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Monograph

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The genus *Enicospilus* Stephens, 1835 (Hymenoptera, Ichneumonidae, Ophioninae) in Saudi Arabia, with twelve new species records and the description of five new species

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Abstract. The species of the genus *Enicospilus* Stephens, 1835 in Saudi Arabia are reviewed. Six species have previously been recorded from Saudi Arabia: *E. brevicornis* (Masi, 1939), *E. capensis* (Thunberg, 1822), *E. nervellator* Aubert, 1966, *E. perlatus* Shestakov, 1926, *E. psammus* Gauld & Mitchell, 1978 and *E. oculator* Seyrig, 1935. Five new species are described and illustrated in this paper: *Enicospilus arabicus* Gadallah & Soliman sp. nov., *E. mirabilis* Soliman & Gadallah sp. nov., *E. pseudoculator* Gadallah & Soliman sp. nov., *E. shadaensis* Gadallah & Soliman sp. nov. and *E. splendidus* Rousse, Soliman & Gadallah sp. nov. Twelve species are newly recorded for the fauna of Saudi Arabia, thus raising the total number to 23 species: *E. bicoloratus* Cameron, 1912, *E. divisus* (Seyrig, 1935), *E. dubius* (Tosquinet, 1896), *E. grandiflavus* Townes & Townes, 1973, *E. odax* Gauld & Mitchell, 1978, *E. oweni* Gauld & Mitchell, 1976, *E. pacificus* (Holmgren, 1868), *E. pallidus* (Taschenberg, 1875), *E. rundiensis* Bischoff, 1915, *E. senescens* (Tosquinet, 1896), *Enicospilus* sp. 1 and *Enicospilus* sp. 2 cf. *bicoloratus* Cameron, 1912. The unknown male of *E. odax* is described for the first time. The COI barcodes of 17 specimens were sequenced, compared to the existing data and uploaded to the BOLD Systems database. An illustrated key and an annotated faunistic list of all species of *Enicospilus* in Saudi Arabia are also provided. Finally, we discuss the biogeographical and ecological significance of the *Enicospilus* fauna in Saudi Arabia.

Keywords. Saudi Arabia, *Enicospilus*, systematic, catalogue, biogeography.

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Introduction

Saudi Arabia is a large arid land, covering the major part of the Arabian Peninsula, with an area of about 2 250 000 km² (Aldhebiani & Howladar 2013). It is characterized by different ecosystems and a large diversity of plant species. Components of the flora are a mixture of Asian, African and Mediterranean elements, and it is therefore considered to be one of the richest biodiversities in the Arabian Peninsula (Aldhebiani & Howladar 2013). There is always a close correlation between insect and plant diversity (El-Moursy *et al.* 2001).

Biogeographically, Saudi Arabia as a whole is on the frontier between the Palaearctic and Afrotropical regions, the Arabian Desert being a strong and forbidding ecological barrier. The southwestern region of Saudi Arabia (including Al Baha and Asir provinces) is, however, considered to be more closely related to the Afrotropical region (Hölzel 1998). Its floristic diversity and richness are the highest in Saudi Arabia. The flora has strong affinities with parts of Africa, particularly East Africa. The *Juniperus* woodland present in the region under study is also well known in Eritrea, Somalia, Ethiopia, Kenya and Tanzania, and is situated at almost the same altitude (Zohary 1973).

The genus *Enicospilus* Stephens, 1835 is one of the largest genera of Ichneumonidae and the most speciose in the subfamily Ophioninae (Townes 1971; Gauld 1985; Bordera *et al.* 1987; Gracia 2011). It encompasses more than 700 species worldwide (Yu *et al.* 2012; Rouse & Villemant 2012; Rouse & van Noort 2014), but most of them are found in tropical or subtropical regions (Townes 1971; Gauld 1985; Gauld & Mitchell 1978, 1981; Gauld 1988; Rouse *et al.* 2016). Only a small number of species is present in north temperate regions where *Ophion* Fabricius, 1798 is the predominant genus (Broad & Shaw 2016).

The genus *Enicospilus* was first proposed by Stephens (1829) in his catalogue of British insects, with a single species, *E. simulator*, which is considered to be a *nomen nudum* because it was published without an accompanying description. The genus was proposed again by Stephens (1835) with a coloured plate. Several attempts have been made to subdivide the genus into a number of smaller genera (e.g., Kriechbaumer 1901; Szépligeti 1905; Seyrig 1935), but these are no longer accepted because they were based on characters which subsequently proved to be homoplastic (Gauld 1985; Rouse *et al.* 2016).

Species of this genus are usually very slender. They are characterized by the combination of the occluded spiracular sclerite together with nearly always strongly tapered and twisted mandibles (Rouse *et al.* 2016). Like many other nocturnal Ichneumonoidea they usually exhibit a characteristic facies (Gauld & Huddleston 1976), i.e., they are moderate to large sized wasps with long slender antennae and enlarged ocelli, and with pale colouration, although a minority of species of *Enicospilus* are partly to totally dark in colour. In addition, the fore wing disco-submarginal cell almost always has a small to large hairless area below the base of the radial cell, a “fenestra”, which usually contains one or more alar sclerites. These sclerites are of great taxonomic help, but have little phylogenetic relevance.

Relatively little is known about the biology of *Enicospilus* species. They are known as primarily nocturnal parasitoids parasitizing a large variety of lepidopteran larvae. Most species seem to attack

larvae that are free-living caterpillars; the few with long ovipositors seem to attack larvae mining stems (Townes 1971; Gauld 1985; Yu *et al.* 2012).

No study has so far focused on the taxonomy of *Enicospilus* in Saudi Arabia. The genus is known to occur in the other countries of the Arabian Peninsula: seven species in the United Arab Emirates and eight in Yemen, while none has been recorded in Kuwait or Oman (Gauld & Mitchell 1978; Yu *et al.* 2012; Wahl 2014). In Saudi Arabia, six species have been reported so far: *E. brevicornis* (Masi, 1939), *E. capensis* (Thunberg, 1822), *E. nervellator* Aubert, 1966, *E. oculator* Seyrig, 1935, *E. perlatus* Shestakov, 1926 and *E. psammus* Gauld & Mitchell, 1978 (Gauld & Mitchell 1978; Horstmann 1981; Yu *et al.* 2012). Five new species are described in the present work and twelve additional species are newly reported, increasing to 23 the total number of species known from Saudi Arabia. An illustrated key is provided and an annotated faunistic list is detailed and then discussed from a biogeographical point of view.

Material and methods

Biogeography and ecology of the prospected localities

The specimens were collected mainly in Central (Riyadh) and Southwestern (Al Baha and Asir) Saudi Arabia (Fig.1). The geographical data of the localities are detailed in Appendix 1. Fig. 2 illustrates the variety of the prospected habitats in these localities. Sampling was done by means of light traps and sweep nets, the collected specimens were pinned directly for further study.

Raydah (Abha-Asir) [15°49'24" N, 44°21'19" E]

Lying at the border of the Somalia-Masai and Afrotropical archipelago-like regional centres of endemism, this locality contains elements of both zones (Ghazanfar & Fischer 1998). It covers only 933 km² (<http://www.birdsofsaudiarabia.com/2012/11/raydah-escarpment-reserve-abha.html>). It protects the last remnants of dense juniper forest found in southwestern Yemen and across the Arabian Peninsula. It is dominated by: *Juniperus procera* Hochst. (Cupressaceae), *Nuxia oppositifolia* Hochst. (Stilbaceae), *Maesa lanceolata* Forssk. (Myrsinaceae), *Celtis africana* N.L.B. Burm. (Cannabaceae), *Teclea nobilis* (Rutaceae), *Tarchonanthus camphorates* Linnaeus (Asteraceae) (below 1700 m), *Ficus* spp. (Moraceae), *Buddleja polystachya* Fresen. (Buddlejaceae), *Ziziphus spina-christi* (Linnaeus) (Rhamnaceae), *Aloe sabaia* Schweinf. (Xanthorrhoeaceae) and other aloes which dominate an unusual succulent community (below 1550 m). *Acacia etbaica* Schweinf. (Fabaceae) is also found on the lowest slopes; among which grow other rare succulents such as *Caralluma* and *Ceropegia* spp. (Apocynaceae). Also found there are *Aloe gracilis* Lam. (Asphodelaceae), *Ceropegia aristolochiodes* Decne (Apocynaceae) and others that are endemic or near-endemic species. This is in addition to 25 other plant species that are rare in Saudi Arabia (Ghazanfar & Fischer 1998).

Shada Al-Ala Mountain [19°34' N, 41°28'60" E]

This is a natural protectorate in southwestern Al Baha province. It is located at an elevation of 514 m above sea level ([http://www.getamap.net/maps/saudi_arabia/saudi_arabia_\(general\)/_shadaalala_jabal/](http://www.getamap.net/maps/saudi_arabia/saudi_arabia_(general)/_shadaalala_jabal/)). It has a high diversity of plants including *Albizia lebeck* (Linnaeus) (Fabaceae), *Solenosteniom* sp. (Lamiaceae), *Juniperus procera* Höchst. (Cupressaceae), *Santalum* spp. (Santalaceae), *Pimpinella anisum* Linnaeus (Apiaceae), *Rhamnus frangula* Linnaeus (Rhamnaceae), *Opuntia ficus-indica* (Linnaeus), *Cactus* sp. (Cactaceae), *Ricinus communis* Linnaeus (Euphorbiaceae), *Olea europaea africana* (Mill.) (Oleaceae), *Prunus dulcis* (Mill.) (Rosaceae), *Maerua crassifolia* Forssk. (Capparaceae), *Pandanus tectorius* Parkinson (Pandanaeae), *Panicum turgidum* Forssk. (Poaceae), *Coffea arabica* Linnaeus, *Breonadia salicina* (Vahl) (Rubiaceae), *Haloxylon salicornicum* (Mosq.) (Amaranthaceae), *Lycium shawii* Roem. & Schult. (Solanaceae) and *Acacia* spp. (Fabaceae) (Sharaf *et al.* 2014).

Al-Harmalyiah [24°15.78' N, 45°12.45' E]

At a distance of 165 km from Riyadh, this is an unfenced area where grazing, camping and vehicles are not controlled. It is characterized by the following kinds of vegetation: *Haloxylon salicornicum* (Moq.) (Amaranthaceae), *Pulicaria undulata* (Linnaeus) (Asteraceae), *Convolvulus hystrix* Vahl (Convolvulaceae), *Rhazya stricta* Dacne, *Calotropis procera* (Aiton) (Apocynaceae) and other seasonal herbs (Al Mobdel 2001).

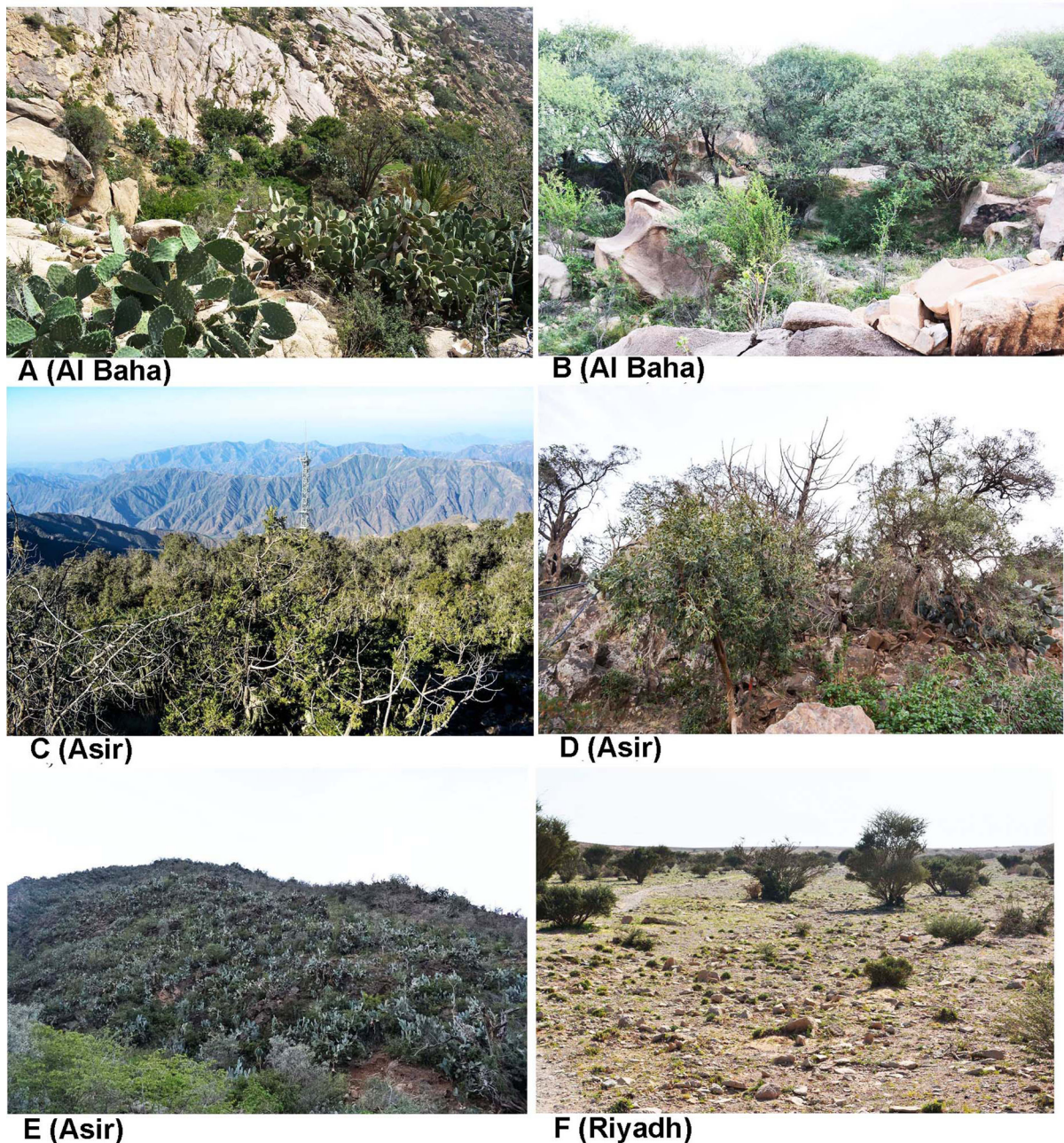


Fig. 1. Examples of habitats where specimens of *Enicospilus* Stephens, 1835 were collected. **A–B.** Shada Al-Ala Mountain (Al Baha). **C–E.** Raydah (Asir). **F.** Rawdet Al Harmalyiah (Riyadh).

Depositories

- NHMUK = Natural History Museum, London, United Kingdom (Gavin Broad)
EFC = Efflatoun Bey Collection, Entomology Department, Faculty of Science, Cairo University, Egypt (Neveen S. Gadallah)
KSMA = King Saud University Museum of Arthropods, Plant Protection Department, College of Food and Agriculture Sciences, King Saud University, Riyadh, Saudi Arabia (Hathal M. Al-Dhafer)
PPDD = Plant Protection Institute, Ministry of Agriculture, Giza, Egypt

Pictures

Photographic images were taken using a Canon EOS 70D Camera attached to a LEICA MZ 125 stereo microscope. Individual source images were then stacked using HeliconFocus v6.22 (HeliconSoft Ltd) extended depth of field software. Measurements of the different parts were made with the help of an ocular micrometer. Further image processing was done using the software Adobe Photoshop CS5.1 (ver. 12.1x32) and Adobe Photoshop Lightroom 5.2 Final (64 bit) [ChingLiu]. The distribution of the prospected sites (Fig. 2) is plotted using DIVA-GIS (ver.7.17).

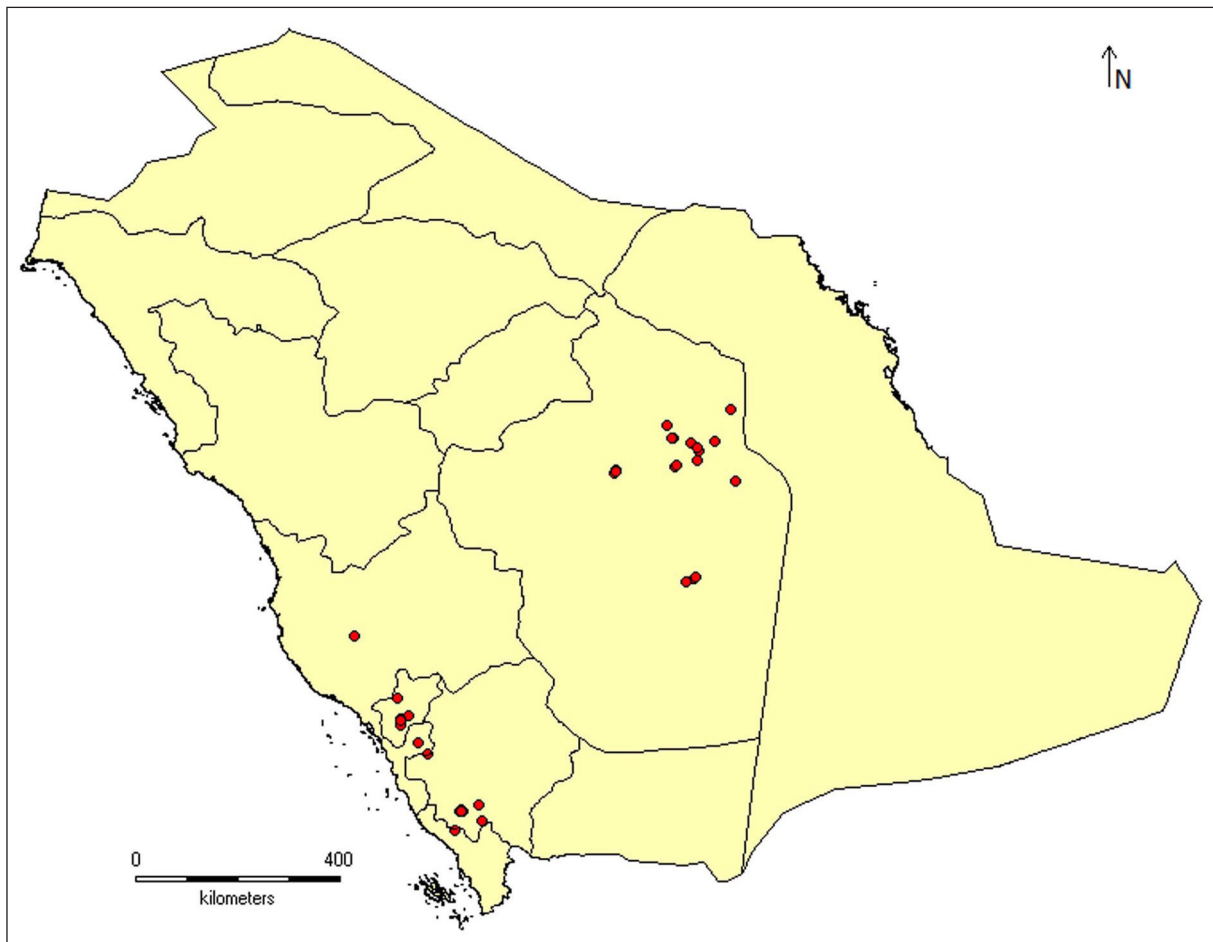


Fig. 2. Distributional map of collection localities in Saudi Arabia.

Terminology

Morphological terms follow Gauld & Mitchell (1978) and descriptions follow Rouse & van Noort (2014) to facilitate comparison. Body-sculpture terminology follows Harris (1979). The following abbreviations are used (indices after Gauld & Mitchell 1978; Rouse & van Noort 2014):

1A	=	first analis
AI	=	alar index of fore wing
B	=	body length (mm)
CI	=	cubital index of fore wing
CT	=	clypeus transversality index
Cu	=	cubitus
cu-a	=	transverse cubito-anal vein
F	=	fore wing length (mm)
FI	=	frontal index of head
Fl1–2	=	relative length of first and second flagellomeres
Fl20	=	length/width of flagellomere 20
ICI	=	inter-cubital index of fore wing
ML	=	malar line index
NI	=	nervellar index of hind wing
OOL	=	oculo-ocellar line index
POL	=	post-ocellar line index
R	=	radius
r-m	=	transverse radio-medial vein
Rs+2r	=	radial sector overlayed with cross vein 2r
Rs & M	=	radial sector overlayed with media
SDI	=	second discoidal index of fore wing
T	=	metasomal tergite

Barcoding

Seventeen specimens were barcoded and compared with existing data. DNA was extracted from one hind leg using the DNeasy Blood & Tissue Kit (Qiagen) following the standard manufacturer protocol. COI (HCO/LCO) was then amplified using the Taq PCR Core Kit (Qiagen): denaturation 94° 2 mn, 35 cycles 94° 30 s, 44° 30 s and 72° 60 s, final elongation 72° 5 mn. All PCR products were subsequently checked on agarose gel and sequenced with an ABI 3130 automated capillary DNA sequencer (Applied Biosystems). The sequences were eventually uploaded on the BOLD Systems database (Ratnasingham & Hebert 2007). The registration references for the database are listed in Appendix 2.

Results

Class Hexapoda Blainville, 1816
Order Hymenoptera Linnaeus, 1758
Suborder Apocrita Latreille, 1810
Superfamily Ichneumonoidea Latreille, 1802
Family Ichneumonidae Latreille, 1802
Subfamily Ophioninae Shuckard, 1840

Genus *Enicospilus* Stephens, 1835

A total of 498 specimens of *Enicospilus* representing 23 species were collected and identified with the keys of Gauld & Mitchell (1978) and Rouse & van Noort (2014). Some uncertain identifications

were confirmed with the help of Gavin Broad (NHMUK). All our sequences and related pictures were uploaded to the BOLD database, and the identification numbers are detailed in the relevant descriptions (see below). The DNA extraction was unsuccessful for *E. senescens* (Tosquinet, 1896) and not enough material was available at the moment of extraction of *E. bicoloratus* Cameron, 1912, *E. perlatus*, *E. psammus*, *Enicospilus* sp. 1 and sp. 2. Six of the 17 COI barcodes significantly matched (> 97% similarity) with databased sequences, all of which were registered as unidentified *Enicospilus* spp. in the BOLD database. These were the barcodes extracted from specimens morphologically identified as *E. capensis*, *E. grandiflavus* Townes & Townes, 1973, *E. oculator*, *E. pacificus* (Holmgren, 1868), *E. pallidus* (Taschenberg, 1875) and *E. shadaensis* sp. nov.

Five new species are described herein: *E. arabicus* Gadallah & Soliman sp. nov., *E. mirabilis* Soliman & Gadallah sp. nov., *E. pseudoculator* Gadallah & Soliman sp. nov., *E. shadaensis* Gadallah & Soliman sp. nov. and *E. splendidus* Rouse, Soliman & Gadallah sp. nov. In addition, this paper documents twelve species newly recorded from Saudi Arabia. Most of the reported species are typical of the Afrotropical region rather than the Palaearctic region, especially those collected from Al Baha and Asir provinces (southwestern Saudi Arabia). Of the Saudi species of *Enicospilus*, 86.9% are Afrotropical, 8.7% are Palaearctic and 13% are both (*E. capensis*, *E. psammus*, *E. pseudoculator* sp. nov.) (Table 1). Interestingly, two species reported from Yemen (*E. justus* and *E. expeditus*) (Gauld & Mitchell 1978) were not collected in the present study from South Western Saudi Arabia. An explanatory hypothesis might be that these two species were collected only in the high mountains in Yemen. As a consequence, we can not ascertain their presence in Saudi Arabia and did not include them in the key.

Key to the species of *Enicospilus* in Saudi Arabia

1. Disco-submarginal cell of fore wing without any alar sclerites (Figs 25C, 27B) 2
 - Disco-submarginal cell of fore wing with one or more alar sclerites 3
2. Rs+2r strongly sinuate proximally, fenestra relatively small, AI > 1 (Fig. 27B); antenna with more than 65 flagellomeres *E. senescens* (Tosquinet, 1896)
 - Rs+2r straighter proximally (Fig. 25C), fenestra larger, AI < 1; antenna with fewer than 65 flagellomeres *E. oweni* Gauld & Mitchell, 1976
3. Mesosoma interspersed with ivory markings (Figs 3H, 4B, 4G, 5B, 5C); antenna relatively short with fewer than 55 flagellomeres 4
 - Mesosoma uniformly coloured, without ivory markings; antenna variable, usually with more than 55 flagellomeres 8
4. Fore wing with one proximal sclerite, central sclerite totally absent (Figs 26C, 27C, 28A) 5
 - Fore wing with one proximal and one central sclerite (Figs 24B, 25A) 7
5. Proximal sclerite very weakly sclerotized (Fig. 28A); outer mid tibial spur very short, less than 0.4 × as long as inner spur (Fig. 33C)..... *E. splendidus* Rouse, Soliman & Gadallah sp. nov.
 - Proximal sclerite fully sclerotized (Figs 26C, 27C); outer mid tibial spur usually longer 6
6. Body dark reddish brown (Fig. 5B); proximal sclerite dark brown to black, triangular, CI > 0.2 (Fig. 27C); face narrow, 1.5 × higher than wide (Fig. 8F); moderately large species (B > 27, F > 12) *E. shadaensis* Gadallah & Soliman sp. nov.
 - Body lighter orange to brown (Fig. 4G); proximal sclerite bright red and dome-shaped, CI < 0.2 (Fig. 26C); face subquadrate, 1.1 × higher than wide (Fig. 8C); smaller species (B < 19, F < 12) *E. pseudoculator* Gadallah & Soliman sp. nov.

7. Metasoma interspersed with ivory markings (Fig. 3H); central sclerite uniformly sclerotized (Fig. 24B); median flagellomeres stout ($Fl_{20} < 1.7$) *E. mirabilis* Soliman & Gadallah sp. nov.
 – Metasoma without ivory markings (Fig. 4B); central sclerite weakly sclerotized proximally (Fig. 25A); median flagellomeres more slender ($Fl_{20} > 1.7$) *E. oculator* Seyrig, 1935
8. Proximal sclerite acutely arrow-shaped, central sclerite very weakly sclerotized (Fig. 25B); moderately to very large species (B 16–30, F 14–20) *E. odax* Gauld & Mitchell, 1978
 – Proximal sclerite obviously different, central sclerite present or absent; usually smaller species ... 9
9. Central sclerite totally absent, without even a faint trace (Figs 22A, 22C, 23C, 24A) 10
 – Central sclerite present (e.g., Figs 22B, 23B, 26A, 26B, 28C) though sometimes weakly sclerotized (e.g., Figs 23A, 24C, 28C) 13
10. Pale yellow species (Figs 3A, 3G) 11
 – Darker yellowish-orange species (Figs 3C, 3E) 12
11. Proximal sclerite obtusely angled without distal extension, $ICI > 0.6$, $CI < 0.3$ (Fig. 24A); propodeum coarsely and concentrically striate (Fig. 19A); clypeus flat in profile; metasoma darkened dorsally and apically (Fig. 3G); large species (B > 25, F > 15)
 *E. grandiflavus* Townes & Townes, 1973
 – Proximal sclerite comma-shaped with very long distal extension, $ICI < 0.6$, $CI > 0.3$ (Fig. 22A); integument is almost longitudinally striate just behind the basal transverse carina of propodeum (Fig. 18A); clypeus very strongly convex in profile (Fig. 10A); metasoma uniformly yellow without any dark markings (Fig. 3A); smaller species (B < 25, F < 15)
 *E. arabicus* Gadallah & Soliman sp. nov.
12. Antenna moderately long with more than 50 flagellomeres, median ones strongly elongate ($Fl_{20} > 2$); metapleuron weakly convex, without punctures, and longitudinally striate
 *E. dubius* (Tosquinet, 1896)
 – Antenna short with fewer than 50 flagellomeres, median ones stout ($Fl_{20} < 2$); metapleuron strongly convex, puncto-striate and longitudinally striate *E. brevicornis* (Masi, 1939)
13. Central sclerite subdivided and U-shaped (Fig. 23B) *E. divisus* (Seyrig, 1935)
 – Central sclerite not elongate, obviously different 14
14. Proximal sclerite rather narrow, comma-shaped with very long distal extension, central sclerite uniformly sclerotized (Fig. 26A) *E. pacificus* (Holmgren, 1868)
 – Proximal sclerite different, more or less triangular sometimes with a faint distal extension (e.g., Figs 22B, 23A, 26B, 28C); central sclerite sometimes weakly sclerotized (e.g., Figs 23A, 24C, 28C) 15
15. Central sclerite crescent-shaped, weakly sclerotized proximally, and large with maximal length larger than distance to $Rs+2r$ (Fig. 26B); pale yellow species (Fig. 4F)
 *E. pallidus* (Taschenberg, 1875)
 – Central sclerite smaller and more or less circular (e.g., Figs 22B, 23A, 28B), sometimes hardly sclerotized proximally and/or distinctly elongate (Figs 24C, 27A) but never crescent-shaped; usually darker yellowish-orange species 16
16. Very small species (F 6–9), with characteristic alar sclerites (Fig. 34A)
 *E. psammus* Gauld & Mitchell, 1978
 – Larger species (F nearly always > 10), with different alar sclerites 17

17. Outer mid (and sometimes hind) tibial spur(s) very short, less than 0.4 × as long as inner spur(s) (Figs 33A); central sclerite longitudinal and weakly sclerotized (Fig. 24C)
 *E. nervellator* Aubert, 1966
 – Outer mid and hind tibial spurs longer; central sclerite variable 18
18. Mandible with a long piliferous furrow from dorsal base to between teeth (Fig. 10D) 19
 – Mandible without such a distinct piliferous furrow (e.g., Fig. 13B) 20
19. Mandible with upper tooth less than twice the length of lower tooth (Fig. 6B), bare or sparsely setose on outer margin (Fig. 6B); central sclerite small, circular, and uniformly sclerotized (Fig. 22B) *E. bicoloratus* Cameron, 1912
 – Mandible with upper tooth more than twice the length of lower tooth (Fig. 6D), with dense setae on outer margin (Figs 6D, 10D); central sclerite not uniformly sclerotized (Fig. 23A)
 *E. capensis* (Thunberg, 1822)
20. Central sclerite small, shortly elongate and totally translucent (Fig. 34B); hind wing with Cu & cu-a (nervellus) intercepted around middle (NI 1.0–1.2) *E. perlatus* Shestakov, 1926
 – Central sclerite circular to distinctly elongate, pigmented at least distally (Figs 27A, 28B–C); hind wing with Cu & cu-a (nervellus) intercepted far below middle (NI > 1.6) 21
21. Central sclerite moderately to very long and curved toward base of wing, proximal sclerite dark brown (Fig. 27A) *E. rundiensis* Bischoff, 1915
 – Central sclerite more or less circular, proximal sclerite lighter (Figs 28B–C) 22
22. Central sclerite weakly sclerotized proximally (Fig. 28C); mesopleuron closely punctate without longitudinal striations (Fig. 17C) *Enicospilus* sp. 1
 – Central sclerite fully sclerotized (Fig. 28B); mesopleuron puncto-striate
 *Enicospilus* sp. 2 cf. *bicoloratus* Cameron, 1912

Enicospilus arabicus Gadallah & Soliman sp. nov.

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Figs 3A, 6A, 10A, 14A, 18A, 22A, 29A

Diagnosis

Moderately sized and yellow overall, including antennae and legs, pterostigma yellow, bordered posteriorly with black; mandible hardly twisted; clypeus strongly convex in profile, ventral margin blunt and in-turned; face 1.2 × as high as wide; antenna with 58 flagellomeres; mesoscutum with exceptionally long notauli distinct over its entire length; mesopleuron and metapleuron nearly smooth, with very slight fine rugosity ventrally; propodeum nearly smooth anteriorly, coarsely rugose-reticulate posteriorly; proximal sclerite comma-shaped with very long distal extension.

Etymology

Named in reference to the country of Saudi Arabia, where the type specimen was collected.

Type material

Holotype

SAUDI ARABIA: ♀, Asir, Abha, Raydah, light trap 1, 18°12.265' N, 42°24.744' E, alt. 2820 m, 26 Aug. 2014, leg. Al Dhafer *et al.* (KSMA).

Table 1. Comparison of local and biogeographical distributions of species of *Enicospilus* Stephens, 1835 collected in Saudi Arabia. All areas but Riyadh are considered to be part of the Afrotropical region, Riyadh is more related to the Palaearctic region (Hölzel 1998).

Species	Biogeography (Yu <i>et al.</i> 2012)	Saudi Arabia (present data; Gauld & Mitchell 1978; Horstmann 1981)
<i>E. arabicus</i> sp. nov.	–	Abha
<i>E. bicoloratus</i>	Afrotropical	Al Baha, Asir
<i>E. brevicornis</i>	Afrotropical	Abha, Asir
<i>E. capensis</i>	Afrotropical, Oriental, Australasian	Abha, Al Baha, Asir, Riyadh
<i>E. divisus</i>	Afrotropical	Asir
<i>E. dubius</i>	Afrotropical	Asir
<i>E. grandiflavus</i>	Afrotropical	Abha, Al Baha, Asir
<i>E. mirabilis</i> sp. nov.	–	Abha, Al Baha, Asir
<i>E. nervellator</i>	Palaearctic	Asir*, Riyadh
<i>E. oculator</i>	Afrotropical	Al Baha
<i>E. odax</i>	Afrotropical**	Al Baha, Asir
<i>E. oweni</i>	Afrotropical	Asir
<i>E. pacificus</i>	Afrotropical	Al Baha, Asir, Riyadh
<i>E. pallidus</i>	Afrotropical, Oriental	Al Baha
<i>E. perlatus</i>	Palaearctic	Mekka, Riyadh
<i>E. psammus</i>	Afrotropical	Abian, Al Lith, Asir, Qunfida
<i>E. pseudoculator</i> sp. nov.	–	Al Baha, Asir, Riyadh
<i>E. rundiensis</i>	Afrotropical	Al Baha, Asir
<i>E. senescens</i>	Afrotropical	Al Baha, Asir
<i>E. shadaensis</i> sp. nov.	Afrotropical***	Al Baha, Asir
<i>E. splendidus</i> sp. nov.	–	Riyadh
<i>E. sp. 1</i>	–	Asir
<i>E. sp. 2</i> cf. <i>bicoloratus</i>	–	Al Baha

* One specimen collected in Asir, 237 in Riyadh. ** Restricted to Yemen. *** According to *Enicospilus* sp. 4 distribution in Gauld & Mitchell 1978

Paratypes

SAUDI ARABIA: 1 ♀, Raydah (Abha), light trap 1, 5 Sep. 2015, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Abha), light trap 4, 6 Jun. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Abha), light trap 9, 26 Aug. 2014, leg. Al Dhafer *et al.* (KSMA).

Description

Female (5 specimens)

MEASUREMENTS. B 19–20; F 13–14; ML 0.4; CT 1.6; OOL 0.1; POL 1.1; FI 0.6; F11–2 1.9; F120 2.25; AI 0.9; CI 0.4; ICI 0.35; SDI 1.3; NI 2.7.

COLOUR. Yellow overall, including antennae and legs, with posterior half of T1–3 slightly darker; ovipositor sheath dark brown to black, pterostigma yellow, bordered posteriorly with black, wing veins dark brown to black, except sub-basal part of Rs+2r which is yellow margined dorsally with black, wing sclerite light orange to yellow; mandibular teeth black.

HEAD. Mandible short and stout, hardly twisted, upper tooth barely longer than lower tooth, bare, without groove on outer surface; clypeus superficially punctate medially, exceptionally convex in profile, ventral margin blunt and in-turned; face 1.2 × as high as wide, smooth; gena relatively broad and slightly swollen behind eyes; occipital carina complete and thin; antenna long and slender, with 58 flagellomeres.

MESOSOMA. Pronotum, mesoscutum, mesopleuron and metapleuron nearly smooth and shiny, with very slight fine rugosity especially ventrally; epicnemial carina distinct to level of ventral corner of pronotum; postpectal carina distinct and complete; notauli weak, but exceptionally long, extending over entire mesoscutum length; scutellum densely, finely punctate, carinate to near apex; basal transverse carina of propodeum sharply distinct; anterior area of propodeum smooth, posterior area finely transversely striate, concave postero-medially.

WINGS. Disco-submarginal cell of fore wing with well developed fenestra; proximal sclerite comma-shaped and connected to very long distal sclerite extending to Rs+2r; central sclerite totally absent; Rs+2r more or less straight, sub-basally thickened; cu-a subopposite to Rs & M; hind wing with 7 distal hamuli on R1.

LEGS. Fore tibia sparsely setose and with a crown of apical brownish spines; hind coxa in profile about 1.5 × as long as high; hind tarsal claws symmetrical, with 8 subequal teeth, that are slightly shorter than claw length.

METASOMA. Stout, widened posteriorly; thyridium slender, extending to slightly more than basal third of T2; ovipositor hardly reaching beyond metasomal apex, with dark brown sheath.

Male

Unknown.

BOLD Identification Number

ADB3498.

Remarks

This species is morphologically exceptional within *Enicospilus*. The hardly twisted mandibles, strongly convex clypeus and very long notauli are characters which occur rarely in the genus. Their combination makes *E. arabicus* sp. nov. unique.

Distribution

Saudi Arabia.

Enicospilus bicoloratus Cameron, 1912

Figs 3B, 6B, 10B, 14B, 18B, 22B, 29B

E. bicoloratus Cameron, 1912: 388, ♂.

Diagnosis (after Gauld & Mitchell 1978)

B 19 ; F 12–15; ML 0.4; CT 1.4; OOL 0.1; POL 0.5; FI 0.5–0.6; FI1–2 1.6–1.8; FI20 2.3–2.6; AI 0.45–0.95; CI 0.35–0.6; ICI 0.4–0.6; SDI 1.2–1.4; NI 2.6.

Body yellowish brown to orange, orbits paler; mandible with upper tooth 1.1–1.5 × as long as lower tooth; clypeus convex in profile, with ventral margin in-turned; face 1.2 × as high as wide; antenna with 50–56 flagellomeres; mesopleuron and metapleuron finely densely punctate; basal transverse carina of propodeum distinct, anterior area of propodeum punctate or nearly so, posterior area coarsely

striate; proximal sclerite triangular and moderately extended distally; central sclerite small, circular and uniformly sclerotized; hind wing with 5–7 distal hamuli on R1; fore tibia not spinose.

Material examined

SAUDI ARABIA: 1 ♀, Wadi Ghanuna (Al Baha), sweep net, 12 May 2011, leg. Fadl *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 9, 26 Aug. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 5, 21 Oct. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 9, 17 Nov. 2015, leg. Al Dhafer *et al.* (KSMA).

Distribution

Angola, Cameroon, Central African Republic, Democratic Republic of Congo, Ethiopia, Ivory Coast, Madagascar, Malawi, Nigeria, Sierra Leone, South Africa, Uganda (Gauld & Mitchell 1978; Yu *et al.* 2012), Zimbabwe (Rousse & van Noort 2014); Saudi Arabia (new record).

Enicospilus brevicornis (Masi, 1939)

Figs 3C, 6C, 10C, 14C, 18C, 22C, 29C

Amesospilus brevicornis Masi, 1939: 32, ♀.

Diagnosis (after Gauld & Mitchell 1978)

B 13–17; F 11–14; ML 0.3; CT 1.4–1.5; OOL 0.1; POL 0.58; FI 0.5–0.55; FI1–2 1.7–1.9; FI20 1.2–1.6; AI 0.4–1.0; CI 0.15–0.25; ICI 0.5–0.7; SDI 1.1–1.2; NI 2.0.

Body reddish brown overall, with upper and ventral sides of metasoma (in profile) black starting from T3; yellowish white in the following parts: posterior orbits of eyes, very thin along orbits (except upper third); pterostigma and most of Rs+2r light red in colour; mandible with upper tooth subequal to lower one; clypeus slightly convex in profile, with ventral margin slightly in-turned; face 1.3 × as high as broad; antenna with 43–47 flagellomeres; mesopleuron and metapleuron puncto-striate and longitudinally striate; basal transverse carina of propodeum distinct, anterior area nearly smooth to finely transversely sculptured, posterior area concentrically striate; proximal sclerite triangular, fully sclerotized; central sclerite totally absent; hind wing with 7–8 distal hamuli on R1; fore tibia sparsely setose.

Material examined

SAUDI ARABIA: 10 ♀♀, Raydah (Abha), sweep net, on olive, 26 Aug. 2014 (leg. Al Dhafer *et al.*); 3 ♀♀, same data but on Juniper (EFC); 2 ♀♀, Raydah (Abha), light trap 4, 27 Apr. 2014, leg. Al Dhafer *et al.* (KSMA); 2 ♀♀, Raydah (Abha), light trap 7, 6 Jun. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♂, Raydah (Abha), light trap 8, 21 Feb. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Abha), light trap (House), 26 Apr. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Wadi Bisha (K. Mushayt), sweep net, 27 Apr. 2014, leg. Sharaf *et al.* (KSMA).

Previous records from Saudi Arabia

Asir (Gauld & Mitchell 1978).

BOLD Identification Number

ADB3412.

Distribution

Egypt, Ethiopia, Saudi Arabia, South Africa (Gauld & Mitchell 1978), Democratic Republic of Congo, Kenya, Madagascar, Sudan, Uganda, Yemen (Yu *et al.* 2012).

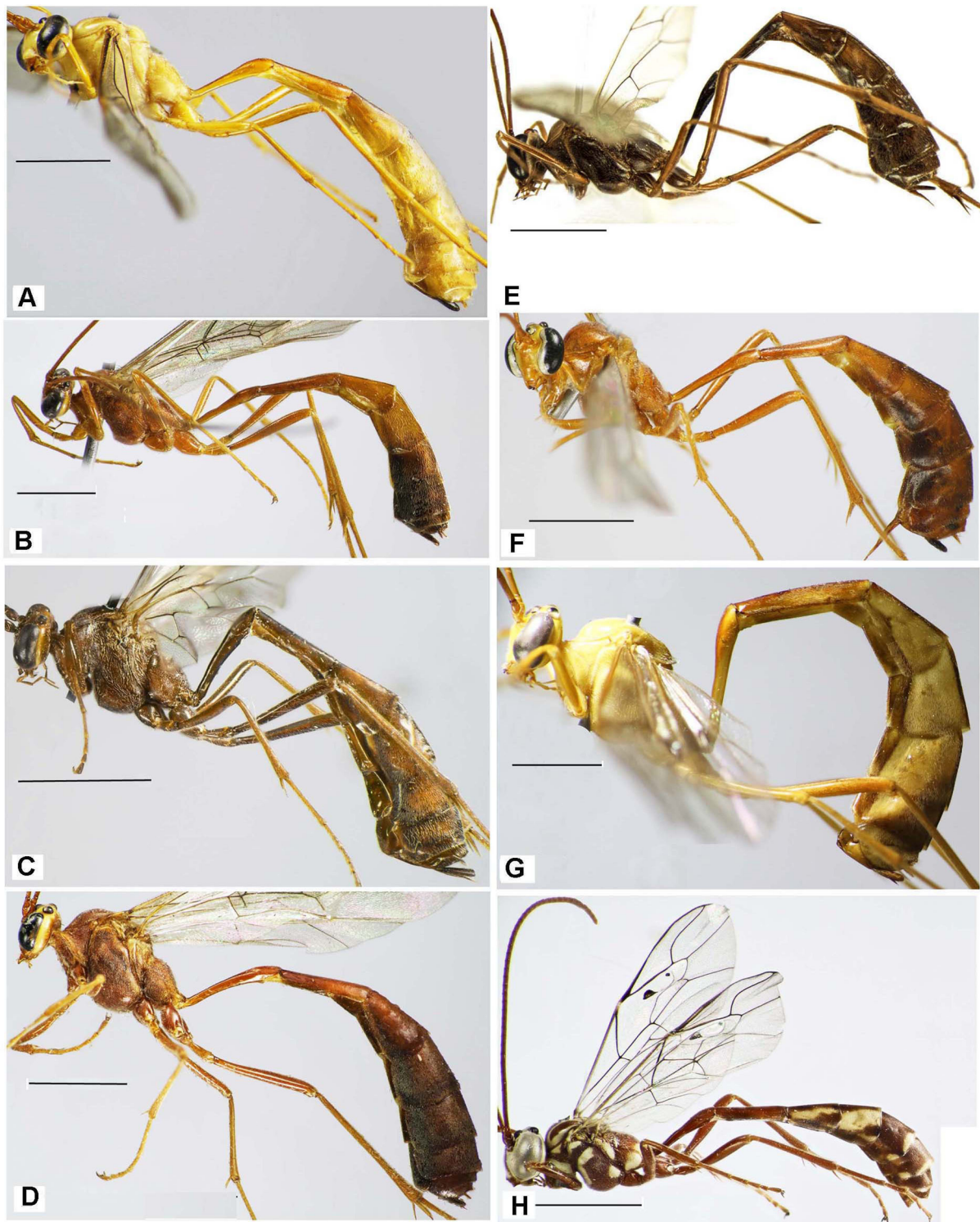


Fig. 3. Lateral habitus. **A.** *Enicospilus arabicus* Gadallah & Soliman sp. nov. **B.** *E. bicoloratus* Cameron, 1912. **C.** *E. brevicornis* (Masi, 1939). **D.** *E. capensis* (Thunberg, 1822). **E.** *E. divisus* (Seyrig, 1935). **F.** *E. dubius* (Tosquinet, 1896). **G.** *E. grandiflavus* Townes & Townes, 1973. **H.** *E. mirabilis* Soliman & Gadallah sp. nov. Scale bars = 2.5 mm.

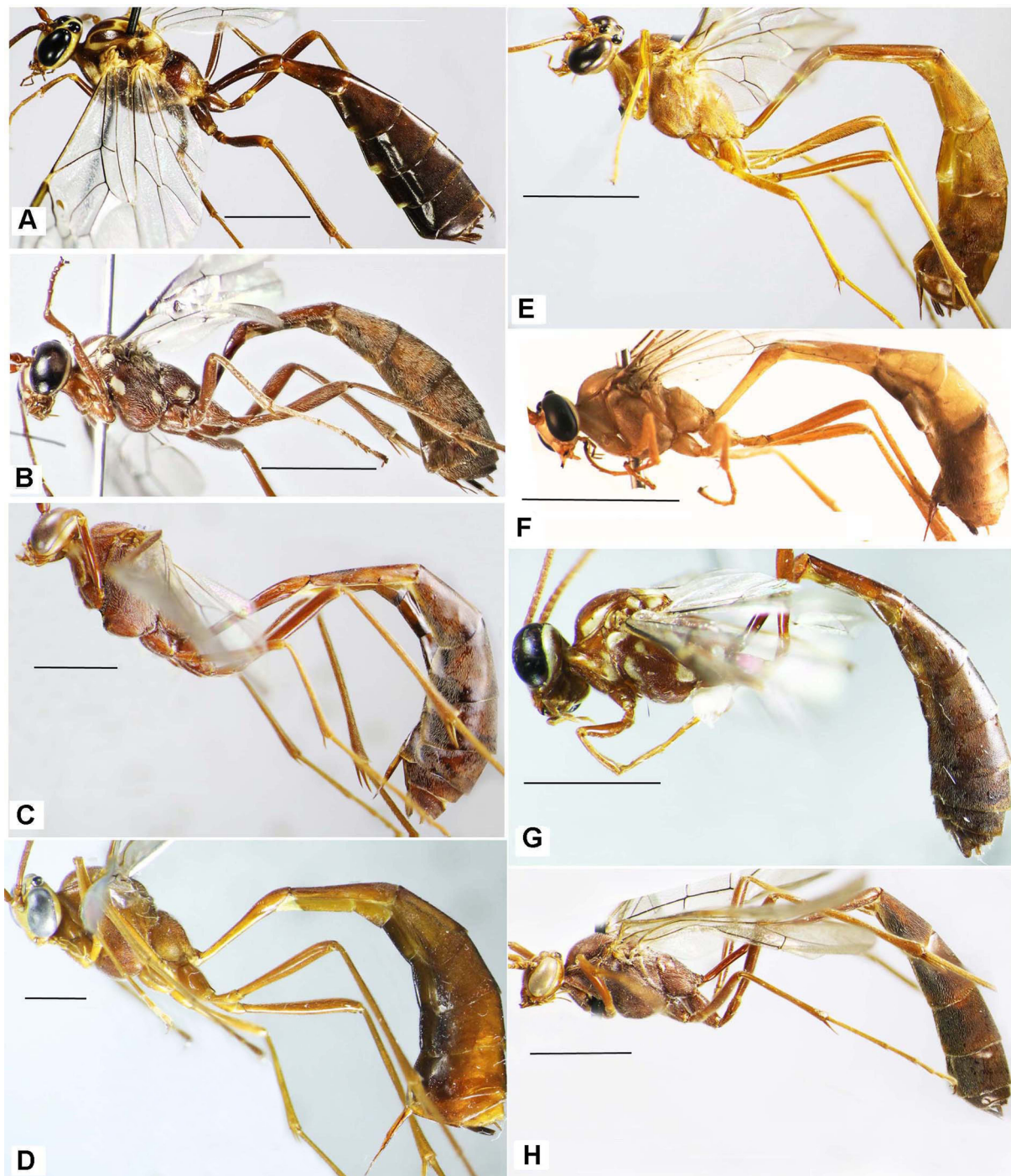


Fig. 4. Lateral habitus. **A.** *Enicospilus nervellator* Aubert, 1966. **B.** *E. oculator* Seyrig, 1935. **C.** *E. odax* Gauld & Mitchell, 1978. **D.** *E. oweni* Gauld & Mitchell, 1976. **E.** *E. pacificus* (Holmgren, 1868). **F.** *E. pallidus* (Taschenberg, 1875). **G.** *E. pseudoculator* Gadallah & Soliman sp. nov. **H.** *E. rundiensis* Bischoff, 1915. Scale bars = 2.5 mm.

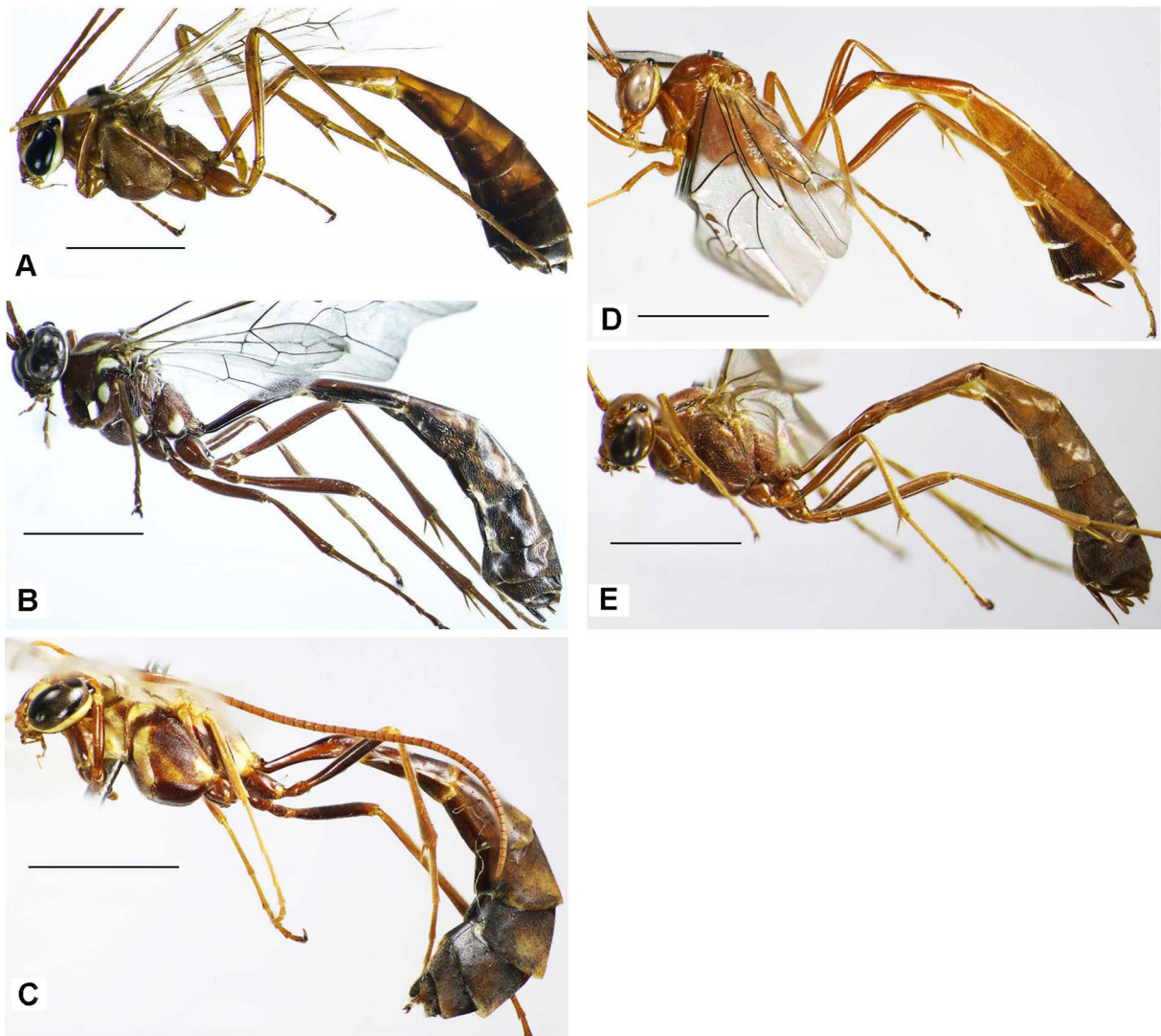


Fig. 5. Lateral habitus. **A.** *Enicospilus senescens* (Tosquinet, 1896). **B.** *E. shadaensis* Gadallah & Soliman sp. nov. **C.** *E. splendidus* Rouse, Soliman & Gadallah sp. nov. **D.** *E. sp. 2* cf. *bicoloratus* Cameron, 1915. **E.** *E. sp. 1*. Scale bar = 2.5 mm.

Enicospilus capensis (Thunberg, 1822)

Figs 3D, 6D, 10D, 14D, 18D, 23A, 29D

Ichneumon capensis Thunberg, 1822: 314, ♀.

Ophion antancarum Saussure, 1892: 21.

Henicospilus praedator Enderlein, 1921: 28, ♀

Henicospilus incarinatus Enderlein, 1921: 30, ♂

Henicospilus euxoae Wilkinson, 1928: 261, ♀.

Enicospilus obnoxius Seyrig, 1935: 75, ♀.

Diagnosis (after Gauld & Mitchell 1978)

B 16–19; F 11–15; ML 0.2–0.3; CT 1.7–2.2; OOL 0.2; POL 0.8; FI 0.47–0.5; FI1–2 1.5–1.7; FI20 1.5–2.0; AI 0.4–0.8; CI 0.35–0.5; ICI 0.43–0.6; SDI 1.28–1.5; NI 1.8.

Body reddish brown overall, orbits and gena pale yellow; mandible slightly twisted, with inner groove along outer margin that is lined with a fringe of pale setae, lower tooth slightly more than $2.0 \times$ as long as upper tooth; clypeus convex in profile, with ventral margin in-turned ventrally; face subquadrate, $0.85\text{--}1.1 \times$ as high as wide; antenna with 46–54 flagellomeres; mesopleuron and metapleuron closely and finely punctate; basal transverse carina of propodeum distinct, anterior area of propodeum nearly smooth to transversely finely shagreened, posterior area coarsely rugose; proximal sclerite dome-shaped; central sclerite small, not uniformly sclerotized; distal sclerite transverse comma-shaped; hind wing with 7 distal hamuli on R1; fore tibia sparsely setose.

Material examined

SAUDI ARABIA: 2 ♀♀, Shada Al Ala (Al Baha), sweep net, on *Cactus*, 17 Oct. 2014, leg. Al Dhafer *et al.* (EFC); 4 ♀♀, Shada Al Ala (Al Baha), light trap 4, 15 Feb. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Shada Al Ala (Al Baha), light trap 5, 15 Feb. 2014, leg. Al Dhafer *et al.* (KSMA); 3 ♀♀, Shada Al Ala (Al Baha), light trap (House), 16 Feb. 2014, leg. Fadl H. (KSMA); 1 ♀, Raydah (Abha), light trap 4, 6 Jun. 2014, leg. Al Dhafer *et al.* (KSMA); 2 ♀♀, Deirab (Riyadh), light trap, 21–25 Oct. 1985, leg.? (KSMA); 4 ♀♀, Deirab (Riyadh), light trap, 4 Nov. 1985, leg.? (KSMA); 1 ♀, Deirab (Riyadh), light trap, 1 Dec. 1985, leg.? (KSMA); 1 ♀: Al Waseel (Riyadh), light trap, 8 Dec. 2012, leg. Sonbati S. (KSMA); 1 ♀, Al Kharg (Riyadh), light trap, 22 Feb. 2004, leg. Al Oqeal Y. (KSMA); 1 ♀, Al Amaryiah (Riyadh), light trap, 28 Jan. 2008, leg. Boy Valenza D. (KSMA).

Previous records from Saudi Arabia

Asir (Gauld & Mitchell 1978).

BOLD Identification Number

AAI5183.

Distribution

Burundi, Democratic Republic of Congo, Kenya, Lesotho, Mauritius, Rhodesia, Rwanda, Senegal, Sierra Leone, South Africa, Tanzania, Uganda, Yemen (Gauld & Mitchell 1978), China, Ethiopia, Gabon, India, Indonesia, Japan, Malaysia, Philippines, Sri Lanka (Yu *et al.* 2012), Madagascar (Gauld & Mitchell 1978; Madl 1996).

Enicospilus divisus (Seyrig, 1935)
Figs 3E, 6E, 10E, 14E, 18E, 23B, 29E

Schizospilus divisus Seyrig, 1935: 80, ♀.

Diagnosis (after Gauld & Mitchell 1978)

B19; F 15.5; ML 0.3; CT 1.4; OOL 0.1; POL 0.7; FI 1.0; FI1–2 1.6; FI20 2.0; AI 1.0; CI 0.5; ICI 0.3; SDI 1.4; NI 2.2.

Dark reddish brown overall, with vertex, posterior margin of head, face (except a median narrow dark longitudinal band extending from fore ocellus to base of clypeus) and most of clypeus (except reddish ventral part) whitish; labrum reddish, mandible red (except black teeth) and slender, with upper tooth subequal to inner tooth; clypeus convex in profile, ventral margin in-turned; face 1.3 × as high as wide; mesopleuron puncto-striate, metapleuron finely shagreened; basal transverse carina of propodeum distinct; propodeum finely shagreened anteriorly, finely wrinkled posteriorly; proximal sclerite triangular, fully sclerotized; central sclerite subdivided and U-shaped; hind wing with 7 distal hamuli on R1; fore tibia sparsely setose.

Material examined

SAUDI ARABIA: 1 ♀, Raydah (Asir), light trap 9, 30 Jan. 2015, leg. Al Dhafer *et al.* (KSMA).

BOLD Identification Number

ABD4430.

Distribution

Widely distributed throughout East Africa from Ethiopia to South Africa (Gauld & Mitchell 1978), Uganda (Rousse & van Noort 2014); Saudi Arabia (new record).

Enicospilus dubius (Tosquinet, 1896)
Figs 3F, 6F, 10F, 14F, 18F, 23C, 29F

Ophion (Enicospilus) dubius Tosquinet, 1896: 390, ♀.

Ophion (Enicospilus) anceps Tosquinet, 1896: 392, ♂.

Henicospilus angustatus Szépligeti, 1906: 136, ♀.

Amesospilus gulosus Seyrig, 1935: 60, ♀.

Diagnosis (after Gauld & Mitchell 1978)

B17–19; F 11–16; ML 0.2–0.3; CT 1.4–1.6; OOL 0.2; POL 0.53; FI 0.6–0.65; FI1–2 1.6–1.8; FI20 2.5–3.0; AI 1.1–2.0; CI 0.5–0.7; ICI 0.25–0.45; SDI 1.29–1.5; NI 1.88.

Body including antennae and legs reddish brown, metasoma darker in colour, orbits paler; mandible with upper tooth 1.4–1.5 × as long as lower tooth; clypeus convex in profile, with ventral margin in-turned; face 1.3 × as high as wide; antenna with 52–61 flagellomeres; mesopleuron impunctate, longitudinally striate, metapleuron finely transversely striate; basal transverse carina of propodeum distinct, anterior area nearly smooth or finely rugose, posterior area concentrically rugose; proximal sclerite triangular, fully sclerotized; central sclerite totally absent, distal sclerite small, crescent-shaped; hind wing with 6–8 distal hamuli on R1; fore tibia not spinose.

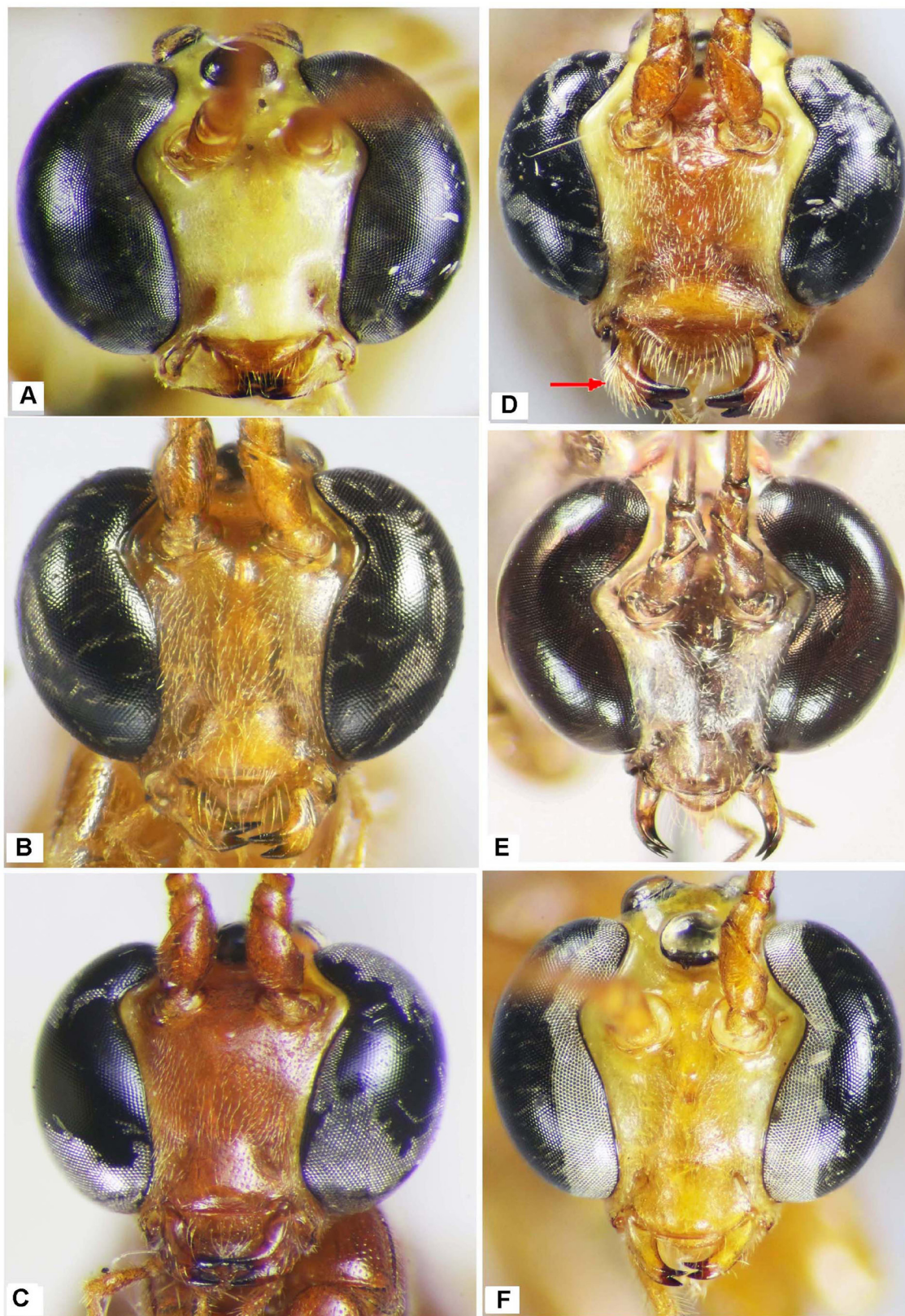


Fig. 6. Anterior view of head. **A.** *Enicospilus arabicus* Gadallah & Soliman sp. nov. **B.** *E. bicoloratus* Cameron, 1912. **C.** *E. brevicornis* (Masi, 1939). **D.** *E. capensis* (Thunberg, 1822). **E.** *E. divisus* (Seyrig, 1935). **F.** *E. dubius* (Tosquinet, 1896).



Fig. 7. Anterior view of head. **A.** *Enicospilus grandiflavus* Townes & Townes, 1973. **B.** *E. mirabilis* Soliman & Gadallah sp. nov. **C.** *E. nervellator* Aubert, 1966. **D.** *E. oculator* Seyrig, 1935. **E.** *E. odax* Gauld & Mitchell, 1978. **F.** *E. oweni* Gauld & Mitchell, 1978.

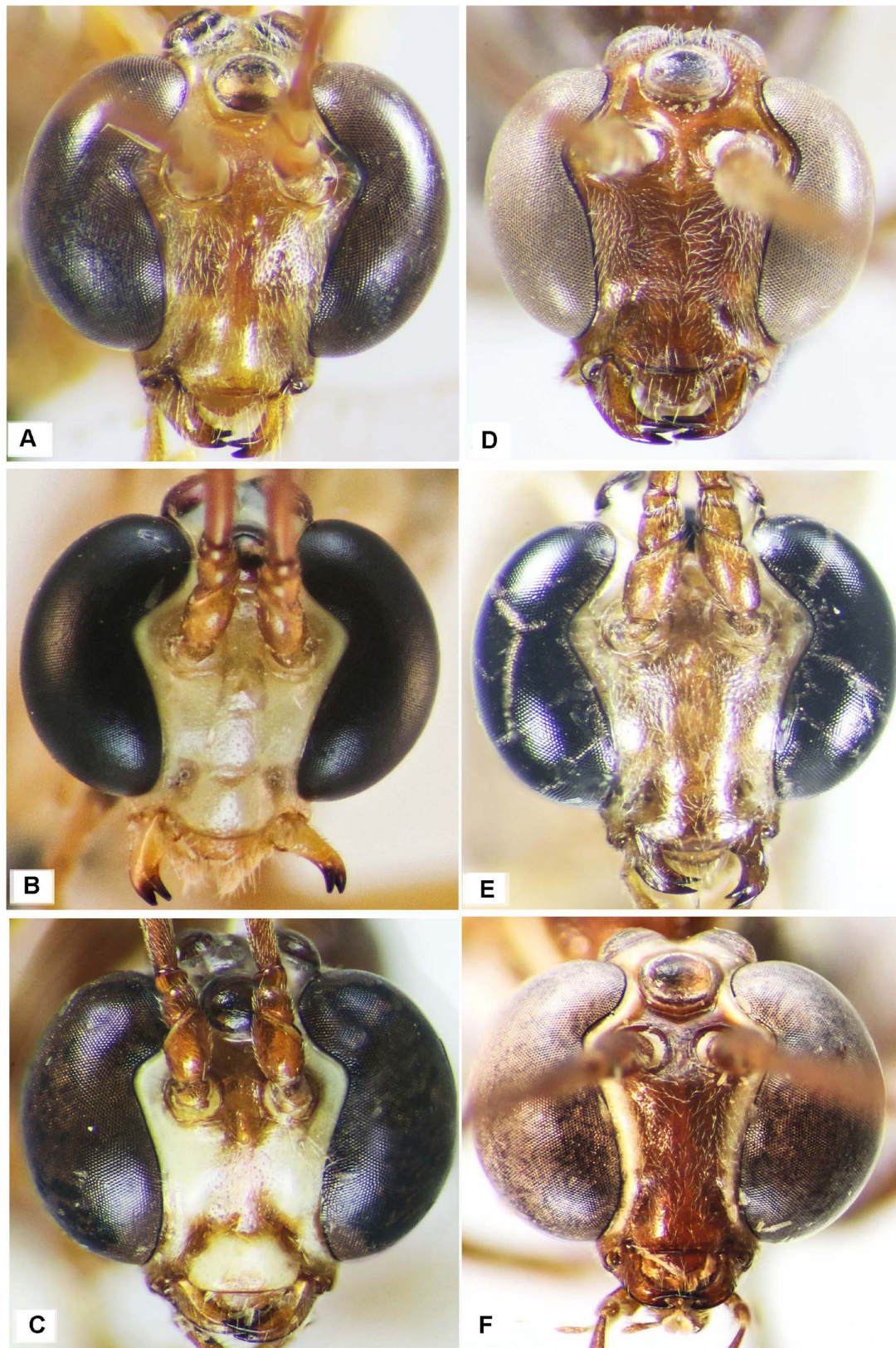


Fig. 8. Anterior view of head. **A.** *Enicospilus pacificus* (Holmgren, 1868). **B.** *E. pallidus* (Taschenberg, 1875). **C.** *E. pseudoculator* Gadallah & Soliman sp. nov. **D.** *E. rundiensis* Bischoff, 1915. **E.** *E. senescens* (Tosquinet, 1896). **F.** *E. shadaensis* Gadallah & Soliman sp. nov.

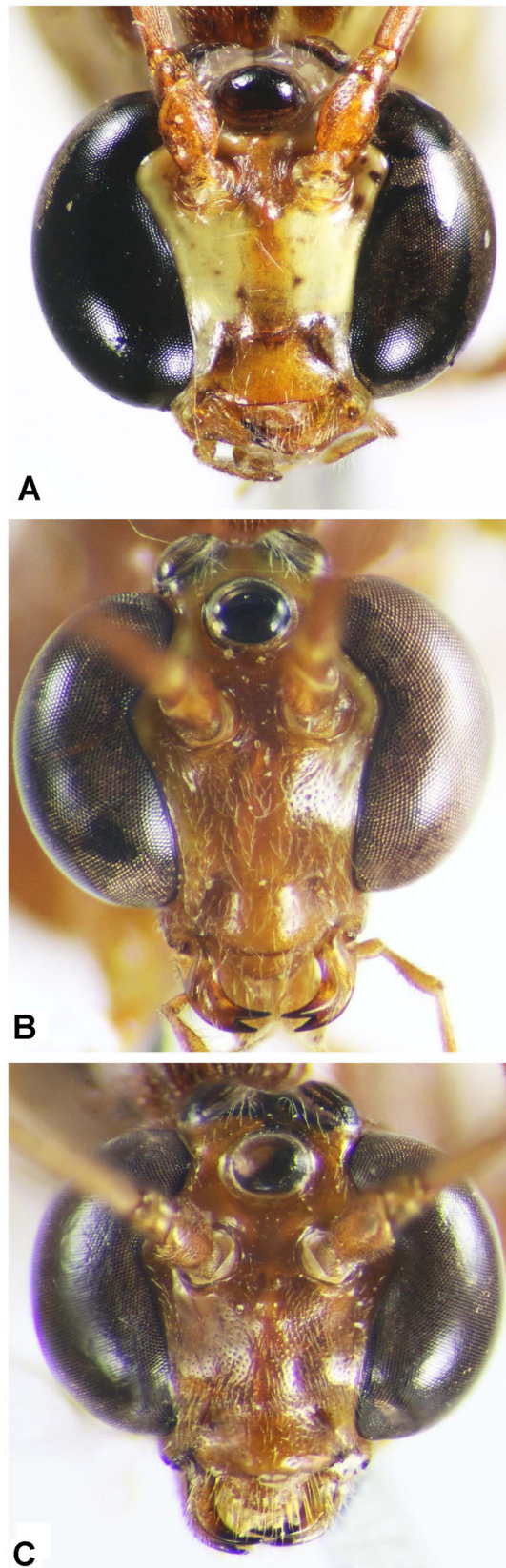


Fig. 9. Anterior view of head. **A.** *Enicospilus splendidus* Rouse, Soliman & Gadallah sp. nov. **B.** *Enicospilus* sp. 2 cf. *bicoloratus* Cameron, 1915. **C.** *Enicospilus*. sp. 1

Material examined

SAUDI ARABIA: 1 ♀, Raydah (Asir), light trap (House), 27 Apr. 2014, leg. Al Dhafer *et al.* (EFC); 2 ♀♀, Raydah (Asir), light trap 7, 20 Feb. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 1, 27 Apr. 2014, leg. Al Dhafer *et al.* (KSMA); 2 ♀♀, Raydah (Asir), light trap 4, 26–27 Apr. 2014 leg. Al Dhafer *et al.* (KSMA); 2 ♀♀, 1 ♂, Raydah (Asir), light trap 3, 6 Jun. 2014, leg. Al Dhafer *et al.* (KSMA); 3 ♀♀, Raydah (Asir), light trap 4, 6 Jun. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 5, 20 Oct. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 5, 18 Nov. 2015, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 8, 18 Nov. 2015, leg. Al Dhafer *et al.* (KSMA); 2 ♀♀, Raydah (Asir), light trap 9, 18 Nov. 2015, leg. Al Dhafer *et al.* (KSMA).

BOLD Identification Number

ABD4296.

Distribution

Angola, Burundi, Cameroon, Central African Republic, Ethiopia, Ghana, Ivory Coast, Kenya, Nigeria, Rwanda, Sierra Leone, South Africa, Tanzania (Gauld & Mitchell 1978; Yu *et al.* 2012), Madagascar (Gauld & Mitchell 1978; Madl 1996; Yu *et al.* 2012), Réunion (Gauld & Mitchell 1978; Rousse & Villemant 2012; Yu *et al.* 2012); Saudi Arabia (new record).

Enicospilus grandiflavus Townes & Townes, 1973

Figs 3G, 7A, 11A, 15A, 19A, 24A, 30A

Enicospilus grandiflavus Townes & Townes, 1973: 177 [replacement name for *grandis* Morley].
Henicospilus grandis Morley, 1912: 41, ♂.

Diagnosis (after Gauld & Mitchell 1978)

B 26–30; F 17–19; ML 0.3; CT 1.5–1.7; OOL 0.1; POL 0.5; FI 0.65–0.7; F11–2 1.6–2.1; F120 1.3–1.5; AI 0.65–0.9; ICI 0.85–0.9; CI 0.22; SDI 1.1–1.2; NI 1.4.

Body predominately light yellow, metasoma darkened dorsally and apically; pterostigma and sclerites light yellow, wing venation black, tip of mandible black; mandible slightly twisted, with upper tooth about 2.0 × as long as lower tooth; clypeus flat in profile, with straight to truncate free margin; face subquadrate, 1.1–1.4 × as high as wide; antenna with 54–60 flagellomeres; mesopleuron closely punctate to puncto-striate, metapleuron coarsely transversely rugose; basal transverse carina of propodeum distinct, anterior area of propodeum finely rugose, posterior area coarsely and concentrically striate; proximal sclerite obtusely angled without distal extension, central sclerite totally absent; hind wing with distal 7–8 hamuli on R1; fore tibia sparsely spinose; claws with black, regular and equal-sized comb of teeth, slightly shorter than claw length, shortened near base.

Material examined

SAUDI ARABIA: 1 ♂, Raydah (Asir), light trap, on *Cactus*, 11 Dec. 2014, leg.? (EFC); 1 ♀, Raydah (Asir), light trap (House), 5 Sep. 2015, leg. Al Dhafer *et al.* (EFC); 1 ♂, Shada Al Ala (Al Baha), light trap (House), 3 Jun. 2014, leg. Al Dhafer *et al.* (EFC); 1 ♀, Shada Al Ala (Al Baha), light trap 4, 3 Jun. 2014, leg. Al Dhafer *et al.* (EFC); 1 ♂, 1 ♀, Raydah (Asir), light trap (House), 8 Nov. 2015, leg. Al Dhafer *et al.* (EFC); 2 ♂♂, Shada Al Ala (Al Baha), sweep net on *Acacia*, 15 Nov. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♂, Shada Al Ala (Al Baha), light trap 4, 21 Apr. 2014, leg. Al Dhafer *et al.* (KSMA); 2 ♂♂, Shada Al Ala (Al Baha), light trap (House), 15 Nov. 2015, leg. Al Dhafer *et al.* (KSMA); 2 ♀♀, 1 ♂, Raydah (Asir), light trap 9, 17–18 Nov. 2015, leg. Al Dhafer *et al.* (KSMA).

BOLD Identification Number

AAI5204.

Distribution

Madagascar, South East Africa (Gauld & Mitchell 1978), Réunion, South Africa (Rousse & Villemant 2012; Rousse & van Noort 2014), Democratic Republic of Congo, Zimbabwe (Yu *et al.* 2012); Saudi Arabia (new record).

Enicospilus mirabilis Soliman & Gadallah sp. nov.

[urn:lsid:zoobank.org:act:8BE2DB48-FE4D-4382-B327-2652AB99B259](https://zoobank.org/urn:lsid:zoobank.org:act:8BE2DB48-FE4D-4382-B327-2652AB99B259)

Figs 3H, 7B, 11B, 15B, 19B, 24B, 30B

Diagnosis

Small and dark reddish brown overall including antennae and legs, with profuse white on all body regions, metasoma interspersed with ivory markings; mandible hardly twisted; clypeus flat in profile, ventral margin straight to truncate; face subquadrate, 1.1 × as high as wide; antennae with 44 flagellomeres; mesoscutum with indistinct notauli; mesopleuron puncto-striate, metapleuron densely finely punctate; propodeum nearly smooth anteriorly and superficially foveolate posteriorly; proximal sclerite dome to triangular shaped, central sclerite small and circular, uniformly sclerotized.

Etymology

Latin adjective meaning “amazing”, in reference to the wonderful appearance of this species.

Type material

Holotype

SAUDI ARABIA: ♀, Al Baha, Shada Al Ala, light trap House, 19°52.598' N, 41°18.672' E, alt. 892 m, 21 Apr. 2014, leg. Al Dhafer *et al.* (KSMA).

Paratypes

SAUDI ARABIA: 1 ♂, Raydah (Asir), light trap 6, on olive, 26 Aug. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Shada Al Ala (Al Baha), light trap (House), 26 Apr. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 7, 26 Apr. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 6, 26 Aug. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♂, Wadi Neera (Al Baha), light trap, 3 Mar. 2015, leg. Al Dhafer *et al.* (KSMA); 1 ♂, Shada Al Ala (Al Baha), light trap 4, 5 May 2015, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Shada Al Ala (Al Baha), light trap 4, 2 Sep. 2015, leg. Al Dhafer *et al.* (KSMA).

Description

Female (5 specimens)

MEASUREMENTS. B 14; F 8; ML 0.5; CT 0.66; OOL 0.1; POL 1.13; FI 0.68; FI1–2 1.6; FI20 1.5; AI 0.57; CI 0.25; ICI 0.35; SDI 1.29; NI 2.1.

COLOUR. Reddish brown overall, including antennae and legs, with profuse white on the following: head (except a narrow middle area just between and beneath antennal bases to base of clypeus, as well as around clypeus and occiput), lateral border of mesoscutum as well as two very thin lines in middle, tegula, axilla, scutellum, anterior border of pronotum (interrupted medially), two large markings on lateral side of pronotum, subalar prominence, an elongate oval marking postero-laterally of propodeum,

two large markings forming together an inverted L-shaped marking on upper side of mesopleuron and a small rounded one on its lower area just above base of mesocoxa, a transverse band at upper side of metapleuron and a small rounded marking at lower area just above metacoxa, metasoma with ivory markings laterally on T3–T7. Fore wing with yellowish pterostigma is bordered above and behind by black, wing veins black, sclerites black.

HEAD. Mandible hardly twisted, with slightly ridged and dark external margin and with two subequal to equal-sized teeth; labrum semicircular, about $1.3 \times$ as broad as long; clypeus flat in profile, ventral margin straight to truncate; face subquadrate, $1.1 \times$ as high as wide; gena moderately swollen behind eye; occipital carina complete and thin; antenna short, with 44 flagellomeres.

MESOSOMA. Pronotum normal; mesoscutum nearly smooth and shiny; mesopleuron closely punctate, metapleuron puncto-striate; epicnemial carina distinct to level of ventral corner of pronotum; postpectal carina distinct and complete; notauli indistinct; scuto-scutellar groove strigated; scutellum smooth, carinate to apex; transverse basal carina of propodeum weak but distinct, propodeum nearly smooth to transversely shagreened, superficially wrinkled posteriorly.

WINGS. Disco-submarginal cell of fore wing with well developed fenestra, proximal sclerite triangular to dome-shaped, central sclerite small circular and uniformly sclerotized; $Rs+2r$ very slightly thickened medially, more or less straight; hind wing with 4 distal hamuli on R1.

LEGS. Fore tibia not spinose.

METASOMA. Slender, T2 in profile $5 \times$ as long as high; thyridium ellipsoid, shallowly dilineated extending along anterior third of T2 laterally; ovipositor short, hardly extending beyond abdominal extremity.

Male (3 specimens)

Similar to female.

BOLD Identification Number

ADB4082.

Remarks

This species resembles *E. oculator*, but differs from it by the following combination of characters: in *E. mirabilis* sp. nov. clypeus almost ivory (except laterally and ventrally) (in *E. oculator* clypeus ivory only ventrally); propodeum and metapleuron each with a large oval ivory marking (in *oculator* no ivory markings on metapleuron and propodeum), metasoma with ivory markings (in *oculator* metasoma without ivory markings); mandibular teeth subequal (in *oculator* upper tooth $1.5 \times$ as long as lower tooth); posterior area of propodeum superficially or shallowly finely wrinkled (in *oculator* coarsely striate); central sclerite uniformly sclerotized (in *oculator* central sclerite weakly sclerotized proximally); $Fl20 < 1.7$ (in *oculator* $Fl20 > 1.7$); hind wing with 4 distal hamuli on R1 (in *oculator* with 5 distal hamuli on R1).

Distribution

Saudi Arabia.

Enicospilus nervellator Aubert, 1966

Figs 4A, 7C, 11C, 15C, 19C, 24C, 30C, 33A

Enicospilus nervellator Aubert, 1966: 43, ♀.

Diagnosis (after Gauld & Mitchell 1978)

B 17–18; F 11–15; ML 0.1–0.25; CT 1.7–2.1; OOL 0.12, POL 0.6; FI 0.5; FI1–2 1.7–1.9; FI20 1.2–1.5; AI 0.54–0.65; ICI 0.6–0.8; CI 0.3–0.4; SDI 1.38–1.5.

Body reddish brown to ferruginous overall, T1, T2 and most of T3 bright red, the following parts pale yellow: face (except red middle, extending from fore ocellus to base of clypeus), posterior margin of head broadly, vertex, almost all pronotum, a middle U-shaped area on mesoscutum extending to its posterior margin as well as lateral margin, posterior half of propodeum, tegula, scutellum (except basally), subalar prominence, upper and lower areas of mesopleuron, lower half of metapleuron; mandible with upper tooth 2.0 × as long as lower tooth; clypeus flat in profile, with ventral margin straight to truncate; face subquadrate, 1.1–1.25 × as high as wide; antenna with 50–52 flagellomeres; mesopleuron punctate, metapleuron shallowly puncto-striate; basal transverse carina of propodeum very weak but complete, anterior area of propodeum sparsely punctate, posterior area superficially rugose; proximal sclerite yellow (weakly sclerotized) dome-shaped, central sclerite longitudinal and weakly sclerotized; hind wing with 6–7 distal hamuli on R1; fore tibia considerably spinose; outer mid (and sometimes hind) tibial spur distinctly less than 0.4 × as long as inner spur.

Material examined

SAUDI ARABIA: 1 ♀, Rhodet Khorim (Riyadh), light trap (B), 6 Mar. 2012, leg. Al Dhafer *et al.* (EFC); 1 ♀, Ummul Hammam (Riyadh), light trap, 10 Feb. 2010, leg. Abdel-Azeem M. (KSMA); 1 ♀, Al Khararah (Riyadh), light trap, 22 Feb. 2012, leg. Al Gharabawy *et al.* (KSMA); 1 ♀, Al Khararah (Riyadh), light trap, 7 Mar. 2012, leg. Al Dyrachim *et al.* (KSMA); 1 ♀, Rawdet Farshet Sheaal (Riyadh), light trap 1, 26 Jan. 2016, leg. Al Gharabawy *et al.* (KSMA); 3 ♀♀, Rawdet Farshet Sheaal (Riyadh), light trap 10, 26 Jan. 2016, leg. Al Gharabawy *et al.* (KSMA); 1 ♀, Rawdet Farshet Sheaal (Riyadh), light trap 11, 26 Jan. 2016, leg. Al Gharabawy *et al.* (KSMA); 1 ♀, Wadi Ghaihab (Riyadh), light trap, 27 Jan. 2016, leg. Al Gharabawy *et al.* (KSMA); 19 ♀♀, Rawdet Al Harmalyiah (Riyadh), light trap 1, 2 Feb. 2016, leg. Al Dhafer *et al.* (KSMA); 49 ♂♂, 104 ♀♀, Rawdet Al Harmalyiah (Riyadh), light trap 3, 2 Feb. 2016, leg. Al Dhafer *et al.* (KSMA); 1 ♂, 53 ♀♀, Rawdet Al Harmalyiah (Riyadh), light trap 5, 2 Feb. 2016, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Rawdet Al Harmalyiah (Riyadh), Malaise trap 4, 2 Feb. 2016, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Wadi Hanifa (Riyadh), light trap, 4 Feb. 2016, leg. Al Dhafer (KSMA); 1 ♀, Wadi Sabeen (Asir), light trap, 22 Feb. 2016, leg. Fadl *et al.* (KSMA).

Previous records from Saudi Arabia

Jeddah, Najd, Rub'al Khali (Gauld & Mitchell 1978).

BOLD Identification Number

ADB4509.

Distribution

Algeria, Saudi Arabia (Gauld & Mitchell 1978; Yu *et al.* 2012), Egypt (Shaumar 1966; Yu *et al.* 2012).

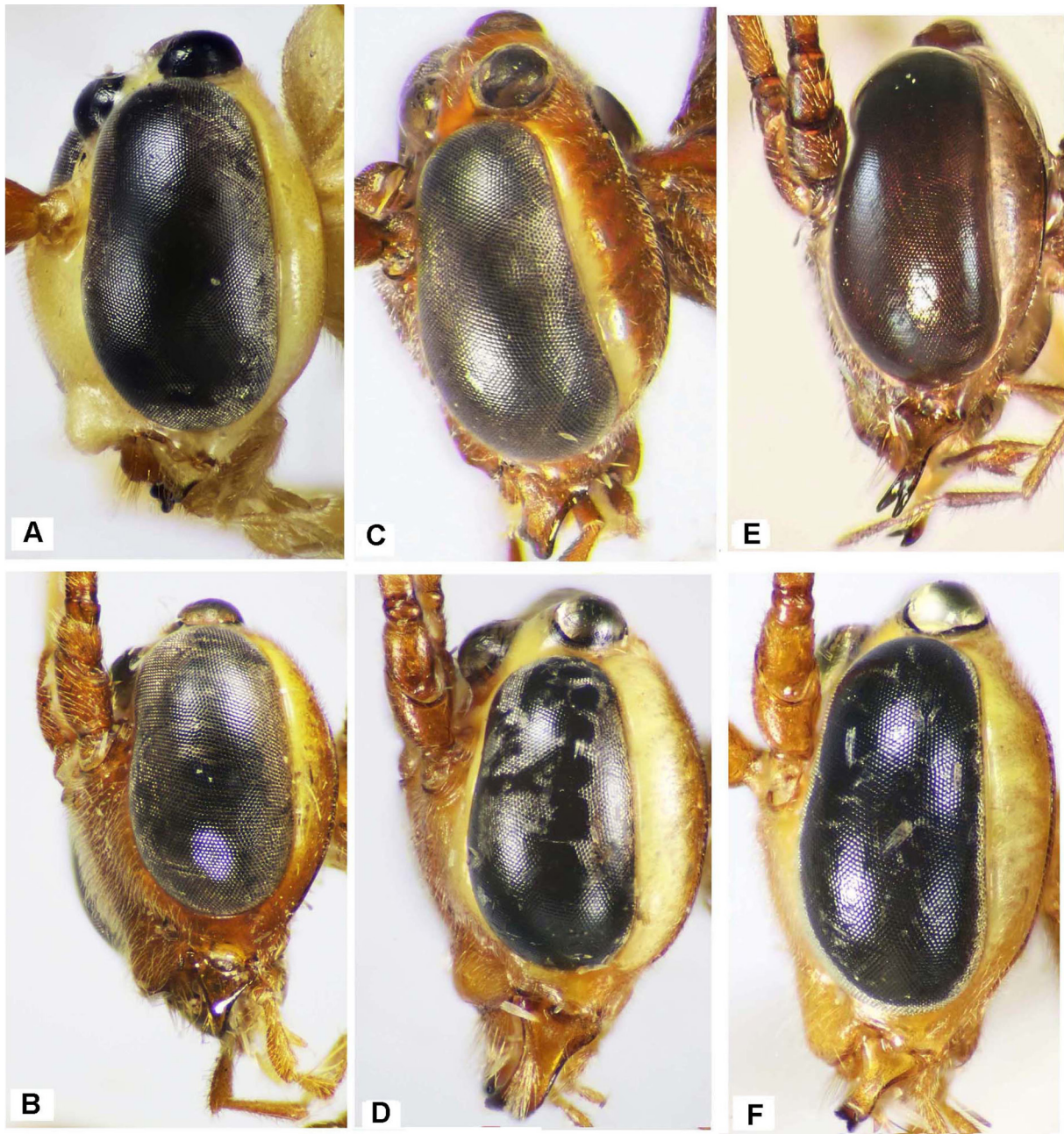


Fig. 10. Lateral view of head. **A.** *Enicospilus arabicus* Gadallah & Soliman sp. nov. **B.** *E. bicoloratus* Cameron, 1912. **C.** *E. brevicornis* (Masi, 1939). **D.** *E. capensis* (Thunberg, 1822). **E.** *E. divisus* (Seyrig, 1935). **F.** *E. dubius* (Tosquinet, 1896).

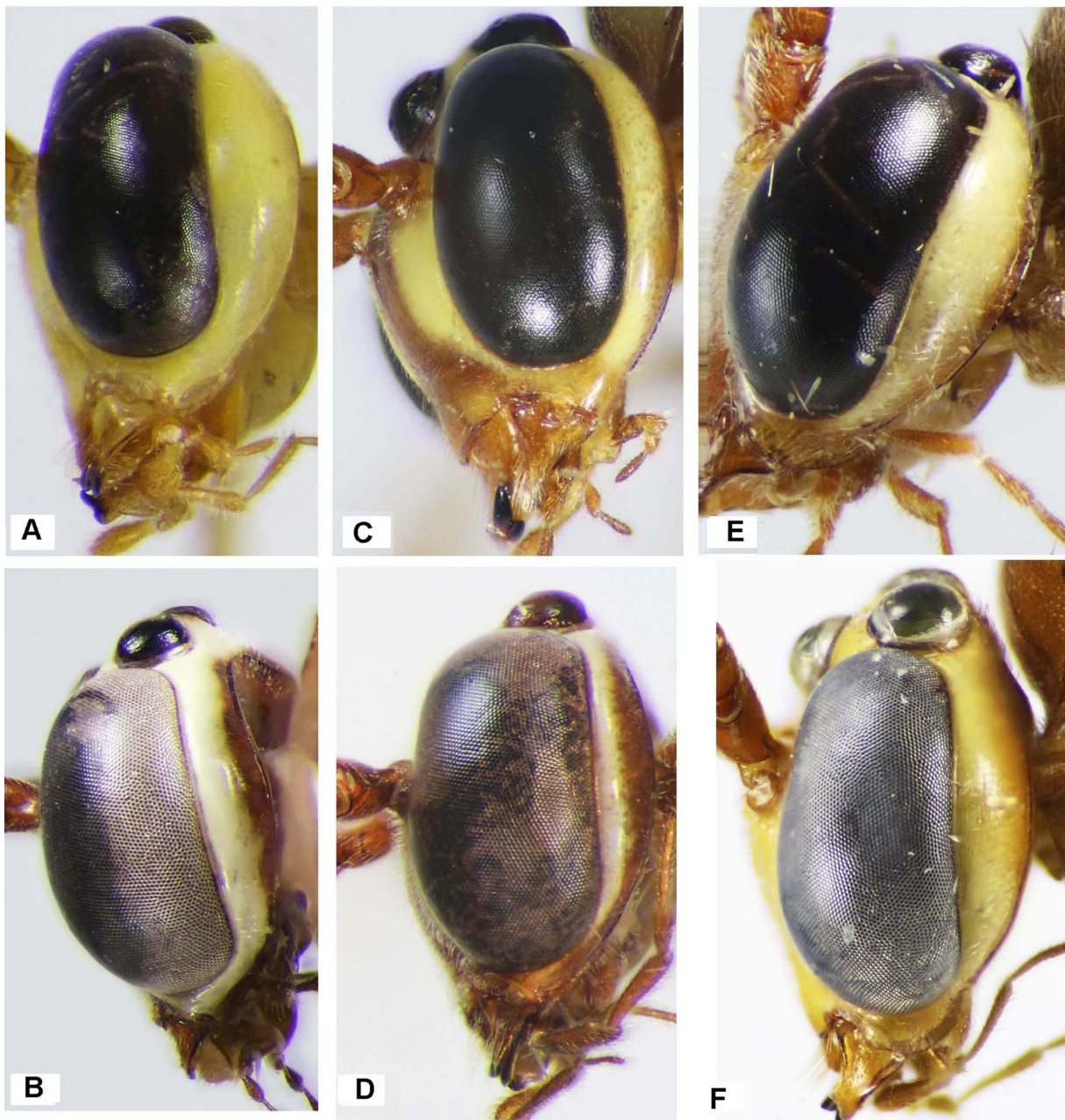


Fig. 11. Lateral view of head. **A.** *Enicospilus grandiflavus* Townes & Townes, 1973. **B.** *E. mirabilis* Soliman & Gadallah sp. nov. **C.** *E. nervellator* Aubert, 1966. **D.** *E. oculator* Seyrig, 1935. **E.** *E. odax* Gauld & Mitchell, 1978. **F.** *E. oweni* Gauld & Mitchell, 1978.

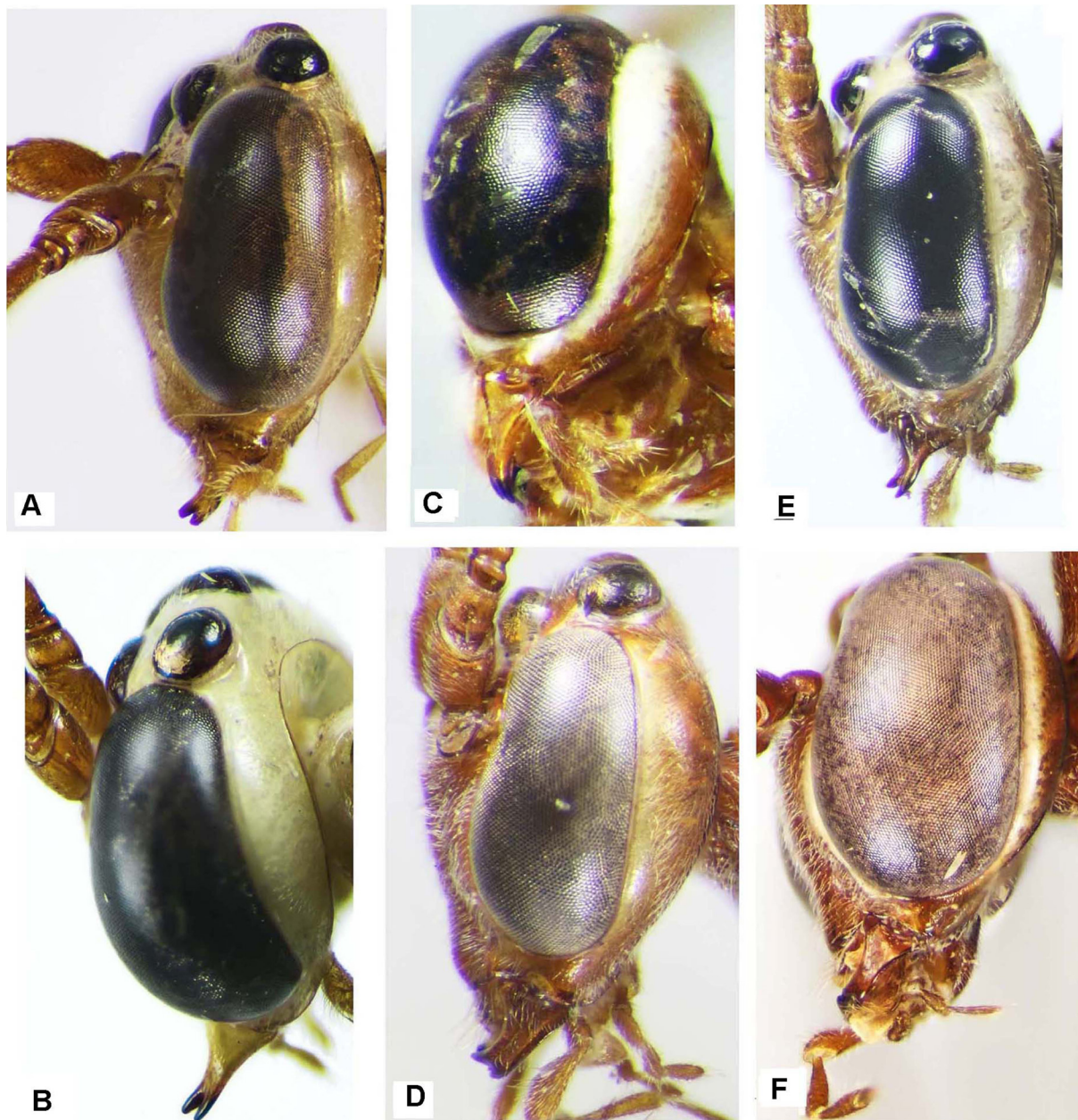


Fig. 12. Lateral view of head. **A.** *Enicospilus pacificus* (Holmgren, 1868). **B.** *E. pallidus* (Taschenberg, 1875). **C.** *E. pseudoculator* Gadallah & Soliman sp. nov. **D.** *E. rundiensis* Bischoff, 1915. **E.** *E. senescens* (Tosquinet, 1896). **F.** *E. shadaensis* Gadallah & Soliman sp. nov.

Enicospilus oculator Seyrig, 1935
Figs. 4B, 7D, 11D, 15D, 19D, 25A, 30D

Enicospilus oculator Seyrig, 1935: 76, ♀.

Diagnosis (after Gauld & Mitchell 1978)

B 15–16; F 8–10; ML 0.2; CT 1.7–1.8; OOL 0.1, POL 0.9; FI 0.8–0.92; FI1–2 1.6–1.8; FI20 1.8–2.1; AI 0.7–0.86; ICI 0.4–0.58; CI 0.2–0.25; SDI 1.1–1.3; NI 2.9.

Body entirely reddish brown including antennae and legs, with T1 mostly dark to black (except apically), with the following ivory parts: vertex, gena, face (except antennal toruli, middle area of face extending from fore ocellus to base of clypeus), clypeus (except basally, laterally and ventral margin), pronotum (patterned with red medially and laterally), lateral margins of mesoscutum, scutellum (except small reddish area basally), postscutellum, subalar prominences, large, oval shaped markings on anterior and posterior areas of mesopleuron, a large rounded to subquadrate marking on posterior area of metapleuron just above hind coxa, T1 black on basal half; mandible with lower tooth 1.6 × as long as lower tooth; clypeus flat in profile, with ventral margin straight to truncate; face subquadrate, 1.0–1.1 × as high as wide; antenna short, with 44–46 flagellomeres; mesopleuron and metapleuron finely and closely punctate, slightly coarser on mesopleuron; basal transverse carina weakly developed, but complete; anterior area of propodeum shallowly striate, posterior area finely transversely striate; proximal sclerite dark to black roundly triangular, central sclerite very small and circular, weakly sclerotized proximally; hind wing with 5 distal hamuli on R1; fore tibia sparsely spinose.

Material examined

SAUDI ARABIA: 1 ♀, Shada Al Ala (Al Baha), light trap 4, 8 Dec. 2014, leg. Al Dhafer *et al.* (EFC); 1 ♀, Shada Al Ala (Al Baha), light trap (House), 13 Nov. 2015, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Shada Al Ala (Al Baha), light trap 6, 14 Nov. 2015, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Shada Al Ala (Al Baha), light trap 5, 14 Nov. 2015, leg. Al Dhafer *et al.* (KSMA).

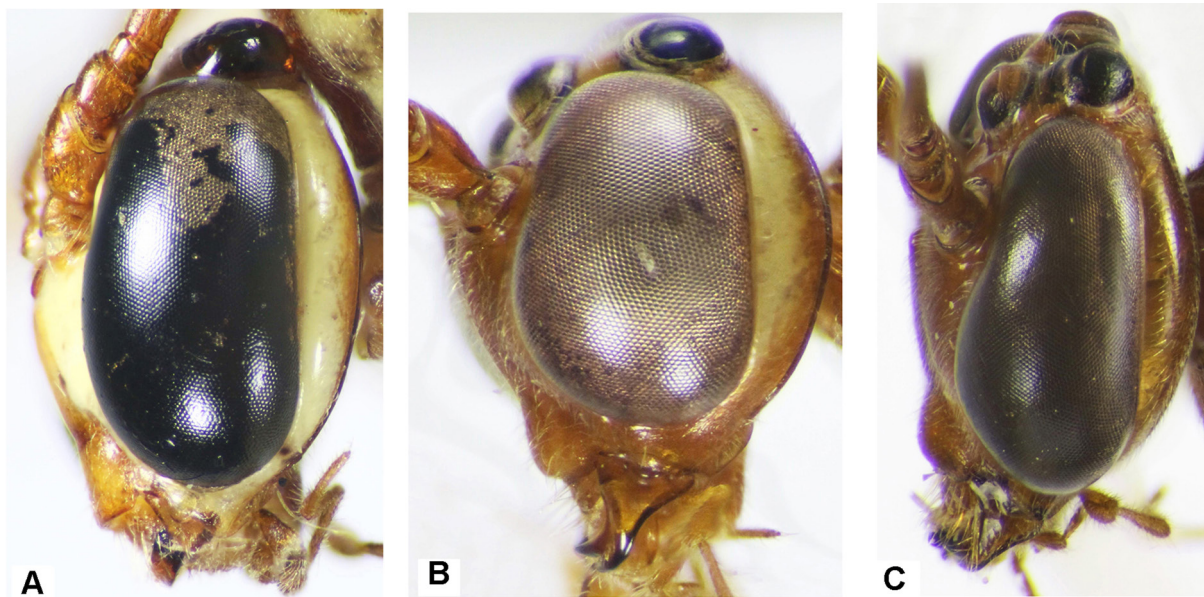


Fig. 13. Lateral view of head. **A.** *Enicospilus splendidus* Rouse, Soliman & Gadallah sp. nov. **B.** *Enicospilus* sp. 2 cf. *bicoloratus* Cameron, 1915. **C.** *Enicospilus* sp. 1.

Previous records from Saudi Arabia

Wadi Shuqub (Horstmann 1981).

BOLD Identification Number

ADB4114.

Distribution

Kenya, South Africa (Gauld & Mitchell 1978; Yu *et al.* 2012), Saudi Arabia (Horstmann 1981; Yu *et al.* 2012), Zimbabwe (Rousse & van Noort 2014).

Enicospilus odax Gauld & Mitchell, 1978

Figs 4C, 7E, 11E, 15E, 19E, 25B, 30E

Enicospilus odax Gauld & Mitchell, 1978: 137, ♀.

Diagnosis (after Gauld & Mitchell 1978)

B 16–30; F 14–20; ML 0.2; CT 1.3; OOL 0.04, POL 0.6; FI 0.6–0.66; FI1–2 1.5–1.6; FI20 1.6–2.0; AI 0.75; ICI 0.47–0.5; CI 0.28–0.36; SDI 1.4–1.45; NI 2.8.

Relatively large-sized insects, body including antennae and legs reddish brown, vertex and orbits pale yellow to whitish; mandible with upper and lower teeth subequal; clypeus flat to hardly convex in profile, with ventral margin truncate; face 1.2–1.5 × as high as wide; antenna with 56–58 flagellomeres; mesopleuron closely punctate, metapleuron coarsely striate; posterior transverse carina of propodeum well distinct, anterior area finely and shallowly striate, posterior area coarsely and concentrically striate; fore wing with proximal sclerite acutely arrow-shaped, central sclerite weakly sclerotized; hind wing with 7–8 distal hamuli on R1; fore tibia sparsely spinose.

Material examined

SAUDI ARABIA: 5 ♀♀, 1 ♂, Raydah (Asir), light trap (House), 26 Aug. 2014, leg. Al Dhafer *et al.*; 1 specimen (without abdomen), Raydah (Asir), light trap (House), 26 Aug. 2014, leg. Al Dhafer *et al.*; 2 ♀♀, Shada Al Ala (Al Baha), light trap (House), 17 Oct. 2014, leg. Al Dhafer *et al.* (EFC); 1 ♂, 1 ♀, Wadi Yabah (Asir), 11 Oct. 2013, light trap, leg. Sonbati *et al.*, (KSMA); 1 ♀, Raydah (Asir), light trap 6, 21 Feb. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 7, 21 Feb. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 8, 21 Feb. 2014, leg. Al Dhafer *et al.* (KSMA); 3 ♀♀, Raydah (Asir), light trap 9, 21 Feb. 2014 (leg. Al Dhafer *et al.*) (KSMA); 1 ♀, Tamniah Dam (Asir), light trap, 24 Feb. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Wadi Rida (Asir), light trap, 24 Feb. 2014, leg. Al Dhafer *et al.* (KSMA); 3 ♀♀, Raydah (Asir), light trap 4, 26 Apr. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 5, 26 Apr. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 6, 26 Apr. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 7, 26 Apr. 2014, leg. Al Dhafer *et al.* (KSMA); 3 ♀♀, Raydah (Asir), light trap 9, 26 Apr. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♂, 1 ♀, Shada Al Ala (Al Baha), light trap 1, 3 Jun. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 2, 6 Jun. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 3, 6 Jun. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♂, 1 ♀, Raydah (Asir), light trap 4, 6 Jun. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 7, 6 Jun. 2014, leg. Al Dhafer *et al.* (KSMA); 3 ♀♀, Raydah (Asir), light trap 6, 26 Aug. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, 1 ♂, Raydah (Asir), light trap 7, 20 Oct. 2014, leg. Al Dhafer *et al.* (KSMA); 3 ♀♀, Raydah (Asir), light

trap 8, 20 Oct. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 9, 20 Oct. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♂, Raydah (Asir), light trap 6, 21 Oct. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Shada Al Ala (Al Baha), light trap 2, 8 Dec. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Shada Al Ala (Al Baha), light trap 3, 8 Dec. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 4, 11 Dec. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 7, 11 Dec. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 8, 11 Dec. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Shada Al Ala (Al Baha), light trap 1, 27 Jan. 2015, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Shada Al Ala (Al Baha), light trap 5, 27 Jan. 2015, leg. Al Dhafer *et al.* (KSMA); 2 ♀♀, Raydah (Asir), light trap 6, 30 Jan. 2015, leg. Al Dhafer *et al.* (KSMA); 1 ♂, Raydah (Asir), light trap 9, 5 Mar. 2015, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), Malaise trap 5, 8 May 2015, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 7, 31 Jul. 2015, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 7, 5 Sep. 2015, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 8, 5 Sep. 2015, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 6, 18 Nov. 2015, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 7, 18 Nov. 2015, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 8, 18 Nov. 2015, leg. Al Dhafer *et al.* (KSMA); 2 ♀♀, Raydah (Asir), light trap 9, 18 Nov. 2015, leg. Al Dhafer *et al.* (KSMA).

Description

Male (7 specimens)

COLOUR. Resembles female but with B 28 and F 20 totally reddish brown, with vertex, orbits and posterior margin of head pale yellowish, pronotum anteriorly light red, T3–7 of metasoma black laterally.

HEAD. Mandibles moderately twisted, with two subequal teeth; labrum 0.3 × as high as broad; malar space 0.2 × mandibular base; clypeus nearly smooth, flat to hardly convex in profile as in female, with ventral margin truncate; face finely shallowly punctate; gena slightly constricted behind eyes; lateral ocellus not touching eye; occipital carina complete; antenna with 54 flagellomeres, F11–2 1.25.

MESOSOMA. Pronotum short, with transverse furrow; mesoscutum finely coriaceous, notauli indistinct; mesopleuron and metapleuron densely setose, but appears as if puncto-striate; basal carina of propodeum strong and complete, anterior area of propodeum finely coriaceous, posterior area coarsely and concentrically striate; postpectal carina complete.

FORE WING. Rs+2r distinctly thickened medially, straight, fenestra less than length of 3r-m from Rs base; wing sclerites as in female (see diagnosis); hind wing with 1A straight basally, with 9 distal hamuli on R1. Fore tibia sparsely spinose.

METASOMA. Long and slender, S2 ending well before spiracle of T2; thyridium ellipsoid, very shallow and hardly visible.

BOLD Identification Number

ADB4115.

Distribution

Yemen (Gauld & Mitchell 1978; Yu *et al.* 2012); Saudi Arabia (new record).

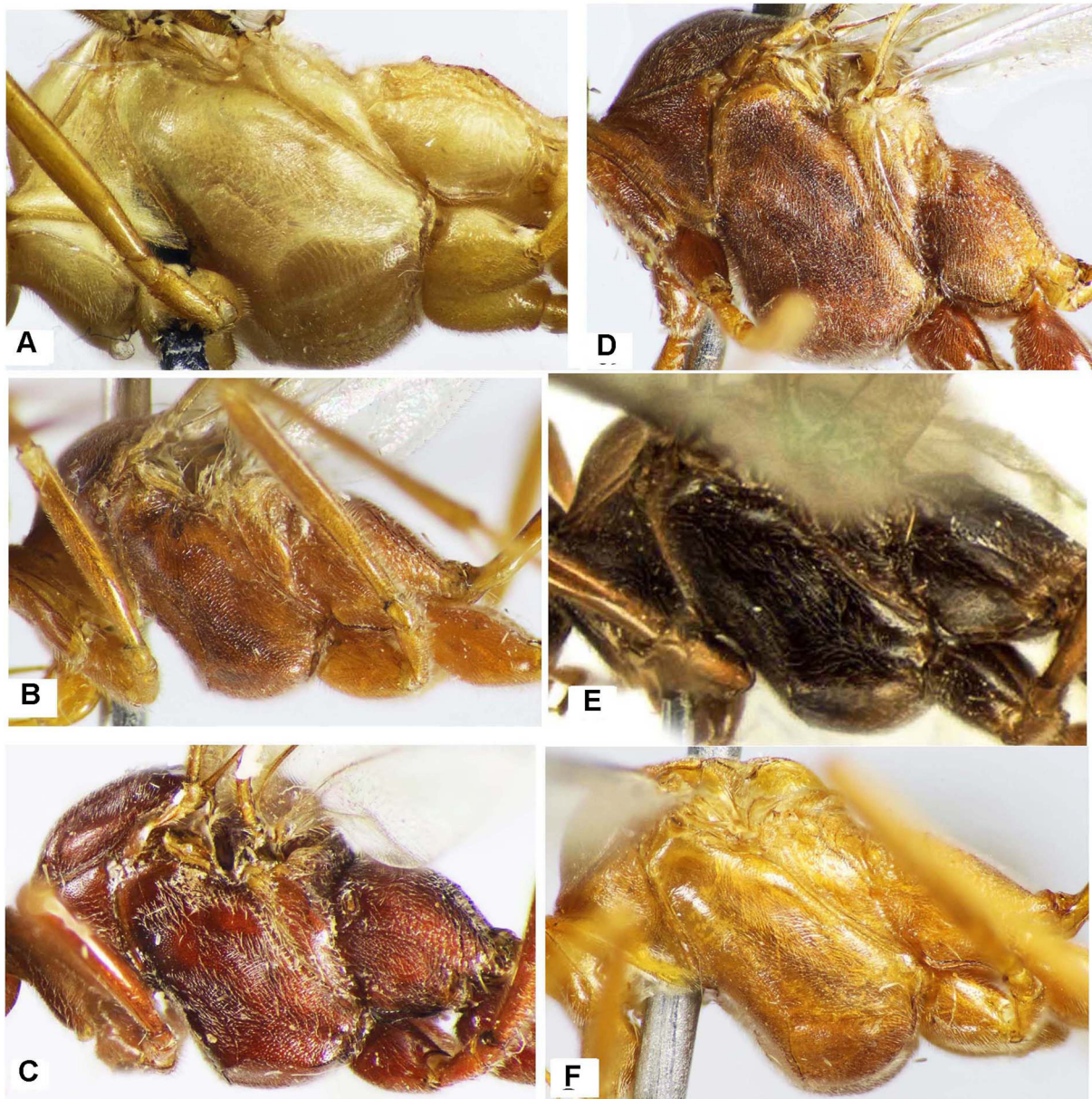


Fig. 14. Lateral aspect of mesosoma. **A.** *Enicospilus arabicus* Gadallah & Soliman sp. nov. **B.** *E. bicoloratus* Cameron, 1912. **C.** *E. brevicornis* (Masi, 1939). **D.** *E. capensis* (Thunberg, 1822). **E.** *E. divisus* (Seyrig, 1935). **F.** *E. dubius* (Tosquinet, 1896).

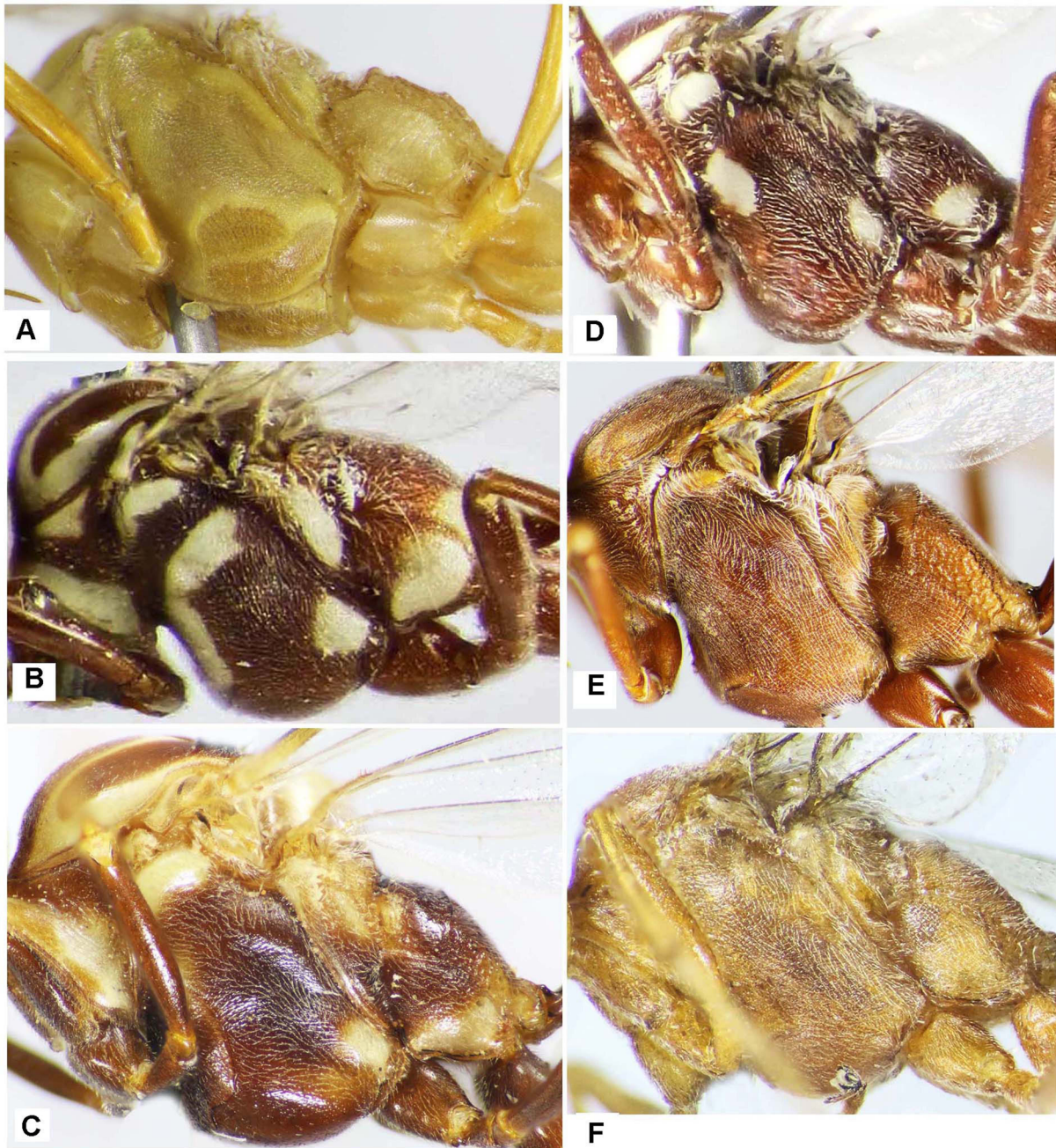


Fig. 15. Lateral aspect of meososoma. **A.** *Enicospilus grandiflavus* Townes & Townes, 1973. **B.** *E. mirabilis* Soliman & Gadallah sp. nov. **C.** *E. nervellator* Aubert, 1966. **D.** *E. oculator* Seyrig, 1935. **E.** *E. odax* Gauld & Mitchell, 1978. **F.** *E. oweni* Gauld & Mitchell, 1978.

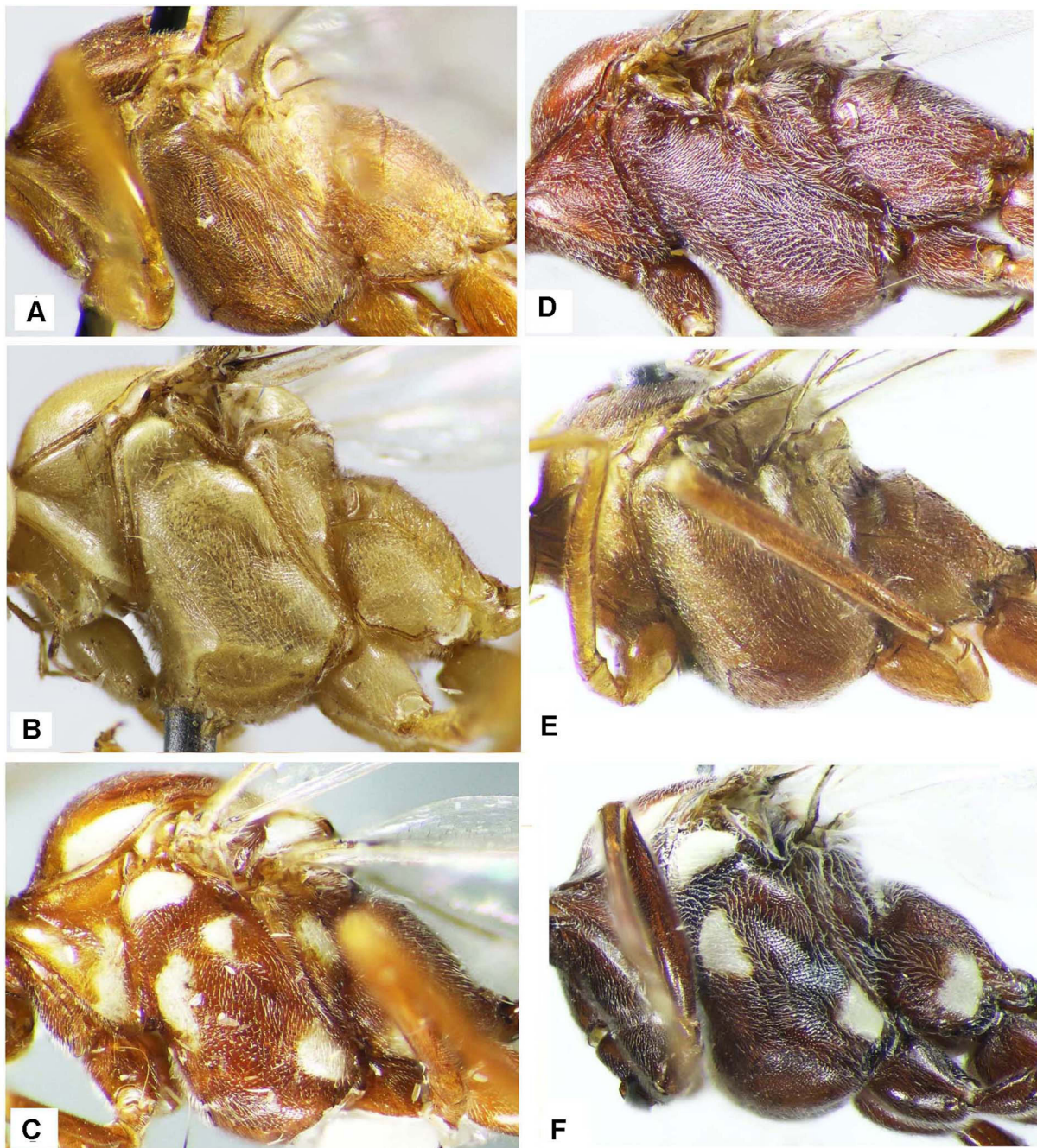


Fig. 16. Lateral aspect of mesosoma. **A.** *Enicospilus pacificus* (Holmgren, 1868). **B.** *E. pallidus* (Taschenberg, 1875). **C.** *E. pseudoculator* Gadallah & Soliman sp. nov. **D.** *E. rundiensis* Bischoff, 1915. **E.** *E. senescens* (Tosquinet, 1896). **F.** *E. shadaensis* Gadallah & Soliman sp. nov.

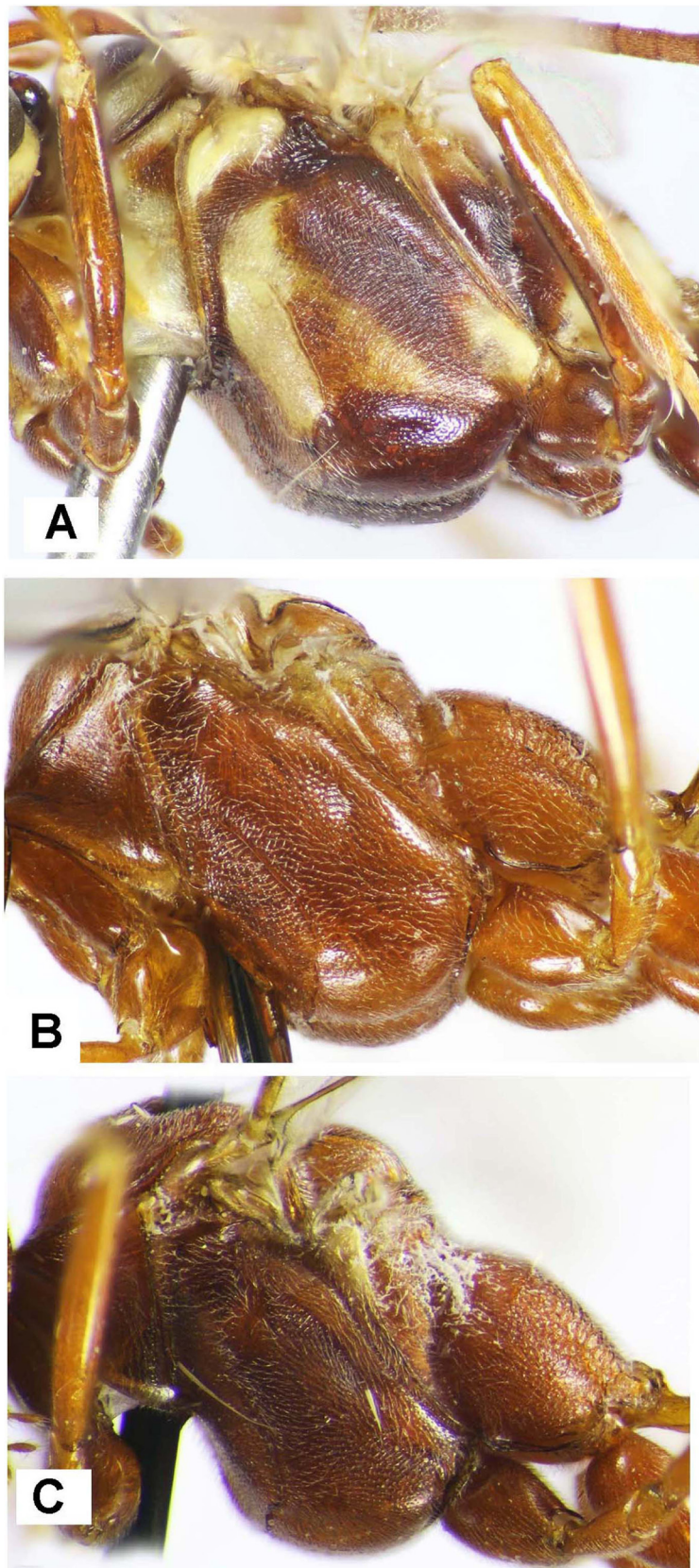


Fig. 17. Lateral aspect of mesosoma. **A.** *Enicospilus splendidus* Rouse, Soliman & Gadallah sp. nov. **B.** *Enicospilus* sp. 2 cf. *bicoloratus* Cameron, 1915. **C.** *Enicospilus* sp. 1

Enicospilus oweni Gauld & Mitchell, 1978
Figs 4D, 7F, 11F, 15F, 19F, 25C, 30F

Enicospilus oweni Gauld & Mitchell, 1978: 67, ♀, ♂.

Diagnosis (after Gauld & Mitchell 1978)

B 21–23; F 13–15; ML 0.2; CT 1.4; OOL 0.02, POL 0.3; FI 0.45–0.6; FI1–2 1.7–2.0; FI20 1.9–2.1; AI 0.6–0.8; ICI 0.51–0.73; CI 0.5; SDI 1.19; NI 2.0.

Body reddish brown overall, vertex, face (including clypeus) and a narrow area along posterior border of head pale yellowish, mandibular teeth black; antennae reddish brown; legs yellowish orange; mandible dark and with subequal teeth; clypeus flat in profile, with ventral margin straight or truncate; face finely densely punctate, 1.1–1.25 × as high as wide; antenna with 55–58 flagellomeres; basal transverse carina of propodeum distinct, anterior area of propodeum finely and superficially punctate, posterior area coarsely transversely striate; disco-submarginal cell without any alar sclerites; Rs+2r straight; hind wing with 5–7 distal hamuli on R1; fore tibia sparsely spinose.

Material examined

SAUDI ARABIA: 1 ♀, Raydah (Asir), light trap (House), 31 Jul. 2015, leg. Al Dhafer *et al.* (EFC); 1 ♀, Raydah (Asir), light trap 3, 6 Jun. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 7, 20 Oct. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 6, 21 Oct. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 6, 7 May 2015, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 9, 7 May 2015, leg. Al Dhafer *et al.* (KSMA).

BOLD Identification Number

ADB4116.

Distribution

Democratic Republic of Congo, Ivory Coast, Nigeria, Sierra Leone, Yemen (Gauld & Mitchell 1978; Yu *et al.* 2012); Saudi Arabia (new record).

Enicospilus pacificus (Holmgren, 1868)
Figs 4E, 8A, 12A, 16A, 20A, 26A, 31A

Ophion pacificus Holmgren, 1868: ?, ♀.

Diagnosis (after Gauld & Mitchell 1978)

B 17–20; F 11–17; ML 0.26–0.3; CT 1.2–1.7; OOL 0.1, POL 0.7; FI 0.55; FI1–2 1.6–2.3; FI 20 2.1–2.3; AI 0.45–0.7; ICI 0.45–0.57; CI 0.31–0.41; SDI 1.38; NI 2.0.

Body reddish brown, but antennae, legs, posterior margin of eye, frons and metasoma are lighter; mandible with upper tooth 1.2 × as long as lower tooth; clypeus convex in profile, with ventral margin in-turned; face 1.17–1.3 × as high as wide; antenna with 57–62 flagellomeres; mesopleuron puncto-striate, metapleuron densely coarsely punctate; basal transverse carina of propodeum distinct; anterior area of propodeum superficially punctate and densely pubescent, posterior area finely longitudinally rugose especially medially, densely clothed with fine, suberect pale pubescence; proximal sclerite rather narrow, comma-shaped with very long distal extension, central sclerite small, uniformly sclerotized; hind wing with 5–8 distal hamuli on R1; fore tibia not spinose.

Material examined

SAUDI ARABIA: 2 ♀♀, Raydah (Asir), light trap 5, 26 Aug. 2014, leg. Al Dhafer *et al.* (EFC); 1 ♀, Raydah (Asir), light trap 2, 26 Aug. 2014, leg. Al Dhafer *et al.*; 1 ♀, 1 ♂, Al Kharj (Loulou Farm), sweep net, 26 Nov. 2008, leg. Hassan (EFC), 1 ♂, Education Farm (Riyadh), sweep net, 19 May 2009, leg. Al Sobaae & Mosbet (KSMA); 1 ♂, Thee Ain (Al Baha), sweep net, 10 Mar. 2012, leg. El Torkey A. (KSMA); 1 ♀, Shada Al Ala (Al Baha), light trap 3, Nov. 2013, leg. Al Dhafer *et al.* (KSMA); 1 ♂, Shada Al Ala (Al Baha), light trap 6, 15 Feb. 2014, leg. Al Dhafer *et al.* (KSMA); 2 ♀♀, Raydah (Asir), light trap 8, 21 Feb. 2014, leg. Al Dhafer *et al.* (KSMA); 3 ♂♂, 2 ♀♀, Raydah (Asir), light trap 9, 21 Feb. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♂, Wadi Rida (Asir), sweep net, 24 Feb. 2014, leg. Sharaf *et al.* (KSMA); 2 ♂♂, Wadi Rida (Asir), light trap, 24 Feb. 2014, leg. Al Dhafer *et al.* (KSMA); 2 ♂♂, Shada Al Ala (Al Baha), light trap 1, 21 Apr. 2014, leg. Al Dhafer *et al.* (KSMA); 2 ♂♂, 1 ♀, Raydah (Asir), light trap 4, 27 Apr. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♂, Raydah (Asir), light trap 8, 27 Apr. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 1, 6 Jun. 2014, leg. Al Dhafer *et al.* (KSMA); 2 ♀♀, Raydah (Asir), light trap 3, 6 Jun. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 6, 6 Jun. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♂, Raydah (Asir), light trap 7, 6 Jun. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 1, 26 Aug. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 9, 26 Aug. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♂, Raydah (Asir), light trap 7, 20 Oct. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 4, 11 Dec. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♂, Raydah (Asir), light trap 9, 5 Mar. 2015, leg. Al Dhafer *et al.* (KSMA); 1 ♂, Raydah (Asir), Malaise trap 8, 8 May 2015, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 7, 18 Nov. 2015, leg. Al Dhafer *et al.* (KSMA); 2 ♂♂, 1 ♀, Raydah (Asir), light trap 9, 17–18 Nov. 2015, leg. Al Dhafer *et al.* (KSMA).

BOLD Identification Number

ACX7776.

Distribution

Angola, Botswana, Burundi, Central African Republic, Congo, Ethiopia, Ivory Coast, Kenya, Madagascar, Nigeria, Rowanda, Sierra Leone, South Africa, Sudan, Tanzania, Uganda (Gauld & Mitchell 1978); Saudi Arabia (new record).

***Enicospilus pallidus* (Taschenberg, 1875)**

Figs 4F, 8B, 12B, 16B, 20B, 26B, 31B

Ophion pallidus Taschenberg, 1875: 436, ♀.

Henicospilus damarensis Cameron, 1906: 81, ♀.

Henicospilus sinicarinatus Enderlein, 1914: 218, ♂.

Henicospilus techowi Enderlein, 1918: 219, ♂.

Henicospilus dinteri Enderlein, 1918: 220, ♀.

Diagnosis (after Gauld & Mitchell 1978)

B 22; F 12–15; ML 0.27; CT 1.66; OOL 0.04, POL 0.5; FI 0.5; FI1–2 1.78; FI20 1.5; AI 0.8; ICI 0.66; CI 0.33; SDI 1.27; NI 2.5.

Body including coxae pale yellow overall, metasoma slightly darker ventrally; mesoscutum with median brown stripe extending over anterior half; remaining parts of legs light brown; pterostigma yellowish; proximal and distal wing sclerites yellowish brown; mandible with upper tooth 1.3 × as long as lower tooth; clypeus flat in profile, ventral margin truncate; face 1.2 × as high as wide; antenna with 60–65 flagellomeres; mesopleuron finely puncto-striate, metapleuron finely punctate; basal transverse carina of propodeum distinct, anterior area smooth, posterior area irregularly arcuately wrinkled; disco-

submarginal cell of fore wing with triangular proximal sclerite, central sclerite crescent-shape, weakly sclerotized proximally and large, with maximal length larger than distance to Rs+2r; hind wing with 7 distal hamuli on R1; fore tibia sparsely spinose.

Material examined

SAUDI ARABIA: 1 ♀, Shada Al Ala (Al Baha), light trap 6, 15 Feb. 2014, leg. Al Dhafer *et al.* (KSMA).

BOLD Identification Number

AAI5153.

Distribution

Namibia, Sierra Leone (Gauld & Mitchell 1978), Chad, Ethiopia, Kenya, South Africa, Sudan (Gauld & Mitchell 1978; Yu *et al.* 2012), Democratic Republic of Congo, Pakistan (Yu *et al.* 2012), Tanzania (Rousse & van Noort 2014); Saudi Arabia (new record).

Enicospilus perlatus Shestakov, 1926

Fig. 34B

Enicospilus perlatus Shestakov, 1926: 30, ♀.

Diagnosis

B 26; F 16; ML 0.8; CT 2.0; OOL 0.2, POL 1.0; FI 0.37; AI 0.4; ICI 0.7 ; CI 0.05; SDI 1.16; NI 1.0–1.2.

Body dark reddish brown overall, with the head yellow (except a red longitudinal band on lower face including clypeus), mesoscutum reddish brown with yellow U-shape, with broad base as well as lateral margin, lateral red lobes of mesoscutum with a longitudinal black line extending along scutellum which is yellow with small red marking basally, propodeum and metasoma (except ventrally black) entirely dark reddish brown, all legs bright red, metasomal T1 and T2 brighter in color, mandible reddish except tip black, meso- and metapleura with traces of yellowish markings (two on mesopleuron and one distally on metapleuron); mandible with upper tooth 2.0 × as long as lower tooth; clypeus flat in profile, distinctly wider than long, with ventral margin truncate; antenna with 57 flagellomeres; mesopleuron and metapleuron puncto-striate; propodeum densely covered with fine setae, basal transverse carina of propodeum weak, hardly visible laterally, anterior area nearly smooth to finely superficially punctate, posterior area coarsely rugose longitudinally, especially medially; proximal sclerite bright red, dome-shaped, central sclerite small, slightly elongate and totally translucent, distal sclerite crescent shaped, enclosing central one; fore tibia sparsely spinose.

Material examined

SAUDI ARABIA: 1 ♀, Hedjaz (Mastoura), 1 Feb. 1937, leg.? (PPDD) (in bad condition).

Previous records from Saudi Arabia

Riyadh (Horstmann 1981).

Distribution

Afghanistan, Canary Islands, Morocco (Yu *et al.* 2012), Egypt (Shaumar 1966), Iran (Hedwig 1957 as *E. tricolor*; Kolarov & Ghahari 2005; Barahoei *et al.* 2012), Israel (Aubert *et al.* 1984; Yu *et al.* 2012), Spain (Bordera *et al.* 1987), Turkmenistan (Shestakov 1926; Kolarov & Ghahari 2005), Iran (Hedwig 1957 as *E. tricolor*), Saudi Arabia (Horstmann 1981 as *E. tricolor*).

Enicospilus psammus Gauld & Mitchell, 1978

Fig. 34A

Enicospilus psammus Gauld & Mitchell, 1978: 147, 148.

Diagnosis (after Gauld & Mitchell 1978)

F 6.0–9.0; ML 0.1; OOL 0.04, POL 0.5; FI 0.5–0.55; Fl 1.8–2.0; Fl20 1.3–1.4; AI 0.5–0.6; ICI 0.3–0.4; CI 0.3–0.4; SDI 1.2–1.3.

Body generally reddish brown, in some cases with propodeum and metasoma infusate, lower face, interocellar area and genae yellowish brown; mandible with upper tooth 2.0–3.0 × as long as lower tooth; clypeus convex in profile, with impressed margin, with ventral margin truncate; lower face subquadrate, 0.8–0.9 × as broad as long; antenna with 44–48 flagellomeres; mesopleuron with upper area puncto-striate, while lower area coarsely punctate; metapleuron puncto-striate; basal transverse carina of propodeum complete, anterior area of propodeum striate, posterior area irregularly wrinkled; fore wing with three sclerites, proximal sclerite dome- to triangular in shape, central sclerite transversely oval, while distal sclerite small, comma-shaped; hind wing with 5–6 hamuli on R1; fore tibia with scattered spines.

Material examined

None.

Previous records from Saudi Arabia

Abian, Al Lith, Asir, Qunfida (Gauld & Mitchell 1978), Bahara (Horstmann 1981).

Distribution

Saudi Arabia (Gauld & Mitchell 1978; Horstmann 1981), Sudan (Gauld & Mitchell 1978).

Enicospilus pseudoculator Gadallah & Soliman sp. nov.

[urn:lsid:zoobank.org:act:0155506A-1D33-4CFA-8456-1B342A1032BE](https://zoobank.org/urn:lsid:zoobank.org:act:0155506A-1D33-4CFA-8456-1B342A1032BE)

Figs 4G, 8C, 12C, 16C, 20C, 26C, 31C

Diagnosis

Dark reddish brown overall, including antennae and legs, with ivory on head and mesosoma as follows: posterior margin of head, all face except medially just from behind fore ocellus (between antennal bases) to base of clypeus (reddish brown), sides of mesoscutum (until tegula, not extending to posterior margin), tegula, two upper and lower mesopleural markings, a large posterior marking on metapleuron (just above hind coxa); mandible with upper tooth 2.0 × as long as lower tooth; clypeus flat in profile, ventral margin truncate; face subquadrate, 1.1 × as high as wide; antenna with 42–44 flagellomeres; mesopleuron and metapleuron finely and densely punctate; basal transverse carina of propodeum distinct, anterior area shallowly punctate to smooth, posterior area shallowly transversely striate; proximal sclerite bright red and dome-shaped, central sclerite totally absent; hind wing with 6 distal hamuli on R1.

Etymology

Named with reference to the similarity of this species to *Enicospilus oculator*.

Type material

Holotype

SAUDI ARABIA: ♀, Raydah (Asir), light trap (House), 18°13.347' N, 42°24.133' E, alt. 2717 m, 26 Aug. 2014, leg. Al Dhafer *et al.* (KSMA).

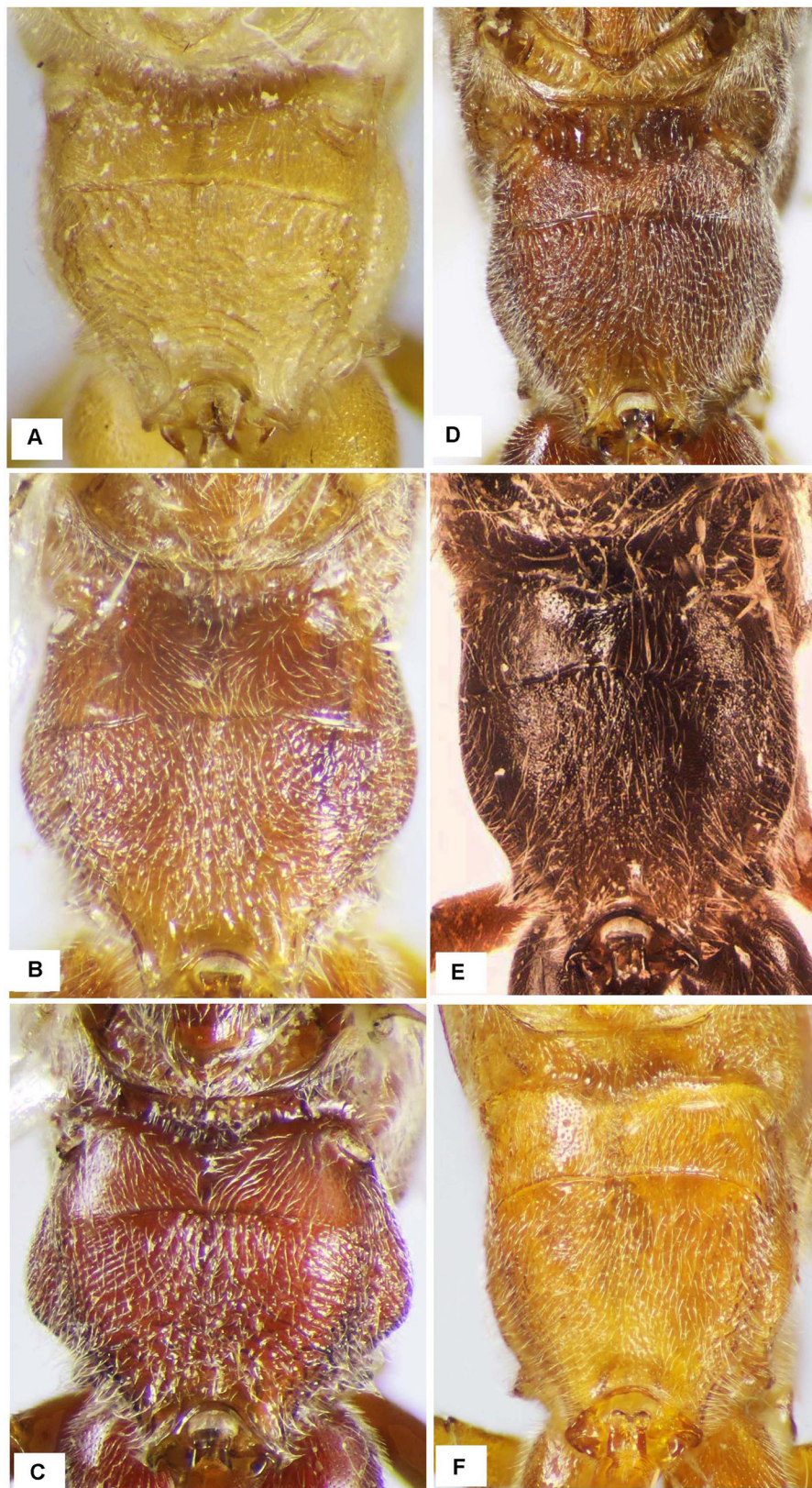


Fig. 18. Propodeum. **A.** *Enicospilus arabicus* Gadallah & Soliman sp. nov. **B.** *E. bicoloratus* Cameron, 1912. **C.** *E. brevicornis* (Masi, 1939). **D.** *E. capensis* (Thunberg, 1822). **E.** *E. divisus* (Seyrig, 1935). **F.** *E. dubius* (Tosquinet, 1896).

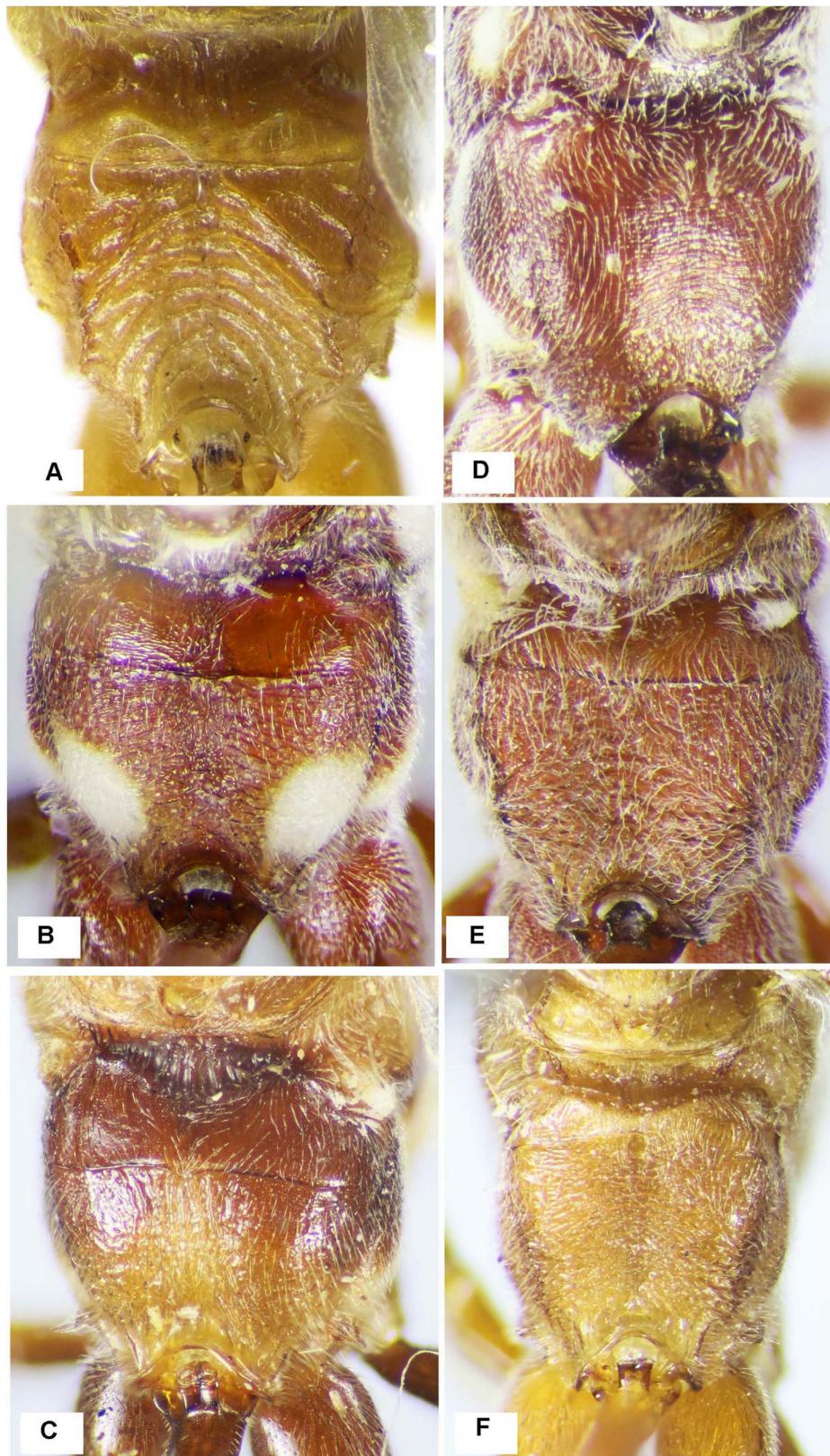


Fig. 19. Propodeum. **A.** *Enicospilus grandiflavus* Townes & Townes, 1973. **B.** *E. mirabilis* Soliman & Gadallah sp. nov. **C.** *E. nervellator* Aubert, 1966. **D.** *E. oculator* Seyrig, 1935. **E.** *E. odax* Gauld & Mitchell, 1978. **F.** *E. oweni* Gauld & Mitchell, 1978.

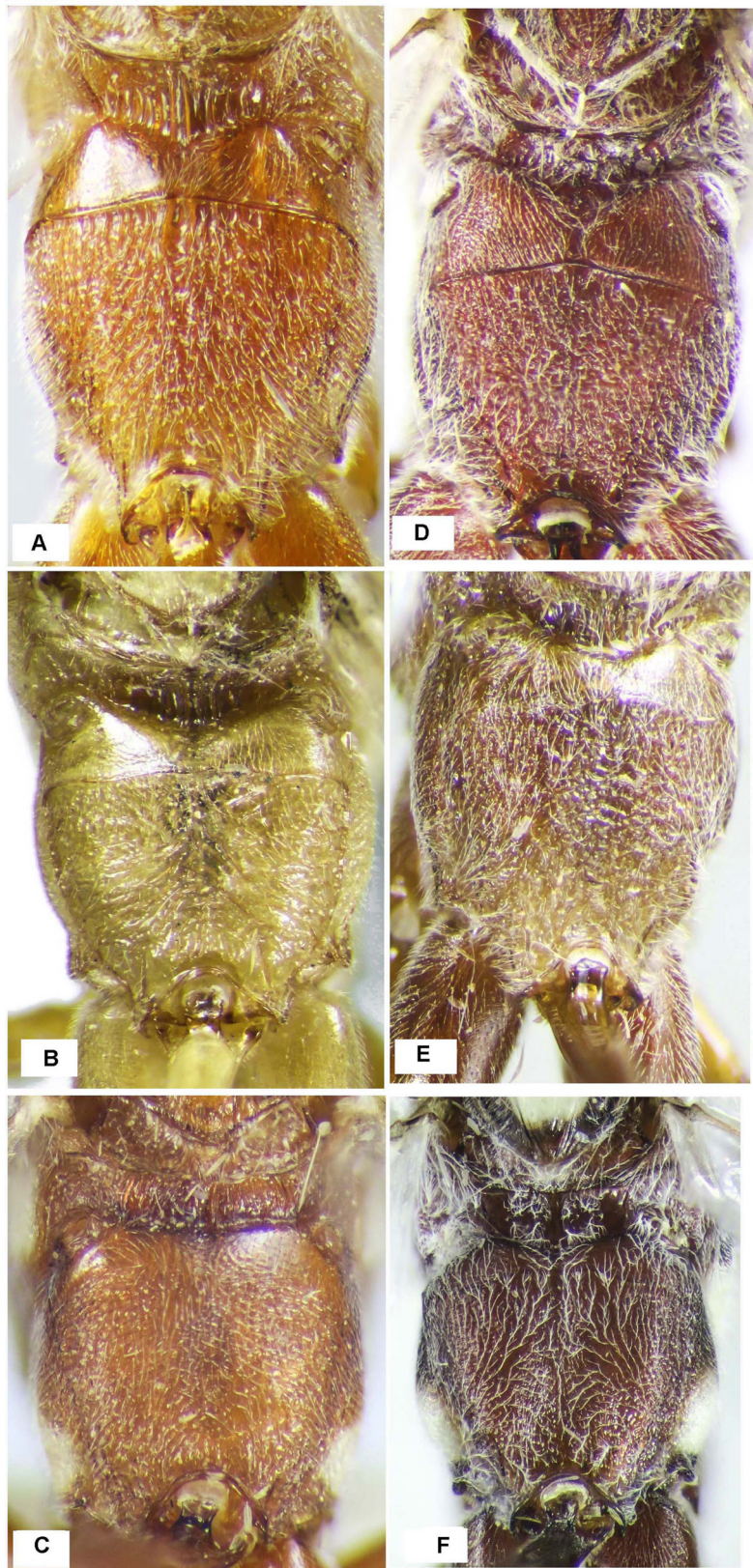


Fig. 20. Propodeum. **A.** *Enicospilus pacificus* (Holmgren, 1868). **B.** *E. pallidus* (Taschenberg, 1875). **C.** *E. pseudoculator* Gadallah & Soliman sp. nov. **D.** *E. rundiensis* Bischoff, 1915. **E.** *E. senescens* (Tosquinet, 1896). **F.** *E. shadaensis* Gadallah & Soliman sp. nov.

Paratypes

SAUDI ARABIA: 1 ♂, Rhodet Khorim (Riyadh), light trap (B), 14 Apr. 2012, leg.? (EFC); 1 ♀, Huraymila (Riyadh), light trap, 1 May 2011, leg. Al Dyrahim Y. and Al Dhafer H. (KSMA); 1 ♂, Rhodet Khorim (Riyadh), light trap (B), 14 Apr. 2012, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 6, 27 Apr. 2014, leg. Al Dhafer *et al.* (KSMA); 2 ♀♀, Raydah (Asir), light trap 4, 6 Jun. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 6, 26 Aug. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♂, Shada Al Ala (Al Baha), light trap 3, 2 Mar. 2015, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Wadi Hanifa (Riyadh), light trap 3, 2 Apr. 2015, leg. Al Dhafer *et al.* (KSMA); 1 ♂, 1 ♀, Rawdet Al Harmalyiah (Riyadh), light trap 3, 17 Jun. 2015, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 4, 5 Nov. 2015, leg. Al Dhafer *et al.* (KSMA).

Description**Female** (9 specimens)

B 15–17; F 12–14; ML 0.5; CT 1.4; OOL 0.1; POL 0.66; FI 0.56; FI1–2 1.5; FI 20 1.66; AI 0.9; ICI 0.68; CI 0.16; SDI 1.1; NI 2.25.

COLOUR. Dark reddish brown overall, including antennae and legs, with ivory on head and mesosoma as follows: posterior margin of head, all face except in middle just from behind fore ocellus (between antennal bases) to base of clypeus (dark reddish brown), sides of mesoscutum (until tegula), under fore and hind wings, two upper and lower mesopleural markings, a large posterior marking on metapleuron (just above hind coxa).

HEAD. Mandible moderately twisted, upper tooth distinctly longer than lower tooth, (2.0 × as long as lower tooth), broad at base and narrowed apically, without groove on outer surface, with fine dense setae; labrum 0.4–0.5 × as high as wide; clypeus flat in profile, ventral margin truncate; face and clypeus finely but somewhat sparsely punctate; lower face subquadrate, 1.1 × as long as broad; gena strongly constricted behind eyes; occipital carina complete; ocelli distinctly enlarged; antenna with 43–44 flagellomeres.

MESOSOMA. Pronotum normal, not visible in dorsal view; mesoscutum densely superficially punctate; epicnemial carina distinct to level of ventral corner of pronotum; postpectal carina weak, just visible

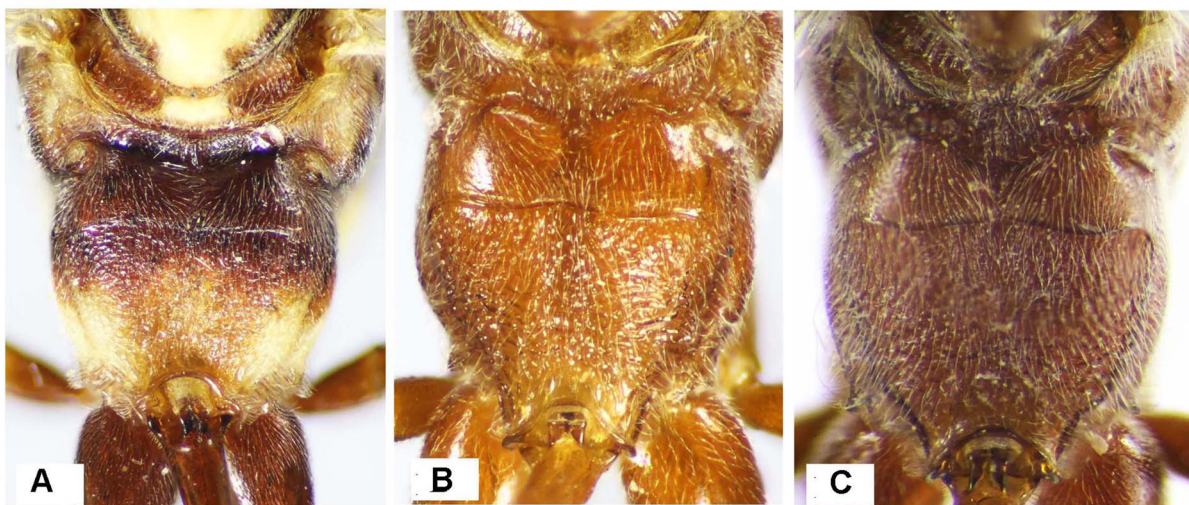


Fig. 21. Propodeum. **A.** *Enicospilus splendidus* Rouse, Soliman & Gadallah sp. nov. **B.** *Enicospilus* sp. 2 cf. *bicoloratus* Cameron, 1915. **C.** *Enicospilus* sp. 1

laterally while indistinct medially; notauli indistinct; scuto-scutellar groove strong, smooth; scutellum shallowly punctate, slightly longer than its basal width, carinate to near apex; meso- and metapleura densely, finely punctate; basal transverse carina of propodeum weak but distinct especially medially, anterior area shallowly punctate to smooth, posterior area shallowly transversely striate.

WINGS. Proximal sclerite bright red and dome-shaped, central sclerite totally absent; Rs+2r straight, not thickened; hind wing with 6 distal hamuli on R1.

LEGS. Fore tibia sparsely setose; hind coxa elongate, 2.0 × as long as high; hind trochantellus mid-dorsally 1.2 × as long as broad; hind tarsal claw symmetrical, with 11–12 equal-sized teeth.

METASOMA. Laterally flattened, widened posteriorly; T2 in profile about 3.5 × as long as high; thyridium deep, bar-shaped, extending along basal third of T2.

Male (4 specimens)

B 14; F 9.

Resembles female but differs in the following: head and mesosoma brighter red while metasoma dark reddish brown; ivory markings on mesosoma larger, tegula marked with ivory; mesoscutum laterally with ivory line extending along whole length of it, ending with two large rounded markings, two thin middle lines (absent in female); hind wing with 5 distal hamuli on R1.

BOLD Identification Number

ADB4338.

Remarks

This species closely resembles *E. oculator* except for the following: central sclerite totally absent (in *oculator* weakly sclerotized proximally); CI 0.16 (in *oculator* CI 0.25).

Distribution

Saudi Arabia.

Enicospilus rundiensis Bischoff, 1915
Figs 4H, 8D, 12D, 16D, 20D, 27A, 31D

Enicospilus (Dispilus) rundiensis Bischoff, 1915: 476, ♂.

Enicospilus ruandensis Roman, 1924: 8, ♀.

Diagnosis (after Gauld & Mitchell 1978)

B 18–21; F 12–16; ML 0.2; CT 1.4–1.8; OOL 0.1, POL 0.29; FI 0.55–0.6; F11–2 1.4–1.6; F120 1.8–2.0; AI 0.55–0.75; ICI 0.45–0.7; CI 0.45–0.65; SDI 1.3–1.4; NI 2.37.

Body reddish brown overall, orbits pale yellow, gena yellowish white, ventral side of T3–6 darker in colour, antennae and legs are brighter in colour, mandibular teeth black; mandible with upper tooth 1.5–2.0 × as long as lower tooth; clypeus slightly convex in profile, ventral margin in-turned; face 1.25 × as high as wide; antenna with 57–61 flagellomeres; mesopleuron finely puncto-striate, metapleuron finely punctate; basal transverse carina of propodeum distinct, anterior area of propodeum finely superficially shagreened, posterior area coarsely closely rugose; proximal sclerite triangular, dark brown, central sclerite moderately to very long and curved toward base of wing; hind wing with 6–8 distal hamuli on R1; fore tibia sparsely setose.

Material examined

SAUDI ARABIA: 1 ♀, Shada Al Ala (Al Baha), light trap 1, 27 Jan. 2015, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 6, 30 Jan. 2015, leg. Al Dhafer *et al.* (KSMA); 6 ♀♀, 1 ♂, Raydah (Asir), light trap 8, 30 Jan. 2015, leg. Al Dhafer *et al.* (KSMA); 11 ♀♀, Raydah (Asir), light trap 9, 30 Jan. 2015, leg. Al Dhafer *et al.* (KSMA).

Description

Males of *E. rundiensis* resemble the female (see diagnosis).

BOLD Identification Number

ADB5118.

Distribution

Burundi, Democratic Republic of Congo, Ethiopia, Kenya, Rwanda (Gauld & Mitchell 1978; Yu *et al.* 2012), Namibia, Zimbabwe (Rousse & van Noort 2014); Saudi Arabia (new record).

Enicospilus senescens (Tosquinet, 1896)

Figs 5A, 8E, 12E, 16E, 20E, 27B, 31E

Ophion (Allocamptus) senescens Tosquinet, 1896: 375, ♂.

O. (Allocamptus) infuscatus Tosquinet, 1896: 373, ♂.

Allocamptus rapax Seyrig, 1935: 50, ♀.

Diagnosis (after Gauld & Mitchell 1978)

B 18–20; F 11–17; ML 0.1–0.2; CT 1.4–1.8; OOL 0.1, POL 0.45; FI 0.6–0.7; F11–2 1.5–1.6; F120 2.5–2.7; AI 1.1–1.65; ICI 0.7–1.0; CI 0.8–1.0; SDI 1.6–1.8; NI 2.5.

Body entirely reddish to orange, orbits pale yellowish; mandible with upper tooth about 1.25 × as long as lower tooth; clypeus slightly convex in profile, ventral margin slightly in-turned; face 1.2 × as long as wide; antenna with 51–62 flagellomeres; meso- and metapleura puncto-striate; basal transverse carina of propodeum distinct, anterior area of propodeum nearly smooth to superficially shagreened, posterior area coarsely reticulate; disco-submarginal cell of fore wing without alar sclerites, Rs+2r strongly sinuate proximally; hind wing with 5–8 distal hamuli on R1; fore tibia sparsely setose.

Material examined

SAUDI ARABIA: 2 ♀♀, Raydah (Asir), light trap 6, 26 Aug. 2014, leg. Al Dhafer *et al.* (EFC); 1 ♂, Raydah (Asir), light trap 9, 21 Feb. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 3, 20 Oct. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 9, 30 Jan. 2015, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 4, 31 Jul. 2015, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Shada Al Ala (Al Baha), light trap 1, 2 Sep. 2015, leg. Al Dhafer *et al.* (KSMA); 1 ♂, Raydah (Asir), light trap 7, 5 Sep. 2015, leg. Al Dhafer *et al.* (KSMA).

Distribution

Togo, Ghana, Ethiopia, Angola, Central African Republic, Guinea, Ivory Coast, Kenya, Madagascar, Malawi, Nigeria, Rwanda, Sierra Leone, Uganda (Gauld & Mitchell 1978), Democratic Republic of Congo, Benin, South Africa, Zimbabwe (Yu *et al.* 2012), Gabon (Gauld & Mitchell 1978; van Noort 2004); Saudi Arabia (new records).

Enicospilus shadaensis Gadallah & Soliman sp. nov.

urn:lsid:zoobank.org:act:F2609434-0E0C-4ACB-BAE7-2A1FCB4F89CB

Figs 5B, 8F, 12F, 16F, 20F, 27C, 31F

Diagnosis

B 19–21, F 12–13; ML 0.2; CT 1.2; POL 1.0; FI 0.65; F11–2 1.6; AI 0.87; CI 0.3; ICI 0.5; SDI 1.2; NI 3.8.

Moderately large sized and reddish brown overall including antennae and legs, with ivory yellow on face (except the middle broadly extending from behind the fore ocellus), posterior margin of eyes, gena, two pale rounded markings on lateral sides of clypeus, lateral sides of mesoscutum that are broad anteriorly, becoming very thin laterally, scutellum, subalar prominence, two markings on upper and lower ends of mesopleuron, upper one distinctly larger, a large one on lower part of metapleuron just above hind coxa. Metasoma with T1 entirely dark brown to black, T2 reddish brown with orange or lighter posterior margin, remaining tergites mostly light red to orange blackish medially, last tergite reddish with dark posterior end; mandible reddish with black teeth, upper tooth 2.0 × as long as lower tooth; clypeus flat in profile, ventral margin truncate, antenna with 50 flagellomeres; meso- and metapleura puncto-striate; basal transverse carina of propodeum distinct, anterior area of propodeum nearly smooth, posterior area superficially reticulate rugose; proximal sclerite triangular, dark brown to black; fore tibia not spinose.

Etymology

The species epithet “*shadaensis*” refers to Shada Al Ala, one of the localities where specimens were collected.

Type material

Holotype

SAUDI ARABIA: ♀, Raydah (Asir), light trap 8, 18°11.618' N, 42°23.420' E, alt. 1772 m, 26 Aug. 2014, leg. Al Dhafer *et al.* (KSMA).

Paratypes

SAUDI ARABIA: 1 ♂, Shada Al Ala (Al Bahha), light trap 4, 8 Dec. 2014, leg. Al Dhafer *et al.* (EFC); 1 ♂, Muzahmiah (Al Khararah), 17 May 2011, leg. Al Drayhim *et al.* (EFC); 1 ♀, Shada Al Ala (Al Baha), light trap 4, 14 Nov. 2015, leg. Al Dhafer *et al.* (EFC); 1 ♂, Wadi Turubah (Al Baha), light trap, 1 Jun. 2011, leg. Al Dhafer H. and Al-Gharabawi A. (KSMA); 1 ♂, Shada Al Ala (Al Baha), light trap (House), 15 Feb. 2014, leg. Abdel-Dayem M. and Rasool I. (KSMA); 1 ♀, Raydah (Asir), light trap 9, 21 Feb. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♂, Raydah (Asir), light trap 7, 26 Aug. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♀, Raydah (Asir), light trap 9, 20 Oct. 2014, leg. Al Dhafer *et al.* (KSMA); 1 ♂, Shada Al Ala (Al Baha), light trap 5, 27 Jan. 2015, leg. Al Dhafer *et al.* (KSMA); 1 ♂, 1 ♀, Shada Al Ala (Al Baha), light trap 4, 14 Nov. 2015, leg. Al Dhafer *et al.* (KSMA); 2 ♀♀, Shada Al Ala (Al Baha), light trap 2, 18 Nov. 2015, leg. Al Dhafer *et al.* (KSMA).

Description

Female (7 specimens)

B 19–21; F 12–13; ML 0.2; CT 1.2; POL 1.0; FI 0.65; F11–2 1.6; AI 0.87; CI 0.3; ICI 0.5; SDI 1.2; NI 3.8.

COLOUR. Reddish brown overall including antennae and legs, with ivory yellow on vertex, orbits, lateral sides of mesoscutum (which are broad anteriorly, becoming very thin laterally, but not reaching end) scutellum, subalar prominence, two markings on upper and lower ends of mesopleuron, upper one distinctly larger, a large marking on lower part of metapleuron (just above hind coxa); metasoma with T1 entirely dark brown to black, T2 with lighter posterior margin, remaining metasomal tergites mostly light red to orange, blackish medially, last tergite reddish, with dark posterior margin; mandible reddish

with black teeth; fore wing with dark to black pterostigma with yellow proximal corner, parastigma yellow, distal end of pterostigma pale brown, sclerites and wing venation dark brown.

HEAD. Mandible hardly twisted, parallel-sided, with black thin outer margin, upper tooth about $2.0 \times$ as long as lower tooth, outer mandibular surface with dense fine pale setae, without groove on outer surface; clypeus superficially punctate, flat in profile, ventral margin truncate; labrum semicircular, about $0.3 \times$ as high as wide; face $1.3 \times$ as high as wide; gena constricted behind eyes; occipital carina complete and thin; ocelli relatively large, lateral one nearly touching eyes; antenna with 50 flagellomeres.

MESOSOMA. Pronotum normal, with deep transverse furrow; epicnemial carina more or less distinct, weak; postpectal carina only distinct laterally, interrupted or indistinct medially; mesoscutum densely punctate-reticulate, notauli indistinct; scutellum smooth, impunctate, slightly longer than basal width, carinate to apex; mesopleuron and metapleuron densely punctate; basal transverse carina of propodeum weak, anterior area of propodeum nearly smooth, posterior area shallowly rugose.

WINGS. Disco-submarginal cell of fore wing with well developed fenestra, proximal sclerite triangular, dark brown to black; central sclerite totally absent; $Rs+2r$ slightly thickened ventrally at basal third, more or less straight; cu-a subopposite Rs & M by about $0.25 \times$ length of cu-a; hind wing with 7 distal hamuli on $R1$.

LEGS. Fore tibia not spinose; claws with black teeth, denser and shorter basally.

METASOMA. Slender; $T2$ in profile about $4 \times$ as long as high; thyridium very shallow, linear basally and widened apically, slightly posterior to one third length of tergite.

Male (7 specimens)

B 23; F 16.

Resembles female except for the following: body more slender; antenna with 52 flagellomeres; ivory markings on meso- and metapleura are distinctly smaller in size. Otherwise very similar to female.

BOLD Identification Number

ABX3540.

Remarks

This species agrees completely with the key characters of *Enicospilus* sp. 4 in Gauld & Mitchell (1978). But compared to the full description, it differs in the following characters: antenna with 50 flagellomeres (in sp. 4 62–64 flagellomeres); alar sclerite resembles that of sp. 4 (Gauld & Mitchell 1978: fig. 379); the mesoscutal ivory margins do not extend the whole length of the mesoscutum (in G. & M. it extends along the whole margins of the mesoscutum); no central ivory marking could be seen on the mesopleuron of our specimen (in G. & M. a central marking is present); metapleuron with a posterior ivory marking (in G. & M. it is present centrally); $T1$ entirely black (not so in G. & M.).

Enicospilus shadaensis sp. nov. resembles *E. pseudoculator* sp. nov. but differs in the following characters: body dark reddish brown, metasoma patterned with bright red to orange (in *pseudoculator* sp. nov. lighter orange to brown, metasoma not patterned with red); proximal sclerite dark brown to black, triangular (in *pseudoculator* sp. nov. proximal sclerite bright red and dome-shaped); face narrow, $1.5 \times$ as high as wide (in *pseudoculator* sp. nov. face subquadrate, $1.1 \times$ as high as wide); $CI > 0.2$ (in *pseudoculator* sp. nov. $CI < 0.2$); moderately large species ($B > 27$; $F > 12$) (*pseudoculator* sp. nov. smaller species ($B < 19$, $F < 12$)).

Distribution

Saudi Arabia.

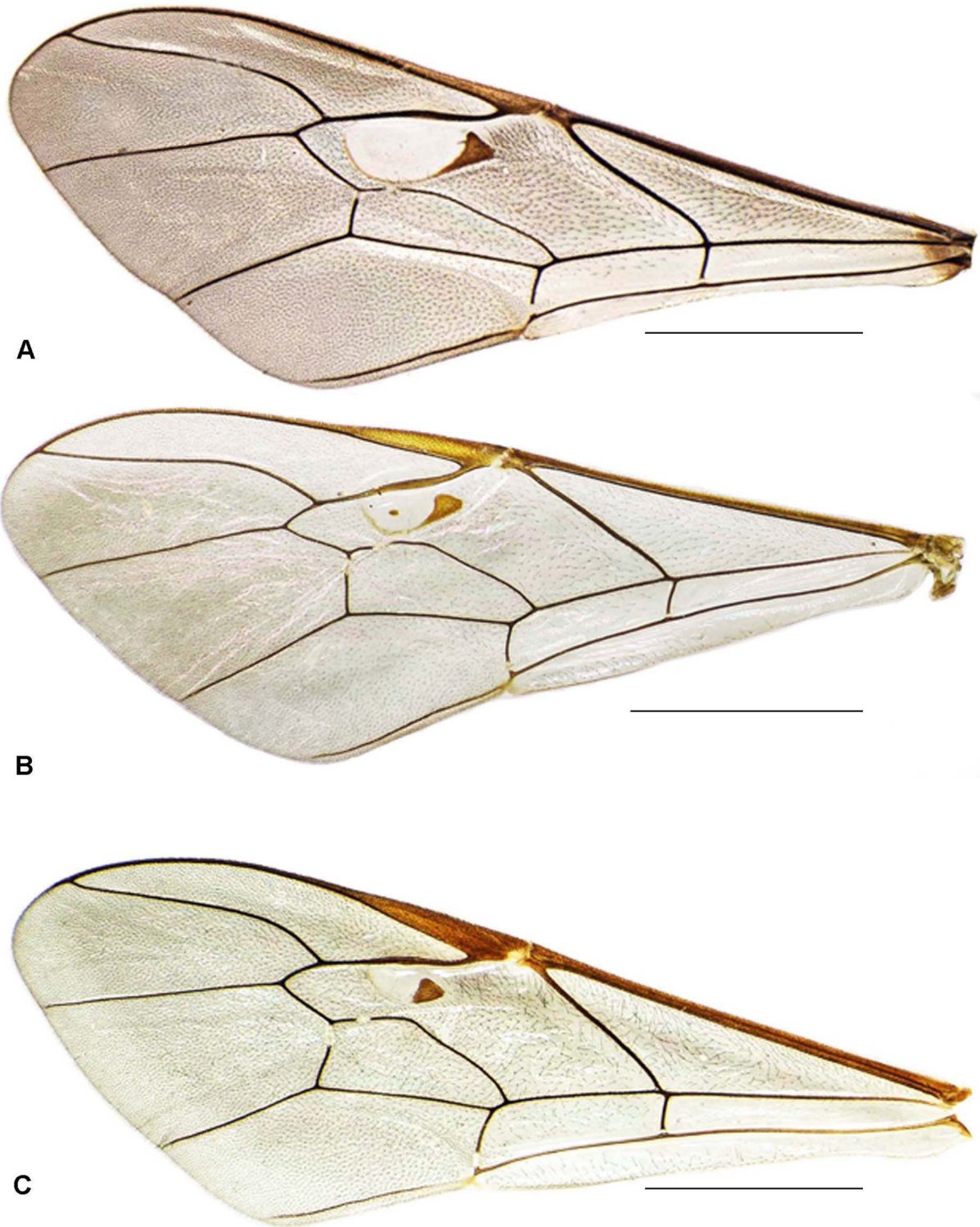


Fig. 22. Fore wing. **A.** *Enicospilus arabicus* Gadallah & Soliman sp. nov. **B.** *E. bicoloratus* Cameron, 1912. **C.** *E. brevicornis* (Masi, 1939). Scale bars = 2.5 mm.

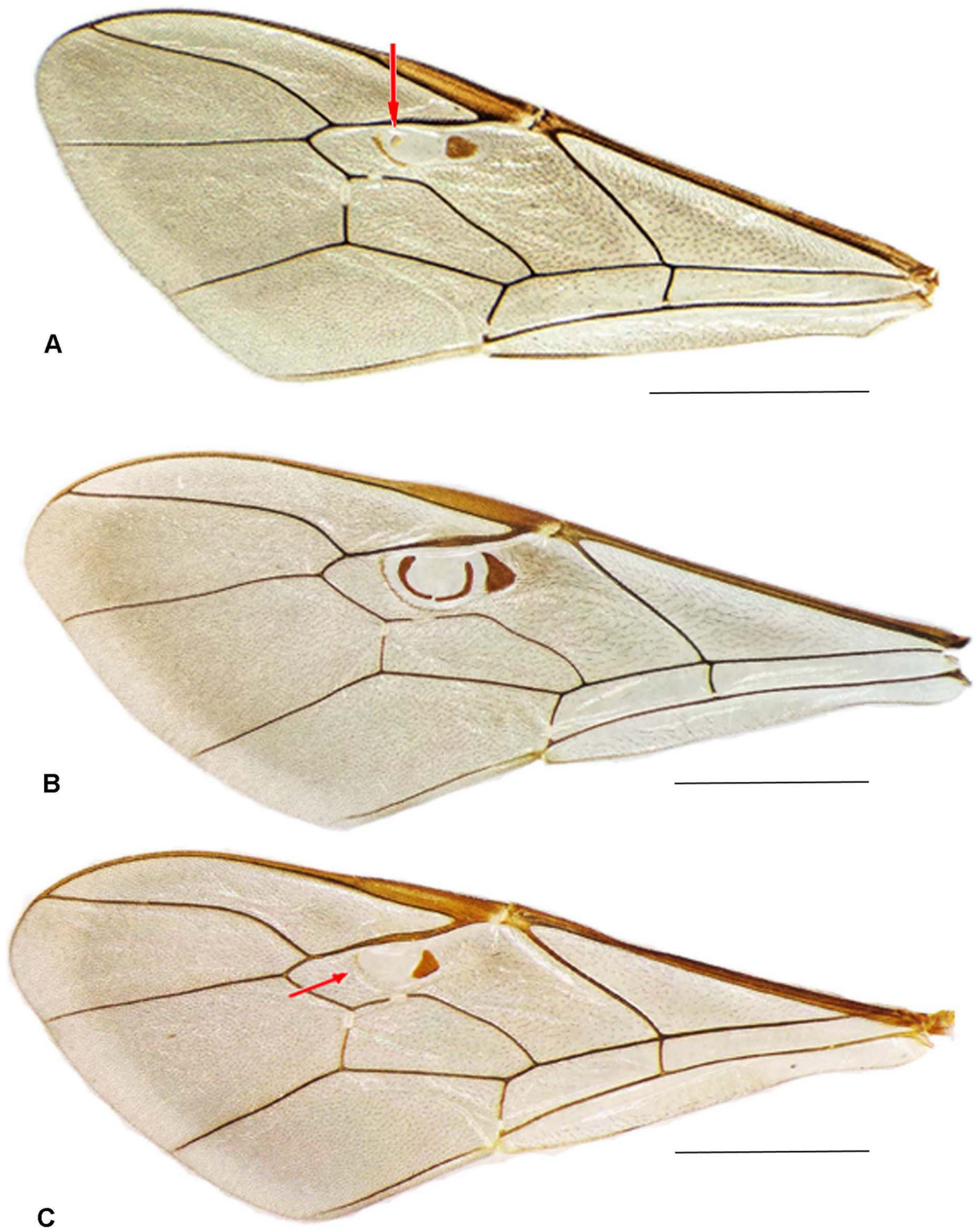


Fig. 23. Fore wing. **A.** *Enicospilus capensis* (Thunberg, 1822). **B.** *E. divisus* (Seyrig, 1935). **C.** *E. dubius* (Tosquinet, 1896). Scale bars = 2.5 mm.

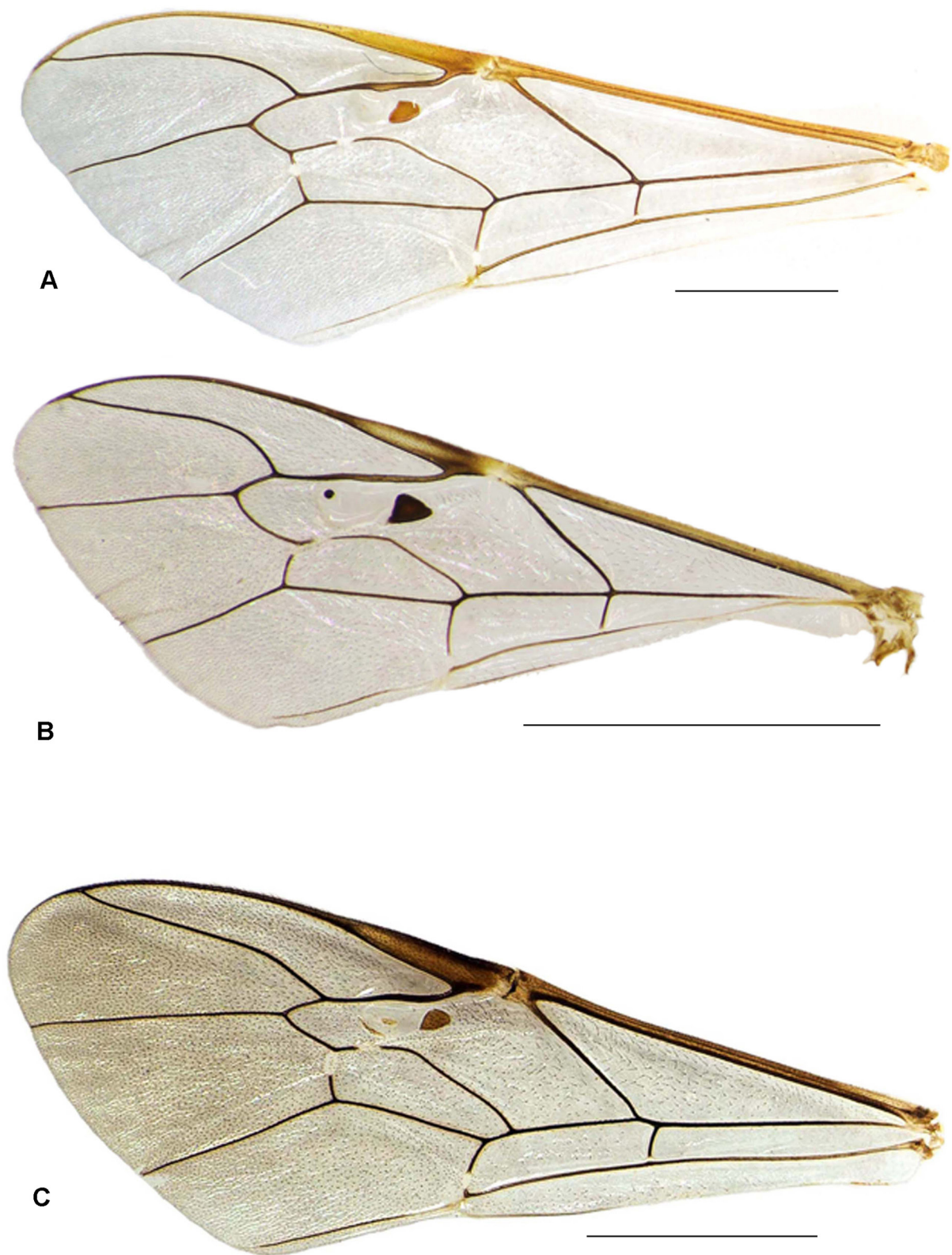


Fig. 24. Fore wing. **A.** *Enicospilus grandiflavus* Townes & Townes, 1973. **B.** *E. mirabilis* Soliman & Gadallah sp. nov. **C.** *E. nervellator* Aubert, 1966. Scale bars = 2.5 mm.

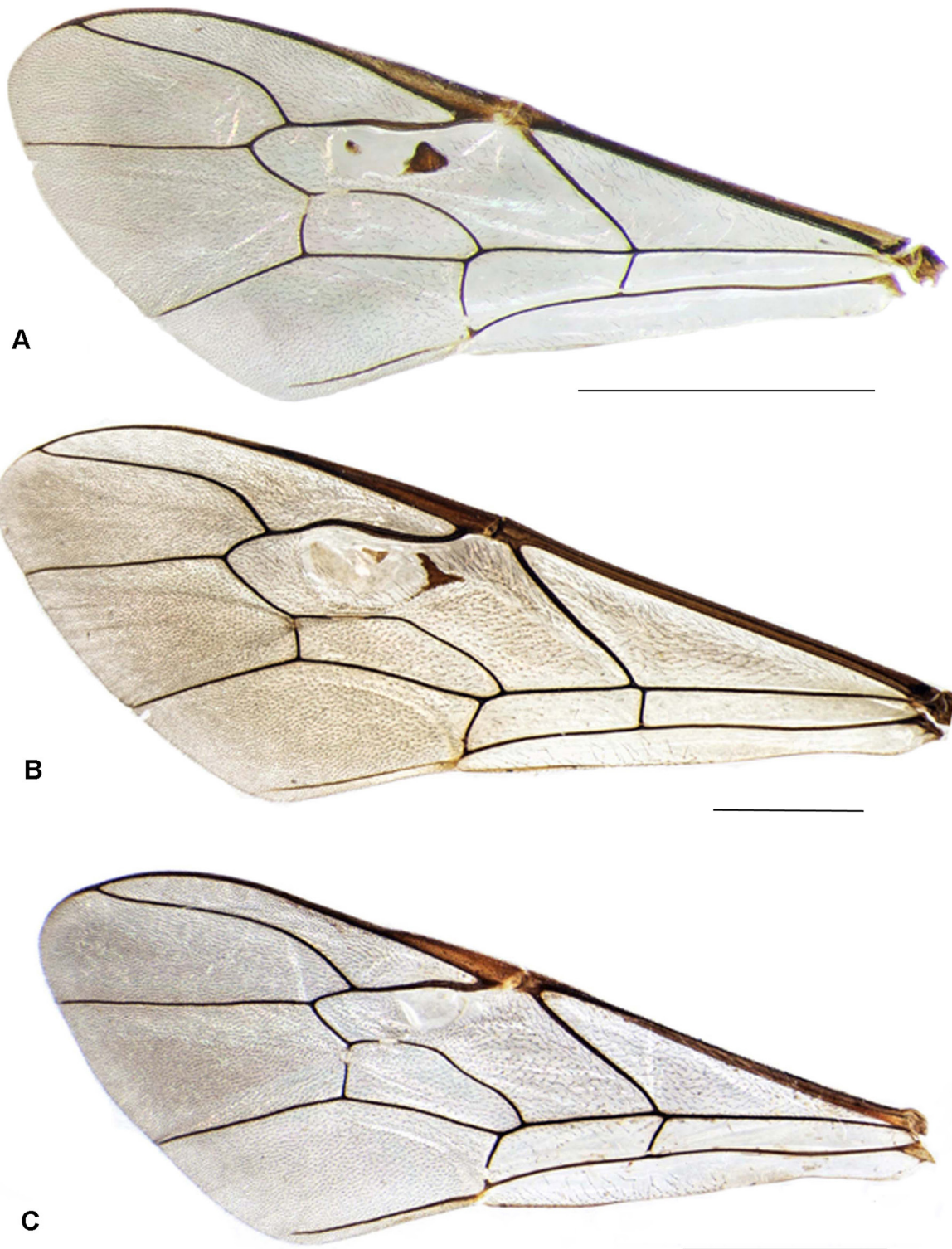


Fig. 25. Fore wing. **A.** *Enicospilus oculator* Seyrig, 1935. **B.** *E. odax* Gauld & Mitchell, 1978. **C.** *E. oweni* Gauld & Mitchell, 1978. Scale bars = 2.5 mm.

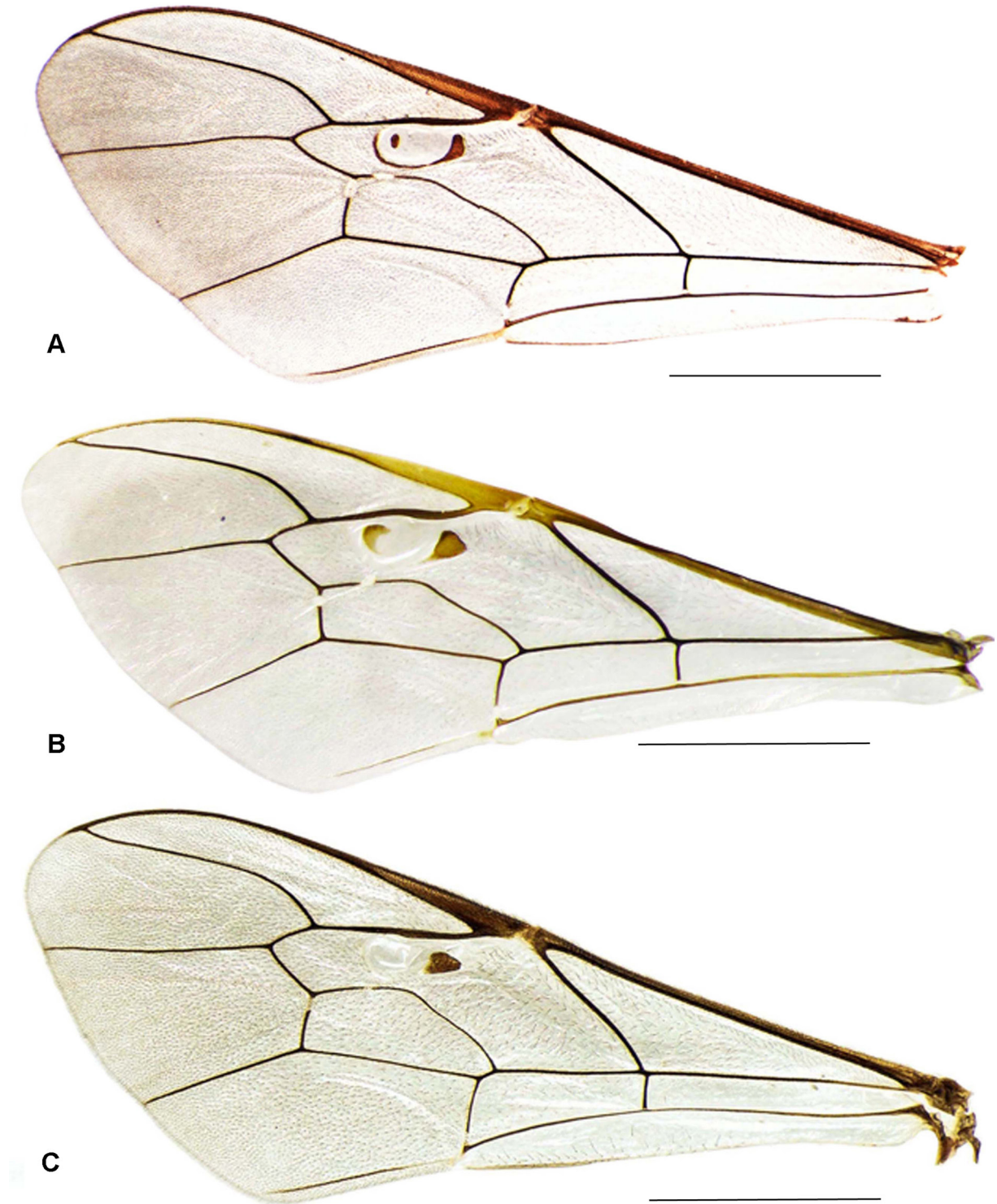


Fig. 26. Fore wing. **A.** *Enicospilus pacificus* (Holmgren, 1868). **B.** *E. pallidus* (Taschenberg, 1875). **C.** *E. pseudoculator* Gadallah & Soliman sp. nov. Scale bars = 2.5 mm.

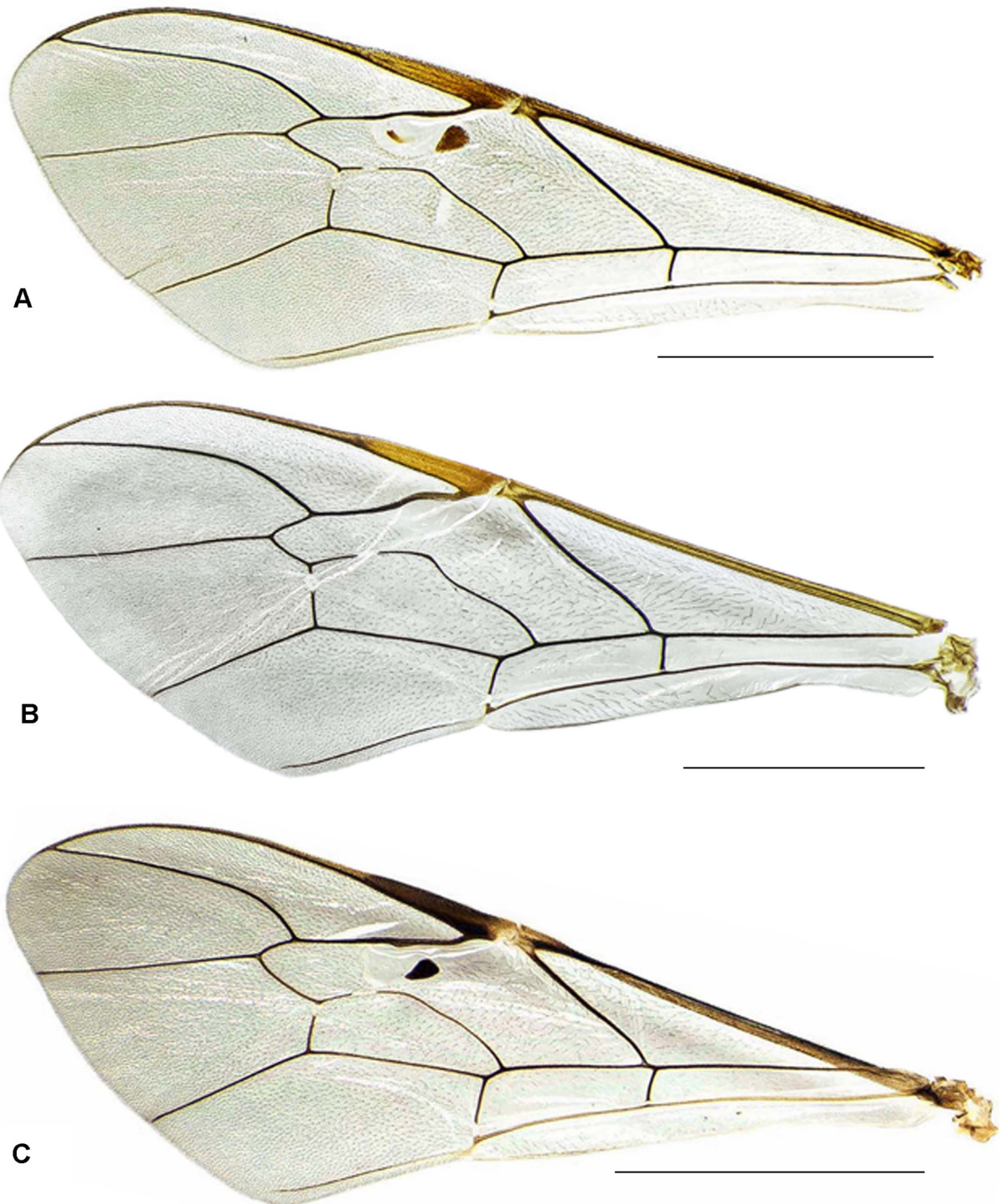


Fig. 27. Fore wing. **A.** *Enicospilus rundiensis* Bischoff, 1915. **B.** *E. senescens* (Tosquinet, 1896). **C.** *E. shadaensis* Gadallah & Soliman sp. nov. Scale bars = 2.5 mm.

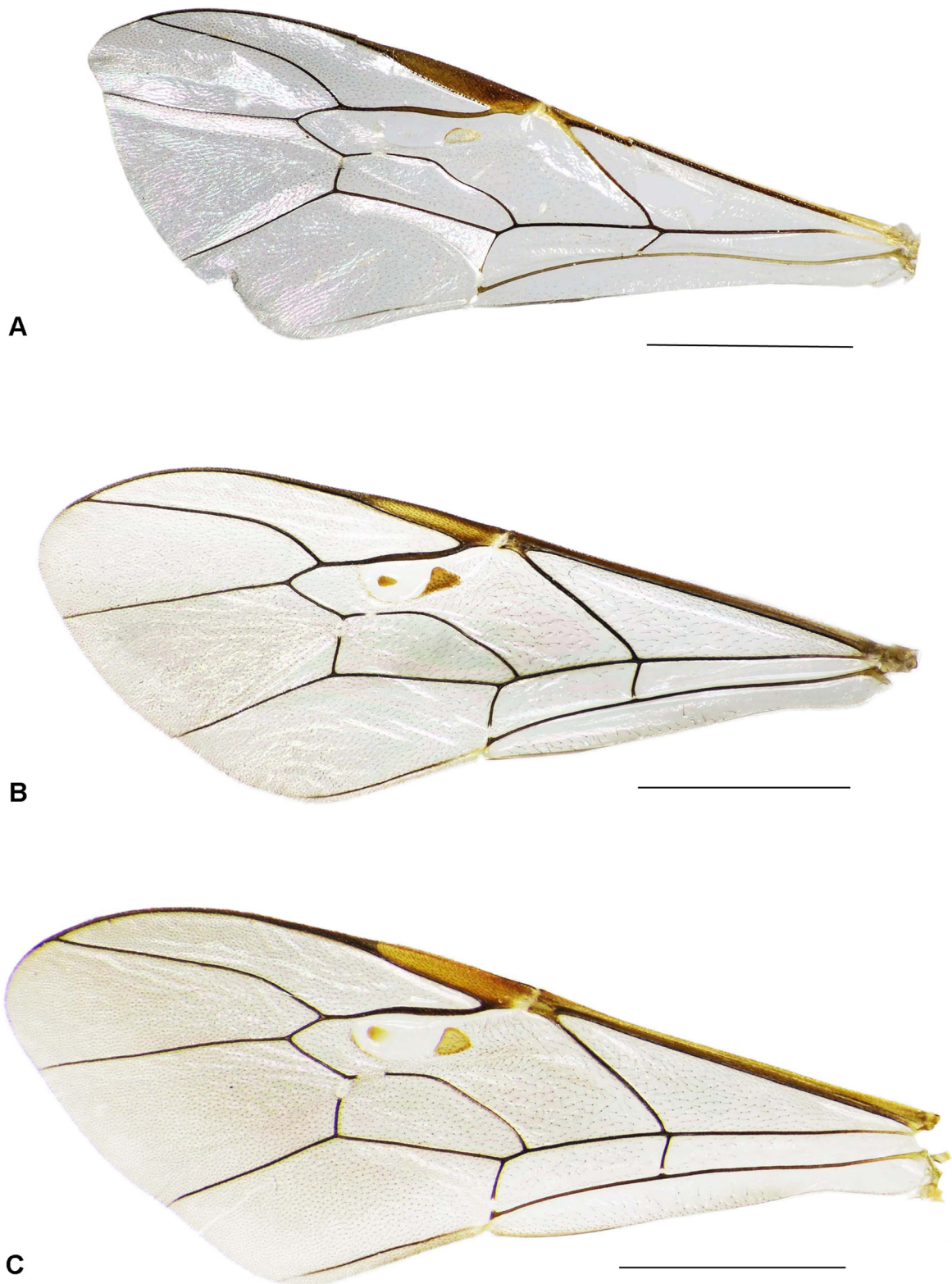


Fig. 28. Fore wing. **A.** *Enicospilus splendidus* Rouse, Soliman & Gadallah sp. nov. **B.** *Enicospilus* sp. 2 cf. *bicoloratus* Cameron, 1915. **C.** *Enicospilus* sp. 1. Scale bars = 2.5 mm.

Enicospilus splendidus Rouse, Soliman & Gadallah sp. nov.

[urn:lsid:zoobank.org:act:3ECBEFEA-22CE-4D5D-848B-B146591DBAB9](https://zoobank.org/act:3ECBEFEA-22CE-4D5D-848B-B146591DBAB9)

Figs 5C, 9A, 13A, 17A, 21A, 28A, 32A, 33B, 33C

Diagnosis

Moderately large sized, dark reddish brown overall, with bright yellowish to white on most of the head and mesosoma and few markings on metasoma; metasoma black posteriorly; mandible with upper tooth 1.6 × as long as lower tooth; clypeus hardly convex in profile, ventral margin truncate; face subquadrate, 1.1 × as high as wide; antenna short, with 52 flagellomeres; mesopleuron finely transversely striate, metapleuron with somewhat coarser striation; basal transverse carina of propodeum distinct, anterior area of propodeum finely rugose, posterior area foveolate; proximal sclerite weakly sclerotized; fore tibia with three longitudinal rows of dispersed but regularly arranged short spines along outer surface.

Etymology

From Latin, in reference to its astonishing and splendid appearance and colour.

Type material

Holotype

SAUDI ARABIA: ♂, Riyadh, Deirab, light trap, 24°30.367' N, 46°37.166' E, alt. 645 m, 25 Oct. 1985, leg.? (KSMA).

Description

Male (1 specimen)

MEASUREMENTS. B 18; F 13; AI 0.6; CI 0.52; ICI 0.46; SDI 1.3; NI 1.8 ; ML 0.3; CT 1.7; OOL 0.38; POL 0.38; FI 0.5; FI1–2 1.6; FI 20 3.0.

COLOUR. Dark reddish brown overall, with yellowish white on the following parts: head (except a narrow longitudinal line extending a short distance after fore ocellus to base of clypeus), clypeus, labrum and palpi, posterior margin of head around occipital carina, mandibles (except teeth ferruginous), pronotum (except a small reddish triangular area just above tegula), mesoscutum (except for three reddish brown lobes, of which middle one doesn't reach posterior margin and lateral ones do not reach anterior margin of mesoscutum), tegula, scutellum, two longitudinal oval patches on postero-lateral part of propodeum, postscutellum, subalar prominence, latero-ventral side of mesopleuron, a small area just above mesocoxa, most of metapleuron (leaving a small upper area reddish brown in colour). Metasoma darker than rest of body, with T2 and T3 above and almost all remaining tergites patterned with yellow, last sternite (subgenital plate) black; legs with coxae, trochanters and femora distinctly darker in colour than rest. Wings hyaline, fore wing with pale brown pterostigma, base of Rs+2r as well as uppermost part of Rs & M and 1A of hind wing pale brown to yellow, otherwise all veins are dark brown to black.

HEAD. Mandible moderately twisted, with upper tooth 1.6 × as long as lower tooth, bare and without groove on outer surface; clypeus smooth, hardly convex to flat in profile, ventral margin truncate; malar space 0.3 × mandibular base; face subquadrate, 1.1 × as high as wide, rather smooth; gena constricted behind eyes; occipital carina complete; ocelli enlarged; antenna with 52 flagellomeres.

MESOSOMA. Pronotum medio-dorsally normal, unspecialized, transversely wrinkled laterally; mesoscutum finely shagreened; epicnemial carina distinct to level of ventral corner of pronotum; postpectal carina distinct only laterally, above bases of mesocoxae, otherwise indistinct; notauli indistinct; scuto-scutellar groove smooth; scutellum nearly smooth, carinate to near apex; mesopleuron finely transversely striate,

metapleuron with somewhat coarser striation; basal transverse carina of propodeum distinct but weak, anterior area of propodeum nearly smooth, posterior area finely foveolate.

WINGS. Proximal sclerite weakly sclerotized; central sclerite totally absent; Rs+2r slightly sinuate basally; cu-a subopposite Rs & M by about 0.25 cu-a length; hind wing with 7 distal hamuli on R1.

LEGS. Fore tibia with three longitudinal rows of regularly arranged dispersed short spines along its outer surface; hind coxa elongate; hind tarsal claw with short, widely spaced teeth; outer mid and hind tibial spurs much shorter than inner spurs (0.23 × and 0.25 × respectively).

METASOMA. Metasomal T2 slightly longer than T1, T2 height 0.4 × its length; thyridium distinct, ellipsoid.

Female

Unknown.

Distribution

Saudi Arabia.

***Enicospilus* sp. 2 cf. *bicoloratus* Cameron, 1915**

Figs 5D, 9B, 13B, 17B, 21B, 28B, 32B

Diagnosis

B 18–19; F 13; AI 0.6; ICI 0.52; CI 0.46; SDI 1.3; NI 1.8; ML 0.46; CT 1.7; POL 0.38; OOL 0.38; FI 0.5; FI1–2 1.6; FI20 3.0.

Body bright orange overall, with white on vertex, posterior border of eye and orbits just above emargination; metasomal T5 and T6 in profile with black ventrally, ovipositor sheath and claws black, antennae dark brown, pterostigma yellow bordered with black above and behind; mandible twisted, with upper tooth 1.25 × as long as lower tooth; clypeus convex in profile, ventral margin in-turned; face 1.2 × as high as wide; antenna short, with 47 flagellomeres; mesopleuron puncto-striate, metapleuron punctate; basal transverse carina of propodeum distinct but weak, anterior area finely and shallowly punctate, posterior area reticulate; proximal sclerite triangular; central sclerite fully sclerotized; hind wing with 5 distal hamuli on R1; fore tibia sparsely spinose.

Material examined

SAUDI ARABIA: 1 ♀, Shada Al Ala (Al Baha), light trap 2, 27 Jan. 2015, leg. Al Dhafer *et al.* (KSMA).

Remarks

This species closely resembles *E. bicoloratus* in almost all alar indices, the puncto-striate mesopleuron, the punctate metapleuron and the black apex of the metasoma. However, it differs from *E. bicoloratus* in the following: lower face 1.2 × as long as broad (in *E. bicoloratus* 1.4 × as long as broad); antennae relatively short, with 47 flagellomeres (in *E. bicoloratus* with 50–56 flagellomeres); hind wing with 5 distal hamuli on R1 (in *E. bicoloratus* with 5–7 distal hamuli on R1).

Distribution

Saudi Arabia.



Fig. 29. Hind tarsal claws. **A.** *Enicospilus arabicus* Gadallah & Soliman sp. nov. **B.** *E. bicoloratus* Cameron, 1912. **C.** *E. brevicornis* (Masi, 1939). **D.** *E. capensis* (Thunberg, 1822). **E.** *E. divisus* (Seyrig, 1935). **F.** *E. dubius* (Tosquinet, 1896).



Fig. 30. Hind tarsal claw. **A.** *Enicospilus grandiflavus* Townes & Townes, 1973. **B.** *E. mirabilis* Soliman & Gadallah sp. nov. **C.** *E. nervellator* Aubert, 1966. **D.** *E. oculator* Seyrig, 1935. **E.** *E. odax* Gauld & Mitchell, 1978. **F.** *E. oweni* Gauld & Mitchell, 1978.



Fig. 31. Hind tarsal claw. **A.** *Enicospilus pacificus* (Holmgren, 1868). **B.** *E. pallidus* (Taschenberg, 1875). **C.** *E. pseudoculator* Gadallah & Soliman sp. nov. **D.** *E. rundiensis* Bischoff, 1915. **E.** *E. senescens* (Tosquinet, 1896). **F.** *E. shadaensis* Gadallah & Soliman sp. nov.

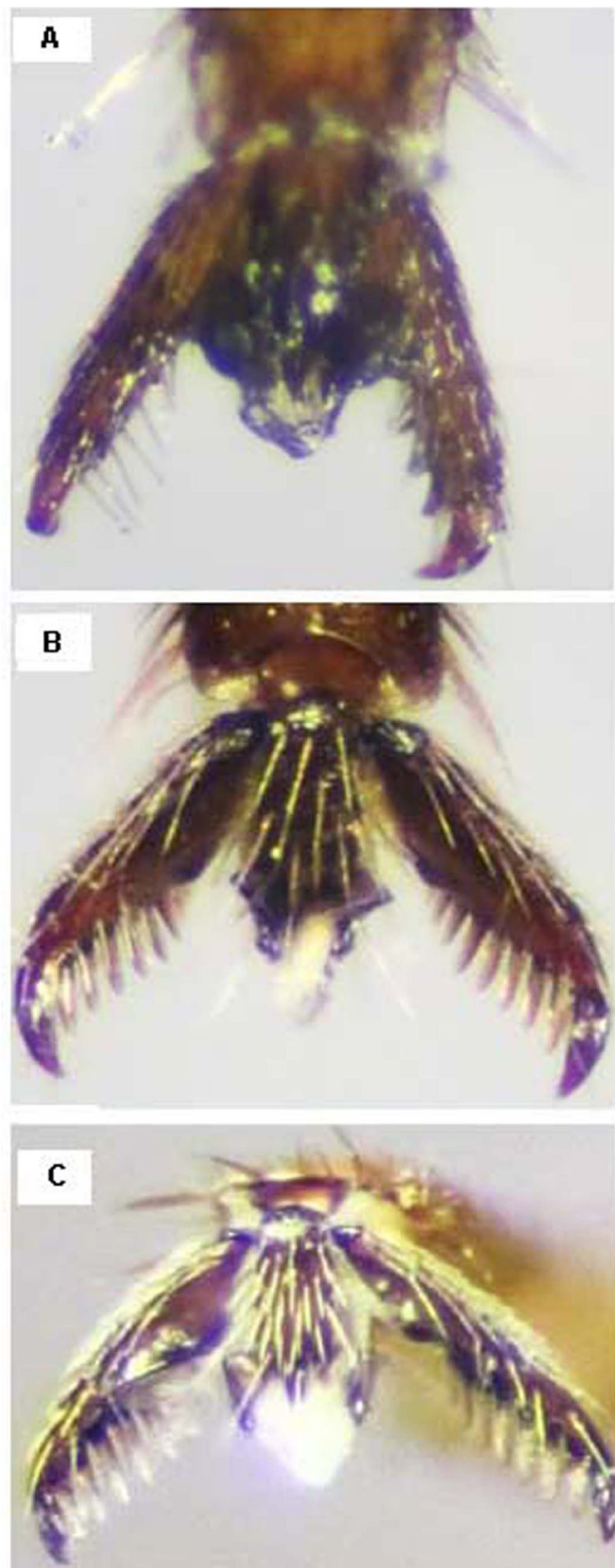


Fig. 32. Hind tarsal claw. **A.** *Enicospilus splendidus* Rouse, Soliman & Gadallah sp. nov. **B.** *Enicospilus* sp. 2 cf. *bicoloratus* Cameron, 1915. **C.** *Enicospilus* sp. 1

***Enicospilus* sp. 1**

Figs 5E, 9C, 13C, 17C, 21C, 28C, 32C

Diagnosis

B 18–20; F 13; AI 0.2; ICI 0.55; CI 0.4; SDI 1.2; NI 1.7; ML 0.4; CT 2.0; POL 0.6; OOL 0.1; FI 0.5; FI1–2 1.5; FI20 2.0.

Body reddish brown overall, with pale yellow on posterior border of eye, vertex and orbits (just above eye emargination), pterostigma of fore wing yellow, all wing veins black; mandible twisted, upper tooth distinctly 2.0 × as long as lower tooth, outer surface fringed with fine setae; clypeus convex in profile, ventral margin in-turned; face subquadrate, 1.1 × as high as wide, finely punctate, with spaces between punctures equal to puncture diameter or slightly more; occipital carina complete; gena constricted behind eye; ocelli enlarged; antenna with 52 flagellomeres; pronotum simple, unspecialized; mesopleuron densely finely punctate, somewhat coarser on metapleuron; epicnemial carina weak; postpectal carina complete; notauli indistinct; basal transverse carina of propodeum distinct, anterior area superficially finely punctate, posterior area areolate; proximal sclerite well sclerotized, central sclerite weakly sclerotized proximally; hind wing with 7 distal hamuli on R1; metasoma densely covered with pale fine and short setae.

Material examined

SAUDI ARABIA: 1 ♀, Raydah (Asir), light trap, 6 Jun. 2014, leg. Al Dhafer *et al.* (KSMA).

Remarks

This species is characterized by its dark colour and very strongly convex clypeus, which are uncommon features. Comparing with other Afrotropical species with an ill-defined central sclerite gives no results, meaning that it could be either an Oriental or Mediterranean species, so we add it here as *Enicospilus* sp. awaiting collection of further specimens.

Distribution

Saudi Arabia.

Discussion

The first general observation emerging from the present study is the strong correlation of the *Enicospilus* fauna with the intermediate biogeographical situation of Saudi Arabia. Of the 16 species collected in southwestern Saudi Arabia for which biogeographical data are available, almost all are exclusively Afrotropical, the only exception being the widely distributed *E. capensis* (Table 1). Conversely, the four species collected in Riyadh are Afrotropical, Palearctic or widely distributed. This is closely correlated with the floristic composition of this area as has been reported by several authors (e.g., Eig 1938; Bolton 1994; Aldawood *et al.* 2011; Sharaf & Aldawood 2011, 2012; Sharaf *et al.* 2012a, 2012b, 2014; El-Hawagry *et al.* 2013, 2015).

A second observation of ecological significance is provided by the large proportion of *Enicospilus* species in the local fauna with rather short antennae and/or profuse ivory markings. Only 10 out of 23 species (43%) have antennae which may reach more than 55 flagellomeres, while this proportion is 75% in the entire Afrotropical fauna (Gauld & Mitchell 1978; Yu *et al.* 2012). Moreover, in the five species described here and probably endemic to the Arabian Peninsula, only *E. arabicus* sp. nov. barely reaches beyond this threshold. Furthermore, five of the 23 species exhibit ivory markings at least on the mesosoma, and this includes all newly described species with the exception again of *E. arabicus* sp. nov. Among the approximately 150 species of the Afrotropical fauna, only four have such conspicuous pale

markings. This is not surprising, since short antennae and pale markings are common features in species of arid open areas (Gauld & Mitchell 1978, 1981). This light pattern is probably related to light reflection and temperature refraction.

However, because of the biodiversity richness of Saudi Arabia, more and more species of this genus are expected to occur. Therefore, further collections and studies are needed to clarify the distribution of this genus in other parts of this large country.

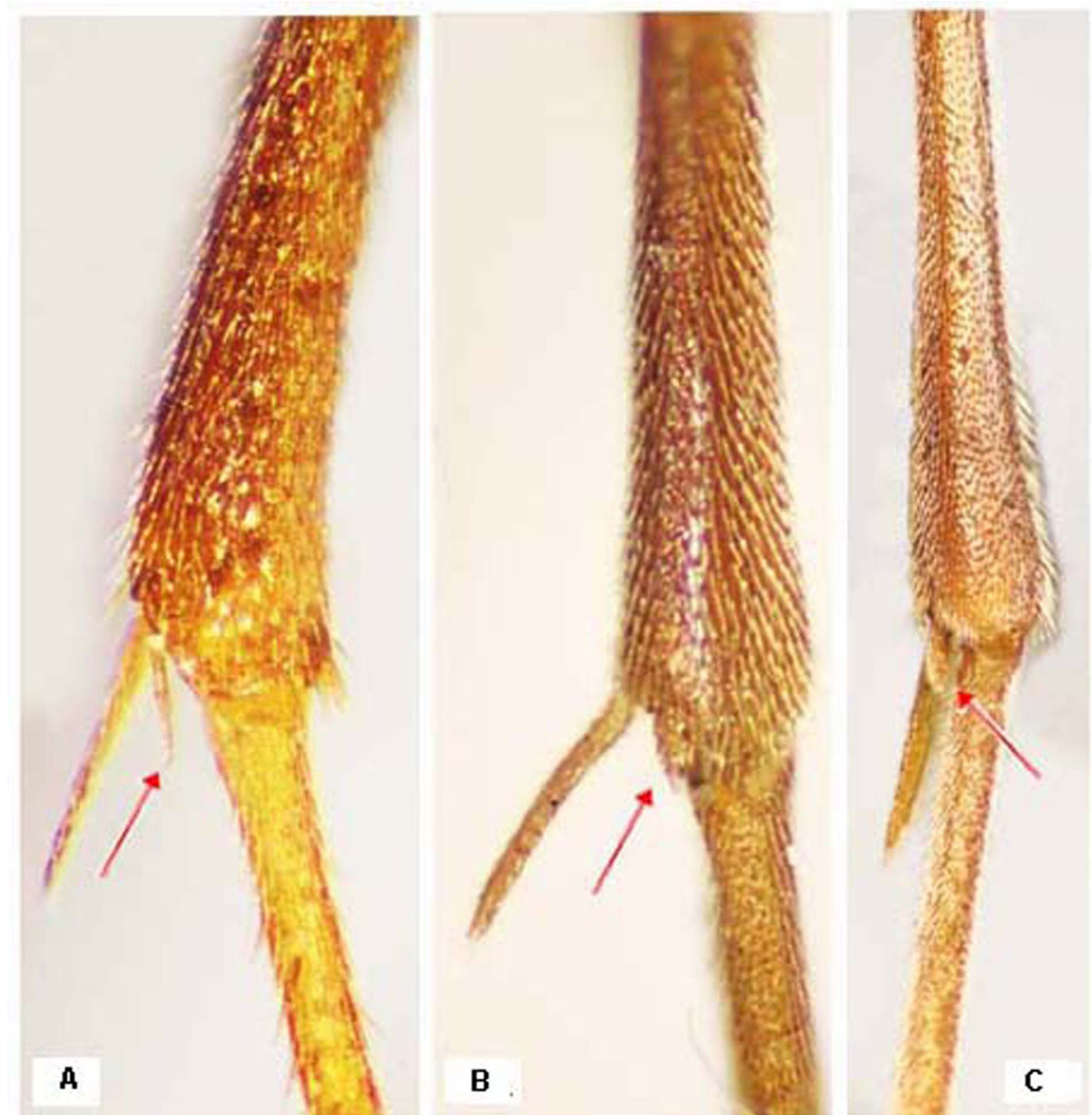


Fig. 33. **A.** Mid tibial spurs of *Enicospilus nervellator* Aubert, 1966. **B.** Mid tibial spurs of *E. splendidus* Rouse, Soliman & Gadallah sp. nov. **C.** Hind tibial spurs of *E. splendidus* Rouse, Soliman & Gadallah sp. nov.

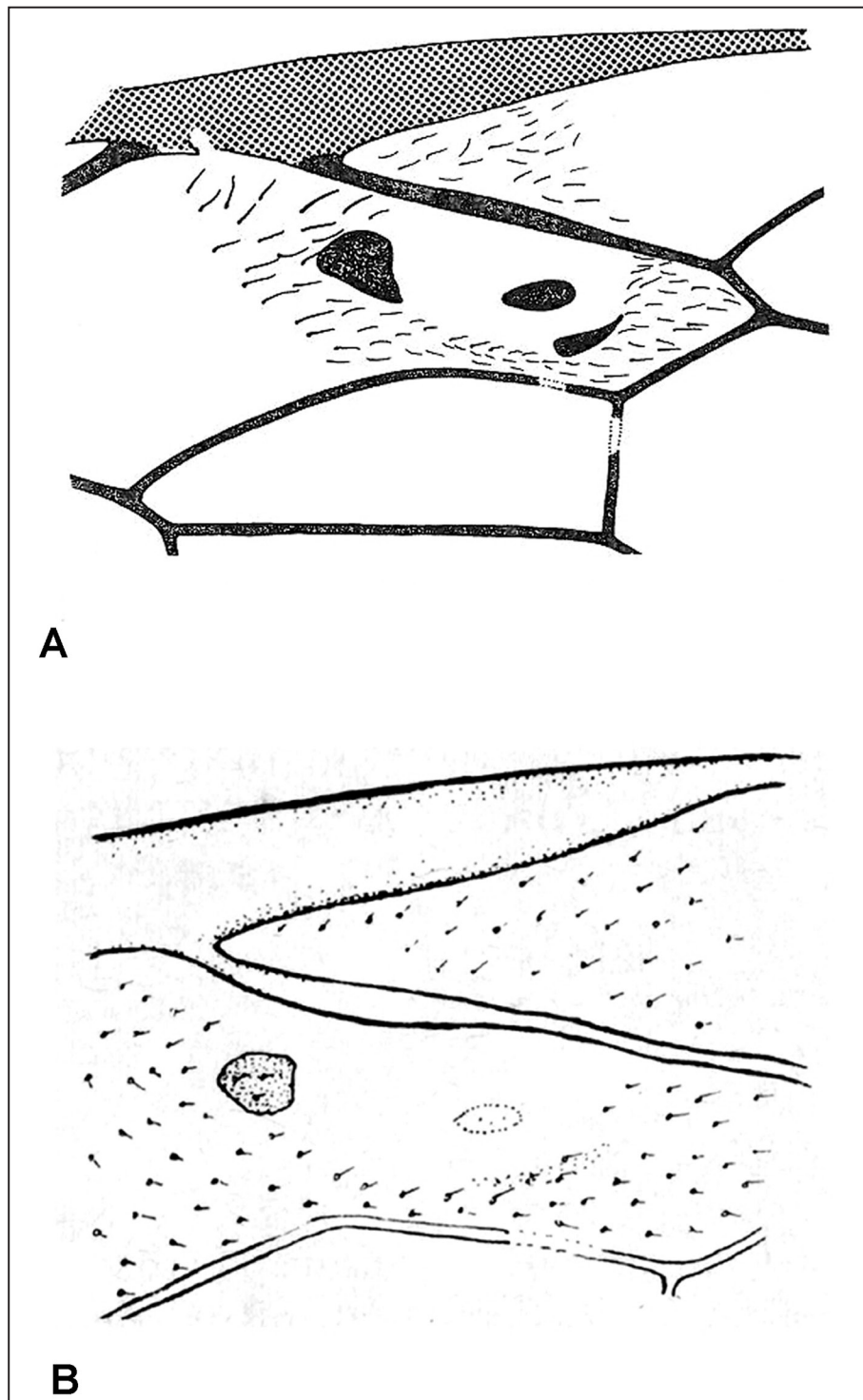


Fig. 34. Disco-submarginal cell. **A.** *Enicospilus psammus* (after Gauld & Mitchell 1978). **B.** *E. perlatus* (after Shestakov 1926).

Acknowledgements

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Appendix 1. Collection sites in Saudi Arabia. Alt.= altitude; LT = light trap; MT = Malaise trap.

Al Baha

Shada Al Ala

- LT 1: 19° 50.575' N 41° 18.691' E, alt. 1666 m.
- LT 2: 19°50.411' N, 41°18.686' E, alt. 1611 m.
- LT 3: 19°50.329' N, 41°18.604' E, alt.1563 m.
- LT 4: 19°50.710' N, 41°18.267' E, alt. 1474 m.
- LT 5: 19°51.066' N, 41°18.037' E, alt.1325 m.
- LT 6: 19°51.762' N, 41°18.089' E, alt.1225 m.
- LT House: 19°52.598' N, 41°18.672' E, alt. 892 m.

Wadi Neera: 19°44.870' N, 41°18.267' E, alt. 471 m.

Thee Ain: 19°55.774' N, 41°26.574' E, alt. 741 m.

Wadi Turubah: 20°14.4' N, 41°15.2' E, alt. 1842 m.

Wadi Ghanuna: 19°25.568' N, 41°36.548' E, 366 m.

Asir

Abha, Raydah

- LT 1: 18°12.265' N, 42°24.744' E, alt. 2820 m.
- LT 2: 18°12.315' N, 42°24.607' E, alt. 2761 m.
- LT 3: 18°12.095' N, 42°24.536' E, alt. 2578 m.
- LT 4: 18°11.884' N, 42°24.435' E, alt. 2387 m.
- LT 5 and MT 5: 18°11.766' N, 42°24.315' E, alt. 2285 m.
- LT 6: 18°11.695' N, 42°23.818' E, alt. 1897 m.
- LT 7: 18°11.679' N, 42°23.691' E, alt. 1851 m.
- LT 8 and MT 8: 18°11.618' N, 42°23.420' E, alt. 1772 m.
- LT 9: 18°11.749' N, 42°23.345' E, alt. 1614 m.
- LT House: 18°13.347' N, 42°24.133' E, alt. 2717 m.

Abha, Wadi Rida: 18°11.71' N, 42°22.081' E, alt. 1656 m.

Abha, Tamniah Dam: 18°01.353' N, 42°45.814' E, alt. 2301 m.

Al-Magardah, Wadi Yabah: 19°14.911' N, 41°47.225' E, alt. 402 m.

K. Mushayt, Wadi Bisha: 18°20.018' N, 42°42.215' E, alt. 1990 m.

Wadi Sabean: 17°52.577' N, 42°16.681' E, alt. 766 m.

Riyadh

Al Quwayiyah, Rawdet Al Harmalyiah

- LT 1: 24°18.572' N, 45°09.993' E, alt. 774 m.
- LT 3: 24°18.572' N, 45°09.993' E, alt. 774 m.
- MT.4: 24°18.372' N, 45°10.776' E, alt. 769 m.
- LT 5: 24°20.226' N, 45°09.256' E, alt. 774 m.

Al Waseel: 24°48.753' N, 46°30.745' E, alt. 660 m.

Al Aflag, Rawdet Farshet Sheaal

- LT 1: 22°24.161' N, 46°35.547' E, alt. 588 m.
- LT 10: 22°23.725' N, 46°34.847' E, alt. 589 m.
- LT 11: 22°23.828' N, 46°34.998' E, alt. 583 m.

Al Aflag, Wadi Ghaihab: 22°19.392' N, 46°26.128' E, alt. 640 m.

Al Amaryiah: 24°51.576' N, 46°55.753' E, alt. 630 m.

Deirab: 24°30.367' N, 46°37.166' E, alt. 645 m.

Al Kharg: 24°30.367' N, 46°37.166' E, alt. 645 m.

Education Farm: 24°43.83' N, 46°37.216' E, alt. 689 m.

Huraymila: 25°07.666' N, 46°05.283' E, alt. 785 m.
 Muzahimiyah, Al Khararah: 24°23.01' N, 46°14.14' E, alt. 650 m.
 Rhodet Khorim: 25°25.943' N, 47°13.863' E, 572 m.
 Ummul Hammam: 24°41.330' N, 46°39.327' E, alt. 633 m.
 Wadi Hanifah
 LT (no number): 24°54.326' N, 46°11.325' E, alt. 814 m.
 LT 3: 24°54.421' N, 46°10.902' E, alt. 809 m.

Appendix 2. COI marker registration numbers (BOLD Systems database).

Species	Length (bp)	Sequence page	Barcode Index Number Registry
<i>Enicospilus arabicus</i> sp. nov.	573	OPSAU004-16	BOLD:ADB3498
<i>Enicospilus brevicornis</i>	575	OPSAU009-16	BOLD:ADB3412
<i>Enicospilus capensis</i>	629	OPSAU011-16	NA
<i>Enicospilus divisus</i>	608	OPSAU015-16	BOLD:ADB4430
<i>Enicospilus dubius</i>	582	OPSAU005-16	BOLD:ADB4296
<i>Enicospilus grandiflavus</i>	632	OPSAU013-16	NA
<i>Enicospilus mirabilis</i> sp. nov.	625	OPSAU010-16	BOLD:ADB4082
<i>Enicospilus nervellator</i>	610	OPSAU012-16	BOLD:ADB4509
<i>Enicospilus nervellator</i>	621	OPSAU016-16	BOLD:ADB4509
<i>Enicospilus oculator</i>	570	OPSAU007-16	BOLD:ADB4114
<i>Enicospilus odax</i>	580	OPSAU001-16	BOLD:ADB4115
<i>Enicospilus oweni</i>	605	OPSAU002-16	BOLD:ADB4116
<i>Enicospilus pacificus</i>	565	OPSAU008-16	BOLD:AAV0745
<i>Enicospilus pallidus</i>	577	OPSAU014-16	NA
<i>Enicospilus pseudoculator</i> sp. nov.	579	OPSAU017-16	BOLD:ADB4338
<i>Enicospilus rundiensis</i>	577	OPSAU006-16	BOLD:ADB5118
<i>Enicospilus shadaensis</i> sp. nov.	635	OPSAU003-16	BOLD:ABX3540