

Biogeography, floral choices and redescription of *Promelitta alboclypeata* (Friese 1900) (Hymenoptera: Apoidea: Melittidae)

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Promelitta alboclypeata (Friese) is the only species included in the bee tribe Promelittini (Melittidae). Its taxonomic position is still dubious mainly because of the limited material available. On the basis of 381 new specimens and type material, we redescribe both sexes of *Promelitta alboclypeata* and designate the lectotype. Previously it was known only from Egypt. We present new biogeographical data from Morocco. In addition, taxonomy and new elements of ecology of *P. alboclypeata* are presented and discussed.

According to Engel (2001), the Melittidae are subdivided into four subfamilies: Dasypodainae, Macropidinae, Meganomiinae and Melittinae. These subfamilies consist of 14 genera, including approximately 165 species, and range worldwide, but not known in Australia and South America (Michener 1981, 2000). Most of these genera have been extensively reviewed (Stage 1966; Michener 1981; Whitehead & Steiner 2001; Michez *et al.* 2004a,b; Michez & Patiny 2005, 2006). One of the main characteristics of Melittidae is their specialist floral choices. In fact, most of melittid bees forage pollen on very few host plants (Michez *et al.* 2004b; Michez & Patiny 2005, 2006).

The taxonomic position of *Promelitta alboclypeata* (Friese) has for a long time been uncertain. Friese (1900) described this bee in the genus *Dufourea* Lepelletier (Halictidae, Rophitinae) from two males from Egypt. The genus *Promelitta* was described by Warncke (1977) on the basis of this previously described species. Michener (1981) transferred the genus to the Melittidae and proposed the new tribe, Promelittini containing the single genus *Promelitta*.

Promelitta alboclypeata is the only known species for the genus and the tribe Promelittini. Its ecology has not been recorded and its taxonomic position remains dubious because of the limited material

available (fewer than 10 specimens) until recently.

In the present paper, we designate the lectotype of *Promelitta alboclypeata*. We redescribe both sexes on basis of 381 specimens and present new biogeographical data from Morocco. In addition, taxonomy, geographic distribution and elements of ecology of *P. alboclypeata* are presented and discussed.

One of us (D.M.) studied the type material of *P. alboclypeata* in the collections of the Naturhistorisches Museum Wien (MNH, Vienna, Austria). Additional material belonging to the Oberösterreichisches Landesmuseum Linz (OOLL, Austria), the Natural History Museum, London (BMNH, U.K.) and the University of Mons-Hainaut (UMH, Belgium) was also examined.

The maps are based on 364 specimens from the OOLL, 1 specimen from the BMNH and 16 specimens from the UMH. Biogeographical data have been included in the *Banque de Données Fauniques Gembloux-Mons* (BDFGM). They were managed using Data Fauna Flora 2.0 (Barbier *et al.* 2000). Conventional geographic coordinates of the records have been searched in the numeric gazetteer included in the software (CFFGazet). Data were mapped using Carto Fauna Flora 2.0 (Barbier & Rasmont 2000). A gall geographical projection was used for mapping the data.

The glossary of Harris (1979) was used for the description of the surface sculpture and Michener (2000) for the morphology. The following abbreviations are used for morphological structures: A = antenna segment (A1 = Scape); Bt = basitarsus; Tb = tibia; S = sternum; F = femur; T = tergum.

Abbreviations followed by a number denotes either that leg or segment.

Cuticular ultrastructure was studied using SEM (JEOL JSM-6100) linked to the software package 'Semafore' (JEOL, Sollentuna, Sweden).

Morphometric values included in the diagnosis and the description are based on 30 females and three males.

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Tribe **Promelittini** Michener 1981

Promelittini Michener, 1981: 54. Type genus:
Promelitta Warncke 1977.

Diagnosis

Jugal lobe about half as long as vannal lobe. Metasomal terga with basal hair bands and without apical hair bands. Clypeus of male largely white. Bt3 female with expanded apical blade (Fig. 1d). Pygidial plate female with median elevated area (Fig. 1e).

Genus **Promelitta** Warncke 1977

Melitta (*Promelitta*) Warncke, 1977: 59. Type species: *Dufourea alboclypeata* Friese (original designation).

Diagnosis

As for the tribe.

Promelitta alboclypeata (Friese 1900)

Dufourea alboclypeata Friese, 1900: 86, male. Original designation of the locus typicus: 'Aegypten'

Diagnosis

Female and male. Head broader than long (Fig. 1a). Paraglossa attenuate apically (Fig. 2a). Maxillary palpus twice as long as galea. Galea as broad as long, tapering apically (Fig. 1b). External margin of galea with long yellow hairs (Fig. 1b). Eyes converging below (Fig. 1a). Propodeal triangle hairless, smooth and polished. Propodeum with anterior half horizontal and posterior half vertical (Fig. 2c). Forewing with two submarginal cells, the second longer than the first. Stigma shorter than second submarginal cell. Spurs of Tb2–3 slightly curved apically, without outstanding teeth, with serrate sculpture (Figs 1c, 2b). Metasomal terga with entire basal hair bands.

Female (Fig. 1). Body length = 8 mm. Tb3 with narrow keirotrochia on inner surface (Fig. 1g). Bt3 three times longer than broad; with expanded apical blade (Fig. 1d). Pygidial plate with median elevated area (Fig. 1e).

Male (Fig. 2). Body length = 7 mm. Clypeus largely whitish to yellowish. Labrum smooth. A3 longer than A4. A5–A13 twice as long as broad. Tb3 with broad keirotrochia on inner surface (Fig. 2b). Pygidial plate absent. S7 with reduced basal part; with two latero-apical structures covered with short appressed hairs; the first is short and

pointed; the second is long and pedunculate (Fig. 2d). S8 with two latero-apical teeth; apical column with appressed whitish hairs; apical area of column oval-shaped. Gonostylus simple, narrow and jointed, with long yellowish erect hairs (Fig. 2e,f). Penis valves narrow, with inner teeth (Fig. 2e,f).

Redescription, excluding diagnostic characters

Female (Fig. 1). *Head.* Length 2 mm. Maximal width 3 mm. Head broader than long and entirely black (Fig. 1a). A1–A3 black. A4–A12 ventrally reddish, dorsally black. Clypeus, face, genal area and preoccipital ridge with erect white hairs (Fig. 1a). Vertex glabrous (Fig. 1a). Labial palpus equal to length of glossa, half as long as maxillary palpus. Entire outer face of galea dull and punctate. Galeal comb with 13 teeth (Fig. 1b). External margin of stipe straight. Mandible with preapical tooth. Labrum strigulate, blade-like. Malar area shorter than length of scape (Fig. 1a). Clypeus glossy and shiny, with few punctures. Face and vertex polished, with dense punctures. *Mesosoma.* Length 3 mm. Maximal width 3 mm. Tegument entirely black, polished, with few punctures. Pronotum, margins of scutum, propodeum, mesepisterna, metanotum and ventral face of mesosoma with long, whitish erect setae. Median area of scutum and scutellum nearly hairless. *Legs.* Tegument mainly black with whitish to yellowish hairs. Distitarsi 1–3 reddish. Spurs of Tb2–3 slightly curved apically, with 'scaled' tegument (Fig. 1c). Basitibial plate present, with yellow appressed hairs. Scopa with long, dense, yellowish, simple hairs (Fig. 1g). Hairs of keirotrochia flattened apically (Fig. 1f). Bt3 three times as long as broad. *Wings.* Basal vein weakly curved. Abscissa of Rs at right angles to longitudinal veins. Apex of marginal cell pointed. *Metasoma.* Length 4 mm. Maximal width 4 mm. Disc of terga and disc of sterna black, with dense superficial punctures. Marginal areas of terga and marginal area of sterna reddish and impunctate. Terga with marginal areas glabrous. Pygidial fimbria brownish. Sterna with long yellowish apical hairs. Marginal areas of terga broader medially, with apical margin straight. Marginal areas of sterna with constant length. Apical margin of sterna straight.

Male (Fig. 2). *Head.* Length 2 mm. Maximal width 3 mm. Tegument mostly black except clypeus. Antennae entirely brownish. Pilosity similar to female. Structure of mouthparts similar to female

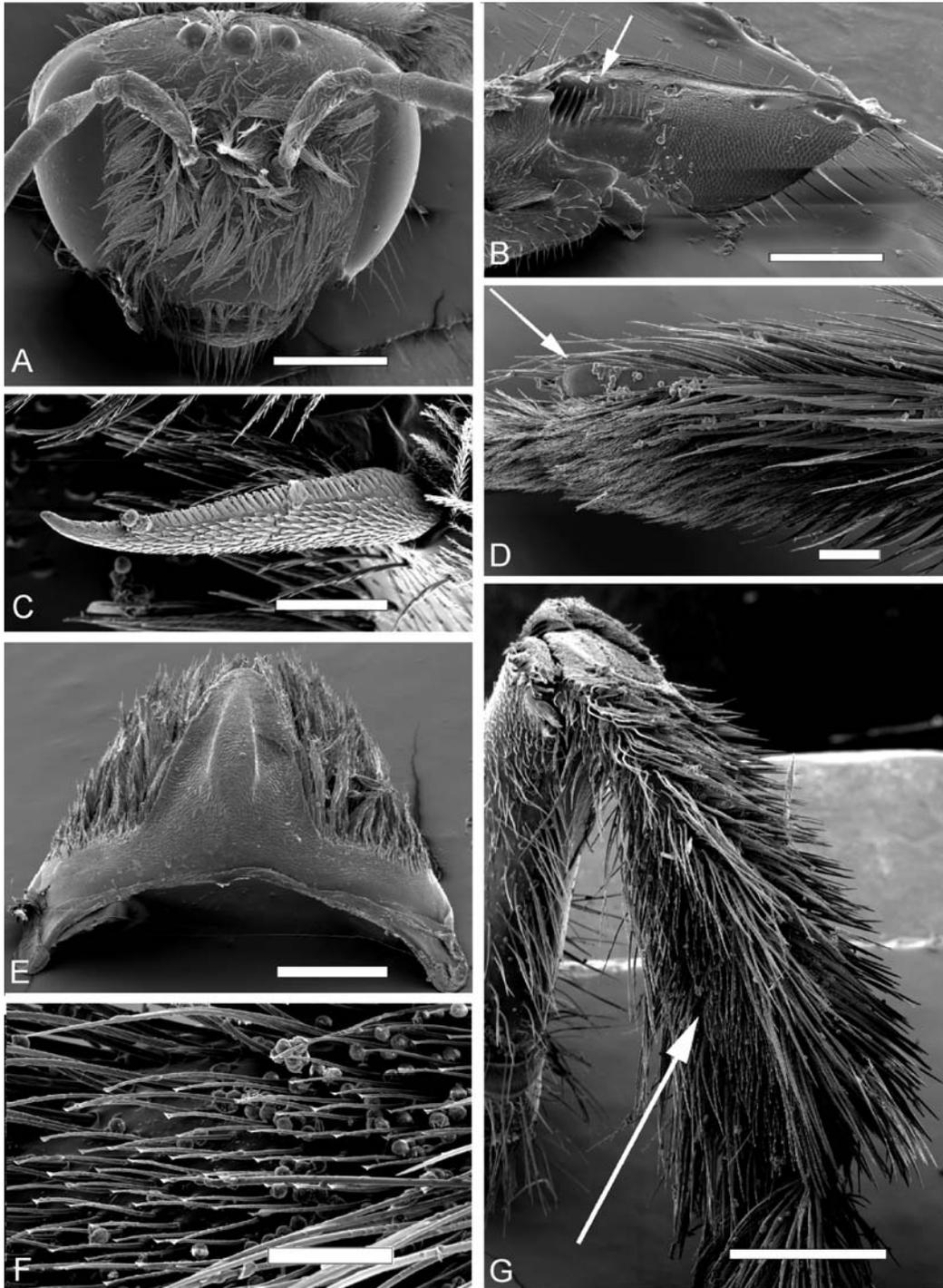


Fig. 1. *Promelitta alboclypeata* female. **A**, head (scale bar = 0.7 mm); **B**, inner surface of galea with fringe (arrow) (scale bar = 200 μ m); **C**, spur of Tb2 (scale bar = 100 μ m); **D**, Bt3 with flat blade on apex (arrow) (scale bar = 100 μ m); **E**, pygidial plate (scale bar = 500 μ m); **F**, detail of hairs of keirotrichia (scale bar = 100 μ m); **G**, tibia 3 with keirotrichia on inner face (scale bar = 0.7 mm).

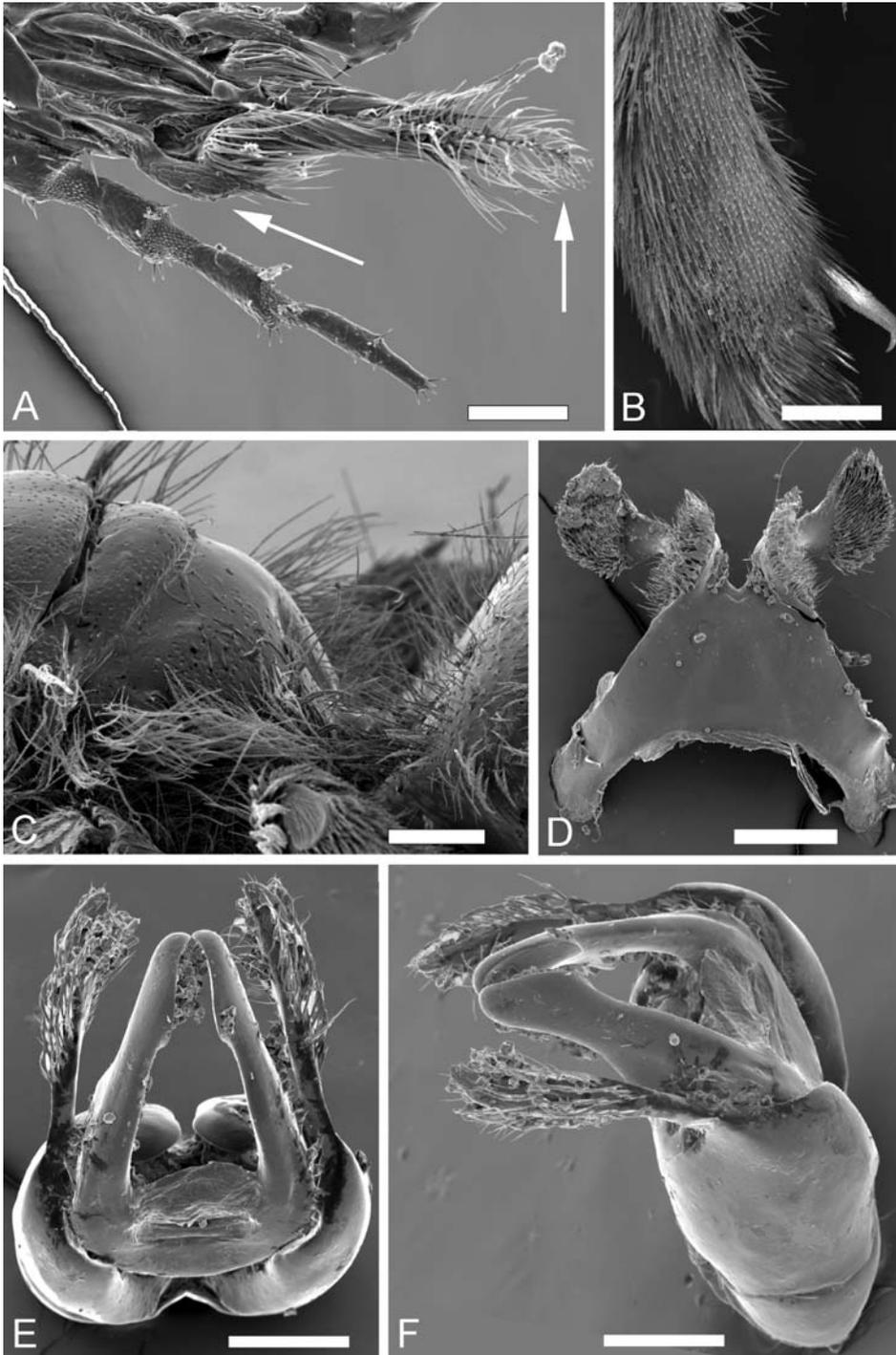


Fig. 2. *Promelitta alboclypeata*, male. **A**, ventral view of proboscis, with attenuate paraglossa (left arrow), with pointed glossa (right arrow) (scale bar = 200 μ m); **B**, inner view of Tb3 with keirotichia (scale bar = 300 μ m); **C**, lateral view of propodeum (scale bar = 0.5 mm); **D**, sternum 7 (scale bar = 200 μ m); **E**, dorsal view of genitalia (scale bar = 300 μ m); **F**, lateral view of genitalia (scale bar = 300 μ m).

(Fig. 2a) except for fringe of galea with only seven teeth. Labrum polished. A3 longer than A4. A5–A13 each twice as long as broad. *Mesosoma*. Length 3 mm. Maximal width 2 mm. Pilosity and structure as in the female (Fig. 2c). *Legs*. Mainly black clothed with white hairs on outer face and with yellow hairs on inner face. Base of Tb1 white. Distitarsi reddish. Basitibial plate present, with whitish appressed hairs. Spurs of Tb2–3 with ‘scaled’ tegument (Fig. 2b). Tb2–3 with broad keirotichia on inner face (Fig. 2b). Hairs of keirotichia with flattened apex. Bt3 three times as long as broad. *Wings*. As in female. *Metasoma*. Length 4 mm. Maximal width 3 mm. Discs of terga and sterna black, with dense superficial punctures. Marginal areas of terga and sterna reddish. Terga with marginal area glabrous. Apical margin of S1 medially notched. Apical margin of S2–S5 straight. S6 with wide basal area; apex broadly truncate; median apical part weakly curved, covered with short, dense, yellowish hairs. S7, gonostylus and penis valves like Fig. 2d,f.

Distribution (Fig. 3). Disjunct distribution; Morocco, Egypt and Sudan.

Floral visits (in Morocco). Convolvulaceae: *Convolvulus trabutianus* Schweinf. & Muschler (one male); Brassicaceae: yellow Brassicaceae (15 females; one male).

First–last observations (in Morocco). 06.IV–17.V

Type material (designated here). Male lectotype, Egypt [?], MNH.

Lectotype male (MNH), labels: first, printed on white paper ‘*Wilm.*’; second handwritten with black ink on blue paper ‘*Aegypt.Kl.*’; third handwritten with black ink on white paper ‘*Dufourea alboclypeata* male det. Friese 1896 type’; fourth printed on red paper ‘*Lectotype Promelitta alboclypeata (Friese) Design Michez D. 2006*’.

Additional material examined. 1♀, Sudan, Gebel Elba [22°12′N 36°20′E], 04.ii.1933, det. Warncke, OOLL; 2♀/1♂, Egypt [?], det. Warncke, OOLL; 3♀/2♂, Morocco, Tafilalet [31°18′N 04°18′W], 11.iv.1979, det. Warncke, OOLL; 10♀/9♂, Morocco, Ouarzazate [30°55′N 06°55′W], 07.iv.1980, det. Warncke, OOLL; 1♀, Morocco, Ait Saïd Ou Amar [32°21′N 04°06′W], 06.iv.1980, det. Warncke, OOLL; 7♀/2♂, Morocco, Oued Zguid [29°46′N 07°10′W], 29.iv.1995, leg. Halada, det. Michez, OOLL; 327♀/1♂, Morocco, Guercif [34°14′N 03°22′W], 15–17.V.1995, leg. Halada, det. Michez, OOLL; 1♀, Morocco, Assa [28°37′N 09°26′W], 16–17.iv.1995, leg. Halada, det. Michez, OOLL; 1♂,

Morocco, Erfoud to Tinejdad road km 40 [31°32′N 04°37′W], 14.iv.1993, on *Convolvulus trabutianus* (Convolvulaceae), leg. Else, det. Else, BMNH; 1♀, Morocco, Erfoud to Msissi road [31°16′N 04°22′W], 763 m, 11.iv.2006, on yellow Brassicaceae, leg. Patiny & Michez, det. Michez, UMH; 1♀, Morocco, Erfoud to Msissi road [31°14′N 04°29′W], 802 m, 11.iv.2006, on yellow Brassicaceae, leg. Patiny & Michez, det. Michez, UMH; 5♀/1♂, Morocco, Erfoud to Msissi road [31°16′N 04°22′W], 763 m, 12.iv.2006, on yellow Brassicaceae, leg. Patiny & Michez, det. Michez, UMH; 1♀, Morocco, Erfoud to Msissi road [31°14′N 04°29′W], 802 m, 12.iv.2006, on yellow Brassicaceae, leg. Patiny & Michez, det. Michez, UMH; 6♀, Morocco, North of Zagora [30°27′N 06°01′W], 788 m, 13.iv.2006, on yellow Brassicaceae, leg. Patiny & Michez, det. Michez, UMH; 1♀, Morocco, North of Zagora [30°26′N 05°59′W], 785 m, 13.iv.2006, on yellow Brassicaceae, leg. Patiny & Michez, det. Michez, UMH.

Morphology and taxonomy

Promelitta alboclypeata shares few apomorphies: metasomal terga with basal hair bands, shape of propodeum, Bt3 female with expanded apical blade, shape of hidden sterna male (S6–S8) and genitalia male. Others features are present in other melittid genera. For example, the female keirotichia and the shape of its setae are also present in *Eremaphanta* (Dasypodaini) and *Capicola* (Dasypodaini) but it is smaller in *Promelitta* (Fig. 1f–g) (Michener 1981; Engel 2005; Michez & Patiny 2006). The pygidial plate of the female has a median elevated area as in *Capicola* (Dasypodaini) and in Sambini (Michener 1981). The clypeus of the male is coloured as in some species of *Eremaphanta* (Dasypodaini) (Michez & Patiny 2006). The outer margin of stipes and latero-apical structure of S7 male are similar to *Dasypoda* (Dasypodaini) and Sambini (Michener 1981; Michez *et al.* 2004b). The gonostylus is articulated as Sambini (Michener 1981).

It is clear that *Promelitta* should be placed within the Dasypodainae but the relationships with others tribes (Dasypodaini and Sambini) are still uncertain. From our diagnosis and description *Promelittini* share more synapomorphies with Dasypodaini. These taxa could be included in a single tribe. To confirm this hypothesis, the phylogenetic relationship of *Promelitta* needs re-evaluation in the framework of a global phylogenetic



Fig. 3. Collecting localities of *Promelitta alboclypeata* in North Africa.

approach to the Dasypodainae, notably with molecular data.

Biogeography and ecology

The Moroccan and Egyptian/Sudanese collecting localities of *Promelitta alboclypeata* are separated by a distance of about 4200 km. The only plausible explanation of this disjunction is a strong extinction of more widely distributed ancestral populations. Similar disjunctions are also observed in other Dasypodainae such as Dasypodaini. The close genera, *Capicola* Friese, *Hesperapis* Cockerell and *Eremaphanta* Popov, are distributed in Southern Africa, North America and Central Asia, respectively (Michener 1981; Michez & Patiny 2006). Like other Dasypodainae, *Promelitta* could be a relict taxon. This could confirm the antiquity of this subfamily and its basal position inside the clade of Apoidea (Danforth 2006).

In Morocco, the species is present mostly in sub-Saharan and xeric areas. The vegetation at

40 km on the Erfoud Tinejdad road was typically of sparse bushes in sandy hollows near the roadside, and with linear growth of the spiny shrub, *Convolvulus trautianus* (Convolvulaceae), in the shallow flash-flood runnels on the hillside slopes.

All females of *Promelitta* were collected on yellow Brassicaceae. Like most of Melittidae, *Promelitta alboclypeata* seems oligolectic. If we validate the hypothesis of Danforth (2006), this specialist behaviour could be plesiomorphic in the bee clade.

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REFERENCES

- BARBIER, Y. & RASMONT, P. 2000. *Carto Fauna-Flora 2.0. Guide d'utilisation*. University of Mons-Hainaut, Mons, Belgium.
- BARBIER, Y., RASMONT, P., DUFRENE, M. & SIBERT, J.M. 2000. *Data Fauna-Flora. Guide d'utilisation*. University of Mons-Hainaut, Mons, Belgium.
- DANFORTH, B.N., FANG, J. & SIPES, S.D. 2006. Analysis of family-level relationships in bees (Hymenoptera: Apiformes) using 28S and two previously unexplored nuclear genes: CAD and RNA polymerase II. *Molecular Phylogenetics and Evolution* **39**: 358–372.
- ENGEL, M.S. 2001. A monograph of the Baltic Amber bees and evolution of the Apoidea (Hymenoptera). *Bulletin of the American Museum of Natural History* **259**: 1–192.
- ENGEL, M.S. 2005. Family-group names for bees (Hymenoptera: Apoidea). *American Museum Novitates* **3476**: 1–33.
- FRIESE, H. 1900. Neue palaearktische Bienenarten. *Entomologische Nachrichten* **16**: 85–87.
- HARRIS, R.A. 1979. A glossary of surface sculpturing. *Occasional Papers in Entomology* **28**: 1–31.
- MICHENER, C.D. 1981. Classification of the bee family Melittidae with a review of species of Meganomiinae. *Contribution of the American Entomological Institute* **18**: 1–135.

- MICHENER, C.D. 2000. *The Bees of the World*. Johns Hopkins University Press, Baltimore.
- MICHEZ, D. & PATINY, S. 2005. World revision of the oil-collecting bee genus *Macropis* Panzer 1809 (Hymenoptera, Apoidea, Melittidae) with a description of a new species from Laos. *Annales de la Société entomologique de France (n.s.)* **41**: 15–28.
- MICHEZ, D. & PATINY, S. 2006. Review of the bee genus *Eremaphanta* Popov 1940 (Hymenoptera: Apoidea, Melittidae), with the description of a new species. *Zootaxa* **1148**: 47–68.
- MICHEZ, D., TERZO, M. & RASMONT, P. 2004a. Révision des espèces ouest-paléarctiques du genre *Dasypoda* Latreille 1802 (Hymenoptera, Apoidea, Melittidae). *Linzer biologische Beiträge* **36**: 847–900.
- MICHEZ, D., TERZO, M. & RASMONT, P. 2004b. Phylogénie, biogéographie et choix floraux des abeilles oligolectiques du genre *Dasypoda* Latreille 1802 (Hymenoptera, Apoidea, Melittidae). *Annales de la Société entomologique de France (n.s.)* **40**: 421–435.
- STAGE, G.I. 1966. *Biology and Systematics of the American Species of the Genus Hesperapis Cockerell*. University of California, Berkeley.
- WARNCKE, K. 1977. Ideen zum natürlichen System der Bienen. *Mitteilungen des Münchner Entomologischen Gesellschaft* **67**: 39–63.
- WHITEHEAD, V.B. & STEINER, K.E. 2001. Oil-collecting bees of the winter rainfall area of South Africa (Melittidae, *Rediviva*). *Annals of the South African Museum* **108**: 143–277.

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