



A taxonomic study of Tunisian species wasps of genera *Philanthinus*, *Philanthus* and *Pseudoscolia* (Hymenoptera: Apoidea: Philanthidae)

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Abstract. Eight Tunisian species belonging to genera *Philanthus* Fabricius, 1790, *Philanthinus* de Beaumont, 1949 and *Pseudoscolia* Radoszkowski, 1876 except *Philanthus minor* Kohl, 1891 and *Philanthus soikai* de Beaumont, 1961 are morphologically described and a key for their identification is provided. Morphological characters are illustrated by digital photos and map of distribution in Tunisia of each species is given.

Keywords: Hymenoptera, Identification key, Morphology, Philanthid wasps, Tunisia.

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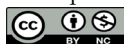
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Introduction

Philanthine wasps are hymenopteran insects having a solitary and predation behaviours and so they are commonly known as beewolves, ant kidnapers, and beetle wasps (Tomlinson, 2023). They are generally found on or about flowers, and considerable quantities of pollen may adhere to them. Taxonomically, in their generic revision of sphecid wasps of the worldwide, Bohart & Menke (1976) considered Philanthine wasps as a subfamily within the family Sphecidae (*s.l.*). Later, based on Hanson & Bohart (2006), the family Crabronidae was formerly treated as several subfamilies within the family Sphecidae (*s.l.*) carrying the subfamily Philanthinae. Recently, phylogenomic studies of Sann *et al.* (2018, 2021) split the former family Crabronidae into eight families including the family Philanthidae. This family includes 1165 species distributed in four tribus and eight genera with the genus *Cerceris* Latreille, 1802 is the most speciose with 894 species (Pulawski, 2024). They have a world wide distribution ranging from Nearctic to Ethiopian and Palaerctic regions (Bohart & Menke, 1976).

Philanthus Fabricius, 1790, *Philanthinus* de Beaumont, 1949 and *Pseudoscolia* Radoszkowski, 1876 which belong to the family Philanthidae (Hymenoptera: Apoidea), comprise species of medium to large size (Bitsch *et al.*, 1997). The total number of species in the genera in the world is estimated by 186 species and 32 subspecies (Pulawski, 2024). In North Africa and Middle Eastern, 45 species and 9 subspecies have been registered (Malash *et al.*, 2023a, 2023b), representing more than 24% of the total fauna in the world. In Tunisia, it is presented by 10 species and subspecies distributed in three genera (Ben Khedher *et al.*, 2021). Studies of these species were started by de Beaumont (1949) who revised and keyed North african species of the family Philanthidae and later in 1961, the same author, in a large work, studied Palaearctic species including species from North Africa. Except Malash *et al.* (2023b) who reviewed recently Egyptian *Philanthus* species and described a new species originated from Egypt, no other studies were focused in details on regional fauna from other North african countries. In the

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previous cited work, variations specifically in color in *Philanthus ammochrysus* W. Schulz, 1905 and *Philanthus variegatus ecoronatus* Dufour, 1854 are presented compared to the species originated from Tunisia.

In present work due to thier specificity and variability in morphology, we aim to describe Tunisian species in brief and establish a key for their identification.

Materials and methods

This study is based on eight species belonging to the collection of BEN KHEDHER deposited at the Laboratory of Entomology and Insect Ecology in Regional Research Centre on Horticulture and Organic Agriculture, Chott Meriem (CRRHAB) Sousse, Tunisia and in Atatürk University Biodiversity Science Museum (ABBM), Erzurum, Türkiye. Specimens were collected from different provinces of Tunisia (Fig. 1). Materials were examined and described under Stereomicroscope Leica MZ 12.5. To illustrate description of species, different photos for morphological characters were taken using mostly an integrated system composed of Canon EOS 6D or EOS 1100D DSLR digital cameras, helicon remote (version 3.9.1) and Helicon focus 6.8.0. To establish the identification key to species, and for species which are not present in the collection of BEN KHEDHER the original descriptions made by de Beaumont (1961) and by Kohl (1891) for *Philanthus soikai* and *P. minor* species respectively were used. Morphological description follows terminology proposed by Bitsch *et al.* (1997). Local and global distribution and distributional map in Tunisia are provided for each species.

Abbreviations used are as followo: MNHN: Muséum National d'Histoire Naturelle Paris, France; ZMHU: Zoological Museum, Helsinki University, Helsinki, Finland; mm: millimeter.

Results and discussion

Eight species belonging to genera *Philanthus* Fabricius, 1790, *Philanthinus* de Beaumont, 1949 and *Pseudoscolia* Radoszkowski, 1876 are generally medium (6 mm) to large sized (20 mm), black and yellow coloured with white or reddish markings; frons large; inner orbit, notched or not; ocelli simple; epicnemial suture absent; fore tarsal rake well-developed in female; middle tibia with one apical spur; fore wing with three submarginal cells, the second submarginal cell not petiolated, first and second recurrent veins lead to second and third submarginal cells respectively; abdomen short petiolated and first segment not nodiform.

Systematic accounts

Genus *Philanthinus* de Beaumont, 1949

Philanthinus de Beaumont, 1949: 194.

Type species: *Philanthus integer* de Beaumont, 1949.

Philanthinus integer (de Beaumont, 1949) (Fig. 2, Fig. 10A)

Philanthus integer de Beaumont, 1949: 194. Holotype: ♀, Morocco: Tadjerouna (Depository: Lausanne).

Short description of male

Body (length: 7,5 mm) black with yellowish white markings (Fig. 2A); head distinctly narrow behind eyes (Fig. 2C); clypeus yellowish white, its anterior side with small median tridentate lamella and a row of hairs on lateral sides; eyes concave, orbital inners not notched (Fig. 2D); frons slightly curved; frons and vertex with punctures more sparser in vertex than in frons (Figs. 2A, 2D); thorax black with yellowish white markings; pronotal collar depressed below scutum, with two lateral yellowish white spots (Fig. 2E); mesonotum smooth and shiny but only with very small and isolated points (Fig. 2E); mesopleuron with long setae (Fig. 2C); propodeal dorsal area shiny (Fig. 2E), laterally more reticulated (Fig. 2C); fore basitarsus with five long spines; wings transparent, nervation light brown, in hind wing media diverging before cu-a; abdomen black, first four abdominal terga with yellowish white bands (Fig. 2B).

Distribution in Tunisia: Kebili (Ben Khedher *et al.*, 2021).

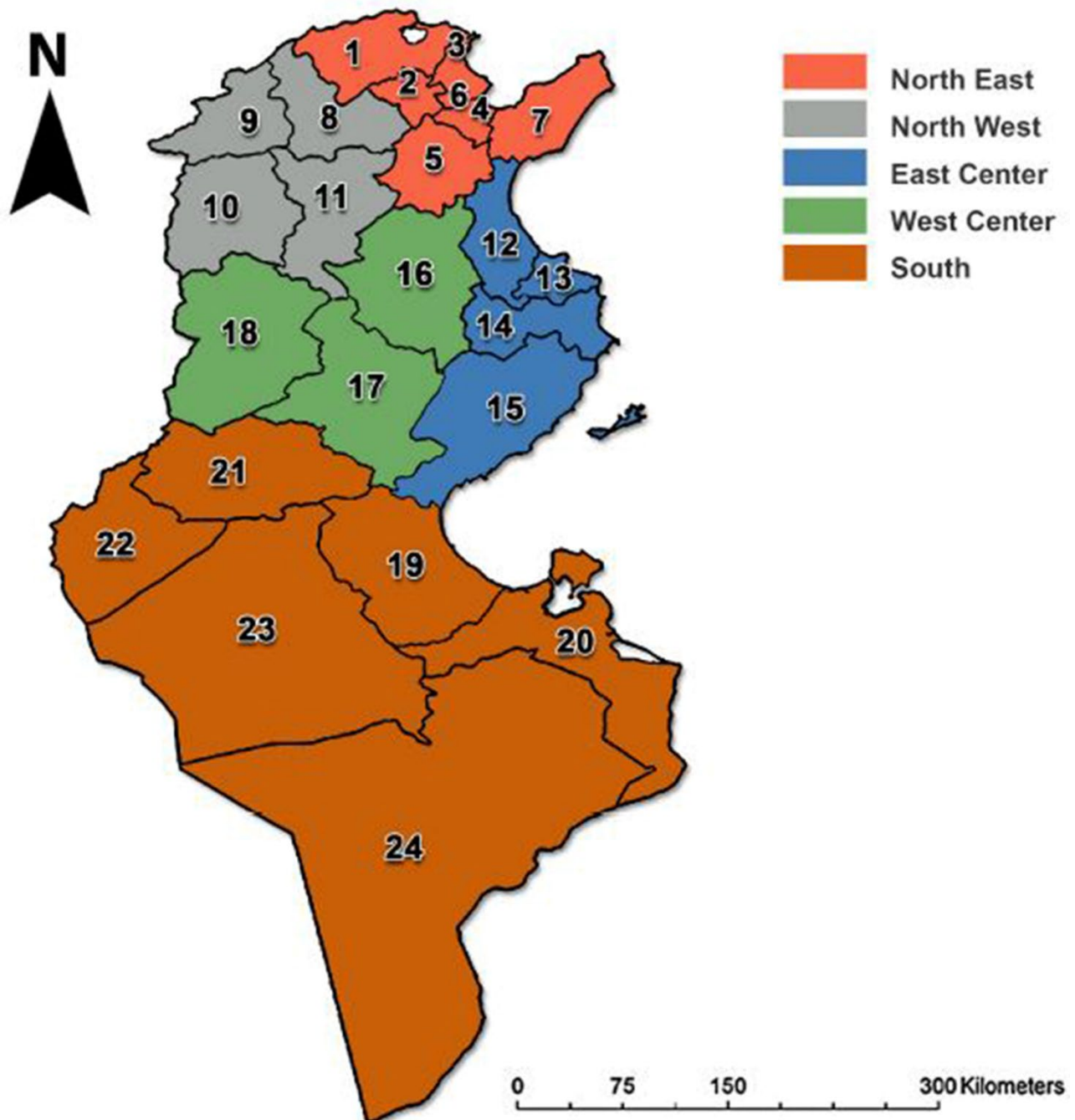


Fig. 1 - Provinces of Tunisia: (1) Bizerte; (2) Mannouba; (3) Ariana; (4) Ben Arous; (5) Zaghuan; (6) Tunis; (7) Nabeul; (8) Beja; 9. Jendouba; (10) Le Kef; (11) Siliana; (12) Sousse; (13) Monastir; (14) Mahdia; (15) Sfax; (16) Kairouan; (17) Sidi Bouzid; (18) Kasserine; (19) Gabes; (20) Medenine; (21) Gafsa; (22) Tozeur; (23) Kebili; (24) Tataouine.

Global distribution: Algeria, Egypt, Morocco, Palestine, Tunisia, United Arab Emirates (Malash *et al.*, 2023a).

Genus *Phlanthus* Fabricius, 1790

Phlanthus Fabricius, 1790: 224.

Type species: *Phlanthus coronatus* Fabricius, 1790.

Phlanthus ammochrysus W. Schulz, 1905 (Fig. 3, Fig. 10B)

Phlanthus ammochrysus W. Schulz, 1905: 59. Holotype, ♂, Tunisia: Sfax (Depository: Unknown).

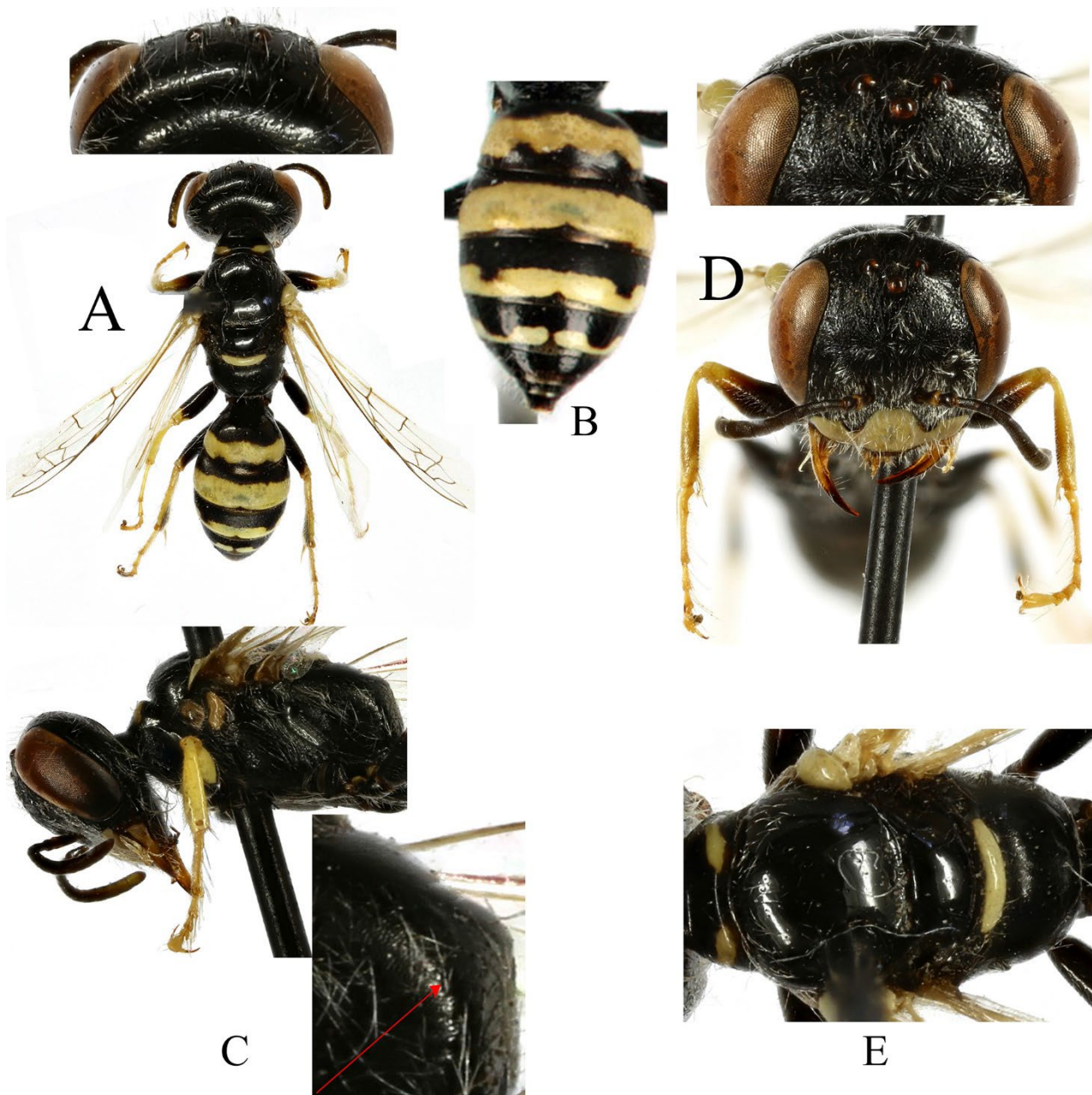


Fig. 2 - General body structure of male in *Philanthinus integer* (de Beaumont, 1949): (A) dorsal view of body with focus on vertex punctures; (B) terga; (C) lateral view of body; (D) frontal view of head with focus on frons punctures; (E) mesonotum and propodeum.

Short description of male and female

Body (length: male 10-13 mm; female: 10-12 mm) black with whitish yellow markings (Fig. 3A); clypeus with median lobe sparsely punctuated, anterior side medially curved and with a lamella (Figs. 3E, F); clypeus of male anteriorly with a long barbs reaching its median lobe (Fig. 3E); frons and vertex relatively densely punctuated (Figs. 3A, E, F); pronotal collar medially with a small notch, laterally rounded (Fig. 3A); scutum with four yellow transverse lines and scattered punctures (Fig. 3D); propodeum with a middle line black, dorsal area totally smooth with a median groove, anteriorly small and short striated (Fig. 3D); mesopleuron shiny, upper part very finely sparsely punctuated, lower part with distinct dense punctures (Fig. 3C); fore basitarsus with seven long spines, last spine clearly surpassing second tarsal segment; abdominal terga yellow (Figs. 3A, B).

Distribution in Tunisia: Kebili, Sfax, Tataouine (Ben Khedher *et al.*, 2021).

Global distribution: Algeria, Jordan, Libya, Morocco, Tunisia (Malash *et al.*, 2023a).

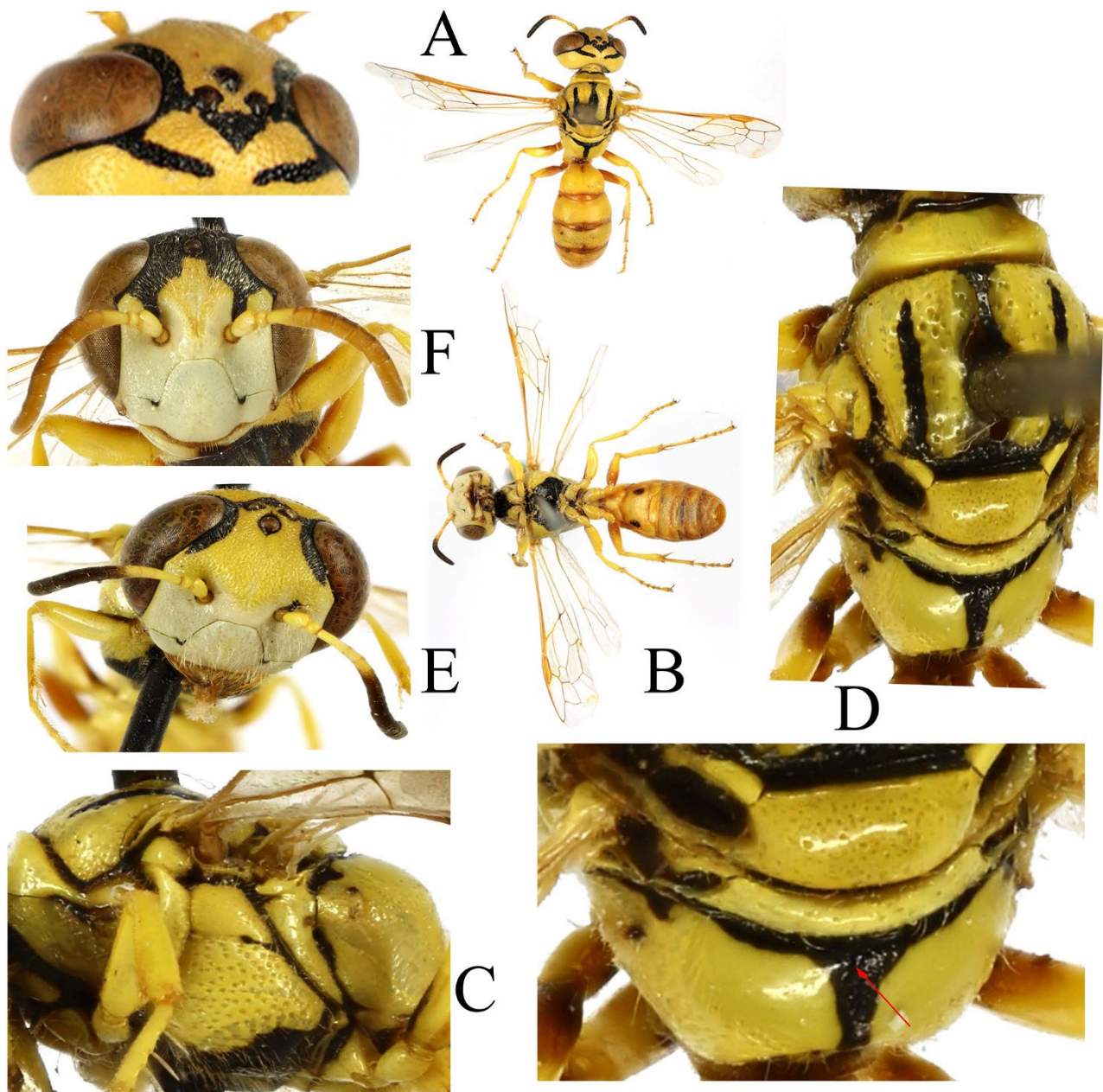


Fig. 3 - General body structure of *Philanthus ammochrysus* W. Schulz, 1905 male: (A), dorsal view of body with focus on vertex punctures, (B) ventral view of body; (C) mesopleuron; (D) mesonotum and propodeum with focus on propodeal dorsal area; (E) frontal view of head; (F) female: frontal view of head.

***Philanthus coarctatus coarctatus* Spinola, 1839 (Fig. 4, Fig. 10C)**

Philanthus coarctatus Spinola, 1839: 486. Lectotype: ♂, Egypt: no specific locality (Depository Collection of M. Spinola, Torino).

Short description of male and female

Body (length: male 6,1- 9 mm; female: 6,5- 8 mm) in female whitish yellow (Figs. 4A, B, C, D), in male golden yellow (Figs. 4E, F, G); clypeus with sparse punctures, spaces between punctures smooth (Figs. 4C, D, E, F, G); mandibles without inner teeth, apically black; supraclypeal sclerite V-shaped yellow marking (Figs. 4C, D, E, F, G); spaces just above anterior ocellus and behind posterior ocelli respectively with spot and band; anterior side of pronotal collar not notched (Fig. 4H); scutum of female with two lateral lines, distinctly punctuated; upper part of mesopleuron smooth, sometimes with scattered punctures (Fig. 4B); propodeal dorsal area medially triangular, shiny and smooth (Fig. 4F); third abdominal tergum totally black or with narrow yellow band; in female first

abdominal tergum totally or partially ferruginous and third abdominal segment with sparse and fine punctures (Fig. 4D).

Distribution in Tunisia: Kairouan, Kasserine, Kebili, Mahdia, Sidi Bouzid, Tataouine, Tozeur (Ben Khedher *et al.*, 2021).

Global distribution: Algeria, Egypt, Iran, Iraq, Jordan, Libya, Morocco, Oman, Palestine, Saudi Arabia, Syria, Tunisia, Türkiye, United Arab Emirates, Yemen (Malash *et al.*, 2023a).

Philanthus coarctatus raptor Lepeletier, 1845 (Fig. 5, Fig. 10D)

Philanthus raptor Lepeletier, 1845: 38. Holotype or syntypes: ♀, Algeria: Oran (Depository: MNHN).

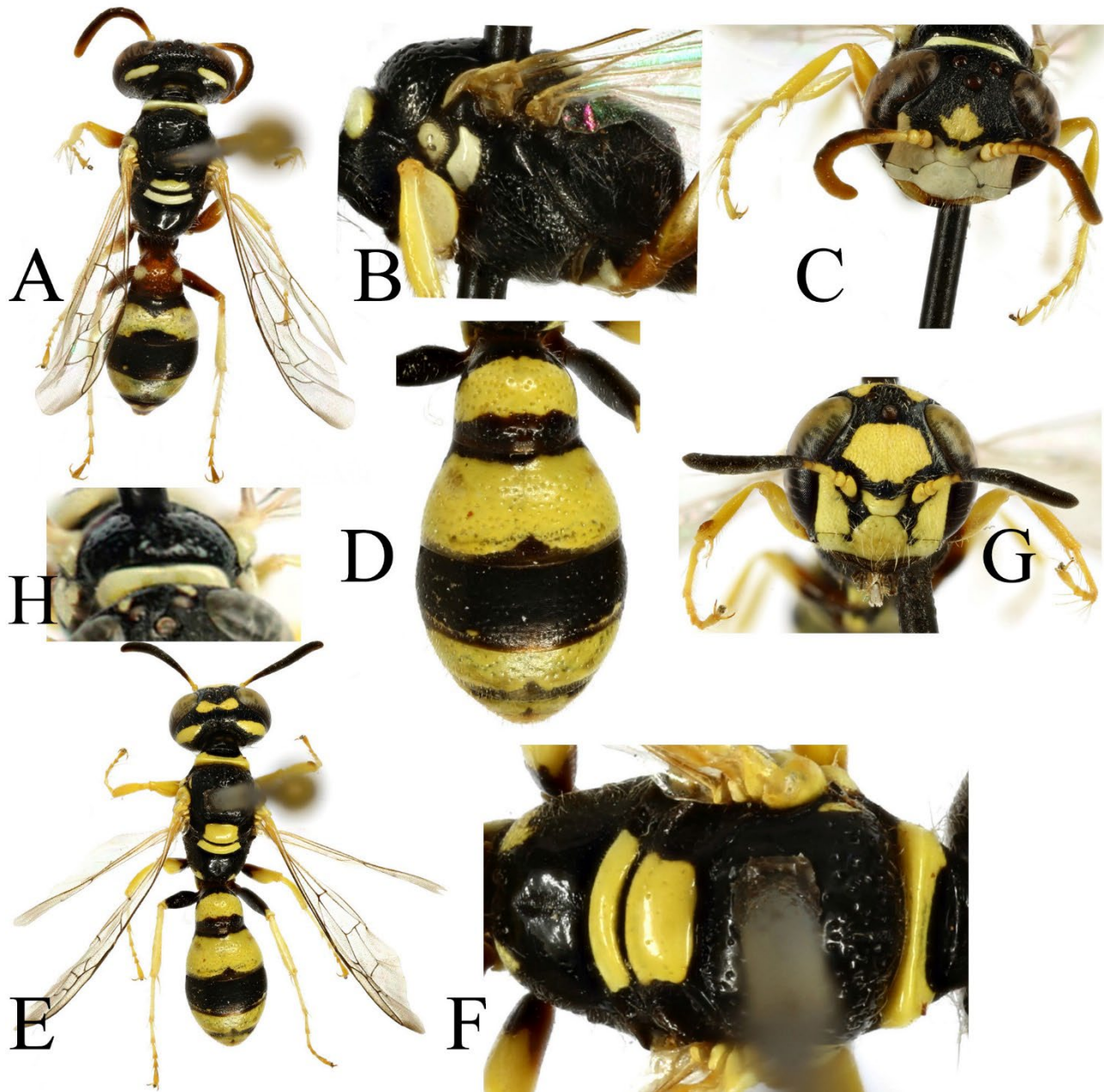


Fig. 4 - General body structure of *Philanthus coarctatus coarctatus* Spinola, 1839 female: (A) dorsal view of body; (B) mesopleuron; (C) frontal view of head, (H) pronotal collar without notch; (D) abdomen; male: (E) dorsal view of body; (F) mesonotum and propodeum; (G) frontal view of head.

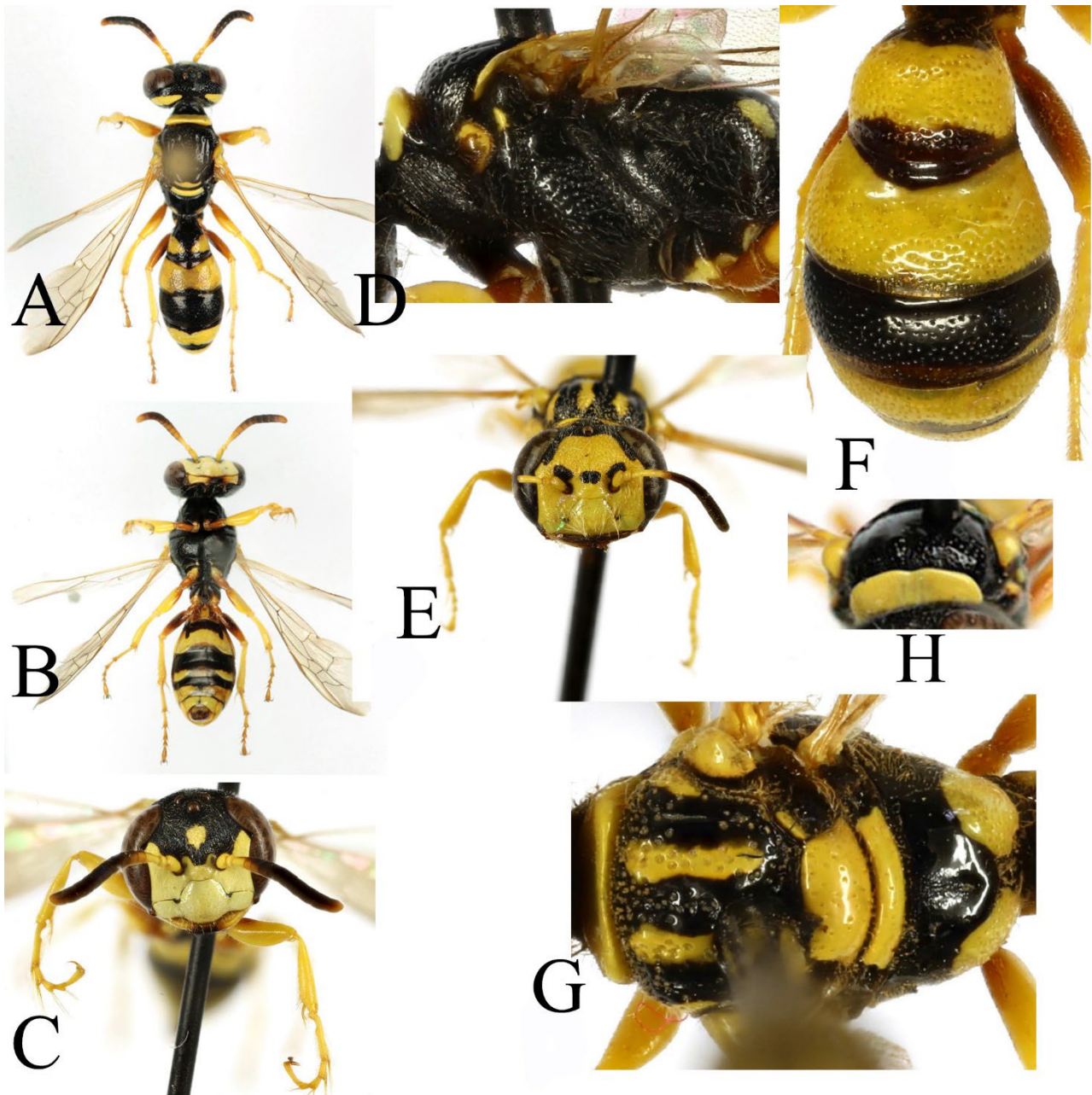


Fig. 5 - General body structure of *Philanthus coarctatus raptor* Lepeletier, 1845 female: (A, B), dorsal and ventral views of body; (C) frontal view of head, (H) pronotal collar with notch; (D) mesopleuron; male: (E) frontal view of head; (F) abdomen. (G) mesonotum and propodeum.

Short description of male and female

It is similar to *P. coarctatus coarctatus* in terms of coloration and pilosity and structure but in this subspecies female with golden yellow markings (Fig. 5A), anterior side of pronotal collar medially slightly notched (Fig. 5H); both sexes with third abdominal tergum distinctly and densely punctuated (Fig. 5F).

Distribution in Tunisia: Kairouan, Kasserine, Kebili, Mahdia, Monastir, Nabeul, Sousse (Ben Khedher *et al.*, 2021).

Global distribution: Algeria, Libya, Morocco, Tunisia (Malash *et al.*, 2023a).

Philanthus triangulum abdelcader Lepeletier, 1845 (Fig. 6, Fig. 10G)

Philanthus abdelcader Lepeletier, 1845: 33. Syntypes: Algeria: Oran (Depository: MNHN uncertain).

Short description of male and female

Body black and yellow coloured with ferruginous markings, female larger than male (length: female 13- 20 mm; male 8.1-13 mm) (Figs. 6A, B, C, D); mandibles without inner teeth (Fig. 6E); clypeus yellow, in female anterior edge with two median strong teeth and with not well pronounced tooth in each lateral side, in male anterior side of clypeus with long brown barbs reaching the middle; supraclypeal sclerite with V-shaped (Fig. 6B) and tridentate-shaped (Fig. 6E) yellow markings in female and male respectively; behind eyes ferruginous; antennae claviform (Figs. 6A, B, C, D); thorax with little pilosity; pronotum more raised than scutum; propodeal dorsal area totally densely punctuated (Fig. 6G); abdomen yellow with black bands in male (Fig. 6D) and totally yellow except first segment black basally in female (Fig. 6A).

Distribution in Tunisia: Beja, Gafsa, Jendouba, Kairouan, Kasserine, Kebili, Le Kef, Mahdia, Monastir, Nabeul, Sousse, Tataouine, Tozeur, Tunis (Ben Khedher *et al.*, 2021).

Global distribution: Algeria, Egypt, Iraq, Libya, Morocco, Oman, Palestine, Tunisia (Malash *et al.*, 2023a).

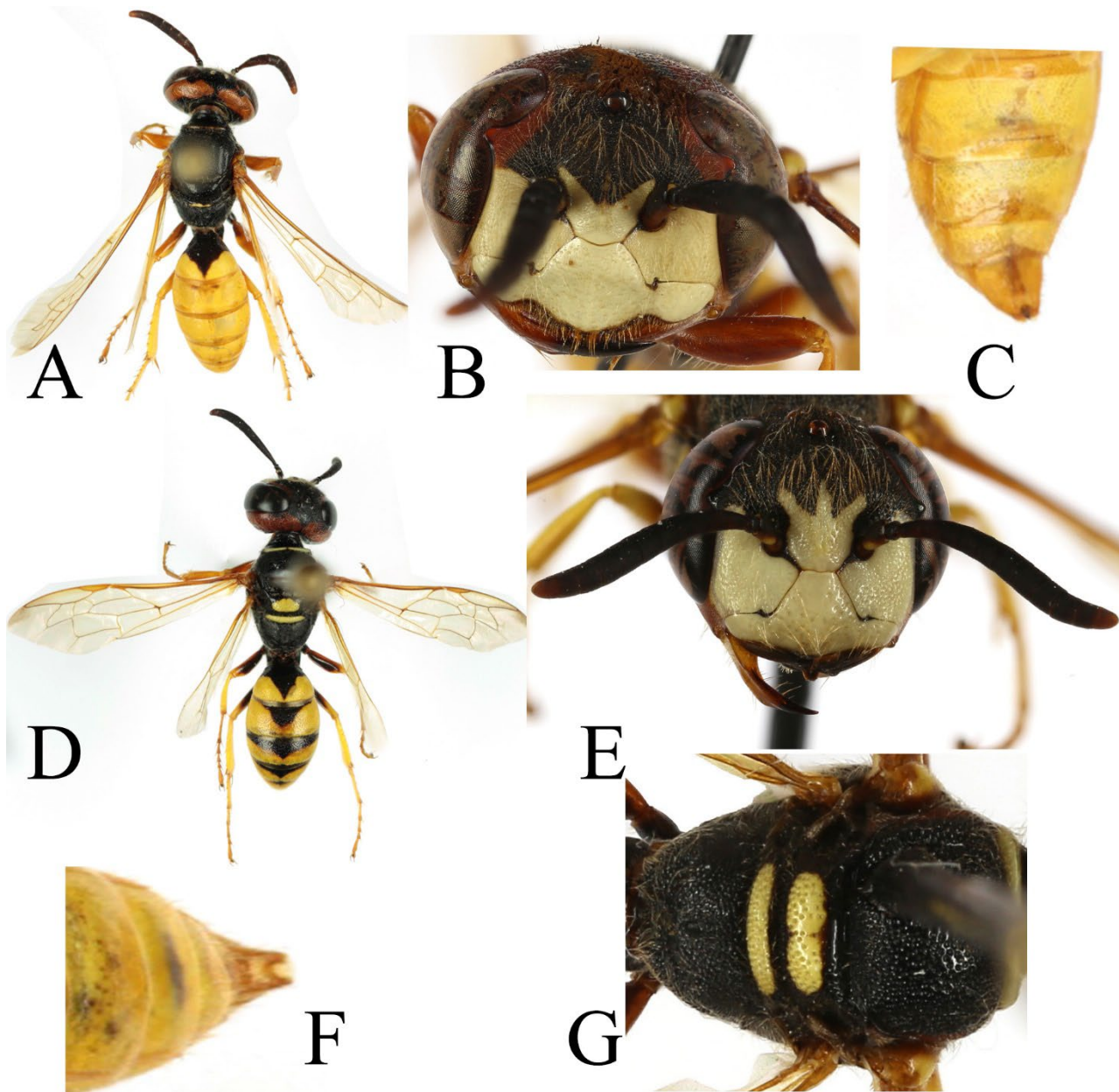


Fig. 6 - General body structure of *Philanthus triangulum abdelcader raptor* Lepeletier, 1845 female: (A) dorsal view of body; (B) frontal view of head; (C) last abdominal segments; male: (D) dorsal view of body; (E) frontal view of head; (F) last abdominal segments; (G) mesonotum and propodeum.

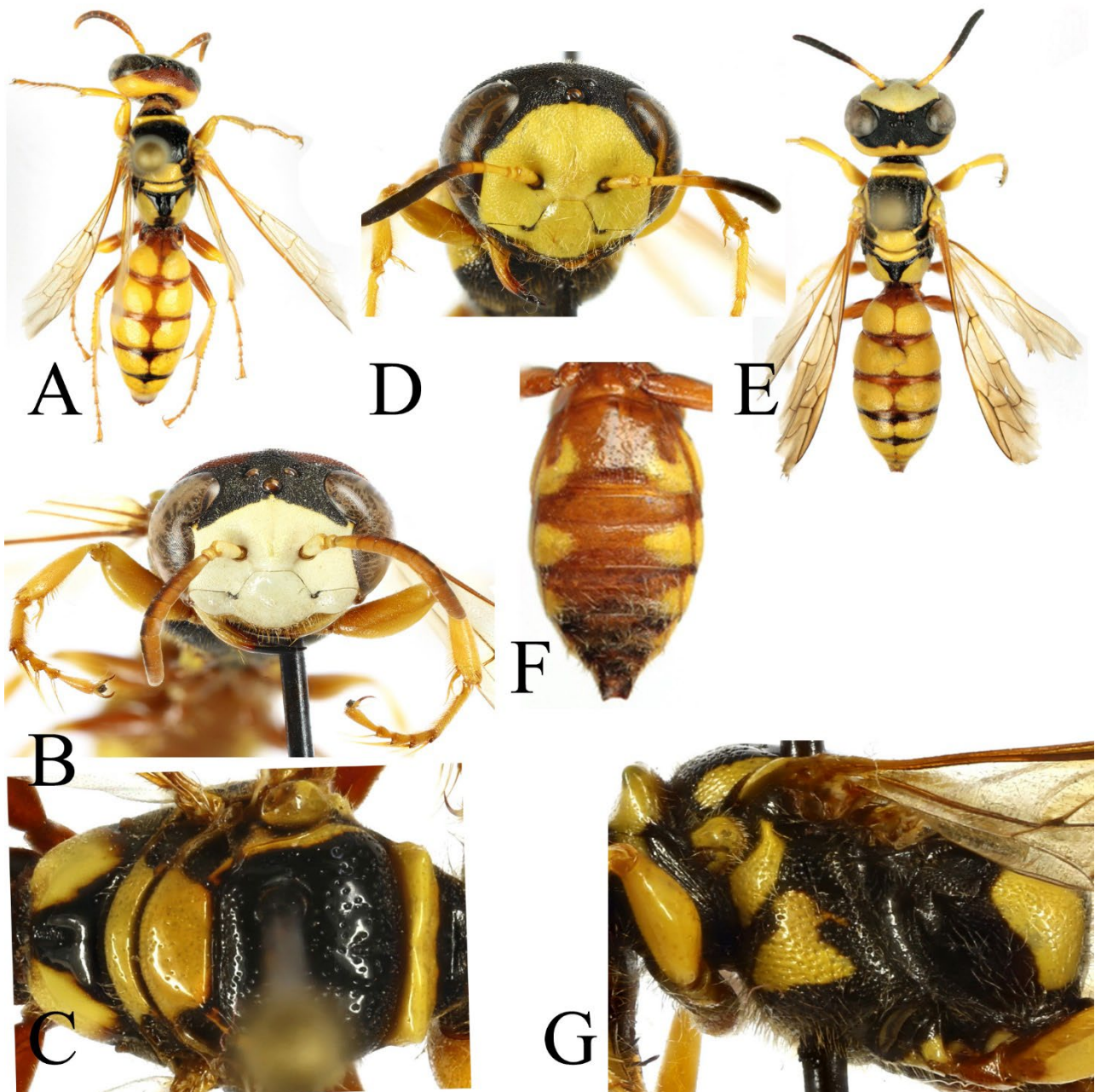


Fig. 7 - General body structure of *Philanthus variegatus ecoronatus* Dufour, 1854 female: (A) dorsal view of body; (B) frontal view of head; (C) mesonotum and propodeum; male: (D) frontal view of head, (E) dorsal view of body; (F) sterna; (G) mesopleuron.

***Philanthus variegatus ecoronatus* Dufour, 1854 (Fig. 7, Fig. 10H)**

Philanthus ecoronatus Dufour, 1854: 380. Syntypes: ♂, Algeria: Oumm ed Drou (Depository: MNHN).

Short description of male and female

Body black and yellow coloured with ferruginous markings, female larger than male (length: female 13 -15 mm; male 7,5-14 mm); clypeus smooth, scattered punctuated, anterior side in female medially with arched lamellae; frons with a median distinct suture, until anterior ocellus yellow, densely punctuated (Figs. 7B, C, D); vertex black and ferruginous in female and totally black in male; middle of pronotal collar with a small notch, laterally pronotal collar protruding (Fig. 7C); scutum with notauli (Fig. 7E); mesopleuron shiny, distinctly punctuated (Fig. 7G); propodeal dorsal area smooth except the middle groove with small and short ridges (Fig. 7C), lateral parts densely punctuated; hind femur in female with long setae which is absent in male; wings brownish; abdomen with large yellow bands; second abdominal tergum distinctly and densely punctuated; first five abdominal sterna ferruginous, the rest black, laterally with yellow markings, provided with a well-developed seta on sterna 4, 5 and 6 (Fig. 7F).

Distribution in Tunisia: Gafsa, Kairouan, Kebili, Mahdia, Sidi Bouzid, Tataouine, Tozeur, Zaghouan (Ben Khedher *et al.*, 2021).

Global distribution: Algeria, Egypt, Libya, Morocco, Palestine, Tunisia (Malash *et al.*, 2023a).

Genus *Pseudoscolia* Radoszkowski, 1876

Pseudoscolia Radoszkowski, 1876: 103.

Type species: *Pseudoscolia maculata* Radoszkowski, 1876.

***Pseudoscolia berlandi* (de Beaumont, 1949) (Fig. 8, Fig. 10I)**

Philoponidea berlandi de Beaumont, 1949: 209. Holotype: ♀, Southern Algeria: Sidi Obka (Depository: MNHN).

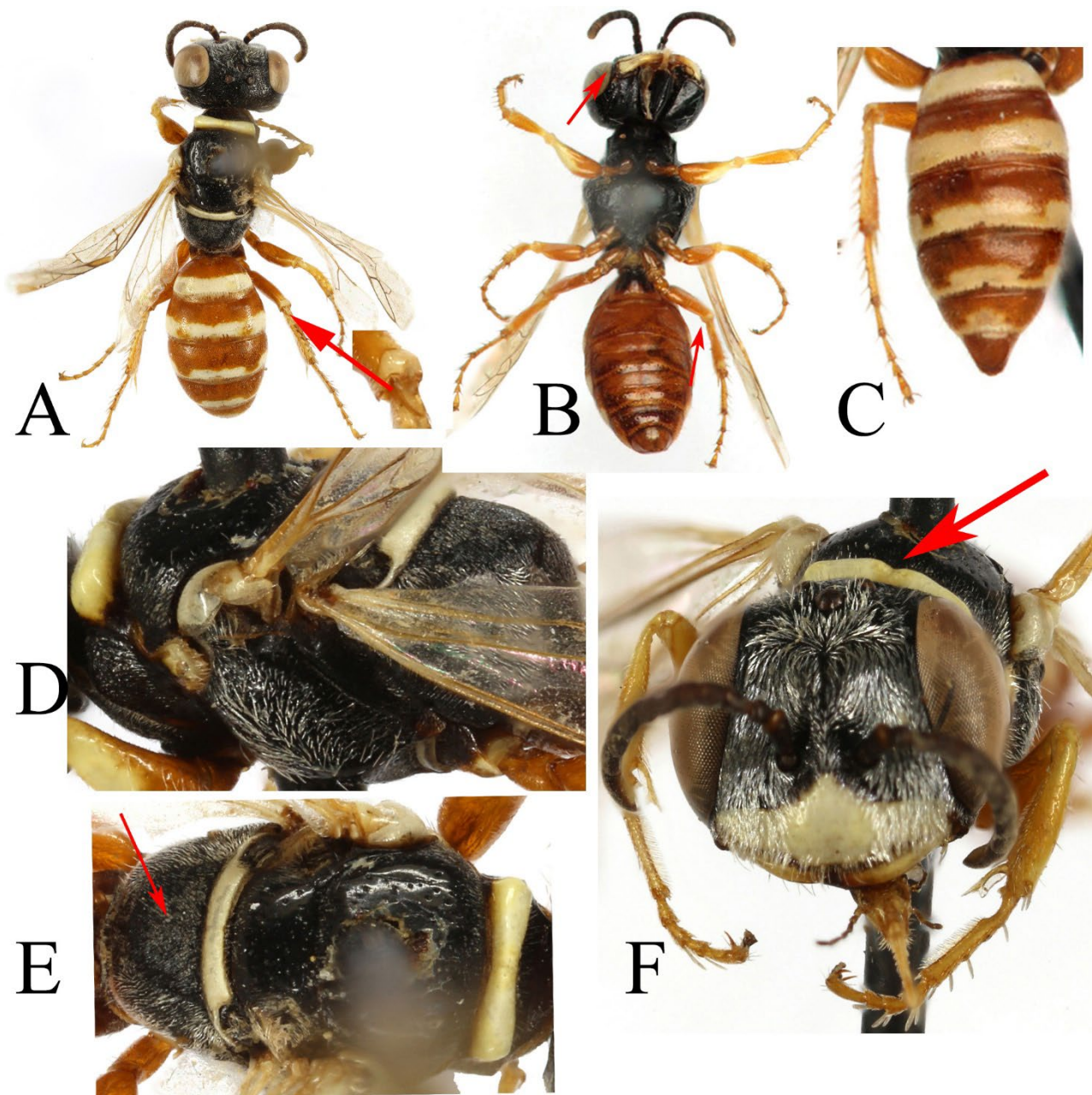


Fig. 8 - General body structure of female in *Pseudoscolia berlandi* (de Beaumont, 1949): (A), dorsal view of body with focus on platform on hind tibia, (B) ventral view of body; (C) terga; (D) mesopleuron; (E) mesonotum and propodeum; (F) frontal view of head.

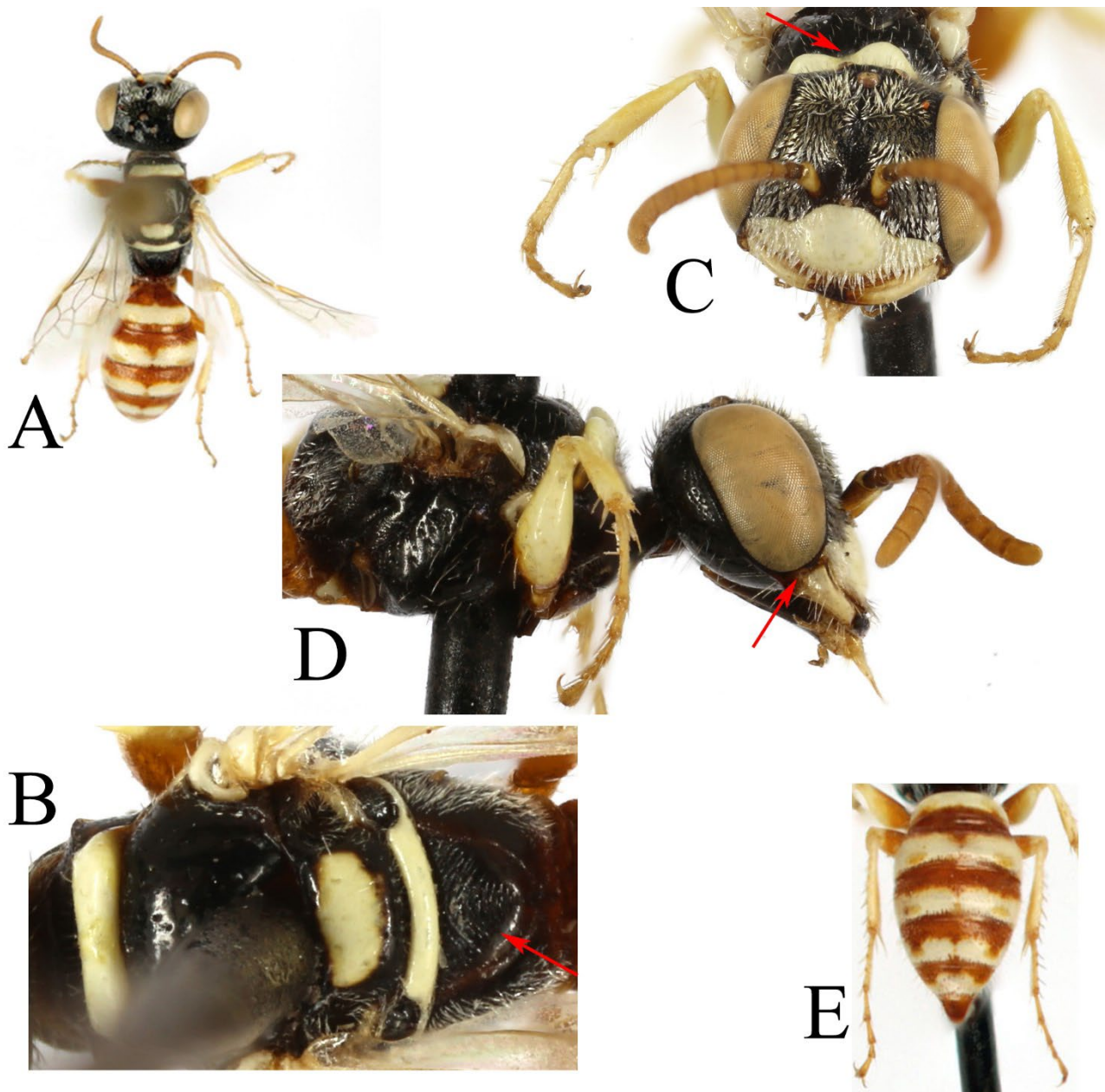


Fig. 9 - General body structure of female in *Pseudoscolia dewitzi* (Kohl, 1889): (A) dorsal view of body; (B) mesonotum and propodeum; (C) frontal view of head; (D) mesopleuron; (E) terga.

Short description of female

Body medium sized (length: 6-8 mm), black with whitish and ferruginous markings; head narrow behind eyes (Fig. 8A); clypeus whitish, medially slightly curved, with silvery setae (Fig. 8F); eyes not fully reach mandibular articulation (Fig. 8B); frons with silvery setae (Fig. 8F); pronotal collar whitish yellow, well-developed, medially notched (Figs. 8E, F); pronotum raised and distinct from scutum; scutellum without whitish yellow band; mesopleuron shiny, with short silvery setae, upper part with fine longitudinal ridges (Fig. 8D); propodeal dorsal area fully finely striated (Fig. 8E); fore basitarsus with 6-8 spines, the apical reaching or slightly exceeding the end of the second tarsal segment; hind tibia basally with small platform (Fig. 8A); median vein of hind wing diverging well before cu-a; abdomen ferruginous with white bands, often interrupted in the middle (Fig. 8C); pygidial plate clearly limited.

Distribution in Tunisia: Gabes, Tataouine, Tozeur (Ben Khedher *et al.*, 2021).

Global distribution: Algeria, Egypt, Morocco, Palestine, Tunisia (Malash *et al.*, 2023a).

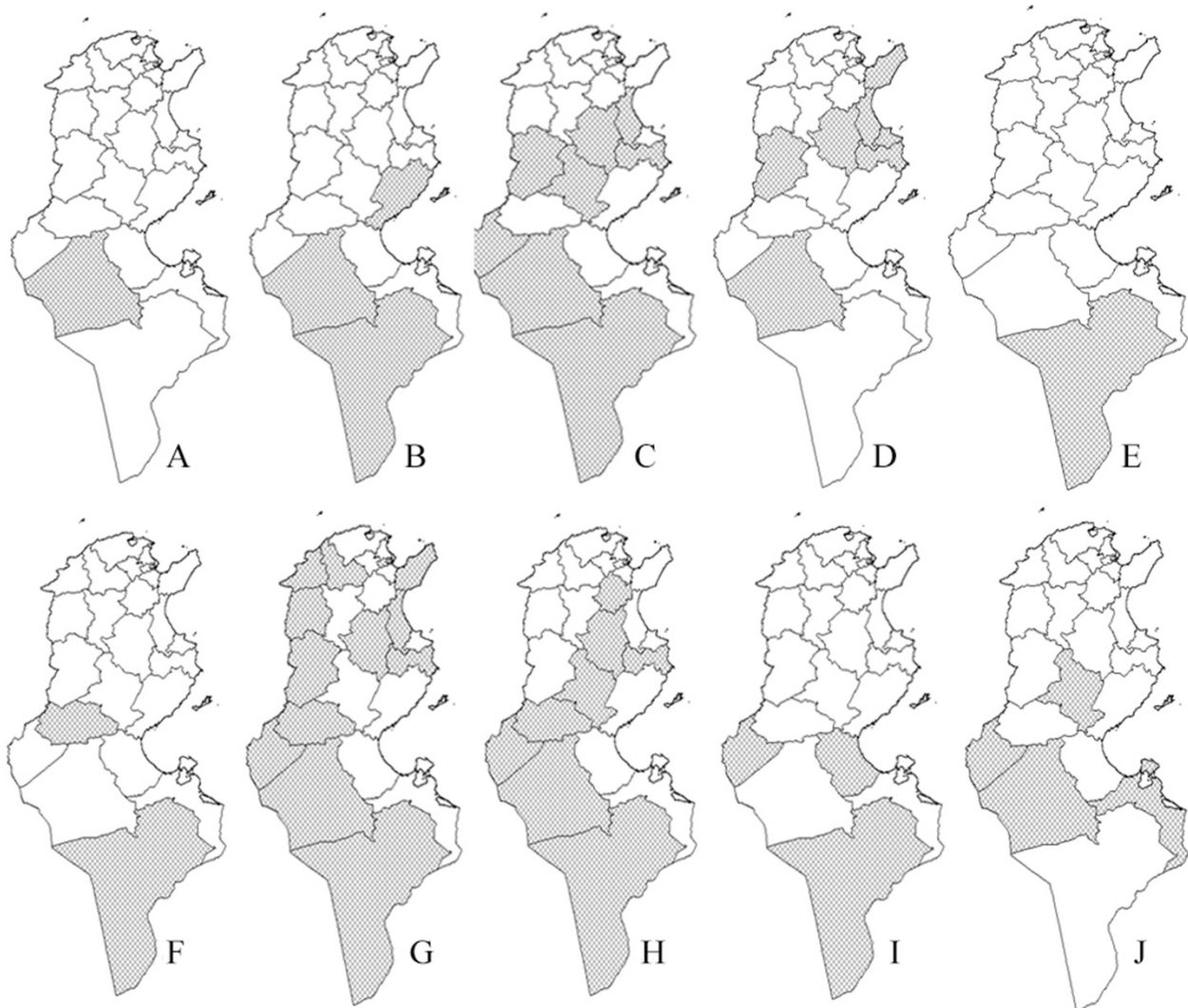


Fig. 10 - Distributional maps of species (black color): (A) *Philanthinus integer*; (B) *Philanthus ammochrysus*; (C) *Philanthus coarctatus coarctatus*; (D) *Philanthus coarctatus raptor*; (E) *Philanthus minor*; (F) *Philanthus soikai*; (G) *Philanthus triangulum abdelcader*; (H) *Philanthus variegatus ecoronatus*; (I) *Pseudoscolia berlandi*; (J) *Pseudoscolia dewitzi*.

Pseudoscolia dewitzi (Kohl, 1889) (Fig. 9, Fig. 10)

Philoponus dewitzi Kohl, 1889: 195. Syntypes: ♂, Egypt: no specific locality (Depository: ZMHU).

Short description of female

It is similar to *P. berlandi* in term of coloration and structure, but it is different by: head behind eyes distinctly narrow (Fig. 9D); compound eyes reaching mandibles (Fig. 9D); scutellum with whitish yellow band; pronotal collar well-developed, medially largely notched, laterally rounded (Fig. 9C); mesopleuron shiny, with little punctures and silvery setae (Fig. 9D); propodeal dorsal area shiny and partially smooth (Fig. 9B); fore basitarsus with six spines, sixth spine not reaching apex of first two tarsal segments combined, middle basitarsus dorsally with four spines.

Distribution in Tunisia: Kebili, Medenine, Sidi Bouzid, Tozeur (Ben Khedher *et al.*, 2021).

Global distribution: Algeria, Canary Islands, Egypt, Jordan, Libya, Morocco, Oman, Palestine, Tunisia, Turkmenistan, United Arab Emirates (Malash *et al.*, 2023a).

Identification key to the Tunisian species male and female of *Philanthus*, *Philanthinus* and *Pseudoscolia* genera

1. Mesopleuron with episternal and epimeral sutures (Fig. 3C); inner orbit concave or notched; pygidial plate less distinct or absent.....2
 - Mesopleuron without episternal and epimeral sutures (Fig. 8D); inner orbit convex; pygidial plate at least present and distinct in female (*Pseudoscolia*).....9
2. Inner orbit not notched (Fig. 2D).....*Philanthinus integer*
 - Inner orbit notched (Figs 3E, F) (*Philanthus*).....3
3. Propodeal dorsal area completely densely punctuated (Fig. 6G); in female anterior side of clypeus with two strong teeth.....*P. triangulum abdelcader*
 - Propodeal dorsal area partially smooth and shiny (Fig. 3D); in female anterior side of clypeus without teeth.....4
4. Upper and lower parts of mesopleuron densely punctuated (Fig. 7G).....*P. variegatus ecoronatus*
 - Upper part of mesopleuron with sparse punctuation and its lower part densely punctuated (Fig. 3C).....5
5. Third abdominal tergum black (Fig. 4A).....6
 - Third abdominal tergum totally with yellow band or ferruginous.....7
6. Third abdominal tergum sparsely punctuated (Fig. 4D); in female markings white; first abdominal tergum ferruginous (Fig. 4A).....*P. coarctatus coarctatus*
 - Third abdominal tergum densely punctuated (Fig. 5F); in female markings golden yellow; first abdominal tergum not ferruginous (Fig. 5A).....*P. coarctatus raptor*
7. Pronotal collar medially slightly emarginated (Fig. 3A).....*P. ammochrysus*
 - Pronotal collar medially distinctly emarginated.....8
8. First three abdominal terga ferruginous.....*P. soikai*
 - Abdominal terga with yellow bands.....*P. minor*
9. Propodeal dorsal area shiny and partially striated (Fig. 9B); pronotal collar medially with a large indentation (Fig. 9C).....*P. dewitzi*
 - Propodeal dorsal area not shiny and totally finely striated (Fig. 8E); pronotal collar medially with a small indentation (Fig. 8F).....*P. berlandi*

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بررسی گونه‌های *Philanthinus*، *Philanthus* و *Pseudoscolia* (Hymenoptera: Apoidea: Philanthidae) در تونس

در تونس

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مکیده

گونه‌های زنبور متعلق به جنس‌های *Philanthus* Fabricius, 1790، *Philanthus* de Beaumont, 1949 و *Pseudoscolia* Radoszkowski, 1876 در تونس به جز دو گونه *Philanthus minor* Kohl, 1891 و *Philanthus soikai* de Beaumont, 1961 بررسی شد و ویژگی‌های ریخت‌شناسی آنها توصیف شده و کلید شناسایی آنها فراهم شد. خصوصیات ریخت‌شناسی گونه‌ها با تصاویر دیجیتال نشان داده شده و نقشه پراکنش هر گونه در تونس ارائه شده است.

کلمات کلیدی: بال غشاییان، کلید شناسایی، ریخت‌شناسی، زنبورهای فیلاتنید، تونس

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