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## Research article

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# Revision of the African shieldbug genus *Afrius* Stål, 1870 (Hemiptera: Heteroptera: Pentatomidae: Asopinae)

Talita ROELL<sup>1,\*</sup>, Valérie A. LEMAÎTRE<sup>2</sup> & Michael D. WEBB<sup>3</sup>

<sup>1</sup> Universidade Federal do Rio Grande do Sul, Instituto de Biociências, Departamento de Zoologia,  
Av. Bento Gonçalves 9500, Porto Alegre, 91501-970, RS, Brazil.

<sup>2,3</sup> Natural History Museum, London, Department of Life Sciences,  
Cromwell Road, London SW7 5BD, UK.

\*Corresponding author: [tali.roell@gmail.com](mailto:tali.roell@gmail.com)

<sup>2</sup>Email: [v.lemaitre@nhm.ac.uk](mailto:v.lemaitre@nhm.ac.uk)

<sup>3</sup>Email: [m.webb@nhm.ac.uk](mailto:m.webb@nhm.ac.uk)

<sup>1</sup>[urn:lsid:zoobank.org:author:42658B3E-4783-48EA-8254-20E8881CEE25](https://zoobank.org/author:42658B3E-4783-48EA-8254-20E8881CEE25)

<sup>2</sup>[urn:lsid:zoobank.org:author:B5DA1AE4-8CF5-4807-BF0A-4A43F47E0C95](https://zoobank.org/author:B5DA1AE4-8CF5-4807-BF0A-4A43F47E0C95)

<sup>3</sup>[urn:lsid:zoobank.org:author:BDD9AB6A-351F-4B32-9B7C-68E283E6F9FA](https://zoobank.org/author:BDD9AB6A-351F-4B32-9B7C-68E283E6F9FA)

**Abstract.** The African shieldbug genus *Afrius* Stål, 1870 is revised. *Cantheconidea migratoria* Distant, 1913 and *A. williamsi* Miller, 1952 are proposed as junior synonyms of *A. (Subafrius) flavirostrum* (Signoret, 1861) whereas *Canthecona marmorata* Dallas, 1851, *Canthecona annulipes* Dallas, 1851 and *A. rubromarginatus* Bergroth, 1903 are proposed as junior synonyms of *A. (Afrius) purpureus* (Westwood, 1837) based on the general morphology and genitalia of the species. The three valid species, viz. *A. (Subafrius) flavirostrum*, *A. (Afrius) kolleri* Schouteden, 1911 and *A. (Afrius) purpureus*, are redescribed with details of male and female genitalia morphology, and a lectotype is designated for *A. (Afrius) kolleri*. A key to identify the species as well as an update of the geographical distribution for each species are provided, including new records for *A. (Afrius) purpureus*.

**Keywords.** Stink bugs, predation, taxonomy, polymorphism, Ethiopia.

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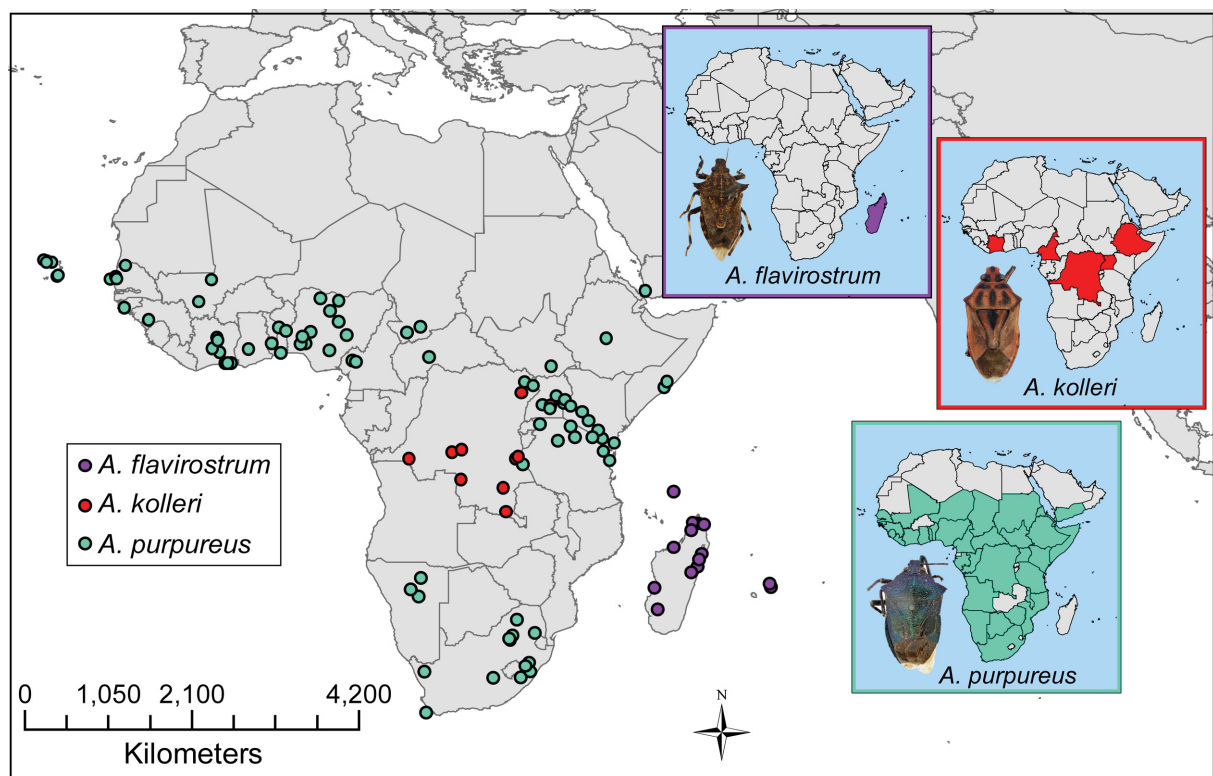
## Introduction

The subfamily Asopinae is the only predatory subfamily of Pentatomidae. It is an important economic group, containing many species used as biological control agents for pest management (Grazia *et al.* 2015). The asopines have a worldwide distribution and are recognized mainly by the robust labium and, in the male genitalia, by the presence of genital plates and a thecal shield (Thomas 1992, 1994). The asopine genus *Afrius* Stål, 1870 is distributed throughout Africa and its species have been considered potential biological control agents for insects injurious to plantations in different regions of Africa (e.g., Miller 1952; Sileshi *et al.* 2004). *Afrius* was created as a subgenus of *Cimex* Linnaeus, 1758

by Stål (1870) with three species, *Cimex (Afrius) figuratus* (Germar, 1838), *C. (Afrius) purpureus* (Westwood, 1837) and *C. (Afrius) flavirostris* (Signoret, 1861), characterized within the inclusive genus by abdominal lateral margins convex and anterior femora armed with spines. In his synopsis of the Old World asopine genera, Thomas (1994) presented a diagnosis of the genus and mentioned the lack of a species identification key and the necessity of revisionary studies on the genus. After examining type and other material of all species, we here provide a revision of the genus, with habitus and genitalia figures and descriptions of each species, new synonymies and new records.

## Material and methods

Type and other material were examined and photographed at The Natural History Museum, London, UK (NHMUK), the Musée royal de l’Afrique centrale, Belgium (RMCA), the Museum für Naturkunde Berlin, Germany (MFNB), the Muséum national d’Histoire naturelle, Paris, France (MNHN), the University Museum of Natural History in Oxford, UK (OUMNH), and the Federal University of Rio Grande do Sul, Porto Alegre, Brazil (UFRG). Extra material was received from the American Museum of Natural History, USA (AMNH), David A. Rider Collection, USA (DARC), the Entomologisches Museum - Insekten Dauerausstellung, Geyer, Germany, and the National Museum of Prague, Czech Republic (NMPC). Photographs were received from the Naturhistorisches Museum Wien, Austria (NHMW), and the Naturhistoriska Riksmuseet, Stockholm, Sweden (NHRM). The examined material is listed in Table 1, and the geographic coordinates in decimal degrees were taken from the Google Earth program (ver. 7: <https://www.google.com/earth/>) and from the ‘GeoNames’ website (<http://www.geonames.org>) when



**Fig. 1.** Geographic distribution of the genus *Afrius* Stål, 1870 throughout Africa. The species points of occurrence and their dispersion in different countries are represented with colours: purple = *A. (Subafrius) flavirostrum* (Signoret, 1861); red = *A. (Afrius) kolleri* Schouteden, 1911; green = *A. (Afrius) purpureus* (Westwood, 1837). The countries highlighted for each species on the right part of the map are based on data from literature. The points marked for each species are from literature and labels information.

**Table 1.** (continued on next 7 pages) Geographic distribution and material examined of the species of *Afrius* Stål, 1870. The data are taken from literature or labels of the examined material. New collection sites located in previously registered countries are referred to as “new locality”, whereas new collection sites located in also newly registered countries are referred to as “new record”.

Locality	Latitude	Longitude	Material examined	Collection	Observations
<i>A. (Subafrius) flavirostrum</i>					
MADAGASCAR			1 ♀, 1 ♂	NHMW	syntypes of <i>Picromerus flavirostrum</i>
MADAGASCAR: Ambanja	-13.66	48.45			Cachan 1952
MADAGASCAR: Amber Forest Reserve	-12.45	49.19			Maldès & Pluot-Sigwalt 2004
MADAGASCAR: Ankarafantsika	-15.72	46.45	3 ♂♂	NHMUK	<b>New locality</b>
MADAGASCAR: Diego-Suarez	-12.32	49.30			Maldès & Pluot-Sigwalt 2004
MADAGASCAR: Fenoarivo Atsinanana	-17.38	49.40			Maldès & Pluot-Sigwalt 2004
MADAGASCAR: Helodranon' Antongila, Antananam	-16.44	49.84			Maldès & Pluot-Sigwalt 2004
MADAGASCAR: Ivondro, between Tamatave and Andevorante	-18.23	49.36			Maldès & Pluot-Sigwalt 2004
MADAGASCAR: Maevatanana	-13.88	48.53			Maldès & Pluot-Sigwalt 2004
MADAGASCAR: Morondava	-20.29	44.29	1 ♂	NHMUK	<b>New locality</b>
MADAGASCAR: Mt. d'Ambre	-12.58	49.15			Cachan 1952
MADAGASCAR: Nosy Mitsio	-12.88	48.60	1 ♂	NHMUK	<b>New locality</b>
MADAGASCAR: Périnet, Analamazoatra	-18.93	48.43			Cachan 1952
MADAGASCAR: Tulear, Zombitse Forest	-22.78	44.67	2 ♀♀	NHMUK	<b>New locality</b>
MADAGASCAR: Vohemar	-13.37	50.00	3 ♀♀, 1 ♂	UFRG	<b>New locality</b>
MAURITIUS: Reduit	-20.23	57.49	8 ♀♀, 3 ♂♂	NHMUK	holotype and paratypes of <i>Afrius williamsi</i>
MAURITIUS: Rose Hill	-20.24	57.47			Mamet 1957
MAURITIUS: Royal Botanical gardens					Mamet 1957
SEYCHELLES ISLANDS: Aldabra	-9.23	46.39			Distant 1913
SEYCHELLES ISLANDS: Aldabra	-9.23	46.39	1 ♀	NHMUK	syntype of <i>Cantheconidea migratoria</i>

Table 1. (continued)

Locality	Latitude	Longitude	Material examined	Collection	Observations
<i>A. (Afrius) kolleri</i>					
DEMOCRATIC REPUBLIC OF THE CONGO			2 ♀♀	NHMUK	
DEMOCRATIC REPUBLIC OF THE CONGO: Elizabethville (Lubumbashi)	-11.68	27.49	1 ♂	NHMUK	<b>New locality</b>
DEMOCRATIC REPUBLIC OF THE CONGO: Galikoko	-4.96	21.25	1 ♂	RMCA	lectotype of <i>Afrius kolleri</i>
DEMOCRATIC REPUBLIC OF THE CONGO: Gorges de la Pelenge					Schouteden 1972
DEMOCRATIC REPUBLIC OF THE CONGO: Ituri	1.87	29.26	1 ♀, 1 ♂	RMCA	<b>New locality</b>
DEMOCRATIC REPUBLIC OF THE CONGO: Kabwekanono	-5.81	28.56			Schouteden 1972
DEMOCRATIC REPUBLIC OF THE CONGO: Keniati river					Schouteden 1972
DEMOCRATIC REPUBLIC OF THE CONGO: Lukombe	-4.37	22.17	1 ♀	RMCA	paratype of <i>Afrius kolleri</i>
DEMOCRATIC REPUBLIC OF THE CONGO: Lulua, Kananga	-7.96	22.43	1 ♀	RMCA	<b>New locality</b>
DEMOCRATIC REPUBLIC OF THE CONGO: Lusinga	-8.92	27.20			Schouteden 1972
DEMOCRATIC REPUBLIC OF THE CONGO: Lusinga	-8.92	27.20	1 ♀	RMCA	
DEMOCRATIC REPUBLIC OF THE CONGO: Mubale river					Schouteden 1972
DEMOCRATIC REPUBLIC OF THE CONGO: Munoi					Schouteden 1972
DEMOCRATIC REPUBLIC OF THE CONGO: Ngowa	-5.74	16.59	1 ♀, 1 ♂	RBINS	
UGANDA: Mpumu	0.35	32.83	1 ♀	NHMUK	<b>New locality</b>
UGANDA: Bukalasa	0.70	32.51			Maldés & Pluot-Sigwalt 2004
<i>A. (Afrius) purpureus</i>					
Africa			1 ♀	OUMNH	syntype of <i>Pentatoma purpurea</i>
BENIN: Agoué					Maldés & Pluot-Sigwalt 2004
BENIN: Bassila	9.00	1.66			Villiers 1952a
BENIN: between Djougou and Kouandé					Maldés & Pluot-Sigwalt 2004
BENIN: Ouidah	6.45	02.06	1 ♀	NHMUK	<b>New locality</b>
BENIN: Tchaourou	8.88	2.59			Linnavuori 1982, 1989
CAMEROON: Baïgom	5.57	10.68			Maldés & Pluot-Sigwalt 2004
CAMEROON: Dschang	5.44	10.05			Maldés & Pluot-Sigwalt 2004

Table 1. (continued)

Locality	Latitude	Longitude	Material examined	Collection	Observations
CANARY ISLANDS			2 ♂♂	NHMMUK	New record
CAPE VERDE: Maio	15.21	-23.16			Arechavaleta <i>et al.</i> 2005
CAPE VERDE: Santo Antão					Arechavaleta <i>et al.</i> 2005
CAPE VERDE: Santo Antão, Porto Novo	17.03	-25.06			Lindberg 1958
CAPE VERDE: São Nicolau					Arechavaleta <i>et al.</i> 2005
CAPE VERDE: São Nicolau, Chã da Preguiza					Lindberg 1958
CAPE VERDE: São Nicolau, Ribeira Brava	16.61	-24.29			Lindberg 1958
CAPE VERDE: São Nicolau, Ribeira do Recanto					Lindberg 1958
CAPE VERDE: São Vicente					Arechavaleta <i>et al.</i> 2005
CAPE VERDE: São Vicente, Monte Verde	16.86	-24.93			Lindberg 1958
CAPE VERDE: Santiago	15.12	-23.62			Lindberg 1958; Arechavaleta <i>et al.</i> 2005
CAPE VERDE: Maio, Monte Penoso	15.22	-23.13			Lindberg 1958
CAPE VERDE: Maio, Porto Ingles	15.14	-23.23			Lindberg 1958
CAPE VERDE: Maio, Porto Ingles	15.14	-23.23	1 ♀	NHMMUK	
CAPE VERDE: Maio, Ribeira da Lagoa					Lindberg 1958
CAPE VERDE: São Vicente, Monte Verde	16.87	-24.93	1 ♂	NHMMUK	
CENTRAL AFRICAN REPUBLIC: Bouar	5.93	15.59	1 ♂	NHMMUK	
CENTRAL AFRICAN REPUBLIC: Mambéré-Kadéï [as Haute-Sangha]	4.50	16.00			Schouteden 1905a
CHAD: Bébédjia	8.67	16.57			Maldès & Pluot-Sigwalt 2004
CHAD: Dar Banda					Maldès & Pluot-Sigwalt 2004
CHAD: "Est des Niellims"					Maldès & Pluot-Sigwalt 2004
CHAD: Goundi	9.36	17.37			Maldès & Pluot-Sigwalt 2004
CHAD: Kaga Batolo					Maldès & Pluot-Sigwalt 2004
DEMOCRATIC REPUBLIC OF THE CONGO: Duma	2.57	30.57			Lehmann 1922
DEMOCRATIC REPUBLIC OF THE CONGO: Faradje	3.74	29.71	1 ♀, 1 ♂	AMNH	New locality

**Table 1.** (continued)

Locality	Latitude	Longitude	Material examined	Collection	Observations
DEMOCRATIC REPUBLIC OF THE CONGO: Kananga	-7.96	22.43			Distant 1901; Schouteden 1909
DEMOCRATIC REPUBLIC OF THE CONGO: Kavala Bland			1 ♀	NHMUK	
DEMOCRATIC REPUBLIC OF THE CONGO: Kivu, Kadidju					Maldès & Pluot-Sigwalt 2004
DEMOCRATIC REPUBLIC OF THE CONGO: Kwango, Indaba	-5.74	17.06			Schouteden 1905a
DEMOCRATIC REPUBLIC OF THE CONGO: Maniema, Kasongo					Schouteden 1913a
DEMOCRATIC REPUBLIC OF THE CONGO: Tanganika, Mpala	-6.73	29.52			Schouteden 1905a, 1909
EQUATORIAL GUINEA: Bioko [Fernando Po]	3.41	8.66			Stål 1870; Schouteden 1905a
ETHIOPIA: Maraquo (Marek'o Bota?)			1 ♀	NHMUK	
ETHIOPIA: Oromiya: Banno	4.85	37.4			Mancini 1953
ETHIOPIA: Oromiya: Koridjalu/Karaju [?]					Hilgert (1908) listed specimens in provenance of Karaju [am Mane, often as Land d Gurra and once as Arussi-Gallaland], collected in the period (21–27 March 1901, mostly on the 23 <sup>rd</sup> ). Schouteden had reported specimens from Koridjalu, collected on 22–23 March 1901. Whether Karaju and Koridjalu are one and the same locality, it is safe to assume that Erlanger collected along the Mena River in March 1901, this places Karaju/Koridjalu in Ethiopia, in the Oromiya region.
ETHIOPIA: Ziway Häyk	08.06	38.83	1 ♀	NHMUK	<b>New locality</b>
GABON: Lambaréné	-0.70	10.24			Schouteden 1905a
GHANA: Ashanti					Reuter 1882
GHANA: Ashanti, Tafo	6.74	-1.61	1 ♂	DARC	
GHANA: Tafo	6.74	-1.61	2 ♂♂	NHMUK	
GUINEA: Damaskanya					Villiers 1956
GUINEA: Kindia	10.4	18.86			Maldès & Pluot-Sigwalt 2004
GUINEA-BISSAU: Bolama	11.57	-15.47			Schouteden 1913b
IVORY COAST: Adiopodoumé	5.43	-4.13			Gillon 1972; Linnavuori 1982, 1989

Table 1. (continued)

Locality	Latitude	Longitude	Material examined	Collection	Observations
IVORY COAST: Bingerville	5.35	-3.88			Schouteden 1964; Gillon 1972
IVORY COAST: Bouaflé	6.99	-5.74			Gillon 1972
IVORY COAST: Bouaké	7.69	-5.03			Villiers 1949; Gillon 1972
IVORY COAST: Foro-Foro	7.94	-5.00			Linnavuori 1982
IVORY COAST: Grand-Bassam	5.22	-3.75			Schouteden 1905a; Maldès & Pluot-Sigwalt 2005
IVORY COAST: Lamto	6.22	-5.03			Schouteden 1963; Maldès & Pluot-Sigwalt 2004
KENYA: Kibwezi	-2.41	37.96	1 ♀	NHMUK	<b>New locality</b>
KENYA: Loitokitok	-2.92	37.51			Schouteden 1910
KENYA: Mombasa	-4.07	39.66			Maldès & Pluot-Sigwalt 2004
KENYA: Mumias. 4500 ft	0.33	34.49	1 ♀	NHMUK	<b>New locality</b>
KENYA: Nairobi	-1.30	36.84	1 ♂	NHMUK	<b>New locality</b>
KENYA: Nakuru			1 ♀, 1 ♂	NHMUK	
KENYA: Nakuru, Ilala, Maromas Dist., 14 m E of Mumias	-0.31	36.11	1 ♀, 1 ♂	NHMUK	<b>New locality</b>
KENYA: Taita Taveta	-3.40	38.44	1 ♂	NHMUK	<b>New locality</b>
KENYA: Upper Kuja Valley, S. Kavironado, 4200 ft			3 ♀♀, 4 ♂♂	NHMUK	
MALI: Dogo, Macina	13.99	-5.73			Villiers 1954; Maldès & Pluot-Sigwalt 2004
MALI: Niono	15.19	-5.95			Maldès & Pluot-Sigwalt 2004
MOZAMBIQUE: Quelimane	-17.87	36.88			Gerstaecker 1892
MOZAMBIQUE: Zambezia, Port. E. Africa, Valley of Kola R., nr E Mt Chipetone			2 ♀♀	NHMUK	
NAMIBIA: Damaraland	-21.00	17.50			Hesse 1925
NAMIBIA: Oshikoto, Tsumeb	-19.23	17.71			Hesse 1925
NAMIBIA: Otjozondjupa, Otjiwarongo	-20.46	16.64			Hesse 1925
NIGERIA: Azara	8.45	9.50	6 ♀♀, 14 ♂♂	NHMUK	<b>New locality</b>
NIGERIA: Enugu	6.73	7.50	1 ♀	NHMUK	<b>New locality</b>
NIGERIA: Geriki					Linnavuori 1982

**Table 1.** (continued)

Locality	Latitude	Longitude	Material examined	Collection	Observations
NIGERIA: Ibadan	7.37	3.90			Linnavuori 1982
NIGERIA: Igbetiti-Igbobo					Linnavuori 1982
NIGERIA: Ile-Ife	7.48	4.56			Linnavuori 1982
NIGERIA: Ilorin	8.49	4.54			Golding 1931
NIGERIA: Kagoro forest	9.58	8.47			Linnavuori 1982
NIGERIA: Kano	12.32	8.61	1 ♀	NHMUK	<b>New locality</b>
NIGERIA: Kaura, Namoda	12.56	6.57			Linnavuori 1982
NIGERIA: Mokwa	9.20	5.33			Linnavuori 1982
NIGERIA: Zaria, Samaru	11.16	7.63	1 ♂	NHMUK	<b>New locality</b>
REPUBLIC OF DJIBOUTI: “Désert des Somalis”					Maldès & Pluot-Sigwalt 2004
REPUBLIC OF THE CONGO [?]: Haut Oubangui					Maldès & Pluot-Sigwalt (2004). From 1894, French Congo (Republic of the Congo) was called Haut-Oubangui. Maldès & Pluot-Sigwalt (2004) referred Haut Oubangui to the Central African Republic; it is likely that it should be referred to the Republic of the Congo. Also, it would match well the fact that Robertson (2009) had included the latter country in his distribution for the species.
SENEGAL: Bambey	14.78	-16.47	4 ♀♀	NHMUK	<b>New locality</b>
SENEGAL: Cambéréne	14.77	-17.42			Maldès & Pluot-Sigwalt 2004
SENEGAL: Dakar (Dakkar, VIII, Senegal 27, Baum)	14.68	-17.45	1 ♀	NMPC	
SENEGAL: Dakar, Gorée	14.66	-17.39			Villiers 1949
SENEGAL: Dakar, Sébikotane	14.74	-17.13			Villiers 1949
SENEGAL: Dakar, Thiaroye	14.75	-17.35			Villiers 1949
SENEGAL: Mboro	15.13	-16.88			Maldès & Pluot-Sigwalt 2004
SENEGAL: Pout	14.77	-17.06			Villiers 1949
SENEGAL: Richard-Toll	16.46	-15.69			Maldès & Pluot-Sigwalt 2004
SIERRA LEONE			1 ♂	NHMUK	syntype of <i>Canthecona marginella</i>



**Table 1.** (continued)

Locality	Latitude	Longitude	Material examined	Collection	Observations
SOMALIA: Afgooye	2.13	45.12			Limnavuori 1976
SOMALIA: Jowhar	2.99	45.56			Mancini 1937
SOUTH AFRICA			1 ♀	NHMUK	
SOUTH AFRICA: Barberton, Mpumalanga	-25.77	31.04	1 ♀	NHMUK	<b>New locality</b>
SOUTH AFRICA: Cape of Good Hope	-34.35	18.47			Maldès & Pluot-Sigwalt 2004
SOUTH AFRICA: Cape of Good Hope	-34.27	18.42	1 ♀	MFNB	syntype of <i>Asopus figuratus</i> ; image examined
SOUTH AFRICA: Delagoa, Limpopo	-23.97	28.75	1 ♂	NHMUK	
SOUTH AFRICA: Eastern Cape, Matatielle	-30.36	28.80	1 ♂	NHMUK	<b>New locality</b>
SOUTH AFRICA, Free State, Toowoomba	-30.25	25.40	1 ♀	DARC	<b>New locality</b>
SOUTH AFRICA, Gauteng, Johannesburg, Bedford Ridge			1 ♀, 1 ♂	AMNH	
SOUTH AFRICA: Interior (Parallel of Delagoa [Bay])			1 ♂	NHMUK	syntype of <i>Canthecona marmorata</i>
SOUTH AFRICA: Interior (Parallel of Delagoa [Bay])			1 ♀	NHMUK	syntype of <i>Canthecona annulipes</i>
SOUTH AFRICA: Johannesburg 6000ft	-26.20	28.04	2 ♀♀	NHMUK	<b>New locality</b>
SOUTH AFRICA: KwaZulu-Natal					syntype of <i>Canthecona miniatescens</i> . See Ruta & Libonatti (2016: 205–206) for an explanation on the boundaries of Caffraria before the second half of the 19th century and their mentioning of detailed data on Wahlberg's excursions in Brinck (1955)
SOUTH AFRICA: KwaZulu-Natal	-29.30	30.00	1 ♂	NHMUK	syntype of <i>Canthecona caerulea</i>
SOUTH AFRICA: KwaZulu-Natal, Weenen	-28.84	30.08	1 ♂	NHMUK	
SOUTH AFRICA: Little Falls	-26.12	27.89	1 ♀	NHMUK	<b>New locality</b>
SOUTH AFRICA: Northern Cape, Hester Malan N.R., E. Springbok	-29.60	17.90	1 ♀	NHMUK	<b>New locality</b>
SOUTH AFRICA, Pietermaritzburg	-29.60	30.38	3 ♀♀, 1 ♂	Geyer Mus.	<b>New locality</b>
SOUTH AFRICA: Pretoria	-25.73	28.24			Distant 1892
SOUTH AFRICA: Pretoria	-25.73	28.24	12 ♀♀, 5 ♂♂	NHMUK	

**Table 1.** (continued)

Locality	Latitude	Longitude	Material examined	Collection	Observations
SOUTH SUDAN: Latuka	4.64	32.55			Schouteden 1905a, 1909
SUDAN: Kita					Maldès & Pluot-Sigwalt 2004
TANZANIA: Arusha, Oldean Rd, 3800 ft	-3.34	35.54	1 ♀	NHMUK	
TANZANIA: Bububu	-5.92	39.22			Jeannel 1914. Bububu is a village 10 km north of the city of Zanzibar
TANZANIA: Kagera	-1.91	31.25	1 ♀	NHMUK	
TANZANIA: Kilimanjaro	-3.07	37.35			Schouteden 1905a, 1910; Maldès & Pluot-Sigwalt 2004
TANZANIA: Musoma, Banagi Hill	-2.30	34.83			Leston 1952
TANZANIA: Old Shinyanga, Boma	-3.56	33.41	2 ♀♀	NHMUK	<b>New locality</b>
TANZANIA: Usambara	-4.75	38.50			Schouteden 1905a
TOGO: Atakpamé	7.53	01.13			Maldès & Pluot-Sigwalt 2004
UGANDA: Between Jinja and Busia or Mbwago's, E. Busoga (Some Forest), 3800–4000 ft			1 ♀	NHMUK	
UGANDA: Eastern Mbale Dist., S of Mt Elgon	01.08	34.18	1 ♀	NHMUK	<b>New locality</b>
UGANDA: Entebe	0.05	32.46	6 ♀♀, 3 ♂♂	NHMUK	<b>New locality</b>
UGANDA: Kadungulu, Eastern Province	1.51	33.20	1 ♀	NHMUK	<b>New locality</b>
UGANDA: Kampala	0.34	32.58	1 ♂	NHMUK	<b>New locality</b>
UGANDA: Kigezi Dist. Afr. Exp., Mabungo Camp. 6000 ft, J. Ford	0.46	31.63	1 ♀	NHMUK	<b>New locality</b>
UGANDA: Mabungo camp	0.46	31.63	2 ♀♀, 1 ♂	NHMUK	
UGANDA: Mbale, Kumi Rd, 3700 ft S. of L. Salisbury	1.96	34.18	2 ♀♀, 3 ♂♂	NHMUK	<b>New locality</b>
UGANDA: «Región Nord du Victoria Nyanza»					Maldès & Pluot-Sigwalt 2004
UGANDA: SE Ankole, 4400–4800 ft			2 ♀♀, 1 ♂	NHMUK	
UGANDA: Semliki Plains, near Sishore of L.A. Albert			1 ♂	NHMUK	
YEMEN: Wādī Risyān	13.56	43.28			Linnavuori 1989
ZIMBABWE: Mashonaland					Distant 1898

**Table 1.** (continued)

Locality	Latitude Longitude	Material examined	Collection	Observations
Niam-Niam (Congo)				Schouteden 1905a. The land of the Niam-Niam [Zande] people was a vast area, now corresponding to parts of the Democratic Republic of the Congo, South Sudan and Central African Republic. Since Schouteden (1905b) listed it under Congo, we may assume that he was referring more specifically to an area in the northeast of the Democratic Republic of the Congo, probably the Uele and Ituri Provinces, from where Schouteden (1972) reported the species.
Oriental Africa				Bergroth 1903; Schouteden 1905a syntype of <i>Afrius rubromarginatus</i> . A handwritten label reads “Probably TANGANYIKA” and it could be so, but we can’t help noticing that the green disc label reads “Afriq Or”, clearly an abbreviation of the French “Afrique orientale”. It could be because the specimen was labelled and/or examined in Belgium (Bergroth published the original description of <i>A. rubromarginatus</i> in the <i>Annales de la Société entomologique de Belgique</i> ), but it could also mean that the specimen was collected in French East Africa, the only mainland country of which was what is now the Republic of Djibouti, from where a record for this species was newly reported by Maldés & Pluot-Sigwalt in 2004. Interestingly, Kirkaldy (1909) catalogued “German East Africa” (including present-day Burundi, Rwanda, and the mainland part of Tanzania) for <i>A. rubromarginatus</i> .
TANGANYIKA or Oriental Africa?		1 ♀	OUMNH	

**Table 2.** Terminology of male genitalia from Singh-Pruthi 1925; Baker 1931; Dupuis 1955, 1970; Konstantinov & Gapon 2005 and Gapon & Konstantinov 2006.

	Singh-Pruthi 1925	Baker 1931	Dupuis 1955, 1970	Konstantinov & Gapon 2005, Gapon & Konstantinov 2006
External genitalia	segment IX	genital segment	pygophore or genital capsule	pygophore
	–	ventral and dorsal borders	–	–
	–	genital plates	processus supérieurs	genital plates or parandria
	segment X	proctiger	anal tube or proctiger	–
	parameres	claspers	parameres	parameres
Internal genitalia	aedeagus	–	phallus	aedeagus
	–	–	phalloteca	theca
	–	–	–	basal theca
	–	–	–	thecal shield
	basal foramen	–	–	–
	basal plates	–	–	–
	vesica	–	vesica	apical outgrowths of median plates of the penis + pons transversus + longitudinal filaments of median plates of the penis
ejaculatory duct	–	ductus seminis	seminal duct + vesica	
gonophore	–	secondary gonopore	secondary gonopore	
conjunctiva	–	conjunctiva	conjunctiva	
ejaculatory reservoir	–	ejaculatory reservoir	ejaculatory reservoir	

the labels or literature information had sufficient data. The map for the distributional records of species of *Afrius* (Fig. 1) was made using the ArcGIS Desktop program (ver. 10.4.1: <http://desktop.arcgis.com>). To understand how the old regions of Africa overlapped with current countries, we consulted the ‘rare maps’ website (<https://www.raremaps.com>).

Measurements in millimeters [mean ± standard deviation (minimum and maximum values found among all specimens measured)] are given for the total length; length and width of the head, pronotum, scutellum and abdomen; and length of the antennal and labial segments. Genitalia were prepared with heated 10% KOH aqueous solution. The terminology of Singh-Pruthi (1925), Baker (1931), Dupuis (1955, 1970), Konstantinov & Gapon (2005) and Gapon & Konstantinov (2006) was adopted for genitalic structures; a correspondence between different terms used for the male genitalia by these authors is given in Table 2. We follow the terminology of Kment & Vilimová (2010) for the external scent efferent system of the metathoracic gland. Drawings were carried out under a stereo microscope coupled with a camera lucida and edited with a vectorial image processor.

## Results

Order Hemiptera Linnaeus, 1758  
Suborder Heteroptera Latreille, 1810  
Family Pentatomidae Leach, 1815  
Subfamily Asopinae Spinola, 1850

### *Afrius* Stål, 1870

*Cimex* (*Afrius*) Stål, 1870: 44. Type species by subsequent designation (Schouteden 1907a: 51): *Asopus figuratus* Germar, 1838 (= *Afrius purpureus* (Westwood, 1837)).

*Afrius* – Lethierry & Severin 1893: 214. — Schouteden 1907a: 50–52; 1909: 64; 1972: 106. — Kirkaldy 1909: 10. — Cachan 1952: 305. — Villiers 1952b: 81. — Mamet 1957: 34. — Gillon 1972: 351–352. — Thomas 1994: 150–152. — Maldès & Pluot-Sigwalt 2004: 20. — Rider 2006: 234. — Robertson 2009: 20–23.

### Diagnosis

Lateral pronotal margins sinuous and crenulated on anterior half; frenal margin of scutellum longer than postfrenal part; abdominal basal tubercle short, not extending beyond metacoxae; profemur with a preapical spine; protibia very slightly expanded; male abdomen with or without ventral setose patches on segments V and VI; posterior angles of seventh abdominal segment obtuse (Fig. 8C, paVII); metapleural evaporatorium thinly surrounding peritreme.

### Redescription

BODY LENGTH. 8.70–13.22 mm (♀♀) and 9.00–11.00 (♂♂).

BODY. Oval or pentagonal, with variable colour patterns.

HEAD. Uniformly punctured, mandibular plates varying from equal to a little shorter or little longer than clypeus, with margins straight to slightly sinuous; ocelli placed close to an imaginary line connecting posterior margin of eyes; antenna with five antennomeres bearing thin setae, denser on fourth and fifth antennomeres; antennal tubercles partially visible from above, acute apically; bucculae rounded; labium robust, extending to posterior margin of metasternum.

THORAX. Pronotum hexagonal, uniformly punctured except on cicatrices; anterior margin concave; lateral margins sinuous, crenulated on anterior half; posterior angles with a prominent small spine; a thin central line without punctures forms a weak longitudinal medial carina that extends from anterior to posterior margin. Scutellum reaching an imaginary line connecting middle of each connexival segment V; a thin central line without punctures also forms a weak longitudinal medial carina, connected with a similar line on pronotum from anterior to posterior margins; frenal margins longer than postfrenal margins. Corium longer than scutellum, uniformly punctured, membrane surpassing apex of abdomen. Pro-, meso- and metasterna covered by small thin setae; prosternum lighter, with a weak median carina; mesosternum black between pro- and mesocoxae, slightly punctured, with central parallel horizontal stripes, and with a median light wide, rectangular and elevated carina, wider anteriorly; metasternum flat or slightly elevated. Metapleural evaporatorium narrowly surrounding peritreme, narrowly extending on posterior meso- and anterior metapleural margins, also extending to anterior angle of mesopleura. Peritreme disc: ostiolar opening laterally directed. Profemur with anteapical spine, protibia slightly expanded, meso- and metatibiae prismatic.

ABDOMEN. Sparsely punctured, punctures less dense on disc, short basal tubercle anteriorly directed. Trichobothria aligned to an imaginary line connecting middle of spiracles. Posterolateral angles of abdominal sternites rounded.

#### Male

ABDOMEN. With or without ventral setose patches on segments V and VI.

GENITALIA. Pygophore bowl-shaped, with setae on entire surface, denser between ventral border and inferior layer of ventral border, and on apex of posterolateral angles (Figs 3, 6, 10 A–F); dorsal border concave, weakly medially elevated (Figs 3, 6, 10 A, D, db); ventral border slightly concave (Figs 3, 6, 10, B, E, vb), medially emarginated in posterior view (Figs 3, 6, 10, C, F, vb), inferior layer slightly excavated (Figs 3, 6, 10, B–C, E–F, il). Posterolateral angles rounded, setose on apex (Figs 3, 6, 10, A–F, pa). Segment X tubular, ventrally directed, dorsally sclerotized, medially carinated, setose, setae denser on apex (Figs 3, 6, 10, A, C–D, F, X). Genital plates between lateral walls of capsule and parameres (Figs 3, 6, 10, A, C–D, F, I, gp). Phallus. Phallosome divided in a globose basal theca and a cup-like thecal shield (Figs 3 J–Q, 6 J–R, 10 J–R, ph, bt, ts). Ejaculatory reservoir contained inside basal theca (Figs 3 J–N, 6 J–O, 10 J–O, er). Basal foramen circular, reinforced by basal plates (Figs 3 L, N, 6 L, O, 10 L, O, bf, bp). Vesica partially inserted in phallosome, golf club-shaped in lateral view, bearing two elongated filaments and a central elevated portion with microsculptures (Figs 3 J–Q, 6 J–R, 10 J–R, v); ductus seminis running between filaments of vesica, ending on a secondary gonopore, dorsally directed (Figs 3J–Q, 6J–R, 10J–R, ds, sg). Conjunctival lobes paired, posteriorly directed, globose, with apices endowed with a set of small sculptured processes (Figs 3J–P, 6J–P, 10J–Q, cl, sp).

#### Female

GENITALIA. Gonocoxites VIII subtriangular, posterior margins sinuous, sutural margins straight, juxtaposed, setae on posterior and sutural margins (Figs 4, 7, 11, A–B, gcVIII). Laterotergites VIII triangular, longer than wide, with spiracles on basal angle (Figs 4, 7, 11, A–B, laVIII). Exposed portion of gonocoxites IX rectangular, wider than long, slightly covering proximal lateral margins of laterotergites IX (Figs 4, 7, 11, A–B, gcIX). Exposed portion of laterotergites IX digitiform, setose on apex, not attaining band uniting laterotergites VIII, separated from each other by gonocoxites IX and segment X (Figs 4, 7, 11, A–B, laIX). Segment X trapezoidal (Figs 4, 7, 11, A–B, X). Inner portion of gonocoxites IX projected in 1+1 straight elongated arms, variable in extension, and with apices rounded or acute (Figs 4, 7, 11, C–D, gcIX). Gonapophyses IX with 1+1 variable secondary thickenings (Figs 4, 7, 11, C–D, gpIX). Ring sclerites absent. Thickening of vaginal intima elongated (Figs 4, 7, 11, C–D, vi). Pars intermedialis small (Figs 4, 7, 11, C–D, pi), narrower than median duct of vesicular area. Capsula seminalis oval, longer and wider than pars intermedialis (Figs 4, 7, 11, C–D, cs).

#### Distribution

Throughout Africa and adjacent islands (Fig. 1).

#### Remarks

*Afrius* was created as a subgenus of *Cimex* Linnaeus, 1758 by Stål (1870), but not within the present understanding of *Cimex*, since *Cimex* currently corresponds to a genus of Cimicidae. At the time of the description, three species of *Afrius* were recognized, viz. *Cimex (Afrius) figuratus* (Germar, 1838), *C. (Afrius) purpureus* (Westwood, 1837) and *C. (Afrius) flavirostris* Stål, 1864, while two others (*Canthecona marmorata* Dallas, 1851 and *C. annulipes* Dallas, 1851) were mentioned as species *incertae sedis*. Lethierry & Severin (1893) included all the above five species in *Afrius*. Schouteden (1907a) divided the genus into two subgenera (*Afrius* s. str. and *Subafrius* Schouteden, 1907a), separating them by the size of the scutellum and by the presence of abdominal silky patches in the male of the subgenus *Afrius*.

*Afrius* can be differentiated from most African genera of Asopinae by the following combined characteristics: lateral pronotal margins crenulated on anterior half, presence of a well-developed spine on profemora, and abdominal basal tubercle short, not extending beyond metacoxae. The genus shares these features only with *Canthecona* Amyot & Serville, 1843, *Glypsus* Dallas, 1851 and *Picromerus* Amyot & Serville, 1843; however, the posterior abdominal segment of *Canthecona* is acuminate, not obtuse as in *Afrius*; the abdominal tubercle is bifid in *Glypsus*, not single as in *Afrius*; and the metapleural evaporatorium is more developed in *Picromerus* in comparison with *Afrius*.

We maintain the division of *Afrius* in two subgenera based on the presence or absence of abdominal glandular patches (Schouteden 1907a; Thomas 1994) and morphological differences of the male genitalia, described below. We do not consider, however, these subgenera as two distinct genera because the presence or absence of abdominal glandular patches can be interspecifically variable in other genera of Asopinae, as in *Macrorhaphis* Dallas, 1851 (Thomas 1994). Besides, the species of *Afrius* present many similarities of general morphology, of female genitalia, and of the pygophore, mainly the genital plates. Perhaps a phylogenetic study may better elucidate the classification of *Afrius* in future.

#### Key to the species of *Afrius* Stål, 1870

1. Scutellum wider than long, humeral pronotal angles laterally well projected to acute angle (Fig. 2B, D, F, H, J). Male abdomen without setose patches on segments V and VI (Fig. 2C, L), parameres with two evident rami (Fig. 3G–H) ..... **A. (*Subafrius*) *flavirostrum*** (Signoret, 1861)
  - Scutellum longer than wide (Figs 5B, D, 8B, D, F, H, J, L, N, P), humeral pronotal angles slightly projected to acute (Figs 5B, 9B), rounded (Fig. 9A, C) or triangular angle (Fig. 9D). Male abdomen with setose patches on segments V and VI (Fig. 8C), parameres without two evident rami, triangular (Figs 6G–H, 10G–H) ..... 2
2. Postfrenal lobe of scutellum enlarged, constriction line (sc) broader than adjacent region (ac) of corium until radial vein (Fig. 8H). Humeral angles slightly emarginated (Fig. 9) ..... **A. (*Afrius*) *purpureus*** (Westwood, 1837)
  - Postfrenal lobe narrow, constriction line (sc) equal or shorter than adjacent region (ac) of corium until radial vein (Fig. 5D). Humeral angles not emarginated (Fig. 5B, D) ..... **A. (*Afrius*) *kolleri*** Schouteden, 1911

#### *Afrius* (*Subafrius*) Schouteden, 1907

*Afrius* (*Subafrius*) Schouteden, 1907a: 51. Type species by original monotypy: *Picromerus flavirostrum* Signoret, 1861.

*Afrius* (*Subafrius*) – Kirkaldy 1909: 10. — Cachan 1952: 306. — Thomas 1994: 152. — Maldès & Pluot-Sigwalt 2004: 20. — Rider 2006: 234.

#### Diagnosis

Males without abdominal glandular patches; parameres divided in two lobes; dorsal disc of vesica covered by fine and inconspicuous microsculptures.

#### *Afrius* (*Subafrius*) *flavirostrum* (Signoret, 1861)

Figs 1–4

*Picromerus flavirostrum* Signoret, 1861: 921.

*Cantheconidea migratoria* Distant, 1913: 144–145. **Syn. nov.**

*Afrius williamsi* Miller, 1952: 183–184. **Syn. nov.**

*Canthecona flavirostris* (incorrect subsequent spelling) – Stål 1864: 68.

*Cimex (Afrius) flavirostris* (incorrect subsequent spelling) – Stål 1870: 44.

*Afrius flavirostris* (incorrect subsequent spelling) – Lethierry & Severin 1893: 214 [with “Stål 1864” as authority]. — Schouteden 1905a: 151–153.

*Afrius (Subafrius) flavirostrum* – Schouteden 1907a: 51. — Kirkaldy 1909: 10. — Cachan 1952: 306. — Thomas 1994: 152. — Maldès & Pluot-Sigwalt 2004: 20. — Gapon & Konstantinov 2006: 809.

*Afrius williamsi* – Williams 1951: 461. — Jolivet & Théodoridès 1953: 5. — Orian 1956: 642. — Mamet 1957: 35. — Cox 1996: 38.

*Subafrius flavirostrum* – Orian 1965: 116.

*Afrius (Subafrius) migratorius* – Thomas 1994: 152.

*Afrius (Subafrius) williamsi* – Thomas 1994: 152.

*Afrius flavirostrum* – Kuklinski & Borgemeister 2002: 59.

### Types examined

MADAGASCAR • *Picromerus flavirostrum* Signoret, 1861; syntype ♂; labels: “Madagasc Coll. Signoret.”, “*flavirostr* det. Signoret.”, “*flavirostrum* d. Schouteden.”; Fig. 2A–C; NHMW • syntype ♀; labels: “Madagascar. Coll. Signoret.”, “*flavirostrum*”, “*flavirostrum* d. Schouteden.”, “*flavirostr*. det. Signoret.”, “*Afrius flavirostrum* Type Sign.”; Fig. 2E–F; NHMW • syntype ♀; labels: “Madag.”, “Stål”, “Type”, “Typus”, “NHRS-GULI 000057896”; Fig. 2D; NHRS-GULI 000057896. These three syntypes were examined by photos.

SEYCHELLES ISLANDS • *Cantheconidea migratoria* Distant, 1913; syntype ♀; labels: blue-margined syntype disc label; red-margined type disc label “Aldabra. APT. 1907”, “Percy Sladen Trust Expedition. 1911-497.”, “*Canthecona migratoria* type Dist.”, “NHMUK 010592166”; Fig. 2G–H; NHMUK010592166.

MAURITIUS • *Afrius williamsi* Miller, 1952; holotype ♂; labels: red-margined holotype disc label, “MAURITIUS. Coll. J.R. Williams i.1949.”, “182”, “Pres by Com Inst Ent BM 1950 – 262”, “*Afrius williamsi* sp.n det. N.C.E. Miller. 1950.”, “COM INST ENT. COLL. NO. 11607”, “Predaceous on *Schematiza cordiae*, Barb”, “NHMUK 010592172”; Fig. 2I–J; NHMUK 010592172 • paratype ♀; labels: yellow-margined paratype disc label, “MAURITIUS Reduit. xii.1948 Coll. J.R. Williams”, “182”, “Pres by Com Inst Ent BM 1950 – 262”, “*Afrius williamsi* sp.n det. N.C.E. Miller. 1950.”, “COM INST. ENT. COLL. NO. 11607”, “Predaceous on *Schematiza cordiae*, Barb”, “NHMUK 010592173”; Fig. 2K–L; NHMUK 010592173 • paratype ♀; labels: yellow-margined paratype disc label, “MAURITIUS Reduit. xii.1948 Coll. J.R. Williams”, “182”, “Pres by Com Inst Ent BM 1950 – 262”, “*Afrius williamsi* sp.n det. N.C.E. Miller. 1950.”, “COM INST. ENT. COLL. NO. 11607”, “Predaceous on *Schematiza cordiae*, Barb”, “NHMUK 010747732”; NHMUK 010747732 • paratype ♀; labels: yellow-margined paratype disc label, “MAURITIUS Reduit. I.1949 Coll. J.R. Williams”, “182”, “Pres by Com Inst Ent BM 1950 – 262”, “*Afrius williamsi* sp.n det. N.C.E. Miller. 1950.”, “COM INST. ENT. COLL. NO. 11607”, “Predaceous on *Schematiza cordiae*, Barb”, “NHMUK 010747733”; NHMUK 010747733 • paratype ♀; labels: yellow-margined paratype disc label, “MAURITIUS Reduit. vi.1949 Coll. J.R. Williams”, “182”, “Pres by Com Inst Ent BM 1950 – 262”, “*Afrius williamsi* sp.n det. N.C.E. Miller. 1950.”, “COM. INST. ENT. COLL. NO. 11607”, “Predaceous on *Schematiza cordiae*, Barb”, “NHMUK 010747734”; NHMUK 010747734 • paratype ♀; labels: yellow-margined paratype disc label, “Dept. of Agric. MAURITIUS”, “Pres by Com. Inst. Ent. B.M.1948-38”, “COM. INST. ENT. COLL. NO. 10958”, “182”, “NHMUK 010747735”; NHMUK 010747735 • paratype ♂; labels: yellow-margined paratype disc label, “MAURITIUS Reduit. i.1949 Coll. J.R. Williams”, “182”, “Pres by Com Inst Ent BM 1950 – 262”, “*Afrius williamsi* sp.n. det. N.C.E. Miller. 1950.”, “COM INST. ENT. COLL. NO. 11607”, “Predaceous on *Schematiza cordiae*, Barb”, “NHMUK 010747736”; NHMUK 010747736 • paratype ♂; labels: yellow-margined paratype disc label, “MAURITIUS Reduit



A. Moutia II.v.1948”, “Pres by Com. Inst. Ent. B.M.1948-38”, “COM. INST. ENT. COLL. NO. 10958”, “Preying on *Schematiza cordiae*”, “182”, “NHMUK 010747737”; NHMUK 010747737 • paratype ♀; labels: yellow-margined paratype disc label, “MAURITIUS Redit. i.1949 Coll. J.R. Williams”, “*Afrius williamsi* sp.n. det. N.C.E. Miller. 1950.”, “Press by Com Inst Ent B M 1950 - 262”, “COM INST. ENT. COLL. NO. 11607”, “182”, “Predaceous on *Schematiza cordiae*, Barb”, “NHMUK 010747738”; NHMUK 010747738 • paratype ♀; labels: yellow-margined paratype disc label, “MAURITIUS Redit. i.1949 Coll. J.R. Williams”, “*Afrius williamsi* sp.n. det. N.C.E. Miller. 1950.”, “Press by Com Inst Ent B M 1950 - 262”; “182”, “Predaceous on *Schematiza cordiae*, Barb”, “NHMUK 010747739”; NHMUK 010747739 • paratype ♀; labels: yellow-margined paratype disc label, “Dept. of Agric. MAURITIUS Redit 19.IV.1948”, “J.R. Williams”, “Pres by Com. Inst. Ent. B.M.1948-38”, “COM. INST. ENT. COLL. NO. 10958”, “182”, “NHMUK 010747740”; NHMUK 010747740.

### Diagnosis

Scutellum wider than long, humeral pronotal angles laterally well projected to an acute angle; male abdomen without setose patches; parameres with two distinct lobes.

### Redescription

**BODY.** Elongated oval, yellowish to brown, usually with a pale posterior margin of the scutellum.

**HEAD.** Subrectangular, wider than long, uniformly punctured; mandibular plates equal or slightly shorter than and twice as wide as clypeus, anteriorly rounded, with margin straight to slightly sinuous; antennomeres yellow to brownish, black coloured on apical halves of third to fifth antennomeres, bearing thin setae, denser on third to fifth antennomeres; proportion of lengths of antennomeres:  $II \geq IV > V > III > I$ ; labium robust, reaching metasternum, last segment darker than preceding; proportion of lengths of labiomeres:  $II > I \geq III > IV$ .

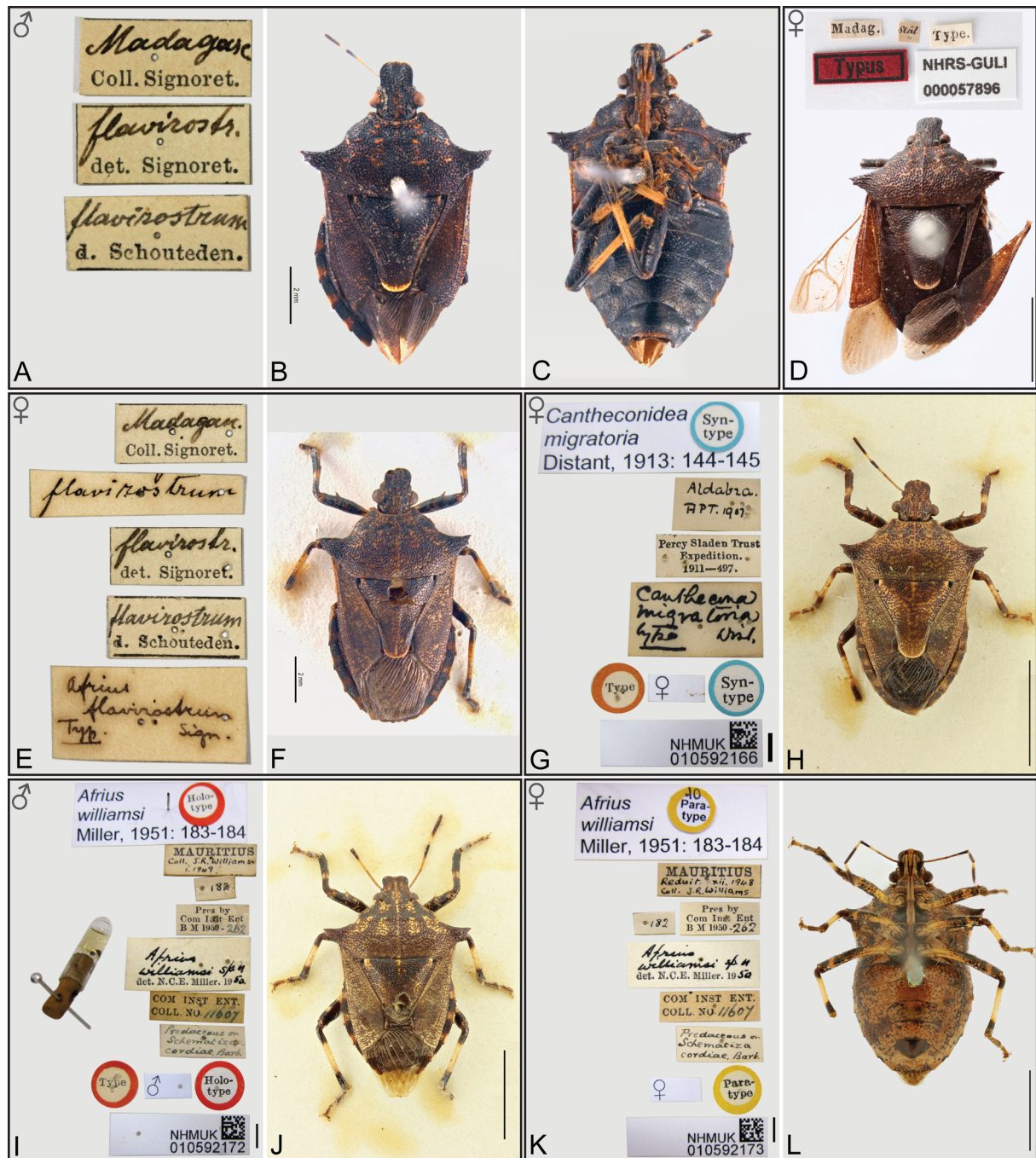
**THORAX.** Pronotum hexagonal, uniformly punctured except on cicatrices, twice or more as wide as long, cicatrices flat. Anterior margin concave. Lateral margins sinuous, slightly crenulated on anterior half, humeral angle laterally projected, emarginated, apices acute. Scutellum wider than long. Corium longer than scutellum, reaching connexival segment VI, uniformly punctured, membrane surpassing apex of abdomen (Fig. 2).

**MALE ABDOMEN.** Without setose patches; parameres biramous (Fig. 3F–H, par).

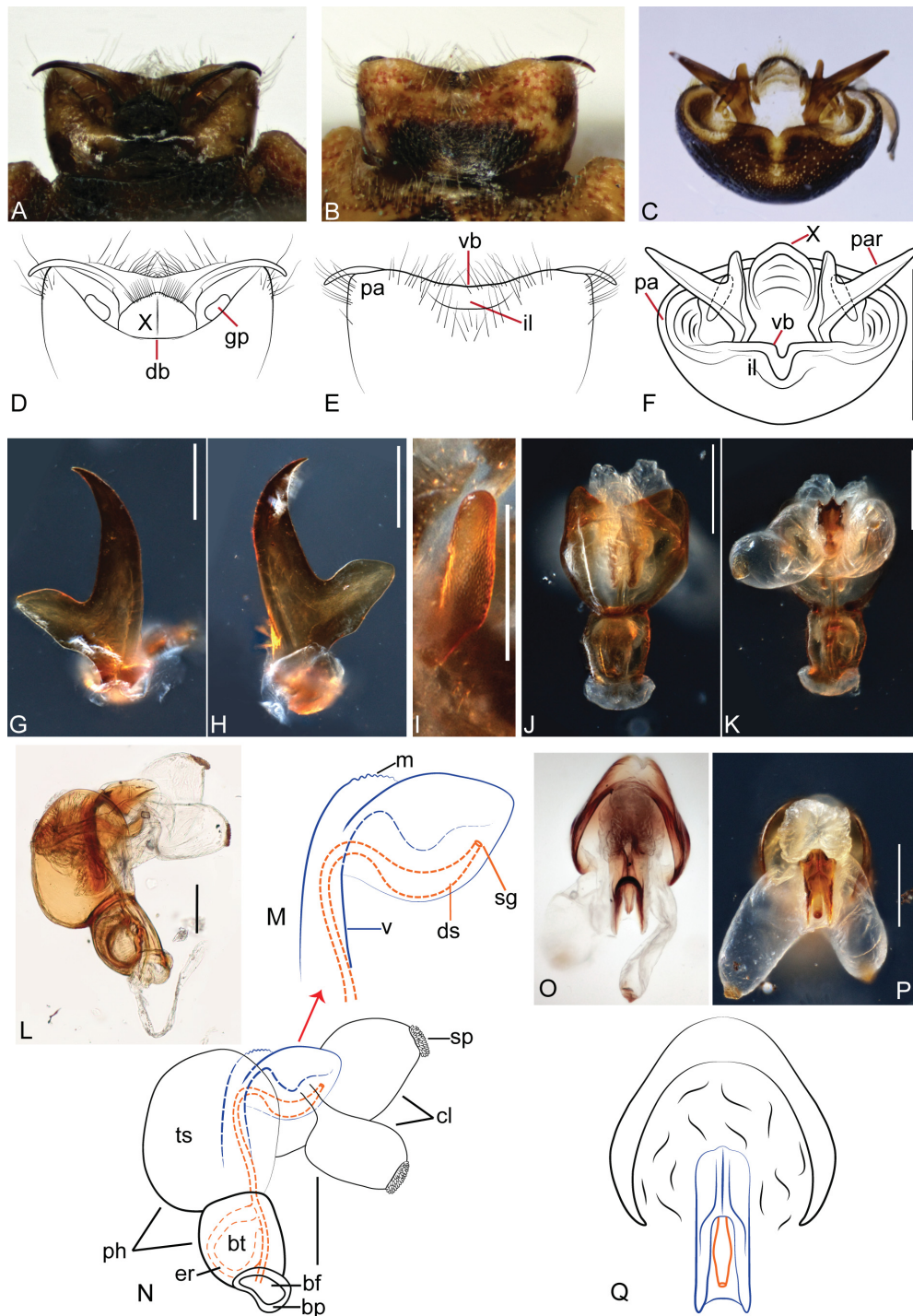
### Male

**MEASUREMENTS** (n = 5). Head length  $1.82 \pm 0.18$  (1.68–2.10); width  $1.93 \pm 0.15$  (1.87–2.13); pronotum length  $2.52 \pm 0.48$  (1.85–3.22); width  $6.44 \pm 0.64$  (5.64–7.25); scutellum length  $3.02 \pm 0.32$  (2.66–3.48); width  $3.22 \pm 0.34$  (2.88–3.75); lengths of antennomeres: I  $0.32 \pm 0.05$  (0.27–0.37), II  $1.26 \pm 0.11$  (1.2–1.39), III  $1.12 \pm 0.23$  (0.97–1.37), IV  $1.32 \pm 0.21$  (1.12–1.54); V  $1.16 \pm 0.13$  (1.05–1.31); lengths of labiomeres: I  $0.94 \pm 0.02$  (0.93–0.97), II  $1.13 \pm 0.09$  (1.05–1.23), III  $0.97 \pm 0.10$  (0.90–1.90), IV  $0.81 \pm 0.02$  (0.78–0.82); length of abdomen  $4.50 \pm 0.70$  (4.00–5.00); width  $4.82 \pm 0.25$  (4.65–5.00); total length  $9.87 \pm 0.71$  (9.19–11.00).

**GENITALIA.** Genital plates elongated and cylindrical (Fig. 3A, C–D, F, I, gp). Parameres long, biramous, head V-shaped divided into one process long, acute and another shorter, rounded, dorsally directed, extended beyond pygophore (Fig. 3A–H, par). Phallus. Thecal shield about twice as long as basal theca, widely opened posteriorly (Fig. 3J–Q, ts). Vesica subrectangular in dorsal view (Fig. 3O–Q, v), golf club-shaped in lateral view, with apex subtriangular and a central, slightly elevated, rounded portion covered by fine and inconspicuous microsculptures (Fig. 3L–N, v, m); ductus seminis enlarged near



**Fig. 2.** *Afrius (Subafrius) flavirostrum* (Signoret, 1861), type specimens. **A–C.** *Picromerus flavirostrum* Signoret, 1861, syntype ♂, labels, dorsal and ventral habitus, respectively (images courtesy of Herbert Zettel and Harald Bruckner, NHMW). **D.** *Picromerus flavirostrum*, syntype ♀, labels and dorsal habitus (image courtesy of Gunvi Lindberg, NHRS). **E–F.** *Picromerus flavirostrum*, syntype ♀, labels and dorsal habitus (images courtesy of Herbert Zettel and Harald Bruckner, NHMW). **G–H.** *Cantheconidea migratoria* Distant, 1913, syntype ♀, labels and dorsal habitus (NHMUK). **I–J.** *Afrius williamsi* Miller, 1951, holotype ♂, labels and dorsal habitus (NHMUK). **K–L.** *Afrius williamsi*, paratype ♀, labels and ventral habitus (NHMUK). Scale bars: 4 mm.

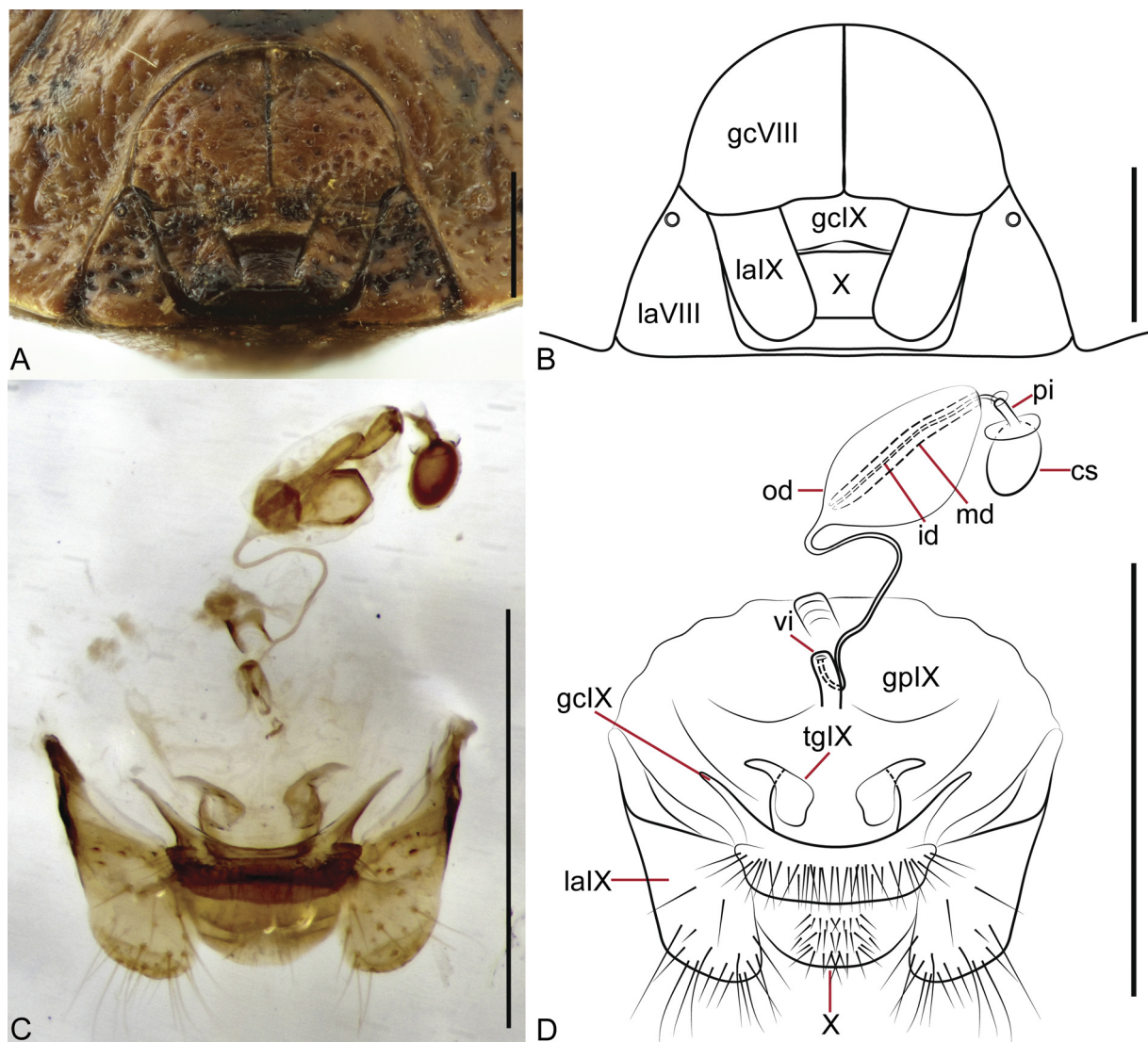


**Fig. 3.** *Afrius (Subafrius) flavirostrum* (Signoret, 1861), male genitalia. **A–F.** Pygophore in dorsal (A, D), ventral (B, E) and posterior (C, F) views. **G–H.** Right paramere in lateral views, internal and external respectively. **I.** Right genital plate, dorso-posterior view. **J–L.** Phallus in anterior, posterior and lateral views, respectively. **M.** Detail of the vesica in lateral view, also represented in N. **N.** Drawing of the phallus. **O–Q.** Phallus in dorsal view. Abbreviations: bf = basal foramen; bp = basal plates; bt = basal theca; cl = conjunctival lobes; db = dorsal border; ds = ductus seminis; er = ejaculatory reservoir; gp = genital plates; il = inferior layer; m = microsculptures; pa = posterolateral angles; par = parameres; ph = phallosome; sg = secondary gonophore; sp = conjunctival process; ts = thecal shield; v = vesica; vb = ventral border; X = segment X. Scale bars: F = 0.5 mm; G–Q = 0.25 mm.

apex (Fig. 3K–Q, ds). Apices of conjunctival lobes globose, endowed with a set of sculptured processes, forming a subrectangular projection in lateral view (Fig. 3K–P, cl, sp).

### Female

MEASUREMENTS (n = 5). Head length  $1.87 \pm 0.10$  (1.80–1.95); width  $1.78 \pm 0.18$  (1.65–1.91); pronotum length  $2.62 \pm 0.17$  (2.5–2.74); width  $3.48 \pm 0.07$  (3.43–3.53); scutellum length  $3.01 \pm 0.07$  (2.96–3.07); width  $3.24 \pm 0.18$  (3.11–3.37); length of antennomeres: I  $0.30 \pm 0.0$  (0.30–0.30), II  $1.29 \pm 0.03$  (1.27–1.31), III  $1.08 \pm 0.0$  (1.08–1.08), IV  $1.28 \pm 0.05$  (1.24–1.31); V  $1.16 \pm 0.06$  (1.12–1.20); length of labiomeres: I  $0.97 \pm 0.06$  (0.93–1.01), II  $1.14 \pm 0.03$  (1.12–1.16), III  $0.94 \pm 0.0$  (0.94–0.94), IV  $0.86 \pm$



**Fig. 4.** *Afrius (Subafrius) flavirostrum* (Signoret, 1861), female genitalia. **A–B.** Genital plates, ventroposterior view. **C–D.** Inner genitalia, ventral view. Abbreviations: cs = capsula seminalis; gcVIII = gonocoxites VIII; gcIX = gonocoxites IX; gpIX = gonapophyses IX; id = inner duct; laVIII = laterotergites VIII; laIX = laterotergites IX; md = median duct of vesicular area; od = outer duct of vesicular area; pi = pars intermedialis; tgIX = secondary thickening of gonapophyses IX; vi = thickening of vaginal intima; X = segment X. Scale bars: A–B = 1 mm; C–D = 0.5 mm.

0.06 (0.82–0.90); length of abdomen  $5.12 \pm 0.05$  (5.08–5.16); width  $5.24 \pm 0.0$  (5.24–5.24); total length  $9.51 \pm 1.14$  (8.70–10.32).

GENITALIA. Gonocoxites VIII slightly longer than wide, mesial portions of posterior margins slightly constricted (Fig. 4A–B, gcVIII). Median and inner ducts of vesicular area with uniform diameter (Fig. 4C–D, md, id).

### Distribution

Madagascar (Signoret 1861), Seychelles Islands (Distant 1913), Mauritius (Miller 1952) (Table 1, Fig. 1).

### Remarks

Although this species seems similar to *A. (Afrius) purpureus* (Westwood, 1837) in general aspect, this is the most distinct species of the genus: the scutellum is wider than long, the males do not have abdominal glandular patches, the parameres are divided into two arms, and the vesica is shorter and less microsculptured in comparison to that of *A. (Afrius) purpureus* and *A. (Afrius) kolleri* Schouteden, 1911. Because of the aforementioned, we have kept the subgeneric classification, grouping *A. kolleri* and *A. purpureus* in the subgenus *Afrius*, and *A. flavirostrum* in the subgenus *Subafrius*.

When describing *A. williamsi*, Miller (1952) compared his new species with *A. marmoratus* (Dallas, 1851), but did not mention *A. (Subafrius) flavirostrum*.

The two new synonymies proposed herein were previously pointed out by Orian in his unpublished thesis (Orian 1965).

### *Afrius (Afrius)* Stål, 1870

*Cimex (Afrius)* Stål, 1870: 44.

*Afrius (Afrius)* – Schouteden 1907a: 51–52. — Kirkaldy 1909: 10. — Thomas 1994: 151–152. — Maldès & Pluot-Sigwalt 2004: 20.

### Diagnosis

Males with abdominal glandular patches; parameres not divided in two lobes; dorsal disc of vesica covered by dense and demarcated microsculptures.

### *Afrius (Afrius) kolleri* Schouteden, 1911

Figs 1, 5–7

*Afrius kolleri* Schouteden, 1911: 180; lectotype herein designated.

*Afrius kolleri* – Schouteden 1963: 399; 1972: 106. — Gillon 1972: 352; 1974: 219. — Thomas 1994: 151. — Maldès & Pluot-Sigwalt 2004: 20. — Robertson 2009: 22–23.

### Types examined

DEMOCRATIC REPUBLIC OF THE CONGO • *Afrius kolleri* Schouteden, 1911; lectotype ♂ (here designated); labels: “Holotypus”, “MUSÉE DU CONGO Galli-Koko Kasai R. CARLIER”, “*Afrius* Stål *kolleri* Schout.”, “*Afrius kolleri* n. sp.”; Fig. 5A–B; RMCA • Paralectotype ♀; labels: “Paratypus”, “MUSÉE DU CONGO LUKOMBE. 6.X.08 A. Koller”; Fig. 5C–D; RMCA.

## Diagnosis

Scutellum longer than wide, postfrenal lobe narrow; humeral pronotal angles not emarginated; male abdomen with setose patches on segments V and VI, parameres triangular, without two distinct lobes.

## Redescription

**BODY.** Pentagonal elongated, reddish to brown, usually with black stripes on head, pronotum, scutellum, and corium.

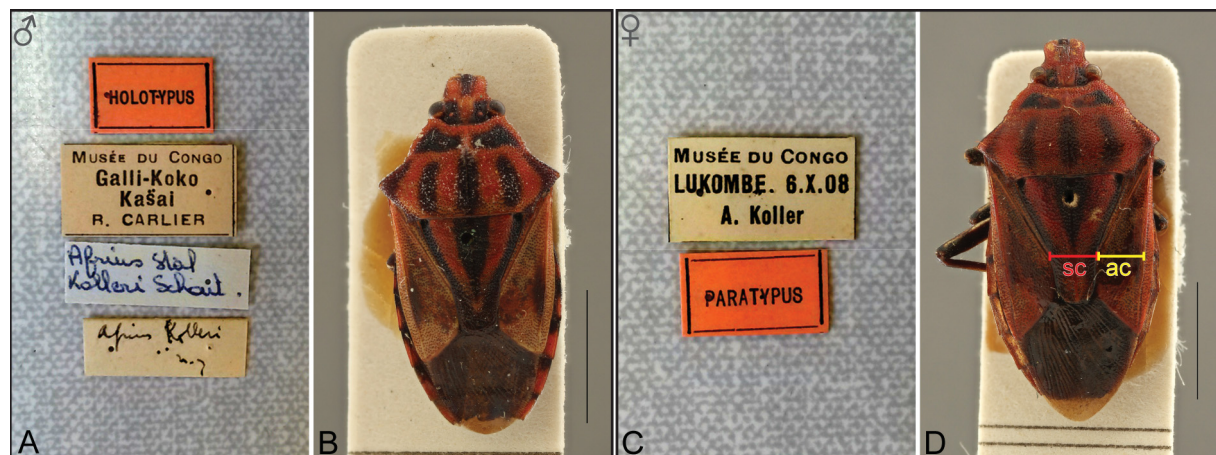
**HEAD.** Quadrate, as long as wide or slightly wider than long, uniformly punctured; mandibular plates equal or slightly longer than clypeus, and slightly wider than clypeus, with margins straight to slightly sinuous; clypeus black; ocelli surrounded by subquadrate black spots; antennomeres usually black, proportion of lengths of antennomeres:  $V > IV > III = II > I$ ; labium robust, reaching metasternum; proportion of lengths of labiomeres:  $II > I > III > IV$ .

**THORAX.** Pronotum hexagonal, uniformly punctured, wider than long, with 1+1 black transversal stripes on cicatrices, 1+1 black vertical spots on humeral angles and 3 longitudinal stripes on disc; cicatrices flat, black, sometimes with a central red spot, demarcated by punctures; anterior margin concave; lateral margins sinuous, crenulated on anterior half; humeri triangular, not emarginated. Scutellum longer than wide, uniformly punctured, reaching an imaginary line connecting middle of connexival segments V, partially or entirely emarginated in black and with one triangular black central spot along frenal lobe; postfrenal lobe narrow, narrower than corium at same region. Corium longer than scutellum, reaching connexival segment VI. Protibiae slightly expanded (Fig. 5).

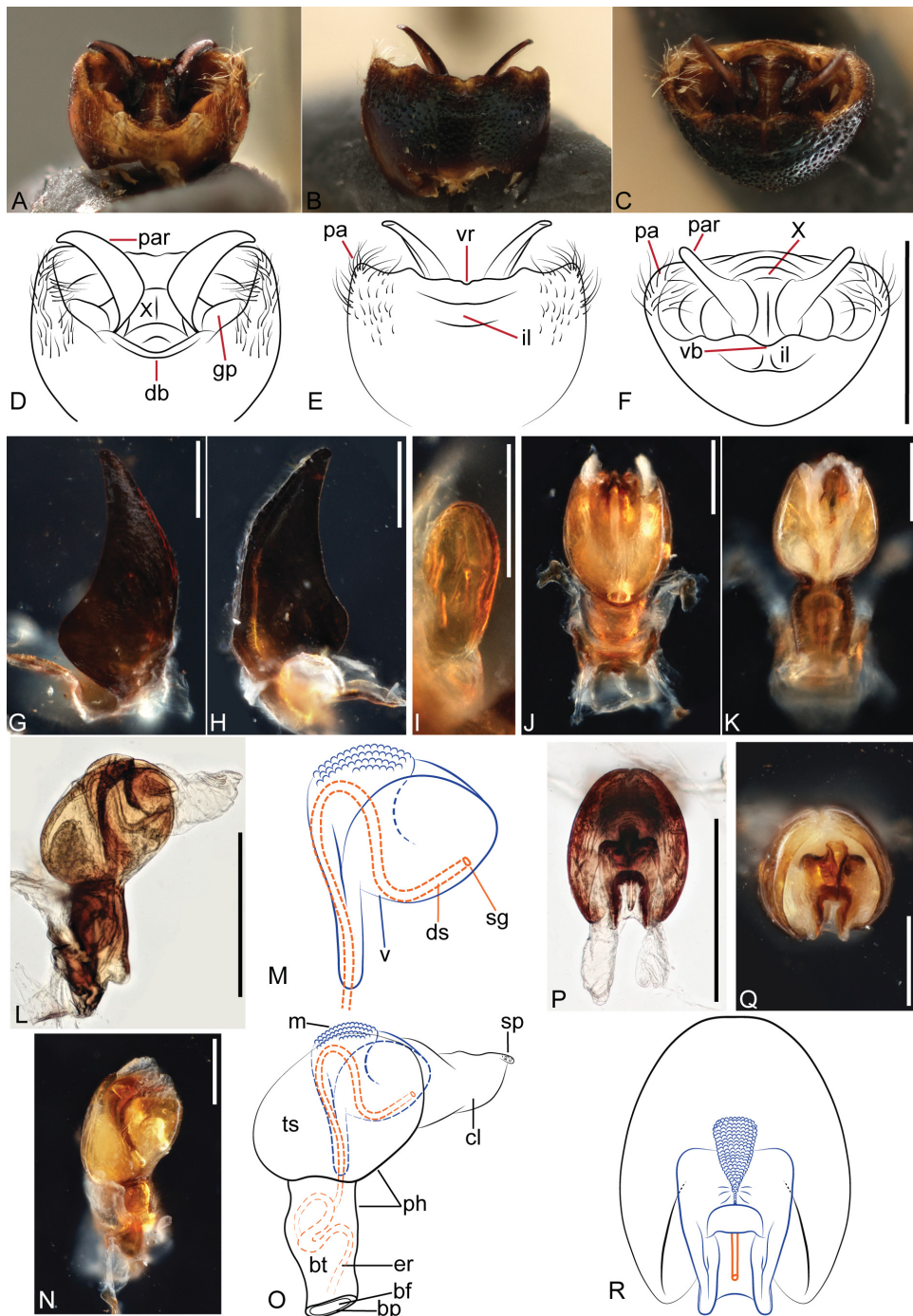
**MALE ABDOMEN.** With setose patches on segments V and VI; parameres uniramous, triangular.

### Male

**MEASUREMENTS** ( $n = 3$ ). Head length  $1.95 \pm 0.20$  (1.72–2.07); width  $2.07 \pm 0.06$  (2.02–2.15); pronotum length  $2.76 \pm 0.23$  (2.52–2.98); width  $4.86 \pm 0.40$  (4.53–5.32); scutellum length  $3.23 \pm 0.13$  (3.08–3.33); width  $2.90 \pm 0.09$  (2.80–2.96); length of antennomeres: I  $0.31 \pm 0.05$  (0.27–0.37), II  $1.05 \pm 0.07$  (0.97–1.12), III  $1.08 \pm 0.04$  (1.05–1.12), IV  $1.34 \pm 0.06$  (1.30–1.38); V  $1.50 \pm 0.00$  (1.50–1.50); length of labiomeres: I  $0.86 \pm 0.03$  (0.84–0.90), II  $1.16 \pm 0.03$  (1.12–1.18), III  $0.92 \pm 0.02$  (0.90–0.93), IV



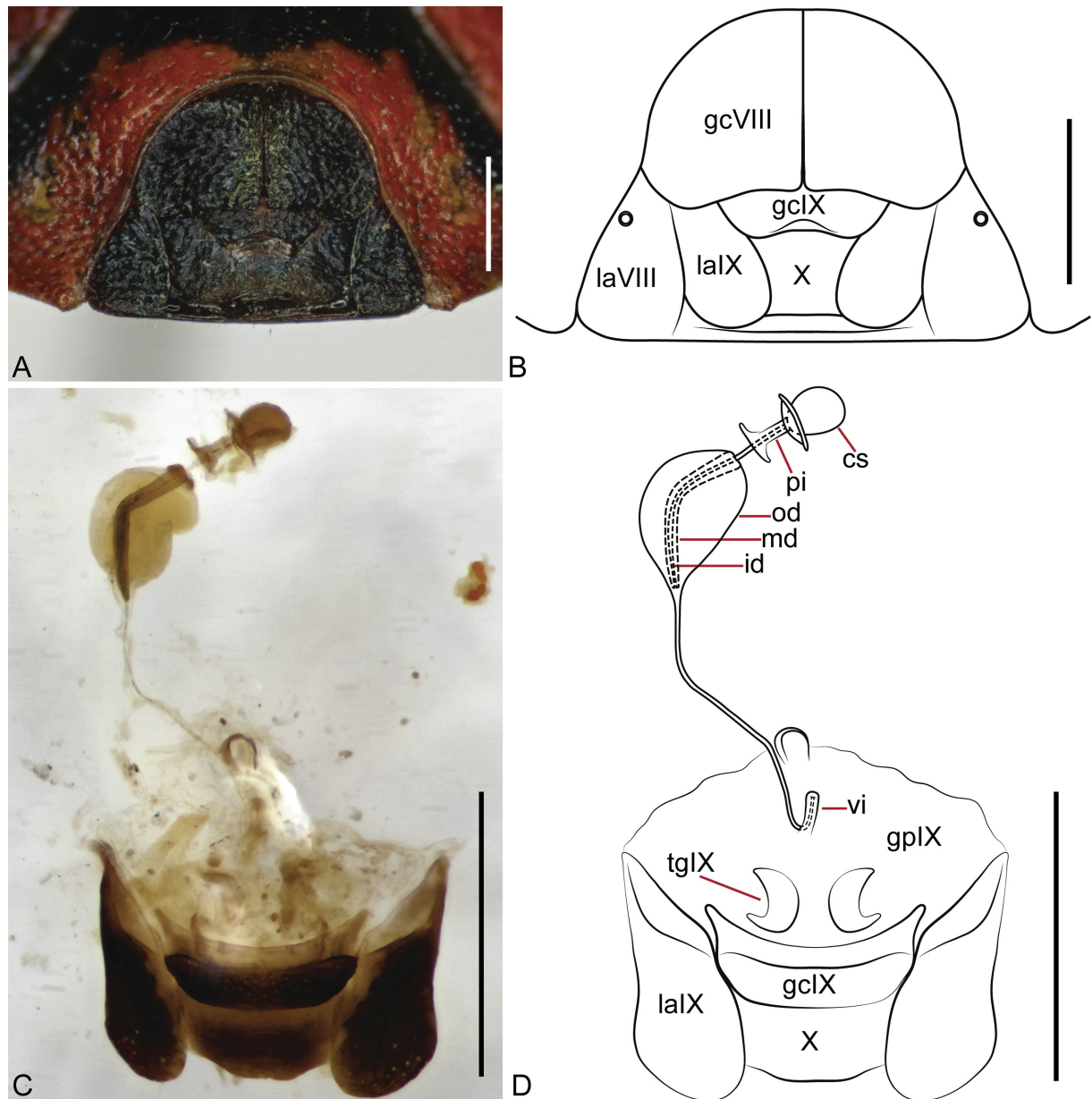
**Fig. 5.** *Afrius (Afrius) kollerii* Schouteden, 1911, types. **A–B.** Lectotype ♂, labels and dorsal habitus (RMCA). **C–D.** Paralectotype ♀, labels and dorsal habitus (RMCA). Abbreviations: ac = corium adjacent to the scutellum constriction; sc = scutellum constriction. Scale bars: 4 mm.



**Fig. 6.** *Afrius (Afrius) kolleri* Schouteden, 1911, male genitalia. **A–F.** Pygophore in dorsal (A, D), ventral (B, E) and posterior (C, F) views. **G–H.** Right paramere in lateral, internal and external views, respectively. **I.** Right genital plate, dorso-posterior view. **J–L.** Phallus in anterior, posterior and lateral views, respectively. **M.** Detail of the vesica in lateral view, also represented in O. **N.** Phallus in dorso-lateral view. **O.** Drawing of the phallus. **P–R.** Phallus in dorsal view. Abbreviations: bf = basal foramen; bp = basal plates; bt = basal theca; cl = conjunctival lobes; db = dorsal border; ds = ductus seminis; er = ejaculatory reservoir; gp = genital plates; il = inferior layer; m = microsculptures; pa = posterolateral angles; par = parameres; ph = phallosheca; sg = secondary gonophore; sp = conjunctival process; ts = thecal shield; v = vesica; vb = ventral border; X = segment X. Scale bars: D–F, L, P = 0.5 mm; G–K, N, Q = 0.25 mm.

0.92 ± 0.02 (0.90–0.93); length of abdomen 5.12 ± 0.17 (5.00–5.24); width 4.56 ± 0.15 (4.45–4.67); total length 10.11 ± 1.00 (9.00–10.97).

GENITALIA. Genital plates cylindrical (Fig. 6A, D, I, gp). Parameres long, uniramous, head triangularly elongated, dorsally directed, extended beyond pygophore (Fig. 6A–H, par). Phallus. Thecal shield and basal theca subequal in length (Fig. 6L, N–O, ts, bt). Vesica shield-shaped in dorsal view (Fig. 6P–R), golf club-shaped in lateral view (Fig. 6L–O, v), with apex rounded and a central elevated microsculptured



**Fig. 7.** *Afrius (Afrius) kolleri* Schouteden, 1911, female genitalia. **A–B.** Genital plates, ventroposterior view. **C–D.** Inner genitalia, ventral view. Abbreviations: cs = capsula seminalis; gcVIII = gonocoxites VIII; gcIX = gonocoxites IX; gpIX = gonapophyses IX; laVIII = laterotergites VIII; id = inner duct; laIX = laterotergites IX; md = median duct of vesicular area; od = outer duct of vesicular area; pi = pars intermedialis; tgIX = secondary thickening of gonapophyses IX; vi = thickening of vaginal intima; X = segment X. Scale bars: A–B = 1 mm; C–D = 0.5 mm.



portion (Fig. 6L–O, m), this central portion rounded in lateral view, subtriangular in dorsal view; ductus seminis with uniform diameter (Fig. 6L–R, ds). Apices of conjunctival lobes with inconspicuous sculptured process (Fig. 6L, O–P, sp).

### Female

MEASUREMENTS (n = 5). Head length  $2.20 \pm 0.09$  (2.06–2.30); width  $2.20 \pm 0.12$  (2.05–2.35); pronotum length  $3.33 \pm 0.24$  (3.06–3.63); width  $5.81 \pm 0.31$  (5.56–6.03); scutellum length  $3.94 \pm 0.27$  (3.71–4.30); width  $3.34 \pm 0.26$  (3.07–3.75); length of antennomeres: I  $0.35 \pm 0.01$  (0.33–0.37), II  $1.18 \pm 0.07$  (1.12–1.25), III  $1.18 \pm 0.08$  (1.12–1.27), IV  $1.47 \pm 0.13$  (1.31–1.62); V  $1.42 \pm 0.0$  (1.42–1.42); length of labiomeres: I  $1.04 \pm 0.13$  (0.90–1.23), II  $1.27 \pm 0.07$  (1.20–1.35), III  $1.00 \pm 0.08$  (0.93–1.12), IV  $0.98 \pm 0.10$  (0.83–1.08); length of abdomen  $6.40 \pm 0.45$  (6.03–7.09); width  $5.59 \pm 0.34$  (5.40–6.20); total length  $11.98 \pm 0.86$  (11.12–13.22).

GENITALIA. Gonocoxites VIII slightly longer than wide, posterior margins sinuous (Fig. 7 A–B, gcVIII). Median and inner ducts of vesicular area slightly widening to apex (Fig. 7 C–D, md, id).

### Distribution

Democratic Republic of the Congo (Schouteden 1911), Ivory Coast (Gillon 1972), Ethiopia, Uganda (Thomas 1994), Cameroon (Maldès & Pluot-Sigwalt 2004) (Table 1, Fig. 1).

### Remarks

This species is apparently most similar to *A. (Afrius) purpureus* because they both present glandular patches on the abdominal venter of males, parameres that are not divided in two rami and vesica microsculptures.

The description of *Afrius kolleri* was based on an unspecified number of specimens of both sexes (Schouteden 1911). We examined two specimens at RMCA: a male labelled as holotype and a female labelled as paratype. Since no holotype was designated in the original description, both of them must be considered as syntypes; accordingly, we hereby designate the male specimen as lectotype.

### *Afrius (Afrius) purpureus* (Westwood, 1837)

Figs 1, 8–11

*Pentatoma yolofo* Guérin-Méneville, 1831: 55, fig. 2 and legend (syn. Stål 1870: 44).

*Pentatoma purpurea* Westwood, 1837: 43.

*Asopus figuratus* Germar, 1838: 185–186 (syn. Schouteden 1905: 147, as a var. of *Canthecona purpurea*).

*Canthecona caerulea* Dallas, 1851: 89 (syn. Stål 1862: 496, as var. of *Canthecona Yolofo* Guérin; syn. Stål 1870: 44).

*Canthecona marginella* Dallas, 1851: 89 (syn. Stål 1862: 496, as var. of *Canthecona Yolofo* Guérin; syn. Stål 1870: 44).

*Canthecona marmorata* Dallas, 1851: 90 (synonymy with *Canthecona purpurea* suspected by Schouteden 1905a: 150). **syn. nov.**

*Canthecona annulipes* Dallas, 1851: 90–91 (syn. Schouteden 1905a: 149–150, with *Canthecona marmorata*; synonymy with *Canthecona purpurea* suspected by Schouteden 1905a: 150). **syn. nov.**

*Canthecona miniatescens* Stål, 1854: 213 (syn. Stål 1864: 66–67, with *Canthecona figurata*, as var. b.; syn. Kirkaldy 1909: 10, with *Afrius purpureus*, as a var.).

*Afrius rubromarginatus* Bergroth, 1903: 289. **syn. nov.**

*Pentatoma (Eurydema) yolofo* – Laporte 1833: 61.

*Canthecona Yolofo* – Amyot & Serville 1843: 82. — Dallas 1851: 89. — Stål 1864: 67–68. — Larousse 1890: 724 [without any capital letters].

*Cimex (Pentatoma) yolofo* – Guérin-Méneville 1844: 344 [description]

- Asopus figuratus* – Herrich-Schaffer 1844: 113, fig. 710.  
*Canthecona figurata* – Stål 1864: 66–67. — Gerstaecker 1892: 345.  
*Cimex (Afrius) figuratus* – Stål 1870: 44.  
*Cimex (Afrius) purpureus* – Stål 1870: 44. — Distant 1884: 459.  
*Cimex marmoratus* – Stål 1870: 46.  
*Cimex annulipes* – Stål 1870: 46.  
*Canthecona Ylofa* (incorrect subsequent spelling) – Wallengren 1875: 133.  
*Afrius purpureus* – Reuter 1882: 9. — Lethierry & Severin 1893: 214. — Schouteden 1907a: 51–52; 1909: 64; 1910: 91; 1913a: 190; 1913b: 324; 1963: 399; 1964: 95; 1972: 106. — Kirkaldy 1909: 10. — Vuillet & Vuillet 1911: 277; 1912: 445. — Hollrung 1912: 280. — Jeannel 1913: 97. — Zacher 1921: 139. — Lehmann 1922: 129. — Hesse 1925: 39. — Carpenter 1926: liii. — Golding 1931: 222. — Van Heerden 1931: 131, fig. cvii. — Hargreaves 1937: 518. — Villiers 1949: 88; 1952a: 1211; 1952b: 82; 1954: 230; 1956: 213. — Risbec 1950: 126, 397, 447, 457. — Cachan 1952: 305; 1965: 5–32. — Leston 1952: 895. — Mancini 1953: 202. — Lindberg 1958: 31. — Le Pelley 1959: 166. — Caswell 1962: 26. — Girard 1969: 7, 52. — Herting 1971: 80; 1976: 71. — Gillon 1972: 351–352; 1974: 219, 241, 246, 251, 266, 270, 285, 287. — Linnavuori 1975: 124; 1976: 129; 1982: 164. — Medler 1980: 123. — Bourdouxhe & Jolivet 1981: 46–48. — Nuamah 1982: 11. — Nonveiller 1984: 54, 142. — Balsbaugh 1988: 276. — Couilloud 1989: 207–208. — Sylvie *et al.* 1989: 277. — Quicke *et al.* 1992: 1024. — Van Harten 1993: 247. — Bijlmakers & Verhoek 1995: 147, 317. — Schaefer 1996: 41. — Jolivet 1997: 153. — Boulard 1998: 41. — Dolling *et al.* 1999: 73. — Beenen & Hawkeswood 2004: 473. — Tchibozo & Braet 2004: 161. — Arechavaleta *et al.* 2005: 76. — Renou 2007: 30. — Poutouli *et al.* 2011: 9, 54–56, 58, 76. — Agboton *et al.* 2014: 9. — Crétenet & Gurlot 2015: 138.  
*Afrius purpureus* var. *marginella* – Reuter 1882: 9. — Kirkaldy 1909: 10.  
*Cimex (Afrius) purpureus* var. *marginella* – Distant 1884: 459.  
*Cimex purpureus* – Distant 1890: LIII [with Hope as author, not Westwood].  
*Cimex figuratus* – Distant 1892: 248 [description and illustration of unnamed variety].  
*Afrius ? annulipes* – Lethierry & Severin 1893: 214. <http://www.palaeontos.be/13/det13.html>  
*Afrius figuratus* – Lethierry & Severin 1893: 214. — Distant 1898: 308; 1901: 27. — Howard 1906: 731. — Leston 1954: 680 (and in title). — Maitai 1958: 291. — Le Pelley 1959: 257; 1968: 195, 501. — McDonald 1966: 44. — Cobben 1968: 116. — Herting 1973: 84, 85, 87. — Medler 1980: 123. — Smith & Barfield 1982: 263. — Scholtz & Holm 1985: 147. — Merrett 1986: 549. — Matanmi & Hassan 1987: 376. — Fry 1989: 108. — Mugo 1995: 2099. — Schaefer 1996: 44. — Sileshi *et al.* 2000: 41, 48.  
*Afrius ? marmoratus* – Lethierry & Severin 1893: 214.  
*Canthecona purpurea* – Schouteden 1905a: 146; 1905b: 15.  
*Canthecona purpurea* var. *figuratus* – Schouteden 1905a: 147.  
*Canthecona marmorata* – Schouteden 1905a: 149–150.  
*Canthecona rubromarginata* – Schouteden 1905a: 150–151.  
*Afrius marmoratus* – Schouteden 1907a: 51. — Kirkaldy 1909: 10. — Thomas 1994: 151. — Robertson 2009: 22.  
*Afrius rubromarginatus* – Schouteden 1907a: 52. — Bergroth 1908: 182. — Kirkaldy 1909: 10. — Thomas 1994: 151. — Maldès & Pluot-Sigwalt 2004: 20. — Robertson 2009: 22. — Krüger & Deckert 2016: 46.  
*Afrius purpureus* var. *figuratus* – Schouteden 1907a: 51–52; 1909: 64. — Mancini 1937: 43. — Le Pelley 1959: 54.  
*Afrius purpureus* var. *caerulea* – Kirkaldy 1909: 10.  
*Afrius purpureus* var. *figurata* – Kirkaldy 1909: 10.  
*Afrius purpureus* var. *miniatescens* – Kirkaldy 1909: 10.  
*Afrius yolofus* – Dupuis 1952: 454. — Leston 1954: 680 (in a note). — Thomas 1994: 151. — Maldès & Pluot-Sigwalt 2004: 20. — Rebagliati *et al.* 2005: 201. — Kerisew 2011: 91.

*Afrius purpureus purpureus* – Linnavuori 1989: 13.

*Afrius purpureus figuratus* – Linnavuori 1989: 12–13 [with unnamed variety].

*Afrius yolofa* – Sileshi *et al.* 2001: 289; 2004: 6, 18. — Kerzhner *et al.* 2004: 18. — Rider 2006: 234. — Robertson 2009: 21–22. — Matesco *et al.* 2014: 352.

### Types examined

AFRICA • *Pentatoma purpurea* Westwood, 1837; syntype ♀; labels: “Type Hem: 242 PENTATOMA PURPUREA WESTWOOD HOPE DEPT. OXFORD”, “TYPE = WEST. (HOPE) C. Hemipt. 1837 Part. I. page 43 Distant, P.Z.S., 1900, p. 807–825.”, “Africa”, “*Afrius purpureus* Westw.”; Fig. 8E–F; OUMNH.

“EAST AFRICA” • *Afrius rubromarginatus* Bergroth, 1903; syntype ♀; labels: “Type Hem: 704 AFRIUS RUBROMARGINATUS BERGROTH. HOPE DEPT. OXFORD”, “*Afrius rubromarginatus* Bergr.”, “Probably TANGANYIKA”, “Ann. Soc. Ent. Belg. 47: 289”, “Afriq Or”, “3/”, “TYPE”; Fig. 8O–P; OUMNH.

SIERRA LEONE • *Canthecona marginella* Dallas, 1851; syntype ♂; labels: blue-margined syntype disc label, red-margined type disc label, “87a”, “*Canthecona marginella* identified by Dallas”, “a”, “NHMUK 010592170”; Fig. 8I–J; NHMUK 010592170.

SOUTH AFRICA • *Asopus figuratus* Germar, 1838; syntype ♀; labels: “*figuratus* Germ. Promont. b. sp. Collect. Germ.”, “*Afrius figuratus* (Germ)”, “7968”, “Typus”; Fig. 8G–H; MFNB.

SOUTH AFRICA • *Canthecona caerulea* Dallas, 1851; syntype ♂; labels: blue-margined syntype disc label, red-margined type disc label, “40 6 26 329”, “*Canthecona caerulea* identified by Dallas”, “a”, “NHMUK 010592171”; Fig. 8A–C; NHMUK 010592171.

SOUTH AFRICA • *Canthecona marmorata* Dallas, 1851; syntype ♂; labels: blue-margined syntype disc label, red-margined type disc label, “Int. S. Africa / 4319”, “3. *Canthecona marmorata*,”, “a”, “NHMUK 010592164”; Fig. 8K–L; NHMUK 010592164.

SOUTH AFRICA • *Canthecona annulipes* Dallas, 1851; syntype ♀; labels: blue-margined syntype disc label, “Int. Africa / 4319”, “*Canthecona figurata* Walker’s catal.”, “a”, “NHMUK 010747805”; Fig. 8M–N; NHMUK 010747805.

SOUTH AFRICA • *Canthecona miniatescens* Stål, 1854; syntype ♀; labels: “Caffraria”, “I. Vahlb”, “*miniatescens* Stål type.”, “Typus”, “NHRS-GULI 000027293”; Fig. 8D; examined by photo; NHRS-GULI 000027293.

### Diagnosis

Scutellum longer than wide, postfrenal lobe enlarged; humeral pronotal angles slightly emarginated; male abdomen with setose patches on segments V and VI, parameres triangular, without two distinct lobes.

### Redescription

**BODY.** Elongate oval, with variable colour patterns from yellowish and brownish with yellow or red stripes (Fig. 8D, H, L, N) to purple, green and blue metallic uniform colours (Fig. 8B–C, F, J, P).

**HEAD.** Subrectangular, wider than long, punctured; mandibular plates equal or slightly longer than clypeus, with margin varying from straight to sinuous; antenna bearing thin setae, denser on third, fourth and fifth antennomeres, proportion of lengths of antennomeres: IV > V > II > III > I; labium robust, reaching metasternum; proportion of lengths of labiomeres: II > I > IV > III.



**Fig. 8.** *Afrius (Afrius) purpureus* (Westwood, 1837), type specimens. **A–C.** *Canthecona caerulea* Dallas, 1851, syntype ♂, labels, dorsal and ventral habitus, respectively (NHMUK). **D.** *Canthecona miniatescens* Stål, 1854, syntype ♀, labels and dorsal view (image courtesy of Gunvi Lindberg, NHRS). **E–F.** *Pentatoma purpurea* Westwood, 1837, syntype ♀, labels and dorsal habitus (OUMNH). **G–H.** *Asopus figuratus* Germar, 1838, syntype ♀, labels and dorsal habitus (MFNB). **I–J.** *Canthecona marginella* Dallas, 1851, syntype ♂, labels and dorsal habitus (NHMUK). **K–L.** *Canthecona marmorata* Dallas, 1851, syntype ♂, labels and dorsal habitus (NHMUK). **M–N.** *Canthecona annulipes* Dallas, 1851, syntype ♀, labels and dorsal habitus (NHMUK). **O–P.** *Afrius rubromarginatus* Bergroth, 1903, syntype ♀, labels and dorsal habitus (OUMNH). Abbreviations: ac = corium adjacent to the scutellum constriction; paVII = posterior angles of seventh abdominal segment; sc = scutellum constriction. Scale bars: 4 mm.

**THORAX.** Pronotum hexagonal, densely punctured, twice or more as wide as long, cicatrices flat; anterior margin concave; lateral margins strongly sinuous, crenulated on anterior half (Fig. 9), humeral angle slightly emarginated, anterior humeral portion varying from convex (Fig. 9A, C) to acute or spinose (Fig. 9B, D). Scutellum longer than wide, densely punctured. Corium longer than scutellum, usually not surpassing connexival segment V, densely punctured.

**MALE ABDOMEN.** Setose patches present on male abdominal segments V and VI (Fig. 8C); parameres uniramous, triangular.

### Male

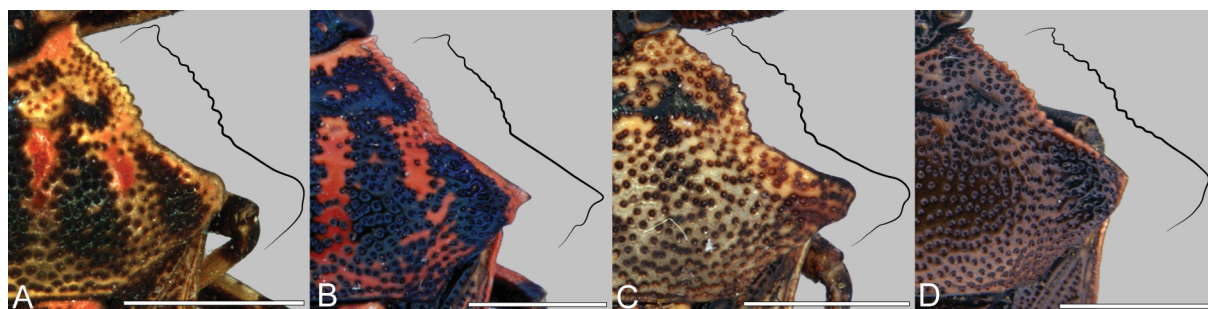
**MEASUREMENTS** (n = 5). Head length  $1.69 \pm 0.08$  (1.61–1.76); width  $1.90 \pm 0.12$  (1.76–2.10); pronotum length  $2.83 \pm 0.30$  (2.41–3.22); width  $5.70 \pm 0.46$  (5.32–6.45); scutellum length  $3.51 \pm 0.29$  (3.14–3.95); width  $3.33 \pm 0.28$  (3.06–3.79); length of antennomeres: I  $0.30 \pm 0.04$  (0.26–0.34), II  $1.08 \pm 0.11$  (0.93–1.24), III  $1.06 \pm 0.10$  (0.93–1.16), IV  $1.26 \pm 0.11$  (1.12–1.39), V  $1.22 \pm 0.09$  (1.12–1.31); length of labiomeres: I  $0.93 \pm 0.12$  (0.79–1.12), II  $1.06 \pm 0.09$  (0.94–1.09), III  $0.80 \pm 0.09$  (0.67–0.94), IV  $0.83 \pm 0.08$  (0.71–0.94); length of abdomen  $4.67 \pm 0.46$  (4.03–5.24); width  $4.83 \pm 0.40$  (4.43–5.48); total length  $10.03 \pm 0.52$  (9.35–10.64).

**GENITALIA.** Genital plates cylindrical (Fig. 10A, C–D, F, I, gp). Parameres long, uniramous, head elongated triangular, dorsally directed, extended beyond pygophore (Fig. 10A–H, par). Phallus. Basal theca and thecal shield subequal in length (Fig. 10L–R, bt, ts). Vesica subtriangular in dorsal view (Fig. 10P–R, v), golf club-shaped in lateral view, with apex obtuse and a central, strongly elevated portion covered by microsculptures (Fig. 10L–O, v, m), this central portion broad, rectangular in lateral view, cylindrical in dorsal view; ductus seminis uniform (Fig. 10L–R, ds), dorsally directed. Apices of conjunctival lobes globose, endowed with a set of small sculptured processes (Fig. 10L, N, O, cl, sp).

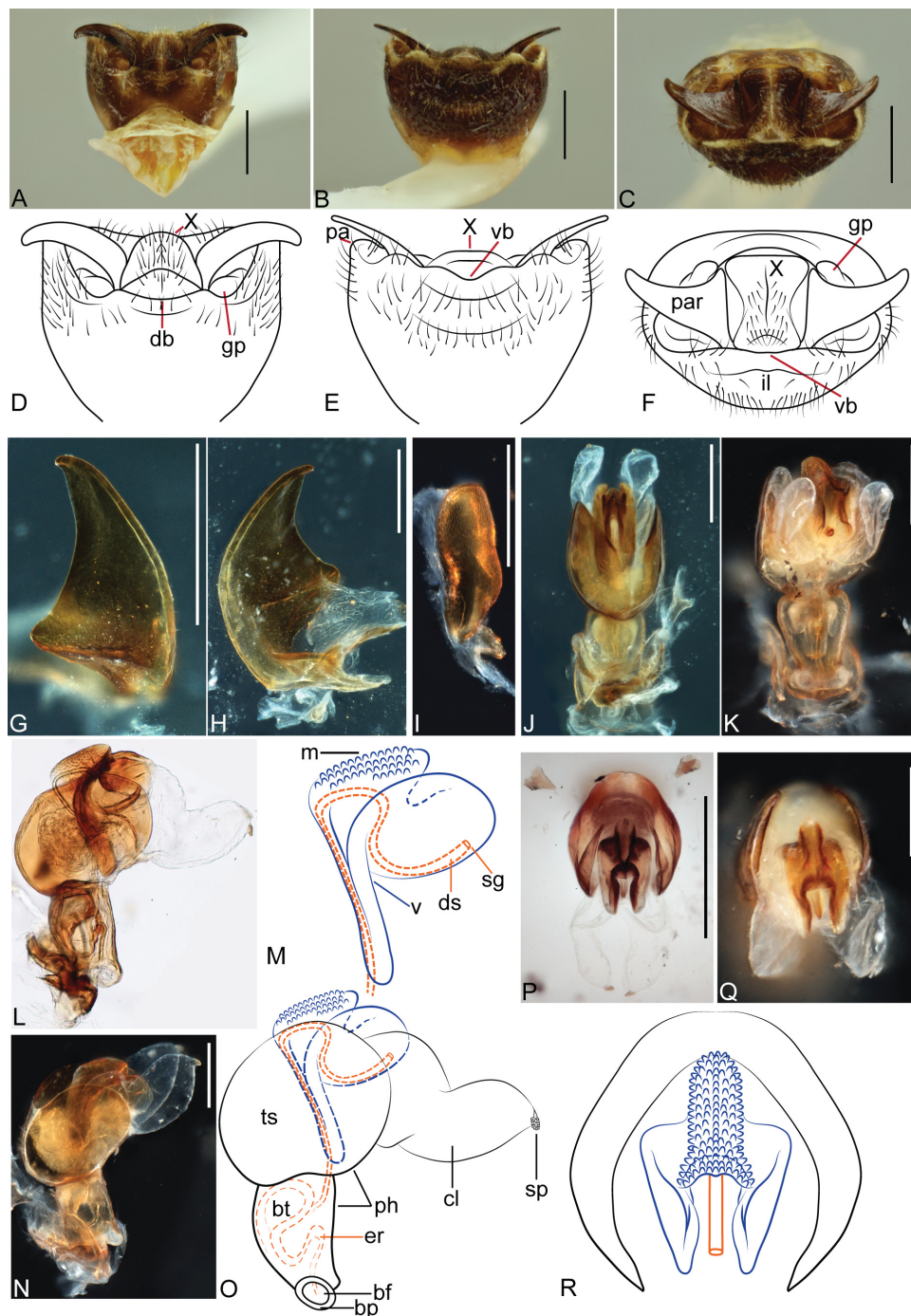
### Female

**MEASUREMENTS** (n = 5). Head length  $2.12 \pm 0.19$  (1.83–2.28); width  $2.12 \pm 0.12$  (1.91–2.21); pronotum length  $3.17 \pm 0.20$  (2.82–3.30); width  $6.94 \pm 0.31$  (6.45–7.25); scutellum length  $4.43 \pm 0.39$  (3.79–4.75); width  $4.06 \pm 0.34$  (3.46–4.35); lengths of antennomeres: I  $0.38 \pm 0.04$  (0.34–0.45), II  $1.30 \pm 0.15$  (1.12–1.42), III  $1.17 \pm 0.14$  (0.93–1.31), IV  $1.50 \pm 0.19$  (1.16–1.61), V  $1.37 \pm 0.15$  (1.12–1.50); lengths of labiomeres: I  $1.04 \pm 0.07$  (0.94–1.12), II  $1.27 \pm 0.15$  (1.01–1.38), III  $0.93 \pm 0.09$  (0.78–1.01), IV  $0.94 \pm 0.11$  (0.75–1.05); length of abdomen  $6.17 \pm 0.34$  (5.64–6.45); width  $6.27 \pm 0.42$  (5.64–6.61); total length  $11.96 \pm 0.83$  (10.80–13.06).

**GENITALIA.** Gonocoxites VIII slightly wider than long, posterior margins sinuous (Fig. 11A–B, gcVIII). Median and inner duct of vesicular area of uniform diameter (Fig. 11C–D, md, id).



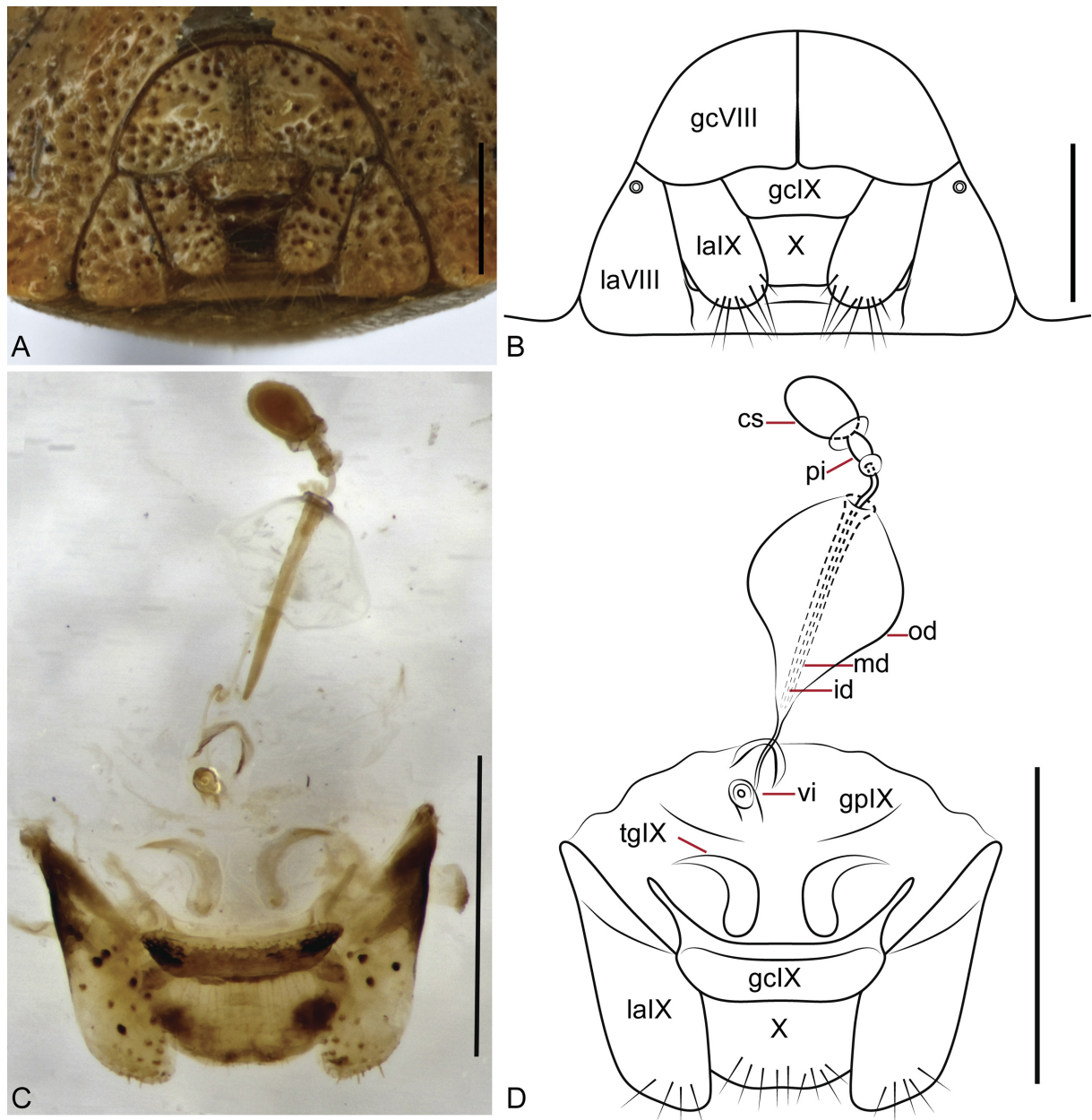
**Fig. 9.** *Afrius (Afrius) purpureus* (Westwood, 1837), variation of the pronotum shape. Scale bars: 2 mm.



**Fig. 10.** *Afrius (Afrius) purpureus* (Westwood, 1837), male genitalia. **A–F.** Pygophore in dorsal (**A**, **D**), ventral (**B**, **E**) and posterior (**C**, **F**) views. **G–H.** Right paramere in lateral views, internal and external respectively. **I.** Right genital plate, dorso-posterior view. **J–L.** Phallus in anterior, posterior and lateral views, respectively. **M.** Detail of the vesica in lateral view, also represented in **O**. **N.** Phallus in lateral view. **O.** Drawing of the phallus. **P–R.** Phallus in dorsal view. Abbreviations: bf = basal foramen; bp = basal plates; bt = basal theca; cl = conjunctival lobes; db = dorsal border; ds = ductus seminis; er = ejaculatory reservoir; gp = genital plates; il = inferior layer; m = microsculptures; pa = posterolateral angles; par = parameres; ph = phallosheca; sg = secondary gonophore; sp = conjunctival process; ts = thecal shield; v = vesica; vb = ventral border; X = segment X. Scale bars: **A–C** = 0.5 mm; **G–K**, **N**, **P–Q** = 0.25 mm.

**Distribution**

South Africa (Germar 1838), Senegal (Guérin-Méneville 1844), Sierra Leone (Dallas 1851), Guinea (Stål 1864), Equatorial Guinea [as Fernando Po] (Stål 1870), Ghana (Reuter 1882), Mozambique (Gerstaecker 1892), Zimbabwe [as Mashonaland] (Distant 1898), Democratic Republic of the Congo (Distant 1901), Equatorial Guinea [as Fernando Po] (Stål 1870), Ghana (Reuter 1882), Mozambique (Gerstaecker 1892), Benin, Cameroon, Central African Republic [as Haute-Sangha], Eritrea, Ethiopia



**Fig. 11.** *Afrius (Afrius) purpureus* (Westwood, 1837), female genitalia. **A–B.** Genital plates, ventroposterior view. **C–D.** Inner genitalia, ventral view. Abbreviations: cs = capsula seminalis; gcVIII = gonocoxites VIII; gcIX = gonocoxites IX; gplX = gonapophyses IX; id = inner duct; laVIII = laterotergites VIII; laIX = laterotergites IX; md = median duct of vesicular area; od = outer duct of vesicular area; pi = pars intermedialis; tgIX = secondary thickening of gonapophyses IX; vi = thickening of vaginal intima; X = segment X. Scale bars: A–B = 1 mm; C–D = 0.5 mm.

[as Abyssinia], Gabon, Ivory Coast [as Grand Bassam], Nigeria [as Benue Niger], Sierra Leone, South Sudan, Sudan, Tanzania [as Usambara and Kilimanjaro] (Schouteden 1905a), Kenya [as Leito-kitok] (Schouteden 1910), Mali [as Koulikoro] (Vuillet & Vuillet 1911), Guinea-Bissau (Schouteden 1913b), Namibia [as Damaraland, Otjiwarongo and Tsumeb] (Hesse 1925), Uganda (Carpenter 1926), Somalia (Mancini 1937), Cape Verde Islands (Lindberg 1958 or 1959?), Chad (Couilloud 1989), Yemen (Linnavuori 1989), Angola, Botswana, Gambia, Liberia (Thomas 1994), Malawi (Sileshi *et al.* 2000), Zambia (Sileshi *et al.* 2001), Republic of Djibouti, Togo (Maldès & Pluot-Sigwalt 2004), Republic of the Congo [as Haut Oubangui?] (Maldès & Pluot-Sigwalt 2004; also in Robertson 2009 as “Congo Brazz.”), Niger (Robertson 2009; in error?), Canary Islands (new record) (Table 1, Fig. 1).

### Remarks

Intraspecific variability in the colour and general morphology has been demonstrated for *A. (Afrius) purpureus* (e.g., Linnavuori 1989; Schouteden 1905a; Van Heerden 1931; Villiers 1952b) as well as for other pentatomids, such as *Nezara viridula* (Linnaeus, 1758) (e.g., Freeman 1940; Kiritani 1970; Ohno & Alam 1992; Vivan & Panizzi 2002; More *et al.* 2017) and *Stiretrus decemguttatus* (Lepeletier & Serville, 1828) (Paleari 2013) for colour pattern, and *Pinthaeus sanguinipes* (Fabricius, 1781) for variation in the pronotum, reported by Zhao *et al.* (2013). Besides, we could not find any connection between the polymorphism and the geographic distribution of *A. (Afrius) purpureus*, i.e., specimens that we have examined, despite different colour patterns and pronotum shapes, are sympatric. The localities where they were collected are denoted by the green dots on Fig. 1.

There has been considerable difference of opinion regarding the name used for this species, i.e., either *yolofa/-us*, *purpurea/-us* or *figurata/-us* and, sometimes, the latter used as a variety or subspecies of the second one (see review of the taxonomic history of the species above). Dallas (1851) was the first to synonymize *figuratus* and *yolofa*; he stated the date of publication of *Pentatoma yolofa* as 1830, while Stål (1864) stated it as 1829. Subsequent authors (including Stål 1870) accepted 1838 as the year of publication for *yolofa* and therefore they recognized either *figuratus* or *purpureus* as the valid name, Wallengren (1875) may have been the last author to use *yolofa* (misspelled as *Ylofa*) as a valid name while Larousse (1890) gave a brief description of it under the genus *Canthecona* (strangely, this entry first mentions that the type species of *Canthecona* is from Senegal and thereafter describes *C. yolofa*, as though implying it were the type species; the type species of *Canthecona* Amyot & Serville, 1843 is, however, *C. discolor* (Palisot de Beauvois, 1811), described from the Kingdom of Oware, now Southwest Nigeria). Dupuis (1952) demonstrated the priority of *Pentatoma yolofa* Guérin-Ménéville, 1831 over *Pentatoma purpurea* Westwood, 1837 and *Asopus figuratus* Germar, 1838. Thomas (1994) adopted the combination suggested by Dupuis (1952), *Afrius yolofus*. This was, as well, used by subsequent authors (Maldès & Pluot-Sigwalt 2004; Rebagliati *et al.* 2005; Kerisew 2011). Some others (Sileshi *et al.* 2001, 2004; Kerzhner *et al.* 2004; Rider 2006; Robertson 2009; Matesco *et al.* 2014), however, chose the combination *Afrius yolofa*, while others again still used *purpureus* and/or *figuratus* after 1952 (e.g., Mancini 1953; Villiers 1954, 1956; Leston 1954; Lindberg 1958; Schouteden 1963, 1964; Gillon 1972; Linnavuori 1975, 1976, 1982; Bourdouxhe & Jolivet 1981; Nuamah 1982; Matanmi & Hassan 1987; Balsbaugh 1988; Couilloud 1989; Quicke *et al.* 1992; Schaefer 1996; Tchibozo & Braet 2004; Poutouli *et al.* 2011; Agboton *et al.* 2014; Crétenet & Gurlot 2015) and yet others treated *figuratus* as a variety or a subspecies of *purpureus* (Schouteden 1905a, 1907a; Kirkaldy 1909; Schouteden 1909; Mancini 1937; Le Pelley 1959; Linnavuori 1989). Others still have used two or three combinations in the same work, possibly because they were reporting facts from primary sources, using the names as they were in the sources, and were not aware that the species were the same (Le Pelley 1959; Schaefer 1996).

The different combinations used for one and the same species clearly are the results of a few misconceptions: when and how *yolofa*, *figuratus* and *purpureus* were synonymized, the problematic dating of *yolofa* and *figuratus* and the status of *yolofa* as an adjective or a noun in apposition.



### Synonymies of *yolofa*, *figuratus* and *purpureus*

Earlier we noted that Dallas (1851) first stated the synonymy of *figuratus* with *yolofa*. Clearly, Stål (1870) and Schouteden (1905a) believed *yolofa* sensu Dallas (1851) was a misidentification, pertaining to *figuratus*. *Pentatoma yolofa* was synonymized with *Cimex (Afrius) purpureus* by Stål (1870). *Asopus figuratus* was considered as a variety of *Canthecona purpurea* by Schouteden (1905a). It appeared as a junior synonym of *Afrius yolofus* together with *Pentatoma purpurea* in Dupuis (1952). Later, Leston (1954) made use of it as the valid name of the species; yet, in a footnote, it was corrected that the valid name should be *Afrius yolofus*. Additionally, the confusion between the use of *figuratus* and *purpureus* has been so great that some authors have even attributed the authorship of *purpureus* to Germar (e.g., Risbec 1950; Herting 1971, 1976). Considering the above, it is no surprise that *figuratus* appeared as a variety or subspecies of *purpureus*, even relatively recently. It is no surprise either that it still appeared as a valid name as late as 2000 (Sileshi *et al.* 2000) and possibly later, concurrently with the other names (*yolofa*, *yolofus* and *purpureus*).

### Problematic dating of *yolofa* and *figuratus*

As stated above, until Dupuis (1952), *yolofa* had been considered as a junior synonym of *purpureus* as its date of publication was thought to be 1838. This actually is that of *figuratus*. For a long time there was considerable confusion about the priority of the works of Westwood (1837) and Germar (1838); the title pages of both works indicated 1837 as the date of publication. Schouteden (1907b) demonstrated that Westwood's work had priority. Sherborn (1922–1932) attributed the date “1840” to all taxa published by Germar in the fifth volume of the *Revue entomologique* (pages 121–192); most modern catalogues of Heteroptera list Germar's work with the date 1838 (e.g., Rolston *et al.* 1993; Schuh 1995; Aukema & Rieger (eds) 1995–2013; Rolston *et al.* 1996; Cassis & Gross 2002; CoreoideaSF Team 2018; Dellapé & Henry 2018). Recently, Nagel & Schmidlin (2014: 97) stated a precise date (21 November 1838) for taxa newly described between pages 1 to 224 of the fifth volume. As a consequence, *Pentatoma purpurea* Westwood, 1837 definitely has priority over *Asopus figuratus* Germar, 1838 [not 1837 as earlier authors had assumed], and *Pentatoma yolofa* Guérin-Méneville, 1831 over them both.

### Should we use *yolofa*, a noun in apposition or *yolofus*, an adjective?

The original description indubitably shows that Guérin-Méneville chose an adjective and not a noun in apposition as may have been thought by recent authors who made use of the combination *Afrius yolofa*, possibly influenced by earlier authors (Amyot & Serville 1843; Dallas 1851).

Guérin-Méneville (1831: plate 55, 1844: 344) used the binomen *Pentatoma yolofa* with a lower case “y”, implying that the name was treated as an adjective (a capital “D” was used for *Scutellera Dives* and a capital “S” for *Tesseratoma [sic] Sonneratii* on the same plate, as one would expect in those days for a noun in apposition or a genitive based on the name of a person); the same author (Guérin-Méneville 1844: 344) also used the French vernacular name P[entatome] yolofe. Amyot & Serville (1843) cited this species as *Canthecona Yolofa* (with vernacular French as Canthécone Yolofa), using a capital “Y” in the Latin binomen (also followed by Dallas 1851), and a final “a” in the French name. Their use of a capital “Y” and of a final “a” in the French name indicates that these subsequent authors treated the species name as a noun in apposition.

The *Grand Dictionnaire Universel du XIX siècle* (Larousse 1876: 1423) has an entry for the adjective “YOLOF ou YOLOFF, OVE”, meaning “relative to the native language of the Wolof people (Senegal, Gambia, Mauritania)”. Although the adjective is there restricted to the field of linguistics and despite the fact that the proper feminine form of the adjective in French is “yolove”, it is clear that Guérin-Méneville (1831) meant to indicate that his *Pentatoma*, collected in Senegal, the land of the wolof/yolof people, was ‘yolove’ (expressed with an adjective), so he called it *Pentatome yolofe/Pentatoma yolofa*. Admittedly, this adjective has not been used much in zoology; Sherborn (1932: 7031) only lists one

other species having *yolofus* as its epithet, *Prionus yolofus* (Dalman, 1817) (Coleoptera: Cerambycidae: Prioninae: Acanthophorini). The latter species is now placed in the genus *Tithoes* Thomson, 1864, which contains two other species whose epithets equally express their rather precise African provenance: *Tithoes congolanus* (Lameere, 1903) and *T. somalius* (Lameere, 1903).

The precedence of *A. yolofa* over its synonyms, pointed out by Dupuis (1952) and echoed by Leston (1954), was generally ignored until Thomas (1994). Even now, few are those who apply it. In almost two centuries, a substantial number of papers on the species have been published using either *purpureus* or *figuratus*. Since *purpureus* has been the most used overall, since it was used continually to refer to this species since its publication and since *Afrius purpureus* is the name used in the latest publication on the species that we are aware of, we have used the name *Afrius purpureus* in this revision as the valid name. In addition, we intend to apply to the International Commission on Zoological Nomenclature, under Article 23.9.3 of the Code (ICZN 1999), so that the prevailing usage of the specific name *Pentatoma purpurea* Westwood, 1837 (currently *Afrius purpureus*) be conserved and ensured in future.

## Discussion

The idea that insects can control agricultural pests is old, and the success of biological control has already been demonstrated in many countries (Caltagirone 1981; McFadyen 1998; Bellows 2001; Parra *et al.* 2002). The predatory stink bugs that make up the subfamily Asopinae are among the insects with potential use in biological control (Magistrali *et al.* 2014), but despite this, there are still few modern phylogenetic and taxonomic studies on this subfamily. The lack of taxonomic studies may result in great economic losses when controlling and controlled species are poorly identified (Zucchi 2002). In this work we revised an important genus of Asopinae for biological control, namely *Afrius* Stål, 1870 (Miller 1952; Sileshi *et al.* 2004), which is distributed throughout Africa and adjacent islands and comprises, after this revision, three species: *Afrius (Subafrius) flavirostrum* (Signoret, 1861), *Afrius (Afrius) kolleri* Schouteden, 1911 and *Afrius (Afrius) purpureus* (Westwood, 1837). The contributions presented here could serve in future phylogenetic and taxonomic studies, as well as in applied agronomical sciences.

We maintained the two subgenera which were proposed by Schouteden (1907a) as they show distinct characteristics, such as the absence of abdominal glandular patches on males of *Afrius (Subafrius) flavirostrum* and the parameres which are divided into two rami in the same species. Perhaps a phylogenetic scenario including other similar genera can better substantiate this classification in the future.

We demonstrated in this study the importance of consulting type materials in taxonomy. For example, Miller (1952) had probably not seen the type material of *A. (Subafrius) flavirostrum* when he described the new species *A. williamsi* Miller, 1952, which we are synonymizing here. Furthermore, we strongly recommend the study of the external and internal morphology of the genitalia in Asopinae, as these were crucial here to the delimitation of species, especially of *Afrius (Afrius) purpureus*, which shows a broad geographical distribution and different patterns of general morphology and colour (Linnavuori 1989; Schouteden 1905a; Van Heerden 1931; Villiers 1952b).

We cannot hypothesize the relationship of the species of *Afrius* without a phylogenetic study, and at present we do not know if the genus is monophyletic. *Afrius (Afrius) kolleri* and *A. (A.) purpureus* seem to be more closely related to each other than to *A. (Subafrius) flavirostrum* based on similar male genitalia, i.e., the presence of vesica microsculptures and the presence of male abdominal glandular patches.

*Afrius (Afrius) purpureus* is a species with a broad geographical distribution and a great intraspecific variability with respect to size, morphology of the head and pronotum, and colour pattern (Figs 8–9).

Because of the observed differences we consider the morphology of the genitalia crucial to delimit the species of *Afrius*.

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