

## Revision of the subgenus *Udamochiras* of *Melaloncha* bee-killing flies (Diptera: Phoridae: Metopininae)

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The genus *Melaloncha* Brues is defined and groundplan character states established based on outgroup comparison with *Phalacrotophora* Enderlein and *Melittophora* Brues. Major groupings within *Melaloncha* are recognized, and two subgenera are established: *Udamochiras* Enderlein (type species *M. colossia* (Enderlein)) and *Melaloncha* s.s. (type species *M. pulchella* Brues). Subgenus *Udamochiras* is revised and 42 species are recognized, including the following 33 new to science: *M. anaticula*, *M. angustifrons*, *M. apicula*, *M. aprica*, *M. basella*, *M. biseta*, *M. brevicarina*, *M. carinata*, *M. compressicauda*, *M. exigua*, *M. falcata*, *M. flavilata*, *M. hamata*, *M. hansonii*, *M. horologia*, *M. individa*, *M. lobata*, *M. maculifrons*, *M. parkeri*, *M. paxilla*, *M. premordica*, *M. rhampha*, *M. rhytopoda*, *M. rostrata*, *M. sinuosa*, *M. spatula*, *M. spicula*, *M. triangularis*, *M. trua*, *M. valeria*, *M. vargasi*, *M. villosa*, *M. woodi*. *Melaloncha simillima* Borgmeier is removed from synonymy with *M. piliapex* Borgmeier and reinstated as a separate species; lectotypes are designated for both. © 2004 The Linnean Society of London, *Zoological Journal of the Linnean Society*, 2004, 140, 1–42

ADDITIONAL KEYWORDS: Apidae – Meliponini – Neotropical – parasitoid – phylogeny – systematics – taxonomy.

### INTRODUCTION

Much of the world's terrestrial biodiversity consists of hundreds of thousands to millions of species of tropical insects (Groombridge, 1992). Most are inconspicuous creatures whose diminutive size and lack of agricultural importance renders them almost invisible to the small cadre of biologists studying tropical ecosystems. Our lack of knowledge about such species impedes plans for conserving natural areas and understanding biogeographical relationships (e.g. Amorim & Pires, 1996; Kotze & Samways, 1999; Margules, Pressey & Williams, 2002; Olson *et al.*, 2002).

A particularly neglected group of insects is the Diptera (true flies), a group that contains about 10% of the world's described species (Groombridge, 1992), yet for which the most basic taxonomic study is at a virtual standstill. On average, less than 1000 new species of Diptera are described per year in the 22 largest families of Diptera (compiled from the *Zoological Record*,

1996–2002), even though it is expected that there are hundreds of thousands of undescribed species in existence. While extraordinary attention is lavished on the much less diverse mammals and birds (Gaston & May, 1992), flies remain virtually unstudied in many parts of the world, with their species richness, ecological roles, and behavioural traits largely unknown.

Of the approximately 150 families of Diptera, the Phoridae is one of the least-studied major groups. Known from about 3400 species, estimates for the true richness of this family range from 20 000 to 50 000 species (Disney, 1983; Gaston, 1991). Additionally, they have extraordinarily diverse life-histories, with various species having larvae that are scavengers, predators, herbivores, parasitoids, and even true parasites (summarized in Disney, 1994). These flies are especially diverse, yet poorly studied, in the Neotropical Region, where the 1000 species described by the previous generations of researchers (Borgmeier, 1968) probably represents only 10–20% of the actual total.

The genus *Melaloncha* Brues is one such neglected genus of phorid flies. Larvae of all *Melaloncha* species are internal parasitoids of various species of bees

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(Hymenoptera: Apidae), and are hereafter referred to as 'bee-killing flies'. They are found exclusively in the Neotropical Region, and the 32 described species represent only a small fraction of the true diversity of this genus. With their relatively large size (up to 5 mm), yellow, black and silver colours, and their imposingly large ovipositors, bee-killing flies are clearly noticeable when they are encountered in collections.

Probably the only reason why this group has not attracted more attention from researchers is because of their apparent rarity. This rarity is an artefact of general collection methods, such as hand collecting and sweeping, which gather relatively few specimens. We (G. Kung and I) have devised a new collecting method that involves attracting large numbers of host bees, that is much more effective for capturing specimens (see below).

The relationships within the genus *Melaloncha*, as well as those of *Melaloncha* relative to other genera, are poorly known. It is assumed that they are related to the structurally similar genus *Phalacrotophora* Enderlein (e.g. Schmitz, 1929), but a close relationship also exists with the unusual genus *Melittophora* Brues. An analysis of the relationships among these three genera, as well as of the groupings within *Melaloncha*, is presented below.

One of the most distinctive subgroups of *Melaloncha* is that containing species similar to *M. colossia* (Enderlein). This subgroup is herein referred to the level of a subgenus, and its species are treated below.

## METHODS

### SPECIMENS

This revision is based almost exclusively on female specimens, and descriptions apply to females only. Males of *Melaloncha* are often extremely different from females and have fewer distinguishing characters.

The posterior section of the female abdomen is extremely varied in species of *Melaloncha*. Ovipositors (segment 7) of all species in the new subgenus are illustrated, and are usually sufficiently diagnostic for species recognition. Illustration and description of intersegment 7–8 is given for the few species for which there are sufficient specimens to attempt potentially damaging dissections.

### GEOGRAPHICAL COORDINATES

Coordinates are quoted as decimal degrees, rather than degrees, minutes and seconds (e.g. 90.50°W, rather than 90°30'W; Crawford, 1983).

### BARCODES

In addition to the usual insect labels recording locality information, specimens were labelled with barcoded

insect labels (Thompson, 1994) and data were recorded in a database. All barcoded labels that begin with the abbreviation 'LACM ENT', indicate that the Natural History Museum of Los Angeles County (LACM) is the institution where the data are stored. Specimens with barcoded labels beginning 'INBIO' have their data stored at LACM and the Instituto Nacional de Biodiversidad in Costa Rica. To make later recognition of holotypes easier, I list their individual barcode number in square brackets.

## MEASUREMENTS

Body length—front of head to posterior apex of segment 6. This measurement varies with preparation technique and is only approximate. For strongly curled specimens an estimate was made for straightened length.

Frontal ratio—frontal width (at mid length) divided by head width.

Costal length—apex of basicosta to apex of costa.

Wing length—apex of basicosta to apex of wing.

Costal ratio—costal length divided by wing length.

Frontal setae—normal means long, well-developed setae that are clearly longer than frontal width (e.g. Fig. 27); short means about as long as frontal width (e.g. Fig. 26).

## COLLECTING METHODS

*Melaloncha* specimens are rare in collections because traditional methods (hand netting, sweeping, Malaise trapping) do not gather many of these flies. We have developed a new collecting technique, spraying undergrowth vegetation or a 'bee screen' (Brown, 2001) with a mixture of honey and water (about 1 part honey to 10 parts water) to attract bee hosts. Once a large number of bees is attracted, parasitoids begin to arrive to attack them (although this can take up to several days). When flies are attracted in sufficient numbers, we can observe their behaviour as they attack their hosts. Honey-spraying is now our preferred method of catching specimens (see Brown, 2001 for more details), and we have collected up to 200 *Melaloncha* in a single day using this technique.

On occasions it is not possible to monitor sprayed vegetation or bee screens throughout the day. We have found that spraying honey on undergrowth directly beside a Malaise trap will tremendously boost the number of bee-killing flies caught by the trap.

## TERMS AND ABBREVIATIONS

Terms for phorid morphology are those of the Manual of Nearctic Diptera (McAlpine, 1981). The term 'ALAS'

in the lists of specimens examined refers to the Arthropods of La Selva (Costa Rica) project (Longino, 1994). Codes from the ALAS project, for example 'M/04/067', refer to Malaise trap (M), trap number (04) and sample number (067). TYC refers to the Tropical Youth Centre (Centro Juvenil Tropical), near Rincon, Puntarenas, Costa Rica.

#### COLLECTION ABBREVIATIONS

Abbreviations were used only for collections for which holdings were repeatedly listed (others are cited in full in the text). They are as follows (for more details, see Arnett, Samuelson & Nishida, 1993).

AMNH	American Museum of Natural History, New York, USA.
CBFC	Colección Boliviana de Fauna, La Paz, Bolivia.
EMUS	Utah State University, Logan, USA.
INBC	Instituto Nacional de Biodiversidad, Heredia, Costa Rica.
INPA	Instituto Nacional de Pesquisas da Amazônia, Manaus, Brazil.
KSEM	University of Kansas, Lawrence, USA.
LACM	Natural History Museum of Los Angeles County, USA.
MCZC	Museum of Comparative Zoology, Cambridge, USA.
MUCR	University of Costa Rica, San Pedro, Costa Rica.
MZSP	Universidade de São Paulo, Brazil.
USNM	United States National Museum, Washington, USA.

#### COMPARATIVE MORPHOLOGY OF FEMALE TERMINALIA

The structure of female abdominal segments 7–10 is crucial to understand the relationships among *Melaltoncha* and related genera. It is necessary to describe these structures so that the relationships among the genera can be hypothesized.

##### *PHALACROTOPHORA*

Segment 7 in *Phalacrotophora* species (Fig. 1; see Appendix 1 for list of specimens examined) has a well-defined dorsal tergite and ventral sternite. Intersegment 7–8 is unmodified and membranous.

The last abdominal segment, formed from segments 8–10, differs in structure among various species. Some species have the dorsal sclerite of 9 + 10 (referred to as the U-shaped sclerite by Brown (1992) which is small (Fig. 2) and similar to that in outgroup taxa like most *Megaselia* Rondani. The dorsal sclerite in other *Phalacrotophora* species is enlarged, triangular, and api-

cally pointed (Fig. 4), apparently an intermediate stage to the situation found in *Melittophora* and *Melaltoncha*. Together with other characters, this variation in the U-shaped sclerite indicates that *Phalacrotophora* as presently defined is possibly paraphyletic.

The ventral structure of segments 8–10 also varies among species. In relatively primitive taxa, the apical lobes are broad and rounded (Fig. 3), but in apparently more derived taxa (based on the dorsum of segments 8–10), they are narrowed (Fig. 5) and begin to resemble the early stages of the same structures in *Melittophora* and *Melaltoncha*.

##### *MELITTOPHORA SALTII* BRUES

Unfortunately, the available material of *Melittophora saltii* is extremely limited and fragile. I dissected one female specimen and was able to make out the following details. There is a distinct, broad triangular tergite 7 and smaller, narrower, triangular sternite 7. The membrane surrounding the sclerites is extremely heavily longitudinally striate.

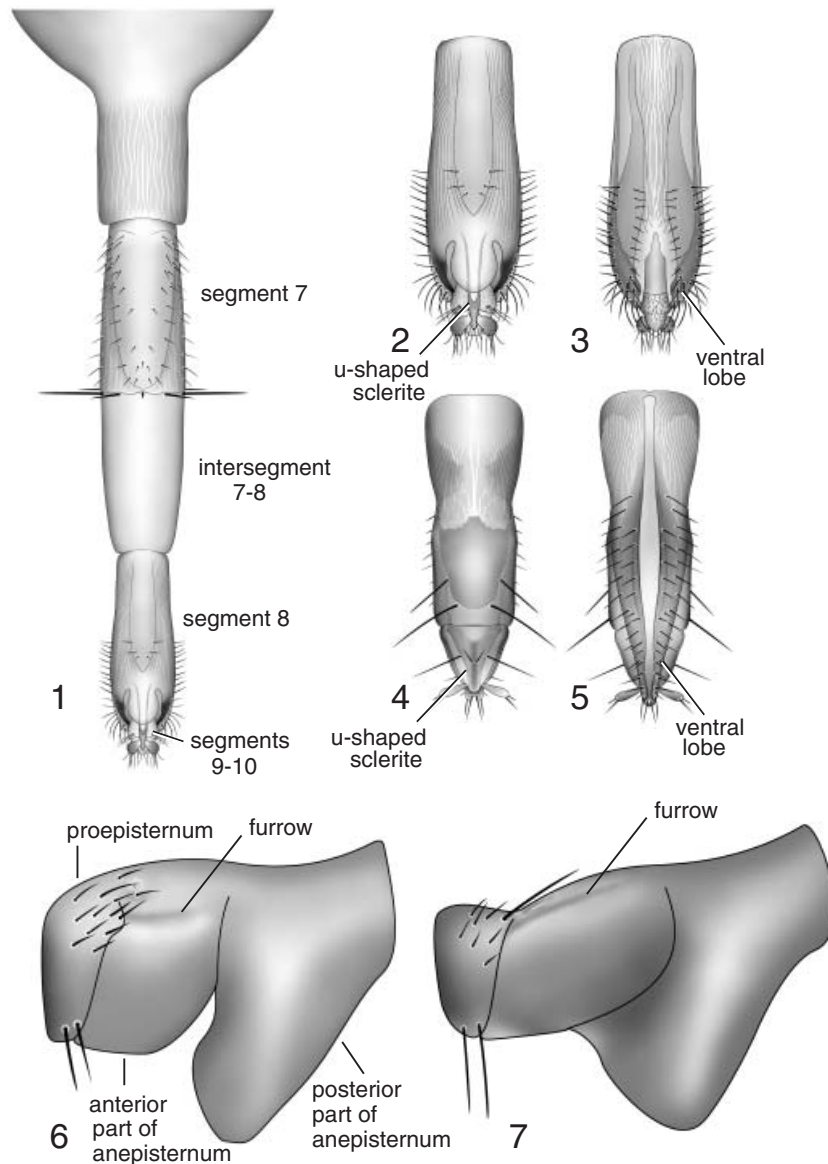
A section of the abdomen, apparently corresponding to intersegment 7–8 in most other phorids, is modified in *M. saltii* (and *Melaltoncha* species, see below). This section bears a long, dorsal sclerite in *M. saltii*.

The apical section of the abdomen is extremely small, forming a stylet as in *Melaltoncha* (below), but I could not observe details of the structure without further, potentially damaging, dissection. New material of this species is needed.

##### *MELALONCHA*

The terminal segments of female *Melaltoncha* are highly modified for their parasitic way of life. Unlike *Phalacrotophora* and *Melittophora*, which retain a membranous segment 7 with a distinct dorsal tergite, segment 7 in *Melaltoncha* is completely sclerotized, forming an ovipositor of various forms (Figs 8, 9). In many species the ventral apex of the ovipositor is deeply cleft, allowing the posterior segments to be extended ventrally.

The section of the abdomen apparently corresponding to intersegment 7–8 in most other phorids is modified in all examined species of *Melaltoncha*, with at least a dorsal, longitudinal, thin sclerite present. In other species the dorsal sclerite is modified with the apex forming a posterior point, usually sheathed in a clear, membranous structure or other lateral processes of unknown function (Figs 10–12). In some species, this sheath has been modified to form a dorsal, three-pronged structure (Figs 8, 9) articulating with the sclerite; in some, the intersegment is relatively heavily sclerotized and brown in colour, proximal to the ovipositor. In some species related to *M. obscurella* Borgmeier there are rows of sclerotized hooks present



**Figures 1-7.** *Phalacrotophora* species. Figs 1-3: *P. berlinensis* Schmitz. 1. Posterior segments of ovipositor, dorsal. 2. Segments 8-10, dorsal. 3. Segments 8-10, ventral. Figs 4 & 5: *Phalacrotophora* sp., Ecuador, Napo R. 4. Segments 8-10, dorsal. 5. Segments 8-10, ventral. Figs 6 & 7: Anepisternum, left lateral. 6. *P. fasciata* (Fallén). 7. *P. rufiventris* Borgmeier.

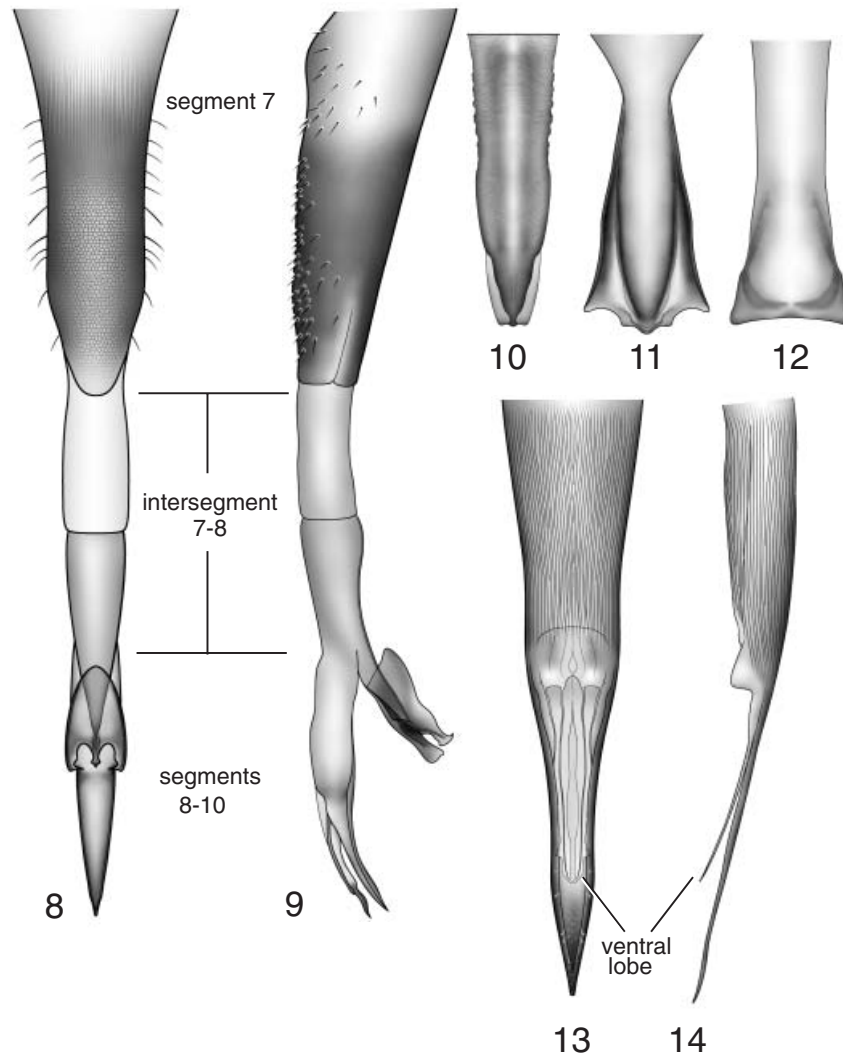
basally on the intersegment. The function of all these modifications of the intersegment is probably to help guide the stylet to the proper location for egg deposition, or to give structural support to the posterior portions of the abdomen.

An argument could be made that the elaborate structures anterior to the stylet are actually part of segment 8, with the stylet formed by segments 9-10. I do not support this idea, however, because the stylet forms an identifiable, sclerotized capsule that is readily comparable with the same sclerotized structure in *Phalacrotophora*. In both *Phalacrotophora* and

*Melaloncha*, the ventromedial cleft of segment 8 is a clearly visible landmark in this capsule (Figs 5, 13).

Posterior to intersegment 7-8 is the stylet, a term proposed by Brown (1993b) for the same structure in species of *Apocephalus* Coquillett. The stylet consists of the fused elements of segments 8-10 and forms an apically pointed structure for piercing the bodies of hosts, allowing eggs to be deposited therein (Figs 13, 14). Cerci are absent. The stylet is nearly always withdrawn into the preceding body segments (usually within intersegment 7-8) in preserved specimens, resulting in the appearance that the sclerotized por-





**Figures 8–14.** *Melaloncha* species. Figs 8 & 9: *Melaloncha* (*M.*) sp. 22. 8. Posterior segments of ovipositor, dorsal. 9. Same, left lateral. Figs 10–12: Intersegment 7–8, dorsal. 10. *M. simillima* Borgmeier. 11. *M. deinocerca* Borgmeier. 12. *M. trua* sp. nov. Figs 13 & 14: Stylet, *M. trua* sp. nov. 13, ventral. 14, left lateral.

tions of the intersegment, which frequently protrude from the ovipositor in preserved specimens, are the actual terminal portion of the abdomen. The dorsal apex of the stylet is sharply pointed and heavily sclerotized, whereas in *Melaloncha* the ventral apex is shorter or longer, and extremely reduced. Often, the ventral lobes appear as merely a pair of long, weakly sclerotized rods, that have thin, almost invisible (with stereoscopes) membrane between them (Fig. 13). Apparently, the dorsal apex assumes the major role in piercing the host, whereas the ventral apex merely helps guide the egg out of the body.

#### SYSTEMATICS

The higher relationships (above the genus level) of

Phoridae are poorly known and highly contentious (e.g. Disney, 1993, 1995; Brown, 1995). In his monograph, Disney (1994) maintained a traditional classification, whereas Brown (1992) proposed some new groupings based on phylogenetic analysis of structural characters. The genus *Melaloncha* has not been mentioned specifically in any of these exchanges, but its supposed closest relative, *Phalacrotophora* Brues, was considered by Brown (1992) to be related to *Rhynchophoromyia* Malloch and *Physoptera* Borgmeier in a grouping called the *Phalacrotophora-series*.

Traditionally (i.e. Schmitz, 1929: 144), *Phalacrotophora* is considered the closest relative to *Melaloncha*. This relationship is supported by a few characters found in some (but not all) species, relating to general body form: frons relatively narrow, wings elongate and

narrow, humeral region of thorax narrowed, and anepisternum posteriorly extended. All of these characters probably relate to a specific function, namely hovering. For instance, large eyes (and a correspondingly narrow frons) are used to seek mates, competitors (in the case of males), and hosts (in parasitoid females). Other *Phalacrotophora*-like characters, such as anterodorsal setae on the mid and hind femora, the presence of dorsal interfrontal setae and the presence of wing vein  $R_{2+3}$ , are found in some *Melaloncha* species, but these are widespread in the Phoridae and could possibly be cases of homoplasy.

If *Phalacrotophora* and *Melaloncha* are closely related, there is a case to be made that the former is a paraphyletic assemblage. Although a revision of all the species of *Phalacrotophora* is beyond the scope of this study, it is clear that some of them share advanced characters with *Melaloncha*, leaving the remainder a cladistically unacceptable grade group.

Although *Phalacrotophora* species appear to be related to *Melaloncha*, the aberrant genus *Melittophora* is probably the closest relative. Specimens of *Melittophora salti* have a posteriorly drawn anepisternum (as in *Melaloncha* and most *Phalacrotophora*), but also share with *Melaloncha* a number of character states. Two of these are either unique (posterior seta on fore femur) or rare (irregular rows of enlarged setulae on mid and hind tibia) in the family Phoridae.

Unfortunately, *M. salti* are highly modified flies with limuloid characters: flattened bodies, broad head, loss of frontal setae, short wings. Such characters are common in phorids that live in close association with social insects (e.g. Brown, 1993a). This highly modified body form makes *M. salti* an outgroup of limited value in cladistic analysis.

## PHYLOGENETIC ANALYSIS

To understand the placement of the *Melaloncha* species related to *M. colossia* (below referred to as subgenus *Udamochiras*) and to establish a foundation for revising *Melaloncha*, I conducted a phylogenetic analysis of the genus. I used as outgroups a number of species of *Physoptera*, *Rhyncophoromyia*, and *Phalacrotophora*, as well as *M. salti*. Some of the *Phalacrotophora* species were unidentified, but all are vouchered in the LACM collection (Appendix 1). Within *Melaloncha* I used representative species, based on my observations on all described and approximately 110 undescribed species (see Appendix 1).

### CHARACTER STATES

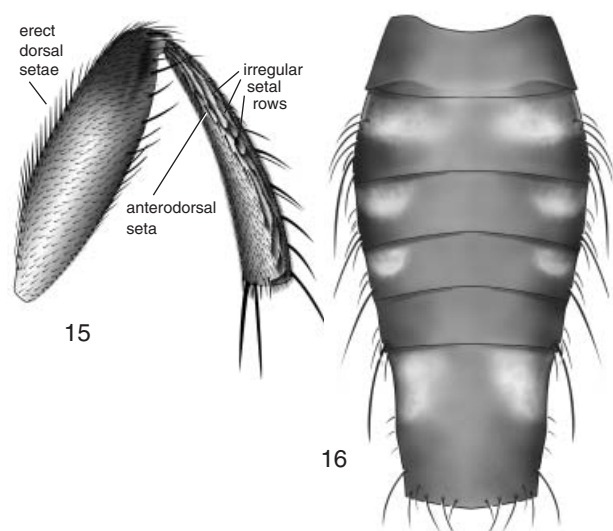
(1) *Posterior portion of anepisternum*: (0) normal, (1) posterodorsally elongate (Figs 6, 7). Most phorids have the posterior margin of the anepisternum vertical in alignment, whereas in *Phalacro-*

*tophora*, *Melittophora* and *Melaloncha* the posterodorsal corner is posteriorly elongate. This character is also found in some other phorid genera.

- (2) *Lateral black, thorn-like process on segment 8* (e.g. Disney & Beuk, 1997; Fig. 9): (0) absent, (1) present. This character defines a group within *Phalacrotophora*, consisting of at least *P. berlinensis* Schmitz, *P. beuki* Disney and *P. quadripunctata* Schmitz.
- (3) *Frontal height*: (0) frons relatively short (frontal ratio [frontal height/frontal width] less than 1.50), (1) frons long (frontal ratio 1.55 or more), (2) frons unusually short (frontal ratio less than 1.0). Frontal ratios for various species are given in Appendix 2. Nearly all 'higher' *Phalacrotophora* (see Fig. 17) have a distinctive, long, narrow frons, with a frontal width of approximately 1.60 or more. One exception, *P. halictorum* (Melander & Brues), at 1.55, is somewhat intermediate.
- (4) *Anepisternum*: (0) bare, (1) setulose, with one or more longer setae.
- (5) *Supra-antennal setae*: (0) two in number, (1) four in number, (2) absent. Species of the outgroup taxa *Physoptera* and *Rhyncophoromyia* generally have two supra-antennal setae.
- (6) *Dorsal interfrontal setae*: (0) similar in size to dorsal fronto-orbital setae (0.88–1.00 length; see Appendix 3, column 3), (1) reduced in size (0.80 or less length), (2) absent. Dorsal interfrontal setae are absent from some *Phalacrotophora*, *Melittophora*, and all *M. (Melaloncha)* species. Within subgenus *Udamochiras* they are absent from the *M. carinata*-group, the *M. colossia*-subgroup and *M. angustifrons*. Their irregular occurrence within *Udamochiras* necessitates at least two gains or losses regardless of whether their presence or absence is considered a groundplan character.
- (7) *Fore tibia*: (0) with weak dorsal row of spines and ventral spurs, (1) with strong dorsal row of spines and strong ventral spurs, (2) without spines or strong spurs.
- (8) *U-shaped sclerite of terminal portion of ovipositor*: (0) small (Fig. 2), (1) enlarged, triangular (Fig. 3), (2) forming a fully integrated stylet (Figs 13, 14).
- (9) *Ventral lobes of apex of ovipositor*: (0) broad (Fig. 3), (1) narrowed (Fig. 5), (2) reduced to thin remnants (Fig. 13).
- (10) *Anterior portion of anepisternum*: small, dorsal furrow lower on pleuron (Fig. 6), (1) enlarged, with dorsal furrow near dorsolateral extremity of pleuron (Fig. 7).
- (11) *Frontal furrow*: (0) present, (1) absent, (2) deep and broad. A frontal furrow is found in most *Pha-*

*lacrotophora* (including primitive species) and some species of *Melaltoncha*, subgenus *Udamochiras*. It is absent from other *Melaltoncha*, *Melittophora*, and some *Phalacrotophora*.

- (12) *Ventral interfrontal setae*: (0) similar in size to other frontal setae, (1) enlarged ( $1.1 \times$  length of ventral fronto-orbital setae or greater). Enlarged ventral interfrontal setae are found in most group 2–4 *Phalacrotophora* and most *Melaltoncha*, except *Udamochiras*. The setation of the ventral part of the frons of *Melittophora* is difficult to interpret. There is one pair of large setae on the lateral margin, near the antennae, but their homology is questionable. For this reason, character 12 is coded unknown (?) for *Melittophora*.
- (13) *Posterodorsal seta on fore femur*: (0) absent, (1) present.
- (14) *Irregular longitudinal rows of enlarged setae on mid and hind tibia*: (0) absent, (1) present (Fig. 15).
- (15) *Flagellomere 1*: (0) round, (1) elongate, apically pointed.
- (16) *Female intersegment 7–8*: (0) membranous, (1) with elongate dorsal sclerite, (2) with 3-pronged process (one dorsal process and two ventrolateral processes; Figs 8, 9).
- (17) *Wing vein  $R_{2+3}$* : (0) present, (1) absent. This wing vein, the presence of which produces a 'forked' apex of the second radial branch, is found in all *Phalacrotophora*, some *Melaltoncha*, subgenus *Udamochiras*, and species of the *Melaltoncha* (*M*) *furcata*-group (see below for definition of this group).
- (18) *Scutellum*: (0) with four setae, (1) with 10 setae.

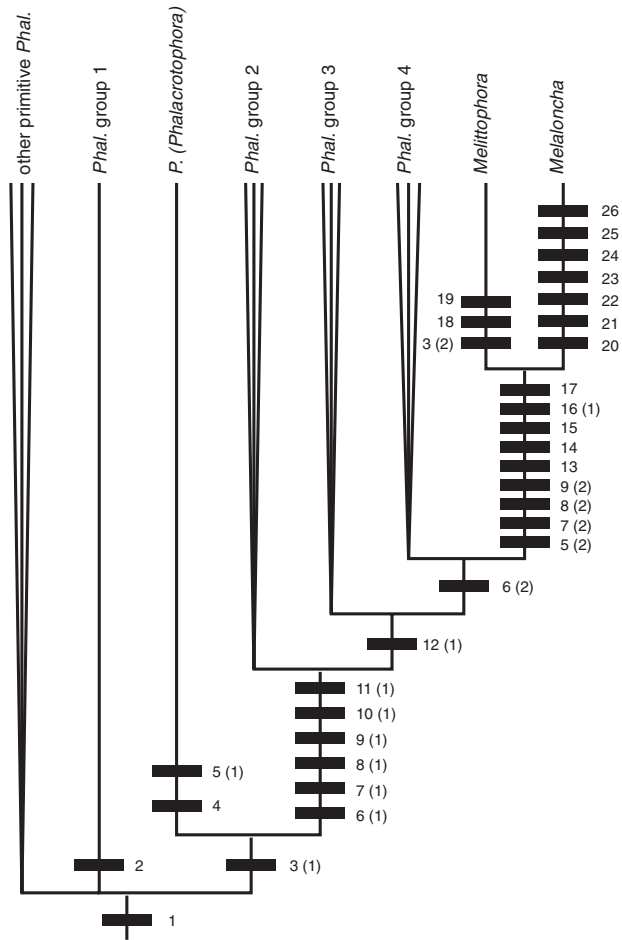


**Figures 15–16.** *Melaltoncha* species. Fig. 15. *M. maculifrons* sp. nov., hind leg, anterior. Fig. 16. *M. angustifrons* sp. nov., abdominal segments 1–6, dorsal.

- (19) *Body*: (0) not flattened, (1) limuloid, dorsoventrally flattened.
- (20) *Erect dorsal setae on hind femur*: (0) absent, (1) present (Fig. 15).
- (21) *Male fore leg*: (0) with usual tarsal claws, (1) lacking tarsal claws.
- (22) *Aedeagus*: (0) relatively short, (1) greatly elongate.
- (23) *Subepandrial plate*: (0) unmodified, (1) with long, posterolateral lobes.
- (24) *Tergite 6*: (0) a flat dorsal plate, (1) extending ventrolaterally on segment.
- (25) *Female abdominal segment 7*: (0) with dorsal tergite (Fig. 1), (1) completely sclerotized (Figs 8, 9).
- (26) *Body with silver pollinosity*: (0) absent, (1) present (Fig. 16).
- (27) *Abdominal tergite 2*: (0) lacking long (longer than tergite) setae, (1) with one long seta, (2) with more than one long seta (Fig. 16).
- (28) *Tarsal claws of mid and hind legs*: (0) unmodified, (1) bifid.
- (29) *Fore tarsal claws*: (0) entire, (1) bifid at tip only, (2) deeply bifid.
- (30) *Anterodorsal rows of setae on hind tibia*: (0) present (Fig. 15), (1) absent.
- (31) *Foretarsal claws*: (0) not thickened internally, (1) thickened internally. Analysis of these character states for exemplar taxa (Appendix 3) with all character states unordered and equally weighted results in one most parsimonious tree (length 45, ci 88, ri 96). The results are plotted in Figures 17, 18.

#### *Relationships within M. Udamochiras*

- (32) *Ovipositor with dorsoapical carina*: (0) absent, (1) present (Figs 31–33).
- (33) *Apex of ovipositor*: (0) rounded, (2) laterally flattened.
- (34) *Dorsal apex of ovipositor*: (0) not strongly differentiated, (1) projecting as lobe-like appendage (Fig. 43).
- (35) *Ovipositor with large ventral setae at apical one-third*: (0) absent, (1) present (Figs 45–47).
- (36) *Hind tarsomere 1*: (0) with small setae in straight rows, (1) with enlarged setae in sinuous rows.
- (37) *Ventral lobe of ovipositor*: (0) unmodified, (1) modified to ventrally directed hooks (Figs 46, 47).
- (38) *Ovipositor at apex*: (0) relatively straight, (1) deflected ventrally (Figs 53–55).
- (39) *Ovipositor at apex*: (0) relatively rounded, (1) dorsoventrally flattened (Figs 53–55).
- (40) *Fore tarsomeres 4 and 5*: (0) yellow, (1) dark brown.
- (41) *Frons colour*: (0) orange to yellow (Fig. 27), (1) black (Fig. 26).
- (42) *Tergite 6 colour*: (0) black, (1) with large, central orange spot.



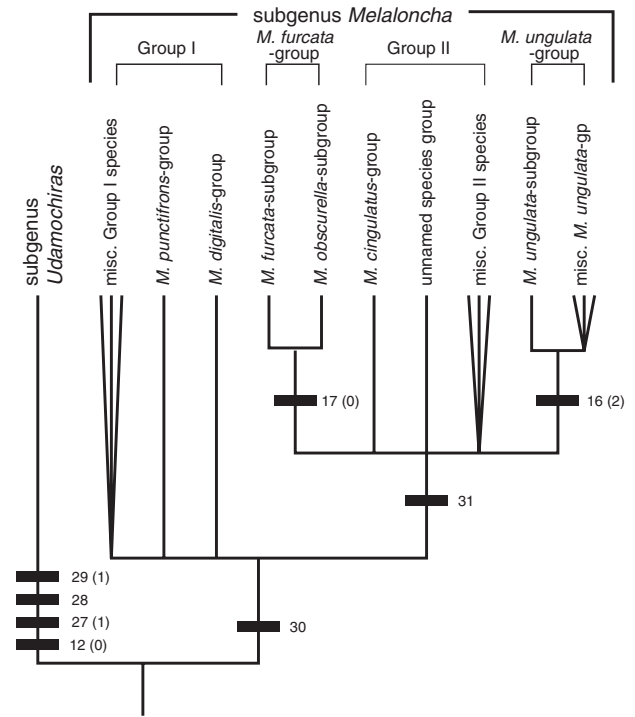
**Figure 17.** Cladogram of phylogenetic relationships among *Phalacrotophora*, *Melittophora* and *Melaloncha*.

(43) *Ovipositor laterally*: (0) relatively rounded, (1) with emargination (Figs 61, 62).

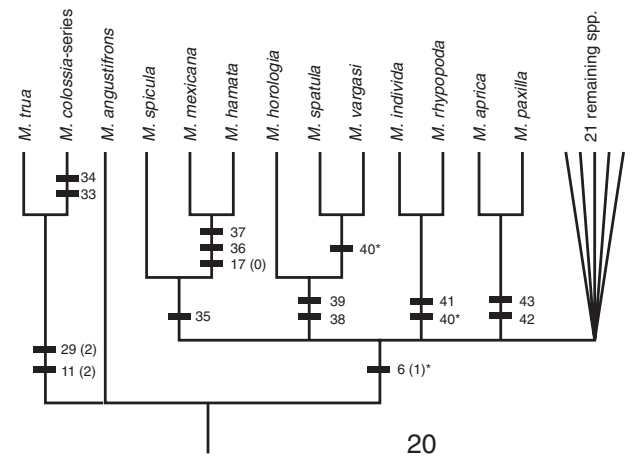
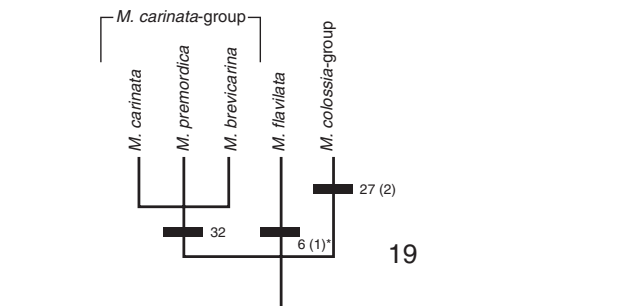
These characters were analysed by hand and plotted on Figures 19, 20. Much further work needs to be done on the phylogeny within this group, a project that is being pursued using molecular characters and techniques (P. Smith, University of California, Bakersfield, and B. Brown, in prep.).

**EVOLUTION OF HOST USE**

Unfortunately, we have limited information on hosts for most species of *Phalacrotophora* (summarized by Disney, 1994). Relatively primitive species are parasitoids of coccinellid beetles, ovipositing in the beetle pupae. Within *P. (Phalacrotophora)* there is one species that parasitizes halictid bees and one that is a spider egg predator. Within *Phalacrotophora* group 2 there is one species known to parasitize nests of sphecoid wasps (Coville & Griswold, 1983, 1984) and there are unsubstantiated records of others associated with



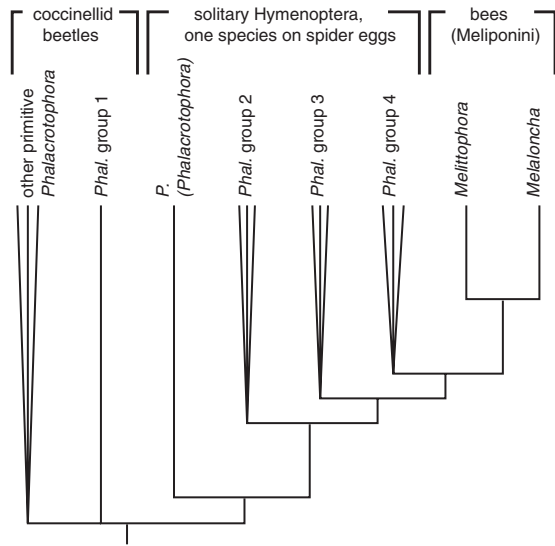
**Figure 18.** Cladogram of phylogenetic relationships within *Melaloncha*.



**Figures 19–20.** Cladograms of phylogenetic relationships within subgenus *Udamochiras*. 19. Basal lineages. 20. *M. colossia*-group.

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**Figure 21.** Life history traits plotted on cladogram of relationships of *Phalacrotophora*, *Melittophora* and *Melaloncha*.

various solitary Hymenoptera. Salt (1929) recorded *Melittophora salti* as a kleptoparasitoid of stingless bees, feeding on pollen in the brood cells. All *Melaloncha* species with known life histories are internal parasitoids of bees, usually meliponines (Apidae: see below). One interesting record is of *M. sinistra* Borgmeier feeding on pollen in the bodies of its hosts before feeding on their tissues (Simões *et al.*, 1980), an intriguingly similar diet to that of *M. salti*.

These data are plotted on the cladogram for the three genera (Fig. 21). Because the outgroup for *Phalacrotophora* + *Melittophora* + *Melaloncha* is unknown, the ancestral host cannot be hypothesized. Obviously, more information is needed on the life history of *Phalacrotophora* species, especially those in groups 3 and 4, before any trends of host use can be firmly established.

#### MELALONCHA BRUES

*Melaloncha* Brues, 1904: 374. Type species *Melaloncha pulchella* Brues, by subsequent designation (Brues, 1906). Holotype (and only known specimen) of *M. pulchella* lost in Hungarian Revolt. Further literature: Brues, 1906: 8, pl. II fig. 13; 1912: 136; 1915: 109; Schmitz, 1927a: 19; 1927b: 147–148; 1929: 144–145; Borgmeier, 1925: 223; 1934: 167–168; 1938: 44–45; 1959: 167–170; 1971: 125–126.

*Melanoloncha* Becker *et al.*, 1907: 176 (unjustified emendation).

*Udamochiras* Enderlein, 1912: 42. Type species: *U. colossia* Enderlein by original designation; 1924: 281. Synonymized by Brues, 1912.

*Most recent key to species.* Borgmeier, 1971: 126–128. Because of the large number of undescribed species (over 100 to date), this key is of limited value.

*Diagnosis.* Frons narrow. Supra-antennal setae absent. Fore femur with posterodorsal seta near apex. Apical tarsomere of fore leg lacking claws in male. Hind femur with erect dorsal setae. Mid and hind tibia with irregular, sinuous rows of enlarged setulae anterodorsally. Tergites and often thorax of most species with silver pollinosity. Female abdominal segment 7 completely sclerotized, forming a parasitic type ovipositor. Intersegment 7–8 modified, with sclerotization of various forms. Posterior segments (9–10) of female abdomen form a sharp, pointed, piercing stylet. Male with subepandrial plate with long, posterolateral lobes; aedeagus extremely elongate.

*Natural history.* Species of *Melaloncha* are endoparasitoids of a variety of bees, but most records are of attacks on stingless bees (Meliponini: Apinae: Apidae; summarized by Disney, 1994). There is one record of a parasitized *Bombus mexicanus* Cresson (Bombinae: Apidae; Ramirez, 1982) but unfortunately the fly specimen has been lost (P. Hanson, University of Costa Rica, pers. comm.).

One species, *M. ronnai* Borgmeier (see species treatment, below), is a well-known parasitoid of introduced honey bees, *Apis mellifera* L. (Apinae, Apidae), but its native host is not known. Other species of *Melaloncha* will occasionally attack honey bees attracted to honey-sprayed undergrowth (B. V. Brown, pers. observ.). A citation of up to eight species of *Melaloncha* reared from honey bees in Costa Rica (Ramírez, 1984) is unsubstantiated; all voucher specimens I received from Dr Ramirez were *M. ronnai*.

A record of a *Melaloncha* species reared from an anthophorid bee (quoted in Roubik, 1989) is unconfirmed, and based on the similarity of the pupae with the described pupae of *M. ronnai* (D. Roubik, pers. comm.). I have been unable to locate these specimens to confirm this record.

A list of potential host-parasitoid records for subgenus *Udamochiras*, including those newly reported in this work, is given in Table 1. Many are based only on circumstantial evidence, the result of collecting the flies attracted to aggregations of bees, often of more than one species. See individual species treatments for discussion of these records.

The flies are often found either around the host nest or at flowers where bees are foraging. Simões *et al.*, 1980) noted that *M. sinistra* Borgmeier were found at the nest entrance of host bees but not at flowers, whereas the reverse was found for *M. ronnai*. Specimens of *Melaloncha* have been collected at the flowers of sweet potato (*Ipomoea batatas* (L.), unidentified male from Nova Teutônia, Brazil, in MZSP collection),

**Table 1.** Potential host-parasitoid records for *Melaloncha*, subgenus *Udamochiras* spp. available in literature and from this paper. Type refers to quality of the record: records based on rearing are superior to observing attacks, which are superior to attraction to aggregations of host bees

Parasite	Host	Type	Reference
<i>M. biseta</i>	<i>Partamona</i> sp.	attraction	new
<i>M. deinocerca</i>	<i>Partamona</i> cf. <i>cupeira</i>	attacking	new
<i>M. deinocerca</i>	<i>Trigona amalthea silvestriana</i>	attraction	new
<i>M. exigua</i>	<i>Trigona hyalinata amazonensis</i>	attraction	new
<i>M. falcata</i>	<i>Trigona amalthea silvestriana</i>	attraction	new
<i>M. horologia</i>	<i>Trigona amalthea amalthea</i>	attraction	new
<i>M. nigricorpus</i>	<i>Partamona</i> sp.	attraction	new
<i>M. rhytopoda</i>	<i>Trigona hyalinata amazonensis</i>	attraction	new
<i>M. ronnai</i>	<i>Apis mellifera</i>	rearing	Ronna (1936, 1937)
<i>M. spatula</i>	<i>Partamona</i> cf. <i>cupeira</i>	attraction	new
<i>M. vargasi</i>	<i>Partamona</i> cf. <i>cupeira</i>	attraction	new
<i>M. vargasi</i>	<i>Trigona amalthea silvestriana</i>	attacking	new
<i>M. (Udamochiras)</i> sp.♂	<i>Cephalotrigona capitata</i>	rearing	new

caboatá (*Cupania vernalis* Cambess.; Ronna, 1937), *Eupatorium* sp. (Asteraceae; see material examined for *M. spatula* sp. nov.), *Phoenix* sp. palm (B. V. Brown, pers. observ.) and *Syagrus coronata* (Mart.) palms (B. V. Brown, pers. observ.).

#### SUBGENUS *MELALONCHA* BRUES STAT. NOV.

*Melaloncha* Brues, 1904: 374. Type species *Melaloncha pulchella* Brues, by subsequent designation (Brues, 1906).

**Diagnosis.** Dorsal interfrontal setae and median frontal furrow absent. Tergites (especially tergite 2) bare or with relatively small setae. Hind tibia lacking anterodorsal rows of enlarged setae. Mid and hind tarsal claws not bifurcate.

**Included taxa.** Subgenus *Melaloncha* includes most of the species of the genus. Some of these can be organized into informal groups, based partly on the analysis of phylogenetically informative characters of higher taxa (Fig. 18), and partly on other characters, discussed below.

**Group I.** These species probably do not form a monophyletic group; rather they are a grade that include *M. (Melaloncha)* species that lack thickened foretarsal claws. Within Group I are the following:

- (i) *M. punctifrons*-group. Includes *M. punctifrons* Borgmeier and one undescribed species. Both have lost the frontal setae, except those of the vertex.
- (ii) *M. digitalis*-group. Containing *M. digitalis* Borgmeier and a few undescribed species, this group is characterized by ventral interfrontal setae that are vertically below the fronto-orbital setae, as well as ovipositors that are dorsally curved and densely setose.

- (iii) Miscellaneous Group I species. This assemblage includes *M. cuspidata* Borgmeier, *M. flava* Borgmeier, *M. plaumanni* Borgmeier, and at least two undescribed species. If Borgmeier (1971) is correct about the type species of the genus, *M. pulchella*, being closely related to *M. plaumanni*, it would also belong here.

**Group II.** This is another probably nonmonophyletic group whose species have thickened claws, but lack the three-pronged process on intersegment 7–8 (thus excluding them from the *M. unguolata*-group) and lack wing vein  $R_{2+3}$  (thus excluding them from the *M. furcata*-group). Within Group II are the following:

- (iv) *M. cingulatus*-group. Besides *M. cingulatus* Borgmeier and possibly *M. lamellata* Borgmeier, contains at least six undescribed species. All have ventral, cercus-like lobes on the ovipositor.
- (v) Unnamed species group. At least three undescribed species belong in this group, united by a distinctive ovipositor structure and a fore tibia with a well developed flange.
- (vi) Miscellaneous Group II species. This assemblage includes *M. clavata* Schmitz, *M. hyalinipennis* Borgmeier, *M. maculata* Borgmeier, *M. palpalis* Borgmeier, *M. sinistra* Borgmeier, *M. striatula* Borgmeier, *M. stylata* (Schiner), and at least 15 undescribed species.

*M. furcata*-group (including *M. furcata*-subgroup + *M. obscurella*-subgroup). Species of both of these subgroups apparently have regained wing vein  $R_{2+3}$  that is otherwise lost in *Melittophora* and most *Melaloncha* (but which is also present in a few *M. (Udamochiras)* species). It is not clear whether the *M. furcata*-subgroup is monophyletic, but it includes at least

*M. furcata* Borgmeier and ten similar species. The *M. obscurella*-subgroup have the frons dark and the base of intersegment 7–8 with rows of minute spinuli; included are *M. obscurella* Borgmeier and at least six undescribed species.

*M. ungulata*-group. This is a probable monophyletic group that is characterized by the presence of a three-pronged process on intersegment 7–8 (Figs 8, 9). It includes:

- (i) *M. ungulata*-subgroup. The females of this group are characterized by the greatly asymmetrical fore tarsal claws, as well as the presence of a large, spine-like seta dorsally near the apex of fore tarsomere 5. There are three described species, *M. glabrifrons* Borgmeier, *M. genitalis* Borgmeier, and *M. ungulata* Borgmeier, and several undescribed species.
- (ii) Miscellaneous *M. ungulata*-group species. Included are *M. nigrifrons* Borgmeier, *M. nigrita* Borgmeier and at least 13 undescribed species.

#### SUBGENUS *UDAMOCHIRAS* ENDERLEIN STAT. NOV.

*Udamochiras* Enderlein, 1912: 42. Type species: *U. colossia* Enderlein, by original description 1924: 281.

**Diagnosis.** Abdominal tergites laterally with large, bristle-like setae as long as tergal length (Fig. 16). Mid and hind leg with anterodorsal row of large setae (Fig. 15). All legs with bifurcate tarsal claws in females.

**Characters shared by most or all species.** See Figure 22 for a habitus photograph of a typical species.

**Head.** Fronto-orbital and interfrontal setal bases surrounded by sulcus that delimits oval setal base (which is also found in at least some *Phalacrotophora* species); setal base in some species coloured differently than rest of frons. Basal one-half of flagellomere 1 white, distally one-half yellow; arista yellow at base, apically black. Palpus yellow with yellow, flattened setae along ventral length and one longer, apicoventral, black seta. Ocular and genal setae flattened, yellow.

**Thorax.** Scutum blackish-brown. Scutellum dark brown with silver pollinosity; with posterior pair of setae much longer than anterior pair. Thoracic pleuron dark brown with silver pollinosity, except katepisternum, which lacks all but posterodorsal pollinosity. Coxae whitish-yellow; fore coxa anteriorly with silver pollinosity. Fore femur and tibia yellowish-brown. Fore tibia with posterodorsal bare region, bounded anteriorly by row of enlarged, widely spaced setae and more anterior, row of larger setae, and posteriorly by row of larger, posterodorsal setae. Mid femur and tibia yellowish-brown; mid tibia with one dorsal setal palisade extending entire length and few anterodorsal,

irregular palisades basally. Mid tibia with anterodorsal row of enlarged setae and posterodorsal row of larger setae that extends to apical one-third of tibia. Mid tarsomeres thin, yellowish-brown, elongate; claws finely bifurcate at apex. Hind femur yellowish-brown with dark brown macula at apex; hind tibia yellowish-brown. Hind tibia with anterodorsal row of enlarged setae extending to mid-length and posterodorsal row of larger setae that extend entire length of tibia and that increase in size posteriorly; with several irregular, anterodorsal setal palisades. Hind tarsomeres thin, yellowish-brown, elongate; claws finely bifurcate at apex. Wing vein  $R_{2+3}$  absent. Halter pale yellow.

**Abdomen.** Abdominal tergites black, with anterior regions of silver pollinosity. Venter of abdomen grey. Stylet as in Figures 13, 14, with ventral processes shorter than dorsal apex.

**Hosts.** The only published host record of a species of *Udamochiras* is that of Ronna, 1936, 1937) who reared *M. ronnai* from honey bees, *Apis mellifera*. In addition to the new records listed in the species treatments below (and summarized in Table 1), I reared a male *Udamochiras* of an unknown species from *Cephalotrigona capitata* (F. Smith) at La Selva Biological Station, Costa Rica, during a study on *Apocephalus* Coquillett (Diptera: Phoridae) parasitoids of stingless bees (Brown, 1997). The bee host was collected alive on 26.iii.1995 and the adult fly emerged 22.iv.1995, giving a minimum of 27 days for the fly's immature stages.

#### *MELALONCHA CARINATA*-GROUP

**Diagnosis.** Ovipositor with dorsomedial carina (Figs 31–33).

**Included species.** *M. brevicarina* sp. nov., *M. carinata* sp. nov., *M. premordica* sp. nov.

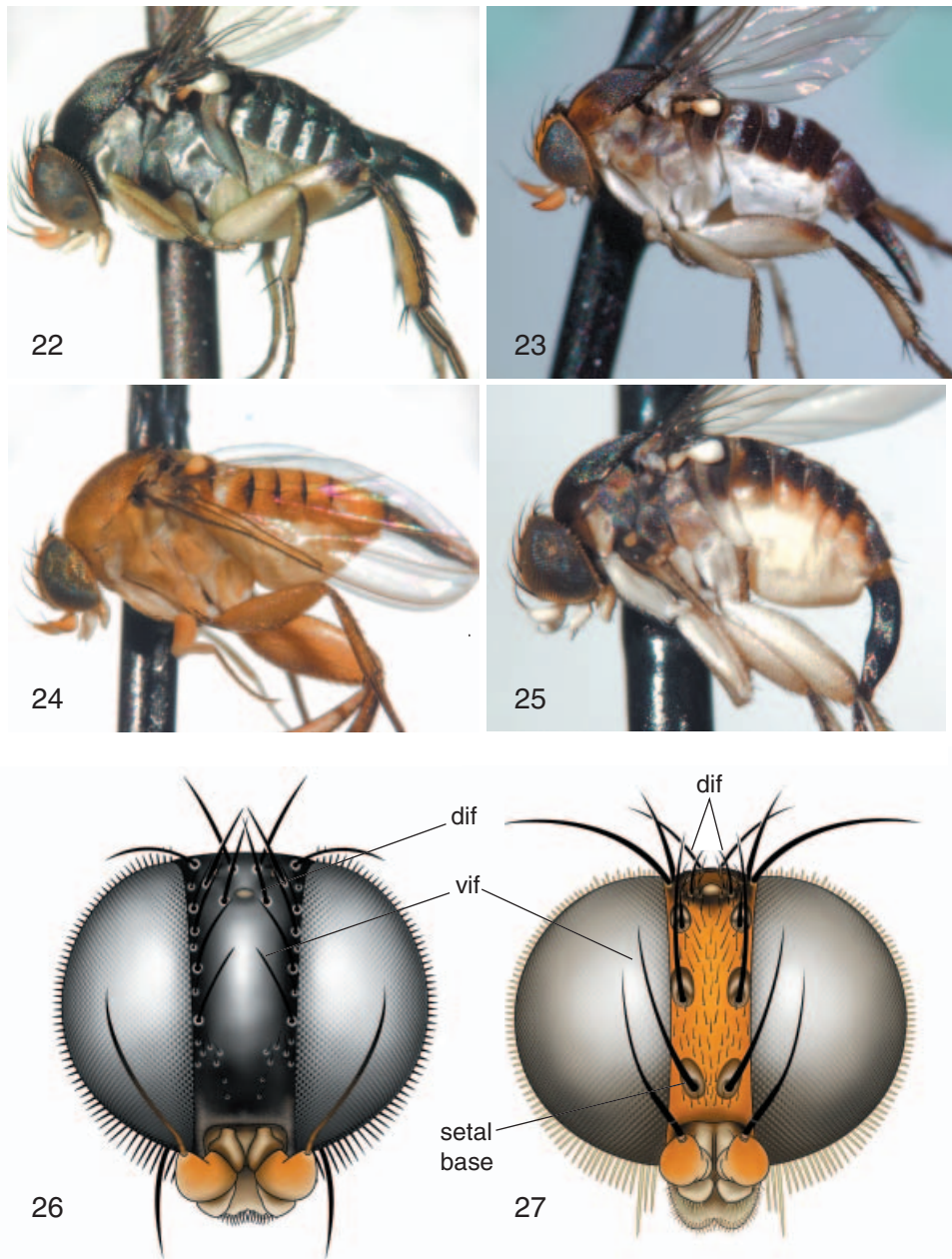
#### *MELALONCHA BREVICARINA* SP. NOV.

(FIGS 23, 28, 31)

**Recognition.** This species is most easily recognized by the brown body colour (Fig. 23), in contrast to the mostly yellow coloration (Fig. 24) of other *M. carinata*-group species.

**Description.** Body length 2.4–2.6 mm. Frons orange, except ocellar triangle black. Setal base of all setae coloured like rest of frons. Mean frontal width 0.4 head width; range 0.39–0.4. Frons with fine reticulate sculpturing, slightly shiny, weakly punctate, with small, pale setulae. Median furrow absent. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae absent. Flagellomere 1 entirely orange. Palpus unmodified. Ocular and genal setae flattened, yellow. Scutum dark brown, except anterolaterally yellowish-brown. Thoracic pleuron



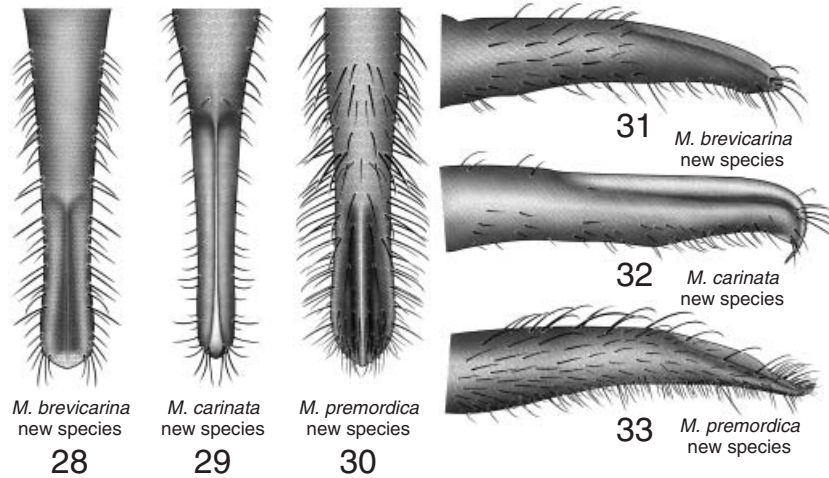


**Figures 22–27.** *M. (Udamochiras)* species. Figs 22–25: Habitus, left lateral. 22. *M. hansonii* sp. nov. 23. *M. brevicarina* sp. nov. 24. *M. carinata* sp. nov. 25. *M. flavilata* sp. nov. Figs 26 & 27: Heads, anterior. 26. *M. deinocerca* Borgmeier. 27. *M. maculifrons* sp. nov. Abbreviations: dif, dorsal interfrontal seta; vif, ventral interfrontal seta.

with anterior portion of anepisternum, dorsum of posterior portion of anepisternum, bottom margin of katepisternum, and round spot on dorsal margin of katepisternum light brown; meron light brown except for dark band on dorsal one-third. Fore tarsomeres yellowish-brown, relatively narrow. Combined length of fore tarsomeres approximately 1.1 tibial length. Fore tarsomere 1 approximately twice as long as tar-

somere 2. Fore tarsomere 5 relatively narrow. Pulvilli of fore leg relatively small. Tarsal claws of all legs small, finely bifurcate at apex. Mid and hind leg yellowish-brown, tarsomeres brown on medial surface. Mean costal length 0.53 wing length; range 0.52–0.54. Abdominal tergites 2–6 dark brown, with small medial and lateroventral orange markings and usual silver pollinosity; with several small and one large





**Figures 28–33.** *M. carinata*-group. Figs 28–30: ovipositors, dorsal. Figs 31–33: ovipositors, left lateral.

seta most evident on tergite 2. Venter of abdomen whitish-yellow. Ovipositor relatively tubular, with dorsomedial carina, relatively straight. In dorsal view, lateral setae of ovipositor large, relatively fine, widely spaced. Ventrally, ovipositor with short, fine, sparse setae. Surface of ovipositor with faint, irregular, reticulate sculpturing.

*Geographical distribution.* Costa Rica.

*Etymology.* Latin adjective, referring to the relatively short carina compared to *M. carinata*.

*Holotype.* ♀, COSTA RICA: San José: Zurquí de Moravia, ix.1991, P. Hanson, Malaise trap, 1600 m [LACM ENT 093434](LACM).

*Paratypes.* COSTA RICA: San José: Zurquí de Moravia, 1♀, iv.1991, 1♀, vi.1992, P. Hanson, Malaise trap, 1600 m (INBC, LACM).

***MELALONCHA CARINATA* SP. NOV.** (FIGS 24, 29, 32)

*Recognition.* In this yellow species the ovipositor is distinctive, with few setae (thus appearing nearly bare) and with the median carina extending completely around the apex of the ovipositor (Fig. 32).

*Description.* Body length 2.7 mm. Frons yellow, except ocellar triangle black. Setal base of all setae coloured like rest of frons. Frons 0.38 head width; with fine reticulate sculpturing, slightly shiny, weakly punctate, with small, pale setulae. Median furrow absent. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae absent. Palpus unmodified. Ocular and genal setae flattened, yellow. Thorax and abdomen almost completely yellow. Fore tarsomeres yellow, relatively narrow. Combined length

of fore tarsomeres approximately 1.2 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 relatively narrow. Pulvilli of fore leg relatively small. Tarsal claws of all legs small, finely bifurcate at apex. Mid and hind leg yellow, except tarsomeres brown on medial surface. Costa 0.53 wing length. Tergites orange-yellow with thin posterior strip of brown; anterolateral corner of tergites 2 and 6 with silver pollinosity. Tergites 2–6 lateroventrally orange-yellow; with several small and one large seta. Venter of abdomen yellow. Ovipositor relatively tubular, with dorsomedial carina, slightly deflected ventrally at apex, with thin, pointed apex of carina curved ventrally. In dorsal view, lateral setae of ovipositor thin, short. Ventrally, ovipositor with short, fine, sparse setae. Surface of ovipositor with faint, irregular, reticulate sculpturing.

*Geographical distribution.* Costa Rica.

*Etymology.* Latin adjective for keeled, referring to the raised median ridge on the ovipositor.

*Holotype.* ♀, COSTA RICA: Puntarenas: 3 km SW Rincon, 8.68°N, 83.48°W, iii.1989, P. Hanson, Malaise trap, 10 m [LACM ENT 048990] (LACM).

***MELALONCHA PREMORDICA* SP. NOV.** (FIGS 30, 33)

*Recognition.* This species differs from the other mostly yellow species, *M. carinata*, by the much more setose ovipositor and the shorter dorsal carina (Fig. 30).

*Description.* (Note: the head is missing from the single known specimen). Body length 2.4 mm (minus head). Thorax and abdomen almost completely dark yellow. Fore tarsomeres yellow, relatively narrow.

Combined length of fore tarsomeres approximately 1.2 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 relatively narrow. Pulvilli of fore leg relatively small. Tarsal claws of all legs small, finely bifurcate at apex. Mid and hind leg yellow, except tarsomeres brown on medial surface. Costa 0.49 wing length. Tergites orange-yellow with posterior brown strip, which comprises about one-half of tergite 6; anterolateral corner of tergites 2 and 6 with silver pollinosity. Tergites 2–6 with several small and one large seta. Venter of abdomen yellow. Ovipositor relatively tubular, with median carina, relatively straight. In dorsal view, lateral setae of ovipositor large, numerous. Ventrally, ovipositor with short, fine, dense setae. Surface of ovipositor with faint, irregular, reticulate sculpturing.

*Geographical distribution.* South-eastern Brazil.

*Etymology.* Latin adjective, loosely meaning biting off in front, referring to the shortened dorsal carina of the ovipositor.

*Holotype.* ♀, BRAZIL: Nova Teutônia, 27.18°S, 52.38°W, iii.1972, F. Plaumann, 300–500 m [LACM ENT 122441](MZSP).

#### OTHER PRIMITIVE-GRADE *M. UDAMOCHIRAS* SPECIES

#### ***MELALONCHA FLAVILATA* SP. NOV.** (FIGS 25, 34, 38)

*Recognition.* The yellow lateral colour of the tergites (Fig. 25), together with the narrow, ventrally curved form of the ovipositor (Fig. 38), is distinctive for this species.

*Description.* Body length 2–2.3 mm. Frons orange, except ocellar triangle black. Setal base of all setae coloured like rest of frons. Mean frontal width 0.26 head width; range 0.26–0.26. Frons with fine reticulate sculpturing, slightly shiny, punctate, with small, pale setulae. Median furrow absent. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.8 length of postocellar setae, level with ventral ocellus. Flagellomere 1 completely white. Palpus white, otherwise unmodified. Ocular and genal setae flattened, yellow. Thoracic pleuron with anterior portion of anepisternum, dorsum of posterior portion of anepisternum, bottom margin of katapisternum, and round spot on dorsal margin of katapisternum light brown; meron light brown except for dark band on dorsal one-third. Fore tarsomeres yellowish-brown, relatively narrow. Combined length of fore tarsomeres approximately 0.9 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 relatively narrow. Pulvilli of fore leg relatively small. Tarsal claws of

all legs small, finely bifurcate at apex. Mid and hind leg yellowish-brown. Mean costal length 0.55 wing length; range 0.54–0.55. Tergite 6 with anterior three-fifths of dorsum orange with silver pollinosity. Tergites 2–6 dark brown, lateroventrally orange. Venter of abdomen yellow. Ovipositor relatively tubular, apically truncate, dorsoventrally flattened at apex, slightly curved ventrally. In dorsal view, lateral setae of ovipositor thin, short. Ventrally, ovipositor with short, fine, sparse setae. Surface of ovipositor with faint, irregular, reticulate sculpturing.

*Geographical distribution.* Amazonian Colombia.

*Etymology.* Latin adjective for yellow flank, referring to the colour of the lateral side of the abdominal tergites.

*Holotype.* ♀, COLOMBIA: Amazonas: Amacayacu National Park, 3.82°S, 70.26°W, 8–12.iii.2000, B. Brown, G. Kung, M. Sharkey, Malaise trap #8 [LACM ENT 128010] (UNCB).

*Paratype.* COLOMBIA: Amazonas: Amacayacu National Park, 3.82°S, 70.26°W, 1♀, 8–12.iii.2000, M. Sharkey, total sweep sample (LACM).

#### *M. COLOSSIA*-GROUP

*Diagnosis.* Abdominal tergite 2 laterally with two or more large setae that are as long or longer than tergal length; tergites 3–5 with one or more long setae.

#### *M. COLOSSIA*-SUBGROUP

*Diagnosis.* Frons with deeply impressed, broad median furrow. Dorsal interfrontal setae absent. Fore tarsal claws deeply bifurcate.

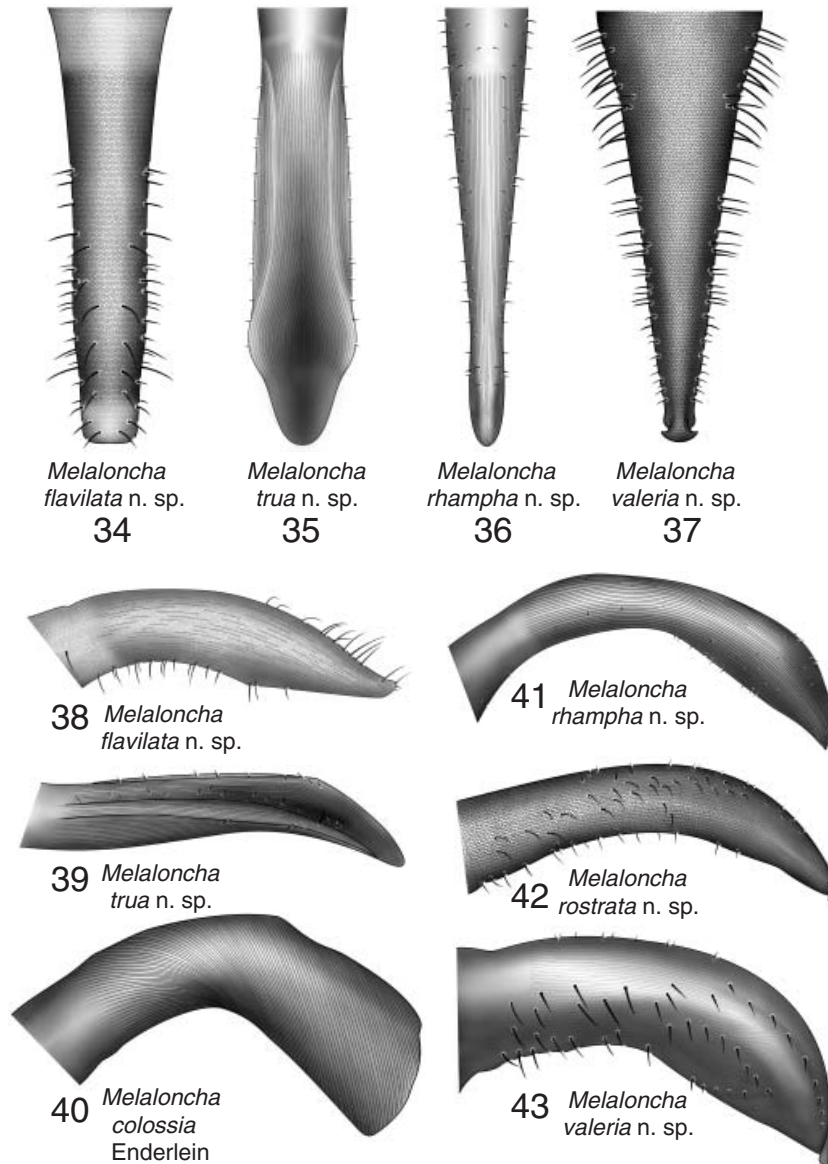
*Included species.* I tentatively assign to this subgroup *M. trua* sp. nov. and the species of the *M. colossia*-series (below). The ovipositor of *M. trua* is extremely unusual within the subgenus, and its relationships are difficult to interpret. It is one of the few species sharing the *M. colossia*-subgroup characters, however.

#### ***MELALONCHA TRUA* SP. NOV.**

(FIGS 12–14, 35, 39)

*Recognition.* This species has an extremely distinctive ovipositor, which is dorsoventrally flattened and dorsally concave (Figs 35, 39).

*Description.* Body length 3.2–3.4 mm. Frons orange, except vertex and ocellar region, which are black. Setal base of all setae coloured like rest of frons. Mean frontal width 0.28 head width; range 0.26–0.3. Frons with fine reticulate sculpturing, slightly shiny, slightly punctate (punctures shallow, nearly invis-



**Figures 34–43.** *Melaloncha* spp., ovipositors. Figs 34–37: dorsal. Figs 38–43: left lateral.

ble), with extremely small dark setulae. Median furrow present. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae absent. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, slightly expanded. Combined length of fore tarsomeres approximately 0.8 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 expanded. Pulvilli of fore leg large. Tarsal claws of all legs enlarged, deeply bifurcate. Mid and hind leg yellowish-brown, with tarsomeres 4–5 and apex of tarsomere 3 of mid leg dark brown dorsally. Mean costal length 0.58 wing length; range

0.57–0.58. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor elongate, dorsoventrally flattened at apex, apically expanded and concave, relatively straight. In dorsal view, lateral setae of ovipositor minute, sparse. Ventrally, ovipositor with minute, sparse setae. Surface of ovipositor with fine longitudinal striae. Intersegment 7–8 apically truncate, with expanded lateral apices (Fig. 12).

*Geographical distribution.* Costa Rica.

*Etymology.* Latin noun for stirring spoon, referring to the shape of the ovipositor.



*Holotype*. ♀, COSTA RICA: Alajuela: 20 km S Upala, 30.x.1990, F. D. Parker [Malaise trap] [LACM ENT 020606] (LACM).

*Paratypes*. COSTA RICA: Alajuela: 20 km S Upala, 1♀, 16.x.1990, 2♀, 30.xii.1990, 1♀, 6.i.1991, 1♀, 22.i.1991, 1♀, 31.i.1991, 1♀, 21–31.viii.1991, F. D. Parker [Malaise trap] (EMUS, LACM); Guanacaste: 9 km S Santa Cecilia, Estación Pitilla, iii.1990, P.Rios, C.Moraga, R. Blanco, 700 m, 330200–380200 (INBC).

#### M. COLOSSIA-SERIES

*Diagnosis*. Ovipositor laterally compressed near apex. Dorsal apex of ovipositor with rounded, lobe-like projection (Fig. 43).

*Included species*. This group includes *M. colossia* (Enderlein), *M. rhampha* sp. nov., *M. rostrata* sp. nov. and *M. valeria* sp. nov.. Both *M. colossia* and *M. rhampha* have longitudinal striations on the ovipositor, and might be considered close relatives, but such striations are also found in *M. trua*.

The structure of intersegment 7–8 of two species, *M. colossia* and *M. rostrata* were examined, and both were found to be deflected ventrally at the apex. More specimens of *M. rhampha* and *M. valeria* is needed to determine if this is a character of all species in the *M. colossia*-series.

#### MELALONCHA COLOSSIA (ENDERLEIN) (FIG. 40)

*Udamochiras colossia* Enderlein, 1912: 42–43, fig. 2; 1924: 281.

*Melaloncha colossia*: Brues, 1912; p. 136. Schmitz, 1923: 51; in Borgmeier, 1924: 18; Schmitz 1927b: 148, 164; 1929: 145–146. Borgmeier, 1925: 223–224; 1934: 182, fig. 2, plate 3, fig. 12; 1959: 172–174, figs 68, 70.

*Holotype*. ♂, BRAZIL: Santa Catarina, Lüderwaldt [LACM ENT 133711] (examined; Polish Academy of Sciences, Warszawa, Poland).

*Recognition*. This species is easily recognized by the apically deepened ovipositor and longitudinal striations of the ovipositor (Fig. 40). Females were associated with the male holotype on the basis of a series of both sexes from Nova Teutônia (Borgmeier, 1959: 174). The holotype is larger than the other males, and Borgmeier attributed this difference to the holotype being ‘an unusually large example’ of the species. He cited other similarities between the females and the holotype, namely the lack of dorsal interfrontal setae, the deeply impressed median furrow and the characteristic wing venation. Some question still remains, however, whether the Nova Teutônia specimens (and thus all females) are conspecific with the holotype.

*Description*. (Female; male holotype described by Schmitz, 1927b: 148, 164; 1929: 145–146). Body length 2.5–3.3 mm. Frons orange, except ocellar triangle black. Setal base of all setae coloured like rest of frons. Mean frontal width 0.28 head width; range 0.27–0.3. Frons glossy, shiny, with small punctures and small, black setulae restricted to lateral one-third. Median furrow present. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae absent. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, except tarsomere 5 dark brown. Fore tarsomeres slightly expanded. Combined length of fore tarsomeres approximately 0.7 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 expanded. Pulvilli of fore leg large. Tarsal claws of all legs enlarged, deeply bifurcate. Mid and hind leg yellowish-brown, with tarsomeres 4–5 and apex of tarsomere 3 of mid leg dark brown dorsally. Mean costal length 0.55 wing length; range 0.54–0.55. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor laterally compressed, deepening greatly near apex, strongly curved ventrally. In dorsal view, lateral setae of ovipositor minute, sparse. Ventrally, ovipositor with minute, sparse setae. Surface of ovipositor with fine, slightly transverse, striae. Intersegment 7–8 narrow, deflected ventrally at posterior apex.

*Geographical distribution*. South-eastern Brazil.

*Other material examined*. BRAZIL: Santa Catarina: Nova Teutônia, 27.18°S, 52.38°W, 2♀, [no date], 1♀, i.1937, 1♀, iv.1947, 1♀, 29.iv.1948, F. Plaumann (AMNH, MZSP, USNM).

#### MELALONCHA RHAMPHA SP. NOV. (FIGS 36, 41)

*Recognition*. The ovipositor of this species is most similar to that of *M. valeria* sp. nov., but differs by being much more slender and having distinctive, longitudinal striations.

*Description*. Body length 3 mm. Frons orange, except ocellar triangle black. Setal base of all setae coloured like rest of frons. Frons 0.28 head width; with fine reticulate sculpturing, slightly shiny, slightly punctate (punctures shallow, nearly invisible), with small dark setulae. Median furrow present. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae absent. Palpus lacking apical black seta, probably because of damage to specimen. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, relatively narrow. Combined length of fore



tarsomeres approximately 0.8 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 slightly expanded. Pulvilli of fore leg large. Tarsal claws of all legs enlarged, deeply bifurcate. Mid and hind leg yellowish-brown, with tarsomeres 4–5 and apex of tarsomere 3 of mid leg dark brown dorsally. Costa 0.59 wing length. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally dark brown to black, with silver pollinosity. Venter of abdomen grey. Ovipositor relatively tubular in shape, apically narrowed and laterally compressed, strongly curved ventrally. In dorsal view, lateral setae of ovipositor minute, sparse. Ventrally, ovipositor with minute, sparse setae. Surface of ovipositor with fine longitudinal striae.

*Geographical distribution.* Costa Rica.

*Etymology.* Greek noun *rhamphē* for a curved knife, referring to the shape of the ovipositor.

*Holotype.* ♀, COSTA RICA: Heredia: La Selva Biological Station, 10.43°N, 84.02°W, 1.vi.1993, ALAS, Malaise trap M/01/108 [INBIOCRI002274109] (INBC).

#### ***MELALONCHA ROSTRATA* SP. NOV. (FIG. 42)**

*Recognition.* This species is similar to *M. rhampha*, but differs in that the ovipositor does not increase in depth apically and the surface of the ovipositor is not markedly striate (Fig. 42).

*Description.* Body length 3.1–3.4 mm. Frons orange, except vertex and ocellar region, which are black. Setal base of all setae coloured like rest of frons. Mean frontal width 0.27 head width; range 0.26–0.29. Frons with fine reticulate sculpturing, slightly shiny, slightly punctate (punctures shallow, nearly invisible), with extremely small dark setulae. Median furrow present. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae absent. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, relatively narrow. Combined length of fore tarsomeres approximately 0.8 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 slightly expanded. Pulvilli of fore leg large. Tarsal claws of all legs enlarged, deeply bifurcate. Mid and hind leg yellowish-brown, with tarsomeres 4–5 and apex of tarsomere 3 of mid leg dark brown dorsally. Mean costal length 0.59 wing length; range 0.58–0.61. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor relatively tubular, laterally compressed near apex; dorsal apex with small, rounded flap, curved ventrally in apical one-third. In dorsal view, lateral setae of ovipositor thin, short, relatively

numerous. Ventrally, ovipositor with short, fine, sparse setae. Surface of ovipositor with faint, somewhat longitudinally directed sculpturing. Intersegment 7–8 narrow, slightly deflected ventrally at posterior apex.

*Geographical distribution.* Costa Rica.

*Etymology.* Latin adjective *rostratus* for beaked, referring to the shape of the ovipositor.

*Holotype.* ♀, COSTA RICA: Heredia: La Selva Biological Station, 10.43°N, 84.02°W, ix.1992, P. Hanson, Malaise trap [LACM ENT 093446] (LACM).

*Paratypes.* COSTA RICA: Alajuela: 20 km S Upala, 1♀, 8–10.v.1990, 1♀, 10.i.1991, 1♀, 22.i.1991, 1♀, 11–20.iv.1991, 16–17.vi.1991, 1♀, 24.vi–22.vii.1991, 2♀, 22–30.ix.1991, F. D. Parker [Malaise trap] (EMUS, INBC, LACM); Guanacaste: 3 km SE Naranjo, 1♀, 21–31.x.1992, 1♀, 1.ii.1993, F. D. Parker [Malaise trap] (LACM).

#### ***MELALONCHA VALERIA* SP. NOV. (FIGS 37, 43)**

*Recognition.* This species is distinctive for its ovipositor that is deep throughout its length and noticeably thick at the base (Fig. 43).

*Description.* Body length 3.1–3.6 mm. Frons orange, except ocellar triangle black. Setal base of all setae coloured like rest of frons. Mean frontal width 0.26 head width; range 0.24–0.26. Frons with fine reticulate sculpturing, slightly shiny, punctate, with small, black setulae. Median furrow present. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae absent. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, relatively narrow. Combined length of fore tarsomeres approximately 0.7 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 slightly expanded. Pulvilli of fore leg large. Tarsal claws of all legs enlarged, deeply bifurcate. Mid and hind leg yellowish-brown, with tarsomeres 4–5 and apex of tarsomere 3 of mid leg dark brown dorsally. Mean costal length 0.6 wing length; range 0.57–0.61. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor relatively short and deep, laterally compressed in apical one-half, apically pointed, slightly curved ventrally. In dorsal view, lateral setae of ovipositor thin, short. Ventrally, ovipositor with short, fine, sparse setae. Surface of ovipositor with faint, irregular, reticulate sculpturing.

*Geographical distribution.* Costa Rica.

*Etymology.* Latin noun for a type of eagle (Brown, 1956), referring to the shape of the ovipositor in lateral view, which resembles the beak of a powerful bird of prey.

*Holotype.* ♀, COSTA RICA: Puntarenas: 3 km SW Rincon, 8.68°N, 83.48°W, xi.1991, P. Hanson, Malaise trap, 10 m [LACM ENT 101528](LACM).

*Paratypes.* COSTA RICA: Alajuela: 20 km S Upala, 1♀, 8–10.v.1990, 1♀, 1.viii.1990, 3♀, 28–30.viii.1990, 1♀, 10.i.1991, F. D. Parker, [Malaise trap] (EMUS, INBC, LACM).

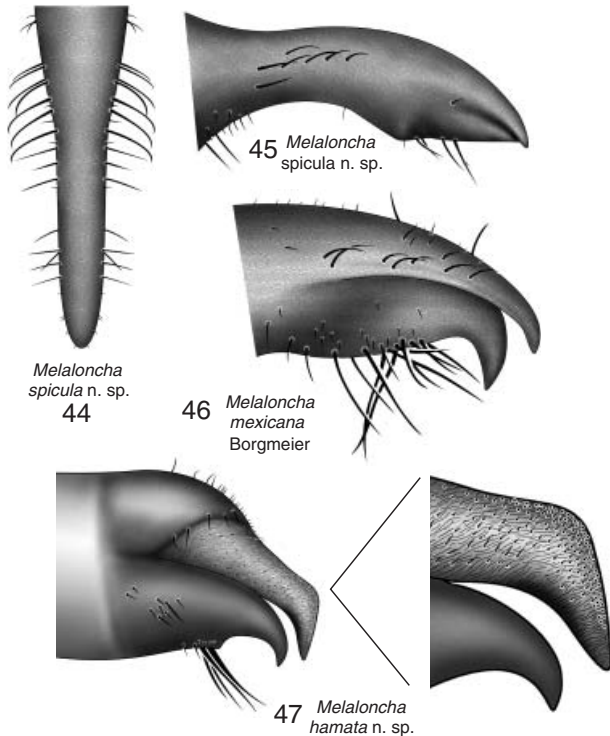
#### M. MEXICANA-SUBGROUP

*Diagnosis.* Ovipositor with large ventral setae at apical one-third (Figs 45–47).

*Included species.* This group includes *M. spicula* sp. nov., *M. mexicana* Borgmeier and *M. hamata* sp. nov. The latter two species are closely related and are placed in the *M. mexicana*-series (below). All specimens were collected from Mexico to northern Costa Rica, near the northern range of the genus.

#### MELALONCHA SPICULA SP. NOV. (FIGS 44, 45)

*Recognition.* This species can be recognized by the apically pointed ovipositor that has a ventral swelling



**Figures 44–47.** *M. mexicana*-subgroup, ovipositors. Fig. 44, dorsal. Figs 45–47, left lateral. 47, right inset, details of ovipositor apex.

and several large setae at the apical one-third (Fig. 45).

*Description.* Body length 2.5–2.8 mm. Frons orange, except vertex and ocellar region, which are black. Setal base of all setae coloured like rest of frons. Mean frontal width 0.22 head width; range 0.22–0.22. Frons with fine reticulate sculpturing, not shiny, punctate, with small, black setulae. Median furrow faint, but present. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.4 length of postocellar setae, level with ventral ocellus. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, relatively narrow. Combined length of fore tarsomeres approximately 0.8 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 slightly expanded. Pulvilli of fore leg large. Tarsal claws of all legs small, finely bifurcate at apex. Mid and hind leg yellowish-brown. Mean costal length 0.53 wing length; range 0.53–0.53. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor relatively tubular in shape, apically narrowed, with large ventral expansion at apical one-third, slightly curved ventrally. In dorsal view, lateral setae of ovipositor arranged in basal group of thick setae and more apical group of thin setae. Ventrally, ovipositor with basal and apical group of long, thick setae. Surface of ovipositor with faint, irregular, reticulate sculpturing.

*Geographical distribution.* Mexico.

*Etymology.* Latin noun for point, referring to the pointed apex of the ovipositor in lateral view.

*Holotype.* ♀, MEXICO: Chiapas: Yerba Buena, 8.vi.1969, W. Mason, Malaise trap, 1980 m [LACM ENT 004006] (LACM).

*Paratypes.* MEXICO: Puebla: 5 mi NE Texuitlan, 1♀, 27.vi.1958, University of Kansas Mexico Expedition, 4700 ft (KSEM).

#### MELALONCHA MEXICANA-SERIES

*Diagnosis.* Wing vein  $R_{2+3}$  present. Hind tarsomere 1 with anterior and anteroventral rows of setulae enlarged, sinuous. Ventral lobe of ovipositor apically modified to ventrally pointed hook.

*Included species.* *M. mexicana* and *M. hamata*.

#### MELALONCHA MEXICANA BORGMEIER (FIG. 46)

*Melaloncha mexicana* Borgmeier, 1971: 131–132, figs 169–171.

*Holotype*: ♀, MEXICO: Nayarit: 8 miles NW Acaponeta, 25.xi.1948, H. B. Leech (examined; MZSP).

*Recognition*. This species differs from *M. hamata*, the only other species with ventral hooks, by the more smoothly ventrally curved dorsal lobe of the ovipositor and by the more scattered ventral setae of the ovipositor (Fig. 46).

*Description*. Body length 3.3 mm. Frons orange, except ocellar triangle black. Setal base of all setae coloured like rest of frons. Mean frontal width 0.26 head width. Frons with fine reticulate sculpturing, slightly shiny, slightly punctate (punctures shallow, nearly invisible), with small dark setulae. Median furrow present. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.4 length of postocellar setae, approximately one-half distance between level of ventral ocellus and dorsal fronto-orbital setae. Palpus with two apical, medium-sized black setae in addition to usual short yellow setae. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, slightly expanded. Combined length of fore tarsomeres approximately 0.7 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 slightly expanded. Pulvilli of fore leg large. Tarsal claws of all legs finely bifurcate at apex. Mid and hind leg yellowish-brown. Mean costal length 0.53 wing length. Wing vein  $R_{2+3}$  present. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor slightly dorsoventrally flattened; consisting of lightly sclerotized, longer dorsal lobe that curves ventrally at apex and ventral pair of heavily sclerotized, ventrally curved hooks, slightly deflected ventrally at apex. In dorsal view, lateral setae of ovipositor long, thin, sparse. Ventrally, ovipositor with group of three large setae near mid length on each side. Surface of ovipositor with faint, irregular, reticulate sculpturing (hooks glabrous). Intersegment 7–8 similar to that of *M. simillima* (Fig. 10).

*Geographical distribution*. Mexico.

#### ***MELALONCHA HAMATA* SP. NOV. (FIG. 47)**

*Recognition*. This species differs from the similar *M. mexicana* by the abruptly ventrally curved dorsal apex of the ovipositor, and by the ventral setae of the ovipositor, which are grouped tightly together (Fig. 47).

*Description*. Body length 3.0 mm. Frons orange, except ocellar triangle black. Setal base of all setae coloured like rest of frons. Frons 0.31 head width; with fine reticulate sculpturing, slightly shiny, slightly punctate (punctures shallow, nearly invisible), with small dark setulae. Median furrow present. Frontal

setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.7 length of postocellar setae, approximately one-half distance between level of ventral ocellus and dorsal fronto-orbital setae. Palpus with two apical, medium-sized black setae in addition to usual short yellow setae. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, expanded, short. Combined length of fore tarsomeres approximately 0.7 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 expanded. Pulvilli of fore leg large. Tarsal claws of all legs enlarged, deeply bifurcate. Mid and hind leg yellowish-brown. Costa 0.59 wing length. Wing vein  $R_{2+3}$  present. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor slightly dorsoventrally flattened; consisting of lightly sclerotized, longer dorsal lobe that curves ventrally at apex and ventral pair of heavily sclerotized, ventrally curved hooks, slightly deflected ventrally at apex. In dorsal view, lateral setae of ovipositor long, thin, sparse. Ventrally, ovipositor with group of three large setae near mid length on each side. Surface of ovipositor with faint, irregular, reticulate sculpturing (hooks glabrous). Intersegment 7–8 similar to that of *M. simillima* (Fig. 10).

*Geographical distribution*. Costa Rica.

*Etymology*. Latin adjective for ‘with hooks’, referring to the apex of the ovipositor.

*Holotype*. ♀, COSTA RICA: Guanacaste: Estación Cacao, ix.1989, R. Blanco, C. Chaves, 1000–1400 m [INBIOCRI000027229] (INBC).

#### ***MELALONCHA SPATULA*-SUBGROUP**

*Diagnosis*. Apex of ovipositor strongly deflected ventrally and dorsoventrally flattened (Figs 53–55).

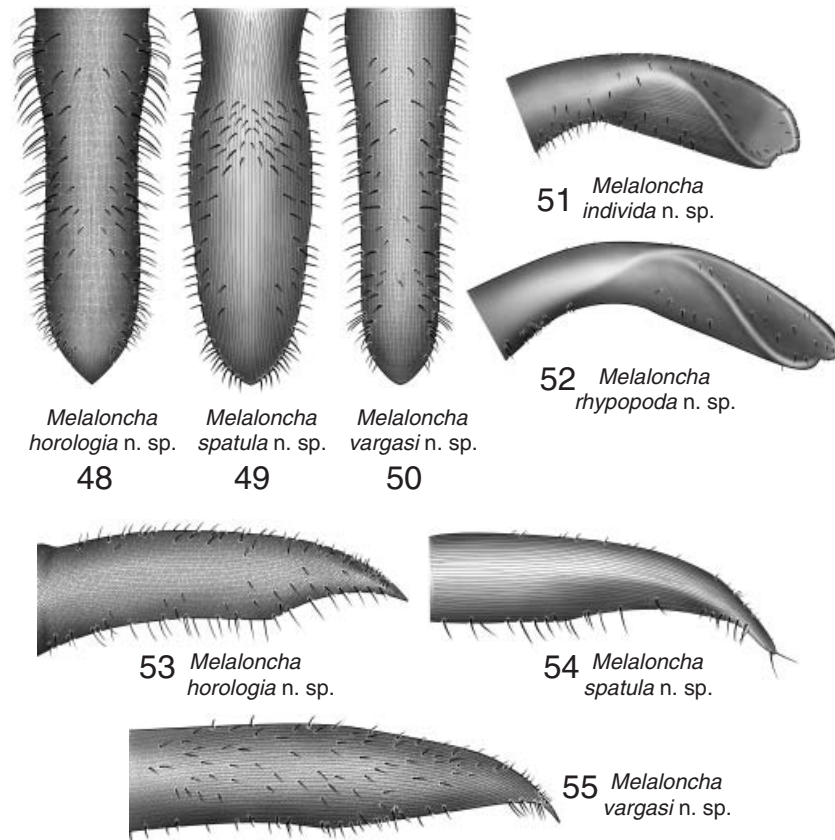
*Included species*. This group includes *M. horologica* sp. nov., *M. spatula* sp. nov. and *M. vargasi* sp. nov. The last two species are more closely related and form a separate group, the *M. spatula*-series (below).

#### ***MELALONCHA HOROLOGIA* SP. NOV. (FIGS 48, 53)**

*Recognition*. The ovipositor of this species is similar to that of *M. vargasi*, but in dorsal view is slightly hour-glass-shaped and less parallel-sided in appearance (Fig. 48).

*Description*. Body length 2.9–3.1 mm. Frons orange, except ocellar triangle black. Setal base of all setae coloured like rest of frons. Mean frontal width 0.32 head width; range 0.31–0.32. Frons with fine reticu-





**Figures 48–55.** *Melaloncha* spp., ovipositors. Figs 48–50: dorsal. Figs 51–55: left lateral.

late sculpturing, slightly shiny, weakly punctate, with small, black setulae. Median furrow faint, but present. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.8 length of postocellar setae, slightly ventral to level of ventral ocellus. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, expanded, short. Combined length of fore tarsomeres approximately 0.7 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2, slightly expanded. Pulvilli of fore leg large. Tarsal claws of all legs enlarged, deeply bifurcate. Mid and hind leg yellow, except tarsomeres brown on medial surface. Mean costal length 0.55 wing length; range 0.54–0.55. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor elongate, slightly narrowed at mid-length, apically pointed, slightly deflected ventrally at apex. In dorsal view, lateral setae of ovipositor thin, short, relatively numerous. Ventrally, ovipositor with short, fine, sparse setae. Surface of ovipositor with faint, irregular, reticulate sculpturing.

*Host.* The holotype was collected at an aggregation of several species of stingless bees attracted to sprayed honey on undergrowth. The most likely host species, based on having sufficient size to allow development of this fly, in this aggregation was *Trigona amalthea* (Olivier). The fly was feeding on honey on the undergrowth leaves.

*Geographical distribution.* Bolivia and Ecuador.

*Etymology.* Latin noun for hourglass, referring to the shape of the ovipositor in dorsal view.

*Holotype.* ♀, BOLIVIA: La Paz: San Juanito, near Teoponte, 15.49°S, 67.80°W, 8.iv.2001, B. Brown, G. Kung, honey-sprayed leaves [LACM ENT 128413] (CBFC).

*Paratypes.* ECUADOR: Napo: Yasuni Research Station, 1♀, 19–30.x.1998, W. J. Hanson, 250 m (EMUS).

#### MELALONCHA SPATULA-SERIES

*Diagnosis.* Tarsomeres 4 and 5 of foreleg dark brown.

*Species included.* *M. spatula* and *M. vargasi*.



**MELALONCHA SPATULA SP. NOV.** (FIGS 49, 54)

*Recognition.* In dorsal view, the ovipositor of this species is broader at midlength than that of the similar *M. vargasi*, which is more parallel-sided.

*Description.* Body length 2–2.3 mm. Frons orange, except ocellar triangle black. Setal base of all setae either orange or black. Mean frontal width 0.32 head width; range 0.31–0.35. Frons with fine reticulate sculpturing, slightly shiny, punctate, with small, pale setulae. Median furrow faint, but present. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.7 length of postocellar setae, approximately 0.4 distance from ventral ocellus to dorsal fronto-orbital setae. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, except tarsomeres 4 and 5 dark brown, tarsomeres relatively narrow. Combined length of fore tarsomeres approximately 0.8 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 relatively narrow. Pulvilli of fore leg large. Tarsal claws of all legs enlarged, deeply bifurcate. Mid and hind leg yellowish-brown, with tarsomeres 4–5 and apex of tarsomere 3 of mid leg dark brown dorsally. Mean costal length 0.52 wing length; range 0.51–0.54. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor relatively tubular in shape, broader on apical one-half, strongly dorsoventrally flattened at apex, slightly deflected ventrally at apex. In dorsal view, lateral setae of ovipositor thin, short, relatively numerous. Ventrally, ovipositor with short, fine, sparse setae. Surface of ovipositor with faint, somewhat longitudinally directed sculpturing.

*Variation.* Setal bases on various specimens are either all black or all orange.

*Host.* The holotype was collected at an aggregation of bees, dominated by the most likely host *Partamona cf. cupeira* Smith (*sensu* Roubik, 1992). Also present were much smaller *Plebia* spp. and *Apis mellifera*.

*Geographical distribution.* Mexico to Panama.

*Etymology.* Latin noun for small spatula, referring to the shape of the apex of the ovipositor.

*Holotype.* ♀, COSTA RICA: Puntarenas: 5.5 km SW Rincon, TYC, 8.70°N, 83.51°W, 10.viii.2001, B. Brown, V. Berezovskiy, E. Zumbado, honey-sprayed leaves [LACM ENT 105068](INBC).

*Paratypes.* COSTA RICA: Alajuela: 20 km S Upala, Bijagua, 1♀, 23.x.1990, 1♀, 8.xi.1990, 1♀, 11–20.iv.1991, F. D. Parker, Malaise trap (EMUS, LACM). MEXICO: Chiapas: 10.ix.1974, G. Bohart, W. Hanson,

Malaise trap (LACM). PANAMA: Panama: Cerro Campana, 8.i.1981, C. D. Michener, on white *Eupatorium* (KSEM).

**MELALONCHA VARGASI SP. NOV.** (FIGS 50, 55)

*Recognition.* This species differs most notably from the similar *M. spatula* by the parallel-sided ovipositor in dorsal view.

*Description.* Body length 2.5–2.9 mm. Frons orange, except vertex and ocellar region, which are black. Setal base of all setae coloured like rest of frons. Mean frontal width 0.3 head width; range 0.28–0.31. Frons with fine reticulate sculpturing, slightly shiny, punctate, with small, black setulae. Median furrow faint, but present. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.5 length of postocellar setae, approximately 0.4 distance from ventral ocellus to dorsal fronto-orbital setae. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, except tarsomeres 4 and 5 dark brown, tarsomeres slightly expanded. Combined length of fore tarsomeres approximately 0.8 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 slightly expanded. Pulvilli of fore leg large. Tarsal claws of all legs small, finely bifurcate at apex. Mid and hind leg yellowish-brown, with tarsomeres 4–5 and apex of tarsomere 3 of mid leg dark brown dorsally. Mean costal length 0.55 wing length; range 0.53–0.57. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor elongate, parallel-sided, dorsoventrally flattened at apex; ventrally with small swelling at mid-length, slightly deflected ventrally at apex. In dorsal view, lateral setae of ovipositor thin, short, relatively numerous. Ventrally, ovipositor with short, fine, sparse setae. Surface of ovipositor with faint, somewhat longitudinally directed sculpturing. Intersegment 7–8 broadly triangular.

*Host.* The specimens from TYC were collected at an aggregation of bees, dominated by the most likely host *Partamona cf. cupeira* Smith (*sensu* Roubik, 1992). Also present were much smaller *Plebia* spp. and *Apis mellifera*. The specimen from La Selva was also collected in an aggregation of different species of bees, but was seen attacking *Trigona amalthea silvestriana* Vachal.

*Geographical distribution.* Lowland Costa Rica.

*Etymology.* Named after José Rogelio Vargas, who encouraged collecting and research at TYC.

*Holotype*. ♀, COSTA RICA: Puntarenas: 5.5 km SW Rincon, TYC, 8.70°N, 83.51°W, 11.viii.2001, B. Brown, V. Berezovskiy, E. Zumbado, honey sprayed leaves [LACM ENT 089484](INBC).

*Paratypes*. COSTA RICA: Heredia: La Selva Biological Station, 10.43°N, 84.02°W, 1♀, 15.iii.1994, ALAS, Malaise trap M/01/376 (INBC), 1♀ [abdomen only; rest of body used for molecular analysis], 16.ii.2002, B. Brown, attacking bees *Trigona amalthea silvestriana* (LACM); Puntarenas: 5.5 km SW Rincon, TYC, 8.70°N, 83.51°W, 1♀, 11.viii.2001, B. Brown, V. Berezovskiy, E. Zumbado, honey sprayed leaves (LACM).

#### MELALONCHA RHYPOPODA-GROUP

*Diagnosis*. Frons black. Tarsomeres 4 and 5 of foreleg dark. Ovipositor with lateral curved ridge (Figs 51, 52).

*Included species*. *M. individa* sp. nov. and *M. rhytopoda* sp. nov.

A number of other species of *Udamochiras* have the frons black (*M. anaticula* sp. nov., *M. deinocerca* Borgmeier, *M. nigricorpus* Borgmeier, *M. sinuosa* sp. nov.), but their relationship to the *M. rhytopoda*-group, if any, is unclear. Similarly, there are other species with dark apical foretarsomeres (*M. spatula*, *M. vargasi*), but they have apparently arisen separately.

#### MELALONCHA INDIVIDA SP. NOV. (FIG. 51)

*Recognition*. This species can be most easily separated from *M. rhytopoda* by the yellow tarsomere 3 (dark brown in *M. rhytopoda*). Remarkably, this species lacks divided tarsal claws.

*Description*. Body length 2 mm. Frons black. Setal base of all setae coloured like rest of frons. Frons 0.35 head width; with fine reticulate sculpturing, slightly shiny, with small punctures and small, black setulae restricted to lateral one-third. Median furrow absent. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.9 length of postocellar setae, slightly dorsal to level of dorsal fronto-orbital setae. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, except tarsomeres 4 and 5 dark brown; fore tarsomeres expanded, short. Combined length of fore tarsomeres approximately 0.8 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 slightly expanded. Pulvilli of fore leg large. Tarsal claws of all legs entire, not bifurcate. Mid and hind leg yellowish-brown, with tarsomeres 4–5 and apex of tarsomere 3 of mid leg dark brown dorsally. Costa 0.49 wing length. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally

black, with silver pollinosity. Venter of abdomen grey. Ovipositor laterally compressed in apical one-half, with sinuous lateral ridge, strongly curved ventrally. In dorsal view, lateral setae of ovipositor thin, short, relatively numerous. Ventrally, ovipositor with short, fine, sparse setae basally. Surface of ovipositor with faint, somewhat longitudinally directed sculpturing, apically glabrous.

*Geographical distribution*. Amazonian Brazil.

*Etymology*. Latin adjective for undivisible, referring to the undivided tarsal claws.

*Holotype*. ♀, BRAZIL: Amazonas: Reserva Ducke, 3.13°S, 60.02°W, 8–15.iv.1992, J. Vidal, 1B-20 m [LACM ENT 029863] (INPA).

#### MELALONCHA RHYPOPODA SP. NOV. (FIG. 52)

*Recognition*. This species is extremely similar to *M. individa*, but tarsomere 3 of the fore leg is dark brown (in addition to tarsomeres 4 and 5) and the ovipositor is shallower in lateral view. Also, the tarsal claws are divided in this species, as they are in most other *Udamochiras*.

*Description*. Body length 2 mm. Frons black. Setal base of all setae coloured like rest of frons. Frons 0.4 head width; with fine reticulate sculpturing, slightly shiny, with small punctures and small, black setulae restricted to lateral one-third. Median furrow present. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, equal in length to postocellar setae, slightly dorsal to level of dorsal fronto-orbital setae. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, except tarsomeres 3–5 dark brown; fore tarsomeres expanded, short. Combined length of fore tarsomeres approximately 0.8 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 slightly expanded. Pulvilli of fore leg large. Tarsal claws of all legs small, finely bifurcate at apex. Mid and hind leg yellowish-brown, with tarsomeres 4–5 and apex of tarsomere 3 of mid leg dark brown dorsally. Costa 0.45 wing length. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor laterally compressed in apical one-half, with sinuous lateral ridge, strongly curved ventrally. In dorsal view, lateral setae of ovipositor minute, sparse. Ventrally, ovipositor with minute, sparse setae. Surface of ovipositor smooth, shiny.

*Host*. The holotype was collected on the flowers of a *Phoenix* palm, where numerous *Trigona hyalinata amazonensis* (Ducke) and *A. mellifera* were foraging. No oviposition attempts were observed.

*Geographical distribution.* Bolivia.

*Etymology.* Greek adjective for ‘dirty feet’, referring to the dark-coloured fore tarsomeres.

*Holotype.* ♀, BOLIVIA: La Paz: Coroico, Hotel Don Quixote, 16.19°S, 67.72°W, 5.iv.2001, B. Brown, on *Phoenix* palm flowers, 1750 m [LACM ENT 128382] (CBFC).

*MELALONCHA APRICA*-GROUP

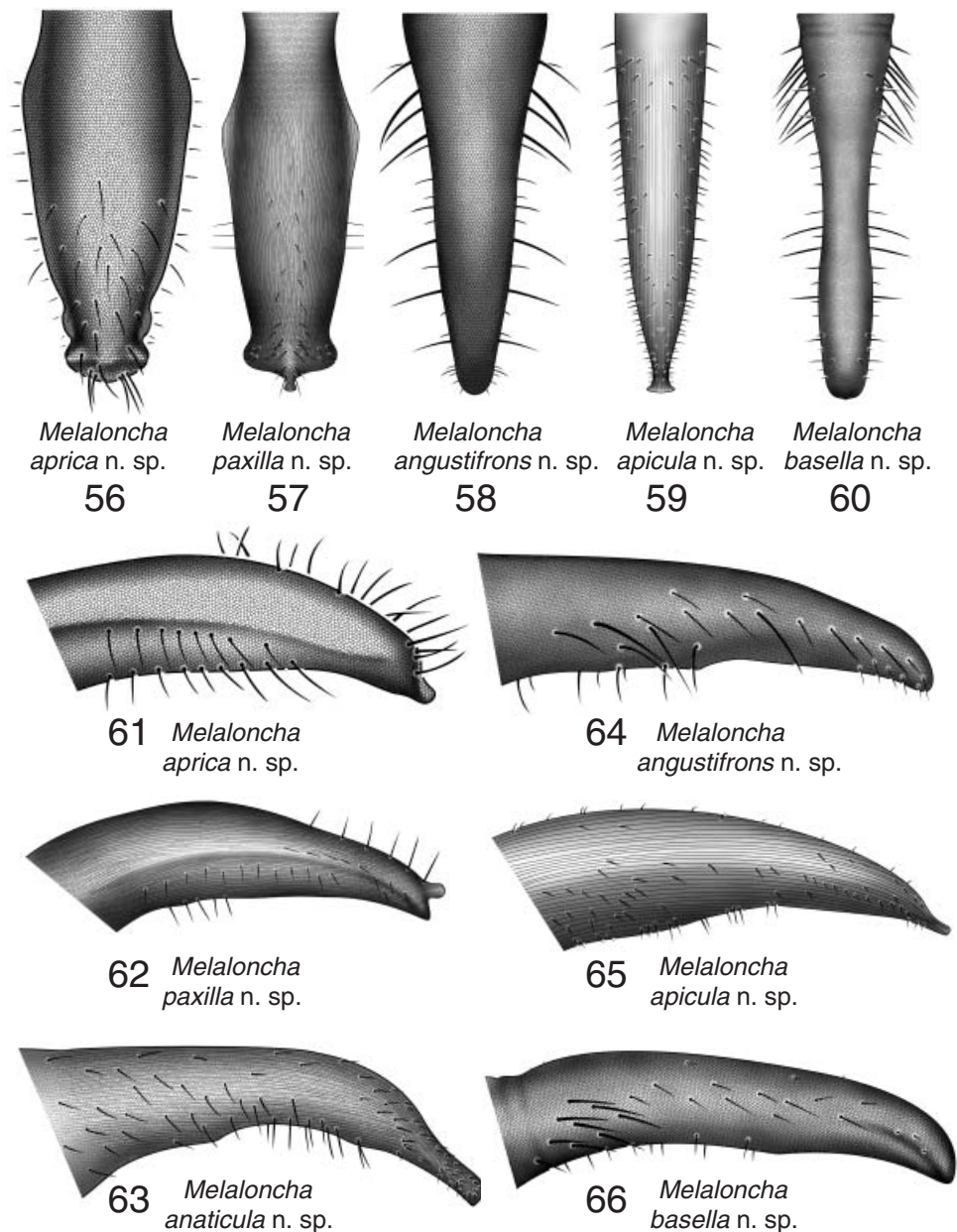
*Diagnosis.* Tergite 6 with large central area of orange colour. Ovipositor somewhat dorsoventrally flattened, laterally emarginate (Figs 61, 62).

*Included species.* *M. aprica* sp. nov. and *M. paxilla* sp. nov.

*MELALONCHA APRICA* SP. NOV. (FIGS 56, 61)

*Recognition.* This species differs from its closest relative, *M. paxilla*, by the broader ovipositor, which lacks an dorsoapical process (Fig. 56).

*Description.* Body length 2–2.5 mm. Frons orange, except vertex and ocellar region, which are black. Setal base of all setae coloured like rest of frons. Mean frontal width 0.27 head width; range 0.26–0.28. Frons



**Figures 56–66.** *Melaloncha* spp., ovipositors. Figs 56–60: dorsal. Figs 61–66: left lateral.



with fine reticulate sculpturing, not shiny, weakly punctate, with small, pale setulae. Median furrow absent. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.5 length of postocellar setae, level with ventral margin of ventral ocellus. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, slightly expanded. Combined length of fore tarsomeres approximately 0.7 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 slightly expanded. Pulvilli of fore leg large. Tarsal claws of all legs small, finely bifurcate at apex. Mid and hind leg yellowish-brown, with tarsomeres 4–5 and apex of tarsomere 3 of mid leg dark brown dorsally. Mean costal length 0.54 wing length; range 0.53–0.55. Tergite 6 with anterior three-fifths of dorsum orange with silver pollinosity. Tergites 2–6 lateroventrally orange. Venter of abdomen yellow. Ovipositor slightly dorsoventrally flattened; basally broad, narrowing apically; with prominent lateral emargination, strongly curved ventrally. In dorsal view, lateral setae of ovipositor thin, short. Ventrally, ovipositor with short, fine, sparse setae. Surface of ovipositor with faint, irregular, reticulate sculpturing.

*Geographical distribution.* Costa Rica and Brazil.

*Etymology.* Latin adjective for sunny, referring to the bright orange coloration of abdominal tergite 6.

*Holotype.* ♀, COSTA RICA: Cartago: Turrialba, 9.93°N, 83.67°W, 15–19.vii.1965, P. Spangler [LACM ENT 003984] (USNM).

*Paratypes.* BRAZIL: Rio de Janeiro: Jacarepaguá, 1♀, T. Borgmeier (MZSP). COSTA RICA: 1♀, same data as holotype (LACM); Alajuela: 20 km S Upala, 1♀, 7.ii.1991, F. D. Parker [Malaise trap] (EMUS).

#### **MELALONCHA PAXILLA SP. NOV.** (FIGS 57, 62)

*Recognition.* This species differs from *M. aprica* by having a narrower ovipositor with a dorsoapical, peg-shaped process (Fig. 57).

*Description.* Body length 2.1–2.2 mm. Frons orange, except ocellar triangle black. Setal base of all setae coloured like rest of frons. Mean frontal width 0.30 head width; range 0.29–0.31. Frons with fine reticulate sculpturing, slightly shiny, weakly punctate, with small, pale setulae. Median furrow absent. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.6 length of postocellar setae, slightly ventral to level of ventral ocellus. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, slightly expanded. Combined length of fore tarso-

meres approximately 0.6 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 slightly expanded. Pulvilli of fore leg large. Tarsal claws of all legs small, finely bifurcate at apex. Mid and hind leg yellowish-brown. Mean costal length 0.52 wing length; range 0.51–0.53. Tergite 6 with all but posterolateral corners orange. Tergites 2–6 lateroventrally orange. Venter of abdomen yellow. Ovipositor slightly dorsoventrally flattened; basally broad (but slightly narrower than in *M. aprica*), narrowing apically; with prominent lateral emargination; relatively straight, with dorsomedial process. In dorsal view, lateral setae of ovipositor thin, short. Ventrally, ovipositor with short, fine, sparse setae. Surface of ovipositor with faint, irregular, reticulate sculpturing.

*Geographical distribution.* Mexico.

*Etymology.* Latin noun *paxillus* for nail or peg, referring to the small, peg-like process on the ovipositor.

*Holotype.* ♀, MEXICO: Puebla: 3 mi NW Petlalcingo, 4.iii.1972, F. Parker, D. Miller [LACM ENT 055909] (USNM).

*Paratype.* MEXICO: Jalisco: Puerto Vallarta, 1♀, 25.i.1984, G. E. Bohart [Malaise trap] (LACM).

#### UNPLACED SPECIES OF *MELALONCHA* (*UDAMOCHIRAS*)

#### **MELALONCHA ANATICULA SP. NOV.** (FIG. 63)

*Recognition.* This species can be recognized by the dark frons and the shape of the ovipositor, with its elongate, narrowed region (Fig. 63).

*Description.* Body length 2.1 mm. Frons black, to dark brown, lighter ventrally. Setal base of all setae coloured like rest of frons. Frons 0.33 head width; with fine reticulate sculpturing, slightly shiny, punctate, with small, black setulae. Median furrow present. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.7 length of postocellar setae, slightly dorsal to level of dorsal fronto-orbital setae. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, relatively narrow. Combined length of fore tarsomeres approximately 0.9 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 relatively narrow. Pulvilli of fore leg relatively small. Tarsal claws of all legs enlarged, deeply bifurcate. Hind leg yellowish-brown, with tarsomeres 4–5 and apex of tarsomere 3 brown dorsally (mid legs missing). Costa 0.53 wing length. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen



grey. Ovipositor relatively tubular, strongly narrowed on apical one-fifth. In dorsal view, lateral setae of ovipositor thin, short. Ventrally, ovipositor with thin setae. Surface of ovipositor with faint, irregular, reticulate sculpturing.

*Geographical distribution.* Ecuador.

*Etymology.* Latin adjective based on the diminutive form of *anas*, meaning duck, referring to the duck's-head shape of the ovipositor in lateral view.

*Holotype.* ♀, ECUADOR: Carchi: Chical, 0.93°N, 78.18°W, 12.viii.1983, J. E. Rawlins, 1250 m [CMNH 238905] (Carnegie Museum of Natural History).

***MELALONCHA ANGUSTIFRONS* SP. NOV.**

(FIGS 16, 58, 64)

*Recognition.* This species can be recognized by the lack of dorsal interfrontal setae, narrow frons, and the shape of the ovipositor (Fig. 58).

*Description.* Body length 2.6–3.5 mm. Frons orange, except vertex and ocellar region, which are black. Setal base of all setae coloured like rest of frons. Mean frontal width 0.19 head width; range 0.17–0.21. Frons with fine reticulate sculpturing, not shiny, punctate, with small, pale setulae. Median furrow faint, but present. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae absent. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, relatively narrow. Combined length of fore tarsomeres approximately 0.8 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 slightly expanded. Pulvilli of fore leg large. Tarsal claws of all legs small, finely bifurcate at apex. Mid and hind leg yellowish-brown, with tarsomeres 4–5 and apex of tarsomere 3 of mid leg dark brown dorsally. Mean costal length 0.55 wing length; range 0.53–0.57. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor relatively tubular, slightly deflected ventrally at apex. In dorsal view, lateral setae of ovipositor large, relatively fine, widely spaced. Ventrally, ovipositor with short, fine, sparse setae. Surface of ovipositor with faint, irregular, reticulate sculpturing.

*Variation.* The specimen from Bolivia is much larger than the Costa Rican individuals, but is apparently otherwise similar in structure.

*Geographical distribution.* Costa Rica and Bolivia.

*Etymology.* Latin adjective based on *angustus* for narrow, referring to the shape of the frons.

*Holotype.* ♀, COSTA RICA: Puntarenas: Las Alturas, 8.95°N, 82.83°W, xii.1991, P. Hanson, Malaise trap, 1500 m [LACM ENT 003714] (LACM).

*Paratypes.* BOLIVIA: La Paz: near Chulumani, Apa Apa Reserve, 16.37°S, 67.51°W, 1♀, 1–3.iv.2001, B. Brown, G. Kung, Malaise trap #5 (LACM). COSTA RICA: Cartago: Parque Nacional Tapanti, 9.76°N, 83.77°W, 1♀, ii.1995, G. Mora, Malaise trap #4506, 1150 m (INBC); Puntarenas: Las Alturas, 8.95°N, 82.83°W, 1♀, vi.1992, P. Hanson, Malaise trap, 1500 m (LACM).

***MELALONCHA APICULA* SP. NOV.** (FIGS 59, 65)

*Recognition.* The ovipositor of this species is distinctive, with short setae and subapical narrowing, followed by a small expansion (Fig. 59).

*Description.* Body length 2.9–3.1 mm. Frons orange, except vertex and ocellar region, which are black. Setal base of all setae coloured like rest of frons. Mean frontal width 0.31 head width; range 0.3–0.32. Frons with fine reticulate sculpturing, slightly shiny, punctate, with small, black setulae. Median furrow faint, but present. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.6 length of postocellar setae, slightly ventral to level of ventral ocellus. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, expanded, short. Combined length of fore tarsomeres approximately 0.8 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 slightly expanded. Pulvilli of fore leg large. Tarsal claws of all legs enlarged, deeply bifurcate. Mid and hind leg yellowish-brown, with tarsomeres 4–5 and apex of tarsomere 3 of mid leg dark brown dorsally. Mean costal length 0.54 wing length; range 0.52–0.56. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor relatively tubular in shape, apically narrowed, slightly curved ventrally. In dorsal view, lateral setae of ovipositor thin, short. Ventrally, ovipositor with short, fine, sparse setae. Surface of ovipositor with faint, somewhat longitudinally directed sculpturing.

*Geographical distribution.* Amazonian Brazil.

*Etymology.* Latin noun for small point, referring to the reduced tip of the ovipositor.

*Holotype.* ♀, BRAZIL: Amazonas: Manaus, Reserva Ducke, 3.13°S, 60.02°W, 6–17.vii.1992, J. Vidal, Arm. Cola 14–20 m [LACM ENT 031103] (INPA).

*Paratypes.* BRAZIL: Amazonas: Manaus, Reserva Ducke, 3.13°S, 60.02°W, 1♀, same data as holotype

(LACM), 1♀, 6–17.vii.1992, J. Vidal, Arm. Cola 1 A-10 m (INPA).

**MELALONCHA BASELLA SP. NOV.** (FIGS 60, 66)

*Recognition.* This species can be recognized by the group of thick lateral setae at the base of the ovipositor, visible in dorsal view (Fig. 60).

*Description.* Body length 4 mm. Frons orange, except vertex and ocellar region, which are black. Setal base of all setae coloured like rest of frons. Frons 0.21 head width; with fine reticulate sculpturing, not shiny, punctate, with small, black setulae. Median furrow absent. Frontal setae normal (except for presence of single supra-antennal seta on right side); arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.6 length of postocellar setae, approximately 0.4 distance from ventral ocellus to dorsal fronto-orbital setae. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, relatively narrow. Combined length of fore tarsomeres approximately 0.9 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 slightly expanded. Pulvilli of fore leg large. Tarsal claws of all legs small, finely bifurcate at apex. Mid and hind leg yellowish-brown. Costa 0.57 wing length. Wing vein  $R_{2+3}$  present, but as incomplete basal remnant only. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor elongate, narrow, relatively tubular, dorsally slightly flattened, slightly curved ventrally. In dorsal view, lateral setae of ovipositor arranged in basal group of thick setae and more apical group of thin setae. Ventrally, ovipositor with minute, sparse setae. Surface of ovipositor with faint, irregular, reticulate sculpturing.

*Geographical distribution.* Costa Rica.

*Etymology.* Latin diminutive noun for base, referring to the large setae at the base of the ovipositor.

*Holotype.* ♀, COSTA RICA: San José: 14 km N San Isidro, 9.37°N, 83.70°W, 20–23.vi.1974, J. Donahue, Malaise trap [LACM ENT 093440] (LACM).

**MELALONCHA BISETA SP. NOV.** (FIG. 67)

*Recognition.* Like *M. hansonii* (Fig. 76) *M. biseta* has slightly differentiated apical setae on the ovipositor, but the ovipositor of *M. biseta* is broader apically and the enlarged lateral seta is less differentiated (Fig. 67).

*Description.* Body length 2.4–3.4 mm. Frons orange, except vertex and ocellar region, which are black.

Setal base of all setae either orange or black. Mean frontal width 0.29 head width; range 0.28–0.29. Frons with fine reticulate sculpturing, slightly shiny, punctate, with small, black setulae. Median furrow faint, but present. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.5 length of postocellar setae, level with ventral ocellus to slightly ventral to level of ventral ocellus. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, slightly expanded. Combined length of fore tarsomeres approximately 0.8 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 slightly expanded. Pulvilli of fore leg large. Tarsal claws of all legs small, finely bifurcate at apex. Mid and hind leg yellowish-brown. Mean costal length 0.55 wing length; range 0.53–0.58. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor relatively tubular, relatively straight. In dorsal view, lateral setae of ovipositor thin, short, relatively numerous, dorsoapical pair long, distinct. Ventrally, ovipositor with short, fine, sparse setae. Surface of ovipositor with faint, somewhat longitudinally directed sculpturing.

*Variation.* The specimen from Zurquí de Moravia has all setal bases black, whereas the other specimens have orange setal bases.

*Host.* The specimens from Cumbre Alto Beni were attracted to an aggregation of bees of several species, but the most likely host (based on size) was *Partamona* sp. Also present in large numbers were *A. mellifera*.

*Geographical distribution.* Costa Rica and Bolivia.

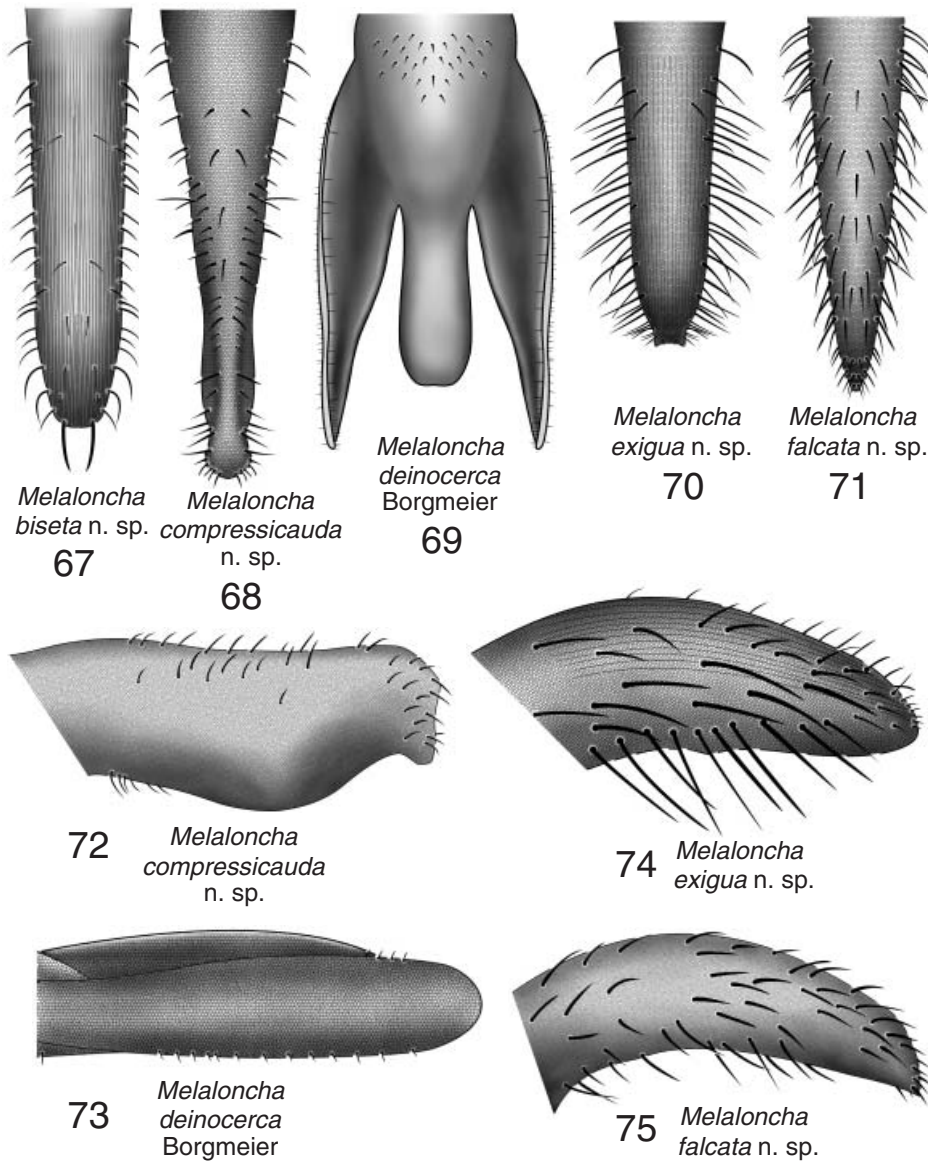
*Etymology.* Latin noun meaning two setae, referring to the larger dorsoapical pair on the ovipositor.

*Holotype.* ♀, BOLIVIA: La Paz: 40 km N Caranavi, Cumbre Alto Beni, 15.83°S, 67.56°W, 14.iv.2001, B. Brown, G. Kung, honey-sprayed leaves, 1600 m [LACM ENT 128399] (CBFC).

*Paratypes.* 1♀, same data as holotype (LACM). COSTA RICA: Alajuela: Reserva Biología San Ramón, 10.22°N, 84.62°W, 1♀, iv–v.1995, P. Hanson, Malaise trap, 900 m (LACM); San José: Zurquí de Moravia, 10.05°N, 84.02°W, 1♀, viii.1995, P. Hanson, Malaise trap, 1600 m (LACM).

**MELALONCHA COMPRESSICAUDA SP. NOV.**  
(FIGS 68, 72)

*Recognition.* This species can be easily recognized by its extremely deep (Fig. 72) and laterally compressed (Fig. 68) ovipositor.



**Figures 67–75.** *Melaloncha* spp., ovipositors. Figs 67–71: dorsal. Figs 72–75: left lateral.

*Description.* Body length 2.1–2.3 mm. Frons orange, except vertex and ocellar region, which are black. Setal base of all setae coloured like rest of frons. Mean frontal width 0.29 head width; range none. Frons with fine reticulate sculpturing, slightly shiny, weakly punctate, with small, pale setulae. Median furrow absent. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.6 length of postocellar setae, level with ventral margin of ventral ocellus to slightly ventral to level of ventral ocellus. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, slightly expanded. Combined

length of fore tarsomeres approximately 0.8 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 slightly expanded. Pulvilli of fore leg large. Tarsal claws of all legs small, finely bifurcate at apex. Mid and hind leg yellowish-brown, with tarsomeres 4–5 and apex of tarsomere 3 of mid leg dark brown dorsally. Mean costal length 0.56 wing length; range 0.55–0.57. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor narrow, deep, extremely laterally compressed, sinuous on ventral margin, relatively straight. In dorsal view, lateral setae of ovipositor thin, short. Ventrally, ovipositor



with short, fine, sparse setae. Surface of ovipositor with faint, irregular, reticulate sculpturing.

*Geographical distribution.* Costa Rica.

*Etymology.* Latin noun meaning compressed tail, referring to the shape of the ovipositor.

*Holotype.* ♀, COSTA RICA: Alajuela: Res. Biol. San Ramon, 10.22°N, 84.62°W, iv–v.1995, P. Hanson, Malaise trap, 900 m [LACM ENT 128764] (LACM).

*Paratypes.* COSTA RICA: Cartago: nr. Tuis, 1♀, 16–22.vii.1993, W. J. Hanson, 3000 ft (EMUS).

*MELALONCHA DEINOCERCA* BORGMEIER  
(FIGS 11, 26, 69, 73)

*Melaloncha deinocerca* Borgmeier, 1960: 304–305, figs 64–66.

*Holotype:* ♀, BRAZIL: Mato Grosso: Westgrenze, v.1954, A. Vieira [LACM ENT 134146] (examined; MZSP).

*Recognition.* Among species with a black frons, and indeed among all *Melaloncha*, the trilobed ovipositor of this species (Fig. 69) is extremely distinctive and unlikely to be confused with any other.

*Description.* Body length 1.8–2.5 mm. Frons black. Setal base of all setae coloured like rest of frons. Mean frontal width 0.3 head width; range 0.29–0.31. Frons with fine reticulate sculpturing, slightly shiny, with small punctures and small, black setulae restricted to lateral one-third. Median furrow absent. Frontal setae short; arrangement of frontal setae modified, with ventral interfrontal setae 0.4 frontal height from ventral margin of frons. Dorsal interfrontal setae present, 0.8 length of postocellar setae, slightly ventral to level of ventral ocellus. Palpus with one longer apical and several shorter, scattered black setae only. Ocular and genal setae normal, black. Fore tarsomeres yellowish-brown, slightly expanded. Combined length of fore tarsomeres approximately 0.9 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 relatively narrow. Pulvilli of fore leg large. Tarsal claws of all legs enlarged, deeply bifurcate. Mid and hind leg yellowish-brown, except tarsomere 5 dark brown. Mean costal length 0.47 wing length; range 0.46–0.47. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor trilobed, with dorsally curved lateral lobes and shorter, flat, apically rounded median lobe, relatively straight. In dorsal view, lateral setae of ovipositor minute, sparse. Ventrally, ovipositor with minute, sparse setae. Surface of ovipositor smooth, shiny. Intersegment 7–8 with triangular central portion and posterolateral processes (Fig. 11).

*Variation.* The holotype specimen appears to be alcohol bleached, and the colours much lighter than the other two more recently collected specimens. The more recent specimens were used for colour in the Description, above.

Unlike the holotype and the specimen from Mexico, which have the median lobe of the ovipositor relatively parallel-sided in dorsal view, the specimens from Costa Rica have the median lobe apically broadened. More specimens are needed to assess the significance of this variation.

*Phylogenetic relationships.* This species, with its unusual ovipositor and frontal setation, is not clearly related to any other *Udamochiras* species. The structure of intersegment 7–8 (Fig. 11) is somewhat similar to that of the *M. colossia*-group species *M. trua*, as is the dorsally concave ovipositor. The claws of *M. deinocerca* are also deeply bifurcate, like other species of the *M. colossia*-group, but it lacks a deeply impressed frontal furrow, the other major character of this group.

*Host.* At TYC I observed a female hovering over and darting at a worker of *Partamona cf. cupeira* (*sensu* Roubik, 1992). At Finca Montezuma a female was attracted to an aggregation of several species of bees, mostly *Plebeia* spp., but the most likely host (based on size) was *Trigona amalthea silvestriana*.

*Geographical distribution.* Mexico to Brazil.

*Other material examined.* COSTA RICA: Guanacaste: 3 km SE Rio Naranjo, Finca Montezuma, 10.67°N, 85.06°W, 1♀ [abdomen only; rest of body used for molecular analysis], 26.ii.2002, B. Brown, honey-sprayed undergrowth (LACM); Puntarenas: 5.5 km SW Rincon, TYC, 8.70°N, 83.51°W, 1♀, 11.viii.2001, B. Brown, honey-sprayed leaves (LACM). MEXICO: Nayarit: San Blas, La Bajada, 1♀, 20–21.iii.1983, W. J. Hanson (EMUS).

*MELALONCHA EXIGUA* SP. NOV. (FIGS 70, 74)

*Recognition.* This species differs from the similar *M. falcata* by having a shorter ovipositor that is broader at the dorsal apex (Fig. 70).

*Description.* Body length 1.9–2.2 mm. Frons orange, except vertex and ocellar region, which are black. Setal base of all setae coloured like rest of frons. Mean frontal width 0.31 head width; range none. Frons with fine reticulate sculpturing, slightly shiny, punctate, with small, black setulae. Median furrow absent. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.7 length of postocellar setae, slightly ventral to level of



ventral ocellus. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, expanded, short. Combined length of fore tarsomeres approximately 0.8 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 slightly expanded. Pulvilli of fore leg large. Tarsal claws of all legs small, finely bifurcate at apex. Mid and hind leg yellowish-brown, with tarsomeres 4–5 and apex of tarsomere 3 of mid leg dark brown dorsally. Mean costal length 0.51 wing length; range 0.5–0.52. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor relatively tubular, short, strongly curved ventrally. In dorsal view, lateral setae of ovipositor large, relatively fine, widely spaced. Ventrally, ovipositor with long, thin, sparse setae. Surface of ovipositor with faint, somewhat longitudinally directed sculpturing.

*Host.* The holotype was collected on the flowers of a *Phoenix* palm, where numerous *Trigona hyalinata amazonensis* and *A. mellifera* were foraging. No oviposition attempts were observed.

*Geographical distribution.* Bolivia and Brazil.

*Etymology.* Latin adjective for short, referring to the small ovipositor.

*Holotype.* ♀, BOLIVIA: La Paz: Coroico, Hotel Don Quixote, 16.19°S, 67.72°W, 5.iv.2001, B. Brown, on *Phoenix* palm flowers, 1750 m [LACM ENT 128385] (CBFC).

*Paratypes.* BRAZIL: Santa Catarina: Nova Teutônia, 27.18°S, 52.38°W, 1♀, [no date], F. Plaumann (MZSP). This specimen bears a Borgmeier determination label for *M. piliapex*.

#### ***MELALONCHA FALCATA* SP. NOV. (FIGS 71, 75)**

*Recognition.* This species is similar to *M. exigua* sp. nov., but the ovipositor is longer and more narrow at the dorsal apex (Fig. 71).

*Description.* Body length 2.2–2.6 mm. Frons orange, except vertex and ocellar region, which are black. Setal base of all setae coloured like rest of frons. Mean frontal width 0.28 head width; range 0.26–0.29. Frons with fine reticulate sculpturing, slightly shiny, punctate, with small, black setulae. Median furrow faint, but present. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.6 length of postocellar setae, slightly ventral to level of ventral ocellus. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, expanded, short. Combined length of fore tarsomeres approximately 0.7 tibial

length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 slightly expanded. Pulvilli of fore leg relatively small. Tarsal claws of all legs small, finely bifurcate at apex. Mid and hind leg yellowish-brown. Mean costal length 0.54 wing length; range 0.53–0.55. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor relatively tubular in shape, apically narrowed and laterally compressed, strongly curved ventrally. In dorsal view, lateral setae of ovipositor numerous, thin. Ventrally, ovipositor with long, thin, sparse setae. Surface of ovipositor with faint, irregular, reticulate sculpturing. Intersegment 7–8 elongate, with narrow, pointed process posterodorsally. Stylet extremely long, narrow.

*Variation.* One specimen from Mexico lacks dorsal interfrontal setae.

*Host.* The specimens collected at Finca Montezuma in 2002 were attracted to an aggregation of several species of bees, mostly *Plebeia* spp., but the most likely host (based on size) was *Trigona amalthea silvestriana*.

*Geographical distribution.* Mexico to Brazil.

*Etymology.* Latin adjective for curved, referring to the shape of the ovipositor in lateral view.

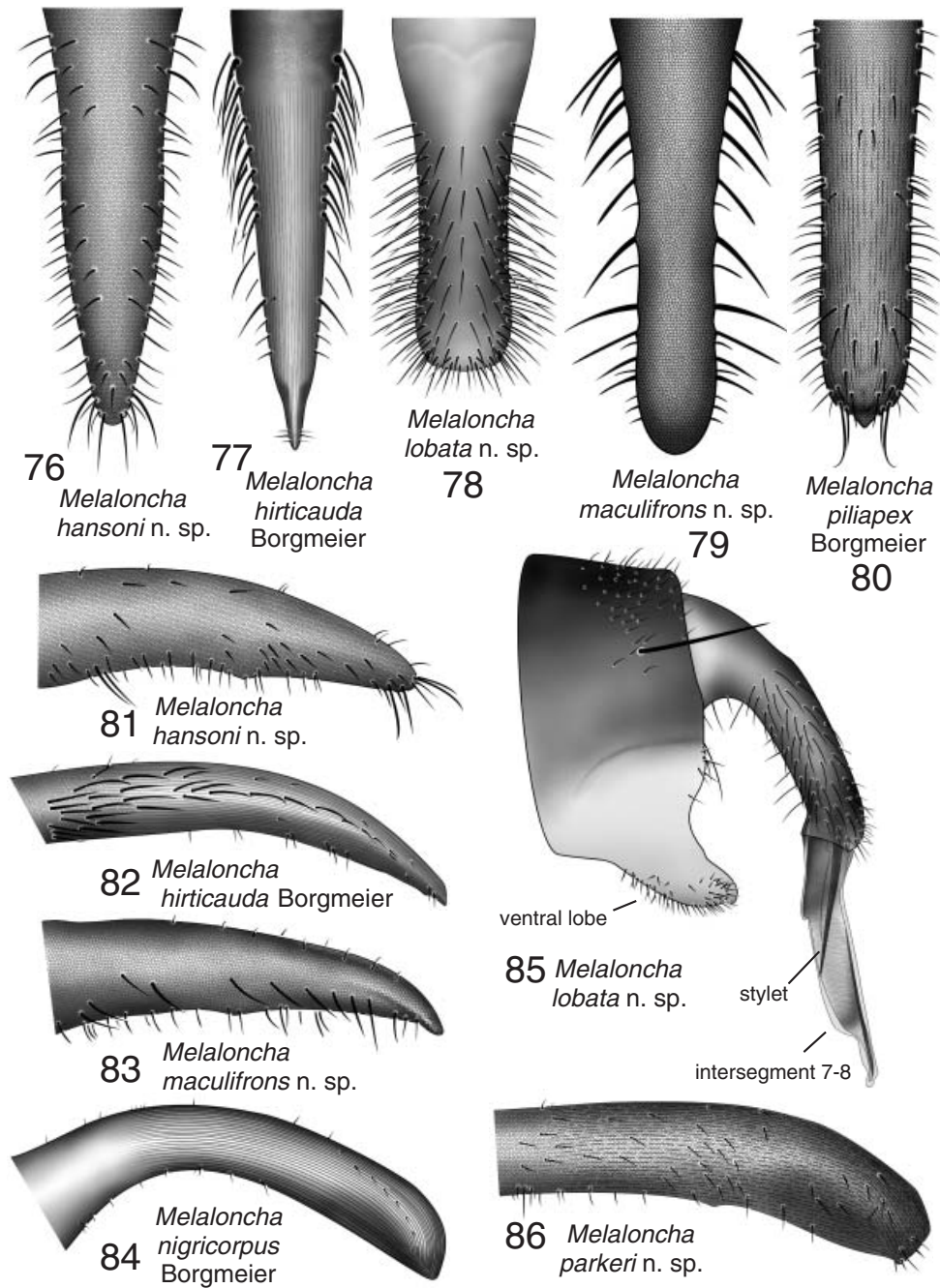
*Holotype.* ♀, COSTA RICA: Cartago: Turrialba, 9.93°N, 83.67°W, 15–19.vii.1965, P. Spangler [LACM ENT 003991] (USNM).

*Paratypes.* BRAZIL: Pará: Mun. Benevides, PA-408 km 06, 1♀, 26.i.1981, T. Pimentel (Museu Paraense Emilo Goeldi, Pará, Brazil). COSTA RICA: Guanacaste: 3 km SE Rio Naranjo, Finca Montezuma, 10.67°N, 85.06°W, 1♀, 1.ii.1993, 1♀, 3–7.ii.1993, 1♀, 19–22.ii.1993, 1♀, 8–12.iii.1993, F. D. Parker (EMUS, LACM), 1♀, 22.ii.2002, Brown, Walker, Gonzalez, Zumbado, honey-sprayed undergrowth (LACM), 1♀ [abdomen only; rest of body used for molecular analysis], 27.ii.2002, B. Brown, honey-sprayed undergrowth (LACM); San José: Zurquí de Moravia, 10.05°N, 84.02°W, iv–v.1993, P. Hanson, Malaise trap, 1600 m (LACM). MEXICO: Quintana Roo: Felipe Carrillo Pto., 19.35°N, 88.03°W, 1♀, 10–14.x.1986, P. F. Torchio (LACM). PANAMA: Panama: San Carlos, 1♀, 17.ix.1972, F. S. Blanton (MZSP).

#### ***MELALONCHA HANSONI* SP. NOV. (FIGS 22, 76)**

*Recognition.* This species is recognized by the four slightly enlarged setae at the apex of the ovipositor (Fig. 76).

*Description.* Body length 2.5–2.8 mm. Frons orange, except vertex and ocellar region, which are black. Setal base of all setae coloured like rest of frons. Mean frontal



**Figures 76–86.** *Melaloncha* spp., ovipositors. Figs 76–80: dorsal. Figs 81–86: left lateral. Fig. 85 additionally shows details of abdominal segment 6, intersegment 7–8 and stylet.

width 0.3 head width; range 0.29–0.3. Frons with fine reticulate sculpturing, slightly shiny, punctate, with small, black setulae. Median furrow absent. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.6 length of postocellar setae, level with ventral margin of ventral ocellus. Palpus unmodified. Ocular and genal setae

flattened, yellow. Fore tarsomeres yellowish-brown, relatively narrow. Combined length of fore tarsomeres approximately 0.8 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 slightly expanded. Pulvilli of fore leg large. Tarsal claws of all legs small, bifurcate at apex. Mid and hind leg yellowish-brown, with tarsomeres 4–5 and apex of tarsomere 3 of mid leg dark brown dorsally.

Mean costal length 0.56 wing length; range 0.54–0.57. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor relatively tubular, slightly curved ventrally. In dorsal view, lateral setae of ovipositor thin, short; larger, thicker, pairs of setae dorsoapically and subapicolaterally. Ventrally, ovipositor with short, fine, sparse setae. Surface of ovipositor with faint, irregular, reticulate sculpturing.

*Variation.* Wing vein  $R_{2+3}$  is present on the left wing of the paratype.

*Geographical distribution.* Costa Rica.

*Etymology.* Named after Dr Paul Hanson, whose Malaise trapping programme has collected many new phorid flies.

*Holotype.* ♀, COSTA RICA: San José: Zurquí de Moravia, 10.05°N, 84.02°W, iii–iv.1993, P. Hanson, Malaise trap, 1600 m [LACM ENT 133207] (LACM).

*Paratype.* COSTA RICA: Cartago: 4 km NE Cañon, Genesis II, 9.71°N, 83.91°W, 1♀, iv.1995, P. Hanson, Malaise trap, 2350 m (LACM).

*MELALONCHA HIRTICAUDA* BORGMEIER (FIGS 77, 82)

*Melaloncha hirticauda* Borgmeier, 1934: 185–186, figs 4, 8, plate 3, fig. 14; 1935: 262 (♂ specimen).

*Holotype:* ♀, BRAZIL: Santa Catarina: Bom Retiro, Prade [LACM ENT 002011] (examined; MZSP).

*Recognition.* This species can be recognized by the posteriorly narrowing ovipositor with the large lateral setae extending along most of the ovipositor length (Figs 77, 82). There are four supposed male specimens of this species, one from Bom Retiro and three from Nova Teutônia, Brazil.

*Description.* Body length 2.6 mm. Frons orange, except ocellar triangle black. Setal base of all setae coloured like rest of frons. Frons 0.29 head width; with fine reticulate sculpturing, slightly shiny, punctate, with small, black setulae. Median furrow present. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present (no remaining postocellar setae to compare length), level with ventral ocellus. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, relatively narrow. Combined length of fore tarsomeres approximately 0.9 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 slightly expanded. Pulvilli of fore leg large. Tarsal claws of all legs enlarged, deeply bifurcate. Mid and hind leg yellowish-brown. Costa 0.49 wing length. Tergite 6 of similar colour to other terg-

ites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor relatively tubular in shape, apically narrowed and laterally compressed, curved ventrally in apical one-third. In dorsal view, lateral setae of ovipositor large, extending along most of length of ovipositor. Ventrally, ovipositor with short, fine, sparse setae. Surface of ovipositor with faint, irregular, reticulate sculpturing.

*Geographical distribution.* South-eastern Brazil.

*MELALONCHA LOBATA* SP. NOV. (FIGS 78, 85)

*Recognition.* This species resembles *M. simillima*, but has more setae on the ovipositor and an extraordinary ventral lobe on abdominal segment 6 (Fig. 85).

*Description.* Body length 2.4 mm. Frons orange, except ocellar triangle black. Setal base of all setae coloured like rest of frons. Frons 0.24 head width; with fine reticulate sculpturing, slightly shiny, punctate, with small, pale setulae. Median furrow faint, but present. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.4 length of postocellar setae, level with ventral margin of ventral ocellus. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, expanded, short. Combined length of fore tarsomeres approximately 0.8 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 slightly expanded. Pulvilli of fore leg large. Tarsal claws of all legs small, finely bifurcate at apex. Mid and hind leg yellowish-brown. Costa 0.59 wing length. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor relatively tubular, broad at dorsal apex, slightly curved ventrally. In dorsal view, lateral setae of ovipositor numerous, thin. Ventrally, ovipositor bare, although lateral setae extend ventrally. Surface of ovipositor with faint, irregular, reticulate sculpturing. Intersegment 7–8 elongate, with elongate apical process and dorsal sclerite (Fig. 85).

*Geographical distribution.* Costa Rica.

*Etymology.* Latin adjective referring to the lobe-like expansion on the venter of abdominal segment 6.

*Holotype.* ♀, COSTA RICA: Alajuela: 20 km S Upala, 12.iii.1991, F. D. Parker [LACM ENT 114155] (LACM).

*MELALONCHA MACULIFRONS* SP. NOV.

(FIGS 27, 79, 83)

*Recognition.* This species can be recognized by the black macula at the base of at least the dorsal fronto-



orbital setae (Fig. 27), the large lateral setae of the ovipositor, and the broad, rounded apex of the ovipositor (Fig. 79).

**Description.** Body length 2.4–3.1 mm. Frons orange, except vertex and ocellar region, which are black. Setal base of dorsal fronto-orbital setae dark brown to black; some specimens (including holotype) also with setal base of ventral fronto-orbital setae dark brown to black; other specimens with setal base of these two pairs plus those of ventral interfrontal setae dark brown to black. Mean frontal width 0.23 head width; range 0.22–0.24. Frons with fine reticulate sculpturing, not shiny, punctate, with small, black setulae. Median furrow absent. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.45 length of postocellar setae, level with ventral ocellus. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, except tarsomere 5 dark brown. Fore tarsomeres relatively narrow. Combined length of fore tarsomeres approximately 0.8 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 slightly expanded. Pulvilli of fore leg large. Tarsal claws of all legs small, finely bifurcate at apex. Mid and hind leg yellowish-brown, with tarsomeres 4–5 and apex of tarsomere 3 of mid leg dark brown dorsally. Mean costal length 0.54 wing length; range 0.53–0.55. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor relatively tubular, relatively straight. In dorsal view, lateral setae of ovipositor large. Ventrally, ovipositor with short, fine, sparse setae. Surface of ovipositor with faint, irregular, reticulate sculpturing. Intersegment 7–8 with narrow, apically pointed dorsal sclerite.

**Variation.** The main variation seen in this species is the number of black spots at the base of frontal setae, as discussed in the description.

**Geographical distribution.** Middle to high elevation (1600–3000 m) sites in Costa Rica.

**Etymology.** Latin noun based on *macula* (spot), referring to the markings at the base of the frontal setae.

**Holotype.** ♀, COSTA RICA: Heredia: Vara Blanca, 10.15°N, 84.15°W, iii–iv.1990, P. Hanson, Malaise trap, 2100 m [LACM ENT 049018] (LACM).

**Paratypes.** COSTA RICA: Cartago: 4 km NE Cañon, Genesis II, 9.71°N, 83.91°W, 4♀, v.1995, 1♀, viii.1995, 1♀, ix.1995, P. Hanson, Malaise trap, 2350 m (LACM), Villa Mills, 9.57°N, 83.73°W, 1♀, i–v.1991, P. Hanson, Malaise trap, 3000 m (LACM); Heredia: Vara Blanca, 10.15°N, 84.15°W, 1♀, iii–iv.1990, P. Hanson, Malaise trap, 2100 m (LACM); San José: 20 km S Empalme,

9.63°N, 83.85°W, 1♀, iii–iv.1989, P. Hanson, Malaise trap, 2800 m (LACM), 6 km N San Gerardo, 9.95°N, 84.05°W, 1♀, vi.1992, P. Hanson, Malaise trap, 2800 m (LACM), Zurquí de Moravia, 10.05°N, 84.02°W, 1♀, ix–x.1990, 1♀, x–xii.1990, 1♀, iv.1991, 1♀, v.1992, 2♀, iv–v.1993, 1♀, ix–x.1993, 1♀, iii.1996, 1♀, viii.1996, P. Hanson, Malaise trap, 1600 m (INBC, LACM, MUCR).

*MELALONCHA NIGRICORPUS* BORGMEIER (FIG. 84)

*Melaloncha nigricorpus* Borgmeier, 1934: 183–185, fig. 7, plate 3, fig. 8 (♀); 1959: 176 (♂).

**Holotype.** ♀, BOLIVIA: La Paz: Mapiri, Sarampioni, 7.iii.1903, 700 m (examined; Staatliches Museum für Tierkunde, Dresden, Germany).

**Recognition.** This relatively small species can be recognized by the narrow, curved, laterally flattened ovipositor (Fig. 84) and the black frons. Also, the dorsal interfrontal setae are unusually low on frons. A male specimen mentioned by Borgmeier (1959) is questionably conspecific.

**Description.** Body length 1.6–2.4 mm. Frons dark brown to black (but most recent, best preserved specimen is black). Setal base of all setae coloured like rest of frons. Mean frontal width 0.34 head width; range 0.33–0.35. Frons with fine reticulate sculpturing, not shiny, punctate, with small, black setulae. Median furrow present. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.8 length of postocellar setae, slightly dorsal to level of dorsal fronto-orbital setae. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, relatively narrow. Combined length of fore tarsomeres approximately 0.8 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 relatively narrow. Pulvilli of fore leg large. Tarsal claws of all legs small, finely bifurcate at apex. Mid and hind leg yellowish-brown. Mean costal length 0.51 wing length; range 0.47–0.54. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor laterally compressed in apical one-half, strongly curved ventrally. In dorsal view, lateral setae of ovipositor minute, sparse. Ventrally, ovipositor with minute, sparse setae. Surface of ovipositor with fine, slightly transverse, striae.

**Host.** The specimen from Cumbre Alto Beni was attracted to an aggregation of bees of several species, but the most likely host (based on size) was *Partamona* sp. Also present in large numbers were *A. mellifera*.



*Geographical distribution.* Mexico to Bolivia. Barnes (1991) reported a specimen from southern Texas, USA, but this specimen has apparently been lost and I cannot confirm its identity.

*Other material examined.* BOLIVIA: La Paz: 40 km N Caranavi, Cumbre Alto Beni, 15.83°S, 67.56°W, 1♀, 14.iv.2001, B. Brown, G. Kung, honey-sprayed leaves, 1600 m (LACM), Mapiri, San Carlos, 1♀, i.1903, 800 m (MZSP). MEXICO: Jalisco: Puerto Vallarta, 1♀, 25.i.1984, G. E. Bohart (EMUS). VENEZUELA: Zulia: El Tucuco, 45 km SW Machiques, 1♀, 5–6.vi.1976, A. S. Menke, D. Vincent (USNM).

***MELALONCHA PARKERI* SP. NOV. (FIG. 86)**

*Recognition.* The ovipositor of this species is distinctive, with its laterally compressed shape and rounded apex (Fig. 86).

*Description.* Body length 2.7 mm. Frons orange, except vertex and ocellar region, which are black. Setal base of all setae coloured like rest of frons. Frons 0.28 head width; glossy, shiny (but obscured and specimen possibly damaged), slightly punctate (punctures shallow, nearly invisible), with extremely small dark setulae. Median furrow faint, but present. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae broken (as are postocellar setae), slightly ventral to level of ventral ocellus. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, relatively narrow. Combined length of fore tarsomeres approximately 0.9 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 slightly expanded. Pulvilli of fore leg large. Tarsal claws of all legs small, finely bifurcate at apex. Mid leg yellowish-brown, hind legs broken off in only existing specimen. Costa 0.54 wing length. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor relatively tubular in shape, apically narrowed and laterally compressed; in lateral view deepening posteriorly, apically rounded, curved ventrally in apical one-third. In dorsal view, lateral setae of ovipositor thin, short, relatively numerous. Ventrally, ovipositor with short, fine, sparse setae. Surface of ovipositor with faint, somewhat longitudinally directed sculpturing.

*Geographical distribution.* Costa Rica.

*Etymology.* Named after Dr Frank D. Parker, who collected many interesting *Melaloncha* specimens in Costa Rica.

*Holotype.* ♀, COSTA RICA: Guanacaste: 3 km SE Naranjo, 1–10.xi.1992, F. D. Parker [LACM ENT 114136] (LACM).

***MELALONCHA PILIAPEX* BORGMEIER (FIGS 80, 92)**

*Melaloncha piliapex* Borgmeier, 1938: 50–52, figs 10, 11.

*Lectotype.* Because of past confusion of *M. simillima* with this species, I here designate a lectotype from the type series to fix the concept of *M. piliapex*: ♀, BRAZIL: Santa Catarina: Nova Teutônia, 27.18°S, 52.38°W, vii.1937, F. Plaumann [LACM ENT 122508] (MZSP).

*Recognition.* This species can be recognized by the long, distinctively curved, apical setae of the ovipositor (Fig. 80). These setae are absent in *M. simillima*, a species that Borgmeier formerly included in *M. piliapex*.

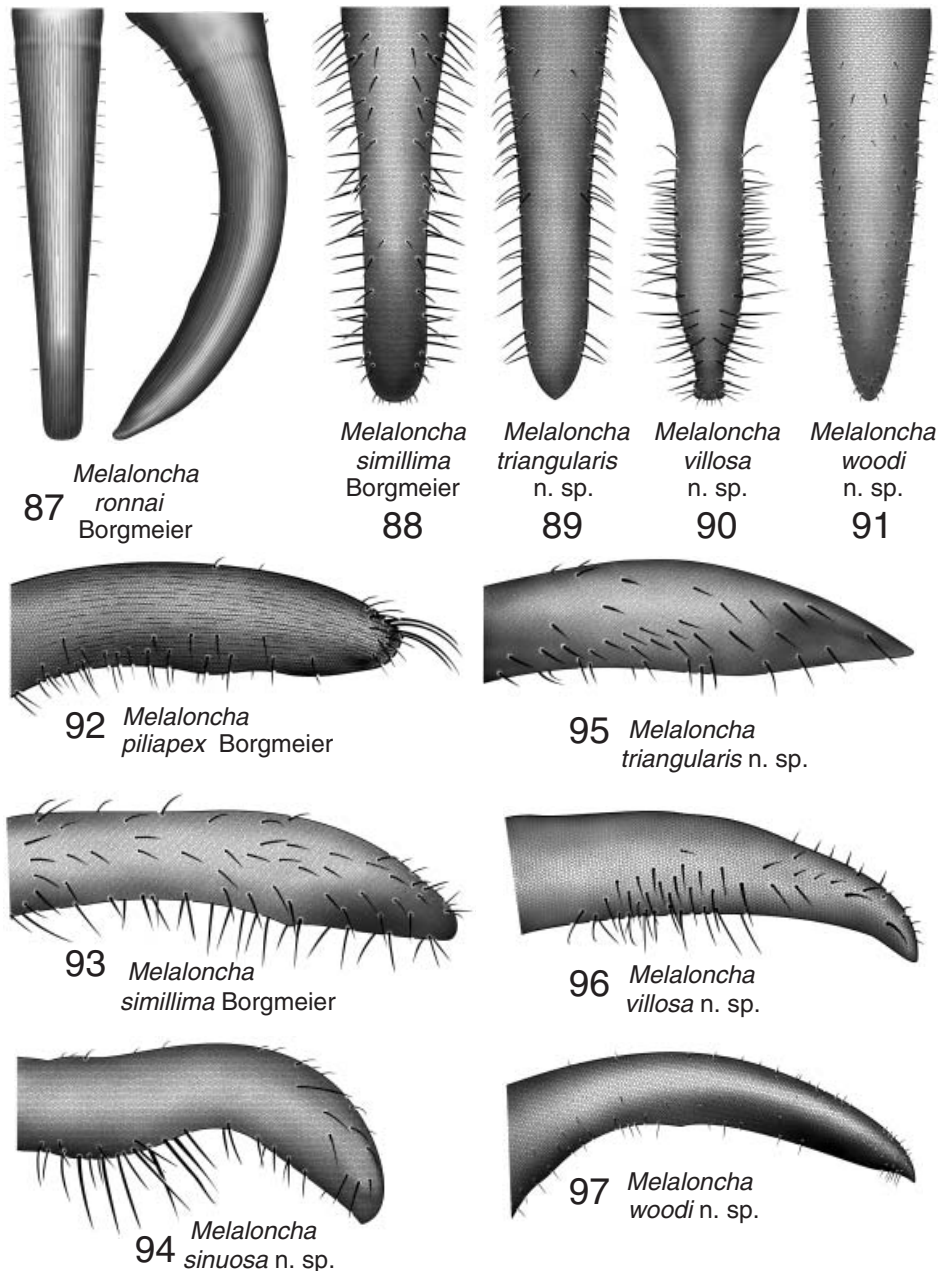
*Description.* Body length 2.2–2.8 mm. Frons orange, except ocellar triangle black. Setal base of all setae coloured like rest of frons. Mean frontal width 0.29 head width; range 0.26–0.33. Frons with fine reticulate sculpturing, slightly shiny, punctate, with small, black setulae. Median furrow present (faint in some specimens). Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.6 length of postocellar setae, slightly ventral to level of ventral ocellus. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, relatively narrow. Combined length of fore tarsomeres approximately 0.8 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 slightly expanded. Pulvilli of fore leg large. Tarsal claws of all legs small, finely bifurcate at apex. Mid and hind leg yellowish-brown. Mean costal length 0.53 wing length; range 0.5–0.56. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor relatively tubular, relatively straight. In dorsal view, lateral setae of ovipositor thin, short, relatively numerous, apically with two pairs of long, curved setae. Ventrally, ovipositor with long, thin, sparse setae. Surface of ovipositor with faint, somewhat longitudinally directed sculpturing.

*Geographical distribution.* Costa Rica and Brazil.

*Other material examined.* BRAZIL: Santa Catarina: Nova Teutônia, 27.18°S, 52.38°W, 1 paralectotype ♀, vi.1937, 3 paralectotype ♀, vii.1937, 1♀, v.1972, 4♀, no date, F. Plaumann (LACM, MCZC, MZSP, USNM). COSTA RICA: San José: Zurquí de Moravia, 10.05°N, 84.02°W, 1♀, iii–iv.1993, P. Hanson, Malaise trap, 1600 m (LACM).

***MELALONCHA RONNAI* BORGMEIER (FIG. 87)**

*Melaloncha ronnai* Borgmeier, 1935: 262, fig. 14, plate 1, figs 2, 3; 1971: 129.



**Figures 87–97.** *Melaloncha* spp., ovipositors. Fig. 87, dorsal and left lateral. Figs 88–91, dorsal. Figs 92–97, left lateral.

*Melaloncha rubricornis*: Borgmeier, 1968: 221 (in part).

*Phora apum* Amerling, 1862: 239 [*nom. nudum*].

**Holotype.** ♀, BRAZIL: Distrito Federal [Rio de Janeiro]: Deodoro, 22.xi.1935, A. Ronna, ex. *Apis mellifera* [LACM ENT 122494] (MZSP).

**Recognition.** This species can be recognized by the narrow, elongate ovipositor, with setae that are so short and sparse that the ovipositor appears nearly bare (Fig. 87). Ronna (1936) described the larva and

pupa of this species. Borgmeier (1935) described the male.

**Description.** Body length 2.7–3.8 mm. Frons orange, except ocellar triangle black. Setal base of all setae coloured like rest of frons. Mean frontal width 0.3 head width; range 0.3–0.32. Frons with fine reticulate sculpturing, slightly shiny, slightly punctate (punctures shallow, nearly invisible), with small dark setulae. Median furrow faint, but present. Frontal setae normal; arrangement of frontal setae unmodified,

with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.6 length of postocellar setae, approximately one-half distance between level of ventral ocellus and dorsal fronto-orbital setae. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, relatively narrow. Combined length of fore tarsomeres approximately 0.8 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 slightly expanded. Pulvilli of fore leg large. Tarsal claws of all legs enlarged, deeply bifurcate. Mid and hind leg yellowish-brown. Mean costal length 0.55 wing length; range 0.52–0.57. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor relatively tubular, strongly curved ventrally. In dorsal view, lateral setae of ovipositor minute, sparse. Ventrally, ovipositor with minute, sparse setae. Surface of ovipositor with faint, somewhat longitudinally directed sculpturing. Intersegment 7–8 extraordinarily elongate, with thin dorsal sclerite. Stylet also unusually long.

*Host.* This species has been reared from the honey bee, *Apis mellifera* in both Brazil (Ronna, 1936, 1937), Costa Rica (Ramírez, 1984) and Guatemala (see Other Material Examined). Obviously, this is not a natural host for this species, as honey bees were introduced into Brazil for agricultural purposes, and have since spread throughout South and Central America, as far north as the southern USA. Interestingly, *M. ronnai* has not been collected in the wild in Costa Rica, and might have been able to expand its range with its adopted honey bee host. The flies have not been found in association with any bees native to the New World. The records of Costa Rican parasitoids of *A. mellifera* are all of *M. ronnai*. Ramírez (1984) speculated that more species were involved, but this conjecture lacks any supporting evidence. Ronna (1937) mentions that flies attacked their hosts on flowers of caboatá (*Cupania vernalis* Cambess.; Sapindaceae).

*Geographical distribution.* Guatemala to Argentina.

*Other material examined.* ARGENTINA: Misiones: Loreto, Ruinas Jesuíticas, 27.77°S, 57.28°W, 1♀, 24.viii.2000, P. Fidalgo, yellow pan trap (LACM). BRAZIL: Distrito Federal: Deodoro, 1♂, 1♀, viii.1935, 1♂ (with puparium), 22.xi.1935, 2♂, 1936, A. Ronna, ex. *Apis mellifera* (MZSP); Minas Gerais: near Timoteo, 1♀, 23–30.viii.1997, 1♀, 9.viii.1999, 1♀, 23.viii.1999, 1♀, 13.x.1999, E. R. DePaula (EMUS, LACM); Rio de Janeiro: Jardim Botânico, 1♀, viii.1934, H. Sousa Lopes (MCZC), Rio Claro, 1♀, 1♀, 28.ix.1935, H. Sousa Lopes (MCZC); Santa Catarina: Nova Teutônia, 27.18°S, 52.38°W, 2♀, vi.1970, 1♂, 1♀ [no date], F. Plaumann (LACM, MZSP, USNM).

COSTA RICA: Alajuela: Grecia, 10.08°N, 84.30°W, 2♀, 28.x.1977, W. Ramirez [ex. *Apis mellifera*] (LACM, MUCR); Guanacaste: 3 km SE Rio Naranjo [Finca Montezuma], 1♀, 19–22.ii.1993, F. D. Parker, [Malaise trap] (EMUS); San José: Escazu, 1♀, 24–30.i.1988, F. D. Parker (EMUS), Farm La Caja, 1♀, 20.vii [no year], H. Schmidt (USNM), Palmitos, 10.07°N, 84.47°W, 3♀, 13.xii.1976, C. Torres, ex. *Apis mellifera* (MUCR), San José, 9.98°N, 84.07°W, 3♀, 16.x.1977, D. Edwards (INBC, LACM, MUCR). GUATEMALA: Antigua, 14.59°N, 90.62°W, 12♀, 10.ii.1983, R. Spencer, ex. *Apis mellifera* (KSEM, LACM, USNM).

#### *MELALONCHA RUBRICORNIS* BORGMEIER

*Melaloncha rubricornis* Borgmeier, 1924: 17–18.

*Holotype.* ♂, BRAZIL: Rio de Janeiro: Petrópolis, 22.i.1923, Ronchi [LACM ENT 122521] (MZSP).

*Species recognition.* This species is known only from the male sex, differentiated by Borgmeier from other species by the wing venation (e.g. Borgmeier, 1971: 130). He stated that the venation of this species was identical with that of *M. piliapex*, a taxon that, at the time, was a mixture of two species. As Borgmeier (1971) stated: 'The segregation of species is not easy. Owing to sexual dimorphism, it is especially difficult to associate the males with respective females. It is therefore highly inconvenient to base new species on males alone, as I unfortunately did several times in the past.'

#### *MELALONCHA SIMILLIMA* BORGMEIER (FIGS 10, 88, 93)

*Melaloncha simillima* Borgmeier, 1938: 52, figs 14–16.  
*Melaloncha piliapex*: Borgmeier, 1959: 175, 1971: 126 (in part).

*Lectotype.* Because of past confusion of *M. piliapex* with this species, I here designate a lectotype from the type series to fix the concept of *M. simillima*: ♀, BRAZIL: Santa Catarina: Nova Teutônia, 27.18°S, 52.38°W, vii.1937, F. Plaumann [LACM ENT 122386] (MZSP).

*Recognition.* This species can be recognized by the long, ventral setae of the ovipositor that extend along its entire length (Fig. 93). Unlike *M. piliapex*, with which it was previously confused, *M. simillima* has no enlarged, dorsoapical setae.

*Description.* Body length 2.2–3.4 mm. Frons orange, except ocellar triangle black. Setal base of all setae coloured like rest of frons. Mean frontal width 0.26 head width. Range 0.26–0.27. Frons with fine reticulate sculpturing; slightly shiny. Frons punctate, with small, black setulae. Median furrow faint, but present. Frontal setae normal. Arrangement of frontal setae



unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.5 length of postocellar setae, slightly ventral to level of ventral ocellus. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, slightly expanded. Combined length of fore tarsomeres approximately 0.8 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 expanded. Pulvilli of fore leg large. Tarsal claws of all legs small, finely bifurcate at apex. Mid and hind leg yellowish-brown, with tarsomeres 4–5 and apex of tarsomere 3 of mid leg dark brown dorsally. Mean costal length 0.56 wing length. Range 0.53–0.6. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor relatively tubular. Ovipositor slightly curved ventrally. In dorsal view, lateral setae of ovipositor thin, short, relatively numerous. Ventrally, ovipositor with long, thin, sparse setae. Surface of ovipositor with faint, irregular, reticulate sculpturing. Intersegment 7–8 darkened basally, with dorsal, pointed sclerite flanked by posterolateral expansions (Fig. 10).

*Geographical distribution.* Costa Rica and Brazil.

*Other material examined.* BRAZIL: Santa Catarina: Nova Teutônia, 27.18°S, 52.38°W, 1 lectotype ♀, iii.1937, 5 lectotype ♀, vii.1937, 1♀, vi.[no year], 4♀, [no date], F. Plaumann (LACM, MZSP). COSTA RICA: Alajuela: 20 km S Upala, 1♀, 14.ii.1991, 1♀, 12.iii.1991, F. D. Parker, [Malaise trap] (EMUS, LACM); Guanacaste: 14 km S Cañas, 1♀, 20–24.iii.1989, F. D. Parker, [Malaise trap] (EMUS); Heredia: La Selva Biological Station, 10.43°N, 84.02°W, 1♀, 1.vi.1993, ALAS, Malaise trap M/01/108, 1♀, 1.iii.1994, ALAS, Malaise trap M/01/360 (INBC, LACM); Limón: R. B. Hitoy Cerere, Valle la Estrella, 1♀, vii.1994, J. F. Quesada, 100 m, #3174 (INBC); Puntarenas: 5.5 km SW Rincon, Tropical Youth Center, 8.70°N, 83.51°W, 1♀, 20.vii.2002, L. Gonzalez, honey-sprayed undergrowth (LACM).

**MELALONCHA SINUOSA SP. NOV.** (FIG. 94)

*Recognition.* This species can be recognized easily by the sinuous outline of the ovipositor in lateral view (Fig. 94).

*Description.* Body length 2.3 mm. Frons black. Setal base of all setae coloured like rest of frons. Frons 0.3 head width; with fine reticulate sculpturing, slightly shiny, with small punctures and small, black setulae restricted to lateral one-third. Median furrow faint, but present. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.5

length of postocellar setae, approximately 0.4 distance from ventral ocellus to dorsal fronto-orbital setae. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, slightly expanded. Combined length of fore tarsomeres approximately 0.8 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 relatively narrow. Pulvilli of fore leg large. Tarsal claws of all legs small, finely bifurcate at apex. Mid and hind leg yellowish-brown. Costa 0.49 wing length. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor laterally compressed in apical one-half, sinuous in lateral view, curved ventrally in apical one-third. In dorsal view, lateral setae of ovipositor numerous, thin. Ventrally, ovipositor with longer, thicker setae in basal one-half and shorter, thinner setae in apical one-half. Surface of ovipositor with faint, somewhat longitudinally directed sculpturing.

*Geographical distribution.* Amazonian Brazil.

*Etymology.* Latin adjective for winding, referring to the sinuous shape of the ovipositor in lateral view.

*Holotype.* ♀, BRAZIL: Amazonas: 60 km N Manaus, Reserva Campina, 2.5°S, 60.0°W, 8–19.vi.1992, J. Vidal [LACM ENT 035996] (INPA).

**MELALONCHA TRIANGULARIS SP. NOV.** (FIGS 89, 95)

*Recognition.* This species is recognized by the distinctive, pointed apex of the ovipositor, giving it a triangular shape in lateral view (Fig. 95).

*Description.* Body length 2.8–3.1 mm. Frons orange, except ocellar triangle black. Setal base of all setae coloured like rest of frons. Mean frontal width 0.29 head width; no range. Frons with fine reticulate sculpturing, slightly shiny, punctate, with small, black setulae. Median furrow faint, but present. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.6 length of postocellar setae, level with ventral ocellus in holotype, just dorsal to dorsal fronto-orbital seta in paratype. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, slightly expanded. Combined length of fore tarsomeres approximately 0.8 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 relatively narrow. Pulvilli of fore leg large. Tarsal claws of all legs small, finely bifurcate at apex. Mid and hind leg yellowish-brown, with tarsomeres 4–5 and apex of tarsomere 3 of mid leg dark brown dorsally. Mean costal length 0.54 wing length; range 0.52–0.55. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen

grey. Ovipositor relatively tubular, slightly, dorsoventrally flattened at apex, slightly curved ventrally, triangular in lateral view. In dorsal view, lateral setae of ovipositor thin, short, relatively numerous. Ventrally, ovipositor with short, fine, sparse setae. Surface of ovipositor with faint, irregular, reticulate sculpturing.

*Variation.* As noted in the description above, the placement of the dorsal interfrontal setae differs widely between the holotype and paratype.

*Geographical distribution.* Costa Rica and Brazil.

*Etymology.* Latin adjective for triangular, referring to the shape of the apex of the ovipositor.

*Holotype.* ♀, COSTA RICA: Puntarenas: Arenal Conservation Area, San Luis Monteverde, Buen Amigo, v.1994, Z. Fuentes, 1000–1350 m, #2926 [INBIOCRI001893901] (INBC).

*Paratype.* BRAZIL: Nova Teutônia, 27.18°S, 52.38°W, 1♀, 10.vii.1936, F. Plaumann (MZSP).

***MELALONCHA VILLOSA* SP. NOV.** (FIGS 90, 96)

*Recognition.* The ovipositor of this species is distinctive, with its narrowed apex and the large number of medium-sized lateral setae in dorsal view (Fig. 90).

*Description.* Body length 3 mm. Frons orange, except vertex and ocellar region, which are black. Setal base of dorsal fronto-orbital setae black. Frons 0.21 head width; with fine reticulate sculpturing, not shiny, punctate, with small, black setulae. Median furrow absent. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.5 length of postocellar setae, level with ventral ocellus. Palpus with 3–4 shorter, subapical setae in addition to usual longer apical seta and short yellow setae. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, except tarsomere 5 dark brown. Fore tarsomeres relatively narrow. Combined length of fore tarsomeres approximately 0.8 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 slightly expanded. Pulvilli of fore leg large. Tarsal claws of all legs small, finely bifurcate at apex. Mid and hind leg yellowish-brown, with tarsomeres 4–5 and apex of tarsomere 3 of mid leg dark brown dorsally. Costa 0.51 wing length. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor relatively tubular in shape, apically narrowed, slightly deflected ventrally at apex. In dorsal view, lateral setae of ovipositor numerous, thin. Ventrally, ovipositor with short, fine, sparse setae. Surface of ovipositor with faint, irregular, reticulate sculpturing.

*Geographical distribution.* Costa Rica.

*Etymology.* Latin for hairy, referring to the lateral setation of the ovipositor.

*Holotype.* ♀, COSTA RICA: San José: 6 km N San Gerardo, 9.95°N, 84.05°W, viii.1993, P. Hanson, Malaise trap, 2800 m [LACM ENT 001441] (LACM).

***MELALONCHA WOODI* SP. NOV.** (FIGS 91, 97)

*Recognition.* This species is similar to *M. ronnai*, but the ovipositor is slightly broader (Fig. 91) and has a slight lateral emargination.

*Description.* Body length 2.2–2.4 mm. Frons orange, except ocellar triangle black. Setal base of all setae coloured like rest of frons. Mean frontal width 0.3 head width; range 0.28–0.32. Frons with fine reticulate sculpturing, not shiny, punctate, with small, black setulae. Median furrow present. Frontal setae normal; arrangement of frontal setae unmodified, with ventral interfrontal setae near venter of frons. Dorsal interfrontal setae present, 0.5 length of postocellar setae, slightly ventral to level of ventral ocellus. Palpus unmodified. Ocular and genal setae flattened, yellow. Fore tarsomeres yellowish-brown, expanded, short. Combined length of fore tarsomeres approximately 0.78 tibial length. Fore tarsomere 1 approximately twice as long as tarsomere 2. Fore tarsomere 5 slightly expanded. Pulvilli of fore leg large. Tarsal claws of all legs enlarged, deeply bifurcate. Mid and hind leg yellowish-brown, with tarsomeres 4–5 and apex of tarsomere 3 of mid leg dark brown dorsally. Mean costal length 0.55 wing length; range 0.52–0.57. Tergite 6 of similar colour to other tergites. Tergites 2–6 lateroventrally black, with silver pollinosity. Venter of abdomen grey. Ovipositor relatively tubular, slightly, dorsoventrally flattened, strongly curved ventrally. In dorsal view, lateral setae of ovipositor minute, sparse. Ventrally, ovipositor with minute, sparse setae. Surface of ovipositor with faint, somewhat longitudinally directed sculpturing.

*Geographical distribution.* Mexico and Bolivia.

*Etymology.* Named after Dr D. M. Wood, who collected the holotype specimen.

*Holotype.* ♀, COSTA RICA: Alajuela: Alberge de Heliconia, 10.71°N, 85.04°W, 18.vi.2000, D. M. Wood, Gressitt-style Malaise trap [LACM ENT 069248] (INBC).

*Paratypes.* BOLIVIA: Beni: Rio Itenez at mouth of Rio Baures, 1♀, 5.x.1964, J. K. Bouseman, L. Lussenhop (AMNH). MEXICO: Chiapas: Palenque, 10.ix.1974, W. Hanson, G. Bohart (EMUS).

KEY TO *M. (UDAMOCHIRAS)* FEMALES

- (1) Ovipositor with dorsomedial carina (Figs 31–33) ..... 2  
 – Ovipositor lacking dorsomedial carina ..... 4
- (2) Thorax and abdomen almost completely yellow, except for dark posterior markings on tergites (Fig. 24) ..... 3  
 – Thorax and abdomen mostly dark in colour (Fig. 23)..... *M. brevicarina* sp. nov.
- (3) Ovipositor with numerous large setae (Fig. 30)..... *M. premordica* sp. nov.  
 – Ovipositor nearly bare (Fig. 29)..... *M. carinata* sp. nov.
- (4) Lateroventral one-half of abdominal tergites with orange-yellow colouring (Fig. 25) ..... 5  
 – Abdominal tergites dark-brown to black laterally (Fig. 22) ..... 7
- (5) Ovipositor broad in dorsal view, with lateral emargination (Figs 56, 57); tergite 6 mostly orange dorsally ..... 6  
 – Ovipositor narrow in dorsal view (Fig. 34), without lateral emargination; tergite 6 mostly dark brown dorsally ..... *M. flavilata* sp. nov.
- (6) Ovipositor with short, peg-like process at dorsal apex (Figs 57, 62)..... *M. paxilla* sp. nov.  
 – Ovipositor without process, somewhat concave at apex (Figs 56, 61)..... *M. aprica* sp. nov.
- (7) Dorsal interfrontal setae present near ventral ocellus (Figs 26, 27)..... 8  
 – Dorsal interfrontal setae absent ..... 40
- (8) Frons mostly dark brown to black ..... 9  
 – Frons mostly orange to yellow, although setal bases might be black (as in Fig. 27) ..... 14
- (9) Ovipositor with three posterior projections: rounded central projection, and two longer, lateral projections (Fig. 69)..... *M. deinocerca* Borgmeier  
 – Ovipositor with single posterior projection ..... 10
- (10) Ovipositor sinuous in lateral view, with long ventral setae basally (Fig. 94)..... *M. sinuosa* sp. nov.  
 – Ovipositor smoothly curved ventrally, ventral setae extremely short..... 11
- (11) Tarsomeres 4 and 5 of fore leg dark brown, in contrast to rest of yellowish-brown leg; frons relatively narrow ..... 12  
 – Fore leg entirely yellowish-brown; frons relatively broad ..... 13
- (12) Only tarsomeres 4 and 5 of fore leg dark brown; ovipositor in lateral view deeper (Fig. 51)..... *M. individa* sp. nov.  
 – Tarsomeres 3–5 of fore leg dark brown; ovipositor not as deep (Fig. 52)..... *M. rhytopoda* sp. nov.
- (13) Ovipositor laterally flattened and deep apically (Fig. 84) ..... *M. nigricorpus* Borgmeier  
 – Ovipositor more rounded, narrow at apex (Fig. 63)..... *M. anaticula* sp. nov.
- (14) Bases of some frontal setae dark brown to black, at least in dorsal fronto-orbital pair (as in Fig. 27)..... 15  
 – Without black setal bases on frons ..... 18
- (15) Ovipositor laterally or posteriorly with prominent setae (Figs 67, 79, 90)..... 16  
 – Ovipositor without prominent setae (Fig. 49) ..... *M. spatula* sp. nov. (in part)
- (16) Longest setae of ovipositor are apical pair (Fig. 67)..... *M. biseta* sp. nov. (in part)  
 – Longest setae of ovipositor are lateral (Figs 79, 90)..... 17
- (17) Apex of ovipositor in dorsal view broadly rounded; lateral setae of ovipositor relatively thick (Fig. 79); palpus with only one apical, black setula as well as several yellow setulae; frons often with dark spots on middle and lower row of setae as well as upper row ..... *M. maculifrons* sp. nov.  
 – Apex of ovipositor narrowed in dorsal view; lateral setae relatively thin (Fig. 90); palpus with more than one black setula; black spots present only on upper row ..... *M. villosa* sp. nov.
- (18)  $R_{2+3}$  present, at least as basal remnant ..... 19  
 –  $R_{2+3}$  completely absent..... 21
- (19)  $R_{2+3}$  complete; venter of ovipositor consists of pair of large, ventrally directed hooks (Figs 46, 47); ovipositor with thick, long ventral setae ..... 20  
 –  $R_{2+3}$  basally present; venter of ovipositor without ventral hooks or large, thick, setae (Fig. 66) ..... *M. basella* sp. nov.
- (20) Ventral setae organized into clumped groups; apex of dorsal lobe sharply curved ventrally (Fig. 47)..... *M. hamata* sp. nov.  
 – Ventral setae more scattered; apex of dorsal lobe gradually curved ventrally (Fig. 46) ..... *M. mexicana* Borgmeier



- (21) Ovipositor extremely deep, laterally compressed, shiny (Figs 68, 72) ..... ***M. compressicauda* sp. nov.**  
 – Ovipositor more tubular in shape ..... 22
- (22) Abdominal segment 6 with large, yellow lobe; ovipositor densely  
 setose (Figs 78, 85) ..... ***M. lobata* sp. nov.**  
 – Abdominal segment 6 without large lobe; ovipositor various ..... 23
- (23) Ovipositor, in lateral view only slightly curved or curved only at apex (Figs 45, 53–55,  
 81, 82, 86, 92, 93, 95). Note: if there is some question about the curvature of  
 an ovipositor, try both leads from this couplet ..... 24  
 – Ovipositor strongly and evenly curved in lateral view (Figs 74, 75, 87, 97) ..... 35
- (24) Venter of ovipositor with long, black, well-developed setae from near base to  
 near apex (Fig. 93); apex of ovipositor without larger setae (Fig. 88) ..... *M. simillima* Borgmeier  
 – Venter of ovipositor with at most fine, long or short setulae, or setae restricted  
 to base or apical one-third; some species with larger setae at apex of ovipositor ..... 25
- (25) Ovipositor in dorsal view with long, thick setae laterally (Figs 44, 77) ..... 26  
 – Ovipositor in dorsal view with only minute or fine setae on lateral margins ..... 27
- (26) Ovipositor with lateral setae strong along entire length, only slightly  
 and gradually smaller near apex (Fig. 77) ..... *M. hirticauda* Borgmeier  
 – Ovipositor with thicker setae near base and thinner, sparser setae  
 near apex (Fig. 44) ..... ***M. spicula* sp. nov.**
- (27) Apical tarsomere of foreleg dark brown, in contrast to other, yellowish-brown tarsomeres ..... 28  
 – Apical tarsomere of foreleg yellowish-brown, like other tarsomeres ..... 29
- (28) Ovipositor in dorsal view expanded posterior to mid-point (Fig. 49) ..... ***M. spatula* sp. nov.** (in part)  
 – Ovipositor in dorsal view parallel-sided (Fig. 50) ..... ***M. vargasi* sp. nov.**
- (29) In lateral view, ovipositor with small, ventral, preapical swelling, and  
 apical point, making apex somewhat triangular (Fig. 95) ..... ***M. triangularis* sp. nov.**  
 – In lateral view, ovipositor not so pointed ..... 30
- (30) Ovipositor laterally compressed at apex, so that apex is deeper  
 than broad (Fig. 86) ..... ***M. parkeri* sp. nov.**  
 – Ovipositor not laterally compressed at apex ..... 31
- (31) Ovipositor dorsoventrally flattened and pointed at apex, slightly downturned;  
 without apically enlarged setae (Fig. 48) ..... ***M. horologia* sp. nov.**  
 Ovipositor otherwise ..... 32
- (32) Apex of ovipositor, in dorsal view, narrowed to point (Figs 59, 76) ..... 33  
 – Apex of ovipositor, in dorsal view, truncate, broad (Figs 67, 80) ..... 34
- (33) Apex of ovipositor with larger, thicker, pairs of setae dorsoapically and  
 subapicolaterally (Fig. 76) ..... ***M. hansonii* sp. nov.**  
 – Apex of ovipositor without large setae (Fig. 59) ..... ***M. apicula* sp. nov.**
- (34) Dorsum of apex of ovipositor with two posterolateral pairs of longer,  
 curved setae (Fig. 80) ..... *M. piliapex* Borgmeier  
 – Dorsum of apex of ovipositor with single pair of relatively straight  
 posterolateral seta (Fig. 67) ..... ***M. biseta* sp. nov.** (in part)
- (35) Ovipositor in lateral view with extremely short setae, thus appearing almost bare  
 (Figs 87, 97) ..... 36  
 – Ovipositor with longer, thin setae (Figs 74, 75) ..... 37
- (36) Ovipositor broad at base; slightly dorsoventrally flattened (Figs 91, 97) ..... ***M. woodi* sp. nov.**  
 – Ovipositor narrow at base; tubular in shape (Fig. 87) ..... *M. ronnai* Borgmeier
- (37) Ovipositor short, truncate apically in dorsal view (Fig. 70) ..... ***M. exigua* sp. nov.**  
 – Ovipositor longer, narrower in dorsal view (Fig. 71) ..... ***M. falcata* sp. nov.** (in part)
- (38) Ovipositor dorsally concave, broader than deep (Figs 35, 39) ..... ***M. trua* sp. nov.**  
 – Ovipositor convex dorsally, deeper than broad ..... 39
- (39) Ovipositor relatively straight (Fig. 64) ..... ***M. angustifrons* sp. nov.**  
 – Ovipositor ventrally curved (Figs 40–43) ..... 40
- (40) In lateral view, ovipositor not deeper apically; ovipositor with long  
 ventral setae (Fig. 75) ..... ***M. falcata* sp. nov.** (in part)  
 – In lateral view, ovipositor deeper apically (Figs 40, 41, 43), or if not greatly  
 deepened (Fig. 42), then ovipositor ventrally without long setae ..... 41

- (41) Ovipositor basally deep (Fig. 43) ..... *M. valeria* sp. nov.  
 – Ovipositor shallow basally, deepening apically (Figs 40–42) ..... 42  
 (42) Ovipositor abruptly deeper at apex, broadly truncate (Fig. 40) ..... *M. colossia* Enderlein  
 – Ovipositor gradually deepening, apically pointed (Figs 41, 42) ..... 43  
 (43) Ovipositor with prominent longitudinal striations; ovipositor apically deeper;  
 lateral setae of ovipositor sparse, thin, and short (Figs 36, 41) ..... *M. rhampha* sp. nov.  
 – Ovipositor without distinct striations; ovipositor apically only slightly deepened;  
 lateral setae of ovipositor denser, thicker, and longer (Fig. 42) ..... *M. rostrata* sp. nov.

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## APPENDIX 1

## SPECIES USED FOR PHYLOGENETIC ANALYSIS

*Phalacrotophora fasciata* (Fallén)  
*Phalacrotophora berlinensis* Schmitz  
*Phalacrotophora epeirae* (Brues)  
*Phalacrotophora rufiventris* Borgmeier  
*Phalacrotophora* sp. (Group 3) LACM ENT 040649  
*Phalacrotophora* sp. (Group 4) LACM ENT 036175  
*Melittophora salti* Brues  
*Melaloncha furcata* Borgmeier  
*Melaloncha obscurella* Borgmeier  
*Melaloncha* sp. 22 LACM ENT 075610  
*Melaloncha brevicarina* sp. nov.



*Melaloncha clavata* Borgmeier  
*Melaloncha* sp. 29 (*M. cingulatus*-group) LACM ENT  
 076069  
*Melaloncha ungulata*-group LACM ENT 128398  
*Melaloncha digitalis*-group LACM ENT 054801  
*Melaloncha hamata* sp. nov.  
*Melaloncha colossia* (Enderlein)  
*Melaloncha ronnai* Borgmeier

## APPENDIX 2

## RATIOS

FR: frontal ratio (frontal height divided by frontal width); VSR: ventral setae ratio (vif/vfo); DSR: dorsal setae ratio (dif/dfo) for representative *Phalacrotophora*, *Melittophora* and *Melaloncha* species

	FR	VSR	DSR
Primitive <i>Phalacrotophora</i>			
<i>P. berlinensis</i> Schmitz	1.30	1.00	0.94
<i>P. delageae</i> Disney	1.42	1.00	0.94
<i>P. fasciata</i> (Fallén)	1.35	1.00	0.94
<i>P. nedae</i> (Malloch)	1.44	1.00	0.90
<i>Phalacrotophora</i> ( <i>Phalacrotophora</i> )			
<i>P. bruesiana</i> Enderlein	2.18	1.12	0.88
<i>P. epeirae</i> (Brues)	1.79	1.00	0.90
<i>P. halictorum</i> (Melander & Brues)	1.56	1.00	0.90
<i>P. petropolitana</i> Borgmeier	1.63	1.07	1.00
<i>P. sp.</i> LACM ENT 045258	1.83	1.00	0.88
<i>Phalacrotophora</i> groups 2–4			
<i>P. longifrons</i> (Brues)	1.71	1.25	0.78
<i>P. pictofasciata</i> Schmitz	1.59	1.29	0.80
<i>P. rufiventris</i> Borgmeier	1.95	1.08	0.65
<i>P. sp.</i> LACM ENT 040649	1.82	1.56	0.69
<i>P. sp.</i> LACM ENT 036175	1.81	1.38	n/a
<i>Melittophora salti</i> Brues	0.83	n/a	n/a
<i>M. (Melaloncha) clavata</i> Schmitz	1.59	1.40	n/a
<i>M. (Melaloncha) digitalis</i> -group	2.00	1.10	n/a
<i>M. (Melaloncha) furcata</i> Borgmeier	2.78	1.30	n/a
<i>M. (Melaloncha) ungulata</i> -group	1.83	1.21	n/a
<i>M. (Melaloncha) obscurella</i> Borgmeier	2.42	1.29	n/a
<i>M. (Melaloncha) sp.</i> 22	1.78	1.14	n/a
<i>M. (Melaloncha) sp.</i> 29	2.00	1.23	n/a
<i>M. (Udamochiras) brevicarina</i> sp. nov.	1.74	0.97	n/a
<i>M. (Udamochiras) carinata</i> sp. nov.	1.90	1.05	n/a
<i>M. (Udamochiras) colossia</i> (Enderlein)	2.36	1.04	n/a
<i>M. (Udamochiras) hamata</i> sp. nov.	2.00	0.94	0.57
<i>M. (Udamochiras) ronnai</i> Borgmeier	2.13	1.00	0.50

## APPENDIX 3: HENNIG-86 INPUT FILE

xread 'phal-mela data'

31 19

out	00000	00000	00000	00000	00000	00000	0
Pfasc	10000	00000	00000	00000	00000	00000	0
Pbero	11000	00000	00000	00000	00000	00000	0
Pepei	10111	00000	00000	00000	00000	00000	0
Prufi	10100	11111	00000	00000	00000	00000	0
Phalgp3	10100	11111	11000	00000	00000	00000	0
Phalgp4	10100	21111	11000	00000	00000	00000	0
Melit	10202	22221	1?111	11110	00000	00000	0
Melfurc	10100	22221	11111	10001	11111	10001	1
Melobsc	10100	22221	11111	10001	11111	10001	1
Mel22	10100	22221	11111	21001	11111	10001	1
Melbrev	10100	22221	10111	11001	11111	11110	0
Melclav	10100	22221	11111	11001	11111	10001	1
Mel29	10100	22221	11111	11001	11111	10001	1
Melglab	10100	22221	11111	21001	11111	10001	1
Meldigi	10100	22221	11111	11001	11111	10001	1
Melhama	10100	12221	00111	10001	11111	12110	0
Melcolo	10100	22221	00111	11001	11111	12120	0
Melronn	10100	12221	00111	11001	11111	12110	0