wing patterns are *S. castanea*-like species from the Philippines, Borneo, Belitung, and Sulawesi; 2) pale, contrasty-colored adults are *S. pallida*-like species spread over Sumatra, Java, Bali, Flores, and Sumba. How the species evolved historically and why the two lineages do not occur together are questions yet to be addressed within a complete revision of the island fauna.

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