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Article

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On the taxonomy of the genus *Sarothroceras* Mabille, 1889 (Erebidae: Calpinae)

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Abstract
The taxonomy of the genus *Sarothroceras* Mabille, 1889 currently containing only the type species *S. banaka* (Plötz, 1880) and its four junior synonyms is revised. *Sarothroceras alluaudi* Mabille, 1889, **stat. rev.** is re-established as a valid species based on external and genitalia morphology as well as barcode data, and *S. sordidus* Rothschild, 1896 **syn. rev.** is synonymised with it. Diagnostic characters to separate the two species are provided together with illustrations of adults as well as male and female genitalia.

Key words Dahomey Gap, revised status, revised synonym.

Introduction

The genus *Sarothroceras* Mabille, 1889 was reviewed in detail by Lödl (2010) and is currently recognised as monotypic, containing only *S. banaka* (Plötz, 1880), a highly-recognisable and widely distributed species throughout the forests of equatorial Africa. Lödl (1994) had initially investigated *S. banaka* as part of his research into the Hypeninae due to Plötz's original tentative assignment to a Hypenine genus and later confirmed its placement within the Calpinae based on structures of the tympanal organ (Lödl 2010). Four taxa were synonymised under *S. banaka* by Lödl (1994; 2010), *Phaegorista pallida* Druce, 1883, *Sarothroceras alluaudi* Mabille, 1889, *S. rhomboidea* Weymer, 1892 and *S. sordidus* Rothschild, 1896. The taxon *tessmanni* Gaede, 1914 described as a variety of *S. alluaudi* is clearly infrasubspecific and is thus unavailable (cf. Lödl 2010).

As part of an on-going DNA barcoding project of recently-sampled Lepidoptera material housed in the collections of the African Natural History Research Trust (ANHRT), several specimens from across its range were barcoded revealing two divergent clusters with geographical circumscription. Further investigations into male and female genitalia confirmed the existence of two sibling species with small but consistent differences in phenotype and genital structures. The taxonomy of the genus is hereby updated and diagnoses are provided for these two species.

Materials and methods

The genitalia were dissected applying standard methods of preparation (Lafontaine & Mikkola 1987; Kononenko 2010), then stained with Eosin Y and embedded in Euparal on microscope slides. Adults were photographed using a Nikon D3100/AF-S camera equipped with a Nikkor 18–55 mm lens while the photos of genitalia were taken using the same camera attached to a microscope with an LM-scope adapter. All images were edited in Adobe Photoshop CC. 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). Wing venation terminology follows Holloway (1986). All material examined in this study is housed in ANHRT unless otherwise stated (OUMNH = Oxford University Museum of Natural History, Oxford, UK). Further distribution data has been mined from Lödl (2010), specimens in Royal Museum for Central Africa, Tervuren, Belgium (RMCA) and private collection of Patrick Basquin (Yvetot-Bocage, France), as well as online sources such as the public data available in BOLD (www.boldsystems.org), iNautralist (www.inaturalist.org) and Afromoths (www.afromoths.net).

Abbreviations used: BIN = Barcode Index Number; PWD = pairwise distance.

Revised taxonomy of *Sarothroceras*

Sarothroceras Mabille, 1889

Sarothroceras Mabille, 1889, *Bulletin de la Société entomologique de France*, (6) 9: xcix.

Type species: *Sarothroceras alluaudi* Mabille, 1889, by monotypy.

Sarothroceras banaka (Plötz, 1880)

(Figs 1–4, 9, 10, 13, 14, 17)

? *Dichromia banaka* Plötz, 1880, *Stettiner entomologische Zeitung*, 41 (7–9): 300 (Type locality: [Cameroon] 'Victoria').

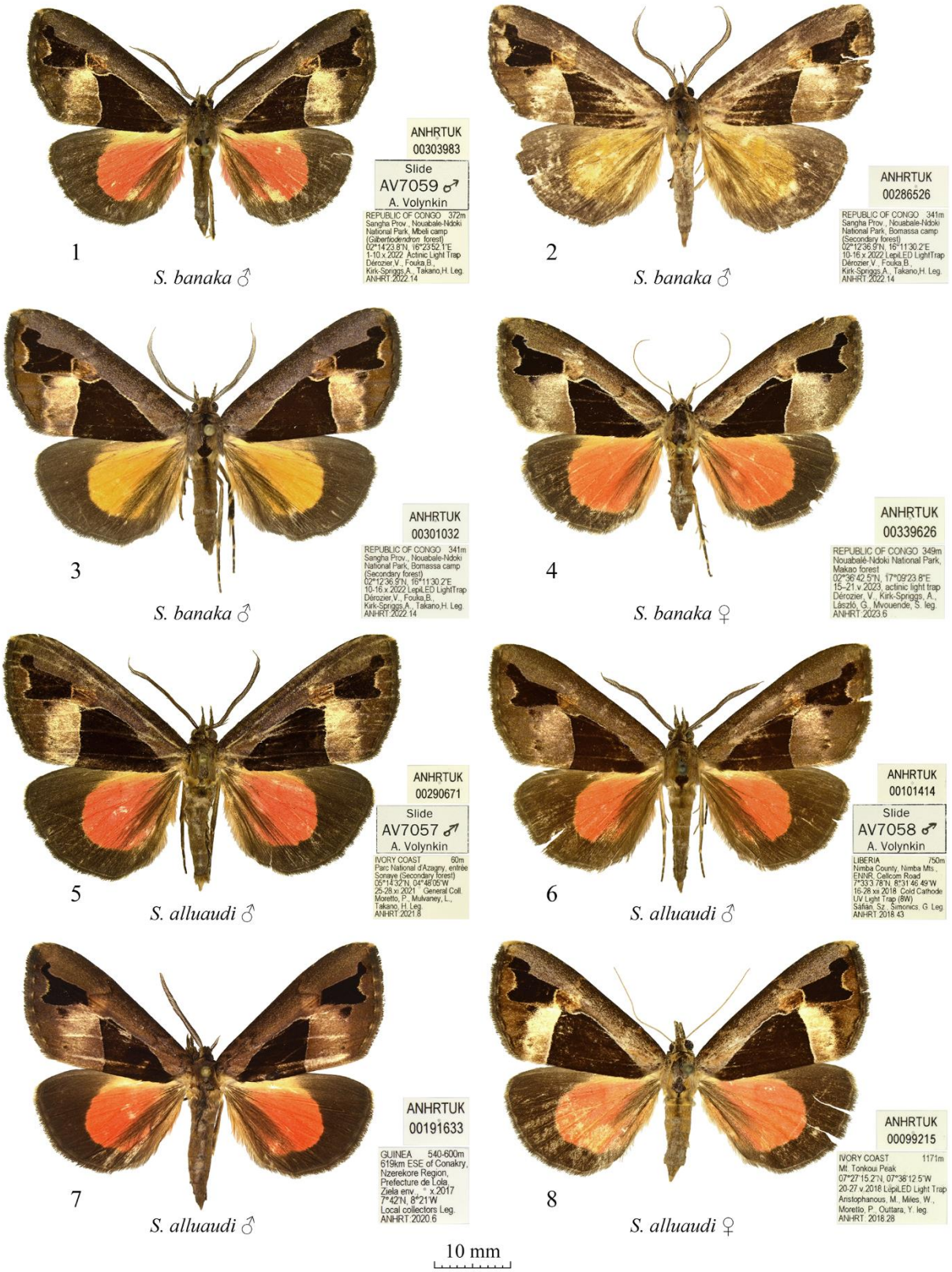
= *Phaegorista pallida* Druce, 1883, *Entomologist's Monthly Magazine*, 20: 156 (Type locality: [Gabon] 'Ogowai, East Central Africa').

= *Sarothroceras rhomboidea* Weymer, 1892, *Stettiner entomologische Zeitung*, 53 (4–6): 104–105 (Type locality: 'Cameroon').

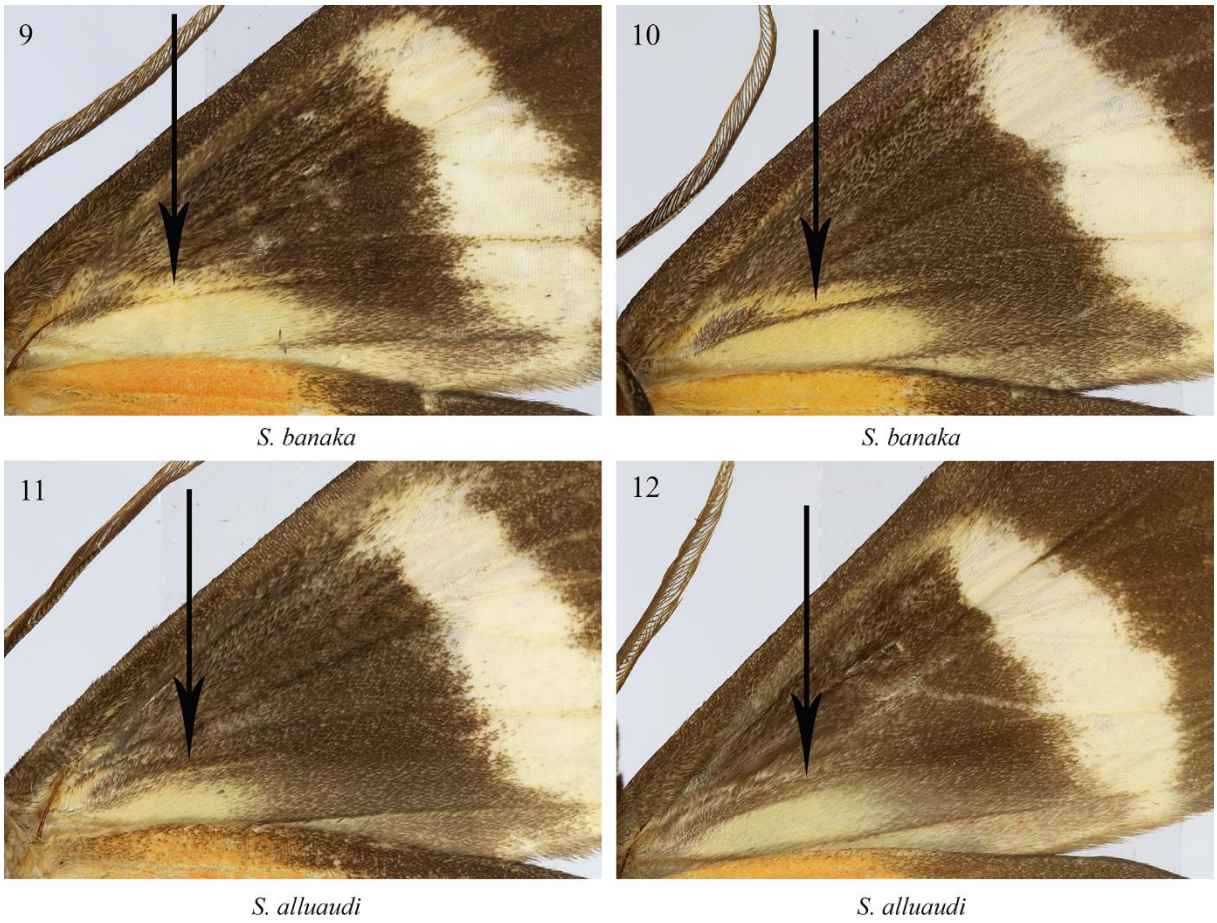
Material examined. REPUBLIC OF CONGO: Nouabalé-Ndoki National Park, Bomassa camp, 341m, 02°12'36.9"N, 16°11'30.2"E, 10–16.x.2022, leg. V. Dérozier, B. Fouka, A. Kirk-Spriggs & H. Takano (3♂♂); same data but Makao forest, 349m, 02°36'24.5"N, 17°09'23.8"E, 24–29.ix.2022 (1♂ 1♀); same data but Mbeli camp, 372m, 02°14'23.8"N, 16°23'52.1"E, 02–10.x.2022 (4♂♂ 1♀); same data but Ndoki formation, 352m, 02°12'47.7"N, 16°23'45.8"E, 29.ix–01.x.2022 (1♂); same data but Mondika camp, 365m, 02°21'50.63"N, 16°16'25.82"E, 27.iv–06.v.2023, leg. V. Dérozier, A. Kirk-Spriggs, G. László & S. Mvouende (1♂ 1♀); **UGANDA**: Bwindi Impenetrable National Park, Cuckooland Lodge, 1700m, 01°00'17"S, 29°43'06"E, 28–29.vi.2022, leg. S. Naumann, E. Ott, A. Schintlmeister & H. Sulak (1♂); Kalinzu Forest, iii.1938, leg. T.H.E. Jackson (1♀, OUMNH).

Diagnosis. Both sexes of *Sarothroceras* have variable upperside markings, some specimens with reduced (or wholly absent) white postmedial markings on the forewing (Figs 6, 7) and the hindwing basal patch varying in colour from red (Figs 1, 4) to yellow (Figs 2, 3). On the forewing underside, *S. banaka* has a suffusion of pale reddish-yellow scales in the space between veins Cu1b and CuP (Figs 9, 10) which is absent in *S. alluaudi* (Figs 11, 12). This feature is most noticeable in fresh specimens but nevertheless visible in older specimens. In the male genitalia, *S. banaka* (Figs 13, 14) differs from *S.*

alluaudi (Figs 15, 16) in the somewhat narrower valva with a more tapered apex, and the somewhat narrower distal diverticulum of the vesica. The female genitalia of the two species display more substantial differences and, unlike *S. alluaudi* (Fig. 18), *S. banaka* (Fig. 17) has a shorter apophysis anterioris, a somewhat longer and broader antrum, and a longer signum bursae.



Figures 1–8. *Sarothroceras* spp.: adults, dorsal view. The specimens are deposited in ANHRT.



Figures 9–12. *Sarothroceras* spp.: forewing underside. Arrows indicate the presence (*S. banaka*: 9, 10) and the lack (*S. alluaudi*: 11, 12) of the suffusion of pale reddish-yellow scales in the space between veins Cu1b and CuP. The specimens are deposited in ANHRT.

DNA divergences. *Sarothroceras banaka* has been assigned the BIN BOLD:ABV9064. Intraspecific PWD were between 0.0–1.1% (n=5) and interspecific PWD between *S. banaka* and *S. alluaudi* were 2.3–3.3%.

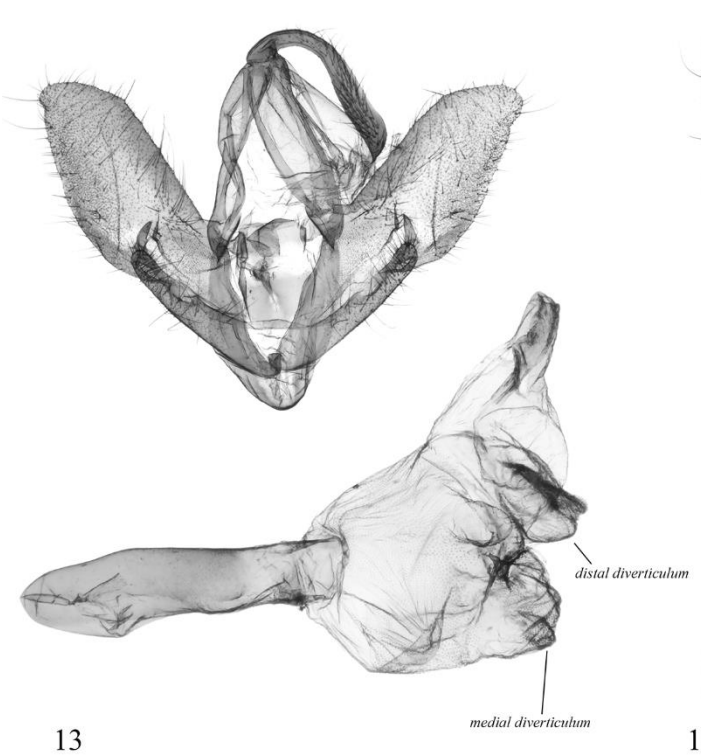
Distribution. Forested regions of central Africa east of the Dahomey Gap (Fig. 19).

***Sarothroceras alluaudi* Mabille, 1889, stat. rev.**
(Figs 5–8, 11, 12, 15, 16, 18)

Sarothroceras alluaudi Mabille, 1889, *Bulletin de la Société entomologique de France*, (6) 9: xcix–c (Type locality: [Ivory Coast] 'Assinie').

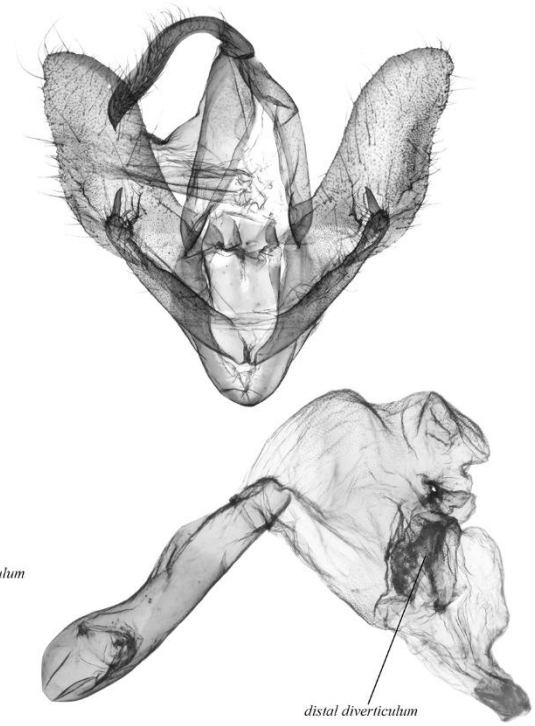
= *Sarothroceras sordidus* Rothschild, 1896, *Novitates Zoologicae*, 3 (1): 55 (Type locality: [Ghana] 'Gold Coast'), **syn. rev.**

Material examined. **GUINEA**: Bossou Forest and Institut de Recherche Environnementale de Bossou, 690m, 07°38'32"N, 08°30'30"W, 24–31.vi.2019, leg. V. Dérozier, J. Suah Dore, S. Koivagui, W. Miles, S. Sáfián & R. Warner (2♂♂); Ziela environs, 540–600m, 07°42'N, 08°21'W, x.2017 (1♂); **IVORY COAST**: Banco Forest, 39–48m, 05°23'03.8"N, 04°03'11.2"W, 21.iv–01.v.2017, leg. A. Aristophanous, M. Aristophanous, M. Geiser & P. Moretto (2♂♂); Mont Tonkoui peak, 1171m, 07°27'15.2"N, 07°38'12.5"W, 01–08.xi.2015, leg. M. Aristophanous, P. Moretto & E. Ruzzier (1♂); same data but 12–18.vii.2015; same data but 19–27.xi.2019, leg. M. Aristophanous, V. Dérozier, P. Moretto & S. Ouattara (2♂♂); same data but 20–27.v.2018, leg. M. Aristophanous, W. Miles, P. Moretto



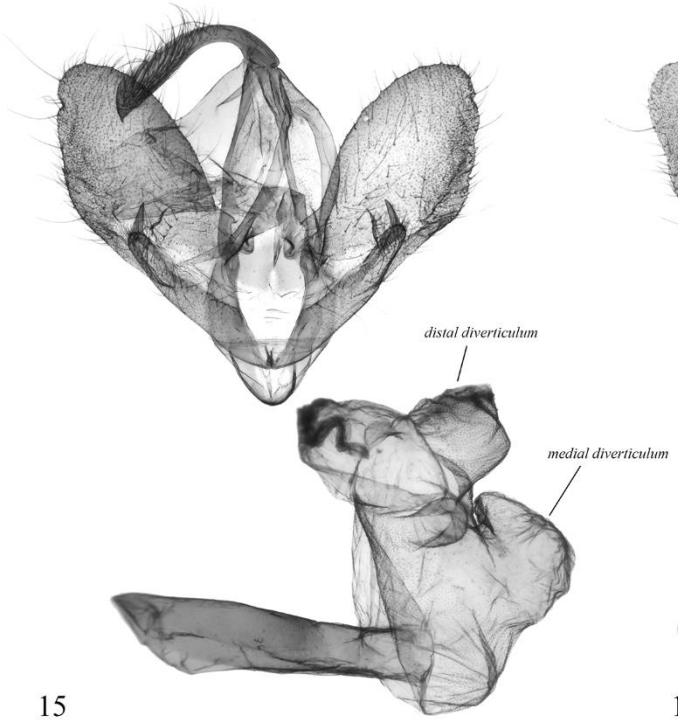
13

S. banaka
Republic of Congo, Nouabale-Ndoki NP, slide AV7059



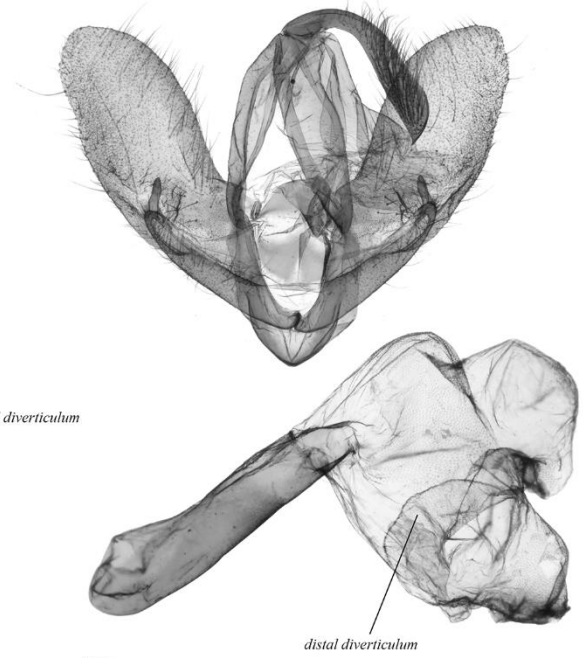
14

S. banaka
Republic of Congo, Nouabale-Ndoki NP, slide AV7060



15

S. alluaudi
Liberia, Nimba County, slide AV7058



16

S. alluaudi
Ivory Coast, Azagny NP, slide AV7057

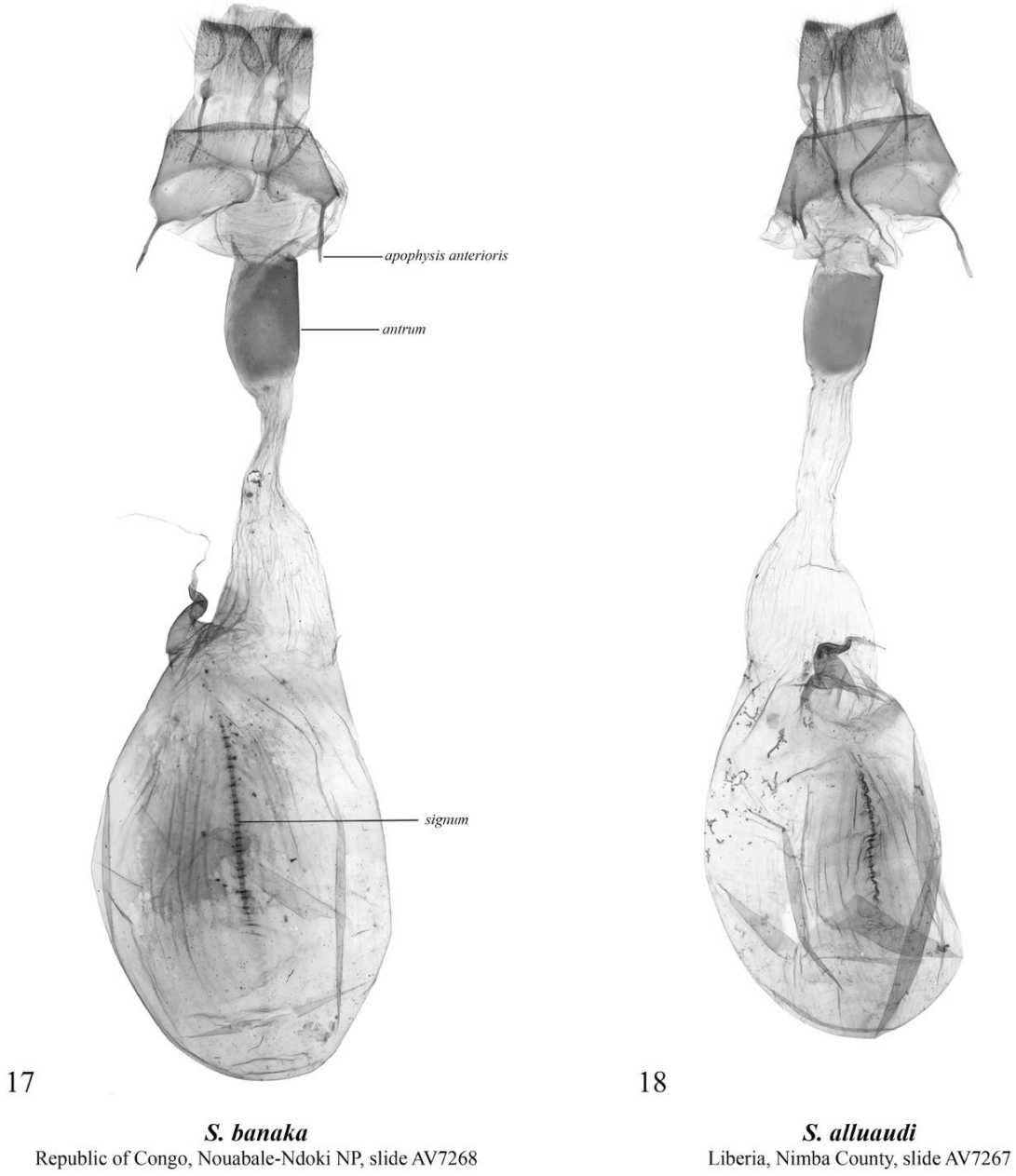
Figures 13–16. *Sarothroceras* spp.: male genitalia, ventral view. The specimens dissected are deposited in ANHRT.

& Y. Ouattara (1♂ 1♀); Parc National d'Azagny, entrée Sonaye, 60m, 05°14'32"N, 04°48'05"W, 25–28.xi.2021, leg. P. Moretto, L. Mulvaney & H. Takano (2♂♂); **LIBERIA**: East Nimba Nature Reserve,

Cellcom Road, 1000–1100m, 07°32’45.88”N, 08°31’21.04”W, 16–28.xii.2018, leg. S. Sáfián & G. Simonics (3♂♂ 1♀); same data but 750m, 07°33’03.78”N, 08°31’46.49”W (2♂♂); same data but Nimba Mts. camp, 1165m, 07°31’45”N, 08°31’37”W, 03–13.xii.2017, leg. M. Aristophanous, S. Sáfián, G. Simonics & L. Smith (1♂); 6.5 km NW of Jacksonville, forest near Solve Problem Village, 103m, 05°26’25”N, 09°07’39.9”W, 23–27.i.2018, leg. M. Geiser, S. Sáfián & G. Simonics (1♂); Mount Gangra, western slope, 700m, 07°33’29.73”N, 08°38’16.4”W, 16–19.iii.2017, leg. S. Sáfián & G. Simonics (1♂ 1♀); Wologizi Mountains, Ridge Camp 2, 883m, 08°07’20.79”N, 09°56’50.75”W, 22–30.xi.2018, leg. S. Sáfián & G. Simonics (4♂♂ 1♀); same data but Elephant Ridge, 1002m, 08°07’01.46”N, 09°55’24.18”W (1♂); **SIERRA LEONE**: York Pass, 23.xii.1913, leg. C.A. Foster (1♂ OUMNH); Kambama village, 110m, 07°33’29”N, 11°21’51”W, leg. H. Takano, R. Goff & W. Miles (1♂).

Diagnosis. See above under *S. banaka*.

DNA divergences. *Sarothroceras alluaudi* has been assigned the BIN BOLD:ABV3614. Intraspecific PWD were between 0.0–0.3% (n=8).



Figures 17–18. *Sarothroceras* spp.: female genitalia, ventral view. The specimens dissected are deposited in ANHRT.

Distribution. Forest and forest-savanna transition zones to the west of the Dahomey Gap (Fig. 19).

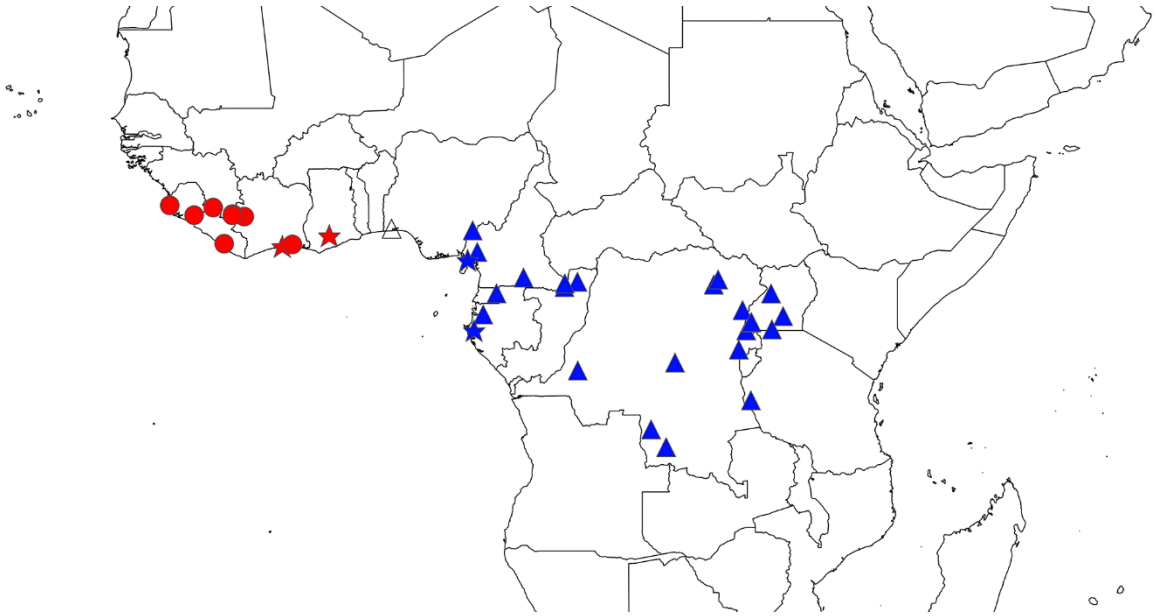


Figure 19. Distribution map of *Sarothroceras alluaudi* (red circles) and *S. banaka* (blue triangles). Stars indicate type localities. The single black open triangle is a specimen from Nigeria cited in Lödl (2010) that has not been examined but is believed to be *S. banaka*.

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