

## Order Hymenoptera, family Braconidae

### Subfamily Microgastrinae from the Arabian Peninsula

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#### INTRODUCTION

Microgastrinae (Hymenoptera) is the second largest subfamily of Braconidae with more than 55 genera and 2200 described species (Yu et al., 2012), and likely thousands more species awaiting description (Mason, 1981; Rodriguez et al., 2012). It is also one of the most diverse groups of parasitoid wasps and has significant importance in biological control programs because they attack the larvae of most families of Lepidoptera (Whitfield, 1995, 1997).

The Arabian Peninsula is probably the least-studied area in the planet regarding microgastrines. Within such a large expanse of land, covering more than  $3 \times 10^6$  km<sup>2</sup>, only two species and one genus of Microgastrinae had been recorded so far: *Cotesia bignellii* (Marshall, 1885) from the United Arab Emirates and *Cotesia ruficrus* (Haliday, 1834) from Yemen (Yu et al., 2012). Even for the northernmost areas of the Arctic the documented diversity of microgastrine wasps is much higher than what was known for the Arabian Peninsula (e.g. Fernández-Triana, 2010).

The present paper records for the first time a significant number of genera and species for the Arabian Peninsula. An illustrated key to the genera and comments on the distribution of all species identified so far, are provided. The following 12 new species are described: *Choeras afrotropicalis*, *Venanides flavus*, *V. longifrons*, *V. supracompressus*, *V. tenuitergus* and *V. vanharteni* (all of them authored by Fernández-Triana & van Achterberg), and *Distatrix yemeniticus*, *Illidops albstigmalis*, *Keylimepie hadhramautensis*, *K. sanaaensis*, *Miopotes inexpectatus* and *Wilkinsonellus arabicus* (all of them authored by van Achterberg & Fernández-Triana).

#### MATERIALS AND METHODS

For the purpose of this work the Arabian Peninsula is defined as all land south of 30°N and bounded (clockwise) by the Persian Gulf, the Gulf of Oman, the Arabian Sea, the Gulf of Aden, the Red Sea and the Gulf of Aqaba (as in Huber et al., 2009). The specimens studied came from localities in Oman, Saudi Arabia, the United Arab Emirates (UAE), and Yemen.

Most of the material was collected by Antonius van Harten, with Malaise and light traps, between 1992 and 2011, and from 20+ localities of the United Arab Emirates and Yemen. The specimens are deposited in the Naturalis Biodiversity Center (RMNH), Leiden, the Netherlands, and the Canadian National Collection of Insects (CNC), Ottawa, Ontario, Canada. Details of the collecting sites in the UAE can be found in van Harten (2009), and those in Yemen are discussed by Lelej & van Harten (2006).

We also studied close to one hundred additional microgastrines from Oman, collected mostly by sweeping between 1970 and 1980, and 19 specimens from Saudi Arabia collected in 1959; that material is deposited in the CNC.

Altogether 4,000+ specimens from the Arabian Peninsula were examined. They were sorted to genera and morpho-species. Most of the species found are new and some are described below; however, many will require comprehensive examination of material from related areas (e.g. Palearctic species) before they can be properly described and cannot be treated here.

For the purpose of the present paper, the morpho-species that remain undescribed were assigned a number after the generic identity, e.g. “*Apanteles* sp. 1”. If DNA barcodes were available for that species, the corresponding interim name applied to those sequences in the Barcode of Life Data System (BOLD, <http://www.boldsystems.org/>) was also provided. For example, “*Apanteles* sp. 1. This species is named in BOLD with the interim name of *Apanteles* jft20” means that a species we identified as morpho-species *Apanteles* sp. 1 in our present study also has the interim name of *Apanteles* jft20 in BOLD.

For generic concepts of Microgastrinae we consider *Apanteles* sensu stricto as discussed by Fernández-Triana et al. (2014) (i.e. *Dolichogenidea*, *Iconella* and *Illidops* were treated as separate genera), and *Protapanteles* sensu lato as discussed by van Achterberg (2003) (i.e. *Protapanteles* was treated as including *Glyptapanteles* of other authors).

Morphological terms and measurements of structures mostly follow Huber & Sharkey (1993), Sharkey & Wharton (1997), Fernández-Triana (2014), and the Hymenoptera Anatomy and Ontology project (<http://portal.hymao.org/projects/32/public/ontology/>). Exceptionally we follow van Achterberg (1988), e.g. ‘hind tibia’ is used instead of ‘metatibia’ of the other authors, ‘front tarsus’ (instead of ‘protarsus’), ‘face’ and ‘frons’ (instead of “lower face” and ‘upper face’).

Descriptions of the new species in this paper are brief and only include some body measurements commonly used in Microgastrinae (e.g. length of body, fore wing, and ovipositor sheath). They are complemented with extensive colour photographs of every species to illustrate, instead of describing with words, other details (e.g. colour, shape, and sculpture). Additionally, molecular data is provided whenever available.

DNA barcodes (henceforth referred as simply ‘barcodes’) for some specimens were obtained using DNA extracts prepared from single legs using a glass fibre protocol (Ivanova et al., 2006). Extracts were re-suspended in 30 µl of dH<sub>2</sub>O, and a 658-bp region near the 5’ terminus of the COI gene was amplified using standard primers (LepF1-LepR1) following established protocols (Smith et al., 2006, 2007, 2008). If the initial 658 bp amplification was not successful composite sequences were generated using internal primers. Primer information for individual sequences can be retrieved from BOLD (Ratnasingham & Hebert, 2007), but primers are as detailed in Smith et al. (2008).

Voucher codes for all specimens of the Arabian Peninsula with sequences available in BOLD, are detailed in the individual treatment of every species. They can be freely accessed in BOLD (e.g. Smith et al., 2012).

DNA barcodes were used to generate a ‘barcode accumulation curve’, a feature available in BOLD (<http://www.boldsystems.org/>) which provides accumulation of taxonomic and/or sequence diversity and allows monitoring sampling coverage. We used Barcode Index Number (BIN) as operational taxonomic units (sensu Ratnasingham & Hebert, 2013).

Photographs were taken with a Keyence VHX-1000 Digital Microscope, using a lens with a range of 13–130×. Multiple images through the focal plane were taken of a structure and these were combined to produce a single in-focus image, using the software associated with the Keyence System.

## SYSTEMATIC ACCOUNT

Genera (and species within every genus) are arranged in alphabetical order.

We record here at least 93 morpho-species and 18 genera of Microgastrinae for the Arabian Peninsula. Most of the species found are new to science, 12 of them are described below, and the rest will be dealt with in future papers. Altogether 20 described species are now known

Table 1. List of described species of Microgastrinae recorded from the Arabian Peninsula and their distribution within the peninsula.

Species	Countries
<i>Beyarslantia insolens</i> (Wilkinson, 1930)	Yemen
<i>Choeras afrotropicalis</i> Fernández-Triana & van Achterberg <b>sp. nov.</b>	Yemen
<i>Cotesia bignellii</i> (Marshall, 1885)	UAE
<i>Cotesia ruficrus</i> (Haliday, 1834)	Yemen
<i>Cotesia saltatoria</i> (Balevski, 1980)	UAE
<i>Cotesia vestalis</i> (Haliday, 1834)	UAE
<i>Distatrix yemeniticus</i> van Achterberg & Fernández-Triana <b>sp. nov.</b>	Yemen
<i>Dolichogenidea appellator</i> (Telenga, 1949)	UAE
<i>Illidops naso</i> (Marshall, 1885)	UAE
<i>Illidops albstigmatis</i> van Achterberg & Fernández-Triana <b>sp. nov.</b>	UAE, Yemen
<i>Keylimepie hadhramautensis</i> van Achterberg & Fernández-Triana <b>sp. nov.</b>	Yemen
<i>Keylimepie sanaaensis</i> van Achterberg & Fernández-Triana <b>sp. nov.</b>	Yemen
<i>Distatrix yemeniticus</i> van Achterberg & Fernández-Triana <b>sp. nov.</b>	Yemen
<i>Dolichogenidea appellator</i> (Telenga, 1949)	UAE
<i>Illidops naso</i> (Marshall, 1885)	UAE
<i>Illidops albstigmatis</i> van Achterberg & Fernández-Triana <b>sp. nov.</b>	UAE, Yemen
<i>Miropotes inexpectatus</i> van Achterberg & Fernández-Triana <b>sp. nov.</b>	Yemen
<i>Venanides flavus</i> Fernández-Triana & van Achterberg <b>sp. nov.</b>	Yemen
<i>Venanides longifrons</i> Fernández-Triana & van Achterberg <b>sp. nov.</b>	Yemen
<i>Venanides supracompessus</i> Fernández-Triana & van Achterberg <b>sp. nov.</b>	Yemen
<i>Venanides tenuitergus</i> Fernández-Triana & van Achterberg <b>sp. nov.</b>	Yemen
<i>Venanides vanharteni</i> Fernández-Triana & van Achterberg <b>sp. nov.</b>	Yemen
<i>Wilkinsonellus henicopus</i> (De Saeger)	Yemen
<i>Wilkinsonellus arabicus</i> van Achterberg & Fernández-Triana <b>sp. nov.</b>	Yemen

from the Arabian Peninsula (Table 1), a significant increase compared with the two species previously recorded for the region (Yu et al., 2012).

Two species from Saudi Arabia are also recorded here (based on 19 specimens from a single locality and collecting event). The diversity of Microgastrinae for that country will certainly be much higher when more material becomes available for study.

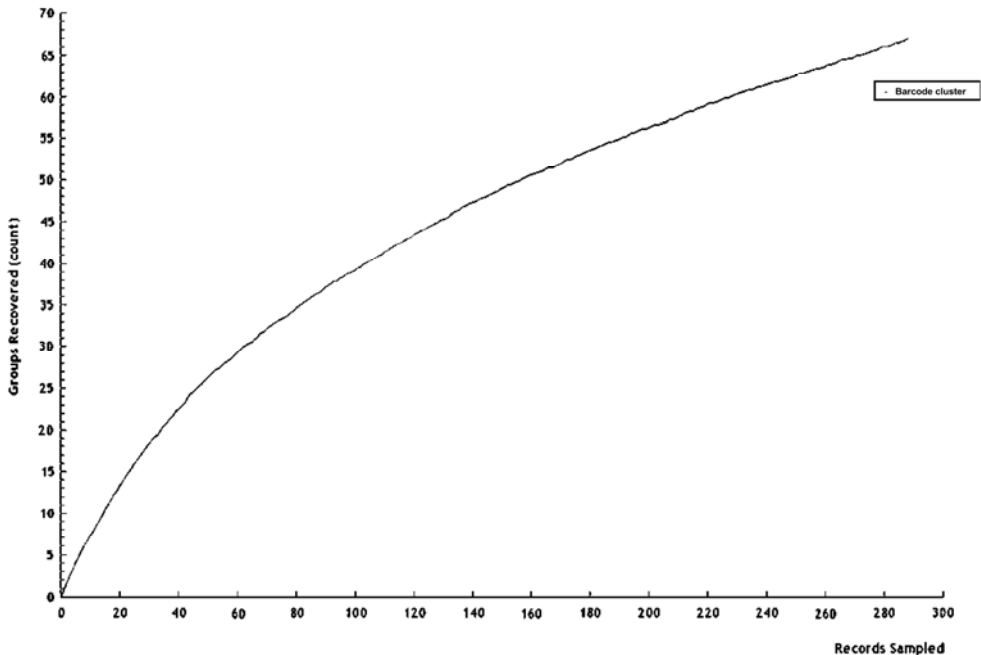
Below an illustrated key to all genera is provided, as well as an annotated checklist for all morpho-species found during our study – including number of specimens, known distribution within the Arabian Peninsula, and molecular data when available. Both the key and the species checklist are intended as a foundation for future studies revising the remaining undescribed species of Microgastrinae of this region.

The most diverse genera found in the Arabian Peninsula were *Apanteles*, *Cotesia* and *Protopanteles* (each with at least 14 morpho-species recognized), *Diolcogaster* (12 morpho-species) and *Microplitis* (8 morpho-species). Significant records were the finding in Yemen of the tropical genera *Beyarslantia*, *Miropotes*, *Parapanteles*, *Venanides* and *Wilkinsonellus*. All of them have most of its known species distributed in more southern latitudes. The range extension for *Beyarslantia* and *Miropotes* are very significant and important.

## Molecular data

We obtained 288 sequences, 219 (76%) of them with more than 500 base pairs and less than 1% of base pairs ambiguity (Annex 1). In spite of the sequence data being only available for just 7% of the total number of specimens here studied, the DNA barcodes revealed more than 70 BINs (Graph 1), most of which are likely to correspond to actual species when studied further.

Graph 1. Barcode accumulation curve for Microgastrinae (Hymenoptera: Braconidae) of the Arabian Peninsula, based on 288 sequences. 'Records sampled' refers to the number of sequences analyzed, and 'Groups Recovered' to Barcode Index Number (BIN) as defined in Ratnasingham & Hebert (2013).



Barcoding additional specimens of the Arabian Peninsula would probably reveal even more species, overlooked now because of being morphologically cryptic. Also, increasing the coverage of the barcoding library for the region would allow for comparisons with other regions which already have barcoded a substantial number of specimens and species of Microgastrinae (e.g. Smith et al., 2013).

Only eight species (8.5%) were shared between Yemen samples (which comprised localities predominantly tropical), and Oman/UAE (which comprised more temperate localities). Based on the composition and diversity of Microgastrinae genera found, it is clear that the fauna of Yemen is mostly Afrotropical, while that of Oman and UAE shows more affinity with the Palearctic region.

**Key to the genera of Microgastrinae from the Arabian Peninsula**

- 1 Eyes strongly convergent below, almost completely obliterating malar space (Plate 57); ovipositor strongly bent (more than 60°) on posterior 0.1–0.2; fore wing with areolet basically obliterated by veins 2RS and 2M (Plate 55); T1 with inner, smoother area delimited by strong sulcus from outer area, which is more membranous (Plate 58) [a genus mostly distributed in Australasia and Oriental regions, reaching its northernmost and westernmost distribution in Yemen] ..... ***Miopotes***
- Eyes, if convergent below, never obliterating malar space; ovipositor, fore wing areolet and T1 not as above ..... **2**
- 2 Propodeum with strong, well defined, median longitudinal and transverse carinae (Plates 6, 8, 11); lateral face of scutellum (lunula) with small polished area and surface above lunula almost completely smooth (Plate 11) ..... ***Beyarslania***
- Propodeum with a different carination pattern: either completely smooth (Plates 39, 63, 74, 85, 90), or only with median longitudinal carina (Plates 16, 23, 29, 34, 50, 52, 61, 99; Fig. 1), a complete or incomplete areolet (Plates 4, 26, 67), or a short median apical band of rugosity apically (Plate 48). Lateral face of scutellum (lunula) with polished area ranging from small to usually half or more lateral face height, usually with surface above lunula showing some striation (as in Plates 4, 23, 29, 34, 47, 52, 61, 64, 57, 74, 77) ..... **3**
- 3 Ovipositor sheath at least half as long as hind tibia, usually longer (Plates 12, 17–21, 42–45; Figure 1); sheaths covered by setae on all or most of its length (setae as long as those on hypopygium) ..... **4**
- Ovipositor sheath shorter than half length of hind tibia, usually much shorter (Plates 24, 26, 30, 40, 41, 53, 62, 65, 66, 68, 69, 72, 82, 86, 95, 97); sheath with few, sparse setae on apical tip (which are usually shorter than setae on hypopygium), or not setae visible (Plates 69, 72, 97) ..... **9**
- 4 Propodeum with median longitudinal carina well defined (Plates 16, 22, 23) ..... **5**
- Propodeum without median longitudinal carina, with a variable developed areola, a short median apical base of rugosity, or completely smooth (Plates 4, 48) ..... **6**
- 5 Fore wing with areolet (Plate 13); lateral face of scutellum with polished area (lunula) at most  $0.3 \times$  lateral face height ..... ***Choeras***
- Fore wing without areolet (Plate 22); lateral face of scutellum with polished area (lunula) at least  $0.6 \times$  lateral face height (Plate 84) ..... ***Iconella***
- 6 Ovipositor sheath at most  $0.6 \times$  hind tibia length; hypopygium evenly sclerotized to median fold, usually without folding pleats (there might be a more translucent, flexible, narrow fold medially but no multiple creases) (as in Figure 2); body smaller than 3 mm (usually 1.5–2.5 mm) ..... ***Pholetesor***
- Ovipositor sheath at least  $0.8 \times$  hind tibia length, usually much longer; hypopygium medially folded and membranous, with multiple creases (Plates 17–20, 42–45); body size variable, but often larger than 3 mm ..... **7**
- 7 Scutellum with postero-median band of rugosity (Plate 47); face, especially in females, usually narrowing from antennal base to clypeus (Plate 46); tergites 3–7 desclerotized medio-apically, giving the appearance of being pushed forward medially (Plate 48); propodeum uniformly rugose (Plate 48) ..... ***Illidops***
- Scutellum polished posteriorly, without median band of rugosity (as in Plates 1, 4); face usually not narrowing from antennal base to clypeus; tergites 3–7 usually not desclerotized medio-apically but of normal appearance; propodeum either smooth, fully or partially areolated (as in Plate 4), or with posterior band of rugosity on apical margin just before nucha ..... **8**

- 8 Hind wing with vannal lobe usually evenly convex, medially with uniformly dense fringe of setae (Plate 3); in species with distinct punctuation on mesoscutum, punctures do not fuse with each other (Plate 4) ..... ***Dolichogenidea***
- Hind wing with vannal lobe usually slightly to strongly concave, medially with fringe of setae sparse or fringe absent (Plate 1); in species with distinct punctuation on mesoscutum, punctures become elongate because of confluence with neighbouring ones ..  
..... ***Apanteles***
- 9 Hind coxa at most  $2.0\times$  as large as middle coxa, not surpassing tergite 2 (as in Plate 50), usually not surpassing tergite 1; hind coxa length less than  $0.3\times$  metasomal length (Plate 98); hind tibial spurs usually shorter than half length of first hind tarsomere ..... **10**
- Hind coxa at least  $3.0\times$  as large as middle coxa, surpassing tergite 2 (as in Plates 37, 91); hind coxa length at least  $0.3\times$  metasomal length, usually much more (Plates 37, 72); hind tibial spurs longer than half length of first hind tarsomere (Plate 18); areolet absent (Plates 36, 91) or, if present, usually small, sometimes slit-like or almost obliterated (Plates 25, 31, 70, 76, 82, 92) ..... **11**
- 10 Tergite 1 with median longitudinal sulcus for most of its length; propodeum with reticulated sculpture (Plate 98); areolet usually large; malar space less than  $2.0\times$  mandible width ..... ***Microplitis***
- Tergite 1 with a depression anteromedially, without median longitudinal sulcus (Plate 16); propodeum with partially defined median and transverse carinae (Plate 51); areolet small; malar space more than  $2.0\times$  mandible width (Plate 9) ..... ***Keylimepie***
- 11 Fore wing with areolet, sometimes areolet small or poorly delimited posteriorly (veins 3RSa and/or r-m might be unpigmented but still visible) (Plates 25, 31) ..... ***Diolcogaster***
- Forewing without areolet (veins 3RSa and/or r-m absent) (Plates 70, 76, 82, 92) ..... **12**
- 12 Ovipositor sheath always without setae (at most with very minute, almost invisible setae, much smaller in length than setae on hypopygium) (Plates 40, 41, 72), and propodeum smooth and without carinae (Plates 39, 74, 85, 88, 90) ..... **13**
- Ovipositor sheath usually with setae of similar length to setae on hypopygium (Plate 68), and/or propodeum usually with carinae and other coarse sculpture (Plates 61, 67, 99; Fig. 1)..... **14**
- 13 Antenna much shorter than body (Plates 75, 80–87, 90, 91, 94); flagellomeres with placodes arranged in one row; legs, especially fore femur, short and stout (as in Plates 75, 80, 91, 93); smaller body size (up to 2.5 mm, usually less than 2.0 mm) ..... ***Venanides***
- Antenna about as long as body or longer (Plate 35); flagellomeres with placodes arranged in two rows; legs of normal appearance, not particularly stout (as in Plates 35–37); larger body size (at least 2.8 mm) ..... ***Distatrix***
- 14 Tergite 1 very narrow, at least  $4.0\times$  as long as width at posterior margin (Plate 99); fore wing with veins 2RS and r forming a peculiar angulation (as in Plate 96) . ***Wilkinsonellus***
- Tergite 1 much wider than above, at most  $2.0\times$  as long as width at posterior margin (Plates 63, 64, 67; Fig. 1); fore wing 2RS and r with different angulation ..... **15**
- 15 Propodeum with carinae completely (rarely partially) delimiting an areola (as in Plate 67) ..... ***Parapanteles***
- Propodeum without areola; either with only median longitudinal carina, or irregularly sculptured, or essentially smooth and without any carination (Plates 60, 61, 63, 64; Fig. 1) ..... **16**
- 16 Tergite 2 with a pair of longitudinal grooves delimiting a median area that is longer than wider (Plate 61), and usually wider anteriorly ..... ***Nyereria***

- Tergite 2 without delimited median area, or if there is a delimited area then it is rectangular or wider posteriorly (Plates 63, 64; Fig. 1) ..... 17
- 17 Propodeum with mostly rugose carination pattern (Fig. 1), including a median carina (which might be partially obscured by rest of sculpture) and usually a partial transverse carina; tergite 2 rectangular or quadrate and usually rugose (partially or completely) (Fig. 1); tergite 2 subequal to slightly smaller than tergite 3; tergite 3 sometimes partially to completely rugose ..... *Cotesia*
- Propodeum usually not as sculptured, either completely smooth (as in Plates 63, 64) or with some sculpture mostly in the apical half; median carina complete, partial or absent, but not obscured, transverse carinae always absent; tergite 2 either sub-triangular (as in Plates 63, 64), trapezoidal or rectangular (if rectangular, anterior margin with rounded corners); tergite 2 much smaller than tergite 3; tergite 3 always smooth (Plates 63, 64) ..... *Protopanteles*

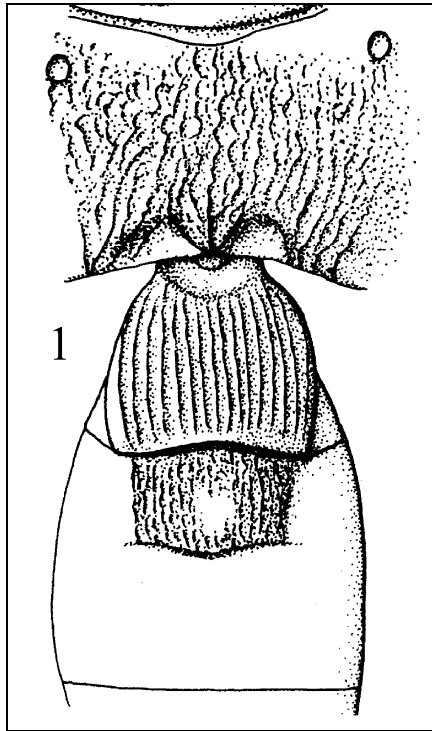


Figure 1. *Cotesia flavipes* Cameron, propodeum and first-third metasomal tergites, dorsal aspect.

### Notes on species of Microgastrinae found in the Arabian Peninsula

#### Genus *Apanteles* Forster, 1862

This is the most diverse genera of Microgastrinae worldwide (Yu et al., 2012). It was also one of the most diverse genera found in the Arabian Peninsula, with at least 14 morpho-species recognized – and probably more when accounting for morphologically cryptic species. We

list below only the morpho-species that had DNA barcodes associated, or those without barcodes but with distinct morphological features.

***Apanteles* sp. 1**

This species is named in BOLD with the interim name of *Apanteles* jft20. This was the most abundantly collected species of the genus in our study, with 184 specimens from Oman (Wahiba Sands), UAE (al-Ajban; SSW of ad-Dhaid; Sharjah Desert Park; NARC, near Sweihan), and Yemen (al-Kowd; Ta'izz). A total of 16 barcodes (voucher codes: CNCH0791–0801, CNCH2696–2700).

***Apanteles* sp. 2**

This species is named in BOLD with the interim name of *Apanteles* jft30. One specimen from UAE (al-Ajban). One barcode (voucher code: JMIC 0371).

***Apanteles* sp. 3**

This species is named in BOLD with the interim name of *Apanteles* jft21. More than 60 specimens from Oman (Salalah), UAE (Fujairah; Sharjah Desert Park; NARC, near Sweihan), and Yemen (al-Ghayda; al-Kowd; al-Lahima; al-Mahrah; 12 km NW of Manakhah; Sana'a; Seyun; Ta'izz). Eight barcodes (voucher codes: CNCH2674, 2675, 2678, 2681, 2690, 2694, 2718, and 2723).

***Apanteles* sp. 4**

This species is named in BOLD with the interim name of *Apanteles* jft02. Two females from the UAE (Sharjah). One barcode (voucher code: CNCH2680).

***Apanteles* sp. 5**

Four females, one from Yemen (al-Kowd), three from the UAE (N of Ajman). No barcodes.

***Apanteles* sp. 6**

Eleven specimens from Yemen (al-Lahima; 12 km NW of Manakhah; Sana'a; Ta'izz). No barcodes.

***Apanteles* sp. 7**

Two females, three males from Yemen (al-Kadan; ar-Rujum; Sana'a; 12 km NW of Manakhah). No barcodes.

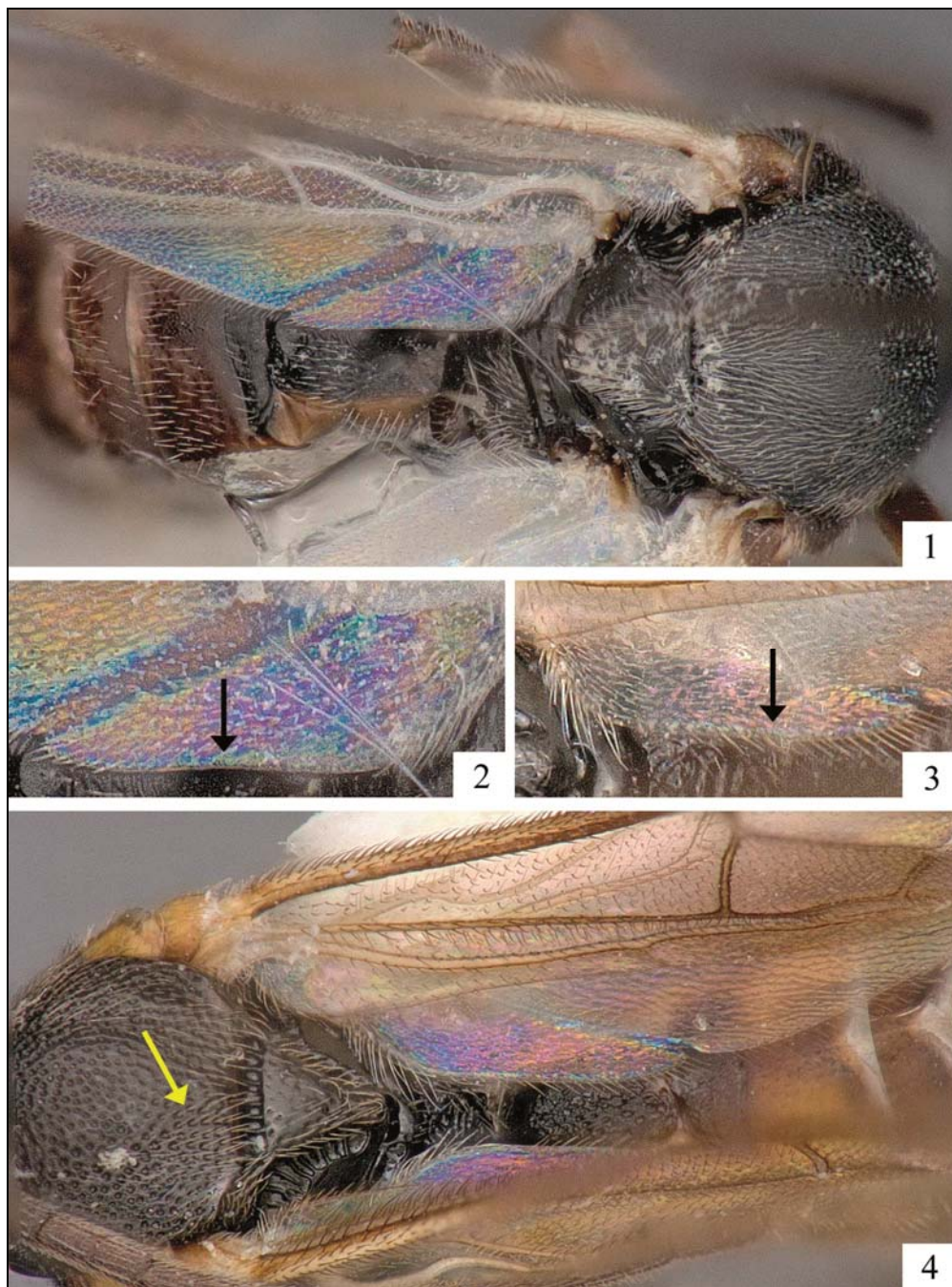
***Apanteles* sp. 8**

Three females, two males from Yemen (al-Lahima). Although no DNA sequences were obtained for this species, it is included here based on its unique morphological characters (white pterostigma, relatively very long ovipositor sheath ( $1.7\times$  as long as hind tibia), and relatively very thick ovipositor). No other *Apanteles* species from the Arabian Peninsula presents such a combination of characters.

***Apanteles* sp. 9.**

More than 50 specimens from the UAE (al-Ajban; Wadi Wurayah) and Yemen (Ghail Ba Wazir; al-Kadan; al-Kowd; al-Lahima; 12 km NW of Manakhah; Sana'a; Seyun; Ta'izz). No barcodes.





Plates 1–4. 1–2. *Apanteles* sp. 1 (specimen voucher code CNCH2688). 1: Mesosoma, metasoma and wings (partially), dorsal view; 2: Detail of vannal lobe of hind wing. 3–4. *Dolichogenidea* sp. 2 (specimen voucher code CNCH2671). 3: Detail of vannal lobe of hind wing; 4: Mesosoma, metasoma and wings (partially), dorsal view.

*Apanteles* sp. 10

This species is named in BOLD with the interim name of *Apanteles* jft03. Seven females from Yemen (ar-Rujum). One barcode (voucher code: CNCH2693).

*Apanteles* sp. 11.

Many specimens from the UAE (al-Ajban; NARC, near Sweihan; Sharjah Desert Park; Wadi Wurayah) and Yemen (al-Kowd; 12 km NW of Manakhah; al-Mukalla; Sana'a; Ta'izz). No barcodes.

*Apanteles* sp. 12

This species is named in BOLD with the interim name of *Apanteles* jft05. Six females and one male from Yemen (al-Kowd). One barcode (voucher code: CNCH2687).

*Apanteles* sp. 13

This species is named in BOLD with the interim name of *Apanteles* jft06. A total of 36 specimens from Yemen (Hammam 'Ali; al-Kowd; al-Lahima; Lahj; Sana'a; Ta'izz). One barcode (voucher code: CNCH2701).

*Apanteles* sp. 14

This species is named in BOLD with the interim name of *Apanteles* jft34. Two specimens from the UAE (NARC, near Sweihan; Sharjah Desert Park). Two barcodes (voucher codes: CNCH2670, JMIC 0375).

Genus *Beyarslania* Kocak & Kemal, 2009

Until a recent nomenclatural change (Kocak & Kemal, 2009) this genus was known as *Xenogaster* Mason, 1981. It was described by Mason (1981) to accommodate a very unique species from Africa.

*Beyarslania insolens* (Wilkinson, 1930)

Plates 5–11

One female from Yemen (Ta'izz). One barcode (voucher code: WAM 0141). The specimen we studied is indistinguishable from the other known specimens. The record from Yemen (13°30'N) significantly expands 2,000 km northwards the distribution of the species – previously known only from Ruhengeri, Rwanda (1°30'S) and Mossel Bay, South Africa (34°15'S) (De Saeger, 1944).

Genus *Choeras* Mason, 1981

This is a cosmopolitan genus, although most of the described species are Holarctic (based on data from Yu et al., 2012). We found one new species from Yemen, which is described below.

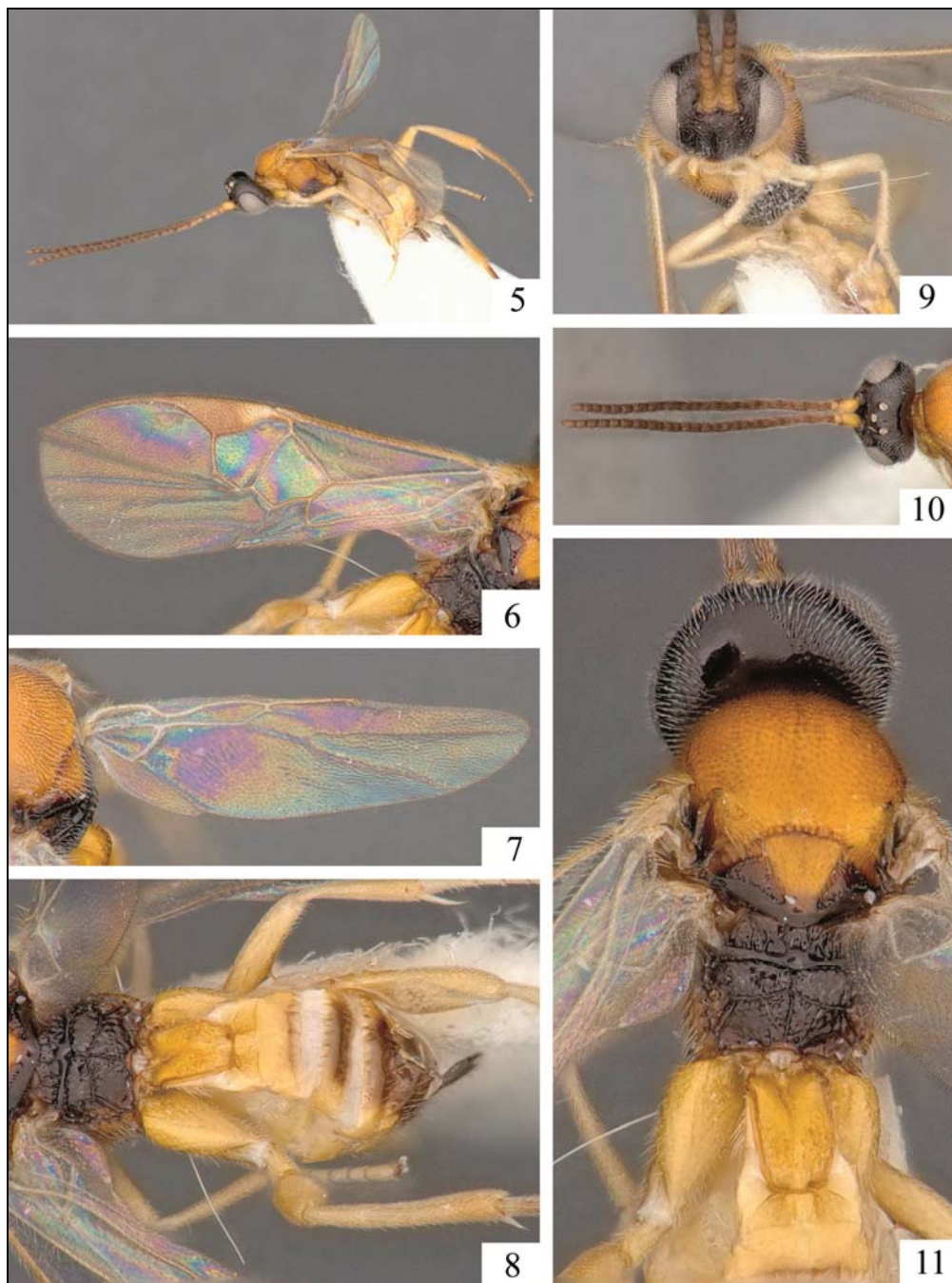
*Choeras afrotropicalis* Fernández-Triana & van Achterberg **sp. nov.**

Plates 12–16

Holotype: ♀ in RMNH. YEMEN, 12 km NW Manakhah. Malaise trap; 24.vi–4.viii.2003; A. van Harten; RMNH'03. Second label with DNA voucher code: WAM 0134.

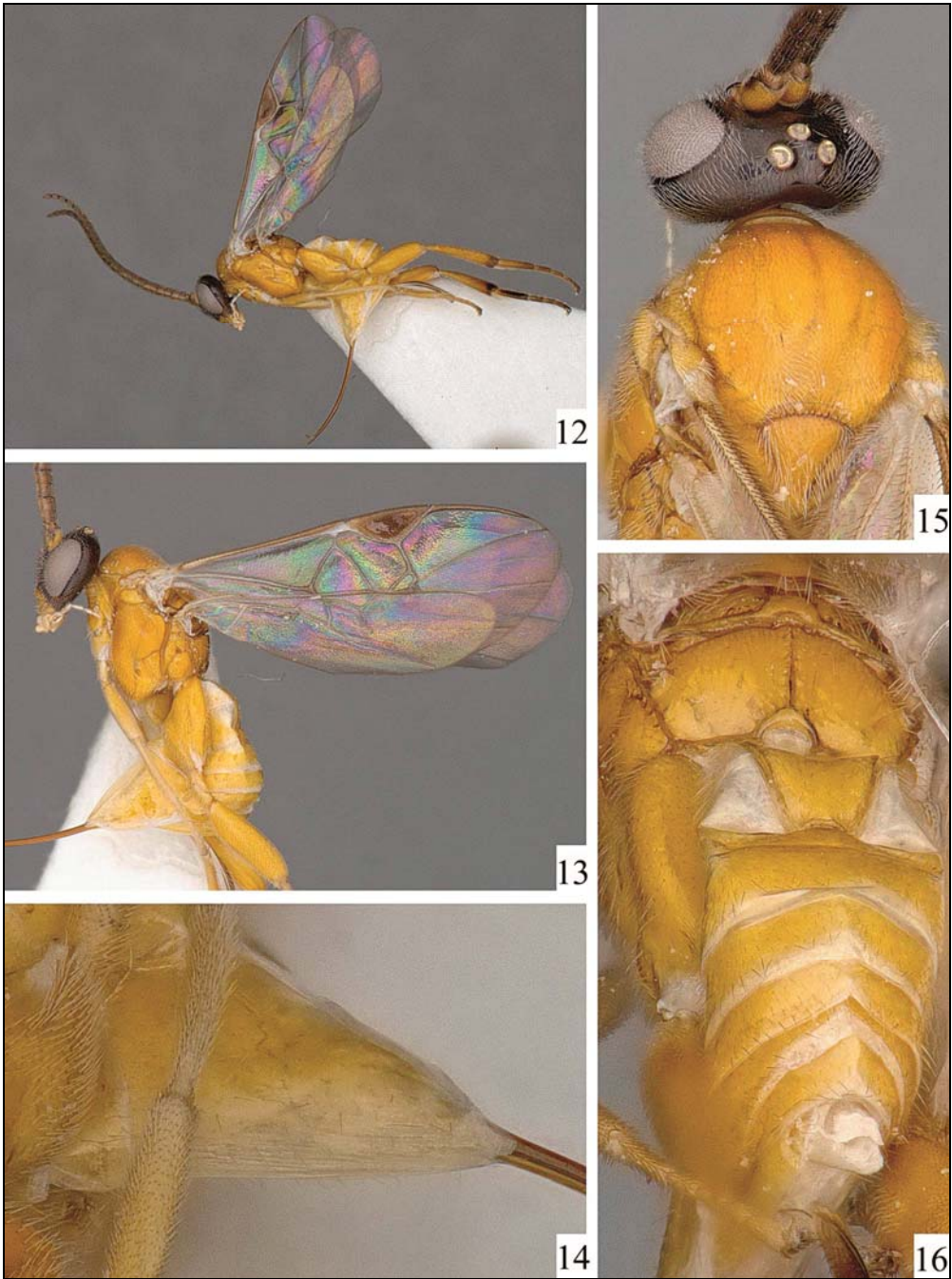
Paratypes: 8♀ in CNC and RMNH. Yemen, same locality as holotype; collecting dates: 3.vii–21.viii.2001, 4.viii–15.ix.2003, 15.ix–22.x.2003. DNA voucher codes: WAM 0128–0133, WAM 0135–0137.

Brief description: Body length: 2.60–3.00 mm; fore wing length: 3.20–3.30 mm; ovipositor sheath: 0.90–1.00 mm; hind tibia length: 1.00–1.10 mm; hind femur length/width: 0.90/0.28



Plates 5–11. *Beyarslantia insolens* (Wilkinson, 1930). 5: Habitus, lateral view; 6: Fore wing. 7: Hind wing; 8: Propodeum and metasoma, dorsal view; 9: Head, frontal view; 10: Head and antennae, dorsal view; 11: Mesosoma and tergites 1–2, dorsal view.





Plates 12–16. *Choeras afrotropicalis* Fernández-Triana & van Achterberg sp. nov. 12: Habitus, lateral view; 13: Wings and partial habitus; 14: Hypopygium, lateral view; 15: Head, mesoscutum and scutellum, dorsal view; 16: Propodeum and metasoma, dorsal view.

mm flagellomere 2 length/width: 0.22/0.08 mm; flagellomere 8 length/width: 0.20/0.07 mm; flagellomere 14 length/width: 0.10/0.06 mm.

Variation: One female paratype has darker colouration (reddish to light brown) on propodeum and mesosternum, as well as an entirely dark (brown to black) head.

Molecular data: Sequences in BOLD: 8, barcode compliant sequences: 6. Comments: *Choeras afrotropicalis* sp. nov. can be recognized by its mostly yellow colouration on meso- and metasoma, head mostly to entirely black, and antenna light brown. So far this is the only species of the genus known from the Arabian Peninsula, and it is also the first record of the genus for the Afrotropical Region. The species *Choeras parasitellae* (Bouché, 1834) has been recorded from Israel (Halperin, 1986) at approximately 32°N, which is close to but out of the limit we set for the Arabian Peninsula in this paper. *C. parasitellae* is an entirely black species, as are most of the Palaearctic species of the genus.

Distribution: Only known from the type locality, where it was collected from late June to late October.

Etymology: The name refers to the biogeographic region where it was collected, the first *Choeras* species described from the Afrotropical Region – although almost certainly more species will be found there when more studies are done in the region.

#### Genus *Cotesia* Cameron, 1891

This is one of the most diverse genera of Microgastrinae worldwide (based on data from Yu et al., 2012). Four described species and at least 10 additional morpho-species are recognized and listed below. We include only the morpho-species that had DNA barcodes associated, or those without barcodes but with distinct morphological features.

#### *Cotesia bignellii* (Marshall, 1885)

Recorded from the UAE by Porter (1979).

#### *Cotesia ruficrus* (Haliday, 1834)

Recorded from Yemen, without further details (Walker, 1994). Here we provide locality records based on 48 specimens from Yemen (al-Kadan; al-Lahima; Lahj; 12 km NW Manakhah; ar-Rujum; Sana'a; Ta'izz). Two barcodes (voucher codes: JMIC 0335, 0347).

#### *Cotesia saltatoria* (Balevski, 1980)

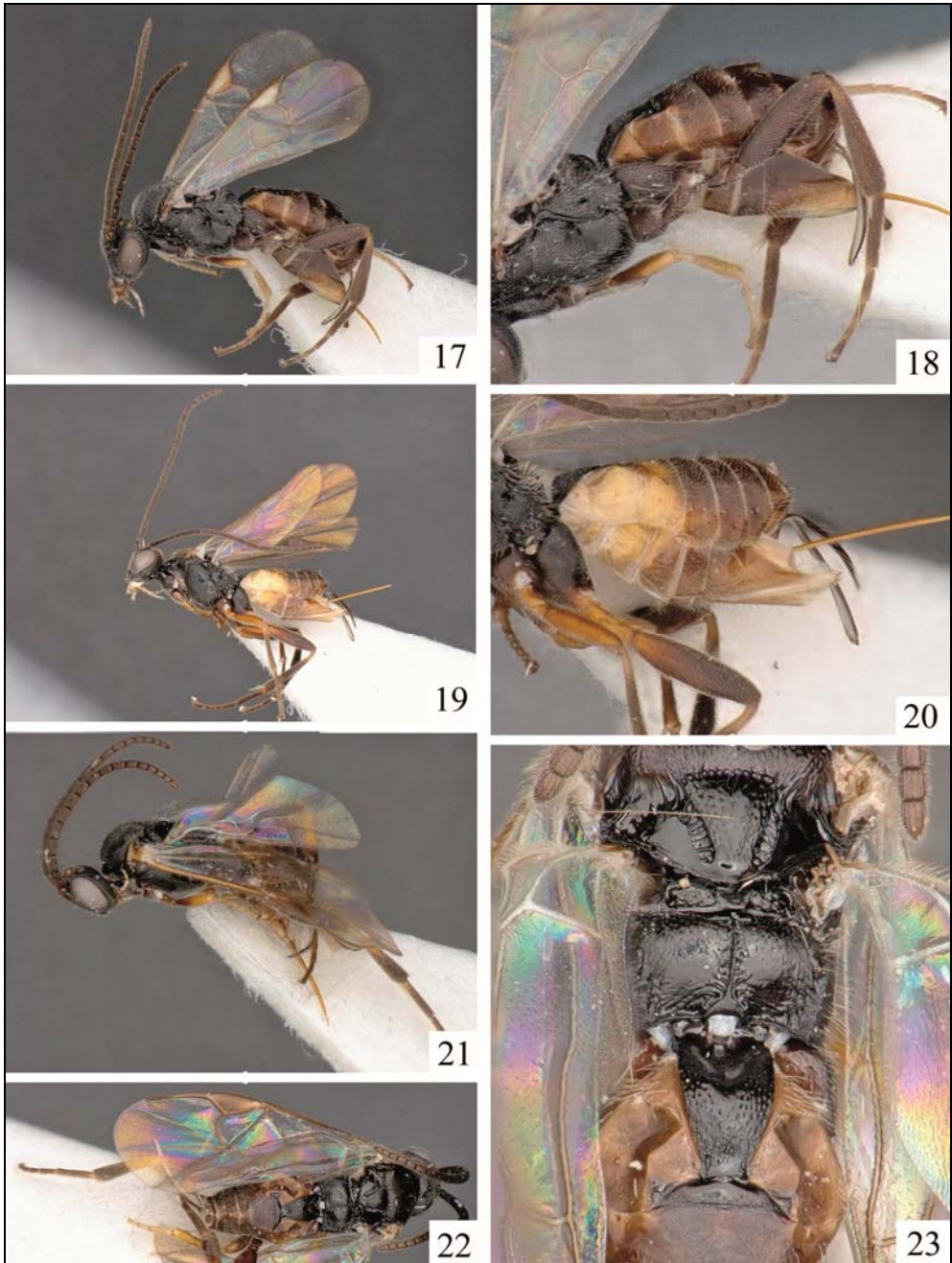
We record here this species for the first time for the UAE, based on five females and 11 males (al-Ajban; Sharjah Desert Park). Two barcodes (voucher codes: JMIC 0303, 0320).

#### *Cotesia vestalis* (Haliday, 1834)

We record here this species for the first time for the UAE, based on more than 120 specimens (al-Ajban; Bithnah; Fujairah; Sharjah Desert Park; NARC, near Sweihan; Wadi Safad). A total of 10 barcodes (voucher codes: JMIC 0293, 0294, 0297, 0300, 0302, 0336, 0349–0352).

#### *Cotesia* sp. 1

This species is named in BOLD with the interim name of *Cotesia* jft52. Almost one hundred specimens from Yemen (Hammam 'Ali; al-Kadan; al-Lahima; Lahj; 12 km NW of Manakhah; ar-Rujum; Sana'a; Ta'izz). Six barcodes (voucher codes: JMIC 0355, 0358, 0359, 0364, 0366, 0368). This species seems to be morphologically related to specimens of *C. vestalis* and *C. ruficrus*. However, it differs from them in having tergite 1 either more or less parallel-sided or just slightly widening at apex, and tergite 2 more transverse (width at apex more than  $2.0 \times$  its length).



Plates 17–23. 17–18. *Apanteles* sp. 1 (specimen voucher code CNCH2688). 17: Habitus, lateral view; 18: Mesosoma (partially) and metasoma, lateral view. 19–20. *Dolichogenidea* sp. 2 (specimen voucher code CNCH2671). 19: Habitus, lateral view; 20: Mesosoma (partially) and metasoma, lateral view. 21–23. *Iconella* sp. 3 (specimen voucher code WAM 0154). 21: Habitus, lateral view; 22: Habitus, dorsal view; 23: Propodeum and tergites 1–3, dorsal view.

***Cotesia* sp. 2**

At least 18 specimens from Yemen (al-Kadan; al-Kowd; al-Lahima; 12 km NW of Manakhah; ar-Rujum.). Three barcodes (voucher codes: JMIC 0306, 0309, 0365), representing three haplotypes. Most of the specimen have a yellow (or at most light brown) metasoma.

***Cotesia* sp. 3**

Two females and two males from the UAE (Sharjah Desert Park; Wadi Safad). No barcodes.

***Cotesia* sp. 4.** Three females and three males from the UAE (al-Ajban; N of Ajman) and Yemen (al-Lahima; Ta'izz). No barcodes.

***Cotesia* sp. 5**

A total of 13 specimens from Yemen (Lahj; 12 km NW of Manakhah; ar-Rujum). Four barcodes (voucher codes: JMIC 0313–0317), representing four haplotypes.

***Cotesia* sp. 6**

One female from Yemen (Sana'a). No barcode.

***Cotesia* sp. 7**

Two females from the UAE (al-Ajban; Wadi Wurayah). One barcode (voucher code: JMIC 0322).

***Cotesia* sp. 8**

Two female specimens from the UAE (Sharjah Desert Park). One barcode (voucher code: JMIC 0328).

***Cotesia* sp. 9**

A total of 16 specimens from Saudi Arabia (ar-Riyadh), from CNC material collected in 1959. No barcodes.

***Cotesia* sp. 10**

A total of 28 specimens from Yemen (al-Lahima; 12 km NW of Manakhah; Ta'izz). Four barcodes (voucher codes: CNCH2729, 2736, JMIC 0318, 0321), representing four haplotypes.

**Genus *Diolcogaster* Ashmead, 1900**

This is a relatively diverse genus of Microgastrinae worldwide (based on data from Yu et al., 2012). It was also one of the most diverse genera found in the Arabian Peninsula, with at least 12 morpho-species recognized in our study – and probably more when accounting for morphologically cryptic species. All morpho-species with DNA barcodes associated, or those without barcodes but with distinct morphological features, are listed.

***Diolcogaster* sp. 1**

This species is named in BOLD with the interim name of *Diolcogaster* jft76. Probably the most commonly collected species. Over 300 specimens from most of the localities in Oman and the UAE sampled for this study. Species characterized by mostly yellow coloration, eyes strongly convergent, large ocelli (oculo-ocellar distance less than half posterior ocellus diameter), and pterostigma mostly yellow with only a darker central area (light brown). Some colour variation in mesosoma, which is sometimes brown to dark brown.

*Diolcogaster* sp. 1 may actually represent a complex of morphologically cryptic species, and the relatively scant molecular data suggests so (see below for examples). A total of 23 barcodes (voucher codes: CNCH0802–808, 810–813, 816–818, 2709–2011; JMIC 0404, 0405, 0414, 0416, 0420, 0422).

***Diolcogaster* sp. 2**

This species is named in BOLD with the interim name of *Diolcogaster* jft74. Three females and four males from the UAE (Fujairah; Sharjah Desert Park). It seems to be morphologically similar to *Diolcogaster* sp. 1, but specimens have a darker colouration and the molecular data also support it as a different species. Seven barcodes (voucher codes: CNCH0809, 0819, 0821, JMIC 0396, 0397, 0413, 0415).

***Diolcogaster* sp. 3**

This species is named in BOLD with the interim name of *Diolcogaster* jft75. A total of 44 specimens from the UAE (mostly al-Ajban, with a few specimens from NARC, near Sweihan). Morphologically similar to *Diolcogaster* spp. 1 and 2, but it can be separated from those species based on having ocelli not nearly as large (oculo-ocellar distance larger or at most equal than posterior ocellus diameter), pterostigma mostly brown with only small pale spot anteriorly, and the molecular data also support it as a different species. Four barcodes (voucher codes: JMIC 0398, 0418; CNCH0814, 0815).

***Diolcogaster* sp. 4**

This species is named in BOLD with the interim name of *Diolcogaster* jft19. One female and one male specimens from Yemen (Sana'a). One barcode (voucher code: JMIC 0442).

***Diolcogaster* sp. 5**

This species is named in BOLD with the interim name of *Diolcogaster* jft21. A total of 15 specimens from Yemen (al-Kowd; ar-Rujum; Ta'izz). Two barcodes (voucher codes: CNCH2708, JMIC 0461).

***Diolcogaster* sp. 6**

This species is named in BOLD with the interim name of *Diolcogaster* jft04. One female and four male specimens from UAE (al-Ajban). One barcode (voucher code: JMIC 0429).

***Diolcogaster* sp. 7**

This species is named in BOLD with the interim name of *Diolcogaster* jft11. One female from Yemen (ar-Rujum). One barcode (voucher code: JMIC 0443).

***Diolcogaster* sp. 8**

This species is named in BOLD with the interim name of *Diolcogaster* jft22. At least 41 specimens from both the UAE (Fujairah; Hatta; Khor Kalba; Sharjah; Wadi Safad) and Yemen (Dabin; al-Kowd; al-Lahima; Lahj; al-Mahrah; Sana'a; Ta'izz). Four barcodes (voucher codes: CNCH0822, 2714, 2716, 2717). A species characterized by its short antenna and ovipositor sheath without visible setae. Future study might place this species in a different genus.



***Diolcogaster* sp. 9**

This species is named in BOLD with the interim name of *Diolcogaster* jft20. A total of 35 specimens from Yemen (mostly from ar-Rujum, with only two specimens from Ta'izz). Nine barcodes (voucher codes: CNCH2702–2706, JMIC 0444, 0450, WAM0295, 0298).

***Diolcogaster* sp. 10**

This species is named in BOLD with the interim name of *Diolcogaster* jft17. At least 117 specimens from Yemen (mostly from 12 km NW of Manakhah; a few specimens from Ta'izz). A total of 15 barcodes (voucher codes: JMIC 0445, 0446, 0451–0454, 0458, 0468, 0469, 0470, 0471, 0473–0475, WAM 0297).

***Diolcogaster* sp. 11**

This species is named in BOLD with the interim name of *Diolcogaster* jft18. One female specimen from Yemen (Ta'izz). One barcode (voucher code: WAM 0293).

***Diolcogaster* sp. 12**

This species is named in BOLD with the interim name of *Diolcogaster* jft15. Two specimens from Yemen (12 km NW of Manakhah; Ta'izz). Two barcodes (voucher codes: JMIC 0465, 0472).

**Genus *Keylimepie* Fernandez-Triana, 2016**

This genus was described recently from a single species found in Florida, United States (Fernandez-Triana & Boudreault, 2016). It includes the species with shortest fore wings recorded in Microgastrinae –female specimens. The finding of two additional species from the Arabian Peninsula is significant, as it expands considerably the known distribution of the genus. Fernandez-Triana & Boudreault (2016) speculated that the short wings in *Keylimepie* might be an adaptation to the dry environments of southern Florida, where the species was found. Similar environmental conditions are also present in the Arabian Peninsula, where the two new species, from Yemen, were collected in localities more than 500 km apart. They are keyed out and described below.

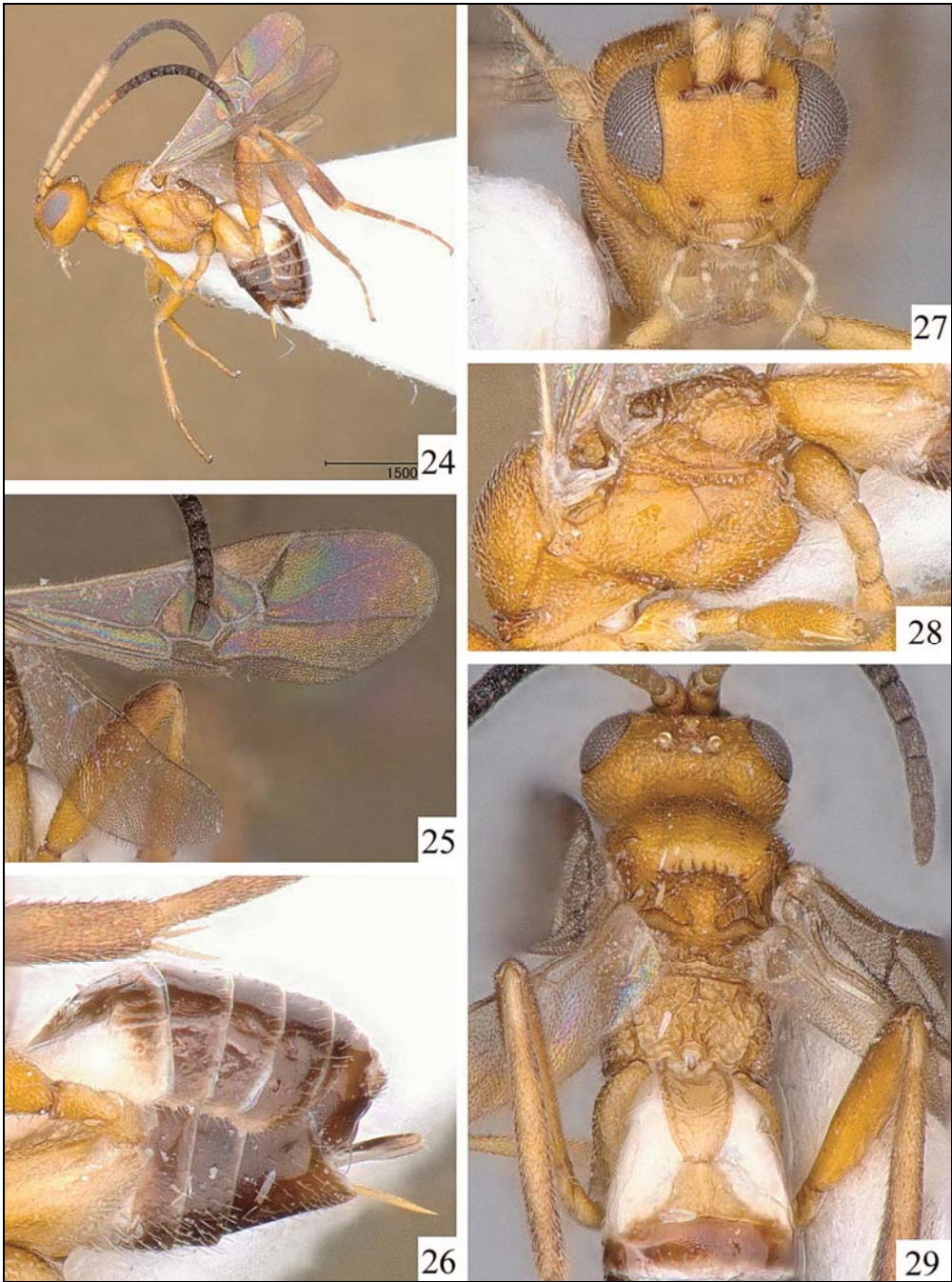
**Key to *Keylimepie* species of the Arabian Peninsula**

- 1 Head, mesosoma, tergites 1 and 2 entirely yellow (Plates 24, 27–29); fore wing length  $6.0 \times$  its maximum width [collected in Ghayl Ba Wazir, Hadhramaut region] ..... ***Keylimepie hadhramautensis* van Achterberg & Fernández-Triana sp. nov.**
- Head, mesosoma (except for propleuron, pronotum and small area anteriorly on mesoscutum), most of middle and hind legs, and most of metasoma reddish brown to dark brown (Plates 30, 32–34); fore wing length  $3.0 \times$  its maximum width [collected in Sana'a] ..... ***Keylimepie sanaaensis* van Achterberg & Fernández-Triana sp. nov.**

***Keylimepie hadhramautensis* van Achterberg & Fernández-Triana sp. nov.**      Plates 24–29

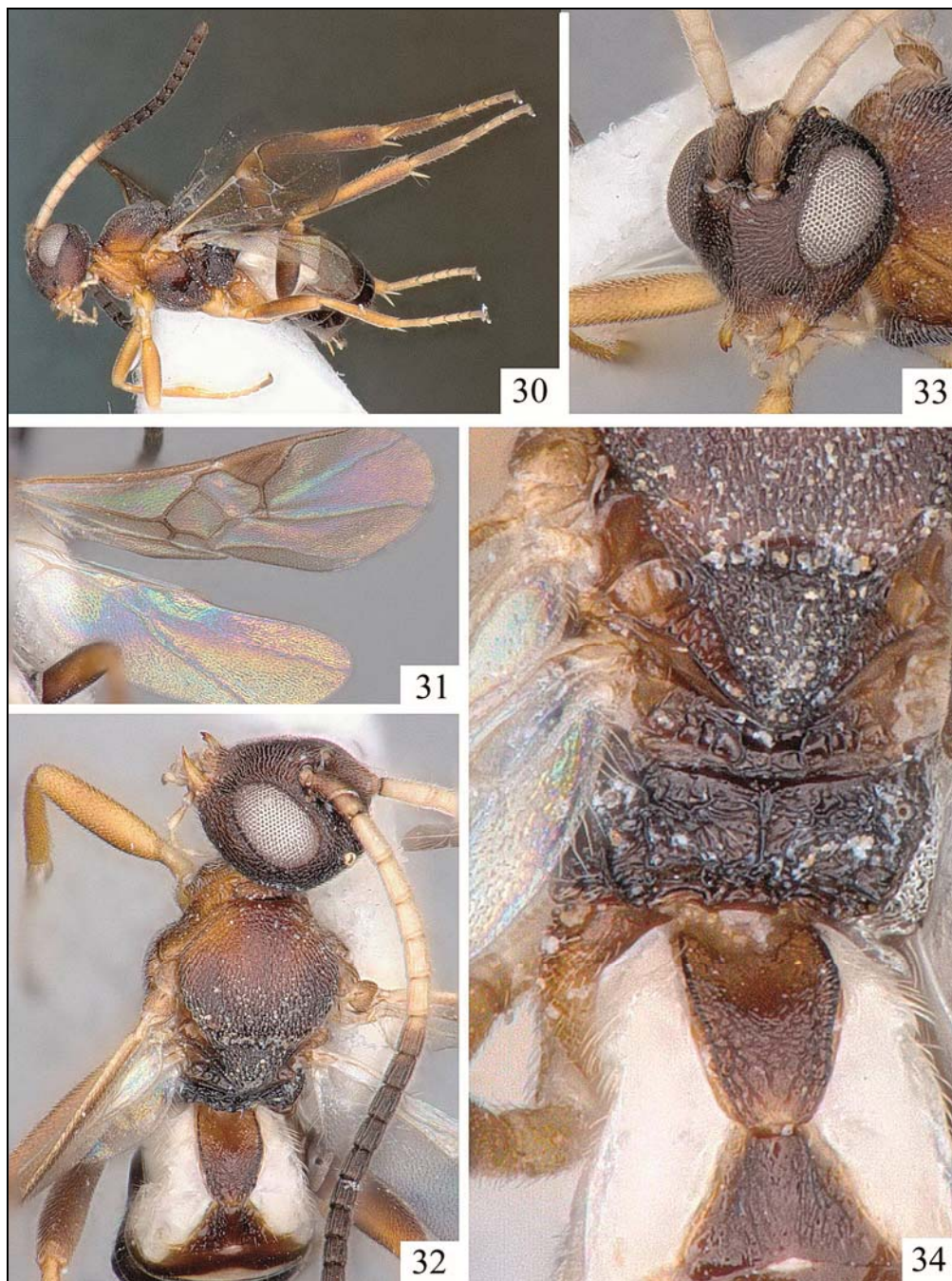
Holotype: ♀ in RMNH. YEMEN, (7803), Ghayl Ba Wazir, i–iv.2003, Malaise trap, A. van Harten, RMNH'03. Second label: WAM 0292.

Brief description: Body length: 2.20 mm; fore wing length: 1.70 mm; fore wing maximum width: 0.27 mm; pterostigma length/maximum width: 0.36/0.16 mm; fore wing vein R1 0.29 mm; fore wing vein r: 0.07 mm; flagellomere 2 length/width: 0.18/0.06 mm; flagellomere 8



Plates 24–29. *Keylimepie hadhramautensis* van Achterberg & Fernández-Triana sp. nov. 24: Habitus, lateral view; 25: Wings; 26: Metasoma, lateral view; 27: Head, frontal view; 28: Mesosoma, lateral view; 29: Head, mesosoma and tergites 1–3, dorsal view.





Plates 30–34. *Keylimepie sanaaensis* van Achterberg & Fernández-Triana sp. nov. 30: Habitus, lateral view; 31: Wings; 32: Head, mesosoma and tergites 1–3, dorsal view; 33: Head, frontal view; 34: Details of mesosoma (partially) and tergites 1–2, dorsal view.

length/width: 0.13/0.06 mm; flagellomere 14 length/width: 0.10/0.06 mm; malar line/mandible width: 0.13/0.05 mm; hind femur length/width: 0.73/0.16 mm; hind tibia length: 0.85 mm; hind tibial inner spur/length of first segment of hind tarsus: 0.18/0.41 mm; ovipositor sheath: 0.15 mm.

Molecular data: One partial barcode with 276 base pairs (voucher code: WAM 0292).

Comments: This species has a much narrower fore wing than the *D. sanaaensis*, and it is more lightly coloured.

Distribution: Only known from one female collected in Ghayl Ba Wazir.

Etymology: Named after the Yemen region of Hadhramaut, where the village of Ghayl Ba Wazir, the type locality of the species, is found.

***Keylimepie sanaaensis* van Achterberg & Fernández-Triana *sp. nov.*** Plates 30–34

Holotype: ♀ in RMNH. YEMEN, (no. 3146), Sana'a, Malaise trap, v–vi.1998, A. van Harten, RMNH'98.

Paratypes: 1♀ in RMNH, Yemen, same information as for holotype. 1♀ in CNC, Yemen, same locality as holotype, collecting date iv.1998, DNA voucher code JMIC 0441.

Brief description: Body length: 2.37–2.67 mm; fore wing length: 1.93–2.1 mm; fore wing maximum width: 0.62–0.70 mm; pterostigma length/maximum width: 0.39/0.18 mm; fore wing vein R1 0.25 mm; fore wing vein r: 0.07 mm; flagellomere 2 length/width: 0.15/0.07 mm; flagellomere 8 length/width: 0.11/0.07 mm; flagellomere 14 length/width: 0.10/0.07 mm; malar line/mandible width: 0.15/0.06 mm; hind femur length/width: 0.72/0.16 mm; hind tibia length: 0.90 mm; hind tibial inner spur/length of first segment of hind tarsus: 0.17/0.42 mm; ovipositor sheath: 0.15 mm.

Molecular data: One partial barcode with 278 base pairs (voucher code: JMIC 0441).

Comments: A much darker species, with wider fore wing.

Distribution: The three known specimens were collected in Sana'a (Yemen).

Etymology: Named after Sana'a, the capital of Yemen and the type locality of the species.

Genus *Distatrix* Mason, 1981

This is a relatively small genus with 16 described species, four of them from the Afrotropical Region (based on data from Yu et al., 2012). We found one new species in the Arabian Peninsula (Yemen), which is described below.

***Distatrix yemeniticus* van Achterberg & Fernández-Triana *sp. nov.*** Plates 35–41

Holotype: ♀ in RMNH. YEMEN, (5700), ar-Rujum, 9.iv–5.vi.2001, Malaise-trap, A. van Harten, RMNH'02.

Paratypes: 1♀ in CNC, Yemen, same locality as holotype, collecting date: 15.i–9.iv.2001.

Brief description: Body length: 2.9–3.0 mm; fore wing length: 3.1–3.3 mm; pterostigma length/maximum width: 0.65/0.26 mm; fore wing vein R1 0.70 mm; fore wing vein r: 0.23 mm; flagellomere 2 length/width: 0.23/0.08 mm; flagellomere 8 length/width: 0.21/0.06 mm; flagellomere 14 length/width: 0.17/0.05 mm; hind femur length/width: 0.82/0.22 mm; hind tibia length: 0.96 mm; hind tibial inner spur/length of first segment of hind tarsus: 0.35/0.50 mm; ovipositor sheath: 0.21–0.23 mm.

Molecular data: One partial barcode with 289 base pairs (voucher code: WAM 0138).

Comments: This is the northernmost species found in the Afrotropical Region so far.

Distribution: Only known from one locality in Yemen (16°15'N 44°43'E).

Etymology: The name refers to the country where the species was collected.

Genus *Dolichogenidea* Viereck, 1911

This genus has been variously considered as an independent genus on its own or a synonym of *Apanteles*. Here we follow Mason (1981) and a recent discussion on the topic (Fernández-Triana et al., 2014) and consider it as a valid genus. Four species (three of them from the UAE, one from Yemen) are recorded below.

*Dolichogenidea appellator* (Telenga, 1949)

We record here this species for the first time for the UAE (Sharjah Desert Park; NARC, near Sweihan). Nine barcodes (voucher codes: CNCH 0824, 0825, 2660–2664, 2666, and JMIC 0370). The species is known to be widely distributed in the Palearctic Region (Shaw, 2012; Yu et al., 2012). The status of *D. appellator* was recently revised (Shaw, 2012).

*Dolichogenidea* sp. 1

This species is named in BOLD with the interim name of *Dolichogenidea* jft22. Close to one hundred specimens are recorded from the UAE (Fujairah; Sharjah Desert Park). Nine barcodes (voucher codes: CNCH0823, 0826–0831, and JMIC 0369). This species is morphologically similar to *D. appellator*, the main difference being the ovipositor length (shorter than hind tibia length in *Dolichogenidea* sp. 1, longer than hind tibia in *D. appellator*). Barcodes from the two species differ by more than 4% (26 base pairs).

*Dolichogenidea* sp. 2

Plates 3, 4, 19, 20

This species is named in BOLD with the interim name of *Dolichogenidea* jft16. At least 20 females and seven males from the UAE (Sharjah Desert Park; NARC, near Sweihan). A total of 11 barcodes (voucher codes: CNCH2671–2173, 2676; WAM 0206, 0207, 0214–218).

*Dolichogenidea* sp. 3

This species is named in BOLD with the interim name of *Dolichogenidea* jft21. Two female specimens from Yemen (al-Lahima). Two barcodes (voucher codes: WAM 0208, 0255).

Genus *Iconella* Mason, 1981

At times this genus has been variously considered as an independent genus on its own or a synonym of *Apanteles*. Here, we follow Mason (1981) and a recent discussion on the topic (Fernández-Triana et al., 2014) and consider it as a valid genus. Five morpho-species were found during our study.

*Iconella* sp. 1

Four specimens from the UAE (Fujairah). No barcodes.

*Iconella* sp. 2

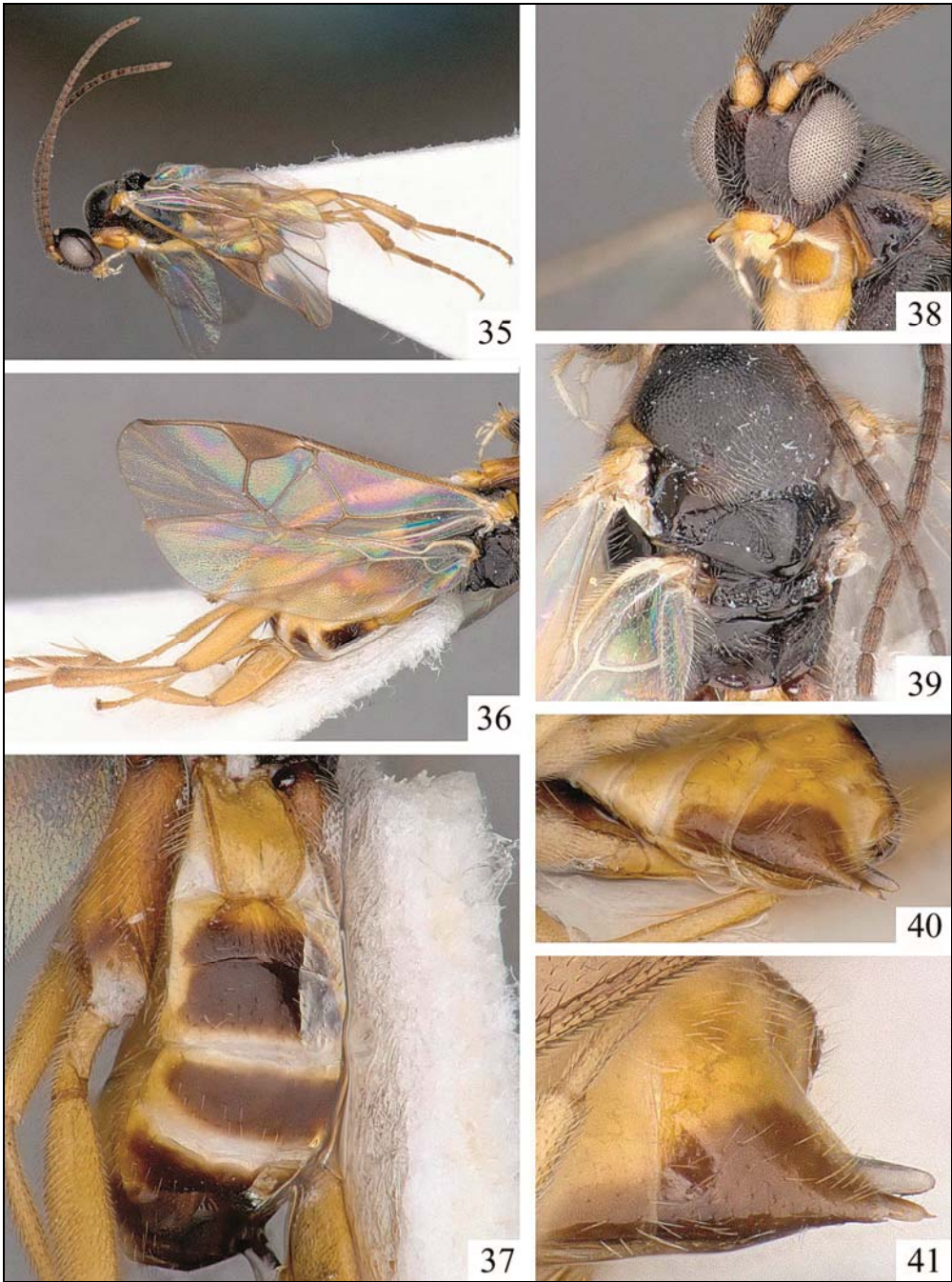
This species is named in BOLD with the interim name of *Iconella* jft06. A total of 26 specimens from the UAE (al-Ajban; Hatta; Sharjah; Wadi Madaq; Wadi Safad). Eight barcodes (voucher codes: WAM 0144, 0237, 0238, 0241, 0242, 0244, CNCH2679, 2713).

*Iconella* sp. 3

Plates 21–23

This species is named in BOLD with the interim name of *Iconella* jft03. Four females from Yemen (12 km NW of Manakhah). Two barcodes (voucher codes: WAM 0153, 0154) representing two rather different haplotypes, but here being kept as one species until more specimens can be studied.





Plates 35–41. *Distatrix yemeniticus* van Achterberg & Fernández-Triana sp. nov. 35: Habitus, lateral view; 36: Wings; 37: Metasoma, dorsal view; 38: Head, frontal view; 39: Mesosoma dorsal view; 40: Hypopygium and ovipositor, ventro-lateral view; 41: Hypopygium and ovipositor, lateral view.

***Iconella* sp. 4**

This species is named in BOLD with the interim name of *Iconella* jft04. Four females from Yemen (12 km NW of Manakhah). Two barcodes (voucher codes: WAM 0156, 0157).

***Iconella* sp. 5**

This species is named in BOLD with the interim name of *Iconella* jft05. One female from Yemen. One barcode (voucher code: WAM 0159).

**Genus *Illidops* Mason, 1981.**

This genus has been variously considered as an independent genus on its own or a synonym of *Apanteles*. Here we follow Mason (1981) and a recent discussion on the topic (Fernández-Triana et al., 2014) and consider it as a valid genus. Two species are recorded here, including a new one described below.

***Illidops naso* (Marshall, 1885)**

We record here the species for the first time for the UAE (Sharjah Desert Park). The species is widely distributed in the Palaearctic Region (based on data from Yu et al., 2012). Five barcodes (voucher codes: CNCH 2665, 2719, 2720; WAM 202, 203).

***Illidops albstigmalis* van Achterberg & Fernández-Triana *sp. nov.*      Plates 42–48**

Holotype: ♀ in RMNH. YEMEN, Lahj, ii.2001, Malaise-trap; A. van Harten & A. Sallam; RMNH'02. Second label with DNA voucher code: WAM 0210.

Paratypes: 1♀ in CNC. United Arab Emirates: Sharjah Desert Park, 22.xi.2004. 14♀, 1♂ in CNC and RMNH. Yemen: Al-Kadan, 20 km N of Bajil, 3.xii.1997–16.ii.1998; al-Lahima, collecting dates: 16.x–31.xii.2000, 1.i–9.iv.2001; Lahj, collecting dates: x.1998, ix.2000, vii–ix.2001, 1.x–17.xii.2001, iii–v.2002.

Other material examined: 1♀, 18♂ in CNC and RMNH. Yemen, Hammam 'Ali, 14.viii.2001; ar-Rujum, 24.vii–17.ix.2001; and same localities as paratypes. 1♀ in CNC, Nigeria, Ibadan, 29.i.1963.

Other material not examined: There are two specimens in BOLD from Pakistan (Sindh, Suk Nai), which were not available for us to study; however, their barcodes match those from Yemen and the UAE, and thus they are considered here as conspecific.

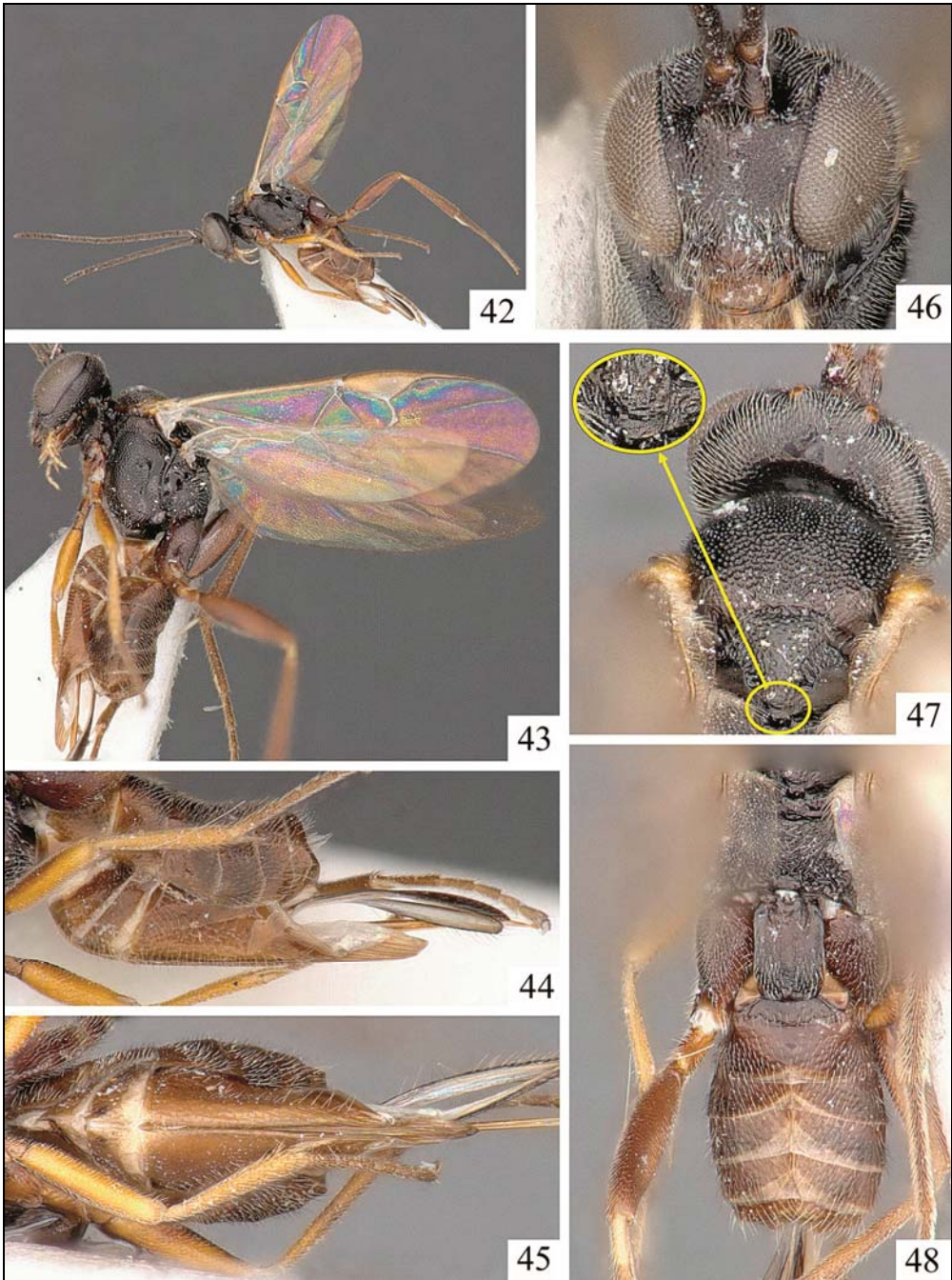
Brief description: Body length: 2.4–2.50 mm; fore wing length: 2.3–2.5 mm; ovipositor sheath: 0.70–0.80 mm; hind tibia length: 0.8–0.90 mm; hind femur length/width: 0.75/0.20 mm; flagellomere 2 length/width: 0.18/0.06 mm; flagellomere 8 length/width: 0.16/0.06 mm; flagellomere 14 length/width: 0.09/0.05 mm.

Variation: The colouration of hind femur and especially hind tibia varies from entirely yellow to almost entirely brown. That variation might be due, at least in part, to the presence of morphologically cryptic species (see Comments below).

Molecular data: Sequences in BOLD: nine, barcode compliant sequences: eight. At least four haplotypes, which might represent different species (see Comments below).

Biology: Two male specimens from Yemen (Hammam 'Ali) were reared from *Prophantis* sp. (Crambidae), named as 'coffee berry moth'. This is the second species of Microgastrinae recorded as a parasitoid of the genus *Prophantis*.

Comments: At present there is no key available to separate the world species of *Illidops*. However, all other described species in the genus have different shapes of tergites 1 and 2; the sculpture of scutellum, propodeum, tergites 1 and 2 are different; and the colour of the pterostigma is usually entirely or mostly dark brown (mostly white with only thin margins in *Illidops albstigmalis*). This is the first *Illidops* described from the Afrotropical Region, and the first species of the genus recorded as a parasitoid of the coffee berry moth.



Plates 42–48. *Illidops albstigmalis* van Achterberg & Fernández-Triana sp. nov. 42: Habitus, lateral view; 43: Wings and partial habitus, lateral view; 44: Hypopygium and ovipositor, lateral view; 45: Hypopygium and ovipositor, ventral view; 46: Head, frontal view; 47: Head and mesoscutum, dorsal view (postero-median band of rugosity on scutellum shown in the inset); 48: Propodeum and metasoma, dorsal view.



The variation in leg colouration and other minor morphological differences, the number of differing base pairs on the DNA barcodes available, and the relatively wide distribution of the species recorded above, strongly suggest that *Illidops albstigmalis* almost certainly includes a complex of morphologically cryptic species. However, only one haplotype (the one that includes the holotype and paratypes) had female specimens in good condition to allow for study. The other three haplotypes were only represented by males, or one female in poor conditions, and thus cannot be described until more material becomes available. The specimens from those haplotypes are likely to represent different species, and thus we decided to exclude them from the paratype series.

Distribution: The species seems to be rather widely distributed, with records from Nigeria, Pakistan, UAE, and Yemen.

Etymology: From Latin 'albus' (= white) and 'stigma' (= fore wing pterostigma), referring to the mostly white pterostigma, one of the diagnostic features of the species.

#### Genus *Microplitis* Forster, 1862

This is a relatively large genus of Microgastrinae, with almost 200 described species, most of them from the Holarctic Region (based on data from Yu et al., 2012). Seven morpho-species are listed below.

##### *Microplitis* sp. 1

Plates 49–53

This species is named in BOLD with the interim name of *Microplitis* jft71. A total of 40 specimens from the UAE (al-Ajban; Bithnah; Fujairah; Sharjah Desert Park; NARC, near Sweihan; Wadi Madaq; Wadi Safad) and Yemen (Seyun). A total of 11 barcodes (CNCH2724, WAM 0221, 0223–0225, 0279, 0280, 0286, 0288, 0290, 0291).

##### *Microplitis* sp. 2

This species is named in BOLD with the interim name of *Microplitis* jft73. Ten specimens (7 females and 3 males) from Oman (Hayl Awamir, 23°38'N 58°14'E; Yiti, 23°31'N 58°38'E), UAE (Wadi Madaq; Wadi Wurayah), and Yemen (12 km NW of Manakhah). One barcode (WAM 0275).

##### *Microplitis* sp. 3

Five specimens from Oman (Sad, Baushar, 23°33'N 58°24'E; near Barka, 23°40'50"N 57°40'46"E; 6 km SW of Qurayat, 23°10'N 58°53'E) and the UAE. No barcodes.

##### *Microplitis* sp. 4

This species is named in BOLD with the interim name of *Microplitis* jft74. Four specimens from Yemen (ar-Rujum). Two partial barcodes (WAM 0269, 0271).

##### *Microplitis* sp. 5

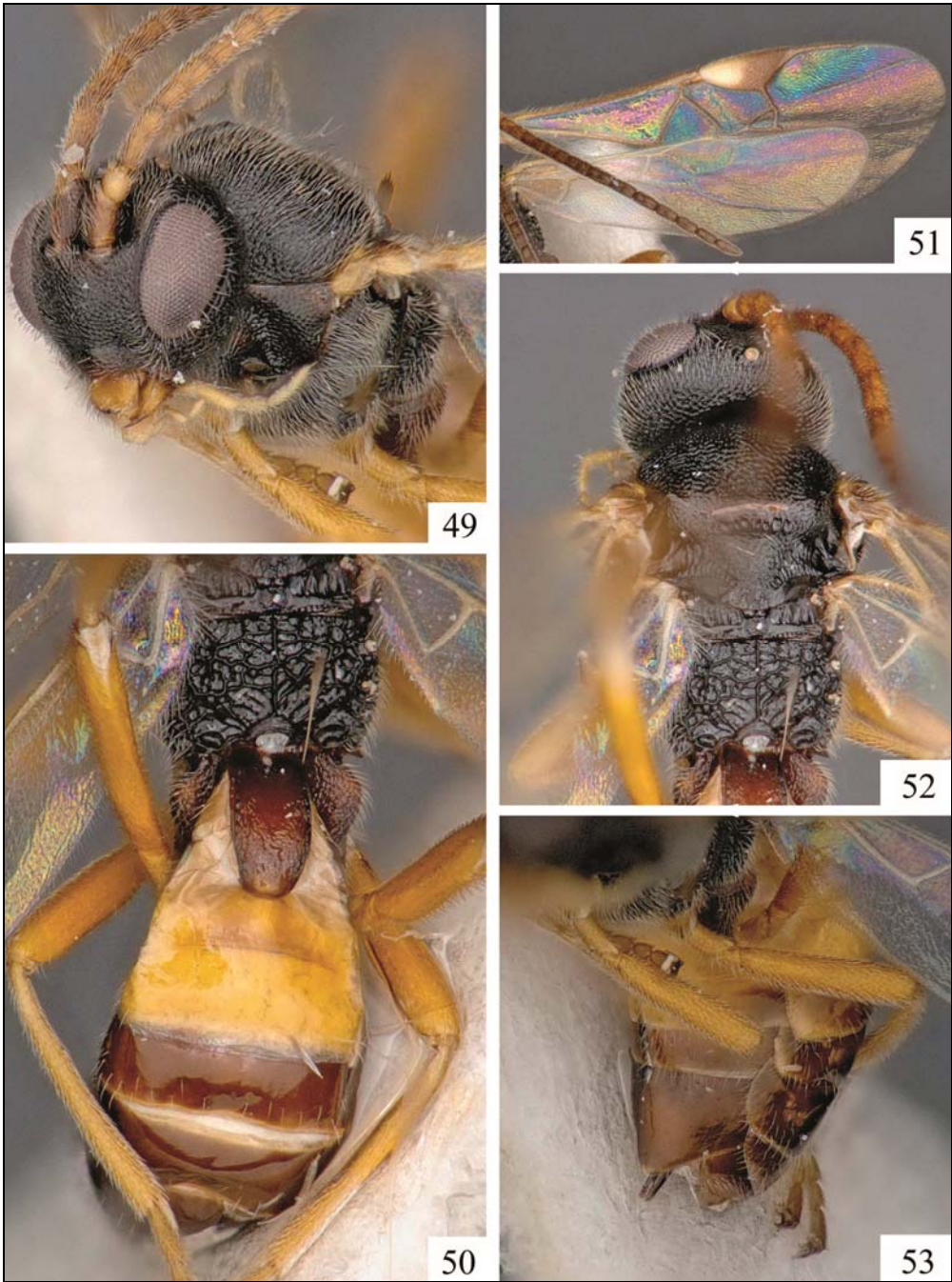
This species is named in BOLD with the interim name of *Microplitis* jft72. Six specimens from Yemen (ar-Rujum). Two barcodes (WAM 0277, 0278).

##### *Microplitis* sp. 6

Three specimens from Saudi Arabia (ar-Riyadh), from CNC material collected in 1959. No barcode.

##### *Microplitis* sp. 7

Six females and one male, from the UAE (N of Ajman). No barcode.



Plates 49–53. *Microplitis* sp. 1 (specimen voucher code CNCH2724). 49: Head and mesosoma (partially), fronto-lateral view; 50: Propodeum and metasoma, dorsal view; 51: Wings; 52: Head and mesosoma, dorsal view; 53: Hypopygium and ovipositor, lateral view.

Genus *Miropotes* Nixon, 1965

This genus was recently revised by Fernández-Triana et al. (2014) and the number of described species (14) increased by 40%. Originally, *Miropotes* was thought to be endemic in Australasia, but one new species found in the Oriental region considerably expanded the known distribution of the genus westwards and northwards. The finding now of yet another new species in Yemen is extremely significant and unexpected; it represents the first record for the Afrotropical Region and the distribution of the genus is expanded by an additional 6,000+ km westwards. It has become evident that *Miropotes* is rather widespread, although rarely collected, in the Old World tropics.

*Miropotes inexpectatus* van Achterberg & Fernández-Triana **sp. nov.**

Plates 54–58

Holotype: ♀ in RMNH. YEMEN (8136), al-Kowd, ix.2003, light trap, A. van. Harten & S. Al Haruri, RMNH'03.

Paratypes: 1♀ in RMNH. Yemen, same locality as holotype, ix.1999; 1♀ in CNC. Yemen, al-Lahima, 5.vi–24.vii.2001.

Brief description: Body length: 1.50–1.65 mm; fore wing length: 1.35–1.50 mm; ovipositor sheath: 0.20–0.25 mm; hind tibia length: 0.40–0.42 mm; hind femur length/width: 0.35/0.10 mm; antenna uniformly dark brown; antenna relatively short and stout, not reaching past mediotergite 2; face width below antennal sockets  $0.5 \times$  head width in anterior view; eyes strongly convergent below; gena dark brown to black, without light spot next to base of mandible and lower margin of eye; margin of dorso-medial pronotum straight; fore wing areolet reduced to a small spot with virtually no transparent area enclosed within; propodeum smooth and shiny; propodeal carina almost entirely absent, only indicated by two short carinae on posterior 0.1 of propodeum; mediotergites 1 and 2 mostly smooth; ovipositor tip gently (slightly) curved.

Comments: This species can be easily recognized from all other described species of *Miropotes* (Fernández-Triana et al., 2014) by its smaller size (body and fore wing length), very reduced areolet in fore wing (almost non-existent), and smooth and unsculptured propodeum.

Etymology: From Latin 'inexpectatus' (unexpected), the name refers to how unlikely it was to expect that this genus could be distributed up to the Afrotropical Region.

Genus *Nyereria* Mason, 1981

This genus has been variously considered as an independent genus on its own or a synonym of *Protapanteles*. Here, we follow Mason (1981) and consider it a valid genus. Most of the 20 described species belong to the Afrotropical Region (Yu et al., 2012), but we have also seen in collections new species from the Oriental Region. For the Arabian Peninsula we record here four morpho-species, to be described in a future paper.

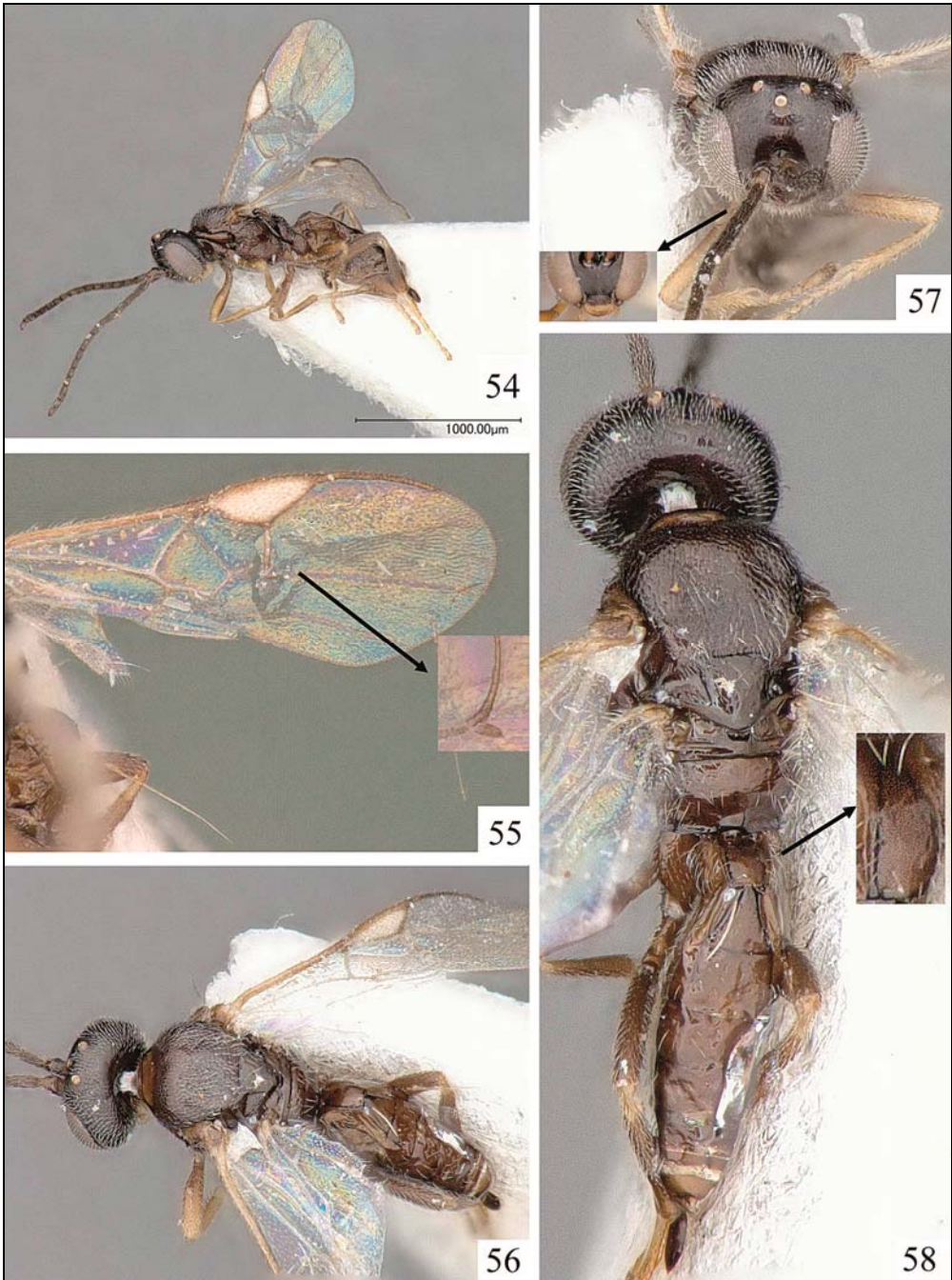
*Nyereria* sp. 1

Plates 59–61

This species is named in BOLD with the interim name of *Nyereria* jft01. A total of 51 specimens from Yemen (ar-Rujum). Eight barcodes (voucher codes: WAM 0160–0163, 165, CNCH0837–839).

*Nyereria* sp. 2

This species is named in BOLD with the interim name of *Nyereria* jft02. Nine specimens from Yemen (al-Kowd; 12 km NW of Manakhah; Ta'izz). Two barcodes (voucher codes: JMIC0356, WAM 0172).



Plates 54–58. *Miropotes inexpectatus* van Achterberg & Fernández-Triana sp. nov. 54: Habitus, lateral view; 55: Fore wing (veins 2RS and 2M shown in the inset); 56: Habitus, dorso-lateral view; 57: Head, frontal view (face shown in the inset); 58: Habitus, dorsal view (tergite 1 shown in the inset).



***Nyereria* sp. 3**

Three specimens from Yemen (Ta'izz). No barcode.

***Nyereria* sp. 4**

A total of 13 specimens from Yemen (al-Lahima). No barcode.

**Genus *Parapanteles* Ashmead, 1900**

Most of the described species so far are found in the New World (based on data from Yu et al., 2012), although recently several species from the Oriental region have been described, and we have seen a number of undescribed species in collections from the Old World tropics. For the Arabian Peninsula we record here four morpho-species, to be described in a future paper.

***Parapanteles* sp. 1**

This species is named in BOLD with the interim name of *Parapanteles* jft01. A total of 32 specimens from Yemen (Hammam 'Ali; al-Kadan; al-Kowd; al-Lahima; 12 km NW of Manakhah; ar-Rujum; Ta'izz). Seven barcodes (CNCH2689, 2691, 2733, WAM 0185, 0188–0190), which represent at least four haplotypes; some of those haplotypes might better be consider as individual species when more study is done. This species is morphologically similar to *Parapanteles rooibos* Valerio, Whitfield & Kole, 2005, but with complete, well defined areola on propodeum.

***Parapanteles* sp. 2**

This species is named in BOLD with the interim name of *Parapanteles* jft02. Seven specimens from Yemen (al-Lahima). Five barcodes (WAM 0191–0195). Mostly yellow metasoma (tergites 3–4 mostly yellow, tergite 2 partially yellow), tergite 1 narrowing on posterior 0.3, tergite 2 trapezoidal (subtriangular), scutellum with punctures.

***Parapanteles* sp. 3**

Three specimens from Yemen (ar-Rujum). No barcodes. Morphologically similar to *Parapanteles* sp. 2, but differing in having darker metasoma (all tergites mostly brown), tergite 1 parallel-sided, tergite 2 subrectangular, and scutellum smooth.

***Parapanteles* sp. 4**

Three specimens from the UAE (Sharjah). No barcodes.

**Genus *Pholetesor* Mason, 1981**

This is a moderately large genus of Microgastrinae, with close to 40 described species worldwide (based on data from Yu et al., 2012) but many more awaiting description.

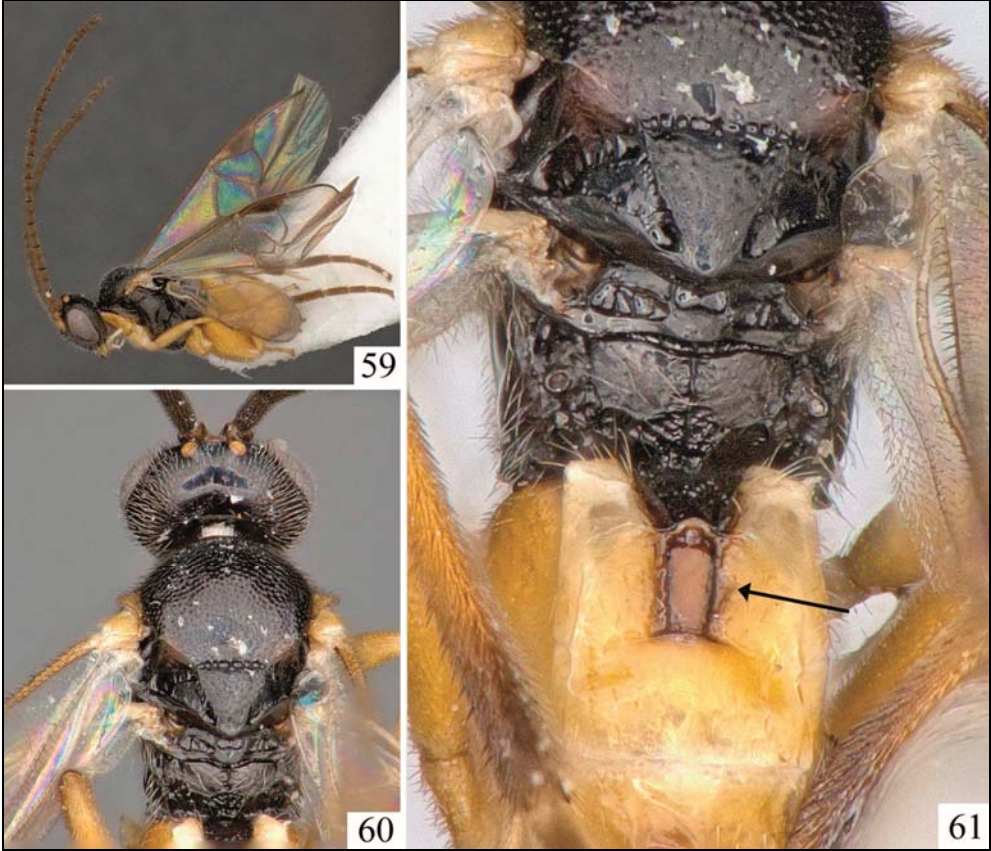
***Pholetesor* sp. 1**

Figure 2

We found two females from the UAE in the available material, but could not study them more. They are only mentioned here to record the genus for the UAE for the first time, but further study of those specimens will be necessary in the future. No barcodes.

**Genus *Protapanteles* Ashmead, 1898**

This is a relatively diverse genus of Microgastrinae worldwide (based on data from Yu et al., 2012). Here it is interpreted sensu van Achterberg (2003) to include the *Glyptapanteles* of



Plates 59–61. *Nyereria* sp. 1 (specimen voucher code CNCH0837). 59: Habitus, lateral view; 60: Head and mesosoma, dorsal view; 61: Scutellum, propodeum, and tergites 1–4, dorsal view (arrow shows tergite 2).

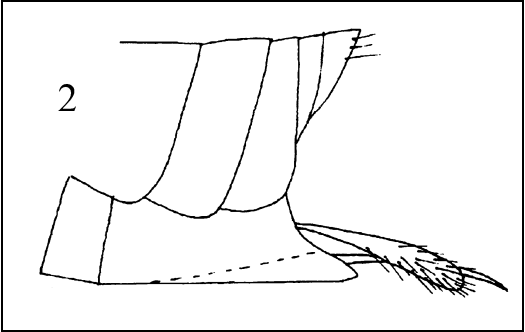


Figure 2. Line drawing of a general hypopygium of the genus *Pholetesor* Mason. Modified after Whitfield (2006).

other authors. Altogether with *Apanteles*, *Cotesia* and *Diolcogaster* (all of them with at least 14 morpho-species, probably more when accounting for morphologically cryptic species) this is one the most diverse genus in the Arabian Peninsula. We list below only the morpho-species that had DNA barcodes associated, or those without barcodes but with distinct morphological features. No species is described in this paper.

***Protapanteles* sp. 1**

Many dozens of specimens, from Yemen (al-Kowd; al-Mukalla; ar-Rujum; Ta'izz) and the UAE (al-Ajban; Fujairah; Sharjah Desert Park; NARC, near Sweihan; Wadi Safad). One barcode (voucher code: CNCH2734), but the sequence has many ambiguous base pairs and it was not included in the analysis.

***Protapanteles* sp. 2**

A total of 37 specimens from Yemen (Hammam 'Ali; al-Kowd; al-Mukalla; Ta'izz). No barcodes.

***Protapanteles* sp. 3**

A total of 17 specimens from Yemen (Lahj; ar-Rujum; Sana'a). Two barcodes (voucher codes: CNCH2730, 2732).

***Protapanteles* sp. 4**

One female and 11 males, mostly from the UAE but two males from Yemen. No barcodes.

***Protapanteles* sp. 5**

Plates 62–65

Nine specimens from Yemen (ar-Rujum). One partial barcode (voucher code: CNCH2731).

***Protapanteles* sp. 6**

Seven specimens from Yemen (al-Kowd; ar-Rujum; Ta'izz). No barcode.

***Protapanteles* sp. 7**

Two specimens from the UAE (Fujairah). No barcode.

***Protapanteles* sp. 8**

Five male specimens from Oman (Sad; Baushar) and the UAE (Bithnah; Sharjah Desert Park). No barcode.

***Protapanteles* sp. 9**

One female specimen from the UAE (al-Ajban). No barcode.

***Protapanteles* sp. 10**

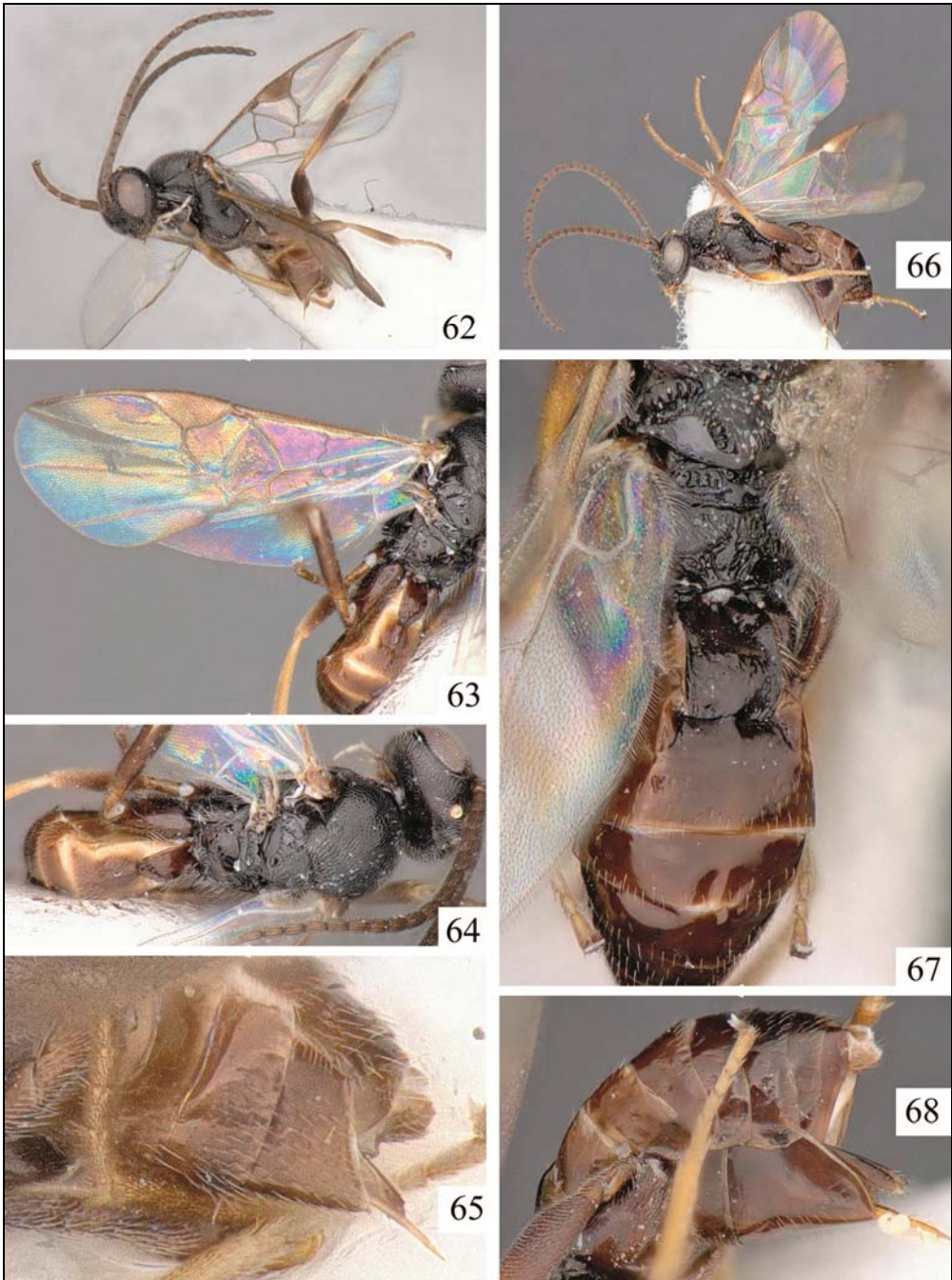
One female specimen from Yemen (ar-Rujum). No barcode.

***Protapanteles* sp. 11**

One female specimen from Yemen (Ta'izz). No barcode.

***Protapanteles* sp. 12**

Three specimens from Yemen (12 km NW of Manakhah). No barcode.



Plates 62–68. 62–65: *Protapanteles* sp. 5 (specimen voucher code CNCH2731). 62: Habitus, lateral view; 63: Wings and partial habitus, dorso-lateral view; 64: Habitus, dorsal view; 65: Hypopygium and ovipositor, lateral view. 66–68: *Parapanteles* sp. 1 (specimen voucher code WAM 0186). 66: Habitus, lateral view; 67: Scutellum, propodeum and tergites 1–6, dorsal view; 68: Hypopygium and ovipositor, lateral view.



*Protopanteles* sp. 13

Three specimens from Yemen (al-Kadan; al-Lahima). No barcode.

*Protopanteles* sp. 14

One female from Yemen (al-Kowd). One barcode (voucher code: CNCH2669).

Genus *Venanides* Mason, 1981

Only three species were previously known for this genus worldwide (Mason, 1981; Yu et al., 2012), although we have seen in collections several more that remain undescribed. Below, a key and descriptions of five new species of *Venanides* from Yemen are provided.

**Key to *Venanides* species of the Arabian Peninsula**

- 1 Head, in frontal view rather flattened (Plates 78, 93) and with very enlarged upper face (frons height twice face height); head width subequal to head height ( $1.0\text{--}1.1\times$ ) ..... **2**
- Head, in frontal view of normal appearance (Plates 73, 84, 89), without enlarged frons (frons height slightly larger than face height); head height at least  $1.3\times$  head width ..... **3**
- 2 Head, mesosoma, most of metasoma (except for few latero-tergites), metacoxa, hind femur and anterior 0.6–0.7 of hind tibia dark brown (Plates 75–80); hind coxa very large,  $0.7\times$  as long as metasoma .....  
..... *Venanides longifrons* Fernández-Triana & van Achterberg **sp. nov.**
- Head (except for interocellar area which is brown-black), propleuron, pronotum (partially), most of metasoma (except for middle of tergites 4+ and part of hypopygium brown), and most of legs (except for posterior 0.2 of hind tibia and hind tarsus entirely brown to black) yellow (Plates 91–94); hind coxa smaller,  $0.5\times$  as long as metasoma .....  
..... *Venanides vanharteni* Fernández-Triana & van Achterberg **sp. nov.**
- 3 Mesosoma extremely compressed, its length  $2.5\times$  its height (Plates 81–85); body length 1.4 mm, fore wing length 1.3 mm .....  
..... *Venanides supracompressus* Fernández-Triana & van Achterberg **sp. nov.**
- Mesosoma much less compressed, less than  $2.0\times$  its height (Plates 69, 71, 73, 75, 77, 80, 86, 89, 90); body and fore wing length at least 1.9 mm ..... **4**
- 4 Hind femur, posterior 0.6–0.7 of hind tibia, and most of hind tarsus dark brown (Plates 86, 89); tergite 1 relatively very thin, its length  $5\text{--}6\times$  its width at posterior margin (Plates 87, 90) .....  
..... *Venanides tenuitergitus* Fernández-Triana & van Achterberg **sp. nov.**
- Metafemur, most of metatibia and metatarsus yellow (Plates 69, 71–74); tergite 1 relatively less thin, its length at most  $3.5\times$  its width at posterior margin (Plates 70, 74) . **5**
- 5 Metasoma with lighter colouration: most of laterotergites and sternites, most of tergite 3 and postero-lateral corners of tergite 2 yellow to white-yellow; tergite 2 smooth [Madagascar, Reunion Island] ..... *Venanides curticornis* (Granger, 1949)
- Metasoma with darker colouration: posterior half of metasoma dark brown (Plates 69–72, 41), tergite 2 and tergite 3 entirely dark brown; tergite 2 with a striated lateral areas and central polished area (Plate 74) [Yemen] .....  
..... *Venanides flavus* Fernández-Triana & van Achterberg **sp. nov.**

***Venanides flavus* Fernández-Triana & van Achterberg sp. nov.**

Plates 69–74

Holotype: ♀ in RMNH. YEMEN (5556), ar-Rujum, 15.i–9.iv.2001, Malaise trap, A. van Harten RMNH'02

Paratypes: 24♀ in RMNH and CNC. Yemen, mostly ar-Rujum, but a few specimens from Sana'a and Ta'izz. Collecting records (from Malaise-traps) indicate that the species flies throughout the year.

Other material examined: 1♂ in CNC, with voucher code WAM 0125, looks slightly different, but is not in good condition and has no associated barcode, so it is not considered part of the type series.

Brief description: Body length: 2.2–2.4 mm; fore wing length: 2.2–2.3 mm; ovipositor sheath: 0.18–0.20 mm; hind tibia length: 0.70–0.72 mm; hind femur length/width: 0.60–0.62/0.20–0.21 mm flagellomere 2 length/width: 0.11–0.12/0.05–0.06 mm; flagellomere 8 length/width: 0.10/0.05 mm; flagellomere 14 length/width: 0.09/0.05 mm.

Molecular data: Five barcodes (WAM 116, 117, 120–122).

Comments: This species is similar to *Venanides curticornis*, which was described from Madagascar (Granger 1949) and later found in the Reunion Island (Rousse & Gupta, 2013). However, the many specimens of *V. flavus* collected in Yemen are invariably darker than *V. curticornis*, and the sculpture and shape of T2 is quite different, thus we consider them as two different species. The ovipositor sheaths of *flavus* are much wider than the rest of the Yemen species.

Etymology: From Latin 'flavus' (= yellow), referring to the yellow hind legs, one of the easiest characters to separate this species from *V. tenuitergitus*.

***Venanides longifrons* Fernández-Triana & van Achterberg sp. nov.**

Plates 75–80

Holotype: ♀ in RMNH. YEMEN (6381), Ta'izz, light trap, ix–x.2001, A. van Harten & A.R. Al Yarimi, RMNH.

Brief description: Body length: 2.0 mm; fore wing length: 1.9 mm; ovipositor sheath: 0.15 mm; hind tibia length: 0.60 mm; hind femur length/width: 0.58/0.22 mm flagellomere 2 length/width: 0.09/0.07 mm; flagellomere 8 length/width: 0.08/0.06 mm; flagellomere 14 length/width: 0.07/0.05 mm.

Comments: The hind tibia spurs are longer than in most species of the genus.

Etymology: From Latin 'longus' (= long) and 'frons', referring to the unusually elongated frons, much longer than face.

***Venanides supracompressus* Fernández-Triana & van Achterberg sp. nov.**

Plates 81–85

Holotype: ♀ in RMNH. YEMEN (no. 2910), Ta'izz, light trap, 5.i–2.ii.1998, A. van Harten, RMNH'98.

Brief description: Body length: 1.4 mm; fore wing length: 1.3 mm; ovipositor sheath: 0.15 mm; hind tibia length: 0.36 mm; hind femur length/width: 0.31/0.14 mm flagellomere 2 length/width: 0.05/0.04 mm; flagellomere 8 length/width: 0.05/0.05 mm; flagellomere 14 length/width: 0.03/0.03 mm.

Comments: This is one of the smallest species of Microgastrinae that we are aware of. It is also unique in the extremely compressed mesosoma and the very thick hind femur (only  $2.2 \times$  as long as maximum width).

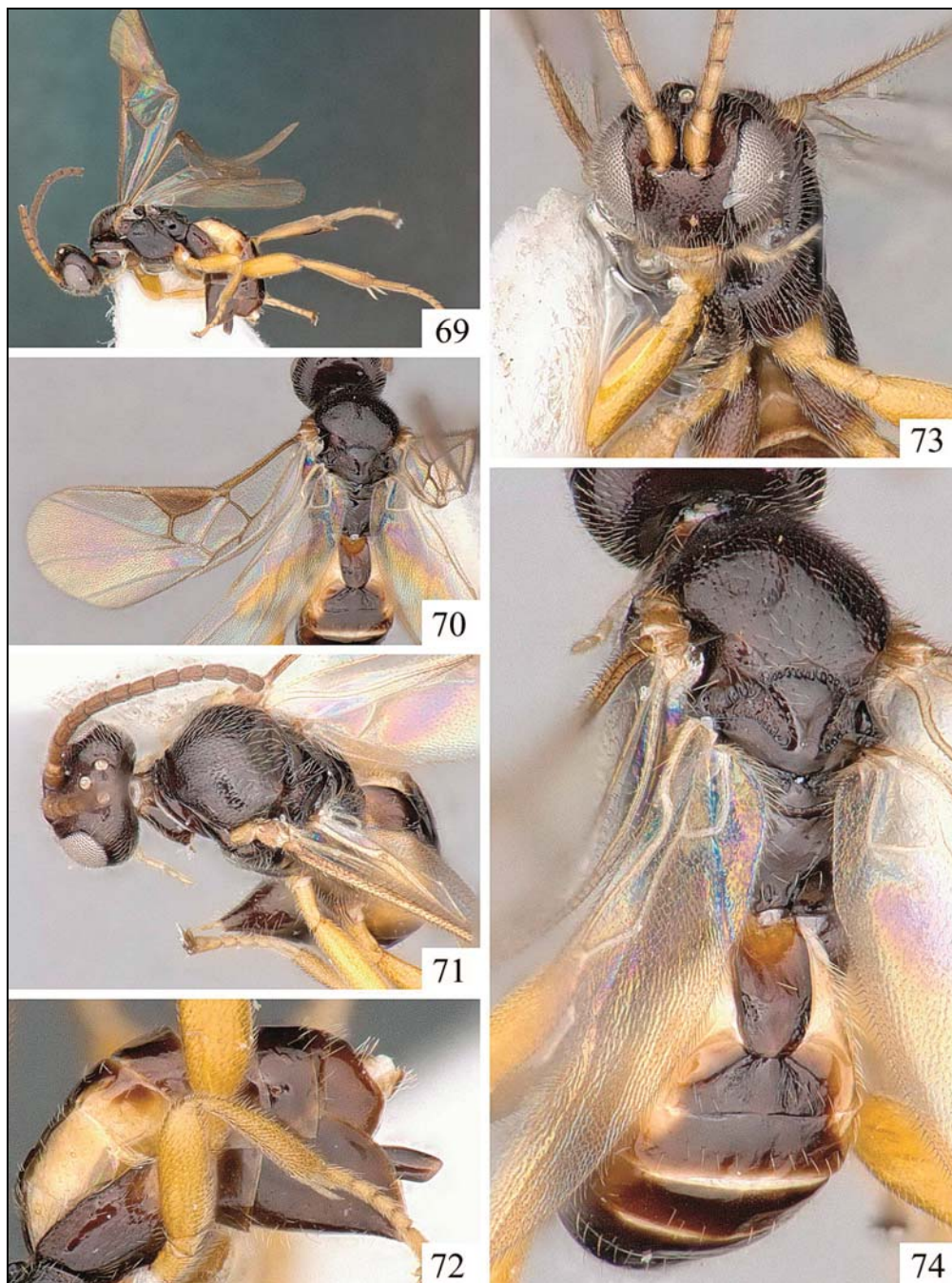
Etymology: From Latin 'supra' (= above, over) and 'compressus' (= compressed), referring to the extremely compressed appearance of the mesosoma, unique among all species of the Arabian Peninsula.

***Venanides tenuitergitus* Fernández-Triana & van Achterberg sp. nov.**

Plates 86–90

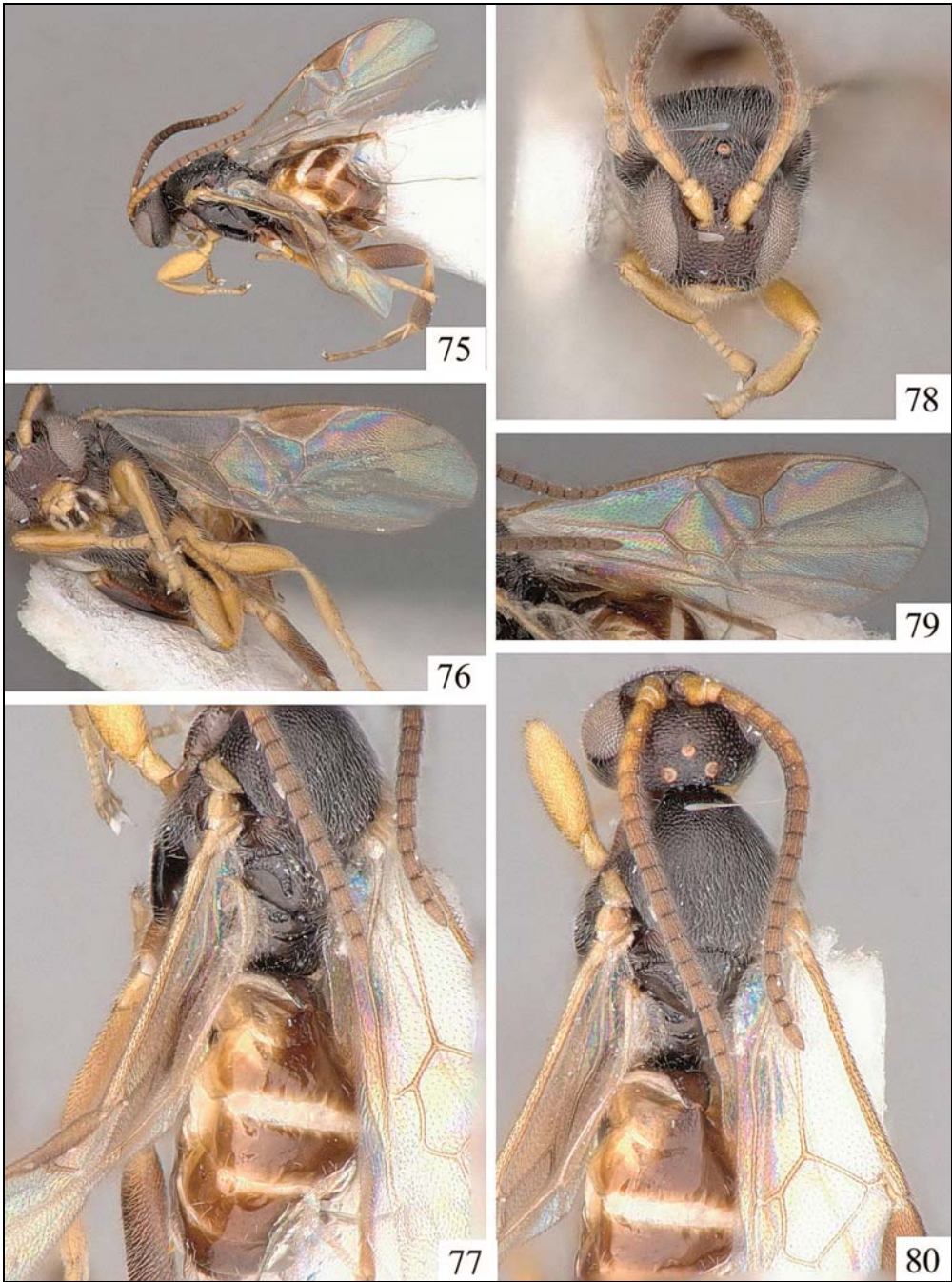
Holotype: ♀ in RMNH. YEMEN (5689), Lahj, v.2001, Malaise-trap, A. van Harten & A. Sallam, RMNH'02.

Paratype: 1♀ in CNC. Yemen, Ta'izz, viii.1999, light trap.



Plates 69–74. *Venanides flavus* Fernández-Triana & van Achterberg sp. nov. 69: Habitus, lateral view; 70: Mesosoma and tergites 1–3, dorsal view; 71: Habitus, dorsolateral view; 72: Metasoma, lateral view; 73: Head, frontal view; 74: Meso- and metasoma (partially), dorsal view.





Plates 75–80. *Venanides longifrons* Fernández-Triana & van Achterberg sp. nov. 75: Habitus, dorso-lateral view; 76: Habitus, ventral view; 77: Meso- and metasoma, dorsolateral view; 78: Head, frontal view; 79: Fore wing; 80: Head, mesosoma and tergites 1–4, dorsal view.

Brief description: Body length: 1.9–2.0 mm; fore wing length: 1.7–1.8 mm; ovipositor sheath: 0.11–0.14 mm; hind tibia length: 0.55 mm; hind femur length/width: 0.50/0.20 mm; flagellomere 2 length/width: 0.08/0.06 mm; flagellomere 8 length/width: 0.06/0.06 mm; flagellomere 14 length/width: 0.06/0.05 mm.

Molecular data: One barcode (code WAM 0128).

Etymology: From Latin 'tenuis' (= narrow, slender) and 'tergitus' (= tergum), referring to the posteriorly thin middle of tergite 1, which is much narrower than in other species of *Venanus* from the Arabian Peninsula.

***Venanides vanharteni* Fernández-Triana & van Achterberg sp. nov.** Plates 91–94

Holotype: ♀ in RMNH. YEMEN (4056), Ta'izz, viii.1999, light trap, A. van Harten & A. Awad, RMNH'00.

Paratype: 1♀ in CNC: Yemen, same locality as holotype, collecting date v.2000 (in light trap).

Brief description: Body length: 2.0–2.1 mm; fore wing length: 1.9 mm; ovipositor sheath: 0.11–0.14 mm; hind tibia length: 0.60 mm; hind femur length/width: 0.54/0.20 mm; flagellomere 2 length/width: 0.09/0.06 mm; flagellomere 8 length/width: 0.08/0.06 mm; flagellomere 14 length/width: 0.06/0.05 mm.

Molecular data: One barcode (WAM 0127).

Comments: The hind tibia spurs are longer than in most species of the genus.

Etymology: We name this species after our dear friend and colleague Antonius (Tony) van Harten, as recognition to his great work and contribution to the knowledge of the insect diversity of the Arabian Peninsula and Cape Verde Islands.

Genus *Wilkinsonellus* Mason, 1981

This genus has been the focus of many studies recently (see references in Arias-Penna et al., 2014). Here the second species known from the Afrotropical Region (Yemen) is described, and also the range of the previously known *W. henicopus* is extended further north.

***Wilkinsonellus henicopus* (De Saeger, 1944)**

One female, two males from Yemen (12 km NW of Manakhah; ar-Rujum). No barcodes. We could not examine type material from *W. henicopus* but the Yemen specimens share the colouration pattern as well as shape of tergite 2.

***Wilkinsonellus arabicus* van Achterberg & Fernández-Triana sp. nov.** Plates 95–99

Holotype: ♀ in RMNH. YEMEN, Ta'izz, xii.1999, light trap, no. 4329, A. van Harten & A.R. Al Yarimi, RMNH'01.

Paratypes: 2♀ in RMNH and CNC. Yemen, same locality as holotype, collecting date: 1–3.iv.1998.

Brief description: Body length: 3.8–4.0 mm; fore wing length: 3.7–4.0 mm; ovipositor sheath: 0.23–0.25 mm; hind tibia length: 1.70 mm; hind femur length/width: 1.50/0.40 mm; flagellomere 2 length/width: 0.34/0.10 mm; flagellomere 8 length/width: 0.32/0.09 mm; flagellomere 14 length/width: 0.29/0.08 mm.

Molecular data: Three barcodes (WAM 0199–0201).

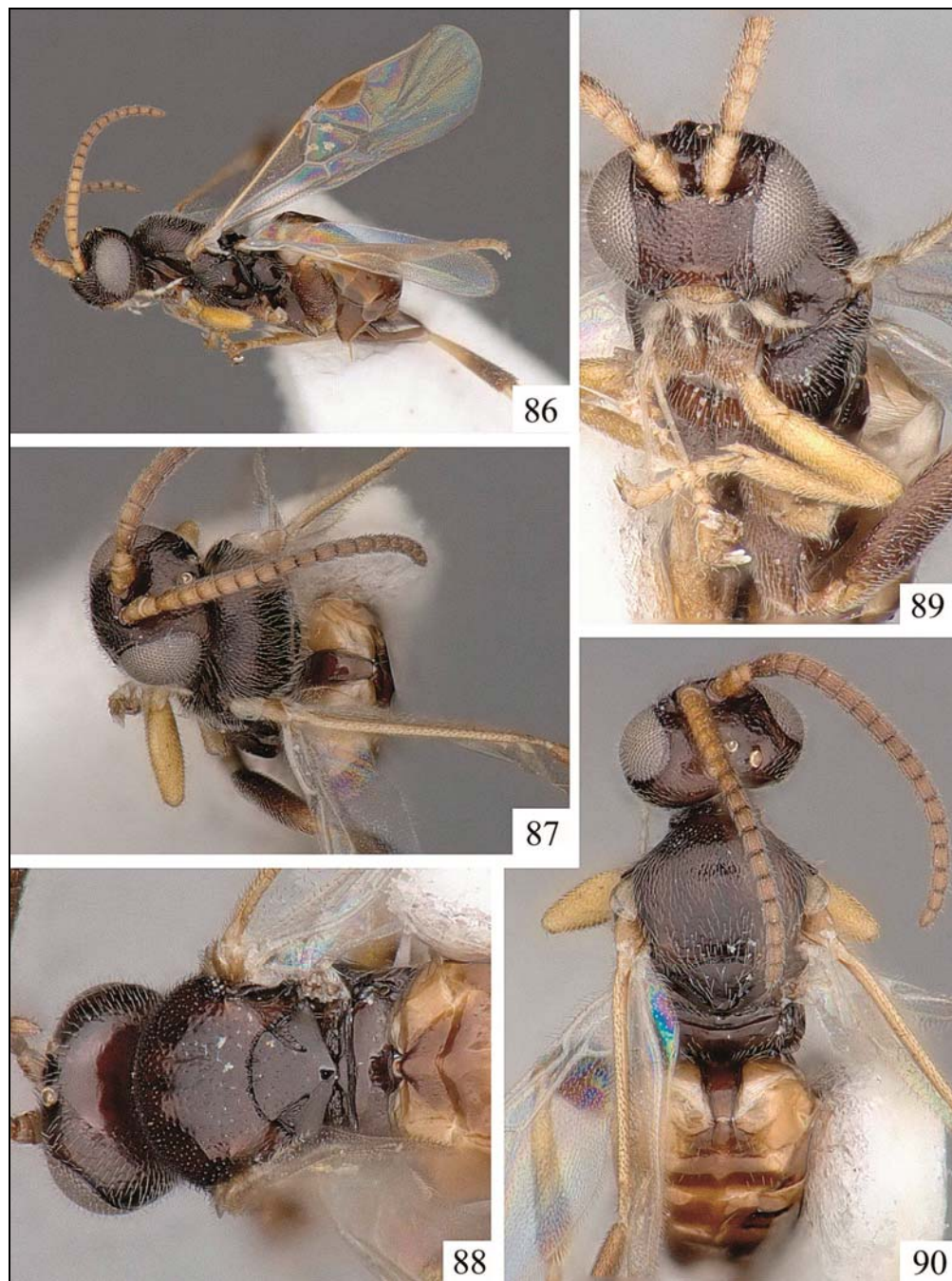
Comments: This species is related to *W. amplus* Austin & Dangerfield, 1992, from Australia, sharing with it the large size (3.6–4.0 mm), big ocelli, and mostly yellow colouration. It does not have the black spots on the hind legs as does *W. amplus*.

Etymology: The name refers to the geographic area where the species was collected, the first record of the genus for the Arabian Peninsula.

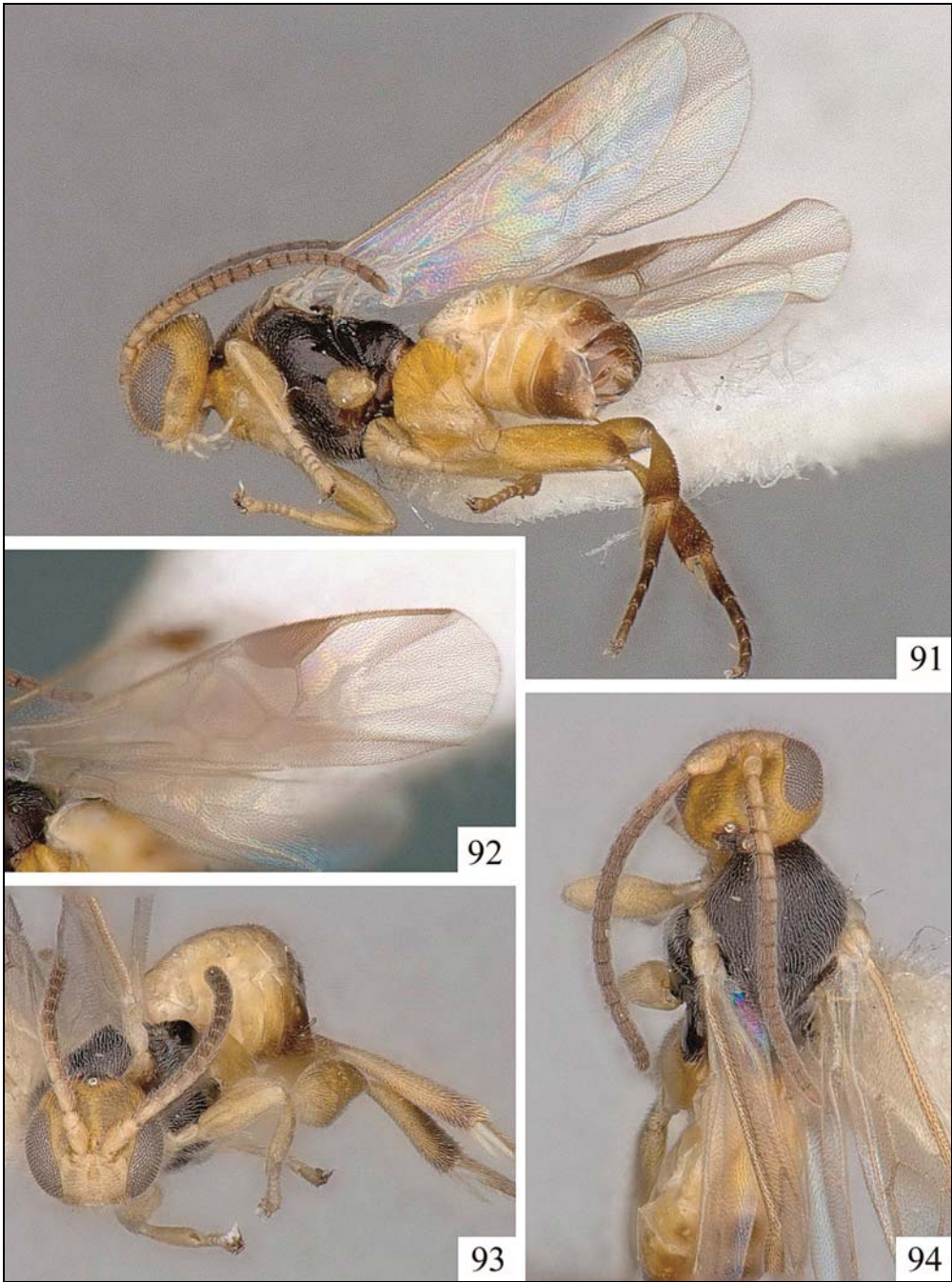


Figure 81–85. *Venanides supracompressus* Fernández-Triana & van Achterberg sp. nov. 81: Habitus, lateral view; 82: Wings and habitus, dorso-lateral view; 83: Head, mesosoma and tergites 1–2, dorso-lateral view; 84: Head, frontal view; 85: Habitus, dorsal view.



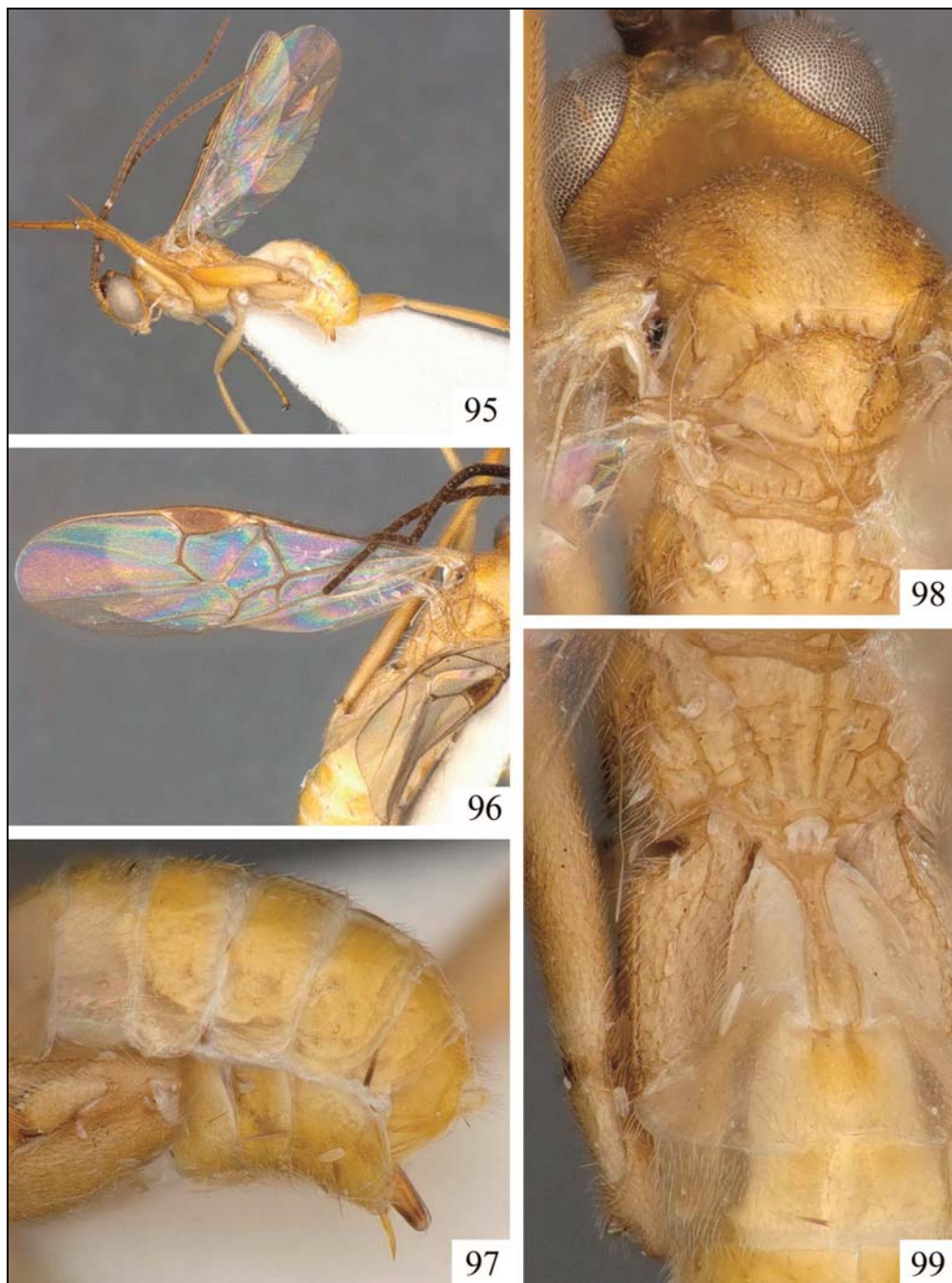


Plates 86–90. *Venanides tenuitergus* Fernández-Triana & van Achterberg sp. nov. 86: Habitus, lateral view; 87: Head, mesosoma and tergites 1–2, dorso-lateral view; 88: Head and mesosoma, dorsal view; 89: Head, frontal view; 90: Habitus, dorsal view.



Plates 91–94. *Venanides vanharteni* Fernández-Triana & van Achterberg sp. nov. 91: Habitus, lateral view; 92: Wings; 93: Head, frontal view (meso- and metasoma, ventrolateral view); 94: Habitus, dorsal view.





Plates 95–99. *Wilkinsonellus arabicus* van Achterberg & Fernández-Triana sp. nov. 95: Habitus, lateral view; 96: Fore wing; 97: Mesosoma (partially), lateral view; 98: Head and mesosoma (partially), dorsal view; 99: Propodeum and tergites 1–3, dorsal view.

## ACKNOWLEDGEMENTS

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Appendix 1. Neighbour-joining tree generated in BOLD under the K2P nucleotide substitution model for 219 sequences of Microgasterinae with more than 500 base pairs and less than 1% of base pairs ambiguity.

