

# The family Ismaridae Thomson (Hymenoptera, Diaprioidea): first record for the Afrotropical region with description of fourteen new species

Chang-Jun Kim<sup>1</sup>, Robert S. Copeland<sup>2,3</sup>, David G. Notton<sup>4</sup>

**1** Division of Gardens and Education, Korea National Arboretum, Pocheon 11186, Republic of Korea  
**2** Biosystematics Unit, International Centre of Insect Physiology and Ecology, P.O. Box 30772, Nairobi 00100, Kenya  
**3** Department of Entomology, U.S. National Museum of Natural History, Smithsonian Institution, Washington, DC, USA  
**4** Department of Life Sciences, Insects Division, Darwin Centre – room 315, The Natural History Museum, Cromwell Road, London, SW7 5BD, UK

Corresponding author: Chang-Jun Kim ([hades821@gmail.com](mailto:hades821@gmail.com))

---

Academic editor: S. van Noort | Received 12 February 2018 | Accepted 29 September 2018 | Published 17 October 2018

---

<http://zoobank.org/BFB0A72E-E3E1-4D19-9361-575B3CD71DDE>

---

**Citation:** Kim C-J, Copeland RS, Notton DG (2018) The family Ismaridae Thomson (Hymenoptera, Diaprioidea): first record for the Afrotropical region with description of fourteen new species. African Invertebrates 59(2): 127–163. <https://doi.org/10.3897/AfrInvertebr.59.24403>

---

## Abstract

The family Ismaridae Thomson, 1858 is reported from the Afrotropical region for the first time. A total of 15 species are recognised, 14 of which are described as new: *Ismarus africanus* sp. n. from Cameroon, Kenya, Malawi, South Africa; *I. apertus* sp. n. from Kenya; *I. bicolor* sp. n. from Cameroon, Kenya; *I. goodrichi* sp. n. from Kenya; *I. kakamegensis* sp. n. from Kenya; *I. kenyensis* sp. n. from Kenya; *I. laevigatus* sp. n. from South Africa; *I. madagascariensis* sp. n. from Madagascar; *I. minutus* sp. n. from Kenya, Malawi, Zimbabwe; *I. nigrofasciatus* sp. n. from Malawi, Uganda; *I. notaulicus* sp. n. from Kenya; *I. rawlinsi* sp. n. from Kenya, Malawi; *I. steineri* sp. n. from Madagascar; *I. watshami* sp. n. from Botswana, Malawi, South Africa, Zimbabwe. *Ismarus halidayi* Förster is reported for continental Africa from South Africa (new record). We provide an identification key to all species in Afrotropical region.

## Keywords

Africa, *Ismarus*, key, new distribution record, new species, review

## Introduction

The family Ismaridae is currently classified as a monotypic family in the Diaprioidea (Sharkey et al. 2012). Prior to this study, the family included 43 described species, distributed worldwide except for the Afrotropical region (Masner 1976; Johnson 1992; Liu et al. 2011; Kolyada and Chemyreva 2016; Comério et al. 2016; Hymenoptera Online 2016; Kim et al. 2018).

Information on the habitats and biology of the species of *Ismarus* is limited; however, they are known to prefer wooded areas at higher elevations in warmer climatic zones and at low elevations in cooler climatic zones and they are hyperparasitoids of plant hoppers (Cicadellidae) via Dryinidae (Hymenoptera, Chrysidoidea) (Chambers 1955, 1981; Nixon 1957; Wall 1967; Kozlov 1971; Masner 1976; Jervis 1979; Tussac and Tussac 1991; Olmi 2000; Kim et al. 2018).

In 2015–2016, the authors examined some unidentified African Ismaridae provided by Lubomír Masner (Canadian National Collection, Ottawa, Canada), David G. Notton (Natural History Museum, London, United Kingdom) and Robert Cope-land (International Centre of Insect Physiology and Ecology, Nairobi, Kenya). This study resulted in the discovery of 15 species of *Ismarus* from the Afrotropical region, the first Afrotropical representatives of the family (Table 1). Hosts are unknown for all the new species.

## Material and methods

The terminology used in the present study follows that of Masner (1976) and Masner and García (2002). The images were captured with a Leica DFC 495 camera through a Leica M205A Stereozoom stereomicroscope (Leica, Microsystems, Solms, Germany) and were produced with LAS software (version 4.1.0., Leica Microsystems, Switzerland). Final plates were prepared in Adobe Photoshop CS6 (Adobe Systems Incorporated, San Jose, United States of America).

Abbreviations. Morphology. **LOL**: distance between the inner edges of lateral ocellus and median ocellus; **OOL**: distance from the outer edge of lateral ocellus to the compound eye; **POL**: distance between the inner edges of the two lateral ocelli. Collecting methods. **MT**: Malaise trap; **YPT**: yellow pan trap.

Collections and depositories. **CNCI**: Canadian National Insect Collection, Ottawa, Canada; **DNPC**: David Notton, personal collection, London; **HNHM**: Hungarian Natural History Museum, Budapest, Hungary; **ICIPE**: International Centre of Insect Physiology and Ecology, Nairobi, Kenya; **KNA**: Korea National Arboretum; **NHMUK**: Natural History Museum, London, United Kingdom; **NHRS**: Swedish Museum of Nature History, Stockholm, Sweden; **NMK**: National Museums of Kenya, Nairobi, Kenya.

**Table 1.** An overview of Afrotropical *Ismarus*. O = known, X = unknown.

Species	Sex		Distribution
	♀	♂	
<i>I. africanus</i> sp. n.	O	O	Cameroon, Kenya, Malawi, South Africa
<i>I. apertus</i> sp. n.	O	O	Kenya
<i>I. bicolor</i> sp. n.	X	O	Cameroon, Kenya
<i>I. goodrichi</i> sp. n.	O	X	Kenya
<i>I. halidayi</i> Förster	O	O	South Africa (new record), Nearctic, Oriental and Palaearctic countries
<i>I. kakamegensis</i> sp. n.	O	X	Kenya
<i>I. kenyensis</i> sp. n.	O	X	Kenya
<i>I. laevigatus</i> sp. n.	O	O	South Africa
<i>I. madagascariensis</i> sp. n.	O	X	Madagascar
<i>I. minutus</i> sp. n.	O	O	Kenya, Malawi, Zimbabwe
<i>I. nigrofasciatus</i> sp. n.	O	X	Malawi, Uganda
<i>I. notaulicus</i> sp. n.	O	X	Kenya
<i>I. rawlinsi</i> sp. n.	O	O	Kenya, Malawi
<i>I. steineri</i> sp. n.	X	O	Madagascar
<i>I. watshami</i> sp. n.	O	O	Botswana, Malawi, South Africa, Zimbabwe

## Taxonomy

### Family Ismaridae Thomson, 1858

#### Genus *Ismarus* Haliday, 1835

*Ismarus* Haliday, 1835: 467. Type species *Cinetus dorsiger* Haliday, 1831, by monotypy.

*Entomia* Herrich-Schaeffer, 1840: 127. Type species *Entomia campanulata* Herrich-Schaeffer, 1840, by monotypy.

*Agonophorus* Dahlbom, 1858: 289. Type species *Ismarus rugulosus* Förster, 1850, designated by Muesebeck (1972).

**Diagnosis.** *Ismarus* can be easily separated from other diapiiids by the combination of the following characters: low insertion of antennae; transverse head; reduced notauli. For a detailed generic description, see Masner (1976).

#### *Ismarus africanus* sp. n.

<http://zoobank.org/F194008B-3A1A-4B7A-A76A-2F2445960564>

Figure 1A–F

**Diagnosis.** In the sculpture of the scutellum and metasoma, *Ismarus africanus* sp. n. is similar to *I. rugulosus* Förster, 1850. The main difference between these two species is

the mesopleural sculpture and radial cell: mesopleuron coriaceous-rugulose and radial cell completely closed in *I. rugulosus*; mesopleuron smooth and radial cell open, as venation becomes weak apically in *I. africanus* sp. n.

**Type material** (13♀♀49♂♂). *Holotype*, 1♀, CAMEROON: Nkoemvon, 16.III–14.V.1980 (MT), D. Jackson leg., CJDAF010001 (deposited in NHMUK). *Allotype*, 1♂, KENYA: Rift Valley Prov., Marich Pass, gallery forest along river, 917 m alt., 01°32.18'N, 35°27.48'E, 8–16.V.2004 (MT), R. Copeland leg., CJDAF010013 (CNCI). *Paratype*, CAMEROON: 1♀, Mbalmayo, VII.1993 (MT), P. Eggleton leg., CJDAF010002 (CNCI); KENYA: 1♀, Eastern Province, Endau Mountain, indigenous forest, 531 m alt., 1.30026°S, 38.52805°E, 28.X–12.XII.2016 (MT), R. Copeland leg., CJDAF010009 (NMK); 1♀, Eastern Province, Mulu Musingila farm, farmland near small, seasonally wet area, 689 m alt., 2.11412°S, 38.23989°E, 30.XI–13.XII.2016 (MT), R. Copeland leg., CJDAF010062 (KNA); 1♀3♂♂, ditto, 13–27.XII.2016 (MT), R. Copeland leg., CJDAF010001, 010049–010051 (NMK); 2♂♂, Eastern Province, Kibwezi Forest, indigenous forest, 945 m alt., 2.41687°S, 37.95388°E, 4–18.V.2016 (MT), R. Copeland leg., CJDAF010041–010042 (ICIPE); 1♀1♂, ditto, 18.V–3.VI.2016 (MT), R. Copeland leg., CJDAF010011, 010043 (ICIPE); 2♂♂, ditto, 30.XI–13.XII.2016 (MT), R. Copeland leg., CJDAF010053–010054 (ICIPE); 1♂, Eastern Province, Marsabit Forest, indigenous forest, near campsite, 1380 m alt., 2.32031°N, 37.98595°E, 16–30.XI.2015 (MT), R. Copeland leg., CJDAF010044 (ICIPE); 4♂♂, ditto, 30.XI–13.XII.2015 (MT), R. Copeland leg., CJDAF010045–010048 (ICIPE); 1♀, Nyanza, Gembe Hills, dry gallery woodland, 1362 m alt., 00°29.36'S, 34°14.60'E, 20.II–6.III.2005 (MT), R. Copeland leg., CJDAF010008 (CNCI); 1♀8♂♂, Rift Valley, Marich Pass, gallery forest along river, 917 m alt., 01°32.18'N, 35°27.48'E, 8–16.V.2004 (MT), R. Copeland leg., CJDAF010003, 010014–010021 (CNCI); 1♀, ditto, 23.I–6.II.2005 (MT), R. Copeland leg., CJDAF010005 (CNCI); 1♀1♂, ditto, 6–20.II.2005 (MT), R. Copeland leg., CJDAF010004, 010026 (CNCI); 1♂, ditto, 18.IV–2.V.2005 (MT), R. Copeland leg., CJDAF010027 (CNCI); 3♂♂, ditto, 2–16.V.2005 (MT), R. Copeland leg., CJDAF010028–010030 (2♂♂-CNCI, 1♂-ICIPE); 1♂, Rift Valley Province, Oloitokitok, edge of indigenous forest, 1853 m alt., 2.94456°S, 37.50714°E, 23.XII.2011–6.I.2012 (MT), R. Copeland leg., CJDAF010034 (ICIPE); 1♂, ditto, 6–20.I.2012 (MT), R. Copeland leg., CJDAF010052 (ICIPE); 1♂ (metasoma lost), Rift Valley Prov., Matthews Range, Sarara campsite, shrubland, 1006 m alt., 1.00661°N, 37.38631°E, 15–29.XI.2015 (MT), R. Copeland leg., CJDAF010055 (ICIPE); 1♂, ditto, 29.XI–12.XII.2015 (MT), R. Copeland leg., CJDAF010056 (ICIPE); 1♂, Rift Valley Province, Matthews Range, riverine forest, near Wamba, 1459 m alt., 0.97984°N, 37.34599°E, 9–23.I.2016 (MT), R. Copeland leg., CJDAF010057 (ICIPE); 1♂, Central Province, Kamwana Forest, swept, near river, indigenous forest, 1824 m alt., 0.38852°S, 37.38458°E, 18.XII.2016, R. Copeland leg., CJDAF010058 (ICIPE); 2♀♀2♂♂, Western Prov., Kakamega forest, 00°14.13'N, 35°51.87'E, 20–27.XI.1999 (MT), R. Copeland leg., CJDAF010006–010007, 010022–010023 (CNCI); 1♂, Eastern Prov., Kasaala area, just inside isolated wood-land patch, 733 m alt., 2.07836°S, 38.22517°E, 3–17.



XII.2015 (MT), R. Copeland leg., CJDAF010031 (ICIPE); 1♂, ditto, 9–23.XII.2016 (MT), R. Copeland leg., CJDAF010059 (ICIPE); 1♂, Coast Province, Muhaka Forest, indigenous forest, 41 m alt., 4.32664°S, 39.52462°E, 23.VIII–6.IX.2015 (MT), R. Copeland leg., CJDAF010033 (ICIPE); 1♂, ditto, 10–24.IV.2015 (MT), R. Copeland leg., CJDAF010060 (ICIPE); 1♀, ditto, 1–15.XII.2015 (MT), R. Copeland leg., CJDAF010012 (ICIPE); 1♂, Coast Prov., Marenje Forest, indigenous forest, 76 m alt., 4.52814°S, 39.45814°E, 25.VII–8.VIII.2014 (MT), R. Copeland leg., CJDAF010032 (ICIPE); 1♂, ditto, 11–25.VII.2014 (MT), R. Copeland leg., CJDAF010036 (ICIPE); 1♂, ditto, 8–22.VIII.2014 (MT), R. Copeland leg., CJDAF010038 (ICIPE); 1♂, ditto, 22.VIII–5.IX.2014 (MT), R. Copeland leg., CJDAF010037 (ICIPE); 1♂, Coast Province, Mrima Hill Forest, indigenous forest, 212 m alt., 4.48576°S, 39.24028°E, 27.XI–11.XII.2011 (MT), R. Copeland leg., CJDAF010035 (ICIPE); 2♂♂, Coast Province, Kasigau Mountain, indigenous forest, 1065 m alt., 3.82700°S, 38.64875°E, 19.X–2.IX.2011 (MT), R. Copeland leg., CJDAF010039–010040 (1♂-ICIPE, 1♂-KNA); MALAWI: 2♂♂, Chitipa District, Jembya Reserve, 18 km South South East of Chisenga, 1870 m alt., 10°08'S, 33°27'E, 11–20.XII.1988 (MT), J. Rawlins & S. Thompson leg., CJDAF010024–010025 (CNCI); SOUTH AFRICA: 1♂, Natal, Lake St. Lucia, 3–11.X.1977 (MT), J. G. H. Londt leg., CJDAF010061 (CNCI).

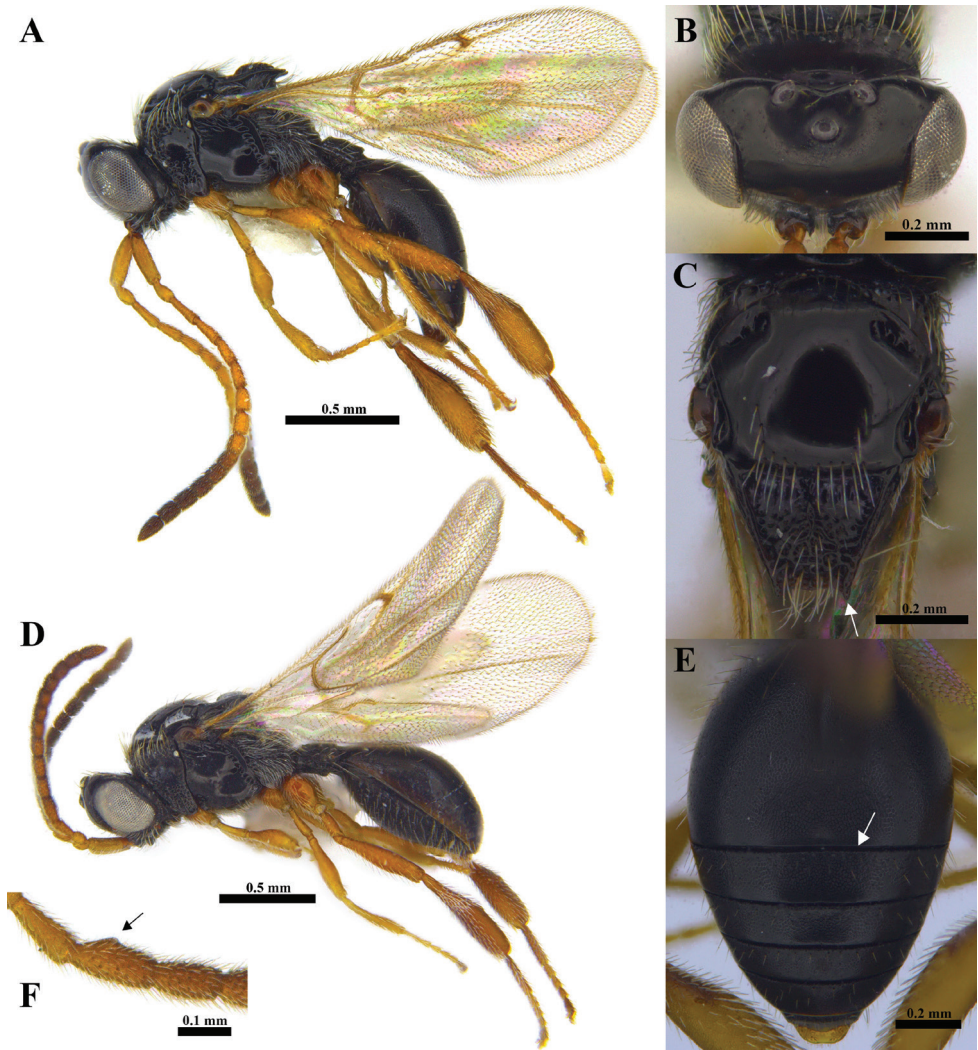
**Description.** Holotype (Female). *Head.* Head in dorsal view much wider than long (35:19), slightly wider than width of mesosoma (35:28) (Fig. 1A–B); POL: 15; LOL: 9; OOL: 14 (Fig. 1B); ocelli large, LOL slightly longer than diameter of lateral ocellus (9:8); vertex behind ocelli nearly flat in lateral view; eye large and without setae; inner orbits, frons and temple with few sparse setae; above antennal sockets, face and cheek with few long setae; antenna much shorter than body length (2:3); scape and pedicel with scattered setae; A3–A15 with dense and short setae; antennal segments in following proportions (length:width): 15:4; 5:3; 10:2.5; 10:3; 7:3; 7:3; 5.5:3; 5:4; 4:4; 4:4; 4:4; 4:4; 4:4; 8:4 (Fig. 1A).

*Mesosoma.* Pronotum in dorsal view smooth with whitish long setae along posterior margin; pronotal shoulders angled; lateral pronotum strongly punctate with whitish long setae upper margin except smooth and concave medially; mesoscutum smooth and convex, with very long setae along posterior margin; notauli present anteriorly, pits merged with the curved notauli (Fig. 1C); humeral sulcus deep and long, longer than length of tegula (3:2); scutellum coarsely rugose, distinctly raised and convex, straight lateral rims, posterior rim truncate with strongly prominent posterolateral corners (Fig. 1C); anterior scutellar pit large and deep, as long as remaining scutellar disc, crenulate at bottom, median keel distinct (Fig. 1C); mesopleuron smooth with deep crenulate line along posterior margin; metapleuron rugose and covered with dense whitish long setae.

*Wings.* Radial cell open, as venation becomes weak apically (Fig. 1A).

*Legs.* Fore and mid legs slender; hind tibiae incrassate posteriorly, its maximum width much wider than hind femora (3:2).

*Metasoma.* Petiole short and expanded (2:3), with strong costae dorsally; tergites strongly rugulose; base of second tergite with several short costae basally and very short



**Figure 1.** *Ismarus africanus* sp. n. (A–C, E Female; D, F Male). A, D Habitus in lateral view; B Head in dorsal view; C Mesosoma in dorsal view; E Metasoma in dorsal view; F Antenna (A3–A5).

median furrow, 0.15× length of second tergite; sutures between tergites complete and deeply impressed (Fig. 1E).

**Colour.** Body black; antennae yellowish-brown except A9–A15 brown; tegulae brown; legs uniformly yellowish-brown; wings hyaline, covered with brown setae.

**Measurements.** Head length 0.54 mm, width 1.01 mm; mesosoma length 1.22 mm, width 0.85 mm; metasoma length 1.70 mm; fore wing length 2.79 mm; body length 3.46 mm.

**Male** (Allotype). Body length 2.34 mm. Similar to female, but POL: 9; LOL: 4; OOL: 7; antenna brown except scape and pedicel yellowish, legs yellowish-brown except hind tibiae and tarsi brown; base of second tergite with several short costae basally

and median furrow deep basally to shallow apically, extending half the length of second tergite; blade-like carina on A4, extending 0.6× length of A4 (Fig. 1F); antennal segments in following proportions: 11:4; 6:3.5; 7:3; 8:4; 7:4; 6:4; 6:4; 6:4; 5:4; 5:4; 5:4; 5:4; 9:3.5 (Fig. 1D).

**Variation.** Body length 1.76–3.46 mm, in both sexes. Body colour black, dark brown to brown; colour of female antenna yellowish-brown except segments 8–15 to 10–15 brown, male antenna brown except A1–A2 or A1–A3 yellowish; head weakly or strongly rugulose in both sexes; mesoscutum smooth to weakly rugulose in both sexes; blade-like carina on A4, extending 0.6–1.0× length of A4; posterior rim of scutellum truncated to slightly emarginated in both sexes; median furrow extending to 0.15–0.60× length of second tergite in both sexes.

**Distribution.** Cameroon, Kenya, Malawi, South Africa.

**Etymology.** This species is named *africanus* from the Latin adjective meaning African, because it is widely distributed and the most common species of *Ismarus* in Africa.

***Ismarus apertus* sp. n.**

<http://zoobank.org/9239A103-7264-45CD-A945-970EBC822808>

Figure 2A–G

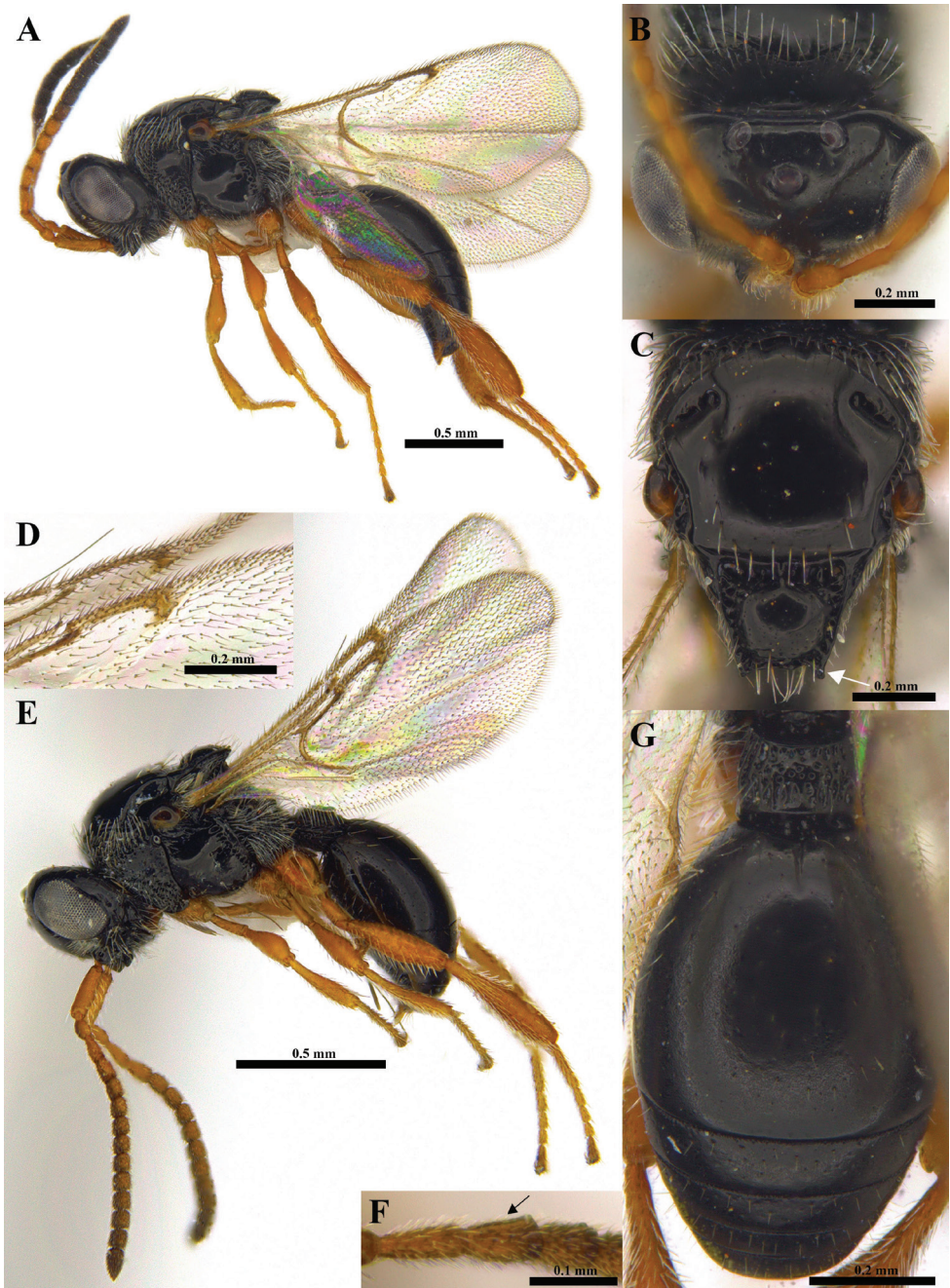
**Diagnosis.** The new species can be differentiated from all *Ismarus* species by the completely open radial cell. *Ismarus apertus* sp. n. is similar to *I. africanus* sp. n. It differs mainly in the radial cell and sculpture of head and scutellum: in *I. apertus* sp. n., radial cell completely open, radial vein almost absent, head and scutellum smooth; in *I. africanus* sp. n., radial cell open, as venation becomes weak apically, head and scutellum rugose or rugulose

**Type material** (1♀1♂). *Holotype*, 1♀, KENYA: Eastern Province, Mulu Musingila farm, farmland near small, seasonally wet area, 689 m alt., 2.11412°S, 38.23989°E, 13–27.XII.2016 (MT), R. Copeland leg., CJDAF010063 (deposited in NMK). *Allotype*, 1♂, KENYA: Eastern Prov., Kasaala area, just inside isolated woodland patch, 733 m alt., 2.07836°S, 38.22517°E, 3–17.XII.2015 (MT), R. Copeland leg., CJDAF010064 (ICIPE).

**Description.** *Holotype* (Female). *Head.* Head in dorsal view much wider than long (11:7), slightly wider than width of mesosoma (11:9) (Fig. 2A–B); POL: 11; LOL: 6; OOL: 9 (Fig. 2B); ocelli large, LOL slightly longer than diameter of lateral ocellus (4:3); vertex behind ocelli nearly flat in lateral view; eye large and without setae; inner orbits, frons and temple with few sparse setae; above antennal sockets, face and cheek with few long setae; antenna much shorter than body length (27:37); scape and pedicel with scattered setae; A3–A15 with dense and short setae; antennal segments in following proportions (length:width): 18:4; 7:4; 12:2.5; 10:3; 8:3.5; 7:4; 6:4.5; 6:5; 6:5; 6:5; 6:5; 6:5; 9:5 (Fig. 2A).

*Mesosoma.* Pronotum in dorsal view punctate with whitish long setae along posterior margin; pronotal shoulders angled; lateral pronotum predominantly punctate except





**Figure 2.** *Ismarus apertus* sp. n. (A–C, G Female D–F Male). A, E Habitus in lateral view B Head in dorsal view C Mesosoma in dorsal view D Radial vein of fore wing F Antenna (A3–A5) G Metasoma in dorsal view.

smooth and slightly concave in the middle; mesoscutum smooth and convex with pairs of long setae in front of scutellar pit; notauli present anteriorly, pits merged with the curved notauli (Fig. 2C); humeral sulcus deep and long, much longer than length of tegula

(11:5); scutellum smooth and distinctly convex, lateral rims straight, posterior rim slightly emarginate with strongly prominent posterolateral corners (Fig. 2C); anterior scutellar pit small and deep, much shorter than remaining scutellar disc, crenulate at bottom, median keel weakly present (Fig. 2C); mesopleuron smooth with deep crenulate line along posterior margin; metapleuron punctate-rugose and covered with dense whitish long setae.

*Wings.* Radial cell completely open, radial vein almost absent (Fig. 2D).

*Legs.* Fore and mid legs slender; hind tibiae incrassate posteriorly, its maximum width slightly wider than hind femora (5:4).

*Metasoma.* Petiole short and distinctly expanded (23:39), strongly punctate; tergites matte, with fine micropunctures; base of second tergite with several short costae basally and very short median furrow, 0.15× length of second tergite; sutures between tergites complete and deeply impressed (Fig. 2G).

*Colour.* Body black; antennae yellowish-brown except A9–A15 brown, tegulae dark brown and legs uniformly yellow; wings hyaline, covered with brown setae.

*Measurements.* Head length 0.49 mm, width 0.77 mm; mesosoma length 0.92 mm, width 0.64 mm; metasoma length 1.18 mm; fore wing length 2.00 mm; body length 2.59 mm.

*Male* (Allotype). Body length 1.88 mm. Similar to female, but antennae brown except scape yellow; base of second tergite with several short costae basally and median furrow completely absent; blade-like carina on A4 percurrent (Fig. 2F); antennal segments in following proportions (length:width): 15:5; 6:4; 7:3; 7:3.5; 5:3.5; 5:4; 4:4; 4:4; 4:4; 4:4; 4:4; 8:4 (Fig. 2E).

**Distribution.** Kenya.

**Etymology.** The specific name *apertus* is derived from the Latin adjective which means open.

### *Ismarus bicolor* sp. n.

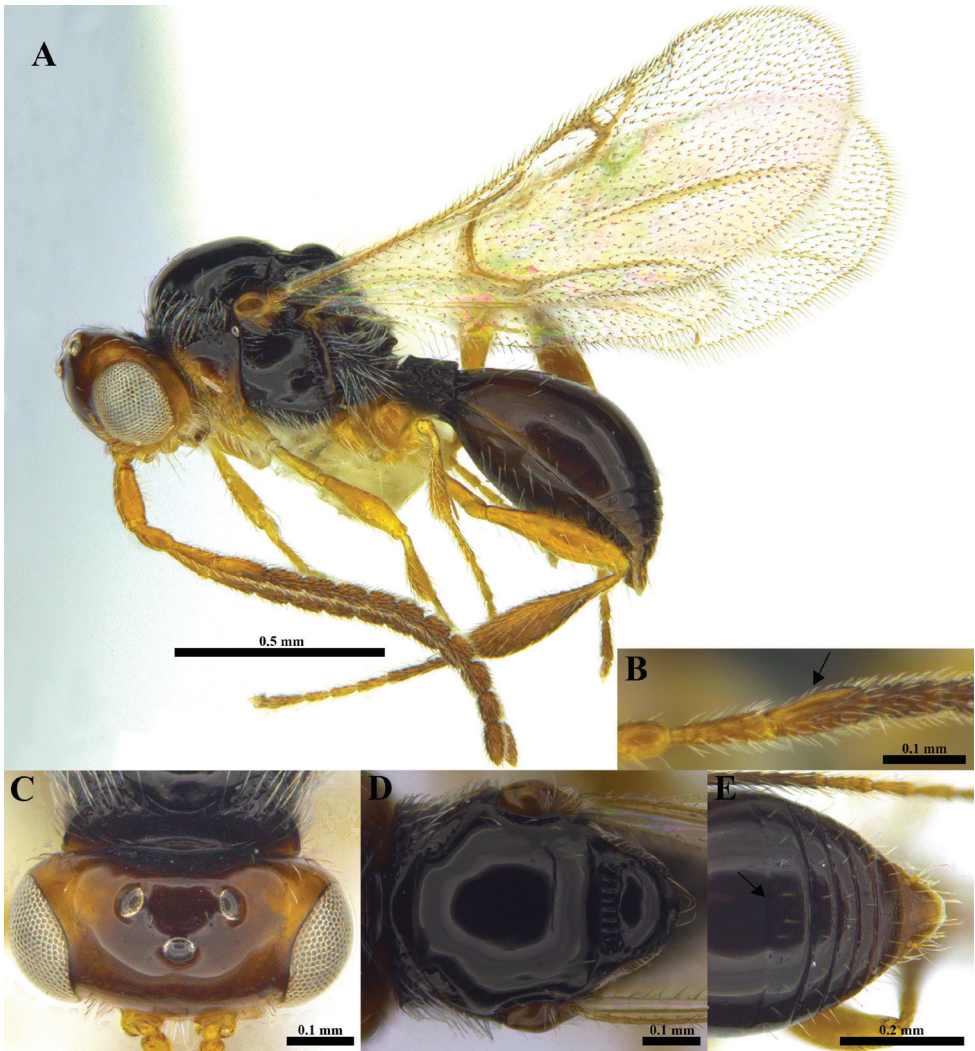
<http://zoobank.org/695E1872-4257-4B8F-B23A-93F537342143>

Figure 3A–E

**Diagnosis.** *Ismarus bicolor* sp. n. is similar to *I. flavigena* Masner, 1976 from the Nearctic Region. It differs mainly in the antenna colour, POL/OOL ratio and radial cell/marginal vein ratio: in *I. flavigena*, antenna dirty yellow ventrally and slightly darker dorsally, POL as long as OOL, radial cell as long as marginal vein; in *I. bicolor* sp. n., antenna brown except A1–A3 yellow, POL longer than OOL, radial cell 0.55× as long as length of marginal vein.

**Type material** (2♂♂). *Holotype*, 1♂, KENYA: Rift Valley Prov., Nakuru National Park, 1,796 m alt., 0°21.078'S, 36°03.477'E, 23.IV–14.V.2006 (MT), R. Copeland leg., CJDAF010065 (deposited in CNCI). *Paratype*, CAMEROON: 1♂, North West Province, Bambili, 19.XII.1981, S. Compton leg., CJDAF010066 (CNCI).

**Description.** *Holotype* (Male). *Head.* Head in dorsal view much wider than long (13:7), slightly wider than width of mesosoma (26:23) (Fig. 3A, C); POL: 9; OL: 5; OOL: 7 (Fig. 3C); ocelli large, LOL slightly longer than diameter of lateral ocellus



**Figure 3.** *Ismarus bicolor* sp. n., male. **A** Habitus in lateral view **B** Antenna (A3–A5) **C** Head in dorsal view **D** Mesosoma in dorsal view **E** Metasoma in dorsal view.

(11:10); vertex behind ocelli nearly flat in lateral view; eye large and without setae; inner orbits, frons and temple with few sparse setae; above antennal sockets, face and cheek with few long setae; antenna much shorter than body length (7:10); scape and pedicel with scattered setae; A3–A14 with dense and short setae; blade-like carina on A4 percurrent (Fig. 3B); antennal segments in following proportions (length:width): 11:4; 6:3; 8:2.5; 8:3; 5.5:3; 5.5:3; 5:3; 5:3; 5:3; 5:3; 5:3; 5:3; 5:3; 7:3 (Fig. 3A).

*Mesosoma.* Pronotum in dorsal view punctate-rugose with whitish long setae; pronotal shoulders angled; upper part of lateral pronotum smooth, bare and broadly convex medially; lower part of lateral pronotum with setigerous punctures; mesoscutum smooth and convex; notauli present with 5 small pits on anterior margin (Fig. 3D);



humeral sulcus deep and long, as long as length of tegula; scutellum smooth and slightly convex, posterior rim rounded (Fig. 3D); anterior scutellar pit small and deep, much shorter than remaining scutellar disc, distinctly crenulate at bottom, median keel absent (Fig. 3D); mesopleuron smooth with deep crenulate line along posterior margin; metapleuron reticulate and covered with dense whitish long setae.

*Wings.* Radial cell completely closed, 1.6× as long as wide and 0.55× as long as marginal vein (Fig. 3A).

*Legs.* Fore and mid legs slender; hind tibiae incrassate posteriorly, its maximum width slightly wider than hind femora (10:9).

*Metasoma.* Petiole subquadrate, with strong costae dorsally; base of second tergite with several short costae basally and very short median furrow, extending 0.15× length of second tergite; suture between T2 and T3 obsolete but the following sutures between tergites distinctly impressed (Fig. 3E).

*Colour.* Head yellow to yellowish-brown except frons, around the ocelli and median part of vertex brown, mandibles whitish-yellow with reddish tips; mesosoma black except lower half of lateral pronotum yellow; metasoma brown except petiole black; tegulae yellowish-brown; antennae brown except A1–A3 yellow; legs yellow except hind tibiae and tarsi brown; wings hyaline, covered with brown setae.

*Measurements.* Head length 0.28 mm, width 0.52 mm; mesosoma length 0.59 mm, width 0.46 mm; metasoma length 0.78 mm; fore wing length 1.58 mm; Body length 1.65 mm.

Female. Unknown.

**Variation.** Body length 1.65–2.09 mm. Paratype with metasomal suture between T2 and T3 well impressed.

**Distribution.** Cameroon, Kenya.

**Etymology.** This species is named *bicolor*, the Latin adjective meaning of two colours, because of the colour of the head.

### ***Ismarus goodrichi* sp. n.**

<http://zoobank.org/9E8F8A80-A31F-4D15-8BF5-1BB28F9F759C>

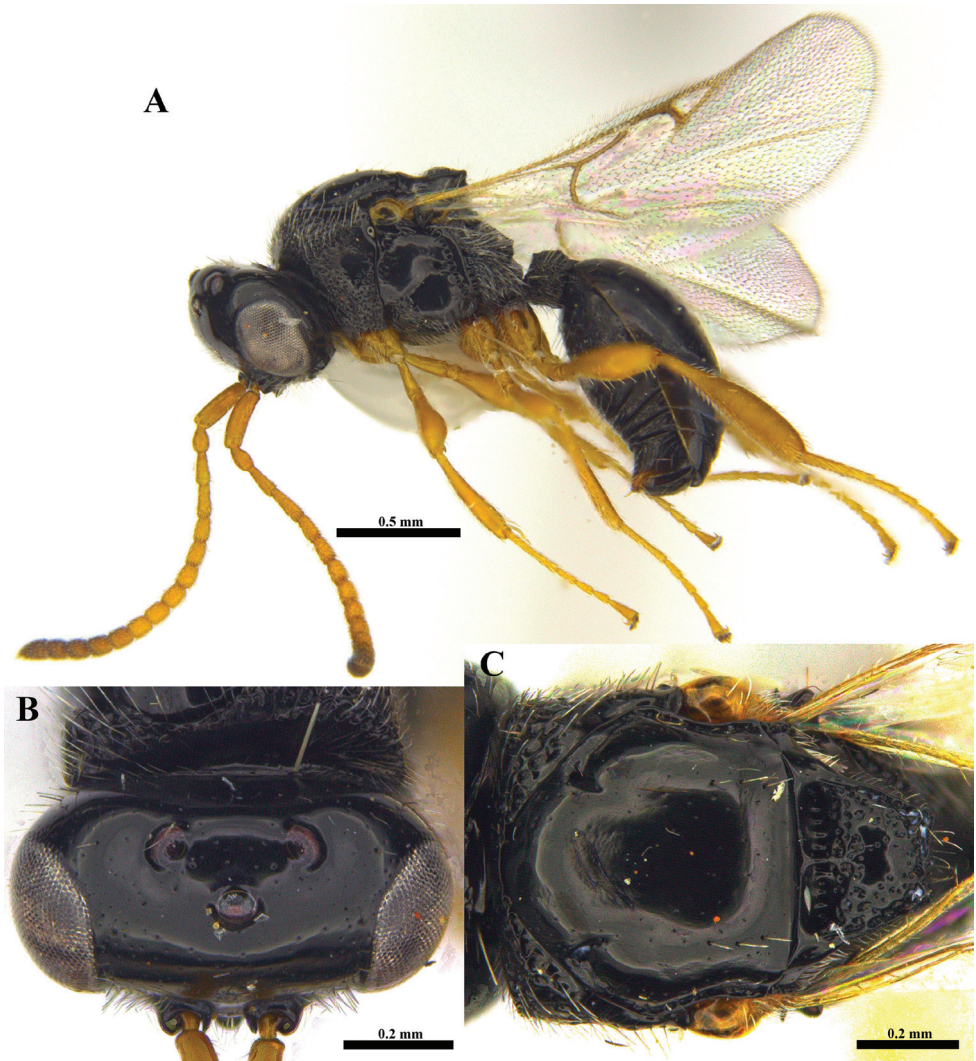
Figure 4A–C

**Diagnosis.** *Ismarus goodrichi* sp. n. is similar to *I. halidayi* Förster, 1850. It differs mainly in the posterior rim of scutellum and furrow on base of T2: in *I. halidayi*, posterior rim of scutellum rounded and base of T2 with long median furrow, at least to half the length of tergite; in *I. goodrichi* sp. n., posterior rim of scutellum truncated and base of T2 with short median furrow, extending 0.2× length of tergite.

**Type material** (1♀). *Holotype*, 1♀, KENYA: Eastern Province, Kasaala area, woodland and grass, 740 m alt., 2.07486°S, 38.22530°E, 28.XI–4.XII.2013 (MT), J. Bukhebi & R. Copeland leg., CJDAF010067 (deposited in NMK).

**Description.** *Holotype* (Female). *Head.* Head in dorsal view much wider than long (20:11), slightly wider than width of mesosoma (8:7) (Fig. 4A–B); POL: 10;





**Figure 4.** *Ismarus goodrichi* sp. n., female. **A** Habitus in lateral view **B** Head in dorsal view **C** Mesosoma in dorsal view.

LOL: 7; OOL: 8 (Fig. 4B); ocelli large, LOL subequal to diameter of lateral ocellus; vertex behind ocelli nearly flat in lateral view; eye large and without setae; inner orbits, frons and temple with few sparse setae; above antennal sockets, face and cheek with few long setae; antenna much shorter than body length (13:19); scape and pedicel with scattered setae; A3–A15 with dense and short setae; antennal segments in following proportions (length:width): 17:5; 8:4.5; 10:3; 10:3.5; 7:4; 7:4; 7:5; 7:5; 7:5; 7:5; 7:5; 7:5; 11:5.5 (Fig. 4A).

*Mesosoma.* Pronotum in dorsal view rugose with whitish long setae; lateral pronotum predominantly rugose punctate except smooth and slightly concave in the middle; mesoscutum smooth and convex with pairs of long setae in front of scutellar pit; notauli

present anteriorly, pits merged with the curved notauli (Fig. 4C); humeral sulcus deep and long, much longer than length of tegula (16:11); anterior scutellar pit small and deep, much shorter than remaining scutellar disc, slightly crenulate at bottom, median keel weakly present; scutellum smooth with punctures and slightly convex, posterior rim truncate (Fig. 4C); mesopleuron smooth with deep crenulate line along posterior margin (Fig. 4C); metapleuron rugose and covered with dense whitish long setae.

*Wings.* Radial cell completely closed, 1.75× as long as wide and 0.95× as long as marginal vein (Fig. 4A).

*Legs.* Fore and mid legs slender; hind tibiae incrassate posteriorly, its maximum width slightly wider than hind femora (9:8).

*Metasoma.* Petiole short and distinctly expanded (3:5), punctate-rugose dorsally; tergites smooth, with scattered setigerous punctures; base of second tergite with several short costae basally and short median furrow, 0.20× length of second; sutures between tergites complete and deeply impressed.

*Colour.* Body black; antennae yellow except A12–A15 brown, tegulae and legs uniformly yellow; wings hyaline, covered with brown setae.

*Measurements.* Head length 0.46 mm, width 0.80 mm; mesosoma length 0.94 mm, width 0.71 mm; metasoma length 1.04 mm; fore wing length 1.99 mm; body length 2.43 mm.

Male. Unknown.

**Distribution.** Kenya.

**Etymology.** This species is named after Gerry Goodrich, a close friend of RSC and an old Kenya hand.

### *Ismarus halidayi* Förster, 1850

? *Entomia campanulata* Herrich-Schäffer, 1840: 127 (nomen dubium).

*Ismarus halidayi* Förster, 1850: 285.

*Ismarus longicornis* Thomson, 1858: 378. Synonymized by Kolyada and Chemyreva (2016).

*Ismarus mongolicus* Szabó, 1974: 23. Synonymized by Kolyada and Chemyreva (2016).

**Type material examined.** ♀ holotype of *I. mongolicus*: MONGOLIA: Central aimak, Tosgoni ovoo, 5–10 km North of von Ulan-Baator, 1500–1700 m alt., Exp. Dr. Z. Kaszab, 19–20, 23–24 Jul. 1968 (HNHM, Type No. 2622, Mus. Budapest); ♀ lectotype of *I. longicornis*: SWEDEN: “Sbg” [Sövdeborg], “Rh” [collector Carl David Emanuel Roth], “NHRS-HEVA 000003605” (NHRS).

**Additional material examined** (9♀♀3♂♂). SOUTH AFRICA: 1♀, Transvaal, Down’s Forest, 1350 m alt., 25 km West of Trichardtsdal, 23.XII.1985, W. R. Mason leg., CJDAF010068 (CNCI); 1♂, Port St. John, Pondoland, I.1924, R. E. Turner leg., CJDAF010078 (NHMUK); 2♀♀, Transvaal, 1350 m alt., Trichardtsdal, 25 km West of The Downs, 23.XII.1985, W.R.M. Mason leg., CJDAF010069–010070 (CNCI); 2♀♀, Transvaal, Down’s Forest, 1350 m alt., 30 km West of Trichardtsdal,

30.XII.1985, sweep, M. Sanborne leg., CJDAF010071–010072 (CNCI); 4♀♀, Cape Province, Outeniqua Pass, 700 m alt., 10 km North of George, 12–15.I.1986 (MT), W.R.M. Mason leg., CJDAF010073–010076 (CNCI); 1♂♂, W. Cape, Cape Town, above Tokai Forest, Constantiaberg, above Donkerboskloof, 460 m alt., 34°02'S, 18°23.5'E, 25.I–2.II.1994 (MT), S. van Noort leg., CJDAF010079 (CNCI), mesic mountain fynbos on sandstone, *Protea* dominated; 1♂♂, Port St. John, Pondoland, I.1924, R. E. Turner leg., CJDAF010077 (NHMUK).

**Distribution.** AFROTROPICAL: South Africa (new record); NEARCTIC: Canada, USA; PALAEARCTIC: Azerbaijan, Bulgaria, China (Ningxia, Tibet), Czech Republic, Denmark, Finland, Georgia, Germany, Hungary, Japan, Mongolia, Netherlands, Norway, Republic of Ireland, Russia., South Korea, Sweden, United Kingdom; ORIENTAL: China (Sichuan, Guizhou, Yunnan).

**Host.** Reared from *Anteon jurineanum* Latreille and *A. infectum* (Haliday) (Dryinidae) (Chambers 1955; Olmi 2000).

**Remarks.** This species, widely distributed in the Nearctic, Palaearctic and Oriental regions, is here reported for the first time from the Afrotropical region (South Africa).

***Ismarus kakamegensis* sp. n.**

<http://zoobank.org/19C63507-862E-4570-98A0-A063FFD12D06>

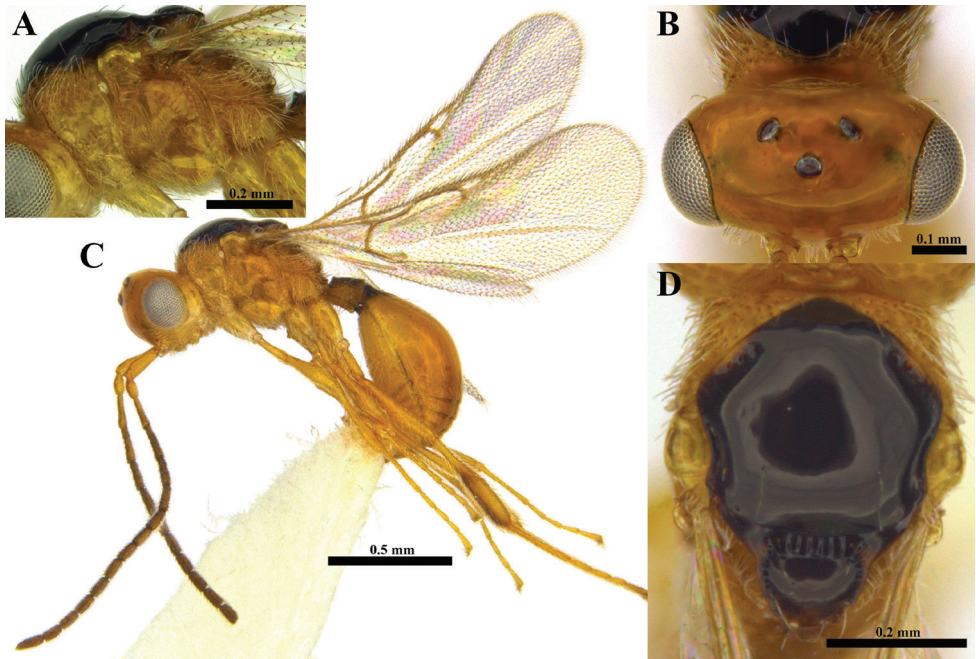
Figure 5A–D

**Diagnosis.** *Ismarus kakamegensis* sp. n. is similar to *I. clarkae* Masner, 1976 from the Nearctic region. It differs mainly in the antenna colour, A1/A3/A4 ratio and metasomal sutures: in *I. clarkae* antenna yellow with whitish ventral side of scape, A1 much longer than A3 and A4, metasoma after T2 mostly obsolete or incomplete; in *I. kakamegensis* sp. n. antenna brown with yellow scape and pedicel, A1 almost equal length to A3 and A4, metasoma after T2 with 4 distinct sutures.

**Type material** (1♀). *Holotype*, 1♀, KENYA: Kakamega District, Isecheno, Isecheno Nature Reserve, 0°24'N, 34°87'E, 21–28.II.2002 (MT), R. R. Snelling leg., CJDAF010080 (deposited in CNCI).

**Description.** Holotype (Female). *Head.* Head in dorsal view much wider than long (5:3), wider than width of mesosoma (5:4) (Fig. 5B–C); POL: 12; LOL: 7; OOL: 11 (Fig. 5B); ocelli large, LOL slightly longer than diameter of lateral ocellus (7:6); vertex behind ocelli nearly flat in lateral view; eye large and without setae; inner orbits, frons and temple with few sparse setae; above antennal sockets, face and cheek with few long setae; antenna long, as long as body length; scape and pedicel with scattered setae; A3–A15 with dense and short setae; antennal segments in following proportions (length:width): 11:4; 7:3; 10:2; 11:2; 8:2; 7:2; 7:2.5; 6:2.5; 6:2.5; 6:2.5; 6:2.5; 6:2.5; 5:2.5; 9:2.5 (Fig. 5C).

*Mesosoma.* Pronotum in dorsal view punctate with whitish long setae; pronotal shoulders angled; lateral pronotum predominantly smooth and concave except lower margins punctate with whitish setae; mesoscutum smooth and convex; notauli pre-



**Figure 5.** *Ismarus kakamegensis* sp. n., female. **A** Mesosoma in lateral view **B** Head in dorsal view **C** Habitus in lateral view **D** Mesosoma in dorsal view.

sent with 3 small pits on anterior margin (Fig. 5D); humeral sulcus deep and long, longer than length of tegula (5:4); scutellum smooth and slightly convex, posterior rim rounded (Fig. 5D); anterior scutellar pit large and deep, much shorter than remaining scutellar disc, distinctly crenulate at bottom, median keel absent (Fig. 5D); mesopleuron smooth with deep crenulate line along posterior margin (Fig. 5A); metapleuron rugose and covered with dense whitish long setae.

*Wings.* Radial cell completely closed,  $1.6\times$  as long as wide and  $0.55\times$  as long as marginal vein (Fig. 5C).

*Legs.* Fore and mid legs slender; hind tibiae incrassate posteriorly, its maximum width slightly wider than hind femora (11:9).

*Metasoma.* Petiole subquadrate (10:11), with strong costae dorsally; tergites smooth, with scattered setigerous punctures; base of second tergite with several short costae basally and very short median furrow,  $0.15\times$  length of second tergite; suture between T2 and T3 obsolete, following sutures complete and deeply impressed.

*Colour.* Body yellow except face whitish-yellow, mesoscutum and scutellum blackish, dorsal part of petiole and basal part of T1 darkened; antennae brown except scape and pedicel yellow, tegulae and legs uniformly yellow; wings hyaline, covered with brown setae.

*Measurements.* Head length 0.33 mm, width 0.55 mm; mesosoma length 0.61 mm, width 0.43 mm; metasoma length 0.82 mm; fore wing length 1.69 mm; body length 1.76 mm.



Male. Unknown.

**Distribution.** Kenya.

**Etymology.** This species is named after the type locality.

***Ismarus kenyensis* sp. n.**

<http://zoobank.org/8E3E41C6-254E-4B0F-8917-BB58AD9A9E30>

Figure 6A–E

**Diagnosis.** *Ismarus kenyensis* sp. n. is similar to *I. minutus* sp. n. It differs mainly in the antennal segments A1/A3/A4 ratio, radial cell/marginal vein ratio and length of median longitudinal furrow on T2: in *I. minutus* sp. n. A1 much longer than A3 and A4, radial cell shorter than half length of marginal vein, T2 with median furrow extending to 0.10× of segment; in *I. kenyensis* sp. n., A1 slightly longer than A3 and equal length to A4, radial cell longer than half length of marginal vein, T2 with median furrow extending to 1/3 of segment.

**Type material** (1♀). *Holotype*, 1♀, KENYA: Eastern Province, Nyambene Hills, Itieni Forest at bottom, edge of indigenous forest, near forest station, 2,142 m alt., 0.24433°N, 37.87016°E, 18.IX–2.X.2011, R. Copeland leg., CJDAF010081 (deposited in NMK).

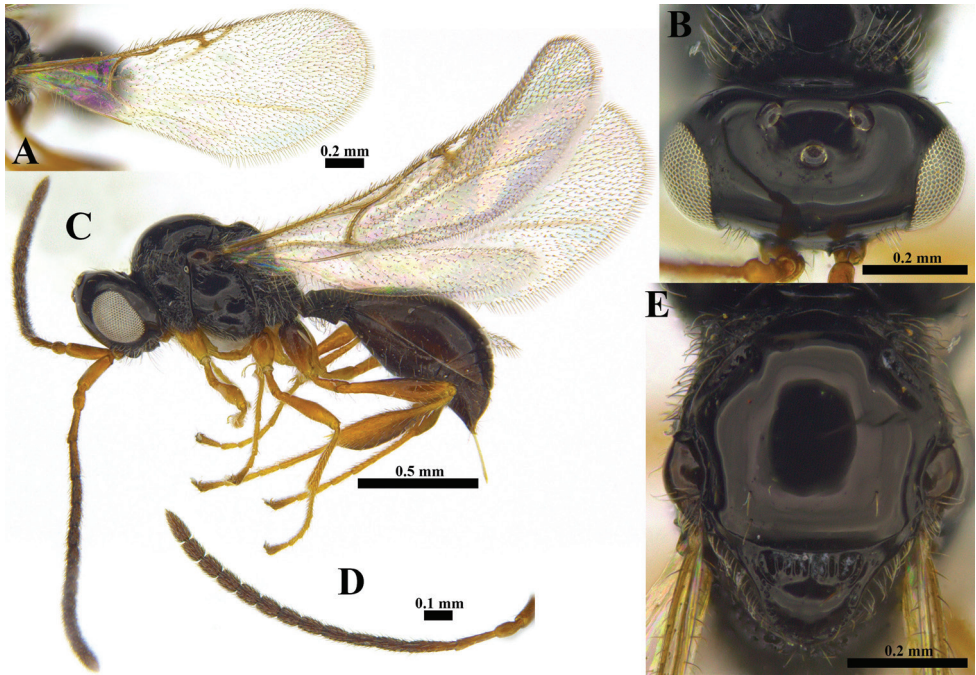
**Description.** Holotype (Female). *Head.* Head in dorsal view much wider than long (7:4), slightly wider than width of mesosoma (6:5) (Fig. 6B–C); POL: 11; LOL: 6; OOL: 9 (Fig. 6B); ocelli large, LOL slightly longer than diameter of lateral ocellus (6:5); vertex behind ocelli nearly flat in lateral view; eye large and without setae; inner orbits, frons and temple with few sparse setae; above antennal sockets, face and cheek with few long setae; antenna slightly shorter than body length (7:8); scape and pedicel with scattered setae; A3–A15 with dense and short setae; antennal segments in following proportions (length:width): 12:4; 7:3; 10:1.5; 12:2; 9:2.5; 7:2.5; 6:3; 6:3; 5:3; 5:3; 5:3; 5:3; 5:3; 9:3 (Fig. 6D).

*Mesosoma.* Pronotum in dorsal view rugose with whitish long setae; lateral pronotum predominantly rugose-punctate except smooth and concave in the middle; mesoscutum smooth and convex; notauli present with 4 small pits on anterior margin (Fig. 6E); humeral sulcus deep and long, much longer than length of tegula (12:7); anterior scutellar pit small and deep, much shorter than remaining scutellar disc, distinctly crenulate at bottom, median keel absent; scutellum smooth and slightly convex, posterior rim rounded (Fig. 6E); mesopleuron smooth with deep crenulate line along posterior margin (Fig. 6E); metapleuron rugose and covered with dense whitish long setae.

*Wings.* Radial cell completely closed, 1.8× as long as wide and 0.6× as long as marginal vein (Fig. 6A).

*Legs.* Fore and mid legs slender; hind tibiae incrassate posteriorly, its maximum width slightly wider than hind femora (14:11).

*Metasoma.* Petiole slightly longer than width (6:5), with strong costae dorsally; tergites smooth, with scattered setigerous punctures; base of second tergite with several



**Figure 6.** *Ismarus kenyensis* sp. n., female. **A** Fore wing **B** Head in dorsal view **C** Habitus in lateral view **D** Antenna **E** Mesosoma in dorsal view.

short costae basally and short median furrow, 0.33× length of second; suture between T2 and T3 obsolete, following sutures complete and deeply impressed.

**Colour.** Head and mesosoma dark brown except antennae yellow with A12–A15 brown, tegulae brown, legs yellow with hind coxae and femora brown; metasoma brown except petiole dark brown; wings hyaline, covered with brown setae.

**Measurements.** Head length 0.34 mm, width 0.57 mm; mesosoma length 0.72 mm, width 0.49 mm; metasoma length 0.90 mm; fore wing length 1.86 mm; body length 1.96 mm.

Male. Unknown.

**Distribution.** Kenya.

**Etymology.** The species is named after the type locality.

***Ismarus laevigatus* sp. n.**

<http://zoobank.org/7EB3493D-2BA3-49F5-BA95-28E3619B5DBF>

Figure 7A–E

**Diagnosis.** *Ismarus laevigatus* sp. n. is similar to *I. spinalis* Kolyada & Chemyreva, 2016 from the Palearctic region. It differs mainly in the female antennal segments ratio and male antennal structure: in *I. spinalis* A7–A14 subquadrate, male A3 and A4 with sharp keels; in *I. laevigatus* sp. n. A7–A14 slightly longer than wide, male A4 with blade carina.

**Type material** (2♀♀9♂♂). *Holotype*, 1♀, SOUTH AFRICA: 75 km West South West of Natal, Estcourt, Cathedral Peaks Forest Station, 1500 m alt., 7–31.XII.1979 (MT), S. & J. Peck leg., CJDAF010082 (deposited in CNCI). *Allotype*, 1♂, SOUTH AFRICA: 75 km West South West of Natal, Estcourt, Cathedral Peaks Forest Station, 1500 m alt., 7–31.XII.1979 (MT), S. & J. Peck leg., CJDAF010084 (CNCI). *Paratype*, SOUTH AFRICA: 1♀5♂♂, 75 km West South West of Natal, Estcourt, Cathedral Peaks Forest Station, 1500 m alt., 7–31.XII.1979 (MT), S. & J. Peck leg., CJDAF010083, 010085–010089 (CNCI); 1♂, ditto, 11–31.X.1979 (MT), S. & J. Peck leg. (CNCI); 1♂, E. Cape Province, Katberg, 4000 ft alt., XII.1932, R. E. Turner leg., CJDAF010090 (NHMUK); 1♂, ditto, 14–26.XI.1932, R. E. Turner leg., CJDAF010091 (NHMUK).

**Description.** *Holotype* (Female). *Head.* Head in dorsal view much wider than long (3:2), slightly wider than width of mesosoma (25:23) (Fig. 7A–B); POL: 11; LOL: 6; OOL: 9 (Fig. 7B); ocelli large, LOL slightly longer than diameter of lateral ocellus (12:11); vertex behind ocelli nearly flat in lateral view; eye large and without setae; inner orbits, frons and temple with few sparse setae; above antennal sockets, face and cheek with few long setae; antenna much shorter than body length (13:18); scape and pedicel with scattered setae; A3–A15 with dense and short setae; antennal segments in following proportions (length:width): 18:5; 7:4; 10:3; 10:2.5; 8:4; 6:4.5; 6:4.5; 6:4.5; 6:5; 6:5; 6:5; 6:5; 6:5; 6:6; 11:5 (Fig. 7A).

*Mesosoma.* Pronotum in dorsal view punctate-rugose with whitish long setae; pronotal shoulders angled; upper part of lateral pronotum smooth and concave in the middle, lower part of lateral pronotum punctate-rugose; mesoscutum smooth and convex with pairs of long setae in front of scutellar pit; notauli present anteriorly as large pits (Fig. 7D); humeral sulcus deep and short, as long as length of tegula; scutellum smooth and slightly convex, posterior rim rounded (Fig. 7D); anterior scutellar pit large and deep, shorter than remaining scutellar disc, slightly crenulate at bottom, median keel present (Fig. 7D); mesopleuron smooth with deep crenulate line along posterior margin; metapleuron punctate to rugose and covered with dense whitish long setae.

*Wings.* Radial cell completely closed, 2.1× as long as wide and as long as marginal vein (Fig. 7A).

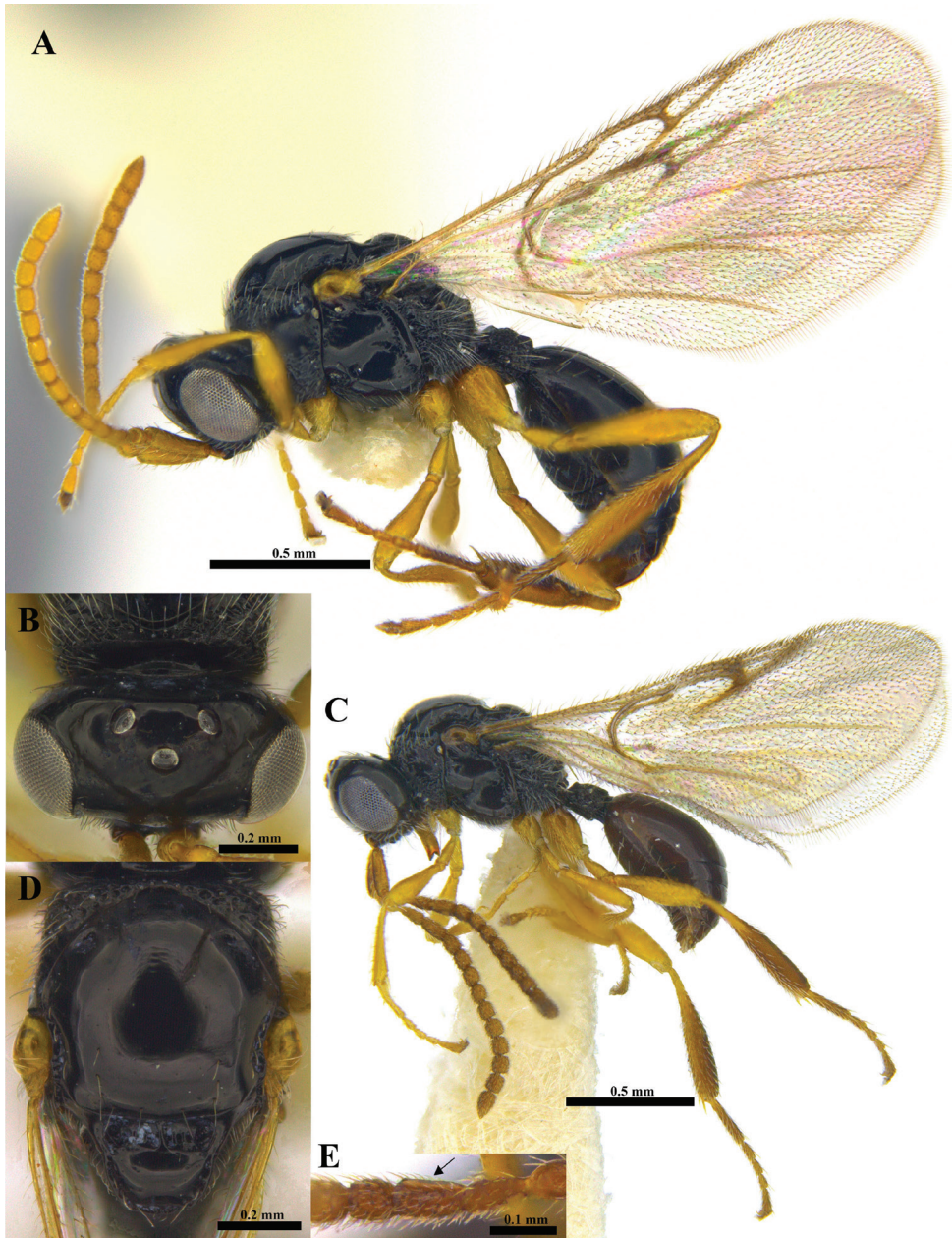
*Legs.* Fore and mid legs slender; hind tibiae incrassate posteriorly, its maximum width slightly wider than hind femora (9:8).

*Metasoma.* Petiole subquadrate, rugose dorsally; tergites smooth, with scattered setigerous punctures; base of second tergite with several short costae basally and very long median furrow, 0.90× length of second; sutures between tergites complete and deeply impressed.

*Colour.* Body black; antennae, tegulae and legs uniformly yellow except inner part of tibiae brown; wings hyaline, covered with brown setae.

*Measurements.* Head length 0.47 mm, width 0.74 mm; mesosoma length 0.97 mm, width 0.69 mm; metasoma length 1.20 mm; fore wing length 2.52 mm; body length 2.63 mm.





**Figure 7.** *Ismarus laevigatus* sp. n. (**A–B, D** Female **C, E** Male). **A, C** Habitus in lateral view **B** Head in dorsal view **D** Mesosoma in dorsal view **E** Antenna (A3–A5).

*Male* (Allotype). Body length 1.88 mm. Similar to female, POL: 8; LOL: 5; OOL: 7; body dark brown except metasoma brown, antennae brown except scape and pedicel yellow, legs yellow except hind tibiae and tarsi yellowish brown to brown; anterior margin of lateral pronotum rugose; blade-like carina on A4 percurrent (Fig. 7E); antennal

segments in following proportions: 13:4; 7:3.5; 7:3.5; 7:3.5; 5:4; 5:4; 5:4; 5:4; 5:4; 5:4; 5:4; 5:4; 8:4 (Fig. 7C).

**Variation.** Body length 1.88–2.63 mm in both sexes. Median furrow very long extending 0.8–0.9× length of second tergite in both sexes.

**Distribution.** South Africa.

**Etymology.** The specific name *laevigatus* is derived from the Latin adjective which means smooth.

***Ismarus madagascariensis* sp. n.**

<http://zoobank.org/C77056B3-F7E6-4DD1-B246-9F34291A0F82>

Figure 8A–C

**Diagnosis.** *Ismarus madagascariensis* sp. n. is quite distinct from other described *Ismarus* species in scutellum shape. Scutellum coarsely punctate, convex and posterior rim truncate with prominent posterolateral corners is unique characters among *Ismarus*.

**Type material** (1♀). *Holotype*, 1♀, MADAGASCAR: near Ambilobe, Ankarana, dry deciduous forest in canyon, IX.1986 (MT), S. V. Fowler leg., CJDAF010092 (deposited in DNPC).

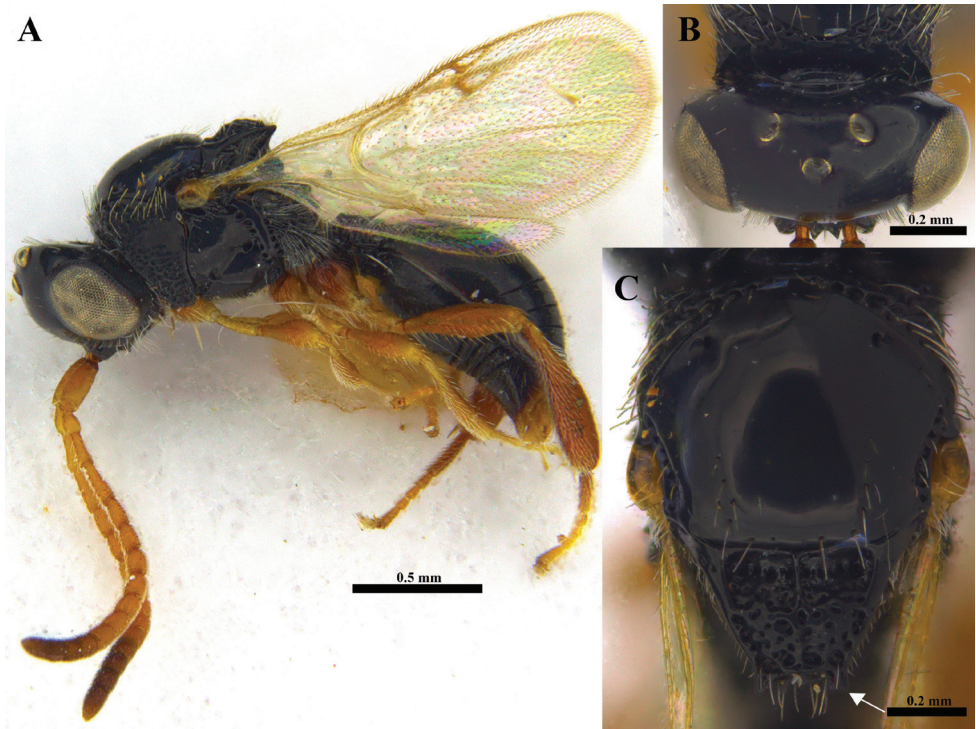
**Description.** Holotype (Female). *Head.* Head in dorsal view much wider than long (26:15), slightly wider than width of mesosoma (29:26) (Fig. 8A–B); POL: 12; LOL: 7; OOL: 8 (Fig. 8B); ocelli large, LOL slightly longer than diameter of lateral ocellus (13:11); vertex behind ocelli nearly flat in lateral view; eye large and without setae; inner orbits, frons and temple with few sparse setae; above antennal sockets, face and cheek with few long setae; antenna much shorter than body length (7:11); scape and pedicel with scattered setae; A3–A15 with dense and short setae; antennal segments in following proportions (length:width): 16:6; 7:4; 10:3; 13:3; 8:4; 7:5; 7:5; 7:5; 7:6; 6:6; 6:6; 6:6; 6:6; 6:6; 10:5 (Fig. 8A).

*Mesosoma.* Pronotum in dorsal view smooth with deep punctures and whitish long setae along the posterior margin; pronotal shoulders angled; lateral pronotum rugose except smooth and concave in the middle; mesoscutum smooth and convex, with long setae along posterior margin; notauli present anteriorly as large pits (Fig. 8C); humeral sulcus deep and long, longer than length of tegula (15:9); scutellum coarsely punctate and distinctly convex, posterior rim truncate with whitish long setae and prominent posterolateral corners (Fig. 8C); anterior scutellar pit large and deep, as long as rest of scutellar disc, strongly punctate at bottom, median keel distinct (Fig. 8C); mesopleuron smooth with deep crenulate line along posterior margin; metapleuron rugose and covered with dense whitish long setae.

*Wings.* Radial cell completely closed, 1.5× as long as wide and 0.6× as long as marginal vein (Fig. 8A).

*Legs.* Fore and mid legs slender; hind tibiae incrassate posteriorly, its maximum width slightly wider than hind femora (8:7).

*Metasoma.* Petiole short and expanded (2:3), with strong costae dorsally; tergites smooth, with scattered setigerous punctures; base of second tergite with several short



**Figure 8.** *Ismarus madagascariensis* sp. n., female. **A** Habitus in lateral view **B** Head in dorsal view **C** Mesosoma in dorsal view.

costae basally and median furrow deep basally to shallow apically, extending  $0.33\times$  length of second tergite; sutures between tergites complete and deeply impressed.

**Colour.** Body black; antennae yellow except for A12–A15 segment brown; legs and tegulae yellowish-brown to brown; wings hyaline, covered with brown setae.

**Measurements.** Head length 0.45 mm, width 0.79 mm; mesosoma length 0.87 mm, width 0.81 mm; metasoma length 1.20 mm; fore wing length 1.90 mm; body length 2.51 mm.

Male. Unknown.

**Distribution.** Madagascar.

**Etymology.** This species is named after the country where the holotype was collected.

***Ismarus minutus* sp. n.**

<http://zoobank.org/45A0E03C-909A-4ECE-AF1A-547179A5CBA2>

Figure 9A–F

**Diagnosis.** The extremely small radial cell, much shorter than half the length of the marginal vein, is a unique character among *Ismarus* species.

**Type material** (1♀9♂♂). *Holotype*, 1♀, KENYA: Nairobi, III.1982, pan trap, M. C. Lubega leg., CJDAF010093 (deposited in CNCI). *Allotype*, 1♂, RHODESIA



(ZIMBABWE): Salisbury, Chishawasha, VIII.1978, A. Watsham leg., CJDAF010094 (NHMUK). *Paratype*, RHODESIA (ZIMBABWE): 1♂, Salisbury, V.1982, A. Watsham leg., CJDAF010095 (CNCI); 1♂, ditto, X–XII.1974, A. Watsham leg., CJDAF010096 (CNCI); 4♂♂, MALAWI: Chitipa District, Jembya Reserve, 18 km South South East of Chisenga, 10°08'S, 33°27'E, 1870 m alt., 11–20.XII.1988, J. Rawlins & S. Thompson leg., CJDAF010097–010100 (CNCI); 1♂, ditto, 21–31. XII.1988, J. Rawlins & S. Thompson leg., CJDAF010101 (CNCI).

**Description.** Holotype (Female). *Head.* Head in dorsal view much wider than long (30:17), slightly wider than width of mesosoma (6:5) (Fig. 9B–C); POL: 11; OL: 6; OOL: 8 (Fig. 9C); ocelli large, LOL subequal to diameter of lateral ocellus (12:11); vertex behind ocelli nearly flat in lateral view; eye large and without setae; inner orbits, frons and temple with few sparse setae; above antennal sockets, face and cheek with few long setae; antenna slightly shorter than body length (12:13); scape and pedicel with scattered setae; A3–A15 with dense and short setae; antennal segments in following proportions (length:width): 14:4; 7:3; 10:1.5; 10:2; 8:2; 8:2; 7:2; 7:2; 6:2.5; 6:2.5; 6:3; 6:3; 5.5:3; 5:3; 9:3 (Fig. 9A).

*Mesosoma.* Pronotum in dorsal view punctate with whitish long setae; pronotal shoulders angled; lateral pronotum smooth and strongly concave except lower half punctate-rugose; mesoscutum smooth and convex with pair of long setae in front of scutellar pit; notauli present with 5 very small pits anterior margin (Fig. 9D); humeral sulcus deep and short, as long as length of tegula; scutellum smooth and slightly convex, posterior rim rounded (Fig. 9D); anterior scutellar pit small and deep, much shorter than remaining scutellar disc, distinctly crenulate at bottom, median keel absent (Fig. 9D); mesopleuron smooth with deep crenulate line along posterior margin; metapleuron rugose and covered with dense whitish long setae.

*Wings.* Radial cell completely closed, 1.4× as long as wide and 0.35× as long as marginal vein (Fig. 9B).

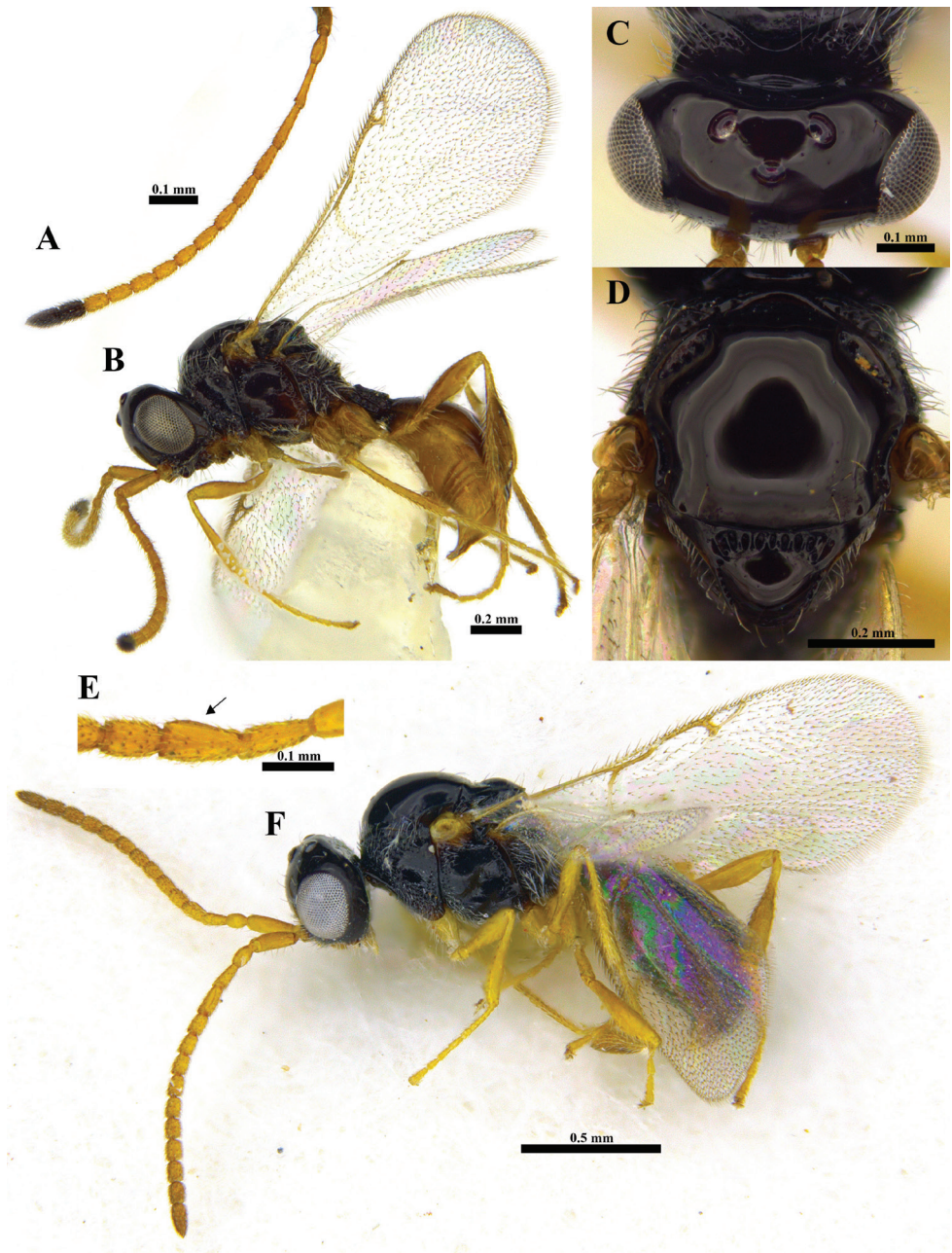
*Legs.* Fore and mid legs slender; hind tibiae incrassate posteriorly, its maximum width slightly wider than hind femora (6:5).

*Metasoma.* Petiole subquadrate, with strong costae dorsally; tergites smooth, with scattered setigerous punctures; base of second tergite with several short costae basally and very short median furrow, extending 0.10× length of second tergite; suture between T2 and T3 obsolete, remaining sutures deeply impressed.

*Colour.* Head dark brown except mandibles yellow with reddish tips and antennae yellowish except A14–A15 brown; mesosoma dark brown except tegulae yellow; metasoma brown except petiole dark brown, all sternites and T5–T8 yellow; legs yellow to yellowish-brown; wings hyaline, covered with brown setae.

*Measurements.* Head length 0.34 mm, width 0.59 mm; mesosoma length 0.68 mm, width 0.50 mm; metasoma length 0.84 mm; fore wing length 1.70 mm; body length 1.85 mm.

*Male* (Allotype). Body length 1.84 mm. Similar to female, body dark brown except mandible, tegulae and legs yellow, antennae yellowish-brown basally, gradually darkened towards apex; POL: 8; LOL: 5; OOL: 7; notauli present with 4 very small pits on anterior margin; base of second tergite with several short costae basally and very short



**Figure 9.** *Ismarus minutus* sp. n. (A–D Female E–F Male). A Antenna B, F Habitus in lateral view C Head in dorsal view D Mesosoma in dorsal view E Antenna (A3–A5).

median furrow, subequal to lateral costae; suture between T2 and T3 obsolete and remaining sutures deeply impressed; radial cell completely closed, 0.6× as long as marginal vein; blade-like carina on A4, basal 0.8× length of segment (Fig. 9E); antennal

segments in following proportions: 12:4; 7:3.5; 7:3; 8:3.5; 6:3.5; 5:3.5; 5:3.5; 5:3.5; 5:3.5; 5:3.5; 5:3.5; 8.5:3.5 (Fig. 9F).

**Variation.** Body length 1.83–2.03 mm in both sexes. Male body blackish-brown to dark brown, antenna yellowish-brown basally gradually darkened towards apex to uniformly brown.

**Distribution.** Kenya, Malawi, Zimbabwe.

**Etymology.** The specific name *minutus* is derived from the Latin adjective which means small.

***Ismarus nigrofasciatus* sp. n.**

<http://zoobank.org/93FEA0A4-A901-4855-8915-86CE6264ED18>

Figure 10A–C

**Diagnosis.** The yellow mesoscutum with blackish longitudinal median band is a unique character among *Ismarus*.

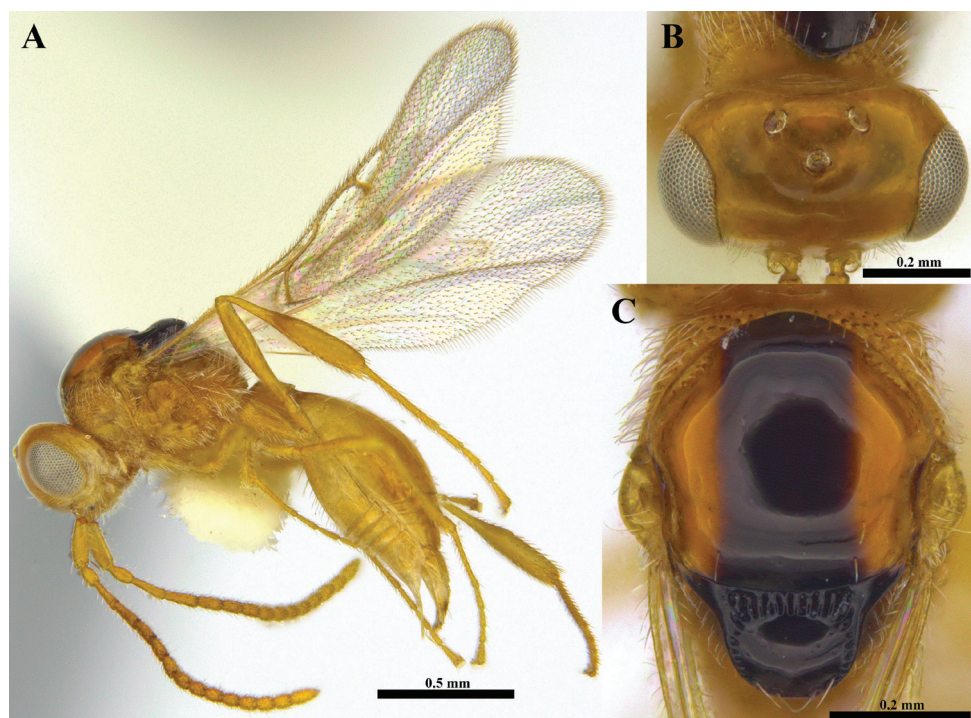
**Type material** (2♀♀). *Holotype*, 1♀, MALAWI: Chitipa District, Jembya Reserve, 18 km South South East of Chisenga, 10°08'S, 33°27'E, 1870 m alt., 11–20.XII.1988 (MT), J. Rawlins & S. Thompson, CJDAF010103 (deposited in CNCI). *Paratype*, UGANDA: 1♀, 20 km South East of Fort Portal, Makerere University Biological Field Station, 0°33.08'N, 30°21.54'E, 9–11.X.2001 (MT), 1570 m alt., B. & J. Gill leg., CJDAF010104 (CNCI).

**Description.** Holotype (Female). *Head.* Head in dorsal view much wider than long (21:11), slightly wider than width of mesosoma (21:17) (Fig. 10A–B); POL: 11; LOL: 7; OOL: 11 (Fig. 10B); ocelli large, LOL slightly longer than diameter of lateral ocellus (7:5); vertex behind ocelli nearly flat in lateral view; eye large and without setae; inner orbits, frons and temple with few sparse setae; above antennal sockets, face and cheek with few long setae; antenna much shorter than body length (12:19); scape and pedicel with scattered setae; A3–A15 with dense and short setae; antennal segments in following proportions (length:width): 12:3.5; 7:3; 8:2; 8:2.5; 6:3; 6:3; 6:3; 5:3; 5:3; 5:3; 5:3; 5:3; 5:3; 8:3 (Fig. 10A).

*Mesosoma.* Pronotum in dorsal view punctate with whitish long setae; pronotal shoulders angled; lateral pronotum predominantly smooth and concave except lower margins punctate with whitish setae; mesoscutum smooth and convex; notauli weakly present with 6 very small pits on anterior margin (Fig. 10C); humeral sulcus deep and long, slightly longer than length of tegula (5:4); scutellum smooth and slightly convex, posterior rim rounded (Fig. 10C); anterior scutellar pit large and deep, much shorter than remaining scutellar disc, distinctly crenulate at bottom, median keel absent (Fig. 10C); mesopleuron smooth with deep crenulate line along posterior margin; metapleuron rugose and covered with dense whitish long setae.

*Wings.* Radial cell completely closed, 1.75× as long as wide and 0.7× as long as marginal vein (Fig. 10A).





**Figure 10.** *Ismarus nigrofasciatus* sp. n., female. **A** Habitus in lateral view **B** Head in dorsal view **C** Mesosoma in dorsal view.

*Legs.* Fore and mid legs slender; hind tibiae incrassate posteriorly, its maximum width slightly wider than hind femora (10:9).

*Metasoma.* Petiole subquadrate (9:10), with irregular longitudinal carinae; tergites smooth, with scattered setigerous punctures; base of second tergite with several short costae basally and short median furrow, extending 0.20× length of second tergite; suture between T2 and T3 obsolete, following sutures complete and deeply impressed.

*Colour.* Body whitish-yellow to yellow except median longitudinal band of mesoscutum and scutellum blackish (Fig. 10C); antennae, tegulae and legs uniformly yellow; wings hyaline, covered with brown setae.

*Measurements.* Head length 0.34 mm, width 0.61 mm; mesosoma length 0.67 mm, width 0.49 mm; metasoma length 1.12 mm; fore wing length 1.92 mm; body length 2.13 mm.

**Variation.** Body length 1.97–2.13 mm. Radial cell closed, 0.65–0.70× as long as marginal vein.

Male. Unknown.

**Distribution.** Malawi, Uganda.

**Etymology.** The specific name is an adjective derived from the Latin words *nigrum* for black and *fasciatus* meaning with stripe or band.



***Ismarus notaulicus* sp. n.**

<http://zoobank.org/2887532C-3E68-4505-92A8-67864AA486F6>

Figure 11A–C

**Diagnosis.** *Ismarus notaulicus* sp. n. is similar to *I. dorsiger* (Haliday, 1831). It differs mainly in the notauli and mesosoma colour pattern: in *I. dorsiger* notauli completely absent, dorsal part of pronotum yellow, mesopleuron completely yellow; in *I. notaulicus* sp. n. notauli present with 7 very small pits, dorsal part of pronotum black, mesopleuron brown except upper margin darkened.

**Type material** (1♀). *Holotype*, 1♀, KENYA: 1♀, Coast Province, Taita Hills, Chawia Forest, 3.47908°S, 38.34162°E, 1614 m alt., (MT) by small forest pond, 18.IX–2.X.2011, R. Copeland leg., CJDAF010105 (deposited in NMK).

**Description.** Holotype (Female). *Head.* Head in dorsal view much wider than long (9:5), subequal to width of mesosoma (Fig. 11A–B); POL: 6; LOL: 3; OOL: 7 (Fig. 11B); ocelli large, LOL slightly longer than diameter of lateral ocellus (6:5); vertex behind ocelli nearly flat in lateral view; eye large and without setae; frons and temple with few sparse setae; above antennal sockets, face and cheek with few long setae; antenna slightly shorter than body length (14:17); scape and pedicel with scattered setae; A3–A15 with dense and short setae; antennal segments in following proportions (length:width): 16:5; 8:4; 12:3; 12:3.5; 10:3.5; 10:4; 9:4; 8:4; 8:4; 8:4; 8:4; 8:4; 8:4; 11:4 (Fig. 11A).

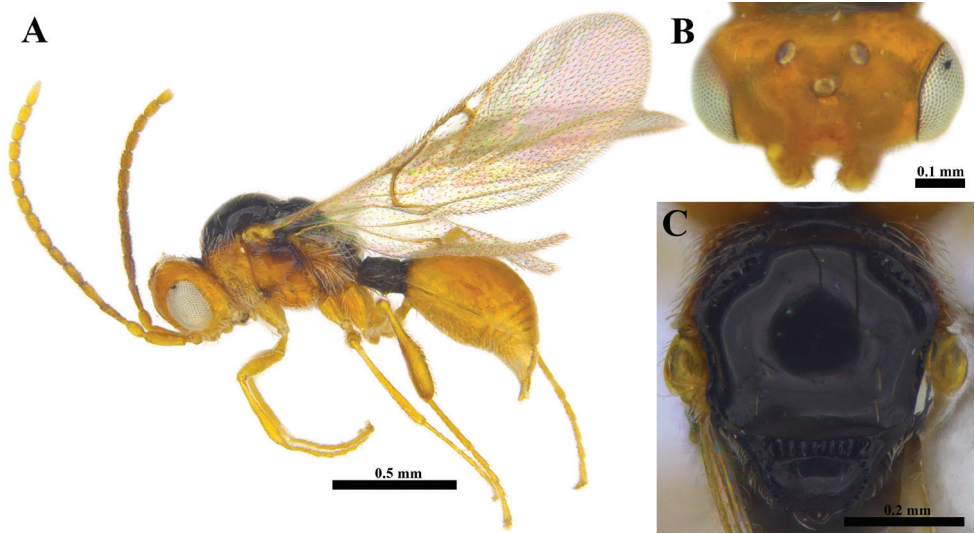
*Mesosoma.* Pronotum in dorsal view punctate with whitish long setae; pronotal shoulders angled; lateral pronotum predominantly smooth and concave except upper and lower margins with whitish long setae; mesoscutum smooth and convex with pairs of long setae in front of scutellar pit; notauli present with 7 very small pits on anterior margin (Fig. 11C); humeral sulcus deep and short, as long as length of tegula; scutellum smooth and slightly convex, posterior rim rounded (Fig. 11C); anterior scutellar pit small and deep, much shorter than remaining scutellar disc, distinctly crenulate at bottom, median keel absent (Fig. 11C); mesopleuron smooth with deep crenulate line along posterior margin; metapleuron rugose and covered with dense whitish long setae.

*Wings.* Radial cell completely closed, 2.0× as long as wide and 0.6× as long as marginal vein (Fig. 11A).

*Legs.* Fore and mid legs slender; hind tibiae incrassate posteriorly, its maximum width slightly wider than hind femora (10:9).

*Metasoma.* Petiole subquadrate, with strong costae dorsally; base of second tergite with several short costae basally and very short median furrow, extending 0.20× length of second tergite; suture between T2 and T3 obsolete but the following sutures between tergites distinctly impressed.

*Colour.* Head yellow except whitish mandibles and antennae yellowish-brown except scape and pedicel yellow; mesosoma black except tegulae yellow and lateral pronotum, mesopleuron and metapleuron brown except upper margin of mesopleuron darkened; metasoma yellow except petiole black; legs yellow; wings hyaline, covered with brown setae.



**Figure 11.** *Ismarus notaulicus* sp. n., female. **A** Habitus in lateral view **B** Head in dorsal view **C** Mesosoma in dorsal view.

*Measurements.* Head length 0.29 mm, width 0.55 mm; mesosoma length 0.48 mm, width 0.49 mm; metasoma length 0.58 mm; fore wing length 1.83 mm; body length 1.35 mm.

Male. Unknown.

**Distribution.** Kenya.

**Etymology.** This specific name means that the notauli are present.

***Ismarus rawlinsi* sp. n.**

<http://zoobank.org/768631EA-0CA1-4718-A26F-E7A89DDEB569>

Figure 12A–E

**Diagnosis.** Metasoma after T2 with only 3 distinct sutures in both sexes is a unique character among *Ismarus*.

**Type material** (5♀♀1♂). *Holotype*, 1♀, MALAWI: Chitipa District, Jembya Reserve, 18 km South South East of Chisenga, 10°08'S, 33°27'E, 1870 m alt., 5–10.XII.1988, J. Rawlins & S. Thompson leg., CJDAF010106 (deposited in CNCI). *Allotype*, 1♂, KENYA: Coast Province, Marenje Forest, indigenous forest, 76 m alt., 4.52814°S, 39.24028°E, 12–26.VII.2014 (MT), R. Copeland leg., CJDAF010110 (NMK). *Paratypes*, KENYA: 1♀, Coast Province, Taita Hills, Mwatate area, 3.48444°S, 38.33251°E, 1011 m alt, (MT) below Bura Bluff, riverine forest, 21.IX–5.X.2011, R. Copeland leg., CJDAF010109 (ICIPE); 1♀, ditto, 3.48444°S, 38.33251°E, 5–19.X.2011, R. Copeland leg., CJDAF010108 (ICIPE); 1♀, ditto, Ngangao Forest, 3.36100°S, 38.34186°E, 1848 m, alt. (MT) indigenous forest, 2–16.X.2011, R. Copeland leg., CJDAF010107 (ICIPE); 1♀, Eastern Province, Kasaala area, just inside

isolated wood-land patch, 733 m alt., 2.07836°S, 38.22517°E, 3–17.V.2016 (MT), R. Copeland leg., CJDAF010102 (KNA).

**Description.** Holotype (Female). *Head.* Head in dorsal view much wider than long (12:7), subequal to width of mesosoma (Fig. 12A, D); POL: 5; LOL: 3; OOL: 5 (Fig. 12A); ocelli large, LOL slightly longer than diameter of lateral ocellus (9:7); vertex behind ocelli nearly flat in lateral view; eye large and without setae; inner orbits, frons and temple with few sparse setae; above antennal sockets, face and cheek with few long setae; antenna slightly shorter than body length (10:13); scape and pedicel with scattered setae; A3–A15 with dense and short setae; antennal segments in following proportions (length:width): 12:3; 6:3; 9:2; 10:2; 6:2; 5:3; 4:3; 4:3; 4:3; 4:3; 4:3; 4:3; 4:3; 4:3; 8:3 (Fig. 12A).

*Mesosoma.* Pronotum in dorsal view punctate with whitish long setae; pronotal shoulders angled; upper part of lateral pronotum smooth and concave in the middle, lower part of lateral pronotum punctate; mesoscutum smooth and convex with pairs of long setae in front of scutellar pit; notauli present with 6 very small pits on anterior margin (Fig. 12E); humeral sulcus deep and short, as long as length of tegula; scutellum smooth and slightly convex, posterior rim rounded (Fig. 12E); anterior scutellar pit small and deep, much shorter than remaining scutellar disc, distinctly crenulate at bottom, median keel absent (Fig. 12E); mesopleuron smooth with deep crenulate line along posterior margin; metapleuron rugose and covered with dense whitish long setae.

*Wings.* Radial cell completely closed, 1.6× as long as wide and 0.6× as long as marginal vein (Fig. 12A).

*Legs.* Fore and mid legs slender; hind tibiae incrassate posteriorly, its maximum width slightly wider than hind femora (11:10).

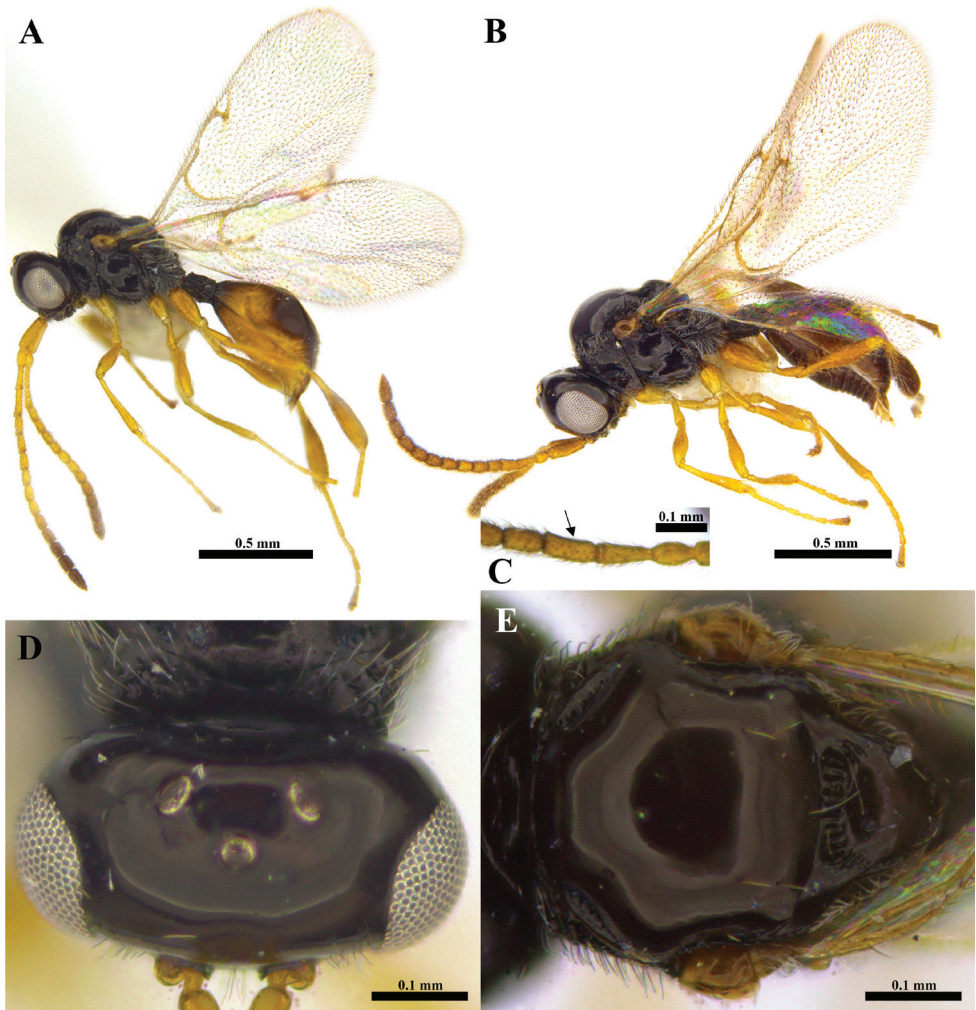
*Metasoma.* Petiole short and expanded (9:10), with strong costae dorsally; tergites smooth, with scattered setigerous punctures; base of second tergite with several short costae basally and very short median furrow, subequal to lateral costae; sutures between T2 and T3, T3 and T4 obsolete, remaining sutures deeply impressed.

*Colour.* Head dark brown except mandibles yellow with reddish tips and antennae yellowish-brown basally gradually darkened towards apex; mesosoma dark brown except tegulae yellow and lower margin of lateral pronotum brown; metasoma brown except petiole dark brown, apical margin of S2 to S6 yellow and T7 and T8 yellowish-brown; legs yellow except hind tibiae and tarsi brown; wings hyaline, covered with brown setae.

*Measurements.* Head length 0.28 mm, width 0.48 mm; mesosoma length 0.55 mm, width 0.49 mm; metasoma length 0.74 mm; fore wing length 1.48 mm; body length 1.57 mm.

*Male* (Allotype). Body length 1.56 mm. Similar to female, POL: 7; LOL: 4; OOL: 6; lateral pronotum completely dark brown, metasoma brown except petiole dark brown; median furrow almost absent to extending 0.20× length of second tergite; radial cell completely closed, 0.6× as long as length of marginal vein; blade-like carina on A4 percurrent (Fig. 12C); antennal segments in following proportions: 10:3; 5:3; 7:2.5; 7:2.5; 5:2.5; 5:2.5; 4:2.5; 4:2.5; 4:2.5; 4:3; 4:3; 4:3; 4:3; 7:3 (Fig. 12B).

**Variation.** Body length 1.31–2.2 mm in both sexes. Paratypes with median furrow very short, subequal to lateral costae to extending 0.20× length of second tergite in both sexes; colour of T2 brown to partly yellow.



**Figure 12.** *Ismarus rawlinsi* sp. n. (A, D–E Female B–C Male). A, B Habitus in lateral view C Antenna (A2–A5) D Head in dorsal view E Mesosoma in dorsal view.

**Distribution.** Kenya, Malawi.

**Etymology.** This species is named after John E. Rawlins, one of the collectors of the holotype specimen.

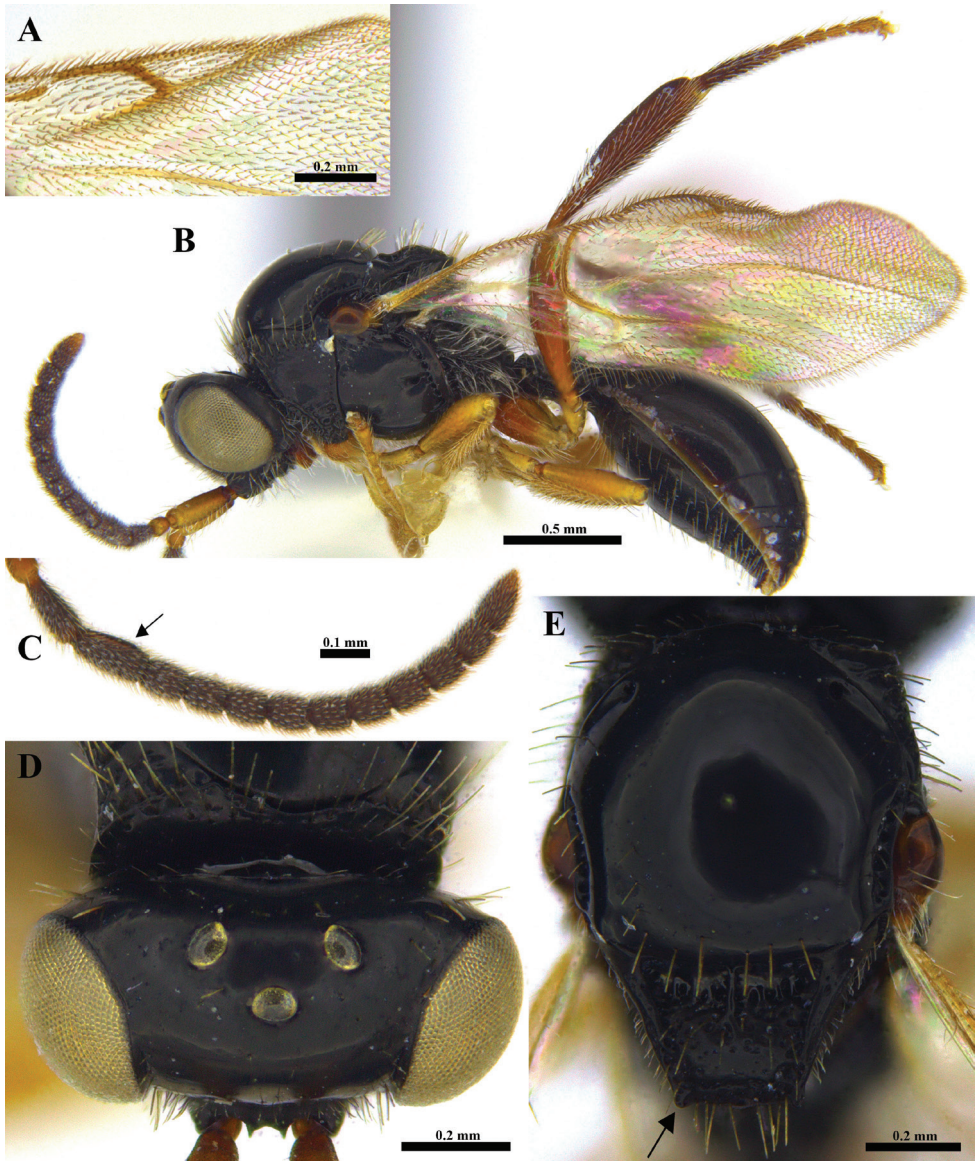
***Ismarus steineri* sp. n.**

<http://zoobank.org/D3E37E8C-4D99-4E7D-B985-2736A7DC8D9A>

Figure 13A–E

**Diagnosis.** The radial cell slightly longer than marginal vein, all metasomal sutures complete but weakly impressed and tergites matte, with fine micropunctures are unique characters among *Ismarus*.





**Figure 13.** *Ismarus steineri* sp. n., male. **A** Radial vein of fore wing **B** Habitus in lateral view **C** Antenna **D** Head in dorsal view **E** Mesosoma in dorsal view.

**Type material** (1♂). *Holotype*, 1♂, MADAGASCAR: Fianarantsoa Province, 7 km West of Ranomafana, flight intercept-yellow pan trap under Malaise trap in montane rainforest, 900 m alt., 21°16'S, 47°25'E, 4–11.IX.1993, W. Steiner & S. Zack leg., CJDAF010111 (deposited in CNCI).

**Description.** *Holotype* (Male). *Head.* Head in dorsal view much wider than long (2:1), slightly wider than width of mesosoma (9:8) (Fig. 13B, D); POL: 18; LOL: 10; OOL: 15 (Fig. 13D); ocelli large, LOL slightly shorter than diameter of lateral ocellus

(5:6); vertex behind ocelli nearly flat in lateral view; eye large and without setae; inner orbits, frons and temple with few sparse setae; above antennal sockets, face and cheek with few long setae; antenna much shorter than body length (5:8); scape and pedicel with scattered setae; A3–A14 with dense and short setae; blade-like carina on A4 per-current (Fig. 13C); antennal segments in following proportions (length:width): 20:6; 8:5; 14:6; 14:7; 8:6; 8:6; 8:6; 8:6; 8:6; 8:6; 8:6; 8:6; 13:6 (Fig. 13C).

*Mesosoma.* Pronotum in dorsal view smooth to slightly rugose with whitish long setae; pronotal shoulders angled; upper part of lateral pronotum smooth, bare and broadly convex medially; lower part of lateral pronotum rugose with strong carina along anterior margin; mesoscutum smooth and convex with pairs of long setae in front of scutellar pit; notauli present anteriorly as large pits (Fig. 13E); humeral sulcus deep and long, much longer than length of tegula (19:12); scutellum smooth and slightly convex, straight lateral rims, posterior rim truncate with slightly prominent postero-lateral corners (Fig. 13E); anterior scutellar pit large and deep, slightly shorter than remaining scutellar disc, slightly crenulate at bottom, median keel distinct (Fig. 13E); mesopleuron smooth with deep crenulate line along posterior margin; metapleuron reticulate and covered with dense whitish long setae.

*Wings.* Radial cell completely closed, 2.1× as long as wide and 1.05× as long as marginal vein (Fig. 13A).

*Legs.* Fore and mid legs slender; hind tibiae incrassate posteriorly, its maximum width slightly wider than hind femora (10:9).

*Metasoma.* Petiole short and expanded (4:5), with strong costae dorsally; tergites matte, with fine micropunctures; median furrow deep basally to shallow apically, extending half the length of second tergite; all sutures complete but weakly impressed.

*Colour.* Body black; mandibles brown with reddish tips; antennae dark brown except scape and pedicel yellow; tegulae brown; legs yellow except hind coxae and femora yellowish-brown, tibiae and tarsi brown; wings hyaline, covered with brown setae.

*Measurements.* Head length 0.51 mm, width 0.92 mm; mesosoma length 1.15 mm, width 0.82 mm; metasoma length 1.49 mm; fore wing length 2.86 mm; body length 3.15 mm.

Female. Unknown.

**Distribution.** Madagascar.

**Etymology.** This species is named after Warren Steiner, one of the collectors of the holotype specimen.

***Ismarus watshami* sp. n.**

<http://zoobank.org/116D5CEB-7010-4BFB-9CD5-CF95F758AB2C>

Figure 14A–E

**Diagnosis.** In antenna colour pattern, *Ismarus watshami* sp. n. is similar to *I. apicalis* Kolyada & Chemyreva. The main difference between these two species is length of median longitudinal furrow on T2, radial cell/marginal vein ratio and posterior rim

of scutellum shape: T2 with median furrow longer than half of length, radial cell slightly shorter than marginal vein and posterior rim of scutellum rounded in *I. apicalis*; T2 with median furrow shorter than half of length, radial cell distinctly shorter than marginal vein and posterior rim of scutellum slightly truncated to slightly emarginated in *I. watshami*.

**Type material** (3♀♀4♂♂). *Holotype*, 1♀, BOTSWANA: Serowe Farmer's Brigade, I.1993 (MT), R. Forchhammer leg., CJDAF010112 (deposited in CNCI). *Allotype*, 1♂, RHODESIA (ZIMBABWE): Salisbury, IX–XII.1975, A. Watsham leg., CJDAF010115 (CNCI). *Paratypes*, BOTSWANA: 1♀, Serowe, 1–20. XII.1984, R. Forchhammer leg., CJDAF010113 (CNCI); RHODESIA (ZIMBABWE): 1♀, Chishawasha, IX.1979, A. Watsham leg., CJDAF010114 (NHMUK); MALAWI: 1♂, Kasaungu, Mtunthama, VIII.1982, J. Feehan leg., CJDAF010116 (NHMUK); SOUTH AFRICA: 1♂, 75 km West South West of Natal, Eastcourt Cathedral Peaks Forest Station, 1400 m alt., 8–20.XII.1979 (MT), S. & J. Peck leg., CJDAF010117 (CNCI); 1♂, Tzaneen, 18–22.II.1983 (UV light), M. Coetzee leg., CJDAF010118 (CNCI).

**Description.** *Holotype* (Female). *Head.* Head in dorsal view much wider than long (19:11), slightly wider than width of mesosoma (13:12) (Fig. 14A–B); POL: 5; LOL: 3; OOL: 3 (Fig. 14A); ocelli large, LOL slightly longer than diameter of lateral ocellus (3:2); vertex behind ocelli nearly flat in lateral view; eye large and without setae; inner orbits, frons and temple with few sparse setae; above antennal sockets, face and cheek with few long setae; antenna much shorter than body length (8:11); scape and pedicel with scattered setae; A3–A15 with dense and short setae; antennal segments in following proportions (length:width): 16:4.5; 8:4; 10:3; 10:3; 7:3; 7:3.5; 6:4; 6:4; 6:4; 6:4; 6:4; 6:4; 5:4; 9:4 (Fig. 14B).

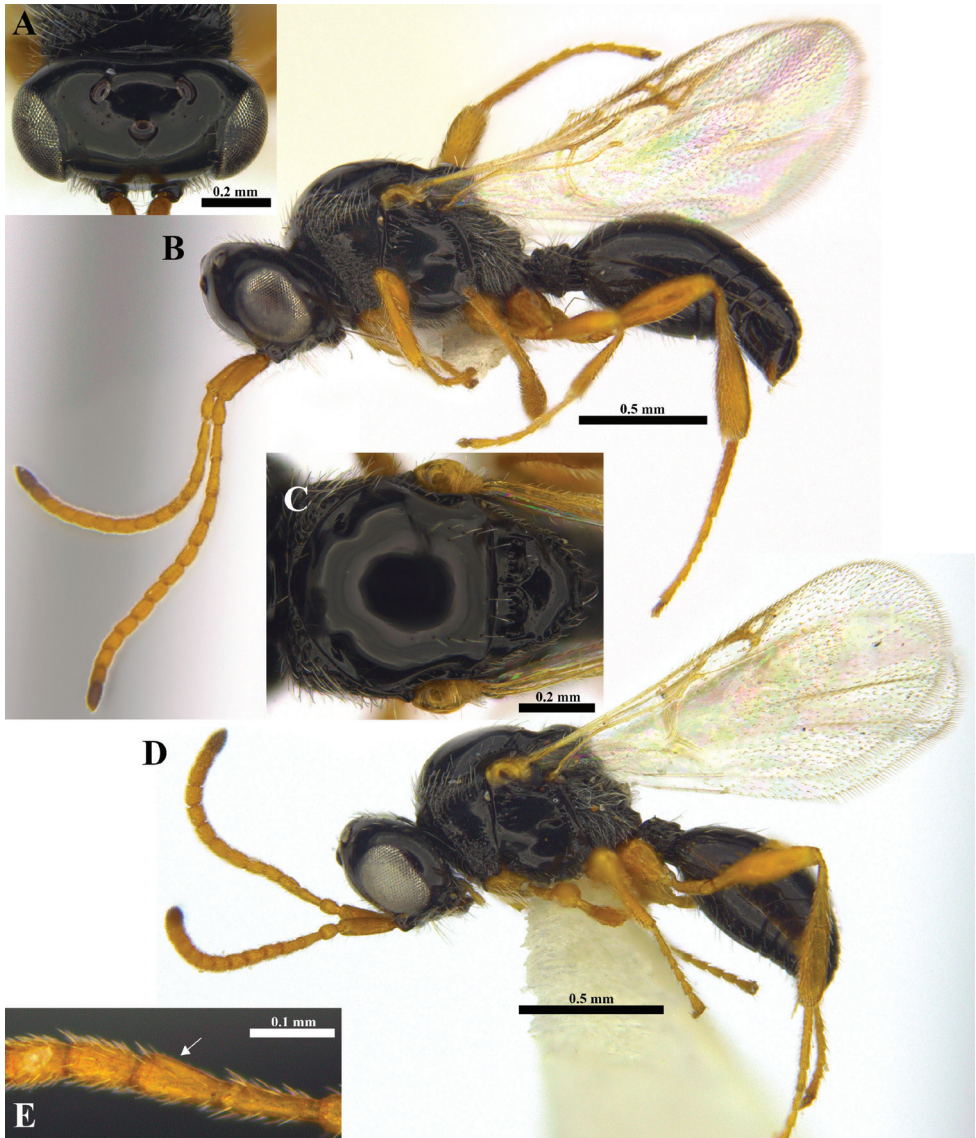
*Mesosoma.* Pronotum in dorsal view rugose with whitish long setae; upper part of lateral pronotum distinctly rugose anteriorly, smooth and slightly concave posteriorly, lower part of lateral pronotum distinctly rugose; mesoscutum smooth and convex with pairs of long setae in front of scutellar pit; notauli present anteriorly as large pits (Fig. 14C); humeral sulcus deep and long, longer than length of tegula (17:13); scutellum smooth with sparse puncturation and slightly convex, posterior rim slightly truncated with slightly prominent posterolateral corners (Fig. 14C); anterior scutellar pit large and deep, as long as remaining scutellar disc, slightly crenulate at bottom, median keel distinct (Fig. 14C); mesopleuron smooth with deep crenulate line along posterior margin; metapleuron rugose and covered with dense whitish long setae.

*Wings.* Radial cell completely closed, 1.6× as long as wide and 0.6× as long as marginal vein (Fig. 14B).

*Legs.* Fore and mid legs slender; hind tibiae incrassate posteriorly, its maximum width as wide as hind femora.

*Metasoma.* Petiole short and distinctly expanded (5:7), punctate-rugose dorsally; tergites smooth, with scattered setigerous punctures; base of second tergite with several short costae basally and short median furrow, 0.35× length of second tergite; sutures between tergites complete and deeply impressed.





**Figure 14.** *Ismarus watshami* sp. n. (A–C Female D–E Male). **A** Head in dorsal view **B, D** Habitus in lateral view **C** Mesosoma in dorsal view **E** Antenna (A3–A5).

*Colour.* Body black; antennae, tegulae and legs uniformly yellow except apical segment of antennae (A15) brown; wings hyaline, covered with brown setae.

*Measurements.* Head length 0.44 mm, width 0.78 mm; mesosoma length 0.92 mm, width 0.68 mm; metasoma length 1.08 mm; fore wing length 1.43 mm; body length 2.44 mm.

*Male* (Allotype). Body length 2.00 mm. Similar to female, POL: 11; LOL: 6; OOL: 7; lateral pronotum predominantly smooth except lower part punctate to rugose; anterior scutellar pit large and deep, slightly shorter than remaining scutellar

disc (7:10); petiole distinctly short and expanded (8:13); base of second tergite with several short costae basally and short median furrow, 0.20× length of second; radial cell completely closed, 0.5× as long as marginal vein; blade-like carina on A4 percurrent (Fig. 14E); antennal segments in following proportions: 14:4; 6:3; 7:2.5; 7:3; 5:3.5; 5:3.5; 5:3.5; 5:3.5; 5:3.5; 5:3.5; 5:3.5; 5:3.5; 9:3.5 (Fig. 14D).

**Variation.** Body length 1.74–2.64 mm in both sexes. Posterior rim of scutellum slightly truncated to slightly emarginated; median furrow short, extending 0.20–0.35× length of second tergite in both sexes.

**Distribution.** Botswana, Malawi, South Africa, Zimbabwe.

**Etymology.** This species is named after Anthony Watsham, who collected some of the type specimens.

## Identification key to Afrotropical species of Ismaridae

### Females

(The females of *I. bicolor* and *I. steineri* are unknown in the Afrotropical region)

- |   |  |                                      |
|---|--|--------------------------------------|
| 1 | Metasoma after tergite 2 (T2) with 3 or 4 distinct sutures .....   | 2                                    |
| – | Metasoma after T2 with 5 distinct sutures (Fig. 1E).....   | 7                                    |
| 2 | Metasoma after T2 with 3 distinct sutures .....  | <i>Ismarus rawlinsi</i> sp. n.       |
| – | Metasoma after T2 with 4 distinct sutures .....  | 3                                    |
| 3 | Body yellow, partly black or brown (Figs 5C, 10A, 11A) .....   | 4                                    |
| – | Body black or brown, partly yellow or brown (Figs 1A, 2A, 4A, 6C, 7A, 8A, 9B, 12A, 14B) .....  | 6                                    |
| 4 | Antenna uniformly yellow (Fig. 10A); mesoscutum yellow with blackish median longitudinal band (Fig. 10C) .....   | <i>Ismarus nigrofasciatus</i> sp. n. |
| – | Antenna brown except scape and pedicel yellow (Figs 5C, 11A); mesoscutum uniformly black .....   | 5                                    |
| 5 | Dorsal part of pronotum, propodeum, petiole black (Fig. 11A); mesopleuron brown except upper margin darkened (Fig. 11A); notauli present with 7 small pits (Fig. 11C); scape much longer than A3 or A4 (4:3:3).....                                  | <i>Ismarus notaulicus</i> sp. n.     |
| – | Dorsal part of pronotum, propodeum, ventral part of petiole brown (Fig. 5C); mesopleuron completely yellowish brown (Fig. 5C); notauli present with 3 small pits (Fig. 5D); scape slightly longer than A3 and equal in length to A4 (11:10:11) ..... | <i>Ismarus kakamegensis</i> sp. n.   |
| 6 | Scape slightly longer than A3 and equal in length to A4 (6:5:6); radial cell of fore wing 0.60× as long as marginal vein (Fig. 6A); base of T2 with median furrow, up to 1/3 of tergite.....   | <i>Ismarus kenyensis</i> sp. n.      |
| – | Scape much longer than A3 or A4 (12:7:7); radial cell of fore wing 0.35× as long as marginal vein (Fig. 9B); base of T2 with short median furrow, almost absent, only extending to 0.10× length of tergite .....                                     | <i>Ismarus minutus</i> sp. n.        |

- 7 T2 rugulose or matte with fine micropunctures (Figs 1E, 2G); radial cell of fore wing open (Figs 1A, 2A) ..... **8**
- T2 smooth with scattered punctures; radial cell of fore wing closed (Figs 4A, 7A, 8A, 14B) ..... **9**
- 8 Head weakly or strongly rugulose (Fig. 1B); scutellum coarsely rugose (Fig. 1C); tergites strongly rugulose (Fig. 1E); radial cell of fore wing open, as venation becomes weak apically (Fig. 1A) ..... ***Ismarus africanus* sp. n.**
- Head smooth (Fig. 2B); scutellum smooth (Fig. 2C); tergites matte with fine micropunctures (Fig. 2G); radial cell of fore wing completely open (Fig. 2A) ***Ismarus apertus* sp. n.**
- 9 Scutellum and anterior scutellar pit distinctly punctate (Fig. 8C)..... ***Ismarus madagascariensis* sp. n.**
- Scutellum smooth or weakly punctate; anterior scutellar pit crenulate or completely smooth (Fig. 4C, 7D, 14C) ..... **10**
- 10 Antennae uniformly yellow or only A15 brown (Figs. 7A and 14B) ..... **11**
- Antennae colour variable, but not yellow (Fig. 4A) ..... **12**
- 11 Posterior rim of scutellum rounded, posterolateral corners not developed (Fig. 7D); radial cell of fore wing as long as length of marginal vein (Fig. 7A); base of T2 with long median furrow, extending to 0.90× length of tergite..... ***Ismarus laevigatus* sp. n.**
- Posterior rim of scutellum truncate with slightly prominent posterolateral corners (Fig. 14C); radial cell of fore wing 0.60× as long as marginal vein (Fig. 14B); base of T2 with short median furrow, extending to 0.35× length of tergite ..... ***Ismarus watshami* sp. n.**
- 12 POL longer than OOL (Fig. 4B); notauli present anteriorly, pits merged with the curved notauli (Fig. 4C); posterior rim of scutellum truncate (Fig 4C); base of T2 with short median furrow, extending to 0.20× length of tergite ... ***Ismarus goodrichi* sp. n.**
- POL equal to OOL; notauli present anteriorly, as oblique, elongate pits or as large pits; posterior rim of scutellum rounded; base of T2 with long median furrow, at least to half the length of tergite ..... ***Ismarus halidayi* Förster**

## Males

(The male of *I. goodrichi*, *I. kakamegensis*, *I. kenyensis*, *I. madagascariensis* and *I. nigrofasciatus* and *I. notaulicus* are unknown)

- 1 Metasoma after Tergite 2 (T2) with 3 or 4 distinct sutures (Fig. 1E) ..... **2**
- Metasoma after T2 with 5 distinct sutures (Fig. 3E)..... **4**
- 2 Metasoma after T2 with 3 distinct sutures ..... ***Ismarus rawlinsi* sp. n.**
- Metasoma after T2 with 4 distinct sutures ..... **3**
- 3 Head bicoloured (Fig. 3C) ..... ***Ismarus bicolor* sp. n.**
- Head unicoloured (Fig. 9F) ..... ***Ismarus minutus* sp. n.**

- 4 Posterior rim of scutellum truncate or slightly excavate, with prominent posterolateral corners ..... **5**
- Posterior rim of scutellum round, posterolateral corners not developed..... **8**
- 5 Radial cell of fore wing open or not clearly closed as venation becomes weak apically (Figs 1D, 2D–E) ..... **6**
- Radial cell of fore wing clearly closed (Figs 7C, 13A, 14D)..... **7**
- 6 Head weakly or strongly rugulose; scutellum coarsely rugose; tergites strongly rugulose; base of T2 with short to long median furrow, at least extending to 0.2–0.6× length of tergite; radial cell of fore wing open, as venation becomes weak apically (Fig. 1D) ..... ***Ismarus africanus* sp. n.**
- Head and scutellum smooth; tergites matte with fine micropunctures; base of T2 with very short median furrow, subequal to lateral costae; radial cell of fore wing completely open (Fig. 4D–E) ..... ***Ismarus apertus* sp. n.**
- 7 Antenna dark brown except scape and pedicel yellow (Fig. 13B–C); radial cell of fore wing 1.1× as long as length of marginal vein (Fig. 13A); tergites matte, with fine micropunctures; base of T2 with long median furrow, extending to half the length of tergite..... ***Ismarus steineri* sp. n.**
- Antenna uniformly yellow except apical segment brown (Fig. 14D); radial cell of fore wing 0.5× as long as length of marginal vein (Fig. 14D); tergites smooth, with scattered punctures; base of T2 with short median furrow, extending to 0.2× length of tergite ..... ***Ismarus watshami* sp. n.**
- 8 Body dark brown to brown (Fig. 7C); POL longer than OOL; A3 as long as A4 (Fig. 7E) ..... ***Ismarus laevigatus* sp. n.**
- Body black; POL equal to OOL; A3 shorter than A4 ..... ***Ismarus halidayi* Förster**

## Acknowledgments

The authors would like to thank Dr. Zoltán Vas (HNHM), Dr. Hege Vårdal (NHRS) for loaning type specimens. Joseph Gitau, Josephat Bukhebi and Juliet Muriuki provided excellent laboratory and field support. RSC thanks Segenet Kelemu, Director General of ICIPE, for her continuing support of our Kenyan Insect Survey and Inventory Project. The authors especially thank Dr. Lubomír Masner (CNCI) for donating specimens, kindly reading and providing many comments on the manuscript. This work was supported by a grant from the Korea National Arboretum (KNA) of the Republic of Korea (as Project no. KNA1-1-15, 14-3).

## References

- Chambers VH (1955) Some hosts of *Anteon* spp. (Hym. Dryinidae) and a hyperparasite *Ismarus* (Hymenoptera. Belytidae). Entomologist's Monthly Magazine 91: 114–115.



- Chambers VH (1981) A host for *Ismarus halidayi* Foerst. (Hym., Diapriidae). Entomologist's Monthly Magazine 117: 29.
- Comério EF, Perito NW, Lara RIR (2016) A New Species of *Ismarus Haliday* (Hymenoptera: Ismaridae) from Brazil and a New Occurrence Record for *Ismarus gracilis* Masner. Entomobrasilia 9(3): 197–201. <https://doi.org/10.12741/ebrasilis.v9i3.589>
- Jervis MA (1979) Parasitism of *Aphelopus* species (Hymenoptera: Dryinidae) by *Ismarus dorsiger* (Curtis) (Hymenoptera: Diapriidae). Entomologist's Gazette 30: 127–129.
- Johnson NF (1992) Catalog of World species of Proctotrupeoidea, exclusive of Platygastriidae (Hymenoptera). Memoirs of the American Entomological Institute 51: 1–825.
- Kim CJ, Notton DG, Ødegaard F, Lee JW (2018) Review of the Palaearctic species of Ismaridae Thomson, 1858 (Hymenoptera: Diaprioidea). European Journal of Taxonomy 417: 1–38. <https://doi.org/10.5852/ejt.2018.417>
- Kolyada VA, Chemyreva VG (2016) Revision of species of the genus *Ismarus* Haliday, 1835 (Hymenoptera: Diaprioidea: Ismaridae) of the Russian fauna. Far Eastern Entomologist 318: 1–19.
- Kozlov MA (1971) Proctotrupoids (Hymenoptera, Proctotrupeoidea) of the USSR. Trudy Vsesoyuznogo Entomologicheskogo Obshchestva 54: 3–67.
- Liu J, Chen H, Xu Z (2011) Notes on the genus *Ismarus* Haliday (Hymenoptera, Diapriidae) from China. ZooKeys 108: 49–60. <https://doi.org/10.3897/zookeys.108.768>
- Masner L (1976) A revision of the Ismarinae of the New World (Hymenoptera, Proctotrupeoidea, Diapriidae). Canadian Entomologist 108(11): 1243–1266. <https://doi.org/10.4039/Ent1081243-11>
- Masner L, García JL (2002) The genera of Diapriinae (Hymenoptera: Diapriidae) in the New World. Bulletin of the American Museum of Natural History 268: 1–138. [https://doi.org/10.1206/0003-0090\(2002\)268<0001:TGODHD>2.0.CO;2](https://doi.org/10.1206/0003-0090(2002)268<0001:TGODHD>2.0.CO;2)
- Nixon GEL (1957) Hymenoptera, Proctotrupeoidea, Diapriidae subfamily Belytinae. Handbooks for the Identification of British Insects 8(3dii): 1–107.
- Olmi M (2000) Bio-ecologia degli Imenotteri Driinidi e loro impiego in programmi di lotta biologica. In: Lucchi A (Ed.) La Metcalfa negli ecosistemi italiani. ARSIA, Firenze, 93–117.
- Sharkey MJ, Carpenter JM, Vilhelmsen L, Heraty J, Liljeblad J, Dowling APG, Schulmeister S, Murray D, Deans AR, Ronquist F, Krogmann L, Wheeler WC (2012) Phylogenetic relationships among superfamilies of Hymenoptera. Cladistics 28(1): 80–112. <https://doi.org/10.1111/j.1096-0031.2011.00366.x>
- Tussac H, Tussac M (1991) Récapitulatif d'une collecte de Dryinidae et Diapriidae (Hym. Chrysoidea et Proctotrypoidea). Entomologiste 47(4): 189–194.
- Various contributors (2017) *Hymenoptera Online* (HOL). <http://hol.osu.edu> [Accessed 5 Apr. 2017]
- Wall I (1967) Die Ismarinae und Belytinae der Schweiz. Entomologische Abhandlungen 35: 123–265.