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A new bee species of the genus *Dasypoda* Latreille (Hymenoptera, Apoidea) from Northwest Africa with comparative remarks on the subgenus *Microdasypoda* Michez

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Abstract

North Africa, with its vast array of ecosystems and reliefs, constitutes a remarkable place to explore and describe the diversity of wild bees. In this paper, a new bee species of the genus *Dasypoda* Latreille (Hymenoptera, Apoidea, Melittidae), *D. schwarzi* Radchenko et Michez sp. nov., is described from the Atlas Mountains area (Morocco and Tunisia). This species belongs to the subgenus *Microdasypoda* Michez and is phenotypically related to *D. brevicornis* Pérez, but differs from all other species of this subgenus by the structure of the male genitals, the metasomal sterna, and by its overall hair colour. A detailed comparative diagnosis of *D. schwarzi* with the other four species of this subgenus is provided, as well as a key to the males of *Microdasypoda*, and a correction to the diagnosis of the subgenus. This new species is the fortieth described *Dasypoda* species and should be looked for in other mountain regions of Northwest Africa, such as in the Algerian Atlas where it could be present.

Key words: *Dasypoda schwarzi* sp. nov., Melittidae s. l., taxonomy, key

Introduction

In a time of global changes, taxonomy has become a key discipline for opening the door to knowledge about the Earth's biodiversity and communicating information about nature (Costello 2020). One of the very charismatic groups that still requires a considerable attention for describing unknown taxa is wild bees (Hymenoptera: Anthophila), a clade comprising more than 20.000 species at the global scale (Michener 2007). Many of the diversity hotspots of wild bees remain poorly studied, and new species are yet to be discovered even in comparatively well studied regions such as the West-Palearctic (Bogusch 2021; Radchenko 2017; Wood *et al.* 2021; Ghisbain *et al.* 2021).

This need for taxonomic attention is well exemplified with the bee genus *Dasypoda* Latreille, 1802, a clade of melittid bees divided into four subgenera and currently including 39 valid species (Michez *et al.* 2004a, b; Michez 2005; Michez & Pauly 2012; Radchenko 2016, 2017; Radchenko *et al.* 2019). The genus is remarkable in its morphology, with females presenting well-developed pollen-carrying scopae on both the hind tibia and the basitarsus (Michener *et al.* 2007; Michez *et al.* 2019). *Dasypoda* is distributed across the Palearctic region except one species from sub-Saharan Africa (Michez & Pauly, 2012). This latter continent is exceptionally diversified in terms of habitat types and hosts a rich yet relatively unexplored fauna of bees, with North Africa alone hosting approximately a quarter of all described species of *Dasypoda* (Michez *et al.* 2004a).

Among the materials collected in Tunisia and Morocco and stored in the MSAA (Maximilian Schwarz, private collection, Ansfelden, Austria), OÖLM (Oberösterreichisches Landesmuseum, Linz, Austria), and UMONS (University of Mons, Belgium) collections, we discovered a new, fortieth species of this genus belonging to the subgenus *Microdasypoda*. Representatives of this subgenus are common across the Mediterranean region, with three of the four previously described species being found only in the western part of this region (Michez *et al.*

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2004a, b; Patiny & Michez 2007; Radchenko *et al.* 2019; Lhomme *et al.* 2020). Only *Dasypoda cingulata* Erichson has a wide range from Morocco, Spain, and Portugal to Greece and western Turkey (Aegean Region; Grace 2010).

Material and methods

We examined three male specimens of *Dasypoda* (*Microdasypoda*) collected in 1981 and 1995 in the Atlas Mountains area (Morocco and Tunisia). For a comparative analysis, we studied representatives of all other known species belonging to the subgenus *Microdasypoda*: *Dasypoda brevicornis* Pérez, 1895, *D. cingulata* Erichson, 1835, *D. crassicornis* Friese, 1896, and *D. iberica* Warncke, 1973 stored in the OÖLM and UMONS collections.

The following abbreviations (after Michener 2007) were used for morphological structures: S1, S2, etc. = first, second, etc., metasomal sterna; T1, T2, etc. = first, second, etc., metasomal terga. L and W mean the length and width, accordingly. The integument and setal ultrastructure of genitalia were studied using scanning electron microscopy (SEM) with an SEM JEOL JCM-6000 (JEOL Ltd., Tokyo, Japan) under Semafore software (JEOL, Sollentuna, Sweden). Colour photographs were made using a Canon EOS 5DS R (Canon Inc., Tokyo, Japan) camera assembled onto a stereomicroscope Leica M205C (Leica Microsystems, Wetzlar, Germany) under Helicon Remote 3.9.10.w software. Photographs were combined into single images using Helicon Focus 7.7.4 Pro (Helicon Soft Ltd, Kharkiv, Ukraine) automontage software. Quick-Photo Micro v2.3 (PROMICRA, s. r. o., Czech Republic) software was used for measurements. Pollen grains taken from the bee bodies were examined under SEM and upright light microscope Olympus BX51 (Olympus Corp., Tokyo, Japan).

Dasypoda schwarzi Radchenko et Michez sp. nov.

Type material. Holotype ♂ with the printed label: "Tunesien, Thala 20 km S [35°23'N 8°41'E], 12.4.1981, leg. Max. Schwarz" (MSAA).

Paratypes: 2 ♂ with the printed label: "Morocco, 40 km S Guercif [33°53'N 3°22'W], 15.-17.5.1995, Ma. Halada lgt." (UMONS); Tunesien, Thala 20 km S, 12.4.1981, leg. J. Gusenleitner (OÖLM).

Etymology. The species is named after Maximilian Schwarz, an authority on bee systematics.

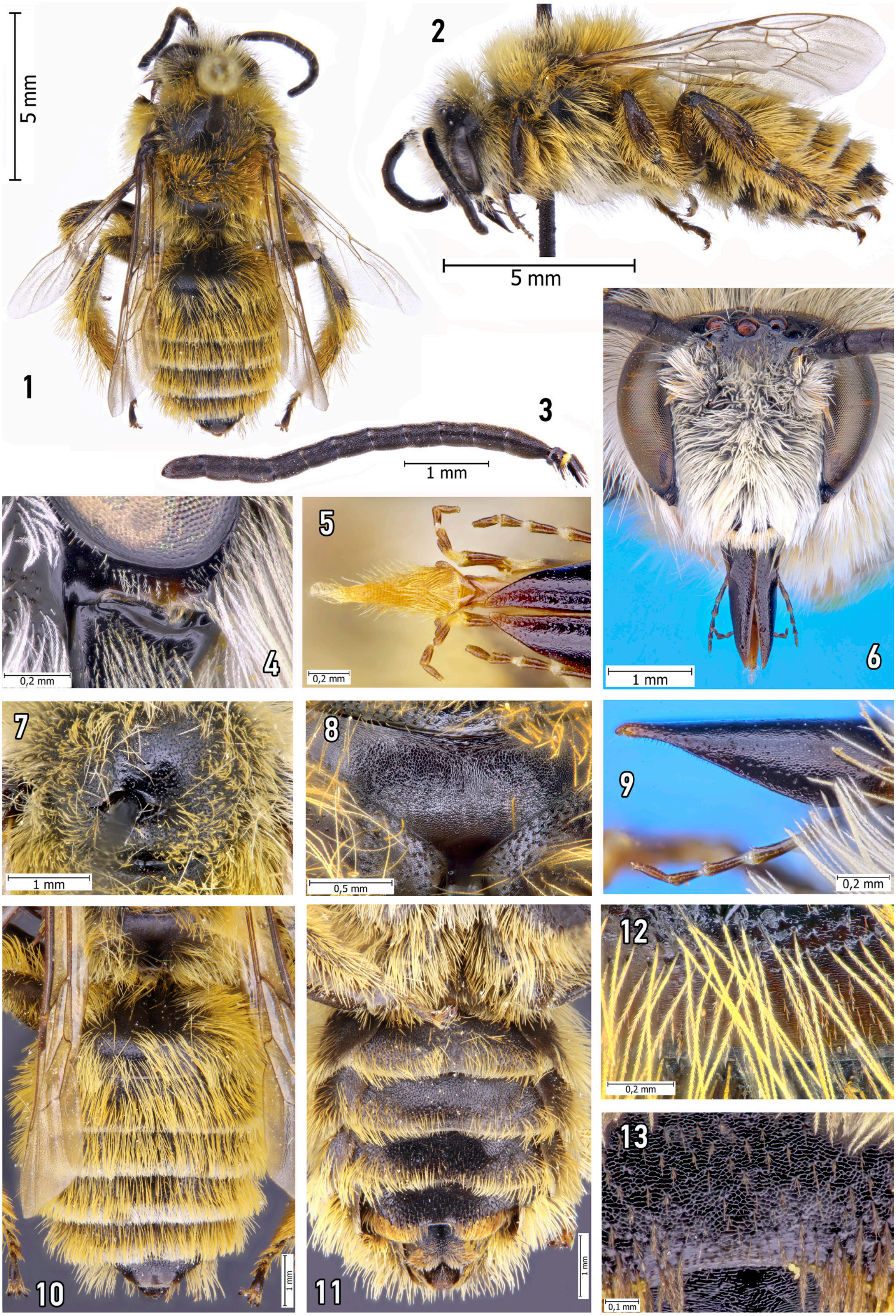
Subgeneric affinity. *Dasypoda schwarzi* sp. nov. can be regarded as a representative of the subgenus *Microdasypoda* Michez (in Michez *et al*. 2004b) due to the combination of its diagnostic features.

First, representatives of the subgenus *Microdasypoda* are characterized by a relatively small body size of approximately 7-12 mm (contrast *Megadasypoda* and many species of *Dasypoda* s.str. and *Heterodasypoda* which are significantly larger). Then, the subgenus is most significantly distinguished from all other *Dasypoda* subgenera by the structure of the male genitalia and S7: the gonostylus of *Microdasypoda* is either unilobed with one basal tooth, or bilobed without a membranous structure that connects these lobes (contrast *Dasypoda* s.str. in which the gonostylus is bilobed with such membranous structure, and *Heterodasypoda* and *Megadasypoda* in which it is trilobed), and the S7 does not bear latero-apical processes, which are characteristic of all other subgenera of *Dasypoda*.

The previously cited apomorphies of *Microdasypoda* should however always be regarded with a combination of other characters that are individually shared by other subgenera, but not all. First, the malar space of *Microdasypoda* is always much shorter than the pedicel (contrast most *Megadasypoda*) and their maxillary palpi and galea are of a sub-equal length (contrast *Dasypoda* s.str. and *Megadasypoda*). The nervulus (*cu-v*) of *Microdasypoda* is strongly antefurcal (contrast most *Megadasypoda*). The apex of S6 of *Microdasypoda* has a long, dense pubescence (contrast *Dasypoda* s.str. and *Megadasypoda* which have short, sparse ones). *Microdasypoda* lack lateral hooks at the basal half of S8 (contrast *Dasypoda* s.str. and some *Megadasypoda*). The external lobe of the gonostyle of *Microdasypoda* is not lanceolate (contrast *Megadasypoda* and some *Heterodasypoda*), and the inner lobe of the gonostyle of *Microdasypoda* does not present a scaly surface (contrast *Heterodasypoda* in which this scaly surface is clearly visible).

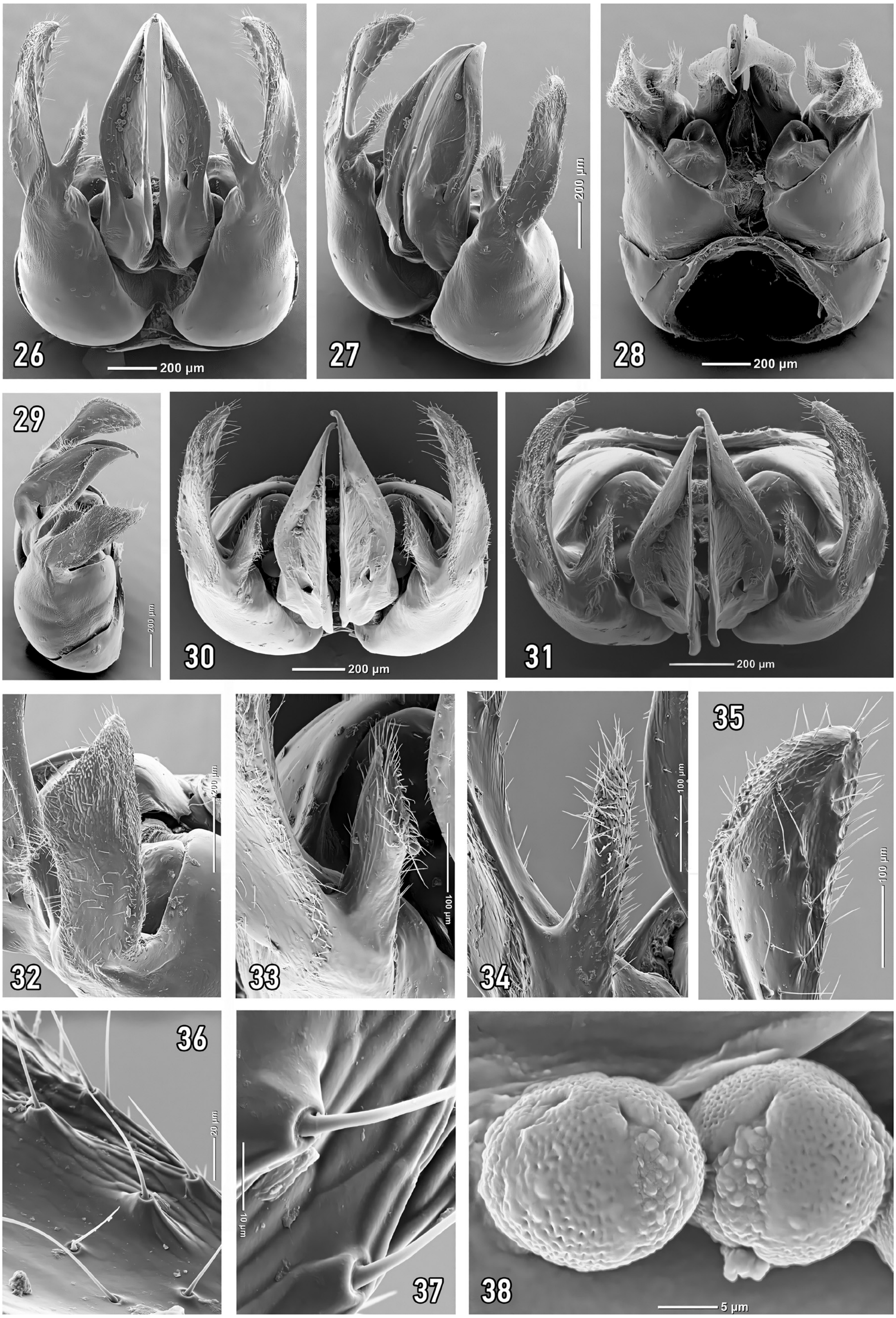
The new species described in this work, *Dasypoda schwarzi* sp. nov., clearly corresponds to all the features that characterize the subgenus *Microdasypoda*.

Description. Male (**Figs 1, 2**): Holotype. Body black, its length (vertex to T7) 11.9 mm (paratypes: 11.5 mm and 10.5 mm).

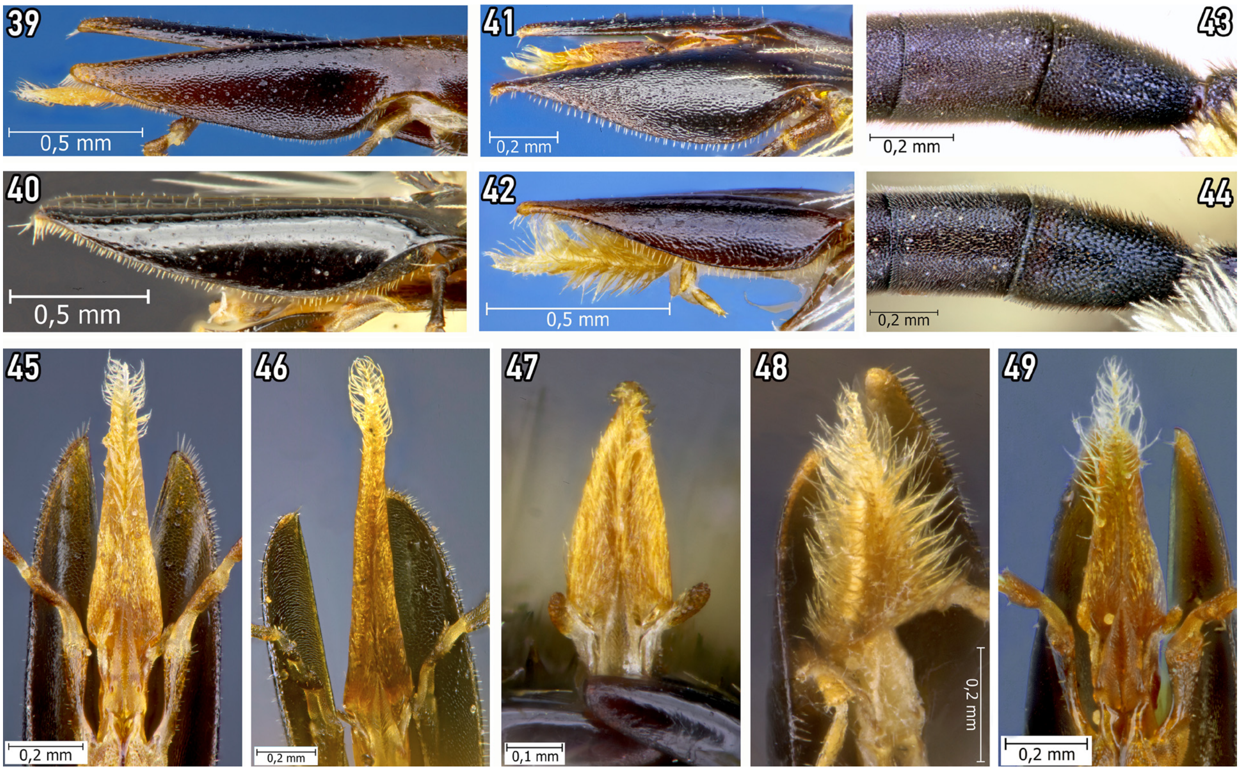


FIGURES 1–13. Male of *Dasypoda schwarzi* **sp. nov.**: 1—Habitus, dorsal view; 2—Habitus, lateral view; 3—Pedicel and flagellum; 4—Malar area; 5—Glossa and labial palpi, dorsal view; 6—Head, frontal view; 7—Scutum; 8—Propodeum; 9—Galea and maxillar palpus, lateral view; 10—Metasoma, dorsal view; 11—Metasoma, ventral view; 12—Marginal part of 1st tergum; 13—Sternum 5. (1, 2, 7–13—holotype; 3–6—paratype).

FIGURES 14–25. Structure of *Dasypoda schwarzi* **sp. nov.** male sterna and genitalia. 14—Sternum 6; 15—Apical part of sternum 6; 16—Apical part of sternum 8; 17—Sternum 7; 18—Apical part of sternum 7; 19, 20—Sternum 8; 21–25—Genitalia. (14, 17, 19, 23—ventral, 15, 16, 20, 21— dorsal, 18—laterodorsal, 22—lateral, 24—dorsoapical, 25—ventro-apical view).



FIGURES 26–38. Structure of *Dasypoda schwarzi* **sp. nov.** male genitalia. 26–31—General view of genitalia, 32—Outer lobe of gonostylus; 33–34—Inner lobe of gonostylus; 35—Inner side of outer lobe of gonostylus; 36–37—part of the inner surface of outer lobe of gonostylus with highly elevated crater-like raised hair-bearing alveoli; 38—pollen grains of Malvaceae on genitalia. (26, 34—dorsal; 27, 35–37—dorso-lateral; 28—ventral; 29, 32—lateral; 30—apico-dorsal; 31—apico-ventral; 33— dorso-ventral view).



FIGURES 39–49. Structure of *Microdasypoda* male galea (39–42, lateral view), glossa (45–49, ventral view), 1st and 2nd flagellomeres (43, 44, frontal view): 39, 43, 45—*Dasypoda brevicornis;* 40, 46—*D. cingulata;* 41, 47—*D. crassicornis;* 42, 48—*D. iberica;* 44, 49—*D. schwarzi* **sp. nov.**

Head slightly wider than long (**Fig. 6**): L = 2.9 mm (paratypes: 2.8 mm and 2.7 mm), W = 3.4 mm (paratypes: 3.2 and 3.1 mm, respectively); clypeus densely punctured by oblique downward hair-bearing punctures separated by 0.5–1 puncture diameter with abundant long, dense, white adjacent hair obscuring underlying surface, apex of clypeus with narrow depressed impunctate band. Paraocular area irregularly punctate, punctures separated by 1–3 puncture diameter. Paraocular and supraclypeal areas and basal part of frons with long erect pale-white plumose hairs, intermixed on upper part near vertex with dark brown hair. Genal area, apical parts of vertex, and occiput with long, erect pale-white pubescence intermixed with dark brown hair. Central part of frons with narrowly depressed, median stripe, upper part of frons medially polished, unpunctured; laterally irregularly, sparsely punctate and very weakly shagreened. Malar space narrow, 4 times as broad as long, (W = 0.43 mm, L = 0.11 mm) (**Fig. 4**). Antennal scape anteriorly with long erect white hair. Flagellum moderately long, first flagellomere 1.7 times as long as its apex width and 1.25 times longer than second one (**Fig. 3, 44**). Labrum polished and shining, apical edge with long dense fringe of golden-yellow or pale-yellow thick hair. Glossa short: L = 0.65 mm, widened at base: W (at base) = 0.23 mm (**Fig. 5**). 2nd and 3rd segments of labial palpi apically swollen. Galea weakly shagreened with very sparse and superficial punctation (**Fig. 9**); maxillary palpi subequal in length with galea.

Mesosoma: W (between tegulae) = 2.9 mm (paratypes: 2.9 mm and 2.7 mm). Scutum with hair-bearing punctation, punctures separated by 1–1.5 puncture diameters with exception of sparsely punctate (3–4 puncture diameters) central part (**Fig. 7**); mesosoma ventrally covered with very long, erect white hair, laterally and dorsally with pale-yellow hair, on scutum intermixed with shorter dark brown hairs; scutellum and metanotum with rufous hair. Propodeal triangle finely shagreened, basally with narrow transverse rugosity; external margins well-defined by lateral lines (**Fig. 8**). Propodeum laterally very weakly shagreened and sparsely punctured with long erect yellow hair. Wings hyaline with light brown tint; tegulae, venation and stigmata dark brown. Nervulus (*cu-v*) antefurcal. Legs with long pale-yellow pubescence, apart from greyish pubescence of inner side of tibiae and dense short ginger-yellow pubescence of inner side of metabasitarsus.

Metasoma (**Figs 10, 11**): L = 5.8 mm (paratypes: 5.7 and 5.3 mm); W = 4.3 mm (paratypes: 4.3 mm and 3.8 mm, respectively). T1 basal part with oblique, moderately sparse punctation with long, semierect hair; separated by 1–3 puncture diameters; marginal part of T1 depressed, almost unpunctured and very thinly and densely transversely wrinkled with sparse superficial weakly noticeable punctation bearing short brown hair (**Fig. 12**); narrow apical margin of all terga light, translucent. Basal parts of T2–T5 moderately dense punctured, punctures separated by 1–2 puncture diameter with long semi-adjacent yellow hair, underlying surface with sparse short brown hair. Apical margins of T2–T5 slightly depressed with entire bands of very short dense white hairs covered from above by apical parts of long yellow hair. Basal part of T6 densely punctate by hair-bearing puncture with semi-adjacent long yellow hair (in holotype specimen this pubescence erased), laterally with long erected pale-yellow hair intermixed with sparse brown hair; apical margin of this tergum polished, impunctate. Basal parts of sterna moderately sparse punctured (denser on S2–S4 and sparser on S5) by very small oblique hair-bearing punctures with very short dark brown hair; underlying surface weakly shagreen (**Fig. 13**). Sternal margins with sparse, yellow hair fringes longer laterally and shorter centrally, narrowly interrupted at the centre of S1–S4, and widely on S5. Marginal parts of S1–S5 very sparse punctured, polished, its narrow apical margin light, translucent, on S2–S5 medially widely roundly notched. S6 marginal part medially with wide projection deeply triangularly emarginated on apex (**Figs 14, 15**). S7 (**Fig. 17**) latero-apically with short, weakly sclerotized semicircular projections bent towards inner side of sternum (**Fig. 18**). S8 relatively short, stumpy, deeply semicircularly concave laterally before widened basal part (**Figs 19, 20**); apex of S8 posterodorsal part with whole transverse carina not notched or emarginated in centre (**Fig. 16**). Genitalia with bilobed gonostyli (**Figs 21–34**). Inner lobe of gonostylus moderately wide and long, widened in a circular shape at apex and covered with sparse long setae on surface facing penis valves and on margins (**Figs 33, 34, 85, 86**); external lobe wide, its apex obliquely truncated (**Fig. 32**), ventral part narrowly, triangularly elongated, inner surface with several hairs, each inserted into crater-like raised alveoli (**Figs 35–37**).

Female unknown.

Distribution. Northwest Africa: Atlas Mountains area (Morocco and Tunisia) (**Fig. 89**).

Floral visitation. Pollen grains of the Malvaceae plant family were mainly found on the body of the paratype (**Fig. 38**), and only a few grains of Asteraceae.

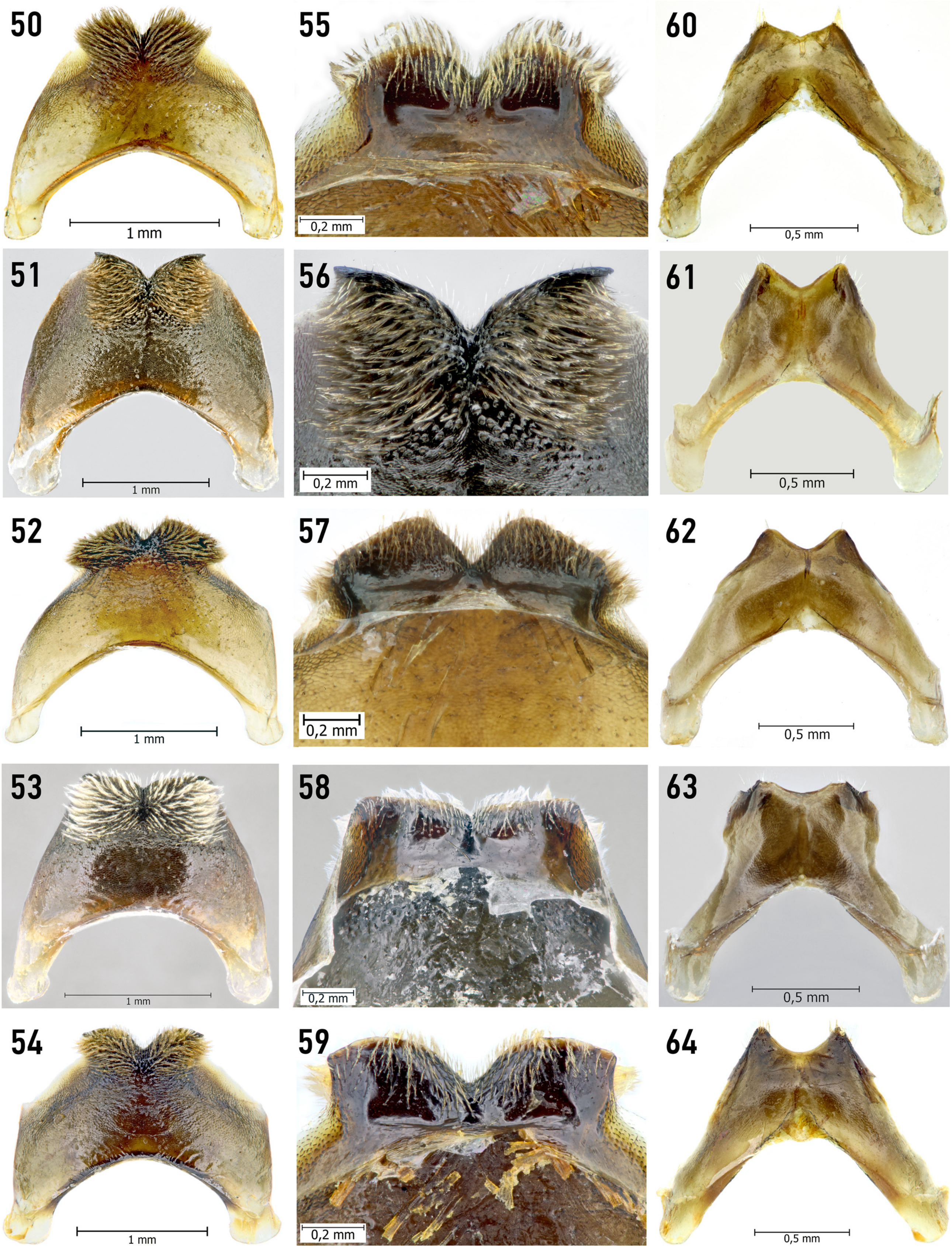
Species diagnosis. The main significant differences *D. schwarzi* sp. nov. from the other known species of *Microdasypoda* concern the structure of genitalia. Other *Microdasypoda* species have single-lobed gonostyli with a spine-like tooth on the inner basal part (in *D. cingulata, D. crassicornis and D. iberica*; **Figs 82–84**) or bilobed gonostyli with a thickened internal lobe that has a very dense, long pubescence on surface facing penis valves (in *D. brevicornis*; **Figs 75, 80, 81**). Unlike other representatives of this subgenus, the genitalia of *D. schwarzi* have bilobed gonostyli with the inner lobes that are laterally flattened and dorso-ventrally widened in a circular shape at the apical part, and with sparse setae on the surface facing penis valves (**Figs 85, 86**).

By the structure of its genitals and sterna, *D. schwarzi* is most similar to *D. brevicornis*, sharing the same structure of S6, S7, dorso-apical part of S8, glossa and galea. In both species, unlike other *Microdasypoda*, the setae along the lower edge of the galea are longer in the apical half than in the basal half where they are very short and poorly visible (**Figs 9, 39**) (Michez *et al.* 2004b indicated the absence of setae in the basal half of galea, probably due to the relatively lower resolution of optics used at that time).

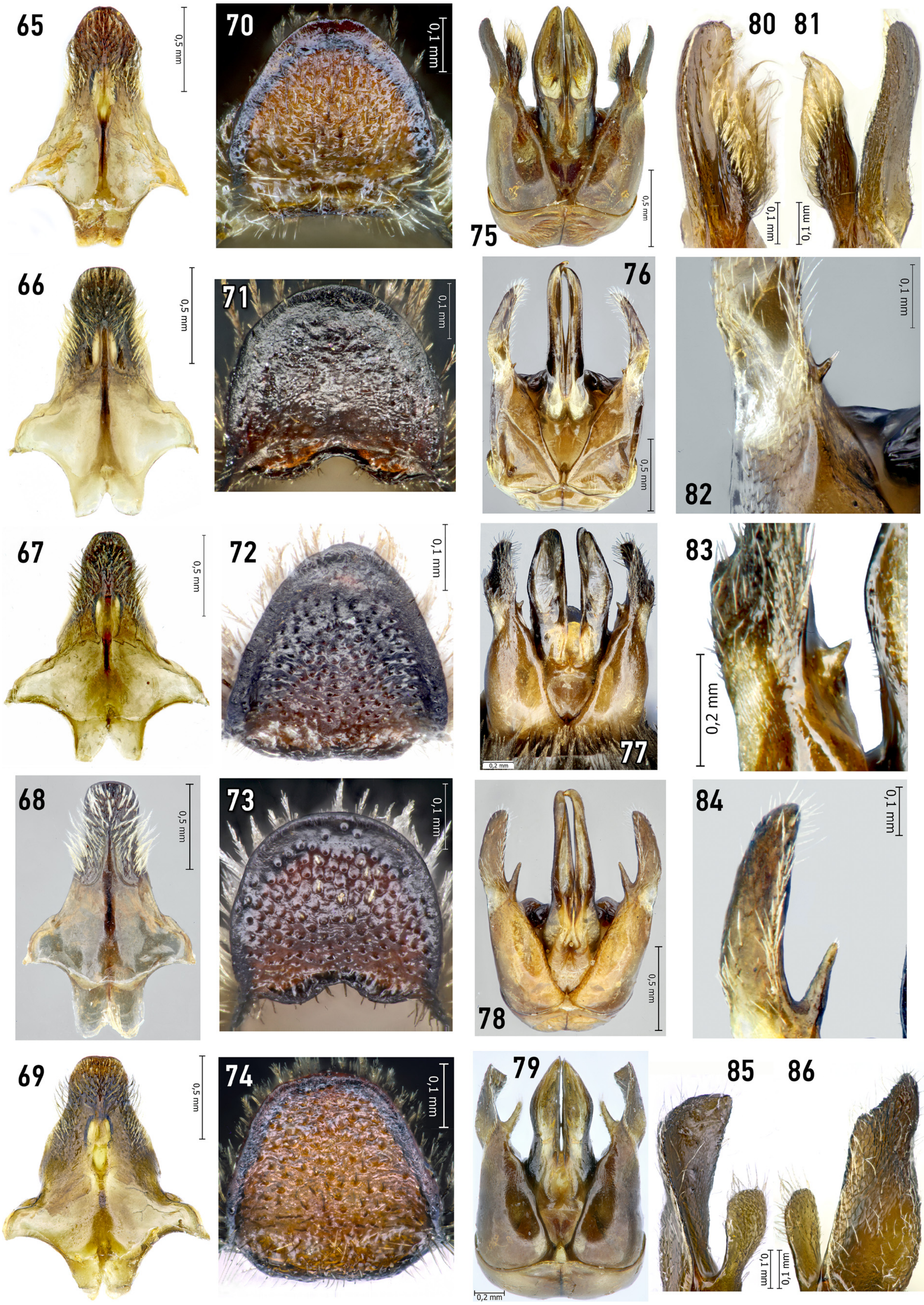
Dasypoda schwarzi can also be separated from *D. brevicornis* by the following features : the external lobe of the gonostyle in *D. schwarzi* with a strongly oblique apex (**Figs 21, 23, 29, 32**); the digitus of its volsella shorter and wider (**Fig. 28**); the 1st flagellomere relatively longer (**Figs 43, 44**); the mandibular palpus with thicker segments (**Figs 5, 6, 9**); the apical projection of the S6 with right angles on the outer edges (rather than rounded lateral corners as in *D. brevicornis*) (**Figs 55, 59**); the lateral margins of the S8 deeply semicircularly notched before the apodemes (straight-beveled lateral margins of S8 in *D. brevicornis*) (**Figs 65, 69**); and the lower half of the face with light pubescence without dark brown or black hair (the latter being typical in *D. brevicornis*).

Remarks on the comparative morphology of *Microdasypoda*. The use of modern optics with a higher resolution made it possible to refine the original diagnosis of the subgenus *Microdasypoda* Michez (Michez *et al.* 2004b). In particular, the outer lobe of the gonostyle may have a lanceolate shape (in *D. crassicornis*), the S7 in almost all species of the subgenus (with the exception of *D. iberica*) has a very small almost non-chitinous latero-apical outgrowths (**Fig. 18**); the dorso-apical part of S8 has an entire transverse carina or two partly or completely separated teeth (**Figs 70–74**); the S6 apicoventrally may have not only brown pubescence (in most species), but can also present a complete silver-white pubescence (in *D. iberica*; **Fig. 53**; Radchenko *et al.* 2019).

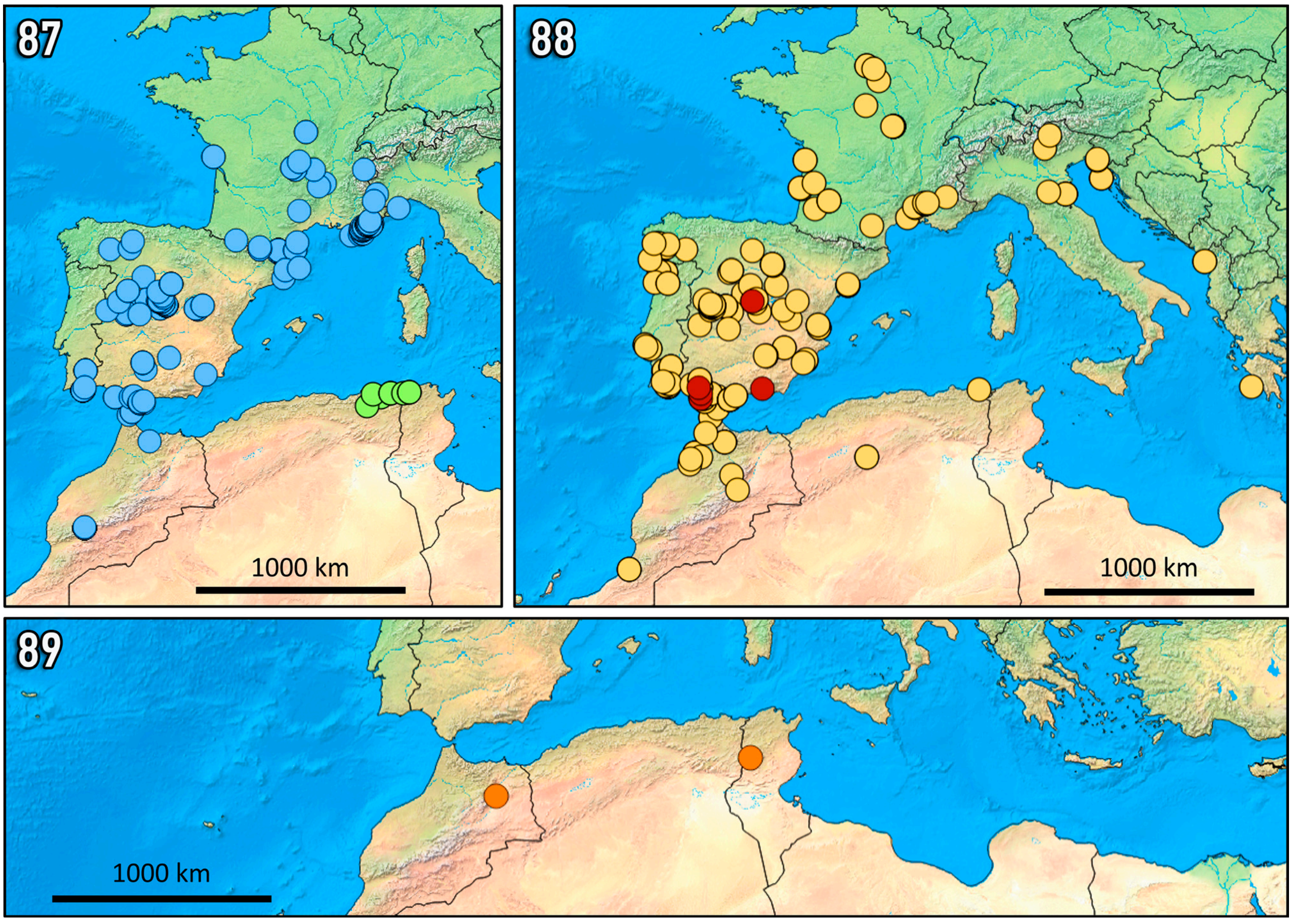
This updated clarification of the diagnostic characters of all species belonging to the subgenus *Microdasypoda*, as well as the detailed morphological characters of the male of *D. iberica* that was recently published (Radchenko *et al.* 2019) made it possible to compose a corrected and updated key for the males.



FIGURES 50–64. Structure of *Microdasypoda* male sternum 6 (50–54) and its apex (55–59), sternum 7 (60–64): 50, 55, 60—*Dasypoda brevicornis;* 51, 56, 61—*D. cingulata;* 52, 57, 62—*D. crassicornis;* 53, 58, 63—*D. iberica;* 54, 59, 64—*D. schwarzi* **sp. nov.** (50–54, 56, 60–64—ventral view; 55, 57–59—dorsal view).



FIGURES 65–86. Structure of *Microdasypoda* male sternum 8 (65–69) and the apex of its posterodorsal part (70–74), genitalia (75–79) and its gonostylus (80–86): 65, 70, 75, 80, 81—*Dasypoda brevicornis;* 66, 71, 76, 82—*D. cingulata;* 67, 72, 77, 83—*D. crassicornis;* 68, 73, 78, 84—*D. iberica;* 69, 74, 79, 85, 86—*D. schwarzi* **sp. nov.** (65–69—ventral view; 70–74, 75–79, 82–84—dorsal view; 80–81, 85–86—laterodorsal view).



FIGURES 87–89. Distribution maps of *Microdasypoda* species: 87—*Dasypoda crassicornis* (blue dots) and *D. brevicornis* (green dots); 88—*D. cingulata* (yellow dots) and *D. iberica* (red dots); 89—*D. schwarzi* **sp. nov.** (orange dots).

Key to the males of *Dasypoda* (*Microdasypoda*) Michez, 2004

1. Galea black, smooth, polished, shiny, with very sparse punctures (**Fig. 40**). Glossa narrow and relatively long, 5 times as long as wide (**Fig. 46**). S6 with brown apical pilosity directed laterally (**Figs 51, 56**). Marginal edge of S6 strongly bent outside ventrally, especially at the lateral angles (**Fig. 56**). S7 marginal part deeply notched centrally, its lateral apodemes relatively short (**Fig. 61**). Dorso-apical part of S8 with two wide, partly separated outgrowths (**Fig. 71**); lateral apodemes before pregladular area of this sternum rectangularly widened on the sides (**Fig. 66**). Gonostylus strongly widened and not rounded apically; inner basal part of gonostylus with very short tooth; penis valvae narrower than gonostylus (**Figs 76, 82**). Mid and hind legs with the last article often yellow. **Distribution:** species mostly distributed in the western part of the Mediterranean basin (**Fig. 88**) . . . . *Dasypoda cingulata* Erichson, 1835

– S6 with apical pilosity directed radially (**Figs 50, 52–54**). Latero-apical angles of S6 flat, not curved outward ventrally (**Figs 55, 57–59**). Dorso-apical part of S8 with entire transverse carina (**Figs 70, 72, 74**) or with two semicircular, completely separated outgrowths (**Fig. 73**); lateral apodemes before pregladular area of this sternum more beveled on the sides (**Figs 65, 67–69**). Inner basal part of gonostylus with longer tooth or lobe-like projection, or penis valvae are wider than gonostylus. Galea brown to dark brown, tightly covered with small tubercles that in some places form the thin wavy striae (**Figs 9, 39, 41, 42**). Glossa wider and relatively shorter, 2.5-3.5 times as long as wide (**Figs 45, 47–49**). Mid and hind legs with last article brown to black **2**

2. Marginal part of S6 very slightly notched centrally and with white pilosity (**Figs 53, 58**). Apical third of S7 strongly widened, its marginal part slightly notched centrally (**Fig. 63**); dorso-apical part of S8 with two deeply separated semicircular outgrowths (**Fig. 73**). Penis valves narrower than gonostyle; inner basal part of gonostylus with a long spine-like tooth (**Figs 78, 84**). Pilosity of the body silver-white. **Distribution:** species endemic to central and southern Spain (**Fig. 88**) . . . . *Dasypoda iberica* Warncke, 1973

– Marginal part of S6 strongly triangularly notched centrally, forming two separate projections covered with a brown pilosity (**Figs 50, 52, 54**). Apical third of S7 narrowed, its marginal part strongly notched centrally (**Figs 60, 62, 64**); dorso-apical part of S8 with entire transverse carina very slightly notched centrally (**Figs 70, 72, 74**). Inner basal part of gonostylus with a small tooth or bilobed without a long spine-like tooth. Penis valves as wide as the gonostyle (**Figs 75, 77, 79**). Pilosity of the body mostly yellowish to brownish. **3**

3. Face with a patch of pure white hairs surrounded by a pure black pilosity. S6 apical projections with right angles on the inner edges (**Figs 52, 57**). Gonostylus narrowed at apex, lanceolate, with a small tooth at the base (**Figs 77, 83**). **Distribution:** species bound to the western part of the Mediterranean basin (Italy, France, Spain, Portugal and Morocco; **Fig. 87**) . . . . *Dasypoda crassicornis* Friese, 1896

– Hair of the face with a different colour pattern. Apical projections of S6 with rounded angles on the inner edges (**Figs 50, 54**). Gonostyli bilobed without spine-like tooth at the base (**Figs 75, 79**) 4

4. 1st flagellomere relatively shorter, conical, 1.4 times as long as wide at the apex (**Fig. 43**). Face with a yellowish pilosity intermixed with black hairs especially on the paraocular areas. Apical projections of S6 with rounded angles on the outer edges (**Fig. 55**). S8 not notched laterally before the widened basal part (**Fig. 65**). Gonostylus with a well-developed internal lobe strongly thickened in the middle and with very dense long pubescence on the side facing the penis valvae; external lobe rounded at the top (**Figs 75, 80, 81**). **Distribution:** species only recorded in the northern parts of Algeria and Tunisia (**Fig. 87**) . . . . *Dasypoda brevicornis* Pérez, 1895

– 1st flagellomere relatively longer, partly cylindrical in apical half, 1.7 times as long as wide at the apex (**Fig. 44**). Face with a white pilosity except vertex and adjacent parts that intermixed with black hairs. Apical projections of S6 with right angles on the outer edges (**Fig. 59**). S8 deeply notched laterally before the widened basal part (**Fig. 69**). Inner lobe of gonostylus widened in a circular shape and flat at the apical half, racquet-like with a widened base, and covered with very sparse long setae on surface facing penis valves; external lobe of gonostylus wide, its apex oblique truncated (**Figs 79, 85, 86**). **Distribution:** species currently known from Morocco and Tunisia (**Fig. 89**) . . . . *Dasypoda schwarzi* Radchenko & Michez **sp. nov.**

Discussion

We provide the description of the melittid bee *Dasypoda schwarzi* Radchenko & Michez **sp. nov.** based on three male specimens collected in Tunisia and Morocco. These specimens present unique morphological features and a differentiated colour pattern amongst the subgenus *Microdasypoda* Michez, making their identification straightforward.

Taxonomy

The combination of morphological features of *Dasypoda schwarzi* confirms some of the synapomorphies of the subgenus *Microdasypoda* proposed by Michez *et al*. (2004b), and our use of modern optics helped us to refine some of its characteristics (see results). Interestingly, Michez *et al*. (2004b) pointed that *D. brevicornis* presents divergent morphological features that are not shared with any *Microdasypoda* described at the time, namely (i) the absence of a more or less long tooth at the base of the gonostyle, (ii) the puncture of the galea being dense and deep, and (iii) the margin of the galea showing clearly visible setae only on the apical half (basal setae being very short). Moreover, the apical projections of S6 have rounded angles on the inner edges and the preapical transverse carina on the dorsal side of S8 does not have a medial notch. Given that *D. schwarzi* shares all of these characteristics with *D. brevicornis*, we can hypothesize that both species are likely to be closely related among the subgenus *Microdasypoda*.

Ecology

Dasypoda bees generally rely on flower-rich environments, and the subgenus *Microdasypoda* is mostly associated with Cistaceae and Malvaceae (Michez *et al*. 2004b, 2008). Here, we observed on the body of a paratype pollen grains of the plant families Malvaceae and Asteraceae, which is consistent with the floral choices of other species of the subgenus. Other representatives of *Microdasypoda*, e.g., *D. cingulata* and *D. crassicornis*, are also associated with Malvaceae and Asteraceae, although *D. crassicornis* was also recorded on Cistaceae, Geraniaceae and Lamiaceae with only few records on the flowers of other plants (Michez *et al.* 2003, 2004b). Additional work is needed to refine our understanding of the habitats and foraged plants of *Dasypoda schwarzi* across its distribution, and the discovery of females with pollen-carrying scopae would be especially helpful to properly assess consistency of its floral choices with regards to other representatives of the subgenus. Furthermore, additional observations of *D. schwarzi* would be necessary to delineate more in detail the timing of its flight period. Our records suggest that the flight period of the males of *Dasypoda schwarzi* encompasses at least April and May. Flight in late spring is consistent with the phenology of the males of *D. brevicornis* whose two described male specimens were recorded in April in Tunisia and in June in Algeria (Michez *et al*. 2004a). More observations of these species are needed to assess if these available data properly reflect their respective phenologies, and if both species can occur in sympatry at least in part of their ranges.

Northern Africa as a bee-rich subcontinent

The distribution of *Dasypoda schwarzi* in Morocco and Tunisia is consistent with the centre of distribution of the subgenus *Microdasypoda*, with all species found across the western part of the Mediterranean basin (Michez *et al*. 2004b; Radchenko *et al*. 2019). The new species is one of the six *Dasypoda* endemic to the African continent (along with *D. brevicornis, D. maura*, *D. oraniensis, D. riftensis*, *D. sinuata*) and the second endemic *Microdasypoda* with *D. brevicornis*. Overall, 15% (6/40) of all known *Dasypoda* are endemic to Africa, and 35% (14/40) include this continent within their range.

The North African subcontinent presents an unusually high diversity of climates, from a Mediterranean climate along the northern coasts to deserts southwards, and from oceanic climates westwards to montane climates in interior mountains. Despite this rich variety of conditions, combined with a striking array of reliefs and microclimates, North African countries have been relatively poorly investigated in comparison to southern Europe (Michez *et al*. 2019). One exception is Morocco and its recently published checklist of wild bees (Lhomme *et al*. 2021), to which *D. schwarzi* can now be added. However, as stated by the latter authors, knowledge on Moroccan bees is still "*very basic*". New expeditions need to be organized and additional endemic species are expected to be described. The case of *D. schwarzi* indeed suggests that continued efforts are warmly encouraged to properly investigate and monitor the very diverse bee fauna of North Africa. Future works focusing on the ecology and distribution of such endemic species are needed to evaluate the potential threats that these insects could face in our changing environments.

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