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A new species of the palaearctic genus *Dasypoda* Latreille 1802 (Hymenoptera: Dasypodaidae) from the Great Rift Valley in Ethiopia

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Abstract

Dasypoda is a genus of solitary bees previously recorded as endemic in the Palaearctic region from Portugal to Japan. We describe here a new species of *Dasypoda* (Hymenoptera, Apoidea, Melittidae), *Dasypoda riftensis* **sp. nov.**, collected from Ethiopia, Great Rift Valley, Gallo. This species is the first record of the genus *Dasypoda* in Sub-Saharan Africa and is of phylogenetic importance. We discuss biogeographical implications of the record in Ethiopia.

Key words: Melittidae *s.l.*, sub-Saharan Africa, biogeography, hotspot

Introduction

Melittidae *s.l.* is one of the smallest groups of bees (198 species among ~20000 described bees) (Michez *et al.* 2009). Its monophyly and phylogenetic position among bees are still debated even though Danforth *et al.* (2006) recently consolidated the hypotheses of a basal position and paraphyly of Melittidae *s.l.* Danforth *et al.* (2006) followed the taxonomic proposition of Alexander and Michener (1995) acknowledging three melittid families (Dasypodaidae, Melittidae *s.s.* and Meganomiidae) based on a morphological dataset. In this hypothesis, Dasypodaidae is the sister group of all others bees. The study of Dasypodaidae is therefore crucial to understanding the early evolution of bees.

Dasypodaidae can be distinguished among other bees by a unique combination of several features: short tongue with all segments of the labial palpus similar to one another, paraglossa reduced, submentum V-shaped and two submarginal cells with the first submarginal crossvein at right angles to the longitudinal vein (Michener 1981). Dasypodaidae are relatively species-rich (101 species) in xeric areas of both the Old World and the Neartic region (Michez *et al.* 2009, 2010, Fig. 1). *Dasypoda* is the only widespread genus, which occurs from temperate to the xeric areas of the Palaearctic. *Dasypoda* determines the northern limit of Dasypodaidae to 62 degrees north (Michez *et al.* 2004a). The other Dasypodaidae genera, *Capicola*, *Eremaphanta*, *Hesperapis*, and *Samba* are each endemic in different Old World and Neartic semi-deserts.

Most *Dasypoda* are longer than 15 mm while the other Dasypodaidae are less than 10 mm. *Dasypoda* share a few apomorphies: black body, vertex elevated, no basitibial plate, female scopae strongly developed and absence of keirotrichia (Michener 1981; Michez 2004a, b). Michez *et al.* (2004a, b) and Michez (2005) listed 33 species and described four subgenera based on morphological cladistic analysis: *Dasypoda s.s.*, *Heterodasypoda*, *Microdasypoda*, and *Megadasypoda*. Diagnostic features are numerous at specific level: sculpture of outer surface of galea, punctures of clypeus, length of malar area, scopae colour, appressed setae on female pygidial plate, shape of male hidden sterna and genitalia.

Dasypoda species are common in the Palaearctic region but most species are west-palaearctic (Michez 2002, 2005, Michez *et al.* 2004a, b). The diversity centres of each four subgenera are restricted to one of the following parts of the Mediterranean region: Balkan, Morocco and Spain.

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Bees have, so far, been poorly collected and studied in Ethiopia (Friese 1915; Alfken 1932). As far as we know, species endemism seems high, especially for genera which are more species diverse in the Palaearctic than in sub-Saharan region. For example, seven of the ten described sub-Saharan species of the genus *Nomada* are endemic in Ethiopia and were mostly collected by K.M. Guichard in the years 1945-46 and revised by Eardley and Schwarz (1991). Another endemic bee species, *Melitta guichardi* Michez & Eardley has been described from Ethiopia in a valley close to Addis Ababa (Michez and Eardley 2007).

The aim of this paper is to describe a new species of *Dasypoda* collected on a recent field trip in Ethiopia in 2011.

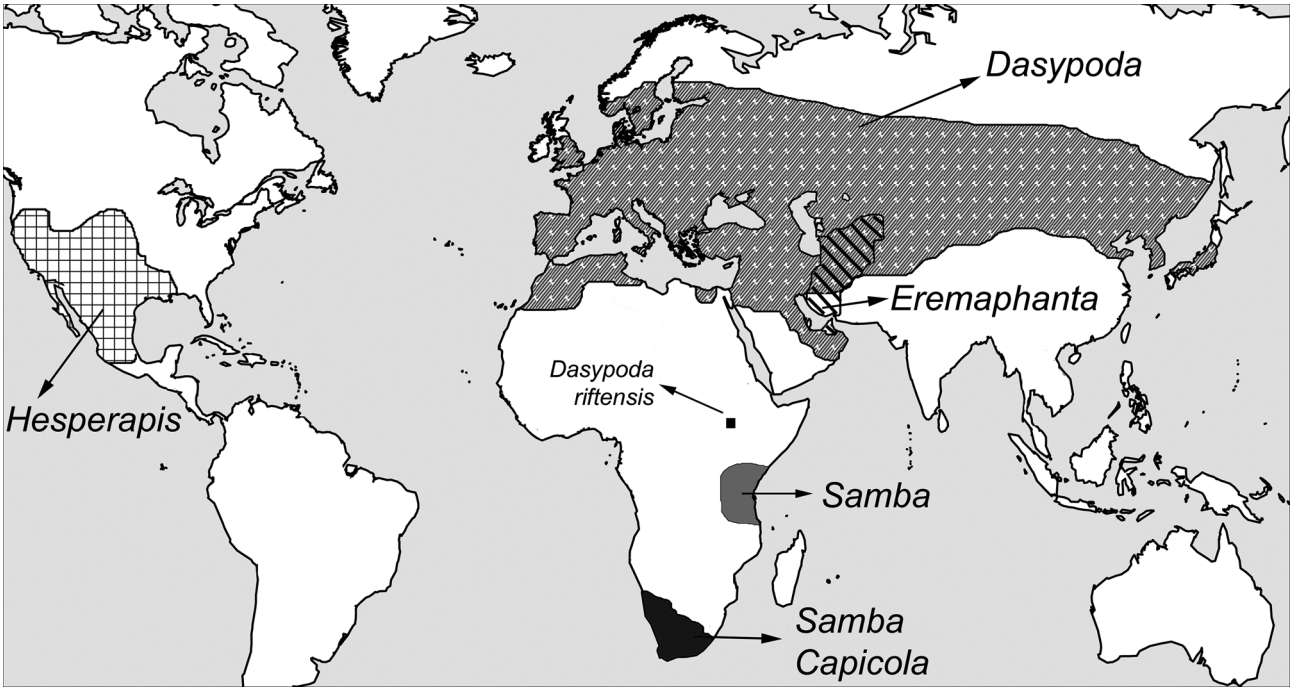

FIGURE 1. Distribution of Dasypodaidae and locus typicus (07°59'47"N 38°38'46"E) of *Dasypoda riftensis* **sp. nov.** (Dasypodaini: *Samba* and *Dasypoda*; Hesperapini: *Capicola*, *Eremaphanta* and *Hesperapis*).

Material and methods

We defined taxa in the sense of the morphological species concept, too little information being available to consider eco-, etho- or pheno-species.

The integument and setae ultrastructures were studied using SEM (JEOL JSM-6100) associated to the software Semafore (JEOL, Sollentuna, Sweden). We used the glossary of Harris (1979) for description of the surface sculpture and Michener (2007) for general morphology. Puncture density is given in terms of relationship between puncture diameter (d) and the spaces between them (i), such as i>d. The following abbreviations were used for morphological structures: Metasomal sternum= S; Metasomal tergum= T.

Specimens were collected by net.

Results

Description of *Dasypoda (Dasypoda) riftensis* Michez & Pauly sp. nov.

Type material. Holotype male: Ethiopia, Great Rift Valley, Gallo, on small road between Ziway and Ziwa, 07°59'47"N 38°38'46"E, 1690m, on flowers of *Launaea cornuta* (Asteraceae), leg. A. Pauly & J.-L. Boevé (Royal Belgian Institute of Natural Sciences, Brussels).

Paratypes: 2 males and 5 females, idem holotype (Royal Belgian Institute of Natural Sciences, Brussels; Zoological Natural History Museum of Addis Ababa).

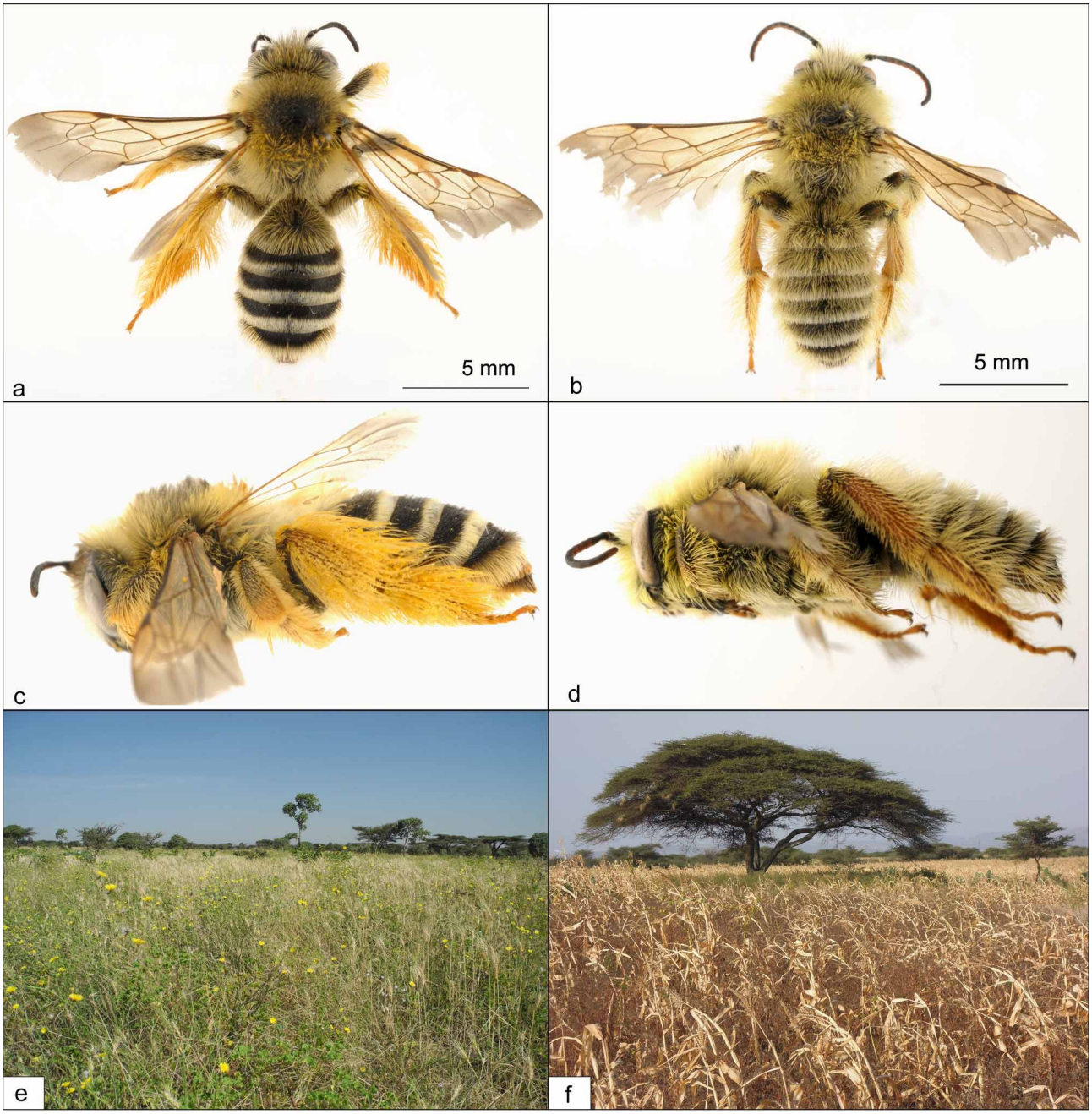

FIGURE 2. Habitus and habitat of *Dasypoda riftensis* **sp. nov.**: a, c. Female in dorsal and lateral view; b, d. Male in dorsal and lateral view; e. Wheat crop with adventices (Asteraceae: *Launaea cornuta*) where type specimens have been collected; f. Landscape in the surrounding area (photo J.-L. Boevé).

Etymology. The specific epithet refers to the locus typicus of the species in the Great Rift Valley.

Diagnosis. *D. riftensis* **sp. nov.** shows most of the diagnostic features of the subgenus *Dasypoda s.s.*: galea matt and densely punctured; maxillary palpus 0.7 times as long as galea; malar area shorter than pedicel; base of gonostylus without spine; gonostylus subdivided in two parts united by a membraneous bridge; S8 male with anterior spine; S6 male nearly hairless; clypeus female fully punctured; scopa entirely reddish; pygidial plate hairless. Male and female of *D. riftensis* can be distinguished from all species of the subgenus *Dasypoda* by the hind tibia and basitarsus with testaceous cuticle (Figs 2a–d, 3). Female with whitish prepygidial fimbria like in *D. albipila* Spinola, *D. sinuata* Pérez, *D. tubera* Warncke and *D. warnckei* Michez; T2 with interrupted apical hair band like in *D. sinuata* and *D. warnckei*; T3 with continuous apical hair band like in *D. albipila* and *D. warnckei* (Figs 2a, c). Male with unique shape of genitalia and S7 latero-apical structures (Figs 4a–c, e). Inner face of hind tibia with unique shape of apical plate (Fig. 3b).

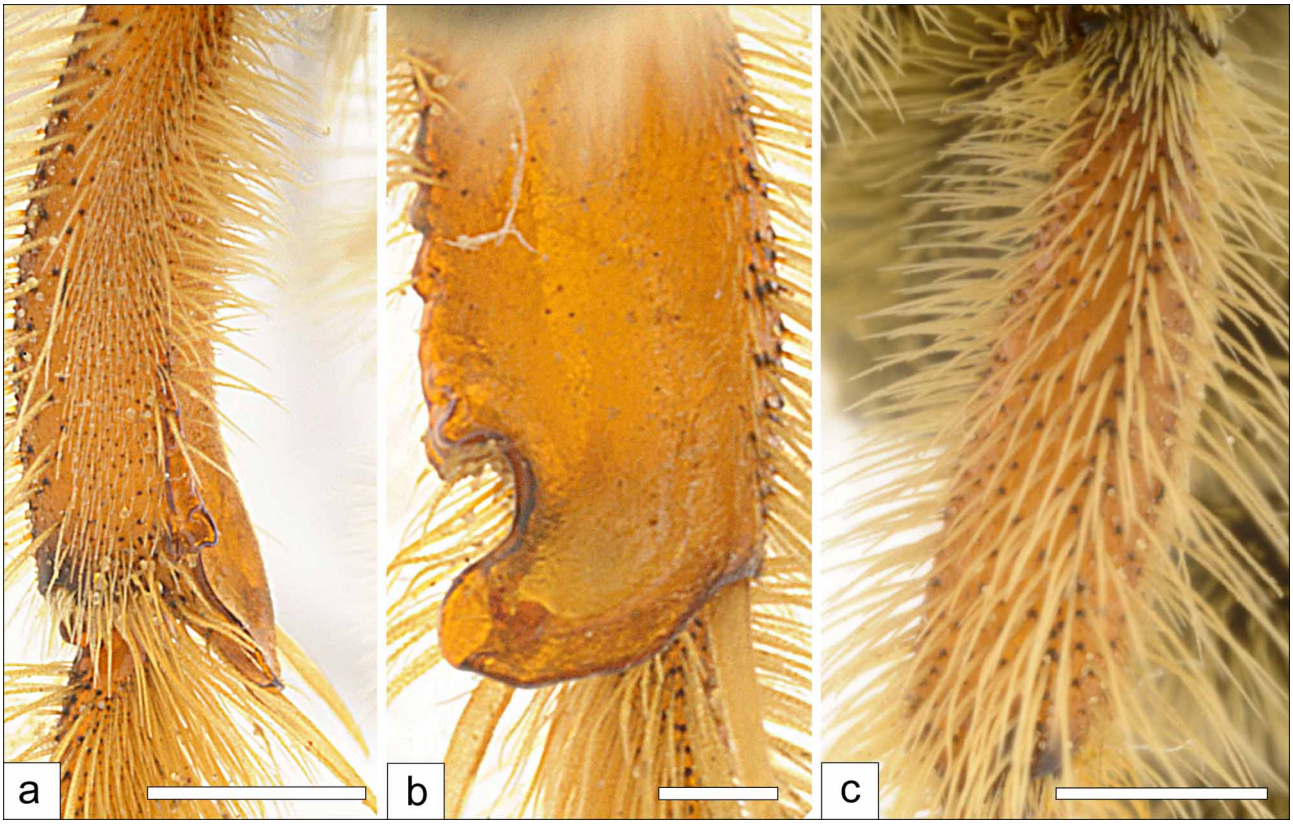

FIGURE 3. Hind tibia of *Dasypoda riftensis* **sp. nov.** male (scale bars = 1mm): a. Lateral view; b. Inner view; c. External view.

Description. Male & female. Black cuticle except mediotarsi, distitarsi, hind tibia and hind basitarsus testaceous. Antenna with black dorsal side and reddish ventral side. Galea matt and densely punctured (i<d). Malar area shorter than the pedicel. Clypeus fully punctured. Inner edges of compound eyes subparallel. Scutum sculptured between punctures. Fore wing with prefurcal nervulus, apical part darker than fore part. **Male** (Figs 2b, d, 4). Body length (vertex-T7): 10.8mm. Head. L= 2.9mm. W= 3.4mm. Pilosity reddish. Mesosoma. L= 3.6mm. W (between tegulae)= 2.4mm. Pilosity reddish. Hind basitarsus hairs twice longer than basitarsus width. Fore and middle legs without particular shape or apical structures. Hind femur with inner apical plate and apical inner face slightly depressed. Lateral inner apical part of hind tibia crenelate. Metasoma. L= 6.3mm. W= 3.5mm. Pilosity reddish except disc of T6–7 and S5 with black hairs. T3-6 with white apical hair band. S6-8 and genitalia like in Fig. 4. **Female** (Figs 2a, c). Body length (vertex-T7): 12mm. Head. L= 3.1mm. W= 3.5mm. Face and genal area with white reddish hairs; vertex with black hairs. Mesosoma. L= 4.2mm. W (between tegulae)= 3.1mm. Pilosity reddish (including legs); scutum with reddish and black hairs mixed. Scutum, scutellum and metanotum densely punctured (i=d); propodeum sculptured and shiny. Metasoma. L= 6.3mm. W= 4.2mm. Disc of T1 and marginal zone of sterna with reddish hairs; disc of T2–5 with black hairs; prepygidial fimbria white; pygidial fimbria black; marginal zone of T1 hairless; T2 with interrupted apical hair band; T3–4 with continuous apical hair band.

Floral visits. All male and female specimens were collected on *Launea cornuta* (Oliv. & Hiern.) (Asteraceae). Oligolectism of *D. riftensis* needs to be confirmed by palynological analysis but all species of the subgenus *Dasypoda* have been so far described as oligolectic on Asteraceae (Michez *et al.* 2008).

Biotope. The specimens were collected in an extensive culture of cereals with many nearby Asteraceae in an *Acacia* woodland and at an altitude of 1690m (Figs 2e–f).

Distribution. Ethiopia. Only known from the locus typicus.

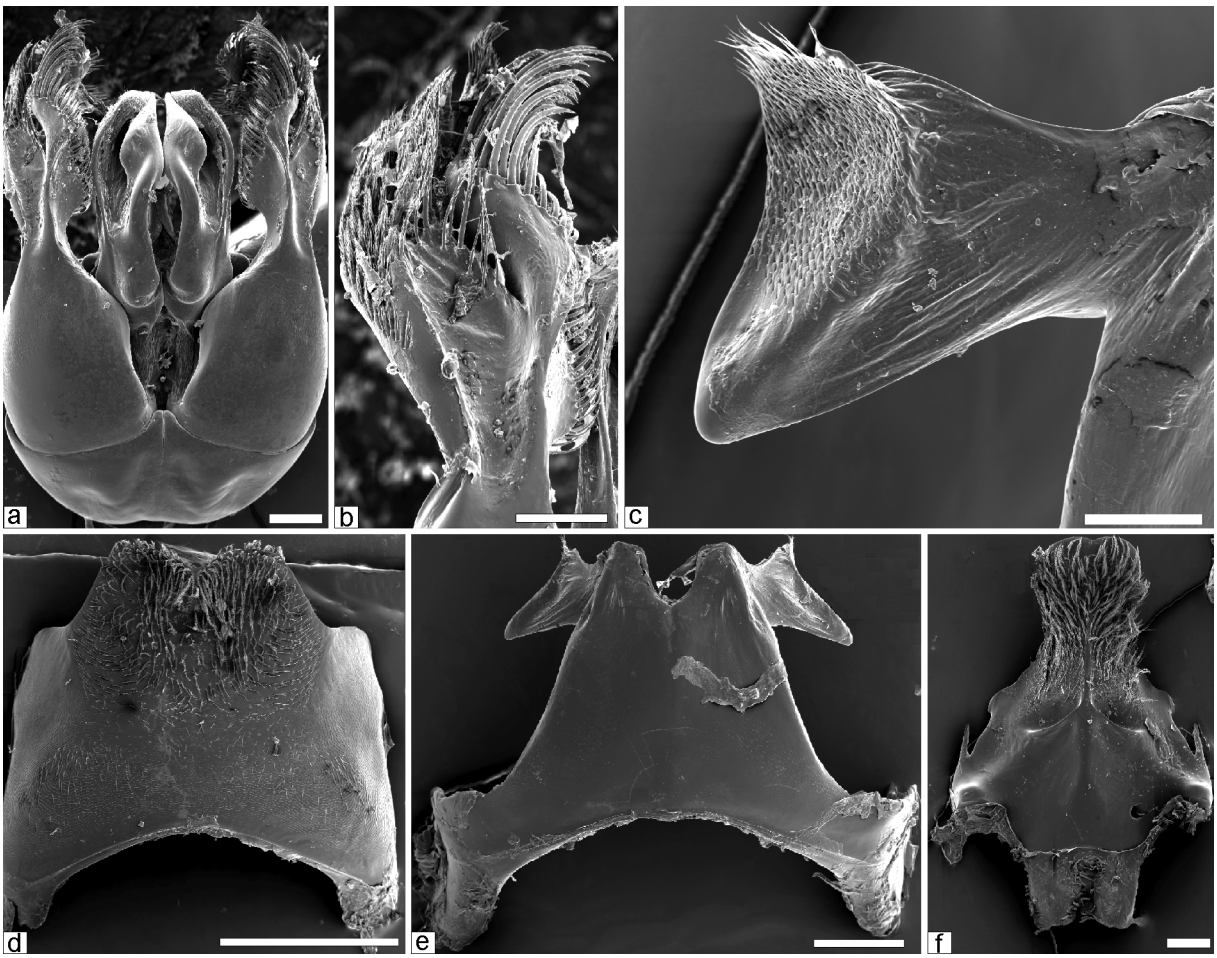

FIGURE 4. Hidden sterna and genitalia of *Dasypoda riftensis* **sp. nov.** male: a. Genitalia in dorsal view (scale bar = 100µm); b. Detail of gonostylus (scale bar = 70µm); c. Detail of latero-apical structure of sternum 7 (scale bar = 100µm); d. Sternum 6 in dorsal view (scale bar = 1mm); e. Sternum 7 in dorsal view (scale bar = 300µm); f. Sternum 8 in dorsal view (scale bar = 200µm).

Systematics and biogeography of the genus *Dasypoda*

Dasypoda riftensis **sp. nov.** is morphologically close to a group of species distributed in the Eastern and Southern part of the Mediterranean basin: *D. albipila* (Israel, Egypt, Arabia), *D. sinuata* (North Africa) and *D. warnckei* (Turkey). Females of the four species show white prepygidial fimbria (see published key in Michez *et al.* 2004a) which could be a character linked to their semi-desert environment. Temperate species like *D. hirtipes* show black prepygidial fimbria (Michez 2002). Moreover the male of *D. riftensis* **sp. nov.** also shows a developed apical plate on the tibia like *D. sinuata* and *D. warnckei* (see published key in Michez *et al.* 2004a). The genitalia structures are very close in all three species (*i.e.*, *alpipila*, *sinuata* and *warnckei*).

The S7 structure similar to *D. visnaga* (Rossi) is likely plesiomorphic as it is also similar to the subgenus *Heterodasypoda* (Michez *et al.* 2004b). It could indicate a basal position of *D. riftensis* **sp. nov.** within the subgenus *Dasypoda s.s.*

Eardley and Urban (2010) listed 99 genera and 2755 species in sub-Saharan Africa. Endemism is relatively high making Africa and mainly Southern Africa a center of bee diversity of global significance (Kuhlmann 2009). Among the endemic taxa are a few likely palaeo-endemics that represent basal lineages within their family (e.g. *Afrodasypoda* within Melittidae, Michez *et al.* 2009; Fideliini within Megachilidae, Litman *et al.* 2011) or tribe (e.g. *Afroheriades* within Osmiini, Praz *et al.* 2008). Records in Ethiopia of genera like *Andrena*, *Dasypoda*, *Melitta* and *Nomada*, more species-diverse in the Palaearctic region than in the Sub-saharan region, probably represent some later additions in the sub-Saharan bee fauna. These additions are linked to the geographical proximity of the Palaearctic region and variations in the Saharan and Arabian desert aridity (Patiny and Michez 2007).

While few bees have been collected and studied from Ethiopia, endemism of the Ethiopian bee fauna seems already very high. Species diversity could be equivalent to other well-known hotspots like western Atlas, Tripolitania, Cyrenaica, Nile valley or Jordan valley (Patiny and Michez 2007). More expeditions are needed to explore this fauna.

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