

Monographic revision of the bee genus *Melitta* Kirby 1802 (Hymenoptera: Apoidea: Melittidae)

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Abstract. Bees comprise a monophyletic group of seven families with more than 16000 described species worldwide. Convincing new phylogenetic hypotheses suggest that one of the smallest families, the Melittidae, could be the basal group of the bee clade. Among the 14 melittid genera, the genus *Melitta* Kirby 1802, is the most widespread and one of the most diverse. Most revisionary studies of *Melitta* were confined to limited geographical areas. An overview of the literature and the examination of 7817 specimens from various collections, including type material, have enabled the first monographic revision of the genus *Melitta*. This revision includes a cladistic analysis, comprehensive catalogue and identification key. We provide diagnoses, global distributions, phenology and host plants for the 43 known species (including 2 new ones). Lectotypes are designated for *M. albofasciata* Friese 1900, *M. caroli* Cameron 1909, *M. schultzei* Friese 1909 and *M. sibirica* (Morawitz 1888). We described *M. rasmonti* n. sp., *M. guichardi* n. sp., the previously unknown male of *M. bicollaris* Warncke 1973 and unknown female of *M. murciana* Warncke 1973.

Résumé. Révision monographique des abeilles du genre *Melitta* Kirby 1802 (Hymenoptera : Apoidea : Melittidae). Les abeilles constituent un groupe monophylétique de 7 familles qui incluent plus de 16000 espèces décrites à travers le monde. De nouvelles hypothèses robustes ont suggéré que la plus petite famille, celle des Melittidae, pourrait être le groupe frère de l'ensemble des autres abeilles. Parmi les 14 genres de Melittidae s.l., le genre *Melitta* Kirby 1802 est le plus répandu et l'un des plus diversifié. La plupart des révisions concernant les *Melitta* sont limitées à des cadres géographiques restreints. Une lecture poussée de la littérature disponible et l'étude de 7817 spécimens de nombreuses collections (y compris le matériel typique), nous permet de proposer ici la première révision monographique du genre *Melitta*. Cette révision inclut une analyse cladistique, un catalogue exhaustif et une clé de détermination. Par ailleurs, nous précisons, pour chacune des 43 espèces connues (y compris 2 nouvelles), la diagnose, la carte de distribution globale, la phénologie et les plantes hôtes. Des lectotypes sont désignés pour *M. albofasciata* Friese 1900, *M. caroli* Cameron 1909, *M. schultzei* Friese 1909 et *M. sibirica* (Morawitz 1888). Enfin, nous décrivons pour la première fois *M. rasmonti* n. sp., *M. guichardi* n. sp., le mâle de *M. bicollaris* Warncke 1973 et la femelle de *M. murciana* Warncke 1973.

Keywords: Melittidae, Apoidea, systematic, biogeography, floral choices, catalogue, identification keys.

Bees comprise a monophyletic group with more than 16000 described species worldwide (Michener 2000). They occur in most ecosystems where they are usually among the most important pollinators, and therefore they play a key role in ecosystem function (Waser & Ollerton 2006). Currently seven bee families are recognised: Stenotritidae, Colletidae, Andrenidae, Halictidae, Melittidae, Megachilidae and Apidae (Michener 2000). Convincing new phylogenetic hypotheses suggest that one of the smallest bee families, the Melittidae (166 species), could be the basal group of the bee clade (Radchenko & Pesenko 1994; Alexander & Michener 1995; Michener

2000; Danforth *et al.* 2006a, b). In this context, it is important to have an overview of the phylogeny of melittid bees to understand the early radiation of bees. An important step of this analysis is determining the diversity, monophyly and subgeneric classification of each of the 14 melittid genera. Revisions are available for most of these genera: *Capicola* Friese 1911 (Michez *et al.* 2007a), *Dasygoda* Latreille 1802 (Michez *et al.* 2004b, c), *Eremaphanta* Popov 1940 (Michez & Patiny 2006), *Hesperapis* Cockerell 1898 (Stage 1966; Michener 1981), *Promelitta* Warncke 1977 (Michez *et al.* 2007b), *Macropis* Panzer 1909 (Michez & Patiny 2005), *Meganomia* Cockerell 1898 (Michener 1981) and *Rediviva* Friese 1911 (Whitehead & Steiner 2001; Whitehead *et al.* in press). A monographic study of the largest genus *Melitta* is nowadays unavailable.

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Accepté le 19 avril 2007

Among the Melittidae, the genus *Melitta* Kirby 1802, is the most widespread and probably one of the most diverse. *Melitta* differs from the other genera by several plesiomorphic features. For example, males are characterised by the structure of sternum 7, which has a large disc and weakly developed lateral process. In this they resemble the structure of Sphecidae (Michener 1981). *Melitta* also has a few synapomorphies, like lateral tubercles on the labrum, apical projection on the posterior basitarsus and volsella with elongated digitus (Michener 1981).

Melitta occur in the Palaearctic, in southern and East Africa, and in the Nearctic regions (Warncke 1973b; Michener 1979, 1981; Snelling & Stage 1995; Wu 2000; Eardley & Kuhlmann 2006). It is most diversified in the Palaearctic Region (Michener 2000).

Celary (2006) described the nesting ecology of *M. leporina*. The female builds its nest in hard, clayey soil. They are not gregarious and the entrance of each nest is concealed by vegetation. Most species of *Melitta* are described as oligolectic or monolectic. For example, *M. haemorrhoidalis* forages on *Campanula* sp., *M. nigricans* on *Lythrum salicaria* and *M. tricineta* on *Odontites* sp. (Westrich 1990; Müller *et al.* 1997; Michez *et al.* 2004a).

Taxonomic history of *Melitta*

The first known Melittidae were described in the genera *Apis* Linné 1758, or *Andrena* Fabricius 1775 (like *Apis leporina* Panzer 1799 and *Andrena haemorrhoidalis* Fabricius 1775), which were the first bee genera described. Kirby (1802) described the genus *Melitta* (from “*Melitta*”, which means bee in Greek) to separate two groups of bees: the short-tongued and the long-tongued bees. In Kirby’s understanding of the bees, *Melitta* included all short-tongued bee; the long-tongued bees remained in the genus *Apis*. Later, when most bee genera and several bee families have been described, *Melitta* were considered to be synonymous with *Andrena* Fabricius 1775. *Melitta* superficially resemble *Andrena*, but differ in that they have only one subantennal suture rather than two, and no facial foveae in females. Recently, some species have been transferred from *Melitta* to *Andrena* (Engel 2005; Eardley & Kuhlmann 2006).

Schenck (1860) described the Melittidae including *Macropis*, *Melitta* and *Panurginus* Nylander 1848 (Michener 1986). Michener (1944) proposed a new conception for bee phylogeny, which forms the basis of today’s classification. For Melittidae, Michener (1944) presented 4 sub-families: Ctenoplectrinae (*Ctenoplectra* Kirby 1826), Dasypodainae (*Dasypoda*, *Eremaphanta*, *Haplomelitta* Cockerell 1934, *Samba* Friese 1908),

Macropidinae (*Macropis*) and Melittinae (*Melitta*, *Rediviva*). *Ctenoplectra* are today included in Apidae (Michener 1981, 2000). According to Engel (2001), the Melittidae are divided into four subfamilies: Dasypodainae (*Afrodasygoda* Engel 2001, *Dasypoda*, *Eremaphanta*, *Haplomelitta*, *Hesperapis*, *Promelitta* and *Samba*), Macropidinae (*Macropis*, *Eomacropis* Engel 2001), Melittinae (*Melitta*, *Rediviva* and *Redivivoides* Michener 1981) and Meganomiinae (*Ceratonomia* Michener 1981, *Meganomia*, *Pseudophilanthus* Alfken 1939, *Uromonia* Michener 1981). Lastly, Danforth *et al.* (2006b) demonstrated the paraphyly of Melittidae. They suggested splitting the Melittidae into three families: Dasypodidae (= Dasypodainae *sensu* Engel 2001), Melittidae s.str. (= Melittinae + Macropidinae *sensu* Engel 2001) and Meganomiidae (= Meganomiinae *sensu* Engel 2001).

Concerning the subgeneric level, Warncke (1973b) recognised three subgenera of *Melitta* (*Cilissa*, *Melitta* s.str. and *Pseudocilissa*) based on the revision of West Palaearctic species. He did not describe the diagnostic characters of these subgenera. Michener (1981) synonymised them within one subgenus *Melitta* s.str.. Snelling & Stage (1995) and Michener (2000) made the previously monobasic genus, *Dolichocheile* Viereck 1909, a subgenus of *Melitta*.

Significant studies of *Melitta* considered only the species from limited geographic areas. Warncke (1973b) presented a catalogue and a key for 17 West Palaearctic species (*M. aegyptiaca*, *M. bicollaris*, *M. budensis*, *M. dimidiata*, *M. haemorrhoidalis*, *M. hispanica*, *M. iberica*, *M. kastiliensis*, *M. leporina*, *M. maura*, *M. murciana*, *M. nigricans*, *M. seitzii*, *M. schmiedeknechti*, *M. tomentosa*, *M. tricineta* and *M. wankowiczii*). Yasumatsu & Hirashima (1956) described two species from Japan (*M. ezoana* and *M. japonica*). Snelling & Stage (1995) discussed four Nearctic species (*M. americana*, *M. californica*, *M. eickworti* and *M. melittoides*). Wu (2000) recorded 13 species from China (*M. borealis*, *M. changmuensis*, *M. fulvescens*, *M. harrietae*, *M. heilungkiangensis*, *M. leporina*, *M. mongolica*, *M. montana*, *M. nigrabdominalis*, *M. quinghaiensis*, *M. sinensis*, *M. taishanensis* and *M. thoracica*). Eardley & Kuhlmann (2006) described three new species from South Africa and one new species from Kenya. They recorded six species from southern and East Africa (*M. arrogans*, *M. barbarae*, *M. danae*, *M. katherinae*, *M. schultzei* and *M. whiteheadi*).

Recently, Baker & Engel (2007) provided very useful taxonomic notes on the genus *Melitta*. They listed 48 valid species, and their synonyms, documenting the original descriptions, *locus typicus* and type depository.

An overview of the literature and the examination of 7817 specimens from various collections (including type material) allow us to produce the first monographic revision of the genus *Melitta sensu* Michener (2000). This revision includes a cladistic analysis, comprehensive catalogue and key. The related species, known distribution, phenology and host plants of each species are provided.

Material and methods

Material

The type material is housed in the following institutions (followed by the acronym): Albany Museum, Grahamstown (South Africa, AMGC); California Academy of Sciences, San Francisco (USA, CAS); Cornell University, Ithaca (USA, CORN); Entomological Laboratory of Kyushu University, Kyushu (Japan, ELKU); Forschungs Institut und Naturmuseum Senckenberg, Frankfurt (Germany, FNSF); Institute of Zoology, Academia Sinica, Beijing (China, IZAS); Natural History Museum of L.A. Country, Los Angeles (USA, LACM); Museo Nacional de Ciencias Naturales, Madrid (Spain, MCN); Museo del Istituto di Zoologia, Bologna (Italy, MIZB); Muséum national d'Histoire naturelle, Paris (France, MNHN); Muséum zoologique, Strasbourg (France, MZS); Plant Protection Research Institute, Pretoria (South Africa, NCSA); Natural History Museum, London (United Kingdom, NHM); National Museums of Kenya, Nairobi (Kenya, NMK); Naturhistorisches Museum, Vienna (Austria, NMW); Oberösterreichisches Landesmuseums, Linz (Austria, OOLL); Iziko South African Museum, Cape Town (South Africa, SAMC); Snow Entomological Collection, Lawrence (USA, SEMC); Természettudományi Múzeum, Budapest (Bulgaria, TMB); Transvaal Museum, Pretoria (South Africa, TMSA); University of California, Riverside (USA, UC); Museum für Naturkunde der Humboldt-Universität, Berlin (Germany, ZMHU); University Museum of Natural History, Oxford (United Kingdom, UMNHO); National Museum of Natural History, Smithsonian Institution, Washington (USA, USNM); Zoological Museum of the Moscow University, Moscow (Russia, ZMMU); Zoological Institute of the Russian Academia of Science, Saint Petersburg (Russia, ZISP).

Additional, non-type material, from the following institutions was studied: American Museum of Natural History, New York (USA, AMNH, 256 specimens); Conservatoire entomologique de Gembloux (Belgium, FUSAG, 300 spec.), Institut national de la Recherche agronomique de Montpellier (France, INRA, 5 spec.); Institut royal des Sciences naturelles de Belgique, Bruxelles (Belgium, IRSNB, 50 spec.); Musée cantonal de Zoologie, Lausanne (Switzerland, MCZ, 184 spec.); Musée national d'Histoire naturelle, Paris (France, MNHN, 136 spec.); Muséum d'Histoire naturelle, Genève (Switzerland, MHNG, 8 spec.); Museum für Naturkunde der Humboldt-Universität, Berlin (Germany, ZMHB, 37 spec.); Muséum zoologique, Strasbourg (France, MZS, 288 spec.); Natural History Museum, London (United Kingdom, NHM, 899 spec.); Naturhistorisches Museum Wien (Austria, NMW, 224 spec.); Oberösterreichisches Landesmuseums, Linz (Austria, OOLL, 1500 spec.); Private collection of M. Schwarz, Ansfelden (Austria, CS, 472 spec.); Private collection of O. Berg, Haslum (Norway, CB, 23 spec.); Rijksmuseum van Natuurlijke Historie, Leiden (Netherlands, RNHL, 429 spec.); Università di Catania

(Italia, UC, 14 spec.); Université de Mons-Hainaut, Mons (Belgium, UMH, 191 spec.); Uppsala University, collection A. Nilsson (Sweden, UU, 6 spec.); Zoological Institute of the Russian Academia of Science, Saint Petersburg (Russia, ZISP, 1944 spec.); Zoologisch Museum van Amsterdam (Netherlands, ZMA, 78 spec.); Zoologische Staatssammlung München (Germany, ZSM, 630 spec.); Zoologisk Museum, Kobenhavns Universitet, Copenhagen (Denmark, UZMC, 24 spec.); Zoologiska Museet, Lunds Universitet (Sweden, MZL, 116 spec.).

Species and subspecies concepts

The genetic definition, eco-ethology and phenology of *Melitta* are unclear. Species have therefore been separated according to morphological differences, which is the most operational method for this first revision.

Subspecific level has been validated when apparent morphological variations of non-specific features (like vestiture) are associated with geographical isolation.

Morphological terms, abbreviations and illustrations

We used the glossary of Harris (1979) to describe the surface sculpture and Michener (2000) for morphological terms. Puncture density is described according to puncture diameter (d) and the spaces between the punctures (i), such as $i > d$.

The following abbreviations were used for morphological structures: antennae segment = A (A1 = Scape); tibia = Tb; femur = F; basitarsus = Bt; metasomal sternum = S; metasomal tergum = T; pygidial plate = Pp; body length = L (from vertex to apical tergum).

The integument ultrastructures were studied using SEM (JEOL JSM-6100) associated to the software Semafore (JEOL, Sollentuna, Sweden) (figs 4–71, 76–99, 105–139, 145–162). The pictures of habitus were made using a Nikon D1 camera associated to binocular Olympus (figs 163–178).

Cladistic analysis

We leaved thirty species in the ingroup including only the species with enough available material (at least 4 specimens) and both sexes described (tab. 1). Danforth *et al.* (2006b) demonstrated that *Rediviva*, *Redivivoides*, *Macropis* and *Meganomia* are sister groups of *Melitta*. The present trees were rooted using *Meganomia* and *Macropis* as outgroups (figs 2–3). Thirty-two morphological characters were analysed.

Female and male

1. Ratio (r) between length of labial palpus and length of maxillary palpus: (0) $r > 0.5$; (1) $r < 0.5$.
2. Maxillary palpus: (0) six-segmented (fig. 13); (1) five-segmented.
3. Outer surface of galea: (0) sculptured (fig. 23); (1) smooth (fig. 115).
4. Outer surface of galea: (0) mat; (1) shiny.
5. Shape of galea: (0) pointed apically (figs 87, 115, 116); (1) rounded apically (figs 13, 14, 23).
6. Mandible: (0) with pre-apical tooth (figs 49, 115); (1) without pre-apical tooth.
7. Malar area: (0) shorter than or equal to length of A2; (1) longer than A2; (2) equal to longer than A3.

Table 1. Character-state matrix for cladistic analysis.

| | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | | |
|---------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|
| Outgroup | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Macropis europaea</i> | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | |
| <i>Meganomia binghami</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | |
| Ingroup | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>M. aegyptiaca</i> | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | |
| <i>M. albida</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ? | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| <i>M. americana</i> | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| <i>M. arrogans</i> | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 2 |
| <i>M. bicollaris</i> | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | |
| <i>M. budensis</i> | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 2 | 1 | 1 | 0 | 1 | 3 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | ? | 0 | 0 | 0 | 0 | 1 | |
| <i>M. californica</i> | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 2 |
| <i>M. cameroni</i> | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 2 |
| <i>M. danae</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| <i>M. dimidiata</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 |
| <i>M. eickworti</i> | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| <i>M. ezoana</i> | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | |
| <i>M. haemorrhoidalis</i> | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 3 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | |
| <i>M. harrietae</i> | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 2 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | |
| <i>M. hispanica</i> | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 2 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | |
| <i>M. iberica</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | |
| <i>M. japonica</i> | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 1 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| <i>M. kastiliensis</i> | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 1 | 0 | 1 | 2 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 2 |
| <i>M. leporina</i> | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | |
| <i>M. maura</i> | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| <i>M. melittoides</i> | 0 | 1 | 1 | 1 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | |
| <i>M. murciana</i> | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| <i>M. nigricans</i> | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | |
| <i>M. rasmonti</i> | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 3 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | |
| <i>M. schmiedeknechti</i> | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| <i>M. seitzii</i> | 0 | 0 | 1 | 1 | 0 | 0 | 0 | ? | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 |
| <i>M. sibirica</i> | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 2 |
| <i>M. tomentosa</i> | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 3 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 2 |
| <i>M. tricincta</i> | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | |
| <i>M. wankowiczi</i> | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 0 | 1 | 3 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | |

8. Centre of scutum: (0) smooth between punctures; (1) sculptured between punctures.

9. Anterior scutellum: (0) smooth between punctures (fig. 92); (1) sculptured between punctures (figs 33, 117).

10. Metanotum: (0) not swollen (fig. 31); (1) swollen (fig. 117).

Female

11. Labrum: (0) without lateral lobes; (1) with lateral tubercles (fig. 49).

12. Centre of propodeal triangle: (0) rugose; (1) with vertical carinae (fig. 123); (2) horizontally costulate; (3) with one pronounced horizontal carina.

13. Tb2: (0) without carina on inner margin; (1) with carina on inner margin (fig. 118).

14. Bt3: (0) without apical projection; (1) with apical projection (fig. 11).

15. Median area of prepygidial fimbria: (0) black; (1) orange.

Male

16. Clypeus: (0) with yellow marking; (1) black to reddish.

17. A4-A12: (0) cylindrical (fig. 91); (1) with weak apical enlargement and slightly convex ventrally; (2) only slightly convex ventrally; (3) with strong apical enlargement and slightly convex ventrally (fig. 113).

18. Distitarsus: (0) twice as long as wide; (1) three times as long as wide.

19. T2-T4: (0) with apical hair bands (fig. 10); (1) without apical hair bands.

20. Pygidial plate: (0) present; (1) absent.

21. S4-S5: (0) apical margin straight or nearly straight; (1) apical margin strongly emarginate (figs 15, 34, 51).

22. Apicolateral structure of S7: (0) swollen or blade shaped; (1) bowl shaped (figs 65, 68, 106, 108, 141, 152, 153, 157, 160).

23. Apicolateral structure of S7: (0) swollen or bowl shaped;

(1) blade shaped (figs 59, 61, 73, 77, 79, 84, 86, 95, 101, 120, 122, 128, 130, 135, 137, 146).

24. Apicolateral structure of S7: (0) bowl or blade shaped; (1) blade swollen shaped (figs 4, 17, 20, 24, 26, 37, 39, 44, 46, 53, 55).

25. Disc of S8: (0) without strong, apicomedian carinae (fig. 80); (1) with two strong, apicomedian carinae (figs 67, 109, 154, 159).

26. Column of S8: (0) without apicomedian carina (figs 27, 38, 54, 67, 74, 96, 109, 154, 159); (1) with apicomedian carina (fig. 136).

27. Column of S8: (0) moderately pubescent to hairless (figs 5, 18, 27, 38, 40, 45, 54, 66, 67, 74, 78, 80, 96, 102, 107, 109, 121, 129, 142, 147, 154, 158, 159); (1) with long, median, bushy hairs (figs 60, 85, 88, 136).

28. External margin of gonostylus: (0) as long as external margin of gonocoxite (figs 7, 22, 29, 42, 48, 57, 139); (1) half as long as external margin of gonocoxite (figs 63, 71, 75, 82, 90, 99, 104, 111, 126, 133, 144, 150, 162).

29. Apex of gonostylus: (0) simple; (1) bifid.

30. Apex of gonostylus: (0) pointed (figs 28, 62, 89, 103, 110, 132, 138, 143, 161); (1) truncated (figs 6, 21, 47, 56, 149, 155).

31. Apex of gonostylus: (0) straight; (1) curved ventrally (figs 75, 99, 150).

32. Digitus of volsella: (0) not expanded; (1) expanded and rounded apically (figs 19, 30, 112); (2) expanded and pointed apically (figs 124, 148).

The cladistic analysis was carried out using PAUP version 4.0b10 (Swofford 2001). The tree search was heuristic using the parsimony optimality criterion. All multistate characters were primarily considered unordered and of equal weight. Complementary tree searches were made considering the characters ordered or of “dollop” type. The starting tree was obtained via stepwise addition. The addition sequence was random (10,000 replicates) with tree-bisection-reconnection used as branch-swapping algorithm. A strict consensus and 50% majority-rules consensus of the obtained trees was computed after each tree search (figs 2–3).

Diversity, biogeography, phenology and floral choices

Species are listed in alphabetic order in a catalogue. Synonyms and subspecies are quoted under the valid species name, in chronological order, with references to their original description and their main subsequent citations. The holotype depository and the locus typicus are given, and we specified whether the type was examined (S) or not examined (NS). Non-type specimen informations are also quoted using the following standardisation of label data: locality, coordinates (or conventional coordinates in decimal degrees between brackets when not on the label), date, collector and depository.

We gave a diagnostic combination of characters for all species, except in the case of *M. changmuensis*, *M. heilungkiangensis*, *M. montana* and *M. nigrabdominalis* for which specimens were not available to us. For these species, we used the original description to develop the diagnoses (Wu 2000).

We indicated global distributions (figs 179–187, 190–193), phenologies and host plant preferences (listed in appendix 1 and table 3). Maps and phenologies are based on 11947 specimen records (fig. 1) and floral choices on 2101 specimens (tab. 3).

Main data came from label informations of type and additional non-type material. Additional data were reported from the following references: Alfken (1905, 1913), Baker (1965), Baker & Engel (2007), Baldovski (1983), Banaszak (1980, 1982a, b, c), Banaszak & Manole (1987), Banaszak & Wendzonka (2002), Benoist (1928), Celary (2000, 2006), Cockerell (1935), Comba & Comba (1991), Dylewska & Noskiewicz (1963), Eardley & Kuhlmann (2006), Elfving (1968), Else (1998), Erlandsson (1960), Friese (1912, 1913), Gogala (1991, 1994, 1999), Heddicke (1933, 1938), Hohmann *et al.* (1993), Jacob-Remacle & Jacob (1988), Kettner & Leclercq (1956), Lecomte & Turgari (1965), Michener (1981), Móczár (1957), Morawitz (1878, 1888), Ornosá *et al.* (1998), Ornosá & Ortiz-Sánchez (1998), Pagliano (1992), Papp (1965), Peeters *et al.* (1999), Pérez (1890), Petit (1977, 1996), Radoszkowski (1891), Rasmont *et al.* (1990), Sitdikov (1986), Smith (1879), Snelling & Stage (1995), Tanács (1975, 1979), Tengö & Bergström (1976), Tkalcu (1974), Vachal (1910), Viereck (1909), Warncke (1973a, b, 1981, 1986, 1988), Woydak (1967), Wu (1978, 1988, 1993, 2000), Yasumatsu & Hirashima (1956). We added the data extracted from the data bank “*Banque de données fauniques Gembloux-Mons*”, of which the most important contributor are J. Leclercq, K. Warncke and C. Lefebvre. The last part was the data bank of S. Roberts (Reading, UK). Data Fauna Flora 2.0 (Barbier *et al.* 2000) and Carto Fauna Flora 2.0 (Barbier & Rasmont 2000) were used for data storage, management and mapping. A Gall geographical projection was used for mapping of data (Barbier & Rasmont 2000).

Host breadth

Each bees is characterised by an original host breadth. Moreover, bees have generally more nectar than pollen hosts (Robertson 1925). Morphological, behavioural and physiological constrains are stronger for pollen than nectar collecting (Wcislo & Cane 1996) and the definition of bee host-breadth is better defined by female pollen host-plant.

Some species visit a restricted number of plant taxa throughout their geographical range. Other species display a wider spectrum of pollen hosts. In a recent review, Cane & Sipes (2006) proposed new definitions reflecting the continuum in bee host breadth. Monolecty and broad polylecty are the uncommon extreme of this continuum. In our study, we used the intermediate states proposed by Cane & Sipes (2006). *Melitta* species are considered as narrow oligolectic if females forage on only one plant genus; as oligolectic if they forage on one to four related genera of the same plant family; mesolectic if they forage on one to three plant families; polylectic if they forage on more than 4 plant families.

Results

Cladistic analysis and taxonomic implications

A heuristic search based on the data set (tab. 1) with multistate characters unordered, yielded 17 equally parsimonious trees, with the length = 89, CI = 0.4270 and HI = 0.5730.

The monophyly of the genus *Melitta* is confirmed. The genus shares 5 synapomorphies: female labrum with lateral tubercles (character 11), female Bt3 with apical projection (character 14), male clypeus without

yellow marking (character 16), male without pygidial plate (character 20) and male volsella with expanded digitus (character 32).

The strict consensus and the 50% majority rule consensus gives two robust groups: the group of *M. leporina* and the group of *M. dimidiata* (figs 2–3). The *M. leporina*-group is supported by 3 synapomorphies; the structure of galea (character 5) and the punctation of mesosoma (characters 8 and 9), and one autapomorphy, the apicolateral structure of S7 (character 24). The *M. dimidiata*-group is supported by two synapomorphies, the apicolateral structure of S7 (character 23) and the structure of the gonostylus (character 28). Structure of hidden sterna and genitalia of male are usually used to define the subgeneric level in bee taxonomy (Michener 2000). We propose to define two subgenera on the basis of these two groups: the subgenus *Melitta* Kirby s. str. (*M. leporina*-group) and the subgenus *Cilissa* Leach (*M. dimidiata*-group).

The subgenus *Melitta* comprises three European species, *M. leporina* + *M. nigricans* + *M. tricineta*, supported by character 21 (apical margin of S5 emarginate). The other North African species, *M. aegyptiaca* + *M. maura* + *M. schmiedeknechti*, constitute the basal group.

The subgenus *Cilissa* presents three robust subgroups: the *M. haemorrhoidalis*-subgroup, the *M. harrietae*-subgroup and the *M. dimidiata*-subgroup. The *M. haemorrhoidalis*-subgroup has six synapomorphies: the swollen metanotum (character 10), the centre of the propodeal triangular being horizontally costulate (character 12), female Tb2 with carina on inner margin (character 13), male A4–A12 strongly enlarged apical (character 17), apicolateral structure of male S7 bowl shaped (character 22) and disc of male S8 with apicomedian carinae (character 25). This subgroup includes five West-Palaeartic species (*M. budensis*, *M. haemorrhoidalis*, *M. rasmonii*, *M. tomentosa* and *M. wankowiczii*) and the Chinese *M. heilungkiangensis*. The *M. harrietae*-subgroup was supported by three synapomorphies: the anterior propodeal triangle with vertical carinae (character 12), curved apex of male gonostylus (character 31) and pointed apex of male volsella (character 32). This subgroup includes four Asian species (*M. cameroni*, *M. ezoana*, *M. harrietae* and *M. sibirica*) and the North American *M. californica* (associated in only 86% of the most parsimonious trees). Lastly, the *M. dimidiata*-subgroup shares only one synapomorphy: the bushy hairs the male S8 (character 27). This subgroup includes four West-Palaeartic species (*M. bicollaris*, *M. dimidiata*, *M. murciana* and *M. seitzii*).

Catalogue of *Melitta* Kirby 1802

Melitta Kirby

Melitta Kirby 1802: 117–119. Type species: *Melitta tricineta* Kirby 1802 (designated by Richards 1935).

Cilissa Leach 1815: 155. Type species: *Andrena haemorrhoidalis* Fabricius 1775 (designated by Westwood 1840).

Kirbya Lepelletier 1841: 145. Type species: *Melitta tricineta* Kirby 1802 (designated by Sandhouse 1943).

Pseudocilissa Radoszkowski 1891: 241. Type species: *Cilissa robusta* Radoszkowski 1876 (= *Melitta dimidiata* Morawitz 1876) (monobasic).

Brachycephalapis Viereck 1909: 47. Type species: *Melitta (Brachycephalapis) californica* Viereck 1909.

Dolichochoile Viereck 1909: 49. Type species: *Dolichochoile melittoides* Viereck 1909.

Diagnosis. Like other Melittidae s.l., *Melitta* have a short tongue with all segments of the labial palpus similar to one another (figs 8, 114), one subantennal suture and no facial foveae. Like other Melittinae, *Melitta* have three sub-marginal cells (the third longer than the second) in the forewing, no yellow markings, declivous propodeum (figs 9, 31, 117), large propodeal triangle usually, with fine granular sculpture (figs 9, 32, 50), lateral tubercles on labrum ♀ (fig. 49), apical projection on Bt3 ♀ (fig. 11), no male Pp and male volsella with elongated digitus (figs 19, 30, 97, 112, 124, 148).

Subgenus *Melitta* Kirby

Melitta Kirby 1802: 117–119. Type species: *Melitta tricineta* Kirby 1802 (designated by Richards 1935).

Kirbya Lepelletier 1841: 145. Type species: *Melitta tricineta* Kirby 1802 (designated by Sandhouse 1943).

Diagnosis. Galea rounded apically. Outer surface of galea mat and sculptured (figs 13, 23). Centre of scutum and anterior scutellum sculptured between punctures (fig. 33). Most of male with A4–A12 slightly convex ventrally. Propodeal triangle rugose (figs 9, 32, 50). Female Pp mostly flat (fig. 12). Apicolateral structure of ♂ S7 blade swollen (figs 4, 17, 20, 24, 26, 37, 39, 44, 46, 53, 55). Disc of ♂ S8 without strong apicomedian carinae; column of ♂ S8 nearly hairless, without median carina (figs 5, 18, 27, 38, 40, 45, 54). Gonostylus as long as gonocoxite (in lateral view) (figs 7, 22, 29, 42, 48, 57, 139). Gonostylus mainly truncate apically (figs 6, 21, 47, 56). Digitus rounded apically (figs 19, 30).

Included species. *Melitta aegyptiaca*, *M. changmuensis*, *M. leporina*, *M. maura*, *M. nigricans*, *M. schmiedeknechti* and *M. tricineta*.

Distribution. Palaeartic.

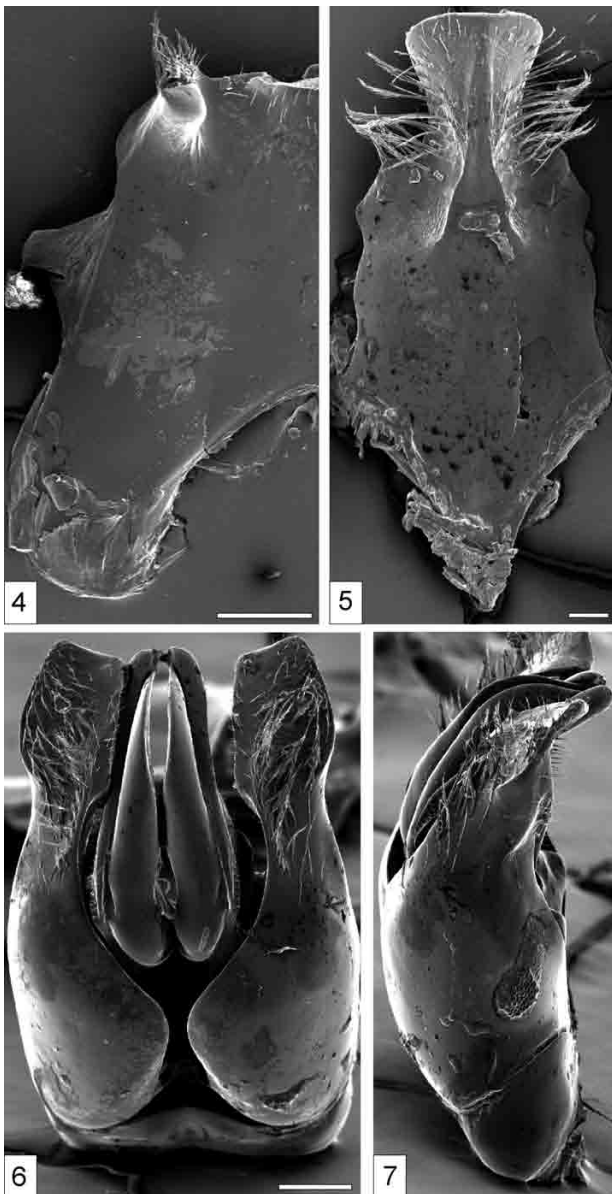
1. *Melitta aegyptiaca* (Radoszkowski)

[Figs 4–7, 163, 179]

Cilissa aegyptiaca Radoszkowski 1891: 237. ♂. Type material. Syntype ♂, Egypt [?], ZMMU, NS. Locus typicus: “Egypte”.

Melitta leporina var. *sakkarae* Friese 1898: 304, ♀. Synonymised by Warncke (1973b: 105). Type material. Syntype ♀, Egypt, Saqqarah [29.85°N 31.22°E], ZMHU, NS. Locus typicus: “Aegypten, Sakkarah”.

Melitta aegyptiaca canariensis Warncke 1973: 105–106, ♀ ♂. Type material. Holotype ♂, Canaries, Corralejo [28.73°S 13.87°W], 27.III.1963, leg. Lindberg, OOLL, S; 1♀ paratype, idem,



Figures 4–7
Melitta aegyptiaca, male. 4, ventral view of sternum 7 (scale = 250 μ m). 5, ventral view of sternum 8 (scale = 100 μ m). 6, dorsal view of genitalia (scale = 250 μ m). 7, lateral view of genitalia.

16.III.1962, OOLL, S; 1♀ 1♂ paratypes, idem, 10.V.1964, leg. Lindberg, NHM, S; 2♀ paratypes, El Golfo [28.97°N 13.83°W], 10.V.1964, OOLL, S; 1♂ paratype, Canaries, Matural [?], 29.III.1963, leg. Lindberg, OOLL, S; 1♂ paratype, Canaries, Graciosa [29.25°S 13.50°E], 20–21.III.1963, leg. Lindberg, OOLL, S; 1♂, paratype, Canaries, Penhas del Chacha [?], 13–22.III.1963, leg. Lindberg, OOLL, S. Locus typicus: “Fuerteventura, Corralejos”.

Melitta aegyptiaca clusia Warncke 1973: 106, ♀ ♂. Type material. Holotype ♀, Canaries, El medano [28.02°S 16.32°W], 12–22.IV.1930, OOLL, S; 1♀ paratype, idem, 15.IV.1933, OOLL, S; 2♂ paratypes, idem, 16.IV.1933, OOLL, S; 1♂ paratype, idem, 04.I.1934, OOLL, S. Locus typicus: “Teneriffa, Medano”.

Melitta aegyptiaca maroccana Warncke 1973: 105, ♀ ♂. Type material. Holotype ♂, Morocco, Marrakech [31.63°N 8.00°W], leg. Escalera, OOLL, S; 5♀ 3♂ paratypes, idem, OOLL, S. Locus typicus: “Marokko, Marrakesch”.

Additional material examined (96 specimens). **Egypt:** 1♀, Saqqarah [29.85°N 31.21°E], leg. Schmiedeknecht, NMW; 1♂, Heluan [29.85°N 31.33°E], leg. Schmiedeknecht, OOLL. **Israel:** 1♀, Dimona [31.06°N 35.03°E], 17.IV.1990, leg. Leys, ZMA; 1♀ 1♂, Yeroham [31.00°N 34.92°E], 21.III.1990, leg. Leys, ZMA. **Morocco:** 2♀, Oued Massa [30.08°N 9.67°W], 12.III.1989, NHM; 5♀ 3♂, idem, 13.IV.1979, OOLL; 1♀, idem, 17.IV.1979, OOLL; 1♀ 1♂, Tamri [30.70°N 9.83°W], leg. Else, NHM; 1♀, Blougra [30.03°N 9.07°W], 10.IV.1988, leg. Gusenleitner, OOLL; 1♀, Guelmina [31.7°N 4.95°W], 27.II.1988, leg. Leveber, ZMA; 1♂, Mogador [31.51°N 9.77°W], 22.III.1932, NHM; 5♀ 4♂, Marrakech [31.63°N 8.00°W], OOLL; 2♂, Mhamid [29.82°N 5.73°W], 21–22.IV.1995, leg. Rosario, CS; 1♂, Aglou [29.77°N 9.82°W], 02.IV.1974, leg. Guichard, NHM; 1♂, idem, 12.II.1974, leg. Guichard, NHM; 2♂, idem, 14.III.1974, leg. Guichard, NHM; 1♀ 1♂, Sidi Ifni [29.38°N 10.17°W], 31.III.1974, leg. Else, NHM; 1♀, Laayoune [27.83°N 12.33°W], 16.II.1988, leg. Guichard, NHM; 2♀, idem, 18.II.1988, leg. Guichard, NHM; 1♀ 2♂, Tan-Tan [28.43°N 11.11°W], 25.III.1986, leg. Schwarz, CS; 1♂, Taroudant [35.37°N 5.62°W], leg. Else, NHM. **Spain (Canaries):** 1♀ 1♂, Fuerteventura [28.33°N 14.00°W], 10.V.1964, leg. Guichard, NHM; 3♂, Haria [29.13°N 13.48°W], 06–11.IV.1990, leg. Guichard, NHM; 2♀, Peninsula de Jandia [28.05°N 14.50°W], 03.I.1988, leg. Vardy, NHM; 2♀, Corralejo [28.73°N 13.87°W], 10.V.1964, OOLL; 6♂, idem, 28.II.1985, leg. Teunissen, RNHL; 1♀ 1♂, idem, 17.II.1985, leg. Rosario, CS; 1♂, El Golfo [28.96°N 13.83°W], 27.III.1963, OOLL; 1♀, idem, 16.III.1963, OOLL; Isla Graciosa [29.25°N 13.50°W], 20–21.III.1963, OOLL; 1♀, Haria [29.13°N 13.48°W], 24.II.1968, OOLL; 1♀ 1♂, Playa Blanca [28.87°N 13.83°W], 24.II.1990, leg. Gusenleitner, OOLL; 1♀, Costa del Rubicon [28.87°N 13.87°W], 19.II.1990, leg. Gusenleitner, OOLL; 7♂, idem, 26.II.1990, leg. Gusenleitner, OOLL; 1♂, Betancuria [28.41°N 14.05°W], leg. Teunissen, RNHL; 1♀ 1♂, El Cotillo [28.08°N 14.48°W], 26.II.1985, leg. Teunissen, RNHL; 1♀ 1♂, idem, 17.II.1985, leg. Teunissen, RNHL; 1♂, Lajares [28.68°N 13.93°W], 19–24.II.1985, leg. Teunissen, RNHL; 1♂, Tefia [28.52°N 13.98°W], 14.II.1985, leg. Teunissen, RNHL; 2♂, La Caleta [29.12°N 13.57°W], 16.II.1979, leg. Thomas, ZMA; 1♀, Puerto Medano [28.03°N 16.53°W], 15.IV.1933, OOLL; 2♂, idem, 16.IV.1933, OOLL; 1♂, idem, 04.I.1934, OOLL; 1♂, idem, 14.IV.1933, OOLL; 1♂, idem, 11.IV.1933, OOLL; 1♀, idem, 12–22.IV.1930, OOLL; 1♀, Adeje [28.11°N 16.72°W], on *Euphorbia regis-jubae*, leg. Van der Vecht, RNHL. **Tunisia:** 3♂, Metlaoui [34.33°N 8.40°W], 18.II.1989, on *Oxalis pes-caprea*, leg. Barbier, UMH.

Related species. *M. maura* and *M. schmiedeknechti*.

Diagnosis. ♀ ♂. Labial palpus as long as glossa. Maxillary palpus as long as galea. Outer surface of galea sculptured and mat. Malar area shorter to longer than A2.

♀. L = 12.5 mm. Entire clypeus sparsely punctate ($i > 2d$), smooth between punctures. Face with whitish hair, vertex slightly above upper extreme of eye. Scutum with reddish hair, posterior region mostly mat, sometimes smooth between punctures. Anterior part of scutellum smooth between punctures. Propodeal triangle as wide as metanotum, finely

sculptured like, entire propodeum. Scopa with reddish to black hair. T1 mostly orange, T2-T3 sometimes partly orange, T2-T4 with continuous, white apical hair bands, as long as marginal zone (fig. 163). Disc of T3-T4 with a few, short, black hairs. Prepygidial fimbria black, mostly with a few, lateral, white hairs. Pp flat. Sterna with long sparse whitish to brownish apical hairs.

♂. L = 10.5 mm. Entire clypeus densely punctate ($i < d$), except apical area smooth. Entire antenna brown, A3-A12 slightly convex ventrally, A3 shorter than A4. Face with dense, erect, white hair and narrow, black, lateral fringe. Scutum mostly mat between punctures, sometimes apicomedian part shiny. Scutellum mostly mat between punctures, sometimes basal area smooth. Propodeal triangle finely sculptured and mat, like rest of propodeum. Mesosoma with yellowish hairs intermixed with dark hairs dorsally, whitish hairs ventrally. Disc of terga with long, erect hairs. Terga with continuous, white apical hair bands. S4-S5 straight apically. S6 with apical margin emarginate. S7 with reduce apicolateral process (fig. 4). S8 with few, long, yellowish, lateral hairs (fig. 5), apical area circle-shaped. Gonostylus truncated apically (figs 6, 7). Inner margin of penis valve higher than outer margin (fig. 6).

Variation. *M. aegyptiaca aegyptiaca* diagnosis: malar area shorter than length of A2, scutum and scutellum mat, mesonotum ♀ with dorsal reddish hairs, Tb3 and Bt3 ♀ with reddish hairs, T1-T3 ♀ mostly orange and prepygidial fimbria ♀ with black vestiture and a few lateral white hairs. Occuring Egypt.

M. aegyptiaca canariensis diagnosis: malar area longer or equal to length of A2, posterior scutum and anterior scutellum smooth between punctures, mesonotum ♀ with dorsal reddish hairs, Tb3 ♀ with inner whitish vestiture and outer black vestiture, outer side of Bt3 ♀ with black hairs, T1-T3 ♀ black and prepygidial fimbria ♀ with black vestiture and few lateral white hairs. Occuring Canaries, Fuerteventura and Lanzarote.

M. aegyptiaca clusia diagnosis: malar area longer or equal to length of A2, posterior scutum and anterior scutellum smooth between punctures, mesonotum ♀ with dorsal brown hairs, Tb3 and Bt3 ♀ with black vestiture, T1-T3 ♀ black and prepygidial fimbria ♀ with black vestiture. Occuring Canaries, Tenerife.

M. aegyptiaca maroccana diagnosis: malar area shorter than length of A2, scutum mat, anterior scutellum smooth between punctures, mesonotum ♀ with dorsal reddish hairs, Tb3 and Bt3 ♀ with reddish vestiture, T1-T2 mostly orange, T3 mostly black and prepygidial fimbria ♀ with black vestiture and a few lateral white hairs. Occuring Morocco and Tunisia.

Distribution (fig. 179). Disjunct distribution through North Africa with population in Canaries, Morocco, Tunisia, Egypt and Israel.

Phenology. Early February to early May.

Host plants (14 specimens). Asteraceae, *Chrysanthemum coronarium* (3♀), *Reichardia tingitana* (1♀); Caryophyllaceae, *Spergula* sp. (1♂); Euphorbiaceae, *Euphorbia regis-jubae* (1♀); Fabaceae, *Lotus* sp. (3♀), *Ononis* sp. (2♀); Oxalidaceae, *Oxalis pes-caprae* (3♂).

2. *Melitta changmuensis* Wu

[Fig. 184]

Melitta changmuensis Wu 1988: 67-68, ♂. Type material. Holotype ♂, 9♂ paratypes, China, Changmukouan [28.20°N 86.00°E], 09.IX.1984, leg. L. Ai-hua, IZAS, NS. Locus typicus: "Xizang, Changmukouan".

Additional material examined. None.

Related species. *M. leporina*.

Diagnosis. ♀. Unknown. ♂. L = 10.5 mm. A1 longer than A2. Scutum covered with long greyish-yellow hairs, intermixed with black hairs on central disc. T2-T5 with white apical hair bands.

Distribution (fig. 184). Only known from locus typicus (Xizang, China).

Phenology. September.

Host plants. Unknown.

3. *Melitta leporina* (Panzer)

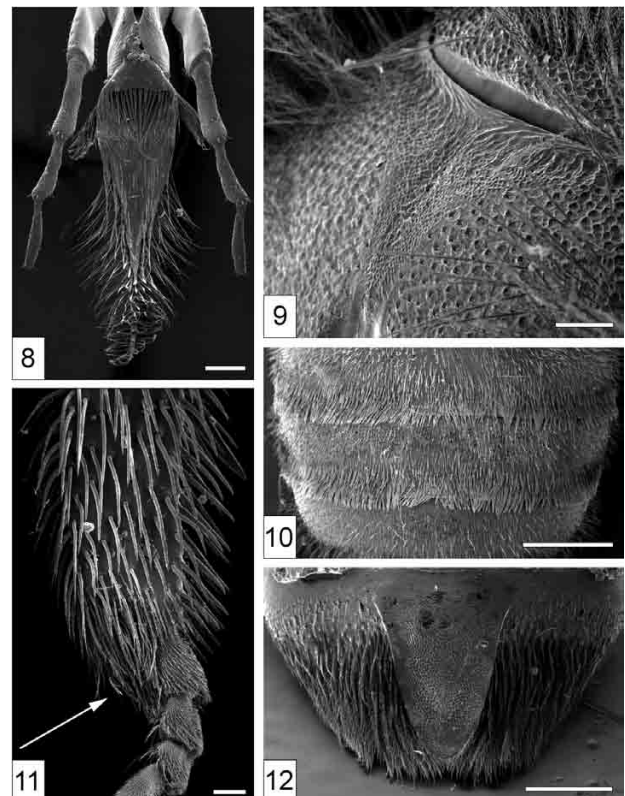
[Figs 8–22, 164, 171, 185]

Apis leporina Panzer 1799: pl.21, ♀. Type material. Type not located. Locus typicus: "in Viennae Austr." [48.20°N 16.37°E].

Andrena fortipes Imhoff 1832: 1207, ♀ ♂. Type material. Type not located. Locus typicus: "Switzerland, Basel" [47.53°N 7.61°E].

Cilisa ruthenica Radoszkowski 1891: 238-239, ♀ ♂. Type material. Syntypes, Russia, Belarus [?], NHM, S. Locus typicus: "Gouvernement de Minsk".

Melitta centaureae Torka 1922: 23-24. Type material. 5♀ 7♂ syntypes, Poland, Oberglogau [50.37°N 17.87°E], 31.VII.1921, on *Centaurea jacea*, no located. Locus typicus: "Oberglogau".



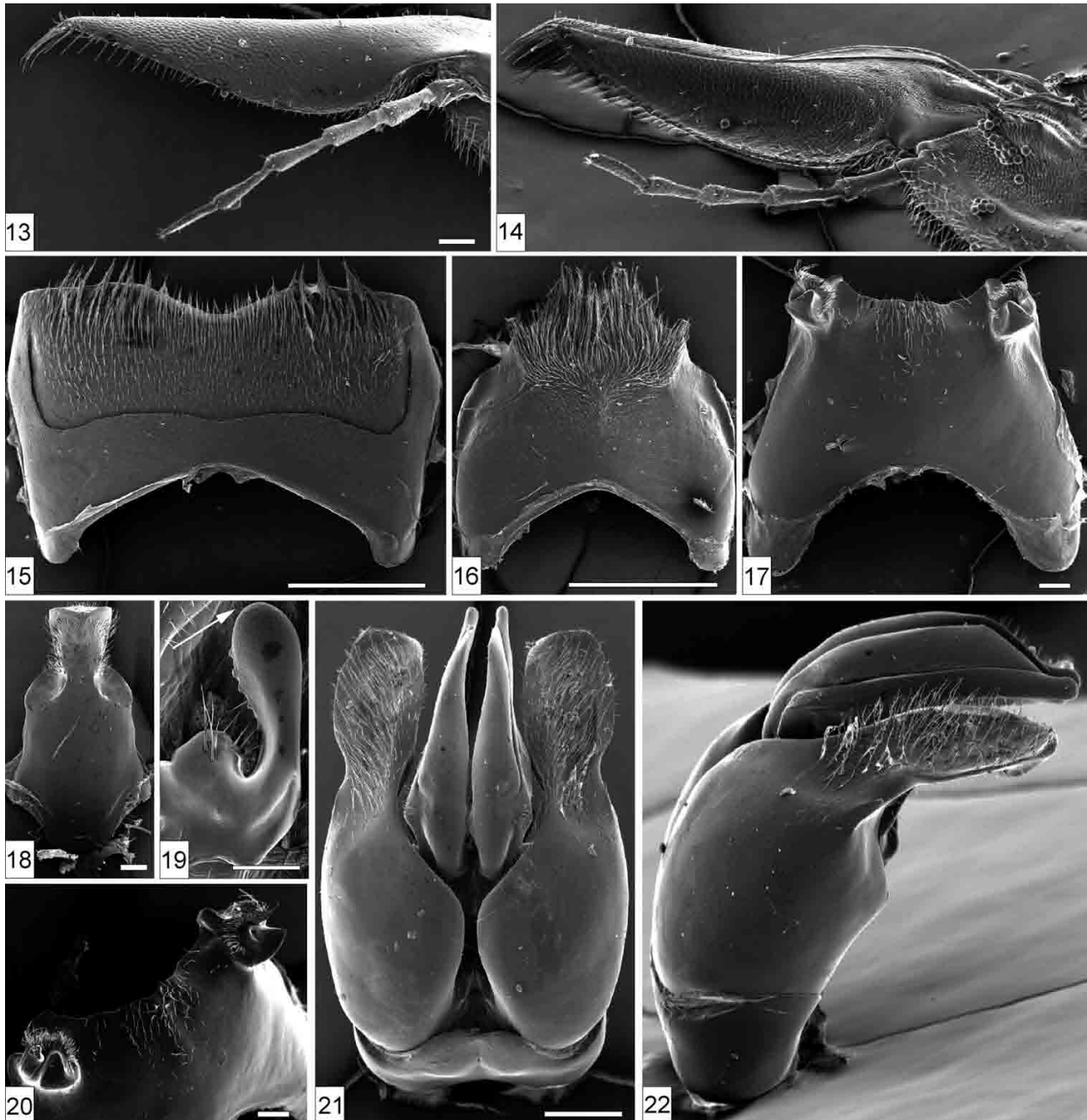
Figures 8–12
Melitta leporina, female. **8**, glossa and labial palpus (scale = 200 µm). **9**, lateral view of propodeal triangle (scale = 300 µm). **10**, terga 2–3 (scale = 1 mm). **11**, metabasitarsus with apical projection (arrow) (scale = 300 µm). **12**, pygidial plate (scale = 500 µm).

Melitta leporina var. *nigrinotum* Alfken 1927: 228, ♀ ♂. Synonymised by Warncke (1973b: 103). Type material. Holotype gender unknown, FNSF, NS (localisation see Baker & Engel 2007). Locus typicus: "Spain, Valle de Ordesa" [42.65°N 0.03°W].

Melitta sinkiangensis Wu 1978: 420, ♀. Synonymised by Wu (2000). Type

material. Holotype ♀, China, Zhaosu [43.17°N 81.12°E], IZAS, NS. Locus typicus: "Xinjiang, Zhaosu".

Additional material examined. 2431 specimens of *M. leporina* were studied (detail of data see ASEF web address).



Figures 13–22

Melitta leporina, male. **13**, outer face of galea (scale = 100 µm). **14**, inner face of galea. **15**, ventral view of sternum 5 (scale = 1 mm). **16**, ventral view of sternum 6 (scale = 1 mm). **17**, ventral view of sternum 7 (scale = 100 µm). **18**, ventral view of sternum 8 (scale = 150 µm). **19**, volsella, row pointed on the expanded and apically rounded digitus (scale = 100 µm). **20**, apicolateral view of sternum 7 (scale = 100 µm). **21**, dorsal view of genitalia (scale = 300 µm). **22**, lateral view of genitalia.

Related species. *M. changmuensis*, *M. nigricans* and *M. tricincta*.

Diagnosis. ♀ ♂. Glossa shorter than maxillary palpus. Maxillary palpus shorter than galea (figs 13–14). Outer surface of galea mat and sculptured (fig. 13). Malar area shorter than A2. Scutum mat and sculptured. Propodeal triangle flat, finely sculptured, slightly different from propodeum (fig. 9). Bt3 with pale hair. Metasoma black.

♀. L = 11.9 mm. Clypeus flat, densely punctate ($i < d$), smooth between punctures, without median carina, sometimes sculptured anteriorly. Glossa and labial palpus as illustrated (fig. 8). Scutum with intermixed black and reddish hairs. Hind metatarsus as in fig. 11. T2–T4 with yellowish, apical hair bands twice as long as marginal zone (fig. 10). Prepygidial fimbria mostly with median black hair and few lateral white hairs. Pp mostly flat (fig. 12).

♂. L = 10.7 mm. Entire clypeus densely punctate ($i < d$). Face covered with yellowish hair, without narrow, black lateral fringe (sometimes with a few black hairs). Antenna brown dorsally and reddish ventrally. A3 as long as A4. A3–A12 slightly convex ventrally. Hairs on underside of F3 longer than width of F3. Bt3 1.5X as long as mediotarsus 3. Terga with sparse, yellowish apical bands, longer than marginal zone. Disc of T3 with erect, reddish hair. S4–S5 emarginate apically (fig. 15). S6 with bushy brown hair apicomedia (fig. 16). S7 with apicolateral process nearly hairless (figs 17, 20). S8 as illustrated (fig. 18). Apex of gonostylus straight and truncated (figs 21–22). Digitus rounded apically (fig. 19).

Distribution (fig. 185). Palaearctic. Widespread in Europe, from 41°N (except one record in Spain, Bayárcal, 37.03°N 2.98°W, CS) to southern Sweden and Finland. In Asia, from Anatolia and Iran (Yazd, 31.9°N 54.37°E, OOLL) to Mongolia (Tuul, 48.95°N 104.8°E, OOLL).

Phenology. Beginning June to end August.

Host plants (778 specimens). Asteraceae, *Achillea millefolium* (1♂), *Centaurea* sp. (3♀ 4♂), *C. jacea* (7♀ 8♂), *C. sterilis* (1♀), *C. stoebe* (2♀), *Cichorium* sp. (1♂), *C. intybus* (1♀ 4♂), *Cirsium* sp. (1♀), *C. monspesulanum* (1♀), *C. vulgare* (2♂), *Inula* sp. (9♂), *I. britannica* (1♂), *Leontodon* sp. (1♂), *Senecio inaequidens* (1♀), *S. jacobaea* (5♀ 1♂), *Serratula tinctoria* (1♂), *Solidago gigantea* (1♀), *Xeranthemum annuum* (1♀); Boraginaceae, *Anchusa* sp. (1♂); Campanulaceae, *Campanula rotundifolia* (1♂); Cistaceae, *Cistus* sp. (2♀ 1♂); Dipsacaceae, *Scabiosa isetensis* (4♂); Fabaceae, *Astragalus onobrychis* (1♀ 3♂), *Glycyrrhiza glabra* (8♀ 6♂), *Lotus* sp. (1♀ 1♂), *L. corniculatus* (12♀ 10♂), *Medicago* sp. (3♀ 8♂), *M. falcata* (17♀ 12♂), *M. lupulina* (1♂), *M. sativa* (236♀ 147♂), *M. x-varia* (2♂), *Melilotus* sp. (5♀ 1♂), *M. alba* (12♀ 3♂), *M. altissima* (1♀), *M. officinalis* (4♀), *Trifolium* sp. (14♀ 34♂), *T. arvense* (8♀ 2♂), *T. montanum* (1♀ 12♂), *T. pratense* (12♀ 18♂), *T. repens* (14♀ 48♂), *Vicia cracca* (1♀), *V. villosa* (3♀ 2♂); Lamiaceae, *Ballota nigra* (1♂), *Lavandula* sp. (1♀), *L. angustifolia* (1♀), *Lycopus europaea* (7♂), *Mentha pulegium* (1♀), *Nepeta nuda* (1♀ 3♂), *Origanum vulgare* (1♀ 1♂), *Salvia nemorosa* (6♂), *S. x-sylvestris* (1♀ 6♂), *Thymus serpyllum* (8♂); Lythraceae, *Lythrum salicaria* (1♂); Malvaceae, *Lavatera thuringiaca* (1♂); Resedaceae, *Reseda lutea* (2♀); Rosaceae, *Rubus* sp. (2♂); Scrophulariaceae, *Linaria vulgaris* (1♂), *Veronica* sp. (2♀ 1♂).

4. *Melitta maura* (Pérez)

[Figs 23–30, 181]

Cilissa maura Pérez 1896: 61–62, ♀ ♂. Type material. Lectotype ♂, 1♀ paralectotype, Algeria, Ghardaia [32.48°N 3.67°E], MNHN, S. Locus typicus: “Barbarie”.

Cilissa atlantis Vachal 1910: 179, ♀. Synonymised by Warncke (1973b: 106). Type material. Holotype ♀, Morocco, Mogador [32.51°N 9.77°W], MNHN?, NS. Locus typicus: “Maroc, Mogador”.

Melitta eryngii Cockerell 1931: 344, ♂. Type material. Not located. Locus typicus: “Morocco, Ifrane” [33.53°N 5.10°W].

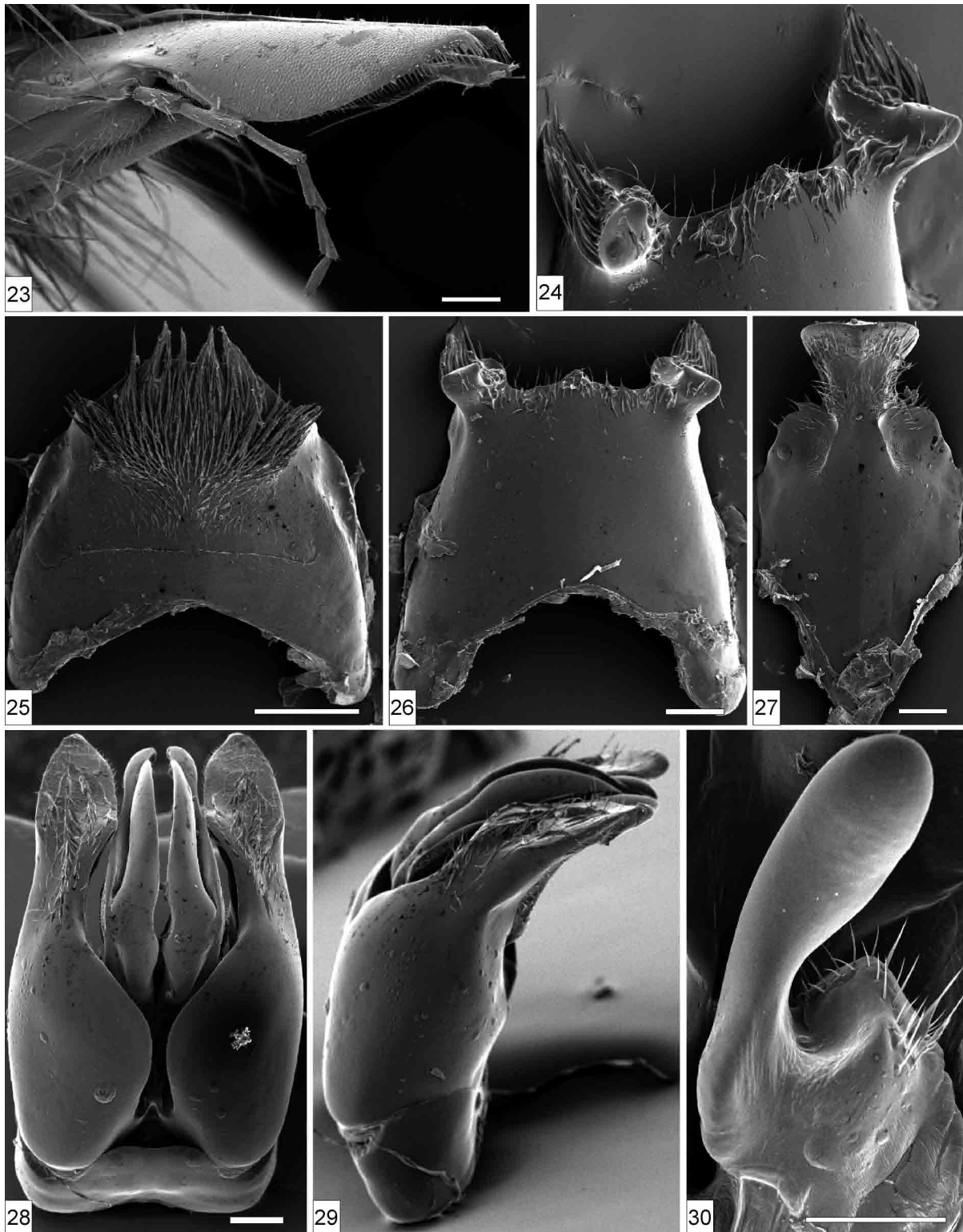
Melitta maura cyrenaicensis Warncke 1973: 107, ♀ ♂. Type material. Holotype ♀, Libya, Bengasi [32.11°N 20.06°E], leg. Krüger, OOLL, S; 1♀ paratype, Algeria, Biskra [34.85°N 5.73°E], MNHN, S; paratype, Tunisia, Kairouan [35.67°N 10.10°E], OOLL, S; paratype, Tunisia, Karthago [?], OOLL, S; paratype, Libya, Tripoli [31°N 15°E], OOLL, S; paratype, Lybia, Teniswa [?], OOLL, S; paratype, Libya, Sabratha [32.79°N 12.48°E], OOLL, S. Locus typicus: “Cyrenaika, Bengasi”.

Melitta maura orientana Warncke 1973: 107, ♀ ♂. Type material. Holotype ♂, Israel, Deganya [32.70°N 35.58°E], 11.II.1949, leg. Bytinski-Salz, OOLL, S; paratype, Israel, Al Maghtas [?], OOLL, S; paratype, Israel, Jericho [31.46°N 35.10°E], OOLL, S. Locus typicus: “Israel, Deganya”.

Additional material examined (150 specimens). **Israel:** 1♂, Tiberias [32.8°N 35.53°E], 22.III.1975, leg. Guichard, NHM; 1♀, idem, 26.III–02.IV.1996, leg. Wolf, OOLL. **Libya:** 1♀, Sabratha [32.79°N 12.48°E], 27.II.1954, leg. Guichard, NHM; 1♀, Tripoli, [32.89°N 13.18°E], 28.II.1954, leg. Guichard, NHM; 2♀, idem, 04.II.1954, Guichard, NHM. **Morocco:** 1♀ 3♂, Agadir [29.92°N 9.27°W], 03.III.2003, on *Volularia lippii*, leg. Berg, CB; 1♀, idem, 19.I.2002, on yellow Brassicaceae, leg. Berg, CB; 4♀ 2♂, idem, 22.I.2002, on yellow Brassicaceae, leg. Berg, CB; 2♀, idem, 25.I.2002, on yellow Brassicaceae, leg. Berg, CB; 2♂, idem, 20.I.2002, leg. Berg, CB; 2♂, idem, 01.III.2003, leg. Berg, CB; 3♀, idem, 24.I.2002, on yellow Brassicaceae, leg. Berg, CB; 1♀, idem, 09.II.1998, leg. Guichard, NHM; 9♂, idem, 28.I.1988, leg. Péraudin, OOLL; 2♀ 9♂, Oued Massa [29.95°N 9.63°W], 15.IV.1979, leg. Warncke, OOLL; 1♂, idem, 15.IV.1979, leg. Warncke, CS; 2♀ 8♂, idem, 14.IV.1979, leg. Warncke, OOLL; 1♀ 1♂, idem, 14.IV.1979, leg. Warncke, CS; 2♀ 15♂, idem, 17.IV.1979, leg. Warncke, OOLL; 4♀, Mehdiya [34.25°N 6.68°W], 23.II.1988, leg. Teunissen, RNHL; 11♀ 11♂, idem, 25.II.1988, leg. Teunissen, RNHL; 1♂, idem, 24.II.1988, leg. Teunissen, RNHL; 1♀, Biougra [31.21°N 8.85°W], 07.II.1989, leg. Teunissen, RNHL; 1♀, Tarhia du Drâa [30.87°N 6.62°W], 13.III.1989, leg. Teunissen, RNHL; 2♀, idem, 09.III.1988, leg. Teunissen, RNHL; 1♂, Taroudannt [30.48°N 8.87°W], 13.IV.1979, OOLL; 4♂, Taroudant [35.37°N 5.62°W], 27.III.1974, leg. Guichard, NHM; 2♂, El Jadida, 33.43°N 8.05°W, 2m, 19.III.1995, on *Lycium ferocissimum*, leg. Rasmont, UMH; 4♂, idem, on *Lycium ferocissimum*, leg. Wahis, UMH. **Spain:** 2♂, Benidorm [38.53°N 0.13°W], FUSAG; 1♀ 5♂, Alicante [38.35°N 0.48°W], 02.XI.1960, OOLL; 16♀ 3♂, Elche [38.25°N 0.70°W], 02.XI.1964, OOLL; 1♂, idem, 02.IX.1964, leg. Warncke, OOLL; 2♀ 2♂, idem, 02.IX.1964, leg. Warncke, CS; 3♂, Benidorm [38.53°N 0.13°W], 12.II.1977, UMH.

Related species. *M. aegyptiaca* and *M. schmiedeknechti*.

Diagnosis. ♀ ♂. Labial palpus longer than glossa. Maxillary palpus as long as galea (fig. 23). Outer surface of galea mat and sculptured (fig. 23). Malar area longer than A2. Scutum mostly



Figures 23–30

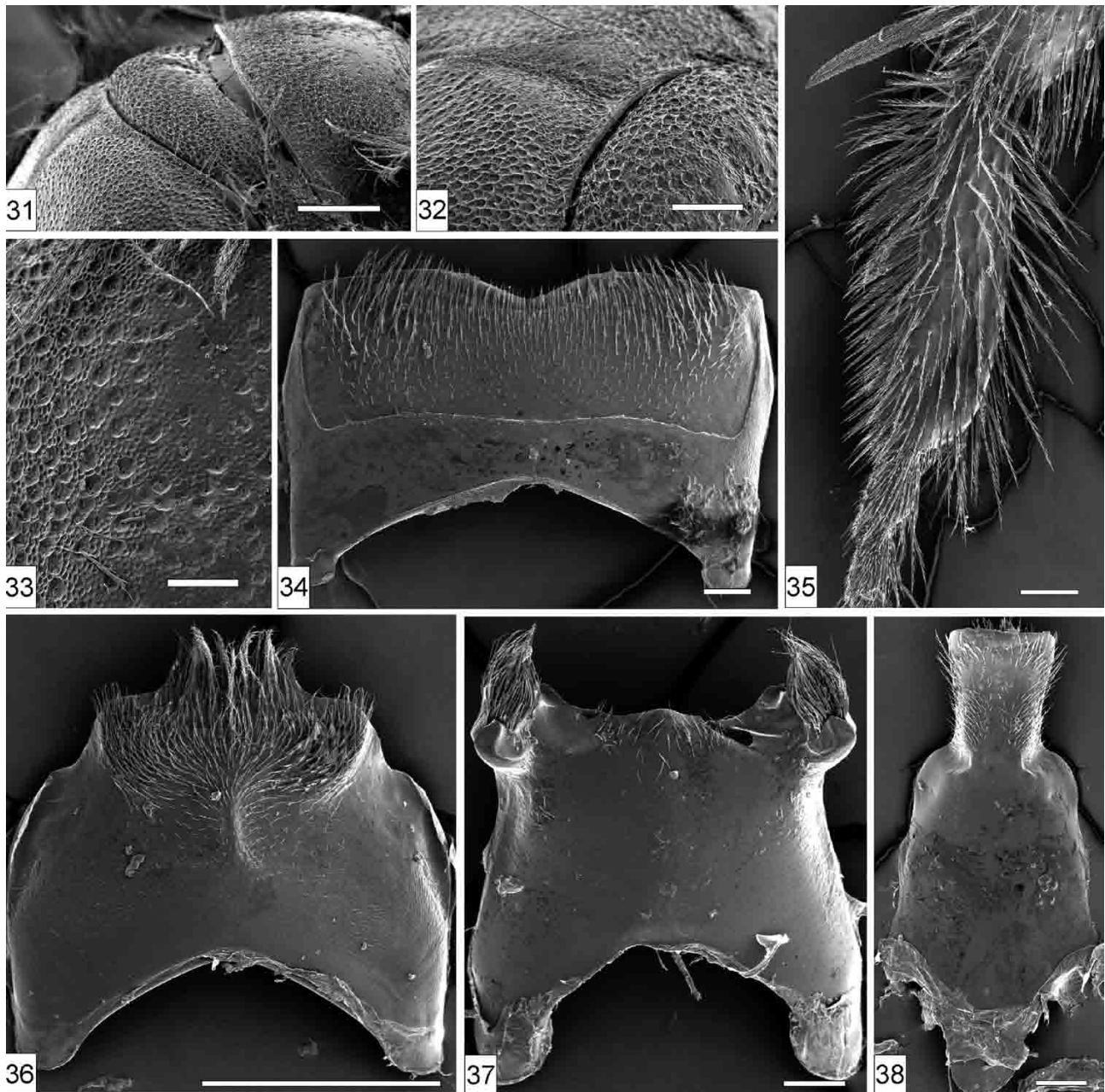
Melitta maura, male. **23**, lateral view of proboscide (scale = 200 μ m). **24**, apicolateral view of sternum 7. **25**, ventral view of sternum 6 (scale = 500 μ m). **26**, ventral view of sternum 7 (scale = 250 μ m). **27**, ventral view of sternum 8 (scale = 150 μ m). **28**, dorsal view of genitalia (scale = 250 μ m). **29**, lateral view of genitalia. **30**, volsella (scale = 120 μ m).

sculptured and mat, sometimes with posterior area shiny.

♀. L = 13.2 mm. Clypeus densely punctate (i = d), finely sculptured between punctures, with impunctate median line. Face and scutum with yellowish to black hairs. Anterior area of scutellum shiny. Mesosoma with black and reddish hairs intermixed. Propodeal triangle finely rugose, narrower than metanotum. T1-T3 mostly partly orange. T2-T5 with apical

hair bands yellow to brownish, and as long as marginal zone. T4 apical hair band longer medially. Prepygidial fimbria brownish to black. Pp flat.

♂. L = 10.9 mm. Clypeus densely punctate, except apical area smooth. A3 shorter than A4. A4-A12 slightly convex ventrally. T2-T4 with yellowish to brownish, continuous apical hair bands. S4-S5 with straight apical margin. S6 as illustrated (fig. 25). S7 with



Figures 31–38

Melitta nigricans. **31**, lateral view of propodeum ♀ (scale = 500 µm). **32**, lateral view of propodeal triangle ♀ (scale = 300 µm). **33**, Centre of scutum ♀ (scale = 100 µm). **34**, ventral view of sternum 5 ♂ (scale = 300 µm). **35**, Bt3 ♂ (scale = 300 µm). **36**, ventral view of sternum 6 ♂ (scale = 1 mm). **37**, ventral view of sternum 7 ♂ (scale = 250 µm). **38**, ventral view of sternum 8 ♂. **39**, apicolateral view of sternum 7 ♂. **40**, lateral view of sternum 8 ♂ (scale = 200 µm). **41**, dorsal view of genitalia ♂ (scale = 300 µm). **42**, lateral view of genitalia ♂.

apicolateral process swollen (figs 24, 26). S8 nearly hairless (fig. 27). Gonostylus pointed apically (fig. 28). Gonostylus straight ventrally (fig. 29). Penis valve and digitus rounded apically (fig. 30).

Variation. *M. maura cyrenaicensis* diagnosis: face with yellowish hairs and lateral terga with brownish hairs. Occuring Algeria, Libya and Tunisia.

M. maura maura diagnosis: face with brownish hairs and lateral terga with yellowish hairs. Occuring Algeria, Morocco and Spain.

M. maura orientana diagnosis: global vestiture brownish. Occuring Israel.

Distribution (fig. 181). Distribution disjunct, in North Africa there are populations in Morocco, Algeria, Tunisia, Tripolitan and Cyrenaica, in Europe they occur in Spain (Alicante) and in Asia they are in Israel.

Phenology. September to November in Spain, and end January to end April in Africa and Israel.

Host plants (19 specimens). Asteraceae, *Volutaria lippii* (1♀); Brassicaceae (10♀ 2♂); Solanaceae, *Lycium ferocissimum* (6♂).

5. *Melitta nigricans* Alfken

[Figs 31–42, 172, 183]

Melitta nigricans Alfken 1905: 96, ♀ ♂. Type material. Holotype ♂, Germany, Bremen [53.08°N 8.8°E], leg. Saunders, NMW, S. Locus typicus: "Nordwestdeutschland, Bremen".

Additional material examined. 608 specimens were studied (detail of data on ASEF web site <http://ann.sef.free.fr/>).

Related species. *M. leporina* and *M. tricineta*.

Diagnosis. ♀ ♂. Glossa elongated, as long as maxillary palpus. Outer surface of galea mat and sculptured. Malar area shorter than A2. Scutum mat and sculptured (fig. 33). Propodeum declivous (fig. 31). Metasoma black.

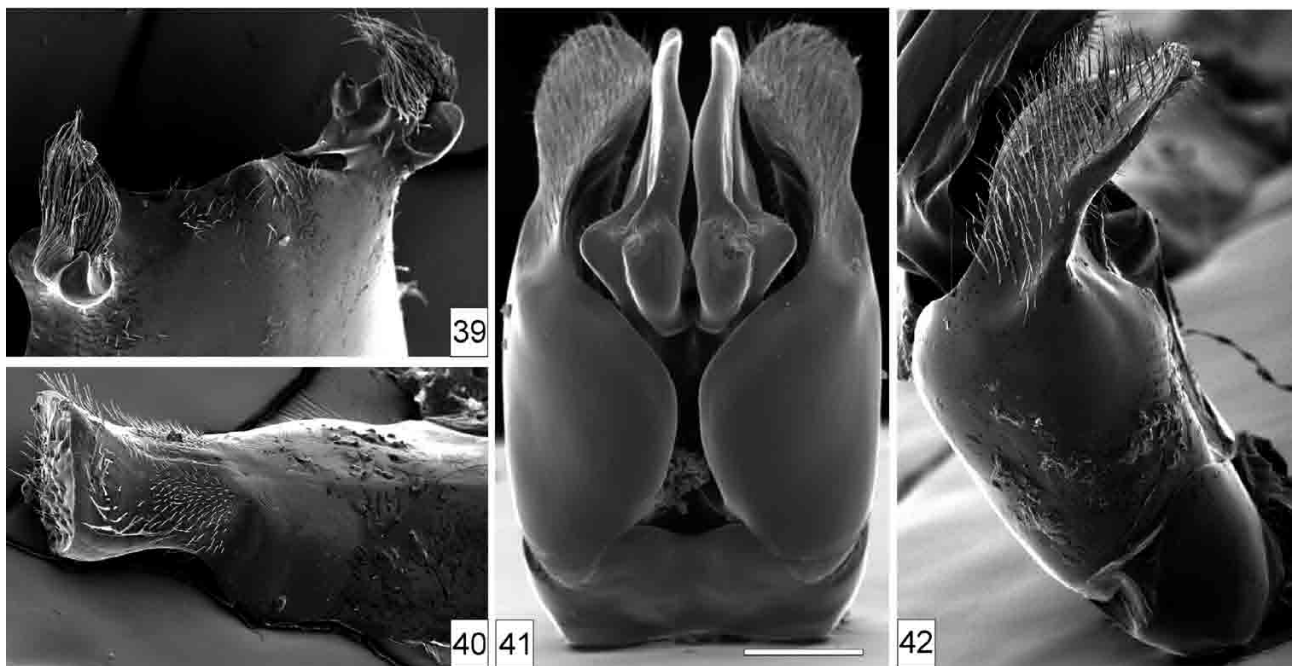
♀. L = 11.1 mm. Clypeus flat, with deep and sparse punctures ($i > 2d$), sculptured between punctures. Centre of scutellum with blackish-brown hairs. Base of propodeal triangle with central area slightly concave (figs 31–32), finely sculptured. Bt3 with pale hair. T2–T4 with yellowish-white, apical hair bands as long as marginal zone. Prepygidial fimbria mostly black medially, this smaller than lateral, white hairs.

♂. L = 9.5 mm. Clypeus convex, with median impunctate line. Antenna brown. A4–A12 slightly convex ventrally. Face with erect, white hairs, and narrow, black lateral fringe. Propodeal triangle finely rugose. Hairs on underside of F3 shorter than width of F3. Mt3 twice as wide as mediotarsus 3 (fig. 35). Terga with dense, white, apical hair bands, shorter than marginal zone. Disc of T3 with black hair. Apical margin of S4–S5 emarginate (fig. 34). S6 as illustrated (fig. 36). Apicolateral process of S7 with long, yellow hair (figs 37, 39). S8 nearly hairless (figs 38, 40). Apical area of S8 circle shaped. Gonostylus truncate apically (fig. 41) and flat ventrally (fig. 42). Penis valve wide basally (fig. 41). Digitus rounded apically.

Distribution (fig. 183). Widespread in Europe, from Coimbra (Portugal) to Sopot (Poland) and Orenburg (Russia). Absent in England and Sweden. One record from Morocco: 1♂, Mogador [31.51°N 9.78°W], 17–22.III.1932, leg. Meyer, RNHL.

Phenology. Early July to early September.

Host plants (160 specimens). Asteraceae, *Carduus* sp. (1♂), *Tanacetum* sp. (2♂); Fabaceae, *Melilotus* sp. (3♂), *Trifolium*



Figures 39–42

Melitta nigricans. 39, apicolateral view of sternum 7 ♂. 40, lateral view of sternum 8 ♂ (scale=200µm). 41, dorsal view of genitalia ♂ (scale = 300 µm). 42, lateral view of genitalia ♂.

sp. (2♂); Lythraceae, *Lythrum* sp. (22♀ 23♂), *L. salicaria* (42♀ 61♂), *L. virgatum* (2♀ 1♂); Onagraceae, *Epilobium angustifolium* (1♂).

6. *Melitta schmiedeknechti* Friese

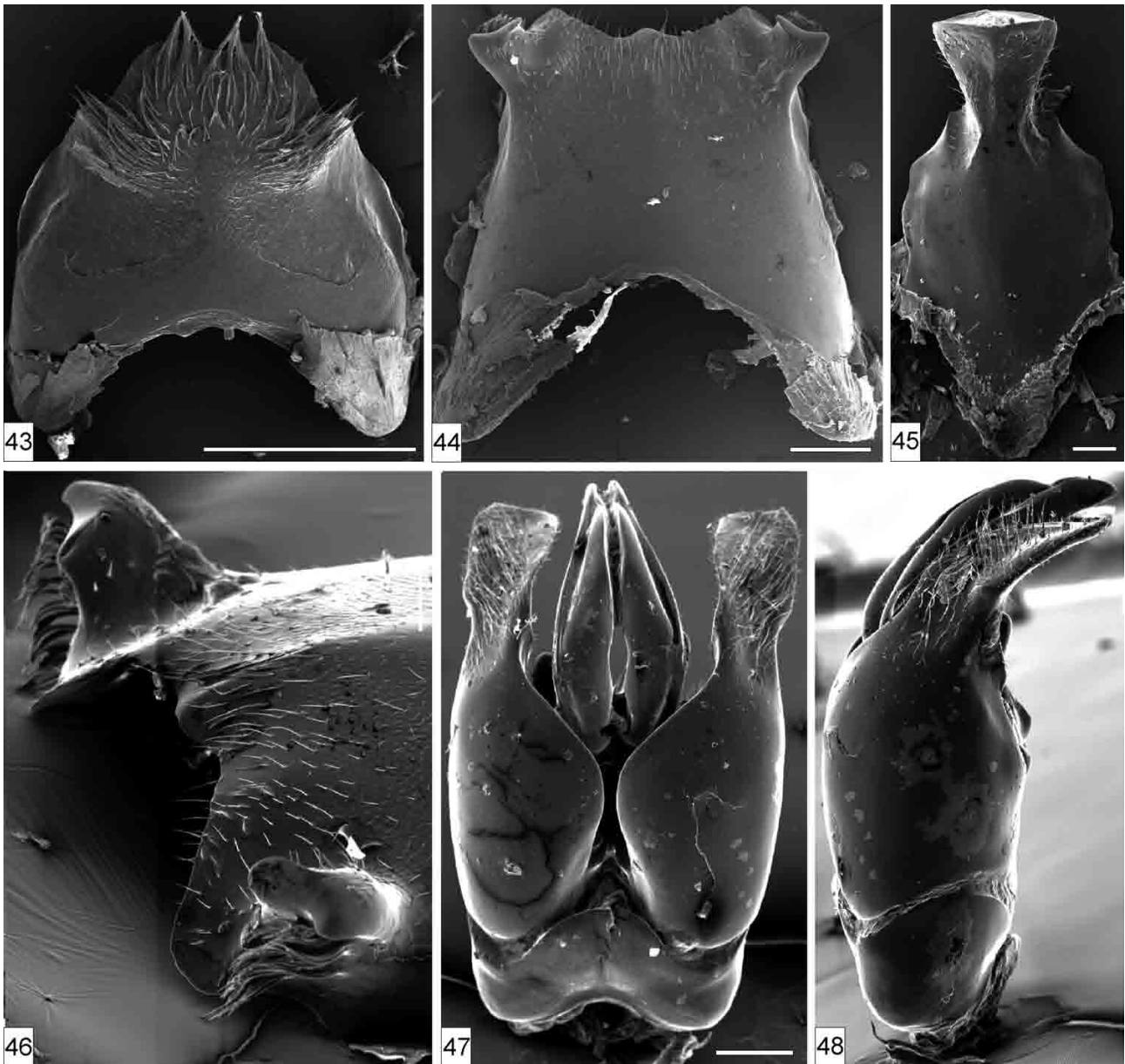
[Figs 43–48, 165, 180]

Melitta schmiedeknechti Friese 1898: 304, ♀ ♂. Type material. 1♀ 2♂ syntypes, not located. Locus typicus: “*Unter-Aegypten*”.

Melitta schmiedeknechti tunensis Warncke 1973: 105, ♀ ♂. Type material. Holotype ♀, Tunisia, Tunis [36.80°N 10.18°E], OOLL, S; paratype

♀, Tunisia [36.80°N 10.18°E], leg. Friese, OOLL, S; paratype ♀, Hamman Bou Hadjar [35.38°N 0.96°W], 10.IV.1918, OOLL; 4♂ paratypes, idem, 04.IV.1910, OOLL. Locus typicus: “*Tunis*”.

Additional material examined (123 specimens). **Egypt:** 2♀ 3♂, Fayum [29.32°N 30.83°E], NMW; 1♂, idem, OOLL; 1♀, Saqqâra [29.85°N 31.22°E], NMW; 1♂, Meadi [29.97°N 31.25°E], 04.III.1912, NHM; 1♂, idem, 27.II.1912, NHM; 1♂, idem, 03.IV.1912, NHM; 3♂, idem, 01.III.1912, NHM; 3♀ 3♂, Cairo [30.05°N 31.25°E], NMW; 3♀ 2♂, idem, OOLL; 1♀ 3♂, Helouan [29.85°N 31.33°E], NMW; 3♂, idem, OOLL; 1♀ 2♂, Abu Tig [27.03°N 31.32°E], 03.IV.1913,



Figures 43–48

Melitta schmiedeknechti, male. 43, ventral view of sternum 6 (scale=1mm). 44, ventral view of sternum 7 (scale = 300 µm). 45, ventral view of sternum 8 (scale = 150 µm). 46, apicolateral view sternum 7. 47, dorsal view of genitalia (scale=300µm). 48, lateral view of genitalia.

NHM; 1♀, Denderah [26.16°N 32.65°E], 12.II.1924, OOLL; 1♂, Louksor [25.68°N 32.65°E], 24.II.1958, leg. Putowski, OOLL. **Israel:** 1♀, Judaeen desert [31.67°N 35.17°E], 17.III.1997, leg. Rozen, AMNH; 2♀, Negev [30.50°N 34.92°E], 18.III.1997, leg. Rozen, AMNH; 1♀, idem, 02.III.1997, leg. Rozen, AMNH; 4♂, Jerusalem [31.75°N 35°E], 14.III.1997, leg. Rozen, AMNH. **Jordan:** 2♂, Petra [30.31°N 35.48°E], 28.II-04.III.1960, leg. Guichard, NHM. **Lybia:** 1♂, Tôcra [32.53°N 20.57°E], 17.III.1958, leg. Guichard, NHM; 1♂, Dérna [32.77°N 22.65°E], 23.II.1958, leg. Guichard, NHM. **Morocco:** 1♀ 2♂, Agadir [29.91°N 9.27°W], 03.III.2003, leg. Berg, CB; 2♂, idem, 21.IV.1996, leg. Schwarz, CS; 7♀ 4♂, Oued Massa [30.08°N 9.67°W], 28-29.III.1989, on *Reseda* sp., leg. Else, NHM; 1♂, idem, 12.III.1989, leg. Else, NHM; 1♂, idem, 30.III.1984, leg. Teunissen, RNHL; 3♂, Tamri [30.70°N 9.83°W], 06.III.1988, leg. Teunissen, RNHL; 2♀, Oulmes [33.43°N 6.02°W], 27.IV.1968, leg. Rozen, AMNH; 3♂, Marrakech [31.63°N 8.00°W], OOLL; 3♂, Biougra [31.22°N 8.85°W], 28.II.1988, leg. Teunissen, RNHL; 2♀, Tarhia du Drâa [30.87°N 6.61°W], 09.III.1988, leg. Teunissen, RNHL; 1♂, Ait Saoun [30.75°N 6.63°W], 06.IV.1980, leg. Warncke, CS; 1♂, Ouarzazate [30.91°N 6.91°W], 07.IV.1980, leg. Warncke, CS; 1♂, Ait Baha [29.55°N 8.98°W], 20.IV.1996, leg. Schwarz, CS; 1♂, Tiznit [29.71°N 9.71°W], 12.III.1974, leg. Guichard, NHM; 1♂, idem, 06.V.1995, leg. Halada, OOLL; 1♀, idem, OOLL; 2♀ 1♂, Sidi Ifni [29.38°N 10.17°W], 04.III.1988, leg. Teunissen, RNHL; 4♀ 1♂, Laayoune [22.83°N 12.33°W], 12.II.1988, leg. Guichard, NHM; 1♀ 2♂, idem, 16.II.1988, leg. Guichard, NHM; 1♂, Taroudant [35.37°N 5.62°W], 27.III.1974, leg. Guichard, NHM; 1♀, Berkane, 34.92°N 2.60°W, 70m, 10.III.1995, on *Oxalis pes-caprea*, leg. Patiny, UMH; 1♂, idem, on *Oxalis pes-caprea*, leg. Wahis, UMH. **Spain (Canaries):** 5♂, Betancuria [28.42°N 14.05°W], 02.I.1988, on *Reseda* sp., leg. Vardy, NHM; 1♂, Isla de Fuerteventura [28.33°N 14.00°W], leg. Bakhuys, OOLL; 1♂, Corralejo [28.73°N 13.87°W], 08.II.1985, leg. Teunissen, RNHL; 6♂, Tefia [28.52°N 13.98°W], 14.II.1985, leg. Teunissen, RNHL. **Tunisia:** 1♂, Rass Tourgueness [33.83°N 11.05°E], 12.III.1974, leg. Guichard, NHM; 1♀, Bou Hadjar [35.68°N 10.87°E], 10.IV.1918, OOLL; 4♀, idem, 04.IV.1910, OOLL; 1♀, Tunis [36.80°N 10.18°E], OOLL; 1♀ 3♂, Zarzis [33.50°N 11.11°E], 22.III-03.IV.1983, leg. Wolf, CS.

Related species. *M. aegyptiaca* and *M. maura*.

Diagnosis. ♀ ♂. Labial palpus as long as glossa. Outer surface of galea mat and sculptured. Maxillary palpus as long as galea. Malar area shorter than A2. Scutum, scutellum and metanotum mat and sculptured. Propodeal triangle finely sculptured, as wide as metanotum, with marginal carina.

♀. L = 11.0 mm. Clypeus densely punctate ($i < d$), sculptured between punctures (at least basally), with impunctate median line (at least basally). Apical half of Bt3 with darkish brown hairs. T1 mostly orange. T2-T3 black. T2-T4 with yellow to yellowish apical hair bands as long as marginal zone. T4 with apical hair band longer medially. Prepygidial fimbria black with few white hairs laterally. Pp flat.

♂. L = 10.5 mm. Face with erect white hairs, narrow and black lateral fringe. A4-A12 slightly convex ventrally. Terga without apical hair bands, sometimes with few yellow, apical hairs. S5 with straight apical margin. S6 with apicomedian bushy hairs (fig. 43). Apicolateral process of S7 swollen (figs 44, 46). S8 nearly hairless (fig. 45), with apical area circle shaped. Gonostylus truncate apically (fig. 47), straight ventrally (fig. 48). Digitus rounded apically.

Variation. *M. schmiedeknechti schmiedeknechti* diagnosis: Face and scutum with brown and reddish hairs intermixed. Occurring Canaries, Morocco and Libya.

M. schmiedeknechti tunensis diagnosis: Face and scutum with brown hairs. Occurring Egypt and Israel

Distribution (fig. 180). Disjunct distribution in North Africa with population in Canaries, Morocco, Tunisia, Cyrenaica, Egypt and Israel.

Phenology. Beginning February to early April.

Host plants (19 specimens). Fabaceae (1♀); Oxalidaceae, *Oxalis pes-caprea* (1♀ 1♂), Resedaceae, *Reseda* sp. (7♀ 9♂).

7. *Melitta tricincta* Kirby

[Figs 49–57, 166, 173, 182]

Melitta tricincta Kirby 1802: 171-172, ♀. Type material. Holotype ♀, United Kingdom [?], NHM (Kirby collection), S. Locus typicus: "Angliâ".

Kirbya melanura Nylander 1852: 101, ♀. Type material. Not located. Locus typicus: not indicated.

Andrena microstigma Eversmann 1852: 21, ♂. Type material. Not located. Locus typicus: "in prov. transuralensibus".

Andrena quadricincta Eversmann 1852: 26, ♀ ♂. Type material. Not located. Locus typicus: "in prov. Orenburgensi, in promontoriis Uralensibus".

Melitta meridionalis Hedicke 1933: 1-2, ♀ ♂. Synonymised by Warncke (1973b: 107). Type material. Holotype ♀, Italy, Grizzana [44.25°N 11.15°E], 30.VIII.1925, leg. Grandi, MIZB, NS; 1♂ 1♀ paratypes, idem, 02.IX.1925, MIZB, NS; 1♀ paratype, Italy, Ebenda [?], 28.VIII.1925, leg. Grandi, MIZB, NS (localisation see Baker & Engel 2007). Locus typicus: "Emilia, Grizzana".

Additional material examined. 837 specimens were studied (detail see ASEF web site <http://ann.sef.free.fr/>).

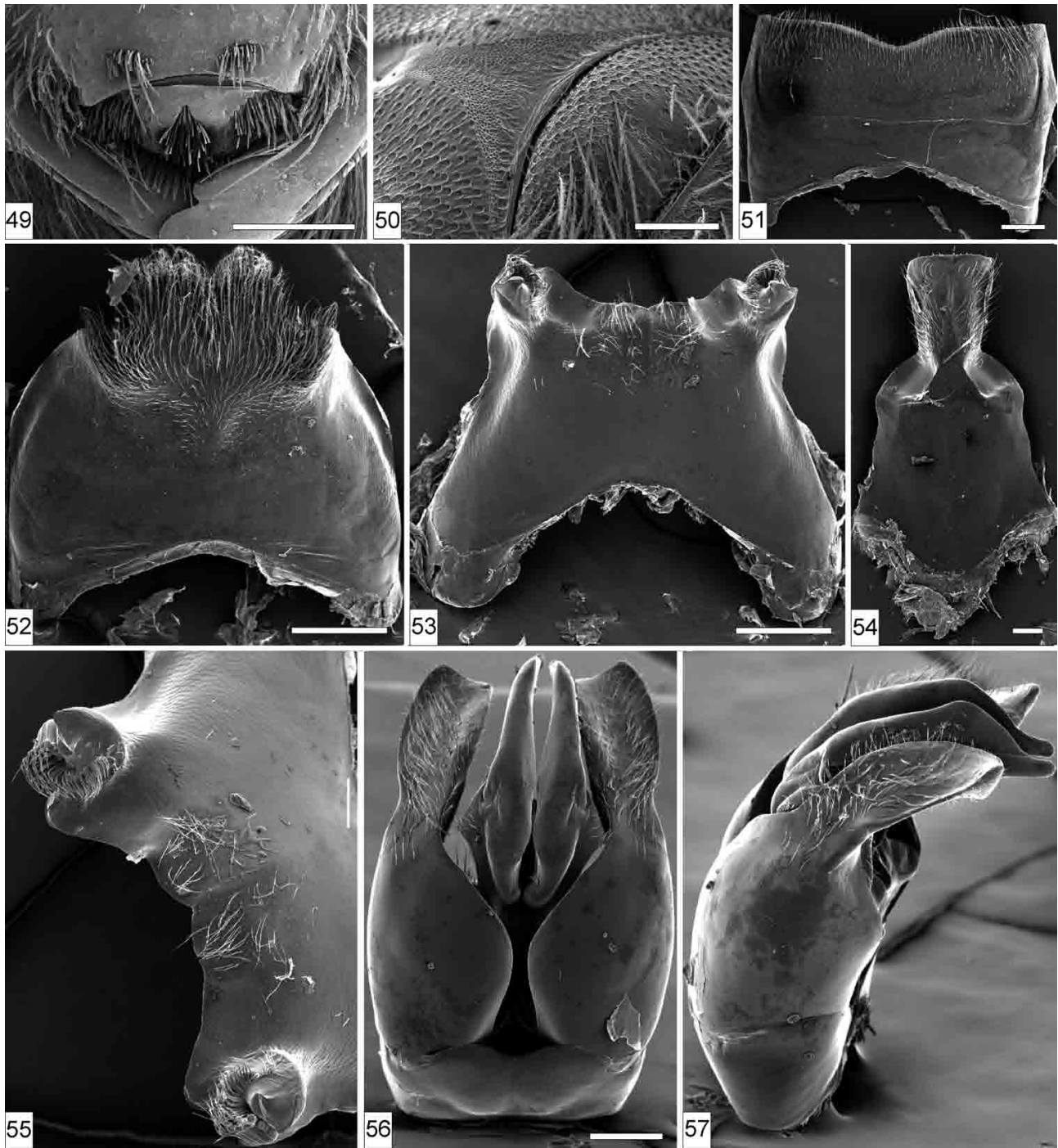
Related species. *M. leporina* and *M. nigricans*.

Diagnosis. ♀ ♂. Glossa shorter than maxillary palpus. Outer surface of galea mat and sculptured. Malar area shorter than A2. Scutum and scutellum mat and sculptured. Propodeal triangle strongly sculptured, margin carinate (fig. 50). Terga black. T2-T4 with yellowish-white apical hair bands (fig. 166), usually as long as marginal zone (sometimes shorter).

♀. L = 10.8 mm. Clypeus convex, with dense, deep punctures ($i < d$), smooth between punctures (at least apically), with impunctate median line. Scutum with reddish and black hair intermixed. Bt3 with pale hairs (fig. 166). Prepygidial fimbria mainly black, with yellowish hair laterally. Pp mostly with a narrow median elevated area.

♂. L = 9.9 mm. Clypeus convex, densely punctate, except smooth, apical area. Antenna brown. A3 as long as A4. A4-A12 enlarged apically and ventrally. Face with narrow, black, lateral fringe. Hairs on underside of F3 shorter than width. Bt3 twice as wide as mediotarsus 3, with parallel margins. Disc of T3 with black hair. S4-S5 with emarginate apical margin (fig. 51). S6 with bushy hair apicomediaally (fig. 52). S7 with apicolateral process nearly hairless (figs 53, 55). S8 nearly hairless (fig. 54). Gonostylus straight and truncate apically (figs 56–57). Digitus rounded apically.

Distribution (fig. 182). Widespread in Europe from the south of England to Ufa (54.73°N 55.93°E) and Udmurtia (57.00°N 53.00°E) (Russia), from Sicily to Löderup (55.43°N 14.11°E) and Kalmar (56.66°N 16.36°E) (Sweden).



Figures 49–57

Melitta tricincta. **49**, labrum ♀ (scale = 500 µm). **50**, lateral view of propodeal triangle ♀ (scale = 300 µm). **51**, ventral view of sternum 5 (scale = 300 µm). **52**, ventral view of sternum 6 (scale = 300 µm). **53**, ventral view of sternum 7 (scale = 300 µm). **54**, ventral view of sternum 8 (scale = 100 µm). **55**, apicolateral view of sternum 7. **56**, dorsal view of genitalia (scale = 200 µm). **57**, lateral view of genitalia.

Phenology. End July to end September.

Host plants (314 specimens). Asteraceae, *Centaurea jacea* (3♀), *Cichorium intybus* (1♂), *Inula britannica* (2♂); Fabaceae, *Glycyrrhiza glabra* (1♂), *Lotus creticus* (1♀); Lamiaceae, *Calamintha* sp. (1♂), *C. nepeta* (2♀), *Lycopus europaeus* (1♂), *Mentha* sp. (4♂); Lythraceae, *Lythrum salicaria* (3♂); Scrophulariaceae, *Odontites lutea* (16♀ 14♂), *Odontites verna* (105♀ 64♂), *Odontites* sp. (24♀ 21♂), *Euphrasia* sp. (36♀ 11♂), *Melampyrum* sp. (4♂).

Subgenus *Cilissa* Leach

Cilissa, Leach 1815: 155. Type species: *Andrena haemorrhoidalis* Fabricius 1775 (designated by Westwood 1840).

Pseudocilissa Radoszkowski 1891: 241. Type species: *Cilissa robusta* Radoszkowski 1876 (= *Melitta dimidiata* Morawitz 1876) (monobasic).

Brachycephalapis Viereck 1909: 47. Type species: *Melitta (Brachycephalapis) californica* Viereck 1909.

Dolichochoile Viereck 1909: 49. Type species: *Dolichochoile melittoides* Viereck 1909. **Syn. nov.**

Diagnosis. Centre of scutum and anterior scutellum mostly smooth between punctures (fig. 92). Female Pp mostly with lateral grooves (fig. 93). Male S7 blade shaped apicolaterally (figs 59, 61, 73, 77, 79, 84, 86, 95, 101, 120, 122, 128, 130, 135, 137, 146) or bowl shaped (figs 65, 68, 106, 108, 141, 152, 153, 157, 160). Gonostylus shorter than gonocoxite (lateral view) (figs 63, 71, 75, 82, 90, 99, 104, 111, 126, 133, 144, 150, 162).

Included species. *Melitta albida*, *M. americana*, *M. arrogans*, *M. barbara*, *M. bicollaris*, *M. budensis*, *M. californica*, *M. cameroni*, *M. danae*, *M. dimidiata*, *M. eickworti*, *M. ezoana*, *M. fulvescens*, *M. guichardi*, *M. haemorrhoidalis*, *M. harrietae*, *M. heilungkiangensis*, *M. hispanica*, *M. iberica*, *M. japonica*, *M. kastiliensis*, *M. katherinae*, *M. latronis*, *M. melittoides*, *M. mongolica*, *M. montana*, *M. murciana*, *M. nigrabdominalis*, *M. rasmonii*, *M. schultzei*, *M. seitzii*, *M. sibirica*, *M. tomentosa*, *M. udmurtiaca*, *M. wankowiczii* and *M. whiteheadi*.

Distribution. Palaearctic, Ethiopian and Nearctic.

1. *Melitta albida* Cockerell

[Fig. 190]

Melitta albida Cockerell 1935: 76-77, ♂. Type material. Holotype ♂, Botswana, Kuke Pan [23.32°S 24.45°E], 21-30.III.1930, TMSA, S. Locus typicus: "Kuke Pan".

Melitta albida, Eardley & Kuhlmann (2006: 301-302), description of female, illustration of genitalia male and S6-S8 male.

Additional material examined (2 specimens). **Namibia:** 1♀ 1♂, Omaruru [21.43°S 15.93°E], 21.III.1979, leg. Rozen, AMNH.

Related species. *M. danae*.

Diagnosis. ♀ ♂. Glossa as long as labial palpus. Outer surface of galea mat and sculptured. Malar area shorter than A2. Scutum and scutellum densely punctate ($i < d$), mat. Propodeal triangle mat, with fine granular sculpture similar to propodeum. Metasoma black.

♀. L = 10.1 mm. Clypeus with deep punctures, smooth between punctures, with a median impunctate line. A4-A12 orange. Face with vertex slightly above upper extreme of eye. Legs with yellowish hair. Disc of T3 with black hair. T1-T4

with white apical hair bands twice as long as marginal zone. Prepygidial fimbria black with a few lateral white hairs. Pp with narrow, lateral grooves.

♂. L = 9.3 mm. Clypeus densely punctate ($i < d$). A3 as long as wide. A4 slightly longer than A3. Entire antenna brown. Face with narrow, black, lateral fringe. Apical margin of Bt3 twice as wide as basal margin of mediotarsus 3. Disc of T3 with brownish-black hair. Disc of T4-T6 with black hair. T3-T5 with white, apical hair bands. S6 nearly hairless, with short, dense, yellow hairs laterally. S7 with two apicolateral blades and two inner apicolateral teeth. S8 with a few yellow hairs laterally, apical plate semi-circle. Gonostylus and digitus rounded apically.

Distribution (fig. 190). Botswana, Namibia and South Africa.

Phenology. November to March.

Host plants. Unknown.

2. *Melitta americana* (Smith)

[Fig. 193]

Cilissa americana Smith 1853: 123, ♀. Type material. Syntype ♀, United States of America [?], NHM, S. Locus typicus: "United States".

Melitta americaniformis Viereck 1909: 50, ♀. Type material. Holotype ♀, USA, Jamesburg [40.35°N 74.45°W], USNM, NS. Locus typicus: "New Jersey, Jamesburg".

Melitta americana, Mitchell (1960: 523-524), description of the male.

Melitta americana, Snelling & Stage (1995: 24), illustration of S6-S8 and genitalia ♂.

Additional material examined (3 specimens). **USA:** 1♀, Burlington [42.71°N 76.34°W], 27.VI.1994, leg. Ascher, AMNH; 1♀, Brown Mills [?], 10.VI.1921, AMNH; 1♂, Lakehurst [?], 27.V, AMNH.

Related species. *M. eickworti*.

Diagnosis. ♀ ♂. Outer surface of galea smooth. Malar area shorter than A2. Scutum and scutellum smooth between punctures. Propodeal triangle mat and rugose. T2-T4 densely punctate ($i = d$). Metasoma black.

♀. L = 11.3 mm. Clypeus finely sculptured, with sparse, deep punctures ($i > 2d$), with a median impunctate line. Inner eye margins and vertex without blackish hairs. Head and mesosoma with reddish hairs. Metanotum entirely mat and black. T2-T4 with white apical hair bands. Prepygidial fimbria black, with a few, white hairs intermixed.

♂. L = 10.5 mm. Antenna brown. A3 shorter than A4. A4-A12 slightly convex ventrally. Disc of T2-T4 with short, white, apical hair bands. Disc of T5-T6 with black hairs. T7 with yellowish hairs. S3-S5 with premarginal line slightly emarginate. S6 with apical margin concave. S8 nearly hairless, apical area smooth and triangle shaped. Apex of gonostylus pointed. Digitus rounded apically.

Distribution (fig. 193). East coast of USA.

Phenology. Beginning April to end June.

Host plants (4 specimens). Ericaceae, *Vaccinium* sp. (2♀ 2♂).

3. *Melitta arrogans* (Smith)

[Figs 169, 174, 191]

Andrena arrogans Smith 1879: 56-57, ♀. Type material. Syntype ♀, South Africa, Burgersdorp [30.98°S 26.31°E], NHM, S. Locus typicus:

“South Africa, Burgersdorp”.

Melitta dimidiata var. *capensis* Friese 1909: 183, ♀. Synonymised by Eardley & Kuhlmann (2006: 295). Type material. 4♀ syntypes, South Africa, Steinkopf [29.27°S 17.3°E], ZMHU, S. Locus typicus: “Klein-Namaland, Steinkopf”.

Melitta longicornis Friese 1913: 575, ♀ ♂. Synonymised by Eardley & Kuhlmann (2006: 295). Type material. ? syntypes, South Africa, Henkries [28.95°S 18.12°E], not located. Locus typicus: “Süd-Afrika: ♀ von Natal and ♂ von Buschmannland Henkries”.

Melitta turneri Cockerell 1935: 76, ♀. Synonymised by Eardley & Kuhlmann (2006: 295). Type material. Syntype ♀, Namibia [?], NHM, S. Locus typicus: not specified (detail see Baker & Engel 2007).

Melitta arrogans, Eardley & Kuhlmann (2006: 295-299); illustration of male S6-S8 and genitalia.

Additional material examined (8 specimens). **Namibia:** 1♀, Swakopmund [23.00°S 15.00°E], leg. Turner, NHM. **South Africa:** 1♀ 1♂, Prince Albert [33.22°S 22.03°E], 14.VIII.1880, leg. Turner, NHM; 1♀, Clanwilliam [32.18°S 18.90°E], 15.X.1972, leg. Rozen, AMNH; 1♀, Nieuwoudtville [31.38°S 19.10°E], 18.X.1972, AMNH; 1♀, Touwsrivier [33.33°S 20.03°E], 09.IX.1968, leg. Rozen, AMNH; 1♀, Willowmore [33.28°S 23.48°E], 20.X.1972, leg. Rozen, AMNH; 1♂, idem, leg. Brauns, AMNH.

Related species. *M. barbarae*.

Diagnosis. ♀ ♂. Glossa shorter than labial and maxillary palpi. Outer surface of galea mat and sculptured; pointed apically. Malar area as long as A3. Propodeal triangle finely rugose and mat, margin carinate.

♀. L = 11.5 mm. Clypeus smooth, with some deep, basal punctures. Face with vertex about level with upper extreme of eye. Propodeal triangle narrower than metanotum. Tb3 and Bt3 reddish. Bt3 with white hairs. T1 orange (fig. 169). T2-T3 mostly orange (fig. 169). T2-T3 with yellow, apical hair bands that are twice as long as marginal zone. T4 with white, apical hair band that is twice as long as marginal zone. Prepygidial fimbria black, with a few lateral, white hairs. Pp flat.

♂. L = 10.2 mm. Posterior clypeus smooth, anterior clypeus densely punctate ($i < d$). Face covered with erect, white hairs, with narrow, black lateral fringe (fig. 174). A4 twice as long as A3. A4-A13 twice as long as wide. A4-A12 slightly convex ventrally. Hind leg mostly reddish. T2-T4 with white, apical hair bands (fig. 174). S6 with mediolateral teeth and apicolateral blades. S7 with apicolateral lobes diverging. S8 with a few yellow hairs laterally, apical area semi-circular. Gonostylus truncate apically. Digitus pointed apically.

Distribution (fig. 191). Namibia and South Africa.

Phenology. Collected every month of the year except March and April.

Host plants (24 specimens). *Amaranthaceae*, *Hermboetidia glauca* (1♂); *Asteraceae*, *Berkheya fruticosa* (1♂); *Asclepiadaceae*, *Asclepias buchenaviana* (3♂); *Campanulaceae*, *Wahlenbergia* sp. (1♀); *Capparidaceae*, *Cleome paxii* (2♂); *Zygophyllaceae*, *Augea capensis* (1♀ 4♂), *Zygophyllum flexuosum* (3♂), *Z. prismatocarpum* (1♀ 4♂), *Z. cf. morganiana* (1♀), *Z. meyeri* (1♂), *Z. stapffii* (1♀).

4. *Melitta barbarae* Eardley

[Fig. 190]

Melitta barbarae Eardley & Kuhlmann 2006: 299, ♀. Type material. Holotype ♀, 5♀ paratypes, Namibia, between Oranjemund and

check point [28.34°S 16.28°E], 26.IX.1997, leg. F.W. & S.K. Gess, on *Lebeckia multiflora*, AMGC, S; 2♀, idem, NCSA, NS. Locus typicus: “Namibia, between Oranjemund and check point”.

Additional material examined. None.

Related species. *M. arrogans*.

Diagnosis. ♀. L = 11.0 mm. Malar area longer than A2. Face densely punctate, smooth between punctures. Scutum densely punctate ($i = d$), smooth between punctures. Propodeal triangle weakly shiny, with fine rugose sculpture. Metasoma black. Prepygidial fimbria black with a few, white hairs laterally.

♂. Unknown.

Distribution and phenology (fig. 190). Only known from the locus typicus (Namibia) in September.

Host plants (7 specimens). *Fabaceae*, *Lebeckia multiflora* (7♀).

5. *Melitta bicollaris* Warncke

[Figs 58-63, 181]

Melitta bicollaris Warncke 1973b: 123, ♀. Type material. Holotype ♀, Turkey, Erzurum [39.92°N 41.28°E], 30.VI.1970, leg. Özbek, OOLL, S; 1♀ paratype, Turkey, Pasinler [39.98°N 41.68°E], 06.VII.1971, OOLL, S. Locus typicus: “Türkei, Erzurum”.

Warncke (1973b) described the female of *M. bicollaris*. We here describe the male, based on a pair of specimens from Erzurum (Turkey). Both specimens share same unsexual features, like wing venation, structure of malar area and proboscide shape.

Additional material examined (16 specimens). **Turkey:** 1♂, Zor Dağı, Sulucan env. [39.72°N 43.92°E], 25.VI.1993, leg. K. Denes, OOLL; 1♂, E of Erzurum [39.92°N 41.28°E], 2000m, 06.VII.2000, leg. Halada, OOLL; 1♂ 1♀, Erzurum, Rizekent, 40°11'N 40°56'E, 20.VII.1997, on *Vicia cracca* sp. *stenophylla*, leg. M. Terzo & P. Rasmont, UMH; 1♀, Erzurum, Kizilkali, 40°10'N 40°58'E, 2200m, 20.VII.1997, on various plant, leg. P. Rasmont, UMH; 1♀, Erzurum, Sarican, 39°49'N 42°27'E, 2070m, 21.VII.1997, on *Medicago sativa*, leg. P. Rasmont, UMH; 1♂, Erzurum, Palandöken dağları, Kayak Merkezi, 39°50'N 41°17'E, 2400m, 16.VII.1997, on *Onobrychis transcaucasica*, leg. M. Terzo, UMH; 1♀, Erzincan, N-Otlukbeli, Eşekmeydanı, 39°53'N 39°34'E, 2390m, 17.VII.1997, on *Onobrychis* cf. *stenostachia*, leg. D. Flagothier, UMH; 1♀, Erzurum, Palandöken dağları, N-Aziyze, 39°48'N 41°18'E, 2855m, 19.VII.1996, on *Astragalus xerophyllus*, leg. D. Flagothier, UMH; 2♀, Kars, S-Eskikılıç, 41°17'N 42°50'E, 2040m, 24.VII.1996, on *Onobrychis transcaucasica*, leg. D. Flagothier, UMH; 1♀, Artvin, Yalnızçam dağları, Yalnızçam Geçidi, 41°30'N 42°18'E, 2650m, 26.VII.1996, on *Trifolium ambiguum*, leg. P. Rasmont, UMH; 3♂, Erzurum, Oltu [40.33°N 41.59°E], 2000m, 7-8.VII.1985, leg. Schwarz, CS; 1♂, Kars, Sarikamış [40.33°N 42.58°E], 2150m, 4-6.VII.1985, leg. Schwarz, CS.

Related species. *M. dimidiata*.

Diagnosis. ♀ ♂. Glossa as long as maxillary palpus. Outer surface of galea mat and sculptured. Malar area shorter than A2. Clypeus densely punctate ($i < d$), with smooth median line. Scutum shiny between punctures. Metasoma black. Terga without apical hair bands.

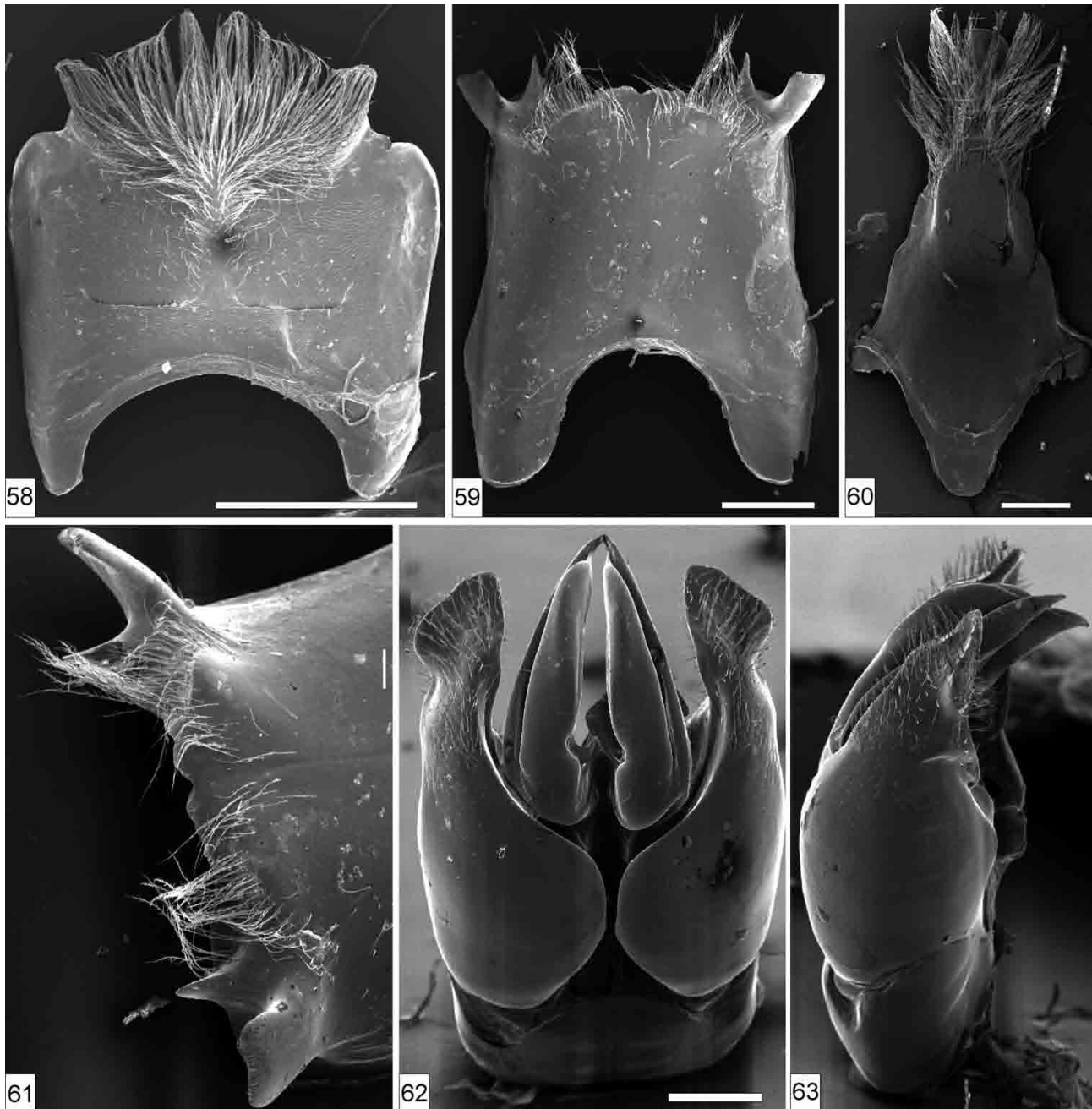
♀. L = 12.8 mm. Mesosoma with black hair dorsomedially, white hair dorsolaterally, and black hair ventrally. Centre of scutum and anterior scutellum densely punctate ($i = d$). Legs with black hair. Disc of T1 with erect, white hairs. Disc of T2-

T4 with black, appressed hair. Prepygidial fimbria black, with a few lateral, white hairs. Pp with shallow lateral grooves.

♂. L = 11.0mm. Face with whitish hair, and narrow, black, lateral fringe. A4–A12 slightly convex ventrally. Scutum densely punctate ($i < d$). Bt3 as wide as mediotarsus 3. S6 with dark, dense, apical hairs (fig. 58). S7 blade shaped apicolaterally (figs 59, 61). S8 very narrow (fig. 60), apical area oval shaped.

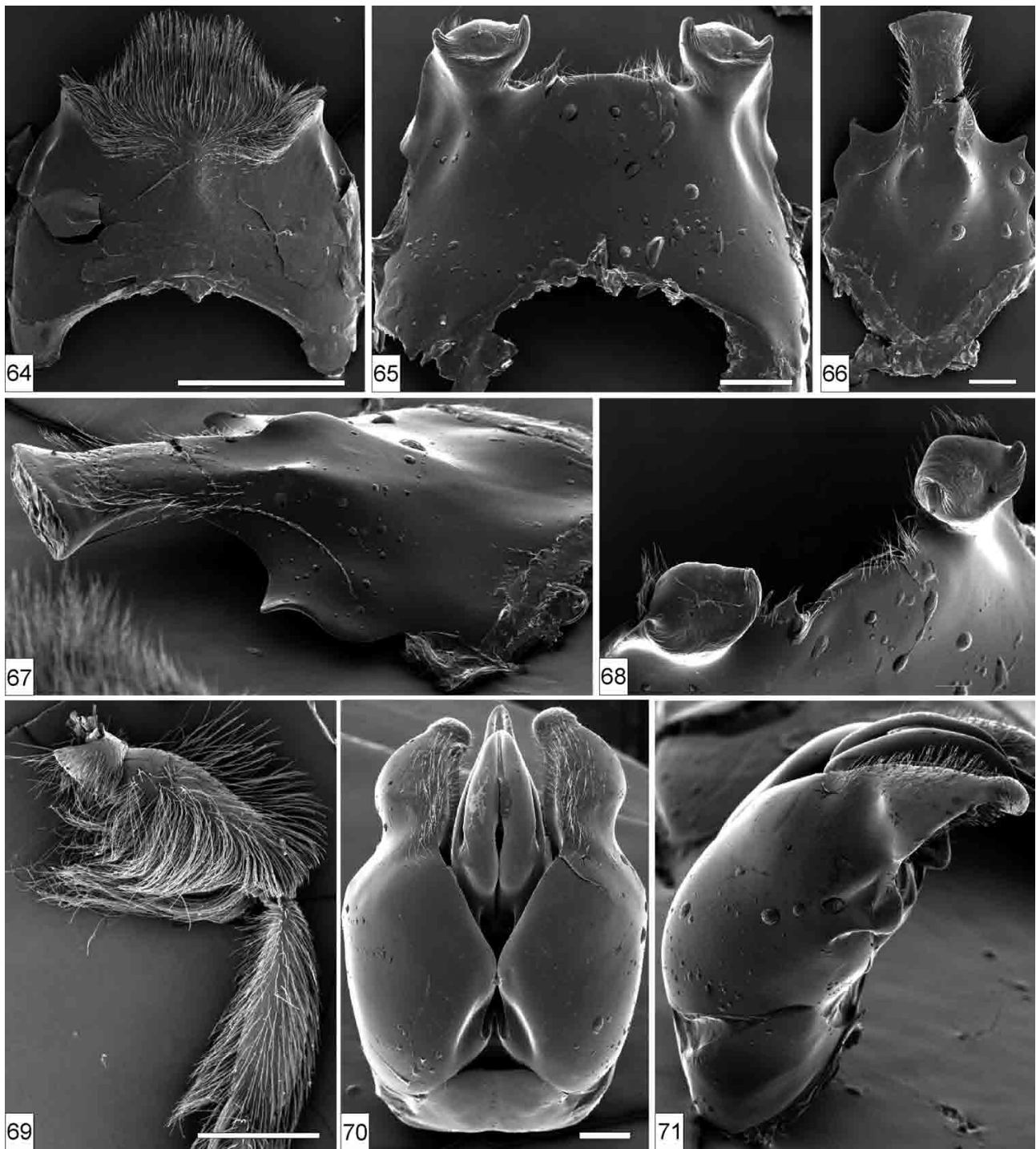
Column of S8 with bushy hair laterally (fig. 60). Genitalia as in figures 62–63.

Description ♂. L = 11.0 mm. **Head.** Integument: mostly black. Glossa as long as maxillary palpus. Outer surface of galea mat and sculptured, with yellow hair laterally. Malar area shorter than A2. Clypeus densely punctate ($i < d$), with smooth median line. Metasoma black. Face and vertex densely punctate,



Figures 58–63

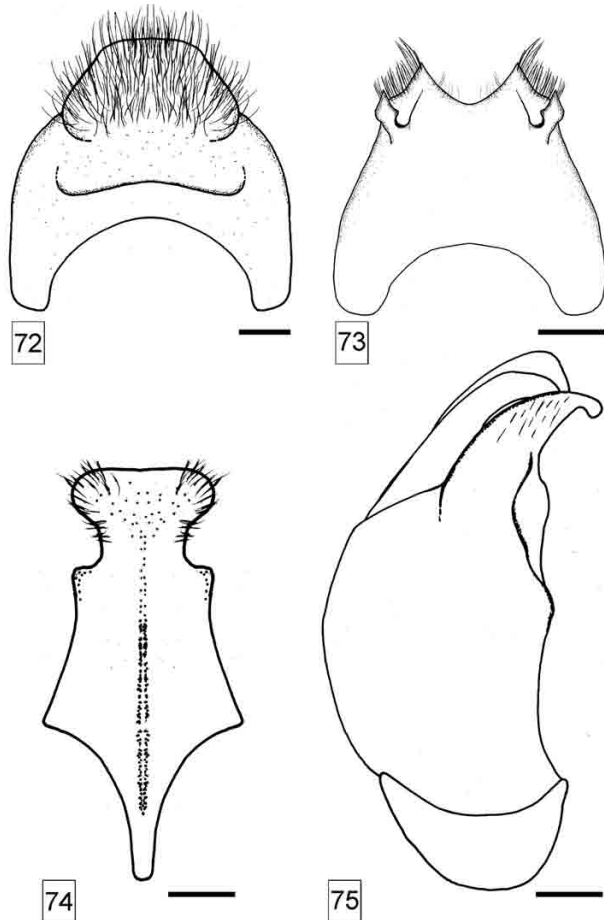
Melitta bicollaris, male. **58**, ventral view of sternum 6 (scale = 1 mm). **59**, ventral view of sternum 7 (scale = 400 μ m). **60**, ventral view of sternum 8 (scale = 400 μ m). **61**, apicolateral view of sternum 7. **62**, dorsal view of genitalia (scale = 300 μ m). **63**, lateral view of genitalia.



Figures 64–71

Melitta budensis, male. **64**, ventral view of sternum 6 (scale = 1 mm). **65**, ventral view of sternum 7 (scale = 300 μ m). **66**, ventral view of sternum 8 (scale = 200 μ m). **67**, lateral view of sternum 8. **68**, apicolateral view of sternum 7. **69**, middle leg (scale = 1 mm). **70**, dorsal view of genitalia (scale = 200 μ m). **71**, lateral view of genitalia.

except around ocellae. A3 as long as A4. A4-A12 slightly convex ventrally. Vestiture: face whitish, except narrow, black, lateral fringe. **Mesosoma.** Integument: black. Scutum densely punctate ($i < d$), smooth between punctures. Entire metanotum mat. Propodeal triangle weakly costulate mediovertically. Vestiture: mesonotum yellowish dorsally, greyish dorsally. **Legs.** Integument: black, except reddish on distitarsi 1-3. Basitibial plate present. Bt3 twice as wide as mediotarsus 3. Vestiture: face whitish laterally, yellow medially. **Wings.** Nervulus infuscated. Fore wing with first recurrent vein meeting weak Rs+M on first half of second submarginal cell. **Metasoma.** Integument: black, except marginal zones of terga reddish. Discs of terga punctate, and hairy. Marginal zones of terga smooth. S1-S2 with apical margins straight. S3-S5 with apical margins emarginate. S6 with convex apical margin. S7 with a pair of apicolateral structures blade-shaped and a pair of apicolateral structure tooth-shaped (figs 59, 61). S8 very narrow (fig. 60), apical area oval. Genitalia as in figs 62-63. Gonostylus very short in lateral view (fig. 63). Vestiture: terga without apical hair band. Disc of T1-T4 with erect, greyish hairs. Disc of T5 blackish. T6-T7 black medially, white laterally. Disc of sterna nearly hairless. S1-S5 with sparse brown hair apically. S6 with continuous brown apical fringe,



Figures 72-75

Melitta cameroni, male. 72, ventral view of sternum 6 (scale = 300 μ m). 73, ventral view of sternum 7 (scale = 300 μ m). 74, ventral view of sternum 8 (scale = 200 μ m). 75, lateral view of genitalia (scale = 300 μ m).

longer laterally (fig. 58). S7 yellow apically. Column of S8 bushy laterally (fig. 60).

Distribution (fig. 181). Endemic to Eastern Turkey.

Phenology. June and July.

Host plants (9 specimens). Fabaceae, *Astragalus xerophyllus* (1♀), *Medicago sativa* (1♀), *Onobrychis cf. stenostachya* (1♀), *O. transcaucasia* (1♂ 2♀), *Trifolium ambiguum* (1♀), *Vicia cracca ssp. stenophylla* (1♀ 1♂).

6. *Melitta budensis* (Mocsary)

[Figs 64-71, 180]

Cilissa budensis Mocsary 1878: 120, ♀ ♂. Type material (detailed in Maréchal 1935: 157). Syntype ♂, Hungary, Gellért [47.28°N 18.77°E], 15.VIII.1876, TMB, NS; syntype ♀, Hungary, Sváb-hegy [46.2°N 18.67°E], 20.IX.1875, TMB, NS. Locus typicus: "Hungaria centrali, in montibus ad Budam sitis".

Additional material examined (13 specimens). **Armenia:**

1♂, Erevan [40.18°N 44.5°E], 16.VII.1987, leg. Oehlke, CS.

Kazakhstan: 1♂, Yanvarstevo [51.43°N 52.25°E], 28.VII.1949,

on *Vicia cracca*, ZISP. **Russia:** 2♀, Rostovskiy Morskoy Kanal [47.08°N 39.08°E], 18.VII.1971, leg. Pesenko, ZISP. **Turkey:**

1♂, Nemrut Mountains [38.67°N 42.20°E], 07.VIII.1986,

OOLL; 1♂, Bolu [40.73°N 31.62°E], 13.VII.1962, OOLL;

2♀ 1♂, Erzurum [39.92°N 41.28°E], 15.VII.1978, OOLL;

1♀, Altin Dağlar [37.50°N 43.30°E], 13.VIII.1979; OOLL;

2♀ 1♂, Mont Cilo [37.50°N 44.00°E], 07.VIII.1982, OOLL.

Related species. *M. rasmonti*.

Diagnosis. ♀ ♂. Maxillary palpus as long as galea. Outer surface of galea smooth. Malar area shorter than A2. Scutellum smooth between punctures anteriorly. Central area of propodeal triangle horizontally costulate. Metasoma black.

♀. L = 14.0 mm. Clypeus densely punctate ($i < d$), with a smooth median line. Face with yellowish-white hair. Metanotum swollen apically. Central area of metanotum impunctate. Legs with yellowish-white hair (including scopa). Inner side of F3 with dense, yellow fringe anteroventrally, almost half as long as F3. T2-T4 with white to whitish apical hair bands, twice as long as marginal zone. Prepygidial fimbria black medially, laterally with a few white hairs. Pp with narrow lateral grooves.

♂. L = 12.3 mm. Entire scutum mat. F1 1.5X as long as wide. F2 twice as long as wide, with long bushy hair (fig. 69). Disc of T1-T3 with reddish hair. Disc of T4-T6 with black hair. Terga without apical hair bands. Apical margin of S6 convex (fig. 64). S7 hooked apicolaterally (figs 65, 68). S8 nearly hairless (figs 66-67). Disc of S8 with carinae mediolaterally (fig. 67), and apicolateral tooth (figs 66-67). Apical area of S8 flat, oval. Apex of gonostylus swollen (figs 70-71).

Distribution (fig. 180). Around Black Sea.

Phenology. July to August.

Host plants (1 specimen). Fabaceae, *Vicia cracca* (1♂).

7. *Melitta californica* Viereck

[Fig. 193]

Melitta (Brachycephalapis) californica Viereck 1909: 47, ♂. Type material.

Holotype ♂, Mexico, Isla de Santa Margarita [28.15°N 113.55°W], CAS, NS. Locus typicus: "Mexico, Isla de Santa Margarita".

Melitta wilmatata Cockerell 1937: 3-4, ♀. Synonymised by Michener (1981: 120). Type material. Holotype ♀, USA, Dublin [32.95°N

109.90°W], 08.III.1937, on *Sphaeralcea*, AMNH, NS. Locus typicus: "Arizona, Dublin".

Melitta maritima Cockerell 1941: 344, ♂. Synonymised by Michener (1981: 120). Type material. Holotype ♂, Mexico, Ensenada [31.90°N 116.60°W], 13.IV.1931, lost from UC. Locus typicus: "Mexico, Ensenada".

Melitta californica, Snelling & Stage (1995: 24-25); illustration of S6-S8 and genitalia ♂.

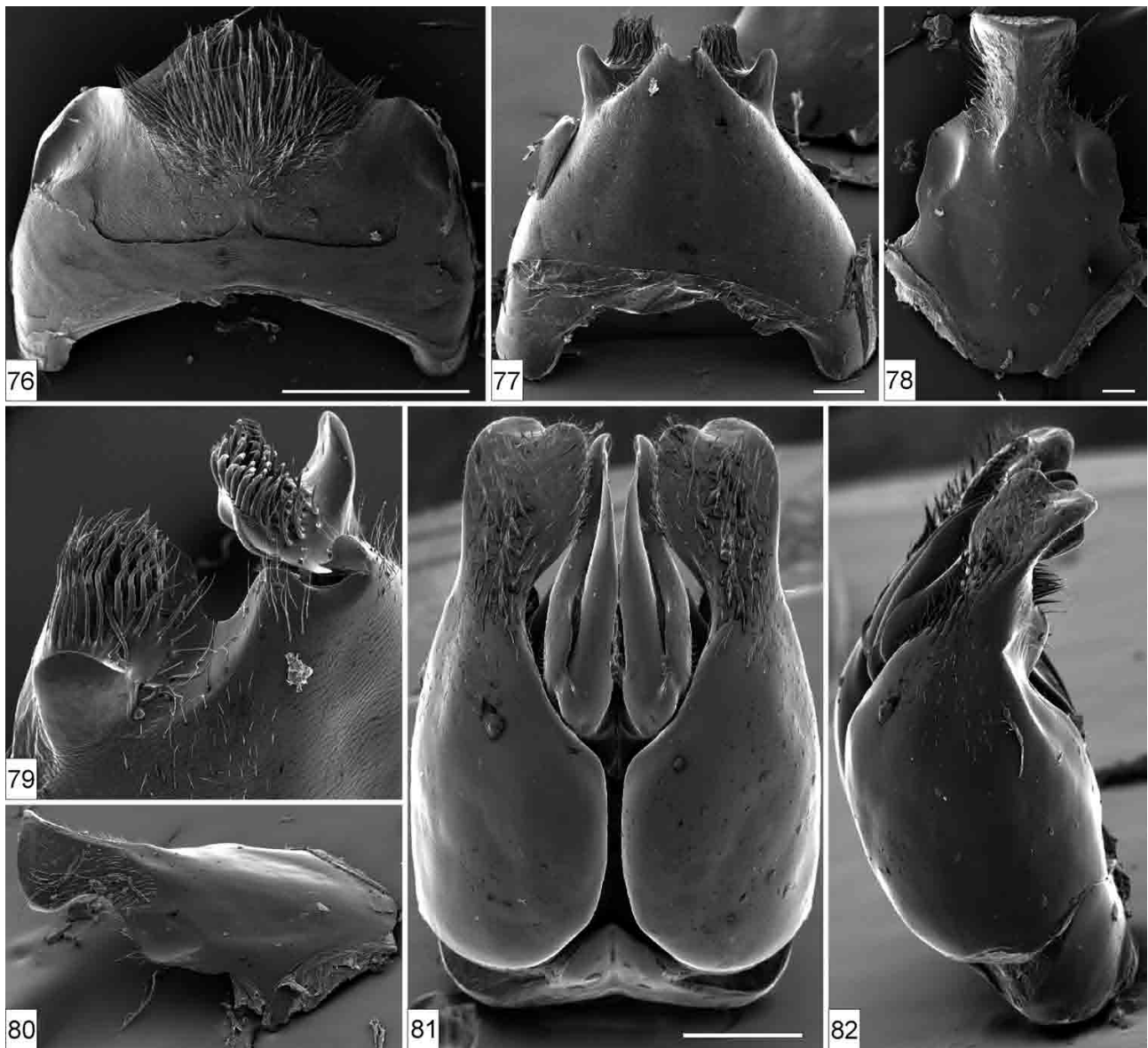
Additional material examined (2 specimens). **USA:** 1♀ 1♂, San Felipe [31.33°N 114.85°W], 28.III.1963, leg. Stage, AMNH.

Related species. *M. ezoana*.

Diagnosis. ♀ ♂. Outer surface of galea smooth and pointed apically. Malar area shorter than A2. Scutum smooth between punctures. Propodeal triangle with a median transversal carina. Metasoma black. T2-T4 with sparse, white, apical hair bands.

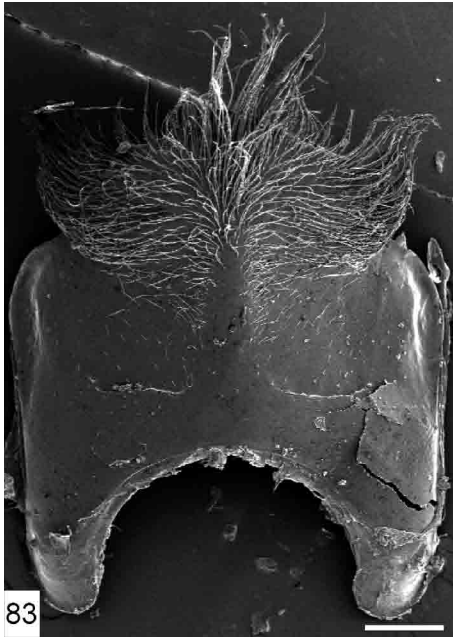
♀. L = 14.5 mm. Punctures on upper two-thirds of clypeus deep and distinct, mostly subcontiguous, interspaces smooth. Inner eye margins and vertex with conspicuous blackish hairs. Head and mesosoma with whitish hairs. Prepygidial fimbria white with a few black hairs medially. Pp with lateral grooves.

♂. L = 12.5 mm. Face with erect, white hairs, and with narrow, black, lateral fringe. A3 shorter than A4. A4-A13 cylindrical. S3-S5 with straight preterminal line. S6 with convex apical

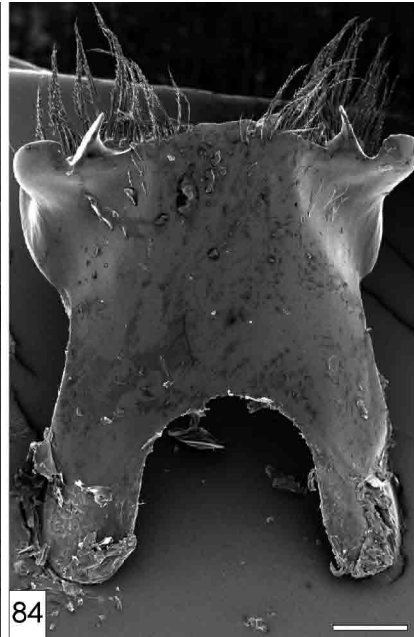


Figures 76–82

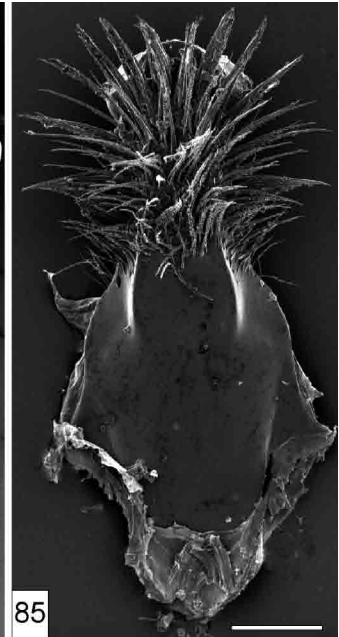
Melitta danae, male. **76**, ventral view of S6 (scale = 1 mm). **77**, ventral view of S7 (scale = 250 μm). **78**, ventral view of S8 (scale = 200 μm). **79**, apicolateral view of S7. **80**, lateral view of S8. **81**, dorsal view of genitalia (scale = 400 μm). **82**, lateral view of genitalia.



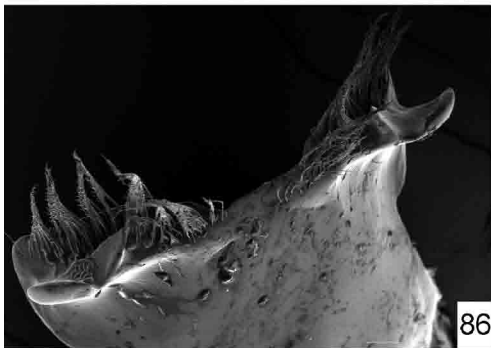
83



84



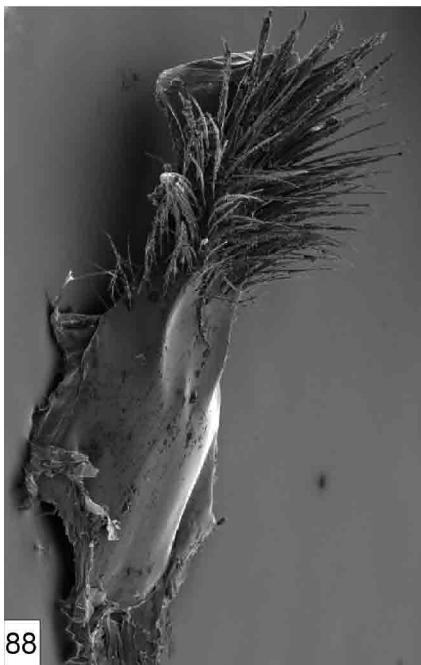
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86



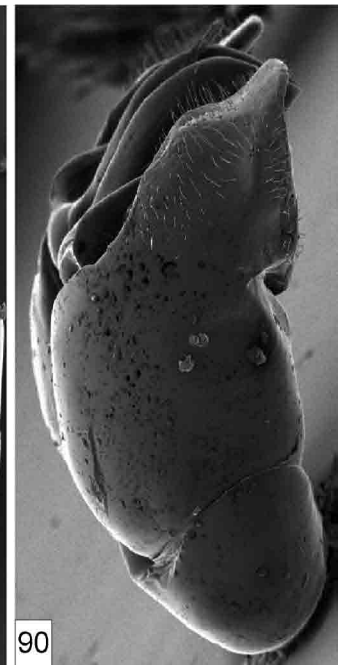
87



88



89



90

margin. S7 with apicolateral process blade-shaped. S8 nearly hairless, with apical area sculptured and mat. Apex of gonostylus curved ventrally. Digitus pointed apically.

Distribution (fig. 193). Mexico and USA (Arizona, California).

Phenology. End February to middle April.

Host plants (65 specimens). Asteraceae, *Encelia californica* (1♂); Fabaceae, *Dalea megacarpa* (1♂); Malvaceae, *Sphaeralcea* sp. (2♀ 11♂), *Sphaeralcea orcutii* (20♀ 26♂); Solanaceae, *Lycium parishii* (3♂); Zygophyllaceae, *Viscainoa geniculata* (1♂).

8. *Melitta cameroni* (Cockerell)

[Figs 72–75, 184]

Andrena caroli Cameron 1909: 130, ♂. *Nomen praeoccupatum* (nec *Andrena caroli* Pérez 1896) (see Baker & Engel 2007). Type material (designated here). Lectotype ♂, paralectotype ♂, India, Simla [31.10°S 77.20°E], NHM, S. Locus typicus: “*Simla*”. Lectotype: ♂ (NHM); labels: 1st printed on white paper “*Type*”; 2nd hand-written with black ink “*Andrena caroli Cam. Type Simla*”; 3rd printed on white paper “*Simla 9.98*”, 4th printed on white paper “*B. M. TYPE HYM 17a 1832a*”; 5th printed on red paper “*Andrena caroli Cameron 1909 lectotype design Michez 2006*”. Paralectotype: ♀ (NHM); labels: 1st printed on white paper “*Simla 9.98*”; 2nd handwritten with black ink on white paper “*Col. C. G. Nurse Collection 1920-72*”; 3rd printed on red paper “*Andrena caroli Cameron 1909 paralectotype design Michez 2006*”.

Andrena cameroni Cockerell 1910b: 249. *Nomen novum pro Andrena caroli* Cameron 1909 (see Baker & Engel 2007).

Additional material examined (28 specimens). **India**: 1♀ 1♂, Gulmarg [34.05°N 74.38°E], 14.VIII.1980, leg. Williams, NHM; 8♀ 16♂, Simla [31.1°N 77.17°E], leg. Nurse, NHM; 2♂, idem, leg. Turner, NHM.

Related species. *M. harrietae* and *M. sibirica*.

Diagnosis. ♀ ♂. Glossa longer than head. Outer surface of galea mat and sculptured. Malar area longer than A3. Clypeus nearly as wide as long. Scutum with reddish and black hair intermixed. Propodeal triangle mat, with fine granular sculpture, carinate antero-laterally. Fore wing with first recurrent vein meeting weak Rs+M in middle of second submarginal cell.

♀. L = 13.7 mm. Clypeus with dense, deep punctures ($i = d$), sculptured between punctures, with impunctate median line. Disc of T1-T2 with yellowish hair. Disc of T3-T5 with short black hairs. T2-T4 with yellowish-white, apical, hair bands, as long as marginal zone. Prepygidial fimbria black, with a few white hairs. Pp with median elevated area.

♂. L = 13.0 mm. Face with white hair, and black lateral fringe. A3 as long as A4. A5-A12 slightly convex ventrally. Bt3 twice as wide as mediotarsus 3. T2-T4 with white, apical hair bands. Disc of T3-T5 with black hair. S6 with long, sparse, brown hairs apically (fig. 72). S7 with apicolateral process blade-

shaped (fig. 73). Column of S8 short, nearly hairless (fig. 74). Apex of gonostylus curved ventrally (fig. 75). Digitus pointed apically.

Distribution (fig. 184). Indian Kashmir.

Phenology. August.

Host plants. Unknown.

9. *Melitta danae* Eardley

[Figs 76–82, 192]

Melitta danae Eardley & Kuhlmann 2006: 300-301, ♀. Type material.

Holotype ♂, South Africa, Harrismith, 28.17°S 29.09°E, I.1982, leg. C. Eardley, NCSA, S. Locus typicus: “*Harrismith*”.

Additional material examined (2 specimens). **Lesotho**: 1♂, Mamathes [29.10°S 27.8°E], 12.XII.1954, leg. Jacot, AMGC. **South Africa**: 1♀, Royal Natal National Park, between The Nek and Witsieshoek [28.75°S 28.9°E], 04.II.1988, leg. Whitehead, SAMC.

Related species. *M. albida*.

Diagnosis. ♀ ♂. Labial palpus as long as glossa. Outer surface of galea mat and sculptured. Malar area shorter than A2. Scutum densely punctate ($i < d$), mat and sculptured between punctures. Propodeal triangle mat, with coarse granular sculpture. Terga with yellow, apical hair bands. Metasoma black.

♀. L = 10.7 mm. Clypeus with deep punctures, sculptured between punctures. Scutum with black hairs centrally and reddish hairs marginally. Leg 3 with orange hairs. Prepygidial fimbria black with a few yellow hairs laterally.

♂. L = 10.3 mm. Antenna black. A3 as long as A4. A4-A12 slightly convex ventrally. Vestiture reddish. S4-S5 with straight apical margin. S6 with a few, short, reddish hairs apically (fig. 76). S7 with a pair of blade-shaped apicolateral processes (figs 77, 79). S8 nearly hairless, column with a median carina (figs 78, 80). Gonostylus with inner lobe (figs 81–82).

Distribution (fig. 192). Lesotho and South Africa.

Phenology. End of December to March.

Host plants (2 specimens). Asteraceae, *Berkheya purpurea* (2♂).

10. *Melitta dimidiata* Morawitz

[Figs 83–93, 167, 175, 184]

Melitta dimidiata Morawitz 1876: 52-53, ♂. Type material. Syntype ♂, Armenia, Mastara [40.45°N 43.87°E], ZISP, S. Locus typicus: “*Mastara*”.

Cilissa robusta Radoszkowski 1876: 87-88, ♀. Synonymised by Baker (1965). Type material. Syntype ♀, Caucasus [?], leg. Mlokosiewitz, ZMHU, NS. Locus typicus: “*Caucase*”.

Cilissa dimidiata var. *hungaria* Mocsary 1883: 58-60, ♀ ♂. Type material. Lectotype ♂, Hungaria, Budapest [47.50°N 19.08°E], TMB, NS; syntype ♀, Romania, Torda [46.57°N 23.78°E], ZISP, S. Locus typicus: “*Hungaria centrali ad Budaepestinum et in Tansilvania ad Tordam*”.

Pseudocilissa robusta, Radoszkowski (1891: 242-243); description of the male of *Cilissa robusta* Radoszkowski 1876.

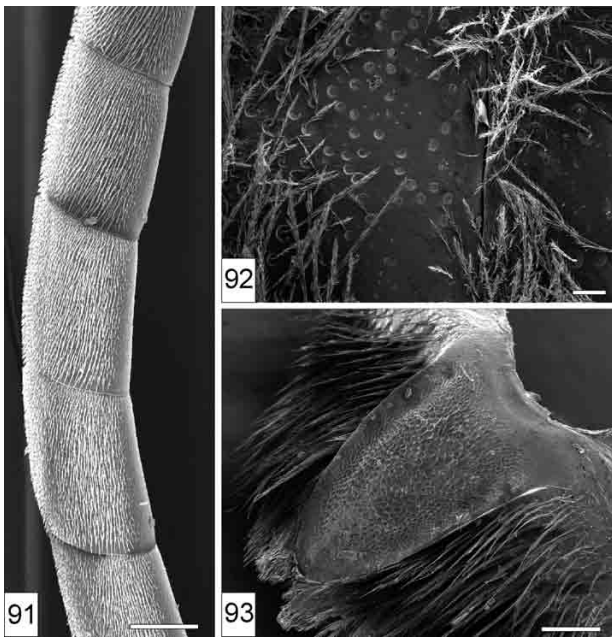
Additional material examined. 1025 specimens studied (details, see ASEF web site).

Related species. *M. bicollaris*.

Diagnosis. ♀ ♂. Galea pointed apically (fig. 87), outer surface

Figures 83–90

Melitta dimidiata, male. **83**, ventral view of sternum 6 (scale = 250 µm). **84**, ventral view of sternum 7 (scale = 300 µm). **85**, ventral view of sternum 8 (scale = 300 µm). **86**, apicolateral view of sternum 7. **87**, inner view of galea (scale = 100 µm). **88**, lateral view of sternum 8. **89**, dorsal view of genitalia (scale = 200 µm). **90**, lateral view of genitalia.



Figures 91–93

Melitta dimidiata. 91, antenna ♂ (scale = 150 µm). 92, Centre of scutellum ♀ (scale = 150 µm). 93, lateral view of pygidial plate ♀ (scale = 200 µm).

mat and sculptured. Maxillary palpus as long as galea. Malar area shorter than A2. Vertex expanded (ocellocular distance as long as distance between median ocellus and preoccipital ridge). Scutum and scutellum smooth between punctures (fig. 92). Propodeal triangle rugulose. Metasoma black.

♀. L = 13.3 mm. Clypeus twice as wide as long, with narrow, smooth, median line. T2-T3 with reddish hair. T2-T4 with white, apical, hair bands, longer than marginal zone. Prepygidial fimbria black, with a few white hairs laterally. Pp with lateral grooves (fig. 93).

♂. L = 11.8 mm. Clypeus and face covered with dense white hair. A3 as long as A4. A4-A12 cylinder shaped (fig. 91). Bt3 mostly three times as wide as mediotarsus. Terga without apical hair bands. S6 with median elevated area (fig. 83). Apex of S6 with long, bushy, brown hair medially and laterally (fig. 83). S7 with apicolateral process blade-shaped (figs 84, 86). Apical plate of S8 triangular. Column of S8 ventrally covered with long, black, bushy hair (figs 85, 88). Gonostylus flat ventrally (fig. 90). Base of penis valve widen (fig. 89). Digitus rounded apically.

Distribution (fig. 184). Southern and Eastern Europe as far as central Asia. Some isolated populations in England (Baker 1965) and Belgium (Michez, unpublished data).

Phenology. Beginning June to end July.

Host plants (87 specimens). Fabaceae, *Onobrychis* sp. (13♀ 6♂), *O. arenaria* (2♀ 7♂), *O. supina* (4♀ 1♂), *O. viciifolia* (12♀ 42♂).

11. *Melitta eickworti* Snelling & Stage

[Fig. 193]

Melitta eickworti Snelling & Stage 1995: 25–26. ♀ ♂. Type material. Holotype ♀, 19♀ 13♂ paratypes, USA, Ithaca vicinity [42.25°N 76.29°W], 10.VI.1981, leg. Eickwort, CORN, NS; 2♀ 2♂

paratypes, idem, LACM, NS. Locus typicus: “USA, Hill reserve, vicinity of Ithaca, Tompkins County, New York”.

Additional material examined (2 specimens). USA: 1♀ 1♂, Reynoldsville [44.00°N 73.58°W], 11.VI.1987, leg. Engel, AMNH.

Related species. *M. americana*.

Diagnosis. ♀ ♂. Labial palpus longer than glossa. Galea with outer surface smooth, pointed apically. Maxillary palpus shorter than galea. Malar area as long as length of A2. Propodeal triangle with median transversal carina. Scutum smooth between punctures. Metasoma black and shiny.

♀. L = 11.3 mm. Clypeus with sparse punctures ($i > 2d$), sculptured between punctures. Inner eye margins and vertex without blackish hair. Head and mesosoma with reddish hair. Disc of T2-T4 with sparse, scattered punctures. Prepygidial fimbria black with a few white hairs laterally. Pygidial plate with narrow, median carina.

♂. L = 7.6 mm. Antenna brown. A3 shorter than A4. A4-A12 slightly convex ventrally. Disc of T2-T4 sparsely punctate ($i > d$). T2-T4 with sparse apical hair bands. S3-S5 with premarginal line slightly emarginate. S6 with convex apical margin. S7 with lateral process blade shaped. S8 nearly hairless. Apical area of S8 smooth, triangular. Gonostylus pointed apically. Digitus rounded apically.

Distribution (fig. 193). North-eastern USA.

Phenology. May to June.

Host plants (35 specimens). Ericaceae, *Polycodium* sp. (2♂), *Vaccinium* sp. (13♀ 11♂), *Vaccinium stramineum* (9♀ 4♂).

12. *Melitta ezoana* Yasumatsu & Hirashima

[Figs 94–99, 185]

Melitta ezoana Yasumatsu & Hirashima 1956: 254–256, ♀ ♂. Type material. Holotype ♂, 6♀ 9♂ paratypes, Japan, Nishi-ashoro [43.33°N 143.67°E], 08.VIII.1955, ELKU, NS. Locus typicus: “Japan, Hokkaido, Nishiashoro”.

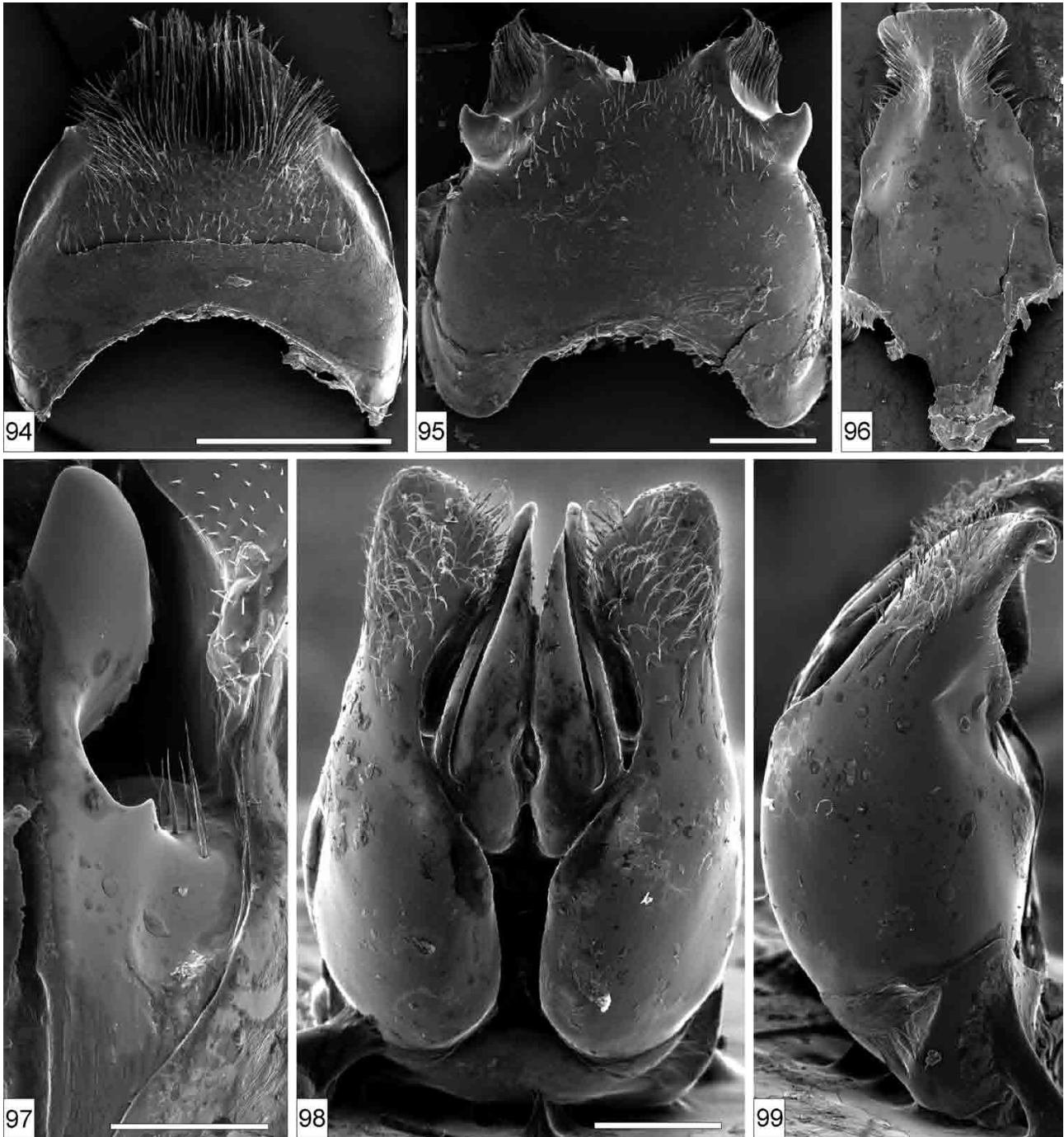
Melitta sinensis Wu 1978: 422, ♀ ♂. **Syn. nov.** Type material. Holotype ♀, China, Jingpo Hu [43.83°N 128.88°E], 06.IX.1970, IZAS, NS. Locus typicus: “Jinpo Hu, Heilong Jiang”.

Additional material examined (22 specimens). **China:** 1♀, Beijing municipality, Xiang Shan [39.98°N 116.20°E], 23.VII.2002, leg. Berg, CB. **Mongolia:** 2♀, Archangay, 48°03'N 102°25'E, 1400m, 24.VII.2004, leg. Halada, OOLL. **Russia:** 2♂, Ussuriland, Lazovski, 43.27°N 134.12°E, 174m, 5.VIII–26.VIII.2001, leg. Quest, ZMHB; 1♂, Ussuriland, Lazovski, 43.23°N 134.13°E, 189m, 3.VIII.2001, leg. Quest, ZMHB; 1♂, Ussuriland, Lazovski, 43.43°N 133.87°E, 270m, 9.VIII.2001, leg. Quest, ZMHB; 2♂, Ussuriland, Lazovski, 43.50°N 134.12°E, 1375m, 13.VIII.2001, leg. Quest, ZMHB; 1♂, Ussuriland, Lazovski, 43.01°N 134.15°E, 0m, 18.VIII.2001, leg. Quest, ZMHB; 1♀, Ussuriland, Lazovski, 43.38°N 133.90°E, 224m, 23.VIII.2001, leg. Quest, ZMHB; 1♂, Ussuriland, Lazovski, 43.25°N 133.13°E, 187m, 26.VIII.2001, leg. Quest, ZMHB; 1♀, idem, on blue Fabaceae, ZMHB; 1♂, Ussuriland, Lazovski, 43.27°N 134.03°E, 398m, 4.IX.2001, leg. Quest, ZMHB; 1♂, idem, on *Chelidonium* sp., ZMHB; 1♂, Ussuriland, Lazovski, 42.87°N 133.80°E, 0m, 11.IX.2003, leg. Quest, ZMHB; 1♂, Ussuriland, Lazovski, 43.01°N 134.15°E, 0m, 12.IX.2001, leg. Quest, ZMHB; 1♂, Ussuriland, Lazovski, 43.03°N 134.15°E, 3m, on blue Asteraceae, 13.IX.2001, leg. Quest, ZMHB; 1♀, Ussuriland,

Lazovski, 43.03°N 134.17°E, 6m, on *Crepis* sp., 13.IX.2001, leg. Quest, ZMHB; Slavyanka, 42.87°N 131.34°E, 17-25.VII.1995, leg. Snizek, CS. **South Korea:** 1♀, Hamyang [35.52°N 127.73°E], 24.VIII-15.IX.2002, leg. Tripotin, CB.

Related species. *M. californica* and *M. sibirica*.

Diagnosis. ♀ ♂. Glossa shorter than maxillary palpus. Outer surface of galea mat and sculptured. Malar area shorter than A2. Posterior scutum, anterior scutellum and anterior metanotum densely punctate ($i < d$), smooth between punctures. Propodeal triangle with basal carinae. Metasoma black.



Figures 94–99

Melitta ezoana, male. **94**, ventral view of sternum 6 (scale = 1 mm). **95**, ventral view of sternum 7 (scale = 400 μ m). **96**, ventral view of sternum 8 (scale = 100 μ m). **97**, volsella (scale = 100 μ m). **98**, dorsal view of genitalia (scale = 300 μ m). **99**, lateral view of genitalia.

♀. L = 13.0 mm. Entire clypeus densely punctate ($i < d$). Mesosoma with black hair centrally and reddish hair marginally. Outer side of legs 1-2 and ventral mesosoma with reddish to yellowish hair. T2-T4 with white, apical hair bands, shorter

than marginal zone. Prepygidial fimbria black medially, white laterally. Pp with lateral shallow grooves.

♂. L = 13.0 mm. Face without narrow, black, lateral fringe. A3 as long as A4. A4 as long as wide. Distitarsus twice as long as wide. T2-T4 with sparse, white, apical hair bands. S6 with few black apicomedian hairs (fig. 94). S7 with apicolateral process blade shaped (fig. 95). S8 nearly hairless, apical plate mostly as wide as long (fig. 96). Apex of gonostylus rounded (dorsal view, fig. 98), curved ventrally (lateral view, fig. 99). Digitus pointed apically (fig. 97).

Distribution (fig. 185). Eastern Palearctic (China, Japan, Mongolia and Russia).

Phenology. End July to September

Host plants (21 specimens). Asteraceae, blue Asteraceae (1♀ 1♂), *Crepis* sp. (1♀); Fabaceae, *Lespedeza bicolor* var. *japonica* (6♀ 10♂), blue Fabaceae (1♀); Papaveraceae, *Chelidonium* sp. (1♂).

13. *Melitta fulvescens* Wu

[Fig. 186]

Melitta fulvescens Wu 2000: 400, ♂. Type material. Holotype ♂, China, Wensu Pochenze [41.25°N 80.23°E], 1930m, 13.VII.1978, leg. Zhang Xue-zhong, IZAS, NS. Locus typicus: "Xinjiang, Wensu pochenze".

Additional material examined (2 specimens). **Kyrgyzstan:** 1♂, Ketmen-Tjube [41.81°N 72.82°E], VI-VII.1999, leg. Gurko, OOLL; 1♂, Moldoto ridge, 41.50°N 74.73°E, 2260m, 30.VI.1990, leg. Rozen, AMNH.

Related species. *M. dimidiata*.

Diagnosis. ♀. Unknown.

♂. L = 12.5 mm. Outer surface of galea sculptured and mat. Malar area shorter than A2. Face covered with erect, white hairs, and narrow, black, lateral fringe. Antenna brown. A3 as long as A4. A5-A12 with ventral surface slightly convex apically. Scutum, scutellum and metanotum smooth between punctures. Terga without apical hair bands. Mesosoma and disc of terga with reddish-orange hair. F1-F3 with white hair. Tb1-3 and Bt1-3 with golden-yellow hair. S6 with reddish hair apically, longer apicolaterally. S7 with apicolateral process blade shaped. Column of S8 with a few reddish hairs, apical area circular. Gonostylus straight ventrally, pointed apically. Digitus rounded apically.

Distribution (fig. 186). Mountains of Tian Shan (Kyrgyzstan and China).

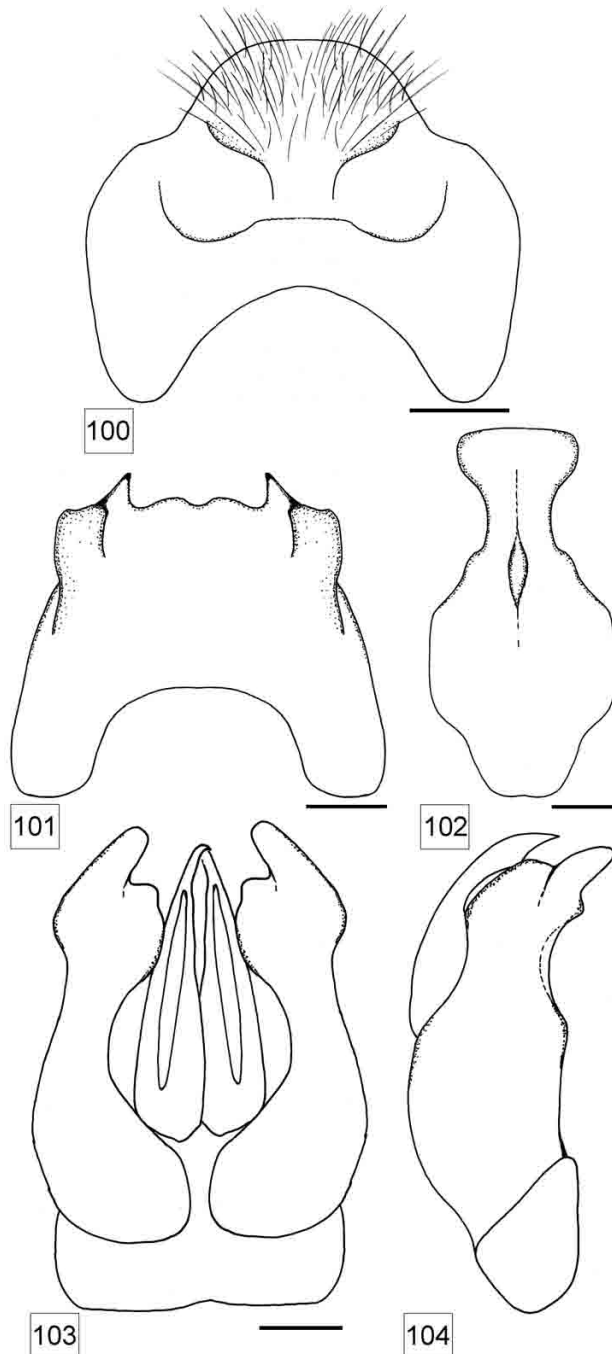
Phenology. June to July.

Host plants. Unknown.

14. *Melitta guichardi* Michez n. sp.

[Figs 100–104, 190]

Type Material (5 specimens). Holotype ♂, 3♂ paratypes, Ethiopia, nr. Addis Ababa [9.03°N 38.70°E], Happy Valley, 30.X.1945, leg. Guichard,

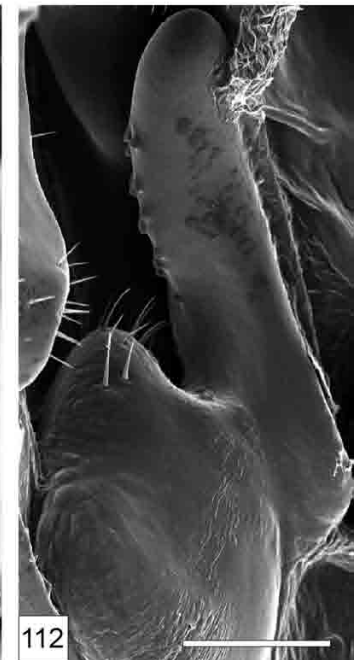
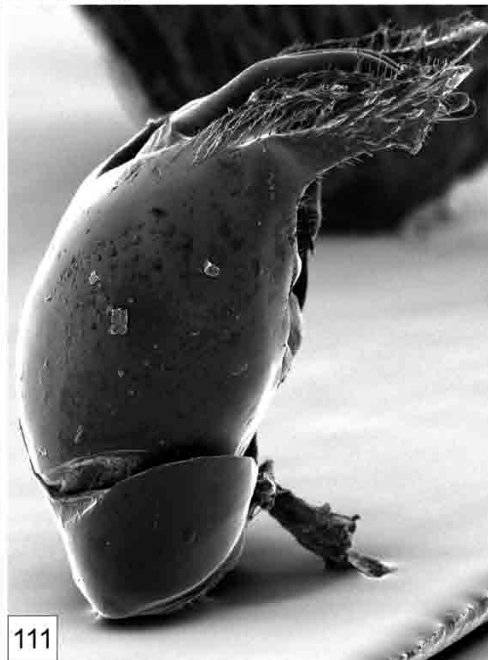
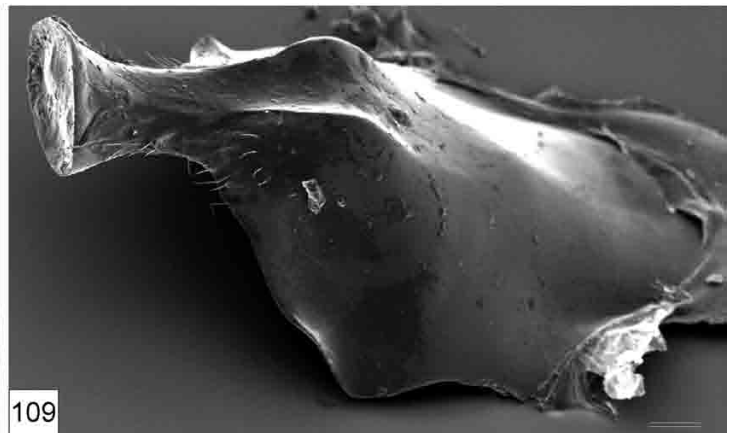
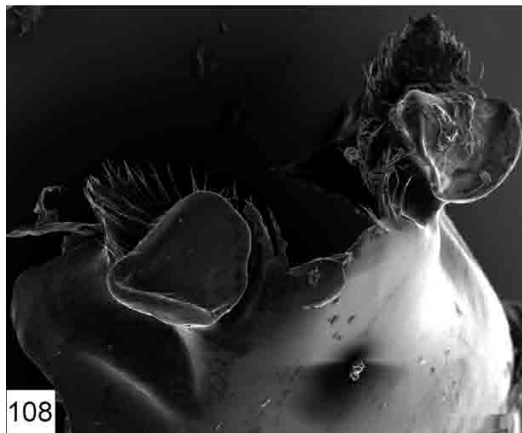


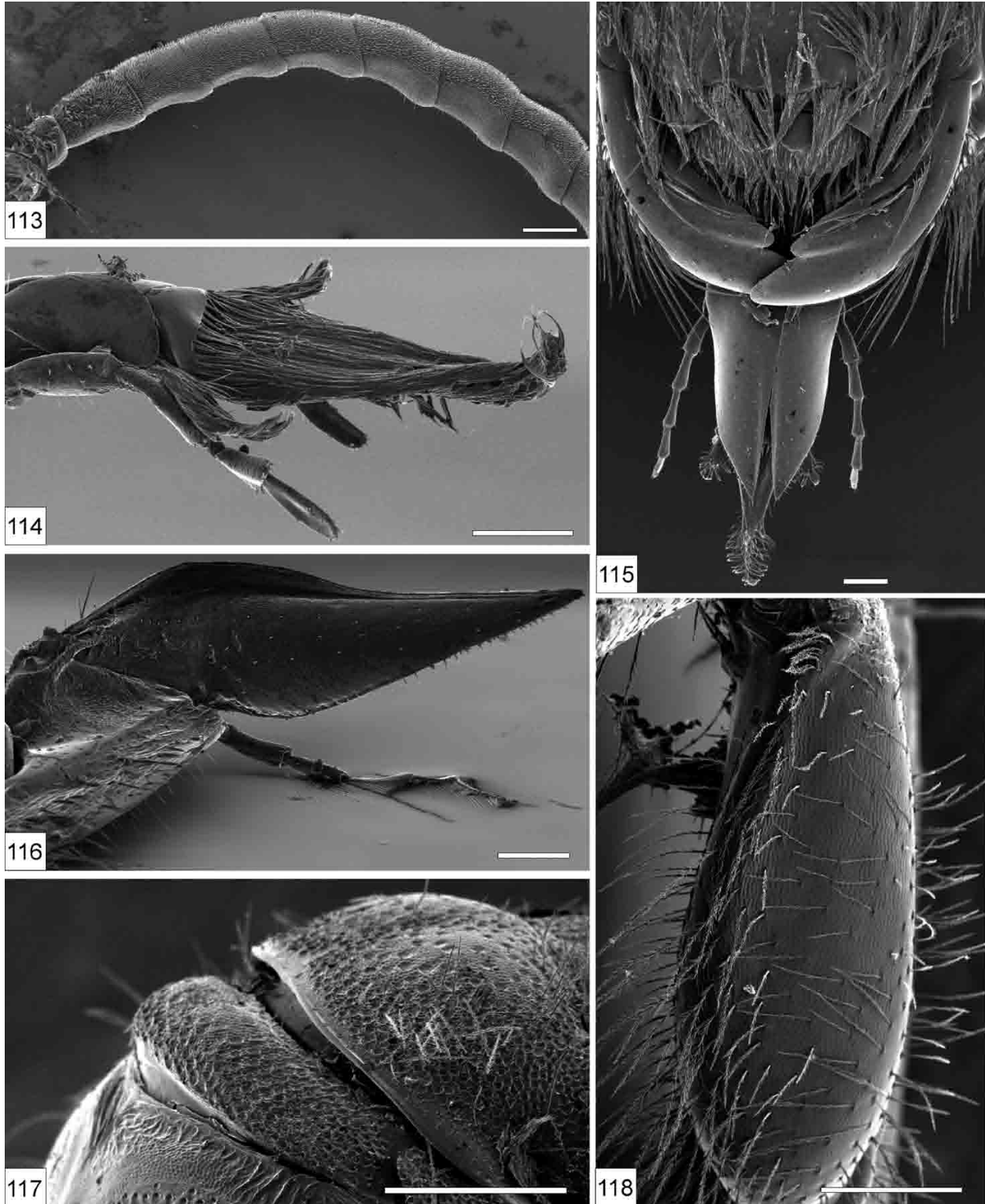
Figures 100–104

Melitta guichardi, male. **100**, ventral view of sternum 6 (scale = 300 µm). **101**, ventral view of sternum 7 (scale = 300 µm). **102**, ventral view of sternum 8 (scale = 150 µm). **103**, dorsal view of genitalia (scale = 300 µm). **104**, lateral view of genitalia.

Figures 105–112

Melitta baemorrhoidalis, male. **105**, ventral view of sternum 6 (scale = 1 mm). **106**, ventral view of sternum 7 (scale = 300 µm). **107**, ventral view of sternum 8 (scale = 150 µm). **108**, apicolateral view of sternum 7. **109**, lateral view of sternum 8. **110**, dorsal view of genitalia (scale = 200 µm). **111**, lateral view of genitalia. **112**, volsella (scale = 100 µm).





Figures 113–118

Melitta haemorrhoidalis. **113**, antenna ♂ (scale = 200 μ m). **114**, glossa ♂ (scale = 200 μ m). **115**, proboscide ♀ (scale = 200 μ m). **116**, inner view of galea ♂ (scale = 200 μ m). **117**, scutellum and mesonotum ♀ (scale = 600 μ m). **118**, median femur ♀ (scale = 400 μ m).

NHM; 1♂ paratype, Ethiopia, Addis Ababa, 7,000 feet, 7.X.1945, leg. Guichard, NHM.

Additional material examined. None.

Etymology. Named after Ken Guichard, who collected the type material.

Related species. *M. seitzii* and *M. iberica*.

Diagnosis. ♀. Unknown.

♂. L = 9.3 mm. Glossa longer than labial palpus. Outer surface of galea mat and sculptured. Maxillary palpus shorter than galea. Malar area shorter than A2. Face and clypeus covered with erect, yellowish hair, and narrow, black, lateral fringe. Antenna black. A3 shorter than A4. A4-A12 slightly convex ventrally. Scutum densely punctate ($i < d$), mat and sculptured between punctures. Propodeal triangle rugose. Disc of terga with erect, yellow hair. T2-T4 without apical hair bands. S6 with a few yellow, apical hairs (fig. 100). S7 with apicolateral process blade shaped (fig. 101). S8 nearly hairless (fig. 102). Gonostylus and digitus pointed apically (figs 103–104).

Description. ♀. Unknown. ♂. **Body length.** 9.3 mm. **Head.** Integument: black. Glossa pointed, longer than labial palpus. Outer surface of galea mat and sculptured. Maxillary palpus shorter than galea. Labrum smooth. Malar area shorter than A2. Clypeus densely punctate ($i < d$), except narrow apical area smooth. Face and vertex densely punctate ($i < d$). A3 shorter than A4. A4-A12 slightly convex ventrally, longer than wide. Vestiture: clypeus, face, vertex and genal area covered with erect, yellowish hair. Face with narrow, black, lateral fringe. Mesosoma. Integument: black. Scutum, scutellum, metanotum and mesepisternum densely punctate ($i < d$), mat and sculptured between punctures. Propodeal triangle rugose. Vestiture: entire mesosoma covered with erect, yellowish hair. **Legs.** Integument: black. Without any structure toothed or swollen. Bt3 1.5X as wide as mediotarsus. Vestiture: all legs covered with erect, yellowish hair. Inner fringe of F3 shorter than wide of F3. **Wings.** Nervulus infuscated. Fore wing with first recurrent vein meeting weak Rs+M in first half of second submarginal cell. **Metasoma.** Integument: mainly black. Marginal zone of terga and sterna reddish. Terga mat and sculptured. S1-S5 with straight, apical margin. S6 with convex apical margin (fig. 102). S7 with apicolateral process blade-shaped (fig. 101). S8 without median carina (fig. 100), apical area semi-circular. Gonostylus and digitus pointed apically (figs 103–104). Vestiture: yellow to reddish. Disc of terga with erect, yellow hair. T2-T4 without apical hair bands. S6 with a few yellow hairs apically (fig. 100). S7 hairless (fig. 101). S8 nearly hairless (fig. 102). Outer side of gonostylus with short appressed yellow hair.

Distribution (fig. 190). Only known from locus typicus (Addis Ababa, Ethiopia).

Phenology. October.

Host plants. Unknown.

15. *Melitta haemorrhoidalis* (Fabricius)

[Figs 105–118, 179]

Andrena haemorrhoidalis Fabricius 1775: 377, sex not specified. Type material. Original material probably lost, neotype ♀, Sweden, Lund [59.90°N 18.50°E], SEMC, NS, proposed by Baker & Engel (2007). Locus typicus: “in Sueciae nemoribus”.

Apis dichroa Gmelin 1790: 2792, sex not specified. Type material. Holotype gender unknown, Lost? (Baker & Engel 2007). Locus typicus: “in Sueciae nemoribus”.

Melitta chrysuria Kirby 1802: 172-173, ♀ ♂. Type material. Syntypes ♀ ♂,

United Kingdom [?], NHM (Kirby collection), NS. Locus typicus: “Barhamiae: Marsham, Trimmer, Haworth, Sowerby”.

Additional material examined. 1103 specimens (detail in ASEF web site).

Related species. *M. wankowiczi*.

Diagnosis. ♀ ♂. Labial palpus half as long as glossa (fig. 114). Outer surface of galea smooth (fig. 115). Galea pointed apically (figs 115–116). Malar area shorter than A2. Scutum and scutellum sculptured between punctures (fig. 117). Propodeal triangle horizontally costulate. Metasoma black.

♀. L = 12.2 mm. Face with erect, reddish hair. Clypeus sculptured between deep punctures, median line impunctate. Metanotum swollen apically (fig. 117). Entire metanotum punctate and mat (fig. 117). Ventral margin of F2 obtusely angled. Bt2 with brownish hair. Tb2 with carina on inner margin (fig. 118). Leg 3 with golden-yellow hair, Bt3 with reddish hair (sometimes with black hair apically). Terga with white, apical hair bands, shorter than marginal zone. Disc of terga nearly hairless. Prepygidial fimbria black (only in Pyrenees) or reddish, with a few, white hairs laterally. Pp sometimes with a small median elevated area.

♂. L = 10.3 mm. Clypeus mat, with deep punctures, except apical area smooth. Face with black lateral fringe. A3 as long as A4. A4-A12 strongly enlarged apically (fig. 113). F2 3X as long as wide. Inner fringe of F3 shorter than width of F3. Marginal zone of T2-T4 nearly hairless, sometimes with a few yellowish hairs. Disc of T1-T2 with brownish-yellow hair. Apical margin of S4-S5 slightly emarginate. S6 with brown apicomedian hair (fig. 105). S7 with apicolateral process bowl shaped (figs 106, 108), without spines. Disc of S8 with mediolateral carina (figs 107, 109). Apical plate of S8 circular. Apex of gonostylus pointed (fig. 110), straight ventrally (fig. 111). Base of inner margin of penis valve shorter than penis valve (fig. 110). Digitus rounded apically (fig. 112).

Distribution (fig. 179). Widespread in Europe from Pyrenees to Finland. This is the only species of *Melitta* that occurs in Scotland. The oriental data are from Erevan (Armenia) and Udmurtia (Russia).

Phenology. June to September.

Host plants (462 specimens). Asteraceae, *Cichorium* sp. (3♂), *Hieracium laevigatum* (1♂), *Tanacetum* sp. (2♂); Campanulaceae, *Campanula* sp. (29♀ 82♂), *C. latifolia* (1♀ 1♂), *C. persicifolia* (3♂), *C. rapunculoides* (7♀ 8♂), *C. rotundifolia* (52♀ 68♂), *C. trachelium* (46♀ 43♂); Dipsacaceae, *Knautia arvensis* (1♀ 1♂); Fabaceae, *Lathyrus latifolius* (1♀); Geraniaceae, *Geranium* sp. (3♂); *G. pratense* (6♂); Malvaceae, *Malva* sp. (1♀ 2♂), *M. moschata* (14♀ 72♂), *M. sylvestris* (11♂); Rosaceae, *Rubus* sp. (4♂).

16. *Melitta harrietae* (Bingham)

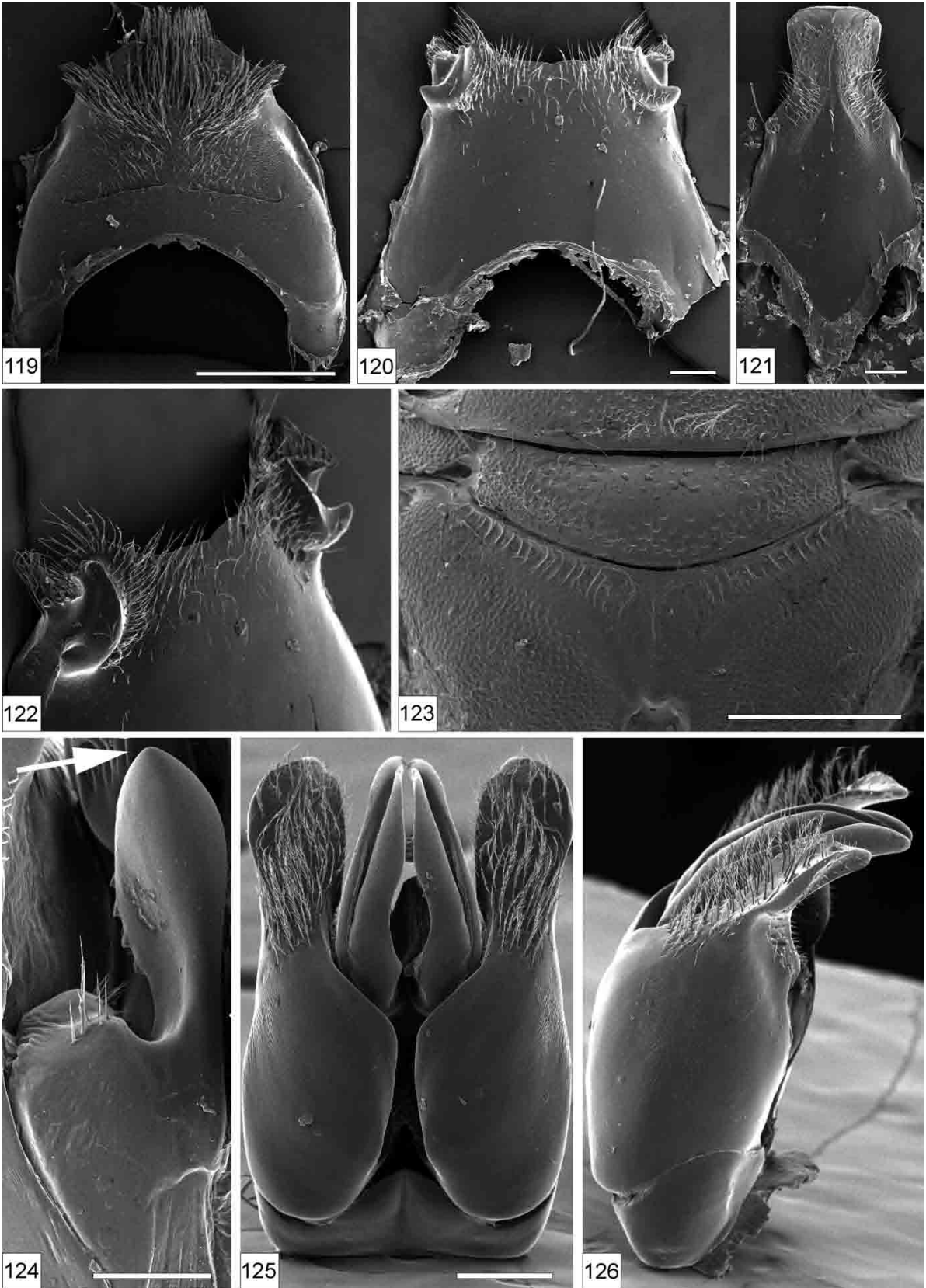
[Figs 119–126, 185]

Andrena harrietae Bingham 1897: 446-447, ♀. Type material. Syntype ♀, India, Rangit Valley, Sikkim [27.75°N 88.50°E], 305m, leg. Bingham, NHM, S. Locus typicus: “Rangit Valley, Sikkim”.

Melitta altissima Cockerell 1910a: 240-241, ♀. Type material. 2♀ syntypes, China, Tibet, Gyantse [28.95°N 89.63°E], 3962m, VI.1904, leg. Walton, NHM, S. Locus typicus: “Thibet, Gyantse”.

Melitta tibetensis Wu 1978: 420-421, ♀. Synonymised by Wu (2000). Type material. Holotype ♀, China, Zhongba [29.65°N 84.17°E], IZAS, NS. Locus typicus: “Xizang, Zhongba”.

Melitta pseudotibetensis Wu 1978: 421, ♀. Synonymised by Wu (2000).



Type material. Holotype ♀, China, Ngamring [29.23°N 87.17°E], 18.VIII.1975, IZAS, NS. Locus typicus: "Xizang, Ngamring".

Additional material examined (51 specimens). **China:** 8♀ 7♂, Gyantse [28.95°N 89.63°E], VI.1904, leg. Walton, NHM; 1♂, Tingri [28.57°N 86.63°E], 06.VII.1924, leg. Hingston, NHM; 1♂, idem, 04.VII.1924, NHM; 5♀ 9♂, Raka [29.43°N 85.83°E], 25.VII.1986, leg. Kraus, OOLL; 1♀, Shakiái [25.25°N 101.13°E], 11.VIII.1986, OOLL; 7♀, Lhasa [29.65°N 91.10°E], 25.VIII.1998, leg. Haubruge, FUSAG; 1♀ 1♂, Lume [?], 12.VIII.2000, leg. Haubruge, FUSAG; 1♀, Datse [?], 15.VIII.2000, leg. Haubruge, FUSAG. **India:** 6♀ 1♂, Ladakh [34.33°N 77.42°E], 29.VII.1980, leg. William, NHM; 1♀, Sikkim [27.75°N 88.5°E], V.1894, leg. Bingham, NHM; 1♀, Ladakh Plateau [34.75°N 79°25'E], 10.VII.1985, OOLL.

Related species. *M. sibirica* and *M. cameroni*.

Diagnosis. ♀ ♂. Glossa as long as maxillary palpus. Outer surface of galea mat, finely sculptured. Maxillary palpus as long as galea. Malar area longer than A3. Scutum densely punctate ($i < d$), smooth between punctures. Base of propodeal triangle vertically carinate (fig. 123). Terga without apical hair bands. Metasoma black.

♀. L = 14.2 mm. Entire clypeus densely punctate ($i = d$), with smooth median line. Vertex with black hair. Ventral mesosoma with black hair. Centre of metanotum smooth. Legs with dark hair. Prepygidial fimbria orange. Pp with lateral grooves.

♂. L = 13.2 mm. Face covered with erect, white hair, and black lateral fringe. A4 as long as wide. Centre of scutum with black hair. Legs with yellow hair. Disc of T1-T2 with long greyish hair. Disc of T4-T6 with long orange hair. Apex of S6 with long bushy hair laterally and medially (fig. 119). S7 with apicolateral process blade shaped (figs 120, 122). S8 nearly hairless (fig. 121). Apical plate of S8 circular. Apex of gonostylus curved ventrally (fig. 126) and truncate (fig. 125). Digitus pointed apically (fig. 124).

Variation. Females with different vestiture, either dark or white. First form with clypeus black, mesosoma orange, mesepisternum and T1-T2 blackish. Second with clypeus white, mesosoma black and white, mesepisternum and T1-T2 white.

Distribution (fig. 185). Himalayas (India and China).

Phenology. May to August.

Host plants. Unknown.

17. *Melitta heilungkiangensis* Wu

[Fig. 187]

Melitta heilungkiangensis Wu 1978: 421, ♂. Type material. Holotype ♂, China, Tongjiang [46.63°N 126.43°E], 11.VIII.1970, IZAS, NS. Locus typicus: "Heilong Jiang, Tongjiang".

Additional material examined. None.

Figures 119–126

Melitta harrietae. **119**, ventral view of sternum 6 ♂ (scale = 1 mm). **120**, ventral view of sternum 7 ♂ (scale = 200 µm). **121**, ventral view of sternum 8 ♂ (scale = 200 µm). **122**, apicolateral view of sternum 7 ♂. **123**, metanotum and propodeal triangle ♀ (scale = 1 mm). **124**, volsella, arrow pointed on the expanded and pointed digitus (scale = 100 µm). **125**, dorsal view of genitalia (scale = 300 µm). **126**, lateral view of genitalia.

Related species. *M. wankowiczii* (possibly conspecific with *M. heilungkiangensis*).

Diagnosis. ♀. Unknown.

♂. L = 10.5 mm. A3 slightly shorter than A4. A3 clearly shorter than A5. Scutum with black hair centrally, yellow marginally. T2-T5 with white, apical hair bands. S7 with apico-lateral structure bowl shaped. S8 with short column. Digitus rounded apically.

Distribution (fig. 187). Only known from locus typicus (North East of China).

Phenology. August.

Host plants. Unknown.

18. *Melitta hispanica* Friese

[Fig. 179]

Melitta hispanica Friese 1900: 85, ♂. Type material. Syntype ♂, Spain [?], ZMHU, NS. Locus typicus: "Hispania, Barcelona".

Melitta hispanica, Ornos & Ortiz-Sanchez (2003a: 311-312); re-description of the holotype ♂, illustration of S6-S8 and genitalia ♂.

Additional material examined (12 specimens). **Spain:** 10♂, Albolodúy [37.03°N 2.62°W], 06-07.V.2003, leg. Halada, OOLL; 1♀, Hoya [37.41°N 2.00°W], OOLL; 1♂, Bayárcal [37.03°N 2.98°W], 24.VI.1988, leg. Schwarz, CS.

Related species. *M. kastiliensis* and *M. udmurtiaca*.

Diagnosis. ♀ ♂. Labial palpus as long as glossa, shorter than maxillary palpus. Outer surface of galea shiny and sculptured. Malar area shorter than A2. Scutum smooth between punctures. Propodeal triangle narrow, mat, rugose, without carina. Metasoma black.

♀. L = 13.2 mm. Clypeus twice as wide as long, sparsely punctate ($i > d$), with impunctate median line. Face with white hair. Vertex with black hair. Scutum with black hair centrally, reddish on margins, medio-apex sparsely punctate ($i > 2d$). Central area of scutellum impunctate. Legs 1-3 with white hair. Disc of T2-T4 with a few appressed, short, black hairs. T1-T4 with white hair bands apically, hair longer laterally than medially. Apical hair band on T1 interrupted medially. Apical hair bands on T2-T4 continuous. Prepygidial fimbria black, with a few white hairs laterally. Pp with two lateral grooves.

♂. L = 12.2 mm. Clypeus densely punctate ($i < d$), except apical area smooth. A3 as long as A4. A4-A12 slightly convex ventrally. Face covered with yellowish hairs, without black fringe laterally (sometimes with a few black hairs laterally). Central area of scutum densely punctate ($i < d$). Propodeal triangle finely sculptured, without carina. Disc of T1-T4 with erect, reddish hair. T2-T4 with whitish hair bands apically. T5-T6 with black hair and a few yellowish hairs laterally. S2-S5 with apical margins straight, with greyish hair. S6 covered with brownish hairs, longer apicolaterally than apicomediaally. S7 with apicolateral process blade shaped. S8 nearly hairless. Apex of gonostylus straight and pointed. Digitus pointed apically.

Distribution (fig. 179). Endemic in Spain (eastern Sierra Nevada).

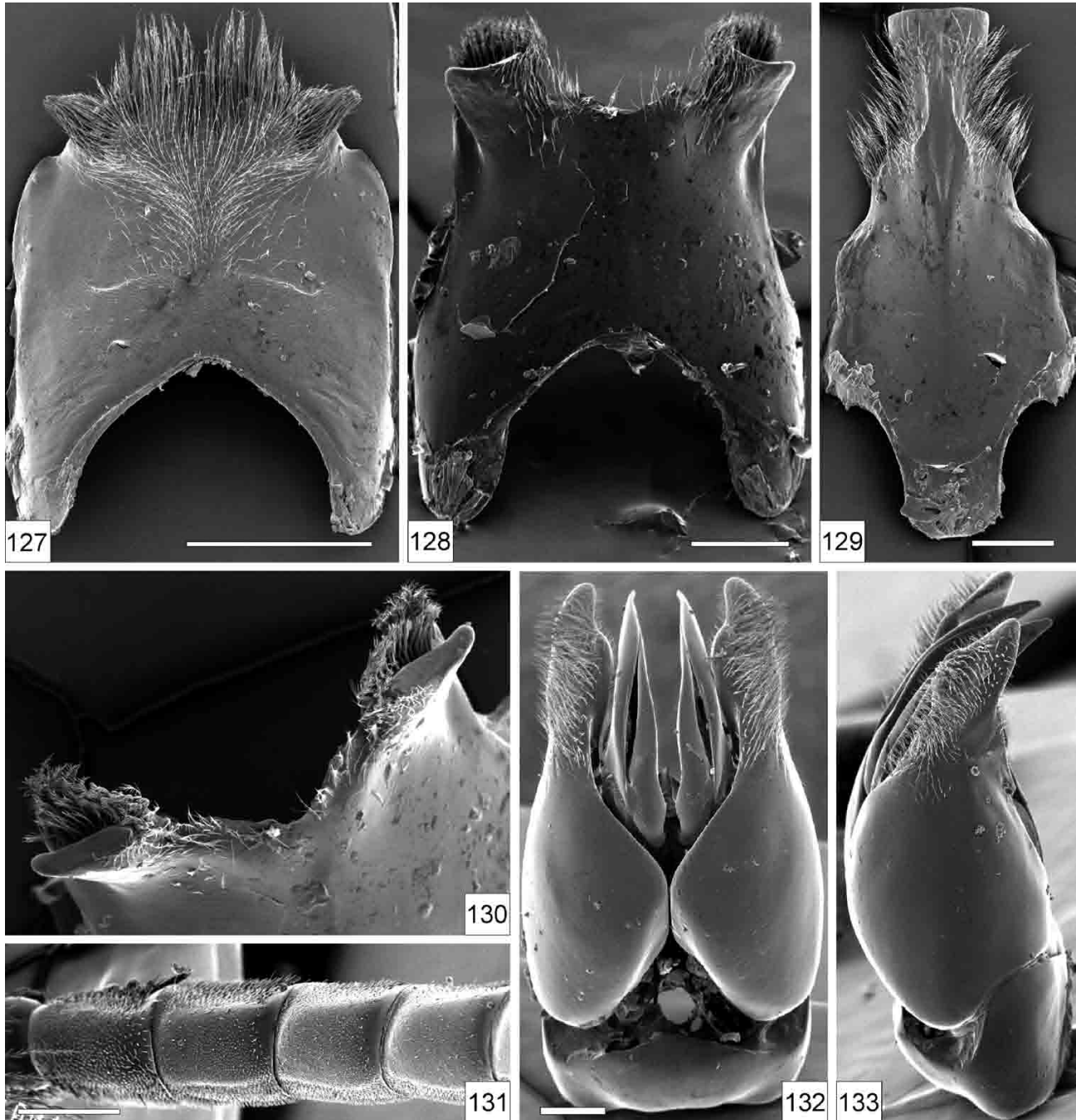
Phenology. May to June.

Host plant. Unknown.

19. *Melitta iberica* Warncke
[Fig. 187]

Melitta iberica Warncke 1973b: 109, ♀ ♂. Type material. Holotype ♂, 1 ♀ paratype, Spain, Sierra de Guadarrama [41°N 3.8°W], leg. Dusmet, OOLL, S; 2 ♂ paratypes, Spain, Valencia [39.47°N

0.37°W], OOLL, S; 1 ♀ paratype, Spain, Navalperal [40.58°N 4.4°W], VII.1904, OOLL, S; 1 ♀ 1 ♂ paratypes, Spain, Arenas de San Pedro [40.12°N 5.05°W], VI.1927, OOLL, S; 1 ♀ paratype, Spain, La Aliseda [40.33°N 5.38°W], VI.1961, OOLL, S; 2 ♂ paratypes, Spain, San Rafael [40.72°N 4.18°W], OOLL, S. Locus typicus: “*Madrid, Sierra de Guadarrama*”.



Figures 127–133

Melitta japonica, male. **127**, ventral view of sternum 6 (scale = 1 mm). **128**, ventral view of sternum 7 (scale = 400 µm). **129**, ventral view of sternum 8 (scale = 400 µm). **130**, apicolateral view of sternum 7. **131**, ventral view of antennal segments 3–6 (scale = 300 µm). **132**, dorsal view of genitalia (scale = 300 µm). **133**, lateral view of genitalia.

Melitta hispanica, Ornos & Ortiz-Sanchez (2003b: 572); illustration of S6-S8 and genitalia ♂.

Material examined (6 specimens). **Spain:** 1♀ 1♂, Arenas de San Pedro [40.20°N 5.09°W], VI.1927, OOLL; 1♀ 1♂, Sierra de Guadarrama [40.99°N 3.8°W], OOLL; 1♀, La Aliseda [40.33°N 5.38°W], VI.1961, OOLL; 1♂, Sierra Nevada [37.09°N 3.17°W], 24.VII.1980, NHM.

Related species. *M. murciana* and *M. seitzii*.

Diagnosis. ♀ ♂. Glossa shorter than labial palpus. Outer surface of galea mat and sculptured. Malar area shorter than A2. Scutum densely punctate ($i < d$), smooth between punctures. Metasoma black.

♀. L = 13.0 mm. Clypeus twice as wide as long, with median impunctate line. Vestiture of face reddish, vertex brown. Scutum with black hair centrally, reddish marginally. Outer surface of leg 1 with brown hair. Legs 2-3 with reddish hair. Disc of T1 with erect, reddish hair. Disc of T2-T4 with a few appressed, short, black hairs. T1-T4 with dense white apical hair bands, hairs longer laterally than medially, those on T2-T4 continuous. Prepygidial fimbria entirely black. Pp with median elevated area.

♂. L = 12.0 mm. A3 shorter than A4. A4-A12 slightly convex ventrally. Face with reddish hair, and narrow black lateral fringe. Bt3 as wide as mediotarsus 3. T2-T4 without apical hair bands. Disc of T1-T3 with erect, reddish hair. Disc of T4-T6 with black hair. Apical margin of S3-S5 slightly convex. S6 with apicomedian area nearly hairless, with long, bushy, black hairs apicolaterally. S7 with apicolateral process blade shaped. S8 nearly hairless, with apical plate oval shaped. Gonostylus truncated apically, shorter than penis valve. Digitus rounded apically.

Distribution (fig. 187). Endemic in Spain.

Phenology. June and July.

Host plants. Unknown.

20. *Melitta japonica* Yasumatsu & Hirashima

[Figs 127–133, 168, 186]

Melitta japonica Yasumatsu & Hirashima 1956: 252–253, ♀ ♂. Type material. Holotype ♂, Japan, Karuizawa [36.35°N 138.63°E], 19.VIII.1949, ELKU, NS; Paratype ♀ (allotype), Japan, Karuizawa [36.35°N 138.63°E], 19.VIII.1949, ELKU, NS; 4♀ paratypes, Japan, Nishi-ashoro [43.33°N 143.67°E], 22.VIII.1953, ELKU, NS; 1♂ paratype, idem, 06.VIII.1953, ELKU, NS; 1♀ paratype, Japan, Karuizawa [36.35°N 138.63°E], 21.VIII.1949, ELKU, NS; 1♀ paratype, idem, 29.VIII.1949, ELKU, S; 1♂ paratype, idem, 19.VIII.1950, ELKU, S; 1♂ paratype, idem, 18.VIII.1950, ELKU, S; 2♂ paratypes, idem, 19.VIII.1949, ELKU, S. Locus typicus: "Japan, Honsbu, Karuizawa".

Melitta taishanensis Wu 1978: 422, ♂. **Syn. nov.** Type material. Holotype ♂, China, Tai'an [36.19°N 117.12°E], 26.VII.1973, IZAS, NS. Locus typicus: "Sangdong, Tai'an".

Additional material examined (21 specimens). **Russia:** 1♂, Novosibirsk [55.05°N 82.92°E], 15.VII.1981, CS; 1♂, Ussuriland, Lazovski, 43.3°N 134.15°E, 0m, 24.VIII.2001, on purple *Aster* sp., leg. Quest, ZMHB; 1♂, Ussuriland, Lazovski, 43.01°N 134.12°E, 5.VII–14.VII.2001, leg. Quest, ZMHB; 1♂, Ussuriland, Lazovski, 43.42°N 133.87°E, 270m, 9.VII.2001, leg. Quest, ZMHB; 1♀, Ussuriland, Lazovski, 43.01°N 134.15°E, 0m, 18.VIII.2001, leg. Quest, ZMHB; 3♂, Ussuriland, Lazovski, 43.01°N 134.13°E, 2m, on *Vicia*

sp., leg. Quest, ZMHB; 4♀ 5♂, Ussuriland, Lazovski, 43.27°N 134.03°E, 389m, 4.IX.2001, on *Vicia* sp., leg. Quest, ZMHB; 1♀ 1♂, Ussuriland, Lazovski, 43.26°N 134.02°E, 4.IX.2001, 350m, leg. Quest, ZMHB; 2♂, Ussuriland, Lazovski, 43.27°N 134.05°E, 398m, 4.IX.2001, leg. Quest, ZMHB.

Related species. *M. udmurtiaca*.

Diagnosis. ♀ ♂. Glossa longer than galea. Outer surface of galea mat and sculptured. Malar area shorter than A2. Posterior scutum, anterior scutellum and anterior metanotum densely punctate ($i = d$), smooth between punctures. Propodeal triangle with fine granular sculpture, mostly with conspicuous transverse horizontal wrinkles. Terga shiny. Metasoma black.

♀. L = 13.0 mm. Clypeus flat, sparsely punctate ($i = d$), smooth between punctures, impunctate apically, with median impunctate line. Outer surface of legs 1-2 and ventral mesosoma with reddish to yellowish hair (fig. 168). T2-T4 with white, apical hair bands, longer than marginal zone (fig. 168). Prepygidial fimbria black medially, white laterally. Pp with lateral grooves.

♂. L = 12.5 mm. Face with whitish to yellowish hair, without narrow black lateral fringe. A3 as long as A4 (fig. 131). A4 longer than wide (fig. 131). A4-A12 slightly convex ventrally, with elliptical depression which ridged at margins (fig. 131). Distitarsus twice as long as wide. Hair on underside of F3 uniform in length. Disc of T1-T3 with reddish hair. Disc of T4-T6 with black hair. T2-T4 with sparse, white, apical hair bands. S6 with basal elevation and bushy hair apicolaterally (fig. 127). S7 with apicolateral process blade shaped (figs 128, 130). Column of S8 with a few lateral hairs (fig. 129). Apical plate of S8 flattened, three times as wide as long. Apex of gonostylus straight and pointed (figs 132–133). Penis valve pointed apically (fig. 132). Digitus rounded apically.

Distribution (fig. 186). Eastern Palaearctic, including Japan.

Phenology. July to August.

Host plants (18 specimens). Asteraceae, *Aster* sp. (1♂); Fabaceae, *Trifolium* sp. (4♀ 1♂), *Vicia* sp. (4♀ 8♂).

21. *Melitta kastiliensis* Warncke

[Fig. 186]

Melitta kastiliensis Warncke 1973b: 110, ♀ ♂. Type material. Holotype ♂, Spain, Montarco [40.35°N 3.53°W], OOLL, S; 1♀ paratype, idem, OOLL, S; 1♂ paratype, idem, MCN, NS; 1♂ paratype, Spain, Alicante [38.35°N 0.48°W], OOLL, S. Locus typicus: "Madrid, Montarco".

Melitta kastiliensis, Ornos & Ortiz-Sanchez (2003b: 572); illustration of male S6-S8 and genitalia male.

Additional material examined (8 specimens). **Spain:** 1♂, Alicante [38.35°N 0.48°W], OOLL; 2♀ 3♂, Estación de Montarco [40.35°N 3.54°W], 01.VII.1930, OOLL; 2♂, Cartagena [37.60°N 0.98°W], 12.V.2005, leg. Halada, OOLL.

Related species. *M. hispanica* and *M. udmurtiaca*.

Diagnosis. ♀ ♂. Labial palpus shorter than glossa. Glossa shorter than maxillary palpus. Galea pointed apically, outer surface smooth. Malar area shorter than A2. Scutum densely punctate ($i < d$), smooth between punctures. Propodeal triangle with one transversal horizontal carina. Metasoma black.

♀. L = 15.5 mm. Clypeus smooth between punctures, apical area impunctate. Face with whitish hair. Vertex with brown hair.

Dorsal part of scutum with reddish hair, intermixed with black hair, ventral part of scutum with white hair. Legs 1-3 (including scopa) with yellow hair. Disc of T1-T2 with appressed, short, whitish hair. T1-T4 with dense, white, apical hair bands. Apical hair band on T1 interrupted medially. Apical hair bands on T2-T4 continuous. Prepygidial fimbria black, with a few white hairs laterally. Pp with lateral grooves.

♂. L = 12.1 mm. A3 shorter than A4. A4-A12 cylindrical, sometimes slightly convex ventrally. Face with white to yellowish hair, with narrow, black, lateral fringe. Bt3 as wide as basitarsus 3. Terga with apical hair bands. T5-T6 with black hair, but yellowish laterally. S2-S5 with straight apical margins. Apex of S6 with long hair medially and laterally. S7 with apicolateral process blade shaped. S8 nearly hairless, apical area circular. Gonostylus with one apical lobe and one inner lateral lobe. Digitus pointed apically.

Distribution (fig. 186). Endemic to Spain (Alicante, Cartagena and Madrid areas).

Phenology. May to July.

Host plants. Unknown.

22. *Melitta katherinae* Eardley

[Fig. 190]

Melitta katherinae Eardley & Kuhlmann 2006: 302-304, ♂. Type material. Holotype ♂, Kenya, Laikipia [0.20°N 36.53°E], 03.VI.2003, on *Acacia gerrardii*, leg. K. Baldock, NMK, S; paratype ♂, idem, NCSA, S. Locus typicus: "Kenya, Mpala Res. Centre, Laikipia".

Additional material examined. None.

Related species. *M. danae* and *M. albida*.

Diagnosis. ♀. Unknown.

♂. L = 9.4 mm. Malar area shorter than A2. Face without black, lateral fringe. Propodeal triangle mat, with fine granular sculpture. Hair on disc of T3 entirely yellowish. Disc of T4-T7 with black hair. T1-T5 with white, apical, hair bands. S6 without apicomedian area elevated and expanded. S7 with apicolateral process blade shaped. Column of S8 with a few lateral hairs. Gonostylus truncate apically. Digitus rounded apically.

Distribution (fig. 190). Only known from locus typicus in Kenya (Laikipia).

Phenology. June.

Host plants (2 specimens). Fabaceae, *Acacia gerrardii* (2♂).

23. *Melitta latronis* Cockerell

Melitta latronis Cockerell, 1924: 596, ♂. Type material. Holotype ♂, Russia, Siberia, Kongaus [?], VIII.1923, NHM, S. Locus typicus: "Kongaus".

Additional material examined. None.

Diagnosis. ♀. Unknown.

♂. L = 11.0 mm. Malar area shorter than A2. A4-A12 cylindrical, orange ventrally, brown dorsally. Face and mesosoma with whitish vestiture. T2-T4 with white, apical bands. Disc of terga with dark hair.

Distribution. Only known from locus typicus in Siberia (Kongaus).

Phenology. Unknown.

Host plants. Unknown.

24. *Melitta melittoides* (Viereck)

Dolichocheile melittoides Viereck 1909: 49, ♀. Type material. Holotype ♀, USA, Clementon [39.80°N 74.98°W], USNM, NS. Locus typicus: "New Jersey, Clementon".

Melitta (Dolichocheile) melittoides, Snelling & Stage (1995: 26); illustration of S6-S8 and genitalia ♂.

Additional material examined (4 specimens). USA: 2♀ 2♂, Black Mountains [?], AMNH.

Related species. No other species of *Melitta*.

Diagnosis. ♀ ♂. Maxillary palpus five-segmented. Outer surface of galea smooth. Labrum shiny. Malar area as long as A3. Scutum and scutellum sparsely punctured ($i > 3d$), smooth between punctures. Propodeal triangle with fine, granular sculpture, concave. Fore wing with first recurrent vein meeting weak R_{5+M} in middle of second submarginal cell. Terga shiny. Metasoma black.

♀. L = 11.6 mm. Mandible slightly longer than eye, flattened apically, blade pointed, without pre-apical tooth, with two small teeth on inner margin. Clypeus with few punctures, sculptured between punctures. Legs with yellowish hairs. T1 with interrupted, white, apical hair band. T2-T4 with continuous, white, apical hair bands. Prepygidial fimbria brownish-black. Pp with median area slightly elevated.

♂. L = 10.6 mm. A3 shorter than A4. A4 twice as long as wide. A4-A12 slightly convex ventrally. Face with whitish hair, with few lateral black hairs. T2-T4 with sparse apical hair bands. Apical margin of S5 emarginate. Apicolateral process of S6 broadly expanded. S7 with apicolateral process blade shaped. Column of S8 with median carina. Gonostylus apically bifid.

Distribution. East USA (New Hampshire to Tennessee and Georgia).

Phenology. May to June.

Host plants. Ericaceae, *Polycodium* sp. (?), *Xolisma* sp. (?) and *Zenobia* sp. (?) (Snelling & Stage 1995).

25. *Melitta mongolica* Wu

[Fig. 184]

Melitta mongolica Wu, 1978: 421, ♀ ♂. Type material. Holotype ♀, China, Erenhot [43.65°N 111.97°E], 13.VIII.1971, IZAS, NS. Locus typicus: "Inner Mongolia, Erenhot".

Additional material examined. None.

Related species. *M. ezoana*.

Diagnosis. ♀. L = 13.5 mm. T1-T4 with wide, yellow, apical hair bands. Mesosoma covered with yellowish-brown hair. Legs with reddish hairs.

♂. L = 11.5 mm. A3 longer than A4. T1-T4 with broad, yellowish, hair bands. Mesosoma covered with yellow hairs. S7 with apicolateral process blade shaped. S8 nearly hairless.

Distribution (fig. 184). China (Inner Mongolia).

Phenology. July to August.

Host plants. Unknown.

26. *Melitta montana* Wu

[Fig. 187]

Melitta montana Wu 1993: 1386-1387, ♂. Type material. Holotype ♂, China, Lijiang [23.57°N 102.00°E], IZAS, NS. Locus typicus: "Yunnan, Lijiang".

Melitta montana, Wu (2000: 83); description of the female.

Additional material examined. None.

Diagnosis. ♀. L = 11.0 mm. Diagnosis not available.

♂. L = 10.5 mm. A3 longer than A4. Mesosoma with greyish-yellow and black hair intermixed. T2-T4 with yellowish, apical, hair bands. Apicolateral process of S7 rounded apically.

Distribution (fig. 187). Only known from locus typicus in South China (Yunnan prov.).

Phenology. Unknown.

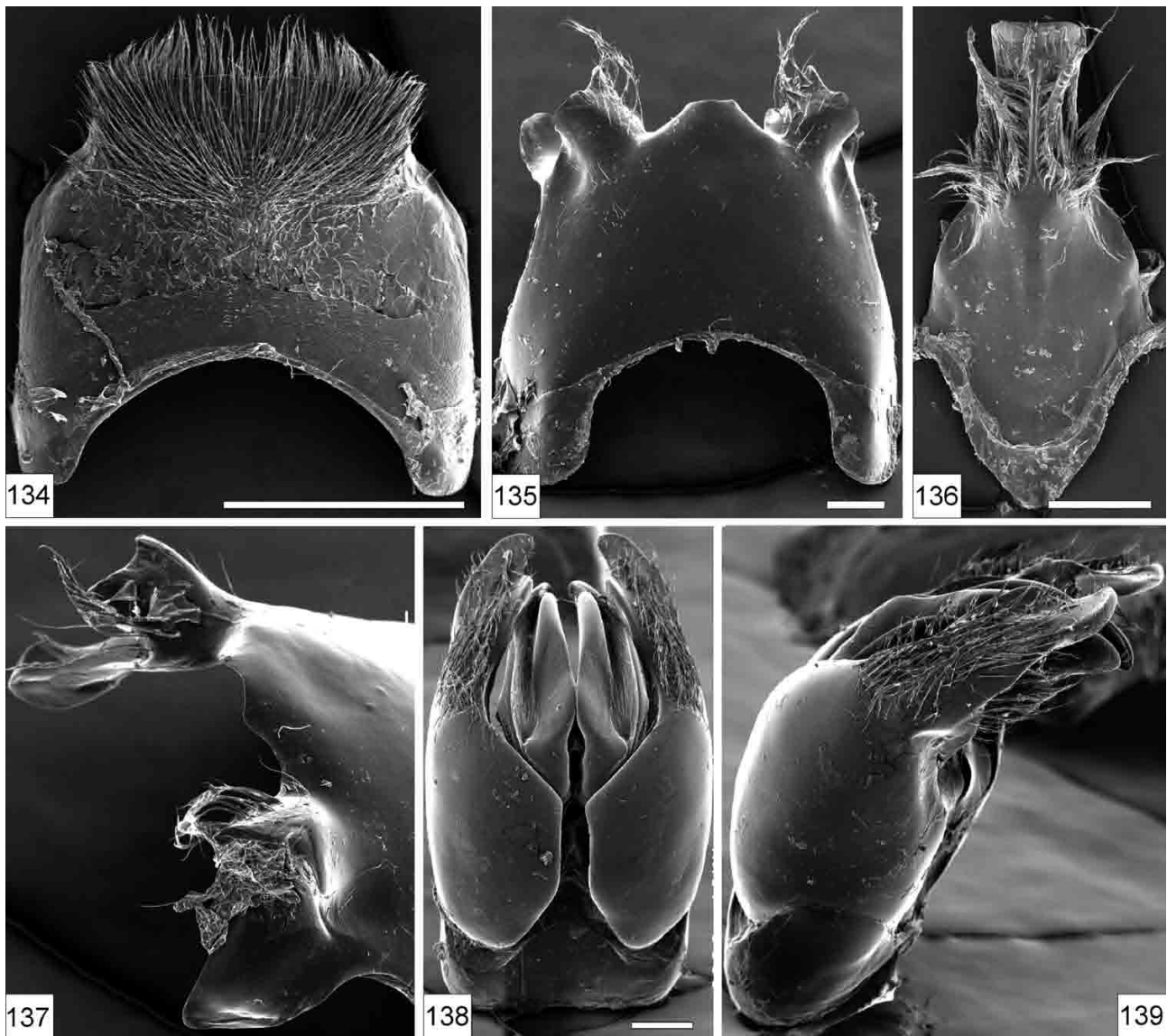
Host plants. Boraginaceae, *Lithospermum erythrorhizon* (?); Lamiaceae, *Origanum vulgare* (?) (Wu 1993).

27. *Melitta murciana* Warncke

[Figs 134–139, 183]

Melitta murciana Warncke 1973b: 110, ♂. Type material. Holotype ♂, Spain, Murcia [37.98°N 1.12°W], 02.V.1941, leg. Andréu, OOLL, S; 1 ♂ paratype, Spain, Orihuela [38.08°N 0.95°W], OOLL, S. Locus typicus: "Murcia".

Warncke (1973b) described only the male of *M. murciana*. We provide the first description of the female based on pairs of specimens collected in the vicinity of Murcia (see additional material below). Both specimens share same unsexual features like wing venation, scutellum punctuation and structure of proboscides.



Figures 134–139

Melitta murciana, male. **134**, ventral view of sternum 6 (scale = 1 mm). **135**, ventral view of sternum 7 (scale = 250 µm). **136**, ventral view of sternum 8 (scale = 400 µm). **137**, apicolateral view of sternum 7. **138**, dorsal view of genitalia (scale = 200 µm). **139**, lateral view of genitalia.

Additional material examined (113 specimens). **Spain:** 1♂, Alicante [38.35°N 0.48°W], 04.IV.1970, OOLL; 1♀ 27♂, Albolodúy [37.03°N 2.62°W], 06-07.V.2005, leg. Halada, OOLL; 5♂, Sierra de los Filabres [37.22°N 2.33°W], 23.IV.2003, leg. Halada, OOLL; 5♂, Ohanes [37.03°N 2.73°W], 05.V.2003, leg. Halada, OOLL; 1♀ 5♂, Lanjarón [36.92°N 3.48°W], 04.V.2003, leg. Halada, OOLL; 2♂, Cartagena [37.6°N 0.98°W], 12.V.2003, leg. Halada, OOLL;

49♂, Murcia [37.98°N 1.12°W], 11.V.2003, leg. Halada, OOLL; 1♀ 11♂, Alhama de Murcia [37.82°N 1.38°W], 24.IV.1993, leg. Schwarz, CS; 1♀ 4♂, Valencia [39.47°N 0.37°W], leg. Halada, OOLL.

Related species. *M. seitzii* and *M. iberica*.

Diagnosis. ♀ ♂. Glossa as long as maxillary palpus and labial palpus. Outer surface of galea smooth. Malar area shorter than A2. Centre of scutum and scutellum smooth between punctures. Base of propodeal triangle with vertical carinae. Metasoma black.

♀. L = 12.9 mm. Clypeus flat, sparsely punctate ($i > d$), with smooth, median line. Dorsal surface of mesosoma with black hair intermixed with reddish hair. Central area of scutum sparsely punctate ($i > 2d$). Legs 1-3 with reddish hair. T2-T4 with yellowish, apical, hair bands that are as long as marginal zone. Prepygidial fimbria black, with a few whitish hairs intermixed laterally. Pp with median elevated area.

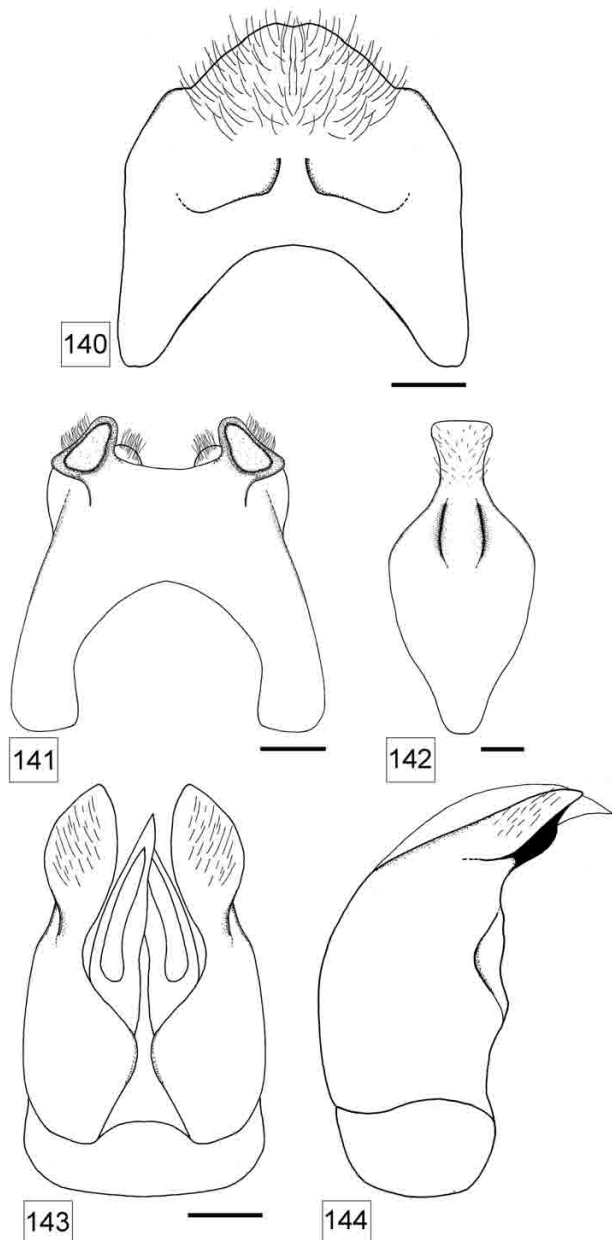
♂. L = 11.8 mm. Vestiture of body reddish. A3 shorter than A4. A4-A12 cylindrical. Face with reddish hair, and narrow, black, lateral fringe. Scutum densely punctate ($i < d$). Bt3 three times as wide as mediotarsus 3. Terga without apical hair bands. Disc of T4-T6 with black hair, and a few white hairs laterally. S4-S5 with straight, apical margins. S6 with truncate apical margin, with bushy hair apicolaterally (fig. 134). S7 with two pairs of apicolateral blade (figs 135, 137). Column of S8 with long, bushy, hairs laterally (fig. 136). Apical area of S8 circular. Gonostylus pointed apically (fig. 138). Gonostylus as long as gonocoxite (lateral view) (fig. 139). Digitus rounded apically.

Description ♀. L = 12.9 mm. **Head.** Integument: mainly black, flagellum reddish ventrally. Glossa pointed, as long as maxillary palpus. Labial palpus as long as maxillary palpus. Outer surface of galea smooth. Malar area shorter than A2. Labrum with 2 distinct tubercles. Clypeus flat, sparsely punctate ($i > d$), smooth between punctures, with median impunctate line. Face and vertex densely punctate ($i < d$). Vestiture: galea with yellow margins. Clypeus, face and genal area yellowish. Face with black, lateral fringe. Vertex black. **Mesosoma.** Integument: centre of scutum and scutellum sparsely punctate ($i > 2d$), smooth between punctures. Anterior scutum, mesepisternum, posterior scutellum, metanotum and propodeum densely punctate ($i < d$), mat and sculptured between punctures. Base of propodeal triangle with vertical carinae. Vestiture: Dorsal face of scutum and scutellum with intermixed reddish and black hair. Mesepisternum reddish. Ventral side of mesosoma whitish. **legs.** Integument: mainly black, distal tarsal segments reddish. Bt2 nearly as wide as F2. Vestiture: intermixed reddish and brown. **Wings.** Nervulus infuscated. Fore wing with first recurrent vein meeting weak Rs+M in first half part of second submarginal cell. **Metasoma.** Integument: black. Terga and sterna densely punctate ($i = d$), sculptured between punctures, with straight apical margin. Pp with median area elevated. Vestiture: Disc of T1 with long, reddish hair. Disc of T2-T5 with short, black hair. T2-T4 with yellowish, apical, hair bands as long as marginal zone. Prepygidial fimbria black, with a few whitish hairs laterally. Disc of S1-S2 nearly hairless. Disc of S3-S4 with long, yellow hair. Disc of S5-S6 with dark hair. S1-S4 with long, yellow, hairs apically. S5-S6 dark apically.

Distribution (fig. 183). Endemic to Mediterranean Region, eastern coast of Spain, from Malaga to Barcelona.

Phenology. April to June.

Host plants. Unknown.



Figures 140–144

Melitta rasmonti, male. **140**, ventral view of sternum 6 (scale = 400 μ m). **141**, ventral view of sternum 7 (scale = 300 μ m). **142**, ventral view of sternum 8 (scale = 150 μ m). **143**, dorsal view of genitalia (scale = 200 μ m). **144**, lateral view of genitalia.

28. *Melitta nigrabdominalis* Wu [Fig. 185]

Melitta nigrabdominalis Wu 1988: 68-69, ♂. Type material. Holotype ♂, China, Xiaowutai Shan [39.85°N 114.98°E], 21.III.1964, leg. H. Ing-heng, IZAS, NS. Locus typicus: "Hebei, Mt. Xiaowutai".

Additional material examined. None.

Diagnosis. ♀. Unknown.

♂. L=14.0mm. A3 longer than A4. Scutum with black hair centrally and long, yellow, hair marginally. T2-T4 without apical hair bands. Disc of terga with short, black hair. S7 with apicolateral process blade shaped. Gonostylus with inner lobe.

Distribution (fig. 185). Only known from locus typicus (China Province of Hebei).

Phenology. March.

Host plants. Unknown.

29. *Melitta rasmonti* Michez n. sp. [Figs 140–144, 170, 176, 182]

Type Material (8 specimens). Holotype ♂, 2♀ 5♂ paratypes, Turkey, Pass Hakkari, Altin Daglari [37.78°N 43.85°E], 2600–3000 m, 13.VIII.1979, leg. Warncke, OOLL (coll. Warncke).

Additional material examined (4 specimens). 3♂, Turkey, W of Hakkari, Tanin-Tanin Pass [37.48°N 43.00°E], 2300–2600 m, 14.VIII.1979, leg. Warncke, OOLL (coll. Warncke); 1♀, Turkey, Erzurum, Palandöken [39.78°N 41.25°E], 15.VIII.1978, leg. Özbek, OOLL (coll. Warncke).

Etymology. Named after P. Rasmont, who studied the Turkish Apoidea.

Related species. *M. wankowiczi* and *M. haemorrhoidalis*.

Diagnosis. ♀ ♂. Galea sparsely punctate ($i > 2d$); outer surface smooth. Malar area shorter than A2. Posterior half of scutum smooth between punctures. Central area of metanotum punctate. Central area of propodeal triangle horizontally costulate. Fore wing with first recurrent vein meeting weak Rs+M in middle of second submarginal cell. Metasoma black (figs 170, 176).

♀. L = 11.4 mm. Clypeus twice as wide as long. Metanotum swollen apically. Tb2 with carina on inner margin. Inner side of F3 with dense, yellow apicoventral fringe one-third as long as F3. T2-T4 with white, apical, hair bands as long as marginal zone. Prepygidial fimbria orange.

♂. L=10.6mm. Entire clypeus densely punctate. Face with erect, whitish hair, and narrow, black lateral fringe. A4-A12 strongly enlarged apically, median area weakly convex ventrally. A3 longer than A4. T2-T4 with whitish, apical, hair bands twice as long as marginal zone. Legs with whitish hair. F1 twice as long as wide. Inner fringe of F3 shorter than width of F3. Apex of T6 with yellowish hair. S6 with emarginate apical margin (fig. 140). Apicolateral process of S7 bowl shaped (fig. 141). S8 nearly hairless, with apical area circular (fig. 142). Gonostylus pointed apically (fig. 143). Digitus rounded apically.

Description. ♀. **Body length.** 11.0mm. **Head.** Integument: mainly black, flagellum orange ventrally. Labial palpus half as long as maxillary palpus (ratio<0.5). Galea punctulate, sparsely punctate ($i > 2d$); outer surface smooth. Malar area shorter than A2. Labrum with 2 tubercles. Clypeus twice as wide as long, densely punctate ($i = d$), smooth between punctures, with median

impunctate line. A3 as long as A4+A5. Face, vertex and genal area densely punctate ($i = d$). Vestiture: clypeus, face and genal area whitish. Vertex brown. **Mesosoma.** Integument: black. Posterior half of scutum and anterior half of scutellum sparsely punctate ($i > d$), smooth between punctures. Anterior scutum, posterior scutellum, metanotum, propodeum and mesepisternum densely punctate ($i < d$), sculptured between punctures. Metanotum swollen apically. Central area of propodeal triangle horizontally costulate. Vestiture: scutum brown centrally, reddish marginally. Mesepisternum and mesosomal ventre whitish. **Legs.** Integument: mainly black, distitarsi 1-3 orange. Tb2 with carina on inner margin. Inner side of F3 with dense yellow apicoventral fringe one-third as long as F3. Vestiture: Inner side of legs yellow. Outer side of legs whitish. **Wings.** Hyaline. Nervulus antefuscated. Fore wing with first recurrent vein meeting weak Rs+M in middle of second submarginal cell. **Metasoma.** Integument: black, mat and sculptured. Vestiture: disc of T1-T2 with long, erect, whitish hairs. T1-T4 with white, apical, hair bands twice as long as marginal zone. Disc of T3-T4 with short, black hairs. Prepygidial fimbria orange. Disc of S1-S4 with long, sparse, white hairs. S1-S4 hairless apically. S5-S6 with long, orange hairs.

♂. **Body length.** 10.6 mm. **Head.** Integument: black. Labial palpus half as long as maxillary palpus (ratio<0.5). Galea sparsely punctate ($i > 2d$); outer surface smooth. Malar area shorter than A2. Labrum smooth and shiny. Clypeus, face and vertex densely punctate ($i < d$). A4-A12 strong enlarged apically; median area weakly convex ventrally. A3 longer than A4. Vestiture: whitish. Face with narrow, black, lateral fringe. Area around ocelli brown. **Mesosoma.** Integument: black. Posterior half of scutum and anterior half of scutellum sparsely punctate ($i > d$), smooth between punctures. Anterior region of scutum, posterior region of scutellum, metanotum, propodeum and mesepisternum densely punctate ($i < d$), sculptured between punctures. Central area of propodeal triangle horizontally costulate. Vestiture: reddish dorsally, yellowish ventrally. Centre of scutum with few black hairs. **Legs.** Integument: mainly black, except distitarsi 1-3 orange. Any structure swollen or toothed. Br3 1.5X as wide as mediotarsus 3. Vestiture: whitish. Inner side of Bt1-Bt3 yellow. **Wings.** As female. **Metasoma.** Integument: black, mat and sculptured. Terga and S1-S4 with straight, apical margins. Apical margin of S5 slightly emarginate. S6 with truncate apical projection (fig. 140). Apicolateral process of S7 bowl shaped (fig. 141). S8 with apical area circle shaped. Gonostylus pointed apically (fig. 143) and straight ventrally (fig. 144). Digitus rounded apically. Vestiture: Disc of T1-T3 with erect, reddish hairs. T1-T4 with whitish, apical, hair bands as long as marginal zone. Disc of T4-T6 black. S8 nearly hairless (fig. 142). Outer side of gonostylus covered with appressed, yellow hairs.

Distribution (fig. 182). Endemic in Eastern Turkey.

Phenology. August.

Host plants and phenology. Unknown.

30. *Melitta schultzei* Friese [Fig. 192]

Melitta schultzei Friese 1909: 183, ♂. Type material (designated here).

Lectotype ♂, 2♂ paralectotypes, South Africa, Steinkopf [29.27°S 17.73°E], leg. Schultze, MZS, S. Locus typicus: "Steinkopf, Klein-Namaland". Lectotype ♂ (MZS); labels: 1st black ink printed on blue paper "Kl. Namaland Steinkopf L. Schultze S."; 2^d hand-written with black ink on white paper "*Melitta schultzei* 1908 Friese det."; 3rd printed with black ink on red paper "Typus"; 4th printed with black

ink on red paper "*Melitta schultzei* Friese 1909 Lectotype design Michez 2006". Paralectotypes ♂ (MZS); labels: 1st black ink printed on blue paper "*Kl. Namaland Steinkopf L. Schultze S.*"; 2^d hand-written with black ink on white paper "*Melitta schultzei* 1908 Friese det."; 3rd printed with black ink on red paper "*Typus*"; 4th printed with black ink on red paper "*Melitta schultzei* Friese 1909 Paralectotype design Michez 2006". ♂ (NMW); labels: 1st black ink printed on blue paper "*Kl. Namaland Steinkopf L. Schultze S.*"; 2^d hand-written with black ink on white paper "*Melitta schultzei* 1908 Friese det."; 3rd printed with black ink on red paper "*Typus*"; 4th printed with black ink on red paper "*Melitta schultzei* Friese 1909 Paralectotype design Michez 2006".

Melitta flavipes Friese 1925: 506, ♂. Synonymised by Eardley & Kuhlmann (2006: 304). Type material. Holotype ♂, South Africa, Capland [?], ZMHB, S. Locus typicus: "*Kapland*".

Melitta schultzei, Eardley & Kuhlmann (2006: 304-305), description of the female, illustration of male S6-S8 and genitalia.

Additional material examined. None.

Related species. *M. albida* and *M. danae*.

Diagnosis. ♀ ♂. Labial palpus twice as long as glossa. Maxillary palpus as long as galea. Galea very narrow, outer surface sculptured, pointed apically. Malar area shorter than A2. Scutum sparsely punctate ($i > d$), smooth between punctures. Propodeal triangle shiny. Metasoma black.

♀. L = 10.8 mm. Scopa yellowish anteriorly and orange posteriorly. Disc of T2-T4 with black hair. T2-T4 with narrow apical hair bands.

♂. L = 8.8 mm. A3 as long as A4. A5-A12 slightly convex ventrally. Face covered with dense, white hair, and narrow, black, lateral fringe. Anterior scutellum sparsely punctate ($i > d$). Legs with yellow to yellowish hairs. Disc of T4-T6 with black hair. S6 with long apicomedian hair. S7 with long apicolateral process blade shaped. S8 nearly hairless. Gonostylus shorter than penis valve. Digitus rounded apically.

Distribution (fig. 192). Endemic to south-western Africa (Western and Northern Cape Provinces).

Phenology. August to September.

Host plants (2 specimens). Iridaceae, *Watsonia* sp. (1♀); Oxalidaceae, *Oxalis* sp. (1♂).

31. *Melitta seitzii* Alfken

[Fig. 180]

Melitta seitzii Alfken 1927: 57-59, ♂ ♀. Type material. 6♀ 2♂ syntypes, Spain, Ordesa [42.65°N 3.33°W], leg. A. Seitz, FNSF and ZMHU, NS; 1♀ 1♂ syntypes, idem, 23.VI, OOLL, S. Locus typicus: "*Pyrenäen, Valle de Ordesa*".

Melitta seitzii cinerea Warncke 1973: 109, ♀ ♂. Type material. Holotype ♂, Spain, Ribas [40.38°N 3.51°W], OOLL, S; 1♀ paratype, Spain, Palencia [42.02°N 4.53°W], OOLL, S; 1♂ paratype, Spain, Cigales [41.77°N 4.7°W], 23.VI, OOLL, S. Locus typicus: "*Madrid, Ribas*".

Melitta seitzii, Ortnosa & Ortiz-Sanchez (2003b: 570); illustration of S6-S8 and genitalia ♂.

Additional material examined (8 specimens). **Spain:** 1♂, Pina de Ebro [41.48°N 0.52°W], 15.V.1992, OOLL; 1♂, Llardecans [41.37°N 0.55°E], 23.V.1983, rec. Teunissen, RNHL; 1♂, Titulcia [40.13°N 3.57°W], 02.VI.1985, leg. Teunissen, RNHL; 1♀, Palencia [42.02°N 4.54°W], OOLL; 1♀ 1♂, Cigales [41.77°N 4.7°W], 23.VI, OOLL.

Related species. *M. murciana* and *M. iberica*.

Diagnosis. ♀ ♂. Glossa shorter than maxillary palpus. Outer surface of galea shiny. Malar area shorter than A2. Scutum

densely punctate ($i < d$). Scutellum densely punctate ($i = d$), smooth between punctures. Metasoma black.

♀. L = 12.9 mm. Clypeus smooth between punctures. Propodeal triangle rugose. Legs 1-3 with yellow hair. T2-T4 with continuous dense, yellow to whitish, apical hair bands, lateral hairs longer than median hairs. Prepygidial fimbria mostly black, white laterally. Pp with median elevated area.

♂. L = 11.1 mm. A3 shorter than A4. A4-A12 cylindrical. Face with white to reddish hair, black lateral fringe. Bt3 twice as wide as mediotarsus 3. Terga without apical hair bands. Disc of T4-T6 with white hair laterally. S4-S5 with emarginated, distal margins. S6 with apical hairs brown, longer laterally, distal edge concave. Apicolateral process of S7 rounded. Column of S8 with long, bushy, hair laterally. Apical plate of S8 oval. Gonostylus and digitus rounded apically.

Variation. *M. seitzii cinerea* diagnosis: face and vertex with white hair, disc of T1 with erect, whitish hair. Occuring Spanish Pyrenees. *M. seitzii seitzii* diagnosis: face with whitish hairs, vertex with brown hair, disc of T1 with erect, reddish hair. Occuring Northern Spain.

Distribution (fig. 180). Endemic to North of Spain.

Phenology. May to June.

Host plants. Unknown.

32. *Melitta sibirica* (Morawitz)

[Figs 145–150, 177, 187]

Cilissa sibirica Morawitz 1888: 237, ♀. Type material (designated here).

Lectotype ♀, Russia, Osnatjennaya [?], ZISP, S. Locus typicus: "*Sibiria, Minussinsk*". Lectotype ♀ (ZISP); labels: 1st black ink printed on white paper "*Osnatjenn.*"; 2^d black ink printed on white paper "*Hammarstr.*"; 3rd black ink printed on white paper "*1068*"; 4th black ink printed on white paper "*Моравиц Ф.*"; 5th handwritten on white paper "*Cilissa sibirica Mor.*"; 6th handwritten on red paper "*Melitta sibirica Mor. design Michez 2005*".

Melitta albofasciata Friese 1900: 85, ♂. **Syn. Nov.** Type material (designated here). Lectotype ♂, Kyrgyzstan, Alai Mountains [39.75°N 72.00°E], NMW, S; 1♂ paralectotype, Mongolia [?], NMW, S; 1♂ paralectotype, Turkmenistan [?], MZS, S. Locus typicus: "*Turkestan (kleiner Alai) und Mongolei*". Lectotype ♂ (NMW); labels: 1st black ink printed on white paper "*Turkestan 1895 kl. Alai*"; 2^d handwritten on white paper "*Melitta albofasciata typ. 1900 Friese det.*"; 3rd black ink printed on red paper "*Melitta albofasciata Lectotype design by Michez 2005*". Paralectotypes ♂ (NMW); labels: 1st black ink printed on white paper "*N. Mongolei Leder 92*"; 2^d handwritten on white paper "*Melitta albofasciata 1896 Friese det.*"; 3rd black ink printed on red paper "*Melitta albofasciata Friese 1900 Paralectotype design by Michez 2005*". ♂ (MZS); labels: 1st black ink printed on white paper "*Turkestan 189*"; 2^d handwritten on white paper "*Melitta albofasciata 1900 Friese det.*"; 3rd black ink printed on red paper "*Melitta albofasciata Friese 1900 Paralectotype design by Michez 2005*".

Cilissa alticola Hedicke 1938: 194, ♀. **Syn. Nov.** Type material. Holotype ♀, Afghanistan, Hindukusch [35.00°N 71.00°E], not located. Locus typicus: "*Nuksan-Pass NO-Hindukusch Alpenwiesenzone*".

Melitta borealis Wu 2000: 400-401, ♂. **Syn. Nov.** Type material. Holotype ♂, China, Xilin Gol Meng [43.97°N 116.03°E], 21.VII.1987, IZAS, NS; 1♂ paratype, China, Ulan Qab Sum [42.71°N 114.57°E], 06.VII.1987, leg. Z. Xue-zhong, IZAS, NS; 1♂ paratype, China, Zhaosu [43.17°N 81.12°E], 2400m, 03.VIII.1978, leg. Z. Xue-zhong, IZAS, NS; 1♂ paratype, China, Mt. Tomur [?], 2200m, 04.VIII.1977, leg. H. Yin-heng, IZAS, NS. Locus typicus: "*Inner Mongolia, XilinGol*".

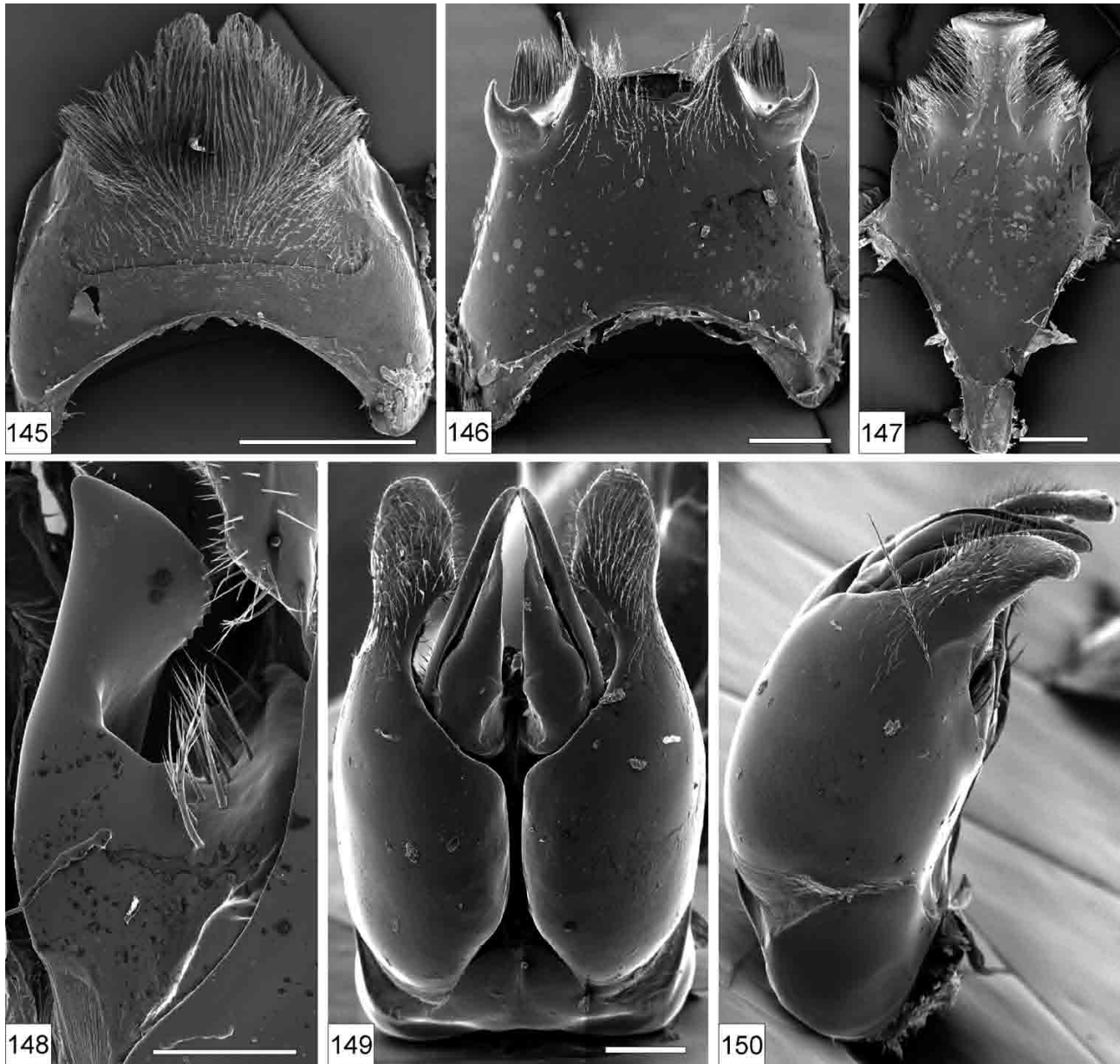
Melitta quinghaiensis Wu 2000: 401, ♂. **Syn. Nov.** Type material. Holotype ♂, China, Xining [36.62°N 101.77°E], 21.VII.1950, IZAS, NS. Locus typicus: "Qinghai, Xining".

Additional material examined (98 specimens). **India:** 2♀ 3♂, Gulmarg [34.05°N 74.38°E], 1913, leg. Thomson, NHM. **Kyrgyzstan:** 1♂, Naryn [42.22°N 75.01°E], 24.VII.2000, leg. Engel, AMNH; 3♂, Osh, 39.87°N 73.36°E, 07.VII.2000, leg. Engel, AMNH; 27♂, Osh, 39.94°N 73.47°E, 07.VII.2000, leg. Engel, AMNH. **Mongolia:** 11♀ 26♂, Arhangay Aymag [46.63°N 101.75°W], 23.VII.2004, leg. Halada, OOLL; 2♂, Bayan Khongor [46.30°N 100.50°E], 11.VII.2004, leg. Halada,

OOLL; 1♂, idem, 12.VII.2004, leg. Halada, OOLL; 7♀ 10♂, Arvayheer [47.33°N 103.67°E], 24.VII.2004, leg. Halada, OOLL. **Russia:** 1♀, Minusinsk [53.71°N 91.70°E], ZISP; 2♀, Novospasskoye [53.15°N 47.76°E], 17.VII.205, leg. Nilsson, UU. **Tadzhikistan:** 2♀ 4♂, Yagnob [39.25°N 68.58°E], ZISP.

Related species. *M. ezoana*, *M. cameroni* and *M. harrietae*.

Diagnosis. ♀ ♂. Glossa shorter than maxillary palpus. Labial palpus as long as glossa. Outer surface of galea mat and sculptured. Malar area as long as A2, sometimes shorter than A2. Scutum densely punctate ($i = d$), smooth between punctures.



Figures 145–150
Melitta sibirica, male. **145**, ventral view of sternum 6 (scale = 1 mm). **146**, ventral view of sternum 7 (scale = 300 µm). **147**, ventral view of sternum 8 (scale = 300 µm). **148**, volsella (scale = 100 µm). **149**, dorsal view of genitalia (scale = 200 µm). **150**, lateral view of genitalia.

Base of propodeal triangle with vertical carinae. Metasoma black.
 ♀. L = 13.2 mm. Clypeus with median impunctate line. Dorsal surface of mesosoma with reddish hair. Central area of metanotum smooth, with a few deep punctures. Disc of T2-T4 with appressed, black hair. T2-T4 with narrow, white apical hair bands. Prepygidial fimbria black, sometimes with lateral white hair.

♂. L = 12.0 mm. Entire clypeus densely punctate. A5-A12 slightly convex ventrally. Face with whitish hair, narrow black lateral fringe. Mesosoma with reddish hair dorsally, white hair ventrally. Bt3 twice as long as mediotarsus 3. Disc of T4-T5 with dark hair. T2-T4 with continuous, apical, hair bands longer than marginal area. S4-S5 with straight apical margin. Disc of S6 with central depression (fig. 145). S7 with apicolateral process blade shaped (fig. 146). Column of S8 with short, brown lateral hairs (fig. 147). Apical area of S8 oval. Gonostylus truncate apically (fig. 149) and curved ventrally (fig. 150). Digitus pointed apically (fig. 148).

Variation. Two subspecies were described: *Melitta sibirica sibirica* Morawitz 1888 and *Melitta sibirica quinghaiensis* Wu 2000 **stat. nov.**

M. sibirica quinghaiensis diagnosis: head, hind leg, ventral face of metasoma and ventral face of metasoma with whitish hair.

M. sibirica sibirica diagnosis: head, legs, ventral face of mesosoma,

ventral surface of metasoma and prepygidial fimbria with dark hair.

Some specimens of *M. sibirica* are intermediate between both subspecific forms. We could therefore consider *M. sibirica quinghaiensis* as synonym of *M. sibirica sibirica*. However, we keep the taxon described by Wu (2000) to highlight the extreme morphological variation of *M. sibirica* waiting comprehensive study of infraspecific variation.

Distribution (fig. 187). *M. sibirica* occurs extended East-Palaeartic distribution, with most populations in Mongolia and Central Asia. There is one record (western Russia, Novospasskoye, 53.15°N 47.76°E) in the west Palaeartic.

Phenology. July to August.

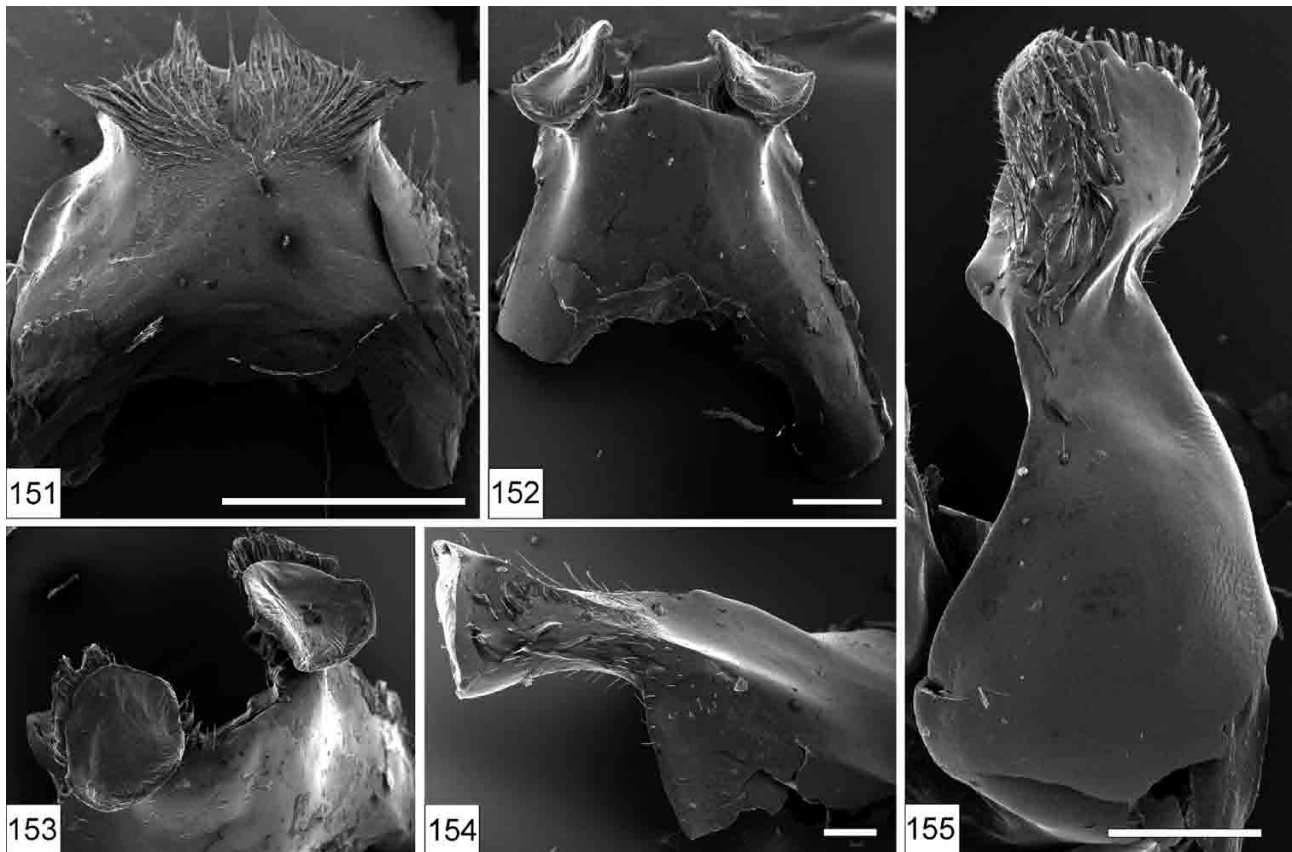
Host plants. Unknown.

33. *Melitta tomentosa* Friese

[Figs 151–155, 181]

Melitta tomentosa Friese 1900: 85–86, ♀ ♂. Type material. Holotype ♂, Croatia, Fiume [45.34°N 14.41°E], ZMHB, NS. Locus typicus: “Fiume”.

Additional material examined (5 specimens). **Croatia:** 2♂, Kacjak [45.2°N 14.65°E], 19.IX.1974, leg. Heinrich,



Figures 151–155

Melitta tomentosa, male. **151**, ventral view of sternum 6 (scale = 1 mm). **152**, ventral view of sternum 7 (scale = 300 µm). **153**, apicolateral view of sternum 7. **154**, lateral view of sternum 8 (scale = 100 µm). **155**, ventral view of gonostylus (scale = 300 µm).

OOLL; 1♂, Krk [45.03°N 14.57°E], 16.VIII-06.IX.1976, leg. Heinrich, OOLL. **Italy:** 1♂, Villa Opicina [45.69°N 13.79°E], 09.IX.1855, on *Campanula* sp., leg. Graeffe, NMW; 1♀, idem, 30.VIII.1900, OOLL.

Related species. *M. haemorrhoidalis*.

Diagnosis. ♀ ♂. Outer surface of galea smooth. Malar area shorter than A2. Metasoma black. Global vestiture reddish-yellow. Scutum mat and sculptured. Scutellum smooth between punctures, at least mediobasally.

♀. L = 13.0 mm. Clypeus with dense, shallow punctures ($i < d$), with median impunctate line. Metanotum swollen apically. Mesonotum with reddish-yellow hair dorsally, yellowish ventrally. Legs with yellow hair. Disc of terga with erect, yellow hair. Terga with apical hair bands longer than marginal zone. Prepygidial fimbria yellow. Pp with median elevated area.

♂. L = 12.0 mm. Clypeus densely punctate ($i < d$), except apical area smooth. Face with yellowish hair and narrow black lateral fringe. A4-A12 slightly convex ventrally, strongly enlarged apically. Entire antenna blackish-brown. Scutum mat between punctures. Scutellum with smooth, narrow basal margin. Bt3 as wide as mediotarsus 3. Disc of terga with erect, yellowish hair. Terga without apical hair bands. S4-S5 with straight, apical margin. S6 with brown, bushy hair apicolaterally, otherwise nearly hairless medially (fig. 151). S7 with apicolateral structures nearly as wide as disc (figs 152–153). S8 apical plate oval. Apex of gonostylus truncated (fig. 155). Penis valve pointed apically.

Distribution (fig. 181). Endemic to Istria and Quarner (Croatia and Italy).

Phenology. End August through September.

Host plants (1 specimen). Campanulaceae, *Campanula* sp. (1♂).

34. *Melitta udmurtiaca* Sitdikov

[Fig. 181]

Melitta udmurtiaca Sitdikov 1986: 108–110, ♀ ♂. Type material.

Holotype ♂, 1♀ 1♂ paratypes, Russia, Udmurtia [57.00°N 53.00°E], 24.VII.1985, leg. Sitdikov, ZISP, S. Locus typicus: “*Udmurtiaka, Kilmez*”.

Melitta udmurtiaca, Celary (2000: 303–305): redescription of both sexes, illustration of genitalia male and S6–S8 male.

Additional material examined. None.

Related species. *M. hispanica* and *M. kastiliensis*.

Diagnosis. ♀ ♂. Outer surface of galea sculptured and shiny. Malar area shorter than A2. Scutum smooth between punctures. Propodeal triangle with granular sculpture. Metasoma black.

♀. L = 13.5 mm. Mesonotum and mesoscutum with sparse punctures ($i > d$), smooth between punctures. Legs with yellow to brown hairs. Lateral parts of terga and sterna covered with long, pale hair. T2–T4 with narrow, white, apical hair bands. Prepygidial fimbria mostly black, with a few yellowish hairs laterally. Pp with weak elevated median area.

♂. L = 12.3 mm. Face without narrow, black, lateral fringe. A4–A13 cylindrical. A3 as long as A4. Bt3 twice as wide as mediotarsus 3. T1–T4 with white, apical hair bands. S6 with bushy, dark hair laterally. S7 with apicolateral process blade shaped. S8 nearly hairless. Apical plate on S8 flat, 3X as wide as long. Gonostylus straight ventrally, pointed apically.

Distribution (fig. 181). Eastern Europe.

Phenology. July and August.

Host plants. Fabaceae, *Lotus corniculatus* (?), *Medicago falcata* (?), *M. media* (?), *Vicia cracca* (?), *V. sepium* (?), *V. villosa* (?); Hydrophyllaceae, *Phacelia tanacetifolia* (?) (Sitdikov 1986)

35. *Melitta wankowiczi* (Radoszkowski)

[Figs 156–162, 178, 186]

Cilissa wankowiczi Radoszkowski 1891: 237–238, ♀ ♂. Type material.

Not located. Locus typicus: “*Gouvernement de Minsk*”.

Additional material examined (62 specimens). **Austria:** 1♂, Neustift [47.72°N 16.33°E], 27.VI.1999, leg. Mazzucco, CS. **Germany:** 1♀, Niemeck Mark [51.62°N 12.37°E], 01.VIII.1958, OOLL; 1♀, idem, 18.VII.1955, OOLL. **Mongolia:** 2♀, Arhangay [47.63°N 101.75°E], 23.VII.2004, leg. Halada, OOLL; 6♀ 3♂, Ulaanbaatar [47.92°N 106.92°E], 27.VII.2004, leg. Halada, OOLL. **Romania:** 1♀, Sibiu [47.80°N 24.15°E], 01.VI.1943, OOLL. **Russia:** 24♀ 9♂, Borisovka [50.60°N 36.02°E], various dates (11–30.VII.1959), on *Campanula* sp., ZISP; 6♀ 5♂, idem, various dates (10.VII–14.VIII.1958), on *Campanula* sp., ZISP; 1♂, Sarepta [48.53°N 44.48°E], OOLL. **Sweden:** 1♀, Mallgards [57.30°N 18.28°E], 13.VII.2001, on *Campanula* sp., leg. Noren, CS. **Turkey:** 1♀, Sarikamis [40.33°N 42.58°E], 06.VIII.1979, OOLL.

Related species. *M. haemorrhoidalis*.

Diagnosis. ♀ ♂. Labial palpus as long as glossa. Outer surface of galea smooth. Maxillary palpus as long as galea. Malar area shorter than A2. Scutum, scutellum and metanotum sculptured and mat between punctures.

♀. L = 11.4 mm. Clypeus densely punctate ($i < d$), sculptured between punctures, with impunctate median line. Face with yellowish hair. Ventral margin of F2 right angled. Bt2 with yellowish or brownish hair. Leg 3 with yellowish hair, except Bt3 black apically. Disc of terga nearly hairless. T2–T4 with white, apical, hair bands shorter than marginal zone. Prepygidial fimbria black with a few white hairs laterally.

♂. L = 11.4 mm. Clypeus densely punctate, except smooth apically. Face without black lateral fringe (sometimes with a few black hairs). F1 1.5X as long as wide. F2 twice as long as wide. T2–T4 with apical hair bands. Disc of T1–T2 with whitish-grey hair. Apex of T6 with brown hair. Apical margin of S5 slightly emarginate. S6 with brown, bushy hairs apicomediaally (fig. 156). S7 with apicolateral structure bowl shaped (figs 157, 160). S8 nearly hairless (figs 158–159). Apical area of S8 circular. Gonostylus pointed apically (fig. 161) and straight ventrally (fig. 162). Base of inner margin of penis valve as wide as penis valve (fig. 161). Digitus rounded apically.

Distribution (fig. 186). Widespread in Palearctic from Austria to Mongolia, in isolated populations.

Phenology. Beginning June to end August.

Host plants (49 specimens). Campanulaceae, *Campanula* sp. (35♀ 14♂).

36. *Melitta whiteheadi* Eardley

[Fig. 192]

Melitta whiteheadi Eardley 2006: 299–300, ♀. Type material. Holotype

♀, 3♀ paratypes, South Africa, Betty's Bay [34.22°S 18.56°E], 04.XI.1998, leg. V.B. Whitehead, on *Watsonia* sp., SAMC, NS; 1♀, idem, NCSA, S.

Additional material examined. None.

Diagnosis. ♀. L=14.2mm. Body length very long. Outer surface of galea mat and sculptured. Malar area longer than A2. Scutum smooth between punctures. Propodeal triangle mat, with fine granular sculpture. Leg 3 black. Disc of terga with short black hair. Metasoma black.

♂. Unknown.

Distribution (fig. 192). Only known from locus typicus (South Africa).

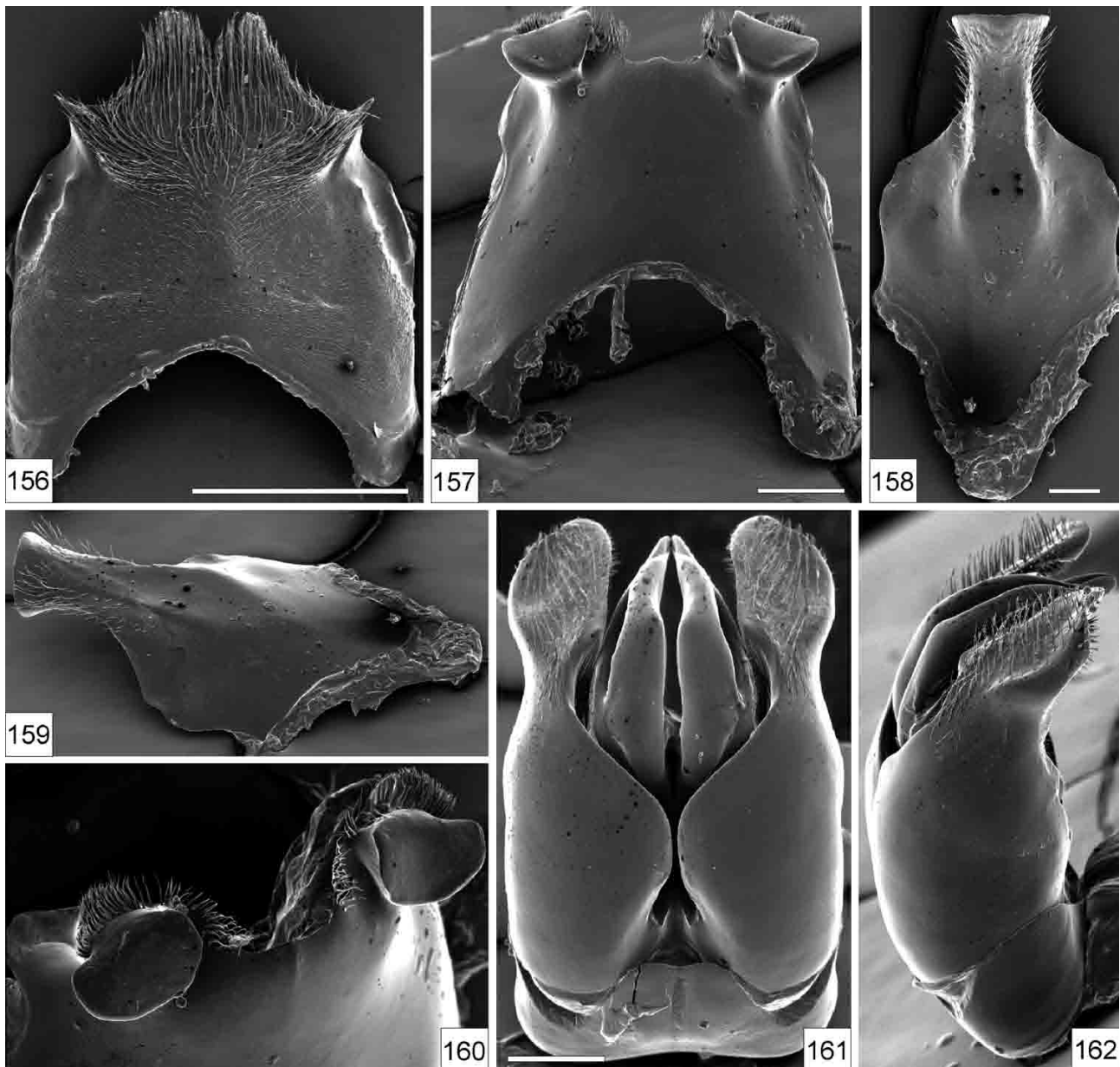
Phenology. November.

Host plants (4 specimens). Iridaceae, *Watsonia* sp. (4♀).

Key to species of *Melitta*

Females

1. Maxillary palpus five-segmented. Mandible slightly longer than eye, flattened apically, blade pointed, without pre-apical tooth, with two small teeth on inner margin. Labrum smooth, without lateral tubercles *Melitta melittoides* (Viereck)



Figures 156–162

Melitta wankowiczi, male. **156**, ventral view of sternum 6 (scale = 1 mm). **157**, ventral view of sternum 7 (scale = 300 μ m). **158**, ventral view of sternum 8 (scale = 200 μ m). **159**, lateral view of sternum 8. **160**, apicolateral view of sternum 7. **161**, dorsal view of genitalia (scale = 400 μ m). **162**, lateral view of genitalia.

- Maxillary palpus six-segmented (fig. 13). Mandible shorter than eye, rounded apically, with pre-apical tooth. Labrum sculptured, with lateral tubercles (fig. 49) 2
- 2. Metanotum apically swollen (fig. 117). Labial palpus mostly half as long as maxillary palpus (ratio < 0.5), always shorter than glossa (fig. 114). Central area of propodeal triangle horizontally costulate. Tb2 with carina on inner margin (fig. 118). Fore wing mostly with first recurrent vein meeting weak Rs+M in middle of second submarginal cell. Galea punctulate, sparsely punctate ($i > 2d$); outer surface smooth (fig. 115). Occurring in the Palaearctic 3
- Metanotum not swollen (fig. 31). Labial palpus longer than half maxillary palpus (ratio > 0.5), mostly as long as glossa. Propodeal triangle not horizontally costulate. Tb2 without carina on inner margin. Fore wing mostly with first recurrent vein meeting weak Rs+M on first half of second submarginal cell. Galea either like in *M. haemorrhoidalis*-subgroup [punctulate, sparsely punctate ($i > 2d$); outer surface smooth] or galea densely punctate and with outer surface finely sculptured and mat (fig. 23). Occurring in Ethiopian, Palaearctic and Nearctic regions 7
- 3. Disc of terga with erect, yellow hairs. Prepygidial fimbria yellow *M. tomentosa* Friese
- Disc of terga nearly hairless Prepygidial fimbria black or reddish 4
- 4. Anterior half of scutellum smooth between punctures. Terga with white or whitish apical hair bands twice as long as marginal zone 5
- Scutellum mat and sculptured between punctures. Terga with either yellow, apical hair bands longer than marginal zone, or white, apical hair bands shorter than marginal zone 6
- 5. Prepygidial fimbria black. Central area of metanotum impunctate. Inner side of F3 with dense, yellow, anteroventral fringe almost half as long as F3 *M. budensis* (Mocsary)
- Prepygidial fimbria reddish. Central area of metanotum punctate. Inner side of F3 with dense, yellow, anteroventral fringe one-third as long as F3 *M. rasmonti* n. sp.
- 6. Prepygidial fimbria black. Ventral margin of F2 right angled. Bt2 with yellowish to brownish hair. Leg 3 with yellowish hair *M. wankowiczi* (Radoszkowski)
- Prepygidial fimbria mostly reddish, rarely black (Pyrenees). Ventral margin of F2 obtuse angled. Bt2 with brownish hair. Leg 3 with golden-yellow hair *M. haemorrhoidalis* (Fabricius)
- 7. Scutum and scutellum sculptured between punctures (except in *M. aegyptiaca canariensis* and *M. aegyptiaca clusia* posterior half of scutum smooth between punctures) (fig. 33). Outer surface of galea mat and sculptured (figs 13, 23). Pp mostly flat (fig. 12). Occurring in the Palaearctic 8
- Scutum and scutellum mostly smooth between punctures (fig. 92). Outer surface of galea either mat and sculptured or smooth. Pp either mostly with narrow, lateral grooves (fig. 93) or with median area elevated. Occurring in Ethiopian, Palaearctic or Nearctic regions 15
- 8. Malar area longer than A2 9
- Malar area equal to shorter than A2 10
- 9. T2-T3 with white apical, hair bands. Clypeus smooth between punctures. Median line of clypeus deeply punctured. Anterior part of scutum smooth between punctures. Labrum with slight median groove Occurring in Canaries *M. aegyptiaca* (Radoszkowski)
- T2-T3 with yellow or yellowish apical, hair bands. Clypeus sculptured between punctures. Clypeus with impunctate median line. Scutum sculptured. Labrum with deep median groove. Occuring in North Africa *M. maura* (Pérez)
- 10. T1 partly orange or reddish (fig. 163). T2-T3 mostly orange or reddish 11
- T1-T3 entirely black (fig. 164) 12
- 11. Apex of clypeus densely punctate ($i = d$), sculptured between punctures, with impunctate median line. T2-T4 with yellow or yellowish, apical hair bands. T2-T3 mostly black. Entire scutum sculptured *M. schmiedeknechti* Friese
- Apex of clypeus sparsely punctate ($i > 2d$), smooth between punctures, without impunctate median line. T2-T4 with white, apical hair bands. T2-T3 mostly orange or reddish. Posterior area of scutum shiny *M. aegyptiaca* (Radoszkowski)
- 12. Half apical of Bt3 with darkish-brown hair. Terga with yellow or yellowish, apical hair bands. T4 with apical hair band longer medially. Propodeal triangle as wide as metanotum, with carinate margin *M. schmiedeknechti* Friese
- Half apical of Bt3 with pale hair. Terga with white to yellowish, apical hair bands. T4 with apical hair band of consistent length. Propodeal triangle narrower than metanotum, with or without carinate margin 13
- 13. Glossa elongated, as long as maxillary palpus. Base of propodeal triangle with slightly concave, central area (figs 31–32). Clypeus sparsely punctate ($i < d$), sculptured between punctures. Prepygidial fimbria mostly with median black hairs area smaller than lateral white hairs areas. Central scutellum with blackish-brown hair. Oligolectic on *Lythrum* sp. *M. nigricans* Alfken
- Glossa not elongated, shorter than maxillary palpus. Propodeal triangle flat (figs 9, 50). Clypeus regularly punctate, mostly smooth between punctures (sometimes sculptured anteriorly). Prepygidial fimbria mostly with median black hairs and few lateral white hairs. Central scutellum with reddish and brown hair intermixed 14
- 14. T2-T4 with yellowish, apical hair bands that are twice as long as marginal zone (figs 10, 164). Entire propodeum finely sculptured (fig. 9). Clypeus flat without median impunctate line. Pp flat. Oligolectic on Fabaceae *M. leporina* (Panzer)
- T2-T4 with whitish, apical hair bands that are as long as marginal zone (fig. 166). Propodeal triangle strongly sculptured, with carinate margin (fig. 50). Clypeus convex with median impunctate line. Pp mostly with median area weakly elevated. Oligolectic on *Odontites* sp. *M. tricincta* Kirby
- 15. Occurring in Nearctic Region 16
- Occurring Ethiopian or Palaearctic Region 18

16. Head and dorsal surface of mesosoma with whitish hair. Prepygidial fimbria white, with a few black hairs medially. Disc of terga mat *M. californica* Viereck
 - Head and dorsal surface of mesosoma with reddish hair. Prepygidial fimbria black, with a few white hairs laterally. Disc of terga shiny 17
17. T2-T4 densely punctate ($i = d$). Pp flat, sometimes median area slightly elevated. Anterior metanotum mat and punctate *M. americana* (Smith)
 - T2-T4 with sparse, scattered punctures ($i > 2d$). Pp with strong, but narrow, median carina. Anterior metanotum smooth *M. eickworti* Snelling & Stage
18. Occurring in southern Africa 19
 - Occurring in the Palaearctic 24
19. Malar area longer than A2 20
 - Malar area equal to or shorter than A2 22
20. Long body (>14 mm) *M. whiteheadi* Eardley
 - Short body (<13 mm) 21
21. T1-T3 partly orange. Propodeal triangle mat *M. arrogans* (Smith)
 - T1-T3 black. Propodeal triangle weakly shiny *M. barbarae* Eardley
22. Propodeal triangle shiny. Labial palpus twice as long as glossa. Anterior scutellum sparsely punctate ($i > d$) *M. schultzei* Friese
 - Propodeal triangle mat. Labial palpus as long as glossa. Anterior scutellum densely punctate ($i < d$) 23
23. Disc of T3 with black hair. T2-T4 with white, apical hair bands *M. albida* Cockerell
 - Disc of T3 with orange hair. T2-T4 with yellow, apical hair bands *M. danae* Eardley
24. Malar area at least as long as length of A2. Occuring in Asia 25
 - Malar area shorter than A2. Occuring in the Palaearctic 27
25. Glossa longer than head. Fore wing with first recurrent vein meeting weak $Rs+M$ in middle of second submarginal cell *M. cameroni* (Cockerell)
 - Glossa shorter than head. Fore wing with first recurrent vein meeting weak $Rs+M$ in first half of second submarginal cell 26
26. Malar area longer than length of A3. Disc of T4-T5 with long, orange hairs *M. harrietae* (Bingham)
 - Malar area shorter than length of A3. Disc of T4-T5 with short, dark hairs *M. sibirica* (Morawitz)
27. Base of propodeal triangle with vertical carinae (fig. 123). Outer surface of galea mat. Occuring in Asia 28
 - Base of propodeal triangle mostly finely sculptured, without vertical carinae (except *M. murciana*). Outer surface of galea mat or smooth. Occuring in West Palaearctic 30
28. Outer face of legs 1-2 and ventral mesosoma with blackish hairs. Posterior scutum, anterior scutellum and anterior metanotum mostly impunctate (sometimes with few, sparse punctures) *M. sibirica* (Morawitz)
 - Outer face of legs 1-2 and ventral mesosoma with reddish to yellowish hairs. Posterior scutum, anterior scutellum and anterior metanotum densely punctate ($i = d$) 29
29. Glossa longer than maxillary palpus. Clypeus sparsely punctate ($i = d$), impunctate apically. A3 longer than $A4+A5$. T2-T4 with white apical hair bands longer than marginal zone *M. japonica* Yasumatsu & Hirashima
 - Glossa shorter than maxillary palpus. Clypeus densely punctate ($i < d$). A3 shorter than $A4+A5$. T2-T4 with white apical hair bands shorter than marginal zone *M. ezoana* Yasumatsu & Hirashima
30. Propodeal triangle with one pronounced horizontal carina. Disc of T2-T3 with short, appressed, reddish hair *M. kastiliensis* Warncke
 - Propodeal triangle without distinct horizontal carina. Disc of T2-T3 nearly hairless, sometimes with short, black hair 31
31. Legs 1-3 and ventral metasoma with dark hair. Centre of scutum with black hair, margin of scutum with white hair dorsolaterally, black ventrally ... *M. bicollaris* Warncke
 - Legs 1-3 and ventral metasoma with pale hair. Scutum vestiture variable, mostly reddish intermixed with black 32
32. Central scutum and anterior scutellum sparsely punctate ($i > 2d$) 33
 - Central scutum and anterior scutellum densely punctate ($i < d$) 34
33. Outer surface of galea shiny. Terga with yellowish, apical hair bands. Vertex not expanded (ocellocular distance shorter than distance between median ocellus and preoccipital ridge). S4-S6 with brown hair. Centre of scutum with reddish hair intermixed with black hairs. Occurring in Spain *M. murciana* Warncke
 - Outer surface of galea mat. Terga with white, apical hair bands. Vertex expanded (ocellocular distance as long as distance between median ocellus and preoccipital ridge). S4-S6 with yellow or whitish hair. Centre of scutum black or brownish. Occurring in West Palaearctic *M. dimidiata* Morawitz
34. Outer surface of galea mat *M. iberica* Warncke
 - Outer surface of galea shiny 35
35. T2-T4 with white, apical hair bands. Disc of T1 nearly hairless 36
 - T2-T4 with yellow, apical hair bands. Disc of T1 with erect hairs *M. seitzii* Alfken
36. Lateral parts of terga and sterna covered with long, pale hairs *M. udmurtiaca* Sitdikov
 - Lateral parts of terga and sterna with black hairs *M. hispanica* Friese

Males

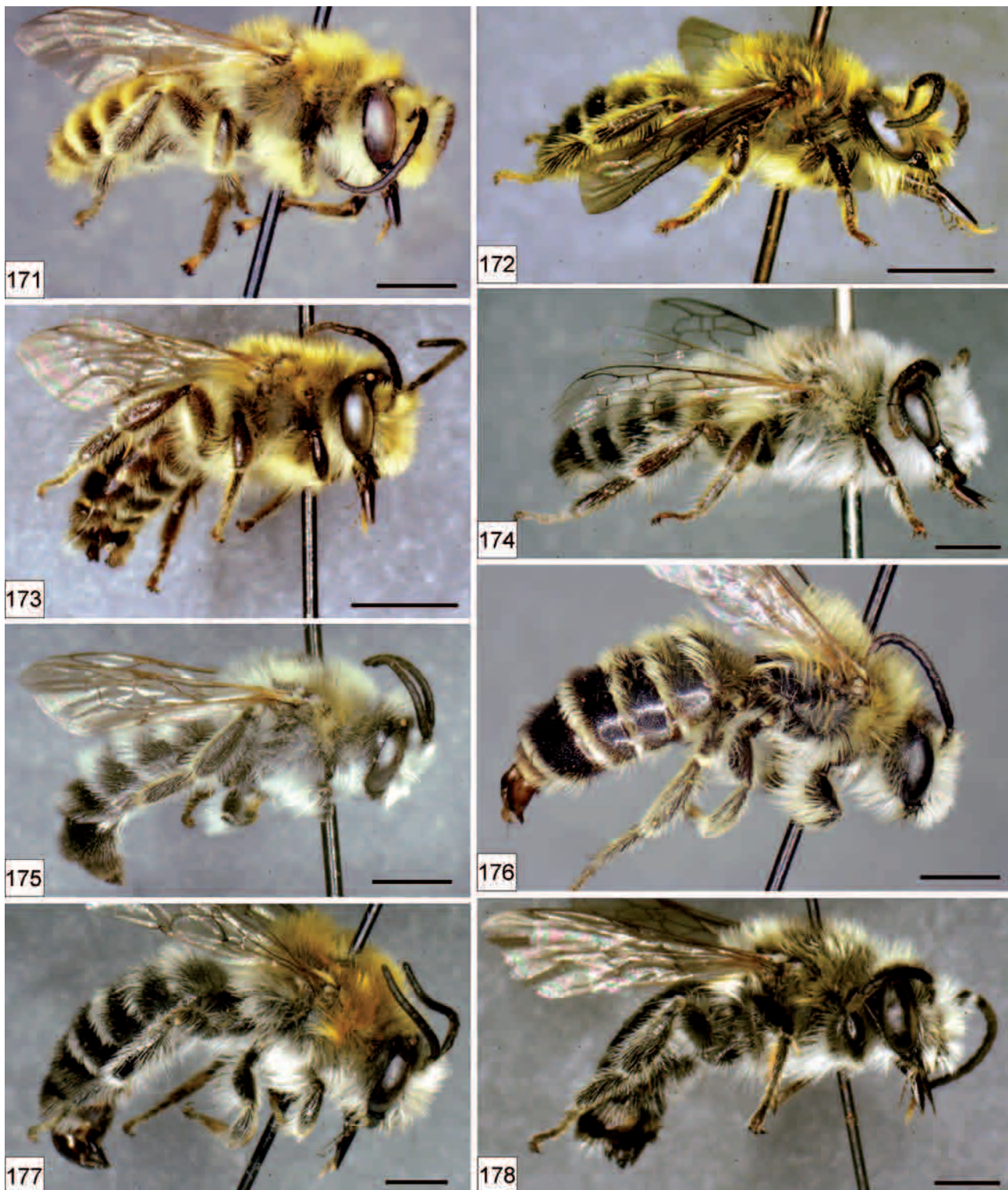
1. Maxillary palpus five-segmented. Gonostylus bifid apically *Melitta melitroides* (Viereck)
 - Maxillary palpus six-segmented (fig. 23). Gonostylus simple apically 2
2. Apicolateral process of S7 bowl shaped (figs 65, 68, 106, 108, 141, 152, 153, 157, 160). A4-A12 greatly enlarged apically (fig. 113), median area cylindrical or weakly convex ventrally. Labial palpus mostly half as long as maxillary palpus (ratio < 0.5) (fig. 114). Fore wing mostly with first recurrent vein meeting weak $Rs+M$ in middle of second submarginal cell. Outer

- surface of galea sparsely punctate ($i > 2d$), smooth between punctures (fig. 115). Central area of propodeal triangle horizontally costulate. S6 with brown hair apically. Occurring in the Palaearctic 3
- Apicolateral process of S7 blade shaped (figs 59, 61, 73, 77, 79, 84, 86, 95, 101, 120, 122, 128, 130, 135, 137, 146) or swollen (figs 4, 17, 20, 24, 26, 37, 39, 44, 46, 53, 55). A4-A12 cylindrical (fig. 91) or slightly convex ventrally (except *M. tricineta* strongly enlarged apically and slightly convex ventrally). Labial palpus longer than one-half maxillary palpus (ratio > 0.5). Fore wing mostly with first recurrent vein meeting weak Rs+M in first half part of second submarginal cell (except *M. cameroni* and *M. ezoana*). Outer surface of galea sculptured, mat or shiny. Propodeal triangle mostly with different sculpture. S6 with pallid or brown hair apically. Ethiopian, Palaearctic or Nearctic regions 7
3. Apical plate of S8 flat, twice wider than long. S7 with small spines on apicolateral process (figs 65, 68). F2-F3 with dense, bushy hair (fig. 69) *M. budensis* (Mocsary)
 - Apical plate of S8 circular. S7 without spines on apicolateral process (figs 106, 108). F2-F3 with sparse hair 4 4. Apex of gonostylus truncated (fig. 155). S7 with apicolateral process as wide as disc (figs 152–153). Istria *M. tomentosa* Friese
 - Apex of gonostylus pointed (fig. 110). Apicolateral process of S7 narrower than disc (figs 106, 108). West-Palaearctic 5 5. Scutum and scutellum smooth between punctures. Terga with dense, white apical hair bands as long as marginal zone (fig. 176) *M. rasmonti* n. sp.
 - Scutum and scutellum sculptured between punctures (fig. 117). Terga with sparse, short, apical hair bands or nearly hairless 6 6. F2 twice as long as wide. T2-T4 with short, sparse, continuous or interrupted apical hair bands. Disc of T1-T2 with greyish-white hair. Face without black lateral fringe. Inner fringe of F3 longer than width of F3 *M. wankowiczi* (Radoszkowski)
 - F2 three times as long as wide. Marginal zone of T2-T4 nearly hairless, sometimes with a few yellowish hairs. Disc of T1-T2 with brownish-yellow hair. Face with black lateral fringe. Inner fringe of F3 shorter than width of F3 *M. haemorrhoidalis* (Fabricius) 7. S7 with apicolateral process swollen (figs 4, 17, 20, 24, 26, 37, 39, 44, 46, 53, 55). External margin of gonostylus as long as external margin of gonocoxite (figs 7, 22, 29, 42, 48, 57). A12 usually slightly convex ventrally. Outer surface of galea mat and sculptured (figs 13, 23). Centre of scutum and scutellum sculptured between punctures (fig. 33) (except *M. aegyptiaca* sometimes with apicomedian region of scutum and basomedian part of scutellum smooth between punctures). Palaearctic region 8
 - S7 with apicolateral process blade shaped, sometimes with spines (figs 59, 61, 73, 77, 79, 84, 86, 95, 101, 120, 122, 128, 130, 135, 137, 146). External margin of gonostylus shorter than external margin of gonocoxite (figs 63, 75, 82, 90, 99, 104, 126, 133, 150). A4-A12 cylindrical (fig. 91) or slightly convex ventrally. Outer surface of galea either mat or shiny. Centre of scutum and scutellum mostly smooth between punctures. Occurring Ethiopian, Palaearctic or Nearctic regions ... 13 8. Terga without apical hair bands, sometimes with a few yellow apical hairs. Propodeal triangle as wide as metanotum. Malar area always shorter than A2 *M. schmiedeknechti* Friese
 - Terga with white or yellow, appressed, apical hair bands. Propodeal triangle half as wide as metanotum. Malar area shorter or longer than A2 9 9. S4-S5 with straight apical margin. Malar area shorter or longer than A2 10
 - S4-S5 with emarginate apical margin (figs 15, 34, 51). Malar area always shorter than A2 11 10. Gonostylus pointed apically (fig. 28). Column of S8 nearly hairless (fig. 27). T1-T3 with yellowish, apical hair bands. Malar area always longer than A2. Disc of T3 with black hair *M. maura* (Pérez)
 - Gonostylus truncated apically (fig. 6). Column of S8 with long lateral hairs (fig. 5). T1-T3 with white, apical hair bands. Malar area shorter or longer than A2. Disc of T3 with reddish hair *M. aegyptiaca* (Radoszkowski) 11. Terga with slightly erect, yellowish, apical hair bands, as long as marginal zone. Disc of T3 with white and dark hair, white hairs generally larger. Bt3 slightly wider than mediotarsus 3. Face only with pale hair, sometimes with few black hairs laterally. Clypeus flat. Antenna brown dorsally and reddish ventrally. Hairs on underside of F3 longer than width of F3 *M. leporina* (Panzer)
 - Terga with dense, appressed, white, apical hair bands, shorter than marginal zone. Disc of T3 only with dark hair. Bt3 twice as wide as mediotarsus 3 (fig. 35). Face with pale hair and narrow, black, lateral fringe. Clypeus convex. Entire antenna brown. Hairs on underside of F3 shorter than width of F3 12 12. Glossa shorter than maxillary palpus. Apicolateral process of S7 with very short hair (figs 53, 55). Propodeal triangle strongly sculptured, margin carinate. A4-A12 slightly convex apically and ventrally. Clypeus without impunctate, median line. Bt3 with parallel margins *M. tricineta* Kirby
 - Glossa longer than maxillary palpus. Apicolateral process of S7 with long apical hair (figs 37, 39). Propodeal triangle finely sculptured, not differentiated. A4-A12 slightly convex ventrally. Clypeus with impunctate, median band. Bt3 wider apically *M. nigricans* Alfken 13. Occurring in Nearctic region 14
 - Occurring in Ethiopian or Palaearctic regions 16 14. S3-S5 with straight premarginal line. S6 with convex apical margin. Apex of gonostylus curved ventrally. S8 with apical area sculptured and mat. Digitus pointed apically *M. californica* Viereck
 - S3-S5 with premarginal line slightly emarginate. S6 with concave apical margin. Apex of gonostylus straight ventrally. S8 with apical area smooth. Digitus rounded apically 15 15. Malar area shorter than A2. T2-T4 densely punctate ($i = d$). Propodeal triangle entirely, finely sculptured *M. americana* (Smith)

- Malar area as long as A2. T2-T4 sparsely punctate (i > 2d). Propodeal triangle with median transverse carina *M. eickworti* Snelling & Stage
- 16. Occurring in Ethiopian region 17
- Occurring in the Palaearctic 22
- 17. Terga without apical hair bands *M. guichardi* n. sp.
- Terga with apical hair bands 18
- 18. Malar area longer than A3. A4 twice as long as A3. S6 with medio-lateral teeth and apicolateral blades *M. arrogans* (Smith)
- Malar area shorter than A3. A4 mostly as long as A3, sometimes shorter than A3-. S6 without medio-lateral or apicolateral process 19
- 19. T3 vestiture entirely yellowish. Face without lateral, narrow, black fringe. S6 without apicomedian area elevated and expanded. Kenya *M. katherinae* Eardley
- T3 vestiture partly brownish-black. Face with lateral, narrow, black fringe. S6 with apicomedian area elevated and expanded. Southern African 20
- 20. Propodeal triangle shiny. Labial palpus twice as long as glossa. Anterior scutellum sparsely punctate (i > d). S6 with long, apicomedian hairs *M. schultzei* Friese
- Propodeal triangle mat. Labial palpus as long as glossa. Anterior scutellum densely punctate (i < d). S6 without long, apicomedian hairs 21
- 21. Disc of T3 with apical hair. Legs whitish. Clypeus without median impunctate median line. S7 with inner apicolateral spines *M. albida* Cockerell
- Disc of T3 with apical hair. Legs yellow. Clypeus with impunctate median line. S7 without spines (figs 77, 79) *M. danae* Eardley
- 22. Apex of gonostylus curved ventrally (figs 75, 99, 150). Digitus pointed apically (figs 97, 124, 148). Column of S8 without carina running entire length, sometimes with two carinae basally; always nearly hairless. Occuring in Asia 23
- Apex of gonostylus straight (figs 63, 90, 133). Digitus mostly rounded apically. Column of S8 mostly with carina entire length; with bushy hair or nearly hairless. Palaearctic region 27
- 23. Malar space longer or equal to length A2 24
- Malar space shorter than A2 26
- 24. Glossa longer than length of head. Fore wing with first recurrent vein meeting weakly Rs+M in the middle of second submarginal cell *M. cameroni* (Cockerell)
- Glossa shorter than length of head. Fore wing with first recurrent vein meeting weakly Rs+M in the first half part of second submarginal cell 25
- 25. Malar space longer than length of A3. T2-T4 without apical hair bands. Disc of T4-T6 with long, orange hair *M. harrietae* (Bingham)
- Malar space shorter than length of A3. T2-T4 with white apical hair bands. Disc of T4-T6 with short, black hairs *M. sibirica* (Morawitz)
- 26. Face with whitish hair and narrow, black, lateral fringe. Apical plate of S8 mostly wider than long. Anterior metanotum partly impunctate. T2-T4 with dense, apical, hair bands, longer than marginal area. Apicolateral process of S7 as in fig. 146 *M. sibirica* (Morawitz)
- Face with whitish to yellowish hair, without black lateral fringe. Apical plate of S8 mostly as wide as long. Anterior metanotum densely punctate (i = d). T2-T4 with sparse, apical, hair bands, equal to or shorter than marginal area. Apicolateral process of S7 as in fig. 95 *M. ezoana* Yasumatsu & Hirashima
- 27. T2-T4 with apical, hair bands 28
- T2-T4 without apical, hair bands 31
- 28. Distitarsus twice as long as wide. Outer surface of galea mat and sculptured. Elliptical depression on A4-A12 with ridged margin (fig. 131). Occuring in Asia *M. japonica* Yasumatsu & Hirashima
- Distitarsus three times as long as wide. Outer surface of galea smooth (sometimes finely sculptured). A4-A12 without elliptical depression. Occuring in West-Palaearctic region 29
- 29. Face with narrow, black, lateral fringe. Propodeal triangle with one pronounced, horizontal carina. Gonostylus with one apical lobe and one inner lateral lobe. A3 shorter than A4 *M. kastiliensis* Warncke
- Face without narrow, black, lateral fringe. Propodeal triangle with fine granular sculpture, or without distinct sculpture. Gonostylus different. A3 as long as A4 30
- 30. S8 flatten and oval-shaped apically. A4-A12 cylindrical. Disc of T2-T4 with long, appressed, brown hair. Inner margin of gonostylus curved *M. udmurtiaca* Sitdikov
- Apical area of S8 circular. A4-A12 slightly convex ventrally. Disc of T2-T4 with short, erect, reddish hairs. Inner margin of gonostylus straight *M. hispanica* Friese
- 31. Apicomedian area of S6 with bushy hair. A3 as long, or longer than A4. Outer surface of galea mat. Palaearctic region 32
- Apicomedian area of S6 without bushy hair. A3 shorter than A4. Outer surface of galea mat or smooth. Endemic into Spain 34
- 32. T5-T6 with reddish hair. External surface of Tb1-3 with reddish hair. Column of S8 nearly hairless *M. fulvescens* Wu
- T5-T6 with black hair. External surface of Tb1-3 with greyish hair. Column of S8 with bushy hair medially (figs 60, 85) 33
- 33. Apical plate of S8 triangular. Galea pointed apically (fig. 87). Vertex weakly expanded (ocellocular distance and distance between median ocellus and preoccipital ridge equal). Penis valve wide basally (fig. 88). Apex of S6 with long hair medially (fig. 83) *M. dimidiata* Morawitz
- Apical plate of S8 oval. Galea rounded apically. Vertex strongly expanded (ocellocular distance longer than distance between median ocellus and preoccipital ridge). Penis valve narrow (fig. 62). Apex of S6 without long hair medially (fig. 58) *M. bicollaris* Warncke
- 34. Outer surface of galea mat. Gonostylus truncated apically. Column of S8 nearly hairless *M. iberica* Warncke
- Outer surface of galea shiny. Gonostylus pointed apically (fig. 138). Column of S8 with long, hair laterally (fig. 136) 35



Figures 163–170
Habitus *Melitta* females, profile view (scales= 2 mm). 163, *M. aegyptiaca*. 164, *M. leporina*. 165, *M. schmiedeknechti*. 166, *M. tricineta*. 167, *M. dimidiata*. 168, *M. japonica*. 169, *M. arrogans*. 170, *M. vasmonti*.



Figures 171–178

Habitus *Melitta* male, profil view (scale = 2 mm). 171, *M. leporina*. 172, *M. nigricans*. 173, *M. tricineta*. 174, *M. arrogans*. 175, *M. dimidiata*. 176, *M. rasmonti*. 177, *M. sibirica*. 178, *M. wankowiczi*.

35. Bt3 twice as wide as mediotarsus 3. S4-S5 with emarginate, apical margin. Apicolateral process of S7 rounded. Apical area of S8 flat and oval ... *M. seitzi* Alfken
 - Bt3 three times as wide as mediotarsus 3. S4-S5 with straight, apical margin. Apicolateral process of S7 pointed (figs 135, 137). Apical area of S8 circular *M. murciana* Warncke

Biogeography of *Melitta*

The genus *Melitta* occurs in three zoogeographic regions: Ethiopian, Nearctic and Palaearctic (fig. 1; tab. 2). *Melitta* seem to be more diverse in the temperate and Mediterranean climatic regions of the Old World Region, like the Mediterranean Basin, the medio-European plain, the North-East of China and the southern region of Africa. In the Palaearctic and Nearctic they seem to be less diversified in the deserts, semi-deserts (i.e. Kysylkum), savannah and tropical forest, but in Africa *M. arrogans*, *M. danae*, *M. albida* and *M. katherinae* occur in deserts, semi-deserts and/ or dry savannah.

The West Palaearctic Region presents the highest species richness (tab. 2). Some distribution patterns can be distinguished. Species like *M. haemorrhoidalis*, *M. nigricans* and *M. tricincta* are distributed throughout Europe *sensu lato* (figs 179, 182, 183). *Melitta dimidiata* presents a West-Palaearctic distribution (fig. 184). Moreover, a lot of species are endemic to narrow areas around the Mediterranean Basin. There are five endemic species in the Iberian Peninsula (*M. hispanica*, *M. iberica*, *M. kastiliensis*, *M. murciana* and *M. seitzi*; figs 179, 180, 183, 186, 187), one in the Balkan Peninsula (*M. tomentosa*; fig. 181), two in Anatolia (*M. bicollaris* and *M. rasmonti*; figs 181–182) and three in North Africa (*M. aegyptiaca*, *M. schmiedeknechti* and *M. maura*; figs 179–181).

The East Palaearctic fauna shows high specific diversity (tab. 2). Three distinct distribution patterns can be recognised: Himalayan, Siberian and isolated. Five species are endemic to the Himalayan Mountains (*M. cameroni*, *M. changmuensis*, *M. harrietae*,

Table 2. Specific diversity of *Melitta*, with centres of diversity in bold.

| Taxa | West-palaearctic Region | East-palaearctic Region | Nearctic Region | Ethiopian Region |
|---------------------------------------|-------------------------|-------------------------|-----------------|------------------|
| Genus <i>Melitta</i> | 20 | 14 | 4 | 8 |
| Subgenus <i>Melitta</i> | 6 | 2 | 0 | 0 |
| Subgenus <i>Cilissa</i> | 14 | 12 | 4 | 8 |
| Subgroup of <i>M. haemorrhoidalis</i> | 5 | 2 | 0 | 0 |
| Subgroup of <i>M. harrietae</i> | 0 | 5 | 1 | 0 |

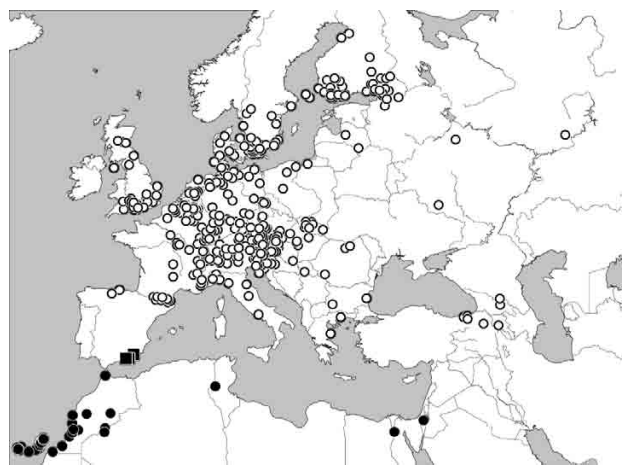


Figure 179
 Distribution of *Melitta haemorrhoidalis* (open circles, 1829 specimens), *M. hispanica* (solid squares, 11 specimens) and *M. aegyptiaca* (solid circles, 128 specimens).

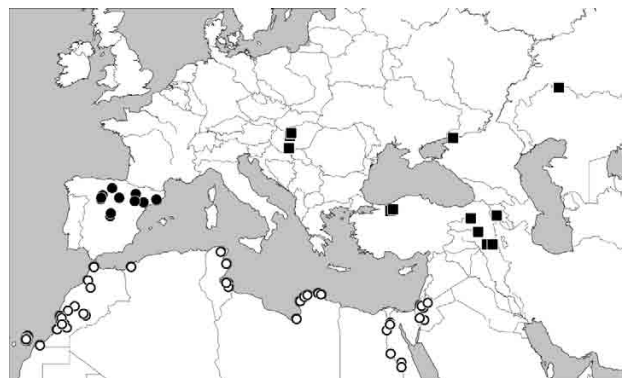


Figure 180
 Distribution of *Melitta seitzi* (solid circles, 13 specimens), *M. budensis* (solid squares, 17 specimens) and *M. schmiedeknechti* (open circles, 141 specimens).

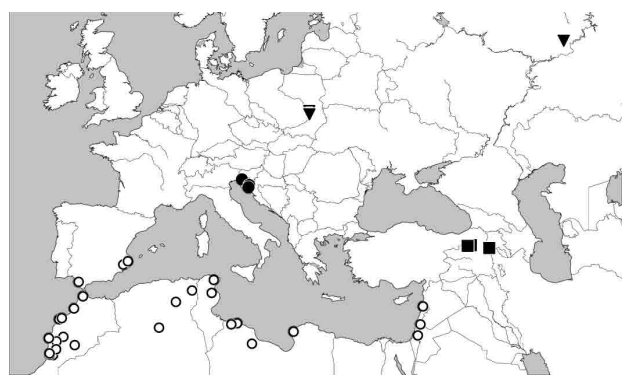


Figure 181
 Distribution of *Melitta udmurtiaca* (solid triangles, 17 specimens), *M. tomentosa* (solid circles, 6 specimens), *M. bicollaris* (solid squares, 29 specimens) and *M. maura* (open circles, 189 specimens).

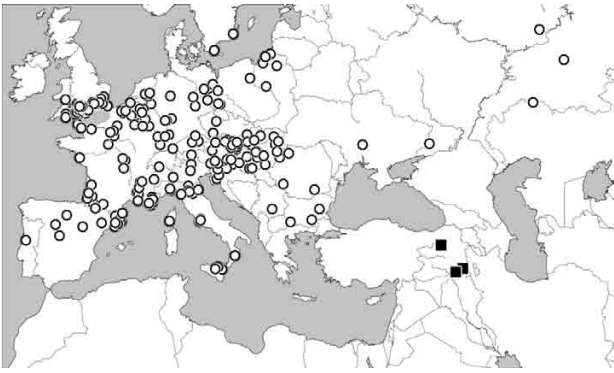


Figure 182
Distribution of *Melitta tricincta* (open circles, 1711 specimens) and *M. rasmonti* (solid squares, 12 specimens).

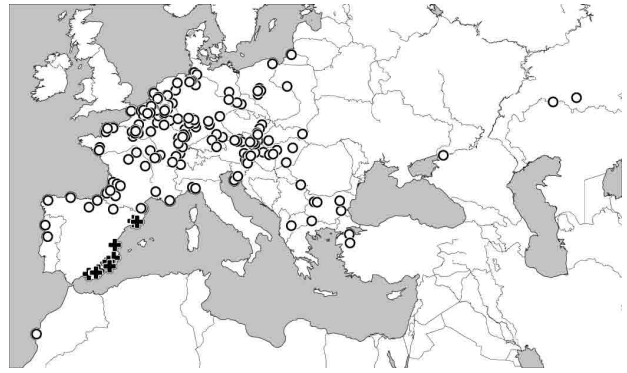


Figure 183
Distribution of *Melitta nigricans* (circles, 906 specimens) and *M. murciana* (crosses, 118 specimens).

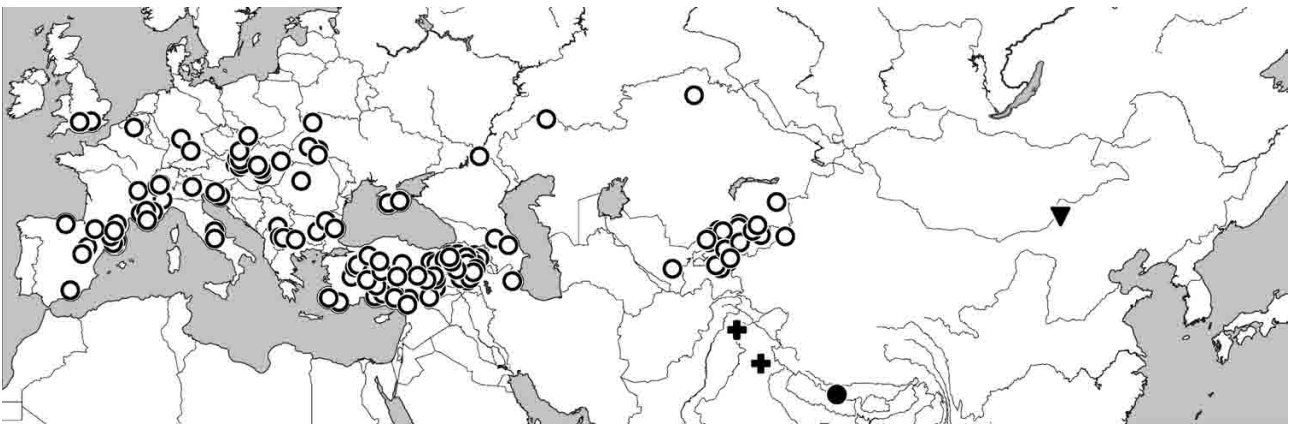


Figure 184
Distribution of *Melitta dimidiata* (open circles, 1565 specimens), *M. cameroni* (crosses, 29 specimens), *M. changmuensis* (solid circle, 10 specimens) and *M. mongolica* (solid triangle, 1 specimen).

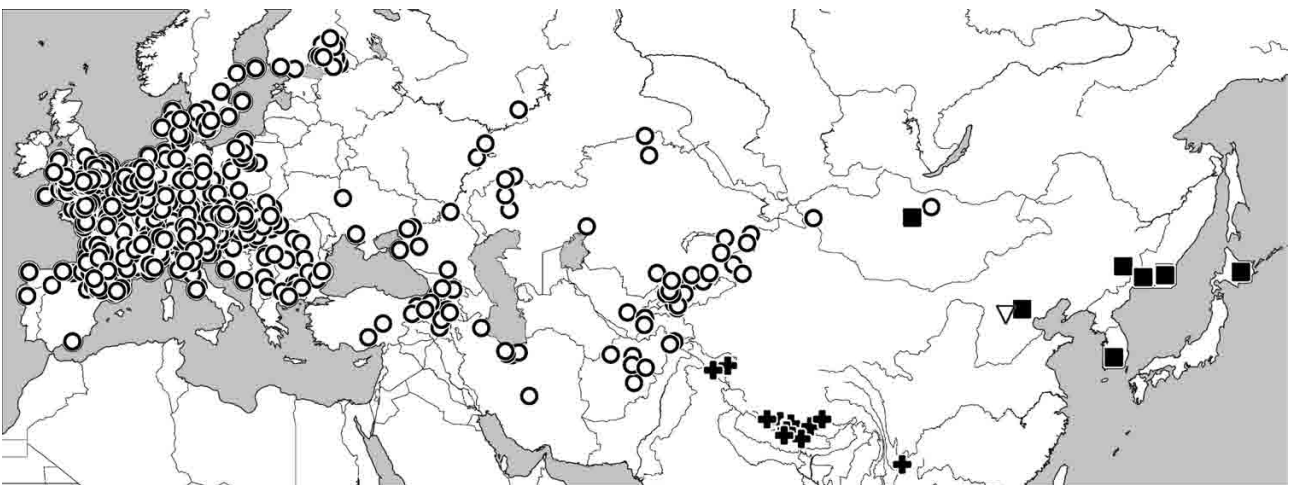
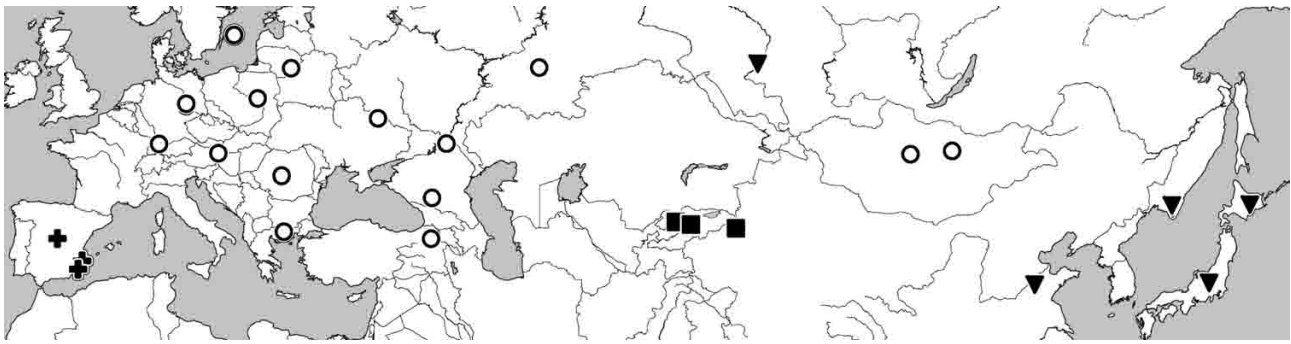
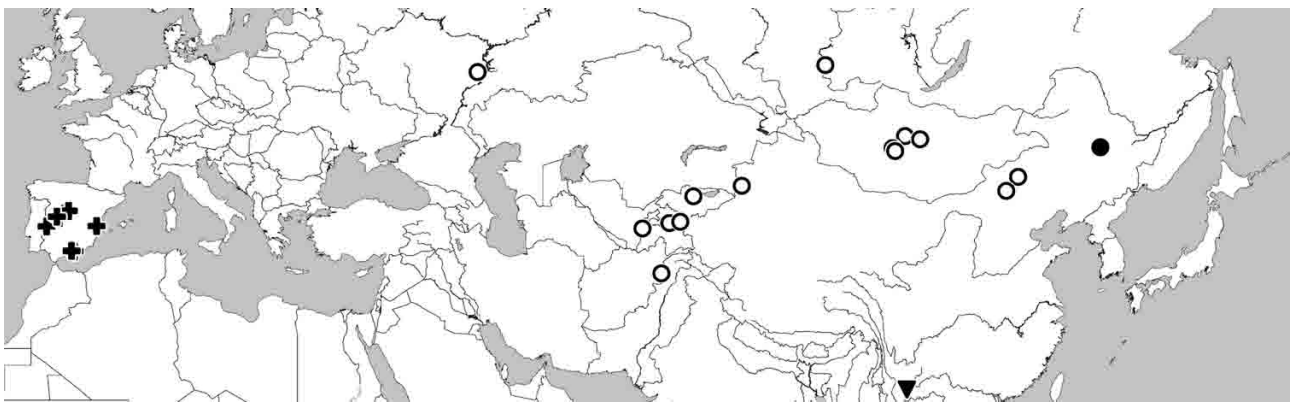


Figure 185
Distribution of *Melitta leporina* (open circles, 4241 specimens), *M. harrietae* (solid crosses, 46 specimens), *M. nigraabdominalis* (open triangle, 1 specimen) and *M. ezoana* (solid squares, 18 specimens).


Figure 186

Distribution of *M. kastiliensis* (solid crosses, 10 specimens), *M. wankowiczi* (open circles, 116 specimens), *M. fulvescenta* (solid squares, 3 specimens) and *M. japonica* (solid triangles, 15 specimens).


Figure 187

Distribution of *M. iberica* (solid crosses, 18 specimens), *M. sibirica* (open circles, 104 specimens), *M. heilungkiangensis* (solid circle, 1 specimen) and *M. montana* (solid triangle, 1 specimen).

M. fulvescenta, and *M. montana*; figs 184–187). Three occur in Siberia (*M. ezoana*, *M. japonica* and *M. sibirica*; figs 185–187), and four are known from their only locus typicus, mostly in China (*M. mongolica*, *M. nigrabdominalis*, *M. heilungkiangensis*, and *M. latronis*; figs 184, 185, 187).

Melitta leporina and *M. wankowiczi* are the most widespread in the Palearctic Region. They are distributed from the European Atlantic coast to Mongolia (figs 185–186).

In the Ethiopian Region, most of species are endemic to Southern Africa (*M. albida*, *M. arrogans*, *M. barbarae*, *M. danae*, *M. schultzei* and *M. whiteheadi*; figs 190–192). They are most diverse and most abundant in the winter rainfall areas (i.e., those areas that have a Mediterranean climate), but the distribution of *M. arrogans* is extended into the Namib Desert and *Melitta barbarae* is known from the southern tip of the Namib Desert (winter rainfall). *Melitta albida* occurs

in summer rainfall semi-desert and desert, which are not as dry as the Namib, and *M. danae* occurs in semi-desert through Savannah to mountain grassland, all with summer rainfall. Two species occur in East Africa, one in Savannah (*M. katherinae*; fig. 190) and one in mountain grasslands (*M. guichardi*; fig. 190).

In the Nearctic region, three species occur along the Atlantic coast (*M. americana*, *M. eickworti* and *M. melittoides*; fig. 193) and one along the California coast (*M. californica*) (fig. 193).

Floral choices of *Melitta*

We give here the floral choices for 25 species of *Melitta*. These species forage on 26 plant families: Amaranthaceae, Asclepiadaceae, Asteraceae, Boraginaceae, Brassicaceae, Campanulaceae, Capparaceae, Caryophyllaceae, Cistaceae, Dipsacaceae, Ericaceae, Euphorbiaceae, Fabaceae, Geraniaceae, Iridaceae, Lamiaceae, Lythraceae, Malvaceae, Onagraceae, Oxalidaceae, Pa-



Figures 188–189

188, *Melitta nigricans* ♀, landing on *Lythrum salicaria* (Lythraceae), Belgium, Hensies, VIII.2004 (photo Y. Barbier); **189**, *Melitta dimidiata* ♂, on *Onobrychis viciifolia* (Fabaceae), Switzerland, Valais, 16.VI.2007 (photo N. Vereecken).

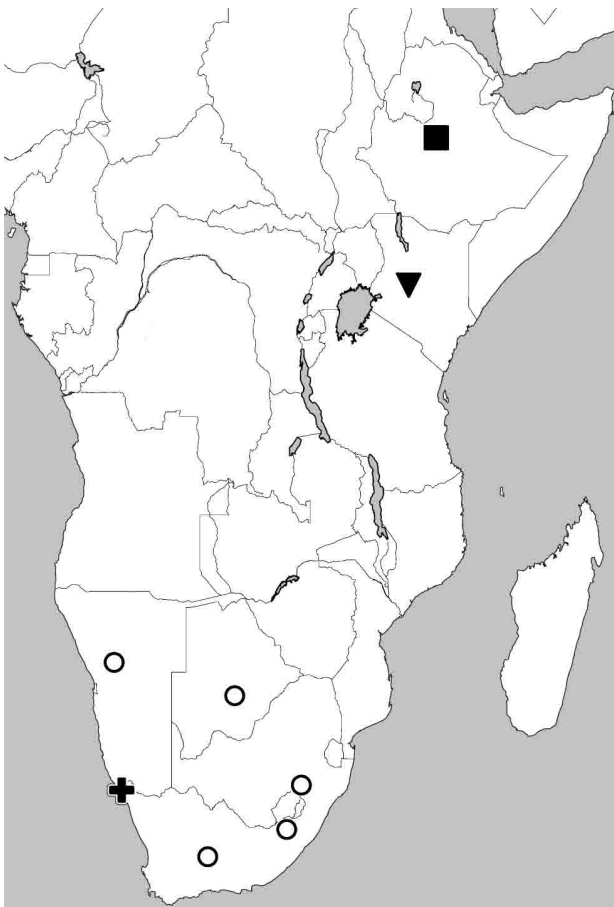


Figure 190
Distribution of *Melitta guichardi* (square, 6 specimens), *M. katherinae* (solid triangle, 2 specimens), *M. albida* (circles, 6 specimens) and *M. barbarae* (solid cross, 7 specimens).

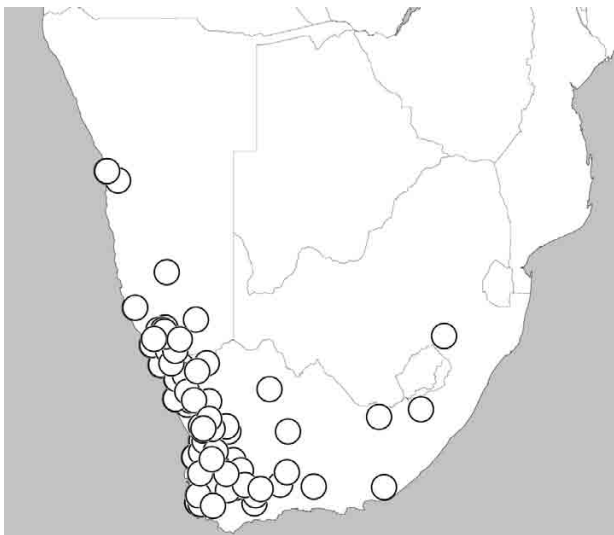


Figure 191
Distribution of *Melitta arrogans* (209 specimens).

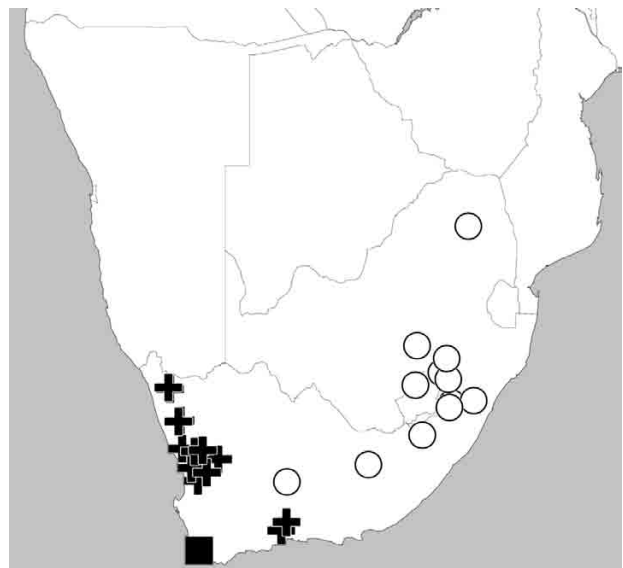


Figure 192
Distribution of *Melitta danae* (circles, 33 specimens), *M. schultzei* (crosses, 34 specimens) and *M. whiteheadi* (square, 5 specimens).

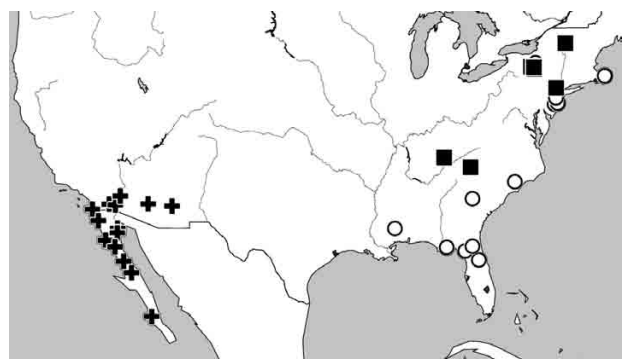


Figure 193
Distribution of *Melitta californica* (crosses, 77 specimens), *M. americana* (open circles, 35 specimens) and *M. eickworti* (squares, 45 specimens).

paveraceae, Resedaceae, Rosaceae, Scrophulariaceae, Solanaceae, Zygophyllaceae (appendix 1). However, only 18 plant families are significant host (occurring more than five percent of specimen visits), and 11 families are the major floral resource for at least one species of *Melitta* (tab. 3).

Fabaceae are the main floral resources for ten species of *Melitta* (e.g. *M. dimidiata*, fig. 189). Ericaceae are visited only by North American species. Iridaceae are visited by two South African species. Three *Melitta* species, those belonging to the *M. haemorrhoidalis*-subgroup (*M. haemorrhoidalis*, *M. tomentosa* and *M. wankowiczi*), visit Campanulaceae. Six families, Asteraceae, Brassicaceae, Lythraceae, Malvaceae, Resedaceae and Scrophulariaceae have only one

specialised *Melitta* species visiting them.

Host breadth of *Melitta*

Our samples are generally too small to define the specific host breadth of *Melitta*. Related observations are lower than 20 females for 14 species (tab. 3). However, some *Melitta* could be moderately described as narrow oligolectic, oligolectic or mesolectic. Six species, *M. californica*, *M. dimidiata* (fig. 189), *M. haemorrhoidalis*, *M. nigricans* (fig. 188), *M. tricineta* and *M. wankowiczi* seem to be narrow oligolectic, foraging respectively on *Sphaeralcea* spp. (Malvaceae), *Onobrychis* spp. (Fabaceae), *Campanula* spp. (Campanulaceae), *Lythrum* spp. (Lythraceae), *Odontites* spp. (Scrophulariaceae) and *Campanula* spp. (Campanulaceae). North American *Melitta* (*M. americana*, *M. eickworti* and *M. melittoides*) are oligolectic on Ericaceae (Cane *et al.* 1985; Snelling & Stage 1995). *M. leporina* and *M. udmurtiaca* forage on numerous genera of various tribes of Fabaceae (mainly *Medicago*, *Trifolium*, *Vicia*). They could be considered as mesolectic (sensu Cane & Sipes 2006).

Discussion

Taxonomy

At species level *Melitta* are unambiguously characterised by several morphological structures, like proboscis proportions, punctuation of clypeus and mesonotum, sculpture of propodeal triangle, shape of genitalia ♂ and hidden sterna ♂ (S6-S8). In general, the different species of *Melitta* are morphologically very similar when compared with other melittid bees (Michener 1981; Michez *et al.* 2004b, c; Michez & Patiny 2005, 2006; Michez *et al.* 2007a). Most *Melitta* share similar size and vestiture, whereas, in contrast, the biggest species of *Dasygaster* are twice as long as the smallest species (Michez *et al.* 2004c).

The cladistic analysis confirms the monophyly of the genus *Melitta sensu* Michener (2000). However, the results of this study do not support the subgeneric hypothesis of Warncke (1973b) and Michener (2000).

First, the ambiguous species *Melitta (Dolichocheile) melittoides* is clearly neither basal nor apical in the clade that represents the subgenus *Cilissa*, being paraphyletic to the subgenus *Melitta* Kirby *sensu* Michener (2000). Consequently, the subgenus *Dolichocheile* is synonymised with *Cilissa* so that the genus comprises only monophyletic taxa. The numerous autapomorphies of *M. melittoides* are probably linked to its ecology and not to its taxonomical distance (as suggested by Michener 2000).

Second, we extend the taxonomic significance of

the subgenus *Cilissa sensu* Warncke (1973b). This subgenus, as proposed by Warncke (1973b), include only species that we here call the *M. haemorrhoidalis*-subgroup (fig. 2). Warncke (1973b) placed the other West Palaearctic species in the subgenera *Pseudocilissa* and *Melitta s.str.* In our cladistic analysis, which includes more taxa, we found that *Cilissa* and *Pseudocilissa* constitute together a single one robust clade (fig. 2). Consequently, *Cilissa* include both of these subgenera *sensu* Warncke (1973b).

Biogeography

The genus *Melitta* is clearly the most widespread genus of melittid bees (see Michener 1981; Michez & Patiny 2005, 2006; Michez *et al.* 2004b, 2007a, b). The *Melitta* present particular climatic affinities when compared with others melittid bees. Most of the Dasygasteridae (*Capicola*, *Dasygaster*, *Eremaphanta* and *Promelitta*) and all Meganomiidae are restricted to the xeric areas of the Old World (Michener 1981; Michez *et al.* 2004c, 2007a, b; Michez & Patiny 2006). The ecological optimum for Melittidae *s.str.* seems to be a temperate climate. *Melitta* and *Macropis* prefer the temperate ecosystems (Michez & Patiny 2005). Both *Macropis* and *Melitta* occur in the Holarctic Region, but *Melitta* is the only genus of Melittidae *s.str.* that occurs in the Himalayan Mountains.

The African distribution of *Melitta* is similar to that of a lot of others insect, like Lycaenini (Lycaenidae, copper butterfly) and *Melitturga* sp. (Andrenidae, solitary bee) (de Jong & van Dorp 2006; Patiny & Gaspar 2000). These groups occur in southern Africa and Eurasia with some disjunct populations in East Africa.

Age and historical biogeography

Fossil bees are very rare, which makes fussy the dating of their appearance. To evaluate the historical biogeography of *Melitta*, we have to consider much indirect data, like non-*Melitta* bee fossil records, continental drift, contemporary *Melitta* distributions and bee phylogeny.

The oldest known bee fossil, *Cretotrigona prisca* (Michener & Grimaldi 1998), is an Apinae from New Jersey amber (Michener & Grimaldi 1998; Engel 2000), estimated from the late Maastrichtian (ca. -65-70 Myr). Most apidologists think that bees originated earlier, around the mid Cretaceous (-110 Myr), in the xeric part of the paleocontinent Gondwana (Roubik 1989; Michener 2000; Engel 2001). In a recent molecular phylogenetic analysis, Danforth *et al.* (2006a, b) estimated that melittid bees could be the basal group of the bee clade. The origin of melittid bees could therefore be in the mid-Cretaceous. *Melitta*,

therefore, could have appeared in the beginning of the diversification of Melittidae, around -100 Myr.

Moreover, *Melitta willardi* Cockerell 1909, is the only *Melitta* fossil described (Michez *et al.* 2007c). This fossil is a compression in Florissant shale from the Oligocene (-32 Myr) (Cockerell 1909; Engel 2001). It is characterised by the scopa of the hind tibia and basitarsus, three submarginal cells and their diagnostic shape.

This fossil record indicates that *Melitta* were present in North America at least since the Oligocene. Considering the contemporary distribution (fig. 1) and diversity (tab. 2), three hypotheses could be proposed: 1. *Melitta* originated in the Nearctic Region and colonised the Old World; 2. *Melitta* ancestors occurred in the Laurasian Region before the split between North America and Eurasia; 3. *Melitta* originated in the Palaearctic Region and colonised the Nearctic Region.

We know that the diversity of *Melitta* is highest in the Palaearctic Region (tab. 2). Moreover, the contemporary Nearctic species are morphologically very similar to the Asian species (fig. 2). The East Palaearctic *M. harrietae*-subgroup is represented by *M. californica*. The three other species (*M. americana*, *M. eickworti* and *M. melittoides*) are included in the subgenus *Cilissa* (fig. 2). This suggests that the genus originally diversified in the Palaearctic Region. As many taxa like Cynipoid wasps (Nordlander *et al.* 1996) and *Xylocopa* (Leys *et al.* 2000), *Melitta* may have crossed the Bering Strait from Asia to America. In fact, a continuous land connection between Asia and North America existed from mid-Cretaceous until the Pliocene (Hamilton 1983; Mckenna 1983). It is difficult to date more precisely this vicariance. Paleobotanical evidences indicate that climates were favourable for *Melitta* during the warm, early Tertiary period (Tiffney 1985). Then much of Beringia was covered with deciduous hardwood forests, the preferred vegetation of contemporary *Melitta*. The crossing of *Melitta* through the Bering Strait could therefore have happened during the Eocene, supporting the Nearctic fossil data.

The hypothesis of a Laurasian *Melitta* ancestor is not feasible if considering the paraphyly of the Nearctic species. In fact, the vicariance of Nearctic and Palaearctic populations would have generated two monophyletic groups on both side of the Atlantic Ocean.

South African and Eastern African species are probably originated from the northern immigration. *Melitta* probably took the savannah corridor through East Africa. This corridor links the Mediterranean area to the Cape 'Mediterranean' area.

Lastly, some of the specific distribution pattern could be explained by cyclical climatic changes during the Tertiary-Quaternary period. During these periods, new ice caps expanded and contracted over the continental

land masses of North America and Eurasia isolating populations into a few climatic refuges (Hewitt 1999; Marchant & Hooghiemstra 2004; Cox & Moore 2005). The formation of such disjunct populations favoured an allopatric speciation process. Consequently, like other bee genera, the endemism of *Melitta* began in very high paleo-climatic refuges like Spain, Maghreb, Balkan and Anatolia (Michez *et al.* 2004b, c; Patiny & Michez 2006; Terzo 2000).

Ecology

Our results confirm the specialised floral choices of some species of *Melitta*. From a larger point of view, it confirms the same tendency in the melittid bees. Indeed, for each genus of this group, most of species are oligolectic: 11 species of *Macropis* forage on *Lysimachia* sp. (Primulaceae) (Michez & Patiny 2005); 8 species of *Dasygoda* on Asteraceae, 4 on Dipsacaceae, 1 on Malvaceae and 2 on Cistaceae (Michez *et al.* 2004c); *Promelitta alboclypeata* on Brassicaceae (Michez *et al.* 2007b), 3 species of *Capicola* on Aizoaceae, 1 on Asteraceae, 3 on Campanulaceae and 1 on Fabaceae (Michez *et al.* 2007a). However, the host plants are particularly diverse for the genus *Melitta*. This could be explained by the high species diversity and the widespread distribution of this genus *Melitta*.

Acknowledgements. We want to thank sincerely the curators of the studied collections: Dr Ascher (New York, USA), Dr Y. V. Astafurova (Saint Petersburg), M. O. Berg (Haslum, Norway), Dr R. Danielsson (Lund, Sweden), Mme A. Freitag (Lausanne, Switzerland), Dr G. Else (London, UK), Dr P. Grootaert (Brussels, Belgium), Prof C. Gaspar (Gembloux, Belgium), Mag F. Gusenleitner (Linz, Austria), Dr W. Hogenes (Amsterdam, Netherlands), Dr M. Kuhlmann (Muenster, Germany), Dr F. Koch (Berlin, Germany), Mme G. Lachaise (Paris, France), Mr F. Martinez (Montpellier, France), Mr. J. Mater (Strasbourg, France), Dr B. Merz (Geneva, Switzerland), Dr V. Nobile (Catania, Italy), Dr G. Pagliano (Turin, Italy), Dr S. Patiny (Gembloux, Belgium), Dr Y. A. Pesenko (Saint Petersburg), Mr F. Rolf (Görlitz, Germany), Dr S. Schoedl (Vienna, Austria), Mr M. Schwarz (Ansfeld, Austria), Dr C. van Achterberg (Leiden, Netherlands), Dr L. Vilhelmsen (Copenhagen, Denmark), Dr C. Villeman (Paris, France). Thanks to Dr Engel for his collaboration to the study of *Melitta*. We are grateful for the proof-reading of two anonymous reviewers.

Addendum. *Melitta melanura* (Nylander 1852) was recently proposed by Nilsson (2007) as valid name for the species that we named *M. wankowiczi* in the present paper. Nilsson reviewed the type material and we agree with his conclusion.

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Appendix 1**Host plant of *Melitta*****Amaranthaceae**

Hermibstaedtia glauca (Wendland) Moquin-Tandon in Alph. de Candolle.

Asclepiadaceae

Asclepias buchenaviana Schinz

Asteraceae

Achillea millefolium L.

Aster sp.

Berkheya fruticosa (L.) Ehrh., *B. purpurea* Benth. & Hook.f. ex Mast.

Carduus sp.

Centaurea sp., *C. jacea* L., *C. sterilis* Stev., *C. stoebe* L.

Chrysanthemum coronarium L.

Cichorium sp., *C. intybus* L.

Cirsium sp., *C. monspessulanum* (L.) Hill, *C. vulgare* (Savi) Ten.

Crepis sp.

Encelia californica Nutt.

Hieracium laevigatum Willd.

Inula sp., *I. britannica* L.

Leontodon sp.

Reichardia tingitana (L.) Roth

Senecio inaequidens DC, *S. jacobaea* L.

Serratula tinctoria L.

Solidago gigantea Herb.

Tanacetum sp.

Voluntaria lippii (L.) Maire

Xeranthemum annuum L.

Boraginaceae

Anchusa sp.

Lithospermum erythrorhizon Siebold & Zucc.

Brassicaceae

Brassicaceae indet.

Campanulaceae

Campanula sp., *C. latifolia* L., *C. persicifolia* L., *C. rapunculoides* L., *C. rotundifolia* L., *C. trachelium* L.

Wahlenbergia sp.

Capparaceae

Cleome paxii (Schinz) Gilg & Benedict

Caryophyllaceae

Spergula sp.

Cistaceae

Cistus sp.

Dipsacaceae

Knautia arvensis (L.) Coult.

Scabiosa isetensis L.

Ericaceae

Polycodium sp.

Vaccinium sp., *V. stramineum* L.

Xolisma sp.

Zenobia sp.

Euphorbiaceae

Euphorbia regis-jubae Webb & Berthel.

Fabaceae

Acacia gerrardii Benth.

Astragalus onobrychis L., *A. xerophyllus* Lebed.

Dalea megacarpa (S. Watson) I.M. Johnst.

Glycyrrhiza glabra L.

Lathyrus latifolius L.

Lebeckia multiflora E. Mey

Lespedeza bicolor var. *japonica* Nakai

Lotus sp., *Lotus corniculatus* L., *L. creticus* L.,

Medicago sp., *M. falcata* (L.) Arcang., *M. lupulina* L., *M. sativa* L., *M. x-varia* Martyn

Melilotus sp., *M. alba* Medik, *M. altissima* Thuill., *M. officinalis* (L.) Lam.

Onobrychis sp., *O. arenaria* (Kit.) DC, *O. stenostachya* Freyn, *O. supina* (Chaix ex Vill.) DC, *O. transcaucasia* Grossh., *O. vicifolia* Scopoli

Ononis sp.,

Trifolium sp., *T. ambiguum* Bieb., *T. arvense* L., *T. montanum* L., *T.*

pratense L., *T. repens* L.

Vicia sp., *V. cracca* L., *V. villosa* Roth.;

Geraniaceae

Geranium sp., *G. pratense* L.

Iridaceae

Watsonia sp.

Lamiaceae

Ballota nigra L.

Calamintha sp., *C. nepeta* (L.) Savi

Lavandula sp., *L. angustifolia* Miller

Lycopus europaeus L.

Mentha sp., *M. pulegium* L.

Nepeta nuda L.

Origanum vulgare L.

Salvia nemorosa L., *S. x-sylvestris* L.

Thymus serpyllum L.

Lythraceae

Lythrum sp., *L. salicaria* L., *L. virgatum* L.

Malvaceae

Malva sp., *M. moschata* L., *M. sylvestris* L.

Sphaeralcea sp., *S. orcutii* ?

Lavatera thuringiaca L.

Onagraceae

Epilobium angustifolium L.

Oxalidaceae

Oxalis sp., *O. pes-caprea* L.

Papaveraceae

Chelidonium sp.

Resedaceae

Reseda sp., *R. lutea* L.

Rosaceae

Rubus sp.

Scrophulariaceae

Euphrasia sp.

Linaria vulgaris Mill.

Melampyrum sp.

Odontites sp., *O. lutea* (L.) Clairv., *O. verna* (Bellardi) Dumort

Veronica sp.

Solanaceae

Lycium ferocissimum Miers, *L. parishii* Gray

Zygophyllaceae

Augea capensis Thunb.

Viscainoa geniculata Greene

Zygophyllum flexuosum Eckl. & Zeyh, *Z. cf. morgana* L., *Z. meyeri* ?, *Z. prismatocarpum* E.Mey. ex Sond., *Z. stapffii* Schinz.

Supplementary material

Details of biogeographical data are available on the website of the *Annales de la Société entomologique de France*: <http://ann.sef.free.fr/>. These data are related to the following species: *M. dimidiata*, *M. haemorroidalis*, *M. leporina*, *M. nigricans*, *M. tricincta*.