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BOLBOCERATINE SCARABS OF THE ORIENTAL GENUS *BOLBOHAMATUM* NOV. (COLEOPTERA, GEOTRUPIDAE)

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With 71 text-figures

ABSTRACT

The genus *Bolbohamatum* nov. is proposed to accommodate four species hitherto combined with *Bolboceras* Kirby, and nine new species. The genus, characterized by a spine-bearing lobe separating the middle coxae, is endemic in the Oriental Region. The 13 species are keyed, illustrated, and their distribution is recorded. The following novelties are described: *Bolbohamatum drescheri drescheri* (Java), *drescheri indosinicum* (Indo-China), *drescheri birmanicum* (Burma, Laos); *B. kuijteni* (India), *marginale* (India), *meridionale* (India, Sri Lanka), *phallosum* (India), *pseudogrande* (India), *pyramidifer* (India), *robustum* (India), *syncopator* (India). The four old species are *B. cyclops* (Olivier) (type-species; synn. nov. are *Scarabaeus veter* Fabricius, *Bolboceras subglobosum* Westwood), *calanus* (Westwood), *laevicolle* (Westwood) (syn. nov. *Bolboceras grande* Westwood), *laterale* (Westwood). For three names lectotypes are designated. The phylogeny of the genus is briefly discussed.

INTRODUCTION

The larger Bolboceratini of tropical Asia, i.e. those with a total length between 13 and 23 mm, belong nearly all in one monophyletic group, for which here a new generic name is proposed: *Bolbohamatum*. This monophyly is inferred from the presence of a characteristically shaped, spine-bearing metasternal lobe between the middle coxae (fig. 56), a feature that seems to be unique within both the tribe and the family. The new genus comprises four species described more than a century ago, and nine described below for the first time. Two names possibly relating to *Bolbohamatum* species remained dubious, their types having disappeared.

With some experience the males of most *Bolbohamatum* species can easily be identified on the basis of the diagnostic information presented in this paper; in some cases the examination of the genitalia will prove to be indispensable. The identification of the females will present greater difficulties, because of their rather poor, uniform cephalic and pronotal ornamentation, and because they cannot always be associated with the opposite sex of the same species. The former factor also renders the identification of the occasional underdeveloped male troublesome. More work on *Bolbohamatum* is certainly needed. It seems, nevertheless, undesirable to delay the publication of the present results, were it alone for the fact that the collections of this group cannot be expected to grow

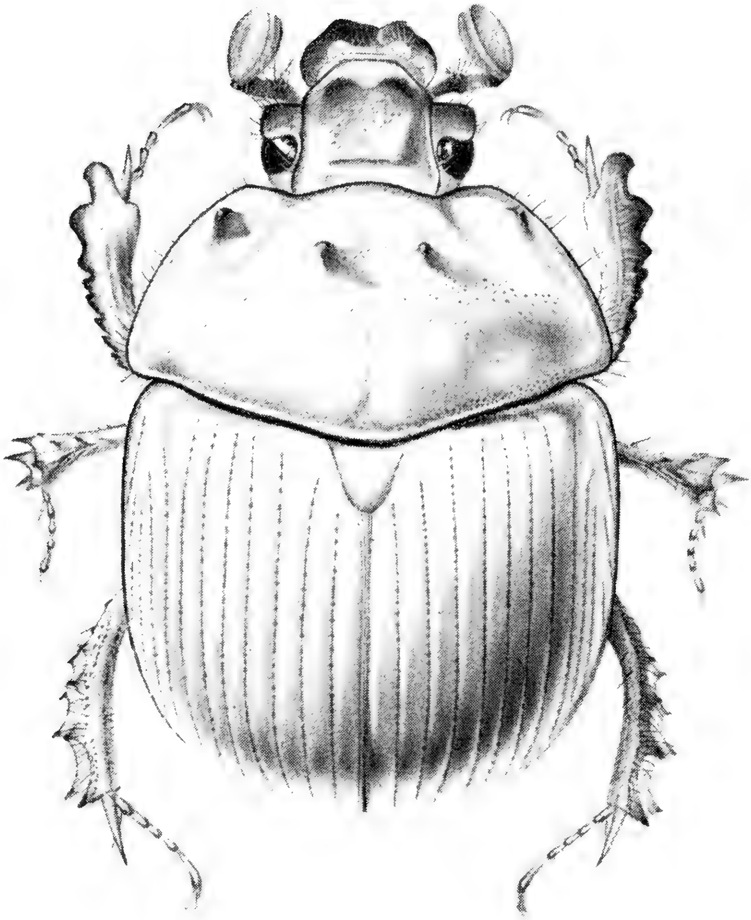


Fig. 1. *Bolbohamatum drescheri drescheri*, holotype (male) from Java. Length ca. 18.5 mm.

significantly in the years ahead. Any supplementary information regarding *Bolbohamatum* will be included in a proposed review of the Asian bolboceratine genera. For more about the scope of this series of papers on Bolboceratini, see Krikken, 1977b.

TECHNICAL REMARKS

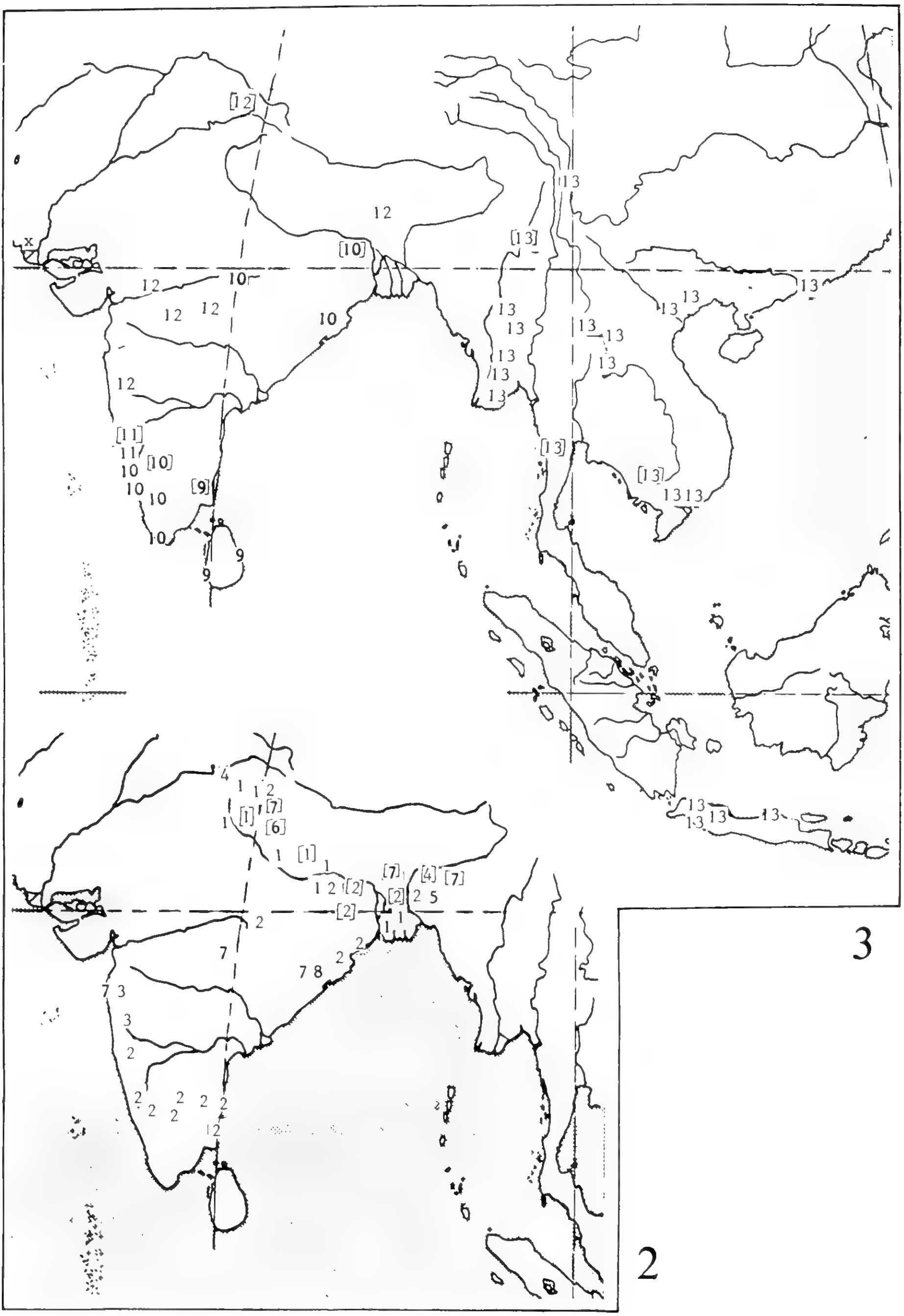
Some points have already been discussed in my *Bolbogonium* paper (1977b). In this treatment of *Bolbohamatum* I have kept the descriptions of the novelties rather concise, and of the other species I give descriptive details only as far as they are taxonomically important (identification, variation, sexual dimorphism).

The parameres and other parts of the phallus are in *Bolbohamatum* usually strongly sclerotized and provide excellent characters for the identification to species. The homologies of these characters, however, are as yet poorly understood. The phallus proper moves within a complex structure (*sagulum), consisting of a (ventral) bottom sledge (*fundus), a pair of lateral flaps, and a roof (*tectum). The parameres frequently have sclerotized protrusions (*paramerites) and sacks (*sacculi); the latter seem to be inflatable. The dorsal side of the basal capsule (in fact consisting of scarcely separated distal and proximal parts) is open, i.e. covered by a membrane. The median lobe (with the penis proper, the internal sac) is usually concealed by the aforesaid parts. The positions of these parts (terms marked with an asterisk proposed ad hoc) are explained in four diagrams (figs. 5—8). The genital characters of the females, as well as the taxonomic value of the sagulum of the males, need further study.

The arrangement and development of the fossorial protrusions on the outer (anterior) side of the middle and hind tibiae are more or less characteristic but difficult to describe. In *Bolbohamatum* these protrusions are bidentate-bilobate and decreasingly pronounced proximad. Usually there is one complete anteapical protrusion (i.e. there are two denticles or lobes connected by a complete crest), denoted 1c. Proximad there are some paired incomplete protrusions (i.e. protrusions lacking a complete crest), numbered 2, 3, n, from apex to base; these are either placed opposite to each other, a situation denoted n po, or shifted relative to each other, a situation denoted n ps. Near the tibial base the protrusions become single and/or obsolescent. In the descriptions given below a formula 1c—2ps—3ps—4 then means that from apex to base the outer side of the tibia is provided with one anteapical pair of protrusions connected by a crest, two pairs lacking a crest, in both cases the superior protrusions being shifted proximad, while, finally, there is a single protrusion near the tibial base. The protrusions 2 on the hind tibia (figs. 54, 55) are used for diagnostic purposes (see synoptic table, character 15).

The dentation of the fore tibia is described as a + b, in which a is the number of large distal denticles, b the number of smaller denticles, the size of which decreases proximad.

Lectotypes are selected if in the original description under a given species-group name at the same time: (1) no specimen is singled out as "type" (the type) or holotype; (2a) there are phrases from which it can be inferred that there was more



Figs. 2, 3. Approximate known distribution of *Bolbohamatum* species. Numbers refer to species as numbered in text. 2, species 1—8; 3, species 9—13. Numbers between square brackets refer to insufficiently detailed locality data.

than one specimen at hand; or (2b) there are no phrases from which it can be inferred that there was a single specimen at hand. This rigid formulation seems necessary because the practice of lectotype selection varies among taxonomists.

Most topographic names have been checked against those occurring in The Times Atlas of the World and the Gazetteers of the U.S. Board on Geographic Names. Places not located with a precision better than a hundred km are followed by an asterisk, and, if mapped, the symbol concerned is placed between square brackets. The spelling of topographic names as given on the labels is frequently maintained, in order to enable easy recognition of the specimens examined. The data of two old species have been condensed by separately giving localities, months, collections.

In the drawings the scale lines all represent 1 mm.

The collection abbreviations used are as follows:

BH Zoologisches Museum der Humboldt-Universität, Berlin D.D.R.
BM British Museum (Natural History), London.
L Rijksmuseum van Natuurlijke Historie, Leiden.
P Muséum National d'Histoire naturelle, Paris.
SMT Staatliches Museum für Tierkunde, Dresden.

Other collections are mentioned in full.

Genus **Bolbohamatum** nov.

Generic diagnosis. — Metasternum with anterior lobe narrowly separating middle coxae, anteriorly always with a small spiniform protrusion (fig. 56), midline of lobe more or less raised; metasternal disc rhomboid in outline. Head of males with pair of tubercles on clypeus or between eye-canthi (figs. 1, 9, etc.); frons of females (fig. 59) with transverse ridge; surface behind cephalic protrusions of males frequently impressed-callose. Pronotum of males with median and lateral protrusions (figs. 1, 9, 10, etc.); surface between paramedian and lateral protrusions usually concave; lateral tubercles in some cases obsolete; females with feeble protrusion(s) on anterior side of pronotal disc. Aedeagus usually strongly sclerotized, structure complex, including various accessory elements. Proximal surface on antennal club segment 1 with glabrous polished area (fig. 57). Pronotum entirely marginate, though base not always distinctly ridged.

Outline of left mandible in dorsal view variable, from simply arcuate to sinuate-lobate (figs. 51—53). Labrum with fine transverse ridge. Outline of clypeus (figs. 1, 9, etc.) approximately trapeziform, with distinct perimarginal ridge. Frontolateral ridge well pronounced. Eye-canthus (figs. 1, 9, etc.) with straight anterior border, anterolateral angle more or less angulate. Eyes not completely divided by canthus and temporal lobe. Dorsally visible area of eye-canthus usually little larger than area of eye-canthus. Scutellum deltoid (figs. 9, etc.), sides more or less sinuate; ratio length/width 1—2; base finely ridged. Apex of pronotum with narrow velum. Elytral base without well-defined ridge. Elytral epipleuron reaching apico-sutural angle. Elytron with 7 striae between suture and humeral umbone, 1 reaching side of scutellum (figs. 9 etc.), stria 2 curved and more or less effaced near base; others reaching base; all striae (except stria 2 in two species) superficially impressed and interstriae flat or slightly convex. Antennal club large, but not thicker than length of pedicel and flagellar segments combined. Anterior paramedian costae of prosternum distinct. Posteromedian part of prosternum simply bulbous. Fore tibia with 7—10 external denticles, their size decreasing proximad. Fossorial elevations on middle and hind tibiae (figs. 54, 55) bidentate-bilobate, their size decreasing proximad. Fore tibial spur long, large, with acute apex. Habitus, fig. 1. Colour uniformly brown to yellow. Medium-sized to large (total length 13—23 mm).

Type-species. — *Scarabaeus cyclops* Olivier.

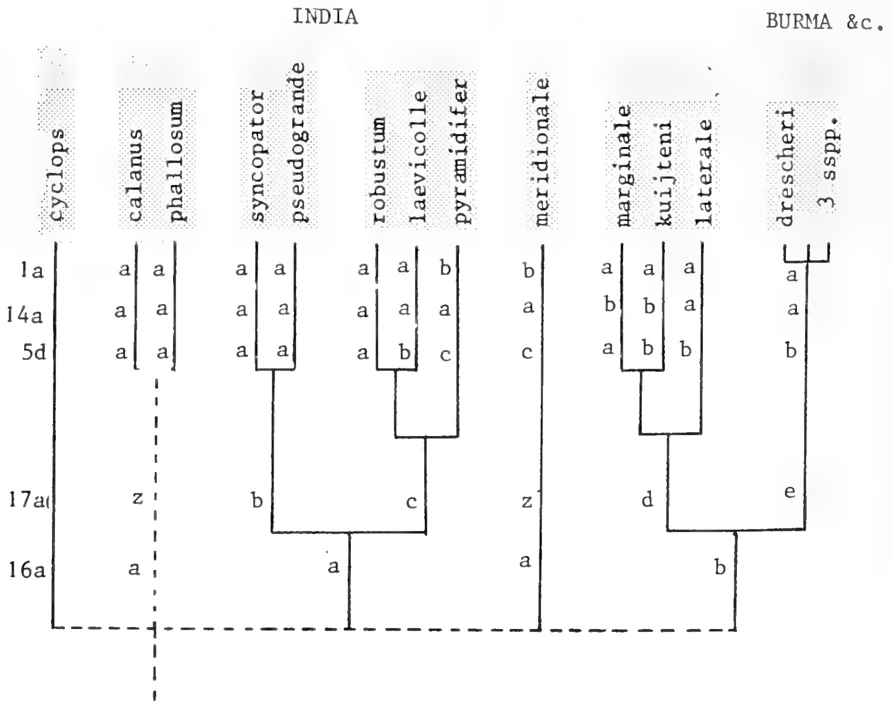


Fig. 4. Phylogenetic diagram summarizing the present classification of *Bolbohamatum*, as based on the stridulatory granules of the pygidium (character 16 in synoptic table, see text), the structure of the phallus (17), the pronotal protrusions (5), the disposition of the first elytral stria (14), and the shape of the cephalic tubercles (1). Letters denote character states; species-groups shaded. See also section Phylogeny in text.

Affinities. — The group around *Bolboceroides validus* (Klug) (Krikken, 1978) seems closely affined to *Bolbohamatum* judged from the strong overall similarity in external characters. The metasternal spine, however, certainly is a unique differentiating character of *Bolbohamatum*. Furthermore, the males of the *Bolboceroides validus* group are characterized by the presence of a simple transverse clypeal ridge, not connected with the margin, whereas *Bolbohamatum* males always have a pair of isolated tubercles on either clypeus or the anterior part of the frons. The only representative of the *validus* group in the Oriental Region seems to be *Bolboceroides carinicollis* (Laporte), the other species being Arabian and Afrotropical.

Bolboceras Kirby, with which four *Bolbohamatum* species were combined up till now, is very remotely related to *Bolbohamatum*; *Bolboceras* is a, probably junior, synonym of *Odonteus* Samouelle (cf. Krikken, 1978: 301, footnote).

Distribution and composition. — Thirteen species in the Oriental Region, with transgression of one species into the Palaearctic Region (figs. 2, 3). Only two species occur outside India, one on Ceylon, the other ranging eastward from Burma to China and Java. The gap between Java and the continental range is also found in *Bolbelasmus* (Krikken, 1977a: 280). The records from Karachi and Taiwan need confirmation.

Infrageneric dissimilarities. — For the identification to species and subspecies it is crucial to study well-developed males. In case of doubt, the characters of the male genitalia are always decisive. On the whole, 17 characters (classified below) proved to have practical diagnostic value. In the key to the males the genital features (character 17) are used first to delimit species-groups, the external features coming second. Three of four species-groups thus delimited are assumed to be monophyletic, primarily because the structure of their aedeagus is unique. The three other groups contain only one species each. With the aid of the synoptic table of characters preceding the analytical key most *Bolbohamatum* males (those of *phallosum* and *calanus* excepted) should be identifiable on external characters. As stated above, in the introduction, the identification of females remains very difficult, and in some cases seems impossible. The key to *Bolbohamatum* females given below only provides some guide-lines. Under each species the specific characters are briefly re-discussed (in the paragraphs headed Identification).

Individual variation. — Most conspicuous is the reduction of pronotal protrusions and cavities, if this is not already a character of the species. The topography of these modifications, reduced or not, however, always remains essentially the same. Such reductions in shape, noticed in all the species available in good series, have not been described in detail under each species. One distinct case of geographic variation has been found (*B. drescheri*).

Bionomics. — Unknown; probably burrowers; collected at light.

Phylogeny. — Evolution in *Bolbohamatum* can, in my opinion, only be discussed if four points are accepted: (1) the genus is monophyletic; (2) in the structure of the phallus there is a trend towards greater complexity (character 17, see synoptic table and explanation); (3) a pronotal ornamentation like in *B. calanus* is plesiomorphous, any reductions and other modifications being, eo ipso, apomorphous (character 5); (4) some unusual character states (1b and 14b) are apomorphous. Complexity in the phallus is here understood as development of paramerites and other elements supplementary to a relatively simple structure like that in *B. calanus* (figs. 27, 28).

It could then be argued that *B. cyclops* is the most strongly derived member of the genus, standing isolated by its peculiar pronotal ornamentation and by its very peculiarly modified phallus; it seems impossible to link this species with any of the others. The *pseudogrande* and *laevicolle* groups might be cladistic twins, because the ventral paramerites of the phallus seem homologous, whereas transitions from one type to the other can easily be imagined. The robust basal capsule of the phallus of *B. marginale*, in combination with its pronotal ornamentation, suggests a link between the *laterale* and *drescheri* groups. Both groups lack the row of stridulatory granules on the pygidium. The position of *B. meridionale* remains enigmatic considering its aedeagus, but that species is here placed near *pyramidifer* because of the similar cephalic and pronotal ornamentation. Finally, there are the apparently primitive *calanus* and *phallosum*, with a perfect external overall similarity, the latter, however, having a modified phallus.

These speculations, plus the known distribution of the species, are summarized in a phylogenetic diagram (fig. 4), which clearly shows with which "loose ends" we are left. The overall situation suggests that *Bolbohamatum* evolved on the Indian subcontinent, and spread in a relatively late stage (possibly after India reached Eurasia) through Burma into Sundaland and China. It is remarkable to see that the only species occurring East of the mountains on the Indian-Burmese border shows signs of subspeciation.

SYNOPTIC TABLE OF *Bolbohamatum* MALES

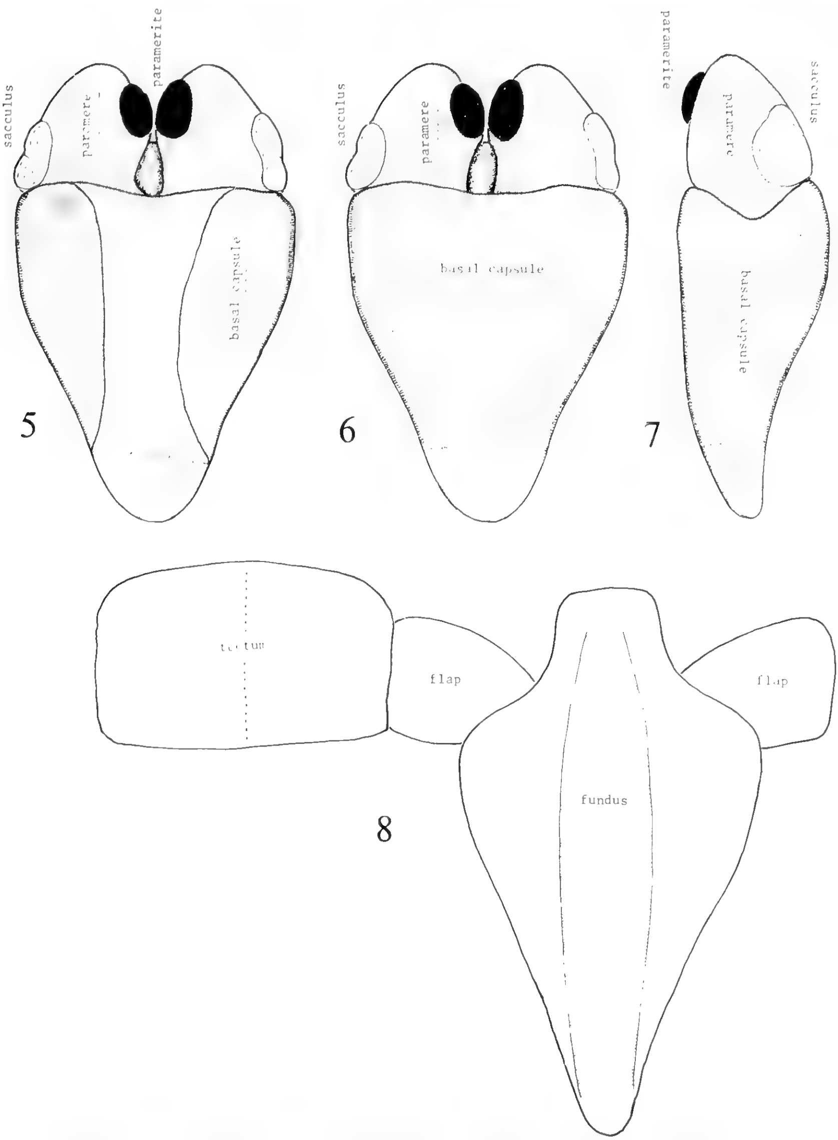
Characters	*1	2	3	4	*5	6	7	8	9	10	11	12	13	*14	15	*16	*17
states																	
1. *cyclops*	a	c	b	a	d	a	0	b	c	b	b	b	a—b	a	a	a	a
2. *calanus*	a	a	b	a	a	a	a	b	c	b	b	a	b	a	a	a	z
3. *phallosum*	a	a	b	a	a	a	a	b	c	b	b	a	b	a	a	a	z
4. *syncopator*	a	a	b	a	a	a	a	b	c	a—b	b	a	a	a	b	a	b
5. *pseudogrande*	a	b	b	a	a	a	a	b	c	b	b	b	b	a	a	a	b
6. *robustum*	a	a	b	a	a	a	a	b	c	b	b	b	a	a	b	a	c
7. *laevicolle*	a	a	a	b	b	a	a	a	a	b	a	b	b	a	a	a	c
8. *pyramidifer*	b	d	a	b	c	b	0	0	c	c	b	b	b	a	a	a	c
9. *meridionale*	b	d	a	a	c	b	(a)	(b)	c	c	b	b	b	a	b	a	z
10. *marginale*	a	c	a	a	a	a	a	b	c	a	a	a	b	b	a	b	d—e
11. *kuijteni*	a	c	a	a	b	a	b	b	c	a	a	a	b	b	a	b	d
12. *laterale*	a	c	a—b	a	b	b	b	0	c	c	b	b	a—b	a	a	b	d
13. *drescheri*	a	a/c	b	a	b	a	a/b	b	b	a	b	b	b	a	b	b	e

Explanation of characters and character states (see comparative illustrations):

*1. cephalic tubercles more or less dentiform (a), pyramidiform (b).
2. cephalic tubercles isolated and placed simply on clypeal disc (a), together on an elevation (b), on or against lateral margin (c); placed between eye-canthi (d).
3. paraocular ridges straight (a), curved laterad along eye (b).
4. dorsal outline of left mandible sinuate-lobate (a), simply arcuate (b).
*5. paramedian tubercles on pronotum placed close together on common

protrusion (a), well separated (b); paramedian tubercles poorly developed or absent (c); pronotum with large, laterally angulate median protrusion (d).

6. lateral tubercles of pronotum well developed (a), very poorly pronounced or absent (b).
7. (related with 5:) paramedian tubercles on pronotum separated by less than/equal to interocular distance (a), separated by more than interocular distance (b).



Figs. 5—8. Some terms relating to male genitalia. 5—7, diagram of phallus, dorsal (5), ventral (6), and lateral views (7); 8, sagulum, unfolded. Paramerites black (also in figs. 25—41).

8. (related with 6:) lateral tubercles on pronotum separated by less than/equal to distance between anterolateral angles (a), separated by more than distance between anterolateral angles of pronotum (b).
9. (related with 5:) median cavity of pronotal disc deep, very distinct (a), shallow (b), obsolescent or absent (c).
10. lateral impression of pronotum (adjacent to (para)median protrusion(s)) deep, very distinct (a), shallow (b), obsolescent or absent (c).
11. primary punctation of pronotal disc behind (para)median protrusion(s) sparse (punctures separated by more than 5 times their diameters) or indistinct (× 25) (a); primary punctation abundant or dense (b).
12. secondary punctation of pronotal disc sparse (punctures separated by more than 5 times their diameter) (a), abundant or dense (b).
13. elytra distinctly opaque, due to microreticulation (a), shiny (b).

*14. elytral stria 1 scarcely, virtually equally impressed over its entire length, and equally punctate over its entire length (a); stria 1 distally more strongly impressed and more strongly punctate (b).

15. distal pair of unconnected protrusions on (right) hind tibia placed more or less opposite to each other, 2po (a), superior protrusion distinctly shifted proximad, 2ps (b).

*16. pygidium with distinct transverse row of stridulatory granules at some distance from apex, elytral file distinct (a); "stridulatory" (strongly infuscated) granules scattered near apex, not transversely arranged, elytral file poorly developed or absent (b) [1]).

*17. phallus of: *cyclops* type, with spatuliform protrusions (a); *pseudogrande* type, with sledge- or collar-like paramerites (b); *laevicolle* type, with crossed paramerites (c); *laterale* type, with short, simply reflexed paramerites (d); *drescheri* type, with reduced parameres and enlarged basal capsule (e); different from preceding alternatives (z).

Between parentheses (in table above): character state poorly pronounced; oblique dash: both states occur (subspecies); dash: transitional state occurs; zero: not applicable; asterisk: used for phylogenetic discussion.

KEY TO SPECIES OF *Bolbohamatum*[2])

1. Males, with pair of protrusions between eye-canthi or on clypeus 2
— Females, with transverse frontal ridge, no pair of isolated tubercles; pronotal

[1]) Whereas the stridulatory capacities of state (b) remain doubtful, those of (a) can be demonstrated clearly by gently rubbing the abdomen (after relaxation) in its natural position against the elytral tips. The elytral file is a series of closely arranged fine transverse ridges (distinct at × 50 and more) on the juxtasutural costa on the inside of the elytral tips. In the *laterale* group of species the elytral files seem fully effaced (magnification × 50), in *drescheri* they are small but distinct.

[2]) For more characters, see synoptic table, and paragraphs under each species headed Identification.

ornamentation poorly developed. TENTATIVE KEY; names between square brackets: actual females unknown, characters established by inference . . 15

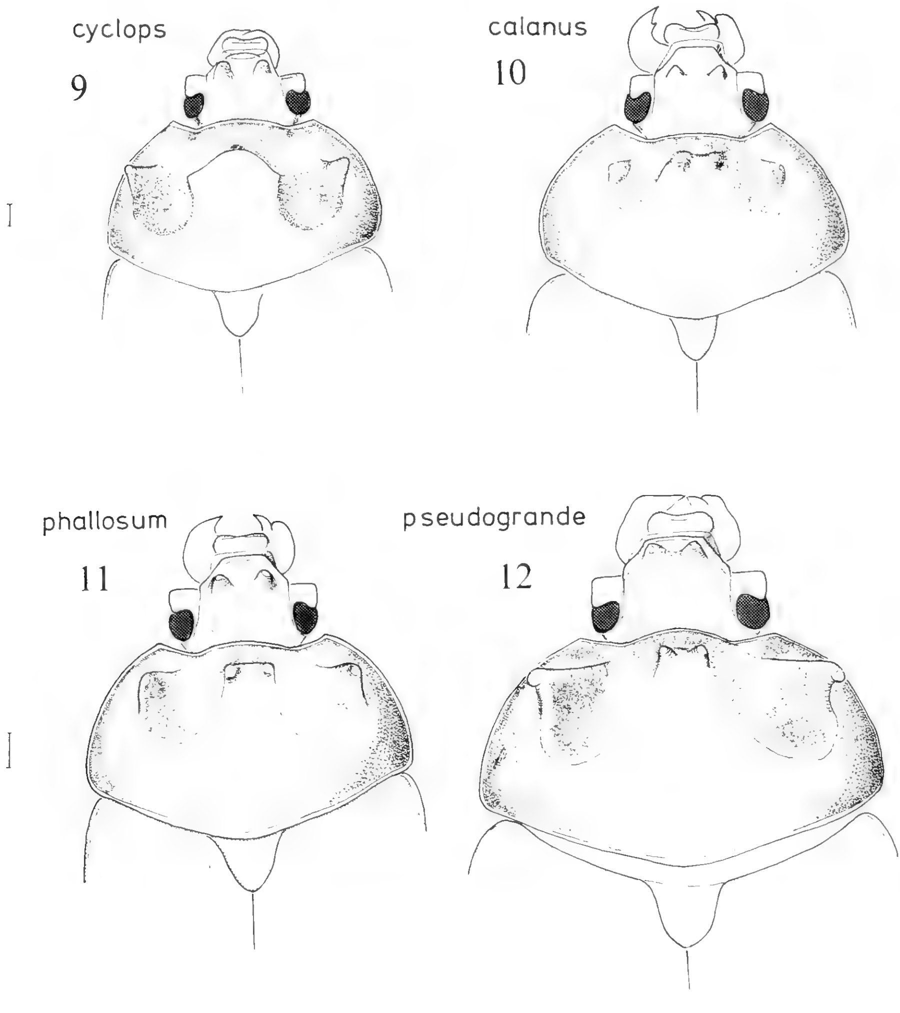
2. Basal capsule of phallus ventrally with paired spatuliform projection (fig. 26); aedeagus with similar projection and other characteristic details. Pronotum with broad, mostly laterally angulate protrusion (fig. 9). *B. cyclops* group . . . . 1. *cyclops*
— Phallus different 3
3. Aedeagus ventrally with pair of crossed spatuliform paramerites (figs. 35—37). *B. laevicolle* group 10
— Aedeagus different 4
4. Apex of parameres dorsally with short reflexed paramerites (figs. 38—40) (check carefully in case penis is extruded). *B. laterale* group 12
— Parameres different 5
5. Parameres and other parts of aedeagus relatively small, usually largely hidden in the greatly enlarged basal capsule of the phallus (fig. 41). *B. drescheri* group . . . . 13. *drescheri*, with subspecies, 14
— Parameres and basal capsule different. If similar, then elytral stria 1 distally more strongly impressed and more strongly punctate, see 12 6
6. Aedeagus ventrally with sledge- or collar-like, laterally reflexed paramerites (figs. 31, 33). *B. pseudogrande* group 9
— Aedeagus different 7
7. Cephalic tubercles pyramidiform (fig. 17). Paramedian tubercles on pronotum poorly developed or absent (fig. 17), other protrusions and impressions ditto. Fossorial elevations 2p on hind tibiae shifted. Aedeagus, fig. 32. *B. meridionale* group . . . . 9. *meridionale*
— Cephalic tubercles dentiform (figs. 10, 11) and aedeagus different. Pronotal protrusions usually well-developed (figs. 10, 11). Fossorial elevations 2p on hind tibiae (sub)opposite. *B. calanus* group 8
8. Aedeagus, figs. 27, 28 . . . . 2. *calanus*
— Aedeagus, figs. 29, 30 . . . . 3. *phallosum*
9. Clypeal tubercles connected at base (fig. 12). Fossorial elevations 2p on hind tibiae opposite (fig. 54). Aedeagus, fig. 31 . . . . 5. *pseudogrande*
— Clypeal tubercles simply separated (fig. 14). Fossorial elevations 2p on hind tibiae shifted. Aedeagus, figs. 33, 34 . . . . 4. *syncopator*
10. Protrusions between eye-canthi pyramidiform (fig. 16). Pronotal ornamentation poorly developed (fig. 16). Aedeagus, fig. 37 . . . . 8. *pyramidifer*
— Protrusions on clypeus more or less dentiform (figs. 13, 15). Pronotal ornamentation usually well developed 11
11. Paramedian tubercles of pronotum closely approximated (fig. 13). Dorsal outline of left mandible sinuate-lobate (fig. 52). Elevations 2p on hind tibiae shifted (fig. 55). Aedeagus, fig. 36 . . . . 6. *robustum*
— Paramedian tubercles of pronotum separated by distinct impression (fig. 15). Dorsal outline of left mandible simply arcuate (fig. 51). Elevations 2p on hind tibiae opposite. Aedeagus, figs. 35 . . . . 7. *laevicolle*
12. Elytral stria 1 virtually equally impressed and equally punctate over the entire

length. Pronotal disc heavily punctate. Elytra subopaque. Clypeal tubercles transverse, low. Aedeagus, fig. 38 . . . . 12. *laterale*

— Elytral stria 1 distally more strongly impressed and more strongly punctate than proximally. Pronotal disc lightly punctate. Elytra shiny. Clypeal tubercles dentiform, high 13

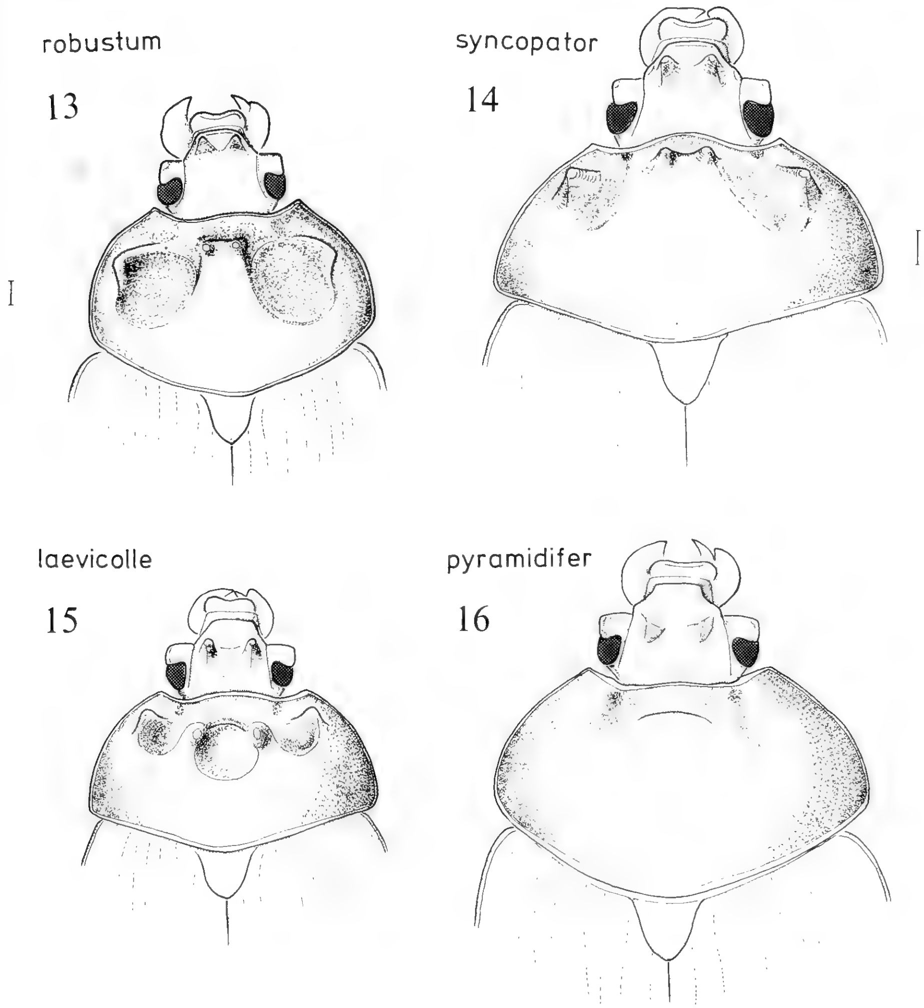
13. Paramedian tubercles of pronotum closely approximated, lateral impressions usually deep, well defined (fig. 20). Phallus (fig. 40) with enlarged basal capsule . . . . 10. *marginale*

— Paramedian tubercles of pronotum widely separated, lateral impressions shallow, ill defined (fig. 19). Aedeagus, fig. 39 . . . . 11. *kuijteni*



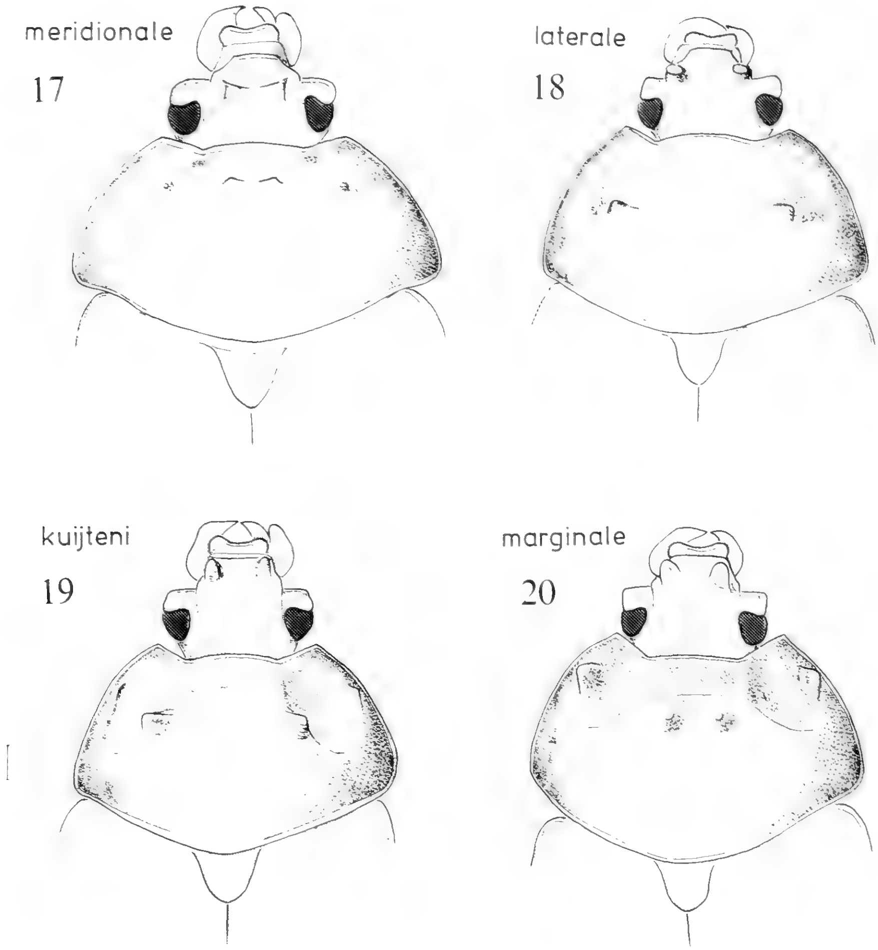
Figs. 9—12. *Bolbohamatum* males; dorsal contours of fore-body. 9, *cyclops*, Nepal; 10, *calanus*, Sylhet; 11, *phallosum*, holotype; 12, *pseudogrande*, holotype. — 10—12, same scale.

14. Occurring on Java. Ratio distance tips of paramedian pronotal cones/distance anterolateral angles less than 0.5; axes of cones inclined to midline (fig. 24) . . . . 13a. *drescheri drescheri*
— Occurring in Burma and Laos. Ratio distance tips of paramedian pronotal cones/distance anterolateral angles more than 0.6; axes of cones upright or inclined laterad (fig. 22) . . . . 13c. *drescheri birmanicum*
— Occurring in Indo-China and China. Ratio variable, in Indo-China usually ca. 0.5; axes of paramedian pronotal cones usually upright (fig. 23). Populations of Vietnam and Cambodia here named . . . . 13b. *drescheri indosinicum*



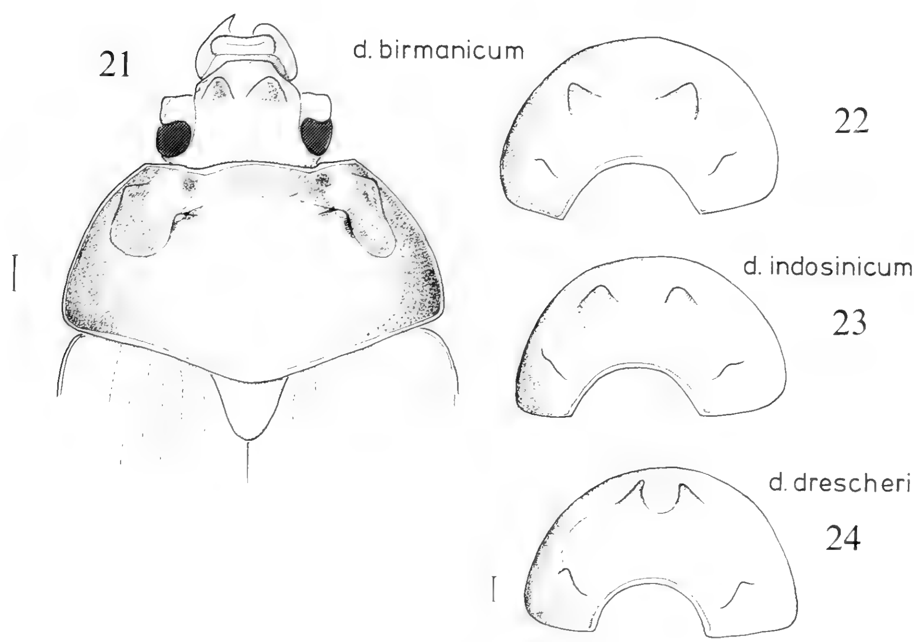
Figs. 13—16. *Bolbohamatum* males; dorsal contours of fore-body. 13, *robustum*, holotype; 14, *syncopator*, holotype; 15, *laevicolle*, Bombay; 16, *pyramidifer*, holotype. — 13, 15, same scale; 14, 16, same scale.

15. Occurring on Java . . . . 13a. *drescheri drescheri*
— Occurring in Indo-China . . . . 13b. *drescheri indosinicum*
— Occurring in India, Sri Lanka, Burma, Laos, China etc. 16
16. Elytral stria 1 distally more strongly impressed and more strongly punctate than proximally . . . . 10. *marginale*, [11. *kuijteni*]
— Elytral stria 1 virtually equally impressed and equally punctate over the entire length 17
17. Pronotum and head heavily punctate. Anteromedian ridge on pronotal disc simply arcuate (fig. 59). Dorsal outline of left mandible sinuate-lobate . . . . 1. *cyclops*
— Pronotum and head less heavily punctate; or not agreeing with the other two characters 18

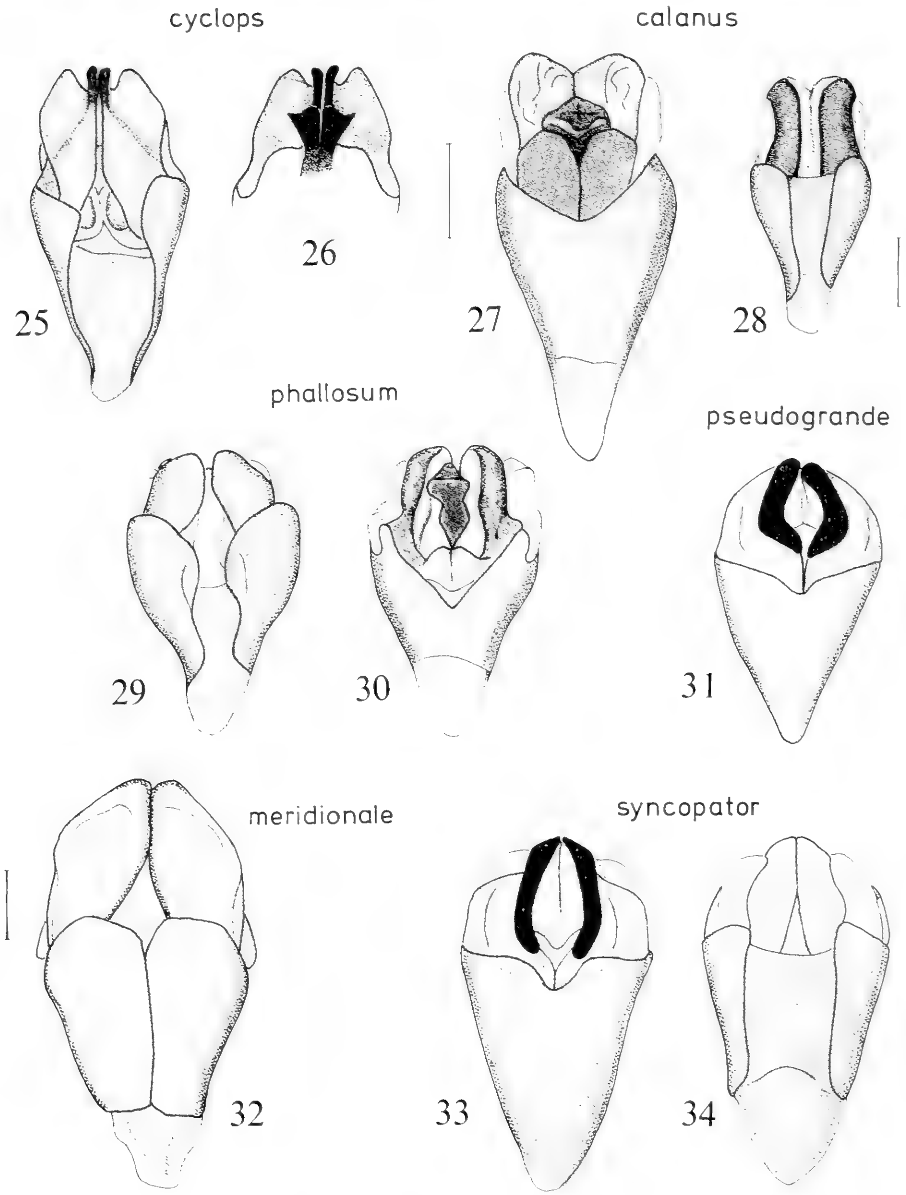


Figs. 17—20. *Bolbohamatum* males; dorsal contours of fore-body. 17, *meridionale*, holotype; 18, *laterale*, Nagpur; 19, *kuijteni*, holotype; 20, *marginale*, holotype. — All same scale.

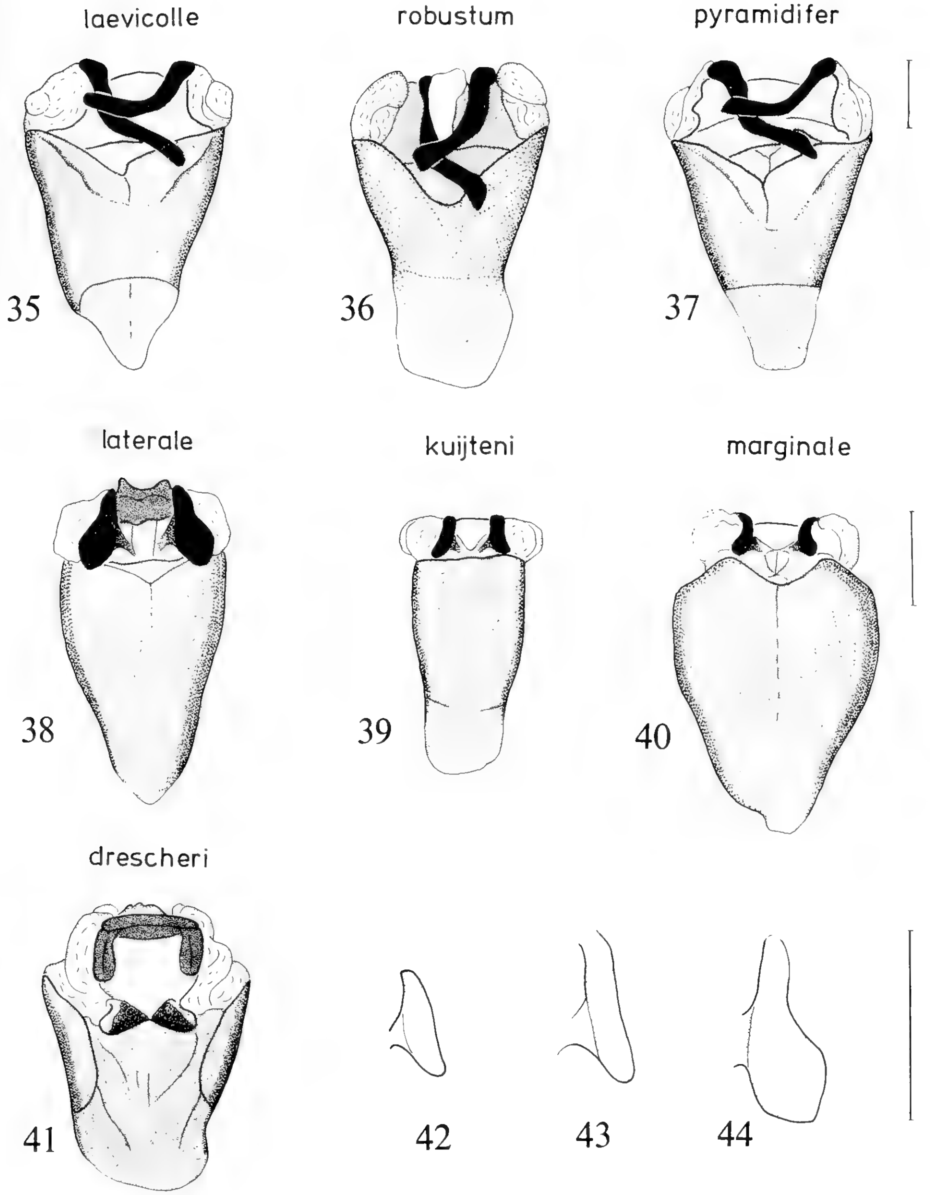
18. Superior (stridulatory) granules on pygidium arranged in transverse row . 19
— All granules scattered near apex 23
19. Dorsal outline of left mandible sinuate-lobate (fig. 52, 53) 20
— Dorsal outline of left mandible simply arcuate (fig. 51) 22
20. Fossorial elevations 2p on hind tibia shifted (fig. 55) . . . . [4. *syncopator*], [6. *robustum*]
— Fossorial elevations 2p on hind tibia opposite (fig. 54) 21
21. Elytra opaque . . . . [4. *pseudogrande*]
— Elytra shiny . . . . 2. *calanus*, [3. *phallosum*], [9. *meridionale*]
22. Elytral striae superficial, interstriae flat. Pronotal disc anteromedially bicallose; pronotal derm densely punctate . . . . 7. *laevicolle*
— Elytral striae more impressed, interstriae convex . . . . [8. *pyramidifer*]
23. Fossorial elevations 2p on hind tibiae shifted. Usually larger (length > 18 mm). Elytral files distinct. Specimens from Burma and Laos, 13c. *d. birmanicum*; from elsewhere . . . . 13. *drescheri*
— Fossorial elevations 2p on hind tibiae opposite. Usually smaller (length ≤ 18 mm). Elytral files absent. Apparently restricted to India . . . . . . 12. *laterale*



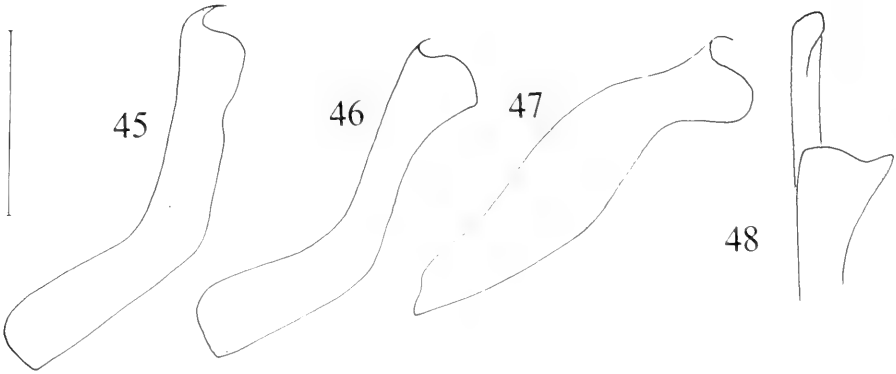
Figs. 21—24. *Bolbohamatum drescheri* males; dorsal (21) and frontal contours (22—24, pronotum), all paratypes. 21—22, *d. birmanicum*, Burma; 23, *d. indosinicum*, Saigon; 24, *d. drescheri*, Sukabumi. — 22—24, same scale.

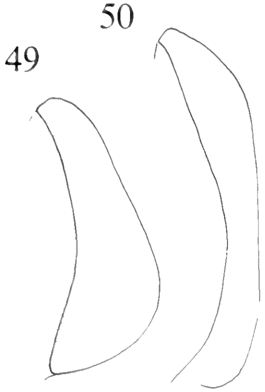


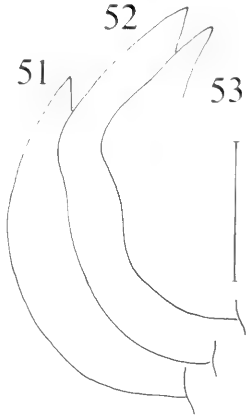
Figs. 25—34. Male genitalia of *Bolbohamatum* (d, dorsal, v, ventral view). 25, *cyclops*, d, 26, v, apex only, Dehra Dun; 27, *calanus*, v, 28, d, Sylhet; 29, *phallosum*, d, 30, v, holotype; 31, *pseudogrande*, v, holotype; 32, *meridionale*, d, holotype; 33, *syncopator*, v, 34, d, holotype. — Same scale, except 27.

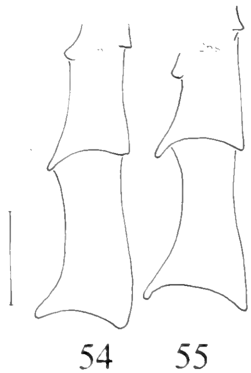


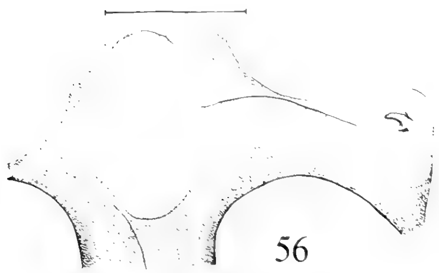
Figs. 35—41. Male genitalia of *Bolbohamatum* (35—40, ventral, 41, dorsal view). 35, *laevicolle*, Bombay; 36, *robustum*, holotype; 37, *pyramidifer*, holotype; 38, *laterale*, Nagpur; 39, *kuijteni*, holotype; 40, *marginale*, holotype; 41, *drescheri drescheri*, Bandung. — 35—37, 41, same scale; 38—40, same scale. Figs. 42—44. Ventral paramerites (left) enlarged, full-face. 42, *kuijteni*; 43, *marginale*; 44, *laterale*. All same scale.

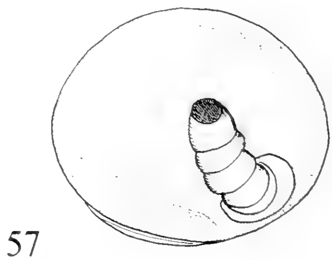












Figs. 45—50. Ventral paramerite (left) enlarged, full-face. 45, *robustum*; 46, *pyramidifer*; 47, *laevicolle*; 48, *cyclops*; 49, *pseudogrande*; 50, *syncopator*. All same scale.

Figs. 51—53. Contours of left mandible. 51, *laevicolle*, Bombay; 52, *robustum*, holotype; 53, *kuijteni*, holotype. Alle same scale.

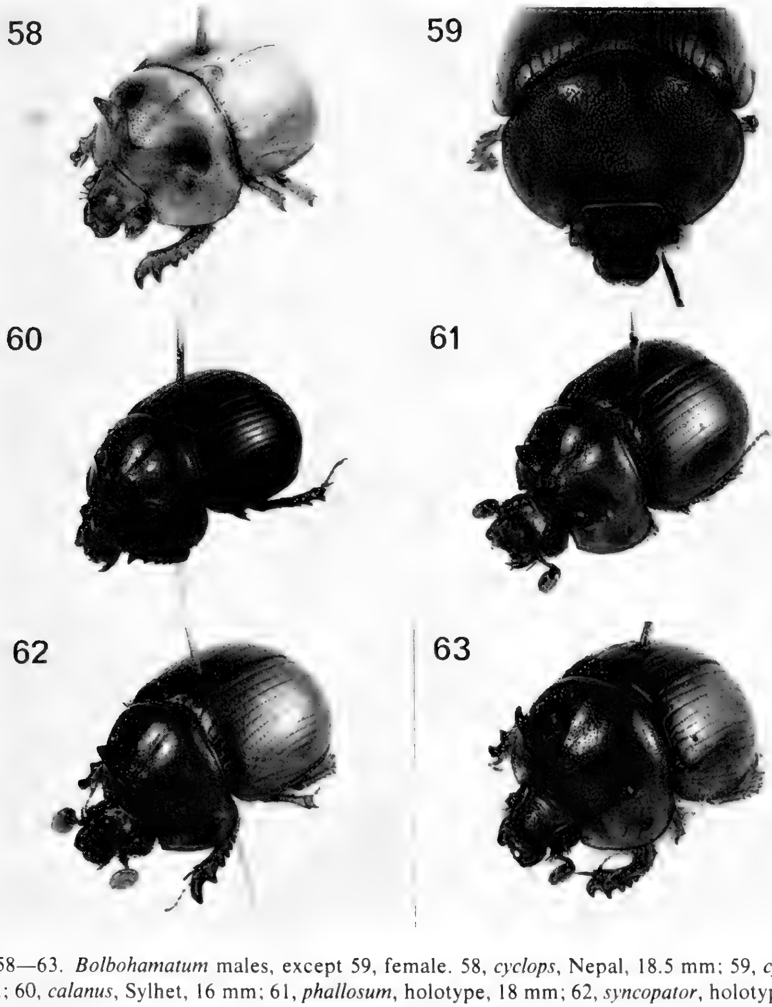
Figs. 54—55. Distal-external section of middle tibia to show disposition of protrusions 2p. 54, *pseudogrande*, holotype, with situation 2po = paired protrusions (no. 2) opposite; 55, *robustum*, holotype, with situation 2ps = paired protrusions shifted. 1c = complete anteapical crest (no. 1). See under Technical remarks.

Fig. 56. Metasternal disc and hook-bearing anterior lobe, ventrolateral view, of *Bolbohamatum drescheri drescheri* holotype. Fig. 57. Antennal club, view of club segment 1, with some proximal (flagellar) segments (*B. pseudogrande*).

The *cyclops* group

1. **Bolbohamatum cyclops** (Olivier) comb. nov. (figs. 9, 25, 26, 48, 58, 59)

Scarabaeus cyclops Olivier, 1789: 60 (diagnosis, no type-loc. given), pl. 15 fig. 140 (habitus). Westwood, 1848a: 384 (*Bolboceras*, diagnosis, records) [1]); 1852: 19 (diagnosis, records), pl. 3 fig. 15 (habitus).
Scarabaeus veter Fabricius, 1792: 33 (diagnosis, type-loc. East India). Boucomont, 1912: 14 (*Bolboceras*, in catalogue). Syn. nov.
Bolboceras subglobosus Westwood, 1852 (diagnosis, type-loc. East India), pl. 4 fig. 4 (fore-body). Syn. nov.



Figs. 58—63. *Bolbohamatum* males, except 59, female. 58, *cyclops*, Nepal, 18.5 mm; 59, *cyclops*, Pusa, 15 mm; 60, *calanus*, Sylhet, 16 mm; 61, *phallosum*, holotype, 18 mm; 62, *syncopator*, holotype, 19.5 mm; 63, *pseudogrande*, holotype, 20.5 mm.

[1]) The text of Westwood, 1848b, is identical.

Identification. — *Bolbohamatum cyclops* males are easily identifiable by the characteristic median protrusion on the pronotum. The phallus has a unique structure. In both sexes the pronotum is heavily punctate. For characters of female, see below.

Note. — The name *cyclops* has been applied to some of the other species, e.g. to *drescheri drescheri*, because allegedly some material came from Java (see labels of lectotype). It seems very unlikely that *B. cyclops* occurs on that island, or elsewhere outside India.

Variation and sexual dimorphism. — Length ♂ 17—19, ♀ 17—19 mm. The median protrusion on the pronotum is simply arcuate in smaller males, whereas the lateral cavities and adjacent denticles may be reduced as well. The density of the cephalic punctation varies strongly.

Females are characterized by a very distinct, feebly arcuate transverse ridge between the obsolescent lateral callosities. The entire pronotum, except for a small area near the base, is crowded with a well-pronounced double punctation. On these characters I have here synonymized *Bolboceras veter* (Fabricius) and *Bolboceras subglobosum* Westwood, both based on the female sex, with *Bolbohamatum cyclops*, the oldest available name for this species.

Material examined. — 22 males, 14 females.

The male lectotype of *Scarabaeus Cyclops* Olivier, here designated, with labels reading "Java" (sic), "cyclops", "type" (in red circle), "Cyclops Fab./Lees Cabt", and a recent Oxford type label "Type COL: 511/Bolboceras/cyclops Oliv./Hope Dept. Oxford". The female lectotype of *Scarabaeus Veter* Fabricius, here designated, bearing a red type label, and a label reading "Ind: orient: Vahl./Mus. S. & T: L:/Cyclops./Oliv./Geotrupes/veter. F." (Zoologiske Museum, Copenhagen). A female from the Hope Dept. of Entomology, apparently the holotype of *Bolboceras subglobosus* Westwood. And material from the following localities, months, collections:

India: Balaghat; Calcutta; Chapra; Dehra Dun; Moghal Sarai; New Delhi; Pusa; Simla; Sitapur (W. Almora); Suruwal*; N. India; N.W. India; Nepal; Himalaya. — Java (mislabelled).

Months vii (7 specimens), viii (2), ix (2), x (2).

Collections BM, P, SMT, Institut Royale des Sciences naturelles de Belgique, Zoologiske Museum (Copenhagen), Bernice P. Bishop Museum.

The *calanus* group

2. **Bolbohamatum calanus** (Westwood) comb. nov.
(figs. 10, 27, 28, 60)

Bolboceras calanus Westwood, 1848a: 385 (diagnosis, type-loc. Bombay); 1852: 21 (diagnosis, ♂, ? ♀), pl. 3 figs. 19 (habitus), 19a (fore-body), 19b (detail), pl. 4 fig. 6 (fore-body, ? ♀).

Bolboceras tumidulus Westwood, 1852: 22 (diagnosis, type-loc. Borhendshukur), pl. 4 fig. 7a, b (fore-body).

Identification. — Only the characters of the phallus distinguish *Bolbohamatum* *calanus* from its relative *phallosum*. The parameres of *calanus* have dorsally a moderately sclerotized, relatively narrow, on the whole poorly developed paramerite; the ventral side of the parameres is devoid of distinct paramerites. For further characters, see under *B. phallosum*.

Notes. — Other *Bolbohamatum* species have frequently been identified as *calanus* Westwood because of their similar pronotal ornamentation. I have not recovered all the specimens on which Paulian (1945: 41) based his *calanus* records for Indo-China, but certainly some of these, if not all, pertain to *B. drescheri*. Paulian's description seems based on *drescheri*, as the paramedian tubercles of the pronotum are said to be separated by a rounded foveole. The specimen figured by Paulian (1945: fig. 25) may, however, indeed belong to *calanus*.

Variation and sexual dimorphism. — Length ♂♀ 14—18 mm.

A large number of females remain which, judged from the non-sexual characters and size, may belong to *calanus* and *phallosum*. Usually their pronotum has a pair of feebly developed, slightly transverse median tubercles and an indication of lateral callosities. The pronotum is abundantly punctate, but never densely punctate throughout. From the females of the *laterale* group they can be separated by their transverse pygidial row of stridulatory granules, and from *marginale* (and *kuijteni*) by their different elytral stria 1. All the females belonging to either *calanus* or *phallosum* that could not be associated with males on the basis of their labels are recorded below as dubious *Bolbohamatum* specimens.

Material examined. — 40 males, 10 females.

Male lectotype, here designated, from "India/Boys Sale", also with label "calanus Hope", abdomen missing! Another male "type" in the Hope Dept. of Entomology, Oxford, is labelled "Madras/Hope", "Calanus/Hope", but that locality was not mentioned by Westwood (1848a: 385); I extracted the phallus of this male, and found it to agree with my original interpretation of *calanus*. In the BM I saw the holotype of *Bolboceras tumidulus* Westwood, apparently a female of either *calanus* or *phallosum*. Further material from the following localities, months, collections:

India: Balasore; Bangalore; Belgaum; Burju* (Bengal); Chickaballapura; Chota Nagpore; Dallongunj* (Bengal); Dehra Dun; Kanara; Madras; Moiyanala*; Motinala R.; Mughal Sarai; Namrum* (Bihar); Shimoga; Surada; Tranquebar; Vellore; Assam; Himalaya; Hindustan; Bangla Desh: Sylhet. — Java (mislabelled!?).

Months v, vii-viii (only 7 specimens had dates).

Collections BH, BM, DEI, P, SMT, Zoologiske Museum (Copenhagen), Forest Research Institute (Dehra Dun), Hope Dept. of Entomology, Senckenberg-Museum, Zoological Survey of India (Calcutta).

3. **Bolbohamatum phallosum** sp.nov.
(figs. 11, 29, 30, 61)

Holotype (male). — Approximate length 18, width 10.5, height 8 mm. Medium-brown, shiny; pilosity yellow-brown. Habitus, fig. 61.

Labrum emarginate in front, sides rounded; surface anteriorly limited by transverse ridge. Cephalic contours, fig. 11. Clypeus with pair of dentiform tubercles; clypeal margin ridged, genae raised; marginal declivities rugulate-punctate, horizontal surface contiguously punctate to rugulate-punctate; clypeofrontal suture effaced. Frontal disc concave; posterior cushion indistinct; entire frontovertex densely, but vaguely punctate. Eye-canthus rugulate-punctate; frontolateral ridge extending from genae beyond eye.

Pronotal contours, fig. 11; midline of pronotum impressed; base marginate; surface behind eyes slightly concave; pronotal punctation double (× 25); primary punctation coarse, dense on midline impression, on lateral declivities and along marginal ridges, absent on disc at some distance from base, in lateral cavities and on tubercles; secondary punctation abundant. Scutellum (fig. 11) subopaque, due to microreticulation, indistinctly punctate.

Juxtasutural punctures of elytra subobsolete; discal striae shallowly impressed, finely punctate; punctures separated by 5 ± 2 times their diameters; peripunctural impressions ill pronounced, slightly affecting interstriae. Elytral interstriae very slightly convex; derm subopaque, due to microreticulation (× 50); punctation minute, sparse.

Phallus figs. 29, 30.

Fore tibia with 2 + 5 external denticles. Middle and hind tibiae with setose fossorial elevations, proximally reduced to pairs of denticles; number of non-apical elevations on right middle tibia 1c—2po—3ps—4, on right hind tibia 1c—2po/s—3ps—4ps; complete anteapical crest bidentate. Stridulatory granules on pygidium arranged in transverse row.

Some measurements in mm. Cephalic maximum length (exclusive of labrum and mandibles) 2.6, maximum width 4.4; distance tips of clypeal tubercles 1.5. Distance anterolateral angles of pronotum 5.0, tips paramedian tubercles 1.2, lateral tubercles 6.3; median length 5.6, maximum width 9.9. Median length of scutellum 1.5, maximum width 1.8. Number of primary punctures on pronotal disc behind paramedian tubercles 6—7/0.25 sq. mm, their diameters 0.10—0.15 mm.

Variation and sexual dimorphism. — Length ♂ 16—18 mm. There is some variation in the development of cephalic and pronotal protrusions.

Females of this species probably go unrecognized in the material recorded further below as dubious specimens.

Identification. — *Bolbohamatum phallosum* and *calanus* differ from the other species by the following combination of characters. Males with closely approximated paramedian tubercles on the pronotum, lateral protrusions not shifted to anterolateral corner; clypeal tubercles dentiform. Elytra shiny. Protrusions 2p on hind tibia more or less opposite to each other. Stridulatory granules on pygidium arranged in transverse row. *B. calanus* and *phallosum* cannot be separated on external characters, but the phalli of both species are very different. Dorsally the parameres of *phallosum* are foliate; ventrally there is a pair of more or less glider-like paramerites; the basal capsule is in lateral view distally strongly emarginate.

Material examined. — 9 males.

Holotype from India: Bombay (Institut Royal des Sciences naturelles de Belgique, Brussels). Paratypes as follows:

India: Belgaum (1 ♂, BM); Bombay (1 ♂, P); ditto, Fontanier (2 ♂, P); East India (1 ♂, BM); East India no "962" (1 ♂, Senckenberg-Museum); India (1 ♂, BM). No data (1 ♂, P).

The *pseudogrande* group

4. **Bolbohamatum pseudogrande** sp. nov. (figs. 12, 31, 49, 54, 57, 63)

Holotype (male). — Approximate length 20.5, width 13.5, height 9 mm. Medium-brown, moderately shiny; pilosity yellow-brown. Habitus, fig. 63.

Labrum emarginate in front, sides rounded; surface anteriorly limited by arcuate ridge. Dorsal outline of left mandible lobate. Cephalic contours, fig. 12. Clypeus with pair of clypeal tubercles more or less connected at base; clypeal margin ridged, genae raised; marginal declivities steep, rugulate-punctate; horizontal surface rugulate-punctate; clypeofrontal suture effaced. Frons with transversely confluent punctures in front, irregularly punctate behind; posterior cushion ill pronounced. Eye-canthus rugulate-punctate; frontolateral ridge strongly pronounced, slightly curved outwards caudad, extending beyond eye.

Pronotal contours, fig. 12. Midline of pronotum slightly impressed; base marginate; pronotum with closely set subtransverse paramedian tubercles, on each side separated from high lateral tooth by deep cavity; anterolateral corner distinctly concave. Pronotal derm with distinct double punctation; primary punctation coarse, crowded laterally, contiguous along margin, sparse or absent in anterolateral corner, finer, crowded on anterior declivity just in front of lateral cavities, secondary punctation ($\times$ 12) abundant, evenly distributed. Scutellum (fig. 12) vaguely, crowdedly punctate.

Juxtasutural punctures obsolete ($\times$ 50); discal striae shallowly impressed, finely punctate; punctures separated by 6 $\pm$ 2 times their diameters; peripunctural impressions ill pronounced, slightly affecting interstriae. Elytral interstriae scarcely convex, sparsely, vaguely, minutely punctate ($\times$ 50) and microreticulate ($\times$ 50).

Phallus, fig. 31.

Fore tibia with 2 + 6 external denticles. Middle and hind tibiae with setose fossorial elevations, proximally reduced to (pairs of) denticles; number of elevations on right middle tibia 1c—2ps—3ps—4—5, on right hind tibia 1c—2po—3ps—4ps; complete anteapical crests bidentate, with moderately long setae. Stridulatory granules on pygidium arranged in transverse row.

Some measurements in mm. Cephalic maximum length (exclusive of labrum and mandibles) 3.5, maximum width 5.3; distance tips clypeal tubercles 1.4. Distance anterolateral angles of pronotum 5.8, tips of paramedian tubercles 1.2, tips of lateral teeth 9.1; median length 7.0, maximum width 12.0. Median length of scutellum 1.7, maximum width 2.3. Number of primary punctures on median protrusion of pronotum 15—20/sq. mm, their diameters 0.08 mm and less.

Female sex unknown.

Variation. — The paratype male is 21.5 mm long.

Identification. — *Bolbohamatum pseudogrande* is a large species, very similar to *syncopator, phallosum, calanus*, and *robustum*. Especially *robustum* can easily be confounded with *pseudogrande*, but the males of the latter have the clypeal tubercles somewhat connected at their base, whereas the protrusions 2p on the hind tibia are placed opposite to each other. Further external features characterizing *B. pseudogrande* include: Scutellum punctate. Lateral protrusions of pronotum high, not situated marginally; pronotal cavities very deep. Shape of ventral paramerites characteristic. This diagnostic information is rather tentative considering the fact that only two males are at hand.

Materal examined. — Holotype from India: Kangra Valley, vii.1899, Dudgeon, 4500 ft (Howden collection). Male paratype from Assam (BM).

5. **Bolbohamatum syncopator** sp. nov.
(figs. 14, 33, 34, 62)

Holotype (male). — Approximate length 19.5, width 12.5, height 9.5 mm. Medium brown, moderately shiny; pilosity yellow-brown. Habitus, fig. 62.

Labrum distinctly emarginate in front, sides rounded; surface anteriorly limited by arcuate ridge. Dorsal outline of left mandible lobate. Cephalic contours, fig. 14. Clypeus with pair of dentiform tubercles; clypeal margin ridged, genae raised; marginal declivities low, rugulate-punctate; horizontal surface rugulate-punctate; clypeofrontal suture effaced. Frontal disc slightly depressed, posteriorly limited by pair of transverse callosities; derm densely punctate. Eye-canthus rugulate-punctate; frontolateral ridge strongly pronounced, slightly curved outwards caudad, extending beyond eye.

Pronotal contours, fig. 14. Midline of pronotum slightly impressed; base marginate; pronotum with paramedian and lateral tubercles, surface between paramedian and lateral tubercles, shallowly impressed; anterolateral corner shallowly impressed. Pronotal derm with distinct double punctation; primary punctures very dense on impressed midline between paramedian and lateral tubercles; rugulate-punctate on lateral declivities and along marginal ridge; secondary punctation (× 12) very abundant, evenly distributed. Scutellum (fig. 14) vaguely rugulate-punctate.

Juxtasutural punctures of elytra obsolete (× 50); discal striae shallowly impressed, finely punctate; punctures separated by 8 ± 3 times their diameters; peripunctural impressions ill pronounced, scarcely affecting interstriae. Elytral interstriae scarcely convex, densely minutely punctate (× 25) and microreticulate (× 50).

Phallus, figs. 33, 34.

Fore tibia with 2 + 6 external denticles. Middle and hind tibiae with setose fossorial elevations, proximally reduced to pairs of denticles; number of elevations on right middle tibia 1c—2ps—3ps—4ps, on right hind tibia 1c—2ps—3ps—4ps;

complete anteapical crests bidentate, with setae of varying length. Stridulatory granules on pygidium arranged in transverse row.

Some measurements in mm. Cephalic maximum length (exclusive of labrum and mandibles) 2.9, maximum width 5.0, distance tips of clypeal tubercles 2.0. Distance anterolateral angles of pronotum 6.0, tips of paramedian tubercles 1.3, lateral teeth 7.3; median length 6.6, maximum width 10.9. Median length of scutellum 1.6, maximum width 2.2. Number of primary punctures behind pronotal impressions 5—10/0.25 sq. mm, their diameters ca. 0.06 mm.

Female sex unknown.

Identification. — The male of *Bolbohamatum syncopator* looks very much like those of *pseudogrande, phallosum, calanus,* and *robustum*, all these having a more or less similar cephalic and pronotal ornamentation. *B. pseudogrande* differs by having the clypeal teeth more or less connected at base, and by the protrusions 2p on the hind tibia being placed opposite to each other. Two of the other species mentioned above have similar protrusions 2p, only *robustum* having them distinctly shifted. As the only reliable character to separate *syncopator* from *robustum*, I would suggest the structure of the phallus.

Material examined. — Holotype only, from Bangla Desh: Sylhet (SMT).

The *laevicolle* group

6. **Bolbohamatum robustum** sp. nov.
(figs. 13, 36, 45, 52, 55, 64)

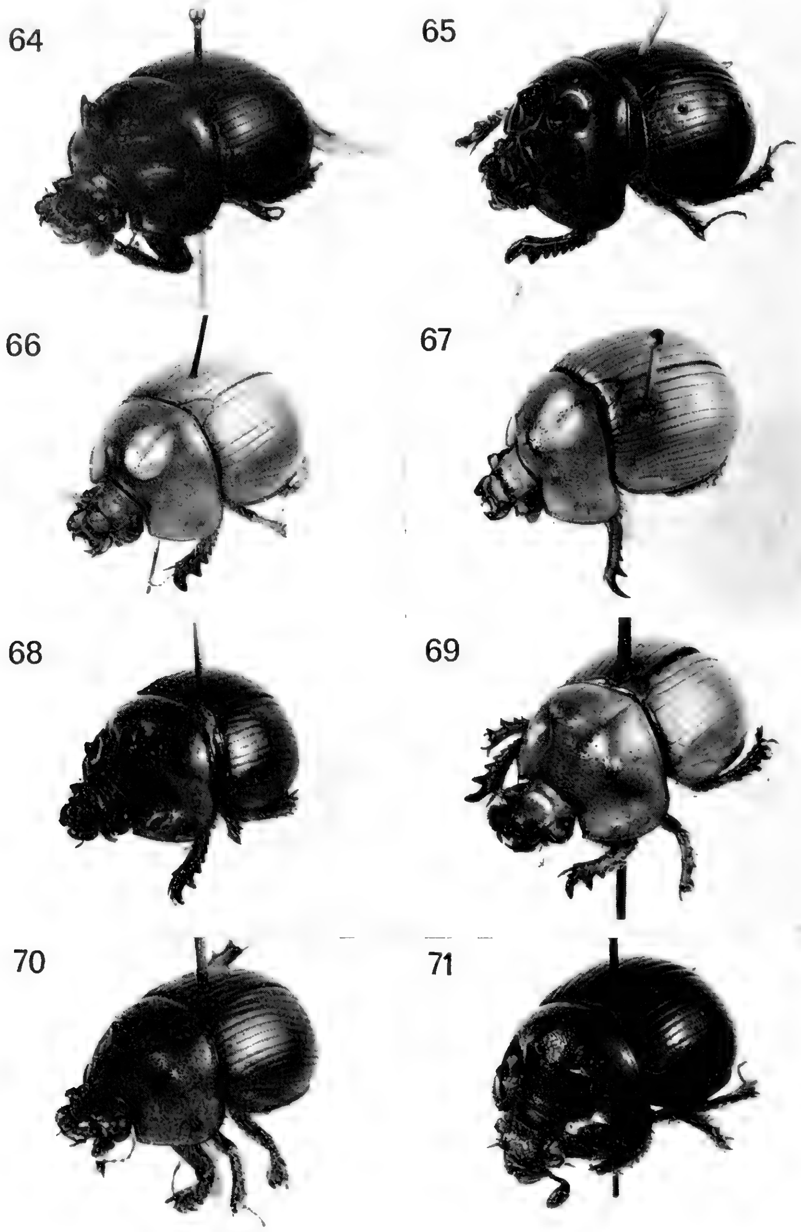
Holotype (male). — Approximate length 21.5, width 14, height 9.5 mm. Light-brown, subopaque; pilosity yellow-brown. Habitus, fig. 64.

Labrum emarginate in front, sides rounded; surface anteriorly limited by fine arcuate ridge, dorsal outline left mandible lobate. Cephalic contours, fig. 13. Clypeus with pair of dentiform tubercles; clypeal margin ridged, genae raised; marginal declivities rugulate-punctate; horizontal surface contiguously punctate to rugulate-punctate; clypeofrontal suture effaced. Frontal disc slightly depressed; posterior cushion indistinct, densely punctate; remainder of frons also abundantly punctate. Eye-canthus rugulate-punctate; frontolateral ridge extending from genae beyond eye.

Pronotal contours, fig. 13. Midline of pronotum impressed; base marginate; surface behind anterolateral angles concave; lateral horns upright; pronotal punctation double ($\times$ 25); primary punctation dense, very dense laterally and behind vertex; secondary punctation very distinct behind lateral cavity; disc at some distance from base sparsely, indistinctly punctate, shiny. Scutellum (fig. 13) superficially, indistinctly punctate.

Juxtasutural punctures of elytra subobsolete; discal striae shallowly impressed, finely punctate; punctures separated by 6 $\pm$ 2 times their diameters; peripunctural impressions ill pronounced, not affecting interstriae. Elytral interstriae flat, distinctly microreticulate ($\times$ 50), abundant minute punctation almost indistinct.

Phallus, fig. 36.



Figs. 64—71. *Bolbohamatum* males. 64, *robustum*, holotype, 21.5 mm; 65, *laevicolle*, Bengal, 19.5 mm; 66, *pyramidifer*, holotype, 19 mm; 67, *meridionale*, holotype, 18 mm; 68, *marginale*, holotype, 16 mm; 69, *kuijteni*, holotype, 17 mm; 70, *laterale*, Nagpur, 16.5 mm; 71, *drescheri indosinicum*, holotype, 18 mm.

Fore tibia with 2 + 6 external denticles. Middle and hind tibiae with setose fossorial elevations, proximally reduced to pairs of denticles; number of non-apical elevations on right middle tibia 1c—2ps—3ps—4ps, on right hind tibia 1c—2ps—3ps—4ps; complete anteapical crest bidentate, with ca. 10 long setae. Stridulatory granules on pygidium arranged in transverse row.

Some measurements in mm. Cephalic maximum length (exclusive of labrum and mandibles) 3.5, maximum width 5.3; distance tips of clypeal tubercles 1.5. Distance anterolateral angles of pronotum 5.9, tips paramedian tubercles 1.3, lateral tubercles 9.1; median length 7.6, maximum width 11.6. Median length of scutellum 1.8, width 2.2. Number of primary punctures on pronotal disc behind paramedian tubercles 6—10/0.25 sq. mm; punctures slightly elongate, ca. 0.10 × 0.08 mm.

Female sex unknown.

Identification. — *Bolbohamatum robustum* is externally very similar to *pseudogrande*, *syncopator*, *phallosum*, and *calanus*, and therefore, with this single male at hand, I am reluctant to discuss any slight external differences. The crossed paramerites of *robustum*, however, are most distinct, whereas the other characters mentioned in the synoptic table and the key readily distinguish between the three species of the *laevicolle* group.

Material examined. — Holotype only, from the "Himalaja" (Zoologische Staatssammlung, Munich).

7. **Bolbohamatum laevicolle** (Westwood) comb. nov. (figs. 15, 35, 47, 51, 65)

Bolboceras laevicollis Westwood, 1848a: 385 (diagnosis, type-loc. East India); 1852: 22 (diagnosis), pl. 4 fig. 8 (fore-body).

Bolboceras grandis Westwood, 1848a: 384 (diagnosis, type-loc. East India?); 1852: 19 (diagnosis), pl. 4 fig. 3 (fore-body). Syn. nov.

Identification. — Externally the males of *Bolbohamatum laevicolle* are easily identifiable by the three usually well-defined, deep cavities separating the four pronotal tubercles. Superficially similar is *B. drescheri*, but its subspecies range from Burma to Java, whereas the pronotal cavities are less deep and less defined. *B. robustum* males, and those of some species outside the *laevicolle* group, are different by having their paramedian pronotal tubercles closely approximated. The females of *laevicolle* have a transverse ridge on the pronotum (see next section).

Variation and sexual dimorphism. — Length ♂ 19—20 mm, ♀ 20—21 mm. The males at hand are scarcely variant.

On the pronotal disc of the females there is a pair of lateral callosities separated by a distinct, feebly arcuate transverse ridge. Pronotum with dense to crowded primary punctation, except on basal part of disc.

Because one of the characters distinguishing *laevicolle* (males and females) is the simply arcuate outline of the left mandible, it appears most likely that *Bolboceras grande* Westwood, the type of which agrees in this and all other characters, is the female of *laevicolle*, and consequently they are synonymized here.

Material examined. — 6 males, 6 females.

The male holotype of *Bolboceras laevicollis* Westwood, which has its wings spread (Hope Dept. of Entomology, Oxford). The female holotype of *Bolboceras grandis* Westwood (same museum). And the following specimens:

India: Bombay (2 ♂, 1 ♀, BM, 1 ♀, BH); Himalaya (1 ♂, BH); Kotapad (1 ♂, BH); Nagpur (1 ♀, BH); Assam (locality illegible) (1 ♀, SMT); Bengal (1 ♂, SMT); no details (1 ♀, BH).

8. **Bolbohamatum pyramidifer** sp. nov.
(figs. 16, 37, 46, 66)

Holotype (male). — Approximate length 19, width 12, height 9 mm. Reddish yellow-brown, shiny; pilosity yellowish. Habitus, fig. 66.

Labrum emarginate in front, sides rounded; surface anteriorly limited by fine transverse ridge; dorsal outline of left mandible arcuate. Cephalic contours, fig. 16. Clypeus rugulate-punctate, punctures superficial; margin entirely ridged, genae raised; declivities with sculpture similar to that of horizontal surface; clypeofrontal suture effaced. Frons with pair of pyramidiform tubercles between eye-canthi; posterior cushion and impression poorly pronounced, derm microreticulate (× 50). Eye-canthus coarsely rugulate-punctate; frontolateral ridge straight, extending from gena beyond eye.

Pronotal contours, fig. 16. Midline om scarcely impressed; top of disc deplanate, anteriorly limited by arcuate ridge; lateral protrusions represented by simple callosities; base marginate; pronotal punctation double (× 25); primary punctures densely set laterally, sparse on subbasal part of disc and on lateral callosities, elsewhere abundant. Scutellum (fig. 16) irregularly densely punctate.

Juxtasutural punctures of elytra subobsolete; discal striae shallowly impressed, finely punctate; punctures separated by 7 ± 3 times their diameters; peripunctural impressions ill pronounced, slightly affecting interstriae. Elytral interstriae scarcely convex; with scarcely distinct, sparse punctures, as well as microreticulation (× 75).

Phallus, fig. 37.

Fore tibia with 2 + 5 external denticles. Middle and hind tibiae with setose fossorial elevations, proximally reduced to pairs of denticles; number of non-apical elevations in right middle tibia 1c—2po—3po—4, on right hind tibia 1c—2po—3po; complete anteapical crests bidentate, with setae of varying length. Stridulatory granules on pygidium arranged in transverse row.

Some measurements in mm. Cephalic maximum length (exclusive of labrum and mandibles) 3.1, maximum width 4.5; distance tips of clypeal tubercles 1.6. Distance anterolateral angles of pronotum 5.5; median length 6.3; maximum width 10.5. Median length of scutellum 1.6, width 2.3. Number of punctures of pronotal disc 12—17/sq. mm, their diameters ca. 0.1 mm.

Female sex unknown.

Identification. — *Bolbohamatum pyramidifer* is externally rather similar to *meridionale* because of the pyramidiform cephalic tubercles and the apparently reduced pronotal ornamentation. *B. meridionale*, however, has its cephalic tubercles connected by a distinct, infuscated straight ridge; the same applies to the paramedian tubercles on its pronotum. The outer margin of the left mandible is in *pyramidifer* simply arcuate; the secondary punctures of the pronotal disc near the base are ocellate. The crossed paramerites place *pyramidifer* immediately in the *laevicolle* group.

Material examined. — Holotype only, from "Ind. or./Kotapad" (BH).

The *meridionale* group

9. **Bolbohamatum meridionale** sp. nov.
(figs. 17, 37, 46, 67)

Holotype (male). — Approximate length 18, width 12, height 8 mm. Yellow-brown, shiny; pilosity yellow-brown. Habitus, fig. 67.

Labrum emarginate in front, sides rounded; surface anteriorly limited by distinct, slightly curved ridge. Dorsal outline of left mandible lobate. Cephalic contours, fig. 17. Clypeus short; between eye-canthi a pair of pyramidiform tubercles distinctly connected by transverse crest; clypeal margin ridged, genae scarcely raised; clypeofrontal suture effaced; clypeal surface, including declivities, finely rugulate-punctate. Frons and vertex with apparent double punctation because some of the punctures (× 18) have an ill-defined peripunctural impression; frontal cushion and impression poorly pronounced. Eye-canthus coarsely rugulate-punctate; frontolateral ridge straight, extending from gena beyond eye.

Pronotal contours, fig. 17; midline of pronotum impressed; base marginate; discal protrusions small, paramedians connected by feebly, more or less infuscated ridge; pronotal punctation double (× 25); primary punctation abundant, except on basal part of disc, somewhat confluent on shallow impression between paramedian and lateral tubercles; secondary punctation abundant. Scutellum (fig. 17) irregularly punctate, slightly wrinkled.

Juxtasutural punctures of elytra subobsolete (× 50); discal striae distinctly impressed, distinctly punctate; punctures fine, infuscated, separated by 8 ± 3 times their diameters, lacking distinct peripunctural impressions. Elytral interstriae slightly convex, abundantly minutely punctate and microreticulate (× 50).

Phallus, fig. 37.

Fore tibia with 2 + 5 external denticles. Middle and hind tibiae with setose fossorial elevations, proximally reduced to pairs of denticles; number of elevations on right middle tibia 1c—2ps—3ps, on right hind tibia 1c—2ps—3ps; complete anteapical crests bidentate, with setae of varying length. Stridulatory granules on pygidium arranged in transverse row.

Some measurements in mm. Cephalic maximum length (exclusive of labrum and mandibles) 3.1, maximum width 4.8; distance terminal tips of transverse ridge 1.6. Distance anterolateral angles of pronotum 5.5, tips of paramedian protrusions 5.3;

maximum length 6.5, maximum width 10.7. Median length of scutellum 1.6, maximum width 2.2. Total number of primary punctures on pronotum behind paramedian protrusions 70—80, their diameters ca. 0.07 mm.

Female unknown.

Variation. — Not significant in the three males available.

Identification. — Males of *Bolbohamatum meridionale* are easily recognized by their cephalic and pronotal protrusions. *B. pyramidifer* looks like a poorly developed *meridionale*, but in case of doubt the characteristics of the parameres are decisive, those of *meridionale* lacking the strongly sclerotized, crossed paramerites. The cephalic pyramids are differently oriented in the two species. *B. pyramidifer* has a simply arcuate outline of the left mandible, which in *meridionale* is sinuate-lobate. The protrusions 2p on the hind tibia are more or less opposite in *pyramidifer*, shifted in *meridionale*.

Material examined. — Holotype from Sri Lanka: Colombo (National Museum, Colombo). Two male paratypes, one from Sri Lanka: Batticaloa, vi.1915, Baker (BM), the other from India: Pondicherry, Martin (P).

This is the only species known from Ceylon.

The *laterale* group

10. **Bolbohamatum marginale** sp. nov.
(figs. 20, 40, 43, 68)

Holotype (male). — Approximate length 16, width 10.5, height 8 mm. Medium-brown, shiny; pilosity yellow-brown. Habitus, fig. 68.

Labrum emarginate in front, sides rounded; surface anteriorly limited by arcuate ridge. Dorsal outline of left mandible lobate. Cephalic contours, fig. 20. Clypeus with pair of dentiform tubercles, each placed against lateral margin; clypeal margin weakly ridged, genae raised; marginal declivities rugulate-punctate; horizontal surface irregularly contiguously punctate; clypeofrontal suture effaced. Frontal disc slightly depressed; posterior cushion distinct, very sparsely punctate; remainder of frons with variably abundant punctures of two size classes. Eye-canthus irregularly contiguously punctate; frontolateral ridge contiguous with inner border of eye, extending beyond eye, adjacent frontal surface impressed.

Pronotal contours, fig. 20. Midline of pronotum slightly impressed; base submarginate, medially virtually emarginate; pronotum with paramedian and lateral tubercles. Median longitudinal zone and lateral declivities of pronotum densely, coarsely punctate; secondary punctation (× 25) evenly distributed, abundant; impression between paramedian and lateral tubercles virtually devoid of punctures (secondary punctation vague), opaque, due to microreticulation (× 50). Scutellum (fig. 20) virtually impunctate.

Juxtasutural punctures of elytra obsolete (× 50); discal striae shallowly impressed, finely punctate; punctures separated by 7 ± 2 times their diameters; diameters of punctures in stria 1 strongly increasing on distal declivity, to 0.1 mm, separated by 2—3 times their diameters; these punctures deep, well defined, distinctly affecting adjacent interstriae. Elytral interstriae scarcely convex, except distal section of 1, which is strongly convex; interstriae shiny, sparsely micropunctate ($\times$ 50).

Phallus, fig. 40.

Fore tibia with 2 + 5 or 6 external denticles. Middle and hind tibiae with setose fossorial elevations, proximally reduced to pairs of denticles; number of non-apical elevations on right middle tibia 1c—2ps—3, on right hind tibia 1c—2ps—3ps; complete anteapical crest bidentate, with setae of varying length. Stridulatory granules on pygidium scattered.

Some measurements in mm. Cephalic maximum length (exclusive of labrum and mandibles) 3.0, maximum width 4.3; distance tips of clypeal tubercles 1.6. Distance anterolateral angles of pronotum, tips paramedian tubercles 1.3, tips lateral tubercles 7.2; median length 6.2, maximum width 9.6. Median length of scutellum 1.3, maximum width 1.7. Number of punctures on anterior declivity of pronotum 35—40, their diameters ca. 0.1 mm.

Variation and sexual dimorphism. — Length ♂ 14—17, ♀ 14.5—17 mm. Ornamention of head and pronotum of smaller males more or less reduced.

A male from Mahé has its paramedian pronotal tubercles wider apart than the other specimens. A male from Wallardi is rather different from all the others, particularly because the small clypeal teeth stand exactly between the genal angles; the pronotum of this male is anteromedially feebly bicallose, whereas the first elytral stria is distally only slightly impressed and scarcely more strongly punctate. Length of that specimen ca. 15.5 mm.

Identification. — The males of *Bolbohamatum marginale* have strongly approximated paramedian tubercles on the pronotum, and a pair of lateral tubercles situated almost marginally. By the latter character they are easily separable from other species with approximated paramedian tubercles; other species with the lateral protrusions placed far apart lack the strongly impressed, more coarsely punctate distal section of elytral stria 1. The slight differences in this character with *kuijteni*, possibly important for the recognition of individual females, have to be verified on more material. The basal capsule of the phallus of *marginale* is very robust compared to those of *laterale* and *kuijteni*, and reminds one of the *drescheri* group treated hereafter. The elytral striae 2 etc. of both *marginale* and *kuijteni* are very feebly punctate.

Material examined. — 14 males, 9 females.

Holotype from India: Baihar [sic!]: Balaghat, 21.vii.1927, B.M. Bhatia (BM). Paratypes as follows:

India: Boria (Jubbulpore), 30.vi.1934, Chatterjee (1 ♂, Forest Res. Inst. and Colleges, Dehra Dun); Kodama Hills*, 5.[?].1934 (1 ♂, BH); Mahé (1 ♂, P); Mercara (1 ♂, 1 ♀, BH); Motinala River, 13.vi.1927, Chatterjee (1 ♂, BM); Nilgiri Hills, Downing (1 ♂, BM); ditto, Andrewes (4 ♂, 1 ♀, BM); Surada, Babault (1 ♂, 1 ♀, P); Travancore: Wallardi*, 5.ix.1903, Faire (1 ♂, excluded from type-series, P); South Mysore (1 ♂, BM); "India/Orient" (1 ♂, BM).

Six females not associated with males excluded from type-series, from India:

Anamalais (1 ♀, BM); Belgaum, 29.vii.1906, Bell (2 ♀, BM); Mountabu, 1940, McCann (1 ♀, Bombay Natural History Society). Pakistan: Karachi, Bell (2 ♀, BM). Not mapped.

11. **Bolbohamatum kuijteni** sp. nov.
(figs. 19, 39, 42, 53, 69)

Holotype (male). — Approximate length 17, width 10.5, height 8 mm. Yellow-brown, shiny; pilosity yellow-brown. Habitus, fig. 69.

Labrum emarginate in front, sides rounded; surface anteriorly limited by fine arcuate ridge. Dorsal outline of left mandible lobate. Cephalic contours, fig. 19. Clypeus bituberculate, tubercles high, posteriorly with 2 vague carinulae running from tip to base; tubercles contiguous with clypeal margin; clypeal margin ridged, genae raised; marginal declivities rugulate-punctate; clypeofrontal suture effaced. Clypeofrons with double punctation (× 25); primary punctation abundant, fine, density decreasing caudad; vertex with similar punctation, but primary punctures larger and restricted to lateral parts; posterior cushion arcuate, more or less costiform. Eye-canthus coarsely, irregularly punctate; frontolateral ridge extending from gena beyond eye.

Pronotal contours, fig. 19. Midline of pronotum impressed; transition from disc to anterior declivity gradual; base submarginate, medially virtually emarginate. Pronotal declivity in front of paramedian tubercles abundantly, distinctly punctate, punctures separated by one to several times their diameters; punctation sparse elsewhere; secondary punctation abundant, but scarcely distinct (× 50). Scutellum (fig. 19) virtually impunctate.

Juxtasutural punctures of elytra subobsolete; discal striae shallowly impressed, finely punctate; punctures separated by 10 ± 5 times their diameters; diameters of punctures in stria 1 strongly increasing on distal declivity to 0.15 mm, separated by 2—3 times their diameters; these punctures well defined, deep, distinctly affecting adjacent interstriae. Elytral interstriae scarcely convex, except distal section of 1, which is strongly convex; interstriae microreticulate (× 75), punctures scarcely distinct.

Phallus, fig. 39.

Fore tibia with 2 + 6 external denticles. Middle and hind tibiae with setose fossorial elevations, proximally reduced to pairs of denticles; number of non-apical elevations on right middle tibia 1c—2ps—3, on right hind tibia 1c—2po—3po; complete anteapical crest bidentate, with setae of varying length. Stridulatory granules on pygidium scattered.

Some measurements in mm. Cephalic maximum length (exclusive of labrum and mandibles) 3.0, maximum width 4.2, distance tips of clypeal tubercles 1.7. Distance anterolateral angles of pronotum 4.8, tips paramedian tubercles 4.7, tips lateral tubercles 7.3; median length 6.3, maximum width 9.30. Median length of scutellum 1.2, maximum width 1.9. Number of punctures on anterior declivity of pronotum ca. 15/sq. mm, their diameters 0.07—0.10 mm.

Female sex unknown.

Variation. — Length ♂ 14.5—17 mm. Cephalic and pronotal ornamentation somewhat reduced in the small specimens.

Identification. — *Bolbohamatum kuijteni* males may be confounded with those of *drescheri birmanicum*, which also have their paramedian pronotal tubercles wide apart. The latter, as well as *B. laterale*, however, has a much denser pronotal punctation. Compared to most other species *kuijteni* is very shiny dorsally. With *B. marginale* the species agrees in having a strongly impressed, coarsely punctate distal section of elytral stria 1, but the pronotal ornamentation of the males is very different. The aforesaid impression and punctation of stria 1 seems stronger in *kuijteni* than in *marginale*, a character that could be important for the recognition of individual females. The basal capsule of the phallus of *kuijteni* is narrow, rather slender compared to that of *marginale*, whereas the paramerites have a characteristic shape.

Material examined. — 8 males.

Holotype from India: Gersappa, 19.vi.1907 (Bombay Natural History Society, Bombay). Paratypes as follows:

India: Gersappa, 28.vi.1907 (1 ♂, Bombay Natural History Society, Bombay); ditto, no date (1 ♂, BM, 1 ♂, Bombay); Igatpuri, 200 ft (1 ♂, BM); Kanara (1 ♂, BM, 1 ♂, Zoologiske Museum, Copenhagen). No data (1 ♂, Senckenberg-Museum, Frankfurt).

Note. — This species is dedicated to my friend P. J. Kuijten who, many years ago, introduced me to the fascinating world of scarabs.

12. **Bolbohamatum laterale** (Westwood) comb. nov. (figs. 18, 38, 44, 70)

Bolboceras lateralis Westwood, 1848a: 385 (diagnosis, type-loc. Gogo); 1852: 22 (diagnosis), pl. 4 fig. 10 (fore-body).

Identification. — *Bolbohamatum laterale* males are very distinct by their pronotal protrusions and by the heavy double punctation of virtually the entire pronotum. The two other species in the *laterale* group have two pairs of pronotal protrusions instead of one, while their first elytral stria is distally more strongly impressed and more coarsely punctate than proximally. Female sex not known for certain, but four females with a heavily punctate pronotum, lacking the transverse row of pygidial granules, and with a medially dentate frontal ridge, may indeed belong to *laterale*.

Variation. — Length ♂ 17—18 mm. Further characters, e.g. anterolateral impressions of pronotum, slightly variant.

Material examined. — 5 males, 4 females.

The male holotype, which, in addition to "lateralis Westw.", bears a label reading "tuberculatus/Hope Gogo"*, plus the usual labels of the Hope Dept. of Entomology, Oxford. Further specimens as follows:

India: Belgaum, at light (1 ♂, BM); Darjeeling (2 ♀, P); Mhow (1 ♀, BM); Nagpur, 31.vii.1916, d'Abreu, 1000 ft (1 ♂, BM); Sagoda (Purna R.), 3.ix.1929, Chatterjee (1 ♀, BM); Kashmir, Hügel (1 ♂, SMT).

The *drescheri* group

13. **Bolbohamatum drescheri** sp. nov.
(figs. 1, 21—24, 41, 56, 71)

Holotype (male). — Approximate length 18.5, width 12.5, height 8 mm. Yellow-brown; subopaque, pronotal disc shiny; tips ridges, margins, sutures more or less infuscated; pilosity yellowish. Habitus, fig. 1.

Labrum emarginate in front, sides rounded; surface with fine arcuate ridge. Dorsal outline of left mandible lobate. Cephalic contours, fig. 1. Clypeus bidentate; surface rugulate-punctate, punctures superficial; margin entirely ridged, genae raised; marginal declivities high, sculpture similar to that of horizontal surface; clypeofrontal suture indistinct. Frons abundantly, irregularly punctate. Vertex with transverse cushion, posteriorly limited by transverse impression. Eye-canthus rugulate-punctate; frontolateral ridge extending from genae beyond eye.

Pronotal contours, fig. 1. Midline of pronotum impressed; base submarginate; pronotal punctation double ($\times$ 25); primary punctures densely set, except in lateral cavities and on disc at some distance along base (where primary punctures are most distinct). Scutellum (fig. 1) irregularly densely punctate.

Juxtasutural punctures of elytra subobsolete; discal striae shallowly impressed, finely punctate; punctures separated by 10 $\pm$ 5 times their diameters; peripunctural impressions ill pronounced, scarcely affecting interstriae. Elytral interstriae scarcely convex, sparsely, minutely punctate as well as microreticulate ($\times$ 75); punctation simple, punctures separated by more than 5 times their diameter.

Phallus, as paratype, fig. 41.

Fore tibia with 2 + 6 or 7 external denticles. Middle and hind tibiae with setose fossorial elevations, proximally reduced to pairs of denticles; number of non-apical elevations on right middle tibia 1c—2ps—3, on right hind tibia 1c—2ps—3ps—4; complete anteapical crest bidentate, with setae of varying length. Stridulatory granules on pygidium scattered; elytral files present.

Some measurements in mm. Cephalic maximum length (exclusive of labrum and mandibles) 3.1, maximum width 5.0; distance tips of clypeal tubercles 1.5. Distance anterolateral angles of pronotum 5.8, tips paramedian tubercles 2.4, lateral tubercles 7.2; median length 6.6, maximum width 11.3. Median length of scutellum 1.5, width 2.0. Number of punctures between paramedian tubercles on pronotum 6—10/0.25 sq. mm, their diameters ca. 0.1 mm.

Variation and subspecies. — Within *Bolbohamatum drescheri* there is a notable geographic variation in the distance of the paramedian pronotal protrusions and the direction of the axes of these (figs. 22—24). The populations of Java are remarkably constant in these male characters, the distance of the tubercular tips being always less than half the distance between the anterolateral angles of the pronotum, whereas the axes of the cones are usually inclined to the pronotal midline. The Burmese specimens always have their pronotal cones much wider apart, up to slightly over 0.75 of the distance between the anterolateral angles, whereas the cones stand outward or upright. The Indo-Chinese and Chinese populations seem more variable, but the paramedian tubercles of the majority of the males from Vietnam and Cambodia appear to have the same distance as in those of Java; the axes of the cones, however, are not inclined. The larger males from Burma and Indo-China have a distinct transverse costa between the paramedian pronotal tubercles.

On the basis of the characters mentioned, the populations of Java, Indo-China and Burma are here considered to belong to three different subspecies, *d. drescheri, d. indosinicum* and *d. birmanicum*. The few Chinese specimens could not be placed. One male and three females from Laos (3 localities) are assigned to *birmanicum*[1]). In addition to this geographic variation the usual reduction of the pronotal ornamentation is observed in smaller males. I have one doubtful male from Palone (Burma), only with very feeble paramedian pronotal protrusions, placed under *drescheri* because of its stridulation apparatus and its phallus. This male is recorded under *d. birmanicum*.

Total length 15.5—21 mm.

Identification. — *Bolbohamatum drescheri* males have a most characteristic phallus, its basal capsule being very large compared to the aedeagus. The lateral tubercles on the pronotum stand very wide apart, their distance exceeding that of the anterolateral angles (see measurements of holotype of *d. drescheri*). *B. marginale* and *kuijteni* are similar in this character, but differ in that their clypeal tubercles are situated directly against the marginal ridge. Contrary to *drescheri*, is the elytral stria 1 in *marginale* and *kuijteni* distally strongly impressed and strongly punctate. There are no records of *drescheri* from localities west of Burma.

Material examined. — Not allocated to subspecies mentioned below: 3 males, 2 females, all paratypes, as follows:

China: Hongkong: Taipokan, 10.vi.1964, Voss & Wai Ming Hui (1 ♀, Bishop Museum, Honolulu); H. Kung [? Hongkong] (1 ♂, BM); Tonglok [? North of Hongkong] (1 ♂, BH); Hupe: Ichang (1 ♀, BH; northernmost locality, province correct?); China (1 ♂, BM).

The above specimen description pertains to the holotype of the nominate subspecies, mentioned hereafter.

Note. — This species is named after F. C. Drescher (1875—1957), ardent collector of Indonesian beetles.

13a. **Bolbohamatum drescheri** subsp. **drescheri** nov. (figs. 1, 24, 41)

Material examined. — 32 males, 31 females.

Holotype ♂ from Java: Tjideres, 24.xii.1935, F. C. Drescher, 100 m (Museum Zoologicum Bogoriense). Paratypes as follows:

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[1]) In principle a good series representing a local population is needed to establish the subspecific identity of individuals (see e.g. Mayr, 1963: point 3 on p. 349), but this is scarcely ever practicable due to the usual paucity of material in taxonomic collections. The features used here for the delimitation of subspecies seem constant enough to justify the present treatment.

Java: Ardja Sari (1 ♂, 2 ♀, L), ditto, 1923 (1 ♀, L); Bandung, 23.vi.1930, Drescher, at light (1 ♂, P), ditto, 12.vi.1936, Drescher, 750 m (1 ♂, Bogor); Bantam, L. de Vos (1 ♂, 3 ♀, L); Bantam (1 ♂, 1 ♀, L); Batavia [= Jakarta], De Gavere (1 ♀, L), ditto, xi.1815 (2 ♀, Zoologiske Museum, Copenhagen); Bogor: Gunung Batu, 25.xii.1936, Van der Vecht, at light (1 ♂, L); Sukabumi (1 ♂, SMT); Gunung Tjerimai, 30.vi.1926 (1 ♀), 4.viii.1926 (1 ♂), Drescher (Bogor); Tjideres, 24.xii.1935 (1 ♀), 10.i.1936 (3 ♀), i.1936 (1 ♂), vi.1936 (1 ♂), vii.1936 (1 ♀), 28.x.1936 (1 ♂), xi.1936 (3 ♂, 4 ♀), 24.xii.1936 (2 ♂, 1 ♀), 27.xii.1936 (1 ♂), iii.1937 (1 ♀), vii.1940 (1 ♂), xii.1940 (2 ♂), vi.1941 (1 ♀), xii.1941 (1 ♀), i.1942 (1 ♂), ii.1945 (1 ♂), xii.1946 (2 ♀), iv.1948 (1 ♀), all Drescher, 35—100 m (Bogor, except 1 ♀, P); Gunung Muria: Tjolo, ii.1934 (1 ♂), 20.iii.1934 (1 ♂), 30.iv.1934 (1 ♂, 1 ♀), Van Doesburg (all L); Preanger (1 ♂, 3 ♀, BH); Java, Aulie (1 ♂, L); Java, one, xii.1815 (♂, BM, Copenhagen, Institut Royal des Sciences naturelles de Belgique); no data at all (1 ♂, in last-mentioned museum, placed sub *calanus* by Gillet).

13b. **Bolbohamatum drescheri** subsp. **indosinicum** nov. (fig. 23, 71)

Material examined. — 3 males, 5 females.

Holotype male from Vietnam: Saigon (L, donated by Y. Cambefort). Paratypes as follows:

Vietnam: Mont de Chaudoc, 1877, Harmand (1 ♀, P); Dong-Dang (Quang-Si frontier), 1901, Lucas (1 ♀, P); Lang-Son, 1904, Neau (1 ♂, P); Luc-Nam region, Blaise (1 ♂, 1 ♀, P); Phu Tho, Duport (1 ♂, P); Saigon (1 ♂, Institut Royal des Sciences naturelles de Belgique); Tonkin (1 ♂, P); Cochinchine, 1898, Amiral Vignes (1 ♀, P); Cochinchine, Amaus (1 ♂, P); Cochinchine (1 ♂, P). — Cambodia, no details (1 ♀, SMT).

Some of these specimens were apparently seen by Paulian, and recorded as *calanus* (1945: 41).

13c. **Bolbohamatum drescheri** subsp. **birmanicum** nov. (figs. 21, 22)

Material examined. — 12 males, 15 females.

Holotype ♂ from Burma: Rangoon (P). Paratypes as follows:

Burma: Maymyo, Downing (1 ♂, 1 ♀, BM); Myitkyina, 30.viii-1.ix.1914 (1 ♀, BM); Rangoon, 8.vi.1898 (1 ♀, BM), ditto, v.1886, Fea (1 ♂, Genoa), ditto, Meggitt (1 ♂, 1 ♀, U.S. National Museum), ditto, v.vi.1927 (1 ♀, same museum), ditto, 1933—34 (1 ♂, BM); S. Shan States: Taunggyi, 1.viii-22.ix.1934, Malaise, 1500 m (1 ♀, Naturhistoriska Riksmuseet, Stockholm); Tharrawaddy (1 ♀, BM); Toungao (1 ♀, BM); N. Chin Hills (1 ♂, BM); Tenasserim (1 ♀, SMT); Lower Burma (2 ♀, BM); North/Upper Burma (1 ♂, 1 ♀, BM); Burma (3 ♂, BM, P). — Laos: Houei Sai, 2.vi.1918, Vitalis de Salvaza (1 ♀, BM); Paklay, 1963 (1 ♂, 1 ♀, Zoologische Staatssammlung, Munich); Luang Prabang, ix.1917, Vitalis de Salvaza (1 ♀, BM).

I have excluded from the type-series a small male (long 16 mm) with feeble paramedian protrusions and subopaque elytra, with labels reading "Inde", "Palone/6.87", "Ex Museo/Bonvoiloir", from the Boucomont collection in P. This may indeed be a representative of *birmanicum*, a geographical confirmation being found in Boucomont & Gillet (1921: 70, "Palon, Birmanie").

Notes. — This subspecies of *drescheri* was by several workers, including G. J. Arrow, identified as *Bolboceras nigriceps* Westwood, but I can find no reason to accept this, the type, apparently a female, not having been recognized beyond doubt in the material at hand. The present females of *d. birmanicum* do not agree with Westwood's drawing (1852: pl. 4 fig. 17).

Although the females from Burma and Laos listed above are slightly variable in size, shape of frontal ridge and development of tibial protrusions, the material as a whole seems homogeneous. Therefore these females, associated with males or not, have all been labelled paratype.

DUBIOUS SPECIMENS, RECORDS, NAMES

Dubious *Bolbohamatum* specimens

Material not identified to species. — 29 females (probably nearly all *calanus* or *phallosum*); 4 males. These males had no phallus, or they were damaged or misshapen. Localities as follows:

India: Bangalore; Bellahunsi; Belgaum; Bombay; Dehra Dun; Getara; Igatpuri; Kasawa (Bombay); Madras; Mahé; Namakal*; Nilgiri Hills; Surat; Sylhet; Travancore; S. Bombay; E. India; N. W. India. — Singapore; Java (mislabelled!?). Months vi—xi (9 specimens). Collections BM, P, SMT; Institut Royal des Sciences naturelles, Brussels; Zoologiske Museum, Copenhagen; Senckenberg-Museum, Frankfurt.

Before me are also 2 females seen by Westwood, one originating from the "Boys Sale", with a label in what seems to be Westwood's hand, reading "*calanus* ♀?"; this specimen is in Oxford. The other, from the BM, is labelled "E. Ind//48/22" (round label), and I wouldn't be surprised if this were the specimen on which Westwood based his *nigriceps*. There is a third old female specimen in the Paris museum, from the collection of "Laferté./5894", "Ex-Musaeo/D. Sharp 1890".

The female from Sylhet mentioned above (SMT, length 15.5 mm) has unusually developed fossorial protrusions on the hind tibiae; the formula of the right tibia is 1c—2—3ps—4po—5po, of the left 1c—2ps—3ps—4ps. The female from the Nilgiris mentioned above (Brussels museum), is very large (19 mm long) and seems different from other *calanus*-like females, i.a. by the frontal carina (crest in frontal view bisinuate).

Dubious *Bolbohamatum* records

Material not recovered. — Under *Bolboceras calanus* Westwood, Paulian (1945: 41): Vietnam: Chapa; Pays Moï; Taiwan. The last record may be based on the unreliable work of Miwa (1931).

Dubious names: possibly *Bolbohamatum*

Bolboceras bicarinatum Westwood, 1852: 24, pl. 4 fig. 15. — East India. — Type not recognized; female?

Bolboceras nigriceps Westwood, 1852: 25, pl. 4 fig. 17; 17 a—b (where are these?). — Distribution not mentioned. — Type not recognized (see also under dubious specimens).

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Our staff artist A. Bos produced the habitus plate.

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CLASSIFICATION AND DISTRIBUTION OF THE SPECIES OF *EUPHOLIDOPTERA* RAMME OF GREECE (ORTHOPTERA, TETTIGONIOIDEA, DECTICINAE)

by

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With 190 text-figures and 2 plates

Abstract

On the basis of variability, several species and subspecies of the genus *Eupholidoptera* Ramme, 1951, are redefined. Consequently some modifications of nomenclature are proposed: i.e., to synonymise *E. chabrieri magnifica* (Costa, 1863) and *E. chabrieri kaltenbachi* Adamović, 1972, with *E. chabrieri schmidti* (Fieber, 1861); to consider *E. garganica* La Greca, 1959, a subspecies of *E. chabrieri* (Charpentier, 1825) and *E. chabrieri epirotica* (Ramme, 1927) a distinct species; to synonymise *E. danconai* La Greca, 1959, with *E. megastyla* (Ramme, 1939) and *E. smyrnensis festae* (Giglio Tos, 1914) with *E. smyrnensis* (Brunner von Wattenwyl, 1882). Two new species are described: *E. leucasi* from the Ionian island of Levkás and *E. icariensis* from the Aegean island of Ikaría. A key to the 14 species and two subspecies known from Greece, including *Uvarovistia (Karabagia) uvarovi* (Karabag, 1952) together with a distribution map are given.

Introduction

During the course of preliminary investigations of the Greek Orthoptera, the important point emerged that the classification of some species of *Eupholidoptera* Ramme, 1951, was not satisfactory. Apparently the amount of variation was not always sufficiently known as some features seem to have been weighted excessively. The need became obvious to revise some taxa. Since the erection of the genus in 1951, the number of species known from Greece has about doubled, including two species described in this paper as new. The distribution of the species in the Greek area was badly known due to insufficient material from the mainland of Greece and confusing nomenclature in the past. On account of rich material now available and the reasons mentioned above, it seems useful to give a survey of the systematics and faunistics of the species of the genus occurring in Greece.

Material and methods

Some material has been borrowed from the Instituut voor Taxonomische Zoölogie, Amsterdam (ITZ), the Naturhistorisches Museum, Wien (NMW) and the Istituto Policattedra di Biologia Animale, Catania (IBA) (abbreviations used in the subsequent text are in parentheses). Additional Greek material (CW) has been collected by the author and his son Lucas (accompagnied by J. Tilmans in 1976) in 1971 and all successive years up to 1978. The dates of capture range from 1st July to 11th August, the altitudes of the localities from sealevel up to 2000 m. The Greek orthography is transliterated into Roman characters in agreement with the system proposed by the Permanent Committee on Geographical Names for British Official Use, London. References listed under the species concern important taxonomical ones, those recording original material from Greece and synonyms. The figures are original unless otherwise stated, those of the epiphallus drawn after dissection, slight maceration in 10% KOH solution and soaking in distilled water.

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SYSTEMATIC PART

Eupholidoptera Ramme, 1951

Eupholidoptera Ramme, 1951: 195, 197—211.

Type-species: *Locusta chabrieri* Charpentier, 1825.

Diagnosis. — Reference is made to the original description. Mainly defined as follows: last abdominal tergite completely black in male, partly black in female; ovipositor narrow, as seen from above, i.e. strongly compressed laterally, and comparatively long.

Differential diagnosis. — Reference is made to the key to the genera of the Pholidopterini in Ramme (1951: 195).

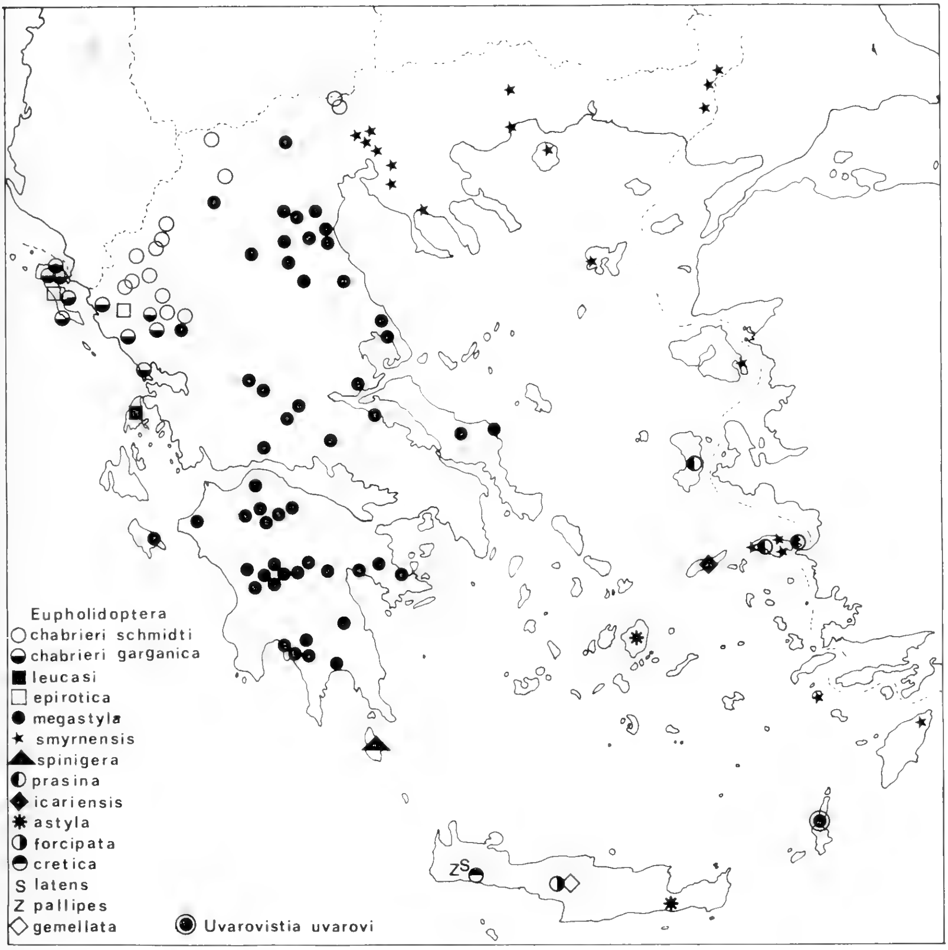
Distribution. — The range of the genus covers southern Europe, Anatolia, Syria, Lebanon and Israel. The distribution of the species in Greece is shown on map 1.

Remarks. — Hitherto about 30 species and some subspecies of *Eupholidoptera* have been recognized. Ramme (1951) recorded eight species and one subspecies from Greece. This number had increased considerably since. In this study the following taxa are recorded from Greece:

E. chabrieri schmidti (Fieber, 1861)
E. chabrieri garganica La Greca, 1959, stat. nov.
E. leucasi sp.n.
E. epirotica (Ramme, 1927)
E. smyrnensis (Brunner von Wattenwyl, 1882)
E. megastyla (Ramme, 1939)

E. prasina (Brunner von Wattenwyl, 1882)
E. icariensis sp.n.
E. spinigera (Ramme, 1930)
E. astyla (Ramme, 1927)
E. cretica Ramme, 1951
E. forcipata Willemse & Kruseman, 1976
E. latens Willemse & Kruseman, 1976
E. pallipes Willemse & Kruseman, 1976
E. gemellata Willemse & Kruseman, 1976

Eupholidoptera seems to be an unnatural grouping of species, as too much emphasis has been placed on morphological features. Presumably quite a number of species of Pholidopterini are not yet known. At this stage not much can be said on generic or specific groupings. Regarding the species of *Eupholidoptera* from Greece the following general observations can be made. Using the morphology of



Map 1. Distribution of *Eupholidoptera* species in Greece

the male and female subgenital plate, the male cercus and the coloration, *E. chabrieri, E. leucasi, E. epirotica, E. smyrnensis* and *E. megastyla* form a distinct group. *E. pallipes* and *E. gemellata* differ from this group in more rounded pronotal dorsum, form of epiphallus and the coloration. Similarly *E. prasina, E. icariensis* and *E. spinigera* may be grouped together on account of the form of the male and female subgenital plate and the unarmed male cercus. This leaves a more heterogeneous assemblage of species, i.e. *E. astyla, E. cretica, E. forcipata* and *E. latens*, with unarmed male cercus and resembling coloration but with diverse forms of male subgenital plate and epiphallus.

Uvarovistia uvarovi (Karabag, 1952), originally described under *Eupholidoptera*, seems closer to some species of the latter genus rather than to the remainder of *Uvarovistia*. Therefore this species is treated in this paper together with the species of *Eupholidoptera*.

Specific characters are found mainly in the external abdominal terminalia and the epiphallus of the male, the female subgenital plate and the coloration in both sexes. Sometimes the shape of the pronotal dorsum and the proportions of the hind femur are useful. Taxonomic distinction is usually apparent, sometimes, however, difficult. The male provides the most reliable, specifically diagnostic features. The female characters are often not useful to differentiate between closely allied taxa.

Key to the species and subspecies of *Eupholidoptera* and *Uvarovistia* from Greece (males). (It is emphasized here that identification should be based on a study of the male and its epiphallus.)

1. Black coloration of distal abdominal tergites confined to last tergite. Cercus slender, much longer than greatest width of base, slightly tapering apically (figs. 34—69) 2
— Black coloration of distal abdominal tergites not confined to last tergite, but extending proximally over lateral parts of penultimate tergite. Cercus, if viewed from above, almost triangular, greatest width of base almost equal to length of cercus (fig. 70) (Kárpathos) . . . . *Uvarovistia uvarovi* (Karabag)
2. Cercus with hook-shaped basal or subbasal tooth (figs. 34— 65) 3
— Cercus unarmed (figs. 66—69) 10
3. Tooth of cercus situated at base (figs. 34—51, 54—65) 4
— Tooth of cercus situated just distal to base (figs. 52—53) 8
4. Emargination of hind margin of last abdominal tergite very wide, about as wide as length of cercus (figs. 28—29) (Makedhonía, Thráki, Thásos, Límnos, Lésbos, Sámos, Nísiros, Ródhos) . . . . *smyrnensis* (Brunner von Wattenwyl)
— This emargination much narrower (figs. 1—27) 5
5. Extending apical parts of epiphallus very close together, slender and straight (figs. 173—180, 184, 185) (Zákinthos, Pelopónnisos, Steréa, Éllas, Thessalía, SE Ípiros, SW Makedhonía) . . . . *megastyla* (Ramme)
— These parts widely separated from each other (figs. 119, 164, 169—170) . . 6
6. Pronotal dorsum of general colour but middle of prozona black (pl. 1 figs. 3—4). Fused part of epiphallus slender, convex laterally, without plate-like

lateral expansions, as in figs. 169—170 (Ípiros, Kérkira) . . *epirotica* (Ramme)

— Pronotal dorsum entirely of general colour. Fused part of epiphallus wider, plate-like, lateral expansions more or less developed (figs. 119—164) . . . 7

7. Epiphallus with fused part strongly inflated and extending apical parts strongly recurved, ranging as in figs. 153—162 (Kérkira, W. Ípiros) . . . . *chabrieri garganica* La Greca

— These characters less apparent, as in figs. 125—148 (E. Ipiros, W. & N. Makedhonía) . . . .*chabrieri schmidti* (Fieber)

8. Pronotal dorsum slightly flattened. Pronotal lateral lobe black, lower margin broadly bordered yellowish (pl. 1 fig. 2). Epiphallus with fused part very short, wide and extending apical parts well separated from each other, very long and strongly recurved (figs. 165—168) (Levkás) . . . . *leucasi* sp.n.

— Pronotal dorsum smoothly rounded. Pronotal lateral lobe of general colour with black dot dorso-posteriorly (as in pl. 1 fig. 6, pl. 2 fig. 8). Epiphallus with fused part long, without well separated extending apical parts (Willemse & Kruseman, 1976: pl. 7 figs. 35—38) 9

9. Tip of epiphallus with a lateral spine on each side (Willemse & Kruseman, 1976: pl. 7 figs. 35—36) (Kríti) . . . .*pallipes* Willemse & Kruseman

— Tip of epiphallus laterally rounded and without spines (Willemse & Kruseman, 1976: pl. 7 figs. 37—38) (Kríti) . . . . *gemellata* Willemse & Kruseman

10. Lobes of subgenital plate with needle-like apex (figs. 112—115) 11

— These lobes with obtuse or rounded apex (figs. 117—118; Willemse & Kruseman, 1976: figs. 2, 7, pls. 4—5 figs. 14—15, 21—22) 13

11. Pronotal lateral lobe black, lower margin widely bordered yellowish. Styli set more proximad, their tips not reaching apex of subgenital plate (Ramme, 1930: fig. 8) (Kíthira) . . . .*spinigera* (Ramme)

— Pronotal lateral lobe of general colour with black dot dorso-posteriorly (pl. 1 fig. 6, pl. 2 fig. 8). Styli set more distad, their tips reaching apex of subgenital plate (figs. 112—115) 12

12. Epiphallus with extending apical parts distinctly divergent, as in fig. 186 (Ikaría) . . . . *icariensis* sp.n.

— Epiphallus with apical part expanding laterally with median apical incision, as in figs. 189—190 (Sámos, Khíos) . . . . *prasina* (Brunner von Wattenwyl)

13. Lobes of subgenital plate rounded apically, styli set pre-apically on ventral surface and pointing ventrad (figs. 117—118; Willemse & Kruseman, 1976: pls. 4—5, figs. 15, 22) 14

— Lobes of subgenital plate narrowly obtuse apically, styli set on apex and pointing distad (Willemse & Kruseman, 1976: fig. 7, pl. 5 fig. 21) 15

14. Epiphallus asymmetrical, extending apical parts close together and pointing laterally (fig. 187) (Náxos, Kríti) . . . .*astyla* (Ramme)

— Epiphallus symmetrical, extending apical parts divergent and pointing dorsad (Willemse & Kruseman, 1976: pl. 7 figs. 32—34) (Kríti) . . . . *latens* Willemse & Kruseman

15. Apical parts of epiphallus fused over almost whole length, tip only slightly divergent (Willemse & Kruseman, 1976: fig. 9) (Kríti) . . . . . *cretica* Ramme

— Apical parts of epiphallus fused in proximal half, strongly divergent, hook-like and recurved in distal half (Willemse & Kruseman, 1976: pl. 6 figs. 29—31) (Kríti) . . . . *forcipata* Willemse & Kruseman

Figs. 1—33. Emargination of the hind margin of the last abdominal tergite in the male of *Eupholidoptera* species: 1—15, *E. chabrieri* (s.l.) (1—2, *E. chabrieri chabrieri* (Charpentier): (1) Col de l'Ablé, Lucéram; (2) Mt. Puzzillo, Velino Mts.; 3—10, *E. chabrieri schmidti* (Fieber): (3) Sperlonga, Latina; (4) Kanešta, Istra; (5) Učka, Istra; (6) Álona, Flórina; (7) Évzonoi, Kilkís; (8) Klisoúra, Kastoría; (9—10) Kalpákion, Ioánnina; 11—14, *E. chabrieri garganica* La Greca: (11—12) Panayía, Préveza; (13) lake Antinioti, Kérkira; (14) Benítzes, Kérkira; 15, *E. chabrieri bimucronata* (Ramme), Colle S. Rizzo, Messina; 16—18, *E. leucasi* sp. n., paratypes; 19—20, *E. epirotica* (Ramme): (19) holotype; (20) paratype; 21—27, *E. megastyla* (Ramme): (21—22) Kámbos, Messinía; (23—24) Lekhainá, Ilía; (25) Mt. Pílion, Magnisía; (26—27) Rámia-Livádhion, Árta; 28—29, *E. smyrnensis* (Brunner von Wattenwyl): (28) Souflíon; (29) Amórion, both Évros; 30—31, *E. prasina* (Brunner von Wattenwyl): (30) holotype; (31) Sámos; 32, *E. icariensis* sp. n., holotype; 33, *E. astyla* (Ramme), Skonef.

Eupholidoptera chabrieri (Charpentier, 1825)
(figs. 1—15, 34—51, 71—90, 119—164)

Locusta chabrieri Charpentier, 1825: 119.
Thamnotrizon chabrieri; Brunner von Wattenwyl, 1861: 293, pl. 10 figs. 6a—d.
Pholidoptera schmidti; Ramme, 1927: 130, figs. 10a, 11a; 1930: 809, figs. 5—7, 9.
Pholidoptera chabrieri; Chopard, 1951: 128, figs. 210, 211, 223.
Eupholidoptera chabrieri; Ramme, 1951: 198, figs. 44, 45, 48, 50; Harz, 1969: 370, figs. 1116, 1121—1124, 1131—1142 (partim).

Diagnosis. — Reference is made to general descriptions by previous authors. The species is well defined in the male, i.e. by the moderate emargination of the hind margin of the last abdominal tergite (figs. 1—5), cercus with basal tooth (figs. 34—51), form, spines (figs. 71—90) and styli of subgenital plate, epiphallus (figs. 119—164) and coloration.

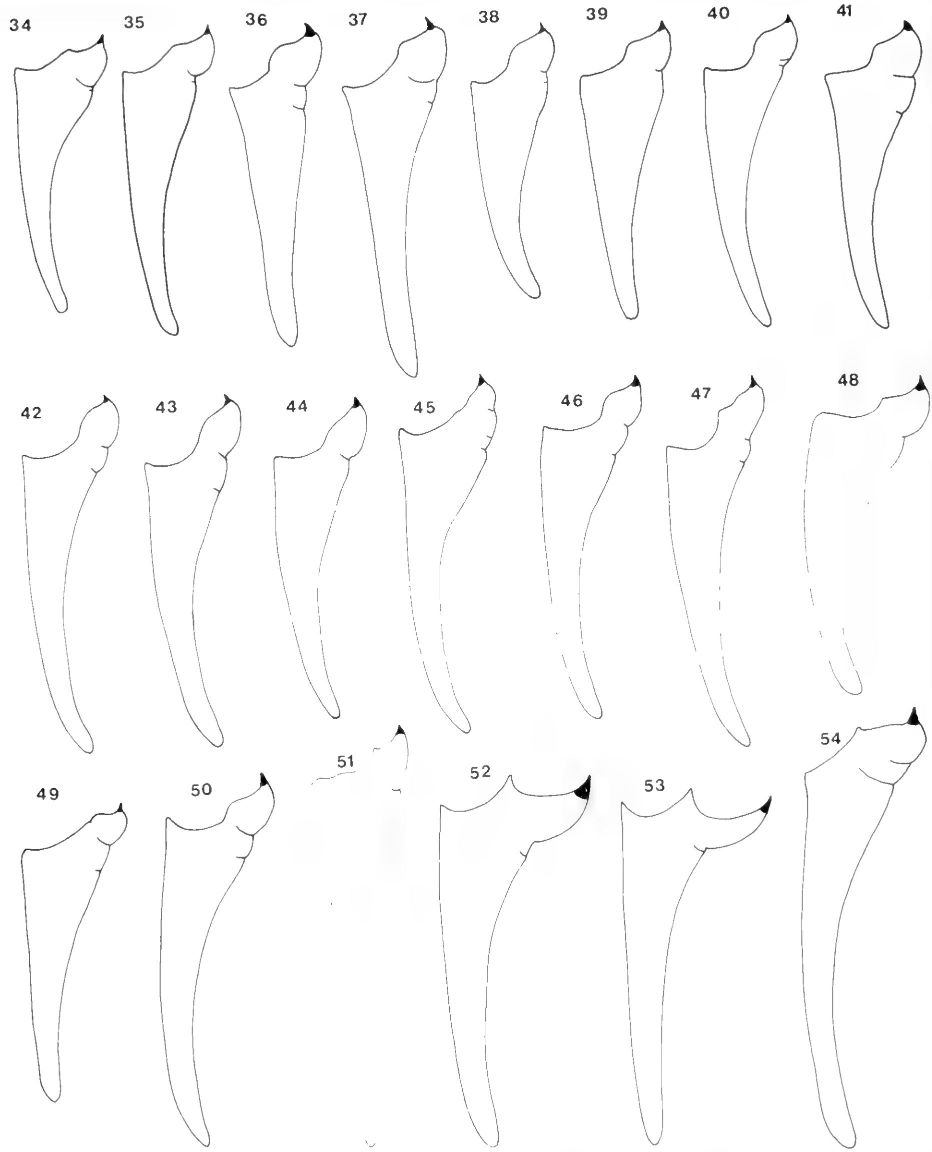
Differential diagnosis. — The male is, with few exceptions, readily distinguishable from other species. Judging from the descriptions and figures, the distinction between *E. chabrieri* and *E. marani* Peshev, 1960, and *E. beybienkoi* Peshev, 1962, is not clear. The female of *E. chabrieri* is indistinguishable from that of its closest relatives, e.g. in Greece *E. leucasi* and *E. megastyla*.

Remarks. — Hitherto the following subspecies have been recognized by La Greca (1959), Harz (1969) and Adamović (1972): *E. chabrieri chabrieri* (Charpentier, 1825), S. France, S. Switzerland, N.W. & N. & (?) Central Italy; *E. chabrieri brunneri* (Targioni-Tozzetti, 1881), considered of doubtful validity, (?) N. & Central Italy; *E. chabrieri magnifica* (Costa, 1863), (?) Central Italy, S.W. Italy, (?) Sardegna; *E. chabrieri bimucronata* (Ramme, 1927), Sicilia, (?) Sardegna; *E. chabrieri schmidti* (Fieber, 1861), N.E. Italy, Istra; *E. chabrieri usi* Adamović, 1972, Adriatic Islands of Krk, Cres, Lošinj; *E. chabrieri galvagnii* Adamović, 1972, Hercegovina, Montenegro; *E. chabrieri kaltenbachi* Adamović, 1972, Serbia, Yugoslav Makedonija; *E. chabrieri epirotica* (Ramme, 1927), N.W. Greece.

These subspecies were recognized mainly on the basis of differences of the epiphallus. In some cases also very slight distinction of external male abdominal terminalia, ovipositor, measurements and coloration were noted or figured. Analogously, an attempt was made to arrange the Greek material at hand. This, however, failed largely, due to considerable variation. Exception is made for *E. epirotica*, which is regarded here a distinct species. But the remainder could be arranged only roughly, i.e., populations agreeing with several known or representing unknown forms of *E. chabrieri* (s.l.), those agreeing with *E. garganica*, and others linking both. Thus the need became obvious for some review of the *E. chabrieri*-complex.

A careful study of the literature and rich material before me (ITZ, CW, IBA), covering most of the range of the species, reveals that, with few exceptions, the characters overlap to such an extent that they cannot be considered reliable (figs. 1—15, 34—51, 71—90). Particularly it seems that, at least in some cases, too great a diagnostic emphasis was placed on the form of the epiphallus (figs. 119—164). Distinction of very few geographical races or subspecies seems justified, e.g. the nominate form (figs. 119—124) and *E. chabrieri bimucronata* (figs. 163—164).

However, the distinction between *E. chabrieri magnifica* (figs. 125—126) and *E. kaltenbachi* (figs. 131—136) is not clear and the distinction between these taxa and



Figs. 34—54. Left male cercus of *Eupholidoptera* species, dorsal views: 34—51, *E. chabrieri* (s.l.) (34—35, *E. chabrieri chabrieri* (Charpentier): (34) le Plan du Peiron, Grasse; (35) Col de Brouis, Castellane; 36—48, *E. chabrieri schmidti* (Fieber): (36—37) Učka, Istra; (38—39) Alona, Flórina; (40) Klisoúra, Kastoría; (41) Botzarás, (42) Kaléntzion, (43—44) Kalpákion, (45—46) Asfáka, all Ioánnina; (47) Katarráktis, Árta; (48) Sperlonga, Latina; 49—50, *E. chabrieri garganica* La Greca, Gazátika, Kérkira; 51, *E. bimucronata* (Ramme), Colle S. Rizzo, Messina; 52—53, *E. leucasi* sp. n., paratypes; 54, *E. epirotica* (Ramme), paratype.

E. chabrieri schmidti (from Istra) (figs. 127—130) refers merely to different measurements. On account of these observations it appears necessary to propose some modifications of the nomenclature (see below).

Kaltenbach (1967) gave a survey of the confusing way in which the name *chabrieri* has been used previously. Records under this name from the period 1927 to 1951 usually refer the name to *E. smyrnensis*, while for *chabrieri* as now understood usually the name *schmidti* has been used. Previous records of Greek material referred to *E. chabrieri* are now assigned to *E. chabrieri garganica*, *E. chabrieri schmidti*, *E. epirotica* and *E. megastyla*.

Distribution. — The range of *chabrieri* (s.l.) covers S. France, S. Switzerland, all of Italy except for its extreme South East, Sicilia, Sardegna and some neighbouring islands, the Adriatic islands, all of Yugoslavia, Albania, extending into N.W. Greece, Bulgaria (?) and Romania. Kaltenbach (1967) pointed out that the species does not occur in Anatolia.

Eupholidoptera chabrieri schmidti (Fieber, 1861)
(figs. 3—10, 36—48, 73—83, 125—148)

Thamnotrizon schmidti Fieber, 1861: 197 (nec Corfu).
Thamnotrizon magnificum Costa, 1863: 28. **Syn. nov.**
Thamnotrizon chabrieri; Brunner von Wattenwyl, 1882: 334 (partim).
Pholidoptera schmidti; Ramme, 1927: 130, figs. 10a, 11a.
Eupholidoptera chabrieri; Ramme, 1951: 198, 204, 206, 207, 209, figs. 44, 45, 48, 50.
Eupholidoptera chabrieri schmidti; La Greca, 1959: 62, figs. 68, 69; Harz, 1969: 370, 371, fig. 1116; Adamović, 1972: 195, 198, figs. 1—3.
Eupholidoptera chabrieri kaltenbachi Adamović, 1972: 198, figs. 1—3. **Syn. nov.**

Material studied. — Makedhonía: Kilkís: Évzonoi, 3♂; Plataniá, 1♀; Flórina: Álona, 2 km E., 2♂ 3♀; Kastoría: Klisoúra, 1♂ (all CW). Ípiros: (=Epirus), Erber, Coll. Br. v. W., 6885, *Pholidoptera schmidti* Fieb. det. Ramme, 1♂ 1♀ (NMW); Ioánnina: Pápingon, 4♂ 1♀; Kalpákion, 4♂ 4♀; Asfáka, 3♂ 5♀; Kónitsa - Eléftheron, 1♂; Á. Paraskeví, Mt. Smólikas, 2♂; Koutselión, 1♂; Kaléntzion, 2♂ 3♀; Botzarás, 2♂; Vrosína, 3♂ 1♀; Árta: Katarráktis, 1♂ (all CW).

Diagnosis. — Epiphallus with extending apical parts usually divergent and, in lateral view, slightly to moderately recurved; fused part inflated only longitudinally in the middle and provided with well developed plate-like lateral expansions, as in figs. 125—148.

Variation. — It seems appropriate to give series of figures covering the considerable amount of variation: epiphallus in figs. 125—148, male cercus in figs. 36—48, spines of male subgenital plate in figs. 73—83, emargination of hind margin of male last abdominal tergite in figs. 3—10.

Differential diagnosis. — The distinction between *E. chabrieri schmidti* and the nominate subspecies appears arbitrary, being difficult to define. It is supposed that the extending apical parts of the epiphallus are parallel or almost so in the nominate form (figs. 119—124) against slightly divergent in *E. chabrieri schmidti* (figs. 127—130). The characters of some material at hand, however, disagree with this assumption (figs. 137—138, 147—148). The distinction from *E. chabrieri*

Figs. 55—70. Left male cercus of *Eupholidoptera* species, dorsal views: 55—63, *E. megastyla* (Ramme): (55—56) Kallithéa, Ilía; (57—59) Rámia — Livádhion, Árta; (60) Akhladhókambos, Argolís; (61) Melidhoní, Fthiótis; (62) Mt. Ólimbos, Lárissa; (63) Lekhainá, Ilía; 64—65, *E. smyrnensis* (Brunner von Wattenwyl): (64) Souflíon, Évros; (65) Yerakiní, Khalkidhikí; 66—67, *E. prasina* (Brunner von Wattenwyl): (66) Sámos; (67) holotype; 68, *E. icariensis* sp. n., holotype; 69, *E. astyla* (Ramme), Skonef; 70, *Uvarovistia (Karabagia) uvarovi* (Karabag), Mt. Lástros, Kárpathos. Figs. 71—106. Spines on apical margin of lobes of male subgenital plate in *Eupholidoptera* species: 71—90, *E. chabrieri* (s.l.) (71—72), *E. chabrieri chabrieri* (Charpentier): (71) Col de Brouis, Castellane; (72) le Plan du Peiron, Grasse; 73—83, *E. chabrieri schmidti* (Fieber): (73) Učka, Istra; (74) Evzonoi, Kilkís; (75) Klisoúra, Kastoría; (76) Epirus, Erber leg.; (77—78) Botzarás, (79) Kaléntzion, (80) Kalpákion, (81—82) Asfáka, all Ioánni-

garganica is pointed out below, that from *E. chabrieri bimucronata* is given in figs. 51, 90, 163—164.

Remarks. — As outlined above, part of the Greek material agrees with several subspecies as hitherto understood. This may be demonstrated by comparison of figs. 125—126 and 131—132 with figs. 133—136 showing the epiphalli of *E. chabrieri magnifica*, *E. chabrieri kaltenbachi* and Greek specimens, respectively; or of figs. 127—130, representing *E. chabrieri schmidti* from Istra, and figs. 139—140 and 145—146 made after Greek specimens. The remainder of the Greek material does not fit precisely into any known form (figs. 137—138, 141—144, 147—148). Apparently the degree of variation, at least among Greek populations, is larger than has been thought. I propose to allocate all this material to *E. chabrieri schmidti* and consider *E. chabrieri magnifica* (Costa, 1863) and *E. chabrieri kaltenbachi* Adamović, 1972, synonyms of *E. chabrieri schmidti* (Fieber, 1861). Whether the distinction between this subspecies and the nominate form is justifiable, is quite doubtful. This question, however, is not settled here.

Distribution. — The range of the subspecies as here understood is not well defined. I studied material from Istra and Slovenija, Hrvatska, Serbia, Yugoslav Makedonija, N.W. Greek Makedhonía, E. Ípiros (map), Central and S.W. Italy.

Eupholidoptera chabrieri garganica La Greca, 1959, stat. nov. (figs. 11—14, 49—50, 84—89, 153—162)

Thamnotrizon schmidti Fieber, 1861: 197 (only Corfu).
Eupholidoptera garganica La Greca, 1959: 66, figs. 46, 50, 64, 65, 70, 71; Kaltenbach, 1967: 190; Harz, 1969: 363, 370, 372, figs. 1118, 1119, 1145.
Eupholidoptera chabrieri schmidti; Cejchan, 1963: 771 (partim?).

Material studied. — Kérkira: (=Corfu), Erber, coll. Br. v. W., 5860, *Pholidoptera schmidti* Fieb. det. Ramme, 1♂; Benítses, 27.vii.1965, A. Kaltenbach, 1♂ (both NMW); Yimárion, 7♂ 7♀; Gazátika, 7♂ 6♀; Pélekas, 1♂ 1♀; Tsáki, 1♂ 1♀; Lávkion, 1♂; Lake Antinioti, 3♂ 4♀; Lake Korissíon, 4♂ 3♀; Petália, 7♂ 4♀; Períthia, 7♂ 3♀; Thesprotía: Igoumenítsa, 1♂; Préveza: Panayía, 3♂ 2♀; S. & N. of Koróni, 1♂; Nikópolis, 34♂ 22♀; Ioánnina: Mt. Tómaros 9♂ 2♀ (all CW). Italy: Foresta Umbra (Gargano), 24.vii.1957, *Eupholidoptera garganica* n.sp. La Greca det., 1♂ paratype, 1♀ allotype (IBA).

Diagnosis. — Epiphallus with extending apical parts, in lateral view, strongly recurved; fused part strongly inflated in combination with strongly reduced size of plate-like lateral expansions, as in figs. 153—162.

Variation. — The Greek material varies considerably. The shape of the epiphallus varies from the type of *E. garganica* all to that met with in *E. chabrieri schmidti* (figs. 153—162). Variation of the cercus, spines of the subgenital plate and

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na; (83) Sperlonga, Latina; 84—89, *E. chabrieri garganica* La Greca: (84—86) Gazátika, (87) lake Antinioti, (88) Benítses, all Kérkira; (89) Panayía, Préveza; 90, *E. chabrieri bimucronata* (Ramme), Colle S. Rizzo, Messina; 91—94, *E. leucasi* sp. n., paratypes; 95, *E. epirotica* (Ramme), holotype; 96—102, *E. megastyla* (Ramme): (96—98) Mt. Ólimbos, Lárissa; (99—100) Bassae, Ilía; (101—102) Mt. Erímanthos, Akhaía; 103—105, *E. smyrnensis* (Brunner von Wattenwyl): (103) Thásos; (104) Tikherón, Évros; (105) Yerakiní, Khalkidhikí; 106, *Uvarovistia (Karabagia) uvarovi* (Karabag), Mt. Lástros, Kárpathos emargination of the hind margin of the last abdominal tergite of the male as shown in figs. 11—14, 49—50, and 153—162.

Differential diagnosis. — The subspecies may be recognized only by the form of the epiphallus. As a result of the large amount of variation the decision whether a given specimen has to be arranged under *E. chabrieri garganica* or not is sometimes arbitrary. The series of figures of the epiphallus of *E. chabrieri garganica* and other subspecies of *E. chabrieri* suggest their distinction proposed here (figs. 119—164).

Remarks. — The occurrence of transitional forms, in Greece, between typical *E. garganica* (figs. 157—158) and *E. chabrieri schmidti* indicates that both taxa are closely related. Further indication of their close relationship is found in the forms described by Adamović (1972) under the names *E. chabrieri usi* and *E. chabrieri galvagnii*, the former from some northern Adriatic islands and the latter from Hercegovina and Montenegro. These forms, defined by the form of the epiphallus (figs. 149—152), also link *E. chabrieri schmidti* and *E. garganica*. In a general way one can see that the epiphallus is subject to a geographical variation in which the recurvation of the extending apical parts, the inflation of the fused part and the reduction in size of the plate-like lateral expansions increases from Istra in the North along the Adriatic coastal area of Yugoslavia into the Gargano area of Italy and the coastal area of N.W. Greece in the South. Distinction at species level between *E. garganica* and *E. chabrieri* appears no longer justifiable and I propose to merge *E. garganica* in the *E. chabrieri* complex as subspecies. The question whether or not *E. chabrieri usi* and *E. chabrieri galvagnii* should be arranged under either the subspecies *schmidti* or *garganica* is not settled here.

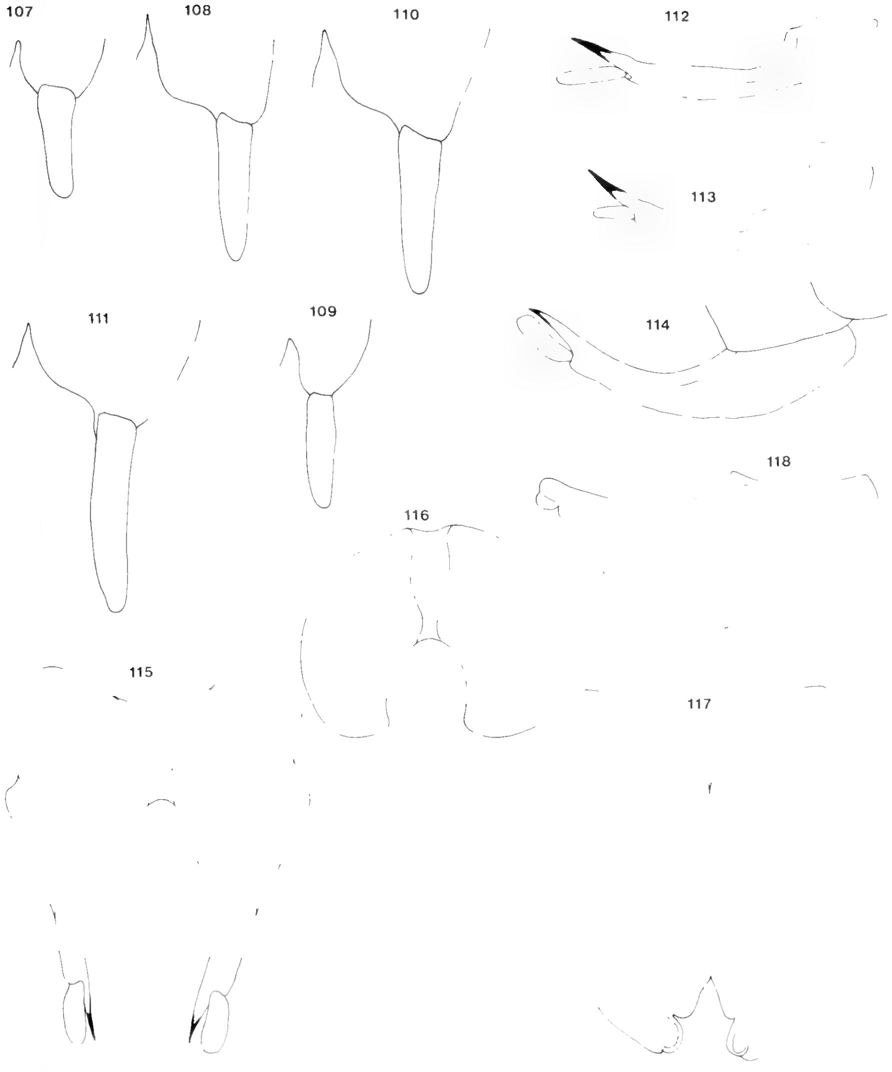
Distribution. — The range of the subspecies as now understood covers the Gargano-Foggia area of E. Italy, the Ionian island of Kérkira and the opposite part of the mainland of Greece (map). As already noted by Kaltenbach (1967) it is quite possible that the subspecies also occurs in Albania (Čejchan, 1963).

Eupholidoptera leucasi sp.n.

(pl. 1 figs. 1—2; figs. 16—18, 52—53, 91—94, 165—168)

Material studied. — ♂ holotype, ♀ allotype, 9 ♂, 16 ♀ paratypes, labelled: Hellas, N. Levkádos, Levkás, Áno Exánthia, 600 m, 15.vii.1976; additional paratypes: Levkás, Nikiána, N. of Nidhríon, 5 m, 14.vii.1976, 4 ♂, 3 ♀ (all F. & L. Willemse & J. Tilmans, CW).

Diagnosis. — Differs from type-species as follows: ♂, pl. 1 figs. 1—2. Median emargination of hind margin of last abdominal tergite slightly larger (figs. 16—18). Cercus with strong inner tooth located about rectangularly and shortly distad from base of cercus (figs. 52—53). Hind margin of lobes of subgenital plate above styli stretched and terminating in two more or less closely set spines of about equal length (figs. 91—94). Epiphallus of remarkable form (figs. 165—168): fused part very short, very wide and conspicuously inflated without lateral plate-like expansions, anterior surface with median longitudinal groove and crossed by some transverse grooves; extending apical parts arising from dorso-lateral edges of fused



Figs. 107—111. Stylus of male subgenital plate in *E. megastyla* (Ramme), ventral views: 107—108, Dhímitra-Anatolí, Lárissa; 109, Elassón, Lárissa; 110—111, Kallithéa, Ilía. Figs. 112—118. Subgenital plate in *Eupholidoptera* species, ventral and/or lateral views: 112—113, *E. prasina* (Brunner von Wattenwyl): (112) ♂, Khíos; (113) ♂, Sámos; 114—116, *E. icariensis* sp. n.: (114—115) ♂, holotype; (116) ♀, allotype; 117—118, *E. astyla* (Ramme), ♂, Skonef

part, parallel or slightly converging or diverging, comparatively very long, their tips reaching in situ the tooth of the cercus and in lateral view always strongly recurved in basal fourth.

♀. Much resembling type-species. Subgenital plate with moderately deep median V-like incision, lobes angulately rounded, the very hind margin sometimes curled inward. Last abdominal sternite slightly projecting in the middle.

Measurements (length in mm): body ♂ 26—32, ♀ 25—32; pronotum ♂ 11.3—13.2, ♀ 11.4—13.9; hind femur ♂ 24.5—28.8, ♀ 25.0—29.5; ovipositor 20.1—23.5.

Variation. — Shape and size of median emargination of hind margin of the male last abdominal tergite vary slightly, as in figs. 16—18. Inner tooth of male cercus varies somewhat in size, the location, however, is invariable (figs. 52—53). Spines of male subgenital plate range from divergent to very close to each other, as in figs. 91—94. The inflation of the fused part of the epiphallus may be less strong, the grooves less apparent, but the short, wide, transverse appearance is always obvious (figs. 165—168).

Differential diagnosis. — The species is well defined in the male by its resemblance with the type-species, *E. chabrieri*, in combination with the location of the cercal inner tooth and the unique form of the epiphallus. The main feature of the latter refers to the combination of strongly recurved and basally widely separated extending apical parts with very short and widely inflated fused part. In *E. hesperica* La Greca, 1959, the fused part is also very short but apparently less wide and the extending apical parts by far less strongly recurved. Somewhat similar extending apical parts are found in *E. chabrieri garganica* La Greca, *E. palaestinensis* (Ramme), *E. anatolica* (Ramme), *E. forcipata* Willemse & Kruseman and *E. ledereri* (Fieber). In these species, however, the fused part of the epiphallus is quite different. Opportunity is taken here to figure more fully the epiphallus of *E. palaestinensis* (figs. 171—172) (Ramme, 1939: fig. 26p, dorsal view only). The female of the new species is indistinguishable or almost so from that of the type-species and some others, e.g. *E. megastyla*.

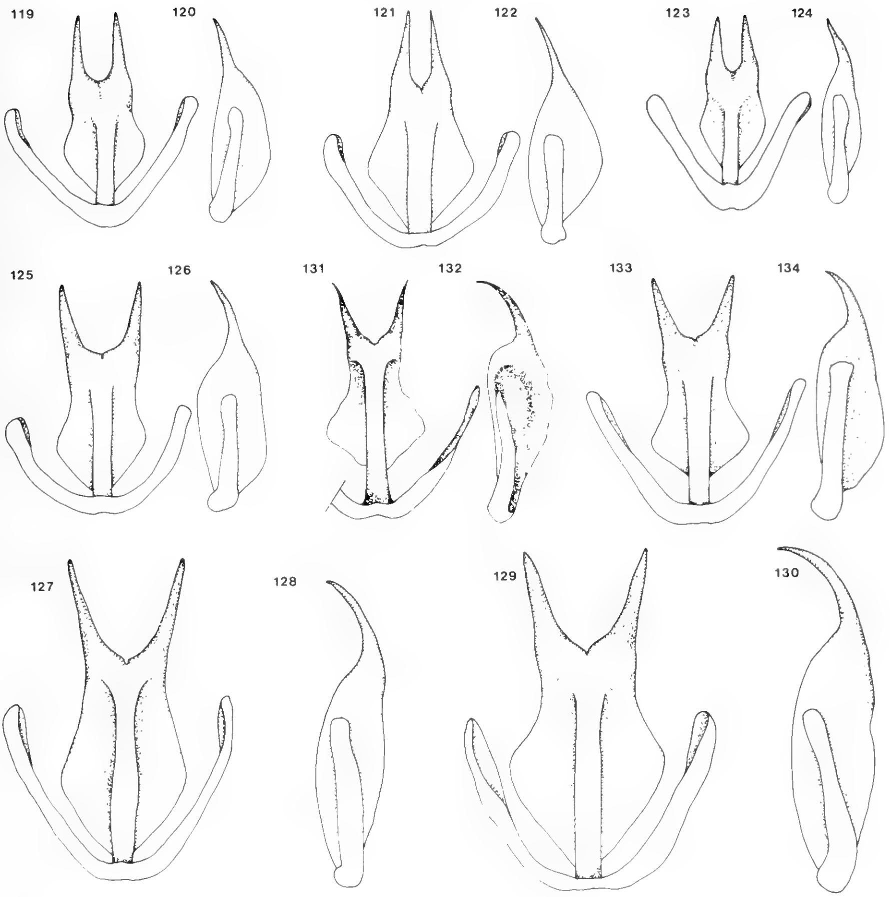
Remarks. — The distinction of *E. leucasi* at species level is justifiable on account of obvious and stable differences in at least two important characters and absence of intermediate forms, especially in regard to *E. chabrieri garganica*, whose range adjoins that of the new species. The tendency of the geographical variation of the epiphallus among *E. chabrieri* in the Adriatic area, as pointed out above, reaches a climax in *E. leucasi*. The new species was found along the road in *Rubus*, *Cirsium* and other prickly shrubs.

Distribution. Known only from the Ionian island of Levkás (map).

Eupholidoptera epirotica (Ramme, 1927)
(pl. 1 figs 3—4; figs. 19—20, 54, 95, 169—170)

Thamnotrizon chabrieri; Brunner von Wattenwyl, 1882: 335 (Varietät aus dem Epirus).
Pholidoptera epirotica Ramme, 1927: 132, figs. 11b, 12.
Pholidoptera schmidti epirotica; Ramme, 1930: 812.
Eupholidoptera epirotica; Ramme, 1951: 198, 203, 206, 207, 209, figs. 44e, 48e, 50; La Greca, 1959: 67; Kaltenbach, 1967: 197.
Eupholidoptera chabrieri epirotica; Harz, 1969: 371, figs. 1122, 1140, 1142.

Material studied. — ♂ holotype, ♂ paratype, labelled: Epirus, Erber Coll. Br. v. W., *Pholidoptera epirotica* Ramme det. Ramme, Type & Paratypus; Kérkira: (= Corfu), coll. Werner, 1 ♀ (all NMW).



Figs. 119—130. Epiphallus in *Eupholidoptera* species, anterior and left lateral views: 119—130, *E. chabrieri* (s.l.): 119—124, *E. chabrieri chabrieri* (Charpentier): (119—120) Col de Brouis, Castellane; (121—122) Col de l'Ablé, Lucéram; (123—124) Mt. Puzzillo, Velino Mts.; 125—130, *E. chabrieri schmidti* (Fieber): (125—126) Sperlonga, Latina; (127—130) Učka, Istra

Diagnosis. — Differs from type-species as follows: ♂, pl. 1 fig. 3. Emargination of hind margin of last abdominal tergite slightly wider (figs. 19—20). Cercus slightly longer and more slender (fig. 54). Epiphallus with extending apical parts, in lateral view, very slightly recurved; fused part without plate-like lateral expansions, much longer than wide, tapering basally, regularly convex laterally, anterior surface with median longitudinal groove (figs. 169—170).

Occiput and prozona of pronotal dorsum broadly black in the middle.

♀, pl. 1 fig. 4. Lobes of subgenital plate slightly more broadly rounded. Coloration as male.

Variation. — Morphological features of both males are similar. The coloration of the type and the female are similar, that of the paratypic male, however, differs in the less conspicuously black coloration of the occiput and the pronotum.

Differential diagnosis. — The species is defined by the resemblance to the type-species, *E. chabrieri*, in combination with the characteristic form of the epiphallus. The reliability of other features, e.g. the black coloration of occiput and pronotum, cannot be judged because of lack of material.

Remarks. — In the collection of Brunner von Wattenwyl there is another pair bearing locality labels similar to those of the types of *E. epirotica*. This pair is quite distinct and agrees fully with *E. chabrieri schmidti*. Similarly, no specimens were found among other material linking *E. epirotica* with *E. chabrieri*.

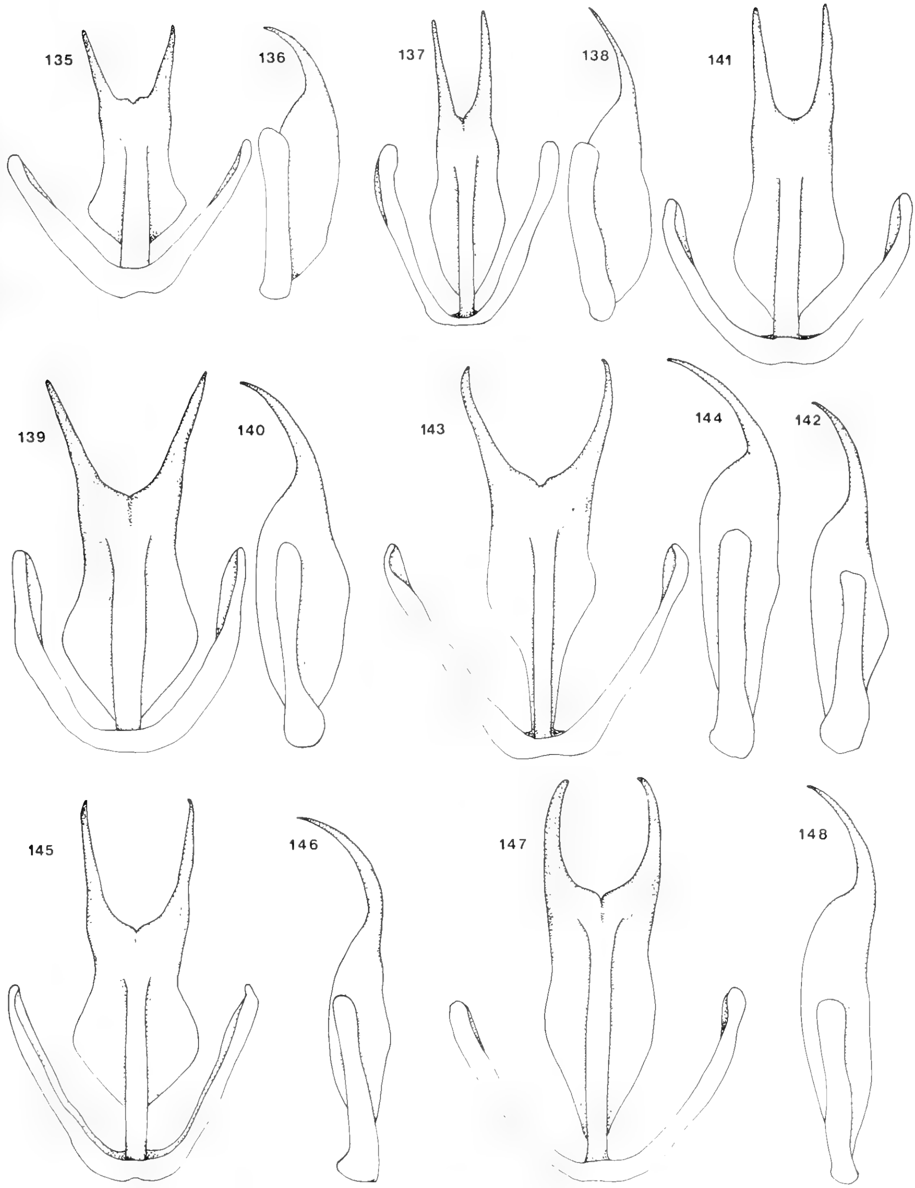
On account of the apparently distinct form of the epiphallus, lack of intermediate forms and the sympatric occurrence of *E. chabrieri* (s.l.), *E. epirotica* is provisionally regarded a distinct species. Additional material, however, is needed to establish this assumed status.

Distribution. — Known only after the types from Ípiros and the female from Kérkira (Kaltenbach, 1967), unfortunately both without precise localities (map).

Eupholidoptera megastyla (Ramme, 1939)
(figs. 21—27, 56—63, 96—102, 107—111, 173—180, 184, 185)

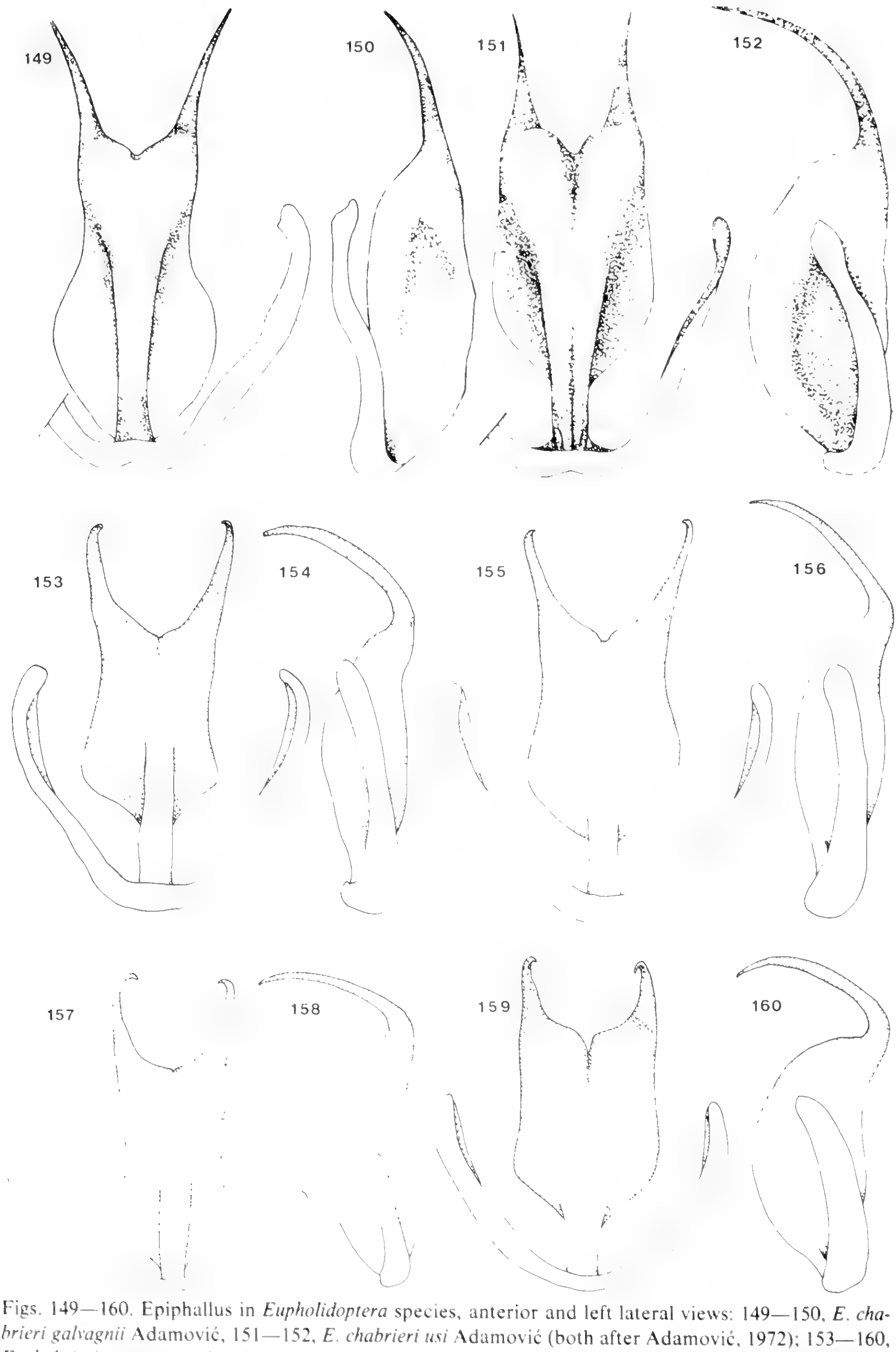
Thamnotrizon chabrieri; Brunner von Wattenwyl, 1882: 334 (only Parnass).
Pholidoptera chabrieri; Werner, 1933a: 407 (?); 1938: 169 (?).
Pholidoptera megastyla Ramme, 1939: 101, fig. 28.
Eupholidoptera megastyla; Ramme, 1951: 198, 203, 205—207, 211, figs. 48, 50; La Greca, 1959: 65; Kaltenbach, 1967: 197; Harz, 1969: 362, 367, 373, figs. 1110, 1148—1150; Willemse, 1971: 17; 1974: 352.
Eupholidoptera danconai La Greca, 1959: 65, figs. 47, 49, 63. **Syn. nov.**

Material studied. — Makedhonía: Pélla: Édhessa, 23.viii.1965, Blommers e.a., 1 ♂ 4 ♀ (ITZ); Kozáni: Velvendós, 9 ♂ 6 ♀; Neápolis, 5♂ 1 ♀; Grevená: Paraskeví, near Dheskáti, 2 ♂; Piéria: Ftéri, 1 ♂; Litókhoron, 15 ♂ 17 ♀ (all CW); Mt. Ólimbos, W. of Litókhoron, 1450 & 1750 m, 13.vii. & 2.viii.1965, 3 ♀; Kolindrós, 10 km W., 24—26.vii.1965, 1 ♂ (both Blommers e.a., ITZ); Leptokariá - Kariá, 2 ♂. Thessalía: Lárissa: Mt. Ólimbos, refuge B, 8 ♂ 19 ♀; Elassón, 20 km NW., 1 ♂, 4 km W., 2 ♂ 2 ♀ (all CW); Tírnavos, 17.viii.1965, Blommers e.a., 1 ♂ 4 ♀ (ITZ); Dhímitra - Anatolí, 5 ♂ 24 ♀; Magnisía: Mt. Pílion, above Portaría, 1 ♂ (CW); Lekhónia, 7—11.viii.1965, Blommers e.a., 1 ♂ (ITZ). Ípiros: Árta: Rámia-Livádhion, 6 ♂ 8 ♀. Stereá Ellás: Aitolía - Akarnanía: Kokkinokhórion, 2 ♂ 3 ♀ (both CW). Fthiótis: Pelasyía, 6.vii.1976, J. P. Duffels, 1 ♂ (ITZ); Timfristós village, 1 ♂ 1♀; Mt. Oíti, above Pávliani, 1 ♀; Melidhoní, 6 ♂ 10 ♀; Fokís: Mt. Vardhoúsia, above Mousounítsa, 1♂; Évvoia: Stení-Kathenoí, 2♂ 2 ♀ (all CW); Kími, 30.vi.1971, A. Kaltenbach, 1 ♂ (NMW); Voiotía: Mt. Parnassós above Arákhova, 2 ♂ (CW), Krüper coll. Br. v. W., 1704, *Pholidoptera schmidti* Fieb. det. Ramme, 1 ♀ (NMW). Pelopónnisos: (= Morea), Staudinger, coll. Br. v. W., 19.524, *Eupholidoptera megastyla* Ramme det. Kaltenbach, 1 ♂ (NMW); Korinthía: Á. Eléni, 1 ♂ 4 ♀; Argolís: Návplion, 3 ♀; Ligouríon, 2 ♂; Mt. Kteniás, Akhladhókambos, 11 ♂ 7 ♀; Lakonía: Mistrás, 2 ♂; Skála, 1 ♂ 1 ♀; Mt. Taïyetos, above Anóyia, 4 ♂ 10 ♀, E. of Spárti, 3 ♂ 3 ♀; Messinía: Kámbos, 8 ♂ 9 ♀; Mikrá Mandhínia, 1 ♂; Arkadhía: Karítaina, 1 ♂; Ipsoús 5 ♂ 5 ♀; Khrissovítsi, 8 ♂ 2 ♀; Kápsia, 1 ♂ 1 ♀; Mt. Párnon 2 ♂ 1 ♀ (all



Figs. 131—148. Epiphallus in *Eupholidoptera* species, anterior and left lateral views: 131—148, *E. chabrieri schmidti* (Fieber): (131—132) Yugoslav Makedonija (*E. chabrieri kaltenbachi* Adamović, after Adamović, 1972); (133—134) Álona, Flórina; (135—136) Évzonoi, Kilkís; (137—138) Klisoúra, Kastoría; (139—142) Kalpákion, (143—144) Kaléntzion, (145—146) Botzarás, all Ioánnina; (147—148) Katarráktis, Árta

CW); Dhimitsána, 14.vii.1977, M. & J. Duffels, 1 ♂ 1 ♀ (ITZ); Akhaïa: Mt. Panakhaïkón, above Zástova, 5 ♂ 2 ♀; Mt. Erímanthos, above Káléntzion,



Figs. 149—160. Epiphallus in *Eupholidoptera* species, anterior and left lateral views: 149—150, *E. chabrieri galvagnii* Adamović, 151—152, *E. chabrieri usi* Adamović (both after Adamović, 1972); 153—160, *E. chabrieri garganica* la Greca: (153—154) Períthia, (155—156) lake Antinioti, both Kérkira; (157—158) Foresta Umbra, Gargano (paratype of *E. garganica*); (159—160) Gazátika, Kérkira

3 ♂ 5 ♀; Aroánia village, 6 ♂ 3 ♀; Mt. Aroánia, above Kalávrita, 3 ♂; Páos, 1 ♀; Vlasía, 1 ♂ 2 ♀; Ilía: Lekhainá, 3 ♂ 1 ♀; Kallithéa, 6 ♂ 3 ♀; Bassae, ruins, 3 ♂ 4 ♀; Róvia, 1 ♀ (all CW). Italy: Irsima (Matera), 21.vii.1957, *Eupholidoptera danconai* n.sp. La Greca det., 1 ♂ paratype, 1 ♀ allotype (IBA).

Diagnosis. — Differs from type-species as follows. ♂: Styli of subgenital plate of variable length (figs. 107—111). Epiphallus very slender, extending apical parts close together, in lateral view not or scarcely recurved, almost as long as length of fused part, which is slender with plate-like lateral expansions but slightly developed, as in figs. 173—180, 184, 185.

Variation. — Width of emargination of the hind margin of the last abdominal tergite in the male varies, as in figs. 21—27. Length, incurvation and shape of the basal tooth of the male cercus as in figs. 55—63. One or two spines on the apical margin of the lobes of the male subgenital plate, as in figs. 96—102. Length of the styli quite variable, sometimes very long, reaching two thirds length of cercus, as in figs. 107—111. Also the epiphallus varies considerably in length, the shortest one about half as long as the longest (figs. 173—180, 184, 185). The coloration usually resembles that of the type-species. Several specimens from some localities (Kámbos, Melidhoní, Neápolis), however, differ in the degree of reduction of the black pattern of the pronotum and hind femur. The populations from Mt. Kteniás and Mt. Párnon differ even more conspicuously from the remainder: general colour yellow to orange brown and bright malachite green instead of dirty brown and dark green; pronotum without any black, lower margin bordered castaneous brown; elytra brown; hind femur with few apical streaks and tip black.

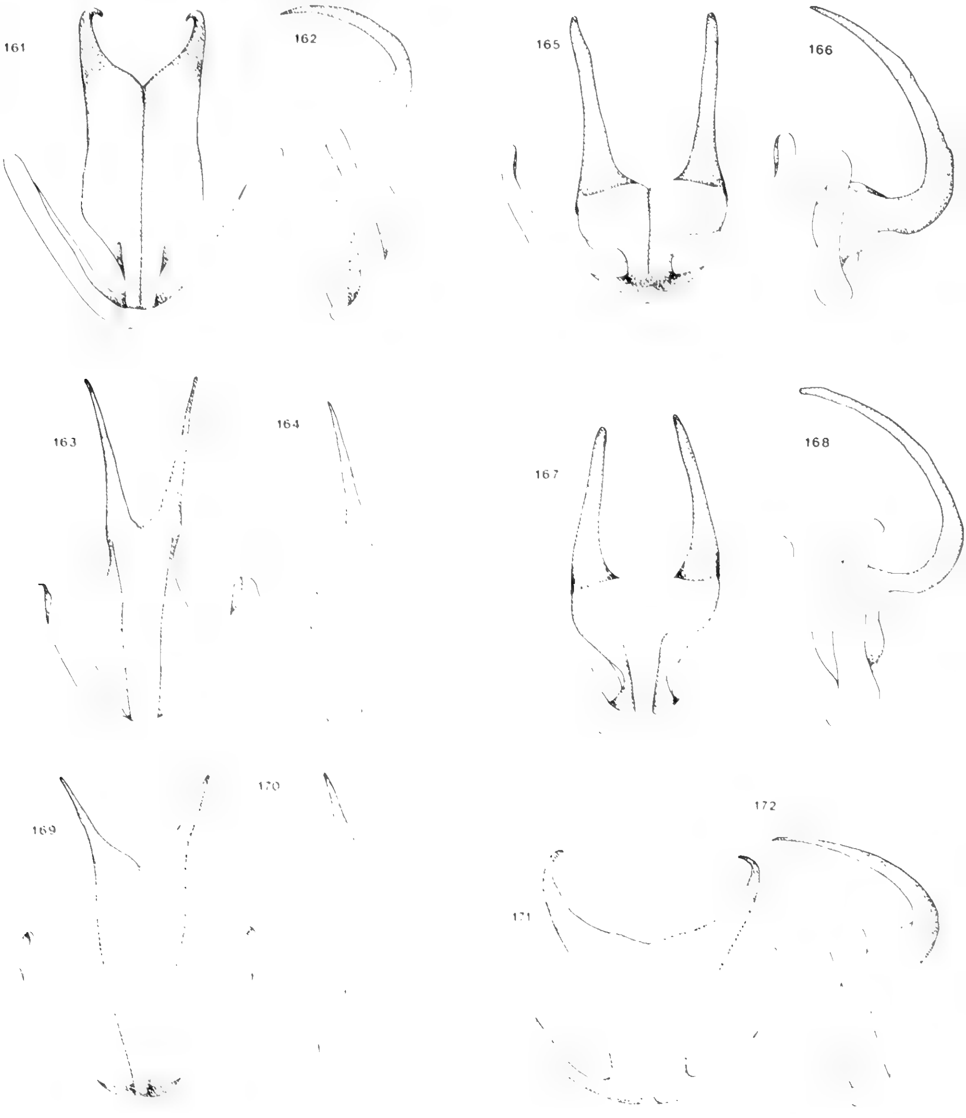
Differential diagnosis. — The male of this species may be distinguished from others by its combination of resemblance with the type-species and the characteristic epiphallus. The length of the styli seems to be no reliable character. The female is indistinguishable from that of the type-species.

Remarks. — The large amount of variation has been given special attention in regard to the existence of subspecies. However, these could not be established. Instead it came out that *E. danconai* La Greca, 1959 (fig. 176), known from the extreme southeastern part of Italy, agrees fully with some samples before me from diverse localities assigned to *E. megastyla*. Therefore I propose to consider *E. danconai* a synonym of *E. megastyla*.

Hitherto *E. megastyla* was known only from the type-species from the island of Zákinthos and scanty material recorded from the Pelopónnisos (Kaltenbach, 1967; Harz, 1969; Willemse, 1971) and Mt. Ólimbos (Willemse, 1974). The Parnass record (Brunner von Wattenwyl, 1882, under *E. chabrieri*) refers to a single female, which I have now at hand and is indistinguishable from the female of *E. chabrieri*. Whether this locality refers to the presently named Mt. Parnassós (=Parnassus) or to Mt. Párnis (=Parness), NE of Athínai is an open question. On account of the ranges of *E. chabrieri* and *E. megastyla* the specimen is now assigned to the latter. Werner's records of *E. smyrnensis* (= *chabrieri* auct.) from the islands of Skópelos (1933a) and Skíathos (1938) refer to *E. megastyla* rather than to *E. smyrnensis* (these localities are omitted on the map).

Distribution. — The range of *E. megastyla* as now understood (map) covers the

Ionian island of Zákinthos, the Pelopónnisos, southern continental Greece including Évvoia, S.W. Makedhonía, and extreme S.E. Ípiros, extending into S.E. Italy. In Árta *E. megastyla* occurs very close to *E. chabrieri*, but sympatric occurrence could not be established.



Figs. 161—172. Epiphallus in *Eupholidoptera* species, anterior and left lateral views, of: 161—162, *E. chabrieri garganica* La Greca, Gazátika, Kérkira; 163—164, *E. chabrieri bimucronata* (Ramme), Mandanica, Messina; 165—168, *E. leucasi* sp. n., paratypes; 169—170, *E. epirotica* (Ramme), holotype; 171—172, *E. palaestinensis* (Ramme), Tiberias, Israel

Eupholidoptera smyrnensis (Brunner von Wattenwyl, 1882)
(figs. 28—29, 64—65, 103—105, 181—183)

Thamnotrizon smyrnensis Brunner von Wattenwyl, 1882: 336; Werner, 1901: 293.
Pholidoptera smyrnensis; Berland & Chopard, 1922: 168; Burr, Campbell & Uvarov, 1923: 124, 140, 152.
Pholidoptera chabrieri; Ramme, 1927: 128; Werner, 1933a: 407 (?); 1933b: 194; 1937b: 109; 1938: 169 (?).
Eupholidoptera smyrnensis; Ramme, 1951: 198, 204, figs. 44—46, 48, 50; Kaltenbach, 1965; 473; 1967: 195; Harz, 1969: 373, figs. 1129, 1151—1154 (? Skopelos; not Kárpathos & Ikaría).
Pholidoptera festae Giglio Tos, 1914: 5. **Syn. nov.**
Pachytrachelurus festae Giglio Tos, 1914: 6; Ramme, 1930: 809; Harz, 1969: 373.
Pholidoptera chabrieri festae; Ramme, 1930: 809; Jannone, 1936: 135; Salfi, 1937: 3.
Eupholidoptera smyrnensis festae; Ramme, 1951: figs. 44, 50; Kaltenbach, 1967: 192.

Material studied. — Makedhonía: Khalkidhikí: Yerakiní, 1♂; Dráma: Adhrianí, 1♀ (both CW); Kaválla: Thásos, Panayía, 17.vii.1963, S. Daan & V. v. Laar, 1♂ 1♀ (ITZ). Dhitikí Thráki: Évros: Tikherón, 1♂ 3♀; Amórion, 1♂; Souflíon, 1♂ (all CW). Sámos: Koútsi, 25—27.vi. & Iraíon, 13.vi. & Pedhiás Valmarís, 29.vi.1977, M. C. & G. Kruseman, 5♂ 2♀ (all ITZ).

Diagnosis. — Differs from type-species as follows. ♂: Median emargination of hind margin of last abdominal tergite much wider, lobes acute (figs. 28—29). Cercus shorter (figs. 64—65). Pair of short spines of equal length on apical margin of lobes of subgenital plate (figs. 103—105). Epiphallus with extending apical parts from slightly convergent to distinctly divergent, in lateral view moderately recurved; fused part of variable width, plate-like lateral expansions well developed (figs. 181—183). Pronotal lateral lobe usually solid black with well delimited yellowish fascia bordering lower margin. Elytron less solid black. Black markings of hind femur usually confined to upper half.

♀: Lobes of subgenital plate triangular, apex more acute. Coloration as in male.

Variation. — Lobes of the last abdominal tergite of the male range from pointing ventrad to ventro-laterad (figs. 28—29). Variation of epiphallus is considerable, already noted by Ramme (1951). Some extreme examples are figured here (figs. 181—183).

Differential diagnosis. — The species comes near the type-species but may readily be distinguished by the very wide median emargination of the hind margin of the last abdominal tergite in the male. The distinction of the female, however, is more difficult. The form of the lobes of the subgenital plate and the coloration may be helpful.

Remarks. — The subspecific distinction of the Ródhos populations under the name *E. smyrnensis festae* (Giglio Tos, 1914) seems not justified. The characters noted by Ramme (1930; 1951: figs. 44, 50) are widely overlapped by the variation of the material before me. I propose to merge the taxon in *E. smyrnensis*.

The species has been recorded from numerous localities in Greece. Most of these records seem correct, some however are doubtful and a few incorrect. Reliable records are indicated on the map and are summarized here: Makedhonía — Vassiliká (Berland & Chopard, 1922); Lembet, Ak Bunar, Aivatli, Naresh and Hortiack plateau (Burr, Campbell & Uvarov, 1923); Kalamíka (Kaltenbach, 1967); Aegean Is — Límnos (=Lemnos), Kástron (Werner, 1937b; Kaltenbach, 1967); Lésvos (=Mytilene) (Werner, 1901; Berland & Chopard, 1922; Ramme, 1927;

Werner, 1933a?); Sámos, Marathókambos (Werner, 1933b, 1937b; Kaltenbach, 1967); Nísiros (Ramme, 1927); Ródhos (Giglio Tos, 1914; Ramme, 1927, 1930; Salfi, 1937), Villanova (Jannone, 1936), Rodhiní (Kaltenbach, 1967). Other records of *E. smyrnensis* (or *E. chabrieri* auct.), however, are omitted or referred to other species, viz., Kíthira (Werner, 1937a) referred now to *E. spinigera*; Kumani, the Pelopónnisos (Ramme, 1927) omitted, being far out of the range of *E. smyrnensis* and presumably based on a misidentified female of *E. megastyla*; Skópelos (Werner, 1933a) omitted, referring to a juvenile female of which identification is considered unreliable; Skíathos (Werner, 1938) omitted as *E. megastyla* rather than *E. smyrnensis* occurs in that island; Yiannitsà (=Yenidjé-Vardar), Pélla distr., (Berland & Chopard, 1922) omitted, as the record refers to a female and its identification needs confirmation, because all *E. smyrnensis, E. megastyla* and *E. chabrieri* may occur in this area; Ikaría (Werner, 1933b) discussed now under *E. ikariensis*; Kárpathos (Werner, 1936) assigned now to *Uvarovistia* (*Karabagia*) *uvarovi*.

Distribution. — The range extends from central Greek Makedhonía, via Dhitikí Thráki, S. Bulgaria into Anatolia and some eastern Aegean islands (map).

Eupholidoptera prasina (Brunner von Wattenwyl, 1882)
(pl. 1 fig. 6, pl. 2 fig. 5; figs. 30—31, 66—67, 112—113, 189—190)

Thamnotrizon prasinus Brunner von Wattenwyl, 1882: 337; Werner, 1901: 293.
Pholidoptera prasina; Ramme, 1930: 816, figs. 5, 6, 8, 9; Werner, 1933b: 194; 1934: 326; 1937b: 109.
Eupholidoptera prasina; Ramme, 1951: 198, 203, 206, 211, figs. 49, 51; Harz, 1969: 376, figs. 1113, 1115, 1157, 1158.

Material studied. — ♂ holotype, labelled: Smyrna, Coll. Br. v. W. Br. v. W. leg., *prasinus* m. det. Br. v. W., 5942, Type; Sámos: Marathókambos, v. Oertzen, *Pholidoptera prasina* Br. Ramme det., 1♂; Khíos: 30.vi.1936, Werner, *Pholidoptera prasina* Br. coll. Werner, 2♂ (all NMW).

Diagnosis. — ♂, pl. 1 fig. 6, pl. 2 fig. 5. Pronotal dorsum smoothly rounded laterally. Elytron reaching hind margin of first abdominal tergite. Hind femur comparatively short. Last abdominal tergite strongly downcurved, hind margin with moderately deep and wide median emargination, lobes acute (figs. 30—31). Cercus without tooth, slender, proximal half very slightly incurved, in the middle of length abruptly tapering into distal half which is straight, apex obtusely pointed (figs. 66—67). Subgenital plate divided into small basal triangular part and pair of elongate lobes; lobes strongly extending and narrowing distad, terminating in needle-like spine, ventral surface with longitudinal ridge with stylus on its distal end, located on base of terminal spine; length of stylus and spine about equal (figs. 112—113). Epiphallus small, fused part narrow, short and cylindrical, extending apical parts widening laterally, in antero-posterior view roughly circular to heart-shaped, fused basally, incised apically, as in figs. 189—190.

General colour yellowish brown to pale green. Face with some symmetrically arranged black points. Hind edge of occiput black. Black stripes from upper margin of eye distad. Pronotum with black spot in dorso-posterior part of lateral lobe, not reaching hind margin. Middle of elytron and first abdominal tergite black. Last abdominal tergite completely black. Fore and middle legs with few black markings, hind femur near the knee and often dorsally in the middle of length black.

♀. Not at hand. Reference is made to the description by Ramme (1930).

Variation. — Among the scanty material before me, the variation of the epiphallus is worth mentioning (figs. 189—190).

Differential diagnosis. — The species is well defined. It comes near *E. icariensis* (pl. 2 figs. 7, 8), which differs in the form of the epiphallus, and *E. spinigera*. The latter has the styli located more proximad, the whole upper part of the pronotal lateral lobe is black and the black pattern of the hind femur is different, resembling that of the type-species.

Remarks. — Previous records of the species are confirmed by the material at hand except for the specimen from Psérimos (=Kappari) (Ramme, 1930). This material could not be traced and the locality is omitted on the map.

Distribution. — The range covers W. Anatolia, extending into the neighbouring Aegean islands of Sámos and Khíos.

Eupholidoptera spinigera (Ramme, 1930)

Pholidoptera spinigera Ramme, 1930: 818, figs. 5, 6, 8, 9.
Pholidoptera chabrieri; Werner, 1937a: 147 (?).
Eupholidoptera spinigera; Ramme, 1951: 198, 204, 207, 209, 211, figs. 49; Harz, 1969: 376, figs. 1114, 1128, 1155, 1156.

Diagnosis. — Reference is made to the original description.

Differential diagnosis. — The rounded pronotal dorsum and the male subgenital plate show the species to be closely related to *E. prasina* and *E. icariensis*. It is distinguished from these two by the emargination of the last abdominal tergite and the location of the styli in the male and the coloration of the pronotal lateral lobe and hind femur.

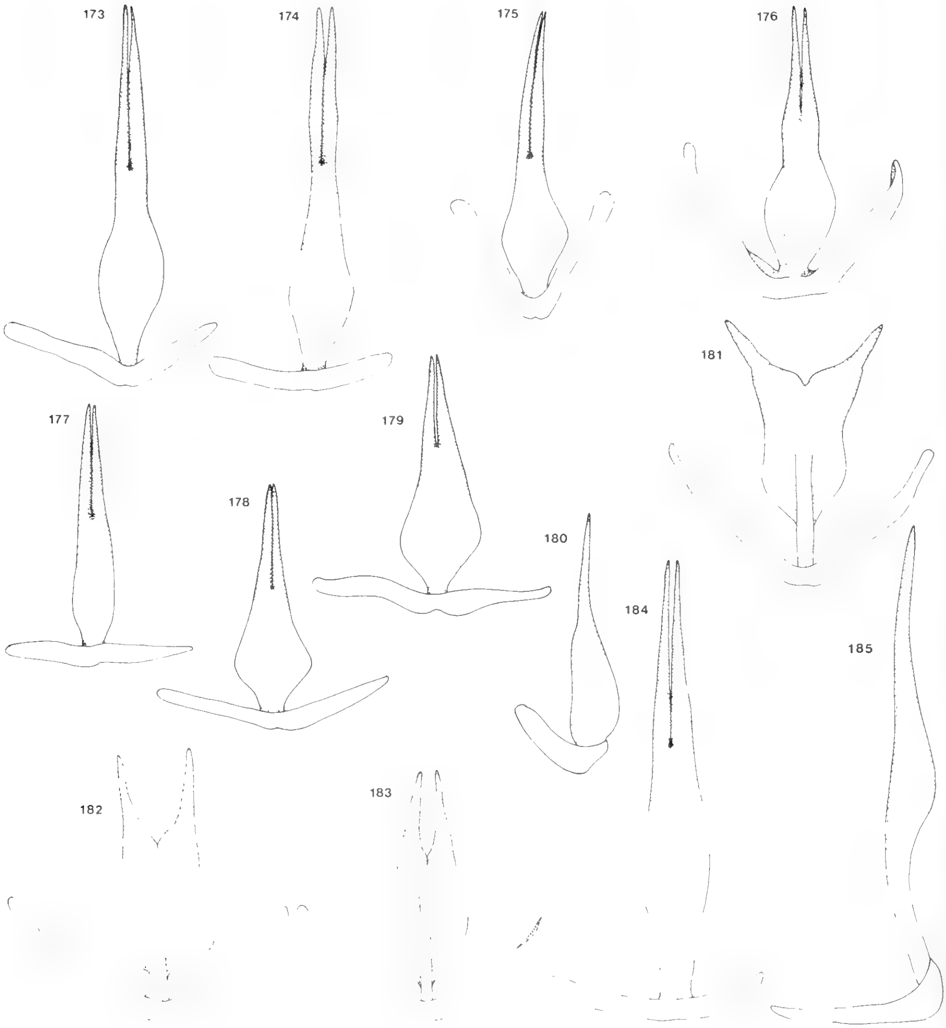
Remarks. — The species is known only from the ♂ holo- and ♀ allotype. The epiphallus was not figured, being lost (Ramme, 1951: 209). Werner's record (1937a) of *E. smyrnensis* (= *chabrieri* auct.) refers to a juvenile pair from the island of Kíthira (= Cerigo), the type-locality of *E. prasina*. This material more probably represents either *E. spinigera* or *E. megastyla*.

Distribution. — Known only from the island of Kíthira.

Eupholidoptera icariensis sp.n.
(pl. 2 figs. 7—8; figs. 32, 68, 114—116, 186)

Pholidoptera chabrieri; Werner, 1933b: 194 (?).

Material studied. — ♂ holo-, ♀ allotype, 1♀ paratype, labelled: Hellas Ikaría Thérma 14/21.vi.1977, M. C. & G. Kruseman; additional paratypes: Ikaría, Thérma Loútra, 16.vi.1963 & Áyios Kirikós, 17.vi.1963, S. Daan & V. v. Laar, 4♀ 1 juv. ♀ (all ITZ).



Figs. 173—185. Epiphallus in *Eupholidoptera* species, anterior and left lateral views, of: 173—180, *E. megastyla* (Ramme): (173) Litókhoron, Piéria; (174) Akhladhókambos, Argolís; (175) Neápolis, Kozáni; (176) Irsina, Matera (paratype of *E. dancomai* La Greca); (177) Melidhoní, Fthiótis; (178—180) Rámia-Livádhion, Árta; 181—183, *E. smyrnensis* (Brunner von Wattenwyl): (181—182) Sámos; (183) Souflión, Évros; 184—185, *E. megastyla* (Ramme), Mt. Panakhaïkón, Akhaía

Diagnosis. — Differs from *E. prasina* as follows: ♂, pl. 2 fig. 7. Hind margin of last abdominal tergite narrowly and not deeply incised medially (fig. 32). Cercus slightly longer (fig. 68), subgenital plate as in figs. 114—115. Epiphallus small, fused part cylindrical without plate-like lateral expansions, extending apical parts robust and V-like diverging apically, as in fig. 186. Hind femur with few transverse dorso-basal stripes, a dorsal spot halfway its length and black apex.

♀, pl. 2 fig. 8. Last abdominal sternite slightly projecting in the middle.

Subgenital plate slightly wider than long, divided in a pair of lobes along median sulcus in proximal half; lobes with hind margin widely rounded laterally, concavely emarginate medially (fig. 116). Coloration as in male.

Measurements (length in mm): body ♂ 23.0, ♀ 22.0 — 23.0; pronotum ♂ 10.3, ♀ 9.7 — 10.2; hind femur ♂ 21.6, ♀ 21.0 — 23.0; ovipositor 15.0 — 19.0.

Variation. — Among the scanty available material the coloration of one female from Á. Kirikós is worth mentioning. In this specimen the black spot of the pronotal lateral lobe is larger, extends dorsad over the pronotal dorsum and an additional pair of black spots is present on the prozona of the pronotal dorsum.

Differential diagnosis. — The species differs from *E. prasina* mainly in the form of the epiphallus and from *E. spinigera* in the location of the styli and the coloration of the pronotum and hind femur. Besides, the species is closely related to *E. krueperi* (Ramme) and *E. unimacula* Karabag. The former species (Ramme, 1930: 819, figs.; 1951: fig.) differs clearly in the epiphallus, the female subgenital plate and the coloration of the pronotal lateral lobe and furthermore in the male cercus, subgenital plate and last abdominal tergite. The latter species (Karabag, 1956: 13, figs.) has vestigial styli and slightly different form of the epiphallus and female subgenital plate.

Remarks. — The only records of a species of the genus from Ikaría is that in Werner (1933b). It refers to a juvenile female, assigned to *E. smyrnensis* (= *chabrieri* auct.). That identification however is considered unreliable and Werner's record is referred here to *E. icariensis*.

Distribution. — Known only from the type-series from the Aegean island of Ikaría.

Eupholidoptera astyla (Ramme, 1927)
(figs. 33, 69, 117—118, 187)

Pholidoptera astyla Ramme, 1927: 133, 196, 198, figs. 11d, 13, 14; 1930: 799, 821, figs. 5—7, 9; 1939: 94—96, fig. 27.

Eupholidoptera astyla; Ramme, 1951: 198, 203, 206, 209, 211, fig. 51; Harz, 1969: 362, 377, figs. 1109, 1130, 1159—1161; Willemse & Kruseman, 1976: 130, 131, figs. 1—5.

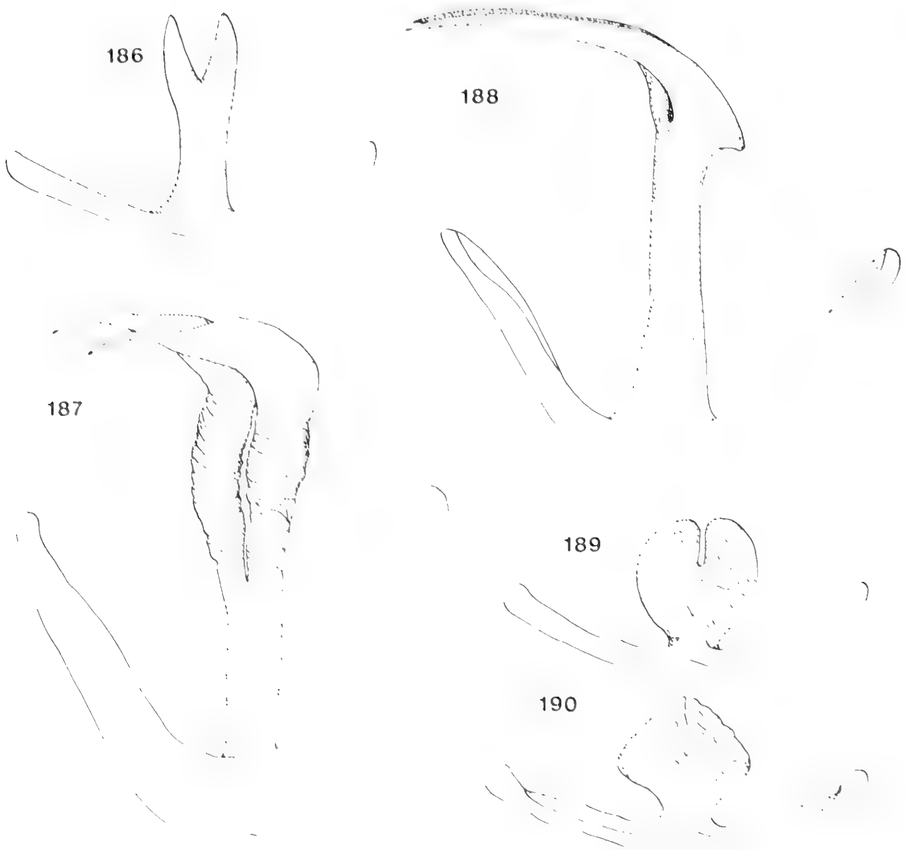
Material studied. — Kríti (?): Skonef, 23.vi, 1 ♂ (CW).

Diagnosis. — Reference is made to the descriptions in Ramme (1927, 1930, 1939).

Differential diagnosis. — The species is well defined by quite a number of characters, cf. figs. 33, 69, 117—118, 187. An asymmetrical epiphallus is found also in *Uvarovistia* (*Karabagia*) *uvarovi*.

Remarks. — Hitherto the species was known only from the original material. The male at hand agrees fully with the original descriptions and figures. The styli of the subgenital plate are not completely reduced, but minute, scale-like, seemingly immovable and located pre-apically on the ventral surface of the plate (figs. 117—118).

Distribution. — The species is known from the island of Náxos, the Kíkladhes, and Kríti. The locality of the specimen before me could not be traced.



Figs. 186—190. Epiphallus, anterior and left lateral views, of: 186, *Eupholidoptera icariensis* sp. n., holotype; 187, *E. astyla* (Ramme), Skonef; 188, *Uvarovistia* (*Karabagia*) *uvarovi* (Karabag), Mt. Lástros, Kárpathos; 189—190, *E. prasina* (Brunner von Wattenwyl), (189) holotype, (190) Khios

Eupholidoptera cretica Ramme, 1951

Eupholidoptera cretica Ramme, 1951: 198, 202, 203, 211, figs. 47, 51; Harz, 1969: 362, 377, figs. 1111—1112; Willemse & Kruseman, 1976: 130, 131, figs. 6—9.

Diagnosis. — Reference is made to the original description.

Differential diagnosis. — The species is readily distinguished by a number of characters (see key).

Remarks. — Hitherto the species is known only from the male holotype.

Distribution. — The type is from Samariá, western Kríti.

Eupholidoptera forcipata Willemse & Kruseman, 1976
Eupholidoptera latens Willemse & Kruseman, 1976
Eupholidoptera pallipes Willemse & Kruseman, 1976
Eupholidoptera gemellata Willemse & Kruseman, 1976

Reference is made to the original descriptions and discussions of these species (Willemse & Kruseman, 1976: 130—137, pls. 2—8 figs. 7—41). They are well defined and all from Kríti.

Uvarovistia Ramme, 1951

Uvarovistia Ramme, 1951: 195, 197, 212.

Type-species: *Olynthoscelis zebra* Uvarov, 1916.

Diagnosis. — Reference is made to the original description.

Differential diagnosis. — The genus is close to *Eupholidoptera* and may be distinguished from the latter by the coloration of the distal abdominal tergites and the ovipositor. In *Uvarovistia* the last abdominal tergite is partly or completely black and the colour extends over the lateral parts of the penultimate tergite; the ovipositor is comparatively more robust, shorter and wider in dorsal view, i.e. less compressed laterally.

Remarks. — Ramme erected the genus on the basis of a well defined group of four species. He studied the epiphalli of three species and found their forms to resemble each other remarkably.

Kaltenbach (1967) arranged *Eupholidoptera uvarovi* Karabag under *Uvarovistia* on account of the black coloration of the distal abdominal tergites. Other characters of this species, however, agree with some species of *Eupholidoptera* rather than with members of *Uvarovistia*. Presumably for these reasons Harz (1969) erected for *U. uvarovi* the subgenus *Karabagia*, but he omitted to point out the distinction between this new subgenus and the nominate taxon. As remarked under *Eupholidoptera*, however, a review of supra-specific groupings in the tribe Pholidopterini can best be postponed for the time being.

Distribution. — The range of the nominate subgenus covers Iran, Iraq and Armenia, that of monotypic *Uvarovistia* (*Karabagia*) the Aegean Island of Kárpathos.

Uvarovistia (Karabagia) uvarovi (Karabag, 1952)
(pl. 2 figs. 9—10; figs. 70, 106, 188)

Pholidoptera chabrieri; Werner, 1936: 12.
Pholidoptera (*Eupholidoptera*) *uvarovi* Karabag, 1952: 135, figs. 1—5.
Uvarovistia uvarovi; Kaltenbach, 1967: 197.
Uvarovistia (*Karabagia*) *uvarovi*; Harz, 1969: 384, figs. 653, 654, 1182—1186.

Material studied. — Kárpathos: Chamili-Sattel bei Volada, 15—18.vi.1935 & Lastros Gebirge, 15.vi.1935, O. Wettstein, *Pholidoptera chabrieri* Charp. det. Werner, 1♂ 2♀ (NMW).

Diagnosis. — Reference is made to the original description.

Variation. — Insufficiently known.

Differential diagnosis. — From the species of nominate *Uvarovistia* this species is quite distinct in the asymmetrical epiphallus (fig. 188), the very short male cercus (fig. 70), the slender ovipositor and the well defined yellow fascia bordering throughout the lower margin of the pronotal lateral lobe (pl. 2. fig. 9). From *Eupholidoptera* it differs in the black coloration of the lateral parts of the penultimate abdominal tergite.

Remarks. — The species seems to link nominate *Uvarovistia* with *Eupholidoptera*. An asymmetrical epiphallus is found also in *E. astyla*, the male subgenital plate (fig. 106) is much the same as in *E. smyrnensis*, the emargination of the hind margin of the last abdominal tergite in the male and the coloration of the pronotum and hind femur are found in several species of *Eupholidoptera*, and the slender ovipositor even in all species of that genus.

The material at hand refers to that recorded by Kaltenbach (1967) and by Werner (1936).

Distribution. — Known only from the island of Kárpathos, the Dhodhekánisos (map).

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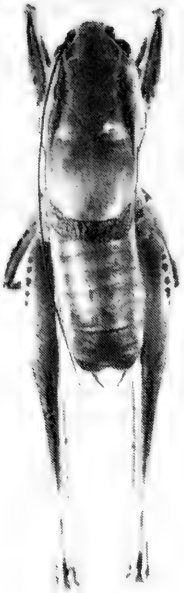

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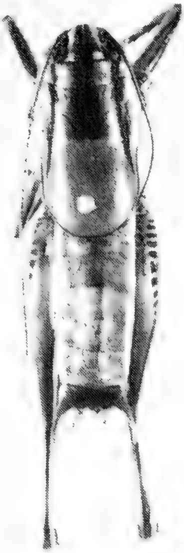

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Figs. 1—4, 6, *Eupholidoptera* species: 1—2, *E. leucasi* sp. n., holotype; 3—4, *E. epirotica* (Ramme): (3) ♂ holotype, (4) ♀, Kérkira; 6, *E. prasina* (Brunner von Wattenwyl), ♂, Khíos

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Figs. 5, 7, 8. *Eupholidoptera* species: 5, *E. prasina* (Brunner von Wattenwyl), ♂ holotype; 7—8, *E. icariensis* sp. n.: (7) ♂ holotype, (8) ♀ allotype. Figs. 9—10. *Uvarovistia (Karabagia) uvarovi* (Karabag), 9, ♂, 10, ♀, both from Mt. Lástros, Kárpathos

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A REVISION OF THE BURMESE PARADOXOSOMATIDAE (DIPLOPODA, POLYDESMIDA) IN THE MUSEO CIVICO DI STORIA NATURALE AT GENOA (PART III)[1]

by

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With 21 text-figures

Abstract

The genus *Antheromorpha* Jeekel, 1968, is diagnosed and its relationship with other genera in the tribe Orthomorphini is discussed. Redescriptions of a number of its species from Burma originally described by Pocock, 1895, under the names of *Orthomorpha miranda, O. melanopleuris, O. bistriata, O. bivittata, O. comotti* and *O. pardalis* are given and their relationship is discussed. The distributional pattern of the species of the group of genera to which *Antheromorpha* belongs, and the relative abundance of them in Burma, Borneo and Java, seems to indicate a dispersal route which bypassed the Malay Peninsula and Sumatra.

Introduction

The third and last part of the revision of the Pocock types of Burmese Paradoxosomatidae in the Genoa Museum deals with the genus *Antheromorpha* Jeekel, 1968, and concerns the species which Pocock (1895) described under the names of *Orthomorpha miranda, O. melanopleuris, O. bistriata, O. bivittata, O. comotti,* and *O. pardalis*. Unfortunately these species, with the exception of *O. miranda* and *O. bistriata*, were based on female specimens only, which renders an evaluation of their systematic status almost impossible. In spite of this it appeared worthwhile to extend the original descriptions of *O. melanopleuris, O. bivittata, O. comotti,* and *O. pardalis* too, in order to facilitate future identifications.

Descriptions

Antheromorpha Jeekel

Brachytropis Silvestri, 1896: 812 (preoccupied).
Antheromorpha Jeekel, 1968: 149.

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[1]) Based on data accumulated through the aid of grant I 954—36 from the Netherlands Organisation for the Advancement of Pure Research (Z.W.O.) and the Italian National Council of Research (C.N.R.).

Parts I and II of this series appeared in Tijdschr. Ent. 108: 95—144, and Tijdschr. Ent. 113: 289—301.

Generic diagnosis. — Medium-sized Orthomorphini with moderately or well-developed paranota having distinct marginal calluses. Colour pattern usually conspicuous, often with pale paramedian stripes in addition to the pale paranotal margins. Pleural keels well developed in anterior somites, disappearing gradually towards the middle or posterior somites. Sternite of 5th somite of male with a process between the anterior legs. Legs of male without particular modifications except the usual scopulae on tibiae and tarsi, which extend caudad to the legs of the second half of the body before completely disappearing. Gonopods with coxa straight, of medium size. Prefemur only slightly elongate. Femorite well-developed, somewhat widening distad. Spermal channel running along the medial side of the femorite. No distinct laminate crest at the medial side of the base of the femorite, and in general no sharp demarcation between the femoral and postfemoral sections. Tibiotarsus and solenomerite relatively short. The tibiotarsus curving rather strongly caudad, consisting of a well-developed lamina medialis and lamina lateralis. The lamina medialis about halfway bearing a well developed prong. Apex of tibiotarsus bilobate.

Type-species. — *Orthomorpha miranda* Pocock, 1895.

Antheromorpha miranda (Pocock)
(figs. 1—6)

Orthomorpha miranda Pocock, 1895: 812, fig. 13—13a.
Antheromorpha miranda; Jeekel, 1968: 57.

Material. — This species was described after an unrecorded, but apparently rather large number of specimens from four localities. The material taken by Oates at Rangoon and Tharrawaddy is in the British Museum (Natural History), London, and has not been incorporated in the present study. Fea collected material at Palon in Pegu and at Thigian, upper Irrawaddy. From these two localities the Genoa museum has three males and one female, and one female, respectively. Weidner (1960) has mentioned four syntypes from Palon in the Hamburg museum. In the loan register of the Genoa museum I found evidence that Silvestri at one time borrowed some material from Palon, which apparently was never returned and probably is still in his collection at Portici.

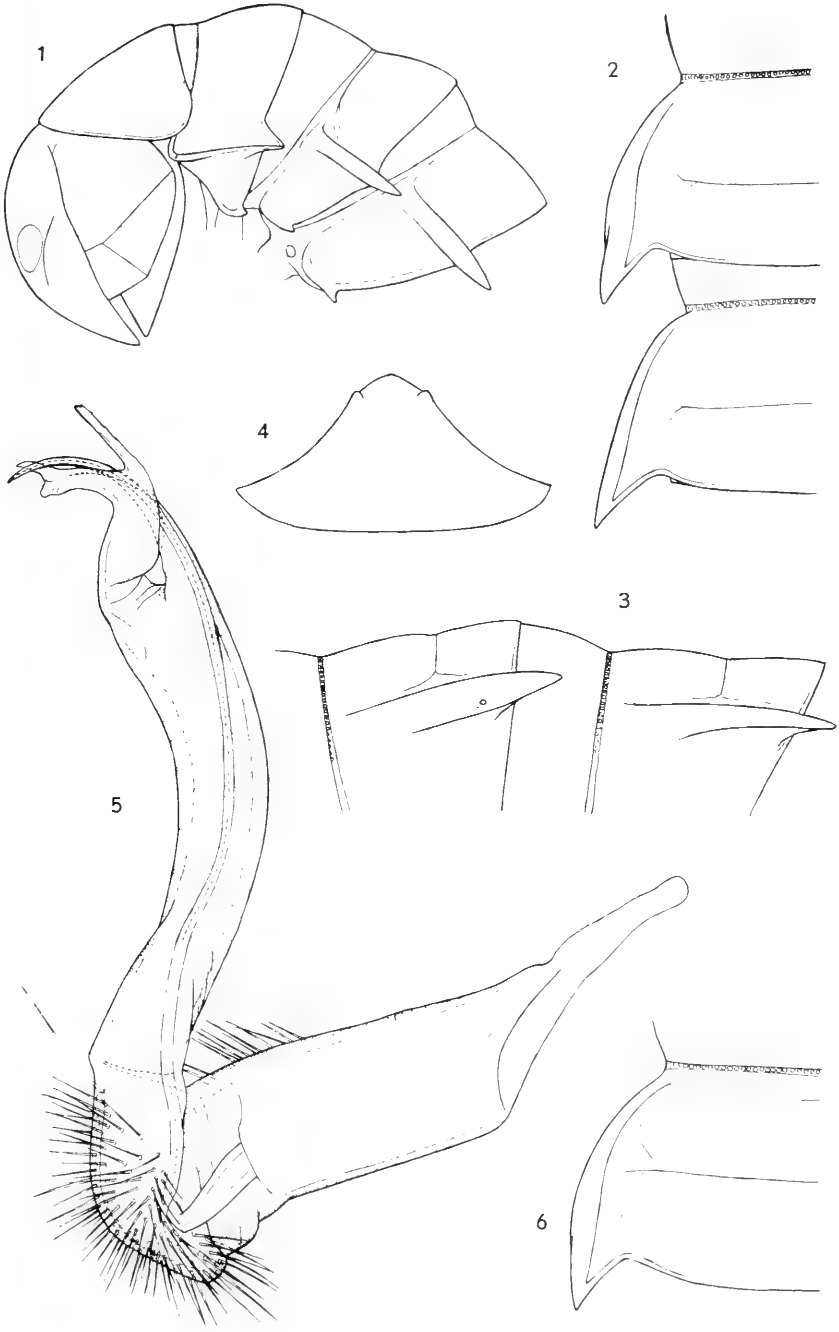
Pocock originally designated Rangoon as the type locality; hence I have labelled the material in the Genoa museum as paratypes (= paralectotypes), pending the designation of a lectotype in the British Museum.

Palon in Pegu, coll. L. Fea, 3 ♂, 1 ♀ paratypes. Thigian, upper Irrawaddy, coll. L. Fea, 1 ♀ paratype.

Description. — Colour: see Pocock.

Width: ♂: 3.2, 3.6, 3.7 mm; ♀: 4.6, 3.6 mm.

Head and antennae: Labrum deeply and rather widely emarginate, tridentate. Clypeus moderately convex, rather weakly impressed towards the labrum; the lateral border weakly rounded, with a slight notch near the labrum. Headplate rather densely to sparsely punctulate and setiferous from the clypeus up to the



Figs. 1—6. *Antheromorpha miranda* (Pocock). 1: head and four anterior somites of ♂ paralectotype, lateral aspect. 2: left side of 10th and 11th somites of same, dorsal aspect. 3: the same, lateral aspect. 4: hypoproct of same, ventral aspect. 5: right gonopod of same, medial aspect. 6: left side of 10th somite of ♀ paralectotype from Palon, dorsal aspect.

ital region, otherwise smooth; vertex hairless. Antennal sockets separated by ne and two fifths times the diameter of a socket, or by just over two thirds of the length of the 2nd antennomere. Postantennal groove deep and rather wide; the wall in front moderately prominent. Vertex moderately convex, the vertigial sulcus rather weakly impressed, running downward to about the upper level of the sockets. Antennae of moderate length, moderately stout, distinctly clavate. Pubescence moderate in the proximal antennomeres becoming dense in the distal ones. Relative length of antennomeres: 2nd = 3rd > 4th > 5th = 6th; the 6th antennomere nine tenths of the length of the 2nd.

Collum: a little wider than the head, subtrapezoidal in dorsal outline (fig. 1). Anterior border faintly convex in the middle, a little more strongly rounded towards the sides, and laterally straight. Posterior border widely emarginate in the middle, becoming faintly convex more laterally; no notch or a very faint one above the lateral rounding. Lateral border rather widely and a little asymmetrically rounded. Surface of collum transversely alnost evenly convex, only slightly flattened in the middle. Marginal rin narrow along the lateral border, disappearing almost completely towards the middle of the anterior border. Surface smooth, shiny, hairless or with a few hairs.

Somites: Constriction rather weak. Prosomites dull, somewhat silky. Stricture narrow, distinctly demarcated from the prosomite, dorsally distinctly beaded down to the level of the paranota, smooth below that level. Metatergites smooth, shiny. Transverse furrow present from the 5th to the 18th somite, weakly indicated also on the 4th and 19th somites. The furrow rather deep, rather wide, distinctly longitudinally striate. Anterior and posterior metatergites with some hairs; the others hairless, but in front of the furrow a transverse row of four minute, now hairless but probably originally setiferous granules. Sides rather coarsely granulate in the anterior somites, to finely rugulose-granulose in the posterior somites. Pleural keels of the 2nd to the 4th somites represented by well-developed curved ridges, which are caudally produced into an acute-angled triangular lappet which projects behind the caudal margin. On the 5th and subsequent somites there is only a triangular lappet at the posterior margin, which up to the 7th somite is pointed and projects slightly behind the caudal margin of the somites. From the 9th somite onwards the lappet is obtuse and does not project, it becomes gradually more rounded caudally in subsequent somites to gradually disappear towards the 17th somite.

Paranota: (figs. 1—3) 2nd somite wider than the collum, but narrower than the 3rd; 4th somite wider than 3rd. Paranota of 2nd somite with its anterior border widely rounded, a little thrust forward, the latero-anterior edge somewhat obtuse, with a weak lateral tooth. The lateral border very weakly convex, with the indication of a tooth halfway. Posterior border practically straight, incurved at base. Latero-posterior edge acutely angular, acuminate. Marginal rim narrow, but sharply demarcated by a furrow. Paranota slightly declined in the lateral direction, the caudal edges projecting well caudad of the posterior margin of the somite. Paranota of 3rd and 4th somites with the anterior border rather widely rounded, not shouldered at base, passing into the practically straight lateral border with an indication of a small marginal tooth. Posterior border straight, not incurved at base. Caudal edges acutely angular, acuminate, projecting well beyond the margins of the somites. Paranota horizontal, their marginal rims somewhat wider than in the 2nd somite. Paranota of 5th and subsequent somites with the latero-anterior border weakly rounded anteriorly, becoming practically straight and distinctly divergent laterally. Posterior border straight or faintly concave. The caudal edges acutely angular, acuminate, becoming subspiniform in the 15th to 19th somites, projecting well behind the margin in all somites. Level of paranota high, raised a little above the horizontal level, the caudal edges generally pointing slightly upwards. Marginal rims rather narrow dorsoventrally, especially in the poreless paranota. The rims also ventrally demarcated by a furrow. Pores lateral, in an elongate oval excavation.

Sternites and legs: Sternites of middle somites as long as wide. Cross impressions with the longitudinal furrow rather weak, the transverse furrow deeper. Pubescence moderate. Sternal cones absent. Sternite of 5th somite with a simply rounded conical knob between the anterior legs, occupying about two fifths of the width between the coxae. The process is a little broader than long. Transverse furrow distinct. Posterior part of sternite rather widely excavated. Sternite of 6th somite deeply excavated, the transverse furrow almost obsolete, the posterior part of the caudal half of the sternite not elevated above the ventral level of the metasomal ring. Sternite of 7th and 8th somites not modified. Legs rather long, moderately slender, not incrassate. Pubescence moderate becoming rather dense in distal podomeres, equally distributed on all sides. Tarsal and tibial brushes moderately thick in the anterior legs, thinning out gradually to become almost obsolete in the legs of the 13th or 14th somite and totally absent in the legs of the 17th somite. Ultimate pairs of legs not modified. Relative length of podomeres: 3rd > 6th > 5th = 2nd > 4th, the 6th podomere just over three quarters of the length of the 3rd.

Anal somite: (fig. 4) Epiproct thick, rather long, the ventral side slightly concave. The base rather broad, the sides moderately converging, practically straight, the lateral setiferous tubercles rather small. The end rather narrowly and straightly truncate, with a pair of rather widely separated slender cones directed backward and very slightly downward. Paraprocts slightly rugulose, the setae on weak tubercles, the marginal rims rather narrow but moderately high. Hypoproct triangular, broad, the sides widely concave, the end obtusely rounded. Setiferous tubercles projecting slightly outside the margin, but not equalling the caudal edge.

Gonopods: (fig. 5) Coxa of moderate size, straight, widening slightly distad, with a latero-anterior setiferous area. Prefemur only slightly elongate, laterally distinctly demarcated from the femorite, the demarcation transverse on the longitudinal axis of the femorite. Femorite long, widely curved, broadening slightly distally. Postfemoral region not demarcated. Spermal channel running straight along the medial side of the femorite towards the base of the solenomerite. Tibiotarsus arising from the caudal side of the distal end of the femorite, short, rather strongly curved in caudal direction. Lamina medialis with an elongate serrulate prong, pointing meso-distad. Apex of tibiotarsus with a sub-uncate lobe. Solenomerite short, tapering distad, largely sheathed by the lamina medialis and lamina lateralis.

Female: differing from the male in the following characters. Antennal sockets separated by five sixths of the length of the 2nd antennomere. Antennae relatively a little shorter. Collum about as wide as head. Somites more robust with the stricture relatively a little less constricted, and the dorsum of the metatergites a little more convex. Pleural keels of 2nd to 4th somites as in the male, those of the 5th somite represented by a rounded lappet near the posterior margin, scarcely projecting. From the 7th somite onwards there is only a slight ridge near the posterior margin, which is rounded and gradually disappears towards the 16th somite. Paranota (fig. 6) extending less laterad, with the lateral borders somewhat more convex. Sternites as long as wide, pubescence as in male. Legs comparatively a little shorter, rather slender. Relative length of podomeres: 3rd > 6th > 2nd > 5th > 4th; the 6th podomere just over three quarters of the length of the 3rd. Two ultimate pairs of legs slightly shorter than the preceding, but not modified.

Antheromorpha miranda (Pocock), var.
(figs. 7, 8)

Orthomorpha melanopleuris Pocock, 1895: 813 (pro parte).

Material. — The male specimen from Minhla which Pocock referred to *Orthomorpha melanopleuris* is certainly not conspecific with the female type of that species. It may represent a geographical form of *Antheromorpha miranda*.

Minhla, coll. G. B. Comotto, 1 ♂.

Description. — Differing from *A. miranda* in the following particulars.

Colour: The lower side of the pleurae of the metasomites is yellowish instead of dark.

Width: 3.3 mm.

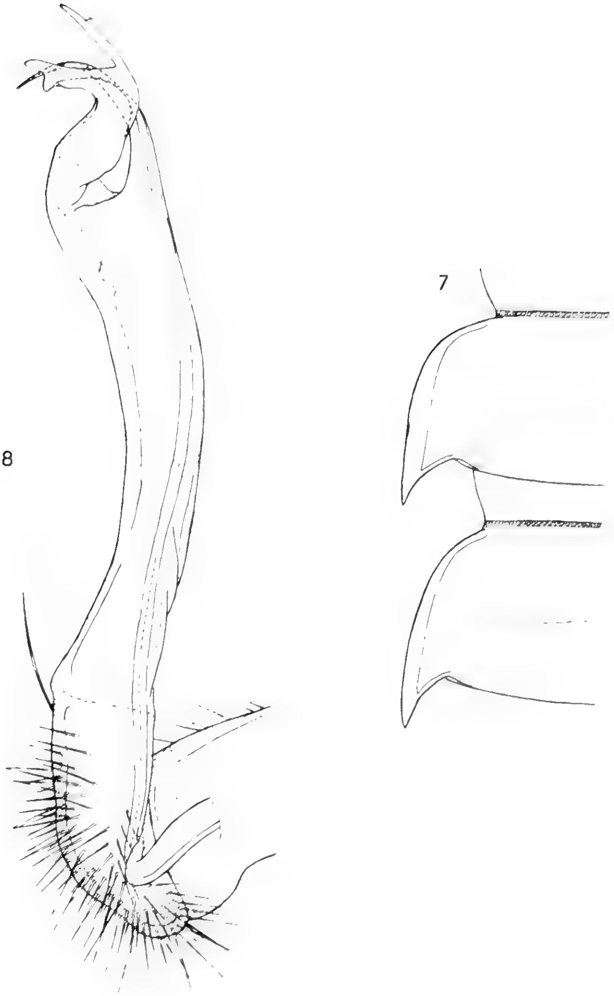
Head and antennae: Antennal sockets separated by three fifths of the length of the 2nd antennomere.

Collum: The posterior margin has a distinct notch above the lateral rounding. The lateral margin is somewhat more pronouncedly asymmetrically rounded.

Somites: The granulation of the pleurae is distinct only in the anterior half of the body, and becomes more dispersed in the middle part and restricted to the lower half of the pleurae. In the posterior part of the body the surface becomes subgranulose. The pleural keels gradually disappear from the 9th somite onwards to become only indicated on the 13th and very faintly indicated on the 14th somite.

Paranota: (fig. 7) The lateral borders of the paranota are less diverging caudad, being more parallel-sided. Paranota not thicker dorso-ventrally than in *A. miranda*.

Sternites and legs: Sternites one and one eighth times longer than broad. Sternite of 5th somite with process slightly thicker than in *A. miranda*; caudal portion of this sternite not modified. Sternite of 6th somite rather deeply excavated, in the caudal half only the median part is scarcely raised above the ventral level of the metasomal ring. The tibial and tarsal brushes of the legs are still visible in the distal part of the tarsi of the legs of the 16th somite, are almost entirely absent in the legs of the 17th somite and completely lacking in the legs of the 18th somite.



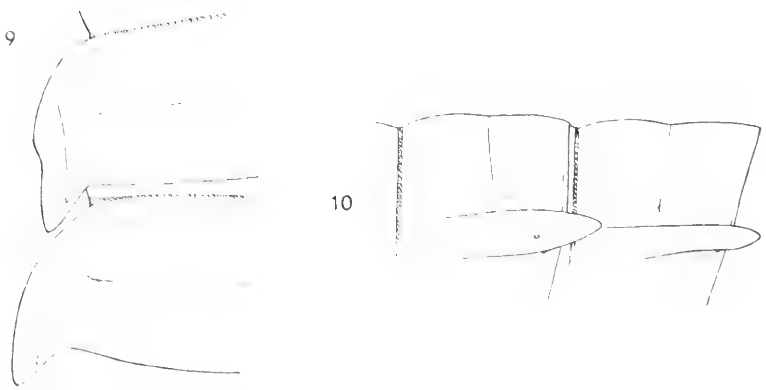
Figs. 7—8. *Antheromorpha miranda* (Pocock), var. ♂ specimen from Minhla, identified by Pocock as *Orthomorpha melanopleuris* Pocock. 7: left side of 10th and 11th somites, dorsal aspect. 8: right gonopod, medial aspect.

Anal somite: Hypoproct more elongate triangular, less trapezoidal. The setiferous tubercles project distinctly outside the border.

Gonopods: (fig. 8) The telopodite on the whole slightly more elongate and slightly less curved. Otherwise as in *A. miranda*.

Antheromorpha melanopleuris (Pocock)
(figs. 9, 10)

Orthomorpha melanopleuris Pocock, 1895: 813 (pro parte).
Antheromorpha melanopleuris; Jeekel, 1968: 57.



Figs. 9—10. *Antheromorpha melanopleuris* (Pocock), ♀ lectotype. 9: left side of 10th and 11th somites, dorsal aspect. 10: the same, lateral aspect.

Material. — The number of specimens upon which this species was based has not been recorded. The collection of the Genoa museum has two female specimens, one of which now has been labelled as lectotype. A syntype (now paralectotype), probably female, is according to Weidner, 1960, in the Hamburg museum; an additional female is in the British Museum, London.

The male specimen from Minhla, tentatively considered by Pocock to belong to *Orthomorpha melanopleuris*, appears to be a variety of *A. miranda* and is described above.

Teinzo, coll. L. Fea, ♀ lectotype, ♀ paralectotype.

Description. — Differing from *A. miranda* ♀ in the following particulars.

Colour: see Pocock. The yellowish paramedian bands of the metatergites are slightly more parallel than in *A. miranda*, where they are distinctly diverging in a caudal direction.

Width: 3.9 mm in both specimens.

Head and antennae: Clypeus moderately impressed towards the labrum; its lateral border widely emarginate above labrum. Headplate punctulate-rugulose in clypeal area, otherwise smooth and shiny. Vertex with two plus two hairs. Antennal sockets separated by three quarters of the length of the 2nd antennomere. Vertigial sulcus well impressed. 2nd to 6th antennomeres of subequal length.

Collum: a little narrower than the head. Posterior border with a slight emargination above the lateral rounding. Surface almost evenly convex, with some dispersed hairs.

Somites: Stricture with a faint lateral striation down to about the level of the stigmata. Metatergites with a faint median furrow in some somites; the transverse furrow weakly striate. Sides in most somites smooth or with some coarse wrinkles, finely dispersedly granulate. In 2nd to about 5th somites a more dense granulation, in posterior half of body granulation in particular in lower half of sides. Pleural keels of 2nd somite caudally rounded, in somites 3 and 4 acutely pointed, all projecting caudad of posterior margin. In 5th and 6th somites the pleural keels are represented by obtusely angular lappets near the posterior margins, which become more rounded in the 7th somite and gradually disappear towards the 12th somite.

Paranota: (figs. 9—10) of 2nd somite with obtusely angular posterior edges. Paranota of 3rd, 4th and 5th somites wider dorsoventrally, the posterior edges less acute. Paranota of subsequent somites with latero-anterior border more strongly curved, the caudal edges less acuminate. Pore area marked by a distinct emargination. Only in the 16th and subsequent somites the caudal edges become spiniform.

Sternites and legs: Middle sternites one and one eighth times broader than long.

Anal somite: Terminal knobs of epiproct shorter. Hypoproct broader, shorter, trapezoidal with sides concave and end rounded. Setiferous tubercles moderately developed, not projecting outside the margin.

Antheromorpha bistriata (Pocock)
(figs. 11—14)

Orthomorpha bistriata Pocock, 1895: 814.
Antheromorpha bistriata; Jeekel, 1968: 57.

Material. — This species was described after a single male specimen, which is preserved in the Genoa museum and which I have labelled as holotype.

Bhamo, 1.x.1886, coll. L. Fea, ♂ holotype.

Description. — Differing from *A. miranda* in the following particulars.

Colour: The dark middorsal stripe is narrower than in *A. miranda*.

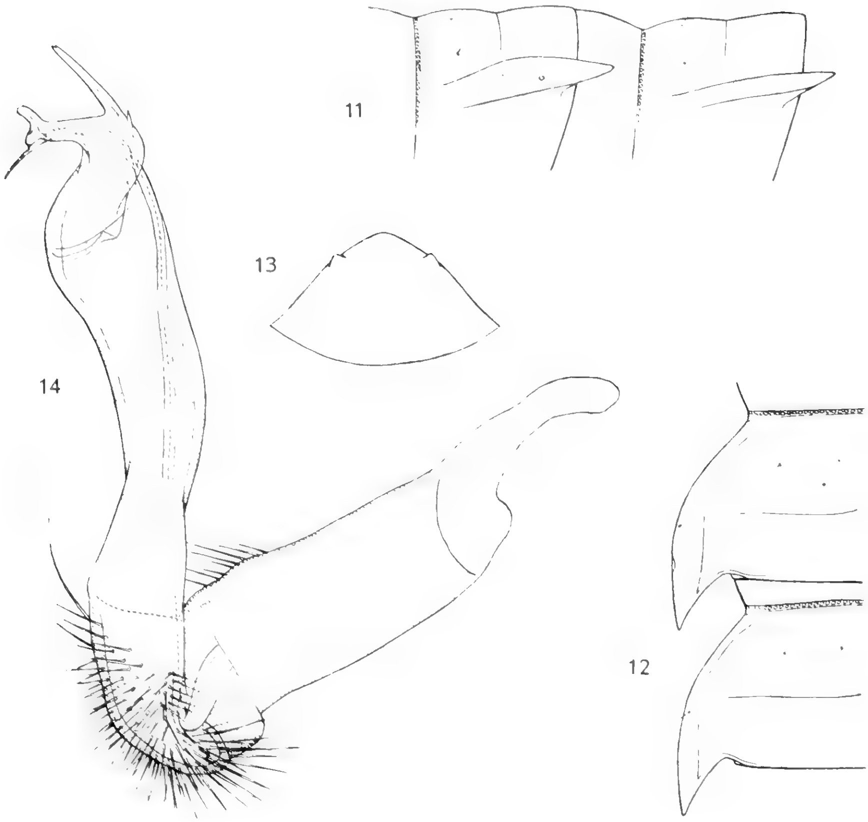
Width: 3.4 mm.

Head and antennae: Lateral border of clypeus faintly rounded, and distinctly emarginate near the labrum. Clypeal and frontal regions punctulate, the clypeus somewhat rugulose; vertex with two pairs of setae. Postantennal groove moderately deep and rather wide; the wall in front rather weakly prominent. Antennomeres decreasing in length from the 2nd to the 6th.

Collum: a little narrower than the head, subtrapezoidal or oblong reniform in dorsal outline. Posterior border with a very weak notch above the lateral rounding. Lateral border almost symmetrically rounded. Lateral sides of collum slightly flaring. Surface of collum with some hairs along the anterior margin and some in the middle.

Somites: Constriction moderate. Metatergites mostly hairless, sometimes four hairs in front of the transverse furrow and some along the posterior margin. Transverse furrow without distinct sculpture, sometimes faintly striate. Sides smooth to weakly granulose, not distinctly granulate in the anterior somites. Pleural keels of 2nd to 4th somites with the caudal lappets rectangular, pointed, scarcely projecting caudad. In the 5th and 6th somites the caudal lappets are obtusely angular, blunt, and do not project caudad. In the 7th somite the caudal end is rounded, and the keels disappear gradually towards the 10th somite.

Paranota: (figs. 11—12) of 2nd somite caudally less produced, the caudal angle



Figs. 11—14. *Antheromorpha bistriata* (Pocock), ♂ holotype. 11: left side of 10th and 11th somites, lateral aspect. 12: the same, dorsal aspect. 13: hypoproct, ventral aspect. 14: right gonopod, medial aspect.

less acute than in *A. miranda*. Paranota of subsequent somites dorsoventrally relatively a little thicker, and projecting less caudad. The lateral borders of the paranota are more parallel, less diverging than in *A. miranda*.

Sternites and legs: Sternites of middle somites one and one eighth times longer than broad. Sternite of 5th somite swollen between anterior legs and bearing a low knob. Sternite of 6th somite rather deeply excavated, but not down to the level of the ventral side of the metasomal ring. Tibial and tarsal brushes are dense in the anterior legs up to the 6th somite, thinning out gradually to become very thin from the 10th somite onwards and totally absent from the 15th somite onwards.

Anal somite: Epiproct with terminal knobs a little shorter. Hypoproct (fig. 13) subtriangular, narrower at base than in *A. miranda* and with the lateral sides more distinctly convex.

Gonopods: (fig. 14) very similar to those of *A. miranda* but with the femorite notably shorter in relation to size of coxa, prefemur and tibiotarsus.

Antheromorpha bivittata (Pocock)
(figs. 15, 16)

Orthomorpha bivittata Pocock, 1895: 814.
Antheromorpha bivittata; Jeekel, 1968: 57.

Material. — The two specimens, both female, upon which this species was based are in the Genoa museum. One has now been designated as lectotype.

Shenmaga, coll. L. Fea, ♀ lectotype, ♀ paralectotype.

Description. — Differing from *A. miranda* ♀ in the following particulars.

Colour: see Pocock. The dark median band is rather broad, slightly constricted in the area of the stricture. Lower side of pleurae yellowish.

Width: lectotype 3.9 mm, paralectotype 3.5 mm.

Collum: a little wider than the head. Posterior border distinctly notched above the lateral rounding.

Somites: Whole surface of lateral sides distinctly granulate. Pleural keels of 5th and 6th somites represented by obtuse triangular lappets, projecting scarcely caudad in the 5th, not projecting in the 6th somite. In the 7th somite the caudal lappet is rounded, from the 8th somite onwards it is very weakly developed to become obsolete in the 11th or 12th somite.

Paranota: (figs. 15—16) Posterior edge of paranota of 2nd somite about rectangular. Paranota laterally slightly more convex, the caudal edges slightly less produced.

Sternites and legs: Sternites of middle somites one and one quarter times broader than long. Cross impressions with the longitudinal furrow also distinct. Pubescence moderate to rather dense. The two ultimate pairs of legs a little shorter than the preceding ones. Relative length of podomeres: 3 rd > 6th > 2nd = 5th > 4th.

Anal somite: Hypoproct broadly triangular.

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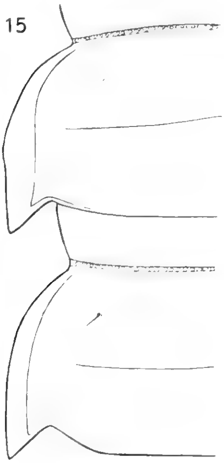

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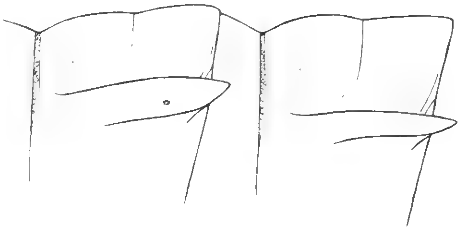

Figs. 15—16. *Antheromorpha bivittata* (Pocock), ♀ lectotype. 15: left side of 10th and 11th somites, dorsal aspect. 16: the same, lateral aspect.

Antheromorpha pardalis (Pocock)
(figs. 17, 18)

Orthomorpha pardalis Pocock, 1895: 815.
Antheromorpha pardalis; Jeekel, 1968: 57.

Material. — According to Pocock this species was based on a unique female specimen. This specimen is preserved in the Genoa museum (it lacks its collum), and has been labelled as holotype.

Palon in Pegu, coll. L. Fea, ♀ holotype.

Description. — Differing from *A. miranda* ♀ in the following particulars.

Colour: see Pocock.

Width: 4.1 mm.

Head and antennae: Lateral borders of clypeus widely emarginate near the labrum. Headplate rugulose in clypeal part. Antennal sockets separated by one and three quarters times the diameter of a socket. Vertex more convex, the sulcus well impressed. Relative length of antennomeres: 2nd > 3rd > 4th = 5th > 6th; the 6th antennomere four fifths of the length of the 2nd.

Collum: lacking.

Somites: Metatergites with weakly leathery integument. Transverse furrow well impressed, almost reaching the dorsal delimitation of the paranota, present from the 2nd to the 18th somite; without distinct sculpture. A fine middorsal furrow is visible in most metatergites. Sides moderately densely granular. Pleural keels of 2nd to 4th somites with pointed caudal lappets projecting caudad of posterior margin. In the 5th somite a weakly developed caudal ridge which gradually disappears in subsequent somites and is absent from the 8th somite onwards.

Paranota: (figs. 17—18) of 2nd somite with anterior border straight and lateral border widely rounded. Latero-posterior edge obtuse. Marginal rim moderately wide, distinctly demarcated, on all sides the furrow along the caudal margin continued upwards to the metasomal margin. Paranota of 3rd somite rather

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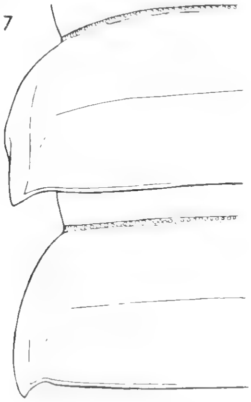

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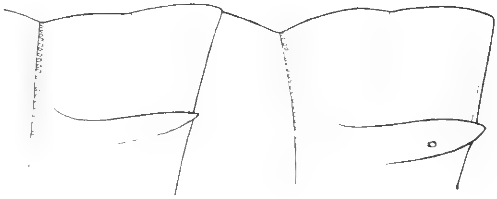


Figs. 17—18. *Antheromorpha pardalis* (Pocock), ♀ holotype. 17: left side of 10th and 11th somites, dorsal aspect. 18: left side of 11th and 12th somites, lateral aspect.

weakly and evenly convex, the posterior edge acute, the posterior border weakly concave. Paranota of 4th somite somewhat less convex than those of 3rd. The posterior edge slightly acutely angular. Posterior edges of 2nd to 4th somites projecting beyond posterior margin of the somites. Caudal edge of paranota of 5th somite about rectangular, not projecting beyond posterior margin. Paranota of 6th and subsequent somites with acute edges, which become spiniform and curving a little inward in the 14th to 19th somites, projecting caudad of posterior margin in all these somites.

Sternites and legs: Sternites of middle somites one and one quarter times broader than long. Cross impressions rather weak. Pubescence of legs ventrally moderate. Relative length of podomeres: 3rd > 6th > 2nd > 5th > 4th.

Anal somite: Epiproct of moderate width and thickness. Sides slightly concave. Near the end a pair of well-developed setiferous tubercles; the end itself with a pair of small cones pointing backwards. Paraprocts rugulose, the setae not arising from tubercles. Marginal rims moderately high and wide. Hypoproct subtriangular, with the sides concave at base, widely rounded more distally, the end obtusely angular. Setiferous tubercles weakly developed, not projecting.

Antheromorpha comotti (Pocock)
(figs. 19—21)

Orthomorpha comotti Pocock, 1895: 814.
Antheromorpha comotti; Jeekel, 1968: 57.

Material. — The type material consists of a single female specimen, which is preserved in the Genoa museum and is now labelled as holotype.

Minhla, coll. G. B. Comotto, 1883, ♀ holotype.

Description. — Differing from *A. miranda* ♀ in the following particulars.

Colour: see Pocock.

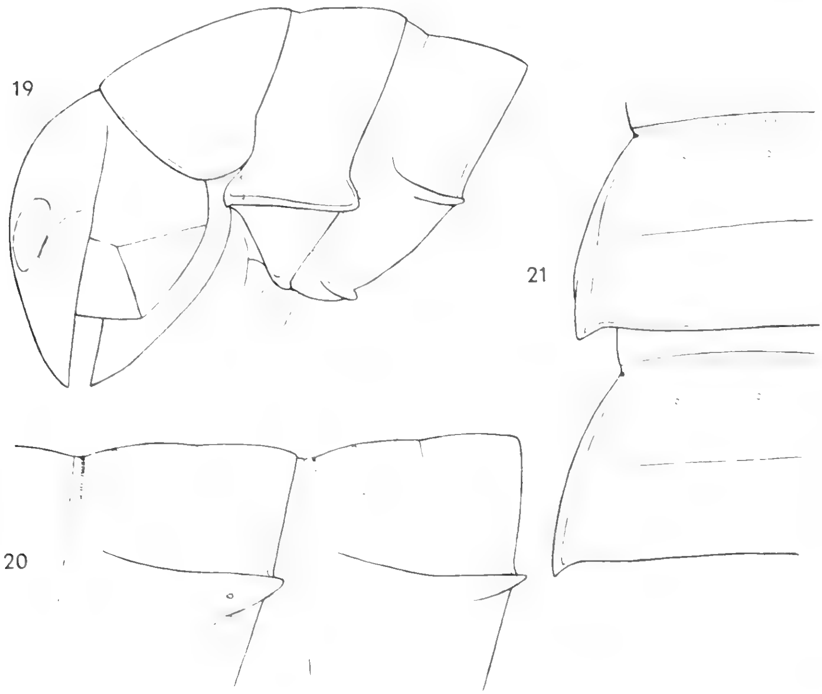
Width: 4.5 mm.

Head and antennae: Lateral border of clypeus faintly convex, widely emarginate above the labrum. Clypeus rugulose-punctulate, remainder of headplate smooth and shiny. Antennal sockets separated by one and five eighths times the diameter of a socket or by about three fifths of the length of the 2nd antennomere. Vertex with median sulcus moderately impressed and running downward to halfway between the antennal sockets. Antennae not clavate, pubescence rather dense in proximal antennomeres to dense in the distal ones. Relative length of antennomeres: 2nd = 3rd > 4th = 5th > 6th; the 6th antennomere almost three quarters of the length of the 2nd.

Collum: (fig. 19) about as wide as head. Its posterior border faintly emarginate, convex towards the lateral sides and emarginate above the lateral rounding. Lateral margin widely rounded, becoming narrowly rounded caudally. Surface of collum hairless, dull, rugulose in the middle becoming sudgranulose towards the lateral sides. Marginal rim narrow and very thin, laterally weakly defined, finely continued along the anterior border. Lateral sides of collum slightly flaring, caudally slightly inflated.

Somites: weakly constricted. The stricture rather narrow, distinctly demarcated. Only the caudal part of the stricture finely but distinctly longitudinally ribbed down to upper level of the paranota, below thafevel finely striate, but no striation below the lower level of the paranota. Metatergites very dull, silky, finely rugulose becoming subgranulose near base of iaranota. In front of the transverse furrow a row of four minute granules. Transverse furrow moderately impressed, linear, finely longitudinally striolate; a fine median furrow on metatergites in front and behind the transverse furrow. Sides densely covered with minute granulae, especially in the 2nd to 4th somites. Pleural keels represented by distinct ridges in the 2nd to 4th somites, caudally produced into slightly acutely angular pointed lappets, which project slightly caudad of posterior margin. In 5th to 7th somites the pleural keels are present only as rounded ridges near the posterior margin of the somites, in the 8th, 9th and 10th somites these ridges gradually disappear.

Paranota: (figs. 19—21) Lateral border of paranota of 2nd somite widely rounded; latero-posterior edge obtusely angular and projecting slightly caudad of margin. Posterior border widely rounded, incurved at base. Marginal rim thin, laterally rather weakly defined. Paranota of 3rd somite with the caudal edge obtusely angular and slightly projecting. The marginal rim rather thick. Posterior border somewhat convex, slightly incurved at base. Paranota of 4th somite with lateral border slightly more widely rounded than in the 3rd somite, the marginal



Figs. 19—21. *Antheromorpha comotti* (Pocock), ♀ holotype. 19: left side of head and three anterior somites, lateral aspect. 20: left side of 10th and 11th somites, lateral aspect. 21: the same, dorsal aspect.

rim thicker than in the 3rd somite. Posterior border straight or faintly concave, the latero-posterior edge about rectanrular, slightly projecting caudad of posterior margin. Paranota of 5th and subsequent somites notably different from those of the other species treated in this paper. Their lateral border faintly convex; the posterior edges acutely angular, pointed, becoming spiniform in the 14th to 19th somites.

Sternites and legs: Sternites with cross impressions well-developed, the transverse furrow a little deeper than the longitudinal one. Pubescence of all sternites rather dense. Legs of moderate length, rather slender. Ventral pubescence of podomeres and dorsal pubescence of distal end of tibiae and the entire tarsi rather dense; dorsal pubescence of proximal podomeres moderate. Last pairs of legs lacking in type specimen. Relative length of podomeres: 3rd > 6th > 2nd > 5th > 4th; the 6th podomere almost four fifths of the length of the 3rd.

Anal somite: Epiproct of moderate length, width and thickness. The lateral sides converging concavely, becoming almost parallel-sided near the apex. Lateral setiferous tubercles very distinct. The end with two rather small, rather widely separated rounded knobs. Paraprocts rugulose, subgranulose. The marginal rims moderately wide, rather low. Setiferous tubercles small and weakly prominent. Hypoproct triangular to subtrapezoidal. The sides concave, the end rounded. The setiferous tubercles rather large but weakly prominent and not projecting outside the margin.

CLASSIFICATION

The name *Antheromorpha*, proposed in 1968 as a substitute for the almost totally forgotten but preoccupied name *Brachytropis* Silvestri, was introduced as a generic name for a rather large group of species occurring in Burma, Siam and Indochina formerly referred to *Orthomorp a* Bollman, 1893, in an attempt to eliminate the heterogeneity in the last genus. To *Antheromorpha* the following species were assigned tentatively (Jeekel, 1968: 57):

A. bistriata (Pocock, 1895) — Burma
A. bivittata (Pocock, 1895) — Burma
A. comotti (Pocock, 1895) — Burma
A. festiva (Brölemann, 1896) — Siam
A. harpaga (Attems, 1937) — Indochina
A. mediovirgata (Carl, 1941) — Burma
A. melanopleuris (Pocock, 1895) — Burma
A. minlana (Pocock, 1895) — Burma
A. miranda (Pocock, 1895) — Burma
A. orophila (Carl, 1941) — Burma
A. pardalis (Pocock, 1895) — Burma
A. uncinata (Attems, 1931) — Siam

In this concept the genus is a fairly large one, and it seems appropriate, therefore, to discuss the interrelationship of the species, a number of which have been redescribed in the previous pages of this paper.

Closely related to the type-species of the genus, *A. miranda*, are *A. bistriata* and

A. mediovirgata. The gonopods of these species are very similar, except that in *A. bistriata* and *A. mediovirgata*, the femorite is relatively shorter. *A. mediovirgata* can be separated from *A. bistriata* by its much smaller size (width of male 2.0 mm as against 3.4 mm), the development of the pleural keels (present up to the 5th somite as against up to the 10th somite), and the development of the tarsal scopulae (disappearing more rapidly in the anterior legs).

The typical colour pattern and general morphology of these three species is shared by two other Burmese species, viz., *A. bivittata* and *A. melanopleuris*, and although these species are known only in the female sex and their gonopod characters are unknown, secondary evidence leaves no doubt as to their close relationship to the type-siecies of the genus.

Less certain is the status of *A. pardalis*. In this species the colour pattern of the metatergites is different, the yellowish paramedian stripes being reduced to a pair of spots in front of the transverse furrow. Still more important is the fact that in this species the transverse furrow of the metatergites is present from the 2nd somite onwards instead of from the 5th onwards. The reference to *Antheromorpha* of this species must be considered more or less arbitrary, and the discovery of the male has to be awaited before a more definite conclusion can be reached.

The position of *A. comotti*, also based on a female, is also not yet settled. Although it has the same colour pattern as *A. miranda*, it differs notably in the structure of the paranota and in the leathery sculpture of collum and metatergites. In this case, however, more can be said with regard to the relationship to *A. miranda*, because *A. comotti* is evidently closely related tot *A. orophila* (Carl), and in fact the latter name may prove to refer to the same species. The male of *A. orophila* has gonopods basically similar to those of *A. miranda*, except that the femorite apically is more strongly curved caudad, whereas the tibiotarsus is a little more elongate and less curved than in *A. miranda*.

The only remaining Burmese species, *A. minlana* (Pocock), was not represented in the collection of the Genoa museum, and has not yet been re-examined. It is a relatively smaller species (width of male 2.6 mm, of female 3.0 mm), with the paramedian light bands vestigial. According to the drawing given by Pocock the gonopods are very slender, with the tibiotarsus more elongate than in *A. miranda*, but otherwise they are essentially similar to those of the latter species.

Of the three non-Burmese species, *A. festiva* (Brölemann) from Siam is evidently quite closely related to *A. miranda*. Apparently, Attems (1937: 69) knew only the brief original description of this species and overlooked the lengthy and lavishly illustrated account by Brölemann of 1904. The species has about the same size as *A. miranda* (width of male 3.2 mm, of female 3.7 mm), the same colour pattern, and the same characteristic habit with the diverging lateral borders of the paranota. The gonopods are of the same general type and differ mainly in the somewhat different course of the spermal channel in the basal part of the femorite, and the relatively larger process of the lamina medialis of the tibiotarsus.

A. uncinata (Attems) from Siam also appears to be related to *A. miranda*, but differs in the stronger curve of the femorite of the gonopods, the relatively larger tibiotarsus, and in colour. Instead of two paramedian yellowish bands, this species has a single median stripe. It is a large species (width of male 5.0 mm) which is also characterized by the presence of two strongly developed cones at the apex of the epiproct pointing ventrad.

A. harpaga (Attems) from Indochina, is a relatively small species (width of male 2.5 mm) which apparently has a colour pattern largely similar to that of *A. uncinata*. In the gonopods it is characterized by the sigmoid curve of the spermal channel in the basal part of the femorite, the presence of a rather distinct denarcation between femur and postfemur, the relatively large tibiotarsus and the large size of the process of the lamina medialis. Like *A. uncinata* it has the epiproct provided with a pair of terminal cones pointing ventrad. Apparently this is the only species in which the lateral sides of the collum are angular.

In conclusion we may distinguish the following groups of species in the genus *Antheromorpha*:

1. *A. bistriata, A. bivittata, A. festiva, A. mediovirgata, A. melanopleuris, A. miranda*;
2. *A. comotti, A. orophila*;
3. *A. uncinata*;
4. *A. harpaga*;
5. *A. minlana*;
6. *A. pardalis*.

Future studies may reveal the necessity of giving one or more of these groups separate generic status.

In 1968 *Antheromorpha* was referred to the tribe Orthomorphini together with *Dajakina* Jeekel, 1963, *Eudasypeltis* Pocock, 1895, *Gigantomorpha* Jeekel, 1963, *Orthomorpha* Bollman, 1893, and *Piccola* Attems, 1953 (Jeekel, 1968: 128). Within this tribe two groups of genera can be distinguished: one, including *Orthomorpha, Eudasypeltis* and *Piccola*, in which the tibiotarsus of the gonopods is simple and undivided, bearing only one or several tiny lobes at the extreme apex, and one, including *Antheromorpha, Dajakina* and *Gigantomorpha*, in which the tibiotarsus has a secondary branch arising from the lamina medialis. To the latter group will be added two new genera to be proposed elsewhere, viz. *Nesorthomorpha* Jeekel (in press) and *Diglossosternum* Jeekel (in press), based respectively on *Orthomorpha coriacea* Carl, 1902, and *Orthomorpha bipulvillata* Carl, 1902, both from Java.

The interrelationship of these genera is evident on account of the gonopod characters, but their position amongst each other is hard to define.

Antheromorpha may come closest to *Dajakina* from Borneo and Sumatra, but the latter genus differs in the absence of a sternal process on the fifth sternite of the male, the very weak development of the paranota, and the presence of pleural keels in a few anterior somites only.

Gigantomorpha is particularly characterized by the presence on the medial side of the gonopod femorite of two longitudinal chitinous crests. The paranota in this genus, which occurs in Borneo as well as in Celebes, are also different in having the latero-anterior border much more strongly rounded.

For the differential characters of the two new genera the reader is referred to the forthcoming paper (Jeekel, in press).

ZOOGEOGRAPHY

The geographical distribution of the group of orthomorphine genera to which *Antheromorpha* belongs, shows a remarkable aspect which deserves some attention. The area in which these genera occur includes Burma, Siam, Indochina, Sumatra, Java, Borneo and Celebes, but according to our present knowledge the representation of the group in the various countries and islands is quite unequal. The following survey may illustrate this.

Of a total of 27 species, Burma has 9, Siam 2, Indochina 1, the Malay Peninsula 0, Sumatra 1, Java 4, Borneo 9 and Celebes 1. There is no doubt that these numbers are biased by insufficient exploration of certain areas, but this affects the absolute numbers and in a much less degree the relative part of the species as against the total number of paradoxosomatid species in the countries. In this respect it is evident that the species of the group are relatively numerous in the faunas of Burma and Borneo, and that they form only a minor part of the faunas of Indochina and Sumatra.

In particular the aspect of the fauna of Sumatra seems to indicate that in the period of dispersal of the group faunal exchanges were possible only between Java, Borneo and Farther India, whereas Sumatra and the Malay Peninsula were apparently isolated and largely inaccessible.

A rather similar distributional pattern of the genus *Orthomorpha*, occurring in Farther India, the Malay Peninsula and Java, was mentioned earlier (Jeekel, 1968: 133). Although this pattern differs from that of the group of genera to which *Antheromorpha* belongs, it agrees with regard to the remarkable dissimilarity in the faunas of Java and Sumatra.

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FEEDING BEHAVIOUR AND RECRUITMENT DISPLAY IN THE SOCIAL SPIDER *STEGODYPHUS SARASINORUM* KARSCH (ARANEAE, ERESIDAE)

by

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With one plate

Abstract

The author describes the sequence of feeding behaviour and recruitment display in the social spider *Stegodyphus sarasinorum* Karsch (Araneae, Eresidae) from India. The display informs the fellow members of the colony about the presence of a prey in the web. The prey is subdued, transported and consumed by these social spiders on a co-operative and social basis.

Introduction

Some general observations on the feeding habits and social behaviour of *Stegodyphus sarasinorum* Karsch have been reported by Jambunathan (1905), Gravely (1915), Kullmann (1968, 1969, 1972), Bradoo (1972) and Jacson & Joseph (1973); on African species, particularly *S. mimosarum* Pavesi and *S. simoni* Giltay has been reported by Cambridge (1889), Marshall (1898), Ghesquière (1926) and Giltay (1927a, b). But detailed studies on the feeding behaviour and recruitment display of these spiders have not been made so far. Hence the present study was undertaken to investigate the sequence of feeding behaviour in *S. sarasinorum*. For the present study material has been used originating from Kerala State in India.

Material and methods

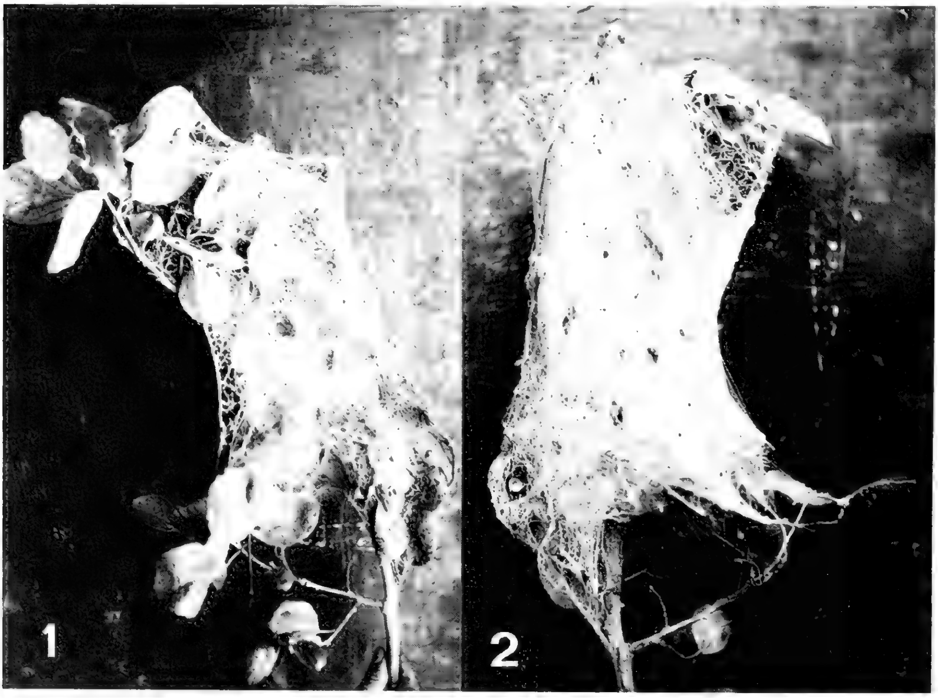
Nests of *S. sarasinorum*, collected from Ferok and Kadalundi, District Calicut, Kerala State, were fixed near the laboratory for making detailed observations on these social spiders. They were fed on cockroaches, house crickets and other live insects collected from the field. Some nests were collected at an interval of few weeks and dissected in the laboratory for determining the types of prey captured by these spiders. Such preys were identified from their chitinous remains and other hard parts of their exoskeleton present in the nest materials. They were also identified during the actual captures made by spiders of natural colonies in the field.

S. sarasinorum is not strictly a nocturnal species. During the day, most spiders stay inside their silken nest but they at once emerge from the nest when diurnal insects like bees, wasps, flies or odonates strike their webs and get entangled in them. However, the maximum general activity begins only late in the evening after sunset, when most spiders come out on the web sheets or on the nest surface, or both.

The preys accepted by the laboratory colonies include different types of mantids, grasshoppers, tettigonids, *Gryllotalpa*, house crickets, termite reproductives, *Forficula* sp., dragon flies, house flies, robberflies, cockroaches, adult antlions, *Eumenes* sp., paussid beetles and lady bird beetles. The preys identified from the nest analysis include, membracids, honey bees, wasps, dipterans, odonates, grasshoppers, mantids and a variety of Coleoptera; the beetles include Carabidae, Curculionidae, Cicindelidae, Coccinellidae, Elateridae, Buprestidae, Hydrophilidae, Staphylinidae, Scarabaeidae and Lampyridae.

STRUCTURE OF THE NEST

S. sarasinorum is a social spider (Jambunathan, 1905). It makes large complex silken nests on thorny bushes, shrubs and trees like *Acacia, Ficus* and *Zizyphus* sp. as reported by Jambunathan (1905), Gravely (1915), Subrahmanyan (1953) and Phanuel (1960). Bradoo (1967, 1972) found the nests of this species on bamboo fencing around paddy fields in Kerala State and described its nest architecture and



Figs. 1, 2. Nests of the social spider *Stegodyphus sarasinorum* Karsch. 1, nest among the leaves of a plant, showing small web-sheets and large nest exits; 2, a large nest with small exits on the surface covered with adhesive cribellar silk.

ecology. The nests are irregular silky constructions of variable shape and size which incorporate leaves of plants (fig. 1), chitinous remains of preys eaten by the spiders, their own exuviae and rolled bits of dry silk removed from their webs.

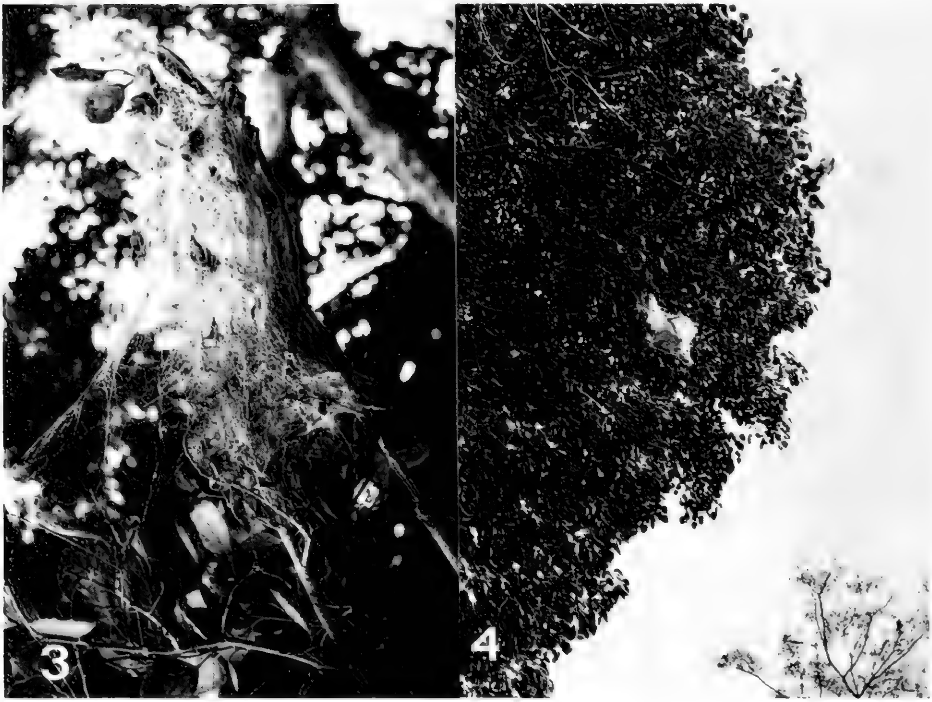
The nest is constructed by the joint and co-operative effort of the individuals of the colony. Its size depends upon the number of spiders in the colony and the number of generations that occupy the same nest, year after year. Normally each generation lives in the nest for about a year. Some large nests (fig. 2) may be a few years old and contain about 500 to 900 individuals. But this number decreases with the increasing age and the longer life history of the spiders. At maturity, each nest contains only few adult spiders. The number of males is less than the females and polygamy is practised (Bradoo, 1975a, b).

The nests of *S. sarasinorum* are traversed by many branched, irregular and interconnected tunnels of variable size which open on the nest surface or near its margin by many exits. The size of the tunnels and the exits varies with the age and the life history of the spiders, being small when the spiders are young, and larger when they are full-grown. In Calicut, *S. sarasinorum* makes rain-proof nests during the monsoons (Bradoo, 1972).

THE WEB

The nests of *S. sarasinorum* are surrounded by large, sticky sheets of cribellar silk made by the joint and co-operative effort of the members of the colony. Some adjacent nests may be interconnected by the common web sheets present between them, as commonly observed among the younger colonies present on the same bush, and among those nests that are formed by sociotomy (Jacson & Joseph, 1973). The structure and construction of the web has been described by Gravely (1915) and Bradoo (1972), and the silk glands by Bradoo & Majupuria (1973).

Late in the evening, most spiders become active and after they come out of the exits, begin to defecate and groom their bodies. Some of them also explore the web and the surroundings, either by leaving fine silk threads floating in the air or by suspending themselves from the nest surface or the web by fine drag lines. Some individuals also begin to repair the damaged areas in the web by spinning characteristic cribellar silk threads in a zigzag manner. The completion of the web normally takes a long time, often a few days, and it attains its full size of 1—3 meters or more in a few days time. The size of the web depends on the life history and the number of spiders present in the nest. Those colonies that contain several hundred spiders usually have a much larger web than those that contain only few individuals. The adult males take no part in web spinning or prey capture, but perform these functions actively when still very young. Even the gravid females and those that are looking after their cocoons take very little interest in spinning and web repair, so that their web remains much smaller and considerably damaged (fig. 3). Such gravid females use their silk for making special brood chambers in the nest for storing their cocoons, as reported by the present author (1975b). They obtain their prey from the surface of their nest, which is covered with sticky cribellar silk (fig. 1).



Figs. 3, 4. Nests of the social spider *Stegodyphus sarasinorum* Karsch. 3, nest with damaged web during the breeding season; 4, nest on *Ficus* plant covered with the drag-lines of spiderlings.

Some gravid females leave the home nest and construct new brood nests for looking after their cocoons and the brood. Such new nests give rise to future colonies of these social spiders (Jambunathan, 1905; Bradoo, 1972; Jacson & Joseph, 1973).

The web sheets of these social spiders do not retain their sticky nature for a long time. Various environmental factors, like excessive rain, heat, humidity and wind, make the web dry and non-sticky. Moreover, the struggles of the ensnared preys and the peculiar method of transportation also damage the web. Such dry and non-sticky parts of the web are examined by the spiders each evening or even in the early mornings at the time of sunrise. These dry webs are cut and rolled into small balls, that are incorporated into the nest structure. But the complete web is never removed or renewed. The damaged areas are jointly repaired by the spiders every day. Krafft (1969) reported a similar co-operative web repair in the social spider *Agelena consociata* Denis.

The structure, size and siting of *S. sarasinorum* webs is consistent with the view that these spiders specialize on preys that are in flight above the ground surface. That web plays a very prominent role and determines the manner of prey capture among spiders has been discussed earlier by the present author (1973, 1977).

FEEDING BEHAVIOUR

The feeding behaviour of *S. sarasinorum*, as observed in the field and in the experimental colonies, consists of the following sequence: (1) perception of vibrations, (2) orientation and approach behaviour, (3) seizure and bite, involving a recruitment display, (4) transportation of the prey, (5) feeding, and (6) treatment of dry remains of the prey.

(1) Perception of vibrations

When some insect gets ensnared in the web sheets of *S. sarasinorum*, its struggles set vibrations in the web, which are perceived by the spiders waiting on the web or near the nest exits. The waiting spiders, hitherto called "pilot spiders", are the first individuals to reach and attack the prey in the web.

That the web spinning spiders respond to vibrations of the web has been demonstrated by many workers (Boys, 1880; Peckham & Peckham, 1887; Barrows, 1915; Rabaud, 1921; Grunbaum, 1927; Wells, 1936; Liesenfeld, 1956; Walcott & Van der Kloot, 1959; Walcott, 1963). Tretzel (1961) found that the female *Coelotes terrestris* (Wider) not only responds to the vibrations of the web but can also distinguish her young from the prey by the differences in the web vibrations. Walcott (1963) and Frings & Frings (1966) showed that the spiderweb also transmits the sound vibrations. While the web vibrations are perceived by the lyriform organs, the sound vibrations are perceived by the sensory hairs located on the legs and the body. The detailed structure of spider lyriform organs has been given by MacIndoo (1911) and Kaston (1935) and the electron microscopic study by Salpeter & Walcott (1960).

(2) Orientation and approach behaviour

The sustained vibrations caused in the web by the ensnared preys elicit an orientation and approach behaviour in the spiders. It involves a rapid locomotion that brings the pilot spiders near the prey. The approach behaviour is released even in the absence of the prey by touching a tunning-fork to the web. Such a response is similar to that shown for a struggling prey. The intensity of web vibrations is very important for the maintenance of orientation, otherwise the spiders move in a random search on the web, keeping their first pair of legs wide apart and finally they stop on the web.

The speed of approach behaviour is dependent on the intensity of the web vibrations. The pilot spiders run straight and direct towards the source of vibration. The "run" of an individual releases a similar behaviour in the other neighbouring spiders present on the web. But certain preys that get ensnared far away from the nest set only mild vibrations. In response, the pilot spiders start rushing towards the prey. But when the prey stops its struggles (as observed in the case of small acriids), the pilot spiders also stop and stay motionless on the web. This is followed by the "plucking behaviour" which induces the prey to resume its struggles and helps the spider to locate the prey. During plucking, the spiders make characteristic web pulls with the help of their first pair of legs. This plucking behaviour is similar to those of the orb-weavers as reported by Robinson (1969), Robinson & Robinson (1971), Robinson & Mirick (1971) and Robinson & Graney (1971).

The orientation behaviour helps the spiders to precisely locate the prey ensnared in the web. As the pilot spiders are the first individuals to reach the prey, they inform the other members of the colony by a special display through the web. The locomotion of pilot spiders and few others that follow them to the prey, is different from the normal locomotory behaviour in that the spiders are very much excited and they run with a higher speed. The vibration receptors on the legs thus play a significant role not only in perceiving the vibrations but also in the orientation and approach behaviour towards the prey.

(3) Seizure and bite (prey-immobility)

The contact with the prey initiates seizure and biting of its appendages. It involves a joint activity of the pilot spiders and many others that receive the signals for subduing the prey. The pilot spiders recognize the prey by leg and palpal contacts. They seize the movable appendages like mouth-parts, legs, wings and antennae with the help of their chelicerae. The prey held taught in this manner cannot escape from the firm hold of the spiders. To make its escape impossible, the spiders exert a maximum pull on the appendages and begin to inject poison to kill the prey. During these activities, the pilot spiders make repeated drumming movements and special webpulls with the help of their hind legs on the web. This display is very prominent when the prey continues to struggle in the web and it induces many spiders (recruits or helpers) to rush out from the nest to assist the pilot spiders in subduing the prey. Hence various preys that cannot be easily captured are successfully subdued by the joint effort of the pilot spiders and the recruits. Unlike in most other spiders, all types of preys receive the same treatment.

The display that induces recruitment and communicates information to the fellow members of the colony is called the recruitment display. It is connected with the vibrations caused over the web. The pattern of recruitment display is almost similar under different conditions. Under optimal conditions (attractive ensnared prey, active and hungry colony) the pilot spiders, while holding and attempting to drag the prey, perform a repeated display by drumming their hind legs on the web and by making special web pulls accompanied by high excitation of their pedipalps. During the display, the pilot spiders do not leave the prey unless they themselves are attacked by the prey. Such a display was never seen "in vacue", meaning without the stimulation caused by a prey. This display is shown only for the live prey and results in a mass-recruitment of the spiders from one or many nests that may be interconnected by the common web sheets. The onset of departure from the nest is induced by the display and the excited behaviour of the pilot spiders, holding the prey. So new individuals ("recruits" or "helpers") emerge out from the nest and run towards the prey. They leave fine drag lines as they run over the web.

The strength of the recruitment is, as a rule, determined by the strength of the display but it also depends upon the struggles of the prey which induces web vibrations and an active display in the pilot spiders. However, once the prey has been subdued, the display alone is responsible for the recruitment. The recruitment display not only stimulates the fellow members of the colony but also directs them to the food source.

(4) Intensity of the recruitment display

The recruitment display is carried out only by the pilot spiders. High intensity display is performed when the pilot spiders are few and its intensity goes down, when many more spiders reach the prey. Finally it disappears completely. Sometimes the display is interrupted when an appendage held by any pilot spider gets detached from the rest of the prey. The spider carries it for a short distance on the web or near the nest to feed on it all alone, an observation that Jambunathan (1905) termed as a "selfish act". The display of the pilot spiders together with the excited running of the recruited spiders results in a greater activity in the nest, and more spiders stream out towards the prey. It may cause a similar behaviour in the other neighbouring nests, having a common snare between them. The display is sometimes superimposed and very brief, when the prey gets ensnared close to the nest where large number of spiders come out to cover the prey, as usually observed late in the evening. The distance of the prey from the nest is very important for the period of excitation.

The intensity of recruitment display gradually diminishes. The display pattern becomes weaker, the drumming movements and the web pulls slower and shorter lasting and finally disappear entirely. Meanwhile the prey is surrounded by large number of spiders that begin to drag it towards the nest. The leg and palpal excitation also slows down, and from the entire display, only hold of the prey remains. The subsequent recruitment is very slow and finally nothing remains of it and it disappears. The mass recruitment finally breaks off as everything grows quiet around the prey.

The intensity of recruitment display, its dropping down and breaking off and the length of the recruitment period, depends on the size and the attractive power of the prey in the web and also on the time of the day. The recruitment display is best observed when preys like flies (Diptera), bees (Hymenoptera), termite reproductives (Isoptera) and other similar and active insects get ensnared in the web, particularly during the day time, when only few pilot spiders are attracted to the prey in the web. During the night, this display is observed when there are only few spiders on the web and larger preys like grasshoppers (Orthoptera), beetles (Coleoptera) or termites (Isoptera) get ensnared in the web sheets of these social spiders. The strength of the recruitment is dependent on the conditions of the colony, prey distance, the type of the prey and also the condition of the web.

Soon after the recruitment ends, all the individuals (pilot spiders, recruits and others) get engaged in a joint and communal feeding on the prey. The dead preys and the members of their own species did not evoke any display, as the pilot spiders do not run and pull the prey. Individuals of *S. sarasinorum*, when thrown on the webs of other colonies of this species, were not treated as prey by the resident spiders. They would simply exchange mutual tactile contacts and would either run to the nest or move in a normal fashion on the web. This indicates that these social spiders do recognize the members of their own species. When they run towards the nest, it induces the other spiders also to rush back to the nest and it indicates that they understand the nature of the web vibrations caused by the fleeing spiders on the web. The mutual recognition, though based on tactile sense, is possibly aided by some chemicals and pheromones as suggested by Kullmann & Zimmermann (1971). Krafft (1975a, b) reported a similar mutual tolerance behaviour among the members of *Agelena consociata* colonies.

(5) Intensity of recruitment

The intensity of recruitment may be determined by the number of spiders leaving the nest after a display of the pilot spiders and also by the number of spiders arriving at the prey. This results in the formation of an aggregation and coherence of many individuals around the prey. The number of recruited individuals varies considerably. Many recruited spiders follow the drag lines left by the pilot spiders and by those that leave the nest first and thus reach the prey. All the recruited spiders do not emerge from the same exit but they come out from several adjacent nest exits, but not from those exits that are far away or those that lie on the different side of the nest.

Sometimes, all the recruited spiders may not arrive at the prey. They may retreat back into the nest, particularly if it is day-time. This retreat behaviour may be due to some mechanical disturbance in the web or may be a result of loss of necessary signals through the web, that may be given by the pilot spiders from a longer distance on the web. The retreat behaviour can also be induced by simply touching the spider and preventing its course towards the prey. It can also be induced by a strong and sudden flash light shown by the observer.

(6) The build up of recruitment

When some suitable prey gets ensnared in the web, the pilot spiders rush towards the source of vibrations and begin to display the presence of the prey. This display induces the recruits to rush out from the nest to help the pilot spiders. The number of recruits depends on the prey size, the intensity of the display and the stimulation received by them according to the distance of the prey from the nest. The strength of the recruitment also depends upon the number of pilot spiders, the struggles of the ensnared prey, colony needs and other possible factors. Thus in a starved colony (which is given no food for two weeks or more) more pilot spiders begin to move about and explore the web for any possible prey that may strike the web. In such colonies, many spiders may even leave the nest and try to start new nests, as observed in the experimental colonies. In a starved colony the period of recruitment is much shorter than usual. The strength of the recruitment markedly diminishes after several preys are available in the snare. In such cases several separate groups of spiders collect around the different preys on the web.

It is not surprising that these social spiders on account of their well developed sense of touch have developed tactile releasers. Tretzel (1961) pointed out that the *Coelotes* mother after prey capture shows remarkable movements and vibrations. The manner of these movements and their repetition has a role as a releaser. Thus the "web-shake" used for longer prey attracts the young from a closer range. The "body-quivering" is given when the mother struggles hard with a beetle. "cheliceral-shaking" is given when a small prey is held in the chelicerae. It may also give a special palpal tap on the web. These movements associated with the entanglement of the prey, act not only as a luring signal for the spiderlings to come to the meal but also helps them to understand the details regarding the magnitude and the situation of the prey. The *Coelotes* mother treats different preys in a different manner.

In the same manner, the recruitment display in *Stegodyphus* spiders acquires a signal value which not only stimulates the fellow members of the colony but also directs them to the food source.

(7) Transportation of the prey

The method of transportion of the prey is characteristic, as it involves a joint and co-operative effort of a large number of pilot spiders and numerous recruits. Unlike in orb-weavers, the prey is never wrapped in silk, before or after the transportation. During transportation, the prey irrespective of its size and kind is practically dragged on the web in the direction of the nest. This damages the web considerably but this joint action of many individuals is necessary for subduing and transporting the prey which normally is much larger than the spiders.

Before the actual transportation begins, the spiders surround the prey from all sides, hold its appendages and some of them even change their positions to get a better hold of the prey. The prey is never separated from the web unless it is to be refused and thrown down. While jointly dragging the prey on the web, the spiders move backwards in the direction of the nest, guided by numerous drag-lines that are laid down on the web by the recruits when they rush out to reach the prey. Thus the recruits not only help in subduing the prey but also in transporting the prey in the proper direction of the nest. The direction of orientation is therefore predictable and determined by the number of recruits coming from a particular nest.

The transportation of the prey finally stops when it reaches the nest. A few more spiders emerge from the nest to assist them and the number of spiders soon increases around the prey. The prey is never carried inside the nest unless it is too small and the spiders are forced to do so. Normally the prey is so large that it cannot be carried into the nest and if the spiders are disturbed, they rather leave the prey and rush back to the nest.

The transportation of the prey is considerably affected by the presence or absence of light. During the day, all types of prey are transported up to the nest, but late in the evening and during the night the prey is consumed on the web itself without transportation. The prey is covered by a large number of spiders. If a torch light is shown on such feeding aggregations, many spiders leave the prey and retreat into the nest. Though the dim light induces the spiders to pull the prey, feeding is resumed soon.

A *Mantis* thrown on the web of an experimental colony was located by the pilot spiders. They held it by the wings and began to perform the display. A few recruits arrived to hold the legs of the mantis but were furiously bitten by the *Mantis* and they ran back to the nest with injured legs. Meanwhile, some more recruits rushed out to assist the pilot spiders and within half an hour, the mantis was surrounded by 31 spiders and was completely subdued. When a dim torch light was shown, the spiders began to move their hind legs and many of them moved away on the web, but returned again to drag it towards the nest.

That the prey is invariably carried to the nest during the day has a survival value. The large aggregations of spiders around the prey in the web would attract many insectivorous birds. Such predators and other kinds of natural enemies of *S. sarasinorum* have been reported by the author earlier (1972). Once the author found a large number of nests of these spiders destroyed by house crows, at Ferok, Kerala. As these avian predators are not active at night, the social spiders need not transport the prey to the nest. But those spiders that continue to feed during the night on the web itself, do carry the prey to the nest as the morning approaches, to minimize the danger of predation and possible damage to the nest.

(8) Feeding

Large feeding aggregations of *S. sarasinorum* have been nicely photographed by Jacson & Joseph (1973). Such feeding groups may have few to hundred or more individuals, depending on the size of the prey, the size of the colony and the physiological state of the spiders.

It should be recognized that in these feeding groups, some individuals may not have actually participated in any way in the prey capture or transportation. But they are permitted by the other active members to partake the food captured by them. This is one of the interesting advantages of their social life, and almost every member receives the required nourishment depending upon the availability of the prey. In such aggregations, and in those colonies that have many individuals, not all the members may receive an equal share of the prey due to insufficient number of preys, in a particular period. Thus the various members of a colony mature slowly in course of time due to differences in the growth rate and prey availability. The prey sharing behaviour indicates a high degree of mutual tolerance and co-operation in this species. A similar prey sharing behaviour has also been reported in the social spider *A. consociata* by Pain (1964) and Darchen (1965), and in *A. republicana* by Darchen (1967, 1973). Even in the solitary species, *S. lineatus* (Latreille), the prey is jointly shared when many individuals were put together under laboratory conditions (Millot & Bourgin, 1942).

In each feeding group, the spiders pour digestive secretions that dissolve the soft interior of the prey. The semidigested liquid is then sucked jointly by the spiders. The maintenance of feeding was found primarily to be dependent on the sensory inputs from the chemoreceptors present around the mouth. The duration of feeding depends upon the size of the prey and the number of feeding spiders. The small acridiids were completely sucked within two hours, a dragonfly in one hour, a large cockroach (*Periplaneta americana*) in four hours. Grasshoppers and larger beetles took longer. These observations clearly show that social spiders feed and consume larger preys in a shortest possible time and the spiders are soon ready for new preys that may strike the web.

(9) Treatment of dry remains of the prey

After the cessation of feeding, the dry remains of the prey are separated and thrown down from the web by the spiders that are the last individuals on the prey. This behaviour is also shown by any individual that may come in contact with the prey-remains (refuse) while exploring the web. Even the dry bits of grass, paper bits or dry remains of the preys if placed on the web are removed and thrown down, a behaviour also known among most other spiders, particularly the orb-weavers. This behaviour of throwing the refuse away keeps the web clean and possible predators away. But the remains of the prey that are transported to the nest are not thrown out but are covered in silk and incorporated into the nest structure. This evidently increases the size of the nest. Such dry remains of preys are eaten by a number of insect commensals found in the nests of social spiders, as reported by Bradoo (1967, 1971), Bradoo & Joseph (1970) and, among the African species, by Marshall (1898).

(10) Drinking

The social spiders *S. sarasinorum* also accept drops of water during the summer months when the colonies contain mature spiders. As soon as some water drops are sprinkled on the nest surface, the spiders after initial contact with the drop of water begin to drink it. This behaviour is particularly observed for the mature males in the nest.

(11) Behaviour with unusual preys

The author studied the behaviour of these social spiders towards some unusual preys that normally do not fall in their webs. The following observations are briefly recorded:

(a) When a medium-sized female Gasteracanth spider was dropped on the web of *S. sarasinorum*, a few pilot spiders rushed forward to hold its abdominal appendages present in the form of small projections. But the pilot spiders ran back to the nest as if in "distress". The Gasteracanth was not accepted as a prey.

(b) A Scutellerid bug when placed on the web or the nest surface was repeatedly thrown down and rejected by the spiders after an initial contact. When placed inside a nest exit, it was again pushed out and rejected. In the same manner, a blister beetle and a Phalangid were also rejected and thrown down from the web.

(c) A green pentatomid bug, when placed on the web, was rejected initially, but later, when placed again, was accepted as prey.

(d) When a large soldier ant was placed on the web, many pilot spiders approached to hold its appendages but the ant struggled hard and injured some of them by biting their legs. Such injured individuals left the ant, which struggled hard, and more spiders rushed out and successfully subdued it without approaching its mouthparts.

(e) Large Rhinoceros beetles and Sphingid moths, when placed on the web, induce a fleeing response in these spiders; the powerful wings of such a moth beat so vigorously that the web gets damaged quickly and the moth finally escapes. The social spiders were unable to hold the strong chitinous and powerful appendages of the large rhinoceros beetle (5 cm long). The beetle damaged the web and fell free to the ground. Such large insects are certainly difficult to subdue and the spiders would face the danger of falling to the ground, along with the prey. The size and suitability of the prey is therefore an essential factor for determining the response of the spiders.

(f) Very minute insects like winged aphids, fig-insects and other chalcids, minute diptera and micro-coleoptera also get ensnared in the sticky web sheets of these spiders. But because of their small size and extremely weak web vibrations, they are not perceived by the social spiders or they are at least not reacted upon. Such minute insects are insignificant for the nutritional requirements of a large colony of spiders. On several occasions, the author observed that the winged aphids were actually separated and removed from the web and dropped down to the ground by the spiders. However, these minute insects are actively captured by a small cribellate spider *Uloborus ferokus* Bradoo (1979) that lives as a commensal on the web sheets of this social spider.

(g) The young of *S. sarasinorum* do not spin the typical cribellar silk threads until they complete the third or fourth moult. They cover the outer surface of the nest with fine drag lines (fig. 4) and leave only minute nest exits for their own use. Due to this close covering on all sides of the nest, the mother spiders are unable to come out and hence they die inside the nest or beneath the covering of drag lines. Their dead bodies are sucked by the spiderlings. They also feed jointly on those small preys that fall on the nest surface.

DISCUSSION

From the results of this study, a complete description may be made of the feeding behaviour of *S. sarasinorum*. The spiders that have not fed recently, remain waiting on the web or near the nest exits, for any possible prey that may get ensnared in the web. These waiting spiders, called "pilot spiders", perceive the vibrations of the web caused by the struggles of the ensnared prey. The intensity and the continuity of the web vibrations releases an approach behaviour in the pilot spiders. They perceive the vibrations with the help of the lyriform organs located on their legs and these organs also help them to reach the prey. Contact with the prey initiates its capture and seizure of its appendages and wings.

The sustained struggles of the prey make the pilot spiders to make repeated leg taps and special web-pulls with their hind legs. This is particularly shown when their number is low and they are far away from the nest. These movements release an approach behaviour in other spiders, called "recruits" or "helpers", to reach the prey. They assist the pilot spiders in subduing the live prey which is normally much bigger than the spiders. While holding the prey, the spiders inject poison and begin to transport it towards the nest, if it is day-time. But late in the evening, the prey is not transported and instead feeding commences on the web itself. The digestive secretions of large number of spiders dissolves the soft parts of the prey in a short time and this semidigested material is sucked jointly by the spiders.

The duration of feeding depends upon the size of the prey and the number of spiders and their physiological state at the time of feeding. On larger preys like grasshoppers and cockroaches, the spiders may continue to feed for several hours, but very large beetles require a much longer time so that the spiders may continue to feed even the second day. Unlike in most other spiders, particularly the orb-weavers, the prey is never wrapped in silk, either before or after the transportation.

The cessation of feeding is based mainly on decrease in the supply of nourishment. The remains of preys consumed on the web are normally rejected and thrown down, but those that are consumed near or on the nest surface are usually incorporated into the nest structure.

The unsuitable preys and those with irritating chemical secretions are rejected after the initial bite or after the first contact with the prey. This indicates the importance of gustatory stimuli in food discrimination apart from those repellant odours and chemicals that are encountered during or after the initial contact and before the actual bite.

According to Buskirk (1975), those spiders that live in groups or colonies are benefitted in several ways. The social life in *S. sarasinorum* also serves many advantages, particularly in feeding, due to following reasons:

(1) the joint and co-operative activity helps these spiders to subdue and kill preys that are normally much larger than the spiders;

(2) several preys that may fall in the web at the same time or at different times one after the other, are successfully captured by the different batches of spiders;

(3) injuries caused by the stronger prey while subduing it are minimized by the joint and co-operative action of many spiders;

(4) the group activity prevents the escape of active preys like flies, bees and wasps from the web;

(5) unlike in most other spiders, all kinds of preys receive the same general treatment by these social spiders;

(6) the joint action of many spiders helps in easy transportation of the prey on the web and makes wrapping to prevent escape superfluous;

(7) the social life and mutual tolerance helps every individual of the colony to get the necessary nourishment;

(8) the mutual prey-sharing behaviour helps even those individuals of the colony that may not have actually participated in the prey capture and its transportation;

(9) the group feeding on a single prey also brings about the quick digestion and disposal of the prey, irrespective of its size; thus, unlike in solitary spiders, the larger prey is consumed in a short time and the spiders are ready and free for the next meal;

(10) the joint effort of these social spiders is very useful in the early part of their life history, because the small spiderlings cannot yet make a typical sticky cribellar silk sheet around their nest; they lack cribellum and calamistrum which develop only after the third or fourth moult (Bradoo, 1972). Hence the juvenile web of these spiderlings is mainly made of drag lines laid out on the outer surface of the nest; this type of web is capable of trapping only smaller preys that are jointly consumed by the spiderlings; they also eat the dead bodies of their mothers.

(11) the mother spiders are also observed catching smaller insects like bees, flies, forficulids, etc., that are carried by them close to the nest and are shared jointly with the numerous spiderlings; on such occasions, it is not unusual for the spiderlings to move about over the body of the mother to reach the prey.

SUMMARY

The social spider *S. sarasinorum* mainly captures large flying insects that are caught in the sticky web sheets around the nest. The ensnared prey sets the web vibrations that are initially perceived by few "pilot spiders" waiting on the web or near the nest exits. While holding the prey, the pilot spiders inform the fellow members of the spider colony by repeated drumming movements of their hind legs on the web, accompanied by the special web pulls. This type of display through the web signals and induces the "recruits" or "helpers" to rush out of the nest and reach the prey. The prey is then jointly subdued, transported and consumed by the spiders on a co-operative and social basis. The prey is neither covered in silken-cover nor is it separated from the web.

All kinds of preys, except those that are "distasteful" are treated in the same manner, as described above. The remains of the preys that are consumed on the web itself are separated and dropped down, but those preys that are transported up to the nest are mostly incorporated into the nest structure.

The transportation of the prey is mainly dependent on the presence of light. During the night, the prey is consumed on the web itself but during the day it is carried up to the nest prior to feeding. The "distasteful" prey is either rejected by a retreat behaviour or by separating and dropping it down from the web. Very minute preys are not accepted because of their small size and extremely weak vibrations caused in the web. Such minute preys are insignificant for the nutritional requirements of a large spider colony.

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THE LIFE HISTORY AND HABITS OF *NOTIPHILA BRUNNIPES* ROBINEAU-DESVOIDY (DIPTERA, EPHYDRIDAE), AN AUTECOLOGICAL STUDY ON A FLY ASSOCIATED WITH NYMPHAEID VEGETATIONS

by

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With 7 figures

Abstract

The life history and some ecological aspects of *Notiphila brunnipes* R.-D. are described. Special attention is paid to the interrelations with the nymphaeid plant species *Nuphar lutea* (L.) Sm., *Nymphaea alba* L., *Nymphaea candida* Presl and *Nymphoides peltata* (Gmel.) O. Kuntze. Observations have been made on phenology, occurrence in space and time, habitat choice, food, general behaviour, sexual behaviour, sex ratio, the deposition of eggs and mortality of the adults. Possible predators are discussed. The eggs are described and the function of the chorion is discussed. Some experiments have been carried out to study the development of the eggs in relation with humidity, oxygen and temperature. The habitat choice, food, mortality of and predation on the larvae are described and discussed. Some data on the puparia are given. Effects of the dry summer of 1976 are described. The geographical distribution is discussed; the absence of *N. brunnipes* north of the limes norrlandicus can be explained from the autecological data gathered during this study.

Introduction

Nymphaeid-dominated ecosystems, which are very common and show an optimal development in the Netherlands, have been studied by us during several years. Nymphaeids are aquatic plants with floating leaves, which root in the bottom and have flowers above or floating on the water surface. By their structure they characterize the ecosystem. They have an important function as habitat for many organisms, among them semi-aquatic insects such as the Ephydridae.

The species *Notiphila brunnipes* Robineau-Desvoidy, 1830 (syn. *N. stagnicola* Stenhammar, 1844, nec Robineau-Desvoidy, 1830, and *N. chamaeleon* Becker, 1896) occurred abundantly on the nymphaeids we studied and appeared to have many interrelations with *Nymphoides peltata* (Gmel.) O. Kuntze, *Nymphaea alba* L., *Nymphaea candida* Presl and *Nuphar lutea* (L.) Sm. Because of our interest in these interrelations, the life history and habits of *Notiphila brunnipes* were studied in detail and a review was made of data from the literature.

DESCRIPTION OF THE STUDY AREAS

Most observations have been made in the Oude Waal near Nijmegen (municipality of Ubbergen, Province of Gelderland) (fig. 1). The Oude Waal is an old river branch cut off from the river Waal. Here extensive vegetations dominated by *Nuphar lutea*, *Nymphaea alba* and *Nymphoides peltata* occur. The

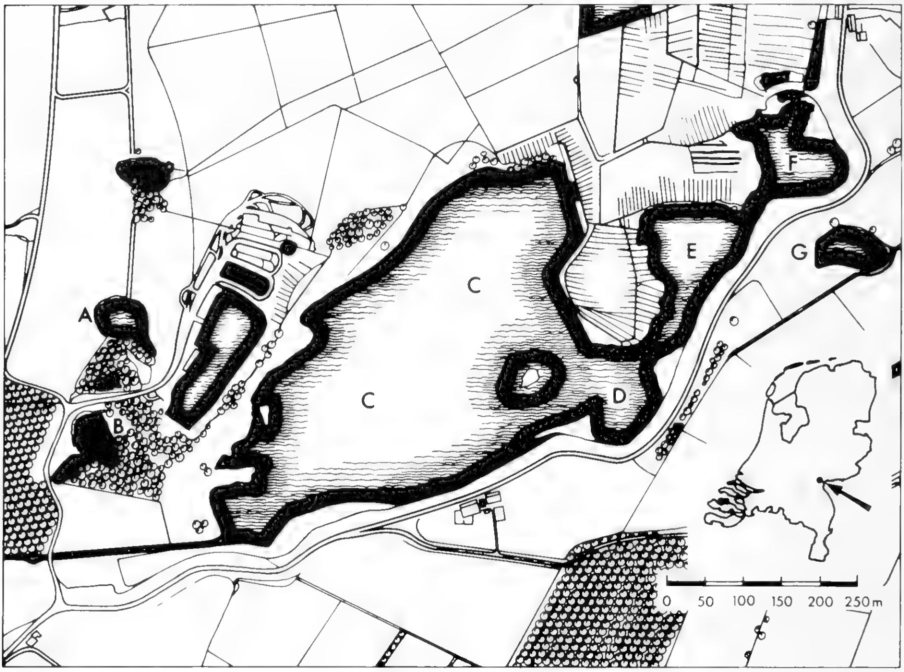

Fig. 1. Map of the Oude Waal.

Oude Waal consists of a large shallow water, 1 km in length and about 250 m wide, and three interconnected ponds (D, E and F). The depth of the large shallow water varies from 0.5 to 1.5 m; in the dry summer of 1976 it became almost completely dry. About once every two years this area is flooded in winter or spring by water from the river Waal; summer high waters occur only occasionally. The depths of the three interconnected ponds increase towards the centre to 2.5, 5.5 and 5.5 m, respectively (D, E and F). The bottom of the Oude Waal consists of a pattern of clay and sand, sometimes mixed, covered by a sapropelium layer of varying thickness.

Some additional observations have been made in the Haarsteegse Wiel (municipality of Vlijmen, Province of Noord-Brabant), which originated from two, but not simultaneous, bursts in the dike of the river Meuse. This water has an area of 17.9 ha and a maximum depth of 17 m. The lake has a vegetation dominated by *Nuphar lutea* and *Nymphaea candida*, which are almost completely restricted to the southern and western parts of the lake and which are sheltered against wave and wind action. *Nymphoides peltata* is very scarce here. The bottom of the Haarsteegse Wiel consists mainly of sand ("wash-over deposits"), but where nymphaeids grow there is a layer of sapropelium, which becomes thicker towards the littoral border. The hydrology of the lake is dependent on rain and ground water only and is more stable than that of the Oude Waal; the water-level shows only small fluctuations.

OCCURRENCE OF ADULTS ON NYMPHAEID LEAVES AND FLOWERS IN SPACE AND TIME

Methods

N. brunnipes (fig. 7) is a small fly with a length of 2.8—4.5 mm, with a remarkable silvery white frons and brownish fore tibiae (see for a description Robineau-Desvoidy (1830), Stenhammar (1844), Grünberg (1910), Becker (1896, 1926), Wahlgren (1927), Séguy (1934) and Dahl (1959)). It can be found in the flowers and on the floating leaves of the nymphaeids mentioned; the fly is not adapted to walk or stay on the water surface, so that they have to fly from leaf to leaf.

To study the changes in numbers during the season an insect-lime method was used. Each week, from June 16th until October 1977, six undamaged floating leaves (five of *Nuphar lutea* and one of *Nymphaea alba*) of the same size were gathered in the Oude Waal, pond F, and covered with insect-lime (Tangletrap or Stikem), which has no odour and consequently does not attract or repel the insects.

These leaves, the petioles of which were removed, were stuck on six other

Fig. 2. Lime-trap for insects. For explanation, see text. The wire netting is kept floating by corks and is attached with a string to the petiole.

floating leaves and then protected from predation by birds by wire netting, with meshes of 3 cm, the netting being supported by cork floaters (fig. 2). The wire netting with cork floaters was attached with a string to the petiole of the supporting leaf. After 24 hours these leaves were taken to the laboratory in the wire netting in plastic bags, so that the catch remained as undamaged as possible. The fauna was washed from the leaves with refined petrol and then fixed in 70% alcohol. The leaves were laid in transects from the littoral border vegetation to the open water, so that the distribution of the animals within the nymphaeid zone could also be studied.

Three *Nuphar* leaves were laid in the western part of pond F; leaf 1 near the broad littoral border vegetation, consisting of *Typha angustifolia* L., *Rumex hydrolapathum* Huds. and *Scirpus lacustris* L., here the floating leaves of *Nuphar lutea* covered up to 60%; leaf 2 six metres from leaf 1 in the centre of the *Nuphar* zone (maximum coverage 70%); leaf 3 twelve metres from leaf 1 at the margin of the *Nuphar* zone with the open water, where *Nuphar* covered up to 60% of the surface. Two leaves were laid in a narrow *Nuphar* zone at the eastern side of pond F; leaf 4 near the littoral helophyte vegetation, which borders on grassland, consisting of a narrow zone of the same plant species mentioned for the western side, but also with *Mentha aquatica* L. (maximum coverage of *Nuphar* 50%) and leaf 5 at three metres distance from leaf 4 at the margin of the *Nuphar* zone with the open water (maximum coverage 40%). Leaf 6, a *Nymphaea alba* leaf, was laid in an isolated vegetation of *N. alba*, surrounded by open water and at six metres distance from the littoral border vegetation at the southern side of the pond (maximum coverage of *Nymphaea* 85%).

The development of floating leaves and flowers was followed in two plots of one square metre, one of *Nymphaea alba* and one of *Nuphar lutea*, as described in Van der Velde (1978). Temperatures of air and water were measured regularly.

Occurrence in time

The results with the insect-lime method are summarized in table 1. Among the total catch of approximately 23,158 specimens (of which 99.4% insects, the rest arachnids), 642 specimens were of *N. brunnipes*, i.e. 2.8% of the total catch (see for some other results Van der Velde (1978)).

Another *Notiphila* species, *N. dorsata* Stenh., was caught in equally large numbers (764 specimens = 3.3% of the total catch). This species has a goldish-yellow frons, so that it cannot be confused with *N. brunnipes*. *N. dorsata* was not observed in the flowers of the nymphaeids and according to Dahl (1959) this species is more or less characteristic for the helophyte zone, although he also observed *N. dorsata* in the nymphaeid zone.

In fig. 3 the water and air temperature, the number of floating leaves and flowers of *Nuphar* and *Nymphaea* per square metre, and the catch of *Notiphila* per week are plotted against time.

The highest number of *N. brunnipes* was caught on July 28th when flowering of *Nymphaea* and *Nuphar* was at its peak.

Adults of *N. brunnipes* have been caught by us with a hand net from the floating

Table 1. Catches of *Notiphila brunnipes* with insect-lime (for further explanation, see text).

Date: 1977	numbers of *N. brunnipes* caught leaf number 1	2	3	4	5	6	total	total catch	% *N. brunnipes* of total catch
16.vi	1	-	-	-	-	-	1	1401	0.07
23.vi	-	-	-	-	-	2	2	715	0.28
30.vi	18	-	-	3	-	-	21	1195	1.76
8.vii	19	22	-	6	2	12	61	2234	2.73
12.vii	10	21	2	6	-	23	62	3168	1.96
21.vii	58	5	1	14	4	9	91	2287	3.98
28.vii	89	16	-	11	2	9	127	1284	9.89
5.viii	64	28	-	2	11	15	120	1580	7.59
12.viii	33	5	1	-	-	27	66	1578	4.18
18.viii	49	2	-	-	-	-	51	1322	3.86
25.viii	3	2	-	1	-	1	7	1303	0.54
1.ix	2	6	5	-	2	1	16	1421	1.13
8.ix	6	3	-	-	-	-	9	1876	0.48
15.ix	-	1	-	-	-	-	1	762	0.13
22.ix	3	1	-	-	-	-	4	584	0.68
29.ix	-	-	-	-	-	-	0	448	-
Total number	355	112	9	43	21	99	639	23158	2.76

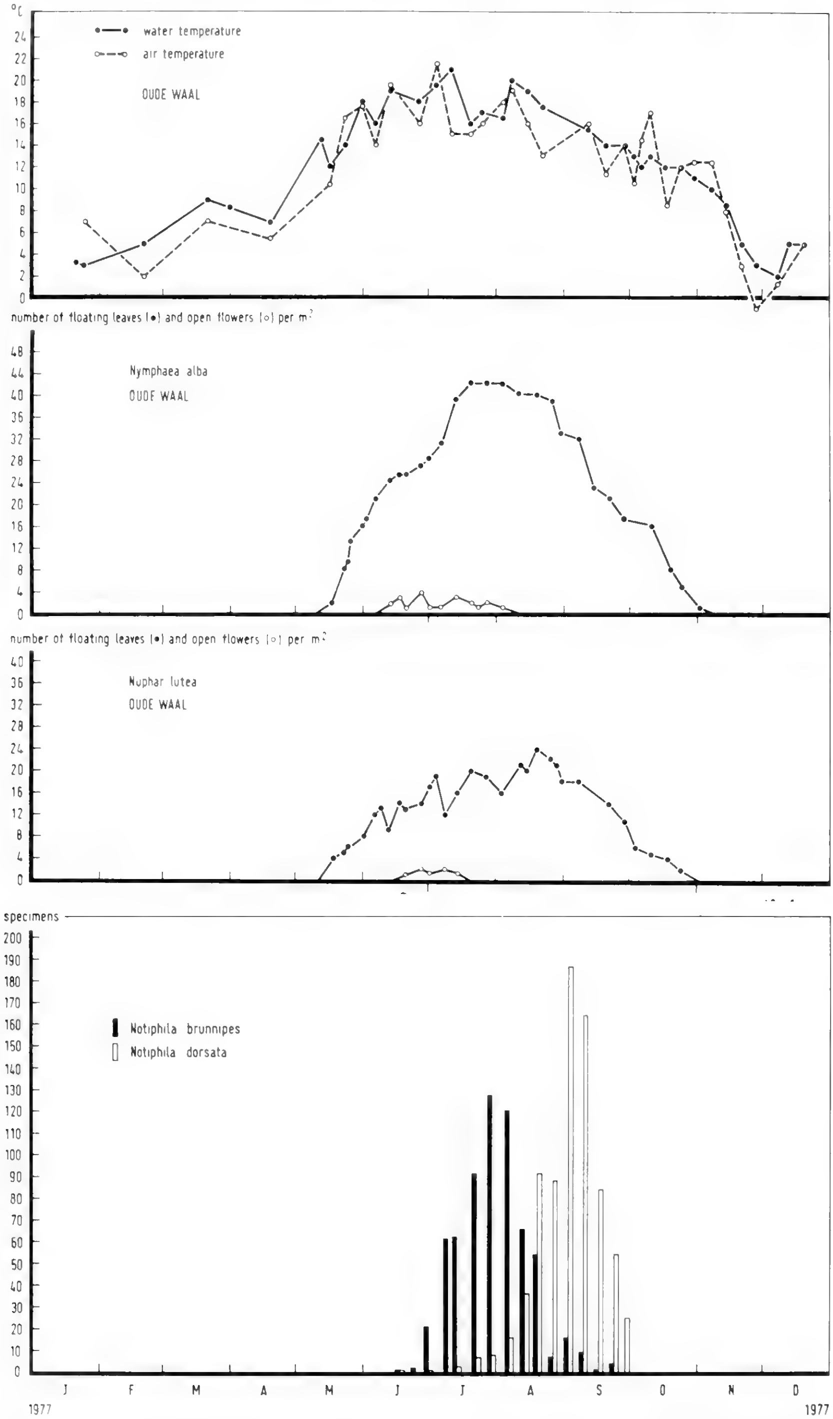

Fig. 3. The course of water and air temperatures, the development of floating leaves and flowers of *Nymphaea alba* and *Nuphar lutea* in two plots of 1 m², and the numbers of *Notiphila* species caught per week with insect-lime on the floating leaves on the Oude Waal in 1977.

leaves and flowers of nymphaeids between 5 June and 29 September 1975, from 1 June until 29 August 1976 and from 31 May until 22 September 1977. Wahlgren (1927) mentioned the months July and August as the time of occurrence.

Discussion. — From fig. 3 it is clear that the development of numbers of the *N. brunnipes* population is highly correlated with the development of the floating leaves and flowers of the nymphaeids mentioned; water and air temperature, the number of floating leaves and flowers and the number of adult *N. brunnipes* have their maximum in the same period. *N. dorsata*, however, has its maximum on the floating leaves when decomposition dominates over production.

From the data obtained with the insect-lime method it can be suggested that both *Notiphila* species have only one generation per year.

With respect to the insect-lime method one should keep in mind that the catch is not only dependent on the size of the population but also on changes in the activity pattern of *N. brunnipes*, for example caused by weather conditions. This also applies to the other insects, so that the percentages of *N. brunnipes* with respect to the total catch per date have been calculated. The absolute numbers and the percentages show the same trend, so that it is very possible that the catches give a real picture of the development of the numbers in time.

OCCURRENCE IN SPACE

The general distribution of the flies over the sampling leaves within the nymphaeid zone can be read from table 1, by comparing the results from the different leaves.

The flies appeared to have a distinctly higher abundance on the floating leaves bordering the littoral helophyte vegetation (leaves 1 and 4); the lowest number of flies has been caught towards the open water (leaves 3 and 5).

Adults of *N. brunnipes* also showed to have a higher abundance on the broad *Nuphar* zone (leaves 1, 2 and 3) in comparison with the narrow one (leaves 4 and 5). Relatively more specimens of *N. brunnipes* were caught on the *Nymphaea* leaf (leaf 6) which is comparable with the *Nuphar* leaves 3 and 5 because of their similar location near the open water.

In the Oude Waal the flies were found abundantly on the floating leaves and in the flowers of *Nymphaea alba, Nuphar lutea* and *Nymphoides peltata* and less so in the littoral border vegetation on *Typha angustifolia*, *Rumex hydrolapathum* and *Scirpus lacustris*. In the Haarsteegse Wiel they were found on the floating leaves and in flowers of *Nuphar lutea* and *Nymphaea candida* and seldom on other plants such as *Acorus calamus* L. and *Iris pseudacorus* L. Our data are in accordance with those of Dahl (1959) who studied the ecological distribution of Ephydridae in Scandinavia; he found that *N. brunnipes* is characteristic for nymphaeid vegetations and occurs in lesser amounts in the bordering reed vegetation.

Discussion. — The higher abundance of adult *N. brunnipes* on the nymphaeids bordering the helophyte vegetation may be explained by the fact that the environment is less dynamic (wind- and wave-action) close to the reed-belt than

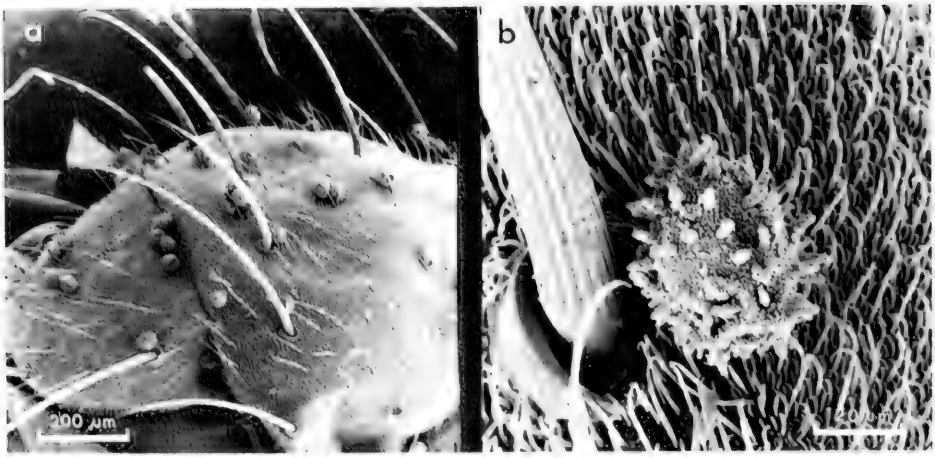

Fig. 4. a, thorax of *N. brunnipes* with attached pollen of *Nymphaea alba*; b, enlarged part of a. Note the many curved hydrophobous hairs on the body which prevent the insect from getting wet.

close to the open water. *N. brunnipes* is, as already mentioned, not able to walk over the water surface, and after a longlasting contact with water it drowns in spite of having numerous curved hydrophobous hairs all over the body (fig. 4).

General behaviour

Generally the flies walk slowly over the floating leaves and fly only short distances to reach other floating leaves or flowers in the neighbourhood. Under warm, sunny weather conditions the flies are more active and fly away sooner than under colder circumstances when they can be captured rather easily by putting a glass tube over them. On a sunny afternoon in July the flies can be found in large numbers on the floating leaves and flowers where they perform several activities like feeding, walking, courting, copulating, polishing, sunning, and depositing eggs.

Under bad weather conditions, for example, heavy rain, they seek shelter in the various flowers, under the aerial leaves of *Nymphaea alba* (leaves of this species often project entirely or partly above the water surface) and between the littoral border vegetation, staying there more or less motionless.

De Meijere (1940b) reports that *N. brunnipes* often forms dense clusters on the leaves of *Nuphar* and *Nymphaea*; the specimens are then situated in a circle with their heads directed to the centre. This behaviour, however, has been noticed by us only sporadically, perhaps because we made observations during day-time while De Meijere (1940b) describes this behaviour for the evening (20.30 h.).

Dahl (1959) has expressed the frequency of a number of activities of the flies in percentages, viz., feeding 8%, polishing 25%, walking 42%, copulating 8%, no movement 17% (the environmental circumstances such as temperature and weather conditions and time of the observation were not mentioned, however).

Feeding behaviour

According to Waitzbauer (1976) the species of the genus *Notiphila* generally feed on fluids of decaying plant material. Adults of *N. brunnipes* were observed by us obviously feeding on fluids of decaying floating leaves but also on exudates of flowers of the nymphaeid species mentioned, and on the body fluids of dead insects, such as Ephemeroptera, Trichoptera and aphids.

In the flowers of *Nuphar*, *Nymphaea* and *Nymphoides* the flies could be seen licking the anthers (even unripe ones) and the stigma. The flowers of *Nymphaea alba* and *Nymphaea candida* do not possess nectaria but on the first day of flowering the stigma profusely produces a sweet-tasting exudate containing glucose and fructose as could be proved by enzymatic tests. On the second day of flowering this exudate has already disappeared. The flowers of *Nuphar lutea* possess nectaria on the outer sides of the petals, which produce nectar, also containing glucose and fructose. The production of nectar occurs especially on the first day of flowering; the flower then has a strong brandy scent while the stigma is sticky or dry and shiny; an extensive description of the development of the flowers of the Nymphaeaceae mentioned is being prepared (Van der Velde, in prep.).

The flowers of *Nuphar* and *Nymphaea* have also many anthers which produce abundant pollen. *N. brunnipes* can often be found with pollen on its body (fig. 4). To check whether the flies also consume pollen the intestines of some of them were studied under the microscope. In some intestines germinated and ungerminated pollen of *Nymphaea alba* could be recognized together with diffuse material and micro-organisms.

The flowers of *Nymphoides peltata* possess nectaria which are sheltered by hairy staminodes. *N. brunnipes* can not reach these nectaria because of the staminodes, although efforts of these flies to reach the nectar can be observed regularly. Furthermore the flies can be observed licking the five anthers and the small stigma of *Nymphoides*, which is papillate and wet according to Heslop Harrison & Shivanna (1977).

This licking behaviour strongly suggests that food is taken up in the form of nectar, stigmatic exudate and pollen in the flowers.

On the floating leaves, *N. brunnipes* can be seen licking on decaying parts, e.g., on decayed tissue around the tracks of the mining larvae of *Hydromyza livens* (Fall.) (Scatomyzidae) in *Nuphar* leaves. Fungi play an important role in the decomposition of the leaves of nymphaeids. By feeding on the fluids of leaf parts infected by fungi the flies can be vectors of these fungi, e.g., via the passage of spores in the digestion canals or by chance presence of spores on their body.

According to Fischer & Gäumann (1929) small flies such as *Drosophila* species can be vectors of the spores of *Glomerella cingulata* (Ston.) Spauld. et Schrenk, which is known from many plant species and also occurs on the floating leaves of *Nymphaea alba* and *Nymphaea candida*; this may well apply to *N. brunnipes* and also to *N. dorsata*.

SEXUAL BEHAVIOUR AND SEX RATIO

The flies can regularly be observed in copulation on the floating leaves and in the flowers of the nymphaeids mentioned. Many of the flies which are found on and in first-day flowers of *Nuphar* and *Nymphaea* are in copulation; sometimes masses of the flies were present on these flowers.

N. brunnipes shows a distinct mating behaviour. This behaviour was described by Dahl (1959) as follows: "During the posturing phase of courtship the male approaches the female from behind and after performing encircling movements around her with his head directed towards her, he stops in front of her head, tapping her antennae with his own. After this phase the partners have been observed slowly circling round face to face. If the female accepts the invitation, she spreads her wings permitting the male to mount. During the insemination the female continues feeding and walking".

It appeared from our field and laboratory data that the mating behaviour as described by Dahl (1959) is not always so elaborate. Sometimes the female spreads her wings immediately when a male approaches her and so copulation is allowed directly. It also has been observed that a male approached a female in a more aggressive way leading to copulation.

Fig. 5. a, abdomen of *N. brunnipes*, male; b, abdomen of female; ventral aspects.

Males and females of *N. brunnipes* can easily be separated from each other because they differ in size and in the position of the genital aperture. Males have a length of 2.8—3.7 mm, so they are smaller than the females which measure 4.0—4.5 mm in length (10 specimens of each sex were measured). The genital aperture is situated on the ventral side of the abdomen in the males and at the caudal tip of the abdomen in the females (fig. 5).

Some samples from the insect-lime catch on the floating leaves were studied for calculating the sex ratio. The results are summarized in table 2. More males than females were caught on the floating leaves in July and more females than males in

Table 2. Sex ratio of *Notiphila brunnipes* in samples caught with insect-lime.

Date: 1977	number of specimens examined	males	females	sex ratio percentage of males
30.vi	14	5	9	35.7
12.vii	18	17	1	94.4
21.vii	53	31	22	58.5
28.vii	66	44	22	66.7
5.viii	72	33	39	45.8
12.viii	43	21	22	48.8
18.viii	45	19	26	42.2
Total	311	170	141	54.7

June and August. Perhaps the females occur more often in flowers during July when also flowering is at its peak; the deposition of eggs in flowers can be mentioned in this respect. Another explanation can be that males are more active in this month than the females because of their mating behaviour.

DEPOSITION OF EGGS

As described by Rousseau (1919) and De Meijere (1940a, b) the females of *N. brunnipes* deposit eggs in the flowers of *Nymphaea alba* and *Nuphar lutea*; we found the eggs also in the flowers of *Nymphaea candida* ancally observed them, during the dry summer of 1976, in the flowers of *Nymphoides peltata*, further on floating leaves of the various nymphaeids of which the margins were curled up and desiccated. The eggs are especially deposited in first-day flowers. The flowers of *Nymphaea candida* in the Haarsteegse Wiel contained relatively few egg clusters because these flowers were very often half-filled with water (Van der Velde et al., 1978).

When the numbers of *N. brunnipes*, and also flowering, are at their peak in the Oude Waal, nearly all *Nuphar* (when intact) and *Nymphaea* flowers contain egg clusters. The number of eggs per flower varies with the population size from year to year; in July 1975 hundreds of eggs could be found per flower of *Nymphaea alba* and *Nuphar lutea*. The maximum number of eggs found in an ovarium of a *N. brunnipes* female was 24.

According to Müller (1921) *Notiphila riparia* Meigen also deposits its eggs on *Nymphaea* (also cited by Hennig, 1943, and De Meijere, 1944), but this has not been confirmed in the present study. With the insect-lime method only one specimen of *N. riparia* was caught on a *Nuphar* leaf. *N. riparia* is more characteristic for a reed vegetation according to Dahl (1959).

MORTALITY AND PREDATION

Especially after heavy rain the population of *N. brunnipes* seems to be diminished. The flies drown easily when they become wet for a long time.

Fig. 3 shows that the numbers of *N. brunnipes* decrease at the end of the summer. Then mortality of adults may have several reasons, e.g., competition with *N. dorsata*, falling temperatures, and lack of food from flowers.

Although predation on the flies has not been observed by us, the following species must be taken into consideration with respect to possible predation: the spider *Pirata piraticus* (Cl.) (Lycosidae), some of the larger Dolichopodid species, the fly *Hydrophoria conica* Wied. (Muscidae), some species of Gerridae, Odonata (*Coenagrion pulchellum* Van der Linden, *Erythromma najas* Hansem., *Ischnura elegans* Van der Linden) and the green frog *Rana esculenta* L. It has been observed that specimens of *Hydromyza livens* approached *N. brunnipes* in an aggressive way, but they were never consumed or killed by this predatory fly. In the flowers the flies have a smaller chance to be caught by large predators such as Odonata.

DESCRIPTION OF THE EGGS

The eggs of *N. brunnipes* have a length of 1.1—1.3 mm and a width of 0.4—0.5 mm (fig. 7); they are white in colour and possess a short toadstool-like micropylar protuberance on the rostral end. The other end of the egg is rounded (fig. 6).

The eggs are deposited in the flowers in rows of usually 2—7 eggs but larger rows are not exceptional. Usually the eggs can be found on the bases of the petals, sepals and even on the anthers of *Nymphaea alba*, *Nymphaea candida* and *Nuphar lutea*. The eggs are attached to the substrate, but not very strongly so; they are, however, very well attached to each other, in such a way that it is impossible to separate the eggs without damaging the chorion.

Eggs have been studied by means of scanning electron microscopy; in this way regular netlike structures and pores could be recognized on the chorion (fig. 6). The eggs of *N. brunnipes* show a striking bipolarity, because they possess different structures on the dorsal and ventral side. The structure on the dorsal side can be described as "wall"-structure, a structure in which concavities are flanked by walls. The structure on the ventral side can be described as "island"-structure; here island-like structures are flanked by canal-like concavities. The "wall"-structure was already described by De Meijere (1940a). On fig. 6 a possible glue substance can be recognized at the margins of the "islands"; this side of the chorion was fixed to a petal.

To study the internal structure of the chorion the eggs were sliced with a razor blade and examined with the scanning electron microscope. The chorion appeared to possess cavities which are in contact with the pores in the external walls of the chorion (fig. 6). The surface structures of the chorion, described as "wall"- and "island"-structure, coalesce on places where the eggs are attached to each other; in this way the eggs support each other so that they maintain their position between the floral leaves.

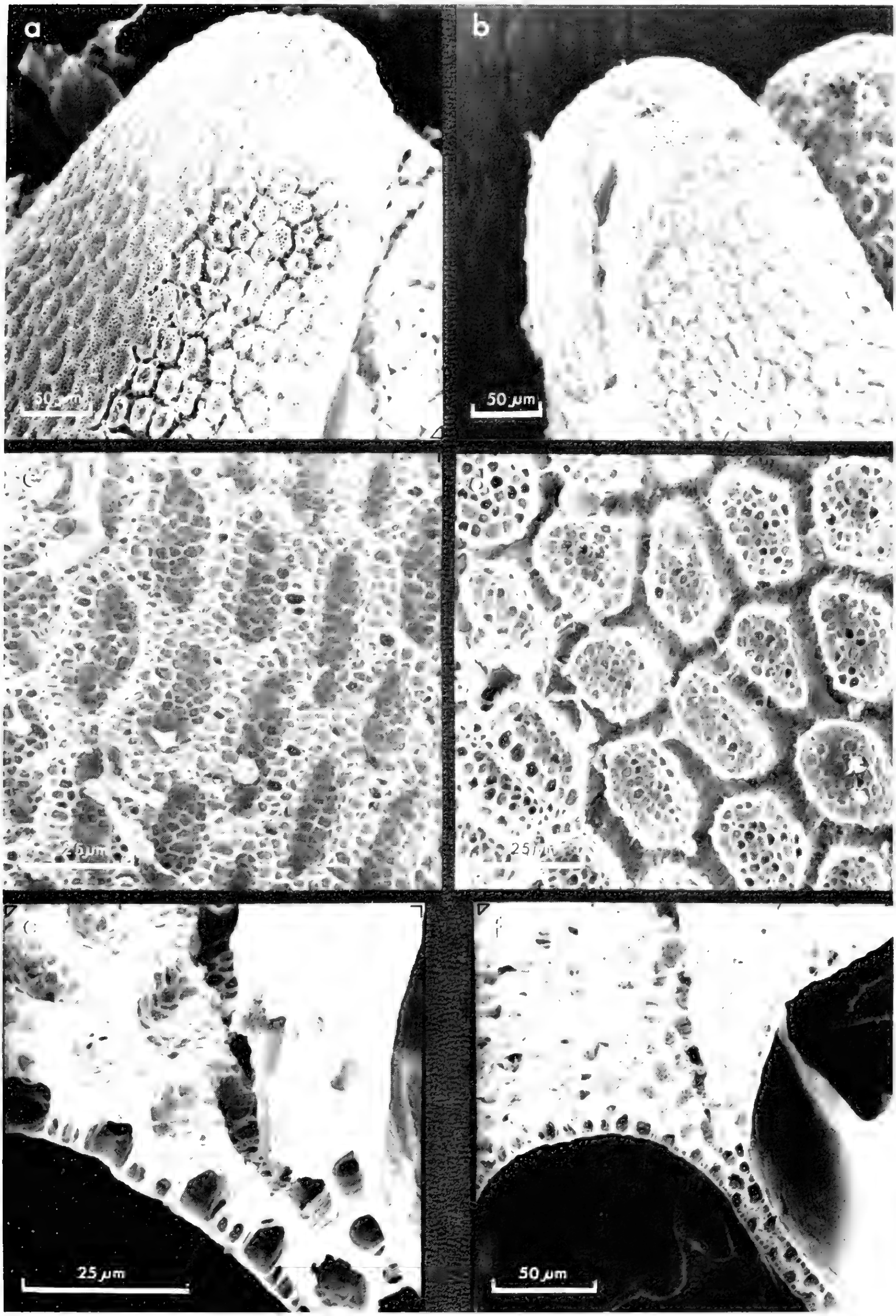

Fig. 6. a, caudal part of *N. brunnipes* egg showing both structures; b, rostral part of the egg (note the micropylar protuberance and the beginning hatching split); c, wall-structure (dorsal); d, island-structure (ventral); e and f, coupe of the chorion showing cavities and the attachment of two eggs by means of both structures.

THE FUNCTION OF THE CHORION

The distinct structures of the chorion of the *N. brunnipes* egg were suspected to hold an air layer which functions as a plastron. Hinton (1960, 1969, 1971) has shown that structures such as a network of walls and pores on the egg surface have the function to hold air, so that the egg can continue with respiration when becoming wet, e.g. by a rain shower. According to this author a system of hydrofuge structures can form the architecture for a permanent or unshrinkable, physical gill which is called a plastron. An egg with a plastron can remain immersed indefinitely and obtains the oxygen it requires from the ambient water, provided that the water is well-aerated.

The flowers of *Nymphaea* close at night and when they close they sink somewhat, to a third, under water, so that the eggs of *N. brunnipes* regularly become wet (Rousseau, 1919; De Meijere, 1940b); the flowers of *Nuphar* do not close at night and during flowering they are always above the water surface (Van der Velde, in prep.).

When the eggs are held under water an air-film around them can be observed; De Meijere (1940b) pointed out, however, that the eggs cannot tolerate a longlasting contact with water, but in that case soon decay.

In the laboratory some experiments were carried out to study the development of eggs with regard to the functioning of the air-layer in and around the chorion as a plastron. For the experiments young first-day flowers of *Nuphar* and *Nymphaea* were collected which contained eggs of *N. brunnipes*; the eggs in these flowers had nearly the same age and thus could be regarded as being in the same developmental stage.

For the first experiment four *Nuphar* flowers with eggs were placed in jars at room temperature (25° C). Flower 1 was placed upright in a jar with water so that the flower was some centimetres above the water surface; flower 2, was placed as flower 1, but was sprayed two times per day with water; flower 3 was placed upside down in aerated water, held in this position with wire netting; flower 4 was treated as flower 3, but the water was not aerated. Furthermore some eggs were taken out of a flower and placed in a dry petridish. Observations were made daily during 2 weeks.

After 4 days there were larvae in the water from the eggs in flower 1 and 2, after 6 days from those of flower 3. The eggs of flower 4 decayed instead of developing into larvae. The eggs in the petridish also did not develop into larvae but desiccated.

It can be concluded that eggs develop into larvae in a relatively dry environment (flower 1), in a dry but temporarily wet environment (flower 2) and in well-aerated, oxygen-rich water (flower 3). Eggs decay in water poor in oxygen (flower 4) and desiccate in a dry environment outside the flower (petridish); probably the air within a flower is humid enough to prevent desiccation. It can also be concluded that the development of the eggs under dry but air-humid conditions goes faster than in water and that the structures of the chorion hold an air-layer which functions as a plastron as the eggs developed in well-aerated water, so that they must have obtained oxygen from this medium.

Table 3. Development of eggs into larvae under three different conditions (for further explanation, see text).

Time	Number of larvae in jar		
	A	B	C
4 days	0	0	14
5 days	0	0	87
6 days	0	75	96
10 days	0	83	96

A second experiment has been carried out to study the development of the eggs more quantitatively. Three-hundred eggs were collected from first-day flowers and used for this experiment. In each of three flowers of *Nymphaea alba* 100 eggs were deposited. In jar A a *Nymphaea* flower with eggs was held upside down in non-aerated water by wire-netting, in jar B the same was done in well-aerated water and in jar C the flower was placed upright (only its stem was in contact with water). The experiment was carried out at room temperature (25° C) and the development of the eggs into larvae was followed by daily observations until the remainder of eggs was disintegrating. The results are summarized below (table 3).

This experiment confirms the results of the first experiment; furthermore the number of eggs not developing into larvae is larger in water (B) than under air-humid conditions (C).

Development of eggs in relation with temperature

To measure the influence of temperature on the development rate of eggs an experiment was carried out in the laboratory. In the field a number of first-day flowers of *Nuphar* and *Nymphaea* were collected in which eggs had been deposited by *N. brunnipes*. A cluster of eggs attached to the innerside of a sepal or petal was placed in a petridish with a layer of water in order to maintain high humidity and to prevent desiccation of eggs. The petridishes were placed in different climate chambers which had constant temperatures of 5°, 10°, 14°, 18°, 20°, 24° and 30° C, respectively. By daily observations the development of the eggs into larvae was followed.

At temperatures of 5° and 10° C the eggs had not yet developed into larvae after 30 days. At 14° C larvae hatched after 13 days and at 18°, 20°, 24° and 30° C after 5, 6, 4 and 6 days, respectively.

It can be concluded from the experiment that the eggs develop well and fast into larvae at temperatures between 18—30° C.

Temperatures within this range indeed occurred in the flowers of *Nymphaea alba* and *Nuphar lutea*, as measured in the field with the aid of a Wallac oy Universal Thermometer (GST 32; probes Ni-101x and Ni-106). By day light, temperatures in flowers can be several degrees higher than the surroundings, due to solar radiation

Table 4. Temperature measurements in °C in flowers and surroundings of *Nymphaea alba* and *Nuphar lutea*.

Nymphaea alba	Tw	Tl	Tf	Ts	Tf - Ts
Date: 23.vi.1977	22.5	26.0	29.0	24.5	4.5
Time: 14.30 h.	22.0	26.1	28.2	24.5	3.7
Sunny, unclouded	21.5	26.0	28.4	25.0	3.4
	22.9	26.1	29.4	24.0	4.9
	22.5	26.1	29.5	24.5	5.0
Date: 7.vii.1977	22.9	23.2	22.1	21.1	1.0
Time: 14.45 h.	23.0	23.8	22.8	22.1	0.7
Heavily clouded	23.0	23.5	23.1	22.9	0.2
	22.9	25.2	22.0	21.8	0.2
	23.4	22.8	23.0	22.0	1.0
Nuphar lutea					
Date: 8.vii.1977	22.0	25.4	27.2	22.6	4.6
Time: 14.30 h.	23.5	28.0	29.8	26.5	3.3
Sunny, unclouded	23.2	25.0	27.1	24.1	3.1
	23.2	26.0	27.8	25.8	2.0
	23.4	26.5	28.0	26.2	1.8
Date: 29.vi.1977	19.0	19.4	18.8	18.8	0
Time: 13.45 h.	19.5	19.5	18.6	17.8	0.8
Heavily clouded	19.1	19.1	19.1	18.4	0.7
	19.2	19.2	17.9	18.0	-0.1
	19.0	19.0	18.0	17.2	0.8

Tw = water temperature, Tl = temperature upper surface floating leaf, Tf = temperature innerside of the floral leaves, Ts = temperature outerside of the sepals of the flower.

(table 4). Table 4 also shows that under clouded weather conditions the differences in temperature between the inner and outer side of flowers are not as spectacular in comparison with those under sunny weather conditions.

A fast development of the eggs into larvae within 4—6 days also has to take place under natural conditions. The flowers of *Nymphaea alba* and *Nymphaea candida* flower 4—6 and 4 days, respectively, before they become definitively closed (Van der Velde, in prep.); the larvae cannot leave the flower in case the development should be longer. This is in accordance with the fact that adult females of *N. brunnipes* deposit their eggs especially in young first-day flowers.

The flowers of *Nuphar* remain open after the flowering so that the larvae can always leave.

MORTALITY AND PREDATION

The experiments prove, that the eggs cannot develop into larvae when they are too long in water poor in oxygen; then the eggs soon decay.

In both study areas, the Coot (*Fulica atra* L.) consumes most of the petals and sepals of the flowers of *Nuphar lutea*. In this way many eggs of *N. brunnipes* attached to these floral leaves must be either consumed or lost into the water. The oviposition substrate is thus strongly diminished in size. The floral leaves of *Nymphaea* were seldom consumed by waterfowl. These facts might explain the higher numbers of *N. brunnipes* adults and eggs on *Nymphaea alba* flowers in comparison with *Nuphar lutea*.

A possible consumer of the eggs might be the fly *Hydromyza livens*, a regular visitor of flowers of *Nuphar lutea*. In the laboratory this fly appeared to consume the eggs but this could not be confirmed by field observations; it is difficult to see, without disturbing them, what these flies are doing in the flowers. It is not known whether there are other consumers of the eggs but in the flowers of *Nymphaea alba* and *Nuphar lutea* some Braconid species have been collected, which are suspected of this.

HATCHING OF THE LARVAE

De Meijere (1940b) described the hatching of larvae as follows (translated from Dutch): "The eggs, on the time of hatching, were dark gray in colour and one saw the larva moving in the egg-shell when using the pocket-lens. Then the egg-shell at once tore cleft-like open on one end and the larva, which was situated with the blackish headtop in front of the developed aperture, crept out. When that had happened, the walls of the egg-shell came together again, so that a flat membrane of white colour was left". From the scanning photographs (fig. 6b) it is obvious that the egg-shell splits open in the surroundings of the micropylar protuberance.

After the larvae have left the egg-shell through this opening, they also creep out of the flower and drop themselves in the water to reach the bottom (see for a description of the larvae, De Meijere (1940b), Hennig (1943), and further fig. 7).

HABITAT CHOICE OF THE LARVAE

When the larvae have reached the bottom they make tracks in detritus and mud as already described by De Meijere (1940b), which could be confirmed by us.

An experiment was carried out to test the response of the larvae to light. Hundred larvae were placed in a petridish with water. The petridish was half covered with aluminum foil and placed under a lamp. After an hour 87 larvae were present in the covered half and only 13 in the uncovered half. Thus the larvae are negatively phototactic and seek dark places.

The detritus, however, is poor in oxygen. It is known that larvae of certain *Notiphila* species obtain oxygen from aquatic and littoral border plants; the larva pierces its pointed caudal stigmata in the plant tissue and so oxygen is obtained from the intercellular cavities (Grünberg, 1910; Varley, 1937; De Meijere, 1940b; Berg, 1950; Oldroyd, 1964).

De Meijere (1940b) and Hennig (1943) recorded puparia of *N. brunnipes* from the roots of *Typha angustifolia* and *Typha* spec.; we inspected various aquatic and littoral border plants in May and July 1977 to find out if larvae or puparia occurred on their roots or root stocks. The plant species *Nymphaea alba*, *Nymphaea candida*, *Nuphar lutea*, *Nymphoides peltata*, *Rumex hydrolapathum*, *Typha angustifolia*, *Glyceria maxima* (Hartm.) Holmb., *Iris pseudacorus*, *Acorus calamus*, *Phragmites australis* (Cav.) Trin. ex Steud. and *Mentha aquatica* were investigated.

In spite of investigations over two years we never found the larvae on roots or other aquatic parts of *Nymphaea alba*, *Nymphaea candida* or *Nuphar lutea*, as also recorded by De Meijere (1940b). Large numbers of puparia and some larvae, however, have been found pierced with their stigmata in roots and short shoots of *Nymphoides peltata* from the Oude Waal. A large number of puparia and full-grown larvae (7—10 mm long) were found on the roots and root-stocks of *Acorus calamus* in the Haarsteegse Wiel (*Acorus* does not occur in the Oude Waal and in the Haarsteegse Wiel *Nymphoides* is very scarce). Furthermore a number of pupae was found on the roots of *Typha angustifolia* at both localities. Some pupae have hatched in the laboratory so that a definite identification of *N. brunnipes* was possible. From the roots of *Typha angustifolia* also a specimen of *N. dorsata* hatched.

It is clear that *Nymphaea* and *Nuphar* are important for *N. brunnipes* to complete its life cycle, but also such plants as *Nymphoides peltata*, *Acorus calamus* and *Typha angustifolia*.

In the Netherlands *Nymphaea alba* also occurs in oligotrophic, dystrophic moorland pools. Here *N. brunnipes* also occurs although the above-mentioned plants do not. Possibly *Typha latifolia* L. fulfills a similar function in these habitats.

Although larvae are observed having pierced their stigmata in roots of plants, it is so far unknown whether the larvae remain attached to one root or plant-individual only or whether they move from one plant to another. It is clear that the larvae do not need to be always pierced with their stigmata in plant roots. They may creep from *Nymphaea* or *Nuphar* to *Nymphoides*, *Acorus* or *Typha*; the distance between these groups of plants can be several metres.

It is possible that the younger larvae can remain longer in detritus poor in oxygen (skin-respiration) and creep larger distances than the full-grown ones without having pierced the stigmata in plant tissue.

How long the development of the larvae takes is not exactly known; in spring full-grown larvae can be found, so that *N. brunnipes* certainly hibernates as a larva. Furthermore it is very likely that *N. brunnipes* has only one generation per year.

FOOD OF THE LARVAE

According to Dahl (1959) De Meijere (1940a) has written that the larvae of *N. brunnipes* mine in the roots of *Nymphaea alba*, but, in fact, De Meijere (1940a, b) denied this. His papers are written in Dutch, which may have caused the misunderstanding. De Meijere (1940b) who studied the young larvae in petridishes with detritus reports that some specimens showed a green or brownish mass in their body and thus concluded that they had fed obviously on fresh plant material or detritus; most of the larvae however were totally colourless, crept restlessly around and did not feed.

To study the feeding habits of the larvae some experiments were carried out. A number of newly hatched larvae were put in petridishes with water; green filamentous algae (1), detritus from the Oude Waal (2), fresh submerged *Nuphar* leaves (3) and decaying floating leaves of *Nuphar* (4), *Nymphaea* (5) and *Nymphoides* (6) were offered as food. Only some larvae kept in the petridishes with detritus (2) and decaying leaves (4, 5, 6) had material in their intestines after a day. Probably the larvae feed on material from the detritus and decaying plant parts or on organisms occurring there, such as bacteria, fungi and protozoa.

Under laboratory conditions the larvae, however, could not be kept alive for a long time. They also tried to creep out of the petridishes via the condensation water; lack of oxygen may have caused this behaviour.

Mortality and predation

When the larvae drop themselves in the water they have a great risk to be eaten by fish; furthermore they can get lost when they creep in wrong directions, when they find no suitable root for attaching and die by lack of oxygen.

PUPA

The puparia of *N. brunnipes* (fig. 7) have been described by De Meijere (1940b) and Hennig (1943). As already mentioned, the puparia can be found pierced with their stigmata in the roots, root stocks or short shoots of *Nymphoides peltata*, *Acorus calamus* and *Typha angustifolia*, possibly in order to obtain oxygen from these plants. The puparia remain attached to the same root.

Puparia were found in spring, thus *N. brunnipes* hibernates also as puparium. After the hatching under water the flies must reach the water surface quickly; it is thus favourable that the puparia occur in shallow water.

EFFECTS OF THE DRY SUMMER OF 1976

By the prolonged drought during the summer of 1976 the broad of the Oude Waal became nearly completely dry and also the interconnections between the ponds, so that the littoral border plants and especially *Nymphoides peltata* suffered badly. In 1977 the coverage and vitality of *N. peltata* in the Oude Waal had strongly diminished, in 1978 the vegetation had regained its vitality.

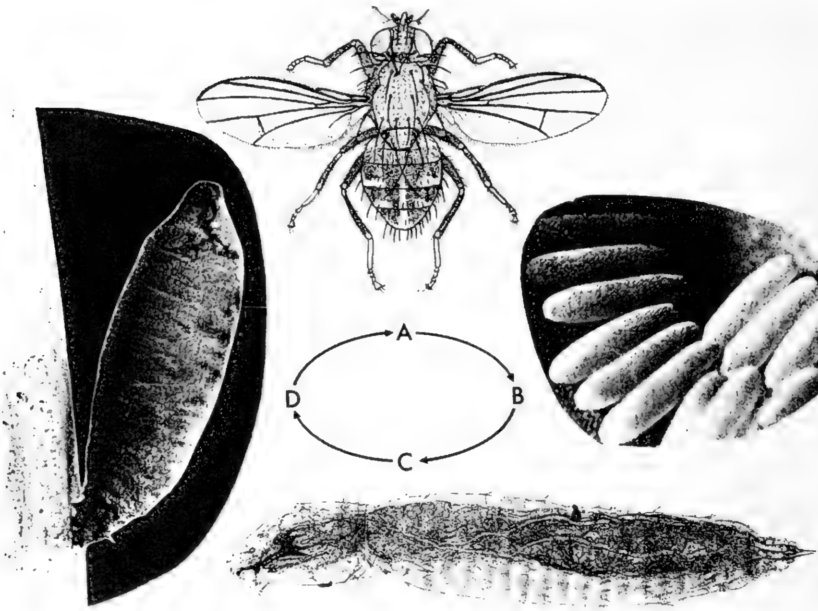

Fig. 7. Life stages of *N. brunnipes*. A, imago; B, eggs; C, larva; D, pupa (pierced in root).

As a result the population of *N. brunnipes* of 1977 remained very small in numbers with respect to other years, which supports the suggestion that there is only one generation per year.

GEOGRAPHICAL DISTRIBUTION

N. brunnipes has been recorded from Central Europe (Becker, 1926), Italy (Torelli, 1922, according to Hennig, 1943), France (Séguy, 1934), Belgium (Rousseau, 1919), The Netherlands (De Meijere, 1940a), North Germany, Silesia (Grünberg, 1910), Great-Britain (Oldroyd, 1975) and Fennoscandia (Dahl, 1959). Dahl (1978) gives the following rough distribution area in Limnofauna Europaea: Iberian Peninsula, Eastern Balkans, Western lowlands, Central lowlands, Baltic Province, England, Boreal highlands, Northern Sweden and Taiga. The second author of the present paper observed the species also in the Republic of Ireland in 1978.

According to Dahl (1959) the species is not found north of the limes norrlandicus (about the 16° C isotherm of July); from Finland there are only some southern records. He writes that both the ecological and phenological distribution is governed by the species' affinity for *Nuphar* and *Nymphaea*, but the geographical distribution of *N. brunnipes* does not appear to include the northern parts of the *Nymphaea* and *Nuphar* area of Fennoscandia.

Our investigations have shown that *N. brunnipes* occurs during its life cycle in two different habitats and is bound indeed to *Nuphar* and *Nymphaea* but also to *Typha angustifolia*, *Acorus calamus*, *Nymphoides peltata*, and probably *Typha* *latifolia*. Both the *Typha* species, as well as *Acorus* and *Nymphoides* have a distribution south of the limes norrlandicus (Hultén, 1950), which may explain the similar distribution of *N. brunnipes*.

SUMMARY

As can be concluded from the data in this paper there are direct relations between *N. brunnipes* and the nymphaeids *Nuphar lutea*, *Nymphaea alba*, *Nymphaea candida* and *Nymphoides peltata*.

Adults of *N. brunnipes* visit the flowers of *Nymphaea* and *Nuphar* for:

(a) food in the form of stigmatic exudate, nectar or pollen;
(b) the deposition of eggs; the development of eggs is favoured by the temperatures and the air-humid or alternately dry and wet environment in the flowers;
(c) protection and shelter against bad weather conditions and certain predators such as Odonata;
(d) copulation site; especially first-day flowers attract many specimens and copulation often occurs there;
(e) resting site, e.g. for warming up the flight muscles; because of the higher temperatures their digestion probably goes faster inside the flowers.

The flowers of *Nymphoides peltata* have these functions only partly (not b). The flies play an important role in the pollination of all the nymphaeids mentioned.

Adults of *N. brunnipes* occur on the floating leaves of *Nuphar*, *Nymphaea* and *Nymphoides* for:

(a) food, viz., directly for consumption of fluids of decaying leaf parts and indirectly to consume body fluids of dead insects;
(b) copulation site;
(c) resting site, also for sunning;
(d) shelter or protection under aerial leaves or leaf margins which have been curled up and dried out;
(e) sporadical egg-deposition on sheltered sites. By their behaviour adults of *N. brunnipes* can function as vectors of spores of fungi, occurring on the floating leaves.

The larvae and puparia seem to be restricted to the roots of *Typha*, *Acorus* and *Nymphoides*, and obtain oxygen by means of pointed stigmata from the intercellular cavities. The larvae feed there most likely on detritus and decaying plant material.

The fact that *N. brunnipes* is bound to at least two different plant species during its life cycle may explain the geographical distribution of the species.

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PRODROME TO A MONOGRAPH OF THE PALAEARCTIC SPECIES OF THE GENUS *MELECTA* LATREILLE 1802 (HYMENOPTERA, ANTHOPHORIDAE)

by

M. A. LIEFTINCK

"Kalliste", 3911 MS Rhenen

With 359 text-figures, 8 plates and 3 maps

Summary

Melecta is a parasitic melectine bee genus of the Anthophoridae, with a Holarctic distribution. In the Palaearctic region it is widely distributed over north temperate Eurasia, all round the Mediterranean basin, and the Canary Islands, off the west African coast. On the African continent *Melecta* does not occur south of the Sahara. So far known, all members are parasitic on *Anthophora* Latr., s.str. and immediate allies. As a prelude to a monograph, a revision is presented of the taxonomy, nomenclature, and synonymy of all Old World taxa, based on — mostly new — characters. No subgeneric names are proposed, and only two fairly definable units are recognized, the one here termed "the *M. albifrons* alliance" being the only group eventually to be segregated from the rest as a nominate subgenus. The essential taxonomic part comprises outline drawings of external structural details, compared to characters given in descriptive keys provided separately for both sexes, 38 species and subspecies being included in the key to the males, 26 for the females. All previously described taxa are re-defined, their pertinent morphological features illustrated, while at the same time the nomenclature of some better known species had to be drastically altered. The validity of 75 nominal taxa is taken into consideration, all names being listed in the Index at the end of this work. Of a total of 67 names which are considered validly proposed in *Melecta*, 17 are described as new, the remaining 50 comprising 21 new synonyms, 22 whose validity is analysed and re-established, and seven of uncertain status, the latter being discussed separately in an Appendix. Distribution maps are given of nine species and subspecies, while 16 types and/or paratypes are photographed. Regardless of their former or present status, the types of 46 previously named taxa were re-examined.

The systematic part is preceded by short non-taxonomic chapters containing brief notes on the phylogeny of the Melectini and their general distribution, followed by some biological aspects, viz. the typically vernal occurrences and bivoltinism, host/parasite relations, orchid pollination, and the recently established (very rare) habit of collecting earthen substance, instead of pollen grains, at the legs, exhibited by females of four species of *Melecta*, — presumably an atavistic phenomenon pointing to common ancestry.

Contents

INTRODUCTION

It is generally understood that ever since the turn of the century, the systematics and nomenclature of Eurasian species of *Melecta* had fallen into a state of utter confusion. Nevertheless, most twentieth century writers, though possibly well aware of what should have properly been done, failed to compare their novelties with the (partly easily accessible) types of some 40 nominal taxa defined by earlier authors. This has given rise to a steady increase of nondescript species, meaningless varietal names, and an incongruously large amount of obvious errors in nomenclature, — a burden which finally caused some students to resignedly give up identifying and studying these attractive bees. Considering the need of putting an end to a deplorable situation, I have ventured to undertake a revision of this difficult genus. In order to accomplish this in a more or less satisfactory way, it became soon clear that a critical taxonomic analysis and a revaluation of characters were urgently needed by finding out new and more reliable features to re-establish the identity of all regional members of the genus. At the same time an attempt was made to unravel an astounding quantity of misidentifications, which eventually led to a thorough check of the validity of all nominal taxa.

The work was started early in 1958, when the opportunity was given to study the types of the earliest described taxa in European museums. Numerous controversial specimens were recovered and borrowed on these occasions, while valuable collections of private bee students could also be consulted. These studies were continued, with many interruptions, and brought to an end at the close of last year (1979). The considerable delay in completing the manuscript has been at least somewhat advantageous to my wish for including also the yearly flow of recent acquisitions received from friends and colleagues who had collected in little explored countries. This material, particularly from the eastern Mediterranean region and Middle East, comprised welcome additional examples of several insufficiently known species, and even one or two novelties.

Comments on specimens examined

The revision is based on an examination of over 2,800 specimens, i.e. presumably only 75% or even less, of all unnamed material still available for study in museums which I have been unable to visit. Apart from that, most of the above total investigated by me belong to common and widespread species. Not counting old and new synonymies, approximately 43% of the remainder belong to species of which not more than six individuals (both sexes) could be compared, whilst no less than six species (three male & three female) are known only from unique type specimens. Consequently, it will be clear that this review does not pretend to be in any way exhaustive except, perhaps, regarding the synonymy of the regional taxa. On the basis of the analytical survey now available, it will be necessary to continue collecting on a much larger scale than has been done before, so that good series also of the less known taxa can be placed into the hands of a future monographer.

The scarcity of *Melecta* in the field is well known, and there are many reasons which have caused these bees to be relatively poorly represented in collections. In the past, collecting was mainly done during the summer holiday months, when the flight season of nearly all species is practically over. Scattered occurrence, short duration of adult life as well as the difficulty of finding the nesting sites of *Anthophora*, are also responsible for the rareness of *Melecta* as compared, to take an example, with the species of *Andrena* and its cuckoo bee *Nomada*, both represented throughout the Holarctic region by a multitude of species and individuals. Taken as a whole, the latter can be found from earliest spring till late autumn. Most *Melecta*, on the other hand, occur singly, skimming low over herbage, visiting flowers, or patrolling old walls, stony roadside banks, etc., in search of their hosts' nest entrances.

The area surveyed

As the title implies, only the specific characters of representatives known to occur in the eastern hemisphere are dealt with in the systematic part, that is to say, the whole of Eurasia with the inclusion of the African countries bordering the Mediterranean Sea north of the Sahara. The Canary Islands, an archipelago situated some 100—300 km off the westcoast of North Africa, are usually all of them considered to form part of the Palaearctic region; they have much in common with the majority of other known taxa and for that reason are also included. The same applies to a few species occurring just outside this somewhat arbitrarily defined area, e.g. those found in the foothills on the south slopes of the Himalayan range, and parts of eastern China as well. They are much alike north (western) forms and exhibit features strongly suggesting Eurasian (non-tropical) origin; their inclusion is based on the fact that the distribution area virtually coincides with that of the host bees of the genus *Anthophora* s. str., and maybe other units closely related to these.

SOME NON-TAXONOMIC OBSERVATIONS ON MELECTINE BEES

Host relations, origin and distribution

Thus far known, all Old World members of *Melecta* are parasitic on a great variety of *Anthophora* species. Leaving out of account a number of smaller, mainly subtropical Afro-Asiatic genera, each with only few species whose anthophorine hosts are quite unknown, there are yet indications that the allied genus *Habropoda* occasionally also serves as host. Apart from the records already summarized in my former revision (1972), a few classic observations relating to this subject published by apidologists of earlier generations (e.g. Friese, J. Pérez), will be brought up again and briefly pointed out in the text under each species in question. Very little of real importance can now be added to what is already known of the relation between host and parasite in the temperate Eurasian fauna, but some recent observations bearing on the subject are, where expedient, also indicated.

Some of the obstructions met with on trying to establish the intimate relation between the host species of *Anthophora* and the *Melecta* parasitizing them, will be exemplified in some detail under *M. albifrons albovaria*, one of the species occurring in central Spain (p. 203). A few more instances mentioned in the text will also illustrate the above difficulty.

Both *Melecta* and *Anthophora* have typically a Holarctic distribution, but the described species of the latter far outnumber those of its parasite: there may be anything up to eight times as many described *Anthophora* in the Palaearctic region alone than there are known of *Melecta* today. Unfortunately, however, the systematics, nomenclature, and distribution of the numerous Old World *Anthophora* are still in a completely chaotic state, and there are no reliable structural illustrations or even keys, — a situation up till now comparable with *Melecta*. So, realizing the undeniable interdependence of these two genera, it would be irrational to speculate on the origin and distribution of *Melecta*, not even of its commonest species. In spite of that I have, of course, taken pains to put on record all available data about the range of each and prepared three maps giving a — undoubtedly preliminary — graphic impression of the distribution pattern of nine taxa occurring round the Mediterranean basin (see maps 1—3).

For an interesting account of the behaviour pattern of the New World species *Melecta separata callura* (Cockerell), for instance the mode of nest entry and oviposition in cells of the Californian *Anthophora edwardsii* Cresson, see Thorp (1969).

Bivoltinism

It is well known to European bee students that the great majority of Eurasian *Anthophora* (s. str.) as well as their suspected cleptoparasites of the genus *Melecta*, are strictly vernal in occurrence, completing only one generation per annum. Yet there appear to be some striking exceptions to this rule found in populations of *M. italica* Rad., *leucorhyncha taormina* Strand, and also a few *albifrons nigra* (Spinola), which occur in Italy, the large Tyrrhenian Isles and Israel. In October 1959, while studying the rich material kept in the museum collections at Bologna, Rome and Torino, I came across a limited number of carefully dated examples of typically "spring species" of *Melecta* and several of *Anthophora* that had been captured also during the late summer months and even in autumn and winter. [1]) Acknowledging this, the dates of capture of all vernal species were noted down for later use. As far as *Melecta* is concerned, the pertinent data were copied and suffixed "(sic)" in the census of material examined, under each species discussed in the present paper. It seems worthwhile in the present context to summarize all late summer records, from August on, in the following list. I noticed that most of these specimens were in perfectly fresh condition and did not differ from conspecific individuals caught during spring. Consequently, with the possible exception of host bees collected at higher altitudes (Apennines, Sicilia), whose flight season evidently shifts into the summer months and which are excluded, there is circumstantial evidence that certain *Anthophora* and *Melecta* complete two generations in one year. Of course, much more selective collecting will be necessary to corroborate the supposed bivoltinism expressed in the list; but I hope that it may form a modest starting point for future investigation and stimulate critical studies in the field by students interested in the seasonal distibution and host-parasite relationship of these bees.

Melecta. — *M. albifrons nigra*: (Italy), ♀, Castelvetro (Emilia), 18.viii.1885 & ♂ same loc., 7.x.1885. — *M. italica*: (Italy), ♀, Castelvetro (Emilia), 12.viii & 7.x.1885, and ♀, Rimini (Romanga), x.1893. (Israel), ♂ Jerusalem, 10.viii.1946. — *M. leucorhyncha taormina*: (Italy), ♀, Castelvetro (Emilia), 10.viii.1886.

Anthophora. — *A. canescens* Dours: (Italy), ♂ ♀ Pietracuta (Emilia), x.1893. — *A. crassipes* Lep.: (Sicily), Mt. Etna, 1890 m, 4.viii.1948. See also Frey-Gessner (1907), ♂ ♀, Wallis (Switzerland), ♂, vi-vii & ♀ "Mitte October, zweite Generation?". — *A. dispar* Lep.; (Sicily), ♂, Taormina, 200 m, 16.xii.1949 and Torre Marica, 19.xii.1949. A notoriously early spring species, evidently of a second generation. — *A. acervorum* (L.): (Sicily), ♂, Sicilia or., Torre Archirafi, 0—800 m, 9.ix.1948 (many also in spring of same year: evidently two generations!).

Melectini and orchid pollination

Since about twenty years, professor Bertil Kullenberg and his staff have reported on observations and field experiments carried out on the pollination of the orchid genus *Ophrys*, chiefly in countries of the Mediterranean region (Kullenberg, 1961). Several species in this genus, the flowers of which do not secrete nectar, are now well known to be pollinated by sexually excited males of various aculeate wasps and bees. Only males are involved, female aculeate Hymenoptera never having been observed visiting *Ophrys* flowers. In 1976, the first instance of a melectine bee thus attracted by these nectarless *Ophrys* flowers was announced by the same authors in a well illustrated publication containing a

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[1]) Under favourable circumstances certain spring species in North Africa and Israel are recorded to be on the wing already from mid January on.

picture of a male bee resting on the labellum of *Ophrys reinholdii* Fl. It was drawn from a colour photograph taken in the island of Rodos and shows a pollinium attached to the bee's front (Kullenberg & Bergström, 1976, sub *Melecta* spec.). This bee was later recognized as a male *Eupavlovskia obscura simulatrix* Lieftinck, a near ally of *Melecta* and a common vernal species in Rodos and other mediterranean islands. Among the many melectines examined by me for the purpose of this paper, some more examples were found of Melectini having pollinia attached to facial parts of the head, viz. one more *Eupavlovskia* male of the same species, taken by myself on Rodos, and one *Melecta*, the holotype of *M. tuberculata* spec. nov., collected in the same island and carrying a similar adornment at its frons; and there are a few more examples of pollinia-bearing *Melecta* listed in the text. Hence the participation of these parasitic bees in the special pollination process, seems to be well established. Chemoreceptory stimuli are undoubtedly responsible for these interactions, and we may assume that at least in the cases presently recorded for *Melecta*, the olfactory sense organs on the flagellar segments of the male antenna (unapparent, it is true, in the genus *Eupavlovskia*!) are responsible for guiding the bee's behaviour on this kind of orchid flower. Kullenberg and his co-workers made it clear that the *Ophrys* flower incites the different phases of male copulatory behaviour, from the approach flight until the attempted copulation, although actual copulation can, of course, never be accomplished that way. The male copulatory instinct is stimulated by the perfume exhaled from the conspicuous labellum of the flower. The excitant males were observed to assume such positions and attitudes on the labellum that the pollinia are loosened and removed, so that pollination can be accomplished. As explained by the authors, neither the approach flight nor the tactilely guided movements of the bee on the labellum can be released without the olfactive stimulation by the flower perfume. Evidently, several *Ophrys* flowers are sometimes visited in succession by a single bee, as witness the extraordinary specimen shown (in pl. 7 figs. 36—37) of *M. tuberculata*, a new species from the island of Cyprus, which I found in the British Museum (Nat. Hist.) collection. This bee carries a cluster of not less than eight pollinia on its forehead. The pollinia attached to the left side of this specimen's face were recognized by Dr. Kullenberg as a species of *Ophrys*, the identity of the rest remaining uncertain. Just before the completion of this article, he kindly sent me a male *M. albifrons albovaria* (Erichson) together with an enlarged photograph of the inflorescence of *Ophrys sphecodes atrata* (Lindl.) A. Meyer, with the bee in the act of "attacking" one of the orchid flowers. This male darted upon the flower three times in succession in an attempt to copulate with the labellum, but just only once the attack was so vigorous that the scene could be filmed during the whole performance and the bee captured and named. The observations were made by Dr. Kullenberg in Languedoc (S. France), near Montbazin (Hér.), 1—5.v.1979, in an old olive and almond-tree plantation. It is the third instance of an equal number of melectine species attracted by the scent of an *Ophrys* labellum and stimulated to copulatory attempts.

Mud-collecting females of *Melecta*

In connection with the above, attention may be drawn to a surprising discovery made while examining the leg structure of many hundred *Melecta* females during the present investigation of the morphology of these bees. In a limited number of individuals (totalling only 14), belonging to four species, definite lumps of earthen matter were found to be firmly attached to the external faces of the hind tibiae and, more rarely, also at one or both of the mid tibiae, of the bees' legs. This substance is clayey, of a yellowish to dark grey-brown tint, and has, in the most perfect state of conservation, a suboval or semicircular shape, closely resembling an almost completed, though somewhat less conspicuous, pollen load at the corbicula of a worker bumblebee. The bees dressed up in this way were collected at random in seven countries and islands all round the Mediterranean. In one female which I took on Rodos island, all four posterior tibiae carried a conspicuous load of these clods. In view of the solid consistence, modelling, and symmetry of this matter, I am convinced that there can be no question of incidental defilement of the legs resulting from digging activities inside the nest tunnels of the host. As far as I know, this phenomenon has not so far been reported in the literature on parasitic bees. One may well ask whether it has ever been observed also in *Psithyrus* ? I venture to interpret this prodigious mode of behaviour as an atavistic device exhibited by a melectine, thereby demonstrating its true kinship with the non-parasitic anthophorine host: — a remains of the pollen collecting instinct of the host bee inherited by its parasite and materialized in the form of a defunct substitute? It is significant that no males are involved and that most females are old, more or less worn specimens having tattered fore wings and partly rubbed off pubescence. The nature of the earthen substance has not yet been analysed, but this can, I hope, be done and the results published along with some photographs showing the matter *in situ*.

ACKNOWLEDGEMENTS

I welcome the present opportunity to express my sincere thanks to all those who have, since many years, provided me with specimens of Old World anthophorid bees, — inspiring gestures, which have in no small measure contributed to the decision of continuing a series of revisional studies on these fascinating bees. First of all, I wish to acknowledge my gratitude for the courtesies received from specialists and curators in charge of the Hymenoptera collections during my visiting their museums and institutes all over Europe, initially to study types but later mainly to compare fresh acquisitions with questionable specimens obtained earlier. I am grateful also to many colleagues who gave me access to their personal collections by sending me on loan specimens collected by themselves and permitting me to retain a number of duplicates, ultimately to be deposited in the Rijksmuseum van Natuurlijke Historie at Leiden (ML).

For the present survey I have again employed a series of abbreviations indicating the ultimate location of the material studied, followed by the names of all taxonomists and field collectors who have supplied material, and without whose

generous assistance this study would not have been possible. To locate the specimens examined, the same symbols are used in the text, placed in parenthesis behind all data recorded in the opening paragraphs under the species headings "Material".

AID	—	Beth Gordon Agriculture & Nature Study Institute, Deganya A, Israel (Y. Palmoni)
AMNH	—	American Museum of Natural History, New York (J. G. Rozen)
BM	—	British Museum (Natural History), London (G. R. Else & I. H. H. Yarrow)
CAV	—	Coll. E. Asensio de la Sierra, Valladolid
CB	—	Coll. J. de Beaumont, Auvernier
CBS	—	Coll. H. Bytinski-Salz, Tel Aviv
CCS	—	Coll. A. Compte Sart, Madrid
CE	—	Coll. P. A. W. Ebmer, Linz/Donau
CFP	—	Coll. F. Parré, Bad Soden
CG	—	Coll. J. Gusenleitner, Linz/Donau
CGS	—	Coll. A. Giordani-Soika, Venezia
CHW	—	Coll. H. Wolf, Plettenberg
CJH	—	Coll. † J. Heinrich, Aschaffenburg (now SMF)
CK	—	Coll. M. Kocourek, Vyskov, CSR
CKW	—	Coll. K. Warncke, Dachau
CL	—	Coll. W. Linsenmaier, Ebikon (Luzern)
CMC	—	Coll. M. Comba, Roma
CMS	—	Coll. Max. Schwarz (incl. coll. H. Priesner, CP), Ansfelden
CO	—	A. Z. Osychniuk, Institute of Zoology Akad. Sci. Ukr. SSR, Kiev
CT	—	Coll. H. Teunissen, Oss
CTP	—	Coll. B. Tkalcu, Praha
CVS	—	Coll. F. Verges Serra, Canet de Mar (Barcelona)
CWG	—	Coll. W. Grünwaldt, München
CVZ	—	Coll. G. van der Zanden, Eindhoven
DEU	—	Department of Entomology, University of Uppsala (Bertil Kullenberg)
EIB	—	Institut f. Pflanzenschutzforschung, Eberswalde DDR (G. Morge & J. Oehlke)
FAG	—	Faculté des Sciences Agronomique de l'Etat, Gembloux (J. Leclercq)
IEB	—	Istituto di Entomologia della Università, Bologna († G. Grandi)
IEM	—	Instituto Espanol de Entomologia, Madrid (Miss E. Mingo)
IEP	—	Istituto di Entomologia Agraria, Portici (R. Priore & E. Tremblay)
INER	—	Istituto Nazionale di Entomologia, Roma (M. Cerruti)
INRA	—	Institut National d.l. Recherche Agronomique, Versailles (R. Desmier de Chenon)
IZK	—	Institute of Systematic & Experimental Zoology, Kraków (M. Dylewska)
MA	—	Instituut voor Taxonomische Zoölogie, Zoölogisch Museum, Amsterdam (J. P. Duffels)
MBUD	—	Hungarian Museum of Natural History, Budapest (J. Papp & L. Móczár, Szeged)
MC	—	Universitetets Zoologiske Museum, Kopenhagen (B. Petersen)
MCG	—	Museo Civico di Storia Naturale, Genova (Miss Delfa Guiglia)
MCNT	—	Museo Ciencias Naturales, Santa Cruz de Tenerife (P. Oromi)
MG	—	Musée d'Histoire Naturelle, Genève (C. Besuchet)
MH	—	Zoological Museum of the University, Helsinki (P. Nuorteva & J. Teräs)
MIT	—	Museo Insular de Ciencias Naturales, Santa Cruz de Tenerife (M. Baez & Pedro Oromi)
MKB	—	Zoologisches Forschungsinstitut u. Museum Alexander Koenig, Bonn († K. F. Buchholz)
ML	—	Rijksmuseum van Natuurlijke Historie, Leiden (C. van Heijningen)
MLLT	—	Museo Depart. Zoologia, La Laguna, Tenerife (M. Baez)
MMB	—	Moravské Museum, Brno, CSSR (J. Stehlik)
MNB	—	Museum für Naturkunde der Humboldt Universität, Berlin DDR (E. Königsmann)
MP	—	Muséum National d'Histoire Naturelle, Paris (Mlle S. Kelner-Pillault)
MT	—	Museo ed Istituto di Zoologia Sistematica, Torino (O. Elter, Mlle M. Goss & U. Parenti)
MUC	—	Museo Zoologico da Universidade, Coimbra (M. de Asensio Diniz)

NMB — Naturhistorisches Museum, Basel († F. Keizer & W. Wittmer)
NMP — Národni Museum V. Praze, Praha (Oldrich Sustera)
NMW — Naturhistorisches Museum, Wien (M. Fischer)
NRS — Naturhistoriska Riksmuseum, Stockholm (S. Erlandsson)
SMF — Natur-Museum Senckenberg, Frankfurt a.M. (D. S. Peters)
UK — University of Kansas, Lawrence (C. D. Michener)
USNM — National Museum of Natural History, Smithsonian Institution, Washington D.C. (P. D. Hurd & K. V. Krombein)
ZIL — Zoological Institute, Academy of Sciences, Leningrad (M. N. Nikolskaja & Ju. A. Pesenko)
ZMM — Zoological Museum, Moscow (A. N. Zhelokhovtsev)
ZSM — Zoologische Sammlung des Bayerischen Staates, München (F. Bachmaier & F. Kühlhorn)

As this paper is based on about 60 private and institutional collections, I regretfully admit not being able to express my indebtedness to any person in particular; suffice it to say that I realise how much I owe to those who sent to me their material for perusal and patiently awaited the completion of this paper, — some of my correspondents, in fact, having been looking forward to the return of their specimens for more than twenty years.

Unfortunately, two important collections containing important specimens of melectine bees from parts of the Mediterranean basin and Middle East countries, had to be left unstudied owing to their inaccessibility, viz., one formerly the property of the late B. Pittioni, cursorily inspected by me several years ago but no more available; and a second, probably substantial collection owned by a British bee specialist who serenely left all appliances unanswered, being not prepared to have his collection incorporated in the present work.

My best thanks are due to my good friends Dr. Max. Schwarz, of Ansfelden (Austria), who kindly presented me with a copy of Rossi's "Fauna Etrusca, 2" and Dr. P. J. van Helsdingen, of the Leiden museum, for having carefully translated some diagnoses contained in the same work; to Prof. Dr. J. T. Wiebes, of the Leiden University, who provided the photographs of the pollinia-bearing male of *M. tuberculata* in the British Museum (Nat. Hist.) collection; to Dr. I. H. H. Yarrow, who supplied the fine picture of *M. grandis* in the same collection; and to Messrs. Roman and the late Ch. Hoorn, photographers at the Leiden museum, for the remaining images of whole insects reproduced on plates 1—8 of this article.

SYSTEMATIC PART

Phylogenetic considerations

As pointed out by J. G. Rozen (1969), the evolution of the subfamily Melectinae is intricate and not easy to understand. In his account of the early stages of the tribe Melectini, based on representatives of the New World, the author memorizes first, that comparative studies on the morphology of the imagines have learned, that the two major divisions of parasitic Anthophoridae, viz., the largest and most complex group, Nomadinae on the one side, and the three melectine tribes, Melectini, Ctenioschelini (Ericrocini *olim*) and Rhathymini on the other, are of different origin and have evolved separately. This was confirmed by a careful comparative study of the mature larvae of both groups. All members of the Melectini have been found in the cells of anthophorine bees, whereas those of the two other tribes depredate the nests of Centridini. An inquiry into the larval morphology and anatomy of these cuckoo bees supports the view that the Melectini evolved from the same lineage as their hosts, the Anthophorinae, or in other words, have arisen from anthophorine ancestors, whereas the two other parasitic tribes evolved from parental stock at the root of the Centridini. In short, an investigation of the early stages implies a diphyletic origin of these tribes. Rozen summarizes his thorough investigations in the following way: "The fact that many parasitic bees have arisen from the same stock as their hosts, is true in many instances and is a matter of significant interest to the evolutionist delving into the relationships of bees". At the same time he emphasizes that "It would be naive, however, to apply this rule *a priori* in order to deduce the origin of parasitic bees". He then adds that this point is proved, for example, merely by the fact that larvae of the nomadine genus *Triepeolus* (of the Epeolini) were recovered from the nests of host bees representing four different families.

Generic characters

The difficulty of the subject and insufficient knowledge of New World forms, prevent me from giving a full account of the generic characters. All *Melecta* inhabiting the western hemisphere being excluded, I see no point in trying to redefine the genus taken as a whole, the more so while the American taxa are much more diversified and discontinuously distributed in the Nearctic parts of the continent. They do not seem to have much in common with those occurring in Eurasia, the set of characters displayed by the two units being of a different nature and arranged according to a different pattern. Moreover, the New World Melectini are still only summarily characterized structurally. They are far less numerous than their Old World tribal members, comprising little more than 20 species and subspecies, which are nevertheless placed in four genera (including six subgenera), though most taxa are assigned to the nominate subgenus. A useful account of the Nearctic melectine fauna was published by Hurd (1953), with a bibliography of the more important publications. Further details are summarized in my 1972 review. The most recent and complete survey of the literature on the American representatives of the tribe, is contained in vol. 2 (Apocrita) of the "Catalog of Hymenoptera in America North of Mexico", under the direction of Karl V. Krombein and Paul D. Hurd, Jr. (1979, Smithson. Inst. Press, Washington, D.C.: 2170—2172). In this catalogue four genera of Melectini are listed for the United States, with a total of 18 species and subspecies, the majority (11) pertaining to *Melecta* s. str. with one monotypic subgenus, the three remaining genera comprising six species and subspecies.

Turning to the Old World group, diagnoses of the eight genera so far known are to be found in two fairly recent revisional studies (for references, see Lieftinck, 1972, with a key to all genera and bibliography). As these definitions are not quite complete and therefore still insufficient, it seems best for the present to leave a comprehensive and really satisfactory review of all genera and subgenera of *Melecta* for a future monographer, who then may be capable to deal with the whole complex on a world basis, making use at the same time of some neglected characters introduced in this paper for the definition of the Old World members.

The type-species of *Melecta*

As pointed out recently by Day & Fitton (1977), the first described and best known Eurasian member of *Melecta* occupying a fairly extensive part of the Palaearctic region is *Apis albifrons* Forster, 1771, a polytypic species. This (inappropriate!) specific name should now replace the much more familiar names applied to the same taxon, viz. *Melecta punctata* (Fabricius, 1775, et auct.) and *M. armata* (Panzer, 1799). The first and earlier defined of the two, Fabricius's *Apis punctata,* became the type-species of the genus by designation of Latreille in 1810; but since *Apis punctata* and *Andrena armata* are conspecific and recently turned out to be synonymous with *albifrons*, the latter *ipso facto* takes the place of *punctata* as the type-species of *Melecta*. Sure enough, the nominate subspecies, here re-defined as *M. albifrons albifrons* (Forster), is the only well known regional member of the genus.

MATERIAL AND METHODS

Museum collections and nomenclature, type studies

The names considered in this revision total 75. To economize space, all nominal taxa are entered in a single alphabetical index at the end of the work.

Apart from five earlier synonymized forms, three homonyms, and 17 species which are described as new, the identity of 50 nominal taxa is verified. Of the latter, 38 were originally described as full species and 12 as varieties (or forms) of either *M. punctata* (c.q. *armata*) or *luctuosa* (Scopoli, 1770). Three of the first category, wrongly assigned to other genera, are transferred to *Melecta*. They are: *Nomada*? *duodecimmaculata* Rossi, *Pseudomelecta baeri* Radoszkowski, and *Crocisa atra* Jurine. Only the latter must be dropped as a synonym of *M. albifrons*.

Regarding the 50 specific and infraspecific ("varietal") names, 21 are found to be synonyms of taxa already known (marked "syn. nov." in the text), and seven *species incertae sedis* discussed separately in an Appendix at the end of the descriptive part of this work. The status of the remaining taxa, amounting to 22, was analysed in the course of the investigation, which proved all of them to be validly proposed species and subspecies (see text). As to the fate of the "varieties" I have, of course, taken the line that their names should be preserved as much as possible by re-studying the types and reconsidering their validity, rather than discarding them as so-called *nomina oblita*. This resulted in the recognition of only three whose names are retained and applied to taxa given specific (two) or subspecific rank (one), the nine others being relegated to synonymy and included in the above total marked "syn. nov.".

It must be added that among the many bees described by O. I. Radoszkowski, the types of 12 species of *Melecta* went to the Berlin museum (MNB). Between 1895 and 1905, these were traced and recognized by Günther Enderlein, at that time one of the custodians in charge of the insect collections. Apparently disinclined to inquire into the validity of Radoszkowski's names, Enderlein merely labelled them by copying the specific name, with the addition "rev. Dr. Enderlein. Type". As far as I know, a list of these has never been published. Therefore the actual existence of these supposed types is confirmed in the present paper and their identity substantiated by holotype and/or lectotype designations, — purely formal statements, which can be found in the paragraphs "Type material" under the heading of the majority of Radoszkowski's species. Regardless of their former status (specific of varietal), and including Enderlein's tentative selections, 46 types were re-examined.

Key and group characters

For the characterization of both sexes, about 45 morphological features were listed and taken into consideration, 70% being unisexual and peculiar to the male. Inevitably, even a number of these had to be disregarded, after all, as a means of specific differentiation, partly by lack of sufficient comparative material of either sex, but also because some important qualities of the integument are sometimes hidden from view by the hairiness of the bees.

Much time and consideration has been devoted to construct workable keys. The initial plan to offer simple dichotomic keys was given up almost from the outset. With the discovery of new species, objectively useful external characters were also detected, so that the keys underwent considerable alteration and repeated tests until they were thought to be acceptable as a tolerably serviceable whole. Of course, key characters, once established, can be arranged in various ways, depending on subjective valuation. The best way to gain an impression of the general appearance of each species proved to try out, for either sex, the most characteristic features combined, thus defining them in a not too elaborate descriptive way. The sexes are treated separately, the male being considered first because it possesses many more reliable and easily observable characters than the female, which is often difficult to identify even after exposing the pygidial plate or, when necessary, dissecting out all terminal sclerites. Male and female characters of the *M. albifrons* alliance are combined in the key to the males, for all other taxa they are kept separate.

Group characters. — As with the nearly allied genus *Thyreus*, the characters employed have not afforded much help in establishing more than two definite species groups in the Palaearctic fauna. With the exception of the *albifrons* alliance just mentioned, which constitutes a division of its own, the male genital organs with their internal sternal plates, have proved to be valueless for this purpose because shapes and setal arrangements, though always differing somewhat interspecifically, are similar in principle, while nearly all other characters are shared in such a haphazard way and allotted so differently in species showing a similar pubescent pattern, that one is disposed to think that many features have had an independent origin. These incongruities are well expressed in the keys, in which the successive characteristics are not always enumerated in the same order. This proved unavoidable, because body texture and vestiture — to take an example — had to be at one time treated separately, but in another were considered logically consistent and best discussed jointly.

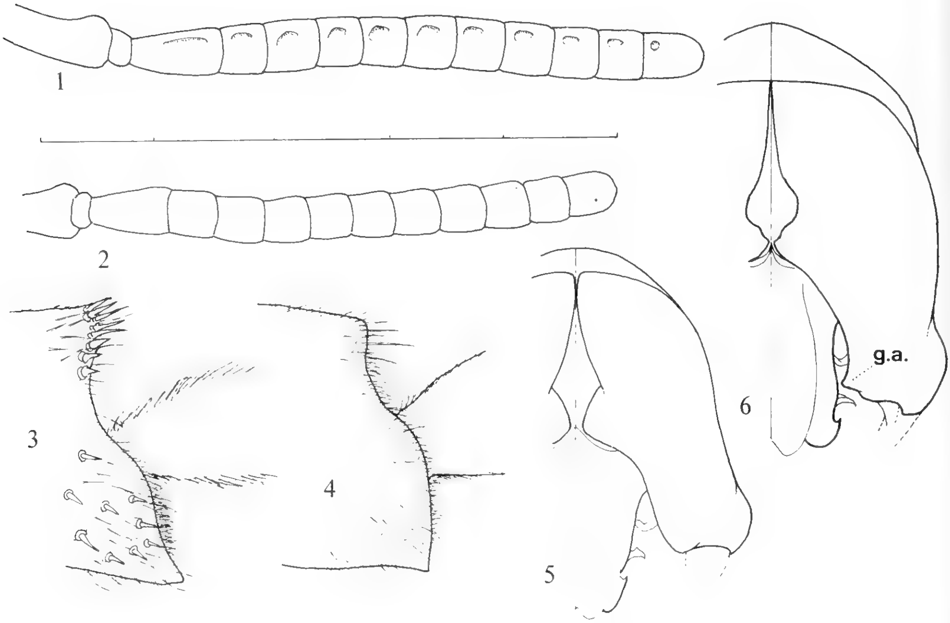
In my last account of Old World melectines (1972: 264 —265), I called attention to a rather aberrant group within the genus characterized by a general dullness of the body integument caused by very dense punctation and short tomentum; in this group also the first two abdominal segments are more nearly equal in length. These unusual features have nevertheless been used in the key in spite of the fact that, with new discoveries, some species are intermediate or fall outside any group. Instances like this may be multiplied, e.g., with regard to the development of strong bristles, impunctate areas on the vertex, depth of sutures, sculpture of propodeum, and the like. It is obvious, therefore, that these keys are rather artificial and only partly reflect true relationships. In no way do I pretend to have found all potentially useful characters, but I do hope that those employed, clarified by portraits of bees and as many sketches of structural parts as were thought convenient, may serve as a basis for further investigation.

In the key to the males, the form of the gonocoxite of the genital bulb will be introduced as one of the few fairly constant localized characters used as a means of specific distinction; it needs a brief explanation. Viewed from above, the distal halves of the gonocoxites, beyond the partly inflected blunt inner tubercle, are somewhat divergent, their inner borders curving at first outward and then inward in a specifically characteristic way, usually forming a broadly convex bend before curving ventrad; this swollen part may be either rounded off, or projects more or less distinctly inward: this is called the "gonocoxal angle" (fig. 6, g.a.). The distally open cavity embracing the central genitalic organs bounded by the swollen gonocoxites, is termed the "gonocoxal enclosure". All remaining characters employed in the keys will be easily understood by comparing the illustrations.

Since the keys also comprise characters not visible externally, the copulatory organs should be dissected out and always compared with the figures. Many species can be recognized with certainty only when fresh examples are available whose body parts have been extended and made plainly visible. Specimens in full dress are found only soon after emergence and then are usually easily recognized. Aged females, however, may have lost much of their freshness and vestiture; they are frequently met with carrying worn off mandibles, imperfect tarsal claws and stubbed pygidial plates, — all characters of some importance reminding to careful inspection before identifying them. Scores of females thus affected had to be left unnamed: torn wing borders always sound a warning note.

Terminology

To avoid any misunderstanding, in the keys and further descriptions, the antennal segments are numbered consecutively from 1 to 12 (13), thus including the scape and pedicel, the latter being always plainly visible. For the sake of



Figs. 1—6. *Melecta*, structures; 1, *M. albifrons albovaria*, posterior view of left antenna, showing impressed sensoria (♂ Montpellier, France); 2, *M. luctuosa*, the same, showing obliterated sensoria (♂ Netherlands); 3, *M. albifrons albifrons*, external view of transitional parts of hind tibio-basitarsus, semi-diagrammatic (♂ Netherlands); 4, *M. luctuosa*, the same (♂ France); 5, *M. italica*, dorsal view of genital capsule, showing rounded gonocoxal angle (♂ Grimaux, France); 6, *M. festiva*, the same, showing pronounced gonocoxal angle (♂ same locality). Scale line 5 mm (figs. 1—2); g.a. = gonocoxal angle

simplicity I have dropped the somewhat ambiguous and rather superfluous terms "mesosoma" (thorax + propodeum) and "metasoma" (or gaster), for the post-propodeal part of the abdomen, and recurred to the regular practice of older authors by using the traditional and more familiar words thorax and abdomen. Consequently, by regarding the propodeum (= first abdominal segment in the Apocrita) as part of, and in conjunction with, the thorax, the next abdominal sclerites being here numbered from the first segment on. A reversion to the original and simple terminology seems justified in purely descriptive articles like the present one, the more so as the morphological segmentation of the thoraco-abdominal complex is common knowledge and correctly interpreted already by Latreille. The rudimentary 9th abdominal tergite (8th gastral) of the male, is a thin, sub-membranous, more of less quadrangular, minute plate which, though always present, is liable to be overlooked, for which reason its shape has been neglected as a means of specific distinction.

All specimens enumerated, whose body parts had to be dissected out for close examination and/or drawing purposes, are marked "(diss.)" under the heading of material studied.

Variation

Apart from the only too well known sexual dimorphism, strongly expressed in structure, nature of pubescence and often also in wing colour and venation, individual (infraspecific) variation is quite considerable, so much so in fact that there is hardly any part of the body which does not participate in showing slight differences in contour, shape or proportion, within a single population in any given locality. As, for example, in the allied genus *Thyreus* (Lieftinck, 1962—1972) and other parasitic solitary bees like the Japanese species of *Nomada* (Tsuneki, 1973: 5—10), this marked inconstancy even of the finer structures, such as the male copulatory apparatus and hidden sternal plates, may greatly impede recognition, especially where two or more near-alike species of *Melecta* occur together in one locality. Added to that, the variation in the alternating black and white pubescent pattern exhibited by both sexes, is pre-eminent and infinite, thus forming an additional obstacle to the taxonomist in search of reliable distinctive characters. Numerous examples of this instability will be found among the taxa treated in the next pages, demonstrated also by outline drawings of the more eminent organs preferably selected from a series of preparations showing the extremes (plus and minus variants) observed in a single population of a given species or subspecies. Wing venation also is a case in point: except colour of the fore wing membrane, no reliance can be placed on the position and course of the cross nerves. Out of all venational peculiarities considered, the only one at all helpful, i.e. as a group character, is the shape of the third submarginal cell, which does seem to be fairly constant, at any rate in the males.

Type designations

Except in a few cases, only holotypes and lectotypes are recognized. For obvious reasons I have since many years renounced the qualification "allotype", also because in practice it has been too often used somewhat thoughtlessly, and as a result of its deceptive usage led a persistent life in collections and literature in cases of erroneous sex-associations. To avoid any misjudgement of the word "type", I have therefore substituted the term allotype by the non-pretentious indication "First defined [male or female]", which then only expresses my belief that the newly characterized specimen of the opposite sex is conspecific with the type. For the same reason paratype designations are avoided and selected only, for convenience, from topotypical material, preferably of the same sex as the type. In all other instances my own identification labels should, I hope, suffice as an expression of my personal conception of a given taxon.

Historical identifications

Full information on localities, dates of capture, and collectors is, with very few exceptions, given for all specimens examined, the personal names of those who identified museum specimens in the past being also copied from the labels. These names are printed in *italics*, on behalf of future students interested in the nomenclatural history of a given species, and also to make them acquainted with the different views expressed by the older generation on the identity of their specimens.

(It is surprising how very few entomologists seem to realise the inconvenience of pinning identification labels in the same position to those indicating the locality data, instead of simply attaching the name-label upside down on to the pinned specimen. By so doing the vexation of being compelled to use one's fingers or a pair of forceps before succeeding to read a scientific name, can be easily avoided.)

Preparation of copulatory organs, and illustrations

The technical manipulations necessary to obtain good preparations for drawing purpose, although often time-consuming, are relatively simple. Pinned or freshly killed specimens can be relaxed over wet sand for six to 24 hours, old museum specimens that were killed in cyanide bottles (a strongly dissuasive method!) sometimes requiring up to 48 hours to soften the sclerotized parts. Thereafter the whole male copulatory complex can be pulled out slowly as far as possible, and the various parts separated by first clipping carefully all basal and lateral ligamentous membranes of the minute sternal plates. After cleaning off all muscles and connectiva still adhering to the various chitinous structures (without the use of caustic potash), the latter are washed in diluted alcohol, transferred to glycerine, and placed on slides protected by loosely applied cover glasses. Since most internal abdominal sternites are usually flexible and often bent in a different way, the shapes (contours) of the hidden plates may at times look rather different in serial preparations of a single species collected in one locality; in any way pressure should be avoided to prevent distortion. Component parts thus protected can be left floating in glycerine for years, and conveniently examined at any time for comparison with serial preparations of other specimens. The objects having been drawn to the desired magnification, they are best demounted for permanent safekeeping. First of all, the sclerites of each individual are washed out in 70% alcohol with at least one change, passed to aceton for a short while to ensure thorough cleaning, and dried on filter-paper. Then they can be kept together in plastic microvials mounted with gum on a slip of cardboard (as for Coleoptera) and attached to the insect's pin. A somewhat delicate, but more convenient and satisfactory method is to paste the objects one by one to the pointed tip and sides of ordinary cardboard slips. For the best adhesive use Velpon (or any other glue soluble in water) dissolved in amyl-acetate, and stir until the solution (to be kept in a glass-topped vial) has become sufficiently syrupy. A minimal quantity of this substance applied to any part of the slip will suffice to securely hold the separate parts in the desired position. Care must be taken to ensure the crucial components of each object (bristly apices of sternites, gonostyli, etc.) to project freely beyond the card's tip or sides, so as to simplify rapid inspection. The drawings in this paper of male and female genital organs were all taken from preparations as described, though not always rendered on the same scale.

All illustrations, including those showing the peculiar pubescent "pads" usually adorning the males' mid tibiae, are original camera lucida sketches.

Flower records

Only unpublished flower records are acknowledged and copied from the labels in the lists of specimens examined, all earlier names of plants mentioned in the literature as being frequented by the — mostly polylectic[1]) — species of *Melecta* and their hosts, are omitted.

DESCRIPTIVE KEY TO PALAEARCTIC SPECIES OF *Melecta*

MALES

(Species *incertae sedis* are excluded but discussed in the Appendix (p. 334); males of *M. canariensis* and *solivaga* are still unknown)

1. Gonostylus of large size, two-fifth to one-half as long as genital capsule, incurved, hollowed out within and subparallel-sided in profile; apex obliquely or squarely cut off, at least with part of bristly setae much longer than diameter of stylus, these bristles characteristically curled and/or twisted, frequently meeting or intertwining (figs. 33, 40, 49, 59). Intero-apical (mesial) angulation of distal portion of gonocoxite drawn out and markedly protuberant in dorsal view, directed obliquely backward and inward to form the gonocoxal angle (g.a., fig. 6, 44). Anterior (basal) arms of sternite 7 relatively short and broad, each expanded at about halfway length, with distinct external angulation, these arms not nearly twice as long as the broad median plate (disk) whose apical lobes are clothed with short setae. Sternite 8 gradually tapering, apex usually produced, excised and also setiferous. Sides of apical extremity of tergal (pygidial) plate 7 subparallel or slightly converging, the apex itself broad, squarely cut off, subtruncated or, more rarely, shallowly emarginate, lacking oblique ventral ridges; surface somewhat shiny, disk almost flat and hairless, closely punctate. Labrum squarish but usually slightly longer than its breadth at base or middle, with or without incomplete median ridge. Maxillary palpus 5-segmented. Distal portion of fore and mid femora clothed posteriorly with longish erect pubescence; hind femur lacking posterior tuft, covered instead with a compact row of fine appressed tomentum, the raised hair tips forming a dense comb hardly projecting beyond hind border of femur; distal half or more with partly exposed blunt or subacute median crest. Extero-apical border of hind tibia distinctly emarginate, its lower angle produced above implantation of spurs and furnished with a row of short, strong, spine-like setae (fig. 3), its outer face and that of basitarsus strewn with strong, spike-like, black denticles

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[1]) See the excellent comprehensive review, "The ecology of solitary bees", published by E. Gorton Linsley (1958, Hilgardia [Berkeley] 27: 543—599, figs. 1—3).

showing through pubescence; surface of hind tibia uneven distally, brightly shiny in places. Hind basitarsus distinctly outbent in dorsal (posterior) view, narrow at extreme base, then rather abruptly expanded, broadest about halfway length, its upper border in side view straight or almost so, the lower one convex; outer face flattened and markedly hollowed out; apex cut off obliquely, produced dorsally to form a straight blunt process running in line with upper border; surface finely tessellate, clothed evenly with short soft decumbent hairs. Inner rami of mid and hind tarsal claws at most half as long as outer and much broader than these, forming thin, axe-shaped or squarish plates which, though often pointed, are never slender and claw-like (fig. 23). Mid tibia somewhat expanded and swollen, its outer surface for the greater part clothed with a compact, elongate-oval patch of short, fine and appressed, predominantly white, silky hairs; its posterior border moreover invariably conspicuously fringed with long, silky and (mostly) white hairs directed caudad (fig. 7). Third submarginal cell of fore wing always longer than high, its apex prolonged distad and more strongly and narrowly elbowed than in any other species group, especially in male (fig. 20); yet all submarginals varying much in size and shape. Antenna of moderate length and strength, flagellar segments strongest in male, squarish or a little broader than long (♂), or a trifle longer than broad (♀); 3 always longer than 4 but not more than 1½ times the length of this; 4 and 5 subequal. Male with well developed, distinctly impressed, subcordate rhinaria (fig. 1). Median mesonotal line not or very shallowly impressed; parapsidal lines short or indistinct. Suture between mesonotum and scutellum rather deeply sulcate; scutellar tubercles short, obliquely and slightly raised above level of scutellar disk. Propodeum coarsely rugose, rugae on lateral edges of triangle usually placed in the long axis of body. Abdomen shiny dorsally, punctation of tergites 1—5 fine, superficial, most punctures setiferous, the setae varying in length, semi-erect; punctures much smaller than interspaces, finest and most widely spaced on postgradular portions. Pubescence of head and thorax long, raised hairs concealing most of surface, including parascutella and spines; colour variable, often more or less yellow-brown. Antennal scape in both sexes fringed on either side with long raised hairs, most conspicuous in male. Abdominal markings varying considerably in size and colour, either pure white, greyish, or (more rarely) black; tergite 1 basally with longish raised tufts especially at sides, the marks on succeeding tergites, when present, either compact, consisting of long, fine, decumbent hairs concealing the surface, or less defined and more loosely arranged; these spots either placed in regular row or, more frequently, constricted or twofold on one or more segments, usually largest on 2—3, thereafter often diminishing rapidly in size, or absent altogether. Pygidial plate of female always narrow, long and slender, evenly and but slightly downbent; length-breadth ratio individually variable, about twice as long as its breadth at extreme base of lateral ridges; proximal to the latter the plate is ill-defined, extending to (unexposed) basal margin of tergite. Surface of plate shiny, flat or almost so, proximal portion of disk punctate, most closely so at base, for the rest minutely tessellate, with rectilinear, finely raised side-margins, tapering gradually from base to apex, the latter simply rounded; apical portion occasionally with feeble median crest. Mid tibia in female also invariably fringed with some raised white hairs (dark in melanistic forms). Hind basitarsus slender, much narrower and less outbent than in male, at least four times as long as its breadth near apex, its outer face slightly convex instead of being hollowed out, clothed densely with longish, mostly decumbent hairs. Body pubescence in extremely melanistic forms throughout deep black. Size very variable, length 6—20 mm. . . . . **M. albifrons** (Forster) alliance 2

— Gonostylus generally much shorter and straighter, at most one-third length of capsule, not or less conspicuously hollowed out within, tips of styli more widely distant, most of these parts strongly setiferous, but longest setae only very rarely curled or twisted. Shape of gonocoxal angle variable, but distal portion of gonocoxites in dorsal view not as described, the intero-apical (mesial) angulation never drawn out or markedly produced obliquely caudad and mesiad, and also less abruptly angled in side view. Anterior (basal) arms of sternite 7 generally longer, more widely divaricate and, with few exceptions, more slender; if broadened at about halfway length to form external angulations, then the latter are feebly sclerotized and semitransparent; shape of median plate very variable but generally much shorter than the limbs and often constricted basally. Tergal (pygidial) plate 7 of male equally variable in shape. Maxillary palpus usually 6- occasionally 5-segmented, very rarely with 4 segments only. Extero-apical border of hind tibia often oblique though rectilinear or only shallowly concave, the lower outer angle of same not markedly produced, but frequently spinulose and/or carrying strong setae and bristly hairs (fig. 4). Inner rami of mid and hind tarsal claws generally longer and more slender, more definitely claw-like. Posterior border of mid tibia lacking conspicuous fringe of backward projecting long hairs, though often with few longish erect bristles instead. Shape of third submarginal cell of fore wing very variable, usually shorter and less abruptly angled distally. Abdominal markings white, often conspicuous, those on tergites 1—5 (or 6), if present, never twofold, occasionally replaced by condensed dots of black hairs, or absent altogether. All remaining species groups 8

2. Both sexes with single row of spots, one each side, on abdominal tergites 2—5 (rarely also 6) in male, and on tergites 2—4 (rarely also 5) in female. These spots may be greatly reduced in size, either lacking on some posterior segments, present only on tergite 2, or absent altogether, in which case abdomen (occasionally whole body) is totally black and unspotted (some *a. nigra*). Except in some female *albovaria* the spots are irregular in shape, characteristically ill-defined and hollowed out anteriorly. A complete collar, or at least a lateral tuft, varying in colour, conspicuous also on tergite 1. If spots on tergite 3 are small, tending to become obliterated or interrupted, then all light hairs (especially on head and thorax) are distinctly brownish yellow or grey-brown in fresh examples, most tergal spots then being ill-limited (all nominotypical *albifrons*). Sternal graduli 3—5 or 4—5 of male with

inconspicuous fringe of longish, decumbent, dark (rarely whitish) hairs. . . . . 1. Group of **M. albifrons** (Forster) 3

— Both sexes invariably with two, usually pure white, spots on each side of abdominal tergite 3 (frequently also paired on 2), and male occasionally also with twin-spot on 4 and even 5, in which case there are two complete rows of white lateral spots. Also a basal collar, or at least a single tuft of white (or faintly brownish) hairs, at sides of tergite 1. Sternal graduli 3—5 or 4—5 of male usually with distinct comb-like fringe of long, decumbent or suberect, bristly hairs, often white and band-like laterally; these bristles in female longer than in male, evenly and more sparsely distributed . . . . 2. Group of **M. duodecimmaculata** (Rossi) 5

3. Head, including long fringes at antennal scape, thorax and legs predominantly brownish yellow to grey-brown on dark brown ground, the thoracic pubescence rather long and dense but nowhere completely obscuring the surface. Suberect, mostly brownish black pile covering abdominal tergites much shorter though easily discernible at low magnification ($\times$ 10); many long raised bristles also at graduli and sides of tergites, 1 moreover with transverse, ill-defined collar of long raised and fluffy brownish hairs, more crowded laterally to form tufts of more or less curved and undulated hairs directed sideways and partly projecting beyond hind margin; tergites 2—5 (♂) or 2—4 (♀) with row of whitish or pale brownish white lateral spots varying much in size, shape and number, but nowhere sharply outlined: usually conspicuous, irregular and tufty on 2, much smaller, placed more inward, depressed and spot-like on next tergites, the one on 3 frequently placed transversely and constricted, or even twofold, in which case the parts are unequal in size; spots 3—4 (5) in northern populations often vestigial or wanting in both sexes. Venation brown: fore wing membrane never entirely hyaline, lightly infuscated except marginal cell, centres of submarginals and papillate border, which are slightly (though not at all contrastingly) darker brown. For structural details, see additional descriptive notes and illustrations (figs. 3, 19—25). Body size and markings extremely variable, length 9—17.5 mm. Hab.: Temperate NW Europe, from Britain eastward far into W Asia . . . . **a. albifrons** (p. 193)

— Head, thorax and legs alternately black and pure white to slightly greyish on deep black ground, but consistence of pubescence not differing from *a. albifrons*. Light hairs covering thorax rarely with distinct pale brown hue. Venation generally darker than in nominotype but colour of membrane variable, darkest in melanistic populations of *a. nigra*. Lateral spot on tergite 3, when present, very rarely constricted or twofold. Body size and markings equally variable: partition of white pilosity specified in next couplet. Two, not sharply differentiated subspecies of more southern and eastern range. Varieties intermediate between populations of typical *albifrons* and *albovaria* on the one hand, and between *albifrons* and *nigra* on the other, are of frequent occurrence and discussed under each subspecies, the latter being roughly distinguished as follows 4

4. Light areas on head and thorax greyish white; abdominal spots white, either

unequal and much reduced in size, or absent altogether. No white hairs between scutellar tubercles. — White extremes of ♂: clypeus dorsally, antennal scape partly, and whole occipital region; mesonotum as far back as scutellum (except around tegulae); sides and venter of thorax; almost complete external patch and posterior fringe of mid tibia; basal one-fifth of hind tibia, and vestiges at tarsi; almost complete collar on tergite 1 and large lateral subtriangular patch on 2; more or less transverse spots on 3—4 (5); sternites all black. Dark extremes of ♂: white hair obscured to grey-brown on occipital area, mesonotum anteriorly, and centre of mesepisterna; external patch of mid tibia and spots at base of hind legs also obscured and small; body for the rest entirely black. — White extremes of ♀: head in front and occipital area (in part); anterior collar of mesonotum and isolated lateral patch; small tuft behind wings; mid and hind legs as in male; lateral tufts on tergite 1 and small lateral spot on 2; vestiges on 3—4; or body (inclusive of tergite 1) totally black except well defined spots on 2—4 only. Dark extremes of ♀: body entirely black. Size less variable, length 11.5—15 mm. Hab.: Discontinuously, from SW England through western France; Italy and Tyrrhenian Is. . . . **a. nigra** (p. 204)

— Both sexes with light areas on head and thorax pure white, on mesonotum anteriorly occasionally faintly tinged light brown. White extremes: abdominal spots conspicuous, placed in regular row, but often ill-limited on tergites 1—5 (♂) or 1—4 (♀), becoming smaller from before backward, those on intermediate segments distinctly transverse, usually largest on 2, irregular in shape, tapering inward, often excised anteriorly, the anterolateral angle occasionally reaching compact tuft at sides of 1. A pair of more or less isolated black dots slightly in advance upon middle of mesonotum rarely present in male, more frequent in female, the latter in addition with pair of larger white tufts to the inside and just beyond halfway level of tegulae, and small tuft of white between scutellar tubercles. Mid tibial pad of ♂ complete, often with tiny rusty brown streak along anterior border. Dark bristly hairs fringing sternal graduli 3—5 of ♂ frequently pure white instead of black laterally. Both sexes of darkest populations in southern France and Spain having vestigial tergal spots 3—4 (5), are practically inseparable from light extremes of *a. nigra*. Body size very variable, length 7—19 mm. Hab.: Discontinuously (see above) from central France and Iberia throughout the whole Mediterranean as far as Iran . . . . **a. albovaria** (p. 196)

5. Size small, length usually 10—12 mm, not exceeding 13 mm. Head and thorax clothed all over with greyish white to light brown hairs, small dark brown areas occasionally only low down at temples, on basal portion of scutellum and, narrowly, at sides of thorax above mid coxae. Integument dark brown, never deep black; legs often lighter brown. Vestiture rather long and dense, scutellum with conspicuous tuft of recurved brown hairs between short spines. Mesonotum of female without any trace of anterior dark spots. Outer faces of mid and hind tibiae and tarsi for the greater part clothed evenly with short, mostly decumbent, pale brownish to white hairs, sparsely distributed at both ends without forming definite patches or spots; hinder pair in both sexes

moreover beset with setiferous punctures of different sizes mixed with few short, raised, pale bristles and strong flattened, suberect, black spicules on somewhat shiny ground, the latter most numerous in female, longest and present also upon distal portion of basitarsus. Wings infuscated except at extreme base; fore wing, from slightly beyond cells to extreme tip, broadly bordered smoky brown. Abdominal pubescence rather long, especially the collar at base of 1, which in male is broad, only slightly arched behind and but little condensed laterally, usually pale brown. All spots on next tergites isolated, decumbent, smallish, but varying in shape and size, always paired on 2—3, often also on 4—5 (♂) or 4 (♀); bristly sternal pubescence long and dense, pregradular fringes oblique, present in both sexes, hairs suberect, most conspicuous and longest on 3—5, colour silvery to light brown. For further details, see text and figs. 57—59. Hab.: E China . . . . **chinensis** (p. 218)

— Size variable, length 11—18, frequently exceeding 14 mm. Head and thorax at least with some black at sides and underneath, markings pure white, strongly contrasting, hair length variable. Integument black. Mesonotum of female often with pair of isolated black spots anteriorly; scutellum and mid-posterior sclerites of thorax predominantly black, the former often with tuft of pure white recurved hairs between short spines. Outer faces of mid and hind tibiae and basitarsi contrastingly white-spotted: at least extreme bases and apices of mid tibiae and distal portion of hinder pair remaining black. Pregradular suberect bristles covering sternites 2—5 of female less numerous and all black 6

6. Body pubescence in both sexes throughout long and rather dense, hairs covering dorsum of thorax partly concealing surface and even exceeding length of tegulae and scutellar tubercles; all black hairs on disk of abdominal tergites suberect, well visible with the naked eye. Basal half or more of tergite 1 with uninterrupted band of long raised white hairs most closely set and tufty at sides, but with its posterior limit almost (or perfectly) rectilinear. Marks on succeeding tergites composed of thickset hairs raised above surface level (male, profile!), the tips recurved or turning sideways, projecting beyond hind border of tergites; spots depressed, less bushy and more sharply outlined in female. All spots, though placed in regular rows, varying much in size and, on terminal segments, also in number: on 2 and 3 invariably paired and completely isolated. Inner spots on 2 always smaller, on 3 a little larger, than outer spots, the interspaces variable though frequently broader than diameter of inner spot. Scutellum completely black, rarely a few white hairs midway between tubercles; propodeum black in middle; thoracic sides predominantly, though never completely, white. Punctation on outer faces of mid and hind tibiae dense, punctures of different sizes, mixed with longish bristles and interspersed with few short, broadly triangular, spike-like setae arising from much larger punctures, most of these spicules in Mediterranean populations hidden under pubescence; interspaces polished though small. Wings only little obscured, membrane of fore wing gradually and only slightly infuscated from base to tip, darkest in marginal cell, but papillated area not contrastingly coloured or

band-like. Male with sternal plates 2—5 clothed all over with suberect hairs, 3—5 moreover with subapical brush of more raised hairs (profile!), longest and partly white at sides. Apical plate of sternite 7 longer than its width at base (fig. 38); distal portion of 8 also relatively long, sides lacking distinct convexities (figs. 38, 42). Gonocoxal angle well pronounced though bluntly rounded, usually less incurved than in next taxa (see, however, fig. 44). Size extremely variable. Hab.: Mediterranean region (typical), through N Asia as far as Peking . . . . **d. duodecimmaculata** (p. 209)

— Body less hirsute, the pubescence shorter, especially so in female; longish hairs on dorsum of thorax mostly shorter than length of tegula. White hair band covering basal half of tergite 1 forming an arched collar, narrowest at middle or even interrupted in the median line. Marks on succeeding tergites composed of compact hairs which are not, however, raised above surface level. Wings darker, fore wing membrane more contrastingly coloured beyond cells. Strong spicules covering outer face of hind tibia well visible. Apical plate of sternite 7 subequal in length to or shorter than its width at base (fig. 43); distal portion of 8 (unknown in *excelsa*) also comparatively short, sides usually with prominent convexities (fig. 43). Gonocoxal angle often more prominent and markedly incurved 7

7. Size large, length 15.5—17 mm. General appearance similar to nominotype but pile shorter, abdominal spots of much larger size and fore wing membrane with broad (ca 2 mm) though not contrasting, grey-brown band bordering distal margin beyond cells. Thoracic pubescence of both sexes shorter but more variegated with snow white: well defined mesonotal spots to the inside of tegulae, conspicuous tufts on metapleurae behind wing bases and propodeum laterally, the scutellum moreover with triangular white spot between tubercles, this isolated tuft consisting of curiously depressed radiating hairs directed cephalad and laterad, female in addition with pair of black dots on mesonotum anteriorly. Legs shaped much as in nominotype, but setiferous punctures on outer faces of mid and hind tibiae (particularly on hinder pair) less numerous and more widely spaced on rather irregular ground, leaving distinctly more shiny areas. Length-breadth ratio of male hind basitarsus = 100: 30. All tergal spots of large size, sharply defined, 2 invariably larger than in nominotype (see descriptive notes). Apical plate of sternite 7 shorter than its breadth at base (fig. 48). Hab.: Transcaspian region and Iraq . . . . **d. jakovlewi** (p. 215)

— General appearance as in pl. 1 fig. 4. Also of large size, length 16.5—18 mm. Differs from previous taxa as follows. Vestiture of whole body still shorter and more even. Alternating black and white thoracic pattern distinctly more contrasting, the black predominating; white spots between tegulae and scutellar tubercles in both sexes small, standing out clearly, the white mesepisternal patch completely isolated. Fore and hind wing membrane subhyaline, but fore wing with costal vein and whole area beyond cells distinctly more contrastingly tinted, the apical band and tips of hinder pair broader and darker brown. Black pile covering abdominal tergites and scattered bristles at sides visible only at some magnification. All tergal spots relatively small, more regular and sharply outlined. Collar-like band at base of 1 markedly concave behind, complete in male, subinterrupted in female, hairs long and thin, partly raised at base, broadest laterally though less defined and composed of longer hairs than in *jakovlewi*; spots twofold and completely isolated on 2 and 3, single on 4—6 (♂) or 4—5 (♀), the latter diminishing gradually in size posteriorly; appressed hairs closely set, not exceeding hind margin of tergites. Sternal plates 3—5 of male very closely punctate, the black setae of minute size, the longer subapical fringes black in middle, slightly raised, small, spot-like and white laterally; raised black bristles much shorter than usual; female with all hairs and bristles more sparsely distributed. Legs more robust, outer faces of mid and hind tibiae more sparsely and rugosely punctate, the surface (especially of hinder pair) being very uneven, with smooth and distinctly shiny areas isolating many strong raised, spike-like setae placed on elevated rugae, especially conspicuous in female. Hind basitarsus more markedly outbent and hollowed out externally and also more expanded at middle, length-breadth ratio = 100 : 34.6. Genital structures of male as in figs. 43—44, the pygidial plate of female shaped and sculptured as in other taxa of the group, but broader, length-breadth ratio = 100 : 65. Hab.: Afghanistan . . . . **excelsa** (p. 217)

8. Antennal rhinaria on flagellar segments 3—13 absent, replaced on 4—12 by large, poorly defined, oval or subrectangular, rather flattened areas occupying nearly the whole posterior surface of each (fig. 2), extreme bases of these areas occasionally with a minute, subtriangular, impressed spot (*rutenica* only): accordingly clearly discernible, distinctly impressed and shiny sensoria are invariably wanting. Mid tibia unmodified, neither flattened nor broadened, nature of pilosity covering its outer face not or hardly differing from that on hind tibia and lacking a well defined oval or subcircular patch of short, compact, felt-like, snow-white (rarely black) tomentum, a white hair spot, when present, being restricted to basal portion of tibia, ill-defined distally and consisting of decumbent hairs, the latter either short or of normal length (fig. 8). Hind basitarsus slightly but distinctly outbent in posterior view. Inner rami of mid and hind tarsal claws slender, not broader than outer, from 2/5 to 3/4 as long as main branch. Antennal scape fringed laterally with long, raised, mostly white hairs. Size moderate, length not exceeding 13.5 mm 9

— Antenna variable but often stronger, usually with shorter, more swollen flagellar segments, the posterior faces of 3—13 or 3—12 always provided with distinct, mostly deep, pit-like and shining rhinaria, placed slightly in advance of the middle (fig. 277), the one on 3 elongate-oval, those on succeeding segments subtriangular or partly linear, often becoming smaller and more rounded distally; if antenna is thin and more slender, then these impressed sensoria are occasionally more superficial and less defined, though invariably present (e.g. *fulgida*). Mid tibia generally slightly expanded and swollen, consistence of pilosity covering outer face markedly different from that of fore and hind tibiae by the presence of an elongate-oval or subcircular flattened patch of short, compact, felt-like and usually white tomentum; long backward directed hairs fringing posterior margin of mid tibia inconspicuous: sparsely distributed or wholly absent 11

9. Antennal rhinaria placed at base of flattened areas of segments 4—12 extremely minute and superficial, as indicated above, absent on 3 and 13; each of the flattened areas bounded posteriorly by a low ridge which, though poorly indicated, is a little convex posteriorly, giving the antennal joints a somewhat swollen appearance. Whole antenna moderately strong, rather short and hardly reaching tegulae; scape clothed with long erect brownish black hairs roundabout; 3 little longer than its breadth at apex (100 : 80) but slightly longer than almost square following segments. Labrum slightly longer than its (greatest) breadth at base, evenly closely punctate lacking median carina, anterior border convex, little upturned. Body texture and nature of pubescence much as in *luctuosa*, but pile on head, thorax and legs predominantly black, the light hairs, inclusive of a long decumbent patch covering clypeus, more greyish instead of pure silvery white; head for the rest black, as is a long fringe at occipital border, save only a small thin tuft of grey on each side of the latter; anterior mesothoracic collar, a tuft at upper half of mesopleurae, and a still smaller spot behind wings, whitish; remaining parts all black. Scutellar tubercles shorter than and partly concealed by long raised hairs, triangular and shiny. Legs more closely and finely punctate, less lustrous, than in *luctuosa*, the rather long pubescence much the same, but long white hairs restricted to a posterior fringe at articulation of fore femur-tibia, and vestigial subbasal spots at outer faces of mid and hind tibiae. Outer face of mid tibia beyond white spot with decumbent, dullish hairs,pile more compact and longer than on the normally hairy and partly exposed hind tibia, thus differing from *luctuosa* and *brevipila*. Hind basitarsus little or not hollowed out externally; with at least some long bristles fringing posterior border. Fore wing membrane darker than in *luctuosa*. White collar of raised hairs at base of tergite 1 thin, intermingled with black medially, the still longer loose tuft on either side replaced by black at the bend; lateral spots on 2—5 transverse, smaller and more rapidly diminishing in size posteriorly than in next species, hairs also shorter. Tergal (pygidial) plate 7 as in fig. 97. Sternites 7—8 as in fig. 98. Genital capsule squarish, more parallel-sided than in *luçtuosa*, but gonostylus and dorsobasal process shaped similarly to quite some *luctuosa*. Size moderate, length 12 mm, fore wing 10.5 mm. Hab.: S European Russia; Turkey (see map 1) . . . . **rutenica** (p. 233)

— Flattened areas replacing impressed antennal rhinaria simple, without any indication of minute centro-basal impressions, these areas not bounded by a low convex ridge posteriorly. Antenna a little longer and distinctly more slender than in *rutenica*. Body pubescence lighter, predominantly white on antero-dorsal part, sides and ventral sclerites of thorax; long white tufts at least posteriorly at fore tibiae, behind wings, and on either side of scutellar tubercles; patches of appressed white hairs at outer faces of all tibiae and tarsi; a band of long raised or suberect hairs, broadest laterally, also on tergite 1, and compact lateral spots on 2—5. Middle of scutellum and sclerites behind this

Figs. 7—12. External view of ♂ right mid tibia, showing white pubescent pad; 7, *M. albifrons albovaria* (Montpellier, France); 8, *M. luctuosa* (Baarn, Netherlands); 9, *M. grandis* (Oran, Algeria); 10, *M. transcaspica* (lectotype Turkmenia); 11, *M. aegyptiaca* (Egypt); 12, *M. baeri* (Krasnowodsk, Turcomania)

invariably black 10

10. Antenna normal, reaching tegula, 3 less than twice as long as its width at apex, but distinctly longer than succeeding segments which, though always slightly longer than broad, vary somewhat in length, the distalia occasionally almost square. Body relatively short and broad, apical segments more rapidly tapered than in next species; pubescence longer and more conspicuous, all raised hairs on thorax directed straight up. Legs posteriorly and externally with many longish erect black bristles, long tufts of white on fore and mid femora, rather long and dense black (or white) fringes also on hinder pair. Outer faces of tibiae and tarsi reticulate-punctate, sculpture partly visible under pubescence; hind tibia distal to white hair-spot rather shiny, with short spine-like setae sparsely intermixed, but fringed with long bristles. Shape and vestiture of hind basitarsus much as in *rutenica*, subparallel-sided in side view and about four times longer than broad, not or scarcely expanded about halfway length, fringed with distinct thick marginal setae and long bristles. Scutellar tubercles greatly variable in shape and length, frequently very short or barely indicated though often straight and more or less pointed, directed obliquely upward and backward; even if spines are long then nevertheless much shorter than, and partly concealed by, surrounding pubescence. Abdominal tergites smooth and shiny, finely superficially and not very closely punctate, all punctures setiferous, much smaller than interspaces, smallest and least impressed on apical portion of tergite 1, but successively more widely spaced on next segments. White lateral spots compact, placed transversely in regular row, composed of long, depressed, finely branched hairs, all spots much broader than long except those on tergite 5, which may be smaller and almost circular. Remaining dorsal pubescence black, hairs suberect and partly branched, with longish black bristles sparsely intermixed at sides and on last two segments. Sternites dull, punctation variable, usually close, except rather broad hind borders of 1—4 more finely so and partly impunctate, all clothed fairly densely with mostly decumbent black hairs, like tergal pile clearly visible even at low magnification in side view; posterior borders impunctate. Tergal plate 7 tapering rapidly, the apex itself narrow, subparallel-sided and hairless; surface shiny, reticulate-punctate on each side of a broad, shallow, impunctate median sulcus; apex straight or slightly upturned, distinctly excised but depth of emargination variable, the side-angles either rounded or almost pointed; usually reddish brown or even paler. Lateral ridges of sternite 6 very low, invisible in side view. Shape of hidden sternites 7 and 8 variable, arms of 7 rather broad and straight (figs. 82, 85, 88, 92). Genital capsule of small size, 1.2 — 1.5 mm (incl. stylus); inner margins of gonocoxites divergent dorsally, the gonocoxal angle evenly rounded (fig. 90). Length 11 — 13.5 mm, fore wing 9.5 — 11 mm. Hab.: Central Europe, W. Asia . . . . **luctuosa** (p. 227)

— Antenna still longer and more slender, reaching back to beyond tegula; 3 almost twice as long as its width at apex, about one and one-fifth as long as next segments, which are all markedly longer than broad. Body relatively long and narrow, general appearance, pl. 2 fig. 7; abdomen elongate-oval, gradually diminishing in breadth, end segments less abruptly pointed than in *luctuosa* and many species resembling it; pubescence generally thinner and much shorter, raised hairs on dorsum and sides of thorax more inclined backward. Scutellar spines strong, straight or slightly downcurved, directed caudad, more exposed than in *luctuosa* though not exceeding tufts of surrounding long pubescence. Legs dull, more closely punctate than in *luctuosa*, reticulation finer but sculpture remaining partly visible under pubescence; most parts, including trochanters, with minute appressed hairs not quite concealing somewhat shiny surface; light tufts present on all coxae; conspicuous, long and more compact white and black hairs only at posterior ridges of fore and mid femora, those covering hind femora extremely short, dense and appressed, and hairs fringing blunt longitudinal ridge suberect, though visible only under a strong lens. Pile covering mid tibiae and tarsi short and depressed, concealing most of surface; outer face of hind tibia distally with few short erect spine-like denticles. Hind basitarsus visibly hollowed out externally, distinctly expanded in side view about halfway length, hence less than four times longer than broad, devoid of any long bristles at posterior border, only apical margin fringed with longish thick bristles. Abdominal tergites dullish, finely superficially and closely punctate all over, basal portions with smooth and rather shiny surface, but postgradular areas finely transversely wrinkled with more closely set punctures, those on apical tergites larger and still more crowded; hind margins narrowly impunctate. White lateral spots relatively small, varying in size and shape, placed in regular row, smallest in holotype (pl. 2 fig. 7); hairs decumbent, much shorter than in *luctuosa*. Remaining dorsal pubescence black; setae very short, suberect, partly branched; no longish black bristles, except few suberect hairs at sides of tergites and near apex on dorsum of 6. Sternites dull, evenly very closely punctate, all punctures setiferous and almost contiguous on distal sternites, the setae minute and in profile visible only at some magnification on two basal sternites; posterior margins not or very narrowly impunctate. Tergal plate 7 tapering gradually toward end; surface dull, flat or very slightly concave lacking median sulcus, clothed densely with elongate setiferous punctures, all setae depressed; lateral rims of apical portion not sharply pronounced, tip subtruncated, more or less translucent, the emargination crescent-shaped with rounded angles (holotype and one paratype, fig. 99), or only very shallow (one paratype); oblique submarginal ridges on ventral face of tergite distinct. Lateral tubercles of sternite 6 distinct though low and visible in side view. Sternites 7 and 8, fig. 100. Genital capsule small, 1.7 mm (type, incl. stylus); inner margins of coxites evenly curved dorsally, at first diverging, then parallel and finally slightly converging, the gonocoxal angle a little prominent and incurved though evenly rounded; gonostylus, fig. 101. Length 14 — 17 mm, fore wing 10.5 — 11 mm. Hab.: Turkestan . . . . **brevipila** (p. 235)

11. Mid tibial and outer hind tibial spurs reduced in size, both thick and spine-like, the former in profile less than one-third as long as apical breadth of tibia, the

latter shorter than half length of inner spur (which is slender and normal) and hardly half as long as apical breadth of hind tibia in side view. Hind femur posteriorly with dense fringe of erect black hairs much shorter than diameter of femur (see description). Outer face of hind tibia strewn with strong suberect black denticles showing through the pubescence. Vertex without glabrous area just outside each of the lateral ocelli and no impunctate areas on propodeum. Labrum squarish. Antenna strong, reaching to a little beyond tegula, flagellar segments 4—13 thick, scarcely longer than broad; rhinaria well developed, deeply impressed. Non-pubescent parts of abdominal tergites shiny, very finely superficially punctate. Body, inclusive of outer faces of legs, extensively white, head and thorax almost entirely so; this pubescence long and dense, forming large-sized depressed lateral marks on abdomen; sternites 2—5 on either side with transverse fringe of longish white submarginal hairs; 6 with pair of distinct low tubercles. Tergal plate 7 rather broad and flat, apex shallowly emarginate (fig. 164). Gonocoxal enclosure V-shaped, i.e. margins nearly straight and divergent, but angles (though rounded off) rather suddenly curving inward; gonostylus parallel-sided, apex almost squarely cut off, dorsobasal process setiferous, figs. 165—166. Size moderate, length 12 mm, fore wing 9.5 mm, wing expanse 22.5 mm. Hab.: Uzbekistan and Turkmenia . . . . **nivosa** (p. 257)

— Mid tibial and outer hind tibial spurs of normal size and length, i.e. the former subequal to apical breadth of tibia as seen in profile, the latter more than half as long as inner spur and at least ⅔ apical breadth of hind tibia in side view; spurs generally somewhat undulated, feebly angulated or S-shaped and/or slightly twisted. Other characters combined not as above 12

12. Labrum long and narrow, in frontal view almost twice as long as its breadth at base (100 : 51—53) almost parallel-sided (fig. 150). Face markedly porrect, clypeus squarish in dorsal view. Antenna slender, all flagellar segments longer than broad, 3 and 4 subequal; rhinaria distinctly impressed. Median mesonotal line slightly but distinctly sulcate. Upper surface of clypeus entirely concealed from view by a thick layer of very long and dense, appressed silvery hairs; sides at least partly white. Long and dense white posterior fringes at fore and mid femora, replaced on hinder pair by a comb of very short black hairs fringing median ridge posteriorly. Wings almost hyaline, all veins yellowish brown, marginal cell of fore wing and a cloudy streak along anterior border distal to it, ferruginous. Pubescence on head, thorax, legs and abdominal tergite 1 extensively white, hairs long, raised and (on mesonotum) dense, characteristically dowdy. White postero-lateral spots 2—5 large, placed transversely, most conspicuous on 3, all much broader than their interspaces, except on 2 abbreviated and rather narrowed inward; remaining pubescence black, all hairs somewhat raised, intermixed with longish white and black bristles at sides and on apical segments. Terminalia as in figs. 151—153. Small, sexually heterochromatic species: ♀ almost wholly black! Length 9 — 11.5 mm, fore wing 7.5 — 8.5 mm. Hab.: Egypt . . . . **angustilabris** (p. 251)

— Labrum in frontal view not nearly twice as long as its greatest breadth at base, usually only little longer than broad, sometimes squarish or even slightly broader than long. White tergal spots on 3—4, when present, not considerably broader than distance separating them and if so, then spots are not three or more times broader than high (see, however, *baeri* and *prophanta*). Often larger, not sexually heterochromatic, species 13

13. Body black (both sexes!), black-haired without any light markings, except a narrow, dirty brownish area centred on outer face of flattened mid tibial pad, and lateral tufts behind wings, the latter exceptionally dark: fore wing for the greater part dark brown with low purplish and blue reflections; veins almost black. M + Cu in hind wing coincident with cu-v, or nearly so. Vestiture of body and legs generally much shorter than usual, the raised hairs covering thorax, though dense anteriorly and at sides, hardly longer than diameter of tegula, and not much exceeding length of scutellar tubercles in perfectly fresh examples (holotype); tufts of longer hair present only on antennocular, genal and occipital areas, laterally behind wings, and on lower parts of thoracic sides. Raised hairs on post-scutellar sclerites sparsely distributed; suberect bristles on mid and hind legs and abdomen remarkably short. Large species, length 17 mm, fore wing 13.5 mm. For further details, see description, figs. 146—148 & pl. 3 fig. 13. Hab.: Egypt . . . . **fumipennis** (p. 248)

— Body at least with some white pubescence anteriorly on mesonotum, tufts on either side of scutellum behind wings, at outer faces of mid and hind tibiae, and/or laterally on one or more tergites of abdomen. Fore wing membrane often strongly infuscated but not strikingly dark brown. If body is wholly black, then fore wings are not exceptionally dark, legs and abdomen are partly clothed with longish hairs, and the size is smaller: length not exceeding 15 mm 14

14. Antennal segment 3 almost or fully twice as long as 4. Integument at outer face of distal portions of mid and hind tibiae brilliantly shining, surface uneven but strikingly polished, with few large, setiferous punctures and strong, triangularly flattened denticles fitting into somewhat raised sockets. Basitarsi more closely punctate but, like tibiae, punctures are strewn on more shiny ground than usual. Preapical tooth on pollex of mandible undeveloped, replaced by a low convexity (fig. 74). Antenna slender with distinct though feebly impressed rhinaria, which fade away distally and are absent on last three segments. Legs also thin and slender; compact patch of white covering outer face of mid tibia less conspicuous and sharply defined than in most other species; apex of hind tibia (fig. 63); inner rami of mid and hind tarsal claws broader and more flattened than usual (fig. 64). Fore wing membrane much obscured, mottled grey-brown with ill-defined subhyaline areas; part of fore wing venation, fig. 65; nervellus antefurcal. Abdomen rather glossy, punctation variable. Body pubescence generally long and fine, though rather fluffy and not very dense. Hidden apical sternites of characteristic form, especially sternite 7 (fig. 67); gonocoxal angle rounded (fig. 68). Pygidial plate of ♀ narrow and slender (fig. 70), resembling in shape that seen in the *albifrons* group. Length variable, 8.5—14 mm. For further details, see specific description. Hab.: From S France through the northern Mediterranean as far east as Iran . . . . . **fulgida** (p. 219)

— Antennal segment 3 less than 1½ times as long as 4 or even shorter. Integument at outer face of distal portion of mid and hind tibiae lacking strikingly polished and impunctate areas; if partly smooth and shiny, then surface is either finely tessellate or fairly closely punctate with or without interspersion of strong, tooth-like setae or spicules; apex of hind tibia not strongly produced externally. Plate of sternite 7 not as described and figured for *fulgida*, apex usually emarginate or bilobate and strongly setiferous 15

15. No raised black or white hairs of any length in the centre upon the bend at base of abdominal tergite 1. The latter relatively long, i.e., up to 4/5 length of 2 in dorsal view (average ratio 79 : 100), its subhorizontal part sloping rather abruptly into the declivous anterior face, but angulation rounded. All tergites noticeably dull (except occasionally slightly shiny on disk of basal and upon middle along hind margin of apical segments), integument exceptionally closely and finely punctate, all punctures in fresh examples bearing minute, decumbent or suberect dark setae, which are finely branched or plumose, most of the surface thus producing the effect of being bare and almost lustreless. Integument of mesonotum posteriorly, disk and sides of scutellum, as well as median area of postscutellar sclerites, sparsely black-haired or naked, the scutellar tubercles remaining well visible. White pubescence covering anterior portion of mesonotum shorter than usual, hairs scarcely longer than diameter of tegulae. Longer white hairs present on clypeus, behind antennae, at occipital border, on posterior angles of mesonotum in front of parascutella, behind wing bases, and on lateral thoracic sclerites; tufts of long white hairs often also around and/or below scutellar spines. Legs not at all hirsute: clothed with short hairs, hence lacking long bristles, except thin tufts at coxae and the usual white posterior fringes at fore and mid femora. Hind femur evenly closely punctate, laterally clothed with minute decumbent pubescence in addition to a posterior brush or comb of extremely short, closely set hairs. Black denticles at outer face of hind tibia not very strong or conspicuous, though frequently just visible amid the white pubescence. Outer faces of all tibiae and tarsi with appressed, predominantly white, tomentum; dense felt-like pad on mid tibia distinct, complete and well defined. Hind basitarsus invariably a little outbent. White abdominal spots conspicuous, sharply outlined, composed of matted hairs, as shown in the photographs (pl. 3 figs. 15—18). Labrum longer than broad or squarish. Antenna relatively slender, scape with dense lateral fringes of raised hairs that are longer than diameter of scape; rhinaria present, distinctly impressed. Paraocular region invariably with smooth impunctate area adjoining outer side of lateral ocellus. At least distal portion of fore wing membrane obscured. Tergal plate 7 broad, subtruncate, hind border variously emarginate; surface uneven, disk somewhat hollowed out between low rims. Paired ventral ridges or small tubercles present at apex of sternite 6, forming low wart-like projections, not prominently visible in profile. Gonocoxal enclosure U-shaped dorsally, the distal angle obtuse-angulate, either broadly rounded or slightly more suddenly deflecting, the angle itself always rounded off. Size rather large, length 14—18 mm 16

— At least a few long raised white or black hairs present in the centre upon the bend at base of tergite 1. The latter shorter, viz., at most slightly over 3/4 median length of 4 (ratio 66.8 : 100 or less), the surface generally less convex and sloping gradually into declivous anterior face of tergite, the transition accordingly more gradual. All tergites invariably somewhat glossy; integument often closely finely punctate but if so, then most microsetae are simple or less finely branched, frequently somewhat raised and not concealing the surface; this vestiture usually interspersed with longer setae or bristles, especially abundant at sides and gradular lines as well as upon disks of apical segments. Integument of posterior thoracic sclerites often partly exposed but most parts clothed with raised hairs exceeding diameter of tegulae in length, those surrounding scutellar spines usually concealing them from view. Tomentum covering posterior two pairs of tibiae and basitarsi invariably also interspersed with some longish hairs or bristles. Size variable 18

16. General appearance and body pattern, pl. 3 fig. 15. Mesonotum slightly biconvex, integument with median and parapsidal lines markedly sulcate, the impressed median line almost reaching scutellum, the parapsidal grooves subequal in length to transverse diameter of tegula. Disk of mesonotum and scutellum coarsely rugosely punctate, most punctures deep, confluent with irregular and shiny rugae; anteriorly and on either side of parapsidae punctures become smaller, circular and contiguous. No median scutellar line; tubercles short, robust, placed transversely, shape somewhat variable: either straight, forming an isosceles triangle, or more slender, compressed and spike-like, their surface punctate. White tufts below scutellar tubercles at least three times as long as these. Propodeal triangle dull, irregularly punctate, with vestigial impunctate area at its base; side angles filled out with 3—4 obliquely placed ribs. Raised pubescence covering head and thorax relatively long, the somewhat depressed hairs on mesonotum anteriorly concealing most of the surface; white at temples and low down on thoracic sides becoming black, hairs on posterior part of mesonotum and scutellum predominantly black. Parascutella hidden from view by a compact brush of deep black hairs. Distal two-fifth of outer faces of hind tibia and bases of mid and hind basitarsi black. Fore wing membrane beyond cells infuscated. White lateral spots at base of abdominal tergite 1 relatively small, placed far apart, subtriangular in outline, broadest basally, mainly composed of short appressed hairs but laterally at extreme base distinctly longer, tufty and suberect; spot on 2 broadly oval or subcircular, those on 3—5 more transverse and narrower, though broader than interspaces, becoming smaller posteriorly, apparently wanting on 6. Length 14.5—18.5 mm, fore wing 13—13.5 mm, wing expanse 30 mm (pl. 3 fig. 15). For further characters, see descriptions and figs. 168—172. Hab.: Uzbekistan to Pakistan; Turkey (?) & Israel . . . . **corpulenta** (p. 260)

— Combined characters not as above, but sculpture on dorsum of thoracic sclerites much as in *corpulenta*. Median mesonotal and parapsidal lines less distinctly impressed. Raised pubescence covering head and thorax shorter, white predominating, hair on mesonotum posteriorly and sides of thorax all white. Outer faces of mid and hind tibiae as well as the tarsi mostly white. All lateral abdominal spots large and sharply outlined, those at base of tergite 1 subrectangular, occupying most of the dorsal surface but abruptly narrowed inward to form pointed basal prolongations nearly meeting in the median line; spots on succeeding tergites also large and conspicuous though varying in shape and size 17

17. Labrum square. Stature slender, with elongate abdomen and slim legs; all femora and tibiae rather thin, the outer faces of mid and hind tibiae not noticeably convex. Fore wing membrane, subhyaline basal and anal cells excepted, abruptly and contrastingly dark smoky brown. Impunctate area on either side of lateral ocelli somewhat impressed, polished; a crescentic area along anterior border of median ocellus also impunctate though not impressed, small circular spot upon middle at some distance behind median ocellus. A small, somewhat shiny and finely wrinkled median impunctate area also at base of propodeal triangle, the latter closely punctate except that lateral angles are traversed by 3—4 irregular rugae placed in the long axis of body, less marked than in *corpulenta*. Clypeus above and paraclypeal area with silvery patch of mostly decumbent hairs not reaching anterior border medially; raised white pubescence covering rest of head, thoracic sides and underneath, short and rather sparse, hairs on mesonotum directed caudad, not exceeding length of tegulae and nowhere quite concealing surface. Facies and body pattern as in pl. 3 fig. 16. Length 15 mm approx., fore wing 10 mm, wing expanse 24.6 mm (holotype). Further details, see description and figs. 173—178. Hab.: Turkey (terr. typ.); Egypt, Israel and Libya . . . . **honesta** (p. 264)

— Labrum a little longer than broad. Stature more robust, with a larger head, broader abdomen and more swollen legs. Outer faces of mid and hind tibiae distinctly convex and more densely pubescent. Fore wing paler, membrane tinged much as in *corpulenta*, the distal half gradually becoming light brown. Impunctate areas surrounding ocelli as in *honesta*, except that there is no smooth spot behind median ocellus. Propodeal triangle closely punctate lacking definite median impunctate area, lateral angles distinctly rimmed but enclosed space devoid of rugae. Raised white pubescence covering head and thorax longer and more compact, hairs upon mesonotum raised but concealing most of surface, more abundant and much longer also at sides and underneath. Length 14 mm approx., fore wing 12 mm, wing expanse 28 mm. For further details, see description, pl. 3 fig. 17 & figs. 179—184. Hab.: Turkestan (terr. typ.); "Sarepta" . . . . **amanda** (p. 266)

18. White tergal spots on 2—4 distinctly transverse, much broader than deep, shallowly emarginate anteriorly, boundary not sharply delimited and contrasting at all sides. Clypeus above clothed with long, little diverging, suberect white hairs, as also the midfrontal and parorbital areas; clypeal hair not definitely spot-like and matted centrally but more fluffy and of unequal length, not concealing all of the surface anteriorly; sides of clypeus and malar area with long raised black hairs. Thorax clothed with long, not very dense, white pubescence, but lower parts of pleurae and ventral sclerites black. Tergal

spots 1—5 conspicuous, hairs on 1 very long and partly raised, on 2—5 transverse, depressed and band-like. Sternites partly with thin fringes of longish decumbent silvery hairs. Dense pad of short felt-like white pubescence covering outer faces of mid tibia incomplete and ill-defined: hairs thinning gradually toward base so as to leave integument partly exposed. Hind femur posteriorly clothed evenly with dense brush of erect brown hairs becoming increasingly longer toward base. Few long raised black bristles bordering hind tibia and basitarsus posteriorly. Inner rami of mid and hind tarsal claws only half as long as outer. Tergal plate 7 slender, sharply defined, perfectly straight in profile, bounded by a pair of subacute rectilinear ridges (fig. 155). Basal arms of sternite 7 unusually broad and flat (fig. 156). Genital capsule slender, enclosure U-shaped, gonocoxal angle evenly and broadly rounded, the diverging borders following an almost straight course toward lower edge of gonostylus, the latter short and broad, hollowed out within (fig. 158). Small species, length 10.5—11 mm, fore wing 8.7 mm. Hab.: Balearics, Romania, and from the Caucasus south into Turkey, Lebanon and Israel . **guichardi** (p. 254)

— White tergal spots on 2—4 varying in shape and size but nearly always sharply outlined anteriorly. Clypeus — if not entirely black above — with conspicuous silky patch (varying in size) of depressed, long and dense, mostly silvery white pubescence concealing the surface; these hairs, implanted from extreme base to beyond halfway length of clypeus, are straight and usually arranged fan-wise, either lying flat upon surface with tips pointing forward, or directed slightly upward, whether or not surpassing anterior border; long hairs covering sides of clypeus, malar space and lower portion of parocular area usually black and distinctly raised. Vestiture of body variable, but hairs at sides of thorax generally all white. Dense pad of short, felt-like pubescence covering outer face of mid tibia varying in size but invariably more sharply outlined, though occasionally obscured. Inner rami of mid and hind tarsal claws nearly always more than half as long as outer. Basal arms of sternite 7 longer and more slender; if short and rather broad, then outer borders of these limbs are more sinuous. Tergal plate 7 and other characters combined not as above 19

19. Gonocoxal angles in dorsal view prominent: the inflected inner margins of gonocoxites, which together form the boundary of the enclosure, at first divergent, rather V-shaped and almost rectilinear (*festiva* fig. 6), or else, more outbent and U-shaped, curved markedly inward round the bend, but in any case forming distinctly pronounced, occasionally subacute, gonocoxal angles (which themselves are rounded), the margins finally diverging again abruptly to reach the dorsobasal process of gonostyli in a straight or undulated line (fig. 344). If gonocoxal angles are only slightly incurved, viz. in *alcestis* and *alecto*, then hind femur is devoid of longish hairs. Antennal scape invariably clothed on either side with long raised hairs. Hind basitarsus in dorsal view always more or less outbent, the outer face at least slightly hollowed out (concave) in side view. Body pubescence variable, but black pile on abdomen usually well visible with a pocketlens (× 10); 2—4(5) conspicuous, compact, usually placed transversely though paired white tergal spots varying in size and shape, made

up of long hairs, which on disk of 1 are loose and raised, becoming gradually more crowded together and spot-like at sides, the tips of these tufts reaching or exceeding posterior border of tergite 20

— Gonocoxal angles in dorsal view not incurved, usually simply rounded: curvature of inner margins of gonocoxites embracing central cavity variable, the borders diverging more markedly before the bend of the open enclosure, but angles are at best subrectangular or, more frequently, broadly rounded, deflecting gradually in a broad curve toward dorsobasal process of gonostyli, either directly (as in fig. 134) or following an undulated course to become "bi-angulated", as e.g. in *leucorhyncha*, fig. 329 24

20. Hind femur closely, rather strongly punctate and short-haired, the vestiture quite inconspicuous and visible only with a powerful lens: short and decumbent at posterior face and along ventral longitudinal ridge, on which punctures are contiguous, beset with a brush, or comb, of extremely minute hairs hardly projecting beyond hind border in side view. Hind tibia and basitarsus entirely devoid of long, widely spaced, erect marginal bristles posteriorly, but on outer face of tibia the soft white and black hairs are intermixed with many strong, tooth-like black spicules. Base of hind basitarsus, just outside ventral ridge, with fairly well pronounced, finely punctate, flattened and shiny area, occupying from one-sixth to almost one-fourth of total length. Antenna much as in next species, intermediate segments slightly but distinctly longer than broad in frontal view. Fore wing membrane smoky grey-brown especially toward apex and in cell centres (wings in old worn males apparently clear) 21

— Hind femur similarly punctate but posteriorly devoid of short dense tomentum, clothed instead at all sides with much longer raised hairs which project caudad well beyond ventral (posterior) ridge, most hairs being at least one-fourth as long as diameter of femur, frequently much longer, especially toward apex. In lateral view the upper gonocoxal margins, just after the angle, follow an (almost) straight course toward lower distal edge of gonocoxite (fig. 228) . . 22

21. Gonocoxal enclosure widely V-shaped in dorsal view, but borders at first gently concave, then curving a little inward round the bend, from which point, after a short and slight concavity, they form a second obtuse angle (hence are "bi-angulated"), until finally diverging again, pursuing a long, shallowly incurved course (profile!) above the dorsobasal process of gonostylus, before reaching base of the latter (fig. 194). Impunctate area on either side close to lateral ocelli not impressed but very shiny and equalling ocelli in size. Legs more robust; hind basitarsus relatively long (100 : 27.7—30.1), nearly parallel-sided in side view. No row of conspicuous strong spines, just above shortest (external) spur, at apical border of hind tibia (fig. 190). Tergal plate 7 rather broad, sides converging with swollen border, tip subtruncated, shallowly emarginate, not upturned; disk flat, striato-punctate and hairy (fig. 191). Long raised black hairs at sides of clypeus and anterior porton of parocular area. Conspicuous tufts of long white hairs on posterolateral sclerites of thorax and roundabout scutellar tubercles, only narrowly separated by black on middle of scutellum.

Abdominal tergites rather shiny, all punctures larger and more deeply impressed than in next species, the black hairs longer and transverse white spots on 1—5 composed of longer hairs, while spots on 2—3 are oblique and not sharply delimited anteriorly. Hind margins of sternites only narrowly impunctate; gradular lines of 2(3)—5 conspicuously decorated with compact white spots on each side. Long soft pubescence covering sides of thorax and sternal faces all white. Body pattern, pl. 2 fig. 11. Size moderate, length 13—14, fore wing 10—10.5 mm, wing expanse 23.5—24.4 mm. For further details, see description and illustrations. Hab.: South European Russia and Israel (?) . . . . **alcestis** (p. 270)

— Gonocoxal enclosure U-shaped in dorsal view, inner margins at first gently concave, then almost straight though curving a little inward round the bend, from which point the margins diverge again, following an almost straight course toward ventral edge of gonostylus. Impunctate areas close to ocelli dullish, not pitted, unapparent or vestigial. Legs distinctly more slender than in *alcestis*, but hind basitarsus shorter (100 : 32—34.3) and more expanded in side view, its greatest breadth slightly beyond halfway length (fig. 195). Apical border of hind tibia, just above shortest (external) spur, with row of 5—6 robust black spines, which are longer than the strong tooth-like black spicules interspersed between the soft white and black pubescence covering its outer face. Tergal plate 7 a little broader, more finely and less distinctly rimmed than in *alcestis*; disk flat, hairless and distinctly more shiny, finely superficially striato-punctate, tips a little upturned (fig. 196). Only sides of clypeus black, parocular area white. Tufts of long white hairs covering posterolateral sclerites of thorax and roundabout scutellar tubercles shorter and less conspicuous, the latter small and broadly separated by black on middle of scutellum. Abdominal tergites more glossy, finely superficially punctate, the black hairs shorter than in *alcestis* and unapparent at low magnification; white spots on tergites 2—5 compact, composed of shorter hairs, those on 2—3 oblique anteriorly though sharply delimited at all sides. Hind margins of sternites broadly impunctate; no white fringes at gradular lines. Tubercles near apex of sternite 6 small, but more prominent than usual, just visible in lateral aspect (fig. 197). Long soft pubescence covering sides of thorax white upon hypoepimeral area and upper portion of mesepisternum, lower parts mixed white and black, or wholly black. Size moderate, length 14 mm approx., fore wing 10—10.5 mm. For further details, see description and illustrations. Hab.: From Turkey and Israel to Iraq and E Turkestan . . . . **alecto** (p. 273)

22\. Large species, length 16—21 mm, fore wing 12.5—14 mm (pl. 5 figs. 29—30). Tergal plate 7 of abdomen relatively narrow, sides strongly converging, very hairy and lacking a blunt carina, apex bifid, ending in a pair of closely approximated rounded tips, which are hairless, light coloured and separated by a deep crescentic V- or U-shaped emargination; surface slightly concave, punctate and densely hairy on each side of a complete elongate, somewhat shiny, naked and variably sculptured area (fig. 225, ventral side!). Tubercles at sternite 6 elongate, varying in size but always small, rather low and hairy, not or only just visible in profile. Dorsobasal process of gonostylus with both angles exposed and rounded off in side view (fig. 229). Propodeum coarsely punctate, but triangle invariably with distinct dullish median impunctate area varying in shape, usually with short impressed median line. Posterior faces of mid and hind femora throughout evenly closely punctate lacking impunctate spaces near apex. Inner face of hind basitarsus sulcate at full length, black hairs covering sides of depression suberect and longer than decumbent pile covering sulcus; no well defined smooth basal concavity of any length at ventral face just inside lower border, the latter evenly convex in oblique side view. Inner rami of mid and hind tarsal claws at least 4/5 length of outer. Body pubescence generally shorter, legs more slender and less hairy, than in next species, but mid and hind tibiae and basitarsi with admixture of longish raised marginal bristles; outer face of hind tibia throughout closely punctate, the tips of short, strong, black spicules clearly visible amid the soft hair. Fore wing membrane distinctly burnt brown beyond cells and, especially, toward apex of marginal cell and further. White tergal spots widely separated, placed far laterad, the hairs shorter, more compactly set, and spots on 2—3 better defined anteriorly, than in next species. Hair covering sternites all black. Antenna strong, intermediate segments slightly but distinctly longer than broad, more elongate than in next species. Silky white patch covering clypeus lying flush with surface and restricted to its dorsum, the hair tips just reaching anterior border. Hab.: see map 2 . . . . **grandis** (p. 286)

— Size smaller, length not exceeding 17 mm, usually less. Tergal plate 7 of abdomen variable, but usually broader, sides less strongly converging, bluntly carinate and hairy, apex straight cut off or shallowly (occasionally more deeply) emarginate, tips more apart and broadly rounded; surface flat or slightly hollowed out, disk sparsely, more broadly, striato-punctate, hairless and rather shiny (figs. 241, 250, 257, 259, 261 & 268, dorsal and ventral sides). Only distal angle of dorsobasal process of gonostylus exposed in side view (figs. 261, 273). Propodeum as in *grandis*, but sculpture of median area of triangle very variable in both species. Abdominal sternites with hind margins not or very narrowly impunctate; gradular lines often fringed with mixture of decumbent, bristle-like, white and black hairs, or with more condensed white lateral patches. Remaining characters combined not as above 23

23. Sternite 6 ventrally with pair of robust, elongate, subapical tubercles on each side of a suboval, less sclerotized area, these bosses either partly naked or hairy (fresh examples), but always plainly visible in lateral aspect (fig. 267). Ventral (inferior) face of hind basitarsus, just inside lower border near base, with distinct elongate-oval concavity, this sulcate area occupying from 1/4 to 1/3 of basitarsal length (occasionally hidden from view by overlying inner tibial spur), its surface slightly shiny, covered with minute setiferous punctures, the hairs minute and depressed; lower border in oblique lateral view shallowly but noticeably concave for about same distance as length of sulcate area (this concavity unapparent if basitarsus is looked at in straight lateral position!). Disk of tergal plate 7 slightly concave, clothed with short appressed brownish

hairs. Gonocoxal angle less abruptly hooked inward than in *festiva*, apex of gonostylus bluntly rounded. Outer face of hind tibia closely reticulate-punctate, basal 1/5 to 4/5 clothed densely with appressed, silvery white, finely branched hairs concealing surface, rest of tibia black; outer faces of hind tibia and basitarsus devoid of short, erect, spine-like black setae between soft, white

Figs. 13—18. External view of ♂ right mid tibia, showing white pubescent pad; 13, *M. leucorhyncha leucorhyncha* ("*ebusana*") (Mallorca, Baleares); 14, *M. leucorhyncha leucorhyncha* (Rodos I.); 15, *M. italica* (Italia mer., Zeller); 16, *M. festiva* (Vesperterminen, Switzerland); 17, *M. candida* (holotype Quetta, Pakistan); 18, *M. prophanta* (holotype, Lanzarote, Canary Is.)

and black pubescence (profile!). Raised white and black bristles at lower border of hind tibia and outer ridge of hind basitarsus much shorter and less numerous than in next species. Inner rami of mid and hind tarsal claws more than half as long as outer (fig. 266). Propodeal triangle usually with small, dullish, median impunctate area. Silvery patch covering clypeus made up of decumbent hairs, as described for *grandis*. For further characters, see description, pl. 6 fig. 35 & pl. 7 figs. 36—37, and illustrations. Hab.: see map 2. . . . . **tuberculata** (p. 300)

— Tubercles at ventral side of sternite 6 not conspicuously prominent, much as described for *grandis*, occasionally just visible in side view. No well marked elongate-oval concavity at base of ventral (inferior) face of hind basitarsus, a sulcate area, when present, unapparent, very short, the lower border of same rectilinear in oblique lateral aspect, or very shallowly concave. Disk of tergal plate 7 coarsely striatopunctate on slightly shiny ground, almost hairless (figs. 241, 261). Gonocoxal angle sharply pronounced, subacute (figs. 245—246, 264); apex of gonostylus usually truncated, its dorsobasal process subtriangular, mostly fringed with long, often finely branched bristly setae (figs. 246—247). Outer face of hind tibia (and/or basitarsus) somewhat more coarsely and less densely reticulate-punctate than in *tuberculata*, white pubescence more extensive, covering at least basal half; this external pubescence moreover with admixture of short, suberect, spine-like black setae whose tips are quite conspicuous (profile!). Broadly spaced white and black bristles fringing inner (lower) border of hind tibia and outer ridge of hind basitarsus, raised, more numerous and of greater length than in *tuberculata* (fig. 249). Inner rami of mid and hind tarsal claws generally shorter (fig. 237). Propodeal triangle usually without dullish median impunctate area. Silvery patch covering clypeus made up of long, slightly raised hairs directed straight forward, leaving clypeal surface partly exposed in front but surpassing a little the anterior border. For further characters, see description, pl. 6 figs. 31—32, and illustrations. Hab.: see map 2 . . . . **festiva** (p. 293)

24. Hind femur clothed at all sides with short hair, much as described above for *alcestis* and *alecto* (couplet 21), i.e. visible only at some magnification; sides occasionally more sparsely beset with longish raised hairs which do not, however, exceed one-third breadth of femur; posteriorly, the pilosity is dense, composed of very short and fine hairs of equal length, sometimes extremely closely set, appressed and directed sideways (*aegyptiaca*), apparent only with a strong lens; midventral ridge usually with brushy comb of equally short hairs not or hardly projecting beyond hind border in side view. If hairs at sides are somewhat longer (NW African *aegyptiaca*), then tergite 7 is elongate, quite flat and pubescent above, its apex truncated. Black pubescence generally short, especially on abdomen and most of legs, with longish raised black bristles only sparingly distributed at margins of hind tibia and basitarsus, and at gradular lines of sternites. Gonocoxal angle evenly rounded: borders of enclosure distal to the bend not undulated (bi-angulate). Antenna rather thick and strong, reaching back as far as halfway or full length of tegula, length-breadth ratios of

intermediate segments variable (figs. 128, 231 & 277) 25

— Hind femur more hirsute; midventral ridge often with comb of short, closely set raised hairs, as before, but pile at sides and along hind border of femur much longer, invariably plainly visible with a hand lens (x 10), projecting caudad well beyond the crest, becoming longer toward base, often quite conspicuously so and exceeding greatest breadth of femur. Black pubescence generally longer at all body parts and legs, hairs on abdominal tergites usually well visible (same magnification) 29

25. Long raised pubescence covering sides and ventral sclerites of thorax at least partly black, often predominantly so, subcircular patch of white restricted to upper portion of mesepisternum, usually also a tuft of black just in front of hind wing base. Tufts of white below wings and on each side of scutellum surrounding the tubercles forming transverse bands only narrowly interrupted by black at middle. Wings strongly darkened, smoky brownish black, fore wing darkest brown at forked main veins, at centre of submarginals and in marginal cell, membrane beyond cells with slight purplish reflex. Tergal plate 7 very broad, covering whole exposed surface of segment, sides converging, somewhat raised and swollen toward apex, which is blunt, very slightly emarginate with rounded angles; disk concave, surface striato-punctate and hairy only at sides, central part with low, broad, finely tessellate median ridge, the latter smooth and sulcate, often again narrowly divided lengthwise (fig. 210); ventral tubercles oblique, placed near inner margin (fig. 207). Swollen ridge of sternite 6 hairy, very low and unapparent. Apex of sternite 8 deeply triangularly excised (figs. 203, 208, 211—213). Labrum square, broadest at middle, disk almost flat. Maxillary palpi 6-segmented, but last joint usually vestigial or absent. Silvery patch covering clypeus lying flush upon surface, most hairs directed straight forward with tips not reaching anterior border. White mid tibial pad broad and sharply defined, with black anterior streak, composed of very compactly set short hairs lacking admixture of short black spicules (fig. 10). White tergal spots large, compact, sharply outlined, except condensed lateral tufts of white forming arched collar at base of tergite 1; spots on 2 more or less curved and crescentic, tapering inward, their anterior limit nearly always distinctly concave (pl. 4 fig. 22). Sternites black. Large species, length 15.5—19.5 mm, fore wing 12.5—13.5 mm, expanse 30 mm (pl. 4 fig. 22). Hab.: see description . . . . **transcaspica** (p. 275)

— Long raised pubescence covering sides and ventral sclerites of thorax all white, except black on metepisternum and posterior parts. Wings much lighter, bases clear or subhyaline, fore wing gradually growing darker, grey to grey-brown, toward apex, light brown (or more contrasting) streaks or spots only at end of radial and marginal cells, and centres of submarginals. Tergal plate 7 more rapidly tapered, disk never bisulcate medially. Apex of sternite 8 not so deeply excised. Maxillary palpus 6-segmented (unknown in *candida*). Abdominal tergites less closely, more finely punctate and shiny 26

26. Tergal plate 7 slender, tapering gradually toward end, sides rectilinear, densely brown-haired mixed with longish depressed bristles, apex truncated or

shallowly emarginate, sides and rounded angles swollen, often distinctly upturned, yellow-brown; disk flat or slightly concave, surface dull, reticulate-punctate but in fresh examples covered with golden brown, decumbent hairs completely hiding the surface, only the tip remaining bare (fig. 132), lower border of tergite below plate with fringe of rather long dark brown bristles. Body more elongate than in *baeri* and *transcaspica*. White tergal spots 2—5 relatively small, placed wide apart in regular row, diminishing gradually in size, spot on 2 often somewhat ill-limited and concave anteriorly, the one on 5 nearly always present, though small, subrectangular (pl. 4 figs. 19—21). Legs slender. Posterior (inner) faces of hind trochanter and femur, in addition to short black pile, clothed all along midventral ridge with regular row of exceedingly dense and fine decumbent hairs concealing the surface; these matted hairs are of even length, directed obliquely caudad and apicad, the tips not or scarcely projecting beyond hind border of femur; colour dark brown in certain lights. Hind basitarsus hardly expanded, subparallel-sided in side view, length-breadth ratio 100 : 30—30.6, scarcely to moderately outbent in dorsal aspect. White mid tibial pad rather narrow, some black spicules interspersed and visibly projecting at least toward apex of tibia (fig. 11). Silvery patch covering clypeus fan-like, hairs slightly raised, tips exceeding anterior border; long raised hair at sides of clypeus upon paraocular area black up to level of antennal base. Body pubescence generally longer than in *baeri* and *candida*. Structural features, figs. 127—145. Size moderate, length 13—16.5, fore wing 11—12 mm. Hab.: see map 1 and also Canary Island Lanzarote (sub *lindbergi* Lieft., syn. nov.) (pl. 4 figs. 19—21) . . . . **aegyptiaca** (p. 244)

— Tergal plate 7 not as above, more distinctly sulcate: disk narrower, median area at least partly exposed, shiny and hairless, the apex pale, shallowly emarginate between slightly upturned tips (figs. 186 & 233). Tergal spots 2—5 conspicuous, much larger and made up of more closely set hairs, than in *aegyptiaca*. Hind basitarsus more expanded at about halfway length 27

27. General appearance, pl. 3 fig. 18. Stature more slender and size smaller than in next two species, length 14 mm, fore wing 10 mm. Median mesonotal line distinctly impressed, obliterated, irregular and punctatę, punctures on middorsum on either side of line strong and deep, in some places larger than somewhat shiny interspaces. Distance separating ocelli about equal to their own diameter; a conspicuous, slightly impressed shiny impunctate area outside and just behind each lateral ocellus. White collar at base of tergite 1 subinterrupted medially, forming well defined lateral spots composed of condensed, mostly appressed fine hairs, spots on 2 almost squarely cut off inward. Short hairs covering sternites mainly black, but 2—5 each with pair of small, well defined, submarginal white spots. Raised hairs on paraocular area shorter than in next two species, black upon antero-lateral part of clypeus but soon becoming white upward along eye margin. Short vestiture of hind femur much as described for *aegyptiaca*, but matted stripe bordering midventral ridge less conspicuous, darker, and composed of still shorter hair, the ridge itself better defined toward apex. Mid and hind tibiae and tarsi almost wholly white

externally (fig. 185), mid tibial pad (fig. 17) convex, composed of very short and dense, silky and shiny tomentum, the curved apical process partly hidden and disk almost lacking black spicules shining through the pubescence; a dark streak present along anterior border of pad. Lower margin of hind basitarsus more evenly convex than in *baeri*, but length-breadth ratio similar. Fore wing membrane more evenly and deeply brown on outer half than in *baeri* and *prophanta*. Punctation of abdomen rather dense, punctures much smaller than interspaces. Tergal pattern as shown in pl. 3 fig. 18. Median area of tergal plate 7 at first convex with few elongate punctures, then flat and almost impunctate (fig. 186). Terminalia, figs. 186—187. Capsule smaller than in *baeri* and *prophanta*, 1.6 mm long; dorsobasal process of gonostylus twofold, but distal branch much narrower in side view (fig. 188). Wing expanse 24 mm. Hab.: Baluchistan . . . . **candida** (p. 268)

— Stature more robust and size larger: length 16—18 mm, fore wing 11.5—13 mm. White collar at base of tergite 1 complete and broad but concave behind, hairs condensed and spot-like, longest and raised at sides. Shiny area outside and just behind each lateral ocellus unapparent and small. Short pile covering sternites all black. Mid tibial pad distinctly more flattened, composed of somewhat longer and less closely set hairs. Hind basitarsus a little narrower basally than in *candida*, length-breadth ratio 100 : 33—36. Body pubescence generally longer, the white tufts behind mesonotum conspicuous, only narrowly interrupted by black upon middle of scutellum. White tergal marks shaped differently 28

28. White tergal spots 3 and 4 exceptionally transverse, broader than the distance separating them, those on 2 and 5 subequal in breadth to the interspaces. Mesonotum not sulcate medially, dorsum evenly convex but median line distinct, somewhat raised, its course irregular. Labrum devoid of an incomplete median carina. Apical segment of maxillary palpus longer and more slender than usual (fig. 232). Ocelli closely approximated, separated by a space less than one-half their own diameter. Legs more slender than in *baeri*; short vestiture of hind femur as described for *candida* but all hairs raised and black, lacking matted stripe bordering midventral ridge, the latter subacute only at distal one-fourth or less. Subbasal one-fifth of fore tibia and basal half of hinder pair white externally, rest black. All basitarsi entirely black, the distalia partly white; hind basitarsus less markedly outbent than in *baeri*, covered all over with setiferous punctures. Mid tibial pad narrow, abbreviated basally, dark anterior streak poorly indicated (fig. 18). Wing bases hyaline, veins very dark; fore wing with ends of distal cells, centres of submarginals as well as whole marginal cell and papillated border, dark grey, more contrastingly variegated than in *aegyptiaca*, *baeri* and *candida*; distal side of third submarginal cell slightly more angulated than in *aegyptiaca*. For more details, see description and illustrations, figs. 231—236. Hab.: Canary Is. (Lanzarote) . . . . **prophanta** (p. 290)

— White tergal spots placed in regular row, less transverse and also slightly deeper than in *prophanta*, those on 2 and 3 subrectangular, squarely cut off inward and on 2 distinctly less broad than the distance separating them. General appearance and pattern, pl. 2 fig. 12. Median mesonotal line indistinctly sulcate, but integument slightly depressed midposteriorly. Labrum somewhat longer than broad with subacute median carina, broadest at apex, occupying distal one-fourth; anterior border a little upturned (fig. 216). Apical joint of maxillary palpus shorter than preceding segments. Ocelli farther apart, distance separating them subequal to their own diameter. Legs more robust, tibiae and basitarsi more expanded, mostly white, including distitarsi; short pile covering hind femur as described for *candida*, with distinct matted stripe bordering midventral ridge, the latter blunt. Nearly whole outer face of fore tibia and basal three-fourths or more of hinder pair white; hind basitarsus distinctly more outbent and a little broader than in *prophanta*, punctation similar but entirely hidden under appressed white hairs. Mid tibial pad occupying almost whole outer face, with few bristles forming thin black streak along anterior border; few black spicules only along posterior border (fig. 12). Distal half of fore wing membrane only little lighter and more evenly tinged with brown, than in *candida*, not dark grey and much less contrasting, than in *prophanta*. Disk of tergal plate 7 finely transversely wrinkled with few punctures at extreme base; tips hairless, light brown, directed straight back, gently rounded (fig. 220). Terminalia, figs. 220—221; sternite 7 with deep, V-shaped incision. Capsule of large size, 2 mm long, dorsobasal process of gonostylus twofold, the distal branch largest, abruptly outbent, oval in side view. Hab.: Kazakhstan; Turkmenistan . . . . **baeri** (p. 282)

29. Median mesonotal line impressed, markedly sulcate middorsally, sulcus closely punctate and partly replacing the line, concealed anteriorly under long and fine, grey-white raised pubescence. General appearance, pl. 8 fig. 40, facies very similar to *italica* (pl. 8 figs. 38—39). Antenna strong, rhinaria as in *italica* (fig. 277), length of 3 slightly exceeding 4, all segments 4—13 a trifle longer than broad (fig. 295). Clypeus with broad patch of long, suberect silvery hairs occupying whole dorsal surface, the tips exceeding anterior border; hairs at sides long, raised, black. Scutellum black, a few white hairs only at side of tubercles. Thoracic pleurae all white. Hind femur clothed densely all over with setiferous punctures, but hairs noticeably shorter than in *italica*. Hind basitarsus even more expanded and outcurved than in *italica*, broadest slightly beyond halfway length. Fore wing membrane somewhat darker beyond cells. Body pubescence rather long, but all hairs shorter than in *italica*. Abdomen distinctly less shiny, more closely punctate, all punctures larger and deeper, than in *italica*. Base of tergite with thin collar of long raised white hairs, similar to that species; spots on 2—4 more defined, those on 3 a little broader and more transverse than on 2, slightly indented by black posteriorly, 5—6 unmarked. Fore more characters and structural details, see description and figs. 295—300. Hab.: Egypt . . . . **assimilis** (p. 318)

— Median mesonotal line not impressed, impunctate, usually well visible though often concealed from view by long pubescence 30

30. Species of eastern range (Transcaspian). Wings almost or entirely hyaline.

Sides of clypeus as well as paraclypeal area clothed with long raised black hairs. Head and thorax (including sides of latter) predominantly white. White tufts behind wings and surrounding scutellar tubercles conspicuous, coalescent on each side of a narrow black-haired area on middle of scutellum, much longer than tubercles. Legs white-spotted and abdomen also with fairly regular row of white spots on each side of tergites 1—5, or those on 1 dispersed, forming a thinner collar of much longer raised white hairs. Pile fringing hind femur posteriorly also erect, black, shorter than diameter of same, no subapical impunctate area at lower face along posterior ridge 31

— Species of more western distribution (Atlanto-Mediterranean to Iran). Wing membrane frequently much darkened beyond cells or wholly obscured, more rarely almost or entirely hyaline. Body marks very variable. Pubescence occasionally entirely black 32

31\. White pubescence long and decidedly fluffy, concealing much of the surface on mesonotum and sides of thorax, the short raised hairs covering abdominal segments black, well visible with a hand lens (profile!). Punctures on vertex as well as on dorsal and posterior sclerites of thorax separated by narrow lustreless ridges; no apparent impunctate areas in front of median and beside lateral ocelli. Body compact, thick-set, thorax and abdomen broad, the latter more shiny than in *sibirica*, cordiform, rapidly tapered, length-breadth ratio 100 : 83 approx. (pl. 2 fig. 8). Antenna thick and strong with deeply impressed recessed rhinaria, but flagellar segments a trifle longer than broad. Legs more expanded, hind basitarsus relatively broad, lower border distinctly convex, length-breadth ratio about 100 : 36. Tergal spots comparatively large, well defined, composed of rather long hairs, placed in regular row, spots on tergite 5 a little broader than deep. Disk of tergite 7 shallowly concave, rather shiny, clothed sparsely with short hairs, surface striato-punctate, except at extreme tip (fig. 118). Body length variable, from 12 (holotype) — 16 mm (pl. 2 figs. 8—9). Hab.: Turkestan (Uzbekistan) and "Alai" . . . . . . **turkestanica** (p. 239)

— White pubescence markedly shorter, the white hairs on mesonotum and thoracic pleurae less dense, more even and mostly of equal length, nowhere entirely hiding the surface, short erect black hairs covering abdomen (except on tergite 1) less easily perceptible. Punctures on vertex and mesonotum-scutellum separated by narrow, somewhat shiny ridges, small areas just in front of median and beside lateral ocelli remaining impunctate, or beset with few scattered punctures. Body elongate and of more slender form, abdomen distinctly less shiny and closely punctate, gradually narrowed toward apex, length-breadth ratio 100 : 70 approx. Antenna and legs thinner, rhinaria less deeply impressed, but flagellar segments of antenna scarcely longer than broad. Hind basitarsus more nearly parallel-sided, length-breadth ratio about 100 : 28. Tergal spots of much smaller size, composed of shorter hairs, those on tergite 5 very small, subcircular. Distal side of third submarginal cell less abruptly angled than in *turkestanica*. Disk of tergite 7 more distinctly hollowed out and more shiny, at most with few scattered punctures, surface minutely transversely striated. Structural details, figs. 103—111. Size small, length

12—13 mm. Hab.: Tadzhikistan, E Kazakhstan . . . . **sibirica** (p. 236)

32. Scutellar spines distinctly downcurved, strong and cylindrical, only little shorter than midlength of scutellum, at least three times as long as their width at base and usually a little longer than the distance separating them; spines parallel, well visible in profile but shorter than surrounding pubescence, at first directed obliquely upward and backward, then downbent and gently tapering to a blunt point; laterobasal edges of scutellum usually a little swollen or even tubercular (fig. 303). Pile roundabout hind femur of moderate length, hairs in side view shorter, of equal length and more closely set, rather comb-like along posterior ridge. Antenna thick and strong, flagellar segments scarcely longer than broad, 3—4 as in fig. 302; scape clothed densely all around with raised hairs, longest at sides and white on internal, black on external faces. Patch of silvery hair covering clypeus flat, fan-like, though all hairs are directed obliquely upward with tips distinctly surpassing anterior border. White tufts below scutellar spines conspicuous, almost continuous with white behind wing bases, but separated across middle by a much narrower black-haired space between spines. Fore wing membrane distinctly infuscated especially beyond cells and (usually) in cell-centres. White pubescence on thorax at sides and underneath divided by a zone of black hairs slightly below midway down. Outer faces of hind tibia and basitarsus punctate, interspaces rather shiny, tibial pilosity mixed with black spicules; dorsal margin of both fringed with longish bristles. No hairless suboval groove or pit near base on lower face of hind basitarsus, the latter slightly outbent and concave externally, little expanded about middle; white external pad covering mid tibia elongate, not reaching apex of segment. Thorax strongly convex above, abdomen broad and compact. Raised white hairs at base of tergite 1 long, collar-like, lateral spots of 1—5 large, made up of rather long hairs, 1—3(4) transverse but far apart, subquadrangular in shape, thick and compact. Sternites invariably black. Tergal plate 7 variable but median area usually smooth and shiny with scattered punctures on each side of an (occasional) low median ridge; apex shallowly (rarely more distinctly) emarginate, the tips a little upturned (fig. 304, ventral aspect). Gonocoxal angle broadly rounded or feebly bi-angulate, the dorsobasal process of gonostylus either as in fig. 308, or distinctly longer and more tapered. Sternites 7 and 8 as in figs. 306—307. Size small, length 9—13.5, fore wing 8—10.5 mm. Hab.: Canary Is.: Tenerife (terr. typ.), Gran Canaria & Gomera . . . . **curvispina** (p. 320)

— Scutellar tubercles varying in shape and size, usually shorter and only very rarely somewhat downcurved. Remaining characters combined not as above 33

33. Body compact (most characteristic "facies", pl. 8 fig. 38), rather like *grandis* and *assimilis*, but all parts more hairy. Thorax high, abdomen short, broadly cordate, more flattened than usual, widest at end of segment 2, then rapidly tapered, length-breadth ratio 100 : 90 approx. Antenna not very long but unusually thick and strong, median segments square or even slightly broader than long, with deeply impressed rhinaria (fig. 277). Scutellum mostly black:

white tufts when present usually small and placed just beside or behind tubercles. Hind femur punctate also along posterior (inner) faces, lacking smooth and shiny area extending alongside posterior ridge and hairy all over, especially posterior fringes long and raised: the vestiture nearest base frequently longer than diameter of femur. Mid tibia expanded, felt-like pad well defined, broad and flat, the hairs very dense, usually pure white (fig. 15). Third submarginal cell relatively long, distal side not sharply angulated, but cell rarely longer than high. Very long, erect, mostly white hairs all along base of tergite 1; spots on 2—4(6) also consisting of longish hairs, their shape and size irregular and very variable, becoming either smaller or larger caudad, but when all spots are present usually largest on 2 and often not sharply outlined, frequently vestigial or absent on posterior tergites in melanistic populations. Sternites unspotted. Tergal plate 7 narrow, sides converging, disk nearly always hollowed out, broadly sulcate and smooth medially (occasionally dull and short-haired!), apex deeply emarginate between closely approximated slightly upturned tips (figs. 278, 288). Gonocoxal angle evenly, broadly rounded, very rarely feebly bi-angulate. Size very variable, 10.5—17 mm, fore wing 9.5—13 mm. See further notes in description, and also *leucorhyncha* and *assimilis* (p. 318). Hab.: From Portugal in the west throughout the whole Mediterranean excluding most of Turkey (see map 3) . . . . **italica** (p. 309)

— Characters combined not as above: antenna less thick and swollen, body usually more slender and less hairy, end of abdomen less abruptly tapered; vestiture generally shorter, especially on dorsum of thorax and at hind femora 34

34. Closely similar in general appearance, size and antennal structure to *turkestanica* from Alai (pl. 2 fig. 9); length 14—16 mm, fore wing 11—12.5 mm. Differences are: white body pubescence, especially on summit of head, mesonotum and abdominal tergite 1 shorter, denser and more even, white and black parts more contrasting. Whole dorsal surface of head closely punctate, but all punctures larger, not quite contiguous in front of median ocellus, a small area just beside each lateral ocellus moreover impunctate, the interspaces, where present, finely tessellate and slightly shiny. Punctures on mesonotum correspondingly less crowded than in *turkestanica*. Wings darker, fore wing membrane distinctly infuscated beyond cells; third submarginal slightly shorter and less strongly angled. Sculpture and shape of legs much the same, but hind femur more densely pubescent at all sides, raised hairs fringing posterior border markedly longer, some almost equaling breadth of femur in side view. Upper border of hind basitarsus (length-breadth ratio 100: 34) nearly rectilinear and beset with long black bristles much as in *italica* (fig. 123), no distinct ventrobasal concavity. Abdomen somewhat more glossy, tergal punctures more widely spaced and superficial; also raised black hairs more finely branched, spots 2—5 a trifle larger and more transverse, than in *turkestanica*. Tergal plate 7 distinctly broader, more trapezoidal, than in that species, surface quite flat with more pronounced and somewhat convex lateral ridges, apex subtruncate or shallowly emarginate, edges almost rectangular,

tips little or not upturned (fig. 124); sculpture as in *turkestanica*. Sternal plates 7 and 8 variable, though generally as in last species, limbs of 7 distinctly more slender and curved. Gonostylus and its dorsobasal process of characteristic shape (fig. 125). Hab.: Cyprus (terr. typ.), Turkey, Israel, Iran .**megaera** (p. 243)

— Size smaller, body length (abdominal segments in natural, non-extended, position) never exceeding 13 mm. Shape of tergite 7 very variable but more narrowly tapered, apex usually distinctly emarginate. White tergal spots, when present, generally smaller, those covering sides of 2—3 frequently somewhat broader than deep but more often subcircular. Whole propodeal area very closely, coarsely punctate. All abdominal sternites black; graduli beset with longish bristles at sides of tergites and along full breadth of sternal plates. Other characters combined not as before 35

35. Apex of abdominal tergite 7 strongly and abruptly tapered, disk almost flat, shiny, finely tessellate with few deep, scattered, striato-punctures on each side of narrow median area; lateral rims conspicuously swollen, ending in a pair of blunt tubercles, the hind margin deeply emarginate, U-shaped (figs. 316, 321). Antenna comparatively long and slender, relative lengths of 3—4 as in fig. 313 (holotype), succeeding segments slightly but distinctly longer than broad; rhinaria on 3—12, oval, moderately deeply impressed. Median mesonotal line extremely fine, incomplete posteriorly. Labrum square, or a little broader than long, not produced medially, distal portion without well defined median ridge. Fan-like silvery patch covering clypeus consisting of long, decumbent, silky hairs projecting markedly beyond anterior border. Body pubescence predominantly black; head, thoracic sclerites and legs variably tufted with white, but abdomen (except some white on either side of tergite 1) nearly always totally black. Hind tibia and basitarsus normally proportioned, much as in *leucorhyncha* (figs. 330, 347). Wing membrane strongly infuscated. Structural details (figs. 313—319, 321). Hab.: Lanzarote (terr. typ.) and Fuerteventura (Canary Is.) . . . . **caroli** (323)

— Apex of abdominal tergite 7 broader and less tapered, lateral rims not markedly raised or swollen, tip not so deeply excised, the emargination shallow (rarely more deeply scalloped: *leucorhyncha* from Libya, fig. 327), more nearly crescent-shaped; disk finely transversely wrinkled, usually distinctly striato-punctate on each side of broader median area. Antenna less slender, length of segments variable, but 3—12 at most a trifle longer than broad, squarish, or even a little broader than long. Pubescence on head and thorax much as in *caroli*, but wing membrane invariably lighter, and white lateral spots on tergites 2—4 only rarely wanting (*gracilipes* from Menorca) 36

36. Legs very slender, all femora, tibiae and basitarsi noticeably more elongated than in allied species (see description and cf. figs. 330 & 341); hind basitarsus more outcurved and also more distinctly hollowed out externally, than in all *leucorhyncha* populations (i.e., incl. "*ebusana*" and subspec. *taormina*); all black, inclusive of very long fringes at posterior ridges of fore and mid femora, which are twice as long as greatest diameter of same, those on hinder pair much shorter. Antenna stronger than in *caroli*, 4—12 hardly longer than broad,

almost square. Body pubescence long and tufted, hair upon clypeus semierect, pointing straight forward, white only upon middle, the rest black; long lateral fringes at antennal scape black anteriorly, those at occipital ridge mixed black and white. Abdomen throughout black, inclusive of nearly all thin raised hairs upon basal portion of tergite 1. For further details, see description and figs. 341—343. Hab.: Menorca (Balearic Is.) . . . . **gracilipes** (p. 332)

— Legs not unusually slender, hind tibia and basitarsus broader (figs. 330, 347). Antenna still somewhat stronger than in *gracilipes*, usually square but occasionally a trifle broader than long (*l. taormina*) 37

37. White-haired areas on whole body extensive, *luctuosa*-like: fan-shaped silvery patch upon clypeus broad, covering whole upper surface, composed of long hairs lying almost flush with clypeal surface, tips projecting beyond anterior border; frons, lower part of temples, long fringes on either side of antennal scape and along occipital ridge; whole mesonotum and most of thoracic sides; conspicuous tufts behind wing bases, those beside (and partly surrounding) scutellar tubercles spot-like, the processes varying much in shape and length but always shorter than white hairs concealing them. Legs black: inner face of hind femur punctate on shiny ground, punctures more widely spaced toward end; hair short, black. Outer faces of all limbs white in places: long (partly black) fringe at base of fore femur and tibia, and spots covering all tarsal distalia, the basitarsus remaining black; long posterior fringe at mid femur and large, elongate, felty pad at tibia of same (figs. 13—14), and all tarsal distalia; hind tibia with oval patch covering its basal one-third, an oblique subtriangular area on lower one-third to four-fifth of basitarsus as well as all distalia, likewise white. Wings subhyaline, membrane of fore wing gradually changing to pale brown toward apex; third submarginal cell varying in length, outer side moderately angled. At least tergites 1—4 of abdomen with broadly spaced white tergal spots, often 5 also with subcircular dots or points, all placed in regular row; spots on 1—2 made up of much longer hairs than on succeeding tergites, at base of 1 forming a distinct broad collar of tufted, semierect hairs, condensed at sides and equalling length of whole tergite. Distance separating spots on 2—4(5) averaging little less than four times their transverse diameter, the spot on 2 usually largest. Colour and structural details (figs. 13—14, 322—332 & 344—357). Hab.: Discontinuously, on Balearic Is. (Mallorca & ? Ibiza), the S and E Mediterranean (except Italy, Tyrrhenian Is., and Malta); parts of Greece, the Ukraine and all over Asia minor (see map 3). For comments on eastern forms, see description and illustrations . . . . **leucorhyncha leucorhyncha** (p. 325)

— Structural characters and — remarkably — also wing colour and venation, as before, but vestiture generally much darker than nominate subspecies: silvery patch upon middle of clypeus narrower, though conspicuous, in sharp contrast with otherwise deep black pubescence covering rest of head; hairs fringing antennal scape and occipital ridge also black (occasionally a little white interspersed). White pile on mesonotum anteriorly and thoracic pleurae stopping short at level of hind margin of tegulae, white tufts behind wing bases and around scutellar tubercles almost all replaced by black; posterior fringes and spots at outer faces of legs likewise much less extensive, mixed black and white, or wholly black; felty pad at mid tibia narrower, completely surrounded by black. Abdominal tergites black, collar-like band of white at base of 1 thin, almost linear, interrupted by black medially, the longish hairs at sides white-tipped only; remaining tergites all black, or 2—3 with mere vestiges of white only at sides of 2(3). Colour design and structural features (figs. 333—340 & pl. 8 fig. 41). Hab.: Italy, Tyrrhenian Is. (terr.typ. Sicily), and Malta (♂ Sardinia and Malta unknown!). For remarks on intermediate forms, see description (and also map 3) . . . . **leucorhyncha taormina** (p. 330)

FEMALES

(Characters of the two groups of the *M. albifrons* alliance are incorporated in the key to the males; females of the new species *M. alcestis*, *candida*, *gracilipes* and *prophanta* are still unknown)

1. Labrum long and narrow, as in male, only little less than twice as long as its breadth at base (fig. 150). Body structure generally as described for male, but vestiture wholly different: Body entirely black, very exceptionally partly light-haired (see description). Antenna more slender than in male, all flagellar segments relatively longer. Wing membrane considerably darker, only bases subhyaline, for the rest dark smoky brown, especially in and beyond marginal cell, cell centres and whole papillate distal area of fore wing; length and depth of third submarginal cell equal. Pygidial plate (fig. 154) slender, not downbent, broad at base, sides of proximal portion converging, the distal half narrow, subparallel-sided, with distinctly convex median ridge. Size small, length 9—11.5 mm, only one specimen (from Wadi Riched) being much larger, 14.5 mm. Hab.: Egypt . . . . **angustilabris** (p. 251)

— Labrum in frontal view not nearly twice as long as its greatest breadth at base or about halfway length, usually only little longer than broad, sometimes squarish or even slightly broader than long. Pubescent body markings not strikingly different in both sexes 2

2. Large species, length 16.5—19.5 mm, fore wing 13—14.5 mm. Similar to male (pl. 3 fig. 13). Body black, entirely clothed with short, sooty black pubescence, lacking any light coloured markings, except occasional greyish hairs on either side of mesonotum in front of tegulae. Fore wing membrane still darker brown than in male, with slight purple and bluish reflections; lighter coloured areas as in male. Body texture also similar, no obvious impunctate areas on vertex and propodeum, except smallish spot in front of median ocellus; median mesonotal line feebly sulcate posteriorly. Vestiture of whole body much shorter than usual, the raised pubescence covering mesonotum and scutellum hardly longer than tegula. Legs slender, sparsely clothed with longish hairs; hind femur throughout closely, finely punctate, except narrow, somewhat shiny area to the outside near apex of blunt median ridge. Spine-like setae covering outer face of

mid and hind tibiae short, not conspicuous, as little as the suberect bristles, though the latter are longer than in male; inner rami of mid and hind tarsal claws about half as long as outer. Antenna much slenderer than in male; all flagellar segments distinctly longer than broad. Pygidial plate (fig. 149) brown, evenly and slightly downbent, the distal one-third obscured; surface extremely finely, transversely reticulated, with or without few small punctures. Hab.: Egypt . . . . **fumipennis** (p. 248)

— Combined characters not as above 3

3. Antennal segment 3 fully twice as long as its width at apex and up to twice as long as 4, the latter subequal to next segments, which are a trifle longer than broad. Wings relatively longer and broader than usual, membrane strongly infuscated, third submarginal cell usually longer than high, its distal side markedly projecting and strongly angled. Pubescence covering head and thorax rather fluffy, as in male. Scutellar sclerites invariably all black, lacking long white tufts around short tubercles; white tufts behind wings isolated. Pygidial plate (fig. 70) slender, long and narrow, up to twice as long as its breadth at base, not or scarcely downbent; surface flat and shiny. Legs slender, outer faces of mid and hind tibiae and basitarsi not very hairy, beset with short thick spicules on uneven, smooth and very shiny ground, especially notable on distal half of hind tibia, the latter closely tessellate-punctate and white-spotted only on basal half. Inner rami of mid and hind tarsal claws about half as long as outer, though broader than usual, resembling those of male and recalling *albifrons* in this respect (fig. 64). Labrum squarish, clypeus broader than long, both clothed with longish raised hairs. Postgradular areas of tergites very broadly impunctate or almost devoid of fine punctures. Median mesonotal line not impressed. Stature, body size and shape of white abdominal marks extremely variable, tergal spots frequently vestigial on one or more segments though never completely wanting. Hab.: From southern France through the northern Mediterranean as far east as Iran, see map 1 . . . . . . **fulgida** (p. 219)

— Combined characters not as above. Antennal segment 3 always much less than twice as long as 4. Distal half of hind tibia not noticeably polished and shiny externally, but if so, then only toward apex 4

4. Stature slender, size small, length 11—12 mm. Resembles *fulgida* in some respects: pygidial plate shaped similarly, dark brown tipped with black, plate nearly twice as long as its breadth at base, apex with or without feebly pronounced median ridge (fig. 163). White hair on clypeus above and frontal area likewise long, suberect and fluffy, only partly concealing surface, not exceeding anterior border of clypeus. Very similar to male, differing from *fulgida* as follows. Abdomen narrower, more rapidly tapered and pointed. Body with rich white markings. Hairs fringing both sides of antennal scape long and dense; conspicuous white tufts behind wings fused together with those covering sides of propodeum and also nearly meeting well defined tufts just behind each of the strong spike-like or markedly downcurved scutellar spines, which are shorter than the spot-like tufts (the latter absent in *fulgida*). Lateral marks on tergites 1—4 transverse, except on 1 forming subcircular patches

narrowly connected across dorsum with thin collar of equally long raised hairs; marks on 2—4 band-like, as in male, characteristically concave and not sharply defined anteriorly; distance separating spots on 3—4 much shorter middorsally than their own breadth; short dark hairs covering tergites suberect. Body punctation closer than in *fulgida*: interspaces of punctures on mesonotum less than one puncture width, less shiny. Raised hairs covering thoracic dorsum anteriorly more sparsely intermixed with black. Legs slender, dark brown; hind femur glossy, throughout closely punctate, except narrow, almost impunctate stripe bordering median ridge distally, hairs scanty, suberect. Outer faces of mid and hind tibiae and tarsi almost wholly white, but sometimes becoming black toward apex of tibiae without forming well marked boundary line; hairs short, decumbent, tibiae with conspicuous admixture of robust dark spines; inner rami of mid and hind tarsal claws little less than half as long as outer and scarcely broader than these, never definitely axe-shaped. Postgradular areas of all tergites 2—5 distinctly but very finely punctate. Appressed sternal pubescence and raised bristles on 2—5 silvery in certain lights, as in male. Balearics, Romania, and from the Caucasus south into Turkey, Lebanon and Israel . . . . **guichardi** (p. 254)

— Characters combined not as described 5

5. Whole body clothed with moderately long, snow-white pubescence; admixture of dark hairs, black bristles and spike-like setae only in places: see below and original description. Labrum longer than in male, widest slightly before halfway length, then somewhat narrowing toward end (length-breadth ratios 40 : 30 : 26), the apical border shallowly emarginate with rounded side-angles; surface at first convex, then little concave, apex slightly upturned; no distinct median ridge; disk coarsely rugosely punctate on shiny ground; discal bristles and apical fringe dark brown. Antenna thin and slender, 3 in frontal view longer than 4 (100 : 74), this equal to next segments, all distinctly longer than broad; scape on both sides with long and dense fringe of pure white. Hair patch upon clypeus dense, depressed, not nearly reaching anterior border, surface shiny, punctation as in male. Non-pubescent parts of abdominal tergites as described for male; band-like lateral markings on 2—6 (sic) occupying most or all of the surface, the distance separating spots on 2 equal to their transverse diameter, on 3 less so, and spots on 4—5 confluent across middle, occupying entire surface. Sternites 1—5, except polished postgradular hairless areas, very closely and finely punctate and clothed all over with short, appressed silvery white tomentum. Pygidial plate, see description and fig. 167. Length 13—14 mm. Hab.: Uzbekistan and Turkmenia . . . . **nivosa** (p. 257)

— Body markings less extensive: abdominal spots not fused together, tergites 4 and 5 not entirely white; pygidial plate shaped otherwise 6

6. Pygidial plate (fig. 215) of characteristic shape and texture, with conspicuous, subacute median crest, highest and most swollen just before apex. Median mesonotal line distinctly sulcate, impression deepest at level of tegulae, dorsum on either side of median line convex, polished and hairless, with few scattered deep punctures. Wing membrane very dark brown, except basally.

Face and frons black, thorax, legs and abdominal tergites 1—4 marked with white; pubescence generally short; integument of tergites very finely reticulated. Large species, length 17 mm, fore wing 12.5 mm (holotype). Male unknown. Hab.: Algeria . . . . **solivaga** (p. 279)

— Pygidial plate not shaped as above. Strongly fluted median mesonotal line and partly hairless dorsal thoracic sclerites not always in combination with very dark fore wing membrane 7

7. Vestiture of whole body recalling *Paracrocisa*: anterior portion of clypeus, temples, upper frons, most of the vertex, mesonotum-scutellum, as well as propodeal area, for the greater part exposed to view, bare, or clothed with short black hairs which are usually hardly longer or even shorter than scutellar tubercles. White markings conspicuous, sharply outlined. Pile covering antennal scape partly suberect, usually white and shorter than diameter of scape about halfway its length. Whole distal half to one-third of clypeus exposed, hairless and closely punctate, most of frons, paraocular and ante-ocellar areas with dense patch of longer, partly suberect, snow-white pubescence; raised collar-like hairs fringing occipital ridge conspicuous, pure white. Surface of mesonotum uneven: median line markedly impressed, the sulcus especially developed anteriorly, partly filled up with an elongate, compact patch (*ms*) of decumbent or slightly raised snow-white hairs directed sideways on each side of line; parapsidal lines usually also indicated by a longitudinal depression. Vertex, immediately beside and slightly distal to each lateral ocellus, with impunctate, smooth and shiny (or finely chagreened) and frequently distinctly concave or pitted, area. Propodeal triangle with small impunctate median area, varying in size and shape, traversed lengthwise by a fine impressed line, more rarely devoid of the latter and punctate like rest of propodeum. Punctation of mesonotum diverse: punctures on anterior surface, as far back as a little before front margin of tegulae, very close and mostly contiguous, covered with short, dense depressed hair, behind this surface is more coarsely, partly confluently punctate, adorned with tufts of suberect white hairs (*lpn-als*, small *mls*, *plsa-t*, and large *pls*). Outer faces of mid and hind tibiae beset with strong black spicules and few longish erect bristles; at least the basal one-third of each marked with white. Abdominal tergites noticeably dull, or at most faintly lustrous (less shiny than in males!), all very closely and finely reticulate-punctate, especially postgradular areas with punctures even more crowded and larger than interspaces, and all setiferous, the non-white spotted areas covered with minute black decumbent hairs; tergal graduli with or without thin fringe of dark bristles, those on the sternal ones usually suberect, more numerous and longer. Sternites invariably black, lacking white hairs. Fore wing membrane usually strongly infuscated, never entirely hyaline 8

— Vestiture of whole body generally longer. Hair fringing both sides of antennal scape longer, sometimes exceeding greatest diameter of scape. Sculpture of mesonotum and disposition of white body markings variable, but not as described. Dorsal surface of abdomen distinctly somewhat glossy, often very brilliantly luminous, punctation frequently dense but punctures always smaller than interspaces, and not necessarily setiferous, though unspotted areas often clothed with longer, suberect dark hairs and bristles 11

8. Pygidial plate very markedly downbent (profile!), its distal portion moreover distinctly constricted before the end, the apex itself noticeably expanded and broadly rounded (figs. 172, 178, 184). First abdominal tergite relatively long, transition between vertical (anterior) and horizontal faces rather abruptly angulated (see key to males) 9

— Pygidial plate either gradually downcurved, or almost flat, distal portion variably expanded, but usually more evenly tapering toward apex, which itself is rounded off (e.g., figs. 136, 214, 224). First abdominal tergite shorter, transition between vertical (anterior) and horizontal face less marked, the dorsal one sloping gradually into declivous anterior face (see key to males) 11

9. Silky white spots at sides of tergites 1—4 differing in shape and size; those on 1 variable: either tapering inward, pointing toward each other along base, with very oblique hind border and only narrowly interrupted in the median line (holotype); or smaller, less than half as broad as the shortest distance separating them, hence shaped much as in male (pl. 3 fig. 15), but composed of short appressed pubescence; spots on 2 larger, subrotundate, as in male, on 3 and 4 transverse with rounded angles, separated by a distance slightly less than their own breadth; all spots lying flush with surface, lacking admixture of raised hairs. Maxillary palpi slender, 6-segmented, the ultimate joint small (proboscis retracted in type). Antenna slender, 3 about twice as long as its apical breadth and 1½ times longer than 4 (100 : 65), this and next segments subequal and only little longer than broad. Impunctate area at base of propodeal triangle vestigial, the lateral edges (with few exceptions) longitudinally rugose. Scutellar tubercles short, subtriangular, directed straight back; white tuft projecting from beneath tubercles at least twice as long as these. Inner ramus of mid and hind tarsal claws only one-fourth length of main branch or even shorter. Fore wing membrane infuscated much as in *amanda* and *candida*, but much lighter, especially near base, than in *honesta* and *transcaspica*; third submarginal cell a little longer than high, its distal side variably angulated. Pygidial plate dark brown, slender, fully twice as long as its breadth at base, more abruptly downbent beyond halfway length than in *honesta* but slightly less so than in *amanda* and *candida*, apex distinctly, though smoothly ridged medially (figs. 172, 189); disk flat with raised margins, surface finely transversely wrinkled. Length not exceeding 14 mm. Hab.: From Uzbekistan through Turkestan to Pakistan; doubtfully, also Turkey and Israel . . . . **corpulenta** (p. 260)

— Silky white tergal marks 1—4 very conspicuous, resembling those of male, even larger and more angular than in *corpulenta* and *transcaspica*, especially those on 1—2 (pl. 3 figs. 16—17). Pygidial plate slender, apex convex medially and rimmed; disk flat, very finely transversely chagreened, colour brown, apex obscured (figs. 178, 183—184). Black hairs covering disk of scutellum and parascutella short, generally shorter than tubercles; brush-like tuft of black covering parascutella not raised above level of surrounding hairs (profile!). Maxillary palpus 6-segmented. Antennal segment 3 slightly but distinctly longer than 4, this and next segments somewhat longer than broad (100 : 80) 10

10. Tergal spots 1—4 situated in a regular row, 1 parallel-sided, forming a slightly oblique quadrangle, diameter of each slightly or more markedly less than the black area separating them; 2—4 little more transverse with convex inner margins, those on 4 smallest. Scutellum entirely black, lacking tuft of white hairs projecting from beneath scutellar tubercles, which are short and directed straight back. Wings very dark, except basally, fore wing membrane almost as dark brown as in *transcaspica*, with low dark bluish and coppery reflex; third submarginal cell usually a little higher than long, with distal side more bluntly rounded. Inner face of hind femur irregularly coarsely punctate, punctures more scattered on shiny ground on area adjoining blunt median ridge. Inner ramus of mid and hind tarsal claws only about one-third as long as main branch. Pygidial plate varying in shape, little less than twice as long as its width between base of lateral ridges, the latter at first outcurved in dorsal view, then incurved at the constriction, and finally again expanded (fig. 178). Length 14—18 mm. Hab.: Egypt, Israel and Libya . . . . **honesta** (p. 264)

— Tergal spots 1—4 less regularly arranged, inner boundary of 1 distinctly more oblique than outer, acute-angulate midbasally, inner side straight or slightly convex; spots on 2—3 less high and more transverse than in *honesta*, those on 4 more approximated. A conspicuous tuft of long white hairs projects from beneath tubercles, which are very short and slightly raised. Wings much lighter, fore wing membrane light brown, this colour deepening gradually in tint toward apex, darkest at end of marginal cell; length of third submarginal cell about equal to its height, the distal side somewhat more prominent and abruptly angled. Inner face of hind femur more superficially and finely punctate, the area adjoining median ridge almost impunctate. Inner ramus of mid and hind tarsal claws about half as long as main branch and also broader, more compressed and sharply acuminate, than in *honesta*. Pygidial plate shaped similarly, proportions equally variable, but apex always deflected more abruptly ventrad (figs. 183—184). Length 14—15 mm. Hab.: Turkestan (terr.typ.); "Sarepta" . . . . **amanda** (p. 266)

11. General appearance, pl. 4 fig. 23. Silky white tergal spots 1—4 quite similar to those of male but at sides of 1 spots are farther apart, better defined, narrower than the space separating them at base, placed transversely and pointing inward, with some suberect hairs at the bend but lacking raised hairs across middle of tergite; spots on 2—3 transverse, 2 usually also pointing inward, and nearly always slightly concave anteriorly, all lying flush with surface (pl. 4 figs. 23—24). Raised black and white hairs covering head and thorax much shorter than in male, resembling the design of female *corpulenta*, *amanda* and *honesta* much more closely, though all hairs a little longer than these; black hair covering disk of scutellum and parascutella also longer and more closely set, about equal in length to tubercles; parascutella clothed with dense compact brush of deep black hairs raised above surface level (profile); large transverse

white tufts behind wing bases and also longish white hairs beside scutellar tubercles. Hair on antennal scape white and decumbent, though mixed with some raised black pile equalling diameter of scape. Maxillary palpi 5-segmented. Fore wing membrane very dark brown with slight greenish, blue and purplish lustre. Outer faces of mid and hind femora closely punctate on shiny ground, punctures covering inner faces irregular, more superficial, with almost glabrous glossy areas beside median ridges; basal half or more of outer faces of mid and hind tibiae white, for the rest black, only last tarsal segment with thin appressed white pubescence. Pygidial plate gradually and evenly downbent, very broad at base, less than twice as long as its basal width, varying in shape but narrowing gradually distad, apex simply rounded, not or scarcely swollen or expanded, lacking median ridge; disk brown, feebly convex, very finely transversely wrinkled (fig. 214). Size moderate to large, length 13.5—18 mm; fore wing 12—13 mm, wing expanse 31 mm (pl. 4 fig. 23). Hab.: see description .... **transcaspica** (p. 275)

— These characters combined not as described above 12

12. Pygidial plate short and broad, tongue-shaped with broadly rounded apex (figs. 126, 136, 139), side margins straight or slightly convex in dorsal view, thin and upturned in dorsolateral aspect; plate gradually and very little downbent from base to apex; colour reddish to dark brown, the side margins and apex more obscured, whole surface dull, throughout very finely reticulated, with occasional interspersion of some minute punctures at base only. Maxillary palpi 6-segmented. Pubescent pattern much as shown for *turkestanica* (pl. 2 fig. 9) and many other species. White are: a patch upon clypeus (often partly replaced by black!); raised tufts behind antennae and bordering occiput; thorax dorsally as far up as slightly beyond tegulae, with pair of deep black dots, more or less confluent anteriorly, upon anterior part of mesonotum; denser tufts to the inside of and just behind tegulae; white mesepisternal patch, and transverse band-like tufts, interrupted by black laterally, at base of tergite 1; and regular row of compact, depressed spots on either side of 2—4; sternites all black 13

— Pygidial plate shaped otherwise, narrower, relatively longer and more slender, its surface often punctate 14

13. Antennal scape clothed sparsely on each side with short, suberect and depressed black and white hairs, most of which being not longer than diameter of scape at apex. Only basal portion of clypeus above clothed with central patch of white depressed hairs, for the rest black; distal part of surface bare and densely punctate. Body pubescence relatively short, hair covering head above, mesonotum and scutellum not longer than transverse diameter of tegula or exceeding tubercles, except white tufts below the latter which are much longer than these. Scutellum medially and posterior sclerites closely punctate, clothed with raised black hairs, but surface well exposed to view; tubercles rather strong, triangular, longer than broad at base, slightly raised, more rarely a little downcurved. Legs with short black hair, outer faces of basal one-third of tibiae and last tarsal segment white; tibiae with distinct admixture of thick

black spinulose setae. Outer faces of mid and hind femora closely punctate on shiny ground, punctures on inner faces of different sizes and more sparsely distributed, with shiny impunctate area extending along median ridge; posterior fringe of suberect black bristles thin, much shorter than diameter of femur; bristles at basitarsi also relatively short; inner rami of mid and hind tarsal claws from one-third to about half length of main branch. Fore wing membrane strongly infuscated, except at extreme base; third submarginal cell a little higher than long, distal side moderately angulated (fig. 131). Labrum distinctly longer than its breadth at base, slightly so about midway length, usually with incomplete median crest or impunctate line, apical border projecting a little anterad, ending in an upturned tubercle. Abdominal tergites and pregradular portions of sternites closely finely punctate and setose on non-white spotted areas, the hairs minute and decumbent on rather shiny ground, though visible only at strong magnification; sides of tergites and postgraduli of sternal surfaces sparsely intermixed (respectively fringed) with somewhat longer, suberect bristles. Pygidial plate relatively slender, average length-breadth ratio 100 : 64; basal 2/3 of disk slightly convex with well pronounced raised borders, for the rest quite flat, distal portion lacking median ridge or with merest indication of same (figs. 136, 139). Length 13.5—17 mm. Hab.: see male, and map 1 . . . . **aegyptiaca** (p. 244)

— Antennal scape on either side with dense fringe of long white hairs, which are markedly longer than greatest width of scape at apex. Clypeus above with patch of partly raised white hairs much longer than in *aegyptiaca*, the tips often reaching anterior border. Body pubescence longer, many hairs covering head above, mesonotum and scutellum even exceeding length of tegula and tubercles, especially long and dense on parascutella, completely hiding surface. Setiferous punctures on abdomen sclerites less superficial and more closely set, the black hairs longer and suberect on less shiny ground, well visible with a hand lens in fresh specimens. Sides of tergites and postgraduli conspicuously bristly. Legs more hairy; white marks at tibiae and tarsi as in *aegyptiaca*, but interspersed black spinules mostly concealed among longer white and black hairs. Femora more closely punctate, scattered punctures also along inner face of median ridge, at the same time much more densely hairy, the posterior fringe at hinder pair at least as long as diameter of femur; raised black bristles at tibiae and basitarsi of great length. Shape of tarsal claws not differing from *aegyptiaca*, equally variable. Fore wing membrane much lighter, pale brownish, base proximal to forking of main veins hyaline; third submarginal cell more obviously higher than long, but distal side more abruptly angulated. Labrum as in *aegyptiaca*, but apical border straight or even slightly emarginate, disk not or scarcely developed (if constant?). Punctation of abdominal tergites and pregradular sternal plates less dense and also more superficial than in *aegyptiaca*, the short black setae longer, suberect, giving the tergites a more glossy appearance; lateral gradular bristles also longer and more numerous. White tergal spots more compact, made up of longer hairs expecially those forming arched collar at sides of 1 conspicuous. Pygidial plate very similar to *aegyptiaca* but a little broader, average length-breadth ratio 100 : 70; disk a little more convex with upturned and sharply pronounced borders, apex somewhat more swollen and downbent, median ridge distinct, though low, nearly always with some scattered punctures at extreme base of disk (fig. 126). Length 13—17 mm. Hab.: Turkey; Cyprus (terr. typ.); Israel; "Perse" . . . .**megaera** (p. 243)

14. Pygidial plate distinctly constricted subapically, thereafter expanded, apex more or less swollen with evenly rounded tip; sides usually strongly rimmed (figs. 201, 224, 228). Median mesonotal line not or scarcely impressed. At least a few raised white hairs immediately below scutellar tubercles. Sternites invariably black 15

— Pygidial plate without distinct subapical constriction, though often strongly narrowed after its middle, the apical portion — if slightly narrowed — longer and more tapered, subparallel-sided with evenly rounded or almost truncated tip 17

15. Large species, length 16—19 mm, general appearance, pl. 5 fig. 28. Fore wing membrane for the greater part very dark brown with low bluish bronze reflex. Propodeal triangle (enclosure) with distinct median impunctate area extending from end to end, usually broadest at base and pointing apicad. Inner face of hind femur closely coarsely punctate, clothed densely with short hair and long bristles, impunctate areas unapparent. Tergal spots 1—4 relatively small, placed widely apart in regular row, only spots on 2—3 distinctly transverse. Antennal scape fringed on each side with longish, partly white hairs. Clypeus either wholly black or only with small central dot of decumbent silvery hairs. Pygidial plate slender, apex expanded (fig. 224). For further details, see description. Hab.: see map 2 . . . . **grandis** (p. 286)

— Size smaller, body not exceeding 16.5 mm, less robust, abdomen more elongated. Fore wing membrane infuscated but not conspicuously darkened. Propodeal triangle lacking median impunctate area. Hind femur not very densely hairy; inner face scatteredly punctate on somewhat shiny ground only in advance of and alongside median ridge 16

16. Moderate-sized species, length 12.5—16.5 mm (average 14 mm, see, however, description). Fore wing membrane smoky grey to grey-brown; third submarginal cell shorter than in male, length about equal to its height. No distinct juxta-ocellar areas, though few punctures are frequently not contiguous. White hairs fringing both sides of antennal scape conspicuous, longer than its diameter. Clypeus above with large, somewhat fan-shaped patch of decumbent white hairs occupying basal half or more of surface, anterior portion naked and closely punctate. Raised pubescence covering mesonotum rather short and thin, nowhere entirely concealing surface, except beneath ill-limited anterior black dots and deep black tufts covering parascutella. Pygidial plate (fig. 248) of characteristic shape: fully twice as long as its breadth at base; margins definitely raised as far as the constriction, at which point the transverse reticulation of the disk ends, the apex first becoming smooth and swollen, then slopes down with the expanded rims surrounding the centre

markedly depressed; in side view the plate bends down gradually, as in *grandis*; colour black upon middle at base, covered with setiferous punctures (unlike *grandis*), the setae being short and depressed, for the rest dark reddish brown, borders and apex obscured. For more characters, see description. Hab.: see map 2 . . . . **festiva** (p. 293)

— Resembles *festiva* in form of pygidial plate but differs considerably from the two preceding species, as follows. Body vestiture much shorter, corresponding with that of male; tergites more dullish, punctation fine and dense, punctures smaller than interspaces. Antenna distinctly longer and more slender, scape longer, not conspicuously hairy, 3 also more attenuated, 4—12 all markedly longer than broad. Labrum longer than broad, widest before middle. Clypeus marked similarly to *festiva*. Scutellar spines short, pricker-shaped. Legs noticeably more slender, all limbs longer and narrower; femora sparsely hairy, inner faces scatteredly punctate on shiny ground; armature at outer faces of mid and hind tibiae and basitarsi as in previous species, with similar anterior and posterior fringes of long bristles, respectively; inner rami of mid and hind tarsal claws about 1/3 length of outer. Wings infuscated, expecially along distal border. White tergal spots compact, arranged similarly but composed of shorter, more depressed hairs, those at sides of 1 wide apart and better defined, broadest basally, the hairs suberect only at sides near base; spots on 2—3 transverse, broadest on 3, almost equalling width of interspaces and removed more inward than preceding spots, the pair on 4 in line with 3, but much smaller. Sternites all black, except tiny midbasal streak of white at gradulus of 5. Pygidial plate, fig. 201, almost straight, only apex slightly downcurved (profile!), lateral rims strong, apex distinctly swollen medially, but surrounding margin less flattened than in *festiva*. Hab.: From Turkey and Israel to Iraq and E. Turkestan. . . . . **alecto** (supposition) (p. 273)

17. Median mesonotal line impressed: sulcus distinct though not deep and at least partly hidden under long pubescence, the line itself extremely fine; parapsidal lines also distinct and feebly impressed but not longer than half diameter of tegula. Antennal scape on either side with rather dense fringe of long raised, mostly white, hairs almost or fully as long as apical diameter of scape. Pygidial plate evenly and but slightly downcurved, sides converging, apex subparallel-sided and obtusely rounded. Tergites 1—4 white-spotted. Length 13—16 mm 18

— Median mesonotal line not sulcate, but if feebly impressed, then the white tergal spots are not placed in regular row, differing among themselves in shape, sometimes greatly reduced in size, or absent altogether 19

18. Body predominantly black: head with thin tuft of white only behind antennae and conspicuous fringe bordering occiput; long fringe at inner (anterior) face of antennal scape also white, the outer rows black. Antenna generally shorter, all segments broader, 3 slightly less than twice as long as its width at apex, much less than 1½ times length of 4—12, the latter little longer than broad. Anterior part of mesonotum alternately white and black: a subrectangular black dot on either side of (slightly narrower) elongate median white patch;

tufts behind wing bases also white; posterior thoracic sclerites and pleurae all black. Wings strongly infuscated, fore wing brown, extreme base and along submarginal cross veins narrowly lighter; third submarginal cell much shorter than high, proximal and distal sides moderately angulated; hind wing lighter brown. Legs black, rather slender; hind femur with narrow impunctate anterior streak along midposterior ridge, pubescence not very long or dense; outer faces of mid and hind tibiae with small, isolated, subbasal white spot, many fine spicules at hinder pair, and not very numerous longish raised bristles. Inner rami of mid and hind tarsal claws scarcely half as long as outer. Shape and markings of abdomen greatly resembling the type male. Pygidial plate twice as long as its breadth at origin of lateral ridges (fig. 301), dark brown; whole surface very finely reticulated on somewhat shiny ground; disk flat but apex almost parallel-sided with distinctly swollen, low median ridge. Hab.: Egypt . . . . **assimilis** (supposition) (p. 318)

— Body profusely marked with white. Resembles the male (pl. 2 fig. 12); average size smaller than *grandis* (pl. 5 fig. 28), length 16 mm (holotype), 14.5—16 mm. Stature much less robust, abdomen more elongate and less expanded, but head and thorax pattern much like *grandis*, though white tergal spots, including tufty patches at sides of 1, occupying more of the surface, spots on 2—3 subrectangular, broad, overlapping side angles, transverse diameter of those on 3 equal to distance separating them, spots on 4 about half their own breadth apart. Differs further from *grandis* and several other species (characters following sequence of supposed importance): inner surface of hind femur sparsely punctate, smooth and shiny toward median ridge; long bristles few in number. Wings much lighter, basal portion of fore wing hyaline, only lightly infuscated distally, darkest (light brown) beyond cells, inclusive of marginal cell; third submarginal cell somewhat higher than long. Pygidial plate coloured as in *grandis* but hardly constricted subapically, more distinctly downbent (profile), the median ridge restricted to apex and only weakly indicated (figs. 218—219); basal part distinctly punctate. Labrum shorter, subequal to its breadth at base (fig. 216), but narrowing anteriorly, as in *grandis* (ratios 100 : 98 : 76 approx.). Clypeus above clothed with shorter, silky white decumbent hairs, its distal one-third or more remaining bare, closely punctate. Antenna more slender, 3 fully twice as long as its width at apex, 4 only 3/5 length of 3, but 4—12 subequal to one another and more markedly longer than broad; pile similar to *grandis*. Scutellar spines robust, oblique and flattened, slightly raised, but directed straight back. Hab.: Kazakhstan; Turkmenistan . . . . **baeri** (p. 282)

19. Pygidial plate coloured as in *grandis* but hardly contricted subapically, the median ridge restricted to apex and only feebly indicated (fig. 274); surface of basal part distinctly punctate. Stature robust, average size 15.5 mm; thorax broad and bulky, subglobular, though dorsum but little convex, scutellum anteriorly almost in line with mesoscutum, tubercles very short, conical or nipple-shaped, tips hardly or not overhanging subvertically inclined posterior sclerites. Propodeum coarsely contiguously punctate, triangle with dullish,

impunctate, subrectangular or cordiform median area, usually divided lengthwise by a fine line in front of propodeal pit; side angles of triangle lacking longitudinal rugae. Median mesonotal line a narrow, smooth, often finely grooved ridge, at least partly exposed among the relatively short, raised hairs. Body pubescence generally shorter and darker than in male. Antenna slender, 3 almost twice as long as its width at apex, about 1½ times longer than next segments, which are all slightly longer than broad; scape not very densely hairy roundabout, hairs shorter than diameter of scape. Clypeal patch never reaching anterior border, extending up to 3/4 distance from base, hairs decumbent, either entirely silvery white (typical series), or reduced to a central spot varying in size, more rarely hairs are entirely black. Wings much darker than in male, fore wing membrane deepest in colour in melanistic populations from Bulgaria, Macedonia and mainland Greece, whose overall pubescent pattern is also much darker than in typical (insular) populations. Scutellum invariably wholly black. White lateral spots on tergite 1 completely isolated, widely separated by black midbasally; spots in 2—4 in regular row but all smaller than in male. Labrum not longer than its greatest breadth at middle, distal portion usually with distinct smooth median ridge. Pygidial plate evenly and but slightly downbent, frequently flat or almost so, but sides converging with raised, somewhat incurved margins, apex neither distinctly expanded nor swollen, flat or feebly convex distally and scarcely rimmed; disk reddish to dark brown, finely transversely wrinkled (fig. 274). Superficially, rather similar to extensively white-spotted individuals of *italica* (= "*meridionalis*" Gribodo), inhabiting S France, Iberia and NW Africa (vide postea). These can be distinguished from *tuberculata* and previously defined taxa of equal size: (1) body pubescence generally longer and denser; (2) raised hairs fringing both sides of antennal scape more abundant; (3) hind femur closely punctate all round and more densely hairy, the raised hairs especially abundant posteriorly at median ridge, some being even longer than greatest diameter of femur; (4) pygidial plate less tapered and more flattened, its apex devoid of a distinct median convexity, or ridge. Hab.: see map 2 . . . . **tuberculata** (p. 300)

— Stature generally more slender, size often smaller, and membrane of fore wing frequently less strongly obscured. Combined characters not as above 20

20. General appearance, pl. 2 fig. 10, closely resembling male from same locality and of equal size (length 16 mm, wing expanse 28.5 mm approx.). Wings subhyaline, only broad area beyond cells of fore wing slightly infuscated. Body pubescence long and dense. White tuft surrounding scutellar tubercles composed of long, radially arranged hairs, only narrowly divided by black; tubercles moderate, conical, considerably shorter than surrounding tufts. Labrum rather long, only little broadened halfway length (midlength-greatest breadth ratio 100 : 58), apex slightly narrower than width at base, border shallowly emarginate; apical 3/4 with distinct shiny median ridge. Silvery patch upon clypeus longer than broad, restricted to middorsum, depressed hairs not quite reaching anterior border. Antenna slender, 3 almost twice as long as its apical breadth, 4—12 all distinctly longer than broad; raised hair fringing both

sides of scape white, long and dense. Summit of head closely punctate lacking distinct shiny or impressed juxta-ocellar areas. About upper half of thoracic sides white, rest and beneath black, as also middle of metanotum and propodeum. Black anterior mesonotal spots isolated. Legs rather densely hairy; inner faces of mid and hind femora irregularly punctate, punctures near apex of hinder pair few in number on shiny ground. Inner branches of mid and hind tarsal claws relatively long and slender, exceeding half length of outer (much shorter in *sibirica*!). Tergites moderately shiny, setiferous punctures fine and crowded, much smaller than interspaces. White collar of raised hairs at base of tergite 1 complete, condensed and spot-like laterally, though smaller than very compact, sharply defined lateral spots 2—4, which are depressed, raised above surface level. Shape and texture of pygidial plate normal, i.e., as in *luctuosa*, the convex median ridge at apex distinct, rather long and high, well visible in profile. Hab.: Turkestan (Uzbekistan) and "Alai" . . . . **turkestanica** (p. 239)

— Facies and combined characters not as above. Fore wing membrane usually darker and body pubescence often less white 21

21. Scutellar processes (fig. 303) parallel, 0.4—0.5 mm long, broad at base, directed slightly upward but soon tapering and distinctly downbent to form cylindrical, bluntly rounded, shiny hooks with scattered punctures near base, partly hidden among surrounding black hairs, but much shorter than conspicuous white (more rarely black) tufts emanating from beneath each spine. Body small, 10—11.5 mm, compact, *luctuosa*-like; pubescent pattern similar, but white spots at outer faces of all tibiae and subrectangular patches at sides of abdominal tergites 1—4 generally larger, composed of more closely set and somewhat longer decumbent hairs, the spots raised above level of surface, hair tips downcurved, exceeding hind border of tergites. Setiferous punctures covering tergites much finer and more widely spaced on shiny ground, than in most species of equal body size discussed hereafter. Antennal scape fringed with long hairs, 4—12 all slightly longer than broad, increasing gradually in length toward end. Pygidial plate, fig. 309. Hab.: Canary Is. (in part) . . . . **curvispina** (p. 320)

— Scutellar processes very variable in shape and length, occasionally tubercular or wanting, never distinctly downcurved and hook-like 22

22. Body pubescence much obscured: head (including antennal scape), thorax and legs wholly black, only basal half of clypeus with ill-limited dorsal patch of decumbent dark golden brown hairs, all the rest of clypeus remaining hairless, closely punctate on shiny ground. Sides of abdominal tergite 1 with tuft of long, raised, entirely black hairs, but lateral spots on 2—4 white, depressed, of irregular small size, just visible from above, the pair on 2 transverse, about twice as large as on 3—4. Fore wing membrane not much darkened, only lightly suffused with grey-brown. Pygidial plate shaped similarly to many *luctuosa*: slender, almost twice as long as its breadth at base, scarcely downbent; disk chestnut brown, impunctate, finely transversely wrinkled, apex smooth, subparallel-sided with rather long convex median ridge clearly visible

in profile. Body more slender and less hairy than *luctuosa*, abdomen distinctly more strongly convex, resembling *brevipila* and *leucorhyncha* much more closely in form than the broader and flat-bodied *italica* and *luctuosa*. Labrum only little longer than its widest point near base, narrowing gradually toward distal border, which is a little upturned, subtruncated, very shallowly emarginate, lacking complete (apical) median ridge. Dorsal punctation of ocellocular area and on disk of mesonotum much as in *luctuosa*, punctures rather deep but slightly smaller than shiny interspaces, those on abdominal tergites much finer and more widely spaced. Only a single specimen known. Size small, 11.5 mm, fore wing 9.5 mm. Hab.: Kiev area, S. Russia; Turkey (see map 1) . . . . **rutenica** (p. 233)

— Combined characters not as above 23

23. Vestiture of whole body totally black (minus variants) or almost so (plus variants), the latter having (1) a tiny white spot at outer faces of mid and hind tibiae at some distance from base, (2) vestiges of white in front of tegulae and more inward posterior to the latter, (3) tufts behind hind wing base and at sides of tergite 1, and (4) a speckle at sides of tergites 2 and 3. Wing membrane throughout dark brown with slight bronze lustre in certain lights, this colour deepest along costa, in whole marginal cell and centres of submarginals; third submarginal somewhat higher than long, outer side not strongly angled; nervellus (hind wing) well proximal to fork. Pygidial plate gradually downcurved (profile), broad at base (length-breadth ratio 100 : 70), converging as far as about 3/4 length from base with rather outbent (fig. 320) or almost rectilinear sides, the long slender apex almost parallel-sided, with distinct blunt median ridge (fig. 320); disk flat, finely transversely tessellated. Short suberect black pubescence covering tergites 2—4 evenly distributed, without forming condensed dots replacing white hair spots. Size small, 10—13 mm, fore wing 8.5—9 mm. Hab.: Canary Is. (in part) . . . . **caroli** (p. 323)

— Vestiture of body more extensively marked or white- spotted; or, if all or most parts are black, then lateral spots on tergites 2—4 form condensed dots of appressed black pubescence replacing white hairs. Wing membrane usually much lighter (darker brown only in *leucorhyncha taormina* from Italy/Sicily). Pygidial plate variable but usually not as described, tapering more gradually; if plate is as slenderly drawn out as in *caroli*, then compact white spots are present at sides of tergites (1) 2—4, while head, antennal scape, thorax and legs are also tufted and spotted with white (certain *l. leucorhyncha* and plus variants of *italica*) 24

24. Stature robust, abdomen broadest at base of tergite 2, then rather flat, subtriangular, tapering rapidly toward apex. Vestiture throughout long and dense, raised hair covering hind femur posteriorly conspicuous, at least basally longer than greatest diameter of femur. Inner faces of mid and hind femora anterior to median ridge closely punctate, but distal portion lacking distinct impunctate glossy strip. Mandible with flattened, rounded, submedian interior tooth (fig. 78). At least distal one-fifth of labrum with smooth median carina. Antenna strong, median segments only little longer than broad; scape densely

fringed with raised hairs laterally. No distinct impunctate areas beside ocelli; propodeum throughout closely rugoso-punctate. Scutellum black, no longish tufts of white surrounding short, slightly curved, blunt processes. Inner rami of mid and hind tarsal claws almost or fully half as long as outer. Wing membrane evenly suffused with brown, much as in *luctuosa*; third submarginal cell relatively long, only little shorter than high, distal side not markedly more angled than proximal side. White body marks extremely variable in shape and size (see descriptive comments in text), sometimes much reduced with hairs largely replaced by black. Pygidial plate relatively broad, not or only very gradually downcurved, disk almost flat, brown, very finely transversely reticulate or chagreened; sides almost rectilinear, margins raised, obscured, less strongly converging than in next species, not or feebly constricted before apex, the latter short, gradually tapered or subparallel-sided, with low, short median ridge (figs. 283, 287). Hab.: See map 3 . . . . **italica** (p. 309)

— Characters combined not as above. Shape of pygidial plate variable but, if as described for *italica*, then body pubescence is shorter and less dense, hairs covering hind femur posteriorly more sparsely distributed and shorter than greatest diameter of same. Inner rami of mid and hind tarsal claws distinctly less than half as long as outer, often very short. Scutellar processes often surrounded by tufts of white. Distal portion of posterior faces of hind femora with shiny, almost impunctate area, or with scattered punctures only. Stature generally more slender and average size smaller. (Includes *brevipila*, which has the inner rami of mid and hind tarsal claws fully half as long as the outer, and wholly black-haired thoracic sides!) 25

25. Apex of pygidial plate in dorsal view slender, narrow and parallel-sided, with well marked blunt median ridge, the much longer proximal part (ratio of lengths 100 : 35.7) suddenly broadening toward base of tergite, the sides feebly convex; in profile the plate gradually but noticeably curves ventrad, the swollen convex median ridge being distinctly visible (fig. 102). Labrum shorter than in male, with distinct, smooth median ridge, incomplete basally. All flagellar segments of antenna longer than broad. Silvery patch of appressed hair upon middle of clypeus short and thin, not nearly reaching anterior border. Scutellar tubercles strong, pricker-shaped. Body pattern *luctuosa*-like, but all white marks smaller; thoracic sides all black. Wing membrane not much obscured. White tergal spots 2—4 subcircular, placed in regular row. Length 11 mm approx. Hab.: Turkestan . . . . **brevipila** (p. 235)

— Apex of pygidial plate in dorsal view less drawn out, usually passing imperceptibly into broadening proximal portion of plate; if apex is longer and more slender (e.g. some *leucorhyncha*, fig. 324), then the plate is less downbent with much lower mid-apical ridge not (or hardly) apparent in profile, and the fore wing membrane is strongly infuscated (brown). Vestiture of all body parts shorter than *italica* (see couplet 24). Inner face of hind femur, alongside and upon its median ridge, with ill-defined, elongate, shiny impunctate area extending from about midway length to almost as far as the end (sometimes a few scattered punctures present) 26

26. Head, thoracic sclerites and legs all jet black, much as in *caroli*, only about 20 per cent or less of any population with tiny white spot near base at outer face of mid and hind tibiae, and a small tuft of white upon parascutella and/or behind base of hind wings. Fore wing membrane smoky brown, darkest distally and toward apex of anterior main veins and cell centres. Abdomen either entirely black (most ex. from Sicily), or with small lateral dots of unequal and variable sizes only on one or more of the tergites (typical *l. taormina* and its varieties); or else, with fairly regular row of sharply pronounced, compact, subcircular dots on either side of (1) 2—4, diminishing gradually in size posteriorly (most ex. from Italy, Corsica, Sardinia, some from Sicily, and Malta). These tergal spots, when present, never raised above surface level, those at sides of 1 composed of much longer, partly raised hairs (always replaced by black upon middle at base). Raised bristles placed at graduli of tergites not very long. Hair fringing antennal scape shorter than greatest diameter of same; segment 3 from ¼ to fully ⅓ times longer than next segments, all of which being a trifle longer than broad. Pygidial plate gradually tapering, disk flat or almost so, side margins somewhat raised, with or without short, weak midapical ridge, apex of plate bluntly rounded; surface dull, impunctate, very finely transversely wrinkled; colour chestnut to almost black. Size small to medium, 10-14 mm (average 11.5 mm). Hab.: Italy and Tyrrhenian Islands (see map 3) . . . . **leucorhyncha taormina** (p. 330)

— Head, thoracic sclerites and legs variegated black and white or greyish white: mesonotum white anteriorly, frequently with pair of black dots, and sides at least partly white. Fore wing membrane often distinctly infuscated but much less obscured than in *taormina*. Relative lengths of antennal segments and shape of pygidial plate greatly varying among local populations of each taxon, but pygidial plate usually slenderer, more abruptly narrowed toward apex. Size small, as before, length not exceeding 13 mm, often less . . . . Group of *luctuosa* . . . 27

27. Besides *luctuosa*, the earliest described species of the group, this cluster of near-alike *Melecta* females includes the nominate subspecies *l. leucorhyncha* Gribodo, and *sibirica* Radoszkowski, three taxa whose males are quite distinct and fairly well characterized in the specific key. The four remaining species are: the little known *canariensis* Lieftinck, and probably also some of those discussed in the Appendix as species of doubtful status, viz. *ashabadensis* Radoszkowski, *eversmanni* Radoszkowski, and *kashmirensis* Nurse, all validly proposed names for species whose males have remained unknown. Of these, the female *eversmanni* is the only one that can be recognized by the rather characteristic shape of its pygidial plate (fig. 112), all others are variable in this and other respects, being practically indistinguishable. Brief descriptions of *luctuosa* (figs. 95—96) are to be found only in a number of faunistic publications dealing with bees occurring in Great Britain and NW. Europe, one of the most recent being contained in a paper on Canarian *Melecta* (Lieftinck, 1958). For illustrations and notes on most others, see the text: **ashabadensis** (fig. 113), **canariensis** (fig. 312), and **l. leucorhyncha** (figs. 324—326 and 350).

I. THE *Melecta albifrons* ALLIANCE

1. Group of *M. albifrons* (Forster)

Melecta albifrons albifrons (Forster)
(figs. 3, 19—25, 71)

Selected references:

Apis albifrons Forster, 1771, Novae species insectorum. Centuria I: 94 (pars: ♂ England only, lectotype coll. Linn. Soc. London).

Apis punctata Fabricius, 1775, Syst. Ent.: 385 (type series ♂♀ England, lectotype ♂ Univ. Zool. Mus. Copenhagen).

Andrena armata Panzer, 1799, Fauna Insect. Germ. init. 6 Heft 70: 22—23, pl. 22 (insect, ♂ ? type lost). — Saunders, 1888, Index to Panzer's Fauna Insect. Germ. London: 8 (cat.).

Melecta armata: Lepeletier, 1841, Hist. Nat. Ins. Hym. 2: 444—445 (♀♂ "Environs de Paris, Pyrénées. Commune en France"). — Pérez, 1883, Actes Soc. linn. Bordeaux 37 (sér. 4, vol. 7): 302—305 (partim). — Gribodo, 1893 (f. typica, exclus. vars.!), Bull. Soc. Ent. Ital. 25: 413 (Europe, various locs.). — Friese, 1895, Bienen Europa's 1: 156—159 (partim). — Saunders, 1896, Hym. acul. Brit. Is. London; 345 (key), 346—347, pl. 45 fig. 3, 8, 11 (Gr. Britain). — Peets, 1910, Jahresber. Nat. Ges. Hannover: 42 & 53 (note on identity of *A. armata* Panzer). — Frey-Gessner, 1910, Hym. Apidae *in* Fauna insect. Helv. 2: 143—144 (♂♀ various locs.). — Jørgensen, 1921, Bier *in* Danmarks Fauna København, 25 (Danish recds). — Semichon, 1922, Bull. Soc. Ent. France, 14: 192—194, 2 fig. (larva); 1925, ibid. 18: 305—306 (larva). — Schmiedeknecht, 1930, Hym Nord u. Mitteleuropas: 830. — Popov, 1955, Trudy Zool. Inst. Akad. Nauk USSR 21: fig. 1[4] (fore wing, sex?). — Osychniúk, 1970, Fauna Ukraini, 12 Apoidea 4: pl. 23 fig. 8 & pl. 24 fig. 1 (struct. ♀, Ukraine).

Melecta punctata: Friese, 1893, Bienenfauna Deutschl. u. Ungarn: 37 ("Mecklenburg, an Hyacinthen; Thüringen; Elsasz: Strassbg., with *Anthophora personata*; Süddeutschland"), 61 (Budapest). — Morice & Durrant, 1915, Trans. Ent. Soc. Lond. 2: 424 (note). — Richards, 1935, Trans. R. Ent. Soc. Lond. 83: 172—173 (notes on ♂♀ Fabrician types: *A. punctata* considered synonymous with *Andrena armata* Panzer; *M. punctata* (F.) reinstated). — Lieftinck, 1958, Comment. Biol. Helsingfors 18.5: 20—22 (general notes); 1972, Tijdschr. Ent. 115: 256 (host relation).

Melecta armata var. *gigantea* Friese, 1925, Konowia 4: 27 (♂♀ Elsasz, various locs). **Syn. nov.**

Melecta albifrons: Day & Fitton, 1977, Biol. J. Linnean Soc. London 9: 33, 40 (notes, designation of lectotype ♂ (not ♀ as stated!) *A. albifrons* Forster, in coll. Linn. Soc. London; *A. punctata* F., syn. nov.).

Type and syntypic material. — Great Britain: 1 ♂ (abd. loose in cellophane capsule), labelled "*Apis albifrons* var. *Anglicana*" (handwritten), purple disk, "Lectotype", and additional identification label "lectotype *A. albifrons* Forster", both by M. C. Day (Linn. Soc. London). — [Great Britain]: 1 ♂ (diss., figs. 21, 25 & 27), labelled "*A. punc/tata*", with red lectotype label *A. punctata* Fabricius, by M. A. Lieftinck, and 1 ♀ (syntype *A. punctata* Fabricius), both with O.W. Richards' labels "*Melecta punctata* (= *M. armata* Pz.)" (MC). — W.Germany 1 ♀, labelled "Strassbg 16.6.87, Friese, *M. armata* var. *gigantea* Friese" (pencil writing), lectotype *M. armata* var. *gigantea* Friese by present selection (MNB); 1 ♂, "Strassb. III.1887, Friese, *M. armata* ♂ var.", det. Friese 1900, syntype var. *gigantea* Friese (SMF); 2 ♂, "Elsasz, 13.v.1887, Friese", and "Strassburg, 21.v.1887, Friese", both unidentified but obviously syntypes of *gigantea* Friese (MCG).

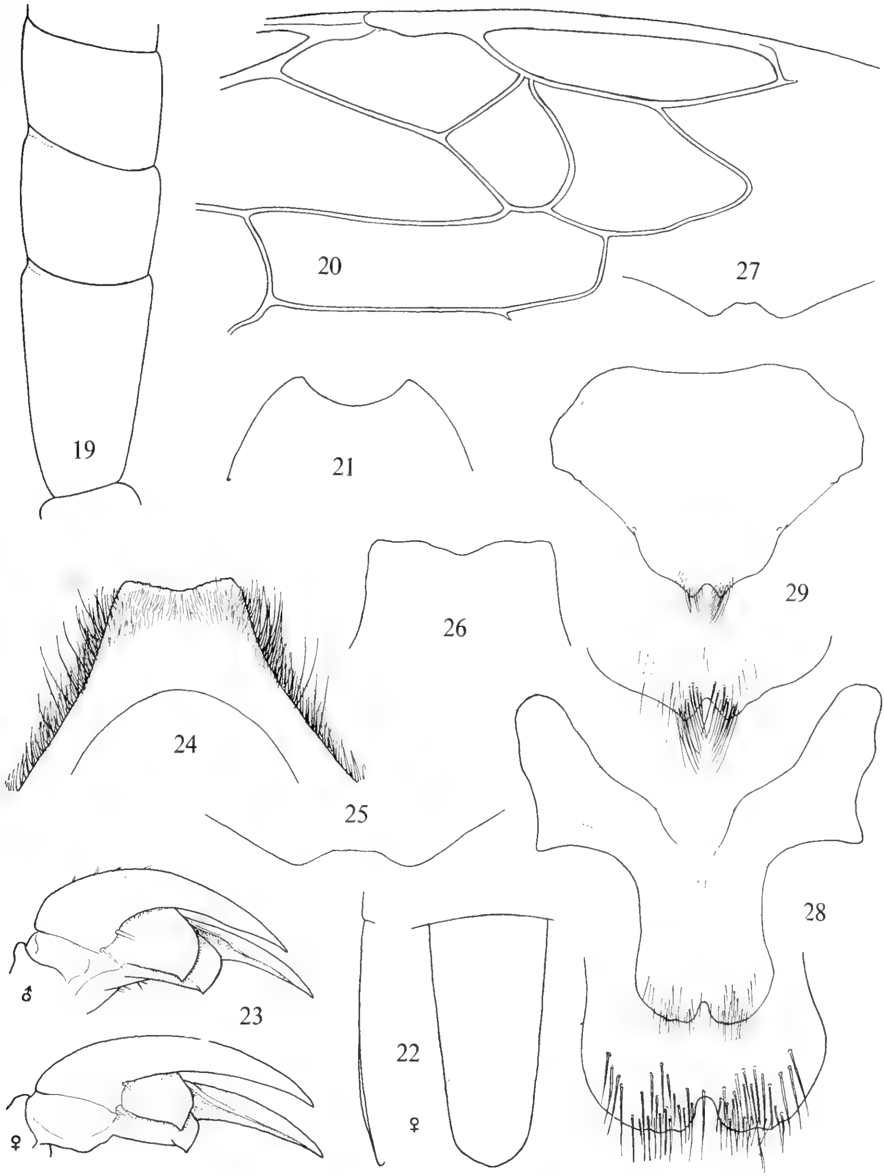
For the oldest and correct name of this well-known bee, see Day & Fitton (1977), whose lectotype selection should be accepted. It is clear that *M. albifrons* now becomes the type species of *Melecta* Latreille. Forster's type, probably collected near Warrington (N Cheshire), in central England, is a male which differs in no way from continental European examples of that sex. The abdominal spots on tergite 2 are comparatively of large size, resembling those of the lectotype of *punctata*, which was also described from Britain. It must be said that *albifrons* is a veritable misnomer, applied to a bee in a nondescript diagnosis. Although the hairs in front of the head and other parts of the body may with much fantasy be called "whitish" in deference to the describer, the overall impression of the long pubescence is distinctly brownish. Forster's diagnosis is based on English, Spanish and German specimens, the selected lectotype standing over his label "*A. albifrons* var. *Anglicana*", the one labelled "*A. albifrons* var. *Hispanica*" being a ♀ *Thyreus histrionicus* (Illiger), while the second (unlabelled) example is a *T. orbatus* (Lep.).

My descriptive notes on the typical examples of *Apis punctata* Fabricius, written down while studying both sexes in 1958, need not be reproduced here, but outline sketches of some structural details made at that time may still prove useful. The somewhat aberrantly shaped 7th tergite of the lectotype is shown in fig. 21: instead of being more or less squarely cut off — the normal condition, shown in other figures — the exposed apical part is more hollowed out dorsally and bears a crescentic incision. The form of this sclerite varies, however, within certain limits, in the entire *albifrons* complex, as is the case with the contour of the last visible (6th) sternal plate (figs. 25 & 27).

The synonymy of *Apis punctata* Fabricius, 1775, and *Andrena armata* Panzer et auct., was first established by O. W. Richards (1935). The male of Fabricius type specimens (1 ♂ 1 ♀) was selected lectotype and labelled as such by me in 1958. This was left unpublished so far but should now be confirmed.

With regard to Panzer's "Bewafnete Waldbiene", *Andrena armata* Panzer, 1799, some doubt has arisen as to whether Alfken's assumption (in Peets, 1910) was right that it stands for a male of *Melecta armata* auct. The picture shows a bee quite unlike the present species, but because we shall, of course, never be sure of its identity, any suggestion would be mere guess-work. Panzer's later interpretation (1804: 34—35) of Schaeffer's picture of "Apis sexta" (1766, tab. 22 fig. 14) must remain equally uncertain, as it shows a much greater resemblance to a male of *M. a. albovaria* Erichson or, even more so, to *M. luctuosa* (Scopoli). In the same work, Panzer also compared the picture with the description of *Nomada? duodecimmaculata* Rossi, which he rightly thought to be a different species (see under that species and *M. luctuosa*).

I believe that the characters used for a new group definition, summarized in the opening paragraph of the key on p. 145, are such as to justify the removal of the *albifrons* series from other Eurasian members of the genus. In addition, several more features proper to the taxa of this particular group could be added to those already known and employed in the same key. The discovery of new characters not shared by most of their congeners has led to the conviction that no useful purpose would be served to comment upon earlier attempts to clarify the relation between the present species (i.e. *armata* olim) and non-related taxa such as *grandis*, *luctuosa* and several others compared with it, whose essential structural characters remained unstudied by authors like Pérez (1883) and Gribodo (1893).



Figs. 19—25. *M. albifrons albifrons*; 19, left antennal segments 3—5, frontal view (♂ lectotype *Apis punctata*, England); 20, fragment of right fore wing (same specimen); 21, dorsal view of apex of tergite 7, showing slightly aberrant emargination, sculpture and hair omitted (same specimen); 22, right lateral and dorsal view of partly exposed pygidial plate (♀ syntype *Apis punctata*, England); 23, right hind tarsal claws, lateroventral view (Netherlands); 24, ventral view of tergite 7 (same specimen); 25, ventral view of apex of sternite 6 (same specimen). — Figs. 26—29. *M. albifrons nigra* (♂ lectotype *M. fasciculata*, Genoa, Italy); 26, dorsal view of apex tergite 7; 27, ventral view of apex sternite 6; 28—29, ventral view of sternites 7 and 8, with apices of both more enlarged (lower fragments in figs.)

Biology. — The earliest and most concise account of the biology and host-parasite relationship of *M. albifrons* is the one summarized by Friese in his classical work "Bienen Europa's" (Apidae europaeae), 1895: 154. It was based on an investigation of the cells of *Anthophora fulvitarsis* Brullé (= *personata* Illiger, olim), a large species, which in those days (1888) nested in loess (löss) banks and formed large colonies in the vicinity of Strasbourg (Alsace). This big species was parasitized by *M. armata* var. *gigantea* Friese, which is, indeed, only an oversized local variety of typically brown-haired *albifrons*, adapted to its equally large-sized host, both probably restricted to some particularly suitable places, inasmuch as normally sized individuals of *albifrons*, possibly committed to smaller species of *Anthophora*, were also found in the suburbs of that town.

Distribution. — The marginal populations occurring within the area occupied by the nominate subspecies *albifrons*, are discussed under *albovaria* and *nigra*, two fairly distinct geographical races which, I believe, can be maintained in spite of the poorly defined limits of their distribution area. Numerous intergradations are known to occur in the borderline zones, radiating almost in any direction. The northern and eastern limits of the range of *a. albifrons*, which is apparently centred in Middle Europe, are very insufficiently known, and it is not possible either to precisely define those of the other subspecies. This is why no maps can yet be provided to indicate the territories occupied by each of them.

Melecta albifrons albovaria Erichson
(figs. 1, 7, 31—37, 72, pl. 1 figs. 1—2)

Melecta albovaria Erichson, 1840, in Wagner, Reisen Algier 3: 192 (♂ Algier). Stat. nov. — Lieftinck, 1958, Comment. Biol. Helsingfors 18 (5): 22 (note on ♂ type, Algeria).
Melecta punctata: Lepeletier, 1841, Hist. nat. Ins. Hym. 2: 441—442 (pars, ♀♂ "toute la France"). — Lucas, 1849, Explor. sci. Algérie 3 Hym.: 221 (Algérie; various locs., no descr.; partim?).
Melecta armata & var. *grandis*: Pérez, 1883, Actes Soc. linn. Bordeauz 37 (ser. 4 t. 7): 302—307 (pars ♀♂; compar. notes).
Melecta pseudoarmata Radoszkowski, 1893, Bull. Soc. Imp. Nat. Moscou, new ser. 7 (2—3): 183, fig. 37 a-c, i, k (♂ struct., "♀♂ Caucase: Lagodechi"). **Syn. nov.**
Melecta armata Var. *Mediterranea* Gribodo, 1893, Bull. Soc. ent. Ital. 25: 413—414 (pars! ♀♂ "Francia meridionale (Montpellier) e dall' Algeria-Algeri?"). **Syn. nov.**
Melecta armata var. *grandis*: Friese, 1895, Bienen Europa's 1: 159 (key, pars; "Südeuropa, Nordafrika").
Melecta luctuosa var. *albovaria*: Friese, 1895, Bienen Europa's 1: 163 (pars! "Südeuropa").
Melecta armata: Dusmet y Alonso, 1905, Bol. Real Soc. esp. Hist. Nat.: 152—153 (pars? Spain, locs.).
Melecta luctuosa Stammform ♀: Alfken, 1914, Mém. Soc. ent. Belg. 22: 236 (♀ Algerien).
Melecta Novellai Dusmet y Alonso, 1915, Mem. Real Soc. Esp. Hist. Nat. 8 (7a): 330—331 (♀♂ Marraquesh, Morocco). **Syn. nov.**
Melecta luctuosa var. *minima* Friese, 1925, Konowia 4: 28 (♂ Algerien). **Syn. nov.**

Type and syntypic material. — Algeria: 1 ♂ (diss., figs. 34—35), labelled "Bone Wagn[er]" (written, white), "*albovaria* Er.* 226" (same writing), "Type" (print on red). Lectotype *M. albovaria* Er. by present selection (MNB). — Portugal: 1 ♀, labelled "Portugal (Lusit.)" (written in light green) "726" (print), "Type" (print on red), "*Albovaria* N. Erichs.* Wagner, Algier/Lusit." (all written on one label, Erichson's handwriting), "*albovaria* Erichs." (written). Paralectotype (syntype) *M. albovaria* Erichs. (MNB). — USSR: 1 ♂ (diss., left antenna missing, genit. glued on card), labelled "Caucasus" (print), "Type" (old print on red), "*Pseudoarmata*" (Radoszkowski's handwriting), "*Melecta pseudoarmata* Radoszk. Type Dr. Enderlein". Lectotype *M. pseudoarmata* Rad., selected by Enderlein and here confirmed (MNB). — Tunisia: 2 ♀, labelled: "Tunisi, Belv[edere] 12.III.1882, G. & L. Doria", and "*M. armata* ♂♀ Panz. var. *mediterranea* Grib. D. Gribodo" (both in Gribodo's writing on blue). Lectotype and paralectotype *M. armata* var. *mediterranea* Gribodo by present selection (MCG). — Morocco: 1 ♂, ♀, both labelled "Marruecos Marraquesh, IV.1907, Escalera" (print), "*Melecta Novellai* Dusm. ♂♀" (Dusmet's writing), "de la collección Escalera" (do.), "Typo" (written on white). Lectotype ♂ and paralectotype ♀ *M. novellai* Dusmet, by present selection (IEM).

The above synonymies are partly new and require a brief explanation.

M. a.albovaria. — Since the earlier discussed male from Bone was meant to represent the "holotype" (Lieftinck, loc. cit., 1958), that specimen should be declared more explicitly lectotype of the present taxon. Male and female, from Algeria and Portugal respectively, are both in the Berlin museum (MNB).

M. pseudoarmata (Caucasus). — This proves to be a medium-sized, entirely white-haired specimen of *albovaria*, as was to be expected, judging from Radoszkowski's sketches of the male terminalia.

M. a. var. *mediterranea* (Tunisia). — Correctly placed as a variety of "*armata*". The two females in the Genoa museum, named by Gribodo himself, conform in size to large individuals from other North African localities. Though only Montpellier and Algeria are given as localities, Gribodo's remarks preclude any possibility of confusion with his *meridionalis* (= *italica* Radoszk.) and/or *leucorhyncha*, two other new names introduced previously to denote varieties of "*luctuosa*" (sensu Gribodo): "L'esame però della scultura, e della forma della piastra epipigiale, delle antenne, oltre alla struttura ed armatura delle gambe li fanno immediatamente distinguere" (loc. cit.: 414, the spacings are mine). The male from Montpellier is evidently one of the bees collected by Lichtenstein and identified with *M. grandis* by J. Pérez.

M. luctuosa "Stammform" (Algeria). — It will be explained sub *M. italica* and *leucorhyncha* that *luctuosa* was misinterpreted by Alfken: by so doing he introduced a superfluous new varietal name for one (or both) of the two taxa just mentioned. In point of fact not one of Alfken's Algerian specimens still available for comparison proved to be conspecific with *luctuosa*!

M. novellai (Morocco). — As with the type(s) of *albovaria*, my selection of the male lectotype seems warranted. The female syntype is undoubtedly conspecific. Both agree perfectly with the original description, as far as it goes.

M. luctuosa var. *minima* (Algeria). — The type male, labelled as such in the Berlin museum collection, is a dwarfish example of *albovaria* and has nothing to do with *luctuosa*. The specimen is one of the smallest known, measuring only 7.3 mm for the body. The author merely says of it: "in allen plastischen Merkmalen mit *M. luctuosa* übereinstimmend (Analsegment, Metatarsus), aber Segment 1 schwarz behaart, 2—5 seitlich mit weisshaarigem Bindenfleck: Antenne dünn, normal. Länge 7½ mm. Breite 2½ mm. ♂ von Algerien."

Further material (roundabout Mediterranean basin, W to E). — Morocco: 1 ♂, Maroc, Oulmès, iii.1961, Meinander (MH); 1 ♀, Maroc, Midelt, 21.v.1947, J. de Beaumont (CB) and 1 ♀, Midelt, 18.v.1965, W. Linsenmaier (CL); 1 ♂, Ifrane, 13.v.1944, K. M. Guichard (BM); 9 ♂ (1 diss.), Azrou, 1250—1400 m, 20—24.v.1966 and 27.v.1968, and Dayet Aaoua nr. Imouzzèr, 1350 m, 26—29.v.1968, all M. A. Lieftinck (ML); 1 ♀, Casablanca, 3—11.iii.1919, R. Benoist (MP); 1 ♀, Maroc, 622.19 (MG). — Algeria: 1 ♂, N.Afrika, Constantine, 17.v.1929, H. Bauer (ZSM); 1 ♂, blue disk, Constantine, coll. J. Pérez (MP); 1 ♀, Sétif, *M. grandis*, det. Friese & *M. funeraria*, det. Radoszkowski (MNB); 2 ♀, Sétif, vi.1891, Handlirsch, *M. armata* var. *grandis* Lep., det. Friese 1893 (MNW); 1 ♀, Alger, coll. de Saussure (MG); 1 ♂, Oran 1910, Schmiedeknecht (SMF); 1 ♂, Alger (MCG); 1 ♂ 1 ♀, Algerien, Les Tamarins, 10.v.1954, W. Linsenmaier (CL); 1 ♂, Algir, Oran 1890 (MBUD); 1 ♂ (very small ex.), Oran, Lepeletier, sub *M. notata* Klug (MT); 1 ♀, Sa. Cruz, Oran, J. Bequaert, *M. albovaria* det. Alfken 1933 (MNB); 3 ♀, Oran, coll. Ernest André 1914 & J. Pérez (MP); 1 ♂, 276/♂/*M. armata* var. *grandis*, Sidi-bel-Abbès, coll. Drescher, ded.v.1936 (MKB); 1 ♂, 123 (square label), coll. Pérez 1915, *M. armata* det.? (MP); 1 ♂, Alger, Husseyn-Dey, J. Bequaert, *M. albovaria* det. Alfken 1933 (MNB); 2 ♂, Bône, coll. J. Pérez (MP); 1 ♂, Bône, coll. O. Sichel 1867, Mars 1864 (MP; 1 ♂, "Algérie, L. Dufour, coll. O. Sichel 1867, *M. grandis* Lep. Alg., det. par L. Dufour" (old written labels in L. Dufour's writing (MP); 1 ♂ 1 ♀, (♂ green disk), Ain Draham & Biskra, coll. J. Pérez (MP); 2 ♀, Biskra, 16.ii.1897 & 20.iii.1894 (BM); 1 ♂, Sidi-bel-Abbès, ex coll. Pittioni, sub *M. albovaria* (BM); 1 ♀, Ain Sefra 1931, R. Arlé, *M. armata* var. *grandis* det.? (MP); 1 ♀, Sétif, C. Saussure det.: *M. grandis* Lep., coll. O. Sichel 1867 (MP); several ♂ ♀, Algier, Mascara, Cros, 1 ♀ "ex larva, 8 avrile, Cave Prade", and 1 ♂ "ex larva, 1 avrile 1907" (sic) (MNB); 1 ♀, 59 (green disk), *M. grandis* Bg. 3757, leg. & det. O. Sichel 1867 (MP); 1 ♀, Laghouat, Sahara algér., coll. O. Sichel 1867 (MP); 1 ♂ 1 ♀, S. Algérie, Laghouat, iii—iv.1929, Dr. R. Meyer, ex coll. Pittioni (BM); 1 ♂ 1 ♀, S. Algérie, Laghouat, iii—iv.1929, R. Meyer, *M. albovaria* det. Alfken (MNB); 2 ♀, Algeria, Laghouat, iv.1911, *M. armata* Panz., det.? (BM). — Tunisia: 1 ♀, Tunesia, Tozeur, iii.1978, K. Guichard (BM); 1 ♂, S. Tunesia, Gabes, 1.iv.1925, J. Omer Cooper (BM); 2 ♀, Gafsa, Biró (MBUD); 1 ♂, Tunisi dint.IV.1882, G. & L. Doria (MCG); 2 ♂ (1 diss., fig. 36 & pl. 1 fig. 1), Tunis, coll. J. Pérez (MP); 1 ♂, Médinine, coll. J. Vachal 1911 (MP); 1 ♀, blue disk, Tunis, coll. J. Pérez (MP); 3 ♀, Tunisie, Gafsa, A. Weis 1904 (MP); 2 ♀, Tunisie, Tozeur, C. Dumont 1921 (MP). — Libya: 1 ♂ 1 ♀, Tripolis, *M. armata* v. *albovaria* = *grandis* det. Friese 1896 (MNB); 1 ♂ 1 ♀, Tripolitania, Zliten, 11.iii.1952, Garian Hills, 31.iii.1952, K. M. Guichard (BM); 2 ♂, Cyrenaica, Cyrene, 1800 ft., 26.iii.1954, K. M. Guichard (BM); large series ♂ ♀, Tripoli, 30.xii.1954—4.iii.1955, K. M. Guichard (BM, ML). — Egypt: 1 ♂ (diss., fig. 37), Aegyptus, Cairo (MBUD); 1 ♂ 1 ♀, labelled "Egypt Waltl *caesia* Ill." and "*caesia* Waltl-Egypt" (MT); 2 ♂, Egypt, Cairo (ML); 1 ♂, Egypt, Cairo, *M. armata* var. *mediterranea* (red label, det.?) (ZSM); 2 ♀, Wan (?) 1912, Kulzer, one with *Melecta* spec., det. Blüthgen 1947 (ZSM, ML); 1 ♂, Le Caire, coll. J. Pérez 1915 (MP); 2 ♂ (diss., fig. 37), Egypten, Schmiedeknecht (Schmiedeknecht's writing) coll. A. Weis, and 1 ♀, Cairo, coll. A. Weis, *M. armata* var. *albovaria* Er., det. Friese 1900 (SMF); 1 ♀, Egypt, Ismailia, 8.iii.1965, K. V. Krombein, "hovering in front of mud wall" (USNM); 2 ♂ 2 ♀, Aegypten, A. Andres, Wadi Rachid, 1.iii.1914, and Esbeth el Nakleh (1 ♂ 1 ♀, MNB), ii.1914, all *M. albovaria* Er., det. Alfken (SMF); 1 ♂, Unter Aegypten, Ad. Andres, *M. armata* det. Friese 1911 (SMF); 4 ♀, Egypte, Naville (MG); 1 ♂ 2 ♀, Fayun, Schmiedeknecht 1900, *M. luctuosa* ♀, det. Kohl (NMW); 1 ♀, Egitto, Gebel Asfar, 6.ii.1936, coll. A. Mochi 8073 (MA); 1 ♀ (pl, 1 fig. 2), Aegyptus, Cairo (print) (ML, ex MBUD); 1 ♀, Egypten, R. Malaise (NRS); 1 ♂, Egypten, Schmiedeknecht, coll. A. Weis (SMF); 1 ♂, Aegypt, Cairo, *M. armata* var. *mediterranea* Gribodo (red, Gribodo's writing?) (ZSM); 1 ♂, Egypt, Fayed, ii.1943, H. Priesner (CP); 1 ♂ 3 ♀, Egypte, Kerdasa, iii.1927, R. Mabrouk, El Maro, ii.1932, M. Aly, and Nawa, i.1913, leg. Neguib (MNB); 1 ♂ 2 ♀, Cairo, iii.1925, Min. Agric. (♂), ♀ with three labels: *grandis armata, armata & aegyptiaca*, all det. Friese (MNB) 2 ♂, Egypt, Cairo, sub var. *mediterranea* Grib., ex coll. & det. Pittioni (BM); 1 ♂, Cairo, sub. *plurinotata* F.-W. (sic) (BM). — Israel-Jordan: 1 ♂ (headless) 1 ♀, Israel, C. Jordan valley, Deganya A, 27.ii.1939 & 9.iii.1942, nos. 2890 & 6333, Y. Palmoni (AID); 1 ♂ 4 ♀, Israel, Jericho, Hisham Palace, 8.iii.1975, K. M. Guichard (BM); 1 ♂, Palestine, Haneger, Mt. Mishmaz, no date, H. Bytinski-Salz (CBS); 1 ♂, Jerusalem, 12.ii.1942, H. Bytinski-Salz; 2 ♂ 5 ♀, Palestine, Jericho, 23.ii.1941 and 3—9.iv.1943, *M. albovaria* Er., det.?, *M. armata grandis* Lep. (1 ♂♀), det. G. Mavromoustakis, and *M. luctuosa* var. (1♂ ♀), det. G. Mavromoustakis (CBS); 1 ♀, Palestine, Daphne Oaks, 13.v.1940, H. Bytinski-Salz (CBS); 1 ♀, id., Desanlah, 18.iii.1941, same coll. (CBS); 1 ♀ (diss., very small), Mt. Hermon, 1600 m, 9.vi.1975, M. Kaplan, and 1 ♀, same loc., 1900 m, 27.vii.1971, H. Bytinski-Salz (CBS); 2 ♀, Israel, Yeroham Retama, 12.iii.1963, J. Wahrman (CBS, ML); 1 ♂ 1 ♀, Jerusalem, 12.ii.1942, ♀ with "24/Anthop. 9", ♂ with *M. armata albovaria* Er. = *grandis* Lep., det. Mavromoustakis (CBS); 1 ♂, Israel, Bir-Rekhme, 15.iv.1953, 1 ♂, Gilgal, 1.iii.1973, M. Kaplan, 1 ♂, Ein Gadi, 19.iii.1975, A. Freidberg, and 1 ♀, Israel, Negev, Ze'elim 300 m, 18.iv.1967, leg. Kugler (all CBS). — Lebanon: 1 ♂, N. Libanon, Cedern bei Becharre, 1900 m, 3—6.vi.1931, Zerny (NMW). — Syria: 1 ♀, Syria 1899, coll. A. Weis, *M. ashabadensis* det. Friese 1900 (SMF); 1 ♂ 1, Syria, viii.1899 (MNB); 1 ♀, N. Syrien, Sendschirli, 500 m, v. Lüschau (MNB); 2 ♂ (diss.), Syria, Becker (NRS, ML); 1 ♀, Syrie, coll. Ernest André 1914, var. *grandis* Lep., det.? (MP). — Cyprus: 1 ♀, Led[erer?] Cypern 1854, *M. armata*, det. Friese (NMW); 1 ♀, Cyprus, Limassol, Yermasoyia, 17.iii.1979, L.-A. Janzon (NRS). — Iran: 2 ♂ (both diss.), Iran, 40 mi. S of Hamadan, 13.v.1960, R. v. d. Bosch (USNM, ML); 1 ♀, yellow disk16/40, Perse, Aucher 16—40 (MP); 1 ♂, Persien, Elburs, 800, S. Kuramahad, iv (MNB). — USSR: 1 ♂, Transcauk. (Armenia), Helenendorf 1886, *M. armata*, det. Kohl (NMW); 1 ♂, Caspian Sea, Enseli, leg. (?) Mocquerys (USNM). — Turkey (Asia minor): 1 ♀, Kleinasien, Smyrna, Loew, with "*pseudoarmata*", det.? (MNB); several ♂♀, Kleinasien, Sewdiköib nr. Smyrna, iv.1917, La Baume (MNB); 1 ♂, Asia min., Tokat, *M. armata* var. *mediterranea* Grib., det.? (ZSM); 1 ♂, Asia min. septentr., Alem Dagh, 600 m, 26—30.vi.1964 and 1 ♂, Asia min. merid., Bulghar Dagh, 1200 m, 6—15.vi.1964, leg. Demelt (FAG); 1 ♂, Türkei, Bulga Haden, 12.vi.1965, leg. Rene (CMS); 1 ♀, Turkiye, Konya, Sultan Dag, Çankurtaran Köy, 1900—2000 m, 19—20.vi.1967, leg. Reinig (SMF); 2 ♀, Brussa 1882, *M. armata* var. *grandis* Lep. ♀, det. Friese 1893 (MBUD); 1 ♀, Adana, Cilicia, 12.v.1911, coll. J. Vachal (MP); 1 ♀, Turkey, above Hasanoglan nr. Ankara, 1500 m, 29.vi.1962, Guichard & Harvey (BM); 1 ♀, Turkey, Bebeh, iv.1960, M. Burr (BM); 1 ♂, Turkey, Rize, at sea level, 22.iv.1959, K. M. Guichard (BM); 1 ♀, Araxesthal, Reitter 1890, *M. armata* var. *grandis*, det. Friese 1893 (NMW); 1 ♀, Türkei, Ürgüp, medio vi.1960, leg. Schläfle (CL); 1 ♂, Constantinople, coll. J. de Gaulle (MP). 6 ♂, 4 ♀, Türkei, Ankara, 3.vi.1972, Erzurum, Ispir, 17.vi.1973, Birecik/Urfa & Halfeti/Urfa, 16—17.iv.1976, and Östl. Türkei, Sirnak/Siirt, 3.vi.1977, all K. Warncke (CKW, ML); 1 ♂ 2 ♀, Türkei, Icel: Sertavul, 1400 m, 9.vi (♂), Urfa: Halfeti, 29.v (♀) & Nevsehir: Ürgüp, 6.vi.1978 (♀), all Max. Schwarz (CMS). — Bulgaria: 2 ♀, Arkutino, Black Sea coast, vi—vii.1970, K. Bleyl (CFP); 1 ♂, N.O. Bulgarien, Pisanec, v.1955 (MNB). — Romania: 1 ♂, Mehadia, Mann 1859, *M. luctuosa*, det. Pohl (NMW). — Greece: 1 ♀, Morea, Cumani, Brenske (print) and 1 ♀, same loc., *M. armata* var. *grandis* Lep., det. Friese 1893 (MBUD); 1 ♂, Greece, Athens, Theseion, 15.iv.1968, J. P. van Lith (CVL); 1 ♀, Griechenland, Chalkis, Euböa, 12—16.v.1956, Fr. Borchmann (MKB); 1 ♀, Graecia, 189, coll. A. Weis, *M. ashabadensis* det. Friese 1904 (SMF); 1 ♀, Graecia, Xiloxastron, 8.v.1962, W. Linsenmaier (CL); 1 ♂ (diss.), Peloponnesus, Chelmos, 2100 m, 1.vi.1962, M. Schwarz (CMS); 1 ♀, Kalamata, 14.v.1964, M. Schwarz (CMS); 2 ♀, Ellas, Athene, Mt. Imitos, 1.v.1963, S. Daan & V. van Laar (MA); 1 ♂ (diss.), Graecia, Delphi, 11.iv.1963 and 1 ♂, Agrinion, 17.iv.1963, Kl. Warncke (CKW); 1 ♂, Greece, Salomis I., 6.iii.1932, E. E. Green (BM); series ♂♀, Graecia, Olympia, Mykene & Lamia, iii.v.1964; Delphi, iv. 1966; Sparta, 9—13.iv.1969; all W. & E. Grünwaldt (CWG); Sikyon, Kastania & Trypi, iv-v.1973, W. Grosz, coll. Grünwaldt (CWG); 1 ♂, Mt. Parnes, 600 m, 17.iv.1977, K. M. Guichard (BM); 1 ♂ ♀, Delphi, 11.iv.1963 (together with *M. fulgida* spec. nov.!), K. Warncke (CKW); 2 ♀, Chalkis, Euboea, iv.1926, Holtz (MNB). Cyclades: 1 ♀, Kykladen, Pholegandros, v.1934, Werner & Wettstein (NMW); 1 ♂ (diss.), Kiklades, Mikonis I., Lino, 3 km SE of town, 13.iv.1974, and Tigani, 5 km NE of Ano Mero, 18.iv.1974 (♂), A. C. & W. N. Ellis (MA); series ♀, Mykonos I., iv.1927, and Ikaria I., iv.1934 (MNB); 1 ♀, Cykladen, Keos [Khios], v. Oertzen (MNB); Samos I., 1 ♀, Samos, Kokkari, 25.iv.1977, H. Teunissen (CT); Kos I., 1 ♀, Kos, Asclepieion, 300 m, 30.iv.1971, M. A. Lieftinck (ML); Rodos I.: 1 ♂, Rhodus, Hedenb. 1904 (NRS); 3 ♂, Rhodos, Fileremos & Archangelos, 29—30.iii.1977, at *Anchusa hybrida*, A. Nilsson (DEU); 1 ♂, Rodi, 17.iv.1928, *M. armata*, det. Hedicke (IEB); 5 ♂, Rodini, 22.iv.1970, H. Teunissen (CT, ML); 1 ♂ 1♀ (♂ diss.), Rodos, Lindos, 26.iii & 17.iv.1970, A. C. & W. N. Ellis (MA); 1 ♂, Rhodos, Fileremos, 23.iv.1976, H. Teunissen (CT); 1 ♂, Rhodos, Profitis Ilias, 8.v.1975, H. Malicky (CG). — Crete: 1 ♂, Crete, nr. Kanea, D. M. A. Bate (BM); 1 ♀, Kreta, Omalos Ebene, 1000 m, vi.1942, Kl. Zimmermann (MNB); 1 ♀, Ost-Kreta, Ssiwa, Ep. Pirgiotissa, 17.v.1925, A. Schulz, *M. armata* v. *albovaria*, det. Alfken (MNB); 2 ♂ 2 ♀, Creta, Canea and Heracleion, iii.1906, Biró (MBUD, ML); 1 ♂ 4 ♀, Crete, Chania, 15.v.1972 & 1.v.1974 (3 ♀), and Omaios, 1250 m, 13.v.1972 (1 ♂ 1 ♀), K. M. Guichard (BM); 1 ♂, Kreta, Tybaki, iv.1914 and 1 ♀, Knossos, coll. F. Werner, *M. armata* var. *albovaria*, det. Alfken (NMW); 2 ♀, Kreta, Knossos, 13.v.1968, J. Gusenleitner (CG); 1 ♀, Kreta, Knossos, 13.v.1963, K. Kusdas (CMS); 1 ♀, Kreta, Kaminaki, 900 m, 12.v.1971, Dr. Malicky, coll. K. Kusdas (CG); 2 ♂ 3 ♀, Crete, Arkhanes, 28.iv.1972, K. M. Guichard (BM); 1 ♀, Kreta, Lassithi, 850 m, 11.vi.1976, K. Warncke (CKW); 1 ♀, Kreta, Neapolis, v—vi.1904, Rebel (NMW). — Ionian Is: 1 ♀. Ionian Is., S. Saunders (BM); 1 ♂ 1 ♀, Corfu, Paganetti 1903 (MNB). — Yugoslavia: 1 ♂ 2 ♀, Makedonien, Babuna Schlucht, 25,iv.1976, M. Kraus (thoracic pubescence brownish: vers *albifrons*!) (CKW); 2 ♂, Nea, Agatoupolis, 27.iv.1976, on *Thymus*, M. Kraus (CKW); 2 ♂, Dalmatia, coll. Simony and Mann, *M. armata* var. *grandis*, det. Friese 1893 (NMW); 1 ♀, Dalmatia, C. Marzio Arbe, 4.vi.1914, *M. luctuosa*, det. Maidl (NMW); 1 ♀, Dalmatia (MBUD); 1 ♂, Fiume [Rijeka] Mann 853, *M. armata* var. *grandis*, det. Friese 1893 (NMW); 2 ♂ (1 diss.), Dalmatien, one with *M. armata* det. Friese 1896 (MNB). — Italy: 2 ♀, Trieste, 8.v.1896, Ducke, with two labels: *armata* & *p. punctata*, both det. Alfken (MNB).

N.B. — Some (not all!) of the last mentioned bees from Yugoslavia and Trieste, across the Italian border, are moderate-sized and possess the usual regularly arranged white abdominal spots of *albovaria*. The pubescence on head and thorax is, however, not pure white but palest brownish grey, thus approaching more northern individuals of typical *albifrons*. Further westward into the northern provinces of Italy and the peninsula, these intermediates become much darker and are true to the melanistic subspecies *nigra* Spinola (see under that taxon).

Except in a few places at the Côte d'Azur in the extreme SE corner of France, purely white haired bees corresponding with typical *albovaria*, are well known also from some mid and west European countries, but have mainly a southerly distribution. In regard to body size, these individuals are as variable as nominotypical *albifrons* of northern occurrence though possessing, as a rule, larger and more regularly placed abdominal spots. Material examined from the above countries, arranged more or less from E to W, can be listed from the following localities.

Switzerland: 1 ♀, Wallis, Sitten, 19.vi.1914, Th. Steck (NMB). — France (N to S): 2 ♀, St. Cyrs s. Mer (S. et M.?), 14.vi.1953 (CVZ); 1 ♂, Argent[at?] (Corrèze), 20.v.1887, coll. J. Vachal 1911, *M. luctuosa* ♀, det.? (MP); 1 ♂, Dieulefit (Drôme), 22.vi. 1960, J. v. d. Vecht (ML); 1 ♂ (diss.), Montmeyran (Drôme), 15.iv.1979, J. Teunissen (CT); several ♂♀, Carpentras (Vaucluse), v.1952 & v.1953, P. M. F. Verhoeff, and 4 ♀, same loc., 30.v.1959, W. Linsenmaier (CL); series ♂ (diss.) ♀, Digne (Bses Alpes), ult v.1957, M. A. Lieftinck (ML); 1 ♀, Montauroux (Var), 30.vi.1960, J. v. d. Vecht (ML); 1 ♂, Fayence (Var), 19—23.iv.1973, G. Barendrecht (MA); 1 ♂, Callian (Var), 21.v.1963, W. Linsenmaier (CL); 1 ♂, Beau Vallon, 12.iv.1967, O. W. Richards (BM); 2 ♀, Gall./Sichel, *M. armata* var., det.? (NRS); 1 ♂, Montpellier (Hér.), D. Lichtenstein 216/11, *M. grandis* Lep., det. J. Pérez (MCG) and 1 ♀, same loc., Lichtenstein (MNB); series ♂♀ (♂ fig. 7), same loc., Jardin botanique, 13.iv.1961, M. A. Lieftinck, "together with *Anthophora acervorum* L." (ML); 1 ♀, Vallon de Connuls, iv.1893 and 1 ♀, Nîmes (Gard) (BM); 1 ♀, Toulon (MNB); 2 ♀, Pont du Gard (Gard), v.1952, exped. H. Engel (MA); 1 ♀, St. Jean de Luz (B^{ses} Pyrén.), Le Lac, 2.v.1946, coll. V. Muspratt (BM). — Spain: 1 ♀, N Spain, Huesca, Boltona (Aragon), 17.v.1953, I. H. H. Yarrow (BM); 1 ♀, NW Spain, Pontevedra above Vigo (Léon), 200 m, 3.iv.1964, K. M. Guichard (BM); 1 ♂, Ponferrada (Léon), 25.iv.1955, I. H. H. Yarrow (BM); 1 ♀, N Spain, Santander, Santillana, 4.v.1958, excurs. ML (ML); 1 ♀, Adradas (prov. Soria, Castilia), 9.vi.1961, H_4, excurs. ML (ML); 1 ♂, Burgos (Castilia), 1.v.1955, I. H. H. Yarrow (BM); 2 ♂, Hispania, Albaracin (Catalon), vi.1953, leg. Fabian (CMS); 1 ♂, violet disk, Barcelone, coll. J. Pérez 1915 (ex MP, ML); 2 ♂, Canet de Mar (Catalon), 25.iii.1960 & 5.iv.1962, Fco. Vergés (CMS); 3 ♂ 3 ♀, Barcelona, Schmiedeknecht, coll. A. Weis (SMF, ML); 1 ♀, Gerona (Catalon), Blanes, 5.iv.1956, and 2 ♂, Barcelona, Vich & Montisquiu, 18.iv.1956, I. H. H. Yarrow (BM); 1 ♂ (diss.), Sierra Morena, Santa Elena (Jaen), 4—8.iv.1926, H. Lindberg (MH); 1 ♀, Ribas (Catalon), Busmet, coll. J. Pérez 1915 (MP); 1 ♀, Spanien, prov. Taragona, Flix, F. Haas 1914—17, *M. albovaria*

Er., det. Alfken 1925 (SMF); 1 ♀, E Spain, Tarragona, 7 km E. 28.v.1960, excurs. ML (ML); 1 ♀, W Spain, Abadia, 700 m, 5.v.1960, excurs. ML (ML); 3 ♀, Caceres (Estremadura), Tornavacas, 1200 m, V83, and Jerte, 900 m, 22.vi.1961, at *Echium*, excurs. ML (ML); 1 ♂, Monchique, 7.iii.1906/Madrid. G. Schramm (MP); 1 ♀, prov. de Madrid, Meco, 610 m, J. Alvarez (CCS); 1 ♀, Aranjuez (Madrid), 25.v.1959, W. Linsenmaier (CL); 3 ♂, Espagne, Uclès (MCG); 1 ♂, Waltl, Spani 1830, *M. armata* var. *grandis* Lep., det. H. Friese 1893 (NMW); 1 ♂, Granada, Staudinger (BM); 1 ♂, Valencia, Betera, Quilis, *M. albovaria*, det. Alfken (MNB); 1 ♂, Hisp., Godelleta Valencia, Peres Torres, coll. Peres, *M.*

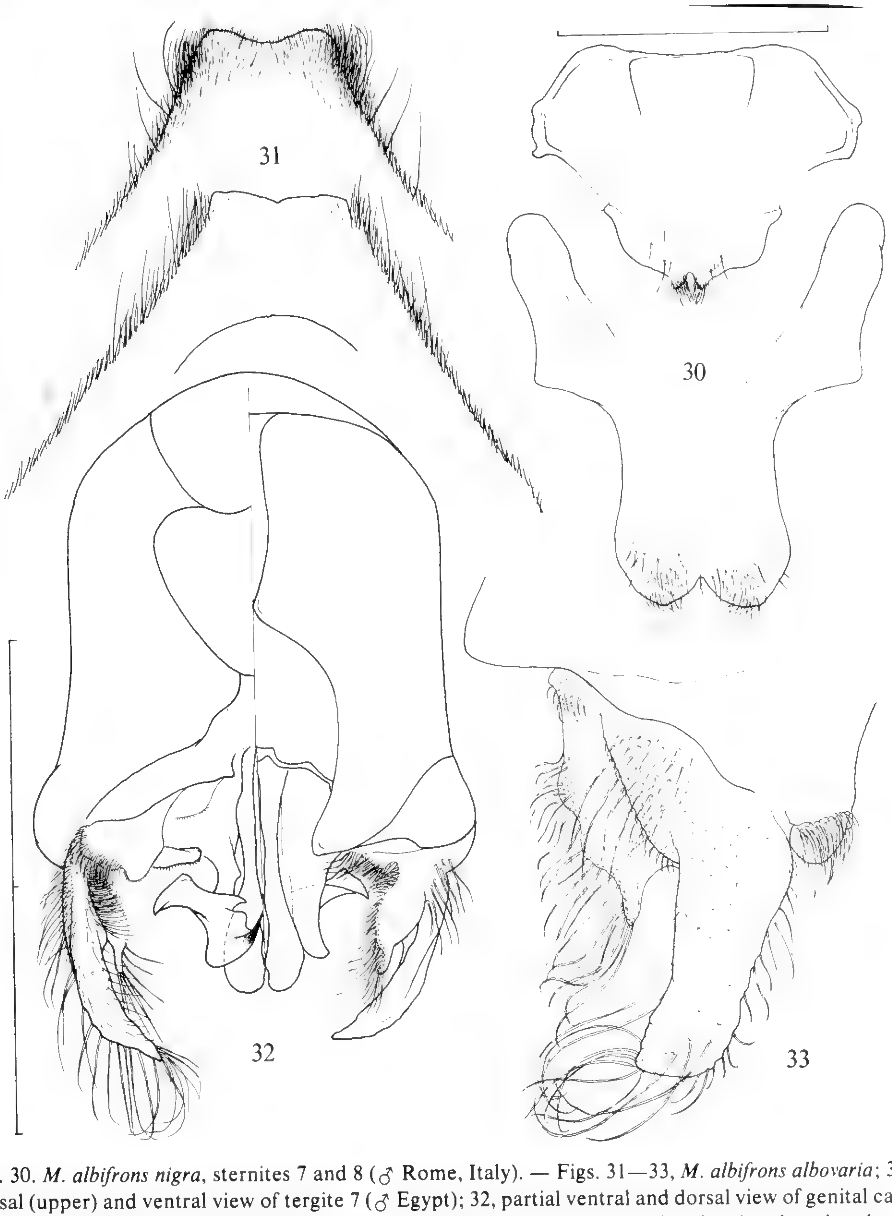


Fig. 30. *M. albifrons nigra*, sternites 7 and 8 (♂ Rome, Italy). — Figs. 31—33, *M. albifrons albovaria*; 31, dorsal (upper) and ventral view of tergite 7 (♂ Egypt); 32, partial ventral and dorsal view of genital capsule (same specimen, bristles partly omitted); 33, lateral aspect of gonostylus showing dorsobasal and ventrobasal processes (same specimen). Scale lines 1 mm (fig. 30) and 2 mm (fig. 32)

luctuosa Scop., det.? (CCS); 2 ♀, Hispania, Valencia, Cañada, Giner Mari (CCS, ML); 3 ♀, Andalusia, Sevilla, 14.v.1972, W. Grosz (CWG, ML); series ♂, Elche (Alicante), v.1933, Hering (MNB); 2 ♂, Südspanien, Granada, 30.iii.1959, W. Schläfle (CL); 1 ♂, Algeciras, 25 iv, coll. O. Vogt (MA); 2 ♂, Andalusia, Algeciras, 1—10.v.1925, and Tarifa, 13.v.1925, Zerny (NMW); 1 ♂, Espana, Cadiz, M. López Banús (CCS); 1 ♂, Porto Sta Maria nr. Cadiz, 17.iii.1906, coll. Schramm, coll. J. de Gaulle 1919 (MP). — Portugal: 1 ♀, Portugal, Wattison coll. (BM); 1 ♂, Lisboa, 3.iv.1955, N. F. d'Andrade (ML); 1 ♂ 1 ♀, Rezende, 14.iv.1950 (together with 1 ♂ *M. luctuosa* Scop.!), N. F. d'Andrade (ML); 2 ♀, Portugal, Algarve, Praja da Rocha, v.1934, H. Main (BM).

Varicoloured specimens intermediate between typical *albifrons* and *albovaria*, with head and thorax pubescence distinctly brownish and with conspicuous pure white abdominal spots, are occasionally met with in mixed populations of the latter, comprising all intergradations. These were found in the following localities:

Austria: 1 ♂, almost all white, Ob.-Österreich, Traunsteingeb., 7.vi.1951, R. Löberbauer (CMS). — France: 4 large-sized ♂ (diss. fig. 71), Antibes sur Colza (Alpes-Mar.), 24.iv.1969, J. Riom, head & thorax definitely brown, abdominal spots small, white (INRA); 1 large ♀, vers *albifrons* typ., with small white-spotted tergites 2—3, Bordeaux (Gironde), 28.iii.1974, H. Hamann (CMS). — Spain: 2 ♀, Soria, St. Maria de Huerta (prov. Soria, Castilia), 13.vii (sic) 1969, P. M. F. Verhoeff, thorax pubescence mixed with brown (CV); 3 ♂, Ronda (Catalon) and Canet de Mar nr. Barcelona, thorax pubescence whitish fading to grey-brown (CVS); 6 ♂, small-sized (10—11.5 mm!), Pozuelo de Alarcón nr. Madrid, R. Ruano, 3.iv.1959, one with distinctly grey-brown thoracic pubescence, abdominal spots of large size (CCS, ML); large series ♂♀, body measuring 9.5—17.5 mm, all profusely spotted but partly with head and thorax pubescence definitely brown, env. Valladolid (Castilia), nr. Fuensaldaña, Los Alamos & Villabañez, v-vii and xi (sic) 1974, at nest entrances of *Anthophora acervorum* (L.), E. Asensio de la Sierra (CAV, ML); 2 ♂ 1 ♀, various sizes (see above), Toro (prov. Zamora), ca. 30 km from Zamora, 25.iv.1974 & i-ii.1975, in nests and at nest entrances of *Anthophora acervorum* (L.), *crinipes* Smith (ii. 1975) and *fulvitarsis* Brullé, E. Asensio de la Sierra (CAV, ML).

Interesting information concerning the host relations of the present taxon in southern France was found (sub *armata*) in the manuscript catalogue of J. Pérez' bee collection in the Paris museum, made available to me now already 20 years ago. Corresponding remarks are contained in the author's more elaborate account of Mediterranean *Melecta* (Pérez, 1883: 302—307). At present we know for certain that several white-spotted "near-alike" species may occur together all over the Mediterranean region inclusive of the southern provinces of France. Therefore it must remain uncertain whether all forms discussed by Pérez were really *albovaria*. Yet I think the author's observations are of some historical interest and worth quotation in his own language:—

"No. 156 — *Melecta armata* Lep. primitivement marqué *punctata* puis rayé. Périgueux, Tarbes, Bordeaux, très commune, en avril et encore en mai sur un grand nombre de fleurs, en particulier celles du chou, dans les jardins comme dans les champs. Parasite des *Anthophora pariétina* [= *plagiata* (Illiger)] et *personata* (= *fulvitarsis* Brullé); aussi la voit-on fréquemment sur les talus où nichent ces apiaires. Grandes variétés de taille et de vestiture. Les sujets qui éclosent des cellules de *personata* sont plus grands, plus fourrés de poils; ceux qui sont parasites de la *pariétina* sont plus petits, leur tête notamment est peu volumineuse; leurs poils sont moins longs et moins épais. Les taches des segments 3, 4, 5 peuvent disparaıtre complètement; d'autres fois elles sont très larges particulièrement chez quelques ♂. Le corselet est généralement chez les ♂ couvert de poils fauves en dessus, sauf sur l'écusson et le post-écusson qui les ont noirs, ainsi que le voisinage de l'insertion des ailes. Chez la ♀ cette variation est assez rare; généralement le noir gagne davantage sur le corselet et ordinairement on distingue quelques houppes de poils noirs dont 2 plus distinctes en avant. Face entièrement noire chez une ♀. — ♀, premiers jours de juin, talus habités par les *Anthoph. personata*, *parietina*, *aestivalis*, *crinipes*, volant en ce moment."

From the above notes on the colour design, it is quite clear that, apart from typical *albifrons* and *albovaria*, specimens of *nigra* Spinola, from maritime districts, were also at the writer's disposal; further details are unfortunately not known.

During recent years an investigation of the host-parasite relationships was started with more precision by the Spanish hymenopterologist Dr. Enrique Asensio, in Castilia and Zamora (north-central Spain). During a period of five years (1971—1975), the nesting sites of three *Anthophora* species were regularly inspected, viz. those of *acervorum* (F.), *crinipes* F. Smith and *fulvitarsis* Brullé. These bees are among the first members to emerge in the spring (mid April) and overwinter as adults. They formed mixed colonies, the nesting sites being preferably in tali of deep and little frequented roads in three or four farming areas just outside Valladolid or at some distance to the W of that town. The contents of many nests were excavated, the adults reared and all stages of development preserved for further study. All species were associated with the cleptoparasitic *M. a. albovaria*, i.e. the only *Melecta* observed in the nesting area. The big host bee *A. fulvitarsis* was first noticed in May 1971 visiting the racemes of vine in company with *albovaria* at a farm near town. Already in July 1974 adults of *albovaria* were present in *A. acervorum* cells near Toro, some 30 km E of Zamora, and also in November of the same year at a nesting site N of Valladolid. During April 1974 and again by the end of January 1975, while digging out the contents of *A. crinipes* nests, also near Toro, a number of surprisingly small adult males of *albovaria* were unearthed resting in cells (or burrows?) of this equally diminutive *Anthophora*. Nest entrances of *A. fulvitarsis* and *acervorum* were close by, and Dr. Asensio noticed that sometimes females of these two species used the same entrance hole, the parasitic intruder being usually also present.

The interesting point here is the striking difference in stature and size exhibited by individuals of a single species of *Melecta* within a limited area. Nests in small mixed colonies of at least three *Anthophora* species were all robbed by *albovaria* alone. As these host bees are not at all closely interrelated, differing markedly *inter se* in structure and dimensions, they will probably have their own foraging capacity, each provisioning its cells with a specific quantity of pollen and nectar. Therefore the outsized individuals of *albovaria* may well have emerged from the well-stored cells of *A. fulvitarsis*, while the smallest would have reached maturity by consuming the less copious food supply available in the cells of the little *A. crinipes*. Two other species of *Melecta*, viz. *italica* Radoszk. and *luctuosa* (Scop.) were also found in Spain by Dr. Asensio. Perfectly fresh, small-sized males of *italica* were collected in May 1972 and April 1973, in a different area near Valladolid, flying in company with *A.* cf. *dispar* Lep.; females of *luctuosa* were caught only at Salamanca.

This predominantly white subspecies of *albifrons* is one of the most widely distributed and undoubtedly the commonest *Melecta* of the entire Palaearctic region. Both sexes of the three subspecies are sufficiently characterized in the key to the males. Once again it must be emphasized that several local populations of all forms are rather puzzling with regard to the colour of the pubescent pattern and extent of white abdominal spots: these aberrant individuals are briefly discussed under the subspecies concerned.

M. a. albovaria occurs discontinuously throughout southern Europe, i.e. with the exception of practically the whole of Italy, the Tyrrhenian islands, and Malta, in which area it is replaced by the next subspecies, *a. nigra*. Its further range comprises North Africa north of the Sahara and eastward as far as the Caspian Sea and into Iran.

Melecta albifrons nigra Spinola
(figs. 26—30, 73)

Melecta nigra Spinola, 1806, Ins. ligur. spec. nov. 1: 44, tab. I, fig. XIV (Habitat in Liguriâ, haud infrequens). — Friese, 1895, Bienen Europa's: 159—160 (not seen!). — Alfken, 1937, Boll. Ist. Ent. Bologna 9: 111 (♀♂ Ronzano: ♀♂ Bozen; ♂ Calabrien: Antonomina; notes: "Wirt vermutlich *Anthophora crinipes* F. Smith"). — Lieftinck, 1958, Comment. Biol. Helsingfors 18.5: 30 (note on type).

Melecta fasciculata Spinola, 1806, Ins. ligur. spec. nov. 1: 45, tab. 1, fig. XV (Habitat propè Genuam, rarior). — Friese, 1895, Bienen Europa's: 160 (not seen!). — Lieftinck, 1958, Comment. Biol. Helsingfors 18.5: 20—22 (synon. notes), pl. 1 fig. 11 (♂ struct., lectotype *M. fasciculata* Spin., Genova, = *nigra* Spin.).

Crocisa atra Jurine, 1807, Nouv. méth. Hym. & Dipt. 1: 241, Taf. 12 Gen. 34 (♀ sine patria (= Europe!). — Frey-Gessner et al., 1882, Mitt. Schweiz. Ent. Ges. 6: 387—397 (remarks on Jurine's type). — Lieftinck, 1958, Nova Guinea, new ser. 9: 24 (list, rect. = *Melecta*). **Syn. nov.**

Melecta punctata var. Spinola, 1809, Ins. ligur. (edit. Francofurti): 153 (diagn. variations).

Melecta bipunctata Lepeletier, 1841, Hist. nat. Ins. Hym. 2: 446 (♀ Italie, Toscane). **Syn. nov.**

Melecta aterrima Lepeletier, 1841, Hist. nat. Ins. Hym. 2: 447 (♀ Ile de Noirmoutiers, Dejean). **Syn. nov.**

Melecta calabrina Radoszkowski, 1876, Horae Soc. Ent. Ross. 12: 95—96 (♂ — not ♀! — Calabria). Radoszkowski, 1893, Bull. Soc. Imp. Nat. Moscou n.s. 7 (2—3): 183, fig. 38 a—c, i (♂ genit.). **Syn. nov.**

Melecta armata cum subspec., Pérez, 1883, Actes Soc. Linn. Bordeauz 37 (ser. 4, vol. 7[1]: 302—307 (pars: compar. notes).

Melecta luctuosa Scop. var. *nigra* Spin., Friese, 1893, Bienenfauna Deutschl. u. Ungarn: 37 (Bozen). — Pérez, 1890, Actes Soc. Linn. Bordeaux 44: 36 (cat. France, sine locs.).

Melecta armata Panz. var. *aterrima* Lep., Frey-Gessner, 1907: 144 (Locarno & Geneva, note).

Type and syntypic material. — Italy: 1 ♀ (not ♂!), over drawer label "*Melecta notata* var. ♂/tota nigra/Liguria" (white). Lectotype *M. nigra* Spin. by present designation (MT). — 1 ♂ (diss., figs. 26—29), over drawer label "*Melecta fasciculata* m. Ins. ligust. ♂ . . . *notata* var.? Gênes" (white). Lectotype *M. fasciculata* Spin. by earlier designation (MT). — 1 ♂, labelled "Italia Genua Spinola S." (modern writing), "Type" (print on red), and old black-rimmed label "*M. fasciculata* Spin. mas S.pr. punctatae/Genua Spinola" (probably Spinola's writing). Syntype *M. fasciculata* Spin. (MNB). — N. Italy or S. Switzerland: 1 ♀, originally mounted upside down at strong pin; pictured in Jurine, loc. cit., with white written label "*rufipes* ×", sine loc. Holotype *Crocisa atra* Jurine (MG). — Italy: 1 ♂ (diss.) labelled "Calabr." (white, Radoszkowski's hand), "Type" (print, red), "*calabrina*" (pencil), "*Melecta calabrina* Radoszk. Type" (written, Dr. Enderlein det.). Holotype *M. calabrina* Radoszk. (MNB). — Other syntypes. Italy: 1 ♂ 4 ♀ (syntypes *nigra* and *fasciculata*): 1 ♂ 1 ♀, ♂ with pin-label *M. punctata*? var. *fasciculata* Spin. Ped. ♂♀; 1 ♀, over drawer label *M. notata* Kl. ♂♀ ... *punctata* Lep. Gênes; 1 ♀, with pin label *M. punctata*? var. F. Lep. ♀ Torino; 1 ♀ over same drawer label as lectotype *M. nigra* (all MT).

Further material. — Italy: Liguria & Piemonte: 17 ♂ 18 ♀ in coll. Fea, Magretti and Gribodo, from env. of Genoa, Borzoli, 10—20.iv.1909 and iv.1883, Orte Botanico, Caneva 1883, C[a] Amata, Paderno Dugnano, spring 1895—1908; Piemonte, Genola, v.1885 and Coazze, leg. Gribodo (all MCG); 1 ♀, Liguria, Mortola-Inferiore, Giardino Hanbury, 28.iv.1975, H. Wiering (MA). Liguria: 1 ♂ 1 ♀, Genua, Lavagna, 26.v.1970, B. J. Lempke (MA); 1 ♂, Italia, Spezia, 10.iv.1906, Dr. Uzel (NMW); 1 ♀, Bordighera, iv.1961, W. Grünwaldt (CVS). Lombardia: 1 ♀, Monza, R. Parco, III.1932, D. Prestifilippe (IEP). Alto-Adige-Trentino: 1 ♂ 1 ♀, Italia, Sanertal/728, ♀ with *M. testaceipes*, det.? (MNB); 11 ♂ 1 ♀, iv-v, various years, 1 ♀ *M. armata aterrima* Lep., det. Friese (MZB); series ♂♀, Südtirol & Bozen, variously labelled *M. nigra* + *fasciculata*, *aterrima*, det.? (MNB); 1 ♀, Bozen, Tirol, 25.iv.1898, *Anchusa*, leg. Friese, *M. nigra* det. Alfken (MNB); 1 ♂, Bozen, 2.iv.1897, *M. armata* var. *bipunctata* Lep., et. Friese (MCG); 3 ♂ 2 ♀, Bozen 1886, F. Kohl, *M. armata* var. *bipunctata*, det. Friese 1893 (NMW); large series ♀, Südtirol, Bozen, at *Saponaria ocymoides*, Stöcklein leg. (ZSM); series 14 ♂ 9 ♀, Bozen, various dates, A. Weis (SMF) & 1 ♂, id., *M. armata* var. *bipunctata* Lep., det. Friese 1893 (MBUD); 2 ♀, S. Tirol, Weidbruck, 15—16.v.1960, H. Priesner (CMS) Emilia-Romagna: 1 ♂, Modena, Casinalbo, iv.1943, G. Fiori (MA); 1 ♂ 1 ♀, Bologna, Ronzano, *M. nigra* and *fasciculata*, both det. Alfken (MNB); series 24 ♂ 19 ♀, env. of Bologna, Ronzano, Gaibolo, iv-v, various years, leg. Grandi et al., *M. nigra* M. Spin. *fasciculata* M. Spin., det. Alfken 1937 (1 ♀), *M. nigra* Spin., det. Alfken 1937 (4 ♀), *M. fasciculata* Spin., det. Alfken 1937 (21 ♂), *M. armata*, det. Hedicke (1 ♂), *armata* f. *bipunctata* Lep., det. Hedicke 1921 (2 ♂), and *armata* f. *nigra* Lep., det. Hedicke (3 ♀) (all IEB), and 6 ♀, Bologna, Gaibolo, v.1953, leg. Grandi (MA); 1 ♀, Bologna, Prj. Fiori (MCG); 1 ♀ (totally black!), Castelvetro, 18.viii. (sic) 1885, coll. Baldini (MT) and 1 ♂, same loc., 7.x. (sic) 1885, same coll. (MT). Toscana: 1 ♂, Florence, coll. O. Sichel 1867 (MP); 1 ♀, Fiesole nr. Firenze, 8.v.1925, at *Salvia*, and 1 ♀, Siena, 16.v.1925, M. A. Lieftinck (ML); 1 ♀, Florence, Picioli, coll. Tournier (MG); 1 ♂ 2 ♀, Castiglioncello (Livorno), 3—11.v.1958, G. Barendrecht (MA); 11 ♂♀, Pisa, iv-v.1953 (CTP). Marche: 2 ♂ 1 ♀, Macerata, 17—30.iv.1939, leg. G. Soika (CVZ). Abruzzi: 1 ♀, Cerchio, Aquila (MCG); 4 ♂ 1 ♀, E-coast, Pescara, 21.iv.1963, W. Grünwaldt (CKW). Lazio: 1 ♂, Marino, iv.1933, and 1 ♀, Caffarella, iv.1935, (ZSM); 1 ♂ (diss., fig. 73), Roma, Aquatraversa, 13.iv.1949, M. Comba (CMC); 5 ♂ 6 ♀, env. of Roma, Bosco Sacao, Subiaco (S. Sco. Castica), Marino, Acilia, Priverno, Formia, Capo Circeo, and Sabaudia, iii-v.1932—1945, leg. Castellani et al. (all INER). Campania: 1 ♀, Neap., "*nigra* et *aterrima* Lep." and "*punctata* Grib. *nigra* Lep." (old writing) (MNB); 1 ♀, Naple, coll. O. Sichel 1867, *M. nigra* (unknown writing, MP); 1 ♀, Neapel, *M. testaceipes*, det. Friese (MNB); 1 ♂, Roy de Naples, O. Costa, 1.53 (MP); 17 ♂♀, Portici, various spring data (IEP); 2 ♂ 2 ♀, Pisciotta, 6—10.v.1936, *M. armata aterrima* & *a. nigra*, det. Alfken (IEP); 1 ♀ (totally black), Monteforte, Intrino, 12.iv.1918 (IEP); 1 ♂, Areve, 2.v.1930 and 1 ♂, S. Vito de Norm, v.1905 (IEP); 1 ♂, Neapel, Coll. Rhd./28985, *bipunctata* (old writing) and 1 ♀, Neapel/728, *M. arm.* var. *aterrima*, det. Friese 1896 (MNB); 1 ♀, Portici (MCG). Puglia: 2 ♂, Monte Argentario & Monte Gargano, 12—14.iv.1975, H. Teunissen (CT, ML); 1 ♀, Manfredonia 1904, Paganetti (NMW); 1 ♂, Barletta, v.1893 (MT); 1 ♂, Apulien, Spongano, 18.iv—3.v.1933, v. Loudon leg. (MNB); 1 ♀, Apulien, same loc., 27.ii—16.iii.1933, same coll., *M. luctuosa*, det.? (ML). Basilicata: 33 ♂ 11 ♀, Rionero, iv—vi.1890—93, coll. Baldini (MT); 1 ♂, Monticchio, 15.iv.1890 (MT); 8 ♂ 1 ♀, Vulture, all vii. (sic) 1891 (MT); 1 ♀, Rionero, 1.v.1891, *M. armata*, det.? (INER); 1 ♀, over old drawer label "*M. nigra* h. in Italia Scop." (ex Scopoli?) (MP). 2 ♂, sine loc., *armata*, det. Saunders (MBUD). Calabria: 1 ♂ 1 ♀, Calabria, Antonimina, Paganetti, *M. nigra*, det. Alfken (MNB). — Corsica: 2 ♂, Corsica, Klinckow (NRS); 2 ♂, Corse, Mann 1855, *armata*, det. Kohl (very large ex.), and *armata* var. *bipunctata* Lep., det. Friese 1893 (smaller ex.) (NMW). — Sardinia: 1 ♀, Sardinia (print, MBUD); 2 ♂, Sardinia, Oristano, Kraus leg. (AMNH); 1 ♀, "Sardin. Kutit." (?), *testaceipes*, det.? (MNB). — Sicilia: 1 ♀, Sicile (lilac disk), coll. J. Pérez 1915 (MP); 1 ♂, Taormina, V. narbon. mm 20, 20.iv.1937, Kuntzen leg. (MNB); 1 ♀, Sicilia orient., Taormina, 200 m, dint.22.iv.1950, Hartig & Grshm. leg. (INER); 1 ♂, Sicilia, Taormina, 23.iv.1976, J. A. W. Lucas; 2 ♂, Sicilia 1885, *M. armata*, det. Mocsary (MBUD); 1 ♀, Sicilia, M. Cuccio, 19.v.1953, A. Fiori (MA); 1 ♂, Sicilia (MCG); 1 ♂, Sicilia, Taormina, 22—30.iv.1921, Zerny, *M. armata*, det. Maidl (NMW); 2 ♀, Sicilia, Palermo, 10—28.v.1921, Zerny, *M. armata* var. *nigra* Lep., det. Maidl (NMW); 2 ♂ 2 ♀, Sicilia, 1858 Mann, *M. luctuosa* det. Pohl (1 ♂), *armata* var. *grandis* Lep., det. Friese 1893 (1 ♂), and *armata* var. *nigra* Lep., det. Friese 1893 (2 ♀) (NMW); 2 ♂, Palermo, 30.iii.1965, M. Schwarz (CMS); 2 ♀, Sicilia, prov. Palermo, Bosco di Ficuzza, 16.v.1965 and S. Martino d.Sc., 1—12.vi.1954, J. Klimesch (CMS); 2 ♀, above Trapani, Sicily, 200 m, 16.iv.1965, K. M. Guichard (BM); 1 ♂ (diss.) 1 ♀, Syracus, iv.1898, ♂ with *punctata* var. *albovaria*, det.? and ♀ with *M. luctuosa* var. *ruthenica*, det. Friese (MNB); 2 ♂, Sicilia, Monte Gargano, 12—14.iv.1975, H. Teunissen (CT, ML).

Synonymy. — Here follow a few remarks on a number of types synonymized with the present subspecies.

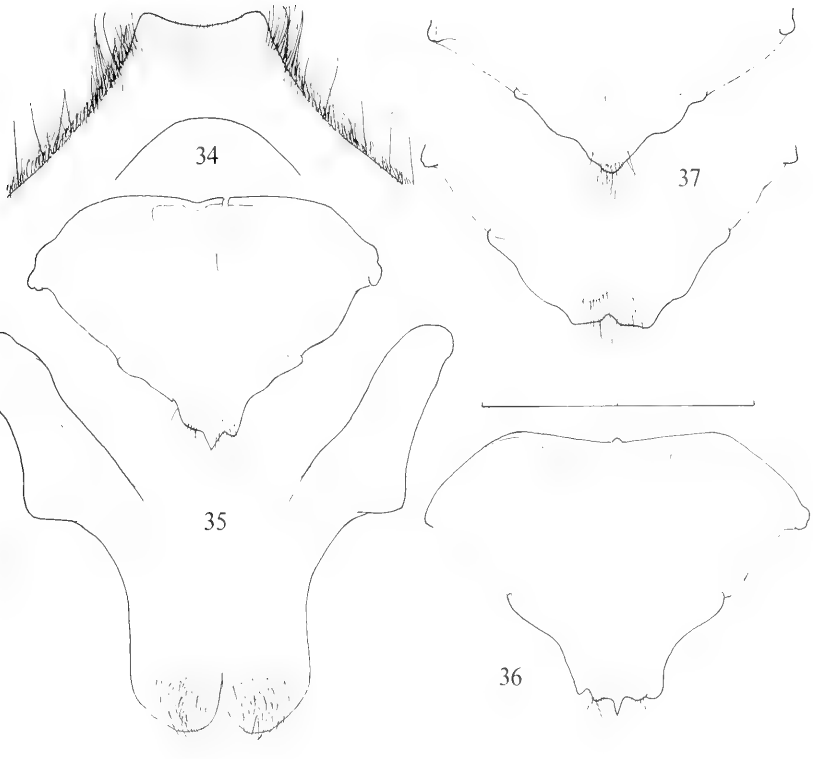
The holotype of *Crocisa atra* Jurine possibly originates from northwestern Italy, or even from south Switzerland, and does not differ from certain examples occurring in the former country. The mandibles are plainly exposed and of the shape characteristic for this and other species of the genus. The specimen lacks two legs (fore and hind), which for the rest are wholly black. The abdomen carries distinct greyish spots, one each side, on tergites 2—4.

Of the five species named by Lepeletier, the localities of two obscurely coloured bees, *nigripennis* and *testaceipes*, are unknown and since the types are no more in existence, their names should be rejected (see *species incertae sedis*, at the end of this work). *M. nigra* Lep., — the name given to a melanistic female from Genoa — is homonymous with Spinola's bee and undoubtedly belongs to the same subspecies. The type of a fourth species, *bipunctata*, a female reportedly from Tuscany, could not be recovered in any collection, but since the brief diagnosis applies perfectly to specimens of *nigra* collected by myself and others in the same province (Toscana), should also be considered synonymous with the present subspecies. Lastly, the type of *aterrima* Lep., described from Ile de Noirmoutier(s), at the Atlantic coast of Bretagne, has also become lost but could not have been anything else but a melanistic individual of what is here regarded as *nigra* Spinola (see below).

The type male of *M. calabrina* Radoszkowski is a true member of the *albifrons* group, its structure agreeing with south Italian specimens of *nigra*. The mid tibiae are predominantly white, the hinder pair only bear a small basal spot. Tergite 1 of abdomen black with greyish hair tuft on either side, those on 2 being larger, while the sides of 3—4 are each marked with a single much smaller white spot placed more inward. The genital organs were dissected out and glued on a card by its describer.

Specimens like this should not be confounded with other black-coloured *Melectae* occurring in Italy and elsewhere in the Mediterranean, like *italica* and *leucorhyncha taormina*, which are closely similar superficially. Though often occurring together with the latter in one locality, *nigra* can be immediately distinguished from these by the characteristic shape of the tarsal claws, its wing venation, and the greater complexity of the male copulatory apparatus.

Variability. — In the past the black-haired *Melecta* occurring in the Mediterranean region and further eastward have given rise to much confusion,



Figs. 34—37. *M. albifrons albovaria*; 34, ventral view of tergite 7 (♂ lectotype Algeria); 35, sternites 7 and 8 (same specimen); 36, sternite 8 (♂ Tunisia); 37, apices of sternite 8 (two ♂ from Egypt, showing variation). Scale line 1 mm (figs. 35—36)

taxonomically as well as, inevitably, in respect of their nomenclature. Feelings of apprehension regarding the proper names for these bees were plainly revealed by Friese (1893, 1896) and Alfken (1937), who assigned no less that seven names to the colour variations of the present subspecies of *albifrons*. This *nigra* has its distribution centre in Italy and the Tyrrhenian islands. The striking variation in the extent of grey and pure white hair covering the body and legs of Italian populations, is best demonstrated by a large series of 58 ex. (44 ♂ and 14 ♀) in coll. Baldini (MT, females labelled var. *aterrima* by Zavattári), collected in the provinces of Emilia and Basilicata, and by 31 ex. (15 ♂ and 16 ♀) from Lombardia and the environs of Genoa, in coll. Gribodo and Magretti (MCG). Though not all of these are still at hand, they were studied by me in 1959 and formed the basis of the key characters. All males have white faces, spotted legs, and at least much grey hair upon the mesonotum, but the white spots on the tergites 3—4 are present only in about 50 per cent of the total, in all others they are restricted to the first two. Females are considerably darker, either entirely black, or marked only with small white abdominal spots.

It will be noted that specimens from Sicily, here all listed under *albifrons nigra*, are not at all homogeneous either. Yet both sexes differ from each other only in the distribution of white and black hair. ♂: White plus variants differ from mainland populations by having a complete row of spots on tergites 2—5, the one on 2 being largest and comma-shaped. ♀: Head, thorax and legs completely black, save for a vestigial spot at base of hind tibia, the abdomen with complete row, as in ♂, except that all spots are a little smaller (from Taormina, Palermo and Syracuse). — ♂: Minus variants only have the two basal tergites white-spotted, the mark on 2 being small, hence are similar to many mainland examples of that sex (from Mts. Gargano and Argentario); ♀ not available.

Melanistic females inseparable from typical *nigra* occurring in Italy, have been examined from the following countries (see also under *albovaria*).

France: 1 ♀, Alpes marit., Castella sur Menton, 1.xii.1954—1.v.1955, J. Briedé (MA); and from more northern and coastal localities in France: 2 ♀, Ouessant (Finistère), 31.v—3.vi.1960, G. Kruseman et al. (MA); 1 ♀, Bar. s. Seine, *M. aterrima* Lep./*aterrima* (print), coll. Gribodo (MCG); 1 ♀, Passy, Rég. Paris, coll. O. Sichel 1867, with old separate labels "Pass." and "*M. aterrima*", in Sichel's hand (MP); 1 ♀, St. Nazaire, 25.v.1911, coll. J. de Gaulle 1919, "*M. luctuosa* var. noire inédite" (MP); 1 ♀, Loire Atl., Nantes, Dominique, coll. Tournier (MG); 1 ♀, Nantes, Coll. J. Pérez 1915 (MP); 1 ♀, Bretagne, Roscoff, vi.1957, J. Pasteels (ML); 1 ♀, dark blue disk, coll. J. Pérez 1915 (MP); 1 ♀, Loire inf. (print), coll. J. Pérez 1915 (MP); 1 ♀, Gironde, Vivonne, près Bordeaux, coll. J. Pérez 1915 (MP).

The Atlantic populations found at the French coast and those listed occurring more scatteredly in the northern parts of that country, are strikingly similar to some specimens from the Channel islands and southern England. This is the form named *M. aterrima* Lep., described from Ile de Noirmoutiers, an island off the French westcoast. In the Brit. Mus. (Nat. Hist.) and the University Museum at Oxford (OUM), I have seen equally dark and occasionally almost entirely black specimens from various counties in Southern England. These are not now before me but I noted the following localities: Colchester (Essex), Oxford, New Forest (Hampshire), Wimborne (24.v.1953), Sandown (Isle of Wight), Bude (Cornwall), and Guernsey I. (Channel Is.). A male from Chouet, Guernsey, 18—23.v.1960, taken by Mr. I. H. H. Yarrow (BM), bears the collector's label "indistinguishable from Italian *nigra*", a statement with which I concur. On the other hand, I have before me a male from Jersey I. (also of the Channel Is.), 8.v—6.vi.1965, J. Briedé (MA), which I am unable to distinguish from typical *albifrons* Forster! The same applies to males from near the Atlantic coast in western France and the Channel Islands; in them the thorax pubescence is distinctly brown while the abdominal spots are relatively of small size, e.g. a male from Finisterre, Ile de Batz, 11.vi.1958, J. H. van Bree (MA).

Apart from the Atlantic forms so closely approaching nominotypical *nigra*, some remarkable varieties also make their appearance toward the east and south, in the marginal parts of its distributional area. Notably two puzzling females should still be mentioned, one from Poland, the other from eastern Turkey. Both are indistinguishable from some white-spotted Sicilian examples of the same sex; yet, on account of their unusual origin and the absence of males, I am referring them to *a. nigra* with some misgivings. Poland: 1 ♀ (diss.), Tal von Otuzy [= Otusch or Otush, 25 km WSW of Posen, teste Dr. Fischer in litt.], 22.iv.1923, W.

Wuczeticz leg. (NMW); and Turkey (Asia minor): 1 ♀ (diss.), labelled Taurien, Magaratsch (print) [Kurdistan, Armenian Taurus, Marasch?], *M. luctuosa*, det. Kokujew (CO).

Pronounced melanism is a well known phemomenon amongst other melectini occurring in Italy and islands round the Tyrrhenian Sea (see also *M. italica*, *leucorhyncha*, and members of the allied genus *Eupavlovskia*). I see no profit in guessing at the factors effecting the localized and discontinuous distribution of *a. nigra* and its outlying forms. However, the facts speak in favour of climatic influences responsible for the general appearance of these obscurely coloured bees, — at least in so far as the analogous Atlantic populations are concerned. To sum up, I still believe that the melanistic *nigra* can be most conveniently maintained as a fairly defined and recognizable geographical subspecies centred in Italy and the big Tyrrhenian islands.

2. Group of *Melecta duodecimmaculata* (Rossi)

It will be understood from our illustrations that the species group here treated, so well characterized by the presence of paired lateral abdominal spots, genuinely only forms a "subgroup" of *M. albifrons* (Forster). The morphology of this alliance considered as a whole, is quite homogeneous, all members having the same 'facies' and show great uniformity of structure. This similarity of characters, expressed also in the wing venation, is undeniable and demonstrates their intimate relation. On the other hand, there is unlimited variety in the pubescent colour pattern, which is very confusing. Whereas *albifrons* only breaks up in a number of fairly defined geographical subspecies, each showing a more or less characteristic design, the diversity within the present cluster is more complicated and less easily understood. Apart from the extent and scheme of coloured markings, its members exhibit slight but apparently constant differences in the armature of the legs, wing colour, nature of pubescence generally, and length of hair. Yet the valuation of these mixed characters must remain subjective and is difficult to reconcile with the distribution of the various components of the group.

In the key for the males not much value has been assigned to the form of the apical sternites and appendages of the gonocoxite. Of these structures, many more than those figured were dissected out and compared, — without much advantage, however. Differences in proportion and outline of the sternal plates sometimes appeared to be incidental and of little significance. For that matter, a comparison of my sketches reveals the same inconstancy throughout the *albifrons* group (and some other species in the genus as well!), thus emphasizing their dubious value as a means of distinction in certain cases.

As will appear from the key characters of the subgroup in question, it comprises only three recognizable taxa deserving full specific rank, viz., *duodecimmaculata* Rossi, *chinensis* Ckll., and *excelsa* spec. nov. Of the previously proposed names, only *jakovlewi* Radoszk. is here re-established, to denote a subspecies of the earliest described taxon of the group, *duodecimmaculata*.

Melecta duodecimmaculata duodecimmaculata (Rossi) stat. nov. (figs. 38—42, 51—56, pl. 1 fig. 3)

Nomada ? 12-maculata Rossi, 1790, Fauna Etrusca 2: 110—111, no. *931 (Italy; sex not stated).

Nomada duodecimmaculata: Panzer, 1804, Syst. Nomencl. Schäffers Abb. regensb. Ins. 1: 35 (compar. note with *A. punctata* F.). — Diniz: (with question mark), 1960, Mem. Mus. Zool. Univ. Coimbra, 266: 34 (list: Portugal).

Melecta plurinotata Brullé, 1832, Expéd. sci. Morée, Zool. 3: 343, pl. 48 fig. 13 (♀ Morée). — Lepeletier, 1841, Hist. nat. Ins. Hym. 2: 442—443 (♀ Bagdad; ♀ Sicile; ♀ Oran). — Lucas, 1849, Explor. sci. Algérie 3 Hym.: 211 ("Oran, vers la fin de l'automne"; other locs. sec. Lepeletier). — Dours, 1874, Cat. synon. Hym. France, Mém. Soc. Linn. Nord 3: 205 (France). — Morawitz, 1880, Bull. Acad. Imp. Sci. St. Pétersb. 26: 492 (SE Mongolia; Samarkand). — Pérez, 1883, Act. Soc. Linn. Bordeaux 37 (ser. 4 t. 7): 307—308 (♀ diagn., France ?). — Friese, 1893, Bienenfauna Deutschl. u. Ungarn, Berlin: 61 (Mehadia, Hungaria). — Gribodo, 1893, Bull. Soc. ent. Ital. 25: 407—408 (♀ ♂ Spain: Catalonia and Andalusia (first description of ♂, after Spanish examples!); Greece; Italy: Sicilia; and (partim?) as far as Persia and Turkestan). — Friese, 1895, Bienen Europa's 1: 156—157 (♂♀ key), 160—161 (♂ Korfu; ♀ Mehadia & Baleares). — Dusmet y Alonso, 1905, Bol. Real Soc. esp. Hist. nat.: 152 (key), 154 (Spain, locs.). — Alfken, 1914, Mém. Soc. ent. Belg. 22: 235 (♀ Algeria, locs.). — Strand, 1915, Archiv f. Naturgesch. 81A: 166 (♂♀Creta, name only). — Schmiedeknecht, 1930, Hym. Nord u. Mitteleuropas: 830 (♀♂ Südeuropa bis Südungarn). — Alfken, 1931, Konowia 10: 164—165 (pars! ♀♂ key, with supposed *M. 14-punctata* Fisch.-Waldheim, ♀♂ sine patria!; Alfken, 1940, Sitzber. Ges. naturf. Freunde Berlin: 243 (syn. note, see citation below). — Garcias Font, 1953, Bol. Soc. Hist. Nat. Baleares 1: 10 (Mallorca). — Móczár, 1957, Fauna Hung. 19 Hym. 3: 31 (note: since 1886 not found in Hungary). —Iuga, 1958, Acad. Rep. Pop. Rom., Ins. 9 Hym. Anthoph.: 208, 212—213 (Mehadia: Hungary). **Syn. nov.**

Melecta quatuordecim-punctata Fischer de Waldheim, 1843, Rev. et Mag. Zool. 13: 3—4 (♂ "ad Ural fluvium superiorem"). **Syn. nov.**

Melecta baeri: Alfken, 1935, Apidae in Wiss. Ergebn. Niederl. Exped. Karakorum, etc., Zool. 1: 253—254 (♀ Yarkand, notes).

Melecta söderbomi Alfken, 1936, Arkiv f. Zool. 27A: 21 (♂ S.W. Mongolei, Lanchow, 28.iv.1928). **Syn. nov.**

Type material. — China: 1 ♂ (diss.), Central China (prov. Kansu), labelled "Sven Hedins Exp. Ctr. Asien/S.W. Mongol. Söderbom" (print), "Lanchow (Lanchou) 25.7.28 (9)" (pencil writing), "*Melecta söderbomi* m. J. D. Alfken det. 1935" (Alfken's writing), "Typus" and "(5)" (print on red). Holotype (NRS).

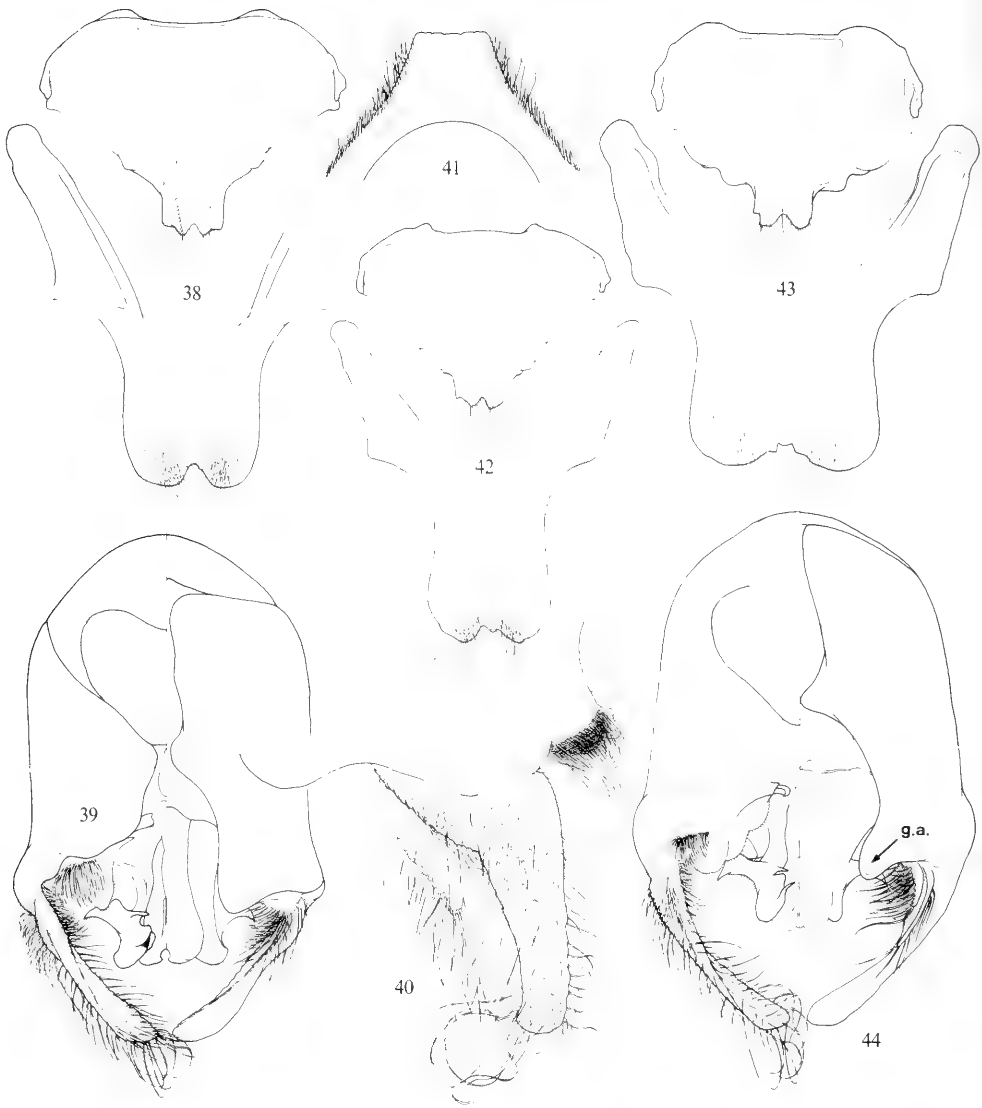
Further material. — Europe. Portugal:1 ♂, Portugal (MNB). — Spain: 3 ♀, over white drawer label "*Melecta plurinotata* Brul. & Lep. D. Ghiliani Espagne" (MT); 2 ♂, 288/1 *M. plurinotata* Br. Spagna, D. Lichtenstein, det. Gribodo (MCG); 2 ♀, Hispania (OUM, MNB); 1 ♂, Barcelona (Cataluna), Schmiedeknecht (SMF); 1 ♀, Elche (Valencia), 10-30.iii.1883, Friese (MNB); 1 ♀, Alicante (Valencia), Callosa de Ansarra, 2.iv.1956, I.H.H. Yarrow (BM); 1 ♂ (diss., figs. 41—42), Spanien, Lorca (Murcia), 24.v.1965, W. Linsenmaier (CL); 1 ♂, Granada (Andalusia), Schmiedeknecht, coll. A. Weis (SMF); 1 ♀, Andalusien, Pto. Sta. Maria, Hering coll. iv.1933 (MNB); 2 ♀, Gibraltar (OUM). — Balearic Is., Ibiza:1 ♂, Ibiza, "da Schmiedekn. *plurinotata*/Iviza/Parente n. *Anthophora hispanica*" (unknown hand) (MCG); 1 ♂, Ibiza, S. Augustin, Giner leg. (ZSM); 2 ♀, Ibiza, 20.iv.1883, Friese (MBUD) and id., 2.iv.1883, Friese (MNB). — Mallorca:1 ♂ 1 ♀, Mallorca, 2.iv.1883 & 1 ♀, id., 2.v.1883, Friese coll. A. Weis (MCG, SMF) & (MNB); 5 ♀, Mallorca, Palma, 1895 (CCS & ML). — Italia: (N to S): 1 ♂ 1 ♀, Dintori di Roma (Lazio), Acilia, 12—14.iv.1932, *M. 12-maculata* Rossi (sic!), det. H. Hedicke (INER); 1

[1]) This specimen unfortunately gives no information about its origin or collector's indications, the vertical pin-label only suggests that it might well be Brullé's type specimen from "Morée" (Greece)!

♀, Marino (Lazio), 1.v.1934, *M. armata*, det. Stöcklein 1955 (ZSM); 1 ♂, Lazio, Roma, leg. Giordani Soika (CGS); 1 ♂, Lazio, Civitavecchia, 24.iii.1935, O. Castellani (ML); 2 ♂, Foggia (Puglia), iv.1905 (IEP); 1 ♂, Brindisi (Puglia), Schmiedeknecht (MNB); 1 ♀, Calabria, Antonimina 1905, Paganetti (MNB). — Yugoslavia: 1 ♂, Spalato (Split), Gasperini, *M. plurinotata*, det. Friese (MNB). — Greece: 1 ♀, Graecia (MCG); 1 ♀, with old vertical pin-label "*plurinotata* Br." (MP)[1]); 1 ♂ 1 ♀, Korfu (Kerkira), 20—30.v.1973, K. Vegter (coll. K. Vegter); 3 ♀, Steni, Euboea & Chalkis, Euböa, iv.1926. Holtz (MNB); 2 ♂ (1 diss., pl. 1, fig 1 & fig. 3), Athen, J. Sahlberg (MH & ML); 1 ♂, Athen, 7.iv.1927 (MNB); 1 ♂ 2 ♀, Tinos, Erber (ML); 1 ♀, Naxos (Cyclades), Krüpper (MNB). — Crete: 1 ♂, 20/2 Creta, v.O., ex coll. Vogt (MA). — Turkey (Asia minor): 1 ♀, Smyrna (Ismir), ex coll. Vogt (MA); 1 ♀, Kleinasien, Sewdiköib, Smyrna, 3—4.17, La Baume (MNB). — Romania:; 1 ♀, SW Romania, Mehadia 1886, Friese (MBUD). — Malta: 1 ♀,with small white label "Malta" over drawer label "M. plurinotata Brul. & Lep." (MT). — Cyprus:; 1 ♂ 1 ♀, Limassol, 5.ii.1931, G. Mavromoustakis (CK); 1 ♂, Cyprus, Amathus, 25.ii.1966, same coll. (FAG); 1 ♂, Limassol (ZSM) & 1 ♂, same loc., 23.ii.1927, same coll., coll. P. Magretti (MCG); 1 ♂ 1 ♀, Limassol, same coll. (NRS) and series ♂♀, Limassol, same coll. (MNB); series ♂♀, Limassol, various dates, ii—iii, all G. Mavromoustakis, ex coll. Alfken (MNB); 1♂ 1 ♀, Is. Cipro, Limassol, iii.1932, Mavromoustakis (IEP). — North Africa. Algeria: 1 ♂ 1 ♀, Prov. d'Alger, Chellala, Jardin Romanetti, 1893, Vauloger, ♀ with 138—97 (MP); 1 ♀, same loc., 1895, *M. plurinotata*, det. Friese (SMF); 1 ♂ 1 ♀, Algeria, Mascara, Sidi Daho, J. Béquaert (MNB); small series ♂♀, Alger (OUM); 1 ♀, Sétif, coll. de Saussure (MG). — Libya: 1 ♀, Tripolitania, Sidi Mesri, iii.1940, G. M. Martelli, *M. plurinotata*, det. D. Guiglia (BM); 1 ♀, Tripolis (MNB); 1 ♀, Cyrenaika, Mars el Brega, ii.1942, Kirchberg leg. (MNB); 1 ♂, Tripolitania, Tripoli, 4.iii.1954, K. M. Guichard (BM). — Egypt: 1 ♀, Egypt, Mansouriah, ii.1926, Min. Agric., R. Mabrouk coll. (MNB). — Israel: 1 ♀, Kappernaum, 11.iii.1935, coll. Hecht (CBS); 2 ♀, Jerusalem, Mt. Scopus — L., 22.ii.1946, at *Lavendula* and *Rosmarinus* (CBS); 1 ♀, Palestina, Audja, v.1945, Bodenheimer leg., at *Asphodelus* (MNB). — USSR: 1 ♀, S.O. Kazakhstan, Kurtagai, 7.vii.1959, leg. Scopin (MBUD); 1 ♀, Turkestan, Adjan (MNB); 1 ♂, Djarkent, Turkestan (MNB); 1 ♂, Tadzhikistan, Geb. Alai Pamir, 1890, *M. 14-punctata* F.-W., det. Friese (MNB); 1 ♀, Turkestan 1912, *M. 14-punctata* F.-W., det.? (MNB); 1 ♂ (diss., figs. 53—55), Siberia, Krasnojarsk (Jenisei R.), (93° long. E, 56° lat. N), 56/Trybom 223/61 (red), and 1 ♀, same loc. and collector, 13/G (NRS). — USSR-China: 1 ♀, Jarkand (W Chinese Turkestan, So-che), 1300 m, 8—27.iv.1930, J. A. Sillem leg., Ned. Karakorum Exped., *Melecta baeri* Rad., det. J. D. Alfken 1933 (MA); 2 ♀, "Jarkend Raquette" (print), and 2 ♂ 8 ♀, "Kaschgar (W Chinese Turkestan, K'ashih), Raquette" (print) (NRS, ML); 1 ♂ (diss., figs. 51—52) 10 ♀, (Chinese?) Turkestan, Fluss Usek, v.1909, ex coll. C. & O. Vogt, acq. 1960 (MA,ML). — China: 1 ♀, Nord Pékin, Jehol, A. David 1865 (MP).

N.B. — In the last category of "Further material", a number of specimens are listed originating from the USSR and frontier states of China (Tadzhikistan, Kirgizyia and Sinkiang, in the interior of central Asia). With the exception of the Kurtagai female, the pair from Krasnojarsk and the female from Jehol, they form a homogeneous series of small bees measuring only 10—12 mm, thus equalling *M. chinensis* in size. All are, however, characterized by shorter pubescence, slender legs, sharply defined small, subcircular abdominal spots placed in a regular row, much black at the thoracic sides, and absence of a white tuft between the scutellar spines. Structurally, the male is rather similar to *chinensis* Ckll. (figs. 57—59), but differs, among others characters, in the armature of the hind legs. These bees are only provisionally classified under the present name and labelled by me "*M. duodecimmaculata* subsp.?". At the moment this form is hardly worth naming, but with much more material may ultimately prove to represent some kind of "ecological subspecies" confined to higher altitudes.

This is evidently the species hitherto known in the literature as *M. plurinotata* Brullé, originally described from Greece. It was probably Hedicke who first consulted Rossi's work and, realising that the author's specimen of "*Nomada*" from Italy should have been a *Melecta*, acknowledged the validity of the specific name given to it. Hedicke also examined Italian examples (collected in 1932 near Rome, see above) and named them correctly, but, as far as I know, did not publish about his findings. The necessity of a nomenclatural change was also fore-



Figs. 38—42. *M. duodecimmaculata duodecimmaculata*; 38, sternites 7 and 8 (♂ Athens, Greece); 39, partial ventral and dorsal view of genital capsule (same specimen, bristles partly omitted); 40, lateral aspect of gonostylus showing dorsobasal and ventrobasal processes (same specimen). — Figs. 43—44. *M. excelsa* (♂ holotype, Jalalabad, Afghanistan; 43, sternites 7 and 8; 44, partial ventral and dorsal view of genital capsule (bristles partly omitted); g.a. = gonocoxal angle

shadowed by Alfken (1940), who wrote: "Es ist erstaunlich, was Rossi alles als *Nomada* angesehen hat. In der Fauna etrusca.... hat er sogar die *Melecta plurinotata* als *Nomada 12-maculata* beschrieben". Yet Alfken did not mention the last name in his later publications. With a view to verify his statement, I asked the opinion of Herrn Max. Schwarz at Ansfelden, the well known specialist in *Nomada*, who had ascertained already that this Italian bee could not have been a *Nomada*. The following passages, referring to the scutellum and abdomen, are taken from Rossi's "Fauna etrusca" (part 2): "Scutellum porrectum, dentibus duobus instructum, qui non apparent nisi pilis abrasis, sed nec postice productum, nec emarginatum". And further: "Secundo & tertio segmento punctis utrinque duobus; reliquis utrinque unico albis, adeo ut puncta abdominis alba, omnino duodecim." (loc. cit.: 111). These words are sufficient to prove the correctness of Alfken's note, so that *plurinotata* unfortunately must be dropped as a synonym of *duodecimmaculata* (Rossi).

Next to the preceding, we have to consider *plurinotata* and *quatuordecimpunctata* Fischer-Waldheim. While the first relates, of course, to populations of Rossi's bee, which is distributed all over the Mediterranean basin (see above), the last-mentioned name applies to a small-sized individual from the Ural mountains. A locality nearest to this is Kurtagai in NE Kazakhstan, whence I have examined another small specimen (12 mm) indistinguishable from the western nominotype. It will be seen that further toward the south we meet with a more profusely white-haired form, *jakovlewi*. The whereabouts of Fischer de Waldheim's type are unknown to me, but that the species belongs here is almost beyond doubt, as witness the scraps taken from the original diagnosis: ".... scutello acute bispinoso... segmente (2—4) maculis utrinque duabus niveis. Anus subbidentatus", — which clearly point to a male of the present species, whose name antedates all others. Consequently, it seems best to follow the opinion expressed by Pérez in Friese, 1895: 162), who placed it in the synonymy of *plurinotata*, i.e. of the nominate species *duodecimmaculata*.

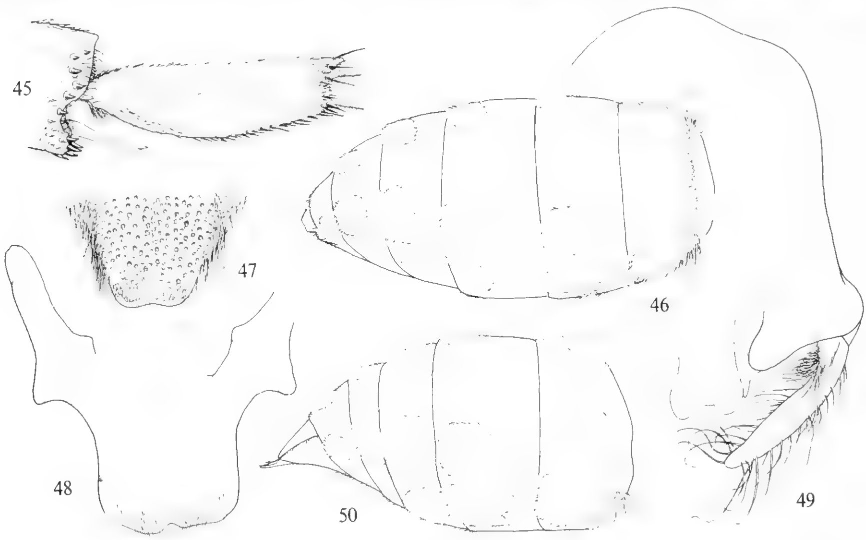
The last synonyms included in the above list are *"baeri"*, employed by Alfken (1935) for a mis-identified individual of *duodecimmaculata*, and *söderbomi* Alfken, which came from Lanchow in SW Mongolia, described by him one year later. Remarkably enough, though possibly as a result of its remote habitat, Alfken failed to compare his far eastern species with the present one and merely placed it "in die Gruppe der *M. armata* Pz.". As a matter of fact, the type of *söderbomi*, also before me, is hardly distinguishable from a male collected at Krasnojarsk, in Siberia. These two specimens are surprisingly similar to normal nominotypical examples from the Mediterranean region, even with regard to the pubescent pattern, as well expressed — though not stated — in terms of Alfken's description!

The following additional description is based on specimens from the type localities of both *duodecimmaculata* and *plurinotata*, hence on populations occurring in the Mediterranean region and adjacent countries, i.e., approximately between 47° and 33° lat. N, and 10°W—50° long E.

Black and white pattern of head and thorax differing in both sexes.

Male. Black are: most bristles upon labrum, sides of clypeus, vertex medially and temples, lateral tuft below wings and — interrupted by white patch — a narrow zone on lateroventral portion of mesepisternum; also the scutellum and parascutella (except occasional white tufts on either side of the short spines and, more rarely, a few recurved white hairs midway between the latter); and lastly, middle of propodeum and metapleural sclerites. Coxae and trochanters with some longish white hairs; femora all black, tomentum on closely punctate hind femur posteriorly extremely short, dense and comb-like, the central carina almost acute, extending along distal half to four-seventh; white external mid tibial pad elongate-oval, incomplete (black) on both ends, the posterior fringe conspicuously white; basal half or less of hind tibia white externally (except black knees), as are most of the tarsal segments. Abdominal spots composed of longish, suberect silvery hairs; with outer row of large spots on tergites 2 and 3, rarely continued rearward also upon 4—5, most conspicuous on 2, and with inner row on 2—6, the spot on 2 smallest, circular, and occasionally vestigial. Disk of sternites clothed with black hairs, 3—5 moreover with long and dense subapical brush of partly white raised hairs. Tergal plate 7 closely longitudinally striatopunctate lacking interspaces, usually with low middorsal ridge; distal border yellow-brown; recurved ventral border with pair of narrow ridges close to apical margin. Genital capsule of large size, 1.7—2.3 mm long.

Female. Differs as follows: White hairs covering clypeus more distinctly raised, not markedly fanned. Thoracic pattern alternatingly black and white: mesonotum white only as far back as base of tegulae, with pair of compact deep black spots placed on each side upon middorsum, immediately behind these the dorsum being also black, but with pair of white dots placed obliquely to the inside of tegulae;



Figs. 45—50. *M. duodecimmaculata jakovlewi*; 45, external view of left hind basitarsus (♂ Bairam ali, Turkmenia); 46, abdominal pattern, right dorsolateral view (same specimen); 47, dorsal view of apex tergite 7 (other specimen, same loc.); 48, ventral view of sternite 7 (same specimen); 49, partial dorsal view of genital capsule (same specimen); 50, ♀ abdominal pattern, right dorsolateral view (same locality)

posterior parts black with conspicuous tufts of white only on each side of both scutellum and propodeum, and (more rarely) a few recurved white hairs also between scutellar spines; sides and ventral parts mostly black, except an isolated, almost circular, white dot upon middle of mesepisternum. Abdominal markings much as in male though more compact: with outer row of large spots on 2 and 3 (rarely wanting on 2) and inner row on 2—5 (rarely on 3—5 only); suberect hairs and gradular fringes on sternites conspicuous but more evenly distributed and invariably black. Outer faces of mid and hind tibiae more densely hairy, concealing most of the surface.

The nominate subspecies and most characteristic "form" of the whole series, is a large, conspicuously marked and densely hairy bee, occurring from Iberia eastward into Turkey, but its range extends all over southern Europe in the same direction as far as Mongolia and N China. Measured specimens before me from North Africa are quite similar though generally somewhat smaller, the average sizes being about 12 and 15 mm, respectively. As stated above, our series from Central Asia comprise still smaller individuals agreeing with *chinensis* in size, but the latter differ markedly in the coloured maculations and longer pubescence. I am convinced that all except *chinensis* and *excelsa* belong to a single, polytypic species.

Melecta duodecimmaculata jakovlewi Radoszkowski stat. nov. (figs. 45—50)

Melecta Jakovlewii Radoszkowski, 1877, Horae Soc. Ent. Ross. 12 (1876): 333—334 (♂ "des environs d'Astrakhan").

Melecta Jakowlevi: Radoszkowski, 1893, Bull. Soc. Imp. Nat. Moscou, new ser. 7 (2—3): 183, fig. 39 a—c, i (♂ genit., type).

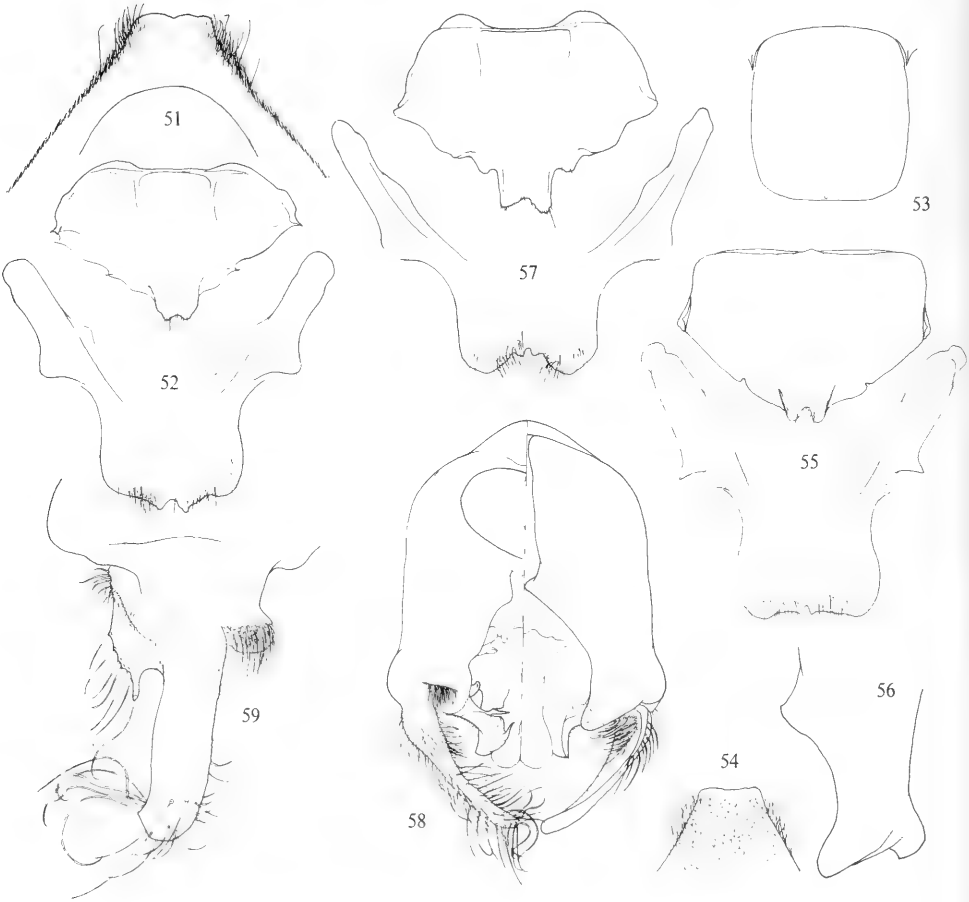
Melecta plurinotata: Morawitz, 1895, Horae Soc. Ent. Ross. 29: 38—39, descr. notes, ♀♂ "Dus-olum, Turkmenia, von Pomeranzew gesammelt".

?*Melecta Baerii* (nec Radoszk.): Kohl & Handlirsch, 1889, Sitzber. Zool.-bot. Ges. Wien, Verh. 39: 273—274 (♀ Aschabad, descr.).

Type material. — USSR: 1 ♂ (diss., genit. glued on card), with red-gold label in poor writing "astrak(an)", "Type" (print on red), and "*M. Jakovlewii* Radoszk. Type det. Dr. Enderlein". Holotype (MNB).

Further material. — USSR: 1 ♀, Turcmenia/Aschabad (Ashkhabad) Leder/Reitter, *M. plurinotata*, det. Kohl (NMW); 1 ♂ (diss., figs. 45—49), Turkmenia, with written label, transl. from Russian "Transcaspian region, Bairam-ali, N. Simonov" and "coll. Kokuev" (print) (ZIL); 1 ♀ (fig. 50), with two written labels, transl. from Russian "12.v.1960 Bairam-ali rayon, Zovkhoz", "Bairam-Ali Turkm(enistan), T. Atdaev", and on reverse side "at wall of old fortress", and "*M. plurinotata* Brullé, det. Ponomareva 1960" (ZIL); 4 ♀, with printed labels in Russian "Turkmenia, Kara-kala (Aral Lake?), Siumy, Petrishcheva, VII.1931 (3 ♀) & 9—10.IX.1931 (1 ♀) (ZIL, ML). — Iraq: 2 ♀, Mesopotamia, both with old vertical pin-label "Bagdad/*orientalis*" and "*plurinotata* Br." (MP); 1 ♂ (diss.), Iraq, Baghdad, 20.ii.1955, Fathi, *M. plurinotata*, det. Mavromoustakis, and 1 ♀, Iraq, Abu Ghraib, 18.iii.1950, A. I. Derwesh, same identification (CKW).

The type of *jakovlewi* came from Astrakhan, the others from the SE side of the Caspian Sea. They agree in most respects with our specimens from Baghdad (Iraq), which for that reason are also referred here. Unfortunately, the internal



Figs. 51—56. *M. duodecimmaculata duodecimmaculata*; 51, ventral view of tergite 7 (♂ Fluss Usek, Turkestan); 52, sternites 7 and 8 (same specimen); 53, frontal view of labrum (♂ Krasnojarsk, Siberia); 54, dorsal view of apex of tergite 7 (same specimen); 55, sternites 7 and 8 (same specimen); 56, apex of right gonobasis, dorsal view (same specimen). — Figs. 57—59. *M. chinensis* (♂ Shanghai, China); 57, sternites 7 and 8; 58, partial ventral and dorsal view of genital capsule; 59, external view of right gonostylus, showing dorsobasal and ventrobasal processes, bristles partly omitted

sexual organs of the type were cut into bits by Radoszkowski and are useless for comparison, as are his sketches of the genital capsule.

The arguments in favour of restoring the name *jakovlewi* are based on the greater density, predominance and purity of all white markings, most luxuriantly developed in our small series from Turkmenia (figs. 45—50). In them the patches on tergite 2 are not definitely interrupted, the outermost portion being the largest and irregular in shape, emitting a subtriangular extension pointing basad and nearly meeting the hind angle of a strongly arched collar on tergite 1. The spots on 3 are also unusually enlarged, the outer subcircular, the inner transverse and at least twice as large again; spots 4—6 (♂) or 4—5 (♀) single, diminishing in size, all except the last broader than the interspaces. Sternal plates 3—5 of male adorned with white transverse bands tapering inward and narrowly interrupted medially, composed of straight decumbent hairs projecting somewhat beyond hind margin.

M. jakovlewi had been synonymized already with *plurinotata* by Friese and contemporary writers, but is here re-instated as a subspecies of *duodecimmaculata*, the new name for the latter. The type measures about 15 mm, thus corresponding with the average size of the nominotype but, along with a number of closely similar individuals, differs from examples inhabiting the Mediterranean region. The vestiture on all parts of the body (including the white abdominal spots) is shorter, composed of decumbent instead of suberect hairs, thus giving the insects a less "woolly" appearance than those of more western occurrence. A striking feature affects the enlarged innermost spot of the lateral patches on abdominal tergite 2. These spots reach their maximum extent in our series from Bairam-ali and Kara-kala, where they are completely fused together (figs. 45—50). In this respect these bees correspond very closely with the one briefly characterized by Morawitz, who wrote: ".... Auf dem 2-ten und 3-ten Hinterleibsringe sind 2 neben einander stehende weisse Filzmakeln jederseits vorhanden, von denen die auf dem zweiten häufig zu einer fast nierenförmig gestalteten zusammenfliessen" (loc. cit.: 38).

I am not quite sure about the identity of *M. baerii* sensu Kohl & Handlirsch, from Aschabad; another specimen from the same locality listed above and labelled *plurinotata* by Kohl, surely belongs to *jakovlewi*, as the spots on tergite 2 are broadly coalescent. The type of *jakovlewi*, and the very similar Iraqi specimens as well, differ from the above only in that the same spots, though much larger than in typical *duodecimmaculata*, are not completely united. A character perhaps of minor concern and therefore not entered into the key, affects the antennae. These are, in both sexes, a little longer and more slender than in the nominotype, segments 4—12 (13) being slightly longer than broad and of equal length, whereas in the great majority of the better known subspecies the 4th is perfectly square and just a little shorter than the next flagellar segments. I believe that these features, taken together with those summarized in the key, justify its separation as a fairly recognizable subspecies of *duodecimmaculata*. The abdominal pattern of a Turkmenian pair and some structural details of the male are shown in figs. 45—49.

The southernmost range of *jakovlewi* in West Asia remains to be established. It is worth noticing that the — very few — examples which I have been able to examine from more northern countries, viz. Kurtagai (S Ural) and Krasnojarsk in the east, differ in no way from the typical subspecies.

Melecta excelsa spec. nov.
(figs. 43—44, pl. 1 fig. 4)

Type and paratypic material. — Afghanistan: 1 ♂ (holotype, mounted and diss., figs. 43—44 & pl. 1 fig. 4), labelled "O. Afghanistan, Prov. Nengrahar, Jalalabad (east of Kabul, nr. Kyber Pass), I—III.1965, legt. D. Povolny" (print); 4 ♂ 4 ♀ (paratypes), "O. Afghanistan, Prov. Nengrahar, D. Povolny et coll.", and same area, "(85) Nemla, 450—500 m, 29.3.1967" (4 ♂ 3 ♀) and "(13) Nemla, 18.2.1966, Povolny & Tenora" (1 ♀) (MMB, ML).

A large species, evidently belonging to the *duodecimmaculata* group and closely related to that species. There is nothing of real importance to improve on the characterization in the key. The sexes are very much alike and can be at once distinguished from the above mentioned taxon by the short-haired body and legs, the more regularly arranged and sharply outlined white abdominal spots, and the broad, contrastingly tinted smoky brown wing border. As in nearly all regional *Melecta*, antennal rhinaria are present on 3—13, quite distinctly impressed, becoming gradually smaller distad, the one on 3 being largest, more or less sausage-shaped, the remainder subtriangular, except the one on 13, which is in the form of a circular pit.

Wing expanse of photographed holotype male, 33 mm.

The habitat of *M. excelsa* is of great interest, since very few *Melecta* have so far become known from Afghanistan. The holotype, though perhaps collected at a much higher altitude than the females, does not in any way differ from the latter, except for the sexual characters.

Melecta chinensis Cockerell
(figs. 57—59)

Melecta chinensis Cockerell, 1931, Amer. Mus. Novit. 466: 6 (♂ Zi-ka-wei, E. China (= Shanghai), Piel).
Melecta 14 punctata: Alfken, 1931, Konowia 10: 164—165 (key ♂♀, with *M. plurinotata* Brullé; pars! Shanghai & Soochow only).

Material. — E China: 1 ♂ (diss., figs. 57—59, topotypical *M. chinensis* Ckll.!), Shanghai, 4.iv.1926, coll. E. Suenson, *M. 14-punctata* F.-W., det. Alfken (ZSM); 1 ♂, Shanghai, i.v. 1891, with old written label, "*M. plurinotata* similiter affin". (MNB); 5 ♀, Shanghai u. Umgeb., Dr. Eidmann, one with 2 labels "*M. 14-punctata* F.W., det. Alfken", and "nicht *14-punctata*", det.? (MNB); 2 ♂, with "Shanghai" and "China", respectively (MNB); 4 ♀, Szetschwan, Omisen, exped. Stötzner, Hedicke (MNB); 1 ♂, Chekiang (Tsekiang), Tien-tai-shan, 30.iv.1935, H. Höne (MNB); 2 ♂ 4 ♀, Chekiang, Hangtchéou (Hangchou), A. Pichon 1925 (2 ♂ 2 ♀), and same loc., no further data (2 ♀) (MP, ML); 2 ♂, Hanchow 1934/China, one with "*chinensis*", det.?, the other with "ex coll. TC Ma, *M. chinensis* Ckll.", det.? (MNB, ML); 1 ♀, Chine, Nanking (Nanching), J. de Joannis 1908 (MP); 16 ♂ 2 ♀, Prov. Fukien, Kuatun, 2300 m, 27°40′ lat. N, 117°40′ long E, 6—29.iv.1938, J. Klapperich (NMW, ML).

Male (additional). — The sternal plates are clothed all over with not very long, suberect, mostly pale hairs and somewhat longer bristles, 3—5 moreover with a subapical brush of almost depressed, mostly silvery hairs forming poorly defined bands on either side of the median line; hind margin of sternite 5 shallowly emarginate. The shape of the hidden plates 7—8 gives no clue as to the interrelation of this and allied members of the group. Curiously enough, sternite 8, with its prominent marginal convexities, approaches most closely the form it has in *excelsa*, which is altogether different in other respects (see also under *duodecimmaculata*).

Our specimens agree with the original description, as far as it goes. Cockerell compares his male of *chinensis* with that of "*plurinotata*" (from Cyprus), stating that it could be regarded as a subspecies of it. The combined characters enumerated in the key seem to justify its position as a full species.

Without mentioning any locality in particular for his *plurinotata*, Alfken (1931) gave a number of male and female characters in tabular form to separate this species from the allied *quatuordecimpunctata*, the type of which he had, of course, not examined. The characters employed refer to the colour and pattern of the body pubescence, and the spinosity of the hind tibia and basitarsus of the female. It is clear that *plurinotata* in this table conforms with the earlier described *duodecimmaculata*, while the characters given for the other species from Shanghai (called *14 punctata* by Alfken), are obviously those of *chinensis*, as here understood.

N.B. — The type locality, Zi-ka-wei, is in the SW part of Shanghai, the headquarters, or stronghold, of the Roman Catholic mission in east and central China. It is also the site of one of the oldest observatories, libraries, and museums, all founded and maintained by the mission. The museum was moved later into a downtown area and renamed Musée Heude (pers. comm. of Prof. T. C. Maa).

II. REMAINING PALAEARCTIC SPECIES AND SUBSPECIES

Melecta fulgida spec. nov.
(figs. 60—70, 74, pl. 1 figs. 5—6, map 1, p. 223)

Type material. — Bulgaria: 11 ♂ 6 ♀, SW Bulgaria, Sandanski steppe, Ortakenei, 25—31.v.1967, at *Anchusa* and *Stachys*, together with *Anthophora crinipes* F. Smith, M. Kocourek leg., some with "*ashabadensis* Rad., det. Kocourek. Holotype ♂ and one paratype ♂ (one diss. pl. 1 fig. 5 & figs. 60—64, 67—69), and two paratopotypic ♀, same loc. and dates, in coll. Kocourek; also several topotypes of either sex (CK, ML).

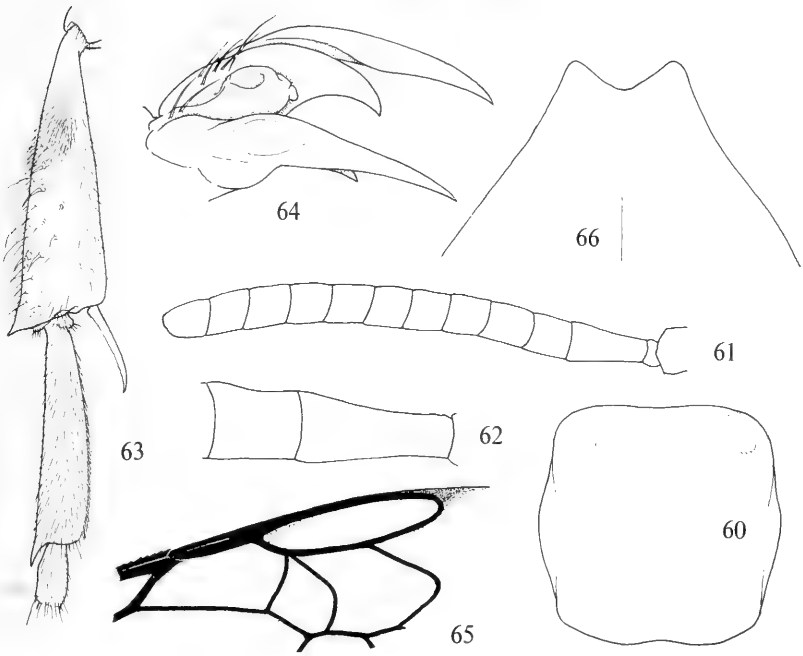
Further material (from SW Europe south-eastward roundabout the Mediterranean). — France: 1 ♀, Fréjus (Var), 28.iv—4.v.1976, H. Wiering (MA). — Yugoslavia: 1 ♂, Macedonia, Ohrid, 29.v—10.vi.1972, H. Teunissen (ML); 1 ♀, Macedonia, Gradsko, v.1916, Müllenhoff (MNB). — Bulgaria: 1 ♂, "Orta-kenei (M. tr. Balcani), D. De Magistris" (topotypical!) (IEP). — Greece: 1 ♂ (diss., fig. 66), "Parnass". (Mt. Parnes?) Vogt coll. (MA); 1 ♂ (fig. 65) 2 ♀ (fig. 70), Graecia, Patras, 4.v.1962, W. Linsenmaier (CL, ML); 1 ♀ (fig. 74), Graecia, Meteora, 26.v.1963, W. Schläfle (CL); 1 ♀, Greece, Euboia, Eretria, 26.iv.1968, J. P. van Lith (CVL); 6 ♂, Graecia, Delphi, 11.iv.1963, together with *M. a. albovaria*, K. Warncke (CKW, ML); 1 ♂ (diss.), Greece, Ancient Olympia, 19.iv.1968, on *Asphodelus*, (CVL); 3 ♂, Graecia, Lamia & Florina, 2.v & 5.vi.1964, W. & E. Grünwaldt; 2 ♂ (diss.), Nemea & Korinth, 5—28.iv.1969, same coll. (CWG); 2 ♂ (diss.), Graecia, Amphissa & Kiaton, 17—29.iv.1973, W. Grosz, coll. Grünwaldt (ML); 1 ♀, Greece, Samos,22.iv.1962, H. Bytinski-Salz (CBS); 1 ♂ (diss.), Graecia, Lesbos, Lepetimnos, 28.v.1975, H. Mařicky (CG). — Rodos: 2 ♂, Profitis Ilias, 800 m, 20.iv.1970, H. Teunissen, and 3.v.1971, M. A. Lieftinck (ML); 5 ♂, Rodos, Attaviros & Profitis Ilias, 24—28.iv.1976, H. Teunissen (CT, ML); 1 ♀, Rodos, Epta Piges, 50 m, 20.iv.1971, M. A. Lieftinck (ML); 2 ♀, Rodos, Lindos, 10.iv.1970, A. C. & W. N. Ellis (MA). — Kos I: 1 ♂ (diss.), Asklepieion, 300 m, 1.v.1971, M. A. Lieftinck (ML). — Turkey (Asia minor): 1 ♀, Asia min. 1890, coll. Magretti, *M. ashabadensis*, det. Friese 1897 (MCG); 1 ♀ (diss.), Amasia, Mann 1860, *M. ashabadensis*, det. Kohl (NMW); 1 ♂ (diss.), Asia min., Erdschias, (= Erciyas) 12.v., Penther leg., *ashabadensis*, det. Kohl (NMW); 1 ♀, Asia min., Angora , iii.29, Náday 1911 (MBUD); 1 ♀, Turkey, Ankara, 15.v.1961 (CVZ); 2 ♂ (diss.), Turkiye, prov. Ankara, Cubuk Baraj, 17—19.iv.1963, J. Leinfest (MA); 1 ♂, Turkey, Amasya, 1600 ft., 22.v.1959, K. M. Guichard (BM); 1 ♂ (diss.), Asia minor, Amasya, 800 m, v—vi.1967, H. & U. Aspöck (CMS); 1 ♀, Trabzon Area, Turkey, 19.iv.1959, K. M. Guichard (BM); 1 ♂ (diss.), Asia minor, Beysehir, 4—6.vi.1964, J.Gusenleitner (CG); 1 ♂ 1 ♀, Turkey, Konya, ult.v.1965, J. Gusenleitner (CG); 4 ♂ (diss.), Türkei, Ürgüp, medio vi.1960, W. Schläfle (CL, ML); 3 ♂ 4 ♀, Türkei, Ankara, 3.vi.1972 (3 ♂ 3 ♀), together with *M. a. albovaria*, and Ephesus, 7.iv.1972 (♀), all K. Warncke (CKW, ML); 1 ♂, Türkei, Göreme, 15.v.1972, on *Rosa* spec., K. Kusdas, M. Kraus (CKW); 1 ♂, Dijarbekir, 6—7.vii.1937 (MBUD); 1 ♂ 1 ♀, Brousse, coll. J. Pérez 1915 (MP); 1 ♂, Brussa, 1894, 1015/

112 (MBUD); 1 ♂ 1 ♀ (diss.), Asia min., Angora, 29.iii (♀) and Seráj-Köj, 8.vi, leg. Náday 1911, *M. ashabadensis* Rad., det. Friese 1893 (MBUD). — USSR: 1 ♂, Transkauk/Helenendorf/1886, *M. ashabadensis*, det. Friese (MNB); 2 ♂ 2 ♀, Transkauk., Helenendorf 1886, *M. ashabadensis*, det. Kohl (NMW, ML); 1 ♀, Armenia, Monastero Chérard, 13.vii.1963, A. Giordani Soika (ML). — Iran: 1 ♂ (diss.) 1 ♀, 16/40 (on yellow disk), Perse, Aucher 16.40 (MP). — Syria: 1 ♂ (diss.), Syria, GO (lilac label), 531/8 (black-rimmed square), 4 (red) (MBUD); 1 ♀ (diss.), Akbes, C.D. 1891, coll. J. Pérez (MP); 2 ♂ (diss.), Syria, Leder, 854, *M. ashabadensis*, det. Friese 1893 (NMW); 1 ♂, Syria 1899, A. Weis, *M. ashabadensis*, det. Friese 1893 (SMF). — Lebanon: 1 ♂ (diss., pl. 1 fig. 6), Syria, Beyruth, ex Staudinger (ML); 1 ♀, Syria, Gödl, 856, *M. ashabadensis*, det. Friese 1893 (NMW). — Israel: 1 ♂, Palestine, Jerusalem, Mar Saba, 15 km SE, 15.iii.1922, P. A. Buxton, *M. armata* Panz., det. B. Uvarov (BM); 1 ♀, Palestine, Jerusalem, 13.iii.1923 (BM); 2 ♀, Jerusalem, M. Pic 1928 (MP); 1 ♂ (diss.), Jerusalem, J. Sahlberg 113 (MH); 1 ♀, Jerusalem, *M. ashabadensis* Rad.? "vide long 2nd joint on the flagellum", det. Saunders, E. Saunders coll. 1910—266 (BM); 1 ♂, Haifa, 26.ii.1977, A. Freidberg (CBS); 2 ♂ 1 ♀ (diss.), Jerusalem, 15—30.iii, 1—15.iv.1939 & 3.iii.1940, all H. Bytinski, *M. rugosa* Drs., det. Mavromoustakis (CBS, ML); 1 ♀, Jerusalem-Jericho road, 31.iii.1969, H.Bytinski-Salz (CBS); 2 ♀, Kabara Hills, Zarqa Br., 10.iv.1946, from *Anthophora* nests (CBS); 1 ♀, Israel, Aqua Bella, Hebrew Univ., 22.iii.1954, J. Wahrman (CBS); 4 ♀ (diss.), Israel, Upper Galilea, Rosh Pinna, 600 m, 29.iii.1951 & 1952, Verechson (CBS); 2 ♂ 1 ♀, Jericho, -200 m, Wadi Kelt, 6—27.iii.1975 (2 ♂), Hisman Palace, 8.iii.1975 (♀), K. M. Guichard (BM); 1 ♀, Israel (?), Kfar Jecheyghal (?), spring, T. Kurtzmig (?), *rugosa* Drs. var. ♀ (unknown writing) (CBS); 1 ♂ 1 ♀, Palestine, Dan, 20 & 26.iii.1941, H. Bytinski-Salz (CBS); 1 ♀, Jerusalem, 1—15.v.1939, H. Bytinski-Salz, *M. rugosa* Dours var., det. Mavromoustakis (CBS); 1 ♀, Centr. Jordan Valley, Deganya A, 28.iii.1962, B 228, Y.Palmoni (AID); 1 ♂, Bethlehem, *Melecta* sp., det. Blüthgen (ZSM); 1 ♂, Palestine, Mt. of Olives, 9.iii.1918, Major E. E. Austen (BM); 1 ♀, Palestine, Nazareth, 1800 ft., 16.iii.1920, P. J. Barraud, *Crocisa luctuosa*, det. Uvarov (BM); 1 ♀, Benjaminah, 6.iii.1924, *Asphodelus*. Hedicke (MNB). — Jordan: 1 ♀, Trans Jordan, Nuwaiqis near Amman, 23.iii.1922, H. St. J. B. Philby (BM); 2 ♂ (diss.), Jordan, AP Baliat, 17.v.1974, and via H. Elmosa, Calihut, 2.iv.1977 (ML); 1 ♂, Jerash, 30.iii.1979, K. M. Guichard (BM).

The following descriptions are based on both sexes of the typical series from Bulgaria (pl. 1, fig. 5).

Male. — Labrum (fig. 60) in frontal view broadest at or slightly before middle, surface concave, shining basally and upon the low tubercles, with few punctures of different sizes, for the rest closely rugosely punctate lacking interspaces, a low smooth median carina usually present on distal half; anterior border not upturned, almost straight. Maxillary palpi 5-segmented, relatively short, the second longest. Mandibles sparsely, finely striato-punctate, surface rather shiny. Clypeus little convex, surface along anterior border glossy, with few large punctures, gradually more finely and very closely punctate posteriorly; rest of head dull, closely coarsely punctate, the interspaces smaller than one puncture width, except very narrow, almost impunctate area (much smaller than in species like *albifrons*) immediately beside each lateral ocellus. Antenna (fig. 61), thin and slender, segment 3 longer than scape, more than twice as long as its width at apex and in frontal view twice as long as 4, which is slightly longer than broad, as are also the next flagellar segments, rhinaria distinct though small and feebly impressed, the one on 3 elongate, the succeeding ones circular, gradually fading away on 6—12.

Thorax segments without peculiarities, all parts closely punctate even on mesonotal disk, where the rather large punctures are about equal in size to the somewhat shining interspaces. Basal half of tegulae finely punctate, the rest dullish, smooth. Scutellar tubercles straight, slightly divergent, directed obliquely upward and backward, shorter than surrounding pubescence. Legs thin and



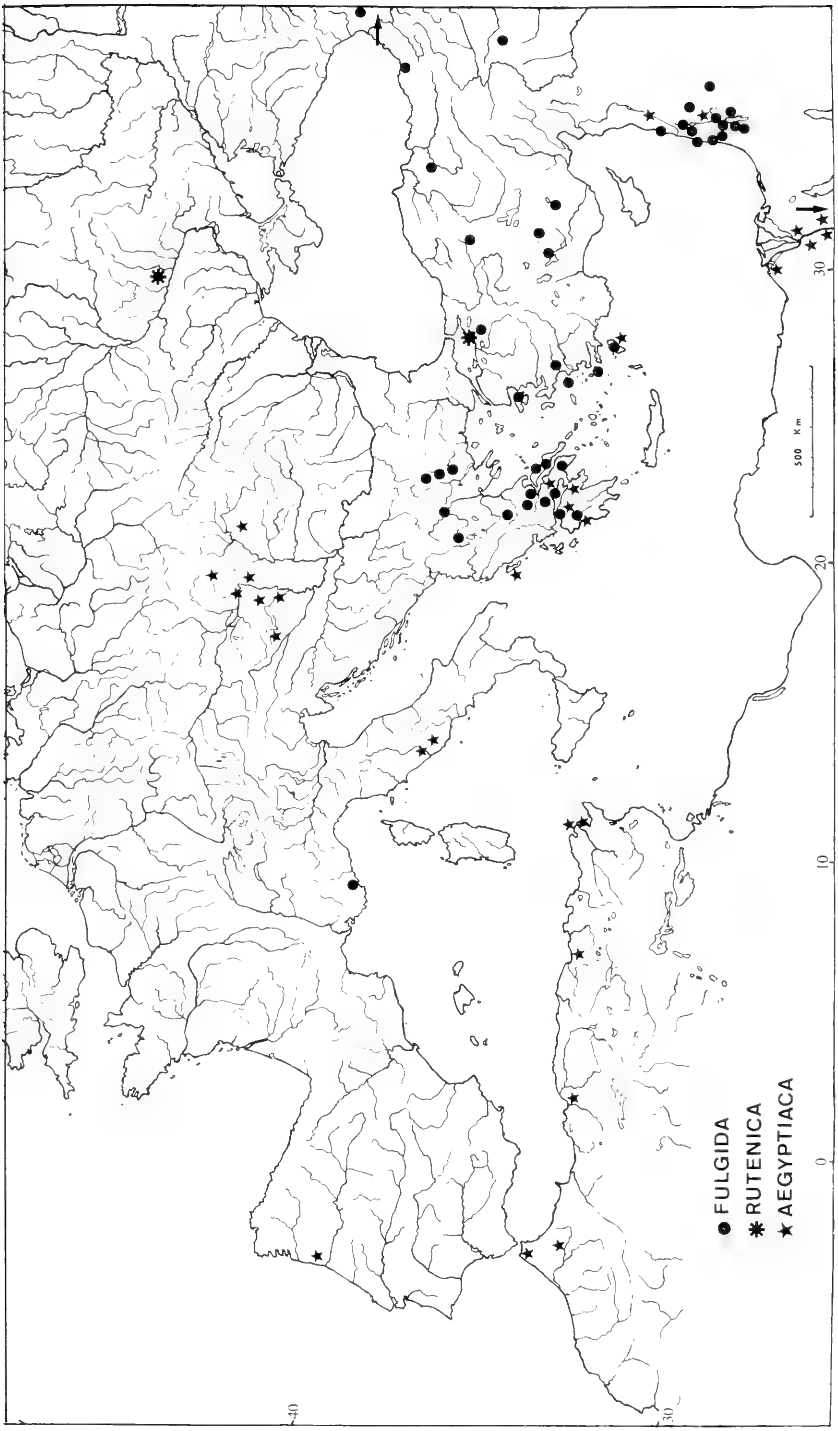
Figs. 60—66. *M. fulgida*; 60, frontal view of labrum (♂ holotype Sandanski. Bulgaria); 61, frontal view of left antenna (same specimen); 62, segments 3—4 more enlarged (same specimen); 63, external view of right hind tibio-basitarsus (same specimen); 64, oblique dorsal view of right hind tarsal claw (same specimen); 65, partial view of right fore wing (♂ Patras, Greece); 66, dorsal view of tergite 7 (♂ Parnass, Greece)

slender; all femora finely closely punctate on a shiny surface. Mid tibia straight in profile, moderately swollen and broadened as far distad as slightly before the truncated apex, which, besides carrying some short marginal bristles, is produced posteriorly into a thick, bluntly triangular spine; outer face very closely punctate basally (similar to fore tibia), but apical portion polished, with much larger and fewer punctures, some of which bear strong bristles. Hind tibia slender, subequal in length to femur, distal three-seventh to one-half of outer face uneven but conspicuously polished and brilliantly shining, coarsely sparsely punctate, each depression carrying a thick, suberect spine-like seta; apex obliquely truncated but its border not excavated, produced posteriorly in a robust triangular tooth (fig. 63). Basitarsi thin and slender, those of hind legs laterally compressed, gradually a little broadened from base to apex, the latter terminating in an acute external tooth; the same segment slightly but distinctly outcurved in posterior view, surface smooth and rather superficially punctate, punctures smaller than interspaces. Hind tibial spurs unequally long, both almost straight, the inner spur being not undulated. Inner ramus of fore tarsal claw slender and a little shorter, flatter and broader than outer, those of mid and hind claws only about half as long and twice as broad as outer, distinctly more expanded than this and also more strongly curved and pointed (fig. 64).

Wing venation brown, membrane invariably obscured, smoky brown, with subhyaline areas occupying only most of the basal portion of fore wing, streaks in first two submarginal cells, and an irregular spot just outside the third; third submarginal strongly elbowed distally, almost as much as in *albifrons* and immediate allies, though a little shorter than these (fig. 65).

Abdomen deep glossy black, apical sternal segments distinctly lighter; all tergites finely superficially and not at all closely punctate, punctures successively more widely spaced posteriorly on all segments, closest basally but all much smaller than interspaces, postgradular (posterior marginal) areas rather broadly impunctate, those of tergite 1 narrowly, of 2—5 and 6 very finely tessellate, punctures at base of 6 more crowded together but still smaller than interspaces. Sides of exposed portion of tergite 7 strongly converging, dorsal surface hollowed out and shining. with widely spaced punctures, apex narrow, posterior margin with distinct crescentic emargination and rounded edges, border dark brown; apex in ventral view without indication of tubercles or ridges. Sternites similar, but much less shiny and more densely punctate than tergites, especially 4 and 5—6, the whole surface of these bearing punctures. Sternite 6 lacking a distinct median impressed area, hind border evenly rounded; 7 and 8 of characteristic shape, basal arms of 7 relatively broad, almost straight, disk more or less square, in the form of a thin flattened plate, apex not emarginate, almost bare, lacking bristles or setae; apex of sternite 8 projecting, ending in a thin bilobed plate (fig. 67). Genital capsule as in fig. 68.

Pubescence generally thin and fluffy, consisting of finely branched black and white hair nowhere concealing the surface, except at sides of tergites 1—5 (♂) or 1—4 (♀) and partly on outer faces of tibiae. Labrum, mandibles outwardly, lower part of paraclypeal area, upper part of genae, and a line bordering inner orbits, with long raised black bristles; hair on genal area finely branched. Clypeus for the most part bare, rest of head above clothed not very densely with white as far back as about halfway between base of antennae and median ocellus, anterior pubescence partly depressed, posteriorly raised and much longer; genal and occipital areas with mixture of back bristles and silky white hair. Antennal scape with few black bristles roundabout and a fringe of long, mostly white, hairs anteriorly. Thoracic vestiture thin and diffuse, alternatingly black and white: mesonotum anteriorly with fairly broad white collar extending back as far as a little beyond anterior border of tegulae, this collar either entire or subinterrupted, some black hairs usually being interspersed on either side of the middle; an indistinctly triangular spot of white and better defined white tufts also in front of tegulae, the latter occasionally forming a whole with the collar; behind this the dorsum is black, but more inward behind tegulae are a second pair of whitish tufts, just in front of the parascutella; entire scutellar area and posterior thoracic sclerites black-haired save for large white metapleural tufts on either side behind the wing bases; hair at sides of thorax long and raised, mainly black but in the centre of mesopleuron an ill-defined tuft of white; ventral parts of thorax black. Legs sparsely clothed with mainly black hairs, which are long and partly white on coxae and femora, much shorter but mixed with long black bristles on tibiae and tarsi; all femora posteriorly with long raised black hairs, those on distal parts being



Map 1. Locality records of some *Melecta* species

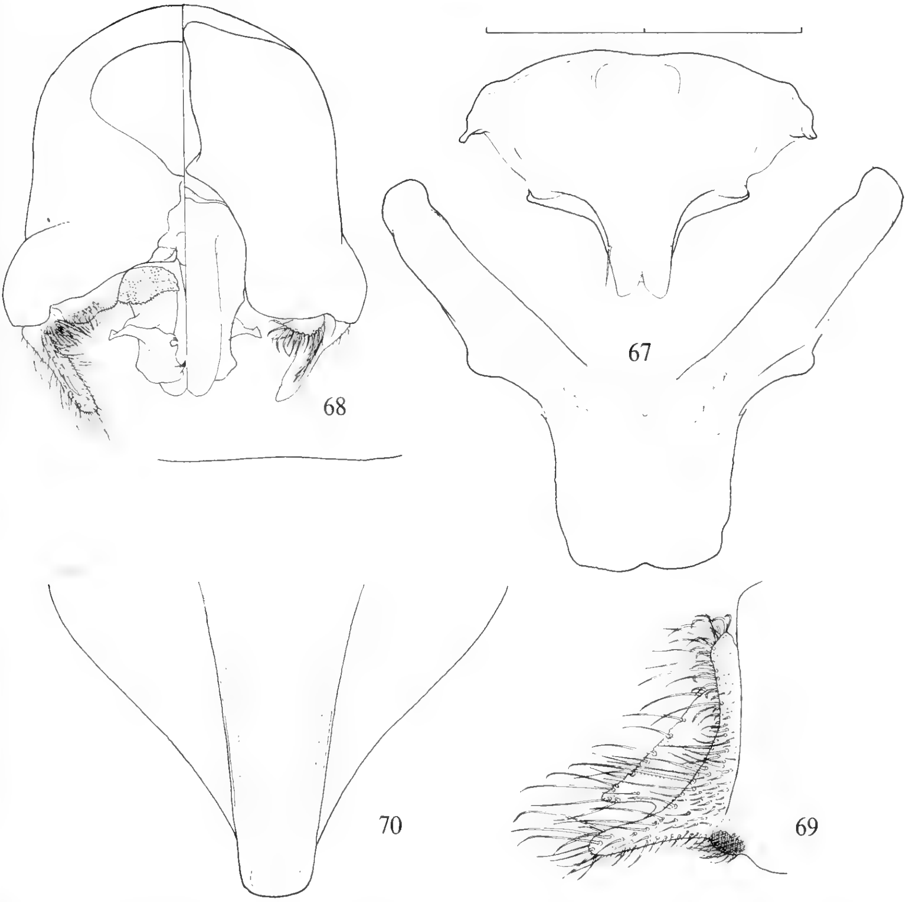
even longer than the diameter of femur; tibiae less hairy, but at least outer faces of mid and hind tibiae with an elongate patch of much denser silky-white appressed tomentum, these spots nearer base than apex and ill-defined, not broadened or pad-like on mid tibiae, which also lack a posterior fringe of long hairs; traces of white frequently also on outer faces of fore tibiae. Abdominal tergites 1—5 each with pair of pure white postero-lateral hair spots, hairs on 1 long, tufty and raised, the innermost exceeding hind margin of tergite, those on 2—5 regular, compact, transverse, subrectangular and depressed, spots on 2—3 subequal in size, about twice as broad as deep or slightly broader, but separated by a distance four to three times their own breadth, those on 4—5 smaller, about half as broad as the black interspaces, on 5 only half the size of preceding spots; tergites 6—7 invariably unmarked. Dorsal hair otherwise short and scanty, all setae suberect and arising from the punctures, but much longer black bristles are present at base and sides of tergite 1, alongside and at graduli of 2—6, and also on disk (with additional marginal fringes) of 7. Sternites 1—2 clothed sparsely with longish black setae, which on 3—6 become shorter, depressed and more numerous, arising from the punctures, but do not quite conceal the surface.

Wing expanse (♂ paratype, Bulgaria, pl. 1 fig. 5), 26 mm.

Female. — Strikingly similar to male in body sculpture and pubescent pattern, but apart from the more obvious sexual characters, the following differences can be noted.

Antennae a trifle more slender but practically of the same length by having all segments relatively longer, especially 3 and 4; rhinaria wanting. Inner ramus of all tarsal claws about half as long as outer but distinctly broader and more flattened than this, much as in male; apex rather abruptly hooked and acutely pointed. Third submarginal cell, though varying in length, averages a little shorter, with its apex less strongly elbowed than in male, several individuals, however, showing hardly any sexual difference in this respect. Legs including tibiae and basitarsi of the same slender form and consistency, polished areas identical; hind basitarsus similarly and but feebly outbent; white pubescent patch at outer face of mid tibia a little less dense and silky, several short, black, suberect spinulose setae remaining clearly visible between the decumbent hairs. Posterior fringes at mid and hind femora shorter than diameter of femur. Abdomen shaped as in male, the raised black and white pubescent spots on dorsum and sides of thorax of the same length and equally diffuse; compact lateral tergal spots also similar but restricted to 1—4. Pygidial plate when fully exposed (fig. 70) almost twice as long as its breadth at extreme base, sides rectilinear or a little incurved before halfway length, then straight-lined and less converging, margins upturned before apex; surface flat, shining, but very finely tessellate except at apex, with low but distinct median ridge that broadens at tip; at either side of the pygidial plate the tergite bears a dense fringe of straigth stiff bristles, the longest of these surpassing the rounded apex of the plate. Sternites much as in male, but posterior marginal areas of 1—5 markedly broader medially and more abruptly becoming impunctate.

The sexes are equally variable in size. Measurements (type series), length



Figs. 67—70. *M. fulgida*; 67, sternites 7 and 8, scale line 1 mm (♂ holotype, Sandanski, Bulgaria); 68, partial ventral and dorsal views of genital capsule (same specimen); 69, external view of right gonostylus, slightly flattened (same specimen); 70, dorsal view of pygidial plate, bristles and hairs omitted (♀ Patras, Greece)

9.5—10.8 mm, fore wing 8.5—9.0 mm; length (remaining specimens), 8.5—15.0 mm.

Variation. — In respect of body size and pubescent pattern, the typical individuals — all from one locality — form a homogeneous series, though not all of them are quite alike as to the extent of black and white spots. Yet *fulgida*, like most other melectines, is evidently a very variable species throughout its known range. True, very dark specimens and profusely white-marked bees, whether or not varying in size, need not have been collected at the same time and in exactly the same locality, but populations of these extremes frequently occur in close proximity in the same area. In our material specimens agreeing closely with the type series are from the following localities: — a male from Ohrid in Yugoslavia; both sexes from Delphi, "Parnass" and Samos in Greece, as well as others from

Helenendorf, Konya and Beysehir in Turkey. Our series collected in Greece (Patras, Olympia and Euboea), Lebanon (Beirut) and Palestine (Jericho, Bethlehem and Dag) include males as well as females varying much in size (body 10.0—13.5 mm), the largest among them at the same time being more robustly built. They are remarkable by having the light thoracic pubescence much more extensive by fusion of the white tufts, which together form a very broad collar, whereas in some of them the white abdominal spots are so small as to be reduced to mere points on tergites 3—4, the spot on 5 being occasionally absent in the male. On the other hand, all individuals from Rodos and Kos, off the westcoast of Turkey, are very white and also superior in size, measuring 12.0—15.0 mm in length. They exhibit a pattern indistinguishable at first sight from large-spotted examples of *M. albifrons albovaria* and *tuberculata* spec. nov., two species with which it was associated in more than one locality. [1])

Careful examination of all salient characters of *fulgida* has revealed no structural differences between representative specimens from nearly all countries whence the species has become known. It has apparently no near allies, although remote (yet undeniable) affinity is suggested with the *albifrons* group, approaching the latter somewhat in the form and sculpture of the hind legs (including the tarsal claws), the shape of the third submarginal cell, and the female also in the somewhat similar form of the pygidial plate. However, it differs widely in the antennal structure and male genitalia, being in fact easily distinguished from all other Eurasian species by a combination of characters, as follows: (1) antennal segment 3 fully twice as long as 4; male rhinaria incomplete distally, not deeply impressed; (2) apices of hind tibia and basitarsus produced posteriorly into a triangular process; (3) exterior surface of apical portion of mid and hind tibiae uneven, though polished and brilliantly shining, bearing scattered setiferous punctures, the thick setae triangular and spine-like, with few long dark bristle-like hairs interspersed; (4) fore wing membrane strongly enfumed save basally, disk with subhyaline spots; (5) male tergite 7 narrowly tapering, apex distinctly excised; (6) male sternite 7 of peculiar shape, ending in a thin subrectangular plate; (7) female pygidial plate slender, gradually narrowed with almost straight sides; (8) pubescent spots on dorsum and sides of thorax ill-limited, made up of long and fine raised hairs.

An additional feature not expressly stated in the description is, that the white tufts behind the wing base on each side of the thoracic dorsum, if at all present, are

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[1]) On Rodos and other islands of the eastern Mediterranean, many Anthophoridae were accumulated over the years along with their melectine parasites and dealt out among several museum collections. As to *Melecta*, collecting was done indiscriminately by various entomologists including myself. At first the composite nature of these captures was not clearly understood, but with the discovery of better specific characters it became evident that several closely similar taxa may occur simultaneously in any given locality. In fact it was established only recently that *M. fulgida* in Rodos, besides keeping company with the two species mentioned above, may be attended also by two (or even three) other congeneric species, all of equal semblance. Thus there is definite proof that during the spring in this one small island at least five species of *Melecta* may occur together in any suitable locality.

isolated, never continuous across middle of scutellum, which always remains black.

With this species the opportunity is given to spend a few words on the armature of the mandibles in Eurasian *Melecta*. Following the example set by Michener et al. (1978), I have figured one of the mandibles of some regional species. As was to be expected, they are similar to those of *Thyreus* (loc. cit., fig. 15), almost invariably bidentate in fresh specimens, i.e. armed with a single, flattened submedian (pre-apical) tubercle, either subtriangular or more or less molar-shaped. Like the apical tooth, the organ is liable to wear off rapidly with age, an abraded mandible being shown in fig. 72. In the present species, however, the inner tooth is apparently obliterated or altogether absent, even in fresh individuals (fig. 74).

Melecta luctuosa (Scopoli)
(figs. 2, 4, 8, 79—96)

Selected references:

Apis luctuosa Scopoli, 1770, Annus hist. nat. Lipsiae, 4: 13 (Hungary). ?"Apis sexta" Schaeffer, 1766, Icones Insectorum.... etc. Ratisbon. 1(1), tab. 22 fig. 14 (insect, sex?), "Apis sexta. Sechste Biene".

? *Apis albifrons*: Rossi, 1790, Fauna Etrusca 2: 111 (compar. note with *Nomada* ? *12-maculata*).

? *Apis punctata*: Panzer, 1804, Syst. Nomenclat. Schäffers Abbild. regensb. Ins. 1: 34—35 (comments on Schaeffer's picture of "Apis sexta").

Melecta punctata: Lepeletier, 1841, Hist. Nat. Ins. Hym. 2: 441—442 (♂ ♀ partim! "Toute la France").

? *Melecta fasciculata* Fischer de Waldheim, 1843, Rev. et Mag. de Zool. 13: 3—4 (? sex, "Hab. ad Ural fluvium superiorem").

Melecta luctuosa: Pérez, 1883, Actes Soc. linn. Bordeaux 37 (ser. 4 t. 7): 305—307 (inclus. key ♂ ♀, ♀ partim, not ♂?). — Radoszkowski, 1886, Horae Soc. ent. Ross. 20: 18, pl. 3 fig. 15 (♂ genit. caps., Askhabad). — Pérez, 1890, Cat. Mellif. Sud-ouest, Actes Soc. linn. Bordeaux 44: 166, pars? (Saint-Sever, Bordeaux, Tarbes, Toulouse). — Friese, 1893, Bienenfauna Deutschl. u. Ungarn: 37 & 61 (Mecklenburg; Thüringen; Elsasz. Budapest; Fiume; Triest). — ? Radoszkowski, 1893, Bull. Soc. Imp. Nat. Moscou, new ser. 7 (2—3): 178—180, fig. 30 a—c, i (♂ genit., loc.?). — Gribodo, 1893, Bull. Soc. Ent. Ital. 25: 408—412 (pars! exclus. vars. *meridionalis* Grib. & *leucorhyncha* Grib.). — Friese, 1895, Bienen Europa's 1: 162—164 (pars, exclus. syn. & vars.). — Saunders, 1896, Hym. acul. Brit. Is., etc. London: 345 (key), 345—346, pl. 45 fig. 4, 9, 10 (locs., "associates with *Anthophora retusa*"). — Dusmet y Alonso, 1905, Bol. Real Soc. esp. Hist. Nat.: 152—153 (pars) (Spain locs.). — Frey-Gessner, 1907, Fauna ins. helv. Hym. Apidae 2: 143—145 (pars, Switserland, locs., ecol. notes). — Alfken, 1914, Mém. Soc. ent. Belg. 22: 235 (pars! exclus. var. *acutivalvis* Alfk. & "Stammform ♀"). — Dusmet y Alonso, 1915, Mem. Real Soc. esp. Hist. Nat. 8 (7a): 330 (pars ? Morocco). — Bischoff, 1927, Biol. Hym. Berlin: 399 (hosts). — Schmiedeknecht, 1930, Hym. Nord u. Mitteleuropas: 830. — Giordani Soika, 1936, Boll. Soc. Ent. Ital. 68: 47—48, figs. 1—2 (early larval stage). — Stoeckhert, 1954, Fauna Apoid. Germ., Abh. Bayer. Akad. Wiss. N. F. 65: 64 & 74—79 (full bibliogr. Pal. Apoidea). —Móczár, 1957, Fauna Hung. 19 Hym. 3 Apidae: 32—33 (key ♀ ♂, pars, Hungary). Móczár, 1958, Rovart.Köslem 11 Cat. Hym. 14: 414 (distrib., ethol. Hungary). — Iuga, 1958, Fauna Rep. Pop. Rom. 9(3) Hym. Apid. Anthoph.: 208—209 (pars, exclus. syn., Romania). — Lieftinck, 1958, Comment. Biol. Helsingfors 18.5: 23 & 26 (key ♂ ♀), fig. 8, 15, 30—34 & 37, pl. 1 fig. 9—10 (♂ ♀ struct., Hungary & Holland). — Osychniuk, 1959, Bull. Acad. Nauk Ukraine SSR, Kiev: 80 (pars!) (♂ ♀ Ukraine, flower records). Osychniuk, 1960, Entom. Obosz. Akad. Nauk USSR Moscow 39: 391 (tab., flower records, Ukraine). — Leclercq, 1965, Bull. Inst. agron. Stat. Rech. Gembloux 33: 114 (Belgian locs. prior to 1950). — Lieftinck, 1972, Tijdschr. Ent. 115: 256 (hosts), 264. — Leclercq, 1971, Atlas provis. Ins. Belg. Gembloux, carte 548 (Belgian locs. prior to 1950). — Kullenberg, 1973, Zoon (Uppsala) Suppl. 1, pl. 2 fig. 6 (good col. phot. of live ♀, Sweden). — Erlandsson, 1976, Entomologen 5: 20 (Swedish locs., hosts).

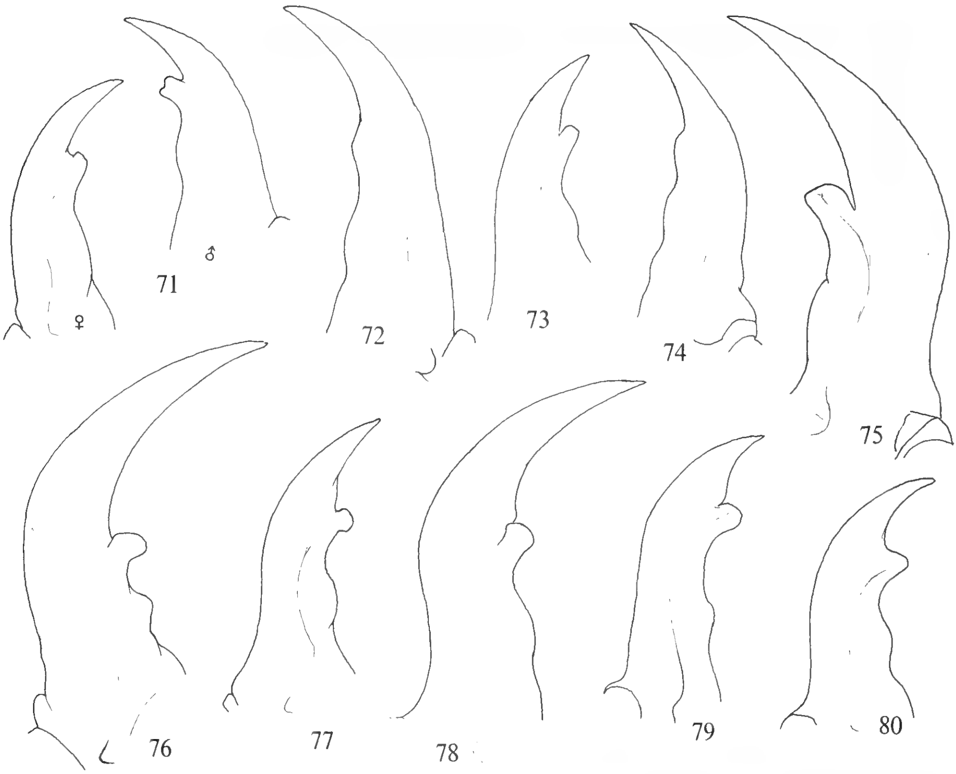
? *Melecta luctuosa*: Radoszkowski, 1886, Horae Soc. Ent. Ross. 20: 18, pl. 3 fig. 15a—c & i, ♂ genit. (♂ Transcaspia).

? *Melecta Eversmanni* Radoszkowski, 1893, Bull. Soc. Imp. Nat. Moscou, new ser. 7 (2—3): 180 (♀ only, not fig. 31a—c & i, ♂ genit.!), "Orenbourg, Astrakan (Ryn-Peski), Tachkend". See under that species.

Melecta Eczmiadzini Radoszkowski, 1893, Bull. Soc. Imp. Nat. Moscou, new ser. 7 (2—3): 181, fig. 33a—c & i (♂ genit.), ♀ incert. (♂ Eczmiadzine). **Syn. nov.**

Type material. — USSR: 1 ♂ (diss., fig. 81—82, right ant. missing), Caucasus, "Caucas/Portz" (print on pale blue), "Eczmiadzin" (Radoszkowski's writing), "Type" (print on orange), "Fass." (unknown handwriting), "*Melecta eczmiadzini* Rad. Type, rev. Dr. Enderlein". Holotype *M. eczmiadzini* Radoszk. (MNB).

M. luctuosa is one of the most widely distributed Eurasian members of the genus, ranging approximately from lat. 60° to 40° N., the centre of its area lying between lat. 40° and 50° N., although the species may occur as far east as long. 90° in west



Figs. 71—80. Dorsolateral (external) view of mandibles of Eurasian *Melecta*; 71, *M. albifrons albifrons* (♂ ♀ Antibes, S France); 72, *M. albifrons albovaria* (worn ♀, Montagne Noir, S France); 73, *M. albifrons nigra* (♂ Lazio, Italy); 74, *M. fulgida* (fresh ♂, Meteora, Greece); 75, *M. transcaspica* (♀ Konya, Turkey); 76, *M. amanda* (♀ Krakow); 77, *M. guichardi* (♀ Israel); 78, *M. italica* (♀ St. Guilhem, S France); 79 , *M. luctuosa* (♂ Peña Ubina, Spain); 80, *M. luctuosa* (♂ Iran). All except fig. 72 taken from fresh specimens, drawn on the same scale; bristles omitted

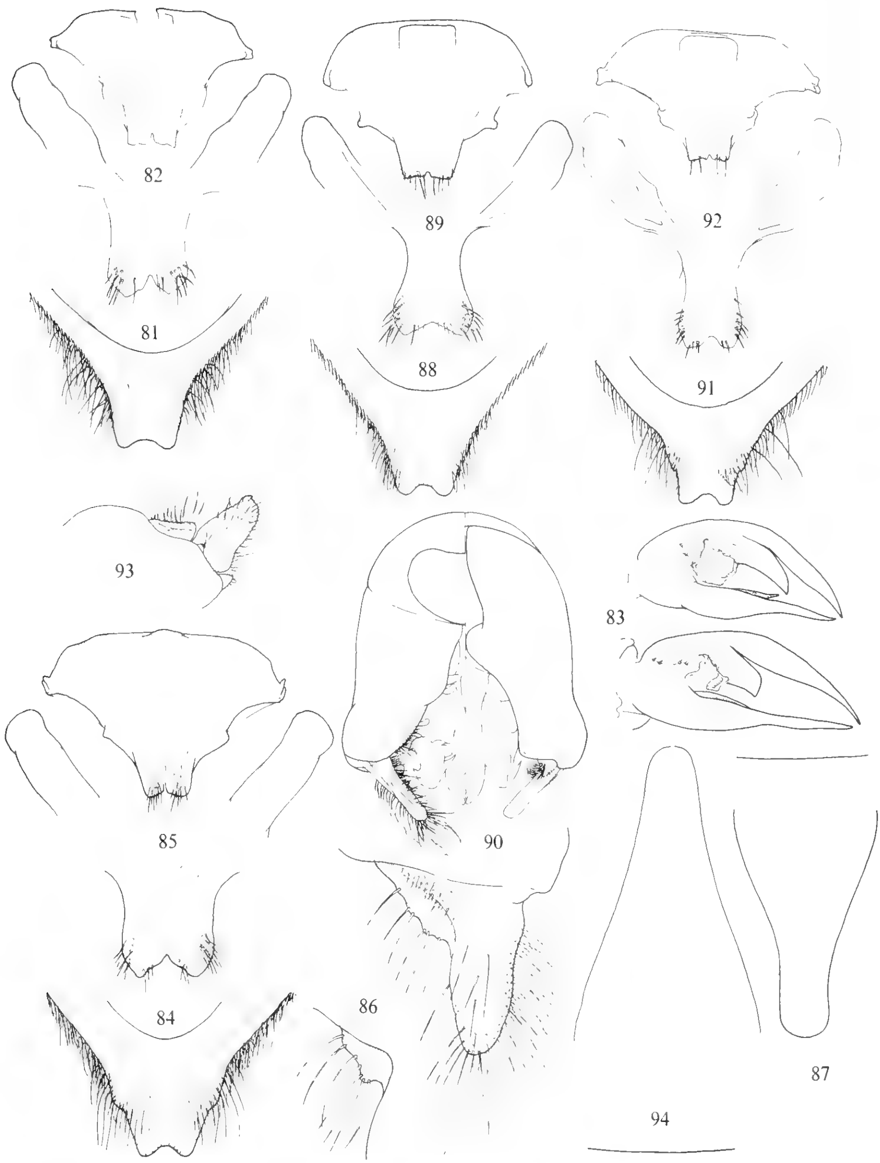
Central Asia. With the exception of data included in publications dealing with the bees of northwestern Europe, *luctuosa* has been frequently confounded in the literature and collections with similarly looking species occurring in more southern and eastern parts of Eurasia, i.e. in countries with a milder, sub-tropical climate. Males of *luctuosa*, though bearing a close *prima facie* resemblance with several other congeners, are always easily recognized, viz. (1), by the absence of impressed olfactory organs on the ventral face of the antennal flagellar segments, and (2), by the unmodified and normally pubescent outer faces of the mid tibiae (see specific key). Females, on the other hand, are much more difficult to identify with certainty and often indistinguishable — even structurally — from one or more congeners inhabiting the same area, with which they often mix, but whose males are on all occasions easily recognizable. Identification of females originating from countries in the temperate zone of northwestern and parts of central Europe, where no *Melecta* other than *albifrons* and *luctuosa* have so far been found, offered no problem as both are easily held apart. These countries are: Scandinavia, Great Britain, the Benelux, West and East Germany, Poland, Czechoslovakia, Austria, and also the greater part of France (to about lat. 46° N.). To save space, drawer- or pin-labels of museum specimens from these parts of its range (all based on specimens examined by myself) are given in condensed form and simply replaced by locality lists, arranged alphabetically for each country, as was done for the well known nominotypical *M. albifrons* (Forster). In some cases certain territorial occurrences are mentioned separately. Countries are arranged somewhat arbitrarily, from north to south (east).

As indicated above, recognition of *luctuosa* females collected outside the northwestern territory of Europe often proved impossible, except of course under special circumstances, e.g. when both sexes were captured simultaneously in some isolated or remote locality. I think that the most reliable impression of the distributional pattern of *luctuosa* can be obtained by enumerating all available data of fully authenticated males (whether or not accompanied by females), and by copying all labels in full. In that way comparisons can be made with the specified data available on the labels of other species. In all instances where only solitary females had come in hand, it has been expressly stated, indicating that they are regarded conspecific. Other localities are left without the prefixed sex symbol, which means that the proper identity of these bees is a little doubtful. The status of a considerable number of soiled or worn females — mostly from the southern Mediterranean and Near Eastern countries — had to be left undecided; these specimens were simply omitted and left unidentified.

Further material. — Sweden: 2 ♂ 1 ♀, Ostro Gothia (Östergötland), Aby, 30.v & 6.vi, leg. Haglund (NRS), and 1 ♂ 2 ♀, "V.G./Schh" & "GL/Bhn-P.Wg" (NRS). Also known from the islands Gotland and Öland (S. Erlandsson, 1976 & in litt.). Apparently rare. In Fabricius' collection (MC) is a typical ♀ (sine patria) with a label "Fals-Samml unter *punctata*" (recent handwriting), which means that the insect had originally been placed under *M. punctata* F. (now *a. albifrons* Forster) (pers. comm. by B. Petersen, Copenhagen). — Denmark: no specimens examined. Recorded by Jørgensen (in 1921) from three localities on Jylland (Jutland), and two others on Jylland and Sjaelland (Zealand), communicated by Dr. Børge Petersen. — Netherlands: Formerly (prior to 1950) widely though sparingly distributed, except in the northern provinces (about 10 more records), nowadays a scarce species. Only eight authentic localities from 1950 onward in the central and southeastern provinces. — Belgium: Also more widely spread before 1950 (21 locs., all in central provinces); since then apparently nowhere turned up again. — Great Britain: 1 ♂ 2 ♀, Angleterre, coll. O. Sichel 1867, with old label "3 *M. luctuosa* Scop. ♂ Angl. F. Sm(ith)" and ♀ with "Baly, *M. luctuosa* ♀" (MP). Restricted to the southern counties of England. In the British Museum (Nat. Hist.) are few specimens from Berkshire, Buckingham, Essex, Gloucestershire, Surrey and Sussex. — West Germany: Atzwang; Bamberg; Bensheim a. B.; Bonn (fig. 94); Ebelsbach nr. Bamberg; Frankfurt & Schwanheim nr. Frankfurt a/M; Fürth; Hannover; Kaiserstuhl; Karlstadt (Spessart); Köln; Lorelei (Rheingau); Lüneburgerheide; Marburg/L.; Mühlhausen; Starnberg (Ober-b.); Strassbourg; Soden nr. Aschaffenburg); Tübingen; Vilshofen (Nordb.); Waldorf/Gulda; Weilburg (Nassau); Weissenfels (Elsasz). — East Germany: ♂♀, Altenburg; Berlin; Dolgelin & Falkenberg (Mark Brandenburg); Frankfort a/Oder; Greifswald; Haabe & Jena (Thüringen); Hainburg (Hundsheimerberg/Donau); Kyffhäuser; Naumburg a/Saale; Mittl. Odergegend; Saaletal; Schwerin (Mecklenburg). — France: Nyons (Drôme) being the northernmost locality of congeneric species having a more southern or eastern distribution, we may safely assume the 46th degree of latitude to form a boundary line for the three or four other species resembling *luctuosa* in certain respects. Examples from French localities to the south of this line, enumerated by Leclercq (1965), would seem to require re-investigation. — Northern France: Finisterre, Fouesnant (Bretagne) and Vitré (I. et-V.); Paris and Fontainebleau (S. et M.); Villers Allerand and Bazancourt (Marne); Viarmes (?), v.1902, L. Chopard (MP). — Southern France: ♂♀: St. Sever (Landes), coll. J. Pérez 1915 (MP); Argent (Corrèze), 25.v (MP); Tarbes (Htes Pyrén.), lilac disk, coll. J. Pérez 1915 (MP, ML); Mont Canigou & Vernet-les-Bains (Pyrén. or.), A. Weis 1908 (MP). — ♀ only: Carpentras (Vaucluse), v.1952, P. M. F. Verhoeff (ML); Callian (Var), 11.vi.1931, Th. Steck (NMB); Fréjus & Valescure (Var), 28.v.1971, K. M. Guichard (BM); Valescure, 15.iv.1913 & Hyères, iii.1898 (BM); Croix-Vaimer (Var), v.1952, P. M. F. Verhoeff (ML); Vallouise (Htes Alpes), vi.1934 & 18.vi.1939, P. M. F. Verhoeff (ML); B.-Alpes, 26.vi.1948, P. M. F. Verhoeff (ML); Montpellier, D. Lichtenstein, *M. punctata* Latr., det.? coll. Gribodo (MCG). — Switzerland: ♂♀; Basel; Valais, E. Favre (CB); Genève, 222/61 (red), Sauss(ure) (NRS). — ♀ only: Belp; Bern; Biel; St. Blaise; Lausanne; Locarno; Lugano; Sierre: (diss., fig. 87); Sion; Alp. Sussillon; Useigne. — Portugal: ♂♀, Porto (Oporto), and Porto (MUC); ♂ Coimbra, O. Hospital (MUC); Rezende, 15.iv.1950, N. F. d'Andrade (♂ only, ML). ♀: Cardigos; Favo; Figuera da Foz, 20.vi.1967, J. van der Vecht (ML). — Spain: ♂♀, Bilbao (Basque), coll. J. Pérez 1915 (MP); ♂, Burgos, Sta. Maria del Invierno, iv-v.1964, I. H. H. Yarrow (BM); 2 ♂ (both diss.), Navarredonda de Gredos (Avila E.), 2.vi.1979, H. Teunissen (CT, ML); ♀, Barcelona, 11.iv.1924, M. Martens, *M. luctuosa*, det. Alfken (SMF); ♀, Albarracin (Aragon), vi.1953 (CS); ♀, Albaracin, H.Wagener (MNB); ♂, Biescas (Huesca), 13.v.1953, I. H. H. Yarrow (BM); ♀, Espagne (Ma.), Puerto El Paular, 9.vii.1950, F. Schmid (CB); 2 ♀, Batuecas nr. Salamanca (Léon), 13—15.v.1976, at nesting site of *Anthophora dispar* Lep.(?), E. Asensio (CAV, ML); ♀, Sierra Guadalupe (Caceres), v.1904, G. Schramm (MP); 2 ♂ (fig. 79), Espagne, Peña Ubina (Valencia), 2.vii.1963, R. Desmier de Chenon (INRA); Alicante (Valencia), Callosa de Ensarria, 2.iv.1956, I. H. H. Yarrow (BM); E. Spain (Valencia), 6 km NE Blagaz, 2.v.1960, exped. Leiden Mus. (ML); ♂, Espagne, "Hisp. 69", O. Sichel 1867 (MP); ♀, Spagna, coll. Magretti (MCG); 2 ♀, S. Spain, Ronda (Malaga), 1000 m, 1—5.vi.1974, K. M. Guichard (BM); ♀, Andalusien (MNB); series ♂, Algeciras (Cadiz) (NMW). — Balearic Is., Ibiza: No males! ♀, Balearen, Ibiza, ult v.1956, *M. luctuosa*, leg. & det. Rebmann 1961 (SMF). — Mallorca: No males! ♀, Mallorca, coll. Gribodo (MCG); Palma, 4.iv.1958 and Mallorca, without further data, A. Compte Sart (ML); Porte Golom, 18.v.1956, F. Keiser (NMB); ♀, Mallorca, 14.iv.1883, Friese (MNB). — Morocco: A few doubtful ♀ from the High Atlas are probably *I. leucorhyncha* Gribodo! (see under that species). — Algeria: No males! ♀ Algérie, Mascara, 28.iv.1908, Dr. A. Cros (MP); Algerien, Batna and Lambesa, vi.1891, leg. Handlirsch (NMW). — Poland: No males! ♀ only: prov. Pinczów, vii.1955; prov. Zabkowice, Muszkowice & Stolek, v.vi; E. Poland, Sandomierz a/Wisla (Weichsel), vi.1953; all leg. W. J. Pulawski (CP, ML). — Czechoslovakia: ♂♀; Dobrany (Dobrzan, S of Plzen) (Bohemia), 1.vi.1930 (ML); Jinonice (Bohemia), v.1953, Pádr (MUC); Bohemia, Chodau, v.1977, R. von Stein (BM); Böhmen, 16.v.1904 (MNB); series ♂♀ (diss., fig. 93), Brno (Moravia), Rájecek, v.1937, A. Hoffer (MMB, ML); Ceje (Moravia), vi.1940, A. Hoffer, and Velke Pavlovice, leg. Stricha (ML); Kobyli (Moravia), 21.v.1965, M. Kocourek (CK); Hostivor, 20.v.1953, leg. Pádr (CK); Hvanice & Hodanice (Moravia), 10—14.v.1942, M. Kocourek (CK); Vyskov (Moravia), 14—15.v.1965, M. Kocourek (CK); Dobsina (Slovenia), vi.1954, Pádr (MUC); Gbelce (Slovenia), 10.vi.1956; Jinonice, 1.v.1953, leg. Pádr (MUC). — Austria: ♂♀, many locs., a.o. Bad Hall; Bisamberg; Bucklige Welt;

Dornbach (N.Ö.); Eisleben; Gottlesbrunn (N.O.); Innsbruck; Leopoldsberg; Linz; Mannersdorf (Leithagebirge); Maschegg; Neusiedl; Oberweiden (N.Ö.); Plesching (Ob.O.), 5.v.1952, M. Schwarz (CMS); St. Pauls (Tirol); Villach; Weidbruck (S. Tirol); Wien; Winden (Burgenland). — Hungary: a series of 42 ♂ 5 ♀ with printed labels "Sárszentmihály Biró 1923 v.1927" and "Dabas 1855, leg. Metelka", all 5 ♀ with identification labels *M. luctuosa*, det. M. Móczar & Mocsáry et Móczár (MBUD, ML); ♂♀, Simontornya, 8.v.1938, Pillich (NMB). — ♀; Thebner Kogel; Budapest; Hungaria centr.; Neusiedlersee, E-side (NMW). —Italy: ♂♀: Cortona (Toscana), 20.v.1975, H. Teunissen (CT, ML); M. Cimius (Lazio), 600 m, 18.iv.1949, M. Comba (ML); M. Sibillini (Marche), 2000 m, Monte Sibilla, 26.vi.1930, G. Binaghi (IEP). — ♀: Corfino di Garfagnana estata (Piemonte), 1954, Wiering (MA); Aosta, Val Pelline, 22.v.1957, Bischoff (MNB) and Torino (Piemonte), Gianelli, coll. P. Magretti (MCG) and Torino, 27.v.1918 (CKW); 2 ♀, Genova (Liguria), under white drawer label "*M. notata* Klug ♂♀ (both are ♀!) — *punctata* Lep., Gênes", together with ♀ *M. a. nigra* Spinola! (MT); Varazze (Liguria), v.1917, F. Invrea (MCG); 1 ♀ (diss.), Bordighera (Imperia), 1.iv.1961, W. Grünwaldt (ex CVS, ML); Appiano (?), Egat, Monticolo, v.1932, "lehmiger, bewachsener Abhang" (ML); Oltr'Adige (Trentino), Bolzano, Montioggi, 11.vi.1930 (ML); Bozen, v-vi, A. Weis (SMF) & same loc. (NMW); Cortina d'Ampezzo, Mann leg. (NMW); Ponte Ticino (Lombardia), 13—28.v.1934, D. Prestifilippe (IEP); Udine (Venezia), Val Rio del Lago Predil, 950 m, viii.1958, Br. Theowald (ML); Lido Venezia, Mura, 10.v.1930, *M. armata*, det. Biegeleben (IEP); Bologna (Emilia), r.Pr.Fiori, M. Gibbio, 11.v.1893 (MCG); Lagopesole (Basilicata), 1.vii.1895, *M. armata* Pz., det.? (MT); Aspromonte (Calabria), Paganetti (MBUD) and "Calabria. Aspromon Paganetti 1905" (NMW); 3 ♀ (diss., much worn), Aspromonte, 1350 m, 1.vii.1973, H. Bytinski-Salz (CBS). — Sicily: ♂♀, Sicily, Zafferana, 800 m, 25.iv.1965, K. M. Guichard (BM); ♀ (diss.), Vittoria, 170 m, 3.vi.1908, G. Mantero, coll. Gribodo (MCG); 3 ♀ (diss.), Mte Etna vers. occ. Pineta, 1700 m, 8.vi.1949, Hartig leg. (INER, ML); ♀, Sicilia, Südhang Aetna, vi-vii.1949, H. Hamann (CMS). — Yugoslavia: ♂ Dobrovnik (Slovenia), 1.vi.1930 (NMW); Istria and Istrien, coll. Graeffe (NMW); Brioni Is. (NMW); Split (Spalato) (NMW). ♀ Dalmatia & Arba in Dalmatia (NMW); Croatie (Hrvatska), coll. E. André 1914 (MP); prov. Kosovo, Kosovska Mitrovica, Akad. Balkan Exped. (MBUD); Katlanovska Banja (Macedonia), 6.vi.1965, W. Vervoort, and between Ohrid & Resen, 19.vi.1965, C. van Heyningen (ML). — Romania: ♂, Mehadia, Mann 1859, *M. luctuosa*, det. Friese "Type" (NMW); Tultscha (E Romania, Tulcea). — Bulgaria: ♂♀: loc. illegible, 1.vi.1952 & v.1955, *M. luctuosa*, det. M. Kocourek (CK); Arkutino (Black Sea coast), 19.vi—4.vii.1970, K.Bleyl (CFP).

— ♀: N. Zagora, 21.vi.1963, S. Niedl (CK); SW Bulgaria, Sandanski steppe, 26—31.v.1967, M. Kocourek (CK). — Albania: ♂♀, Albania Exped., Kula Ljums, Kruma & Hodzha nr. Prizren (NMW). — Greece: No males! Females almost certainly belonging to *luctuosa* are labelled as from the following localities:Graecia, Ikaria, leg. Werner (NMW); Corfu, Athen and Delphi (NMW); Attiki, Neo Peramos, 30.iv.1932, Dr. Fodor (MBUD); Peloponnesus, Vytina W of Tripolis, 22.v.1962, W. Linsenmaier (CL); Olympia, 21.iv.1964, W. Grünwaldt, and Trypi, 19.v.1973, W. Grosz (CWG); Karadagh, 30.v.1924, auf *Euphorbia*, and Umgeb. Tokluk (near Turkish frontier), 21.v.1924 (NMW). — Turkey: ♂♀: Turkey, Erzurum, 31.v.1972, H. Özbek, at *Anchusa* (CKM, ML); Turkey, Madensehir/ Konya, 20.vi.1973, K.Warncke (CKW). — ♀: Erzurum, 18.vi.1965, 9.viii.1966, 28.v.1970 & 15.vii.1971, H. Özbek (CKW, ML) and Erzurum, Ispir, 17.vi.1973, K. Warncke (CKW); Ankara, 25.iii & v.1934, A. Seitz (SMF) and Ankara, 3.vi.1972, K. Warncke (CKW); Türkei, Giglikara, 1860 m, N. N. Zedernwalde, 30.v.1966, H. Felten, *M. luctuosa*, det. D. S. Peters (SMF); Çiftahan, and Posanti nr. Ulukishla (Taurus), v.1955, Seidenstucker (CKW, ML); Taurus, Akseli, 1300 m, 13.iv.1974, K. Warncke (CKW); Turkey, Halfeti/Urfa, Insesu/Kayseri, Erçek/Van, and Agri, N. Süphan Dagi, iv-vi.1976—77, all K. Warncke (CKW). — USSR: ♂ (4 ex., one diss., figs. 88—90), Uralsk, Bartl (print), one with "*M. luctuosa* aggr. sp. thyridia variable", det. D. B. Bakker (NMW); ♂♀, Ukraine, Kievskaja dist., Christinovka, distr. Umanj. gub. Kiev, 12.v.1901, I. Zhicharev leg., *M. luctuosa*, det. Osychniuk (CO); 2 ♂ 1 ♀, Chersonskaja dist., Novaja Tjaginka and vicinity of Cherson, 14 & 19.v.1954, *M. luctuosa* leg. & det. A. Z. Osychniuk (CO, ML); 1 ♂, Ross. mer., Uschakoff (MH); 2 ♂, Russia mer., with two partly illegible labels in Russian "Woro Zaljogwitsj, Galitscha Gora, Kutschark, 15.v & 22.v.1938, A. Golidche" (?) (MNB); ♀, Caucasus, Araxesthal, Leder-Reitter, *M. luctuosa* var., det. Friese (MNW); 1 ♀, Irkutsk, 22.iv—12.v.1904 (MNB); 1 ♂ 1 ♀, Irkutsk, 14—27.v.1913, O. Hesse (MNB); ♂ (diss., ex alcohol), Jelan, Région du Baikal et env. d'Irkutsk, Paul Labbé 1902 (MP); ♂♀, "Dschungarey, Post 1 1878" (Dzhungarskiye, SE Kazakhstan) (NMW); 1 ♀, Siber (ia), *M. luctuosa*,



Figs. 81—82. *M. luctuosa*; 81, ventral view of tergite 7 (holotype ♂ *M. eczmiadzini*, Caucasus); 82, sternites 7 and 8 (same specimen). — Figs. 83—94. *M. luctuosa*; 83, oblique dorsal view of right hind tarsal claws (♂ ♀ Hulshorst, Netherlands); 84, ventral view of tergite 7 (♂ same locality); 85, sternites 7 and 8 (same specimen); 86, right gonostylus, oblique extero-lateral view, with separate dorsobasal process of left gonostylus (same specimen); 87, dorsal view of pygidial plate (♀ Sierre, Switzerland); 88, ventral view of tergite 7 (♂ Ural); 89, sternites 7 and 8 (same specimen); 90, genital capsule, ventral and dorsal halves (same specimen); 91, ventral view of tergite 7 (♂ Iran); 92, sternites 7 and 8 (same specimen); 93, exterior view of left gonostylus (♂ Moravia); 94, dorsal view of pygidial plate (♀ Bonn, W Germany)

det.? (MBUD); ♀, Transkauk (asia), Helenendorf 1880, *M. luctuosa*, det. Kohl (NMW); 4 ♀, Samarkand, Aman Kutan, 1—2.vi.1919, J. Niedl (CK); Usbekistan, Samarkand, 12.vi.1957 (MNB); 2 ♂, Ost-Turkestan, Narin, E. A. Böttcher (MNB). — Iran: 2 ♂ (diss., figs. 80, 91—92), Iran, Karadj Lake/ Keredj river/, 2000 m, ca. 30 km W Teheran, 24.v.1972, H. Bytinski-Salz (CBS, ML).

Synonymy. — Concerning the questionable synonymy cited above, any comment would seem too speculative to be of any use. *M. fasciculata* Fischer-Waldheim is preoccupied by *fasciculata* Spinola (= *albifrons nigra* Spinola), *eversmanni* is most likely a synonym (see *species incertae sedis*), while *eczmiadzini* and *luctuosa* are undoubtedly also conspecific.

Distribution. — It will be seen, that several references cited above under *luctuosa* are affixed "pars", which means that more than one species may be involved. Therefore, all published information on this species based on material originating from the more southern and eastern parts of its range, should be considered with caution. For instance, Radoszkowski (1893), after briefly describing the pubescent pattern, mentions the following localities taken from specimens in his own collection: "Astrakhan (Ryn-Peski), Odessa, Ukraine, Sibérie, France, Italie, Kissingen". It must, of course, remain uncertain how many — and if any — of the author's "*luctuosa*" are really that species! As to the material examined by myself, and reviewing all reliable data, it must be admitted that, as long as no authentic males have become known, the occurrence of *luctuosa* remains to be established in the following countries (arranged alphabetically): — Balearic Is., Corsica, Crete, Cyprus, Egeian Is., Iraq, Israel, Jordan, Lebanon, Malta I., whole North Africa (incl. Egypt!), Rodos I., Sardinia. In many of these countries and islands the species is likely to turn up sooner or later; but, by the absence of males, many solitary females supposed to be *luctuosa*, mainly from Asiatic Turkey, had to be left unidentified.

Note on the occurrence of *M. luctuosa* in the Netherlands.

In former days, from 1938 to 1942 (and once again in 1947), the late biologist F. C. Mijnssen regularly observed *luctuosa* in May and June inspecting the nesting site of *Anthophora retusa* (L.), on the S-slope of a railway cutting near the station at Baarn (prov. of Utrecht). Though no definite evidence of parasitization could be acquired, the *Melecta* always kept company with the *retusa* bees, which undoubtedly acted as host of *luctuosa* in this particular place. While collecting together at the same locality on May 15, 1938, we observed the two species jointly gathering nectar at flowers of *Lamium album*, *Lithospermum officinale*, and *Nepeta cataria*.

Melecta rutenica Radoszkowski
(figs. 97—98, map 1, p. 223)

Melecta luctuosa var. *Rutenica* Radoszkowski, 1893, Bull. Soc. Imp. Nat. Moscou, new ser. 7 (2—3): 179—181, fig. 30a—c, i (♂ genit.) (♀ ♂ "Cechocinek, Pologne" [err.!], see below).

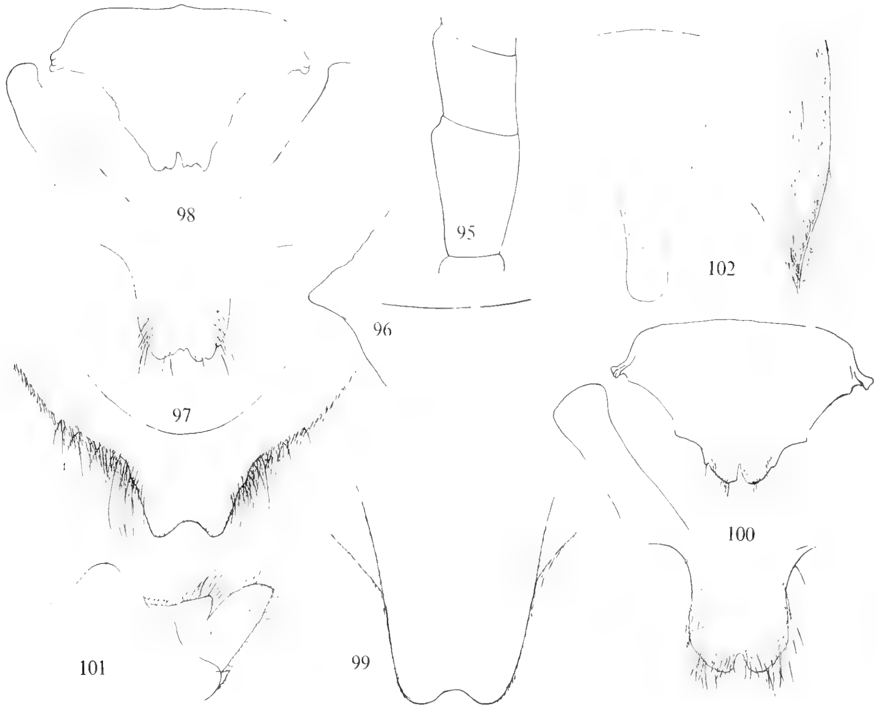
Type material. — USSR: 1 ♂ (diss. & fig. by Radoszkowski), labelled "Nickon: p. Stani:" (?) (poor writing, unknown hand), "*Rutenica*" (Radoszkowski's handwriting), "Type" (print on red), "*Melecta luctuosa* var. *rutenica* Rad. Type", rev. Dr. Enderlein (MNB). Type designation by Enderlein confirmed and here selected lectotype.

Further material. — USSR: 1 ♀, "Distr. Kiev, Kirill-ravine, 24.v.1917, V. Alexand." (transl. from written label), "*M. luctuosa* v. *rutenica* Rad. ♀", det. A. Z. Osychniuk (CO). — Turkey (Asia minor): 1 ♂ (diss., figs. 97—98), "Mann Brussa 10" (written), "167" (ditto), "*Melecta luctuosa* var. ♂, det. Friese 1893" (NMW).

The identity and habitat of this species are of some historical interest, warranting the following observations.

Radoszkowski's diagnosis of the two sexes runs as follows:

"A Cechocinek, en Pologne, il y a une varieté que je nomme: Var. *Rutenica*. Poils de la tête et du thorax complètement noirs, excepté la touffe blanche du chaperon. Le male de cette variété (il a été pris avec sa femelle à la même place) est garni de poils gris sur le prothorax [i.e., anterior portion of mesonotum] et de chaque côté du métathorax. Dans ma collection, je possède aussi un exemplaire [sex not stated!] de cette localité avec le chaperon et les pieds sans taches blanches". Follows a description of the ♂ genitalia of which sketches are also



Figs. 95—96. *M. luctuosa* (♀ Hungary); 95, antennal segments 3—4; 96, left scutellar tubercle, interodorsal view. — Figs. 97—98. *M. rutenica* (♂ Brussa, Turkey); 97, ventral view of tergite 7; 98, sternites 7—8. — Figs. 99—102. *M. brevipila* (♂ holotype and ♀ paratype, Almasy, Turkestan); 99, dorsal view of ♂ tergite 7; 100, sternites 7 and 8 (same specimen); 101, external view of left gonostylus (same specimen); 102, dorsal and left lateral view of ♀ pygidial plate (paratopotype)

given. As these organs had already been figured earlier by the same author (1886) for a supposed *luctuosa* from Ashkhabad, the drawings accompanying Radoszkowski's 1893 description are clearly those of this *rutenica*. These figures are not alike, but too schematic to be of any use.

Concerning the habitat of this taxon, Dr. W. J. Pulawski, of the Zoological Institute, Wroclaw, kindly gave me important information, now several years ago. He wrote to me as follows: "The historical term Ruthenia is more or less the same as the present day Ukraine. The most western part of it is the Lvov district, which since 1939 is part of the Soviet Union. Therefore, *M. ruthenica* Rad. certainly does not belong to the Polish fauna. It is more probable that this bee was described from specimens from the Kiev area or even the Black Sea coast. I have no idea about the type location."

Male. — As the Brussa specimen agrees in every respect with the lectotype, found in the Berlin museum and identified by Radoszkowski, we are now somewhat better informed about the occurrence of *rutenica*. With *luctuosa* and *brevipila* it is the only species of which the male can be recognised by the absence of well developed impressed antennal sensoria. It can be distinguished from the former and most other *Melecta* by the reduction of white marks, small size, fairly long black pile, and relatively strong antennae. The genital capsule of the type has been cut to pieces, but the sternal plates are still intact and do not differ from those here figured for the second specimen (fig. 98). Seeing how variable these structures are in its near ally, *luctuosa*, the differences shown are almost negligible and would point to their close relationship.

Female. — The dark specimen from the Ukraine (Kiev area), is the only one that can be assigned to *rutenica* with reasonable certainty. Of course, more material of both sexes, preferably from one and the same locality, is needed to confirm the correctness of the present sex association. Here follow a few more characters of the specimen in hand, in addition to those given in the key.

Antennal segments 3—12 only little longer than broad, 3 less than twice as long as its breadth at apex and less than one and one-third longer than next segments, the intermediate joints almost square. Punctures on disk of mesonotum partly smaller than rather shiny interspaces; median mesonotal and parapsidal lines fine, not impressed. Scutellar tubercles moderate, parallel, conical, raised obliquely upward and backward, shorter than surrounding pubescence. Third submarginal cell in fore wing distinctly higher than long (24 : 20), its distal side moderately angled. Inner ramus of mid and hind tarsal claw about one-third length of outer. Abdominal tergites markedly shiny, setiferous punctures smaller than interspaces.

Little could be found to distinguish *rutenica* from our series of *leucorhyncha taormina*, i.e., the subspecies commonly distributed all over Italy and some of the islands in the Mediterranean. It is held distinct from that taxon on account of the non-developed antennal rhinaria and longer hair.

Melecta brevipila spec. nov.
(figs. 99—102, pl. 2 fig. 7)

Type material. — USSR: 1 ♂ (diss., figs. 99—102, pl. 2 fig. 7), with two printed labels "Vallis Kabak" and "Turkestan, Almasy 1906". Holotype (MBUD).

Further material. — USSR: 2 ♂ 1 ♀ (diss., figs.), all with same labels as holotype (MBUD, ML). — Turkey (Asia minor): 1 ♂ (diss., much worn, wings frayed), Asia minor, Umgebung Konya, 4.vi.1964, H. H. F. Hamann (CMS).

The rather comprehensive diagnosis of this remarkable new species, found in the descriptive key to the males, is given on purpose for comparison with that of *luctuosa*, mainly because they are almost unique by the absence of antennal rhinaria. For that reason alone the two species run out together in the same paragraph of the key. There are, however, no further points of agreement between them, and they do not seem to be at all closely related.

Wing expanse of male holotype (pl. 2 fig. 7), 27 mm.

Here follow a few more characters not mentioned in the key.

Male. — Labrum subrectangular, distinctly though slightly longer than broad, surface at first convex, then markedly hollowed out, the anterior border finally again upturned; side angles rounded but apex distinctly projecting, bearing a subacute median denticle, the latter in two paratypes prolonged basad for a short distance, forming an indistinct median ridge; surface deeply, irregularly punctate. Maxillary palpus slender, 6-segmented, the last joint very short. Silvery white patch upon clypeus squarish, the long hairs straight, lying flush upon surface, tips not or scarcely exceeding anterior border; sides black. No distinct smooth areas in front of median and just beside lateral ocelli, surface dullish; distance separating ocelli little shorter than their own diameter. Head and thorax closely, almost contiguously punctate; median mesonotal line not impressed. Wings subhyaline, but fore wing membrane gradually somewhat infuscated beyond cells; third submarginal cell shaped much as in many *luctuosa*, with distal side rather strongly angled. Subbasal white spots at outer faces of mid and hind tibiae and at sides of tergites 2—5 characteristically small and isolated.

Female (unique). — An aged specimen, with much of the body pubescence rubbed off and with fore wing borders revelled out. Probably conspecific, agreeing with the male in many respects and bearing identical printed locality labels.

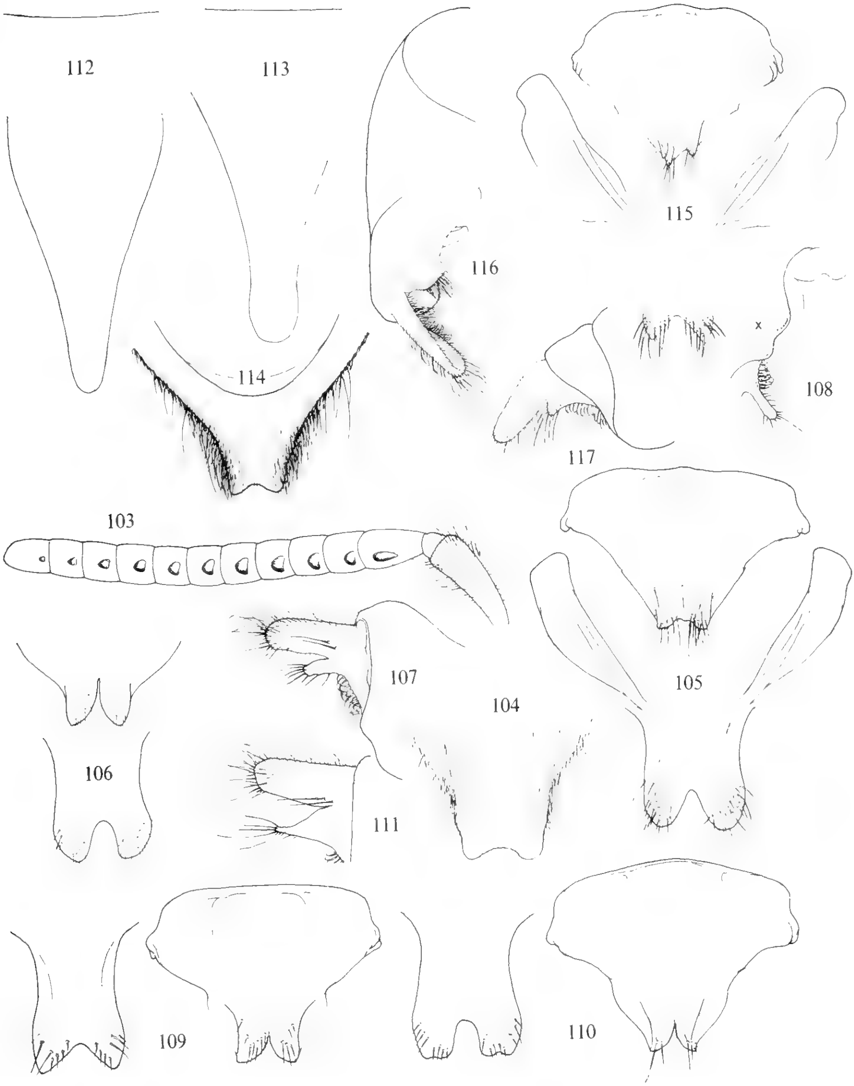
Chiefly characterized by predominantly black head and thorax (including sides of the latter), dullish abdominal tergites, caused by relatively more closely set setiferous punctures than in similarly looking species of equal size. Flagellar segments of antenna also more markedly longer than broad than usual. Third submarginal cell much higher than long, the distal sides of second and third cells moderately angled but more nearly parallel than in most other species of the same sex. Length 11.3 mm approx. Pygidial plate, fig. 102.

Melecta sibirica Radoszkowski
(figs. 103—111)

Melecta sibirica Radoszkowski, 1890, Horae Soc. Ent. Ross. 25 (1—2): 246—247 (♀ Irkutsk, feu Eckert).

? *Melecta sibirica* Radoszkowski, 1893, Bull. Soc. Imp. Nat. Moscou, new ser. 7 (2—3): 184 (♀ Irkutsk).

Type material. — USSR: 1 ♀, labelled "Ekert" (print), "Siberie orient" (print),



Figs. 103—111. *M. sibirica*; 103, posterior view of antenna (♂ Ramit, Tadzhikistan); 104, dorsal view of tergite 7 (same specimen); 105, sternites 7 and 8 (same specimen); 106, apices of sternite 8 (upper) and 7 (lower) (second specimen); 107, external view of left gonostylus (same specimen); 108, partial dorsal view of gonocoxal angle (+), with dorsobasal process (same specimen); 109, apex of sternite 7 (left) and whole sternite 8 (right) (♂ Akfasch/Tashkent) and 110, the same of second specimen from same locality; 111, external view of left gonostylus (♂ Akfasch/Tashkent). — Fig. 112, *M. eversmanni*, dorsal view of pygidial plate (♀ lectotype, Orenbourg). — Fig. 113, *M. ashabadensis*, dorsal view of pygidial plate (♀ lectotype, Ashabad). — Figs. 114—117, *M. turkestanica* (♂ lectotype, Tashkent); 114, ventral view of tergite 7; 115, sternites 7 and 8; 116, ventral view of right half genital capsule; 117, external view of left gonostylus

"Type" (print on orange), "*sibirica*" (pencil writing, Radoszkowski's hand), "*Melecta sibirica* Radosz. Type, rev. Dr. Enderlein" (MNB). Holotype designation by Enderlein, confirmed.

Further material. — USSR: NW Tadzhikistan: 2 ♂ (both diss., figs. 103—108, one with frayed wings), with written labels "Tadcikistan, Ramit [NE of Dushanbe], 1.vi.1966, Niedl" (CK), and "Tadz SSR, Ramit, 1.vi.1966, Deros (?) legt." (partly printed) (ML); 1 ♀ (diss.), Tadzhikistan, Federobod [Fadrobod?], 7.vi.1966, Niedl (CK); 2 ♂ (both diss., figs. 109—111), with written labels "Turkestan, Akfasch, 60 km NNO Tashkent", 1500 m, 15.v.1974, at *Eremurus*, M. Kraus (CKW, ML).

Doubtful specimens. — USSR: 1 ♀ (diss.), Turkestan: Bokhara, Tschardschui 1913, H. Veth (BM 1925—553); 1 ♀ (diss.), with four labels: green square/yellow disk with 2206/8 on reverse side/Museum Paris/Turkestan/Capus Bonvalot/*Melecta* (MP); 2 ♀ (diss.), Turkestan, Osch 1905—Korb (MBUD, ML). — Afghanistan: 1 ♀ (diss.), NO. Afghanistan 1953, Nuristan, 2200 m, Kamdesh, 28.iv.1953, J. Klapperich (MBUD).

This is the first of a small series of puzzling taxa, described consecutively by Radoszkowski at the close of the last century. *M. sibirica* is the earliest species in this group, characterized in 1890, and for that reason deserves particular attention. Three others were described three years later and are being discussed in the next pages. For *M. eczmiadzini* Rad., see under *luctuosa*; the identity of *M. rutenica* Rad. has been established elsewhere in the present article.

As to *M. sibirica*, it will follow from the above references, that the author possibly described two species under the same name, both originating from Irkutsk and from a comparison of the diagnoses it is not at all clear whether Radoszkowski had the same specimen before him at the time of describing them. The present individual, fixed by Enderlein as the type, corresponds with the very brief 1893 description, but not exactly with the earlier and more fully described *sibirica*. For the sake of clearness, both characterizations are here given in full.

1890. "*Melecta sibirica* n.sp. Nigra; capite thoraceque niveo-variegatis; abdomine subopaco, segmentis 1—4 niveo-maculatis; alis subfuscis; scutello bidentato. Long. ♀ 11—12 mm. Reçue de feu Eckert des environs d'Irkutsk. Femelle. Noire. Tête garnie de poils noirs; le chaperon porte une touffe; on voit autour des antennes deux taches et derrière la tête une lisière de poils blancs de neige. Thorax densément ponctué, sa partie antérieure garnie de poils longs blanchâtres; sous les ailes les touffes sont formées de ces mêmes poils; on voit des taches pareilles de chaque côté de l'écusson, qui est bidenté. Abdomen nu, presque opaque; sur la base du premier segment on voit quelques poils gris; les deux premiers segments portent de chaque côté une petite tache blanche et le troisième en porte deux de chaque côté (spacings are mine), qui sont éloignées du côté, le quatrième porte deux taches rondes; toutes ces taches sont formées de blancs couchés; ventre nu. Pieds garnis de poils noirs; les jambes portent des taches blanches. Ailes faiblement enfumées."

1893. "*M. sibirica* n.sp. Femelle. Par sa stature se rapproche du *Pseudomelecta diacantha*; abdomen plus long et moins large que celui du *M. luctuosa*, avec lequel elle a beaucoup de ressemblance par la disposition des poils blanchâtres sur la tête et sur le thorax, et par la petitesse des dents de l'écusson. Taches des quatre premiers segments abdominaux sont d'un blanc de neige, petites, non allongées, et garnissent les bords postérieurs des segments; sur les deux premiers segments ces taches sont disposées très près des côtés, sur les segments suivants, elles en sont assez éloignées. Long. 13 mm. Irkoutsk."

But for the absence of paired white spots on each side of tergite 3 (a surprising statement!), the present individual also fits Radoszkowski's first description of *sibirica*. But since the whereabouts of the last described female — if there really were two specimens — remained unknown, I have accepted the author's own type selection as the correct one, there being no other specimens named as such in the Berlin museum.

As stated in the 1893 description, this bee, by the dullness of its finely and rather closely punctate abdominal tergites, somewhat recalls *Pseudomelecta diacantha* (Eversmann). The white tergal spots consist of very short, fine and closely set, appressed feathery hairs, those covering the sides at base of tergite 1 are, however, erect, tufty and much longer. It is undoubtedly a true *Melecta*, agreeing fairly closely with *luctuosa*, but differing from this by having a distinctly less shiny, more closely punctate abdomen (see above); also by the placement of the white spots, which on tergites 3 and 4 are situated more inward, removed from the bend by a distance almost equal to their own diameter. The neuration is that of *luctuosa*, while the antennae, tarsal claws and other parts of the body are not different in shape from *luctuosa*. Only the apex of the pygidial plate is exposed and this also is shaped similarly to that of the latter. Length 12.3 mm approx., fore wing 9.0 mm.

Of all species hitherto known, the males here associated with *sibirica* resemble *M. turkestanica* Radoszk. most closely. The latter averages larger in size but is, nevertheless, probably related. I have little to add to the key characters as given in comparison with the male of that species. *M. sibirica* can be at once distinguished from *turkestanica* by the shorter pile, more slender form of the hind basitarsus, and the flat, much smaller white abdominal spots. These males are, however, also very similar in size, general appearance and abdominal spots to certain bees here assigned to *M. leucorhyncha* (itself a very variable species), especially to populations from the Ukraine, eastern Mediterranean islands and Turkey, sharing with these also the almost colourless wing membrane. The two males from Ramit (figs. 103—108) and those from Akfasch (figs. 109—111) are also reminiscent of our new species *megaera*, but apart from its superior size and details of structure, the latter can be recognized by having a more even, less fluffy, vestiture and slightly darker wings.

I am unable to distinguish the supposed female of *sibirica* from those of *brevipila* spec. nov., and certain populations of *leucorhyncha*. Lastly, in comparison with the type of *M. eversmanni* Radoszk. (fig. 122), the pygidial plate of *sibirica* is broader at base and more suddenly narrowed apically, the swollen and bluntly carinated tip being a little downbent.

Melecta turkestanica Radoszkowski
(figs. 114—122, pl. 2 figs. 8—10)

Melecta turkestanica Radoszkowski, 1893, Bull. Soc. Imp. Nat. Moscou, new ser. 7 (2—3): 181—182, fig. 34 a-c, i (♂ genit., ♀ ♂ Tachkend (Boc-cy). — Popov, 1967, Trans. Zool. Inst. Akad. Nauk Leningrad 43: 207 (♂ Iran, no descr.).

Type material. — USSR: E Uzbekistan: 1 ♂ (diss., figs. 114—117) pl. 2 fig. 8, labelled "Boc-cy 23 Mrs" (written), "Tach ken" (print), "*Turkestanica*" (Radoszkowski's writing), "Type" (print on orange), "*Melecta turcestanica* Radosz. Type", rev. Dr. Enderlein. Holotype, evidently selected by Enderlein (MNB), confirmed.

Further material. — USSR (Turkestan) or Afghanistan: 1 ♂ 1 ♀ (diss., figs. 118—122 & pl. 2 figs. 9—10), both with small purple cadre (= captured in April), a small written label "Alai", and the usual printed museum labels "Muséum Paris coll. J. Pérez 1915" (MP).

The two males before me are from different localities and therefore described separately. The Alai male differs from the type in that the long white scutellar hairs are not restricted to just behind the spines but surrounding (and concealing) them at all sides; the white mid tibial pad is better defined and the hind basitarsus is a little more outbent. In spite of these differences I believe the two to be conspecific. To enable future recognition both are here photographed (pl. 2 figs. 9—10), the Alai specimen along with its female, which undoubtedly belongs to the same species. The key characters are partly based also on the larger-sized male from Alai.

Here follows first a brief description of the unique type and only authentic example. I have not seen the specimen from Iran recorded by Popov, which may or may not be conspecific.

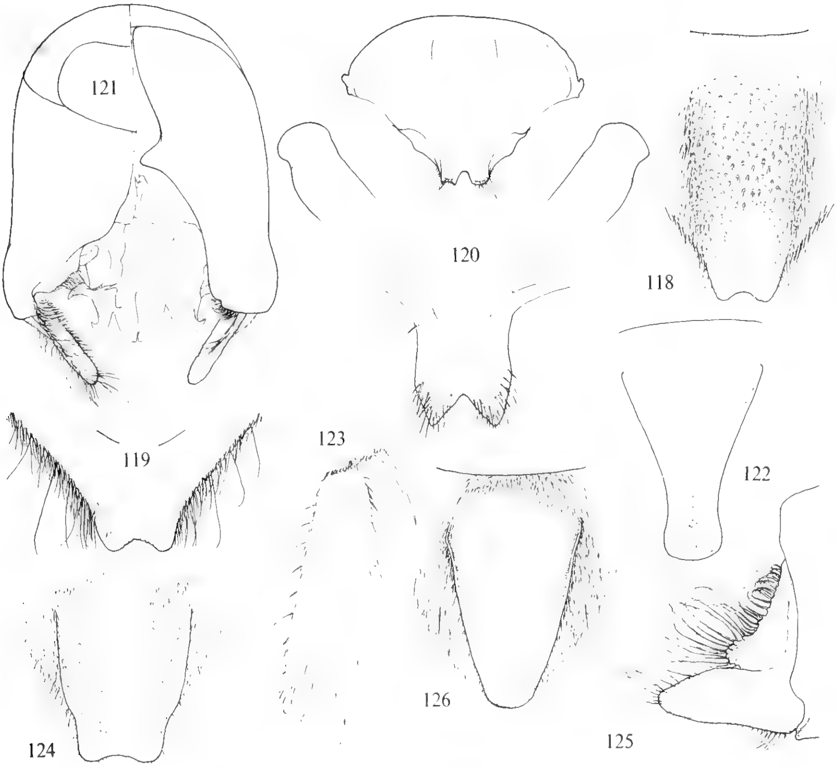
Male (holotype). — Labrum hidden from view, apparently slightly longer than broad, with long erect blackish bristles. Mandibles black. Maxillary palpi 7-segmented (sic), 2—5 subequal in length and longer than 1 and 7. Pubescence on disk of clypeus long, decumbent, silky white; hairs alongside also long, black. Antenna thick, scape clothed with very long white hairs; 3 subequally long to 4, both a trifle longer than broad, the flagellar segments almost square; rhinaria deeply impressed, present on 3—13, horseshoe-shaped, but oval on 3, circular on 13. Head above and aside strongly, contiguously punctate; long raised white hairs not very dense, becoming black laterally, except white at temples. Posterior part of mesonotum black, thorax for the rest entirely white, hairs mostly concealing the surface. Scutellar spines rather long, conical, pointed, with tufts of very long white hairs just behind each of them. Fore and hind femora black, the posterior fringe at fore femur longer than its diameter, tuft fringing mid femora posteriorly very long and white, that on hinder pair much shorter and more compact. Tibiae closely punctate; white external pad of mid tibia isolated but not very conspicuous, much longer than broad, lacking thin fringe of longish hairs posteriorly; outer face of hind tibia for the greater part clothed with short white hairs but devoid of spine-like black setae. Hind basitarsus not markedly concave externally, broadest at about halfway length, the outer border straight, the inner (lower) distinctly outcurved (convex). Tarsi yellow-brown; inner rami of all tarsal claws very slender and but little shorter than outer. Wings almost hyaline, neuration brownish yellow.

Abdominal tergites rather shining, sparsely superficially punctate inclusive of the hind margins of 1—5; sternites similar, pubescence not very dense, consisting of short, black decumbent hairs which are longest on posterior sternites. Tergite 1 clothed with very long raised white hairs, most densely so, longest and tufty, at the sides; pile on dorsum of 2—5 short, black, sparsely intermixed with longish hairs at sides of tergites, the white pubescent spots of regular shape. Tergite 7 rapidly tapered with slightly concave sides, hind margin emarginate; dorsal surface smooth and shining, dark reddish brown, except the apex which is colourless, the tips of the side angles very slightly upturned (fig. 114, ventral view). Hind margin of sternite 6 little prominent, rounded, median impressed area shallow, suboval, lighter in colour and less hairy than the rest.

Parts of the extruded genital organs were figured by Radoszkowski, but could be further dissected out and examined. They are here redrawn, together with sketches of tergite 7 and the apical sternal plates. It must be emphasized that the drawings and description of the gonostyli ("branche du forceps conique — non arrondie, mais pointue à l'extrémité — avec sa partie postérieure richement garnie de longs poils") are not quite correct, the tip of the left gonostylus being more rounded than that of the right one, as shown in fig. 117.

Total length 12.0 mm approx., wing expanse 24.3 mm.

Male (Alai, pl. 2 fig. 9). — Labrum of the usual shape, slightly longer than broad,



Figs. 118—122. *M. turkestanica* from Alai; 118, dorsal view of ♂ tergite 7; 119, ventral view of same (same specimen); 120, sternites 7 and 8 (same specimen); 121, partial ventral and dorsal views of genital capsule (same specimen); 122, dorsal view of ♀ pygidial plate. — Figs. 123—126. *M. megaera*; 123, external view of right hind basitarsus (♂ holotype, Polemedia, Cyprus); 124, dorsal view of tergite 7 (same specimen); 125, lateral view of right gonostylus (same specimen); 126, dorsal view of pygidial plate (♀ Polemedia Hills, Cyprus)

closely coarsely punctate lacking a definite median ridge, anterior margin broadly rounded. Entire dorsal surface of head and thoracic sclerites dull, very closely, contiguously punctate. Antenna strong, scape fringed all around with long raised white hairs, the apical ones characteristically recurved; 3 about one and one-fourth as long as its apical breadth (100 :76), somewhat longer than next ones, which are subequally long. Silky white patch covering clypeus broad, thick and conspicuous, all hairs long and straight, lying flush with surface and even somewhat downcurved, tips projecting well beyond anterior border; paraocular bristles deep black. Thorax, including sides of propodeum and ventral sclerites clothed with long, fluffy white pubescence, only metapleurae posteriorly, a poorly indicated T-shaped median area traversing scutellum anteriorly, and a narrower zone (representing short stem of T) between scutellar spines, black.; long white tufts behind wings confluent with still longer and curly hairs surrounding scutellar spines, the latter much shorter, triangular, acuminate. Wings entirely hyaline, veins yellowish brown. White pad of mid tibia well defined, elongate, covering outer face from near base to near apex. Hind femur throughout closely punctate; pubescence black, moderately long raised hairs fringing posterior ridge much shorter than diameter of femur. Outer face of hind tibia white on basal half, for the rest black; few short black spicules between punctures on somewhat shiny ground. Hind basitarsus slightly but distinctly outcurved, broadest at about midway length (length-breadth ratio 100 :37), both upper and lower borders convex, the former lacking fringe of long raised bristles (profile!); hairless ventrobasal pit-like concavity to the inside of lower ridge distinct, elongate-oval, shiny and punctate; mid and hind basitarsi white externally, except at extreme base, the remaining tarsal segments being all white; claws reddish.

Tergal plate 7 rather narrow, tapering, disk a little hollowed out, punctures largest and setiferous only on basal portion, lateral ridges poorly indicated, a little swollen and hairy with well-marked crescentic emargination, the rounded tips yellow-brown, slightly upturned, impunctate. Sternite 6 with very low lateral tubercles; 7 and 8 as in fig. 120. Genital capsule relatively small, 1.8 mm long (incl. gonostylus), gonocoxal angle completely rounded, feebly bi-angulate, course of diverging borders thereafter straight (fig. 121).

Size larger, length 16 mm, fore wing 13.2 mm, wing expanse 28.5 mm.

Female (Alai, pl. 2 fig. 10). — Undoubtedly conspecific with the last described male. There are few characters additional to those given in the key which may help to distinguish it from other regional species. *M. turkestanica* is more stoutly built than *sibirica*, with much lighter wings and larger, more regularly arranged, subrectangular tergal spots, while the body pubescence is longer throughout. Though similar in general appearance to the eastern Mediterranean *megaera*, these two species are probably not at all closely related, the females especially differing so much in the shape of the pygidial plates that *megaera* can not possibly be confounded with other large-sized species (cf. figs. 122 & 126).

Length 15.6 mm, fore wing 12.3 mm.

Melecta megaera spec. nov.
(figs. 123—126)

Type material. — Cyprus: 1 ♂ (diss., figs. 123—125), labelled "Polemedia, 9.3.50, No. 5" in G. A. Mavromoustakis' handwriting. The specimen is the holotype (MNB).

Further material. — Cyprus: 1 ♂ (diss.), same label as holotype, No. 4 (ML); 1 ♀ (diss., fig. 126), Cyprus, "P. Hills, 14.3.50, No. 3" (do.) (MNB); 1 ♀ (diss.), Limassol, Yermasoyia, 13.3.1979 (2 days later than 1 ♀ *M. tuberculata* sp.n.!), L. A. Janzon (NRS). — Rodos I. (Greece): 1 ♀ (diss.), Rhodus, Hedenb. (written), "1904 Friese det." (print, but no name) (NRS); 4 ♀ (all diss.), Rhodos, Monte Smith, 21—25.3.78, K. J. Hedquist (NRS, ML). — Crete: 1 ♀ (diss.), Kreta, Omalos Ebene, 26.iv.1942, 1000 m, Kl. Zimmermann (MNB); 1 ♀ (diss.), O. Kreta, Iraklion (Gándia), 3.v.1925, A. Schulz (MNB). — Greece: 1 ♀ (diss.), Chalkis, Euboea, iv.1926, Holtz (MNB). — Turkey (Asia minor): 1 ♀ (diss.), Kleinasien, Sewdiköib b. Smyrna, 4—19.iv.1917, La Baume (MNB); 2 ♂ (diss.), W. Türkei, Ayvalik, 18.iv.1965, Kl. Warncke (CKW, ML); 1 ♂ 1 ♀ (both diss.), Türkei, Side, 30.iii.1972, Kl. Warncke (CKW); 1 ♀ (diss.), Aksehir, Türkei, 4.v.1960, Rassl, no. 364 (ex CP, CMS); 1 ♀ (diss.), Smyrna, coll. C. & O. Vogt acq. 1960 (MA); 1 ♀ (diss.), Exp. Turkey Mus. Leiden, East Turkey, 2150 m, Erzincan, 20 km N, v.1959 (ML). — Israel: 1 ♀ (diss.), Palestine, Tiberias, 17.iii.1946, H. Bytinski-Salz (CBS); 1 ♀ (diss.), Israel, C. Jordan Valley, Deganya A, no. 6333, 27.ii.1939, Y. Palmoni, *M. aegyptiaca* Rad.? det. J. D. Alfken 1937, and *M. luctuosa* Scop. var. (unknown hand) (AID); 1 ♀ (diss., much worn), Negev Mts., between Djebel Hureishe and Wadi Ramon, ca. 600 m, 20.iv.1952/19 (CBS); 1 ♀ (diss.), Kappernaum, 11.iii.1935, coll. Hecht (CBS). — Iran: 1 ♀ (diss.), yellow disk, with 16/40 on reverse side/Museum Paris/Perse/Aucher 16—40 (MP).

Doubtful specimens. — 1 ♀ (diss.), N Africa (?), "Barbara 7.iv.14" (green pencil), *M. luctuosa* var. *albovaria* Er. (unknown hand) (MG). — Central Asia: 1 ♀ (diss.), Alai (written), Museum Paris, coll. J. Pérez 1915, no. 182 (MP). 1 ♀, Wernyi, Turkest[an] (print), Slg. Alfken (MNB). USSR: 1 ♀ (diss.), S. Russland, with two written labels "Sarepta, S. Russland, Stein" & "Sarepta" (together with equally labelled ♀ having quite differently shaped pygidial plate! (MNB). One of the other questionable females labelled "Alai" (MP), is a species totally different from the one attributed to *turkestanica* (pl. 2 fig. 10), bearing an exactly identical locality label. In the shape of its pygidial plate it comes very near *megaera*.

The male of this new species most closely resembles *turkestanica* (pl. 2 fig. 9) in general appearance and pubescent pattern, but these two do not seem to be closely allied (see descriptive key). Both are also rather like *baeri* and *candida* (pl. 3 fig. 18); apart from structural differences, one of the features most helpful to separate these bees from *megaera*, is found in the relative hair lengths of all body parts.

The female of *megaera* runs out in the key to near *aegyptiaca*, with which it seems, indeed, more nearly related than with the two just mentioned for comparison with the male.

As in *aegyptiaca* and the eastern *turkestanica*, the long white tufts behind the wings are more or less confluent with those surrounding the scutellar tubercles, leaving only a narrow black-haired space upon middle of scutellum, thus differing from *assimilis* and most large-sized individuals of *italica*. Typical males of the latter (from Italy and France) have the middle of scutellum almost wholly black; these *italica* also have much stronger antennae and a deeply emarginate 7th tergal plate.

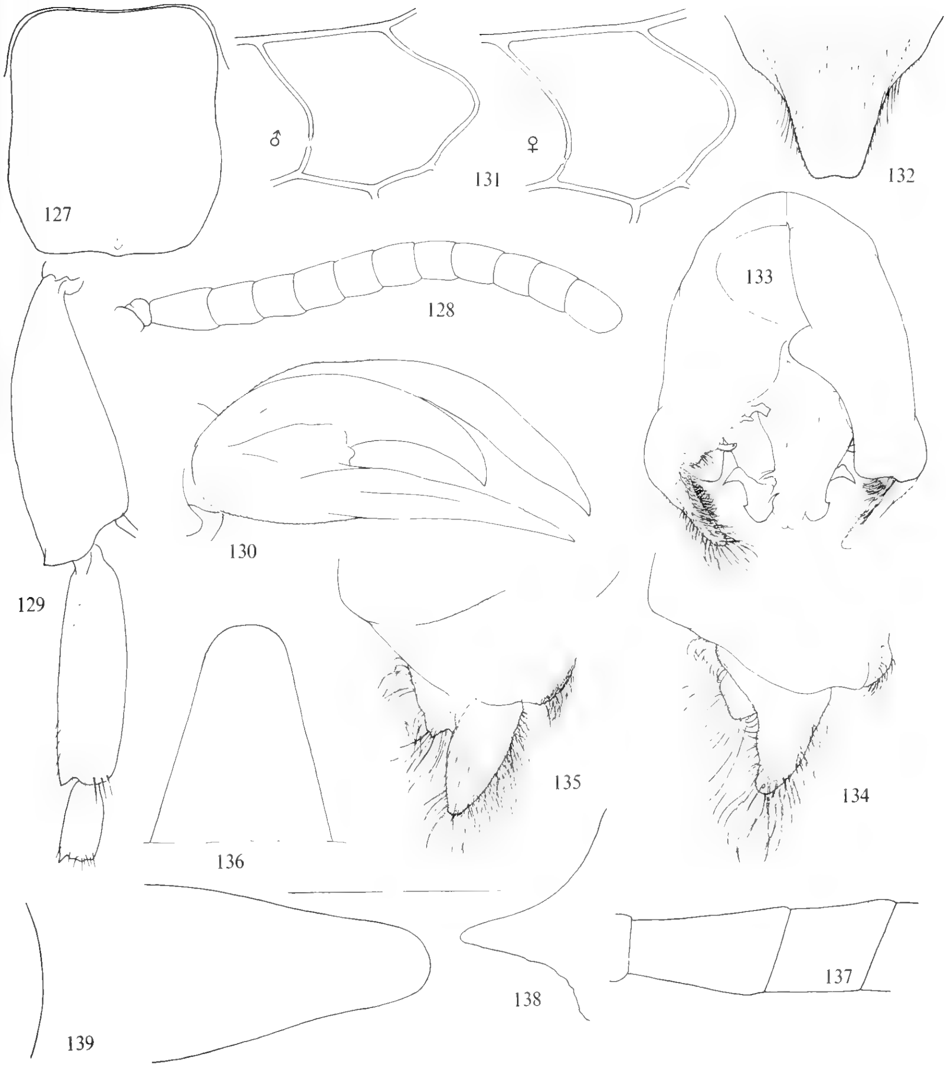
Melecta aegyptiaca Radoszkowski
(figs. 11, 127—145, pl. 4 figs. 19—21, map 1, p. 223)

Melecta aegyptiaca Radoszkowski, 1876, Horae Soc. Ent. Ross. 12: 123—24, pl. 3 fig. 2 (♀ col. fig., Egypt). Radoszkowski, 1893 (sub *egyptiaca*, identity uncertain), Bull. Soc. Imp. Nat. Moscou, new ser. 7 (3): 182, fig. 35 a-c, i, k (♂ genit., sine loc.). — Friese, 1895, Bienen Europa's: 165—166 (pars ? orig. descr. copied; ♂ Persien, note). Friese, 1925, Konowia 4: 28 (pars !? "Ägypten; Beirut; Südspanien; Algerien").

Melecta lindbergi Lieftinck, 1958, Comment. Biol., Soc. Sci. Fenn. 18 : 25 (key), 28 fig. 21 (scutellum) & 39 (pygidium) (♀ Lanzarote, Canary Is.). **Syn. nov.**

Type material. — Egypt: 1 ♀ (fig. 131), labelled "Egypt C:Bra" (print on green), "Type" (orange), "*aegyptiac*" (Radoszkowski's writing), "*M. aegyptiaca* Radosz. Type Dr. Enderlein"; lectotype by present selection (MNB); 1 ♀, gold disk, same loc. & type labels, syntype *M. aegyptiaca* (MNB). — Canary Is.: 1 ♀ (holotype *M. lindbergi* Lieft., figs. 137—139), Lanzarote I., Haria, 19.iii.1949, H. Lindberg (MH).

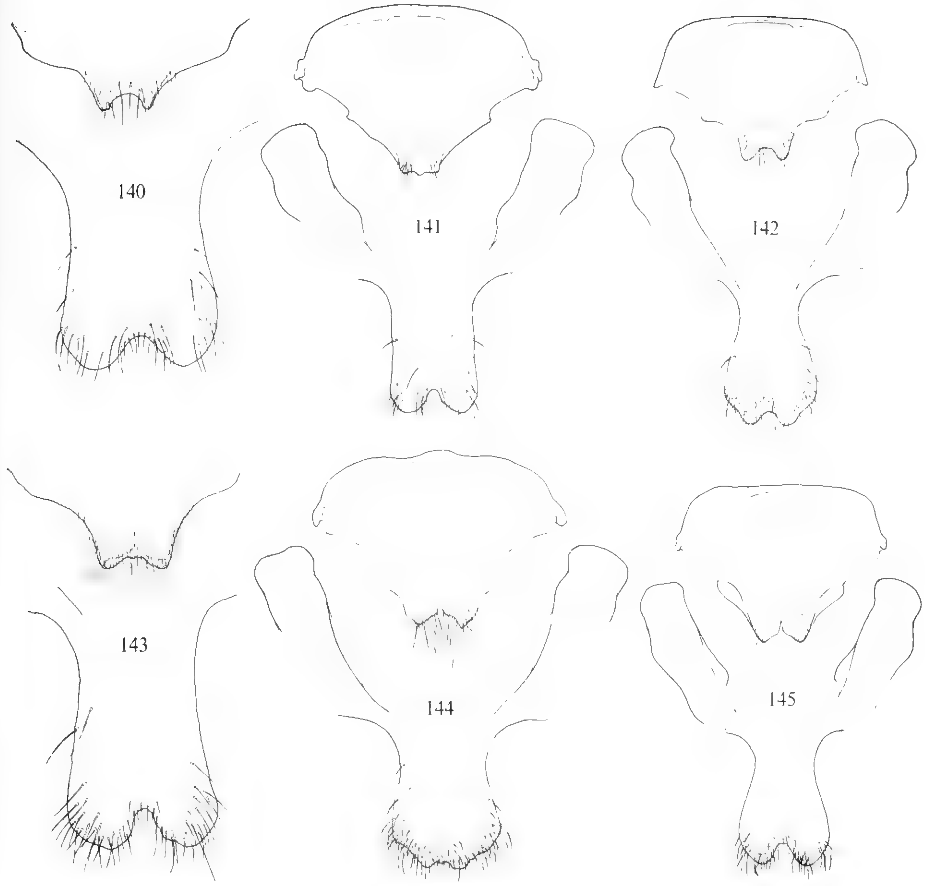
Further material (from W to E, roundabout Mediterranean & S Europe). — Morocco: 3 ♂ (one diss., fig. 143), Maroc, 622—19 & 623—22 (MG); 3 ♂ (one diss.), Tanger, Vaucher, Cn. Tournier (MG & CB); 2 ♂, Tanger, coll. J. Vachal 1911 (MP); 5 ♀, Maroc, Midelt, 23 & 30.v.1947, J. de Beaumont (CB). — Algeria: 1 ♀, Algérie, coll. J. de Gaulle 1919 (MP); 1 ♀, Algérie, Vauloger 138—97 (MP); 1 ♂, Algérie, coll. J. Vachal 1911, *grandis* Lep. 334, det.? (MP); 1 ♂ 2 ♀, Orléansville, Ernest André 1914 (MP, ML); 1 ♂ 1 ♀ (♂ abdomen missing), 1 Sétif, coll. O. Sichel 1867, ♀ with note "*Mel. luctuosa*, 3 ♀ 5 ♂ C. Sss" [Saussure], in Sichel's hand (MP); 1 ♀ Sétif, Cn. de Saussure (MG); 1 ♀, Algerien, vi, coll. A. Seitz, *Melecta* spec.? det. Alfken (SMF). — Tunisia: 1 ♂, Tunis, coll. Schmiedeknecht, *M. aegyptiaca*, det.? (MNB); 1 ♀, lilac disk, Carthag., coll. J. Pérez 1915 (MP); 1 ♀ (diss.), Tunesia, Feriana, 8 km S, 9.v.1973, K. Kusdas (CJH), and 2 ♀ (diss.), 10 km N, 8.v.1973, J. Gusenleitner (CG, ML). — Egypt: 1 ♂ (diss., figs., 131, 135, 140), Cairo Aegypt, *M. armata* var. *mediterranea* Grib., det.? (ZSM); 1 ♀, Cairo Aegypten, *M. dasypyga*, det.? ex coll. Univ. Groningen (ML); 3 ♂ (pl. 4 fig. 19), Schmiedeknecht, Egypten, coll. A. Weis, *M. luctuosa* Scop., det.? (SMF, ML); 1 ♀, Egypt, Sezira-Cairo, iv, H. Priesner (ex CP, ML); 1 ♂ 1 ♀, Aegyptus, Cairo (MBUD); 1 ♀, Egitto, Asyut, 2.ii.1933, Schatz-Koch (ex CGS, ML); 2 ♂ 1 ♀, Aegypten, Pyramiden III, H. Rolle-Berlin, *M. aegyptiaca*, det.? (MNB); 1 ♀, Aegypten, Ehrenberg/XIII/725, *M. grandis* Lep., det.? (old handwriting, MNB); 1 ♀, Alexandria, Winter 1902/03, Dr. Osborne, *M. aegyptiaca* Rad., det. J. D. Alfken, Slg. Alfken 1933 (MNB); 1 ♂ (diss.), Egypte, *Melecta orientalis* Egyp (on green disk), coll. Romand (MG). — Ethiopia: 1 ♀, Abyssinia, Dr. Rüppel, *M. luctuosa* Scop., det. H. Friese 1900 (SMF). — Israel: 1 ♂ (diss.), Israel, Jordan Valley, Zerqa R. Colony, ca. 100 m below sea level, Mid Mar. 1952, "Bee + Bombilid" (sic), Trevor Trought, *Crocisa* sp., det. I. H. H. Yarrow (BM). — Syria: 2 ♂, Syria 1899, Morice, *M. aegyptiaca*, det. Friese 1904 (MNB). — Rodos (Greece): 3 ♂ (1 diss.), Rhodos-Kattavia & Gaduras road crossing, 5.iv.1971, V.S. v.d. Goot (MA). — Greece (mainly continental): 3 ♂ 2 ♀ (diss.), Corfu (Kerkyra), Schmiedeknecht 1912, coll. A. Weis, one with *M. luctuosa* Scop., det. Schmiedeknecht (SMF, ML); 1 ♂, Graecia (MBUD); 1 ♀, Olympia, Schmiedeknecht (SMF); 1 ♂, Olympia, coll. Schmiedeknecht, *M. luctuosa*, det.? (MNB); 3 ♀ (diss.), Graecia, Olympia, 19—21.iv.1964, W. Grünwaldt (CWG, ML); 1 ♀, Graecia, Levadleia (Levadhia), 4.vi.1966, W. Linsenmaier (CL); 4 ♀, Graecia, Peloponnesus, Alt Korinth, 11, 13 & 19.v.1964, Max. Schwarz (CMS, ML). — Hungary: 1 ♂, Simontornya, Hung. occ., 24.v.1933, leg. Pillich, at *Anchusa officinalis*, *M. albovaria*, det. Alfken 1933, "zur *armata*-Gruppe gehörend, sicher nicht *M. luctuosa*", Alfken (MBUD); 1 ♂, Simontornya, Hu.occ., 27.v.33, leg. Pillich (ML); 3 ♀ (fig. 136), Sárszentmihály, 23.v.1927, Biró, *M. luctuosa*, det. Móczár (MBUD); 1 ♀, Dabas 1855, leg. Metelka, *M. luctuosa*, det. Mocsary & M. Móczár (MBUD); 3 ♂, Apaj-p., Bokor E., *M. luctuosa* Scop., det. M. Móczár, Csömör, Ujhelyi leg., same identif., and Isaszeg, Ujhelyi leg., same identif. (MBUD, ML). — Czechoslovakia: 1 ♂ (diss., figs. 133—134, 145), Slovakia, Parlzán 1933, A. Hoffer (CTP); 2 ♂ (one diss., (fig. 142, pl. 4 fig. 21), CSSR, Slovak, 2.vi.1965, Sturovo,



Figs. 127—139. *M. aegyptiaca*; 127, frontal view of labrum (♂ Sturova, CSR); 128, frontal view of left antenna (same specimen); 129, external view of right hind tibio-basitarsus (same specimen); 130, oblique dorsal view of right hind tarsal claw (same specimen); 131, third submarginal cell of right fore wing (first described ♂, Egypt, and ♀ lectotype, Egypt); 132, dorsal view of tergite 7 (♂ Sturova, CSR); 133, partial ventral and dorsal view of genital capsule (♂ Parlzán, CSR); 134, external view of right gonostylus (same specimen); 135, the same of first described ♂ (Egypt); 136, dorsal view of pygidial plate, partly exposed (♀ Hungary); 137, segments 3—4 of antenna (♀ holotype *M. lindbergi*, Lanzarote, Canary Is.); 138, lateral view of scutellar tubercle (same specimen); 139, dorsal view of pygidial plate (same specimen)

leg. M. Kocourek (CK); 1 ♂ 2 ♀ (1 ♂ diss., fig. 144), Slovak., Obelce, vi & 14.vii.1953, leg. M. Kocourek (CK, ML). — Italy: 1 ♂ (diss., fig. 141, pl. 4 fig. 20), Lazio, Caffarella, 9.v.1937, no. 53 (INER); 1 ♀ (diss.), Lazio, Roma, vi.1947, Bisleti leg., *M. luctuosa*, det. Pittioni (NMW); 1 ♀, sine loc., 198, *luctuosa* var., det. Friese 1893 (NMW). — France: 1 ♀, Gallia, Draguignan (Var), Schmiedeknecht 1903, coll. A. Weis (SMF); 1 ♀, Carpentras (Vaucluse), 15—23.v.1953, P. M. F. Verhoeff (ML). — Portugal: 1 ♂ (diss.), Sobreiral [Famalicão, ca. 20 km NE of Oporto, M. Diniz in litt.] (MUC).

Male. — Labrum distinctly longer than its breadth at base (100 : 80 approx.), slightly narrowed toward apex; surface concave, coarsely rugosely punctate, lacking a distinct median ridge but frequently with short, shiny impunctate subapical median streak ending in a minute pointed tubercle; or else, with somewhat broader, impunctate median area extending from near end of basal tubercles as far as the end; anterior border otherwise broadly rounded, more rarely almost straight. Clypeus less closely punctate, punctures at sides isolated on a smooth surface. Head above dullish, all punctures, including those on paraocular area, contiguous and most crowded together upon summit behind ocelli; frontal line feebly indicated and only slightly raised posteriorly; impunctate juxtaocellar area of irregular form, hardly exceeding size of one ocellus; interocellar distance hardly less than diameter of median ocellus. Antenna (fig. 128), the rhinaria distinct, well impressed but rather small, oval. Mesonotum and scutellum closely, deeply punctate, punctures of different sizes, those surrounding median area of mesonotum smallest, contiguous, the ridges dull; centrally, nearly all punctures are isolated, deepest and larger than interspaces, the latter but slightly shiny. Scutellum, propodeum and thoracic sides dull, very closely punctate, the scutellum feebly biconvex, lacking median line; spines variable in length, usually robust, acute and spike-like, directed almost straight back, punctate dorsally. Integument of legs somewhat glossy, closely finely punctate; hind femur lacking raised hairs of any length interspersed between the short and dense posterior brush, the latter in profile just visible with a hand lens (× 10); suberect bristles and thick setae at tibiae and tarsi of moderate length; mid tibial pad distinct, though nowhere sharply outlined, hind border fringed with some long white bristles (fig. 11). Outer face of hind tibia reticulate-punctate, distal 3/4 of surface hidden under white pubescence; hind basitarsus slender, more than three times longer than broad (fig. 129). Inner rami of mid and hind tarsal claws long and slender, over 4/5 length of outer and of equal breadth (fig. 130). Wings relatively long, not much obscured, bases subhyaline, only centres of submarginal and larger cells as well as most of the broad papillate border, slightly and diffusely infuscated; third submarginal cell a little longer than high, its distal side rather strongly elbowed much more so than the convex proximal side (fig. 131). Abdomen elongate-oval, broadest at end of segment 2, rather flattened, apex pointed; tergites even more shiny than in *baeri*; punctures fine, not very close, most superficial and widely spaced on tergite 1, closest (though smaller than interspaces) on apical segments. In profile, the short black semierect setae covering disk of tergites, are all visible with a hand lens. Raised hairs at base of tergite 1 very long, though sparsely distributed in middle, becoming more numerous laterally to form long compact tufts of white, the hindermost hairs decumbent; spots on 2—5 varying much in shape and size, placed far laterad in a regular row, those on 2 and 3 less defined



Figs. 140—145. *M. aegyptiaca*, sternites 7 and 8 of ♂; 140, from Cairo (first described example of that sex); 141, from Caffarella (Italy); 142, from Sturova (CSR); 143, from Morocco; 144, from Obelce (CSR); 145, from Parlzán (Slovakia)

anteriorly, the hairs being more raised and dispersed. Sternites progressively more closely punctate from base to apex of abdomen, punctures on 1—2 much smaller than interspaces, the postgradular areas of all superficially and more sparsely distributed, hind border of 2—4 often more brownish than black. Sternal plate 6 distinctly narrowed and tapering toward a bluntly pointed apex; lateral ridges distinct though low, little oblique and hairy, barely visible in profile. Exposed portion of tergite 7 (fig. 132) with straight converging sides, characteristically brown-haired. Genital capsule rather large, 1.6 mm approx., gonocoxal enclosure shaped much as in *baeri*, mesial borders of coxites at first diverging and concave, but soon almost parallel as far as the bend, the angle hardly noticeably incurved (fig. 133). Gonostylus about twice as long as its breadth at base, subtriangular in outline and tapering gradually to a blunt point; dorsobasal process broadly attached to base of stylus, its free portion broad, though short and small, tip bluntly triangular, the marginal bristles long but nowhere curled inward (figs. 134—135).

The most helpful and easily observable recognition marks of *aegyptiaca* are found in the shape and hairiness of the 7th tergite of the male and pygidial plate of the female. Other features are summarized in the descriptive keys, which together with the illustrations and photographs (pl. 4 figs. 19—21) may suffice to distinguish the species fairly easily from its congeners. The elongate body form, pale grey-brown tinge of the fore wing membrane, dense comb-like brush of short hair at the posterior face of the hind femur, as well as the widely separated white tergal spots, are distinctive features of the male. Females are less easily determined, but after uncovering the tongue-shaped brown pygidial plate, the characteristic shape of the latter will be evident.

Central European *aegyptiaca* are absolutely indistinguishable from those collected in the Mediterranean. I am unable to explain the discontinuity of its range, unless the scarcity of this bee, and unconcerned collecting, are responsible for the wide gaps existing between the northern accumulation of localities in the Danube basin area, and the scattered southern habitations: a marked contrast possibly due to the efforts of several well known entomologists in Czechoslovakia and Hungary, who since many years paid special attention to the bee fauna of their countries.

There is little variation in size among the various populations, the body measuring from 14.5—16.5 mm in length, independent of locality. The noted difference in stature between the photographed males on pl. 4 figs. 19—21, are entirely due to the extension of the abdomina in the dissected specimens. The wing span of these mounted examples measure 29.4 mm (fig. 19), 24.8 mm (fig. 20), 28 mm (fig. 21), and of the holotype *lindbergi* (not shown), 27 mm.

Distribution. — The scattered distribution is shown on map 1, the arrow indicating its further southward range.

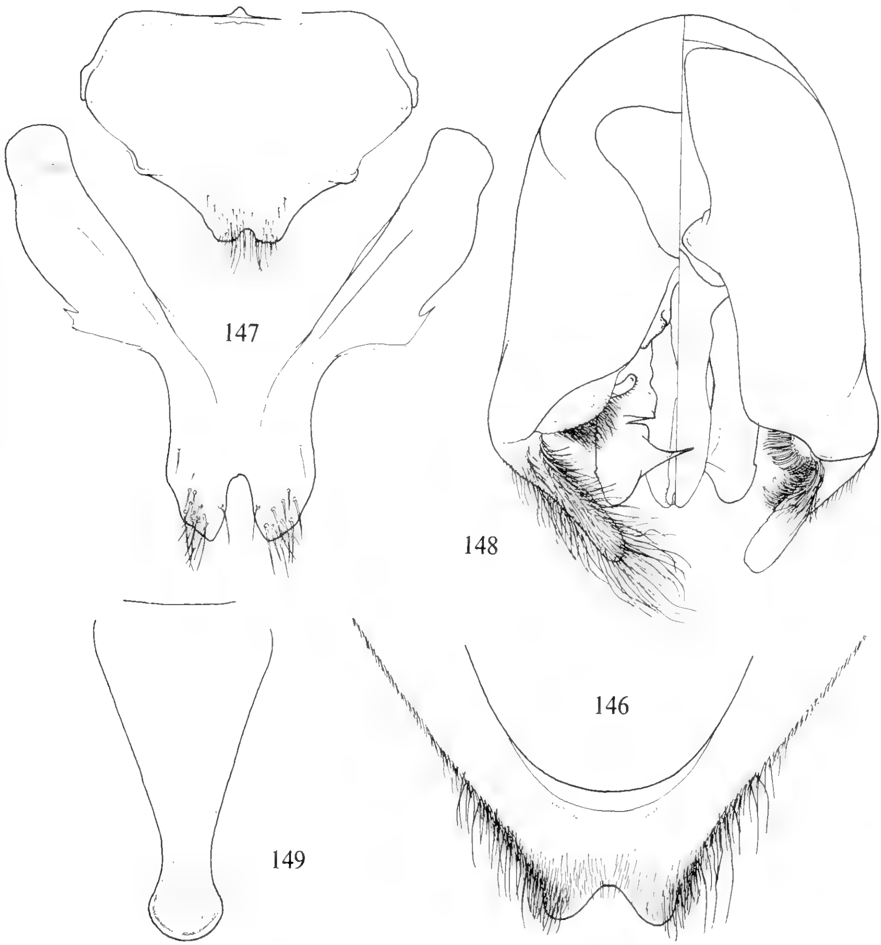
Melecta fumipennis spec. nov.
(figs. 146—149, pl. 3 fig. 13)

Type material. — Egypt: 1 ♂ (diss., figs. 146—148, pl. 3 fig. 13), labelled "Egypt, Wadi Gerani, 3.iii.1935, on *Stachys*, Dr. H. Priesner". Holotype (ex coll. Priesner, ML).

Further material. — Egypt: 1 ♀, labelled "Dep. Agr. Egypt, Giza, 23.iii.1914, coll. Naguib", "*Melecta fumipennis* Alfken 1933" and "Typus" (print on red), det. J. D. Alfken, in Alfken's handwriting (MNB); 1 ♀, Dep. Agr. Egypt, Meadi, 30.ii.1913, Col. L. H. G., Paratypus (print on red), same identification label (MNB); 1 ♀, Egypt, Ougret el Sheq, 20.iii.1924, coll. Alfieri, Paratypus (print on red) same identification label (MNB); 1 ♀, Um Assad Egypt, 9.iv.1934, Dr. H. Priesner, Paratypus (print on red), same identification label (MNB); 1 ♀, 26.iii.1933/3e torre (MNB); 2 ♀ (diss., fig. 149), Um Assad, Egypt, 9.iv.1934, on *Stachys*, Dr. H. Priesner, one with Paratypus (print on red) and *Melecta fumipennis* m., in Alfken's writing, det. J. D. Alfken 1936 (ex. coll. H. Priesner, ML). All females are paratypes.

A large, totally black, short-haired species lacking white spots, with very dark fore wings.

Male. — Labrum rather long (length/greatest breadth ratio 100 : 70), broadest at level of low , somewhat flattened and shining basal tubercles bearing one or two large punctures; surface otherwise almost flat, coarsely densely striato-punctate, distal portion with incomplete shiny median line or smooth ridge, anterior border straight or slightly emarginate (some females!), median line ending in a minute upturned subapical tubercle; whole surface clothed with longish raised bristly hairs. Antenna long and strong, exceeding tegula, last segment obliquely truncated; scape normally curved, longer than 3, the latter a little longer than its breadth at apex (10 : 8) and also somewhat longer than 4 and next segments, which are subequal, all slightly longer than broad; rhinaria on 3—13 distinct, deeply impressed, the one on 3 elongate-oval, 4—11 horseshoe-shaped, 12—13 almost circular. Clypeus closely punctate, punctures circular, most crowded together and



Figs. 146—149. *M. fumipennis*; 146, ventral view of tergite 7 (♂ holotype, Egypt); 147, sternites 7 and 8 (same specimen); 148, partial ventral and dorsal views of genital capsule (same specimen); 149, dorsal view of pygidial plate (♀ paratype, Um Assad, Egypt)

smallest upon basal part of disk, growing larger and deeper distally, surface at sides shiny with punctures more elongate and much smaller than interspaces; whole anterior border broadly impunctate and glossy; upper surface concealed from view by a patch of long appressed pubescence, but sides with equally long raised hairs. Head above and at temples otherwise coarsely punctate on dullish ground, punctures almost contiguous; small impunctate (though not polished) areas just in front of median and on either side of lateral ocelli. All thoracic sclerites dull, closely coarsely punctate, except a little impunctate area mid-posteriorly on mesonotum; punctures otherwise deep and contiguous, those on scutellar areas coalescent. Scutellar spines strong, smooth and shining, slightly curved with bluntly pointed tips, directed obliquely upward and backward and projecting well beyond level of almost vertical posterior sclerites. Legs rather long and slender, without peculiarities; hairless areas dull, but posterior faces of fore and mid femora slightly more shiny, very closely and rather deeply punctate, those of hinder pair more coarsely so. Outer faces of tibiae and tarsi rugosely punctate lacking conspicuously shiny areas, mid and hind tibiae and tarsi, in addition to short appressed pubescence, with slightly stronger spine-like setae and semi-erect bristles somewhat sparsely intermixed, especially at margins; setiferous punctures on mid and hind basitarsi closely set and evenly distributed. Hind basitarsus about three times longer than broad, slightly but distinctly outcurved, subparallel-sided in side view with lower border only very little convex. Inner rami of mid and hind tarsal claws about ¾ lenght of outer and not or scarcely broader than these. Hair mostly short and dense, but fore and mid femora with much longer and denser posterior fringes, which are replaced by a very short comb at the blunt posterior median ridge of hinder pair. Felty pad covering outer face of mid tibia distinctly flattened and rather obscured, only an isolated and ill-defined elongate-oval central area remaining dirty brownish white, the surrounding hairs consisting of much stronger, suberect crowded bristles with shining black denticles more sparsely intermixed. Wing membrane very dark (see specific key), remaining pale brownish or subhyaline areas in fore wing are: a broad anterior streak in radial cell, a well defined narrow stripe in the cells bordering anal vein, and most of the anal (vannal) lobe; base of hind wing subhyaline except most of the papillate distal one-third becoming light brown; third submarginal cell slightly less than twice the size of second, not longer than high, its outer side rather strongly angled. Abdomen oval, strongly convex, sides of intermediate segments subparallel, last segments rather abruptly tapered; integument rather dull, but tergite 1 more shining, very finely, superficially and more sparsely punctate than next ones, on which punctures, though very small, are more crowded especially at sides, where all are more widely spaced; hind margins narrowly impunctate; sternites similar, but punctures larger and more deeply impressed, except those on broad hind margin of sternite 1 sparsely and finely distributed. No trace of compact lateral spots on any of the tergites, the first with thin raised fringe upon middle of basal portion, the lateral tufts being, however, conspicuous, more compact and longer. Succeeding segments clothed evenly and not very densely with very short suberect hairs, longer and bristly ones being present only at sides of tergites and fringing gradular lines of sternal plates 1—3, the posterior parts of remaining sternites clothed more densely with short hairs. Tergal plate 7 rapidly tapered with narrow tip, the apex itself parallel-sided for a long distance, becoming gradually more deeply and broadly hollowed out above, its surface shining, carrying large elongate punctures; hind margin, on either side of an almost semicircular emargination, with upturned rounded side lobes; no submarginal ventral ridges (fig. 146). Hind margin of sternite 5 shallowly emarginate, apex of 6 a little projecting, surface scarcely elevated laterally, the ridges being very long, though more densely hairy than on median area. Shape of sternites 7 and 8 as in fig. 147. Genital capsule of normal size, 2.0 mm; gonocoxal enclosure U-shaped in dorsal view, the angles obtuse, broadly rounded (fig. 148). Gonostylus short, thumb-shaped; dorsobasal process more or less axe-shaped, its oblique distal border fringed with strong bristles of great length.

Female. — See descriptive key.

This extraordinary species, both sexes of which are, I believe, adequately characterized in the keys, has no near allies. Although immediately known by its sombre outward appearance, male and female being very similar in this respect, they do not differ appreciably in structure from other regional species (figs. 146—149). I have adopted Alfken's specific name, which has remained a *nomen nudum* in two collections.

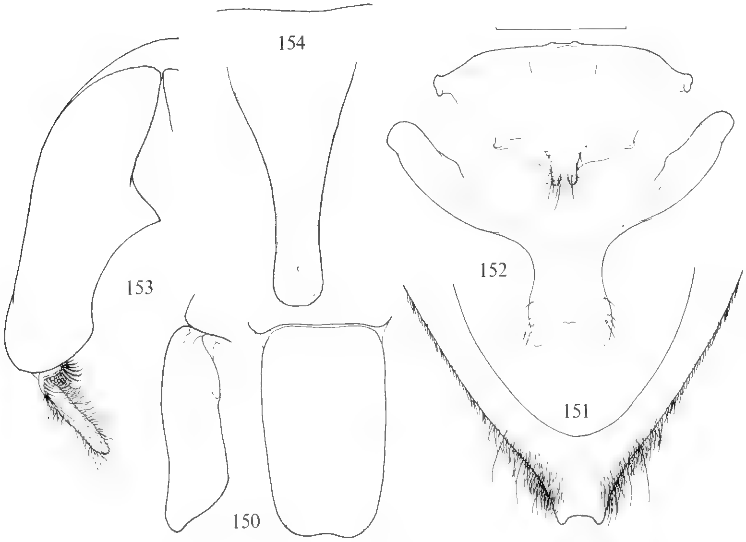
A new species of *Anthophora* from Egypt, also of large size, measuring 19 mm in length, was described and named *A. fumipennis* by Alfken (1926: 120), after a single female. Like the present *Melecta*, this is an almost totally black species having black-brown fore wings with bluish sheen. Priesner (1957, Bull. Soc. Ent. Egypte 41: 86—87), examined a second female labelled "Dabaa (May)", also in Egypt. The male is still unknown. It would be of great interest to keep watch for this bee at the above localities of *M. fumipennis*, with a view to find out whether the *Anthophora* may be, perhaps, the host of its namesake *Melecta*, the two being so much alike.

Melecta angustilabris spec. nov.
(figs. 150—154, pl. 3 fig. 14)

Melecta sp. nov.? Alfken, 1926, Senckenbergiana 8: 103 (♂ ♀ Egypt: Heliopolis & Wadi Rachid, note).

Type material. — Egypt: 1 ♂ 1 ♀ (diss., figs. 150—154, pl. 3 fig. 14), "Fayed, Egypt, ii.1943, Dr. H. Priesner". Holotype ♂ and first described ♀ (ex CP, CMS).

Further material. — Egypt: 10 ♂ 34 ♀, Egypt, same loc., ii, iii and iv.1943, all Dr. H. Priesner. Paratypes (CMS, CDB, CBS, ML). 1 ♂ 1 ♀, Aegypten, Heliopolis, A. Andres 4.ii.1914 (♀) and 19.ii.1915 (♂), the latter with note "*Melecta* sp.n. Labrum lang", in J. D. Alfken's handwriting, Slg. Alfken (MNB); 1 ♀, Egypt, Min. Agric. Coll., Six Tower Suez Road, 26.iii.1926, R. C. Efflatoun, *Melecta nigra* Spin. ♀, det. J. D. Alfken 1933 (MNB); 1 ♀, Aegypten, W.-Riched, 1.iii.1914, A. Andres, with label "*Melecta* sp. nov.? Labrum lang u. schmal", in Alfken's writing (SMF); 2 ♀, Aegypten, Heliop. des. (written), 19.ii.1915, A. Andres, "*Melecta* sp. n. Labrum lang", Bischoff det., and 1 ♀, Aegypten, Heliopolis, 15.ii.1915, Andres (SMF); 1 ♀, Egypt, Meadi. 27.ii.1919, Dep. Agr. Egypt, leg. E. B. S. (BM).



Figs. 150—154. *M. angustilabris*; 150, lateral and frontal view of labrum (♂ Fayed, Egypt); 151, ventral view of tergite 7, tubercles not shown (same specimen); 152, sternites 7 and 8 (same specimen); 153, dorsal view of partial genital capsule (same specimen); 154, dorsal view of pygidial plate (♀ Fayed, Egypt). Scale line 0.5 mm (fig. 152)

A small, strikingly sexual dimorphic species.

Male (pl. 3 fig. 14). — Basal tubercles of labrum large, elongate, smooth and shiny, bearing few rugae; whole surface striatopunctate bearing scattered setiferous punctures, apex with short median crest, distal margin scarcely upturned, shallowly emarginate with dense fringe of short stiff bristles. Antenna reaching back to a little beyond tegula; scape of normal length, slightly curved, with dense lateral fringes of long silvery white hairs, those in front and behind being less abundant and shorter; 3 in frontal view subequal to 4, in posterior view distinctly longer; 4 markedly longer than broad and subequal to next segments; rhinaria on 3—12 (absent on 13), deeply impressed, placed in the long axis, elongate-oval on 3, subcircular and diminishing gradually in size toward apex, those on distal segments (11—12) very small. Disk of clypeus closely punctate but anterior border narrowly bare; upper part at sides of disk with large, widely spaced punctures, the parts below lateral bends almost polished, with much finer punctures. The closely punctate vertex with three small polished areas, one in front of median ocellus, the others beside lateral pair. Mesonotum, pleurae, scutellum and postscutellar sclerites dull, punctures deep lacking interspaces, except a fairly large smooth area on either side of mesonotal impression (about the size of tegula) with few, widely spaced large punctures. Scutellar spines strong, spike-like, though varying in length, directed obliquely upward and backward. Legs of normal slender form, hairless areas rather shiny, sparsely superficially punctate. Outer face of distal portion of tibia somewhat glossy, surface irregular with large, deeply impressed punctures bearing thick, spine-like denticles. Hind basitarsus distinctly curved in posterior view, a little less than four times as long as broad, in side view slightly expanded about midway length, with (almost) straight upper and slightly convex lower margin; inner rami of mid and hind tarsal claws about three-fourth length of outer and not or scarcely broader than this. Vestiture white on top of head, sides of mesonotum, scutellar areas, and middle of tergite 1; some dark hairs only anteriorly at sides of clypeus and temples underneath, but vertex across and beside ocelli with broad, almost hairless band; dark and partly naked areas also posteriorly on mesonotum, between scutellar spines and medially behind that level, on which parts hairs are black; conspicuous long white tufts present wings and to the outside of scutellar spines. Legs mostly short-haired; all tibiae and tarsi, in addition to short adpressed white and black tomentum, with long dark bristles sparsely intermixed. External pad of mid tibia well defined though not quite reaching base of segment; thick black setae strongest at apex of tibia, the tips remaining partly visible amidst the white tomentum. Upper (posterior) border of mid and hind basitarsi moreover fringed with long, erect white and dark bristles. Second submarginal cell of fore wing much shorter than high, its proximal side straight, the distal one convex; third cell twice the size of second, a little longer than high, its outer side rather strongly angled. Abdomen oval, but markedly pointed with tapering end segments; integument of tergites shining, basal ones finely superficially punctate, on succeeding segments more closely so, especially laterally on pregradular areas, but all punctures setiferous and smaller than interspaces; hind margins of 1—2 narrowly impunctate. Sternites dullish, punctation more even and also closer, especially on 1 and 2. Pubescence covering sternites consisting of short and fine decumbent hairs, with longish raised black bristles sparsely fringing gradular lines. Tergal plate 7 (fig. 151, ventral) trapezoidal, basally almost flat, dull and coarsely punctate, then somewhat hollowed out and impunctate with slightly upturned sides, apical emargination obtuse-angulate with narrowly rounded angles; colour of apex rusty brown with yellowish seam. Sternite 6 with pair of distinct low tubercles, which are just visible in side view. Shape of hidden sternites 7 and 8 as in fig. 152. Genital capsule (fig. 153) relatively large, 1.6—1.7 mm; gonocoxal enclosure U-shaped, inner border of gonocoxites at first diverging, then slightly incurved, but gonocoxal angle not prominent, rounded; gonostylus shaped much as in *luctuosa* though more rapidly tapered and bluntly pointed.

Female. — General appearance and body sculpture similar to male, as described in the keys, the median mesonotal line equally somewhat sulcate. Scutellar spines distinct, slightly raised, often somewhat downcurved, mostly hidden under much longer pubescence. Legs slender, all parts not very densely beset with long dark bristles posteriorly; outer faces of mid and hind tibiae clothed with dense appressed black hairs and robust, spine-like setae; inner and outer rami of mid and hind tarsal claws similar in shape, the inner branch about half as long as outer. All white areas and tergal spots on the body of the male are typically replaced by dark hairs, the vestiture thus being throughout obscurely brownish black or black, with very rare exceptions.

Variation. — Only a single specimen in our series of topotypes (from Fayed, ii.1943) represents a white extreme, approaching the male pattern, as follows.

Small tufts or fringes of white present upon upper surface of head and antennal scape, occiput, a narrow collar on mesonotum anteriorly (partly surrounding a pair of small black dots), the mesepisterna and sclerites behind wings, and laterally just beside scutellar spines; also a tuft of long raised hairs on either side of tergite 1; transverse postgradular spots at sides of 2 and 3, those on 3 only little shorter than the interspace. Two or three other females are somewhat intermediate in this respect, showing few light hairs on mesonotum and tergite 2.

Size small, total length 9.0—11.4 mm; only a single ♀ (from Wadi Riched) sallies out remarkably in being of much larger size, measuring 14.5 mm.

This is another easily recognizable species, apparently restricted to certain more or less isolated areas in Egypt, and having no near allies. The very pronounced sexual dichromatism is unique among Palaearctic *Melecta*.

Although Alfken had already noticed the unusual elongate form of the labrum more than sixty-five years ago, and made a note of that on the labels (see above), the species has so far remained undescribed. The photographed holotype male, with somewhat retracted terminal abdominal segments (pl. 3 fig. 14), measures 9 mm in length and has a wing span of 20 mm, i.e. the average size of both sexes. It must be emphasized that compact pubescent spots are present at the sides of tergites 2—4 or 2—5 in all females; these are shaped similarly to those of the male, but all markings are brownish black or black instead of white and therefore not at all clearly discernible.

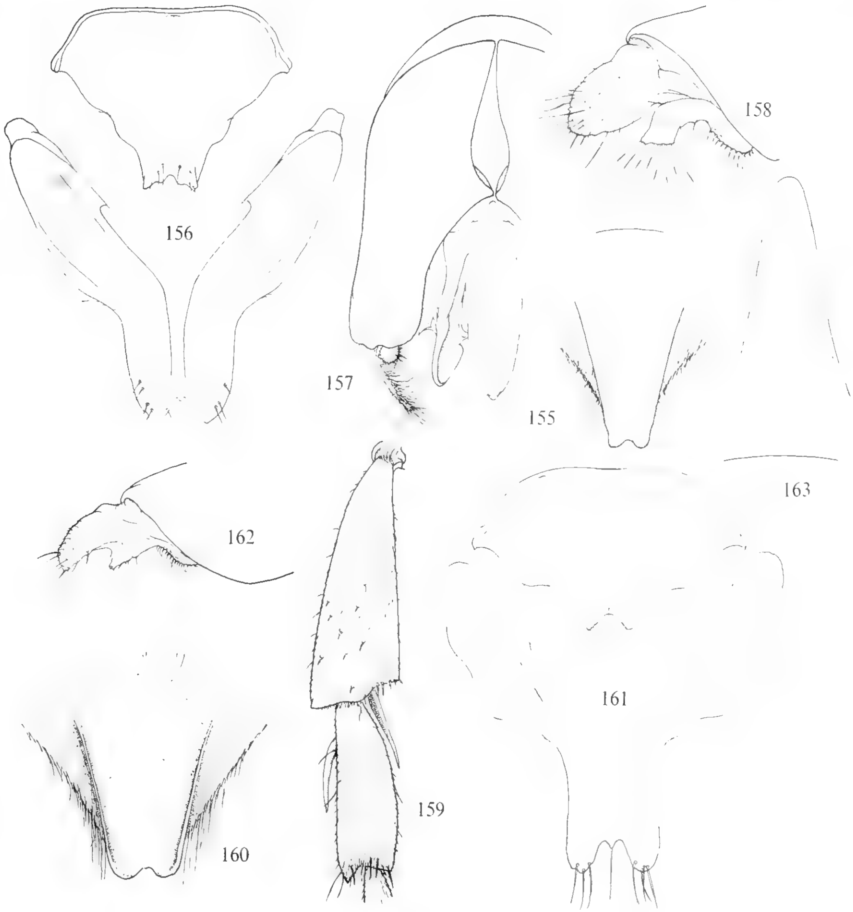
Melecta guichardi spec. nov.
(figs. 77, 155—163)

Melecta luctuosa var. *ebusana* n.var., Friese, 1925, Konowia 4: 28 (pars: Ibiza only!).

Type material. — Turkey (Asia minor): 1 ♂ (diss., figs. 155—158), labelled "Turkey, Trabzon, Hamsikoy, 1245 m, 24.v.1962, Guichard & Harvey. B.M. 1962—299". Holotype (BM).

Further material. — Turkey (Asia minor): 1 ♂ (diss., genit. wanting), Kleinasien, Sewdiköib/Smyrna, 18—31.3.1917, La Baume (MNB); 3 ♀ (diss.), Türkei, S Ankara, 16.vi.1977 (2 ♀) & Ankara, 3.vi.1972 (1 ♀), Kl. Warncke (CKW, ML); 1 ♀, Asia min. 1890 (print) (CKW); 1 ♀ (diss.), Türkei, Nevsehir: Ürgüp, 6.vi.1978, Max. Schwarz (CMS). — USSR: 1 ♀, Kauk[asus] 1885/10 (MNB). — Lebanon: 2 ♀, both with "Beyruth Syria Stauding[er]", written on white disk (ML); 1 ♀ (diss.), Syria, Aug. 1899/10 (MNB). —Israel: 2 ♂, Palestine, Smith coll., Mrs. Farren-White (BM); 1 ♂ (diss., ant. and legs partly missing), Israel, Jerusalem, 25.v.1937, at *Satureia*, leg. Kugler (CBS); 1 ♀, Israel, Ein el Qilt (Kelt), 10.iii.1978, leg. Kugler (CBS). — Rodos (Greece): 1 ♀ (diss., fig. 163), Rodos, Kalathos, 5 km N of Lindos, 2.iv.1970, A. C. & W. N. Ellis (MA). — Romania: 1 ♂ (diss., figs. 159—162), Dobrutscha 1882 (written), 13 (written on red), *M. luctuosa* Scop., det. Friese 1893 (MBUD). —Spain (Balearic Is.): 1 ♀ (diss.), Ibiza: 20.iv.1883/11, Friese, *M. luctuosa* v. *ebusana* Fr., det. Friese (MNB).

Male. — Labrum squarish, almost flat, anterior border straight, very slightly upturned; surface shining, coarsely rugosely punctate, with raised black hairs only scatteredly distributed, not very long. Mandible-bases finely closely punctate, except upper one-third impunctate and glossy. Maxillary palpi normal, 5-segmented, 1 very short, 2—4 slender, subequal in length to one another, 5 shorter than preceding. Clypeus slightly convex in profile, throughout closely deeply punctate lacking interspaces, except more widely spaced ones on anterior half of exposed dorsal surface. Whole upper surface of head more deeply punctate on dullish ground; narrow, impunctate, minutely striated areas in front of median and beside lateral ocelli. Antenna rather long and strong, exceeding hind margin of tegula, black; scape curved, subequal in length to 3—4 combined, clothed on either side with fringe of very long finely branched white hairs; 3 short, little longer than 4, about 1⅓ as long as its breadth at apex, 4—13 shorter, intermediate segments squarish, 9—12 even a trifle broader than long; rhinaria deeply impressed. Thorax segments coarsely, closely and deeply punctate, all punctures contiguous save for small, irregular, finely chagreened, impunctate median area just behind mesoscutal line, the latter indistinct, obliterated, not impressed;



Figs. 155—163. *M. guichardi*; 155, dorsal view of tergite 7 (♂ holotype, Trabzon, Turkey); 156, sternites 7 and 8 (same specimen); 157, dorsal view of left half genital capsule (same specimen); 158, laterodorsal view of left gonostylus (same specimen); 159, external view of right hind leg (♂ Dobrutscha, Romania); 160, dorsal view of tergite 7 (same specimen); 161, sternites 7 and 8 (same specimen); 162, laterodorsal view of left gonostylus (same specimen); 163, dorsal view of pygidial plate (first described ♀, Rodos)

transverse sulcus separating mesonotum and scutellum deep; scutellum only little convex, median concavity shallow, tubercles widely separated, robust and spike-like, directed almost straight back, punctate; all posterior and lateral parts of thorax coarsely, contiguously punctate. Anterior half of tegulae strongly punctate on shiny ground, surface suddenly becoming dull, very finely reticulated and interspersed with scattered shallow punctures posteriorly. Legs rather strong, throughout finely closely punctate on rather shiny ground, black. Mid tibia somewhat swollen, broadest beyond middle, outer face convex; inner hind tibial spur slightly nodded at about halfway length; hind basitarsus distinctly outcurved and concave externally, broadest slightly beyond middle, upper border straight, lower border convex, length-breadth ratio 100 : 33—33.7. Wing membrane, except fore wing basally, distinctly brownish, ends of marginal cells and centre of submarginals more definitely infuscated; third submarginal cell equal in length to its height, distal side markedly angled, more abruptly so than proximal side. Abdomen short, oval, the apex rather abruptly pointed, integument black. Tergites smooth, rather shiny, moderately strongly and deeply punctate, setiferous punctures largest on basal part of tergite 1, though much smaller than interspaces on all segments, becoming increasingly more widely spaced, smaller and more superficial distally, the hind border of all tergites impunctate. Punctation of sternites much more even and closer, except hind margins narrowly impunctate. Pygidial plate of tergite 7 well marked off, brown, sharply black-ridged laterally, sides below ridge vertical, extending from near apex anterad onto the disk, the latter narrow, straight in side view, but surface at first somewhat convex, then concave with feeble median impressed line as far as the apex, the latter narrow, slightly upturned and emarginate; surface rather shiny, proximal part transversely tessellate basally, the distal portion smooth, strewn with few large deep punctures; oblique ventral keels subacute (figs. 155 & 160). Sternite 6 projecting medially, the tubercles distinct though low and hairy, the thin shallow area separating them almost three times as long as broad. Sternites 7—8, figs. 156 & 161. Genital capsule relatively long and narrow, gonocoxites hardly expanded distally (fig. 157).

Vestiture (see key) long, predominantly white, but on head and thorax nowhere quite concealing the surface. Sparsely distributed and black on disk of labrum, along lower margin of mandibles, lateral faces of clypeus, the ocellar area, and low down on temples behind eyes. No defined fan-like patch of white on disk of clypeus: instead of this all hairs slanting upwards, those on paraclypeal, frontal and occipital areas directed straight up and also white. Long pile covering pronotum, basal half of mesonotum and upper portion of mesepisternum likewise white, but lower part of sides and metepisternum black, as also the scutellum and vertical sclerites of thorax; white spots are present on each side on dorsum just beyond tegulae, behind wings at sides of propodeum, and long tufts immediately below scutellar spines. Pile of legs not very long, except the usual white tufts fringing fore and mid femora posteriorly, and scanty dark hairs at coxae and trochanters. Outer faces of tibiae and tarsi all white, all hairs comparatively short and fine. Silky white external pad of mid tibia nowhere sharply outlined, the hairs gradually becoming thinner toward base: proximal one-fourth of the dark integument often exposed between the short and scanty white pile, the passage oblique and ill-limited; pad itself interspersed with robust, acuminate, deep black denticles, its anterior and apical borders also beset with strong suberect black setae, especially toward apex. Hind femur clothed all around with short, raised dark hairs which become longer, more closely set (rather brush-like) postero-basally toward the blunt median ridge; white pubescence covering outer face of hind tibia and basitarsus short, decumbent, not very dense on distinctly shiny ground, the tibial hairs intermixed with strong, suberect, spine-like black denticles, which are often partly hidden by soft white hairs. Only few longish bristles projecting beyond posterior margin of mid and hind tibiae and basitarsi. Abdominal tergites with short, erect black setae distinct, though much shorter than in species like *italica* and *tuberculata*. Band-like tergal spots 2 and 3 broadest and slightly concave anteriorly; postgradular areas of sternites 3—5 thinly clothed with longish, straight, and but slightly raised silvery hairs, especially conspicuous upon middle of sternites.

Female. — Differs from the male in some respects, as described in the key, though mainly in sexual distinctions.

A delicate, slender species richly adorned with white, the hairs covering head and thorax rather long and silky. Antennae relatively of great length but not very strong. Easily distinguished from other small-sized species by the almost entirely white-haired outer faces of mid and hind tibiae and tarsi, and also by the much less defined mid tibial pad of the male, the depressed silvery hairs covering most of the abdominal sternites of both sexes being also quite characteristic. Mandible, fig. 77. The conspicuously broadened arms of the 7th sternite of the male and narrowly tongue-shaped female pygidial plate, are reminiscent of the *albifrons* alliance, for which reason I believe that *guichardi*, together with the somewhat allied *fulgida*, leads over structurally to group 1 of the *albifrons* assemblage.

Evidently a somewhat scarce species.

Melecta nivosa F. Morawitz
(figs. 164—167)

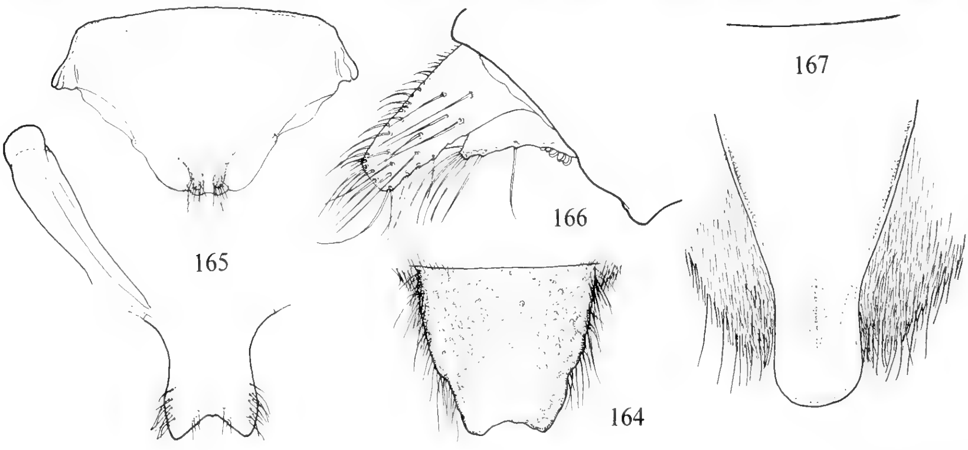
Melecta nivosa Morawitz, 1893, Horae Soc. Ent. Ross. 28: 56—57 (♀ Dshisak). — Popov, 1955, Trudy Zool. Inst. Akad. Nauk USSR 21: 325 (locality record). — Lieftinck, 1972, Tijdschr. v. Ent. 115: 284 (generic status corrected).

Type material. — USSR: 1 ♀ (holotype), labelled "Dschisack iv.5 Glasun. [ow] Coll. Morawitz" and "*Melecta nivosa* F. Mor. ♀" in F. Morawitz' writing (ZIL).

Further material. — USSR: ♂ (diss., figs. 164—166), TransCaspi G. Turcmenien E. König (print), Kilti-Tschinan (written) Coll. F. Morawitz (print), *nivosa* ♂ F. Mor. (Morawitz' writing) (ZIL); 1 ♀ (diss., fig. 167), Station Kuniu-Mazar, W. Bukhara, 28.iv.1912, Golbek (print, transl. from Russian), *nivosa* F. Mor. ♀ (Morawitz' writing) (ZIL); 1 ♀, Krasnowodsk, Coll. Morawitz, *nivosa* F. Mor. ♀ (id.) (ZIL); 2 ♀, Farab/Buchara 13.iv.1913, Coll. Wollmann, *nivosa* det. Wollmann, and Balgakum bei Djulek, Turkest., S. Malischew, *nivosa* det. Wollmann (ZIL); 1 ♀, Kara-Boges, 40 km N (illegible) Arwata, 8.v.1953, *nivosa* det. Popov (ZIL).

The original diagnosis (in Latin) and description (in German) are based on a single female from Dzhizak in Uzbekistan, NE of Samarkand. I found several more individuals, including one male, in the Zoological Institute at Leningrad, one of either sex being still before me. Alle are undoubtedly conspecific; the following characters of male and female are best given separately in addition to those given in the keys and Morawitz' description of the female.

Male (unique). — Labrum squarish, hence shorter than in female, but the slightly concave surface similar; punctation dense, median ridge replaced by a short, irregular, impunctate and somewhat shiny streak near apex. Maxillary palpi slender, 6-segmented (4—5 apparently fused on left palpus!), the ultimate joint short. Silvery patch covering whole upper surface of clypeus composed of long and straight, decumbent hairs slightly exceeding anterior border; bristly hairs at sides all black. Ocelli separated by a distance equal to diameter of median (largest) one. Antennal scape white-fringed at all sides, but hairs are longest laterally. Head closely contiguously punctate leaving no interspaces, black and almost hairless across vertex and postocellar area, for the rest clothed with long raised white hairs interspersed with black only at temples. Median mesonotal line neither sulcate nor visibly impressed (cf. female!). Thoracic sclerites throughout dull, closely deeply punctate, all white-haired, only mesonotum posteriorly and middle of scutellum, as well as narrowly between spines and propodeum, black. Spines long, robust and blunt, at least three times longer than their width at base, somewhat raised though slightly but distinctly downcurved and directed almost straight back when viewed from above; white tufts below spines conspicuous, considerably longer than these. Legs moderately strong; all femora closely, finely punctate on somewhat shiny ground; fore and mid femora with the usual long white posterior fringes, but hinder pair clothed evenly all over with short, raised black hairs, fringed posteriorly with very few longish dark bristles. Outer faces of all tibiae and tarsi clothed with short depressed white hairs; marginal bristles short, partly brownish. Mid tibial pad occupying almost whole surface, few black bristles only along anterior and posterior margins, and some suberect, dark external spicules intermixed toward end of tibia. Hind basitarsus rather broad, widest about midway



Figs. 164—167. *M. nivosa*; 164, dorsal view of tergite 7 (♂ Kilti-Tschinan); 165, sternites 7 and 8 (same specimen); 166, external view of right gonostylus (same specimen); 167, dorsal view of pygidial plate (♀ Kuniu-Mazar)

length, upper border almost straight, the lower convex in side view (length-breadth ratio 100 : 33 approx.). Mid and hind tarsal claws reddish, inner rami about ¾ length of outer. Wing-bases subhyaline, veins light brown except costa of fore wing almost black; fore wing membrane distinctly infuscated toward apex, light to darker brown, especially evident at junction of main anal veins midway length of wing, the brown colour also filling out whole marginal cell and beyond; third submarginal cell a little longer than high, its distal side moderately angulated. Abdomen strongly tapered; white marks fairly well defined, composed of long decumbent hairs; white collar on tergite 1 complete, narrowest and partly invaded by black from behind at middle, spots on 2—5 occupying whole lateral surface, those on 2 broadly, on next tergites only narrowly, interrupted by black medially, all of them broadly rounded off inward. Sternal faces as described in the key, the conspicuous white fringes exceeding hind borders; sternite 6 black-haired, the tubercles distinct, elongate, broad and convex but scarcely visible in profile. Tergal plate 7 occupying most of the surface, dark reddish brown, with slightly upturned tips (fig. 164). Terminalia as described in the key and as in figs. 165-166.

Female. — Head as well as thoracic sclerites closely contiguously punctate; mesonotal and parapsidal lines both distinctly though shallowly sulcate, punctures on mesonotum irregular middorsally, separated in places by shiny areas much broader than their own diameter. Scutellum broadly sulcate; spines robust, as in male, shorter than spinal tufts, flattened, curved a little inward, raised obliquely upward and backward, punctate. Thoracic pubescence shorter than in male, especially anteriorly not longer than tegulae, black (and thin) on middle of scutellum and (very dense) on parascutella. Legs slender; femora moderately closely punctate and shiny, clothed sparsely with very long, partly dark, hairs; tibiae and basitarsi (except black knees) white externally, fringed thinly with very long white hairs posteriorly, outer surface of middle and hinder pair strewn with exceptionally strong, black spine-like setae; inner rami of all tarsal claws half as long as outer, strongly curved, acuminate. Pygidial plate very little downcurved, surface flat, dullish and finely tessellate, apex with blunt, distinctly raised median ridge, as in fig. 167. Body length 13—14 mm.

This is an easily recognized species which differs from all its congeners by the abundance of white pilosity covering most parts of the body. The male is highly remarkable by the reduction (abbreviation) of the mid and outer hind tibial spurs, a unique feature within the genus. On comparing the females in the Leningrad collection, I noticed that the type as well as two others of that sex, were more extensively white-haired than the one described above. The latter is a somewhat worn individual with frayed wings whose body hairs are partly rubbed off. To emphasize the uniqueness of the pubescent pattern exhibited by a fresh individual of *nivosa*, it may be found interesting to attend to Morawitz' own account of the type:

"Das Gesicht ist wie auch die übrigen Teile des Kopfes mit langen schneeweissen Haaren dicht bekleidet. Auf der Oberlippe sind den weissen einige schwarze Haare beigemischt. Der Fühlerschaft ist weiss behaart, die Geissel abgeflacht, deren mittlere Glieder nur wenig länger als breit erscheinen. Der

Brustkorb zeigt überall sehr dichte und lange schneeweisse Haare; nur auf dem Schildchen stehen schwarze. Das Mittelsegment ist gleichfalls weiss behaart. Die glänzenden schwarzen Flügelschuppen sind sehr fein und spärlich punktirt. Die glashellen Flügel sind dunkel pechbraun geadert, der Aussenrand derselben schwach rauchig getrübt, in der Radial- und den Cubitalzellen sind Spuren dunkler Flecken vorhanden. Das erste Abdominalsegment ist mit längeren, die beiden folgenden sowohl an den Seiten, wie auch deren hintere Hälfte mit kürzeren, überall sehr dichten schneeweissen Haaren bedeckt. Auf dem zweiten Segmente ist die helle Binde mitten unterbrochen, auf dem dritten aber nur mitten dreieckig ausgeschnitten. Die beiden letzten Segmente sind vollständig schneeweiss behaart. Die Ventralplatten sind glänzend, 2—5 am Grunde sehr breit weisslich dicht tomentirt und mit wenigen dunkeln Haaren besetzt. Die Beine sind weiss behaart, alle Schienen und Tarsen aussen dicht schneeweiss befilzt; die Schenkel tragen an der hinteren Fläche lange schneeweisse Haare." (loc. cit.: 57).

The male of *nivosa* is here characterized for the first time. (The specimens enumerated above are not strictly syntypes, but since all were obviously compared with the holotype, may be considered homotypical (or plesiotypical), as formerly understood).

Melecta corpulenta F. Morawitz
(figs. 168—172, 189, pl. 3, fig. 15)

Melecta corpulenta Morawitz, 1875, *in* Fedsch. Reise Turkestan 5: 140 (♀ Zarafschan Valley, 18 May, Oalyk rift, 2550 ft.). [Kyzylkum, Uzbekistan]; Morawitz, 1880, Bull. Acad. Imp. Sci. St. Petersb. 26: 371—372 (♀ only, not ♂ ! addit. descr., Tjan-Schan, Dr. Regel leg.); Morawitz, 1895, Hor. Soc. Ent. Ross. 29: 39—40 (addit. descr. ♀ Tschuli, A. von Semenow); Morawitz, ibid.: 43 (compar. notes with *M. glasunowi* Mor. nov. spec.). — Popov, 1955, Trudy Zool. Inst. Akad. Nauk SSSR 21: 325 (not seen; compar. notes with *M. baerii* (Rad.) and *M. nivosa* Mor., and distrib. in USSR). — Lieftinck, 1972, Tijdschr. Ent. 115: 284 (generic position corrected).

Melecta baeri: Kokuëv, 1909, Trudi Yaroslavskogo estest-istor. Obshchestva [Proc. Nat. Hist. Soc. Jaroslav] 2: 105 (distrib. notes, part., see also *M. baeri*).

Type material. — USSR: 1 ♀, under drawer label "*corpulenta* Mor. n. sp.", with small pin-labels "18" (print), "Zarafschan Valley (transl. from Russian, print), red square, with "*M. corpulenta* Mor." (in Morawitz' handwriting). Lectotype *M. corpulenta* Morawitz, by present selection (ZMM). See *M. transcaspica* F. Morawitz!

Further material. — USSR: 4 ♂ 1 ♀, Baigakum bei Djulek, Turkestan, S. Malischew, Wollmann, *corpulenta* Mor., det.? ex Coll. Wollmann (ZIL); 1 ♀, Karatangeb. bei Djulek Balamurun, Koshantschikow, *M. corpulenta* Mor., det. Wollmann (ZIL), 2 ♂ (1 diss., figs. 168—171 & pl. 3 fig. 15), both with two written labels in F. Morawitz' handwriting: Margilan [Margelan, between Kokand-Fergana], *M. robusta* F. Mor., and Margilan, Mauser, *M. robusta* F. Mor., coll. F. Morawitz (print in Russian) (ZIL, 1 ♂ ML); 3 ♀, Pendshikent/Glasunow (written by Morawitz ?), V.27.1892/Coll. Morawitz (print in Russian), *corpulenta* Mor. ♀ (in Morawitz' handwriting) (ZIL, 1 ♀ ML); 1 ♀, Krasnowodsk [E-coast Caspian Sea], Coll. Morawitz, *M. corpulenta* ♀ F. Mor. (in Morawitz' handwriting (ZIL); 1 ♀, Samarkand [Uzbekistan], gold disk, "*M. corpulenta* Mor. Typ. ♀" (in Morawitz' writing) (ZIL); 1 ♀, Serbent Glasunow, *M. corpulenta* Mor., det. Morawitz (ZIL); 1 ♂, "Masgiku (?) Menzer (?), coll. F. Morawitz", *M. robusta* ♂ F. Mor., det. F. Morawitz (ZIL); 1 ♀, Rynpeski, Coll. F. Morawitz, *M. corpulenta* Mor., det. F. Morawitz (ZIL). —Pakistan: 1 ♀ (diss., fig.

189), Baluchistan, Quetta, 5,500 ft., iv.1931, Capt. D. Harrison, B.M. 1932—353 (BM).

Doubtful specimens. — USSR: 1 ♀ (diss.), Uzbekistan, Kara-Tepe (Samarkand), 1.vi.1959, J. Kohoušek lgt., *Melecta baeri* Rad., det. Dr. Z. Pádr (KU). — Turkey: 1 ♀ (diss.), with written label "Mesopotamia Malatia 1886" [error for Malatya, in E Central Turkey?], "74b/100" (black-rimmed square), "11" (on red) (MBUD). — Israel: 1 ♀ (diss.), Jordan Valley, Jericho, 24.iii.1923, P. A. Buxton, pres. by Imp. Bur. Ent. Brit. Mus. 1923-454 (BM); 2 ♀ (diss.), Palestine, Jericho, 23.ii.1941 & 9.vi.1943, leg. Bytinski-Salz, one with *M. aegyptiaca* Rad? det. Mavromoustakis (CBS, ML).

This is the first described species of a remarkable little group of short-haired *Melecta* with partly exposed thoracic dorsum and a relatively long first abdominal segment.

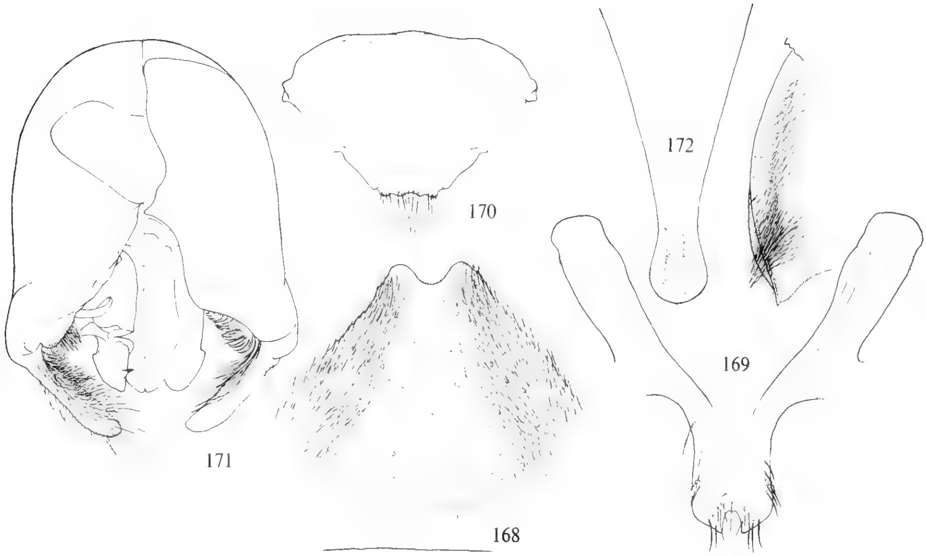
As follows from the above, the type of *M. corpulenta* is a female in the Moscow museum. Through the kindness of Prof. A. N. Zhelokhovtsev, I was enabled to examine and redescribe this unique specimen during my visiting there in August, 1968. Shortly afterwards, I had occasion to consult the *Melecta* collection in the Zoological Institute of the Academy, at Leningrad. Here an assortment of about twenty bees, dispersed over three boxes, was found under the drawer label "*corpulenta*". These had been assembled and provisionally arranged by Morawitz who, realizing their heterogeneity, identified and labelled only few of them. Many years later, the same bees were examined also by the late V. B. Popov (1955), who assigned a number of them to their proper genera and expressed his views on the identity of some others. Unfortunately, the specific status of most specimens as contained in the Leningrad collection was left undecided as not one of them was definitely identified or labelled. It soon became evident that Morawitz had confounded part of the available specimens of *M. corpulenta* with *M. baeri* (Radoszk.), *M. transcaspica* F. Mor., 1895, and even with *M. glasunowi* F. Mor., 1895 (now synonymized with *Paracrocisa kuschakewiczi* Radoszk., 1890, see Lieftinck, 1972), a species described by him subsequently. The confusion was initiated by Morawitz himself who, in 1880, mistook a male of a different species — and probably of *M. transcaspica* as well — for *corpulenta* (see below). He aptly remarked on the female of the latter (loc. cit., 1875, in Russian) "abdomen covered with rather dense black down and accordingly wholly mat, almost as far as tergite 5 . . .". And again in 1880 (in German): "Der Hinterleib ist bei frischen Exemplaren mit einem sehr dichten schwarzen Tomente überzogen und erscheint dann vollkommen mat . . .", etc., a definition applying perfectly to *corpulenta*. Morawitz' characterization of the supposed male, however, does not fit, as he wrote: "Gesicht mit Einschluss des Clypeus, der vordere Rand des Mesonotum sehr breit, die Meso- und Metapleuren, so wie auch das erste Abdominalsegment lang und dicht weiss behaart, das fünfte jederseits weiss befiltzt, das letzte sehr schwach ausgerandet. Die Beine wie beim Weibchen, die Mittelschienen und die Metatarsen des dritten Beinpaares aber aussen vollständig weiss befiltzt. Im Tjan-Schan von Dr. Regel gesammelt." (loc. cit., 1880: 493—494). The last mentioned male is possibly a mis-identified specimen of *M. baeri*.

The reasons for the existing confusion are manifold and can be easily explained. As stated before (see p. 140), sexual dimorphism greatly hampers a correct association of the sexes. Apart from some males, all doubtful specimens are solitary females caught at random in places scattered all over West and Central

Asia. Besides exhibiting an almost identical pubescent pattern, they hardly differ from each other structurally and also seem to vary individually. This is exactly what has happened with the museum specimens of the present taxonomic group and annectent forms resembling them. Moreover, in the past, individuals of either sex belonging to four or more species were obviously collected indiscriminately, but may have occurred together in a given locality. It must be admitted that even at present the identity of several specimens has to remain uncertain.

The following descriptive notes are based on Morawitz' material of both sexes enumerated above, comprising also 2 males from Margilan, labelled *robusta* (a *nomen nudum*) by Morawitz, and 1 female from Quetta.

Male. — Labrum little longer than its greatest breadth at some distance from base, narrowing gradually distad and lacking a median crest; length-breadth ratios 40 : 35, and 40 : 26 at apex; surface closely, coarsely punctate, punctures large, mostly contiguous; border straight or shallowly emarginate, apex with indication of a short upturned tubercle. Antenna moderately strong, reaching to a little beyond tegula; segment 3 only about one and one-fifth as long as 4, which is a trifle longer than broad and equals the succeeding segments. Summit of head dull; vertex behind ocelli and postocular area very closely punctate, all punctures contiguous; paraocular area just beside lateral ocelli impunctate, smooth and rather shining, the outer half of the distance toward eye-margin with large, circular, well-spaced punctures on equally shiny ground; a crescentic area just in front of median ocellus also with few punctures on dullish surface. Punctures on dorsum of thorax of different sizes. White hair tufts below scutellar spines fully three times longer than these. Wing venation as in pl. 3 fig. 15; veins brown,



Figs. 168—172. *M. corpulenta*; 168, dorsal view of tergite 7 (♂ Margilan); 169, sternite 7 (same specimen); 170, sternite 8 (same specimen); 171, partial ventral and dorsal view of genital capsule (same specimen); 172, dorsal and right lateral view of pygidial plate (♀ Pendshikent)

membrane of fore wing lighter than in both *honesta* and *amanda*, subhyaline, becoming gradually light smoky brown beyond cells, darkest in marginal and at apex of radial cells. All sternites of abdomen dull, closely punctate and black-haired, except 1—4 with crescent-shaped postgradular areas somewhat more shiny, finely tessellate, with few superficial punctures. Apex of tergite 7 broadly trapezoidal, disk almost flat, impunctate, either hairless and rather shining, or naked only on both sides of a pubescent median streak (2 males from Margilan); lateral ridges swollen and hairy, posterior border brown, bare and somewhat upturned, with crescentic emargination and rounded angles (fig. 168). Raised ventral tubercles at apex of sternite 6 elongate, distinct though low, clothed densely with short decumbent hairs. Sternites 7 and 8 as in figs. 169—170. Genital capsule normal, about 1.5 mm long, inner border of distal portion of gonocoxites almost straight, enclosing a narrowly U-shaped space, the gonocoxal angle not incurved, more evenly rounded than in *honesta*; gonostylus narrower and a little longer than in that species, but dorsobasal process similar.

Female. — The type, with most others, shares the group characters summarized in couplet 15 of the key. The most striking features are the dullish, closely punctate abdomen with its fine, appressed, sharply outlined white tergal spots. Even on tergite 1, the latter are completely isolated, composed of very short matted hairs. Nevertheless even *corpulenta* exhibits great variation in the shape and size of these markings. On tergite 1 of the type they are almost triangular, pointing toward each other along base; those on 2 are large, more widely separated, subquadrangular with broadly convex inner border, on 3 more transverse, less deep and more approximated, while on 4 they are small and subcircular. Other females have spots shaped much as in *candida* (pl. 3 fig. 18), though made up of much shorter hair. The pygidial plate in our small series also varies somewhat in shape and texture, the deflecting angle of the nodded apex being not exactly identical in all (figs. 172 & 189). A number of specimens could not be determined with absolute certainty, for which reason they are listed above under "Doubtful specimens". The variation is best demonstrated by three undoubtedly conspecific females from Israel, all collected — at diffent times — near Jericho, yet differing between themselves, not only in the presence or (near) absence of lengthwise rugae on the sides of the propodeal triangle, but also in the varying distinctness of juxta-ocellar pits. Lastly, one perfectly fresh example from Kara-Tepe (Uzbekistan), has tergal spots almost of equal size and of exceptionally small size, being almost circular on 1-2, while those on 3 are transverse though only little prolonged inward. Otherwise this individual conforms to *corpulenta* from Israel and Turkey. All of them can be distinguished from similar-looking bees by the markedly sulcate median mesonotal line. Unfortunately no males are available of any of these aberrant specimens.

In this connection it is of interest to observe that the solitary female from Quetta corresponds very closely with typical *corpulenta* and consequently can not possibly be associated with the unique male of our new species *candida* (pl. 3 fig. 18) which, though bearing exactly the same printed locality label, was collected one year earlier in a different month. It is undoubtedly specifically distinct! (See under that species, the female of which is still unknown).

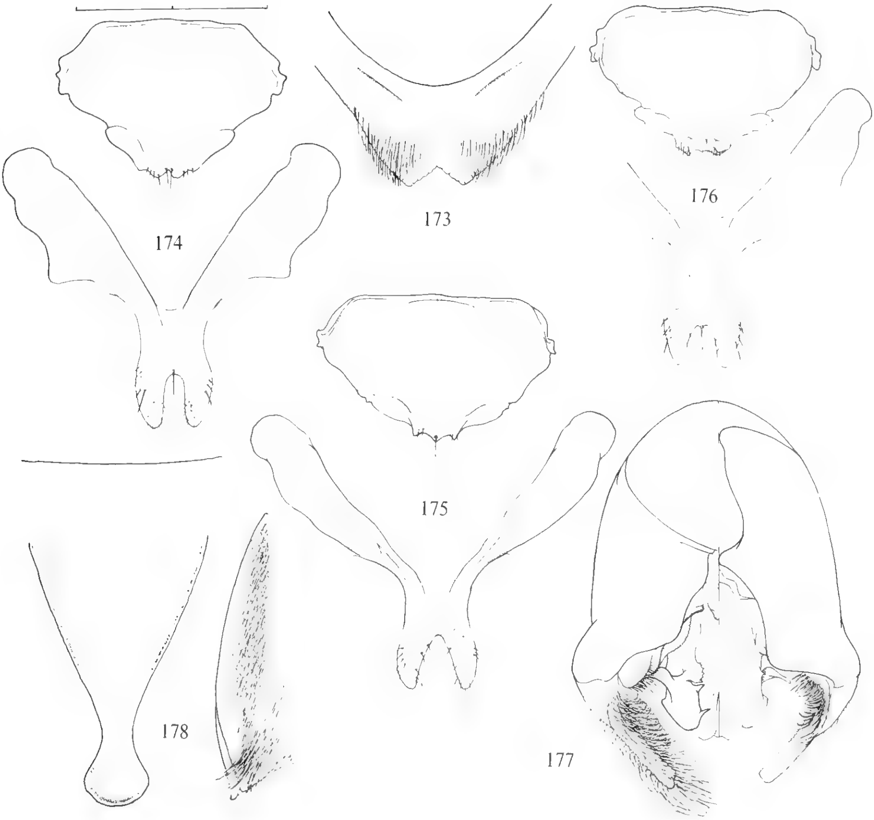
The measurements of the lectotype are: length 1.45 mm, fore wing 12 mm. It agrees very closely with the female from Quetta, still before me.

Melecta honesta spec. nov.
(figs. 173—178, pl. 3 fig. 16)

Type material. — Turkey (Asia minor): 1 ♂ (diss., figs. 173—178 & pl. 3 fig. 16), "Türkei, Mut, 28.v.1967, J. Gusenleitner" (print). Holotype (CG).

Further material. — Turkey (Asia minor): 5 ♀ (diss.), same labels as holotype, Mut, 9—13.vi.1965 (1 ♀, CG), 10.vi.1968 (1 ♀, fig. 178, CG), 19.v.1970 (1 ♀, ML); 1 ♀ (diss.), Asia min., Mut, 275 m, 27.v.1967, K. Kusdas (ML); 1 ♀ (diss.), same loc., 10.vi.1968, K. Kusdas (CJH); 1 ♀ (diss.), Asia min., Turcia, Karapinar, 995 m, 15—17.vi.1969, G. Friedel (CG). — Egypt: 1 ♀ (diss.), Amrieli (?, written), 17.iv.1914, coll. Alfieri/Egypt, *Melecta* spec., Alfken det. 1928, *Crocisa dimidiatipunct* Spin., det. J. D. Alfken 1933, *Crocisa nubica* Lep., det. J. D. Alfken 1939, all identification labels in Alfken's handwriting (MNB). — Israel: 1 ♂ (diss., figs. 173—174, Palestine, Jerusalem, 25.v.—10.vi.1941, *Melecta caesarae* Friese? (both in H. Bytinski-Salz' writing), and *Paracrocisa sinaitica* (pencil writing, det.?) (CBS). — Libya: 1 ♂ (diss., fig. 175), Cyrenaica, R. U. Agrario, CIRENP (?) V, Geo C. Krüger (print), "*Pseudomelecta* spec. nova", and "aff. *Ps. (Melecta)* aff. *glasunowi* J. Mor." (both labels in J. D. Alfken's writing), det. J. D. Alfken 1933 (BM).

Male. — Labrum short and square, but broadest at middle (ratio 50 : 50), distal border nearly straight; surface but little concave, coarsely contiguously punctate lacking a median ridge, but apex with minute upturned median tubercle; bristles short, black. Silvery white hairs covering disk of clypeus shorter and less compact than in *amanda*; anterior border and sides bare, the former punctate, the sides striated. Antenna moderate, a little stronger than in *amanda*, reaching as far as end of tegula; scape with lateral fringes of white also shorter than in that species; segment 3 about one and one-fourth as long as 4, which is a trifle longer than broad, equalling the succeeding segments in length. Vertex closely punctate, but small, smooth shiny areas are present in front of median and on either side of lateral ocelli. Mesonotum, scutellum and parascutella with large, closely set, deep punctures leaving no interspaces, the ridges separating them dull; punctures smallest and most crowded alongside slightly impressed parapsidal lines; median mesonotal line indistinctly sulcate. No median scutellar line; spines short, similar to *amanda*, but punctate all over. Long pubescence covering head, thoracic sclerites and legs, comparatively short and thin, the integument on most parts remaining visible; hairs at temples, thoracic sides, sternal faces, tufts behind wings, and sides of propodeum, all white; hair upon scutellar lobes and parascutella deep black, the white tufts surrounding apices of scutellum short and thin, not much longer than spines. Legs slender; hind basitarsus subparallel-sided, length-breadth ratio 100 : 36.3. Outer faces of tibiae predominantly white, of tarsi mixed black and white; hairs short, decumbent, pile covering hind tibiae not very dense, leaving black-tipped setae shining through; integument of distal one-fourth almost hairless, the underlying surface rugosely punctate and somewhat glossy. Tarsi black, claws dark brown, inner rami of middle pair about half as long as outer, on the hind legs slightly shorter. Wing venation as in pl. 3 fig. 16; membrane of fore wing much darker than in *amanda*, as described in the key. Sternites for the greater



Figs. 173—178. *M. honesta*; 173, ventral view of tergite 7 (♂, Jerusalem); 174, sternites 7 and 8 (same specimen); 175, sternites 7 and 8 (♂ Cyrenaica); 176, sternites 7 and 8 (♂ holotype, Mut, Turkey); 177, partial ventral and dorsal view of genital capsule (same specimen); 178, dorsal and right lateral view of pygidial plate ♀ paratype (Mut, Turkey). Scale line 1 mm

part dull, closely punctate and clothed with short decumbent hairs, longer bristles being sparsely distributed only at gradular lines; small white spots present on either side at apex of sternites 2—5. Apex of tergite 7, fig. 173; upper surface, proximal to somewhat upturned naked tubercles, with smooth, rather glossy, finely transversely wrinkled median area, the sides clothed with longish, mostly depressed, brown bristles. Raised ventral tubercles at apex of sternite 6 distinct, though small and not very prominent, mostly covered with dark hairs. Sternites 7 and 8, figs. 174—176; arms of 7 straight, relatively broad. Genital capsule normal, 1.5 mm long, inner border of distal portion of gonocoxites not strongly concave, the space enclosed more broadly U-shaped than in *amanda*; gonocoxal angle, though slightly prominent, rounded off (fig. 177); gonostylus broad, widest basally, apex broadly rounded, dorsobasal process broad at base, apex short, subtriangular, free margin beset with long bristles.

Length 14.0—15.0 mm approx., fore wing 10.2—11.5 mm.

The two males from Israel, besides being somewhat larger in size, are a little different from the holotype by having less obscured fore wings, approaching *amanda* in this respect, but the abdominal markings are more nearly quadrangular, as they also are in the females that were collected simultaneously with the type. On dissecting out the copulatory apparatus (with its hidden sternites), the latter proved to be very similar in form to those of the Turkish specimen. Moreover, the Israeli males could not possibly be associated with the questionable females from the same country which I assigned to *corpulenta* (antea), because in them the abdominal spots are placed farther apart and definitely more rounded in shape.

Female. — Differs from the male by having much darker wings, still more conspicuous, subquadrangular silvery marks, which at the sides of tergites 1 and 2 are nearly of equal size, standing out brightly in contrast with the deep black ground colour of the rest of the abdomen. It differs from our small series of *amanda* females also by the more squarish form of the first two tergal spots, those on segment 1 of *amanda* being distinctly more prolonged inward and oblique than in *honesta*. Otherwise the two species are much alike and undoubtedly closely related.

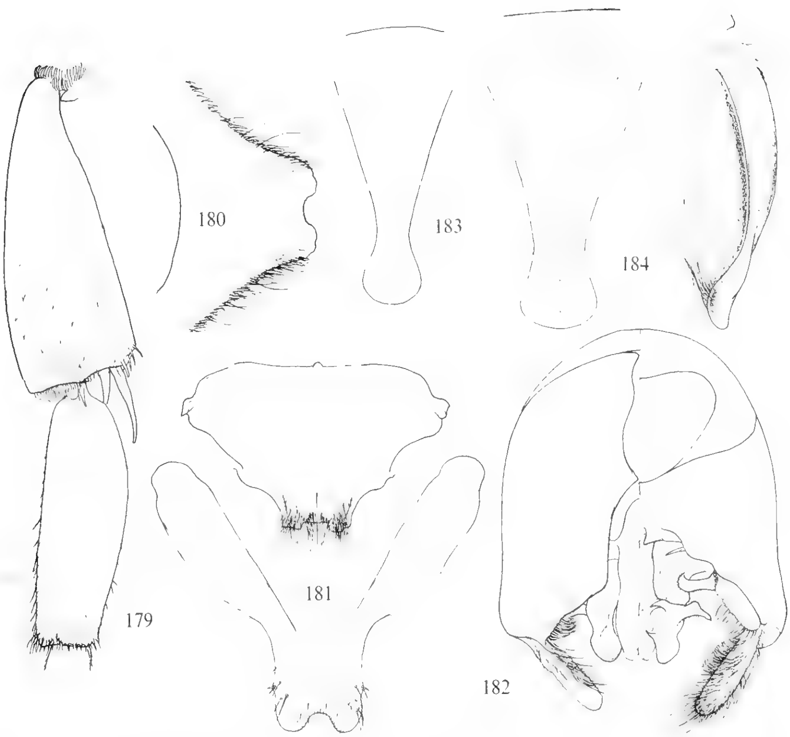
Without the possibility of consulting the photographs of male *corpulenta*, *honesta* and *amanda* (pl. 3 figs. 15, 16 and 17, respectively), it would be difficult to obtain a good impression of the peculiar "facies" of these remarkable and rather aberrant bees. As mentioned in the key and shown in the pictures, the great length of the first abdominal segment in proportion to the second, — already referred to in an earlier paper (Lieftinck, 1972: 264—265) — is the most striking feature separating them from all others; this is accentuated by the outstanding white lateral patches, which do not consist of partly raised tufts, as is usual in regional *Melecta*, but are made up of sharply delimited marks of much shorter, decumbent, silky hairs shaped similarly to those adorning the next segments. More recent investigations showed, however, that these characteristics are not tenable as subgeneric criteria, since there are a number of species showing transitions to normal (e.g. *alecto* and *candida*), the position of *transcaspica* being intermediate in that the tendency towards equalization in length of the basal segments is hardly present and only seen in the female.

M. honesta and *amanda* are evidently very locally distributed and rare species as only few specimens of each have become known.

Melecta amanda spec. nov.
(figs. 76, 179—184, pl. 3 fig. 17)

Type material. — USSR: 1 ♂ (mounted, diss., figs. 179—182 & pl. 3 fig. 17), "Turkestan" (typewritten on blue-rimmed label "Coll. Gribodo") (blue print). Holotype (MCG).

Further material. — USSR: 1 ♀ (fig. 184), "Turkestan" (print) (ex MBUD, ML); 1 ♀ (fig. 183), "Djarkent Turkestan" (print) [Dzhungarskiy Alatau area] (MBUD); 1 ♀, "Turkestan Schmiedk. 1912" (print), "Collection A. Weis" (print), "*Melecta luctuosa* Scop. var. *albovaria* Er. Turkestan" (Schmiedeknecht's handwriting) (SMF); 1 ♀ (diss.), with small written label "Sarepta" [S Russia] and "ex coll. Radoszkowski Inst. Zool. P. A. N. Kraków 25/27" (small print), "*Pseudomelecta baerii* Rad." (written) and on same label "ex coll. Radoszkowski" (print) (IZK).



Figs. 179—184. *M. amanda*; 179, external view of right hind leg (♂ holotype, Turkestan); 180, ventral view of tergite 7 (same specimen); 181, sternites 7 and 8 (same specimen); 182, partial ventral and dorsal view of genital capsule (same specimen); 183, dorsal view of pygidial plate (♀ Djarkent, Turkestan); 184, dorsal and left dorsolateral view of same (♀ Turkestan)

Male. — Labrum somewhat longer than broad at base, apex narrowed, length-median- and subapical breadth ratios as 40 : 33 : 26; apical border straight, surface coarsely punctate, punctures of different sizes, contiguous and partly coalescent, distal ⅔ with feebly indicated median ridge; bristles short, black. Disk of clypeus thickly clothed with long, decumbent silvery hairs completely concealing the surface, sides striato-punctate. Scape of antenna with long and dense fringe of white, these hairs longer than diameter of scape; segment 3 little longer than 4, which itself is about one and three-fourth times longer than broad and equal in length to the succeeding segments. Hairless areas on upper surface of head with punctures of different sizes on rather shiny ground: area in front, behind and partly also at sides of ocelli with larger, almost contiguous punctures, those on paraocular area smaller anteriorly, more crowded than in *honesta*; a fairly large area on either side of lateral ocelli and a smaller, crescentic space just in front of median ocellus, smooth and shining. Punctation of mesonotum, scutellum and parascutella much as in *honesta*, but all interspaces and ridges distinctly lustrous; a pair of small, shiny impunctate spots also upon dorsum of mesonotum, just before level of tegulae; median mesonotal and parapsidal lines distinctly sulcate. Scutellar spines short and small, placed transversely, much broader than high, directed straight back and forming an isosceles triangle in dorsal view; surface punctate, but tip smooth and shining. Long pubescence covering head, thoracic sclerites and legs markedly longer and denser than in *honesta*, tufts at sides of propodeum mixed white and black; hair upon parascutella, disk of scutellum and spines, black and also rather longer, the white tufts underneath spines conspicuous, greatly exceeding the latter in length. Legs stronger than in *honesta*, hind basitarsus subparallel-sided, length and breadth ratio 100 : 47.3. Outer faces of all tibiae and tarsi almost entirely white, the hairs short, dense and decumbent, evenly distributed and silvery, especially on hind basitarsus, the latter nearly three times as long as its greatest breadth (fig. 179). No black-tipped spicules visible within the compact pad of mid tibia and few only on hind tibia, the former with an isolated dark hair-line anteriorly. Claws reddish brown, inner rami of mid and hinder pair normal, one-half to two-thirds length of outer. Wing venation as in pl. 3 fig. 17; veins light brown, membrane hyaline, on fore wing becoming gradually light smoky brown beyond the cells, darkest in marginal and at apex of radial cell.

Measurements: length 13.8—15 mm, fore wing 11.7—13 mm.

This is the third in a small group of conspicuous Palaearctic species differing from the rest by a combination of characters summarized in paragraphs 15—17 (♂) and 8—10 (♀) of the keys. The female is marked similarly to the male (pl. 3 fig. 17), although all tergal white patches are a little less broad. Our specimens differ from *honesta* in the less obscured fore wing membrane and the presence of white tufts under the scutellar tubercles. I have no doubt about the correct association of the sexes.

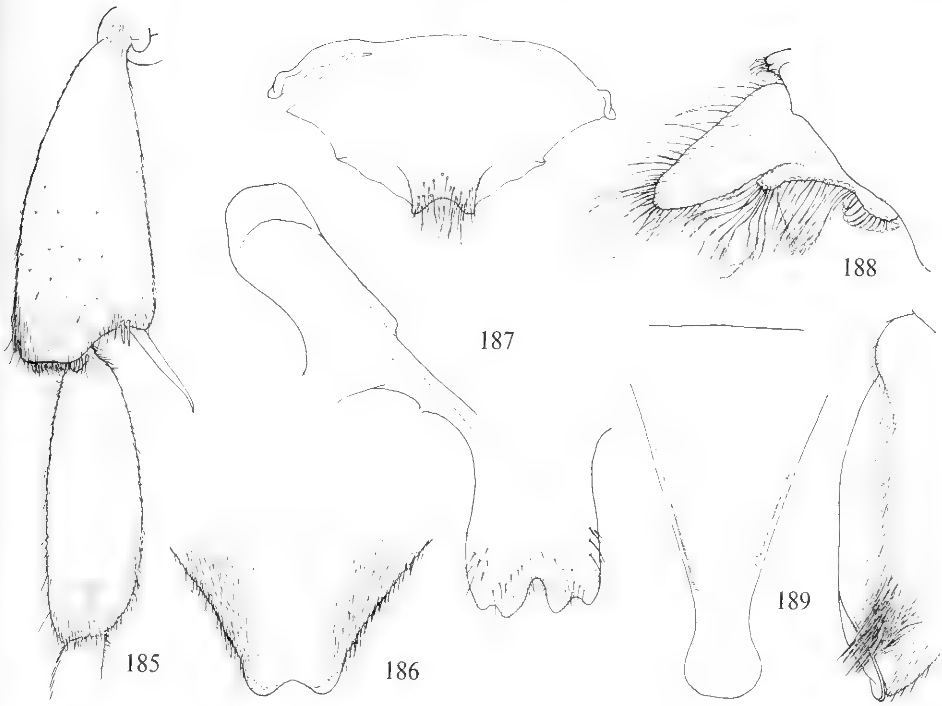
Melecta candida spec. nov.
(figs. 17, 185—188 & pl. 3 fig. 18)

Type material. — Pakistan: 1 ♂ (diss., figs. 17, 185—188 & pl. 3 fig. 18), with printed label "Baluchistan, Quetta, 3500 ft., x.1930, Capt. D.Harrison, B. M. 1932—353". Holotype (BM).

Further material. — None. For a ♀ carrying an identical locality label, see *M. corpulenta* Morawitz (fig. 189).

Male. — Similar in general appearance and clear-cut white abdominal spots to members of the *M. corpulenta* group, and possibly allied to these. Distinguished from all by the lustrous abdomen and somewhat longer pubescence.

Labrum short and square, broadest at middle, closely rugosely punctate lacking interspaces; basal tubercles relatively small, dullish, microscopically tessellate; anterior border straight, with minute raised median tubercle at apex. Antenna moderately strong, reaching beyond tegula, 3 about 1¼ as long as its breadth at apex (100 : 72) and somewhat longer than 4, which equals the succeeding segments in length, all being distinctly longer than broad. Clypeus closely punctate, the anterior border narrowly, very finely, transversely wrinkled, matted white hair covering dorsal surface not quite reaching front margin. Head above closely, deeply punctate on shining ground, punctures on summit behind ocelli lacking interspaces, elsewhere mostly separated by one puncture width; a conspicuous,



Figs. 185—188. *M. candida* (Pakistan); 185, external view of right hind tibio-basitarsus (♂ holotype, Quetta, Baluchistan); 186, dorsal view of tergite 7 (same specimen); 187, sternites 7 and 8 (same specimen). — Fig. 189. *M. corpulenta*, dorsal and right lateral view of pygidial plate (♀ Quetta, Baluchistan)

polished and slightly concave, area on either side adjoining lateral ocelli and a subtriangular, finely chagreened, impunctate area also in front of median ocellus. Mesonotum closely deeply punctate, punctures contiguous leaving shiny ridges; median line distinctly sulcate anteriorly. Scutellum feebly bituberculate lacking a median line; spines strong, spike-like, directed straight back, but tips slightly downcurved, punctate dorsally. Raised dorsal thoracic pubescence not very dense, consisting of grey-white hairs nowhere entirely concealing the surface, not much longer than diameter of tegula, though longer than in members of the *corpulenta* group; pubescence at sides of thorax and underneath much longer and denser, all white. White tufts surrounding scutellar spines long though not definitely outlined; scutellum and parascutella black, the closely punctate, rather shiny scutellum remaining well visible under the raised hairs. Legs less slender than in *alecto*, shaped much as in *alcestis* and *honesta*, the more robustly built *amanda* having stronger legs than all of them. Punctation and nature of pubescence similar to these species. Mid tibial pad, fig. 17. Femora more dullish than in *alecto* and also less compressed laterally, the posterior ridge blunt and incomplete, poorly developed only toward apex. Hind basitarsus (fig. 185) distinctly more outbent and hollowed out externally than in *alecto*, and also somewhat more expanded in side view. Inner rami of mid and hind tarsal claws only half as long as outer, a little broader than in the allied species of the group.

Wings darker than in both *alcestis* and *alecto*, but much less obscured than in the type of *honesta*: basal one-third of fore wing membrane, and that of the hind wing entirely, hyaline, for the rest smoky light brown; third submarginal cell shaped similarly to *alecto*, its distal side moderately strongly angulated, more convex than proximal side. Abdomen rather shiny, as in *alcestis*, but integument of all tergites decidedly more finely and closely punctate, though punctures are slightly less crowded than in *alecto*. Pubescent pattern as in pl. 3 fig. 18; snow-white lateral spots present on tergites 1—6, almost as compact and sharply delimited as in *alecto*, in agreement with the slightly more widely spaced punctures; spots on tergite 1 more oblique in dorsal view than in *alecto*, with numerous suberect longish hairs all along base, which become decumbent and very dense laterally; spots on 2 a little larger and more rounded inward than in *alecto*, those on 3—5 transverse, more regularly rectangular, but distance separating them as in that species; spots on 6 very small. Raised black hairs on disk of tergites extremely short, as in *alecto*, visible only under a strong lens. Sternal pilosity likewise very short and depressed, with few longer suberect postgradular bristles, all black; sternites moreover with a regular row of small, roundish, white hair-spots placed on either side at some distance from the tergal margins. Sternite 6 dark brown, apex broadly rounded, the apical tubercles distinct and hairy, but lower and more apart than in *alecto*, the less sclerotised interspace being oval in outline. Pygidial plate of tergite 7 brown, more rapidly tapered than in that species, disk almost flat, rather shiny and hairless, the lateral rims hardly swollen, tip slightly hollowed out with upturned, broadly emarginate hind margin; ventral ridges shaped much as in *alecto*. Gonocoxal enclosure V-shaped, the inner borders of gonocoxites almost straight, gonocoxal angle obtuse, broadly rounded off, not incurved; stylus with its dorsobasal process shaped as described for *alcestis*.

Size moderate; length 14 approx., fore wing 10 mm.

Female. — Unknown.

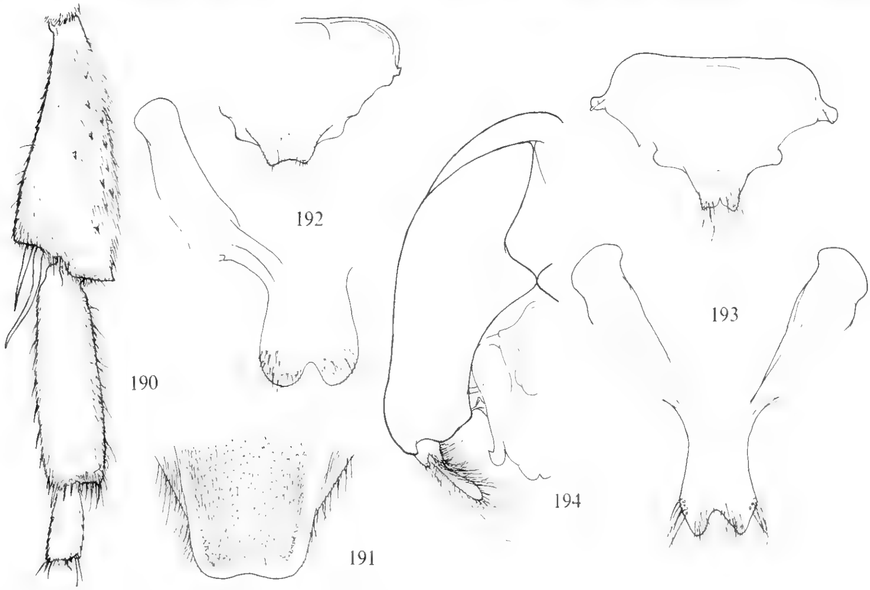
This new species runs out in the key to near *baeri*, hence far removed from the earlier defined taxa of the *corpulenta* group, whose members are, indeed, very similar superficially. *M. candida* is, I suppose, more nearly related with *alecto* and *alcestis*, all three being distinguished from the former, among other characters, by the relatively shorter first abdominal segment, as mentioned in the key. For the same reason it is impossible to regard the female from Quetta as the opposite sex of the present species (see under *M. corpulenta*).

Melecta alcestis spec. nov.
(figs. 190—194, pl. 2 fig. 11)

Type material. — USSR: 2 ♂ (one diss., figs. 190—194), labelled "Jiz. Rusko Toscoe" (i.e. south Russia), one with large label *Melecta* (print) "*luctuosa* var. *eczmiadzini* Rad." (Friese's writing), and both with "*Melecta luctuosa* v. *eczmiadzini*" (unknown handwriting). Holotype *alcestis* (figs. 190—192, 194 & pl. 2 fig. 11), in NMP (Prague); topotypical paratype ♂ (ML).

Doubtful material. — Israel: 1 ♂ (diss.), with written label "found in the car between Elat and Jerusalem, 8.iii.1964", leg.? (CBS).

Male. — Labrum broadest about midway length, length-breadth ratio 100 : 74; anterior border convex, slightly produced, apex upturned with raised, shiny marginal tubercle; coarsely deeply punctate, tubercles and disk beyond middle with irregular, somewhat shiny, impunctate area. Antennal segment 3 short, only little longer than broad at apex and only a trifle longer than 4, which is hardly longer than broad, equal in length to succeeding segments. Clypeus closely punctate, except anterior border narrowly smooth; tips of depressed silky white hairs upon dorsal surface not or hardly exceeding anterior margin. Head above shining, closely deeply punctate, punctures not contiguous, larger than interspaces, except anteriorly behind antennae, upon summit behind ocelli, and on paraocular area and temples, where punctures are partly coalescent. An irregular shiny streak in front of median ocellus with few punctures. Mesonotum and scutellum coarsely deeply punctate, all punctures confluent, leaving no interspaces; median and parapsidal lines faintly indicated, not impressed; sulcus between mesonotum-scutellum deep. Scutellum moderately biconvex, lacking a median line; spines rather long and slender, directed straight back and hardly downcurved. Propodeum dull, coarsely punctate, lacking impunctate areas. Thoracic pubescence long, dense and silky, the sides and ventral sclerites all white, but hairs nowhere entirely concealing surface; parascutella and middle of scutellum black, the white tufts below spines much longer than these; lateral propodeal tufts also long, white. Legs rather slender, all parts predominantly white externally. Interpunctate areas of hind femur smooth and shiny; matted hair and posterior fringe as described in the key, with very few longer bristles intermixed; hind tibia and basitarsus reticulate-punctate; basitarsus subparallel-sided, about



Figs. 190—194. *M. alcestis* (S Russia); 190, external view of left tibio-basitarsus (♂ holotype, Jiz Toscoe); 191, dorsal view of tergite 7 (same specimen); 192, sternites 7 and 8 (same specimen); 193, sternites 7 and 8 (second, topotypical specimen); 194, dorsal view of left half genital capsule (♂ holotype)

three times longer than broad (fig. 190). Mid tibial pad distinct and compact though not sharply defined, with some raised white hairs projecting posteriorly. Inner rami of mid and hind tarsal claws about three-fourth length of outer. Fore wing membrane lightly infuscated, smoky brown, especially toward apex; third submarginal cell as long as high, distal side moderately angled, ar in *alecto* (pl. 2 fig. 11). Abdomen more expanded basally than in *alecto*, moderately lustrous, finely, rather densely punctate, punctures much smaller than interspaces; pubescence rather long and dense. Short black, suberect setae covering disk of tergites well visible with a hand lens in profile. White tergal spots conspicuous and broad, the raised hairs on 1 very long, condensed at sides but not sharply defined, the depressed spots on 2—3 also ill-limited anteriorly, and with sparse admixture of longish white bristles at gradular lines. Sternal vestiture consisting of almost depressed, mainly black hairs intermixed with white: 2—5 with transverse gradular bands of white, diverging posteriorly, one on each side of the median line. Sternite 6 black, apical ridges very low, hairy. Tergite 7 shaped much as in *alecto* but more hairy and closely punctate; disk flat, margins broad and slightly swollen, apex a little narrower and more hairy in paratype than in holotype (fig. 191); oblique ventral ridges short, thick and densely hairy. Sternites 7—8, fig. 193. Genital capsule, fig. 194. Gonostylus thumb-shaped in side view, but only twice as long as broad at base, convex externally, apex evenly rounded; dorsobasal process broad at base, curving suddenly upward to form a setiferous distal process which, though much smaller, is similar in form to the stylus.

The sketches of the two — evidently topotypical — south Russian males clearly demonstrate how different these sclerites can appear in simple glycerine preparations mounted in exactly the same way. Also the apices of tergite 7 are not quite alike in the two specimens, the whole plate in the paratype being a little narrower and more densely hairy. Yet I am convinced that they are conspecific, because in other respects the males are practically identical. The third male, from Israel, may or may not belong here, the main incongruity consisting in the fact that the gonocoxal angle is evenly and broadly rounded instead of a little incurved, as it is in the type (fig. 194), a character otherwise of great constancy and importance. More material is much needed to definitely establish its identity.

Female. — Unknown. I have not succeeded to discover a suitable partner for this species among the many *Melecta* left unnamed.

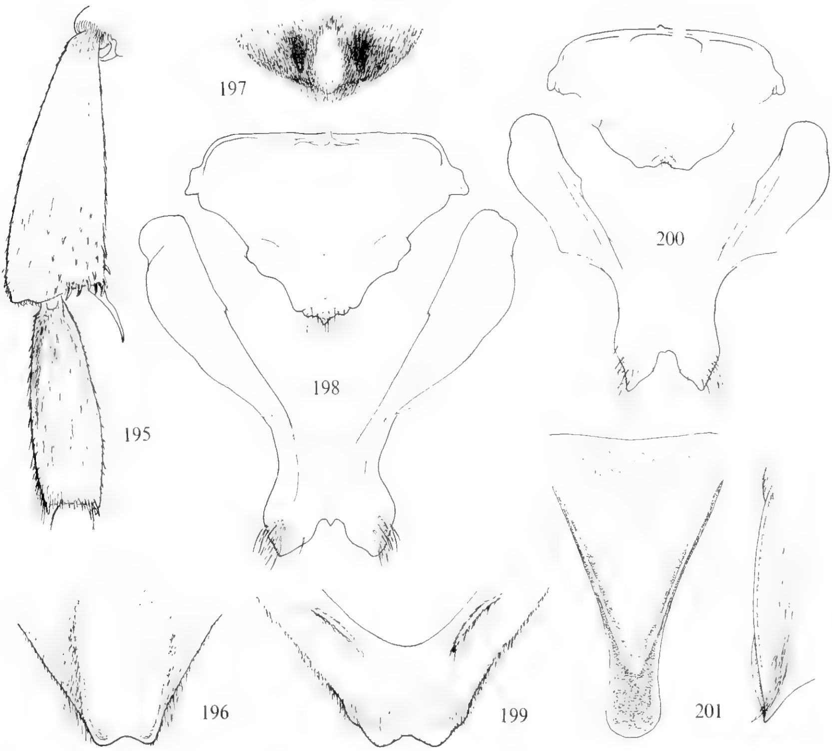
A medium-sized species, superficially resembling *festiva*, but immediately distinguished therefrom by the extremely short hairs covering the hind femur posteriorly, and the less incurved gonocoxal angle. The conspicuous, oblique, silvery hair bands fringing the graduli of sternites 2—4(5), one on each side of the median line, are also characteristic, as is the relatively slender form of the legs. Possibly allied to *alecto* spec. nov., which also occurs in Israel and is of the same size. However, *M. alcestis* can be separated from that species by the presence of longish black and white bristles at the tergal graduli (wholly absent in *alecto*), less sharply defined abdominal markings, and also by the longer overall pubescence.

Melecta alecto spec. nov.
(figs. 195—201)

Type material. — Iraq: 1 ♂ (diss., figs. 195—198), labelled "IRAQ: Kurdistan, Shaqlawa nr. Sala Huddin, N of Kirkuk, 19.v.1957, L. G. Higgins, B. M. 1957—391". Holotype (BM).

Further material. — Israel: 1 ♂ (diss.), Palestine, Mar Saba, 15 mi SE of Jerusalem, 15.iii.1922, P. A. Buxton, Pres. by Imp. Bur. Ent. Brit. Mus. 1923—530, *Melecta luctuosa*, det.? (ex BM, ML); 1 ♂ (diss.), Palestine, Jerusalem-Jericho road, 29.iii.1943, H. Bytinski-Salz (CBS). — USSR: 1 ♂ (diss., much worn), 2 ♀ (diss., figs. 199—201), Turkestan: Ost-Buchara, Tschitschantan, coll. Hauser 1898 (print), one pair labelled "*Melecta* sp.", det. D. B. Baker (NMW); 1 ♂ (soiled and worn), O. Turkestan, Narin, E. A. Böttcher, *M. ruthenica* Rad., det.? (MNB). — Syria: 1 ♀ (diss.), Syria 1899, *M. ashabadensis* Rad., det. Friese 1900 (MNB). — Turkey (Asia minor): 1 ♀ (diss.), 724/Brussa [Bursam, NW Turkey] (ML).

Male (holotype). — Labrum distinctly shorter than in *alcestis*: little longer than its greatest breadth at middle, coarsely rugosely punctate lacking a median crest; anterior border in frontal view almost straight, somewhat swollen and upturned, with pair of minute, more or less confluent, marginal tubercles. Antenna of moderate strength, segment 3 little less than one and one-fourth as long as its breadth at apex (100 : 70) and somewhat longer than 4, this and succeeding segments almost square. Disk of clypeus nearly flat, surface shining, covered with large, widely spaced punctures much as described for *alcestis*, only sides closely punctate. Head above also closely deeply punctate, punctures greater than interspaces; surface somewhat glossy; ocelli surrounded by a narrow, irregular, dullish impunctate area prolonged forward to merge into the raised, smooth frontal crest; some punctures in front of median ocellus more widely spaced than the rest. Median mesonotal and parapsidal lines very fine, the former scarcely impressed anteriorly, but more distinctly so posteriorly; mesonotum and scutellum very closely, contiguously punctate, except distally upon disk of mesonotum, where large punctures on either side of median line are somewhat more widely spaced on shiny ground; sulcus between mesoscutum-scutellum as described for *alcestis*. Scutellum normally biconvex, lacking a median line; spines triangular, slightly divaricate, somewhat depressed, very little downbent, punctate. Thoracic sclerites and propodeum otherwise as described for *alcestis*, the propodeum dull, closely rugosely punctate lacking impunctate areas. Legs black, slightly more slender and glossy than in *alcestis*, more throughout closely punctate and short-haired; mid and hind femora more compressed laterally than in that species, all with distinct though blunt median ridge, most marked at distal half of femur. Mid tibial pad elongate-oval, well defined, its posterior fringe composed of few short, widely spaced, black hairs. Hind basitarsus (fig. 195) very slightly outbent, as with *alcestis*, but narrower basally and with both sides a little convex, about three times longer than broad, length-breadth ratio 100 : 34. Inner rami of mid and hind tarsal claws relatively short, about two-thirds length of outer (ca. 67 : 100) and a little broader basally. Wing membrane as lightly infuscated as in *alcestis*; third submarginal cell of fore wing moderately angled, length and height subequal, as in that species, but second cell shorter, with distal side less outwardly convex. Tergal



Figs. 195—201. *M. alecto* (Iraq and Turkestan); 195, external view of right tibio-basitarsus (♂ holotype, Kirkuk, Iraq); 196, dorsal view of tergite 7 (same specimen); 197, ventral view of sternite 6, showing tubercles (same specimen); 198, sternites 7 and 8 (same specimen); 199, ventral view of tergite 7 (♂ Ost Buchara, Turkestan); 200, sternites 7 and 8 (same specimen); 201, dorsal and right lateral view of pygidial plate (♀, supposition, Tschitshantan, Buchara, Turkestan)

punctation of abdomen superficial, punctures fine and widely spaced on more shiny ground, than in *alcestis*.

Thoracic pubescence much as in *alcestis*, but scutellum, between the white tufts below spines, more broadly black; white hairs covering sides restricted to about upper two-fifth of pleurae, the remaining parts black with scattered white tufts sparsely intermixed (hence not at all white as in *alcestis*). Abdominal vestiture much shorter than in *alcestis*, visible in profile only at high magnification; white tergal spots conspicuous, transverse, placed in regular row, sharply defined even anteriorly, all more condensed and longer (deeper) than in that species, with hairs more finely branched; spots on 1 subtriangular, distance separating those on 1—2 about three times their own diameter, twice that distance on 3 and about equal on 4, spots on 5 smallest. Sternal pile also short, decumbent, with few suberect postgradular hairs of somewhat greater length; no white spots. Sternite 6 black, apex projecting somewhat between a pair of blunt hairy tubercles, one at each side of an elongate, less sclerotised and much less hairy depression, these tubercles just visible in profile (fig. 197). Tergite 7 (fig. 199) broadly trapezoidal, sides slightly outwardly convex in dorsal view, the rims rather swollen and a little upturned, not very hairy, apex shallowly emarginate with rounded angles; oblique ventral ridges distinct, somewhat curved, the crests bare. Sternites 7—8, fig. 200. Gonocoxal enclosure U-shaped, the inflexed margins (inclusive of gonocoxal angle) rather strongly incurved (concave) mesially, but angulation well rounded; stylus elongate-triangular in outline, twice as long as its breadth at base, apex bluntly pointed; dorsobasal process broadest at base but shorter than in *alcestis* and tapering gradually to a broadly rounded apex. Size moderate, total length 14—15 mm approx., fore wing 10 mm (holotype Iraq and male Turkestan).

The two males from Palestine (Mar Saba and Jerusalem-Jericho rd.), are practically identical structurally and unquestionably not conspecific with the one from the same country referred to *alcestis* with some misgivings (*antea*).

Female. — There is nothing of interest to complete the description in the key. The two specimens labelled "Tschitschantan" and Brussa, are in much better condition than the male from the first-mentioned locality bearing an identical printed label. I take it that all males and females are conspecific, but here also, more material from all countries involved is greatly to be desired.

The females measure: length 15—15.5 mm, fore wing 11.5 mm.

Melecta transcaspica F. Morawitz
(figs. 10, 75, 202—214, pl. 4 figs. 22—24)

Melecta transcaspica Morawitz, 1895, Horae Soc. Ent. Ross. 29: 39 (♂ "Bei Hodscha-kala, von Pomeranzow gesammelt").

Melecta caesareae Friese, 1925, Konowia 4: 28—29 (♀ "Caesarea; Palästina"). **Syn. nov.**

? *Melecta octomaculata* Radoszkowski, 1876: 124 (♀ Egypte).

Melecta octomaculata Friese, 1925, Konowia 4: 29 (♂ "Kar-Boghaz, Taur. cil. & ♂ Mersina, Kleinasien"). Nom. preocc. **Syn. nov.**

Type material. — USSR, Turkmenia: 1 ♂ (diss., mounted, figs. 202—205, & pl. 4 fig. 22), labelled "Chodshakala P." (F. Morawitz' handwriting), "*Melecta transcaspica* F. Mor. ♂" (id.), "c. F. Morawitz" (print in Russian). Lectotype *M. transcaspica* F. Morawitz, by present selection (ZIL). — Israel: 1 ♀ (pl. 4 fig. 24), labelled "Caesarea, Paläst." (written), "Type" (print on red), *Melecta caesareae* Fr. Kl. As." [sic], in Friese's handwriting. Holotype *M. caesareae* Friese (MNB). — Turkey (Asia minor): 1 ♂, labelled "Kar-Boghaz, Taur. cilic." [S Peninsula, opposite Cyprus] "Holtz 1897" (print), "Type" (print on red), "*Melecta octomaculata* Fr. Kl. As. u." (in Friese's hand). Holotype *M. octomaculata* Friese, by present confirmation (MNB).

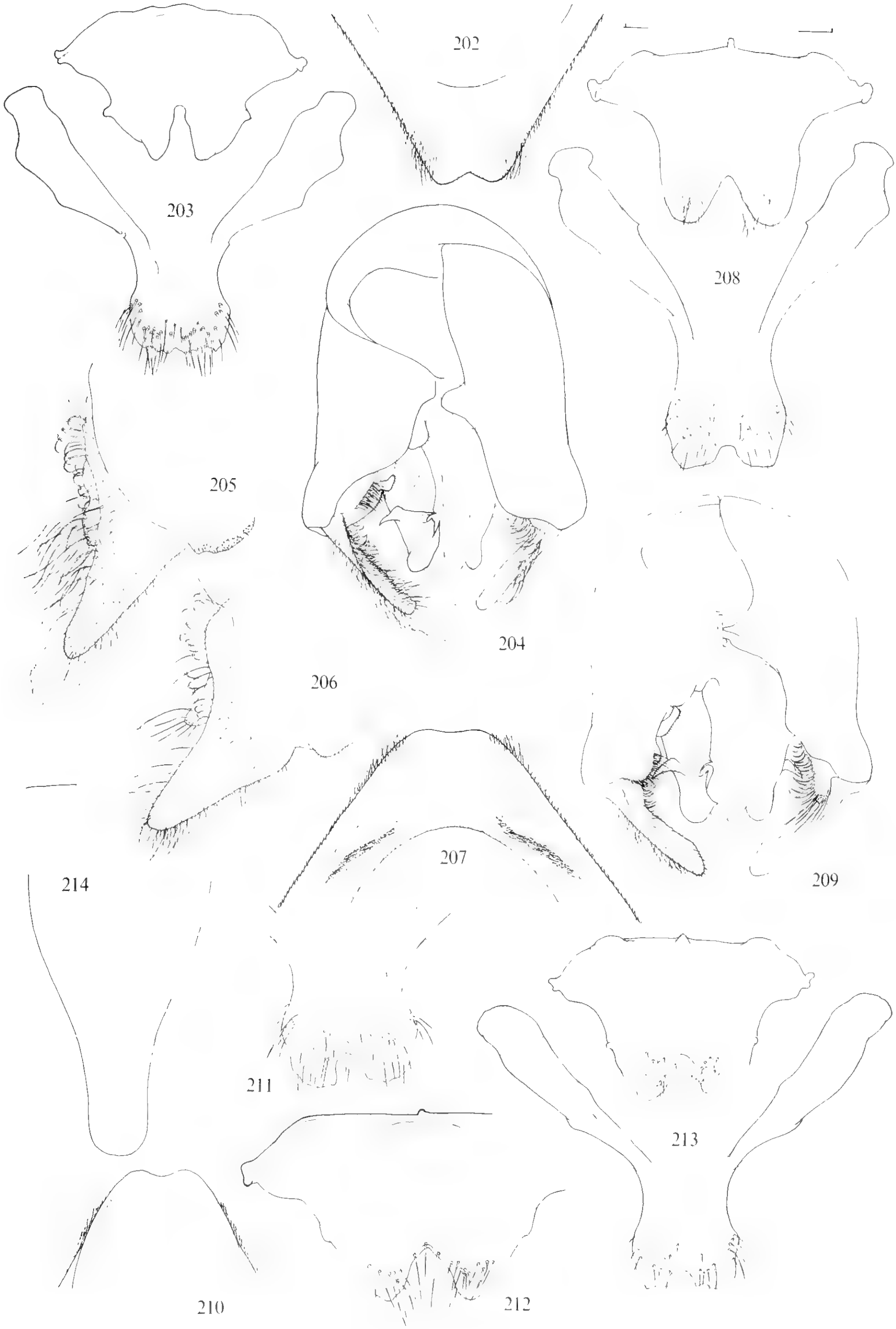
Further material. — USSR: 1 ♂, sine loc., but with pinned gold disk [sic], & "107626/*corpulenta* Mor. Typ. ♂", in F. Morawitz' writing (ZIL); 3 ♂, Uzbekistan, Okr. Kopala Semieretsj (illegible), 13.v.1910, Sj..tn..kov (illegible), *M. transcaspica* Mor., det.? (ZIL); 1 ♀, Uzbekistan, Buchara occ., Hum-Kala 1892, *Melecta robusta* F. Mor., in F. Morawitz' handwriting, *M. transcaspica* Mor., det.? (ZIL); 1 ♂ 1 ♀ (diss., in perfect condition), sine loc., but with printed label "21", both with *Melecta* spec. ♂, det. H. Hedicke 1934 (NMW). — Iran: 1 ♂ (diss.), Persien (written), "*M. aegyptiaca* Rad., m. Typ. vergl. [ichen]." (Friese's writing), det. Friese 1893, and "*Melecta not aegyptiaca*", in D. B. Baker's writing (NMW). — Lebanon: 1 ♂ (diss.), Nd. Liban., Cedern b. Becharré, 1900 m, 3—6.vi.1931, Zerny (print) (NMW); 1 ♂ (diss.), Lebanon, Nr. Cedars Hotel, 6400 ft., 15.vi.1944, H. B. Cott (BM). — Israel: 1 ♀ (diss.), W. Jaar, Golan, 1.vi.1970, H. Bytinski-Salz (CBS); 1 ♀ (diss.), Palestine, Judean desert, Ma'ale

Haadumim (formerly Khan Chadrur), 200 m, 18.iv.1943, H. Bytinski-Salz, *M. caesareana* [sic] Fr., det.? (CBS). — Turkey (Asia minor): 1 ♂ (diss.), Turquie, 11—14 km avant Çiftehan-Ulukisla, 1150—1300 m, 28.vi.1976, R. Desmier de Chenon (INRA); 1 ♂ (diss.), Turkey: Ankara, Ravli, 1000 m. 30.vi.1962, Guichard & Harvey (BM); 1 ♀, Turkey: Ankara, above Hasanoglan, 1500 m, 29.vi.1962, Guichard & Harvey (BM); 1 ♀, Turkey: Ankara, Beynam, 1000 m, 26.vi.1962, Guichard & Harvey (ex BM, ML); 1 ♀ (diss.), Turkey:Mersin, Sertuvul Gecidi, 4,500 ft., 22.vi.1960, Guichard & Harvey (BM); 1 ♀ (diss.), Asia min., Eski-Tshehir, vii.1906, Dr. Lendl (print) (MBUD); 1 ♀ (diss.), Asia min., Konya, colli steppici ad W, 6.vii.1962, A. Giordani Soika (print) (MP); 1 ♀, Armenia, Monastero Chérard, 13.vii.1963, A. G. Soika (MP); 1 ♀ (diss.), Erzerum 1868, Malinowsky (written) (NMW); 1 ♀, Turkey, Çorum, Bogaskale, 18.vii.1966, F. N. Bakels (ML); 1 ♀ (pl. 4 fig. 23), Türkiye, Denizli, Babadag Kazik Beli, Kiefernstufe, 11—1200 m, 23.vi.1967, Reinig (SMF); 1 ♀ (diss.), Turkey, Konya, 22.vi.1969, W. Linsenmaier (CL); 5 ♂, Türkei, Madensehir/Konya, 20.vi.1973, K. Warncke (CKW, ML); 1 ♂ (diss.), Türkei, Yeşilhisar/Kayseri, 19.vi.1973, K. Warncke (CKW); 1 ♂, SW Türkei, Şarkişhla/Sivas, 15.vi.1977, K. Warncke (CKW); 1 ♀ (diss.), Türkei, Kaiseri (Ali-Dagh), 15—22.vi.1962, leg. Seidenstücker (CWG); 1 ♂, Asia min., Merrina, 1901 (MNB); 1 ♀, Kleinasien, Brussa, leg. Ihirk (MNB); 1 ♂ (diss.), Türkei, Icel:Sertavul, 1400 m, 9.vi.1978, Max. Schwarz (CMS).

A large, robustly built species.

Male. — Disk of labrum coarsely rugosely punctate, punctures large, contiguous; basal tubercles low, rather shiny, with few large irregular punctures; an incomplete obtuse median ridge present (a.o. distinct in lectotype) or wanting, usually restricted to distal one-fourth or less and highest, ending in a raised tubercle, at the upturned apical border, the latter feebly convex in frontal view. Mandible-bases finely striatopunctate, the upper portion smooth and shiny, as in most other *Melecta*. Disk of clypeus closely punctate, all punctures contiguous and partly confluent, smaller than on labrum, those at sides more widely spaced, striatopunctate on smooth surface; silky white patch of decumbent hairs fan-like, restricted to dorsal face, tips of hairs barely reaching anterior border. Antennal segment 3 longer than its breadth at apex (100 : 71) and a little longer than 4, which is only slightly longer than broad, the succeeding segments squarish. Head above closely deeply punctate, especially anteriorly in front of ocellar area and upon middle on summit of vertex behind ocelli, where punctures leave no interspaces; a broad line running from median ocellus to frontal carina as well as a fairly large flat space adjoining (slightly posterior to) each of the lateral ocelli, smooth and impunctate, the latter occasionally with few scattered punctures. Punctation on mesonotum dense, irregular, punctures differing in size: small and contiguous all around middorsal area, on which they are more irregularly distributed and partly smaller than interspaces, the latter smooth and rather shining. Median mesonotal line markedly impressed posteriorly but sulcus punctate; parapsidal lines poorly indicated bij fewer punctures. Scutellum, parascutella, sides of thorax and propodeum, dull, very closely contiguously punctate. A small, slightly lustrous impunctate spot at mid-base of propodeal triangle invariably present, but varying

Figs. 202—214. *M. transcaspica*; 202, ventral view of tergite 7 (♂ lectotype, Chodshakala); 203, sternites 7 and 8 (same specimen); 204, partial ventral and dorsal views of genital capsule (same specimen); 205, external view of right gonostylus (same specimen); 206, the same (♂, Persien); 207, ventral view of tergite 7 (same specimen); 208, sternites 7 and 8 (same specimen); 209, partial ventral and dorsal view of genital capsule (same specimen); 210, dorsal view of apex of tergite 7 (♂, Lebanon); 211, apical portion of sternite 7 (same specimen); 212, whole sternite 8 (same specimen); 213, sternites 7 and 8 (♂, Turkey); 214, dorsal view of pygidial plate (♀, no. 21, NMW). Scale line 1 mm (figs. 203, 208 and 213)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in size and shape; lateral edges filled out with 6—8 short longitudinal rugae. Scutellum but little biconvex, lacking distinct median sulcus; spines robust, variable in size and shape, short and triangularly pointed in the lectotype, much stronger and/or more or less curved in others, but in all implanted at a high level, their dorsal face punctate, almost in line with basal part of scutellum. Legs robust, integument dull, all segments closely, finely punctate. Hind femur with low, hairy median longitudinal carina restricted to distal one-third; punctation very close on smooth ground, diameter of punctures hardly less than interspaces, except ventrally toward apex irregular and widely spaced on flattened, elongate-triangular area. Mid tibial pad, fig. 10. Outer face of hind tibia rather convex, whole surface coarsely, irregularly punctate with short, erect black spicules abundantly interspersed. Hind basitarsus rather broad, widest at middle, shorter than tibia, upper border straight, the lower somewhat convex; markedly outcurved, the external face hollowed out, closely punctate, clothed with short, fine, decumbent black hairs which are silvery at middle; no marked impunctate infra-basal pit on hind basitarsus. (The shape and depth of the external hind basitarsal concavity is rather variable: in lectotype and a male from Lebanon, for instance, the joint is less outbent in posterior view than in a second Lebanese specimen and one from "Persien", while the length-breadth ratios also vary somewhat (e.g. 100 : 32.5 in lectotype, 100 : 37 in a Turkish specimen. Yet all males presently recorded are undoubtedly conspecific). Inner rami of mid and hind tarsal claws relatively short, only half as long as outer and a little more broadened basally than usual. Wings much more obscured than in many other species: membrane of fore wing dark smoky brown only in basal portion of median cell, all along anal vein as far as end of first discoidal cell posteriorly, in most of the anal lobe, and along the dark central areas of the outermost cells. Abdomen above rather dullish, distinctly less shining than in *M. baeri*, *candida*, *aegyptiaca*, and the smaller-sized species pertaining to the group having short-haired hind femora. Punctation dense and fairly strong, punctures smallest and most crowded together on postgradular parts of tergites on which they are equal in size (though less superficial) to those on disk of tergite 1; all punctures smaller than interspaces. Gradular lines at sides of tergites 2—5(6) fringed thinly with rather long black bristles, present also and more numerous at the corresponding sternal plates. Sternites otherwise very closely finely punctate, the broad, almost impunctate and smooth mid-posterior crescents accordingly more contrasting than in the equally large-sized male of *baeri*; sternite 6 not projecting, simply rounded, its ventral ridges hairy, very low and unapparent. Pubescence short, not at all concealing the surface, the suberect tergal hairs just visible with a hand lens (× 10); lateral spots snow-white, well defined, transverse, arranged as in pl. 4 fig. 22, the long raised hairs at base of 1 arranged archwise, narrowest and thin medially, becoming compact and spot-like laterally, the broad crescentic posterior area remaining dark and short-haired. Spots on 2 transverse, somewhat comma-shaped, their front margin characteristically a little incurved and less sharply delimited anteriorly than behind, the apices of the spots pointing more or less inward; spots on 3—5 more nearly rectangular, decreasing gradually in size posteriorly, those on 5, though small and subcircular, nearly always present. Exposed portion of tergite 7 (figs. 202, 207, 210) broad, trapezoidal, sides slightly outwardly convex or more nearly straight in dorsal view, the lateral rims continuing all along border, becoming gradually more swollen and upcurved toward apex; disk hollowed out between a pair of low, closely approximated median ridges (rarely unapparent), which diverge toward base of tergite; surface dull, irregularly striatopunctate and sparsely hairy; oblique ventral ridges well developed, rather broad. Sternites 7—8, figs. 203, 208, 211—213. Genital capsule large, 2.0—2.2 mm; gonocoxal enclosure widely U-shaped, mesial borders of gonocoxites at first markedly concave, then curving outward, the angle evenly and broadly rounded. Gonostylus thumb-shaped, its dorsobasal process small, rather variable in shape, its base attached to stylus for a fairly long distance (figs. 204, 206 & 209).

Female. — First recorded — and quite insignificantly described — as *M. caesareae* Friese (pl. 4 fig. 24), a species which turns out to be synonymous with *transcaspica*, agreeing in all respects with other females of the latter from Israel.

It differs from the male by having still darker wings, more deeply sulcate mesonotal line, and shorter body pubescence. With *honesta* it shares the rich snow-white abdominal ornamentation, in strong contrast with the dull, very finely punctate abdomen; distinguished from *honesta* at a glance by the more normal (i.e. shorter) length of the first abdominal segment.

The complications with reference to the taxonomic position and nomenclature of *transcaspica*, are explained under *corpulenta* (p. 260). The type of *M. octomaculata* Radoszkowski, from Egypt, is a wrongly sexed male, either of *aegyptiaca* or *transcaspica*. For a transcription of the original diagnosis, see under that species in the Appendix.

With the aid of the photographs of both sexes (pl. 4 figs. 22—24), the key characters, and the structural details figured, this fine deep black, dark-winged *Melecta* is one of the more easily recognized species in the Eurasian fauna. There is little variation in the shape and size of the white body markings in comparison with many congeners. The slightly curved, more or less comma-shaped transverse spots on tergite 2 are characteristic for both sexes.

Distribution. — From Transcaspia (Turkmenia) and Iran in the east, ranging westward into the eastern Mediterranean. Apparently fairly common where found, especially in Asia minor, in which country *transcaspica* was met with by a number of hymenopterologists not especially interested in bees.

Melecta solivaga spec. nov.
(fig. 215)

Type material. — Algeria: 1 ♀ (diss., fig. 215), with green disk (meaning caught in June), with on reverse side "872/80", and "Museum Paris" (print), "Ouargla 1894 Weisgerder" (written), i.e. oasis about 480 km S of Constantine. Holotype (MP).

Female (holotype). — Body elongate, abdomen broadest across end of segment 2, tapering gradually, length-breadth ratio as 10 : 6. Labrum squarish, greatest breadth little before middle, at that point slightly exceeding its median length; apex thin-margined with distinct crescent-shaped emargination; no median crest; surface (smooth basal tubercles excepted) strongly punctate on shiny ground, clothed with numerous very strong, raised black bristles. Face not very prominent; clypeus squarish in frontal view, with numerous punctures smaller than somewhat shiny interspaces, anterior border polished, impunctate. Head behind face more closely punctate, all punctures small, subequal in size to their interspaces. Antenna normal, 3 distinctly longer than 4 (ratio 10 : 6), the latter subequal to next segments, all a trifle longer than broad. Anterior surface of thoracic dorsum and sides finely, contiguously punctate, punctures on posterior part of mesonotum, scutellum and hindermost sclerites larger, deeper and isolated, those covering dorsal convexities on each side of median sulcus scattered on brilliantly shining ground; parapsidae also distinctly impressed distally. Transverse suture between mesonotum-scutellum deeply recessed. Scutellum exposed, hairless, feebly biconvex on either side of shallow concavity, rounded off posteriorly and but slightly overhanging posterior sclerites; spines robust, triangular, flattened and bluntly pointed, directed abruptly upward and backward. Legs moderately strong; femora smooth and shiny, sparsely, not strongly punctate, fringed posteriorly with few long raised hairs; hind femur with incomplete, blunt median ridge. Outer faces of mid and hind tibiae and basitarsi clothed with appressed pubescence interspersed with small, suberect spinulose setae and fringed with erect bristles, which are longest posteriorly. Inner rami of all tarsal claws broadly triangular and flattened, less than one-third length of main branch, claw-like. Tibial spurs normal, all evenly and but slightly curved, outer spur on hind tibia only little shorter than inner. Wing venation blackish brown; membrane of fore wing very

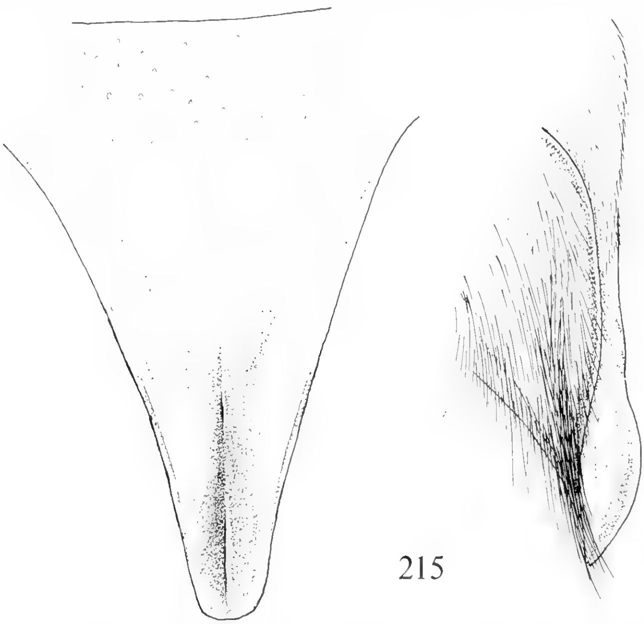

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Fig. 215. *M. solivaga*, dorsal and left lateral view of pygidial plate (♀ holotype, Ouargla, Algeria)

dark brown with low purplish blue reflections, subhyaline basal areas much as described for the equally dark-winged *fumipennis* spec. nov., but brown slightly lighter in tint roundabout cubital cell-centres and along distal margin; hind wing also lighter brown. Venation normal; third submarginal cell a little shorter than high. Integument of all tergites throughout extremely finely reticulate-punctate on somewhat shiny ground, most superficially chagreened on postgradular areas; sternal surfaces similar, except broad and brightly polished postgradular annules of 1—4, but whole sternal plate 5 dull, caused by fine reticulation. Black and white pubescent pattern well defined; hair covering head and thoracic segments longest, though only partly concealing surface, black on mouth-parts, clypeus and summit of head, with long tufts of white just behind antennae and along occipital border, but hairs at temples and underneath all black. Thorax with conspicuous elongate white patches dorsally in front of tegulae and a median tuft filling out mesonotal sulcus, on each side of which are small, deep black spots of shorter raised hairs, all hiding the surface; also small tufts of white just in front of black parascutella, large patches of raised white hairs on each side behind wing bases, and slender white tufts projecting caudad from beneath scutellar spines. Posterior sclerites and sides of thorax black, save a smallish white central spot upon middle of mesepisterna. Outer faces of mid and hind tibiae white in proximal half. Abdomen rather dull; short pubescence covering tergites consisting of minute, closely set, black decumbent hairs; sides of 1—4 marked with white: all spots placed far laterad in regular row, those on 1 and 4 smallest, subtriangular or oval, respectively, those on 2 and 3 distinctly transverse, nearly rectangular, more widely distant across dorsum than their own transverse diameter; all spots compact, depressed, made up of not very long hairs. Sternites all black. Dorsal and ventral bristles fringing graduli sparsely distributed and relatively short, but more numerous and longest at sides of tergite 5. Pygidial plate triangular, basal two-third of disk finely reticulated, gently convex and somewhat shiny, thereafter broadly sulcate between slightly raised side margins and base of crest, which is smooth, more shiny and rounded off (fig. 215).

Male. — Unknown.

The decision of giving a new name to a single female *Melecta* is mainly based on the extraordinary shape of the pygidial plate of this species. The type is an aged specimen with frayed wings and parts of the black tergal pubescence rubbed off. Additional features, which may also serve to the recognition of the still unknown male, can be summarized as follows. A large, dark-winged species with relatively small, subrectangular white tergal spots, which at sides of tergite 1 are made up of short hairs; hind wing nervellus (cu-v) coinciding with point of origin of Cu-M fork; and great number of short, acuminate, spike-like setae covering outer faces of mid and hind tibiae of female.

A peculiar bee, easily known also by its size and deeply impressed median mesonotal sulcus, as mentioned in the key (p. 180).

Melecta baeri Radoszkowski (figs. 12, 216—221, pl. 2 fig. 12)

Pseudomelecta Baeri Radoszkowski, 1865, Horae Soc. Ent. Ross. 3: 56, pl. 1 fig. 3 (col. pict., whole insect, "Gouvernement d'Orenbourg", vide Popov, 1955!). — Popov, 1960, Entom. Oboz. Akad. Nauk SSSR 39: 239 (no type selection!). — Lieftinck, 1972, Tijdschr. Ent. 115: 282—284 (note on generic position).

Melecta baeri: Popov, 1955, Trudi Zool. Inst. Akad. Nauk SSSR 21: 325 (type not studied, but compar. notes with *M. corpulenta* Mor. and *nivosa* Mor., all transferred to *Melecta*; type loc. of *baeri* discussed). — Kokuëv, 1909, Trudi Yaroslavskogo estest. — istor. Obshchestva [Proc. Nat. Hist. Soc. Jaroslav] 2: 105 (distrib. notes; see *M. corpulenta*).

Melecta baerii: Friese, 1895, Bienen Europa's 1: 155—156 (key ♀ ♂), 168—169 (not seen! orig. descr. quoted; not *M. baeri* ex Kohl & Handlirsch, 1889, ♀ Aschabad, misidentified).

Type material. — USSR: 1 ♀ (figs. 216—218, lectotype *P. Baerii* Rad., by present selection), with pinned gold disk and labelled "Cauca Mlokos" (bad capital print), "*Baerii* 94.30" (Radoszkowski's writing), "ex coll. Radoszkowski Inst. Zool. P. A. Krakow 25/27" (print), "*Pseudomelecta baerii* Rad., det. ex coll. Radoszkowski" (print), "Typus" (written on red) (IZK).

Further material. — USSR: 2 ♂ (both diss., figs. 12, 221, one mounted, pl. 2 fig. 12), "Turcomania, Krasnowodsk" (print) (MBUD, ML); 1 ♀ (diss.), "Krasnowodsk" (written), "coll. F. Morawitz" (print in Russian), "*Melecta corpulenta* F. Morawitz" (in Morawitz' handwriting) (ZIL); 1 ♀ (diss., mounted, fig. 219), "Stauding [er] Siberia occ. Altai" (written, white disk) (ML); 1 ♀, "Stauding[er]/Krasnow/Turkestan" (written, white disk), "*M. baerii* Radosz.?, det. C. Ritsema" (ML); 1 ♀ (diss.), Krasnovodsk/Ahnger/158, *M. albovaria* Er., ex coll. & det. Pittioni (BM).

Doubtful material. — USSR: 1 ♂, small-sized (diss.), "Turcomania/Krasnowodsk" (print) (MBUD).

This conspicuous bee is a true *Melecta*. Though one of the earliest described Eurasian species, its relation to others has given rise to much speculation and confusion with similar large-sized members of the genus, like *corpulenta* F. Mor. and *transcaspica* F. Mor. In an attempt to find out more about the status and distribution of *baeri*, Popov supplied interesting information. The following sentences are partly translated from Popov's meditations expressed in his own language. In a first article (1955), the author already concluded that *baeri* was wrongly placed in *Pseudomelecta*, as is evident from the superficial description and colour picture of this bee. He also pointed out that Kokuëv (1909), while discussing the distribution of *baeri*, was mistaken by referring three females from Boz-Dara (leg. Shelkovnikov) to that species. In point of fact, these individuals came from Krasnowodsk and — at least one of them — should be referred to *M. corpulenta* F. Mor.: they were labelled as such by Morawitz himself. Friese's statement at the end of his description of *Paracrocisa caesareae* (1925), that *baeri* is a short-haired bee, had to be rejected, because both the picture and description clearly point to a more hairy species. Popov further explains that the original habitat of *baeri*, viz. "Orenbourg government", before its incorporation with the Kirgisian district in 1868, extended very far toward the south and included the Caspian and Aral lakes. He remarks in passing that Eversmann also understood the region to be that extensive. In view of this and considering also the large size of Radoszkowski's female, Popov at the same time considered the possibility that *baeri* could be identical with *M. corpulenta* or *nivosa*, a conjecture which later proved to be untrue, though both species were correctly placed in *Melecta*. The former is distributed from the Ryn Sands in the north (in coll. Morawitz) as far as Bajgakum in the Syr-Darja (in coll. Malyshev); *nivosa* is rather smaller in size but otherwise agrees more closely with *baeri* and is also known from Bajgakum (in coll. Malyshev). So it appears that both occur in the southern part of the former Orenburg government. The above statements can now be confirmed, in so far that at least some of Morawitz' females from Ryn Sands (Rynpeski) and Krasnowodsk are indeed true *corpulenta* (see under that species). In a next publication, dealing with Radoszkowski's so-called "types" in the Zoological Institute at Krakow, Popov (1960) argues that a "careful re-examination of the bees in that collection described and/or illustrated by him as such, very often turned out to be not types, for example his *Pseudomelecta baerii* and *Andrena oulskii*" (loc. cit.: 239). Popov's hesitation to decide upon the status of *M. baeri*, thereby renouncing the selection of a lectotype, can be easily explained by the lack of any available specimen corresponding exactly with the original diagnosis and colour picture. Of course, this only caused the existing uncertainties to persist, but at the same time justifies the belief that Popov's concept of *baerii* was less confused than were Radoszkowski's ideas in general. The matter was further complicated by the existence of three more females, turned up recently in other collections, which inevitably also deserve attention in the present context. Though resembling the bees presently regarded as *baeri*, they are even more extensively white-haired than any of the others. One of them, here called "spec. A", was found in a consignment of *Melecta* sent to me on loan recently by Dr. Königsmann of the Berlin museum, while two others ("spec. B", one of which unnamed, see below) had apparently remained unnoticed in the Berlin and Leningrad collections, respectively. The neglected (or overlooked) "spec. A" shows a white pattern surprisingly similar to Radoszkowski's portrait of "*baerii*", so much so in fact that it might even have served the artist as a model for that species! Unfortunately, it is exactly this particular specimen "A" which lacks a clear locality record, the two identification labels being also confusing. Apart from that, this bee is a good deal smaller than the one described, viz. 13.5 mm as against 16 mm for *baeri* in the original diagnosis. The two other females ("spec. B"), though undoubtedly conspecific, are again different from all others. For these reasons, and also because the males are still unknown, I am reluctant to describe them as new. Instead, it would seem enough to make up the whole by transcribing their labels only, as follows:

Spec. A. — ♀ (mounted), with written labels "[illegible] ", "*Melecta* n.sp. *bispinosa* Evm." (Eversmann's writing), „*PseudoMelecta Beeri* [sic] Rad". (unknown handwriting), "Type" (print on red) (MNB). Obviously a distinct, undescribed species (see above).

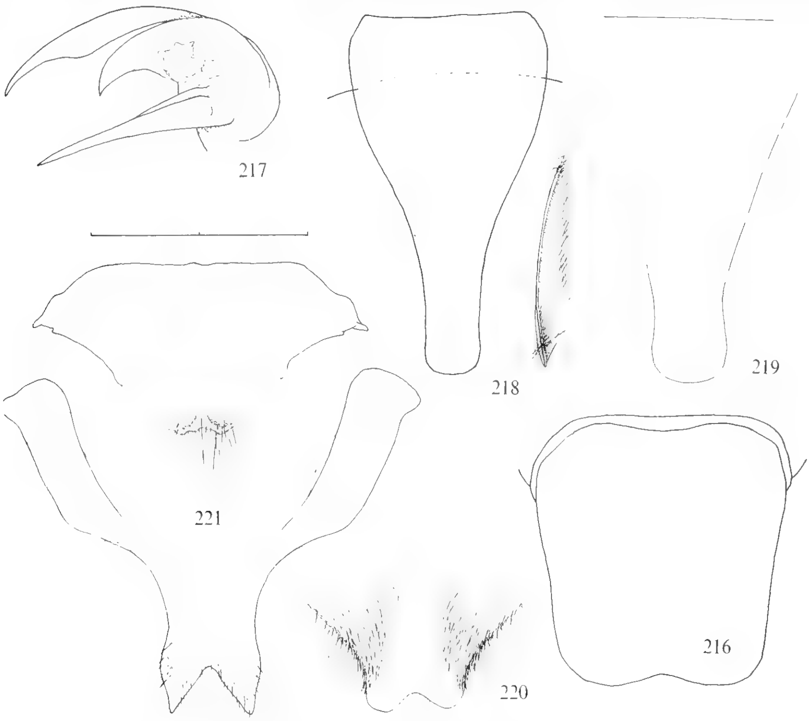
Spec. B. — ♀ (mounted), with written and printed labels (in Russian) "2614 Aulis-Anak/Syr-Darja lake (orange) and "coll. Kokuev" (print); ♀ (idem), "Dsungarei [Dzunggarskiye, SE USSR frontier area] Sandwüste . . . (illegible) 27.6.25, leg. Beik", and "*M. arm.* v. *grandis*" (pencil, det.?) (MNB). These two are undoubtedly conspecific, resembling "spec. A" and *M. baeri* nob., but differing structurally from both. Like the former an undescribed species.

Summarizing the above, and assuming that Radoszkowski mixed up at least two species brought to his attention, I have decided to accept his own unmistakable type labels as settling the matter, selecting the specimen in his own collection as lectotype and leaving the identity of "spec. A and B" undecided.

The six good specimens here characterized (one male mounted and photographed, pl. 2 fig. 12, and one female with gold disk and Radoszkowski's type labels), are very similar to one another and unquestionably conspecific. The status of a much smaller female in the Budapest museum must remain doubtful.

M. baeri runs out in my keys to near *candida* (♂) and *grandis* (♀), but resembles *transcaspica* most closely in general appearance. Differs from the last in details of structure, by having lighter coloured wings, more regular abdominal maculae and a more strongly outcurved hind basitarsus.

Male. — Labrum almost square, a fraction longer than broad, the widest point slightly before halfway length; apical one-fourth with smooth median carina, better pronounced and more sharply acute, the anterior border less distinctly upturned, than in *transcaspica*. Disk of clypeus less coarsely, more superficially punctate, punctures not contiguous, those at sides isolated and separated by more than one puncture width on shiny surface; silky white patch flat, somewhat more compact and broader, covering upper parts of sides as well, the hairs longer,



Figs. 216—221. *M. baeri*; 216, frontal view of labrum (♀ lectotype, Orenbourg); 217, left hind tarsal claw, oblique dorsal view (same specimen); 218, dorsal and right lateral view of pygidial plate (same specimen); 219, the same (♀, "Siberia occ."); 220, dorsal view of exposed portion of tergite 7 (♂, Turcomania); 221, sternites 7 and 8 (♂ Krasnowodsk, Turkmenia), scale line 1 mm

reaching anterior border. Antenna slightly more slender than in *transcaspica*, all segments including 3 a little longer (length-breadth ratio of the latter 100 : 60). Head above closely punctate but most punctures smaller, more evenly distributed, the interspaces where present dullish, finely tessellated, especially on paraocular area, the impunctate spots in front of median and beside lateral ocelli small and of irregular form; frontal line distinctly raised, subacute, running up as far as anterior ocellus. Punctation and sculpture of mesonotum, scutellum and propodeum as described for *transcaspica*, the interspaces (where present middorsally on mesonotum) smooth and shining; scutellar spines robust though equally variable in shape; no distinct median scutellar line. Legs shaped much as in *transcaspica*, expect that all tarsal segments appear to be somewhat stronger, especially the hind basitarsus being more markedly outcurved than in that species (length-greatest breadth ratio 100 : 35.7); inner rami of mid and hind tarsal claws longer, about ⅔ length of outer (fig. 217). Mid tibial pad, fig. 12. Hind tibia below fringed with long, raised, widely spaced marginal bristles, the margins of hind basitarsus with shorter, suberect setae; outer face of hind tibia clothed with depressed plumose white hairs interspersed with thick black spicules. Wing membrane much lighter than in *transcaspica*: hind wing entirely and fore wing for more than its basal half, hyaline; a spot at extreme base, an elongate dot at apex of median cell, as well as the entire marginal cell, rusty brown (with diffuse marginal extension distal to it), all the rest of membrane but little infuscated (pl. 2 fig. 12). Abdomen definitely more shining than in *transcaspica*, all setiferous punctures smaller, more widely spaced, the integument accordingly more plainly exposed, than in that species. Black and white vestiture much alike in the two species, except that the long white hairs covering most of tergite I are all of the same length, not subinterrupted in the median line; also the compact white lateral spots on tergites 2—5 are more regularly rectangular (cf. pl. 2 fig. 12 and pl. 4 fig. 22), those on 2 (—3) not at all excised anteriorly or pointing inward. Sternites of all segments much more glossy and at the same time less contrastingly punctate and hairy before and behind; gradular bristles also shorter and more depressed. Sternite 6 as in *transcaspica*, but ventral ridges rather longer and more protuberant, just visible in profile. Exposed portion of tergite 7 broad, trapezoidal, sulcate, shaped similarly to *transcaspica*, though differing markedly in that the longitudinal ridges are better marked off, more widely distant, shiny and hairless (fig. 220). Genital capsule large, 2.0 mm long, gonocoxal enclosure more narrowly U-shaped than in *transcaspica*, mesial borders of gonocoxites at first diverging and a little concave, at about halfway distance toward the angle parallel, then very little converging and finally again curving outward, the angle slightly better pronounced and less evenly rounded. Gonostylus somewhat shorter, broader basally, and more distinctly tapering toward apex, which is either subtruncated or rounded, clothed with relatively short bristles; dorsobasal process more abruptly angled at apex than in *transcaspica* and attached to stylus almost at right angle.

Wing expanse of first described mounted male, 30 mm.

Female. — Differs from the male in the usual variegated black and white pubescent pattern of head and thorax. In addition to the key characters, the following details are taken from the lectotype and are worth recording.

Mandibles wholly black, with the usual, though rather narrow, inner tubercle about midway length. Occipital ridge with dense fringe of long white hairs curving outwards on either side at the rounded hind angles; long pubescence lower down along orbits and on temples, black. Mesonotum with pair of distinct, oval, black dots placed in the long axis, separated by a distance greater than transverse diameter of one spot. Median mesonotal line very fine but distinctly sulcate. A pair of conspicuous white tufts, one each to the inside of and just behind middle of tegula; large tufts of much longer and thinner white hairs beneath and partly surrounding scutellar tubercles, the latter short, conical, directed slightly upward and straight backward, much shorter than white tufts, which are almost coalescent with equally long white hairs behind posterior wing base. Propodeum only laterally beset with white hairs, which are directed sideways. Sides of thorax with large white hair spot covering upper portion below mesospiracle, for the rest black. Basal three-fifths of mid and hind tibiae white externally, the tips of not very strong, black spike-like setae visible through decumbent white pilosity. Wing membrane unusually light: only faintly smoky, especially along margin beyond pterostigma. Abdomen short-haired, but tergal marks conspicuous, well defined, the hairs longest and forming large semi-erect tufts at sides of tergite 1, those on 2—4 transverse, subrectangular, broadest on 3. Longish black bristles at graduli and hind angles of tergites 2—5. Sternites all black, clothed with very short hair.

Length 16.5 mm, fore wing 12.5 mm, expanse 29 mm.

Three of the Krasnowodsk females still before me agree very nearly with the lectotype, although in one of them black anterior mesonotal dots are wanting, the pattern resembling Radoszkowski's picture in this respect.

Melecta grandis Lepeletier
(figs. 9, 222—230, pl. 5 figs. 25—30, map 2, p 303)

Selected references

Melecta grandis Lepeletier, 1841, Hist. Nat. Ins. Hym., 2: 443—444 (pars, ♀ only! Oran, "comme parasite de l'*Anthophora* Espagnole" [= *A. hispanica* (F.)]. — Lucas, 1849, Explor. Sci. Algérie, 3, Hym.: 211—212 (descr. ♀ ♂), pl. 9 fig. 11a—e (sex?, whole insect, mouthparts & ant.; Algérie, Oran, sec. Lepeletier). — Pérez, 1883, Actes Soc. Linn. Bordeaux, 37 (sécr. 4, t. 7): 303—305 (notes, Algérie). — Gribodo, 1893, Bull. Soc. Ent. Ital. 25: 406—407 (? pars, notes, sine patria). — Friese, 1895, Bienen Europ.: 159 (? pars, Südeuropa, Nordafrika). — Alfken, 1914, Mém. Soc. Ent. Belg. 22: 235 (flower record, Algeria).

Melecta luctuosa: Gribodo, 1924, Boll. Mus. Zool. & Anat. Univ. Torino, 39 n.s.: 39 (♀ Cyrenaica).

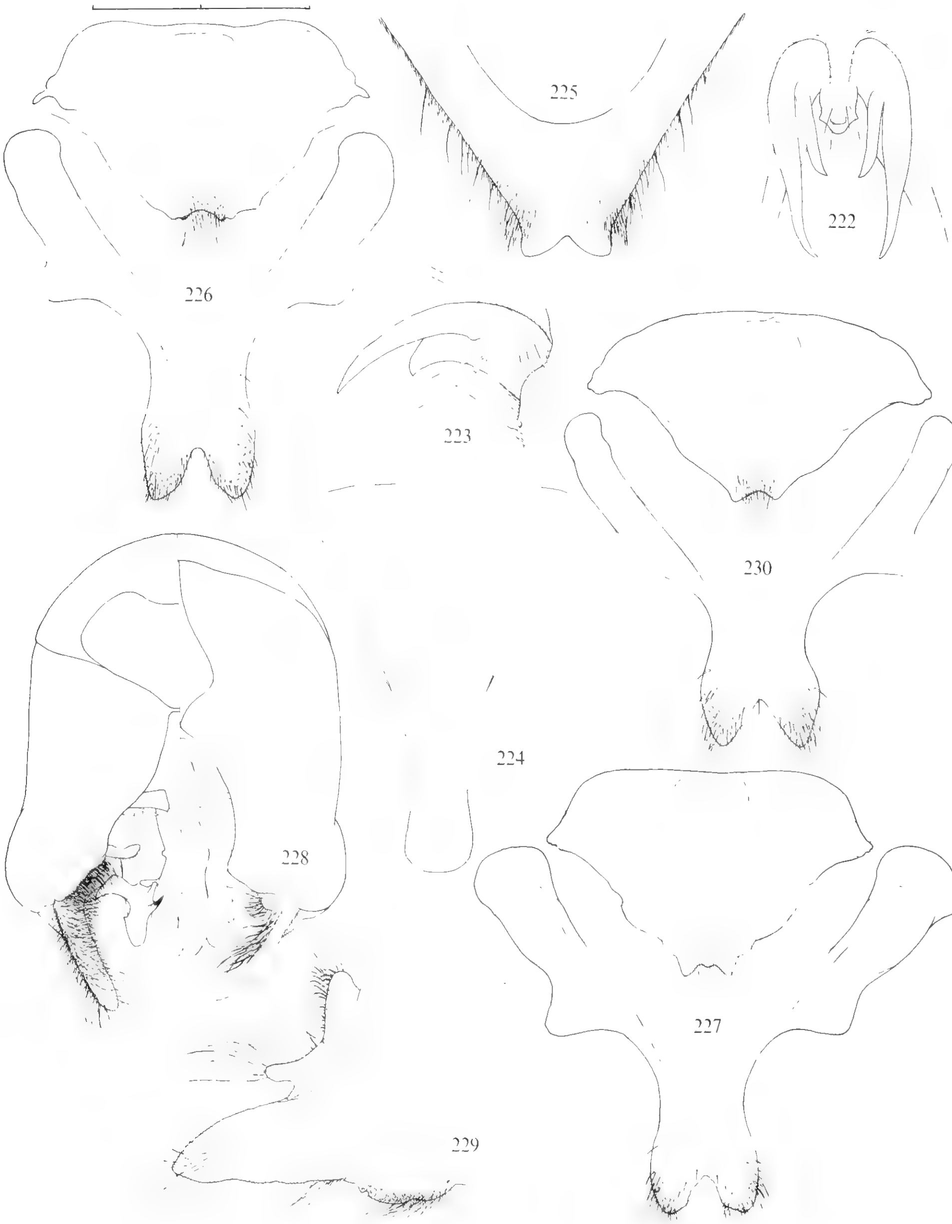
? *Melecta* n.sp.? ó *M. luctuosa* n.var.? Dusmet y Alonso, 1915, Mem. Real Soc. esp. Hist. Nat. 8 (7a): 330 (Morocco: ♀ ♂ Mogador).

Type and syntypic material. — Algeria: 1 ♀ (pl. 5 figs. 25—27), no pin label but over drawer label "*M. grandis* Lep. Oran, coll. St. Fargeau"; lectotype *M. grandis* Lep. by present designation (MP); 1 ♂ (diss., figs. 9, 225—226), in bad condition, left hind leg partly missing, Algeria, with old white written label "Oran" and green printed museum label "coll. J. Pérez 1915", first described ("allotypic") ♂ *M. grandis* Lep. by present selection (MP).

Further material. — Algeria: 1 ♀ (pl. 5 fig. 28) Algérie 49/65 (white disk), apical tarsal segments of right hind leg missing (BM). — Morocco: 1 ♂ (diss.), Maroc, Moyen Atlas, between Azrou & Timahdite, 1800 m, 8.vi.1973, M. A. Lieftinck (ML); 1 ♂ (diss.), Maroc, Midelt, 24.v.1947, J. de Beaumont (CB). — Tunisia: 1 ♂ (diss., pl. 5 fig. 29, figs. 227—229), Médinin, 3.95 (green label), coll. J. Pérez 1915 (MP); 1 ♀, Gafsa 1910, P. Chrétien (on green), 19.3 (red ink), *Melecta luctuosa* Scop., det.? (MP); 2 ♂ 1 ♀, Tunisi, Belv [edere], 12.3.1882, and Tunisi dint., Bab Alena, 8—10.3.1882, G. & L. Doria, ♀ with *M. grandis* Lep. (Gribodo's writing) (MCG, ML); 1 ♂, Tunis, 15.iii.08 (MBUD); 1 ♂, Tunis, coll. Schmiedeknecht (MNB); 1 ♀, Tunis merid., *Melecta aegyptiaca* Fr. [sic], ex coll. & det. J. D. Alfken (MNB). — Libya: 1 ♀ (figs. 222—224), in bad condition, Zavia, Mecchili, Festa, *M. luctuosa* Scop., det. Gribodo (MT); 4 ♂ 3 ♀, Cyrenaica, Mars el Brega, 8—11.ii.1942, Kirchberg leg. (MNB, ML); 4 ♀, Cyrenaica, Cyrene, 1800 ft., 26.iii—3.iv.1954, K. M. Guichard (BM, ML); 1 ♀, Tripolitania, Uadi Caäm, 5 aprile 1953 (MA); 1 ♀, Cyrenaica, R. U. Agrario, Ain Raru, 10120, iii.1926, *M. crassicornis* Fr., det. Schulthess 92 (MG). — Egypt: 1 ♀, Aegypten, A. Andres, "*Melecta* zur *luctuosa* Gruppe", det. J. D. Alfken (SMF); 1 ♀, Aegypten, A. Andres, *M. aegyptiaca* Rad., det. & coll. Alfken 1934 (MNB); 1 ♀ Frfd [Frauenfeld], Alex [andria], *M. grandis*, det. Kohl (NMW); 2 ♀, sine patria, Coll. Graeffe, one with *M. grandis*? det.? (NMW); 1 ♀, Egypt, Mariut, 10.iii.1914, coll. L.H.C. & G.S., Dept. Agric. Egypt (MNB). — Israel: 1 ♀ (diss.), Palestine, Subeita, 9.iv.1946, H. Bytinski-Salz (CBS); 1 ♀, Palestine, Bir Rechme, 13.iii, H. Bytinski-Salz (CBS). — Spain: 1 ♀, Andls [Andalusia], coll. J. Pérez 1915 (MP); 2 ♀, Andalusien, Chiélana, 22—23.iii.1890, Korb (MNB, ML); 1 ♂, "Andalusien, 11.2. Coll. Gerst. [aecker?] var. nov.? ♂ ♀ Andalus? (MNB); 1 ♂, Hispania 189 (print) (ML); 1 ♂ 1 ♀, SE Spain (prov. Murcia), Cartagena, J. Caceves (written), *M. luctuosa* Scop. ♂ (unknown hand), *Melecta grandis* ♂, det. Alfken, and *M. luctuosa* Scop. var. *albovaria* Er. ♀, det.? ex coll. J. D. Alfken (MNB). — Sicilia (Italy): 1 ♂ (diss., pl. 5 fig. 30 & fig. 230), Sicilia 1878, Mann (print), *grandis*, det. Kohl (NMW).

The female lectotype (pl. 5 figs. 25—27) is an old, worn individual with frayed wings, its missing body parts having been eaten away by *Anthrenus*. Nevertheless it is clearly recognizable as the specimen from Oran dealt with in the original description of *grandis*. However, one of the supposed males, likewise from Oran, is a misidentified example of *italica* Radoszkowski, photographed on pl. 6 figs. 33—34. This bears a vertically pinned blue disk, which would also prove its origin from one of the old collections kept in the Paris museum (see under *M. italica*). To avoid nomenclatural difficulties, it seems justified to consider the second male from Oran a syntype, because this is an indubitable specimen of *grandis*. On the other hand, I gather from certain comments upon the genus given by J. Pérez in his publication (1883), that some at least of his presumed examples of *grandis* are not that species but outsized individuals of *M. albifrons albovaria*, which occurs all over southern France and in many parts of North Africa as well. This inference was corroborated on a later occasion, when all specimens in the Paris museum had been re-examined. Still arguing on the assumption that only a single species was involved, — even true *grandis* being considered a variety of "*armata*", — Pérez was of opinion that, like the last, considerable size differences also exist in Algerian populations of *grandis*. That statement is undoubtedly wrong, because we now know for certain that several of his specimens (including medium-sized females) were misidentified, at least three distinct species having since been recognized in the available material of "*grandis*"; moreover, exceptionally small females of *grandis* are unknown.

Male (pl. 5 figs. 29—30). — Sufficiently characterized in the key. Head and thorax dull, very closely contiguously punctate, except on middle of mesonotum. Legs not very strong, closely finely punctate on somewhat shiny ground. Mid tibial pad, fig. 9. Outer face of hind tibia reticulate-punctate, lacking impunctate areas toward apex; inner face broadly sulcate and hairy along full length. Hind



Figs. 222—230. *M. grandis*; 222, external view of mid tarsal claw (♀, Zavia, Cyrenaica); 223, the same, lateral view (same specimen); 224, dorsal view of pygidial plate (same specimen); 225, ventral view of tergite 7 (first described "allotypic" ♂, Oran, Algeria); 226, sternites 7 and 8 (same specimen, scale line 1 mm); 227, sternites 7 and 8 (♂, Medinine, Tunisia); 228, partial ventral and dorsal views of genital capsule (same specimen); 229, external view of right gonostylus (same specimen); 230, sternites 7 and 8 (♂ Sicily). Figs. 226, 227 and 230 drawn on the same scale

basitarsus long and slender, subparallel-sided, borders very little convex in profile view. Genital capsule large and compactly built, 2 mm long. Gonostylus short, broadest at base, tapering rapidly, tip bluntly rounded; dorsobasal process of characteristic shape (fig. 229).

Female. — Labrum longer than its breadth at base but narrowing distad (ratios as 100 : 75 : 54 approx.), distal border, gently upcurved, a little projecting and swollen medially, as in male, whole surface deeply, coarsely rugoso-punctate lacking interspaces; basal tubercles large, brilliantly shining with few large, irregular punctures roundabout; raised bristles long, black. Head above closely punctate on slightly shiny ground, as in male; no impunctate juxta-ocellar areas of any size. Suberect hairs covering clypeus long, predominantly or wholly black, some white only upon middle; distal one-third or less bare, closely punctate. Antenna only little less strong than in male, segment 3 markedly longer than 4 (ratio varying between 100 : 75—86), and also longer than in male, but the remainder scarcely more elongated than in the other sex. Scutellar tubercles variable, usually short and straight, much shorter than surrounding long white tufts. All thoracic sclerites, including sides of propodeum, hidden from view by dense black and white pubescence, only centre of mesonotum, scutellum and vertical postscutellar sclerites remaining visible under much thinner raised hairs. Propodeal triangle dull, finely chagreened, smooth and somewhat shiny, usually bisected by a short, fine median line. Wings obscure, fore wing darkest in distal cell-centres, apex of radial cell, entire marginal cell, and along anterior border beyond the latter; length of third submarginal about equal to its height. Abdomen more expanded and flattened than usual, broadest about midway segment 2, tapering rapidly and pointed. Hairs at basal edges of tergite 1 somewhat raised and subinterrupted at middle by thin basal collar of longer erect hairs. Pygidial plate rather long en slender, but less than twice as long as its width at base; sides straight or feebly outcurved in dorsal aspect; margins hardly raised as far as the constriction, apex expanded, slightly spatulate, with low median ridge; plate very gradually a little downbent from base to apex, surface dull, very finely transversely wrinkled, impunctate; colour dark brown, lateral margins and whole apex obscured (fig. 224).

Affinity. — *M. grandis* is one of the larger, sturdily built and less common members of the genus. Males are easily recognizable by a number of structural characters while females can only be confounded with oversized individuals of the allopatric *M. tuberculata* and some poorly known eastern species resembling it only superficially. Like most others, it is an early spring species that has been observed in the coastal districts of North Africa as early as the first week of February. It occurs from near sea level up into the lower mountain zone to about 1800 m alt., at which height males were still on the wing in June.

Bionomics. — The single male which I caught in Morocco was taken at about 10 a.m. while gathering nectar from the attractive lilac flowers of the Boraginacea *Anchusa azurea* Miller, growing abundantly in clusters beside the road, in the hills near Timahdite. The *Melecta* kept company with males and females of *Anthophora* *robusta* (Klug), a big, fast-flying polylectic and locally common species with a very long proboscis; I encountered this *Anthophora* in several places, a.o. near Midelt, at the foot of the High Atlas mountains, a locality where Dr. J. de Beaumont had also taken *Melecta grandis* on an earlier occasion, so the latter may well be a parasite of *A. robusta*. Females of that species were collecting pollen and nectar, while the males were observed (and filmed) hovering in front of the *Anchusa* flowers, taking nectar in the same way to a fairly large Bombyliid and a very peculiar, excessively long-tongued Nemestrinid fly (*Neorhynchocephalus tauscheri* Fischer)[1]), with brilliant emerald green eyes. All three insects were jointly extracting nectar from flowering *Anchusa* on the same spot. Unfortunately I failed to discover the nesting sites of *A. robusta*.

I do not know whether Lepeletier's remark regarding the possible host of *M. grandis* in Algeria, the large and conspicuous *Anthophora hispanica* (F.), is indeed founded on field observations made by his son, who first discovered the species. Perhaps the statement is merely conjectural and based on the corresponding superior sizes of these bees. Otherwise actual data on the parasite-host relationship and their biology are quite unknown. It is of some interest to note that *A. hispanica* has repeatedly been taken on Ibiza, of the Balearic islands, but has never been observed in one of the more frequently visited islands of the group, neither has *M. grandis* been collected in any of the Balearics.

For its distribution, see map 2.

Melecta prophanta spec. nov.
(figs. 18, 231—236)

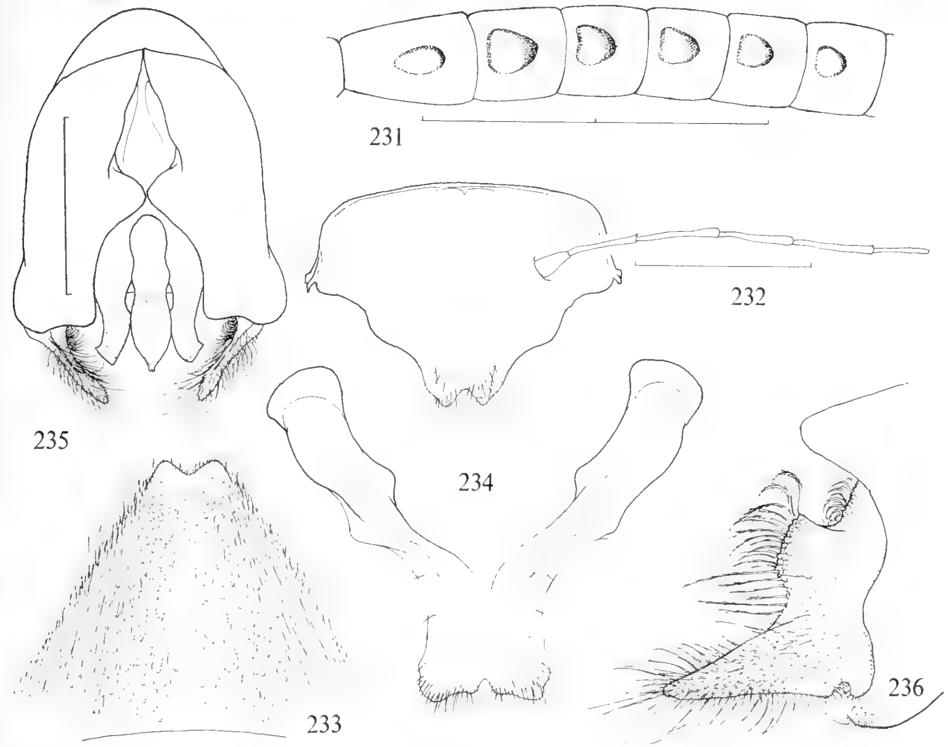
Type material. — Canary Is.: 1 ♂ (holotype, diss., figs. 18, 231—236), Lanzarote I., Famara, 4—15.ii.1979, W. N. Ellis & R. T. Simon Thomas (MA).

Large species, total length 18 mm approx., fore wing 12 mm. Stature and pubescent pattern most closely resembling *M. transcaspica* and *baeri*, but abdominal markings even more transverse and prolonged inward.

Male (unique). — Labrum a trifle longer than its greatest breadth across basal tubercles, a little narrowed toward apex (breadth ratios 100 : 67), anterior border straight, angles broadly rounded. Squarish silvery patch lying flush upon clypeus, the tips of long hairs exceeding anterior border. Antenna (figs. 231—232) markedly shorter and thicker than in *aegyptiaca*, 4—12 square instead of somewhat longer than broad, with larger, more deeply impressed rhinaria; long fringes on either side of scape white. Ocelli closely approximated, distance separating them less than one-half their own diameter. Punctation of head and thorax as in *aegyptiaca*, but pubescence, though shorter on all parts, relatively long and

[1]) Nemestrinidae are known to be parasitic upon the larvae of small Lamellicorn beetles, but in view of the same semblance in behaviour, body size and striking co-operation noticed at the spot, this particular species might deposit its eggs at the nest entrances or within the burrows of *Anthophora robusta* as well. The fly was kindly identified by my colleague, Dr. P. J. van Helsdingen, of the Leiden museum.

predominantly white, e.g.: raised tufts on each side of antennal scape, behind antennae, fringes at occipital border, and most of thoracic sclerites; black are only hinder part of mesonotum, scutellum and, narrowly so, metepisternum between spines, as also whole posterior surface. Scutellar spines straight, slightly raised and pricker-shaped, punctate, directed straight back, much shorter than long white tufts beside each of them, the area between spines remaining only narrowly black. Mid tibial pad (fig. 18) narrow, the white squarely cut off basally, with very few black spicules and some longish posterior bristles. Outer face of hind tibia with few raised spicules, the black posterior bristles short. Hind basitarsus wholly black, slightly less than three times as long as its widest point about midway length (ratio 100 : 35.7), moderately outbent, outer face concave, evenly closely punctate, short-haired, with few longish bristles at lower level posteriorly. Inner rami of mid and hind tarsal claws about ¾ length of outer. Tergites of abdomen distinctly more shiny than in *aegyptiaca*, all punctures setiferous, much smaller and more superficial, the setae shorter, more finely branched. Snow-white marks very conspicuous, more approximated, compact and better defined, than in *aegyptiaca*, the hairs markedly shorter; 2—5 all transverse, 2 and 3 three times broader than deep, especially spots on 2 somewhat hollowed out anteriorly. Tergite 7 tapering



Figs. 231—236. *M. prophanta* (♂ holotype, Lanzarote, Canary Is.); 231, antennal segments 3—8 (scale line 2 mm); 232, antenna (scale line 0.5 mm); 233, dorsal view of tergite 7; 234, sternites 7 and 8; 235, dorsal view of genital capsule (scale line 1 mm); 236, right lateral view of gonostylus, with dorsobasal process

rapidly, apex narrow, slightly emarginate (fig. 233), the oblique ventral ridges low, flattened and hairless. Sternites all black; ventral ridges at apex of 6 low, barely visible in profile, densely black-haired, the enclosed median area elongate, with sparse setiferous punctures on somewhat shiny ground. Sternites 7—8, figs. 234, apices of both strongly setiferous. Genital capsule 2.3 mm long, gonocoxal angle subrectangulate, evenly rounded; gonostylus much less rapidly tapering in full profile view than shown in fig. 236, which shows the curious squarish form of the basodorsal process in side view.

Doubtful female (unique). — Morocco: 1 ♀ (worn, wing borders damaged), High Atlas, Oukaimeden, 2600—2800 m, 8.vii.1976, J. Gusenleitner, *M. luctuosa albovaria*, det. J. Heinrich (CG).

Stature, size and tergal markings very similar to male, length 17.5 mm approx. Labrum shaped similarly, but with distinct, subacute, median crest extending anterad for little less than two-thirds its whole length and terminating in a small tubercle (barely indicated in male); anterior border slightly but distinctly concave. Basal half of mandible smooth and shiny externally, impunctate (male, finely longitudinally striato-punctate). Head above as in male, closely punctate, vertex lacking impunctate areas. Antenna more slender, 3 one and one-fourth as long as next flagellar segments, all being a trifle longer than broad. Mesonotum and scutellum deeply, contiguously punctate, as in male, the median mesonotal line not impressed, reaching back to a level halfway length of tegulae, very finely bilineate; parapsidal lines similar, though considerably shorter. Scutellar tubercles directed obliquely upward, triangular, very slightly curved and punctate, as in male. Propodeum dull, closely punctate throughout. Legs strong, size normal; distal portion of inner faces (behind median carina) of mid and hind femora almost impunctate, the carina of hinder pair distinct, almost complete, subobtuse. Wings only little darker than in male; distal side of third submarginal slightly less markedly angled. Abdomen much as in male, tergites smooth and shiny, finely superficially punctate (microsetae rubbed off on disk of tergites). Pydigial plate shaped much as in *festiva*, about twice as long as its width at base, almost straight in profile, only the broadened apex a little downbent; disk flat, very finely transversely wrinkled, with few scattered punctures at extreme base only; colour black. — Pubescence moderately long and dense (rubbed off in places); depressed patch of longish white hairs upon middle of clypeus not nearly reaching anterior border, raised upon whole vertex, and fringing occipital border. Mesonotum with the usual white areas and a pair of subrectangular black spots anteriorly; scutellum mostly black, a few long white hairs only below the tubercles; sides and under surface black, upper portion of mesopleurae with large patch of white. Legs moderately hairy, as in most species; robust, suberect, shiny macrosetae at outer faces of mid and hind tibiae interspersed with longish bristles and short decumbent fine hairs. White are: basal one-third of fore tibiae and about basal half of mid and hinder pair; for the rest all black. Compressed inner rami of mid and hind tarsal claws about two-fifths as long as outer. White lateral marks of abdominal tergites 2—4 very similar in shape and size to those of male, all transverse spots broadest on 3, about three times broader than deep; spots at sides of 1 isolated, subquadrangular, a little diverging posteriorly, consisting of longer, somewhat tufted, suberect hairs, the remaining spots compact, decumbent, though not raised above level of integument. Sternites fringed with longish black bristles at gradular lines; no white hairs.

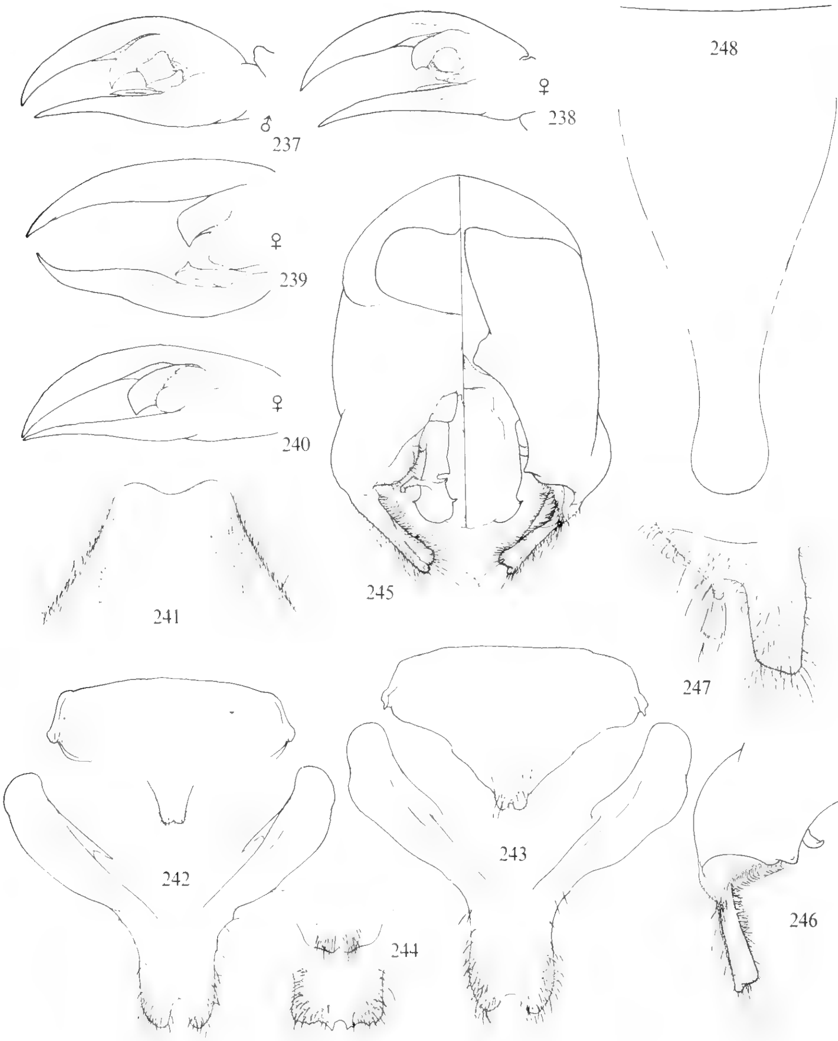
This conspicuous new species superficially resembles other fairly large-sized congeners, like *aegyptiaca*, *baeri*, *festiva* and *tuberculata*, but can be distinguished from all by a combination of characters. Its nearest ally would seem to be *aegyptiaca*. Apart from the differently shaped copulatory organs, the male disagrees with the latter by having much more enlarged white tergal spots, a shorter labrum, stronger antennae, broader and more outbent hind basitarsi, and by the very differently shaped 7th tergite. An additional feature separating the two is the sculpture of the outer face of the broad basal portion of the mandible, which in *aegyptiaca* is smooth and shiny with a few scattered punctures distally, whereas in *prophanta* this part is wholly finely striato-punctate. The differences between *prophanta* and the other species just mentioned are best understood by consulting the key and illustrations. It is impossible to associate the male of *prophanta* with the female of my "*lindbergi*", described from the same island of the group, but which has now proved to be synonymous with *aegyptiaca*, the male of which is wholly different from that of *prophanta*. The same applies to the supposed female of the latter, of the high mountains in Morocco, which is immediately distinguished from *aegyptiaca* by the shape of its pygidial plate. Hence we are confronted with two evidently related species occurring side by side in the same island of the north-eastern group of the Canaries. This is surprising and certainly needs confirmation. It is of interest to note that Dr. S. Erlandsson recently sent me a single pair of yet another *Melecta*, taken in Gran Canaria (San Bartolome, 9.iv.1973, leg. T. Palin), representing an undescribed species. I am reluctant to characterize these as new, because both specimens are in too poor condition to serve as types of a new taxon. At all events these discoveries indicate that the bee fauna of the Canary Islands is of high quality and unexpectedly rich in species. For some further remarks, see under *M. caroli* (p. 324).

Melecta festiva spec. nov.
(figs. 6, 16, 237—265, pl. 6 figs. 31—32, map 2, p. 303)

Melecta luctuosa var. *albovaria* subvar. *eczmiadzini*: Friese, 1895, Bienen Europa's: 163—164 (key: Kaukasus).

Type material. — France: 1 ♂ (diss., fig. 237, holotype) and 1 ♀ (diss., paratype), Callian (Var), 22.v.1963, W. Linsenmaier (both ex coll. Linsenmaier, ML).

Further material. — Switzerland: 1 ♂ (diss.), Wallis (Valais), Vesperterminen, S of Visp, 1250 m, 8.vi.1972, on *Thymus serpyllum* (figs. 16, 244), M. A. Lieftinck (ML); 1 ♀, Wallis, Useigne, 26.vi.1924, Th. Steck (NMB); 2 ♀, Valais, Sierre, vi.1949 and v.1950, W. Linsenmaier (CL & ML). — Italy:1 ♀, Piemonte, with square label / Susa (written) 108, "*Melecta punctata* F. Lep. *notata* Illig. Klug. Ped. ♀" (old writing), Spinola collection, supplement (MT); 2 ♂ (one diss., figs. 241, 247), Tirol, Bozen 1886 F. Kohl, *M. luctuosa* v. *albovillosa* (sic) and v. *albovaria* Er., det. Friese 1893 (NMW). — France: 1 ♀, Nyons (Drôme), coll. J. de Gaulle (MP); 1 ♀ (figs. 239—240), Vallouise (Htes Alpes), ca 400 m, 18.vi.1939, "*luctuosa*, white variety with convex plate anale", P. F. M. Verhoeff (ML); 1 ♀ (fig. 238) Bses Alpes, v.1891, coll. J. Vachal (MP); 1 ♂ 3 ♀ (diss.), Provence, Callian (Var), 17—18.vi.1930 & 8.vi.1931, Th. Steck (NMB); 1 ♂, 1 ♀, Callian (Var), 10.v.1959 & 2.v.1963, W. Linsenmaier (CL); 1 ♂, Les Arcs (Var), 18.iv.1939, W. Fassmidge (BM); 1 ♂, Beauvallon (Var), 7.iv.1967, O. W. Richards (BM); 1 ♂ (diss., figs. 242, 245), Grimaux (Var), 15—24.iv.1968, G. Barendrecht (MA); 1 ♂ (diss.), St. Aegulf (Var), 22.v.1954, W. Linsenmaier (CL); 2 ♀, Cap Camerat (Var), 5.v.1976, H. Wiering (MA); 1 ♀, Massif de Moures (Var), 8.v.1965, "flew together with 2 ♂ 2 ♀ *Habropoda tarsata* (Spin.) along



Figs. 237—248. *M. festiva*; 237, right hind tarsal claw, oblique dorsal view (♂ holotype, Callian, S France); 238, the same (♀, Basses-Alpes, S France); 239—240, right mid (239) and hind (240) tarsal claw (♀ Vallouise, Htes-Alpes, S France); 241, dorsal view of tergite 7 (♂, Bozen, Italy); 242, sternites 7 and 8 (♂, Grimaux, S France); 243, the same (♂, Castilia, Turkey?); 244, apices of sternite 8 (upper) and 7 (lower) (♂, Vesperterminen, Wallis); 245, partial ventral and dorsal view of genital capsule (♂, Grimaux, S France); 246, dorsal view of left gonostylus (same specimen); 247, lateral view of left gonostylus (♂, Bozen, Italy); 248, dorsal view of pygidial plate (♀, Gard, S France)

loamy wall at roadside near overgrown excavation", S. J. van Ooststroom (ML); 1 ♀, Montauroux (Var), 29.vi—6.vii.1970, P. M. F. Verhoeff (ML); 4 ♀, Bonnieux, 6.vi.1975 and Meyrargues (Vaucluse), 8.vi.1975, H. Teunissen (CT & ML); 1 ♀ (diss.), Carpentras (Vaucluse), 25.v.1952, P. M. F. Verhoeff; 1 ♀ (diss., fig. 248), Mas Méjean (Gard), 29.v.1962, H. Wiering (MA) 1 ♀, La Fontaine du Buis (Gard), 3 km S, 14.v.1971, R. Desmier de Chenon (MP); 1 ♀, Vernet-1.-B. (Pyr. or.), Col de Juell, 7.vi.1963, W. H. Gravestein (MA). — Spain: 1 ♀ (diss.), Arganda, SE of Madrid (= Montarco olim), 11.v.1964, W. Linsenmaier (CL); 1 ♂, Cuenca, Motilla, 8.iv.1955, I. H. H. Yarrow (BM). — Portugal: 1 ♂ (diss.), Sobreiral (probably nr. Famalicão, 20 km NE of Oporto, M. Diniz in litt.) (MUC). — Albania: 1 ♀ (diss.), Alban. Exp. 1918, Hodzha bei Prizren, 15.v, *M. luctuosa*, det. Maidl (NMW). — Romania: 1 ♂ (diss.), Mehádia (E of Belgrad), leg. Pável/17/1, *Melecta albovaria* Erichs., det. Mocsáry, *luctuosa* v. *albovaria calabrina* Rad., det. Friese 1893 (MBUD). — Bulgaria: 1 ♀ (diss.), Sliveu, Pavlasz (MBUD). — USSR: SW Russia, Gruziaya ? [Georgia]: 1 ♂ (diss., pl. 6 fig. 31 & 259—260), "Kauk. 1885" (written), "*M. eczmiadzini* Rad. mit Typ. vergl [ichen]", det. Friese 1893, "Typus" (print on orange), labels of H. Friese, with additional label "holotype *M. alecto* spec. nov. in litt. Lieftinck" [not *M. alecto* spec. nov., huj. op.!] (MNB); 1 ♂ (diss.), S. Russia, Crim (written), Slg. Alfken (MNB); 1 ♀, Armenia, 18 km. Erevan, 11.vii.1963, A. Giordani Soika (MP); 1 ♂ (diss.) 3 ♀ (id.), Turkestan, Gouldscha/Ferghana 1905 Korb (print) (MBUD, ML). — Turkey (Asia minor): 1 ♀ 1 ♂ (both diss., fig. 243 and pl. 6 fig. 32), labelled in identical handwriting "Mesopotamia Malatia 1886" (err. pro Malatya, in E central Turkey!) and "Mesopotamia Castilia 1886", respectively, ♂ moreover with "12" (written on red) and "74b/125" (black-rimmed cadre), the ♀ with "74b/100" (same cadre), ♂ with *Melecta luctuosa* v. *albovaria* Rad., det. Friese 1893 (both MBUD; 1 ♂ (diss., figs. 256—258), Sultan Dag, 1500 m, 22.v.05, ex coll. C. & O. Vogt (MA); 2 ♂ (both diss.), Turkey, Mut, Sertavul, 1300 m, 7.vi.1968, and Asia minor, Cardak, 7.vi.1964, J. Gusenleitner (figs. 261—264); 7 ♀ (all dis.), Turkey & Asia minor, Mut, Sertavul, 1300 m, 1—2.vi.1967 (5 ♀, fig. 265), 7.vi.1968 (1 ♀), same loc., 1600 m, 22.v.1970 (1 ♀), all J. Gusenleitner (CG, ML); 2 ♀ (diss.), Turkey, Sertavul-pan bei Ulut, and Karuman, 20.vi.1969, both W. Linsenmaier (CL); 2 ♂ 1 ♀ (diss., figs. 253—255), Türkei, Östl, Sirnak/Siirt, 4.vi.1977 (♀), E. Uludere Hakkari, 5.vi.1977, and Pass E. Uludera, 6.vi.1977 (2 ♂), all K. Warncke (CKW, ML); 3 ♂ 12 ♀ (all diss.), Türkei, Nevsehir-Ürgüp, 6.vi. (2 ♀), Icel-Sertavul, 1400 m, 9.vi. (3 ♂ 1 ♀), and Konya-Karamon, 9—11.vi.1978 (8 ♀), all Max. Schwarz (CMS, ML); 1 ♀, Turkey, Amasya, 1400©, 4.vi.1959, K. M. Guichard (BM); 6 ♀, Bileçik, 27.v.1964 (1 ♀), Eskisehir, 28.v.1964 (1 ♀), Beysehir, 4—6.vi.1964 (1 ♀), Konya, 15.vi.1968 (3 ♀), all J. Gusenleitner (CG & ML); 1 ♀, Konya, 1030 m, 11.v.1966, K. Kusdas (CJH); 1 ♀ (diss.), Turquie, Ulukişla, 1500 m, 1 km avant Col de Caykavak Geçidi, "fond de combe très riche en fleurs", 28.vi.1976, R. Desmier de Chenon (MP); 6 ♀ (diss.), As. Türkei, Elazig, 28—29.v.1975 (2 ♀), and 9.vi.1976 (4 ♀), J. Heinrich, *M. luctuosa* v. *albovaria* Fr., det. J. Heinrich 1975 (CJH & ML); 1 ♀(diss.), As. Türkei, Ürgüp, 17—19.vi.1976, J. Heinrich (CJH); 1 ♂, Asia minor, Beysehir See, NW Ecke, 5.vi.1964, H. Hamann (CMS); 2 ♀(diss.), Turkey, Erzurum, 20 km Ispir-Ikizdere Rd., 1700 m, 1—2.vi.1962, Guichard & Harvey (BM); 1 ♂(diss.), Turkey, Erzurum, 15.vi.1967, H. Oxizek (CKW); 1 ♀(diss.), Turkey, Ankara, Polatli, 800 m, 2.v.1962, Guichard & Harvey (BM). — Rodos I (Greece): 2 ♂ (diss.), Profitis Ilias, 800 m, 3.v.1971, M. A. Lieftinck (ML); 1 ♀, Kamiros, 17.iv.1970, H. Teunissen (ML); 4 ♀, 10 km N of Malona, 11.iv.1970, A. C. & W. N. Ellis (MA). — Israel/Jordan: 1 ♂(diss.), Jerusalem, 800 m, 20.iii.1975, K. M. Guichard (BM); 1 ♀ (diss.), Judaean Highlands, Artüf (?), 12.iv.1923, P. A. Buxton, *M. ashabadensis* Rad., det. B. Uvarov (BM), 1 ♀ (diss.), Eshtaol, Kesalon Valley, 300 m, 1.v.1975, K. M. Guichard (BM); 3 ♀ (diss.), Jerusalem, 23.iii, 23.iv. & 7.v.1947, H. Bytinski-Salz, *M. aegyptiaca*, det. Mavromoustakis (CGS); 2 , Ramat Gan, 6.iii.1942, *M. luctuosa* var., det. Bytinski (CBS) and same loc., 4.v.1951, P. M. F. Verhoeff (ML); 1 ♀, Jericho, 9.iv.1943, H. Bytinski-Salz (CBS); 4 ♂ 1 ♀ (all diss.), Israel, Mt. Hermon, 1650 m, 8.vi.1975, Kugler (1 ♂ 1 ♀), same loc., 1700 m, 11.vi.1976, D. Simon (1 ♂), same loc., 1800 m, 11.vi.1976, A. Freidberg (1 ♂), same loc., 1400 m, 31.v.1978, D. Furth (1 ♂) (CBS, ML); 2 ♀ (diss.), Israel, Jerusalem, 12.iii.1937/122 & 25.v.1937, at *Satureia*, leg. Kugler (CBS); 1 ♀, Palestine, Jerusalem, 25.v.1937, J. Wahrman (CBS). — Greece: 3 ♀, Attica (1 ♀), Graecia, Doris, v. Oertzen (1 ♀) and Graecia (1 ♀), all ex coll. C. & O. Vogt (MA); 15 ♂ (all diss., figs. 249—252, Graecia, Peloponnes, Chelmos, 1900—2100 m, 1—4.vi.1962, Max Schwarz (CMS, ML); 1 ♂ (diss.), Greece, Mt. Parnes, 600 m, 17.iv.1977, K. M. Guichard (BM); 1 ♀, Peloponnes, Athen, Acropolis, 21.v.1962, H. Hamann (CMS); 1 ♂ (diss.), Euboea, Steni, iv.1926, Holtz (MNB); 2 ♂ (diss.), Griechenland, Euböa, Stehni, 800 m, 4—11.v.1956, and Frioni, Olymp, 1000 m, 3—13.vi.1956, both Fr. Borchmann (MKB, ML); 1 ♀ (diss.), Ellas, Athene, berg Imitos, 1.v.1963, S.

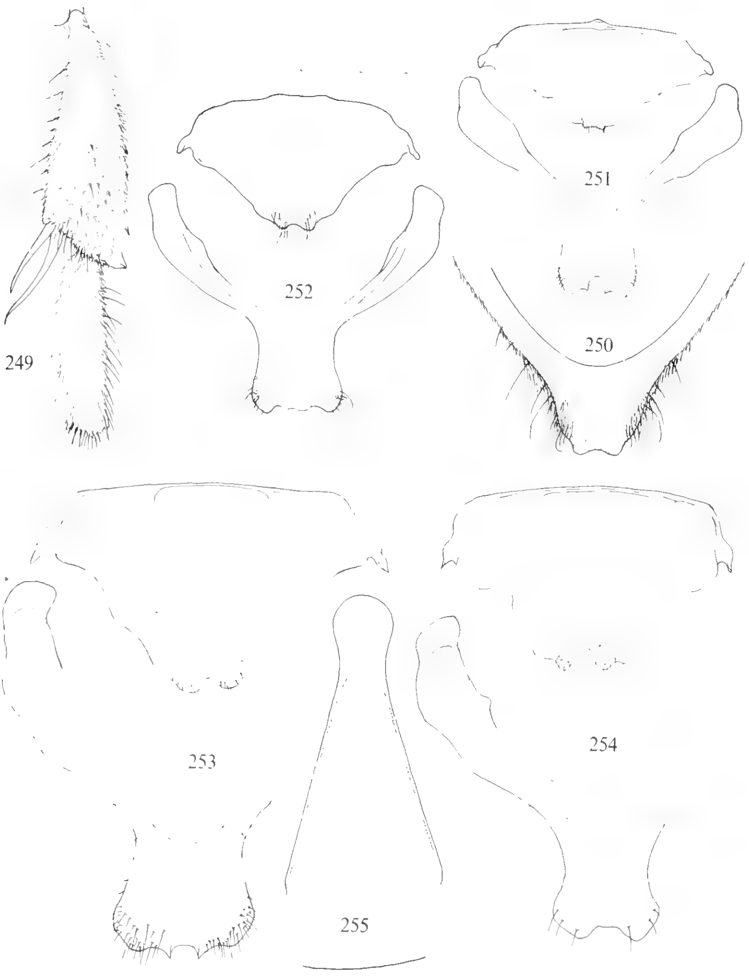
Daan & V. van Laar (MA); 1 ♀, Cumani, Brenske, *M. luctuosa* Scop.? det. Friese 1893 (MBUD); 1 ♀ (diss., fig. 255), Graecia, Peloponnes, Vytina, westlich Tripolis, 20.v.1962, W. Linsenmaier (CL).

Doubtful material. — USSR: 2 ♀ (diss.), Süd-Turkestan, Digai, 18.vi.1913, leg. K. Küchler (SMF, ML); 1 ♀ (diss.), Turkestan, O. Chaffanjon, 243—95 (MP); 1 ♀ (diss.), Turkestan, Fluss Üsek, v.1909, coll. C. & O. Vogt acq. 1960 (MA); 1 ♀ (diss.) Transcasp. Ashabad (MBUD); 1 ♀ (diss.), Transcauc. Derbent 1886, *M. luctuosa*, det. Kohl (NMW); 1 ♀ (diss.), Turkestan, Mts. Ghissar, F. Hauser 1898 (NMW). — Crete: 4 ♀ (identity uncertain), Creta Biró, Herakleion 1906 (3 ♀) & Anoya, 2.vii.1906 (1 ♀) (MBUD). — Cyclades: 2 ♀ (identity also somewhat doubtful), Cyclades, ex coll. C. & O. Vogt (MA) and Cyclades (MCG).

A richly spotted species, averaging a little smaller than *tuberculata* but resembling that species fairly closely in general morphology and pubescent pattern.

Male. — The following differences are worthy of note. Maxillary palpi (both sexes) 6-segmented, relative lengths of separate segments variable, but 2—5 usually subequal and always longer than 1 and 6. Antennae as described for *tuberculata* except that segment 3 is relatively shorter and only little longer than 4. Punctation on disk of mesonotum coarser, the punctures slightly larger, lacking interspaces and even more or less coalescent in places; scutellar spines variable though frequently a little downbent and generally longer than in *tuberculata*. Mid tibia relatively shorter, less markedly broadened from base to apex; outer face of hind tibia rugose, more coarsely tessellate-punctate, with 9—12 irregular black spicules shining through the pubescence. Hind basitarsus similarly outbent but a little shorter and less slender than in *tuberculata*, about three times as long as the greatest breadth at a point slightly beyond half-way its length; surface reticulate-punctate but, like *tuberculata*, mostly concealed from view by short, appressed white hairs. Inner ramus of fore tarsal claw about three-fourth length of outer, those of mid and hind legs much shorter, at most a little over one-third length of main branch (fig. 237); outer faces of remaining tarsal segments white-haired. Colour and neuration of wings much as described for *tuberculata*: shape of submarginal cells equally variable and not appreciably different, except that the fore wing membrane is somewhat darker (in the female, on the contrary, usually less obscured than in *tuberculata*!). Abdomen more gradually tapered posteriorly, the paired white pubescent spots on 2—5, though about equal in size and shape, accordingly more closely approximated, than in *tuberculata*. Integument of all tergites still more shining than in the latter, the setiferous punctures finer, more widely spaced, the raised hairs consequently somewhat shorter and more sparsely distributed.

Tergite 7 shaped similarly to *tuberculata*, sculpture of exposed portion equally variable: coarsely striato-punctate, but median area frequently slightly hollowed out, transversely striated, occasionally feebly ridged on either side of the middle; apex subtruncated, smooth and bare, the hind border brownish, shallowly emarginate, a little swollen with upturned rounded angles; ventrally, the folded apical rim carries a pair of curved, converging ridges similar to those seen in *tuberculata*. Like the tergites, the whole surface of the sternites 1—4 is distinctly more shining, the punctation finer, more superficial, than in *tuberculata*, leaving broader and almost impunctate posterior margins on 2—4; pubescence shorter



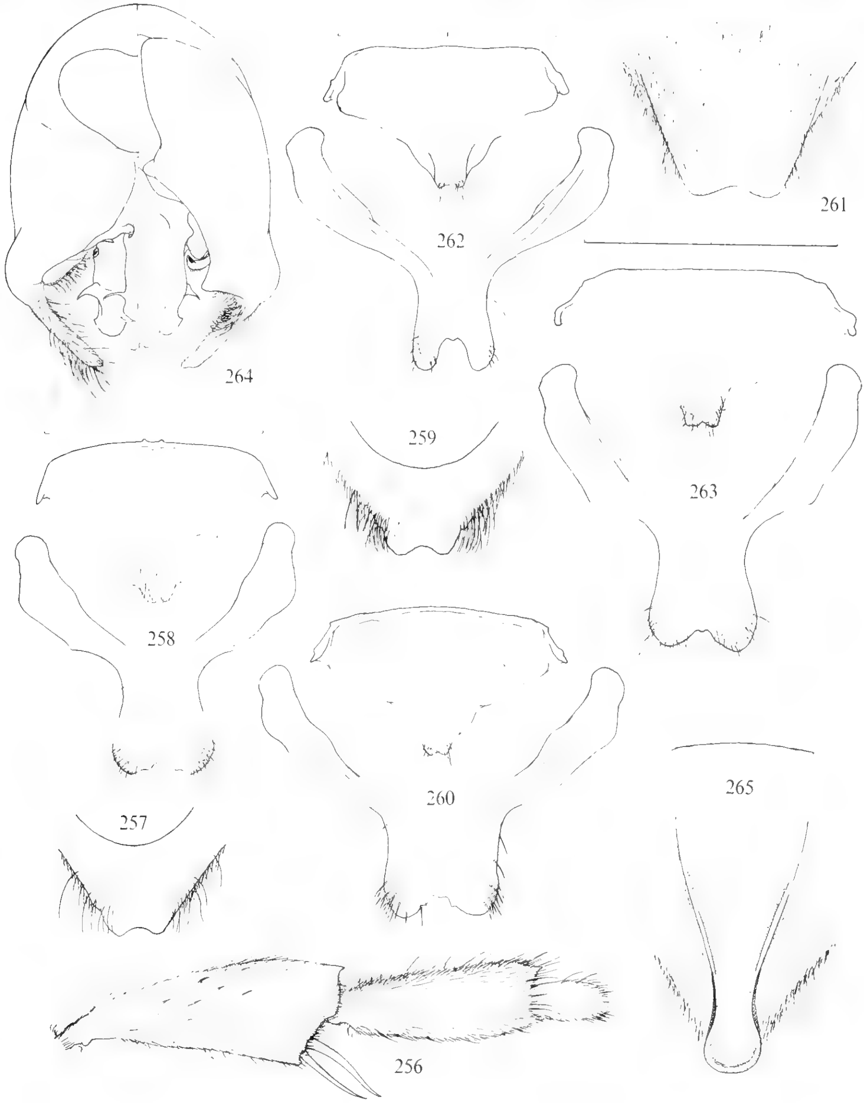
Figs. 249—255. *M. festiva* (♂ ♀ Greece); 249, external view of left hind leg (♂, Chelmos); 250, ventral view of tergite 7 (same specimen); 251-252, sternites 7 and 8 (2 ♂, same locality; scale line 1 mm); 253—254, sternites 7 and 8 (2 ♂, Uludera, Turkey); 255, dorsal view of pygidial plate (♀, Tripolis, Peloponnesus)

and less dense, hair fringes in front of gradular lines also thinner, but white submarginal tufts frequently present at either side of 3—4 (or 5). Posterior border of sternite 5 straight, surface closely punctate; exposed portion of sternite 6 bluntly triangular in outline, as in *tuberculata*, closely punctate, the median area elongate, somewhat hollowed out, thinner and lighter in colour than the side portions, the latter forming a pair of low, unapparent ridges placed in the long axis and not visible in profile. Sternal plates 7 and 8 as in figs. 242—243. Basal arms of 7 more broadened, hollowed out and incurved than usual, the anterior margin of each, about halfway its length from base, with a tiny recurved process; median plate subparallel-sided and fringed on either side with many setae; its apex variable in outline, either rather abruptly truncated with subcircular and narrow emargination (Wallis, and one from France, fig. 244), or a little longer with more rounded side-edges and more deeply emarginated (France and Spain, figs. 242—243). Sternite 8 relatively broad in all dissected specimens, up to twice as broad as its median length, apex suddenly narrowed and a little excised (same figs.), but in a male from Wallis a little shorter and broader and also more deeply excised than shown in the sketches. All dissected specimens agree in the form of the genital capsule and gonostylus: in dorsal view the inner apical angle of the gonocoxite is sharply pronounced, hooked inward, but the angle itself more or less rounded; gonostylus not very long and perfectly straight, laterally compressed with obliquely truncated apex, which in some specimens is slightly emarginate, the inner and outer (basodorsal and basoventral) processes shaped as shown in figs. 246—247. Genital capsule (incl. gonostylus) of moderate size, 1.7—1.8 mm.

Female. — Sexual dimorphism less pronounced than in many other species, the alternating black and white pattern of the thoracic dorsum not as markedly contrasting is in species like *grandis*, *baeri* a.o., the anterior mesonotal black dots diffused. Labrum squarish, broadest about middle, distal half usually with distinct carina terminating in a small tubercle, the anterior border slightly emarginate. Median mesonotal line not impressed but evenly, finely raised; parapsidal lines short, often obliterated and replaced by an irregular area with few punctures. Sculpture of propodeum obviously also variable, frequently throughout coarsely, closely punctate, but triangle occasionally with finely chagreened, somewhat shiny, trapezoidal impunctate area in front of propodeal pit, its presence or absence apparently quite independent from locality (e.g. examples from S. France). Sides of posterior sclerites (black in *grandis*!) clothed with abundant long white hairs. Much longer white tufts behind wing bases almost fused together with smaller ones projecting from beneath scutellar spines, which themselves are directed obliquely upward and backward, though varying in shape and length. Inner face of hind femur more sparsely punctate than in *grandis*, setiferous punctures rather deep and of different sizes, those toward blunt median ridge becoming scattered on more shiny ground, carrying long erect hairs. At least basal two-thirds of outer faces of mid and hind tibiae white, those of tarsi usually also more or less white; tips of all black spicules visibly projecting from the soft pubescence. White tergal spots placed more inward and much larger than in *grandis*, those at sides of 1 subcircular, with many of the raised hairs at outer edges shorter than in male, these same spots often almost connected across middle at base by a thin collar of erect hairs, similar to *grandis*. Spots on 2—4 more compact than in male and distinctly transverse, broadest on tergite 3 and subequal in width to the black interspace. Suberect gradular bristles at tergal sides and sternites quite distinct, only little shorter than in *grandis*.

Body size very variable. Some measurements are: ♂ holotype, length 13.8 mm, fore wing 10.7 mm, wing expanse 24 mm; ♀ paratype, 15 mm approx., and 10.5 mm, respectively. Further specimens, ♂ length 11—16.5 mm, for wing 8—11 mm; ♀ 12—17 mm and 9—11.5 mm, respectively. Wing expanse (pl. 6 figs. 31—32), 25—26.5 mm, respectively.

With good series of either sex, taken together in one locality, discrimination between *festiva* and *tuberculata* (next to be described), offers no great difficulties, because the sexual characters of each, particularly those of the males, are quite specific. Without uncovering the pygidial plates of the females it is, however, less easy to separate them, so that a number of features apparently only of secondary



Figs. 256—265. *M. festiva*; 256, external view of left hind leg (♂, Sultan Dagh, Turkey); 257, ventral view of tergite 7 (same specimen); 258, sternites 7 and 8 (same specimen); 259, ventral view of tergite 7 (♂ syntype *M. eczmiadzini*, Caucasus); 260, sternites 7 and 8 (same specimen); 261, dorsal view of tergite 7 (♂, Sertavul/Mut); 262, sternites 7 and 8 (same specimen); 263, sternites 7 and 8 (♂, Cardak, Turkey); 264, partial ventral and dorsal view of genital capsule (same specimen); 265, dorsal view of pygidial plate (♀, Sertavul, Turkey). All scale lines 1 mm

importance, such as the shape and armature of the legs, presence or absence of white-tufted scutellar tubercles, etc., must also be taken into consideration. Infraspecific variation is considerable in this species. For instance, on comparing the sketches figs. 237—248 of morphological structures, with figs. 249—265 of the same details, some striking differences can be observed between the shapes of the hidden sternal plates of the male. In a general sense, the former are taken from the more typical, western populations of *festiva*, the latter from those occurring in the eastern parts of the Mediterranean and Turkey. As a matter of fact, however, only the specimens from Chelmos in the Peloponnesus (S Greece) are a little different from the rest by their smaller average body size (only 12 mm); unfortunately no females were taken with them. All other specimens of more eastern distribution are indistinguishable from western examples. As to the drawings compared, it must be said that these are selected extremes, to demonstrate differences as well as local conformities (cf. e.g. figs. 252—254), many intergradations existing.

Distribution. — Discontinuously, from Iberia, S France (terr. typ.), S Switzerland, NW Italy and, scatteredly, through Greece and the Balkans eastward via Turkey probably far into Transcaspia and Turkestan (see arrows on map 2).

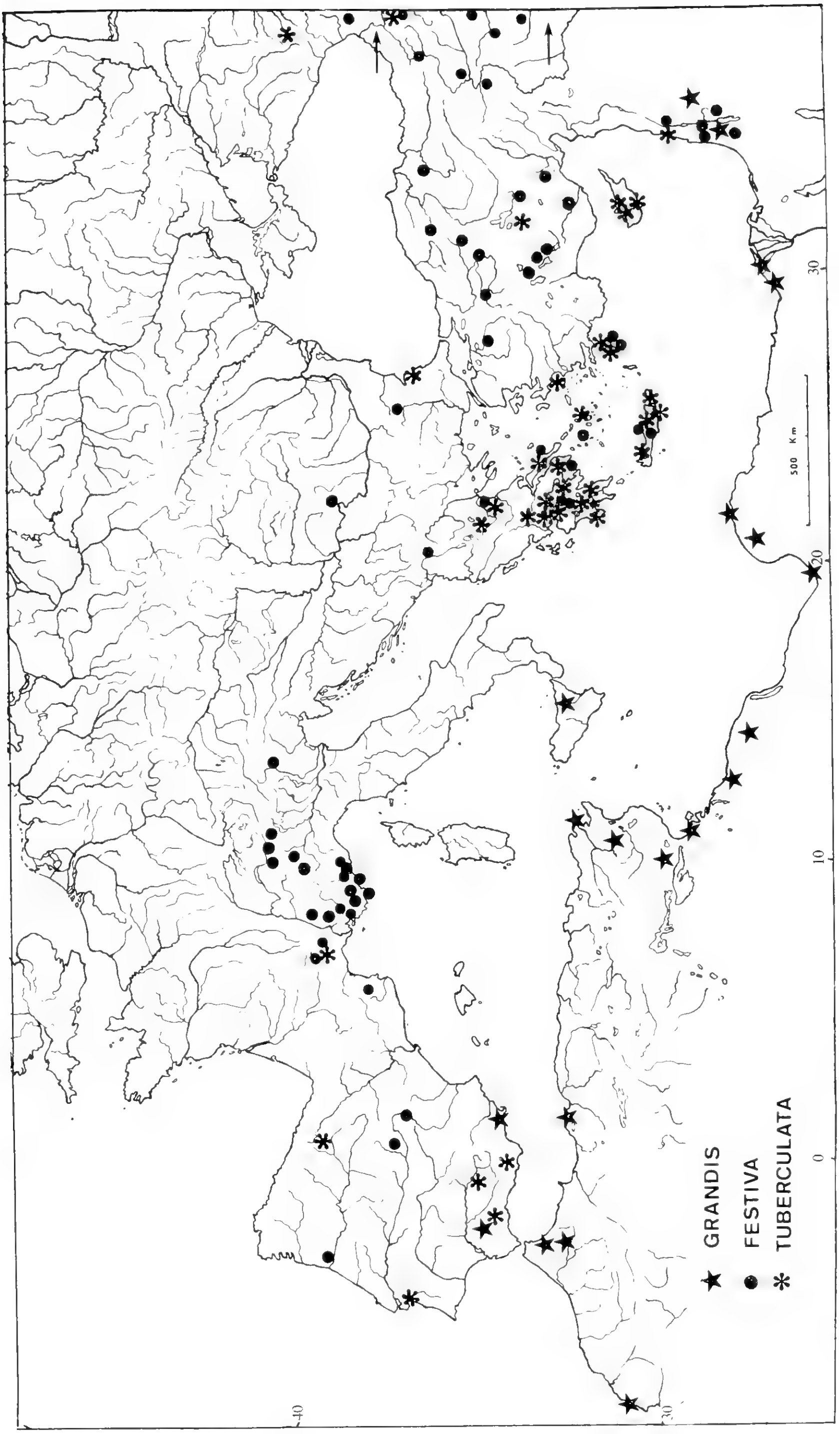
Melecta tuberculata spec. nov.
(figs. 266—274 & pl. 6 figs. 35—37, map 2, p. 303)

Type material. — Rodos I. (Greece): 1 ♂ (holotype, with *Ophrys* (?) pollinium upon middle of frons) 1 ♀, Fileremos, 300 m, 19.iv.1971, M. A. Lieftinck (ML); 4 ♂ (diss., figs. 226—267), same locality and dates as holotype, id. (ML); 1 ♀, Fileremos (Ialissos), 21.iv.1970, D. C. Geijskes (ML). The latter specimens of either sex are paratypes.

Further material. — Rodos I. (Greece): 1 ♂, Petaloudes, 500 m, 22.iv.1971, M. A. Lieftinck (ML); 1 ♀, Epta Piges, ca. 50 m, 7—8.v.1971, M. A. Lieftinck (ML); 10 ♂ (diss.), Profitis Ilias, 800 m, 3.v.1971, M. A. Lieftinck (ML); 8 ♂ 2 ♀, Profitis Ilias, 800 m, 20.iv.1970 (6 ♀), Ataviros, 18.iv.1970 (2 ♂), Rodini, ca. 150 m, 22.iv.1970 (2 ♀), all H. Teunissen (CT, ML); 1 ♂ 4 ♀, Fileremos, 23.iv, Epta Piges, Kalithea, 1.v, Faliraki, 25.iv.1976, all H. Teunissen (CT, ML); 7 ♂ (diss.) 4 ♀, Rhodes, Aegios Isodores, Festa (5 ♀), M. Ataviro, Rodi, Festa, one *M. luctuosa* Scop., det. Zavattari (2 ♂ 1 ♀), and Kattabia, Rodi, Festa (3 ♀), all leg. E. Festa, iii-iv.1913 (MT, ML); 5 ♀, Lindos, 10.iv.1970 (3 ♀), Kalathos, 5 km N of Lindos, 2.iv.1970 (1 ♀), and 10 km N of Malona, 13.iv.1970 (1 ♀), all A. C. & W. N. Ellis (MA); 1 ♀, Stadt Rhodos, Oertzen (MNB); 1 ♂, Rhodus, Hedenb. (NRS); 1 ♂, Rhodos, Profitis Ilias, 8.v.1975, H. Malicky (CG); 1 ♀, Rodi, 17.iv.1928, *M. luctuosa* Scop. ♀, det. Hedicke 1931 (IEB); 1 ♀, Rhodos, Fileremos, 29.iii.1977, at *Anchusa hybrida*, A. Nilsson (DEU). — Samos I: 1 ♀, Kokkari, 25.iv.1977, H. Teunissen (CT). — Cyclades: 1 ♂ (diss., fig. 268), 1772, Naxos I. (ML). — Crete: 1 ♀, Kriti, Nom. Iraklion, Malia, 18.v.1972, M. C. & G. Kruseman (MA); 1 ♀, O. Kreta, Sitia, 8.v.1942 & 1 ♀, Kreta, Chanea, 24.iv.1942, Kl. Zimmermann (MNB); 3 ♂, Kreta, Omalos Ebene, 1000 m, 26.iv.1942 & 11—16.vi.1942, Kl. Zimmermann, one with *M. aegyptiaca* Rad., det.? (MNB) 1 ♂, Ost-Kreta, Hochebene Nidha, 1418 m, 11.v.1925, A. Schulz, *M. armata* v. *albovaria* Er., det. Alfken (MNB); 2 ♀, Ost Kreta, Iraklion, (Gándia), 29.iv.1925, and Kloster Apésanäs, Ep. Käntergion, 20.v.1925, A. Schultz, *M. luctuosa* Scop., det.? (MNB); 1 ♀ (diss.), Kreta, östl. Jerapetra, 8.iv.1971, Dr. Malicky leg., H. Kusdas (CG); 5 ♀, Amnissos beach and Anogia-Axos, 16—23.iv.1972, D. C. Geijskes (ML); 1 ♂ (diss.), Kreta, Hersonissos, 14.iv.1976, M. van Lookeren Campagne (coll. R. Leijs); 1 ♀, Crete, Katharo, Lassethe, 4000 ft., D. M. A. Bate (BM); 2 ♂, Crete, Arkhanes, 28.iv.1972 and 2 ♀, Chania, 15.v.1972 & 1.v.1974, K. M. Guichard, one ♂ with 2 orchid pollinia attached to clypeus (BM); 1 ♂, Creta, v.O., ex coll. Vogt acq. 1960 (MA); 1 ♀, Kriti, Festos, 11.v.1965, F. Keiser (NMB); 1 ♀, Creta, Herakleion, Biró 1906 (MBUD); 25 ♀, W Creta, Herakleion, 22—25.v.1963 (4 ♀), Sitia and Knossos, 17—20.v.1963 (20 ♀), 3 ♀ K. Kusdas, all others J. Gusenleitner & Max. Schwarz (CG, CMS, ML); 1 ♂ (diss.), Kreta, Mitki, 13.iv.1971, leg. Malicky, K. Kusdas (CJH); 1 ♂ (diss.), Arkanes, 4.v.1972, at *Borago officinalis*, J. van der Vecht (ML). — Greece (mainly continental): 1 ♀, Chalkis, Euboea, iv.1926, Holtz (MNB); 1 ♂ 1 ♀ (diss.), Athen, Lange 1872, *M. luctuosa* v. *albovaria* Er., det. Friese 1893 (NMW); 1 ♂ (diss., fig. 270), Athen, Akropolis, 12.v.1963, Max. Schwarz (CMS); 1 ♀ (fig. 274), Athen, Melissia, 31.v.1966, W. Linsenmaier (CL); 4 ♂ 1 ♀, Graecia, Delphi, 2.iv.1966, W. Grünwaldt, and 1 ♀, Souli, 5.v.1973, W. Grosz (CWG); 1 ♂, Greece, Attica, 1915.412, Fossberg (BM); 1 ♀, Griechenland, Attika, Th. Krüper (NMW); 1 ♀, Olympia, Schmiedeknecht (SMF); 3 ♀, Griechenland, Olympia, Prioni, 1000 m, 3—13.vi.1956 (♀), Gorgopotamos, Oitigebirge, 800 m, 26—28.v.1956 (♀) and Euböa, Stehni, 800 m, 4—11.v.1956 (♀), all Fr. Borchmann (MKB); 3 ♀, Greece, M. Veluchi [Velouchi], Emvritania, 1000 m, 15—19.vi & 12—1400 m, 13.vii, Holtz (MNB); 12 ♂, Centr. Greece, Pilion, Portaria, 3—4.vi.1971, J. van der Vecht & P. M. F. Verhoeff, flower 51 (ML); 1 ♀, Greece, *M. luctuosa* Scop., det.? ex coll. Vogt acq. 1960 (MA); 1 ♀, Macedonia centr., Shar-Planina, Vratnica, 900 m, 21.vii.1956, F. Daniel (ZSM); 1 ♀, Graecia, Megalopolis, 8.vi.1963, W. Schläfle (CL); 1 ♀, Peloponnesus, Zachlarou, 700 m, 20.vi-3.vii.1958, R. Loberbauer (CG); 1 ♀, Peloponnesus, Altkorinth, 3.vi.1963, J. Gusenleitner (CG); 8 ♀, Peloponnesus, Xylokastron, 28.v.1966 (♀), 18 km südlich Tripolis, 4—6.vi.1961 and 19.v.1966 (4 ♀), Korinthos, 9—23.v.1962 (3 ♀), all W. Linsenmaier (CL, ML); 11 ♀, Peloponnesus, Kalamata, 11—14.v.1964 (3 ♀), Zachlarou, 27.v.1964 (♀), xK Korinth, 23.v.1962 (♀), Alt-Korinth, 5.vi.1963 (♀), and 20—31.v.1964 (5 ♀), all M. Schwarz (CMS, ML). — Cyprus: 1 ♂, Cyprus, Lakkavoumera Forest, Kythrion foothills, 6.iv.1950, N. Waloff, with cluster of 8 bright orange orchid pollinia adhered to frontal area (pl. 6 figs. 36—37) (BM); 1 ♂ 1 ♀, Cyprus, 10.iv.1928, G. Mavromoustakis, *M. luctuosa* var. *crassicornis* Fr., det. Enslin, coll. Pillich (MBUD); 1 ♀, Cyprus, 9.iv.1924, *M. luctuosa crassicornis* Fr., det. Mavromoustakis (MCG); 1 ♂ 6 ♀, Limassol, 14.iii.1924, 15.iii.1927 (♂ *M. aegyptiaca*, det.?), 3.iv.1928, 15.iii.1931, and 1.v.1932, all G. Mavromoustakis, *M. luctuosa crassicornis* Fr., det. Mavromoustakis, 1 ♀ with "*luctuosa*-Gruppe", Slg. Alfken, det. Alfken (MNB, BM); 1 ♂ 1 ♀, Nelondia, 18.iii.1926 (♂) and (illegible) 16.iii.1931 (♀), Nos. 1—2 (MNB, ML); 2 ♀, Kyrenia, 22.iii.1932, E. E. Green (BM); 4 ♂ 3 ♀, Cyprus, Antifanitis, 12.iii.1971 (2 ♂) and Dhavlos, 10.iv.1971 (2 ♂ 3 ♀), all K. M. Guichard, sub *M. albovaria*, det. Guichard (BM); 1 ♀ (diss.), Cyprus, Limassol, Yermasoyia, 11.3.1979 (one day earlier than 1 ♀ *M. megaera* sp. n.), L. A. Janzon (NRS). — Turkey (Asia minor): 1 ♀, Asia min. (MCG); 1 ♂, Asia min., Obruk, 3.vi.1964, H. Hamann (CMS); 1 ♂, Karakurt, Arastal, 23.v.1975, Kl. Warncke (CKW). — Lebanon: 1 ♂, Syria, Beirut/12, Stoll, *M. aegyptiaca*, det.? (MNB). — Israel: 1 ♂, Jerusalem, 25.v.1937, at *Satureia*, leg. Kugler, and 1 ♂, Jerusalem B.G. 7.iv.1950, J. Wahrman (CBS, ML); 1 ♀ (diss.), Israel, Elat, 29.iv.1974, A. Freidberg (CBS). — USSR: 1 ♀, "Russ. mer., Tausch" (MNB). — Bulgaria: 2 ♂ 2 ♀ (diss.), SE Bulgaria, S of Burgas, Arkutino (Black sea coast), vi-vii.1970, K. Bleyl (CJP, ML). — France: 1 ♂, Gallia mer., Dohrn, Coll. Makl (three printed labels), *M. punctata*, det.? (MH); 1 ♀, sine loc., coll. J. Pérez 1915 (MP). — Spain: 2 ♂, Hispania, *M. aegyptiaca*, det. Friese 1904 (MNB); 1 ♀, Spain, Burgos (Castilia), Aranda de Duero, 1.vii.1973, Z. Boucek (BM); 1 ♂ (diss., figs. 271—273 & pl. 6 fig. 35), S. Spain, Jaen, Vadillo de Castril, S. Cazosla, Mateu-Cobos leg. (ex coll. Verges, ML); 1 ♀, S Spain, Andalusia, with "Andlsie coll. J. Pérez 1915" (MP); 1 ♀, Granada, Sierra Alfacor, H. Reisser (ex NMW, ML). — Portugal: 1 ♀ (diss.), Estoril [Lisboa], 13.iii.1896, coll. Yerbury (BM).

A robust black species with well defined white markings, clear-winged (♂), or with fore wing much obscured (♀). The following descriptions are based on specimens of either sex from the Greek islands of Rodos, Cyprus, Crete and Naxos, which are considered "typical" and very similar to the male from France and the pair from Spain. Individuals from continental Greece are generally darker on head and thorax segments than the rest, the female also having darker wings.

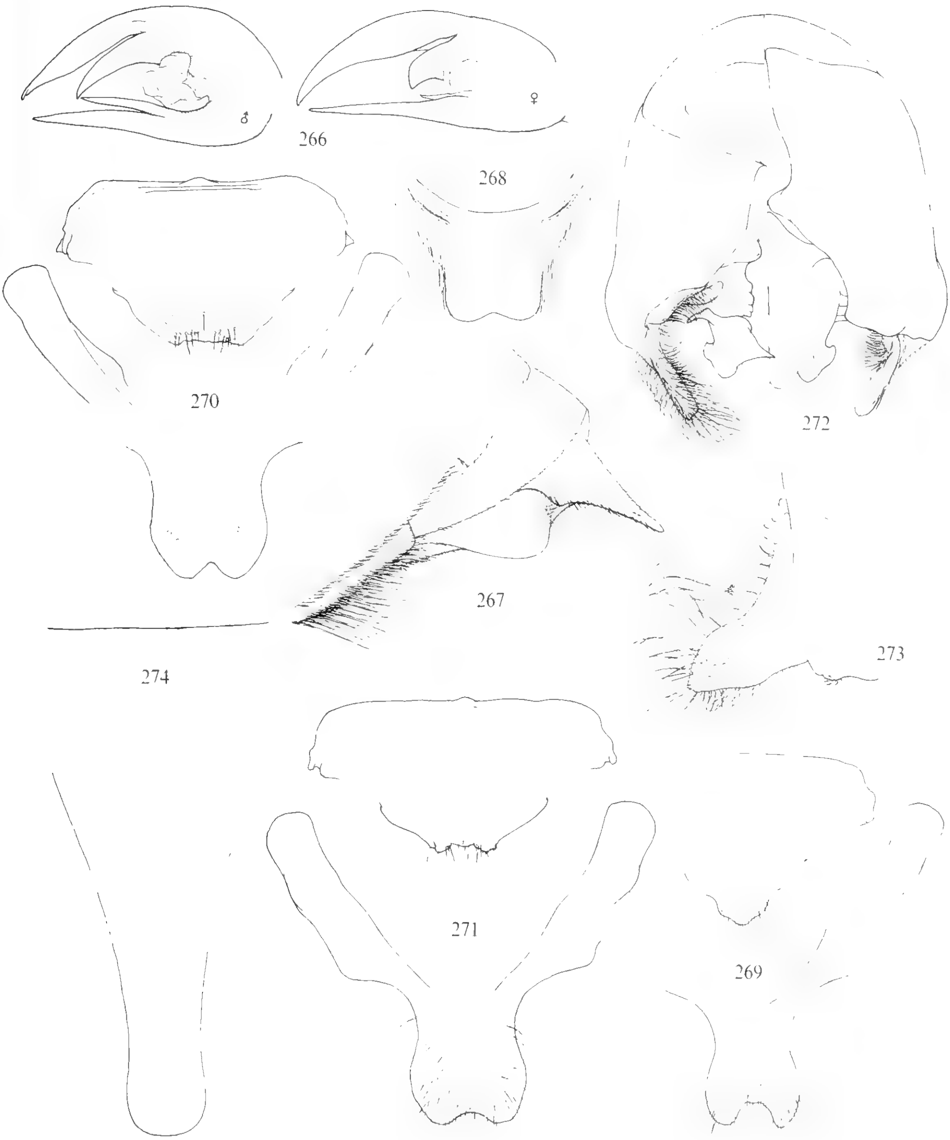
Male. — Integument deep black, only mandibles distally often more or less brown. Labrum subrectangular, only little longer than its width at base, surface except on top of basal tubercles, very coarsely punctate, punctures partly coalescent and often with feeble indication of a median crest about halfway length; disk slightly concave, free margin not raised, straight or shallowly emarginate. Maxillary palpi usually 5-segmented, but a short 6th segment frequently also present; relative lengths variable, 1 and 6 usually the shortest and 3—4 generally a little longer than 2. Mandible-bases smooth and shiny, sparsely striato-punctate. Clypeus but little convex, closely punctate. Head for the rest densely, rather deeply punctate, punctures lacking interspaces and often partly confluent, except a small area just beside each of the lateral ocelli. Antenna strong, reaching back to end of tegula, scape cylindrical, broadest apically and somewhat curved, much longer than 3, which is about one and one-third as long as 4, flagellar segments from 3 onward square or almost so; rhinaria distinct on segments 3—13, elongate on 3, circular on succeeding segments, all deeply impressed. Punctures on disk of mesonotum deep, circular and of one size, the interspaces mostly less than the diameter of one puncture; anteriorly, on either side of parapsidae, scutellar area, propodeum and pleurae the punctures are still more crowded and coalescent in places; propodeal triangle finely punctate and frequently partly tessellate or glabrous. Tegulae superficially punctate on basal half, more scatteredly so distally, surface either smooth and shiny or minutely striato-tessellate. Scutellum convex, median sulcus shallow, tubercles short, variable in length and form (occasionally a little curved), usually nipple-shaped but frequently vestigial or barely indicated. Femora and tibiae not unusually expanded or armed; mid tibia evenly broadened to beyond halfway length and slightly convex above; few apical spicules, dorso-apical tooth short, spur almost straight. Hind tibia normal, outer surface convex, evenly, finely reticulate-punctate lacking spines, its apex truncated, with some thick marginal setae and very short, bluntly triangular dorso-apical tooth; spurs normal, the inner one longest, gently curved. Tarsi thin and slender, depressed, hind basitarsus subparallel-sided, little expanded, about twice as broad as mid basitarsus, slightly but distinctly outcurved and 3.4 times as long as its greatest breadth about halfway length, apex truncated with short dorso-apical tooth and row of strong setae; outer face somewhat hollowed out, reticulate-punctate but surface mostly hidden under pubescence. Inner ramus of all tarsal claws about ¾ or a little less length of outer, all slender, evenly curved and acuminate. Wing veins dark, second and third submarginal cells variable in shape and length, the third relatively short, not or scarcely longer than high, but apex strongly angulated; membrane of fore wing subhyaline, the apicial border gradually enfumed (pl. 6 fig. 35). Abdomen relatively broad, subcordate, tergites only moderately convex, considerably broader than high, segments tapering rapidly posteriorly; dorsal surface very shining, punctures small, widely spaced and superficial, successively more sparsely distributed and finer toward apex of tergites, and all bearing erect black hairs well visible under low magnification in fresh examples. Distal portion of tergite 7 rather broad, the exposed part gradually narrowed from base to apex, which is truncated with rounded angles, the hind border brownish, a little swollen and bare, usually shallowly emarginate and slightly upturned; surface flat or somewhat hollowed out above, proximal portion striato-punctate and clothed with appressed brownish hairs; in ventral view the folded rim carries a pair of convergent elevated ridges



Map 2. Locality records of some *Melecta* species

(fig. 268). Sternites dull, whole surface of all segments finely closely punctate, the postgradular punctures more widely spaced and smaller than the rest. Posterior border of sternite 5 slightly, shallowly emarginate; 6 closely microscopically punctate, sides of exposed portion converging, tapering gradually and bluntly pointed; this median triangular area continues basad to form an almost rectangular flat area on each side of which arises a conspicuous ridge-like tubercle placed in the long axis of the sternite and well visible in profile; these tubercles are highest apically, reaching back as far as the base of the median triangle, and are clothed with dark bristle-like hairs; the tubercles are rather shiny and bare in worn individuals (fig. 267). Sternal plates 7 and 8 somewhat variable in shape and setoseness, even in specimens from one locality; examples are shown in figs. 269—271. Genital capsule of large size, measuring 2.0—2.4 mm (incl. gonostylus) in the dissected males; gonostylus short, broadly thumb-shaped, apex strongly bristled; dorsobasal process small, more or less triangular, ventrobasal process broad, ridge-like, carrying a dense row of strong setae (fig. 273).

Pubescence. Labrum clothed with rather long and stiff, closely set hairs; stiff hairs fringing lower margin of mandibles of great length, white and/or black. Clypeus with brilliantly shining pad of long, depressed silvery hair entirely concealing the surface, all hairs directed straight forward, not surpassing anterior border; laterally with long black bristles. Summit of head (vertex and postocular area) with few short black hairs, pubescence on remaining parts long, erect, pure white but often mixed with black on paraclypeal and upper part of genal areas as well as on orbits posteriorly. Antennal scape with short hair in front and behind, but at either side along full length with tuft of very long raised hairs which are longer than greatest diameter of scape. Thoracic pubescence conspicuous, forming a very broad collar of long, dense and raised white hairs with a silvery gloss; this broad collar extends onto the sides all around tegulae as far back dorsally as a little beyond the latter posteriorly, the middorsum (inclusive of most of the scutellum and the sclerites behind it) is black-haired; this transverse dark area suddenly appears narrower in the median line by the presence of fairly well defined tufts of long white hairs around the scutellar tubercles, similar white tufts being present also at the sides of the propodeum and above the hind coxae; ventral parts likewise white, including the leg bases. Femora black-haired anteriorly, but fore and mid pairs fringed behind with much longer white hairs, most conspicuously so on mid femora at which they sometimes attain a length greater than the breadth of femur; fringe at hind femora thin and much shorter, either wholly black or white only along distal portion. Inner faces of all tibiae black, fore tibiae with long white posterior fringe; mid tibia clothed very densely with silky white pubescence from near base to near apex, except an isolated linear intrusion of black at anterior border, the raised hairs along posterior border short and sparse, black. Hind tibia densely white-haired, including posterior carina, but those at extreme base and postero-apical one-third (or more) black. Outer faces of hind basitarsus hidden from view by dense, appressed, finely branched, silvery white hairs, except at extreme base and, narrowly, along posterior border, where hairs are black. Remaining tarsal segments all white-haired exteriorly, except fore and mid basitarsi, which are more shining and partly black basally. Abdomen



Figs. 266—274. *M. tuberculata*; 266, oblique dorsal view of hind tarsal claw (♂ ♀, Fileremos, Rodos); 267, apex of abdomen, showing tubercles, left lateral view (♂, same locality); 268, ventral view of tergite 7 (♂, Naxos, Greece); 269, partial view of sternites 7 and 8 (same specimen); 270, sternites 7 and 8 (♂, Acropolis, Athens); 271, sternites 7 and 8 (♂, Vadillo, Spain); 272, partial ventral and dorsal view of genital capsule (same specimen); 273, external view of right gonostylus (same specimen); 274, dorsal view of pygidial plate (♀, Melissa, Athens)

clothed with short, semi-erect black hairs, the disk of postgradular portions in worn specimens almost or wholly naked; basal part of 1 profusely covered with long, raised white pubescence right across tergite, though longest and most condensed at the sides; sides of 2—5 each with dense, subrectangular, snowy-white marginal spot composed of decumbent hairs, these spots widely apart and successively a little smaller from before backward, their limits straight or (usually) slightly concave anteriorly and a little convex posteriorly, the pair on 5 placed away from the side margin and separated by a distance subequal to their own diameter. Sternites with very short depressed black hairs, 2—5 just before postgradular line moreover with rather dense fringe of much longer, slightly raised, bristly setae, which are directed caudad, black, with few white ones interspersed on 3—4. Vestiture of apical sclerites as described above.

Female. — The long and slender, gradually downbent pygidial plate is one of the characteristics assisting in the recognition of this sex. It is a more stoutly built bee than the female of *festiva*, from which it is most easily distinguished by the lack of white tufts around the scutellar tubercles.

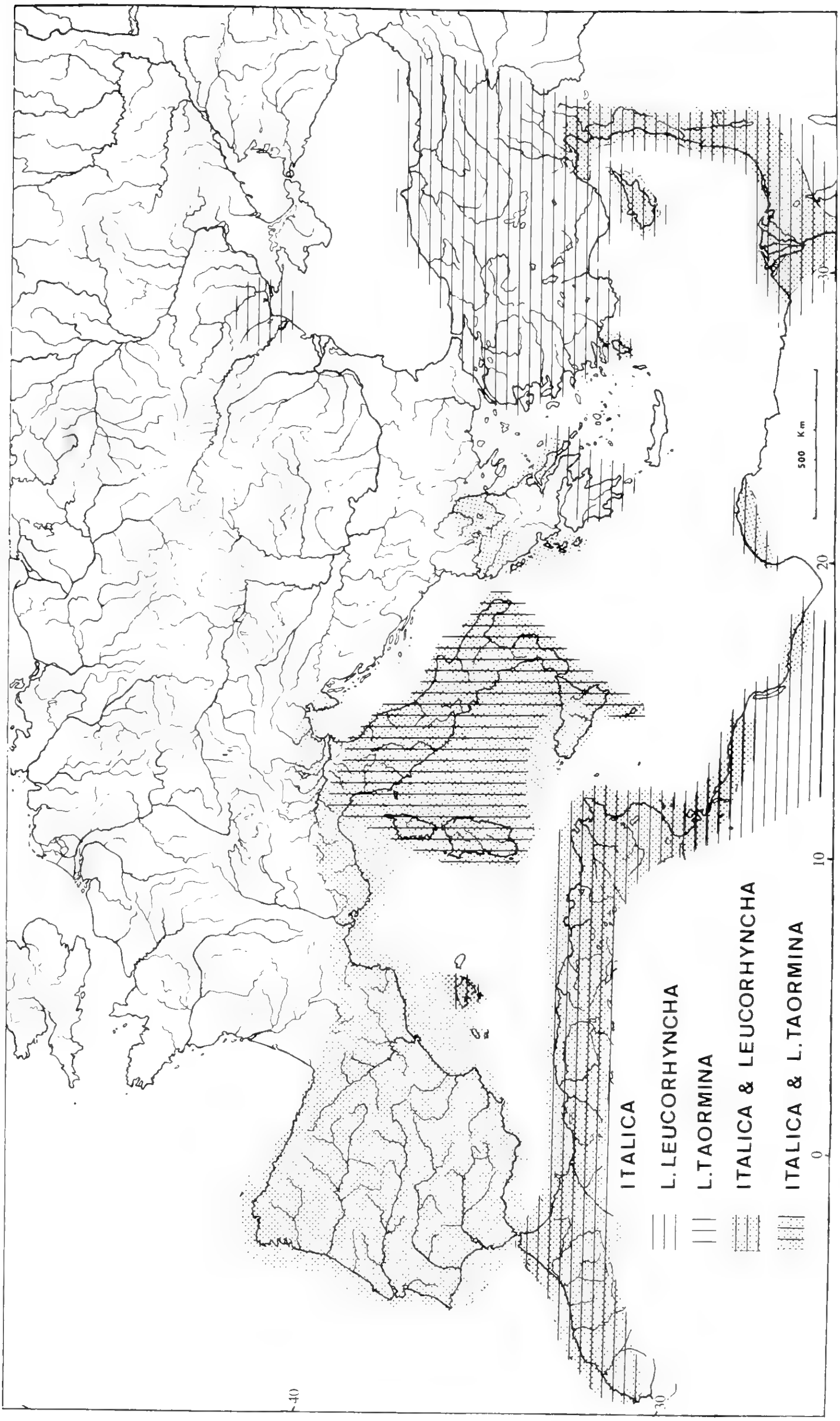
Variation. — As mentioned before, individuals collected simultaneously with unquestionable conspecific males in Bulgaria, central Macedonia and various parts of Greece (mostly in the Peloponnesus), are noticeably darker than anywhere else. This applies to both sexes, all of these having much darker, grey-brown wings. Moreover, the light pubescence on head and thorax in the male is not pure white but has acquired an ashy grey tint, while in the female most of the white hairs on these parts are deep black with traces of silvery white only upon middle at base of clypeus, at the thoracic sides, and behind the wing bases. In melanistic extremes even these light hair spots may disappear completely; in them also, at least half of the external white hairs and spots on the legs are replaced by black, which gives these obscured populations a most peculiar appearance. This is the more interesting because typical examples from the adjacent islands and more eastern countries (Crete, Rodos-Kos, Turkey, Cyprus, Palestine), resemble each other closely in being much lighter.

(The stout body form of *tuberculata* is not too well brought out in pl. 6 fig. 35, which shows a more slenderly built male from Spain).

Size variable, averages slightly larger than *festiva*; ♂ holotype, length 16.5 mm, fore wing 11.7 mm, wing expanse 32 mm approx.; ♀ paratype, 17.2 mm and 12 mm, respectively; other specimens (♂♀), length 12.8—18.5 mm, fore wing 10—13.5 mm; wing expanse (pl. 6 fig. 35), 28 mm; other specimens (♂♀), 27—33 mm.

Distribution. — Discontinuously, in the west ranging from Iberia to S France (very rare); then again throughout the eastern Mediterranean as far as beyond the Black Sea and Israel (see map 2). Unknown from Italy and the Tyrrhenian Is.!

M. tuberculata is evidently the species arranged in the Paris museum collection over the drawer label *grandis*, but which was called *M. bituberculata* J. Pérez, a *nomen nudum* in the unpublished catalogue: — "Bône 1 ♂ voisin de *M. punctata*.



Map 3. Distribution patterns of some *Melecta* species

Anus faiblement échancré, lobes arrondis, peu ponctué à peu près comme 982 (= *pygialis* J.P. ou *nigripennis* Lep.?); plaque anale inférieure portant 2 tubercules triangulaires".

Bionomics. — This is also one of the *Melecta* whose males were observed more than once to play a role in orchid pollination, and of which females sometimes exhibit the peculiar habit of collecting earth clumps at the legs (see chapter on mud-collecting, p. 135).

Melecta italica Radoszkowski, 1876 & 1893, and **leucorhyncha** Gribodo, 1893

In the next pages I shall have to deal with the status and nomenclature of two nearly similar — though not necessarily closely related — polytypic species whose taxonomic and systematic position has so far remained a complete mystery. Although the original description of *italica* was published 17 years in advance of Gribodo's *leucorhyncha* so that there are no nomenclatural difficulties involved, Radoszkowski's second treatment of *italica* appeared almost simultaneously with that of *leucorhyncha* in a much more comprehensive and significant article. The two names were validly proposed for two common and widespread species inhabiting vast expanses of land surrounding the Mediterranean Sea, but the status of both has been ignored ever since they were described and named. As might be expected as a result of this negligence, subsequent writers gave new specific and varietal names to them (and a number of non-related bees as well), so that the necessity of studying the primary types and clarifying the nomenclature of all, became obvious. Therefore I take this opportunity to straighten out the question of priority in nomenclature in the two publications mentioned above. This could be definitely settled in December 1963, by Dr. A. C. Townsend, the then librarian of the General Library of the British Museum (Nat. Hist.), London, who informed me at length about the dates of publication. It became clear that the seven (!) specific names proposed for *Melecta* by Radoszkowski have priority over the three varietal names introduced by Gribodo, antedating the latter by two or three weeks (Dec. 11 and 31, 1893, respectively). The confusion in the nomenclature is briefly summarized under *italica*, first to be discussed.

The analysis has been impeded from the outset by a variety of difficulties. Owing to the complicated nature of their variation and the irregular distribution pattern of the various populations, discrimination is sometimes decidedly difficult. If local populations of each had shown greater specific diversity of structure, separation would have been easier. As it is, however, they exhibit considerable infraspecific variation not only in the extent of white maculations, wing colour and venation, but also in numerous details of the male genital organs and form of the female pygidial plate. Consequently, the characters employed in the keys are few and had to be generalized for both sexes. All the same, a preliminary investigation led to the conviction that *italica* and *leucorhyncha* are distinct, polytypic species with broadly overlapping ranges. However, the degree of their geographic variation is different. While *leucorhyncha* has developed a melanistic subspecies, *taormina* Strand, confined to Italy and the big Tyrrhenian Isles (terr. typ. Sicily), all forms occurring to the west and east of this central part of the Mediterranean are more profusely white-spotted and hardly differ among themselves in this respect. Nominotypical *italica*, on the other hand, shares with *l. taormina* a distinctly melanistic pattern, a form also restricted to Italy and the Tyrrhenian islands; elsewhere, however, it exhibits greater plasticity and becomes differentiated into a number of irregularly distributed clinal populations, the instability being so great that segregation into subspecies proved impossible. For the present I have contented myself with the key characters and an enumeration of all material at my disposal, giving full details of localities where populations of the two taxa occur together. They could be told apart only tentatively on direct comparison by weighing one set (or "sum total") of characters against another. My present observations on the various phenotypes are merely factual, no attempt having yet been made to explain the astonishing coincident or near-identical distribution patterns which so often go hand in hand with analogous colour designs (see map 3). A detailed analysis of all local populations, each on its own, must be reserved for the future.

Melecta italica Radoszkowski
(figs. 5, 15, 78, 275—294, 358—359, pl. 6 figs. 33—34, pl. 8 figs. 38—39, map 3, p. 307)

Melecta italica Radoszkowski, 1876, Horae Ent. Soc. Ross. 12: 96—97 ♀♂ Italie, partim! "♀" only: wrongly sexed = ♂; ♂ = *Eupavlovskia* spec., probably *E. obscura obscura* (Friese). Radoszkowski, 1893, Bull. Soc. Imp. Nat. Moscou, new ser. 7 (2—3): 182, figs. 36a-c, ♂ genit. — Lieftinck, 1969, Tijdschr. v. Ent. 112: 111 (note on synonymy).

Melecta grandis: Lepeletier, 1841, Hist. Nat. Ins. Hym. 2: 443—444 (pars, ♂ only! not *M. grandis* Lep., ♀ Oran, Algeria).

Melecta quadripunctata Radoszkowski, 1893, Bull. Soc. Imp. Nat. Moscou, new ser. 7 (2—3): 184 (♀ Italie). **Syn. nov.**

Melecta luctuosa Scop. Var. I *Meridionalis* mihi, Gribodo, 1893, Bull. Soc. Ent. Ital. 25: 409, 410 (♀♂ partim! "Piemonte: Torino, Susa; Francia: Montpellier Germania: Mecklenburg; Algeria." **Syn. nov.**

Melecta luctuosa Scop. var. *albovaria*: Friese, 1895, Bienen Europa's 1: 163 ("♂ Südeuropa").

Melecta armata var. *grandis* & *M. luctuosa*: Alfken, 1914, Mém. Soc. ent. Belg. 22: 235 (pars, ♂♀ Algerien).

Melecta luctuosa Scop. var. *acutivalvis* Alfken, 1914, Mém. Soc. ent. Belg. 22: 235 (pars, ♂ only, Algerien). **Syn. nov.**

Melecta luctuosa var. *crassicornis* nom. nov. pro *M. albovaria* Friese, 1895 (nec Erichson), Friese, 1921, Archiv f. Naturgesch. 87A (3): 168, 176, diagn. ♂♀ "Südeuropa; Chanzik, Amanus Mts. (SE Turkey) & Taurus cilic.". Friese, 1922, Zool. Jahrb. Syst. 46: 207 (repeated remarks, ♂ Kaluckova, Makedonien; "sonst mehrfach aus Südeuropa erhalten, auch von Chanzik im Amanusgebirge (Nordsyrien), Tölg leg." **Syn. nov.**

Melecta luctuosa var. *crassicornis* n.var.: Friese, 1925, Konowia 4: 28 (repeated remarks, "Balearen, Korsika, Sardinien; ♀ auch Aegypten, Kingi 14. Februar 1912").

Type and syntypic material. — Italy: 1 ♂ (antennae and tarsi partly incomplete, genitalia dissected out and glued on card by Radoszkowski, relaxed and redrawn by present author, figs. 275—276), labelled "Italie" (Radoszkowski's ink writing), gold disk, "♀" (error! print on lilac), "*italica*/Type" (print on red square), "*Melecta italica* Rad. type" (Dr. Enderlein's writing). Lectotype *M. italica* Rad., by present type confirmation (MNB). — Italy: 1 ♀ (diss.), labelled "*4 pustulata*" (old ink-written grey label, Radoszkowski's writing?), "Type" (print on red), "*Melecta 4 pustulata* Type", Dr. Enderlein's printed label and handwriting (MNB). Lectotype *M. quadripunctata* Rad. by present designation. — Tunisia: 1 ♂ (diss., genit. examined), labelled "Tunisi dint. I—II—1882, G. & L. Doria" (small print), *Melecta luctuosa* Scop. var. *meridionalis* Grib. ♂ D. Gribodo" (Gribodo's writing on pale blue), collezione Gribodo" (print). Lectotype ♂ *M. l.* var. *meridionalis* Gribodo by present selection (MCG); 1 ♀ (diss., fig. 287), labelled "Tunisi Belv. [edere] 12.III.1882, G. & L. Doria" (small print), "*Melecta luctuosa* Scop. var. *meridionalis* Grib. ♀ D. Gribodo (Gribodo's handwriting in pale blue), "Collezione Gribodo" (print). Paralectotype (syntype) *M. l. meridionalis* by present indication (MCG). — Algeria: 1 ♂ (diss.), with printed labels "Alger, Bab el Oued", and written on reverse side "8.iii.10" "Dr. J. Bequaert", "Slg. Alfken", "*Melecta luctuosa* Scop. f. *acutivalvis* Alfk." in J. D. Alfken's handwriting. Lectotype *M. acutivalvis* Alfken, by present selection (MNB). — Corsica: 1 ♂ (diss.), labelled "Corsica, Ajaccio, 3.1902, Guglielm., *Melecta luctuosa* (erased), v. *crassicornis* Friese" (Friese's writing), "Type" (print on dark red). Evidently holotype ? a. crassicornis, selected by Friese (MNB).

Further material. — Italy (continental, S to N): 1 ♂ (diss., fig. 15, pl. 8 fig. 38 & figs. 281), Italia mer. Zeller (ML); 1 ♂, S. Italien (Puglia), Lecce, 10.iv.1963, Kl. Warncke (CKW); 1 ♂, Brindisi, J. Sahlberg, *M. luctuosa* det. Friese 1897 (MH); 2 ♀ (fig. 283), Bari (Puglia), *M. luctuosa* Sc., det.? (MT); 1 ♀, Calabria, Antonimina, 1905, Paganetti (NMW); 1 ♀, Monteleone, coll. Magretti (MCG); 1 ♂ (diss., fig. 278), Monticchio (Basilicata), 4.v.1892, *M. luctuosa* Sc., det.? (MT); 2 ♂ (one diss.), Vulture (Basilicata), 20.iii.1890 & 20.vii. (sic) 1891, both with *M. armata* Pz., det.? (MT); 1 ♂ (very small), Basilicata, 20.iii.1890, *M. armata* Pz., det.? (MT); 1 ♀, Apulien, Paganetti, *M. italica* Rad. (Alfken's pencil writing) (MNB); 3 ♀, Apulia, Manfredonia, 1904, Paganetti (NMW); 1 ♂ 1 ♀, Apulia, Foggia, Apr. 05, ♂ with *M. calabrina* Rad., det. Alfken 1928, ♀ with *M. italica* (pencil) (ML); 2 ♀, Portici, 1 ♀, Retcina (?), 2 ♀, Lecce (Puglia), Novoli, 3—22.5.1915 (IEP) and 1 ♀, Monteforte Irpino, 12.iv.1918 (ex IEP, ML); 1 ♂ 4 ♀, Campania, Portici (IEP); 3 ♀, Capua (Caserta, Campania), 3.1933, 1 ♀ with *M. luctuosa* var. *ruthenica* Rad., det. Alfken (IEP); 2 ♂, Portici, coll. Magretti (MCG); 5 ♂ 1 ♀ (diss.), Foggia, 4—5.1905 (IEP); 1 ♀, Lederi, 16.iv.1928 and 4 ♀ sine loc. (IEP); 1 ♂, Naple, coll. O. Sichel 1867, "Torti Nap. 59/159" (MP); 1 ♀, Gihellina (? loc.), v.1884, coll. J. Pérez 1915 (MP); 1 ♀, Neapel, Mai 1896 Andriai (?), *M. luctuosa* v. *ruthenica* Rad., det. Alfken 1904 (MNB); 1 ♀, Lazio, Puerta di Castelfusano, 15.iv.1949, Bisleti leg. (CMC); 1 ♀, Roma, 8.iv.1927, Giordani Soika, *M. luctuosa* v. *calabrina* Rossi, det.? (CGS); 1 ♂ (diss., figs. 278, 280, 282), Lazio, M. Cimino, 600 m, 18.iv.1949, M. Comba (CMC); 1 ♀, Lazio, Marino, 19.iv. & 1.v.1934, *M. armata*, det. Stöcklein 1955 (ZSM); 3 ♀, Lazio, Marino, 19.iv. & 1.v.1934, leg. Hartig (INER); 1 ♀, Capo Circeo, Quarta media basso, 20.iv.1940, leg. Hartig (INER); 1 ♀, Firenze (Toscana), vii. (sic) 1949, B. Tkalcu (CTP); 1 ♀, Livorno 1872, Mann no. 153, *M. luctuosa ruthenica* Rad., det. Friese (NMW); 3 ♂ 6 ♀, Castiglioncello nr. Livorno, 3—11.v.1958, G. Barendrecht (MA, ML); 1 ♂ 2 ♀, Rimini (Emilia-Romagna), 22.iii.1894 (♂♀) & x. (sic)1893 (♀), A. Tosi, one pair with "*M. armata* Pz. ♂♀ et varietates", det.? (MH, ML); 1 ♀, Dintorni di Rimini, 3.7 (sic). 1890, Zanghi (ex coll. Pittioni, BM); 2 ♀, Cattolica [18 km Rimini], 2.v.1958, W. Grünwaldt (CVZ) & 22.iv.1963, Kl. Warncke (CKW); 1 ♂, Bologna (Emilia), M. Calvo, 30.iv.1931, *M. luctuosa*, det. Hedicke 1931 (IEB); 4 ♀, Bologna, Gaibolo, 3.v.1953 & Torren Ravone, 5.iv.1949 (IEB); 1 ♂, Modena (Emilia), *M. luctuosa*, det.? (ex MT, ML); 2 ♂ (very small) 1 ♀, Castelvetro (Emilia), 12.viii. (sic) 1885 (♂), 7.x. (sic) 1885 (♂) and 1 ♀ without date, together with 1 ♀ *M. leucorhyncha taormina* Strand, 10.viii (sic) 1886; one ♂♀ with *M. luctuosa* Sc., one ♂ with *M. armata* Pz., det.? (MT, ML); 1 ♀, Is. Giglio, iv.1900, G. Doria (MCG); 1 ♀, sine loc., *M. luctuosa* var., det.? (MG); 3 ♀, Venezia, Lido, 11.v.1931, 8.v.1934 & 21.vi.1909, *M. luctuosa rutenica*, det.? (CGS & CVZ); 2 ♂ 1 ♀ (fig. 277), Genova dint., Borzoli, 11.iv.1909, G. Doria, "su fiori *Brassica oleracea*" (MCG, ML); 2 ♀, 36/G Borzoli, v.1883, G. Doria *M. luctuosa* Scop., det. Gribodo (MCG, ML); 1 ♂, Sestri Levante, 7.iv.1906, Dr. Uzel (NMW); 1 ♀ Lago di Garda (Lombardia), S. Vigilio, 13.iv.1942, leg. Hartig (INER). — France: 1 ♂, purple disk, Tarbes (written; H.-Pyrén.), coll. J. Pérez 1915 (MP); 1 ♂, Tarb[es?], 4.93, E. M. Saunders coll. (BM); 6 ♂ 3 ♀ (most diss., fig. 78), St. Guilhem le Désert (Hér.), 20.iii.1966, J. Riom (INRA, ML); 2 ♀ (diss.), Bedoir s.l.Madeleine (Hér.), 19.iv.1974, no. 7b, Desmier de Chenon (INRA, ML); 1 ♂ (diss.), Provence (MNB); 1 ♂ (diss.), Provence, St. Rémy, 9.iv.1933, A. Naville (CB); 1 ♀ (diss.), "Camargue 39" (B.-du-R.), S. Kelner Pillault (MP); 1 ♂, Marseille (B.-du-R.) . . . 1848 (written), Schmiedeknecht vid. (print), v. Heyden (print) (SMF); 1 ♂, Marseille, coll. Ernest André 1914 (MP); 1 ♂, sine loc., coll. J. A. Snyder, 20.iii.1931, *M. luctuosa* Scop., det. Schmiedeknecht (sic, ML); 2 ♂ 3 ♀, Le Trayas (Var), 16—21.iv.1933, G. Barendrecht (MA, ML); 1 ♂, Le Lavendou (Var), 24.iv.-5.v.1956, G. Barendrecht (MA); 2 ♂ (diss., fig. 284), Grimaux (Var), 15—24.iv.1968 & 1 ♂, same loc., 25.iv.1973, G. Barendrecht (MA, ML); 1 ♀ (diss.), Var, le Beausset, de B., coll. J. de Gaulle 1919 (MP); 1 ♂ (diss.), Cannes (Alpes-Mar.), 4.90, coll. J. de Gaulle 1919, *M. luctuosa*, det.?; 1 ♀, Cannes, E. Saunders coll., *M. armata* Panz. (pencil writing) (BM). — Corsica: 5 ♂ 5 ♀, Corsica, Klinckow (NRS, ML); 1 ♀, Cors. Mann 1855, *M. albovaria* var. *calabrina*, det. Friese 1893 (NMW); 1 ♂ 3 ♀, Corse, coll. O. Sichel 1867 (MP, ML); 1 ♀, Corsica, *M. calabrina* Rad., det. Friese 1893, and *M. luctuosa calabrina*, det. Friese 1904 (MNB); 1 ♂, Corsica, *Melecta luctuosa* v. *calabrina* Rad., det. Friese (MNB); 1 ♀, Corsica, Ajaccio, 5.1901, Guiglielm., coll. A. Weis, *M. luctuosa* var. *crassicornis* Friese, det. Friese 1900 (SMF); 3 ♀, Corsica, Ajaccio, 5.1901, 3.1902 and 9.1902, Guiglielm./ 8—9 (MNB, ML); 2 ♀, Ajaccio, 10.3.06, coll. J. Vachal (MP); 1 ♀, Corsica, env. Zonza, 8—900 m, Giglio, 30.v.1967, M. A. Lieftinck (ML); 1 ♀, W. Corsica, Ajaccio, Parata road, 15.iv.1938, G. Kruseman (MA); 1 ♀, Ajaccio, 5.iv.1956, H. Wolf (ML). — Sardinia: 1 ♂, Sardinien, Tissi stat. (?), 7.iii.91, *M. luctuosa crassicornis* Fr., det. Friese 1904 (MNB); 2 ♀, Sardegna, Sassari-Ploaghe & Sassari-Sorso (the latter together with 1 ♀ *leuc. taormina* !), maggio 1956 (IEB); 1 ♀ (diss.), Sard. Cn. de Saussure (MG). — Sicilia: 1 ♀ (diss.), "Sicil. Schultz" (very old written label), and Sicilien, Schultz (MNB); 1 ♂ 1 ♀, Sicily 66, Mrs. Farren-White (BM); 1 ♂, Sicil./722 (print), Sicula N. Sicil. Zell[er] (written), and 1 ♀, Sicil./725 (written), *M. luctuosa* v. *crassicornis*, Fr., det. Friese 1896 (MNB); 1 ♀, Sicilia, Staud[inger] (MBUD); 1 ♀, Sicile, coll. O. Sichel 1867, "Sic. 59" (MP); 2 ♀, "Sic. 59 Cn. de Saussure", one with *Melecta grandis* ♀ Sicil., coll. Sichel (MG); 9 ♀, Sicily, Selinunte, 13.iv.1965 (6 ♀) and above Trapani, 200 m, 16.iv.1965 (3 ♀), K. M. Guichard (BM); 1 ♀, Sicilia, Agrigento, v.1959, C. v. d. Voorn (ex coll. Barendrecht, MA); 1 ♀ (diss.), Sicilia, Taormina, Sirinatal, 12.iv.1971, K. Kusdas (CG); 1 ♀, Sicilia, Zappulla, Aprile 1914, coll. Mariani (INER); 5 ♀, Sizilien, Siracusa, 22.iii.30 (1 ♀), Selinunt, 1.iv.30 (1 ♀), Girgenti, 9.iv.30 (2 ♀), Troll/Hym. Inv. 31.III Nos. 314, 317 & 316 (2 ex.), together with 1 ♂ 5 ♀ of *M. leucorhyncha taormina* (NMW, ML); 1 ♀ (diss.), Sicilia Mann 1858, *M. grandis* det. Kohl, together with differently identified ♀ of *M. leucorhyncha taormina* (NMW); 1 ♀, Sicilien, Agrigento, 23.ii.1977, *M. luctuosa* det.? (CMS); 1 ♀, Sicilia, S. Nicola di Maz, 31.iii.1935, collected the same day along with 1 ♀ *M. leucorhyncha taormina* (INER); 1 ♂, Sicilien, Agrigento, 23.iii.1977, M. Schwarz, *M. luctuosa*, det. Schwarz (CMS). — Malta: 2 ♂, Malta, 90—126, and Malta, iv.1927, H. C. Harford, *M. luctuosa*, det. Uvarov (BM). — Balearic Is., Mallorca: 1 ♂ (diss.), Mallorca, Soller de Mallorca, 1956/57, J. Briedé (MA); 1 ♂ (diss.), Mallorca, 2.4.83, H. Friese, *M. luctuosa* var. *crassicornis*, det. Friese 1900, coll. A. Weis (SMF); 2 ♀, Mallorca, 2.4.83, H. Friese, *M. luctuosa* v. *crassicornis*, det. Friese 1904 (NMB); 3 ♀, Mallorca, 2.4.83 (2 ♀) and 6.5.83 (1 ♀), all with 71b/16 (black-rimmed cadre), and one with *M. luctuosa* var. *albovaria/calabrina* (sic), det. Friese 1893 (MBUD, ML); 1 ♂, "Südeuropa" [probably Mallorca!] (written on green), "720" (print), "*Notata Centripunctata* Fab." (old handwriting, MNB); 1 ♀, Palma, Moraga, coll. Tournier (MG); 1 ♂, Mallorca, Albufera, Breit leg. (NMW); 1 ♂, Baleares, Palma de Mallorca, coll. Ernest André 1914 (MP); 3 ♂ 1 ♀, Mallorca, Son Moro, Monacor, 15.ii.1894, *M. luctuosa* Scop., det. A. Compte Sart (CCS, ML). 1 ♀, Mallorca, Palma, 23.3.56, A. Compte Sart (CCS). — Ibiza: 1 ♀, Ibiza, "Behaarung d. 5. Stern. dichter u. kürzer", and "*crassicornis* Fr.", det. Alfken (MNB). — Spain: 1 ♂, Espãna, Cadiz, Castellar de la Frontera, 19.iii.1968, R. Straatman (MA); 1 ♀, Cadiz, Guadiaro, 23.iii.1968, R. Straatman (ML); 1 ♀ (diss.), Spain, San Roque (Cadiz), iv.1955, J. Ramirez leg. (MUC); 4 ♂, C. Spain, Valladolid, Granja Escuela, Camino Hondo, 26.v.1972 (2 ♂), and two with addition "talud I", 26.iv.1973 (2 ♂) (CAV); 1 ♂ (diss.), Spanien (two written labels) (MNB); 1 ♀, Andalusien, coll. Gerst[äcker], 11.2 (MNB); 1 ♀ (diss.), blue disk, Espagne, Léon Dufour, coll. O. Sichel 1867, "*M. grandis* Lep. hisp." in L. Dufour's handwriting (MP); 1 ♀, Zaragoza, 19.7.02, L. Navás (ML); 1 ♂ (diss., fig. 285, pl. 8 fig. 39, mounted), NE Spain, Llobregat (Catalonia, prov. Barcelona, MP); 2 ♀ Canet [de Mar? nr. Barcelona], 4.93, E. Saunders (BM). — Portugal: 1 ♀, W. Portugal, Coimbra, and

3 ♂ (1 diss.) 8 ♀, N Portugal, Rezende, 28.iii, 1—6.iv (3 ♂) 14—18.iv, 27—29.iv, 5.v.1950 (8 ♀), all N. F. d' Andrade (MUC, ML); 1 ♀, C Portugal, Estoril, 20.iv.1952, N. F. d'Andrade (MUC). — North Africa (W to E). Morocco: 1 ♂ 1 ♀, Tangier, J. J. Walker, E. Saunders coll., & 11.2.02, Wlsm. Morocco (BM); 1 ♀, Tanger, J. Vachal 1911 (MP); 1 ♀, N Morocco, Chaouen, 22.v.1971, F. Hüschinger (CE); 1 ♂, Maroc, Dj. Amsittene, S de Mogador, 13.ii.1961, H. Lindberg (MH); 1 ♀, Maroc, 622/19 (MG); 2 ♀, Maroc, M. Atlas, Col du Zad, ca. 2150 m, 8.v.1965, H. Linsenmaier (CL, ML); 1 ♀, Moyen Atlas, Imouzzèr di Kandar, 1350 m, 25—26.v.1968, M. A. Lieftinck (ML); 1 ♀, same area, Azrou, 1250—1400 m, 20—24.v.1966, M. A. Lieftinck (ML). — Algeria: 1 ♂ (pl. 6 figs. 33—34), with vertically pinned blue disk, labelled "*Grandis* ♂" (Lepeletier's writing), obviously one of Lepeletier's ♂ of *M. grandis* Lep.! (MP); 5 ♂, Algérie, coll. J. de Gaulle 1919 (MP); 1 ♀, Arzew (?) avril 1888, coll. J. Vachal (MP); 1 ♂ 2 ♀, Prov. d'Alger, Chellala, Jardin Romanetti, Vauloger 138—97 (MP); 1 ♀, Bône, 4.3.96, E. Saunders coll. (BM); 2 ♀, Algiers & El Biar, 9—23.iii.1893 (BM); 1 ♂ 3 ♀, N. Algeria, Hamman Rhira, v.1911, Rothschild & Hart., and Hamman Meskoutine, v.1911, E. G. B. Meade-Waldo (BM, ML); 1 ♀, Algier, Mascara, Cros, 9.iv.1911 (MNB); 1 ♂ (diss., figs. 288—290) 2 ♀, Algeria, Philippeville, 25—27 Marzo 1952 (IEB); 2 ♀, Algeria, Batna, 27 Marzo 1952 (IEB); 7 ♀ (1 diss.), Algir 1881/593.107 & 108 (MBUD, ML); 1 ♀, Algeria, Bone, 4.iii.1896 (MNB); 1 ♂ (diss.), Kabylie, Dr. Martin (MKB); 1 ♀, Sétif, *M. luctuosa* Scop., det.? coll. de Saussure 1910 (MG); 2 ♂ 3 ♀, Alger, Oran, Schmiedeknecht 1910, coll. A. Weis (SMF); 1 ♂ (diss.), Alger, Bab el Oued (same loc. as lectotype *acutivalvis* Alfken!), 25.ii.1910, Dr. J. Bequaert, Slg. Alfken (MNB); 1 ♀, Alger, Birmandreis, 20.iii.1910, J. Bequaert, with Alfken's three labels "*luctuosa* Fr., nicht *grandis*", "*M. crassicornis* Fr.", and "Behaarung d. 5. Stern. lockerer u. kürzer", Slg. Alfken (MNB); 1 ♂, Alger, 19.i.1910, Dr. J. Bequaert, *M. grandis* Lep., det. Alfken 1933, with addit. pencil-written label "Ypsilon Type", Slg. Alfken (MNB); 2 ♀, Alger, 25.iii & 7.iv.1910, Husseyn-Dey, Dr. J. Béquaert, *M. grandis* Lep., det. Alfken 1933 (MNB); 2 ♀, Alger, 5.iii.1910, and Maison Carrée, 16.iii.1910, J. Bequaert (MNB); 1 ♂ 2 ♀ (diss., fig. 286), Algiers, Maison Carrée, 12.ii.1943, K. M. Guichard (BM). — Tunisia: 2 ♂ 6 ♀, Tunisi dint., I—I, 1882, with additional dates: 5.II & 10.II.1882, arranged in drawer sub *M. luctuosa meridionalis* (2 ♂), Tunisia, Cartagina, I—II. 1882, arranged sub *luct. leucorhyncha* ♀ (3 ♀), and Tunisi dint. I—II.1882, arranged sub *luct. leucorhyncha* (3 ♀), all G. & L. Doria, but none bearing identification labels: probably syntypic for both varieties (MCG, ML); 1 ♀ (diss.), Oasis Gafsa, B. v. Bodemeyer, M. Pic coll. 1928 (MP); 1 ♂ (diss., fig. 291), Tunisie, Gafsa, coll. A. Weis 1904 (MP); 1 ♀, Tunesien, Oase Gafsa, 28.ii.1977, *M. luctuosa*, det.? (CMS); 1 ♀, Tunis, Gafsa, 21.4.03, Biró (MBUD); 1 ♂ (diss., figs. 292—293) 14 ♀, Tunis, 7.2.03 (♂) 22.2.03 (14 ♀) Biró (MBUD, ML); 2 ♀, Tunesien, Weidholz (MBUD); 1 ♀, Umg. Tunis/Dint. Tunis, 10.iv.1911, Miali (?) (MP); 1 ♂ (together with ♂ *M. leucorhyncha*!), Kairouan, ii-iii.1927, Santschi, *M. crassicornis* Fr.=*italica* Rad., det. Alfken, Slg. Alfken (MNB); 1 ♂ (diss.), Tunis, Kairouan, coll. Santschi, *M. crassicornis*, det. Friese (MNB); 1 ♀, Tunis, coll. Schmiedeknecht (MNB); 1 ♂ (together with ♂ *M. leucorhyncha*!), Tunis, 3—5.1912, Zobrys, Slg. Alfken (MNB); 1 ♂, blue disk, Tunis/coll. J. Pérez 1915 (MP); 2 ♂, Tunisie, Gafsa, P. Chrétien 1910 (MP, ML); 5 ♀, Tunis 1911, Schmiedeknecht, coll. A. Weis, one with *luctuosa*, det. Schmiedeknecht (SMF); 1 ♀, Tunis, Dr. Vohsen 1903, coll. A. Weis, *luctuosa*, det.? (SMF); 1 ♀, Tunésie, Dermech/Carthage, 20 m, 6.iv.1965, R. T. Simon Thomas (MA); 2 ♀, Tunis, Schmiedeknecht 1898, one with *M. luctuosa*, det. Schmiedeknecht (NMW); 2 ♂ 6 ♀, Tunis, Coll. Graeffe, *M. aegyptiaca* Rad., det.? (NMW, ML); 1 ♀, Tunis, März, Coll. Graeffe, *M. armata* var. *grandis* Lep., det.? (NMW); 4 ♀, Tunis, Coll. Graeffe, III (Kohl's writing), *M. luctuosa* var. *albovaria*, det.? (NMW); 2 ♀, Nord Tunis, Spatz, *M. luctuosa*, det. Friese, and Tunis, iv.1927, R. Meyer, *M. luctuosa*, det. Alfken 1935 (MNB); 1 ♂, Médinine, coll. J. Vachal 1911 (MP). — Libya: Tripolitania, 5 ♂ (1 diss.) 17 ♀, Tripoli, 4.ii—4.iii.1954 & 30.i.1955 (3 ♂ 8 ♀), Gargarese, 15.iii.1952 (1 ♀), Sidi Mesri, 29.i.1954 (2 ♂ diss.), Garian, ca. 2500 ft., 22.ii.1954 (1 ♀), Sabrata O' A.SL, 27.ii.1954 (2 ♀), Caradin Hills, 4.i.1955 (1 ♀), Leptis Magna, 5.i & 11.iii.1955 (4 ♀), all K. M. Guichard (BM, ML); 5 ♀, Cyrenaica, Cyrene, 1800 ft., 16.iii-2.iv.1954 (2 ♀), Ras el Hilal, 7.iv.1954 (2 ♀), and Latrum, 14.iv.1954 (1 ♀), all K. M. Guichard (BM, ML); 1 ♀, Tripolis, Sirte, 22.i.1942, Decker (MNB). — Egypt: 1 ♀ (diss.), "Aegypten, Kingi, 17.2.1912" (Friese's hand) (MNB); 2 ♀, Aegypten, A. Andres, one with *Melecta* aff. *assimilis* Rad., det. Alfken (SMF). — Israel-Jordan: 7 ♂, O. Jordan, Wald bei Jerash, 600 m, 15.iii.1959, J. Klapperich (MBUD, ML); 1 ♂, Jerusalem, J. Sahlb[erg] (MH); 1 ♂, Palestine, Jerusalem, 29.ii.1940, leg. Bytinski-Salz, *M. luctuosa* var., det. Mavromoustakis (CBS); 4 ♂ (1 diss., fig. 294), Palestine, Dahlia, 6.ii.1948, leg. Bytinski-Salz (CBS, ML); 1 ♂, Palestine, Jerusalem, "10.8.1946" (sic), leg. Bytinski-Salz (CBS); 1 ♂ 1 ♀, Palestine, Nazareth, 1800 ft., 16.iii.1920, P. J.

Barraud (BM); 4 ♂, Jerusalem, Mt. Scopus-N., Bellevalia, 13.ii.1947, one at *Rosmarinus* (CBS, ML); 2 ♀, Israel, Montfort, 7.iv.1950 & 20.iii.1964 (CBS); 1 ♀, Israel, Bridge Beerotaim, 26.ii.1968, 11—12 a.m., coll. Gerling (CBS). — Turkey (Asia minor): 1 ♀, Adana[Cilicia] coll. J. Vachal (MP). — Cyprus: 1 ♂ (diss.), Lagoudera, 15.iii.1971, 3000 ft., K. M. Guichard (BM); 1 ♂ (diss.), Famagusta, 7.iii.1932, E. E. Green (BM). — Rodos (Greece): 2 ♂ (both diss.), Rhodus, 18008 (MNB) & Rhodus Loew, 18008 (MBUD); 1 ♂ (diss.), Rhodos, Monte Smith, 20.iii.1978, K. J. Hedquist (NRS). — Greece: 1 ♂ (diss.), Macedonia, Langhadas-Saloniki [Thessaloniki], 3—8.iv.1956, Fr. Borchmann (MKB); 1 ♀ (very small), Attica, ex coll. Vogt (MA); 3 ♀ (diss., small-sized), Chalkis, Euboea [= Evvoia I.] iii.1926, Holtz (MNB); 1 ♂, Ionian Is., Sir E. Saunders (BM). — Yugoslavia: 1 ♀ (diss.), Istria, Rovigno, v-viii.1911, leg. Anisits S. G. (NMB).

The position of *M. italica* among its congeners has been ignored ever since Friese (1895 et seq.) relegated it to the synonymy of *Melecta funeraria* F. Smith (see Lieftinck, 1969, sub *Eupavlovskia*). The suppression of the name was accepted offhandedly by contemporary and subsequent authors publishing on Palaearctic *Melecta*. Even in Schmiedeknecht's "Hymenopteren Nord- und Mitteleuropas" (1930) *italica* still figures as a synonym of *M.* (rect. *Eupavlovskia*) *funeraria*. This neglect was initiated by Radoszkowski himself, who in the original description (1876) not only mistook the type male of *M. italica* for a female but, only one paragraph further down, added the definition of an indubitable example of *Eupavlovskia*, misidentifying this as the male of that "female" *italica*. Without giving any explanation, the author corrected the error many years later by describing and figuring the male genitalia of true *italica* (1893 : 182, figs. 36 a-c. i), — only to get mixed up again on a next page of the same publication by supplying sketches taken from a male which he thought was *Melecta grandis* Lep.! In fact, the last mentioned drawings pertain to a specimen of *Eupavlovskia*, as is evident from his illustrations (figs. 40 a-c, i & k). The result of all this has been that *M. italica* remained hidden and unrecorded in the literature for over half a century. It was the late G. Enderlein who finally implied that the original specimen preserved in the Berlin Museum, whose sexual organs had been first dissected out and illustrated by Radoszkowski in 1893 (loc. cit., fig. 36), should be the original *italica*. This was never published, although Alfken, as time went on, may have been aware of the nomenclatural confusion and its bearing upon a species so well represented in many private and European museum collections. Nevertheless, as will be seen from the above census of studied material, a disorderly situation persisted, since all *italica* (save its type), brought together for the purpose of the present work, remained misidentified or were left unnamed. Enderlein's type designation was acknowledged by Lieftinck (1969) and can now be substantiated by descriptions and illustrations.

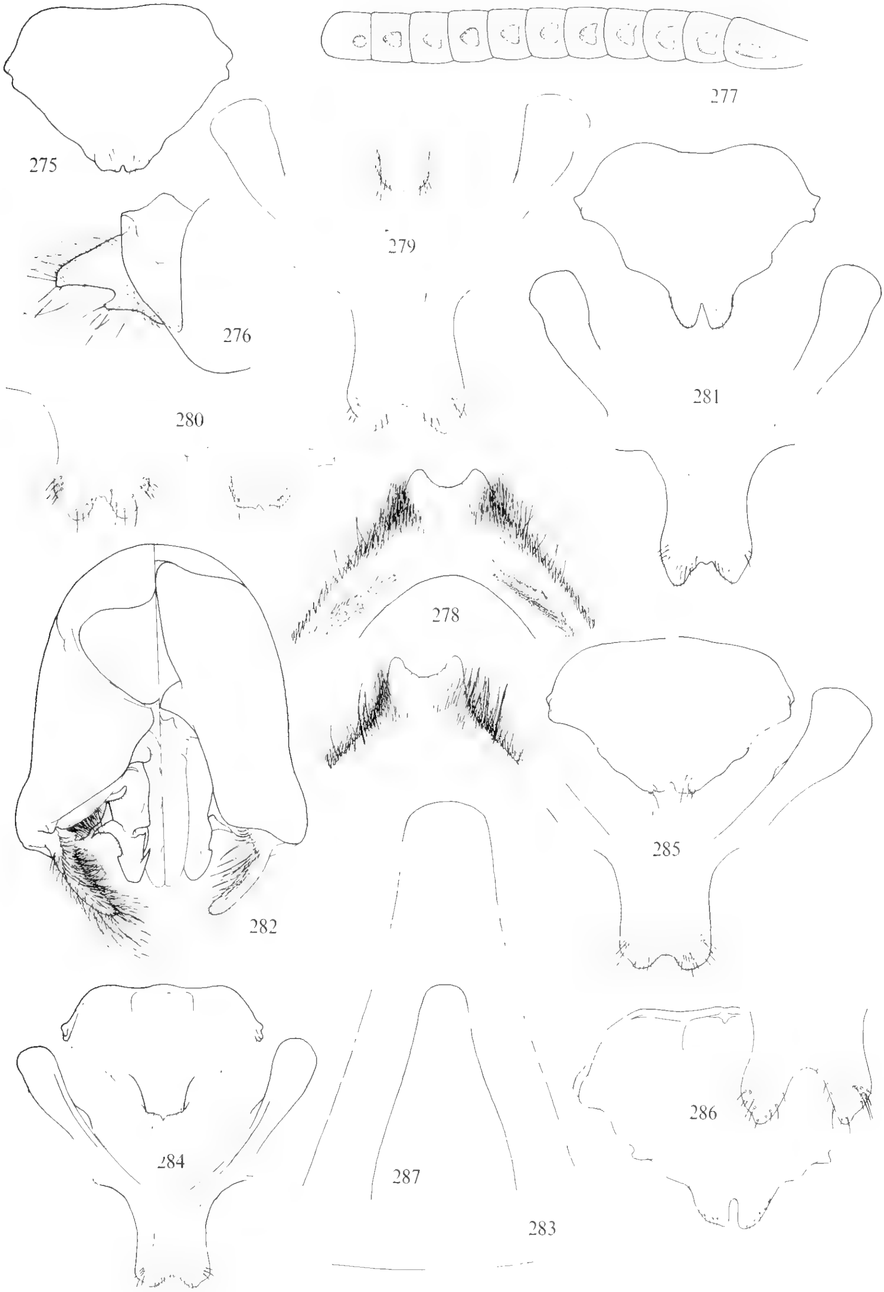
Synonymy. — *M. meridionalis* (Tunisia). — As will appear from Gribodo's comments on the diagnosis of "*luctuosa* Var. I *meridionalis*", it is evident that this is only a profusely white-haired form of *italica* Radoszk. The author aptly described a number of features shared alike by *meridionalis* and *leucorhyncha*, but failed to explain why two new varietal names were proposed for the evidently composite taxon "*luctuosa*" sensu Gribodo. The author, overlooking Radoszkowski's diagnosis of the much earlier defined *italica*, mentions a variety of localities for *meridionalis* (see above) but, as Dott. D. Guiglia informed me in a letter (June 14, 1958), specimens from Piemonte, specified in the first place, are altogether wanting, only North African individuals being available. Thereupon, while attempting to interpret the present variety, the chief difficulty met with concerns the selection of an appropriate lectotype. As with Gribodo's "*armata* Var. *mediterranea*", all individuals named *meridionalis* (or arranged under that name) bear near-identical labels "Tunisi leg. Doria . . ." etc., there being no single specimen of European origin amongst them. As none of these could be traced, we may safely assume that all French, Italian or German bees stated to belong here were confounded with other taxa, or shared out among correspondents outside Italy. Of the whole series, comprising 3 males and 3 females, I have selected a lectotype male and a topotypical syntype female from Tunisia, i.e. the only ones bearing the author's own written identification labels, albeit that one of the females figured as *leucorhyncha*. All are still in fairly good condition.

M. acutivalvis (Algeria). — While engaged in a study of Bequaert's Algerian collection of bees, Alfken (1914) got entangled by proposing another new varietal name of "*luctuosa*", viz. *acutivalvis* n.var. This was based on examples apparently differing from others called by him "Stammform" of *luctuosa*. As far as I could ascertain, no single *luctuosa* was amongst the many Algerian specimens enumerated under that name, some pertaining to *albifrons albovaria*, several others to *italica*, while one male proved to be *leucorhyncha*. All names written on Alfken's pin-labels will be found specified under "Further material" listed for the respective taxa just mentioned. Only one of the two males from Bab el Oued carries the author's own identification label "*v. acutivalvis*, for which reason this was selected lectotype. It differs in no way from light-haired (i.e. "plus variants") of *italica* occurring in Algeria and elsewhere in North Africa.

M. crassicornis (Corsica). — The male from Corsica was selected and labelled Type by Friese himself, and by that very fact should be considered holotype. It is a dark specimen of moderate size with reduced abdominal spots, quite similar to nominotypical examples of *italica* from the same island and opposite provinces of Italy.

M. quadripunctata (Italy). — The brief description of this puzzling bee is based on a single female recorded from Italy, but lacking a locality label. It was also erroneously named "*4 pustulata*" by Radoszkowski, or in someone else's handwriting. Enderlein considered this female to be one of several more types — formerly in Radoszkowski's collection — acquired by the Berlin museum. On selecting and labelling types from this collection, he evidently recognized it as

Figs. 275—287. *M. italica*; 275, sternite 8 (♂, lectotype "Italie"); 276, lateral view of gonostylus (same specimen); 277, left antenna, showing rhinaria on segments 3—13 (♂, Borzoli, N Italy); 278, ventral view of apex tergite 7, showing ridges (upper, ♂ Lazio, Italy; lower, ♂ Monticchio, Italy); 279, sternites 7 and apex of 8 (♂, Basilicata, Italy); 280, apices of sternites 7 and 8 (♂, Lazio, Italy); 281, sternites 7 and 8 (♂, "Italia mer., Zeller"); 282, partial ventral and dorsal view of genital capsule (♂, Lazio, Italy; 283, outer contour: dorsal view of pygidial plate (♀, Bari, Italy); 284, sternites 7 and 8 (♂, Grimaux, S France); 285, sternites 7 and 8 (♂, Llobregat, Spain); 286, apices of sternites 7 and part of 8 (♂ Maison Carrée, Algeria); 287, inner contour: dorsal view of pygidial plate (♀, syntype *meridionalis*, Tunisi). All figures, including 283 and 287, on different scales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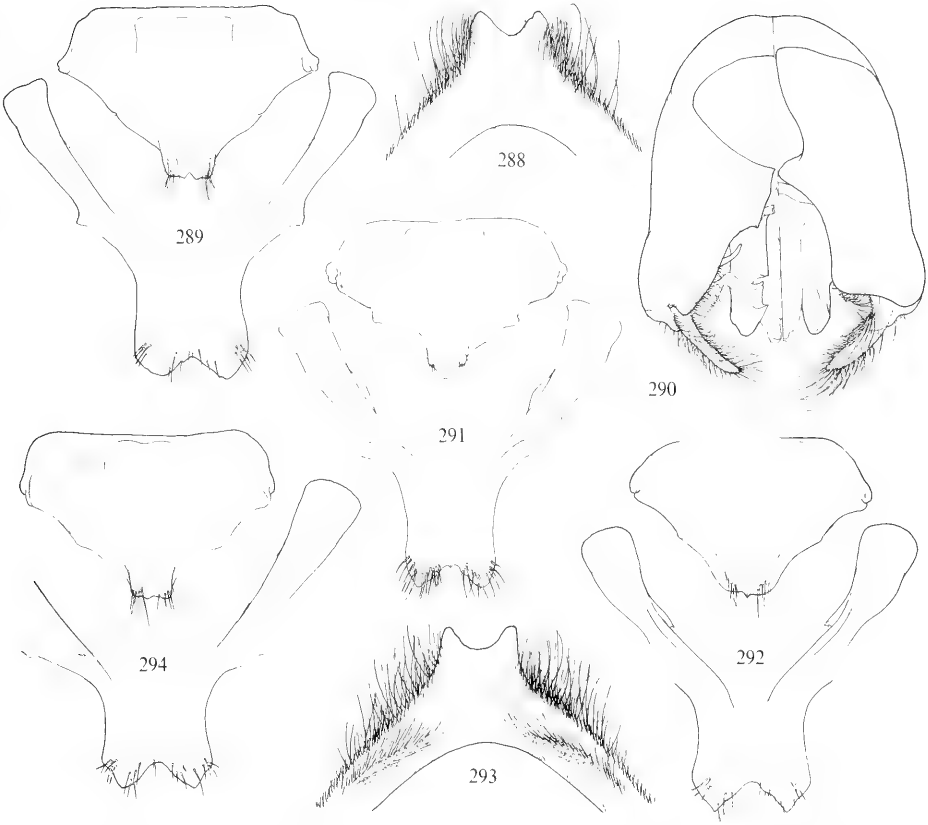
such, but instead of correcting the mis-spelt name he copied the original and labelled it "*M. 4 pustulata* Rad. Type, Dr. Enderlein". While assuming this specimen to be indeed the mislabelled type of *quadripunctata*, I have accepted Enderlein's type designation, especially because it corresponds closely to the (incomplete) description of that species. It is a somewhat worn specimen, measuring only 11.5 mm, yet undoubtedly conspecific with *italica*. Features of interest are the small size and predominance of white on the thoracic dorsum, agreeing in these respects with a few other atypical females listed above as from Venice, southern France, "Syra" (?), and one labelled "Attica". All differ from *M. leucorhyncha* in the long pubescence, compact body form and short, broad subcordate abdomen. The original description being worthless, the next brief characterization may not be found out of place: — Antenna moderate, segments 4—12 slightly but distinctly longer than broad. Dorsum of head and thorax closely, almost contiguously punctate, interspaces slightly shiny; punctation of abdominal tergites finer, less dense on more lustrous ground. Scutellar spines suberect, longer than broad at base but much shorter than surrounding hair. Body pubescence throughout long and dense, predominantly black; thin fringe of white only on inner (anterior) face of antennal scape, just behind that level, and more densely so at occipital border. Thorax dorsally mixed black and white as far back as tegulae, with pair of indistinct black dots upon mesonotum anteriorly; small white tuft upon middle of sides; remaining parts black. Legs hairy; small white subbasal spots at outer faces of mid and hind tibiae, vestiges of white also at fore tibia. A thin raised fringe of silky white at base of tergite 1, exceptionally long and tufty at sides without forming condensed spots, the latter on 2—4 relatively small, subcircular, placed wide apart in line, forming dense decumbent patches raised above level of surface, but on 2 almost twice as large as on 3—4. Pygidial plate in side view almost straight, subtriangular, length/breadth ratio 30 : 20, raised margins straight in dorsal view, tip not suddenly narrowed but almost parallel-sided, the rounded apex with short, feebly raised median ridge; disk flat, impunctate, finely reticulated, colour chestnut.

The diagnostic characters of *italica*, given in the key, can be supplemented as follows:

Male. — Labrum squarish, disk concave, anterior border straight or slightly convex, often with tiny midapical spicule. Fan-like silky white patch covering middle of clypeus depressed or slightly raised, the hair tips usually exceeding anterior border; long hairs at sides erect, black. Antennal scape fringed roundabout with long raised white hairs (partly obscured or interspersed with black only in dark populations). Similar long raised hairs on either side behind wings not continuous across scutellum: median area of the latter always more or less broadly black. Body pubescence throughout long and dense; black and white partaking in design extremely variable, white hairs replaced by black in certain populations. Outer face of hind tibia closely punctate, clothed more or less densely with appressed hairs and thick setae, scantily interspersed with strong, acuminate, spike-like denticles but often also fringed with long, erect, marginal bristles. Hind basitarsus relatively short and broad, gently outcurved, surface at least slightly



Figs. 288—294. *M. italica*; 288, ventral view of tergite 7, ridges omitted (♂, Philippeville, Algeria); 289, sternite 7 and 8 (same specimen); 290, partial ventral and dorsal view of genital capsule (same specimen); 291, sternites 7 and 8 (♂, Gafsa, Tunisia); 292, the same (♂, Tunisia); 293, ventral view of tergite 7, showing ridges (♂, same specimen); 294, sternites 7 and 8 (♂, Dahlia, Israel)

concave externally, the upper border nearly straight, usually beset with long raised bristles, lower border convex; elongate-oval ventral pit near base small or unapparent. Wings subhyaline, or fore wing membrane lightly infuscated toward apex. Tergal spots greatly varying in size, occasionally vestigial, though never entirely wanting on tergite 2. Ventral ridges at apex of sternite 6 low, hairy. Shape of sternal plates 7 and 8 unstable, see figs. 275—294 and 359, bristly setae on apical lobes of 7 characteristically more or less arranged in two groups, one on each side of the median line. Gonocoxal angle never incurved, the diverging borders of enclosure following a straight or feebly undulated (shallowly concave) course toward distal edge of gonocoxite, the dorsoventral process of gonostylus almost or fully twice as long as its breadth at base, subtriangular, varying in shape, but never finger-like (fig. 276, of lectotype, taken from dry sclerite).

Female. — Previously undescribed. The most outstanding distinctives of this sex are here recorded for the first time in the key.

Like many other species, *M. italica* varies much in size and stature, certain males and females listed from the Italian provinces of Emilia and Campania, and those collected in Corsica and Mallorca (Balearics), are among the bulkiest and largest of all populations examined, measuring up to 17 mm in length. These also have the strongest and broadest antennae.

Outside Italy and the Tyrrhenian, viz. all populations of *italica* s.str., which occur in the west, south and east of that area, look very different, the array of white pubescence being on the average much more extensive in both sexes, especially the white tergal maculations occupying more of the surface and are more regularly arranged. Since intergradations do occur, I am reluctant to split *italica* into two subspecies. But if it comes to that, *meridionalis* could be re-instated as the first available name for a more richly white-marked race occurring in the west, but ranging from southern France, Iberia and northwest Africa eastwards to as far as Egypt and Israel-Jordan.

A few males of very small size, listed as from Cyprus and Rodos, are rather puzzling (figs. 358—359). Though agreeing with the "*meridionalis*"-type of *italica* in respect of hairiness, with much more material these may ultimately prove to be specifically distinct. They were collected in the same islands, together with some equally small-sized individuals (both sexes) which I am unable to distinguish from *leucorhyncha* (see under that species).

Melecta assimilis Radoszkowski
(figs. 295—301, pl. 8 fig. 40)

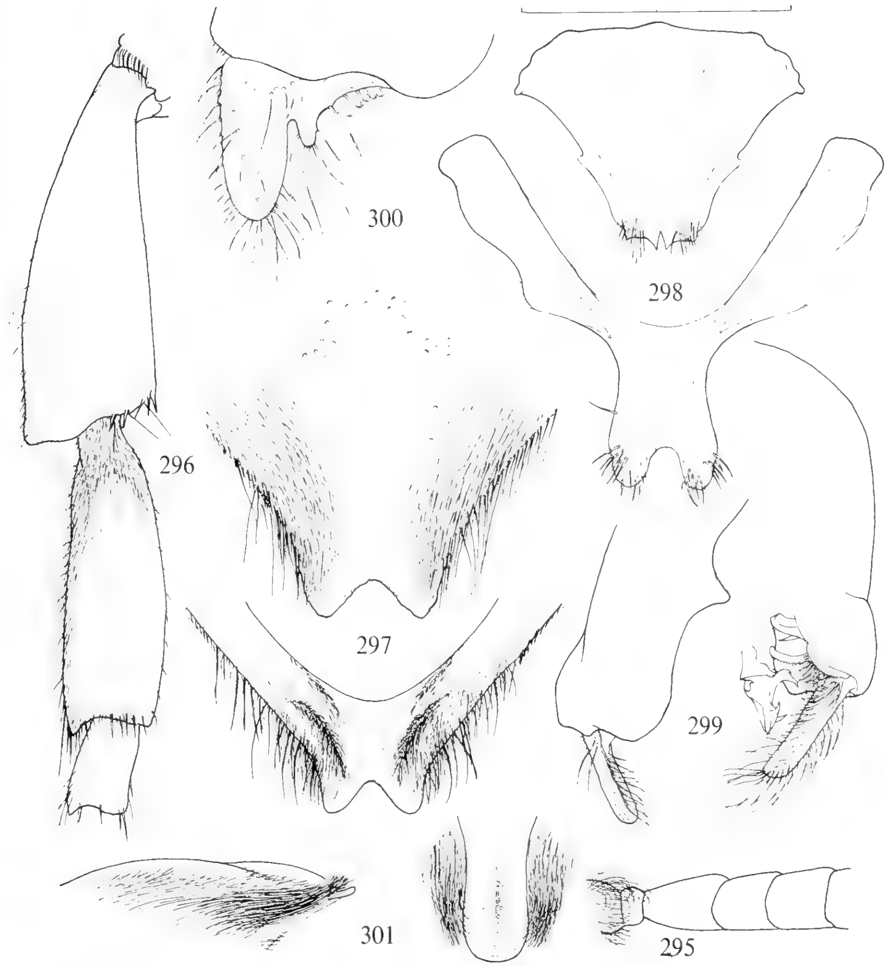
Melecta assimilis Radoszkowski, 1876, Horae Ent. Soc. Ross. 12: 122—123, pl. 3 fig. 6 (col. picture "♀" Egypte, wrongly sexed = ♂).

Type material. — Egypt [collected by Comte Alexandre Branicki's assistant Dr. Dziedzicki, teste Rodoszkowski]: 1 ♂ (diss., figs. 295—300, pl. 8 fig. 40), labelled "Egypt C: Bra" (capital print on green) "Type" (orange-red), "*assimilis*" (Radoszkowski's writing). Holotype *Melecta assimilis* Radoszk. (MNB).

Further material. — Egypt: 1 ♀ (in perfect condition), Coll. Alfieri Egypte (print), Wadi Rischrash, 27.3.1935 (written), Anastase Alfieri Collection 1965 (print), 921 (USNM).

This species is correctly described as a male, but in the legend of the very poor-coloured picture the specimen is erroneously given as a female. The brief description of the abdominal marks is liable to be misinterpreted: "... sur le troisième de chaque côté deux taches rondes qui se touchent et dont la deuxième est plus petite." In fact the spot is merely somewhat indented by black behind, the outermost portion being the smallest, — obviously an aberrance.

Male (unique). — General appearance, pl. 8 fig. 40. Additional characters: Labrum slightly longer than its width at base (100 : 85.2), little narrowed toward apex, coarsely punctate, anterior half with fine impunctate median carina. Antennal scape a trifle longer than 3 + 4, fringed on either side with long white hairs; 3 little longer than its apical width, exceeding length of 4 in the same degree (10: 8), fig. 295. Punctation on mesonotum dense, punctures large and rather deep



Figs. 295—301. *M. assimilis*; 295, frontal view of antennal segments 2—5 (♂, holotype, Egypt); 296, external view of right hind tibio-basitarsus (same specimen); 297, dorsal and ventral view of tergite 7 (same specimen); 298, sternites 7 and 8 (same specimen); 299, partial dorsal and ventral aspects of genital capsule (same specimen); 300, external view of left gonostylus (same specimen); 301, left lateral and partial dorsal view of pygidial plate (♀, Wadi Rischrash, Egypt). Scale line (298) 1 mm

on shiny ground, especially so where more widely spaced, at level of tegulae. Scutellum strongly convex on each side of middle, transverse basal sulcus deep, whole surface closely, coarsely and contiguously punctate; spines raised, bluntly pricker-shaped, directed obliquely caudad, shorter than surrounding pubescence. Hind tibia longer than basitarsus (100 : 77), outer face reticulate-punctate, rather shiny, clothed with short black hairs and scattered spike-like setae. Felty pad at outer face of mid tibia isolated, sharply defined, elongate-oval, finely black roundabout, with few dark hairs posteriorly. Inner rami of mid and hind tarsal claws slender, only little shorter than outer. Graduli of abdominal sternites beset with longish black bristles, but all hairs much shorter and less closely set than in *italica*. Tergal plate 7 with narrow, smooth and shiny, median area extending nearly whole length, this space slightly concave but sparsely punctate at base only, deeply sulcate between the two apical tubercles; colour brown, the posterior border in ventral view yellowish (figs. 297). Apex of sternite 6 broadly rounded, median depression elongate-triangular between low ridges, which are invisible in profile but more hairy than the impressed area. Sternites 7—8, figs. 298. Genital capsule, fig. 299: gonostylus short and broad, gradually narrowed toward apex, which is broadly rounded; dorsobasal process distinct, subtriangular, one-fourth to one-fifth as long as stylus, apical bristles very long, the longest exceeding tip of stylus (fig. 300). Total length 14.0 mm approx., fore wing 11.2 mm.

Female (unique). — Head and thoracic sclerites rather deeply punctate on shiny ground, punctures only little smaller than interspaces, except middorsally on mesonotum where punctures are more spaced, those at sides being much smaller and contiguous. Scutellar spines short and strong, bluntly pointed and shiny, raised almost straight up, but shorter than surrounding pubescence. Abdomen short, broadest at end of 1, as in male, deep black; tergites moderately lustrous, tergal punctation and pubescence also similar, but all black hairs shorter than in male; white lateral spots small, 1—2 and 4 subcircular, 3 slightly more transverse, all placed far apart, very compact, composed of depressed hairs slightly raised above surface level, the hair tips not extending beyond hind margin of tergites; spots on tergite 1 somewhat tufty, the broad space separating them clothed basally with few long and thin, raised darkish hairs. Pygidial plate broad at base, then converging with slightly convex, subacute and raised lateral carinae, the smooth median ridge occupying about apical one-third of whole length of plate (fig. 301). Total length 13.5 mm approx., fore wing 11.0 mm.

The male of this remarkable species is very similar in many respects to *italica* and was first thought to be only an aberrant individual of that species. It can be distinguished therefrom by the thin fringes of much shorter and fewer raised hairs covering the hind femora at all sides, the latter being replaced in all fresh specimens of *italica* by a dense garment of much longer black pubescence covering this and other parts of all legs.

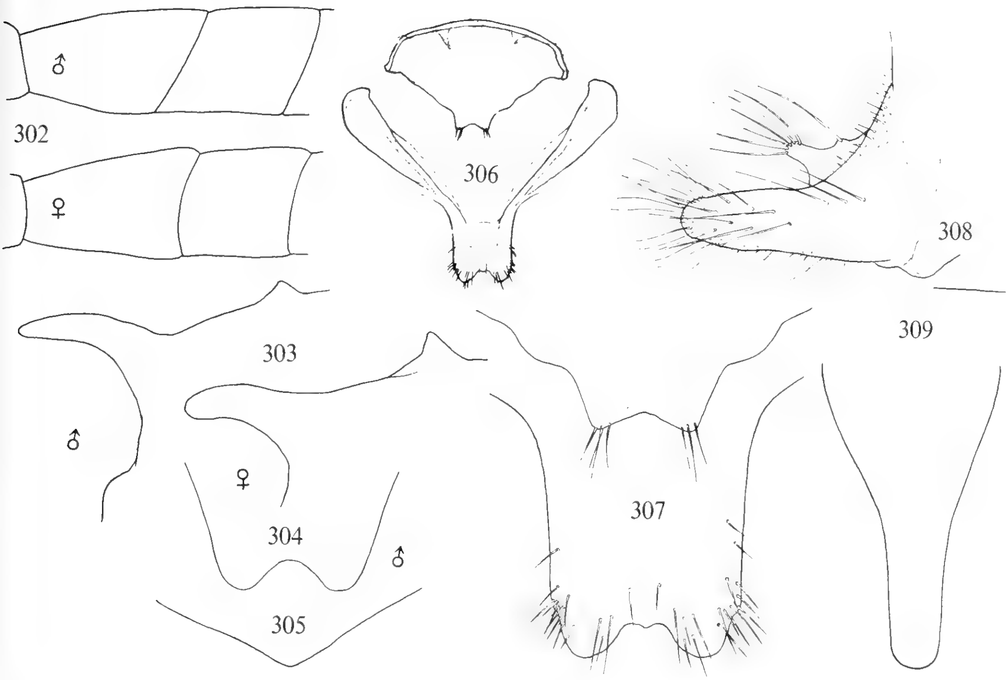
Always excepting the sexual differences, the female is the only specimen which corresponds closely with the type. As to its stature and markings, the resemblance to Egyptian examples of *italica* is undeniable; but, in addition to the main key characters, it can be distinguished from the latter by the darker wing membrane, shorter third submarginal cell, smaller tergal spots, less shiny abdomen, and shorter vestiture of all body parts; the more slender and swollen apical portion of the pygidial plate of the female being an additional feature of *assimilis*.

Melecta curvispina Lieftinck
(figs. 302—309)

Melecta curvispina Lieftinck, 1958, Comment. Biol. Helsingfors 18.5: 22 & 25 (key ♂♀), 28—29, fig. 9—10, 16—17, 22—25, 35 & 38 (♂♀ struct., Tenerife & Gran Canaria).

Additional material. — Canary Is., Tenerife: 1 ♀, Tenerife, Dr. Verneau (MP); 1 ♂ 2 ♀, Bajamar, 4.xii.1955, J. M. Fernandez (CB); 4 ♀, Las Canadas, 14.iv.1957 (♀), El Rosaria, 20.iv.1960 (♀), and Cumbre de Ergo, 13.v.1960 (2 ♀), all O. Lundblad (NRS, ML); 1 ♀, Cumbre de Aguirre, 26.iv.1959, Fernandez (ex coll. Verhoeff, ML); ♀♂, Cruz da Afur, 5.iv.1904, E. Saunders coll. (BM); series ♂♀ Tenerife, 1000—2100 m, v—vi.1964, K. M. Guichard (BM); series of 72 ♂♀, Orotava, Agua Garcia, Canadas, Mercedes, Villaflor and P. del Hidalgo, 25.iv—2.v.1971, H. Teunissen (CT, ML); 2 ♂ 1 ♀, Las Canadas, 6.iv.1972 (2 ♂) and Buenavista, 19.iv.1972 (♀), K. W. R. Zwart (ML); 1 ♀, Arona, 13—26.ii.1977, J. Wolschrijn, coll. H. Wiering (MA); 1 ♀, Barranco de los Silos, 170 m, 27.iii.1972, J. Klimesch (CE); 4 ♂, Puerto de la Cruz, 23—27.iii.1976, S. Erlandsson, together with *Anthophora a. alluaudi* J. P. (NRS, ML); 3 ♂, Vilaflor, 1300 m, 4.iv.1977, H. Wolf (CHW); 1 ♂ 1 ♀, Bco. Infierno, 25.iii.1972 (♂), A. Machado, and Los Gigantos, 11.iii.1972 (♀), B. Gustafsson (NRS). — La Palma: series ♂♀, v—vi.1964, K. M. Guichard (BM); 1 ♀, La Palma, Cumbre Nueva, W slope, "cleared pine woods", 30.v.1976, P. J. Chandler (BM); 1 ♀, La Palma, La Caldera, 4.v.1973, A. Machado (NRS); 1 ♀, Palma, Canar. Is., 23.iii.1898, Hintz (MNB). — Gomera: 1 ♀, Gomera, Can. Ins., 15.iv.1898, Hintz, *M. luctuosa*, det. Friese (MNB); 1 ♂ (diss.), Kanar. Ins., La Gomera, Valley Gran Rey, 2—16.iv.1971, J. Klimesch (CE). — Gran Canaria: 2 ♀, Grande Canarie, env. de Sta. Brigida, San José Montañela, 26.iii.1903, P. Lesne, *M. luctuosa* Scop., det.? (MP, ML); 1 ♂ 1 ♀, Gran Canaria, San Agustin, 27.iii—6.iv.1970, H. Wolf (ML); 1 ♂ 1 ♀, Gran Canaria, Caldera de Bandama, 11.iii.1968 (♂) and San Bartolomé de Tirajana, 16.iii.1968 (♀), W. Backhuys (ML).

A very distinct species, well characterized by the curved processes arising from the scutellar lobes. The type is from Tenerife.



Figs. 302—309. *M. curvispina* (Canary Is.); 302, frontal view of left antennal segments 3—4 (♂♀, Tenerife); 303, left scutellar spines (same specimens); 304, apices of tergites 7 and 8 (♂, same specimen); 305, apical border of sternite 6 (♂, same specimen); 306, sternites 7 and 8 (♂, same specimen); 307, apices of same; 308, oblique lateral view of gonostylus (♂, same specimen); 309, dorsal view of pygidial plate (♀, Tenerife). After Lieftinck, 1958

Male. — The characters summarized in my previous key (1958) are incomplete, no mention having been made of one very important character, viz. the presence of rhinaria on the antennal segments, which are well developed in the males of all species known from the Canaries. In *M. luctuosa* these scent organs are absent, but this species has not yet been found in the islands. With the amended note on the antennal structure, the original descriptions and copied illustrations (figs. 302—309), it will be easy to separate *curvispina* froms its congeners. Apart from the usual infraspecific variation in structure, no differences could be detected between males from Tenerife and three other main islands of the group.

Female. — Two fairly distinct insular varieties (subspecies?) are recognizable: (1) Tenerife: Clypeus, a broadly hairless anterior border excepted, invariably clothed with raised black hairs; long dense pubescence fringing antennal scape white anteriorly, black posteriorly; abdominal spots conspicuous, largest and completely isolated on tergite 1. — (2) Gran Canaria: A brilliant fan-like patch of decumbent silvery hairs upon middle of clypeus; hairs all around antennal scape black; tergal spots similar to (1), but all comparatively smaller. These (unisexual!) differences in hair colour and size of tergal spots between populations from Tenerife (terr. typ.) and Gran Canaria, are worthy of note. By the absence of a female from Gran Canaria, these features could not be taken into account in my earlier description, but certainly deserve full attention. La Palma and Gomera are new insular records for this species. Females from these islands are no more available for comparison with the others.

Melecta canariensis Lieftinck
(figs. 310—312)

Melecta canariensis Lieftinck, 1958, Comment. Biol. Helsingfors 18.5: 26—28 (key ♀), 30, fig. 11, 18 & 40 (♀ struct., "Canary Is.", MP).

Additional material. — Canary Is.: 1 ♀ (diss.), labelled "69/85" (written on white disk), small purple square, "Canary Islands" (written on white rectangle), and my own identification "*M. canariensis* = ?*curvispina* Lieft., det. 1958" (BM).

This second female, though not in too good a condition, compares well structurally, in colour and size, with the holotype of *canariensis*, whose precise habitat is also unknown! Apart from the specific difference in the scutellar processes, which are distinctly shorter and not markedly curved, it agrees best with variety (2) of *curvispina*, since it possesses a silvery spot upon middle of clypeus, while all hairs fringing the antennal scape are black. Pubescent pattern and size of tergal spots as in populations from Gran Canaria. It is evident, therefore, that this specimen was not collected on the island of Tenerife. With the discovery of yet another species, *M. prophanta* spec. nov., in the Canaries, it seems best to consider all taxa presently known from these islands distinct species. The nearest ally of *canariensis* would seem to be *M. leucorhyncha* Gribodo, discussed hereafter.

Male. — Unknown, but likely to be discovered in one of the islands, which will be necessary to establish its status and affinities with more precision.

Melecta caroli Lieftinck
(figs. 313—321)

Melecta caroli Lieftinck, 1958, Comment. Biol. Helsingfors 18.5: 23 & 28 (key ♂♀), 29—30, fig. 12—13, 19—20, 26—29, 36 & 41 (♂♀ struct., Lanzarote).
Melecta nigra Brullé, 1839, *in* Webb & Berthelot, Hist. nat. Iles Canaries 2 Ent.: 89 (♀ Canaries). — Lieftinck, 1958, Comment. Biol. Helsingfors 8 (5): 30 (homonym).

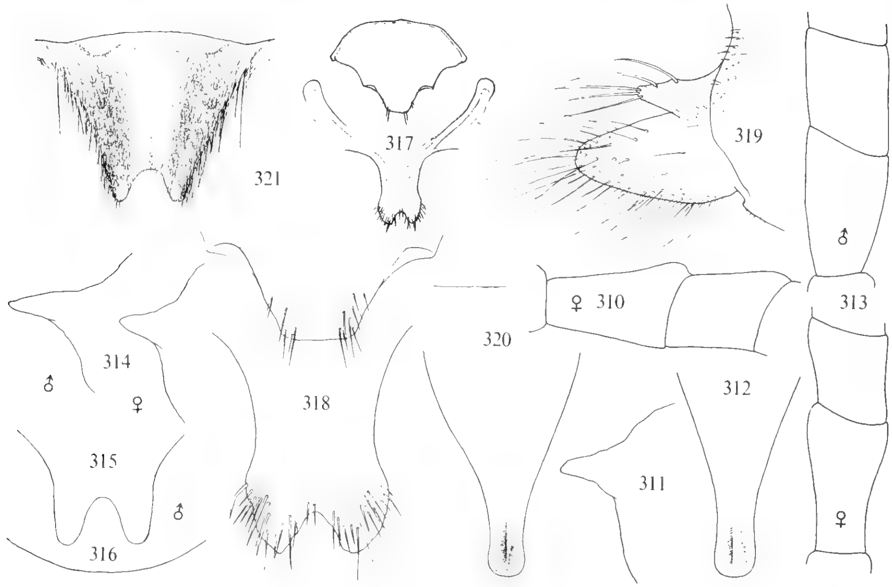
Additional material. — Canary Is., Lanzarote: 4 ♀, Islas Canarias, Lanzarote, Puerto del Carmen, 1.iii.1977 (♀), Mozaga, 5.iii.1977 (♀), Mirador del Rio (♀), and 3 km N of Maguez, 9.iii.1977 (2 ♀), M. C. & G. Kruseman (MA, ML); 22 ♂ 11 ♀, Lanzarote, Famara, 4—15.ii.1979, R. T. Simon Thomas & W. N. Ellis (MA, ML). — Fuerteventura: 2 ♀, Betancuria, 2.v.1964 & above Ampuyenta, 29.iv.1964, K. M. Guichard (BM); 1 ♀, Fuerteventura, Canar. Ins., Polatzek, ii.1894 N.1 (NMW); 2 ♂ 2 ♀ (diss.), Fuerteventura, Betancuria (♀), Vega Rio Palma (2 ♂) and La Oliva (♀), 12—13.ii.1977, leg. M. Báez (MLLT, ML); 2 ♀, Fuerteventura, La Oliva, 11.v.1974, J. M. Fernandez, and 29.v.1974, A. Machado (NRS); 1 ♀, Canar. Ins., Fuerteventura, 13—26.iii.1926, Hering (MNB).

The rich supply of specimens presently available for study enabled me to supplement the original description of this interesting little species (see also the keys and figs. 313—321).

Both sexes. — Incomplete median carina of labrum slightly compressed and upturned apically, occasionally extending upward toward base for about ¾ whole length of labrum. Antenna invariably 6-segmented.

Female. — Body totally black or almost so: occasionally a tiny white spot on outer faces of mid and hind tibiae at some distance from base, and (still more rarely) tufts of white in front of tegulae, behind wing bases and at outer sides of tergite 1. No condensed black hair spots at sides of tergites 2—4.

Labrum short and squarish, broadest at base, anterior border slightly projecting, the mid-apical crest ending in a pinched tubercle. Antenna slender, 3 much shorter than scape, about one and one-third as long as next segments, but all distinctly longer than broad; 2—5 subequal, 6 from one-half to two-thirds as long as preceding ones. Head and thoracic sclerites closely punctate, punctures on ocellocular area and disk of mesonotum deep, rather irregular, sometimes smaller in part than smooth and shiny interspaces. Median mesonotal line very fine, not impressed, ending at a level halfway length of tegulae, the latter superficially punctate only near base. Scutellar tubercles suberect, bluntly pricker-shaped, slightly divergent, shorter than surrounding pubescence. Inner (antecarinal) faces of mid and hind femora impunctate for a long distance beyond base. Hind tibiae densely hairy, outer faces dull, with numerous spicules evenly distributed. Inner rami of mid and hind tarsal claws less than half as long as outer. Wings strongly infuscated with slight bronze reflex, darkest along main veins and in cell centres; third submarginal cell a little higher than long, outer angle not strongly convex; nervellus well proximal to fork. Abdominal tergites finely, rather superficially punctate, most closely on posterior segments, all punctures setiferous on smooth, somewhat shiny ground. Pubescence moderately long and dense, as are the raised subapical bristles on abdominal segments and legs, those fringing posterior faces of mid and hind basitarsi distinctly longer than diameter of same. Pygidial plate gradually downcurved, broad at base, length-breadth ratio about 100 : 70; sides almost rectilinear, strongly converging as far as about ¾ length from base, then



Figs. 310-312. *M. canariensis* (Canary Is.); 310, frontal view of left antennal segments 3—4 (♀ holotype); 311, left scutellar tubercle (same specimen); 312, dorsal view of pygidial plate (same specimen). — Figs. 313—321. *M. caroli* (Canary Is.); 313, frontal view of left antennal segments 3—4 (Lanzarote); 314, left scutellar spines (same specimens); 315—316, contour of apex ♂ tergite 7 (315) and apical border of sternite 6 (316); 317, sternites 7 and 8 (♂, same specimen); 318, apices of the same, more enlarged; 319, oblique exterolateral view of right gonostylus (♂, same specimen); 320, dorsal view of pygidial plate (♀, Lanzarote); 321, dorsal view of tergite 7 (♂, Fuerteventura). All except fig. 321, after Lieftinck, 1958

pinched, the long slender apical portion almost parallel-sided (fig. 321).

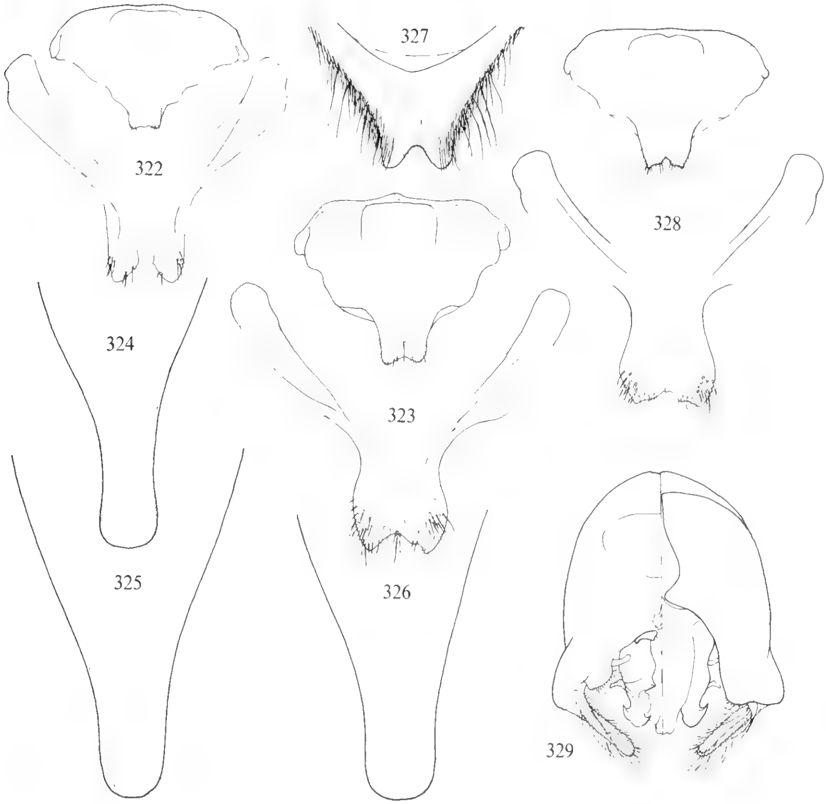
Hab.: Apparently restricted to Lanzarote and Fuerteventura.

M. caroli is one of the five *Melecta* species presently known from these Atlantic islands, and the only one showing pronounced melanism. It is quite distinct from the other small-sized members, which are probably closely interrelated. At the same time, however, *caroli* comes very near three other melanistic forms separated from it geographically by a wide gap, all occurring in the mid-Mediterranean area. These taxa are: *gracilipes*, from Menorca I. (Balearic Is.), and the much obscurated geographical subspecies of two very distinct and widely distributed species, viz. *albifrons nigra* and *leucorhyncha taormina*, occurring in most parts of Italy as well as in the islands of Corsica, Sardinia, Sicily, and Malta. They share the same tendency towards darkening of the vestiture, and accordingly look remarkably similar, especially the two extremes amongst them, namely females of *taormina* (Sicily) and *caroli* (Canaries), which are distinguishable only on close scrutiny. The phenomenon is difficult to explain, but I venture to suppose that climatic as well as edaphic influences have played an important role in the development of subspecies showing a similar colour design.

Melecta leucorhyncha leucorhyncha Gribodo
(figs. 13—14, 322—332, 344—357, map 3, p. 307)

Melecta luctuosa Scop. Var. II *Leucorhyncha* Gribodo, 1893, Bull. Soc. Ent. Ital. 25: 410—412 (pars: "Piemonte: rarissima, e dall'Algeria: Boghari").
Melecta luctuosa Scop. var. *leucorhynea* (sic): Gribodo, 1924, Boll. Mus. Zool. Anat. comp. Univ. Torino 39 n.s. 16: 39 (♀ Cyrenaica: Zavia-Mechili; ♀ Tecnis; no descr.).
Melecta luctuosa Scop. var. *ebusana* Friese, 1925, Konowia 4 : 28 ("♂ ♀ mehrfach von Palma (Mallorca), im April 1883, ♀ auch von Ibiza am 20.April 1883"). **Syn. nov.**

Type and syntypic material. — Algeria: 1 ♀ (diss., fig. 325), "Algeria" (written, white label), "*Melecta luctuosa* Scop. *leucorhyncha* Grib. ♀♂ D. Gribodo" (Gribodo's handwriting, on light blue), lectotype *M. leucorhyncha* by present selection (MCG). — Tunisia: 4 ♀ (diss.), with written black-rimmed labels "Tunisi Belv[edere], 12.III.1882, G. e L. Doria" (1 ♀), "Tunisi dint. IV.1882, G. e L. Doria" (2 ♀), and "Tunisia Cartagine, 1.III.1882, G. e L. Doria" (1 ♀),



Figs. 322—329. *M. leucorhyncha leucorhyncha* (N Africa); 322, sternites 7 and 8 (♂, Chellala, Algeria); 323, sternites 7 and 8 (♂, Colomb Bechar, Algeria); 324, dorsal view of pygidial plate (♀, Oran, Algeria); 325, the same of lectotype (♀, Algeria); 326, the same (second ♀ from Oran, Algeria); 327, ventral view of tergite 7 (♂, Bu-el-Gherab, Tripolitania); 328, sternites 7 and 8 (same specimen); 329, partial ventral and dorsal view of genital capsule (same specimen)

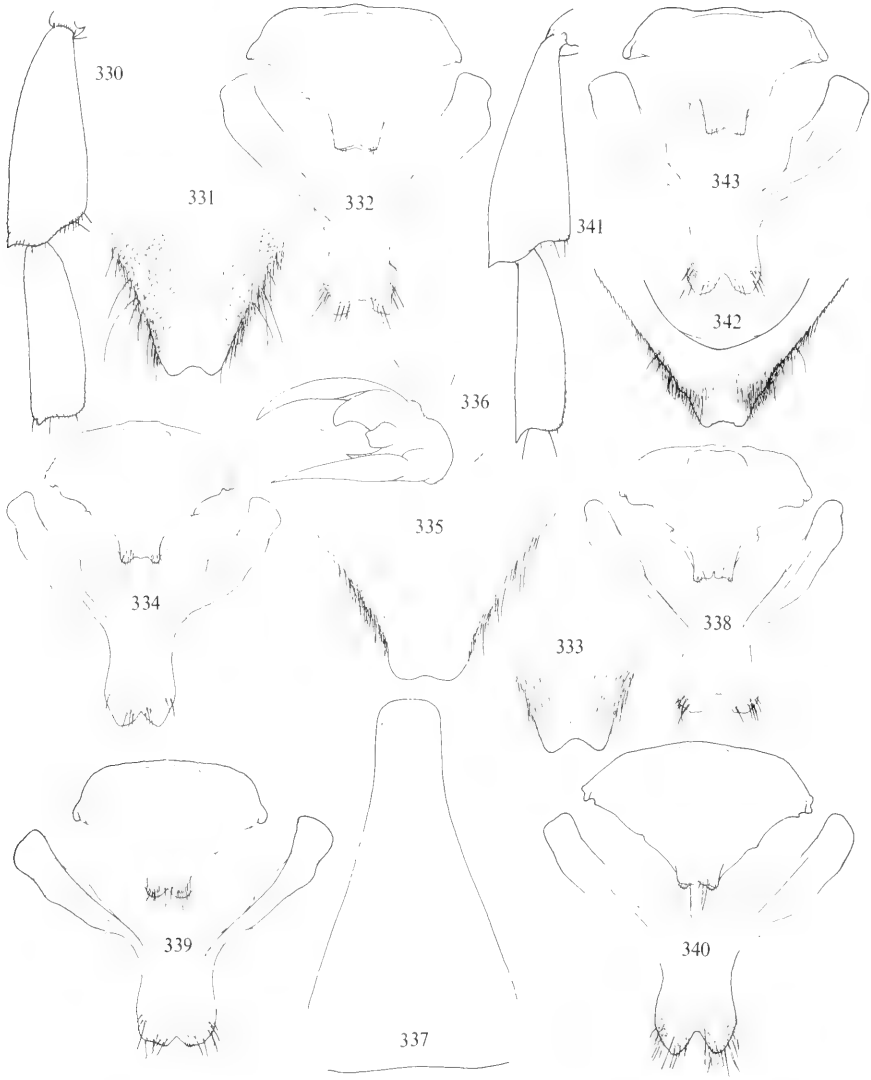
syntypes, all under drawer label *M. leucorhyncha* Gribodo (MCG, 1 ♀ ML). — Spain, Balearic Is.: 1 ♂ (diss., figs. 13, 330), "Mallorca, Friese" (print), "1891, Type" (print on red), "*Melecta*" (print) "*luctuosa* v. *ebusana* Fr. Balear." (Friese's writing), lectotype *M. ebusana* Friese, by present designation (MNB).

Further material. — Spain, Balearic Is.: 1 ♂ (diss., figs. 331—332) 1 ♀, Mallorca, 20.iii.1959, O. Lundblad (ex NRS, ML): 1 ♀ Palma de Mallorca, Baléares, coll. Ernest André 1914 (MP); 1 ♀, Palma Mallorca, C'as Catala, 4.iv.1958, A. Compte Sart (ML). — N Africa (W to E): Morocco, 1 ♀ (diss.), Middle Atlas, Azrou, 3000 ft., 6.iv.1935, D. Aubertin (BM); 2 ♀, Maroc, Moyen Atlas, Midelt, 1500 m, 23.v.1947, J. de Beaumont (CB); 1 ♀ (diss.), Moyen Atlas, Tizi-n-Tretten, Mischliffen, 1900 m, 30.v.1968, M. A. Lieftinck (ML); 2 ♀, Moyen Atlas, Ifrane, 1650 m, 26.v.1966, M. A. Lieftinck (ML); 4 ♀ (diss.), Haut Atlas, Oukaimeden, 2600—2800 m, 8.vii.1975, A. W. Ebmer, (2 ♀) and same loc., 8—11.vii.1975 (2 ♀), J. Gusenleitner (CG); 1 ♀ Morocco, 32 km S Ben-Slimane, 29.iv.1968, J. G. Rozen (AMNH); 1 ♀, Marocco, Fritsch-Rein (?), von Heyden (SMF); 1 ♀, Marrakesh, 25.ii.1935, R. & C. Koch (AMNH). — Algeria: 16 ♂ (2 diss., fig. 322) 2 ♀, Prov. d'Alger, Chellala, Jardin Romanetti, Vauloger 138—97 (MP, ML); 1 ♂ (diss.), Alger, Baraki, 10.iii.1910, Dr. J. Bequaert (MNB); 4 ♂ (2 diss., fig. 323), Algeria, Colomb Bechar, 4.iii.1944, K. M. Guichard, very small ex.! (BM); 1 ♀ (diss.), Algeria, Maison Carré, 27.iv.1943, K. M. Guichard, same locality as ♂♀ *M. italica* Radoszk., but later in season! (BM); 1 ♂ 1 ♀ (fig. 324), Oran, 1910, Schmiedeknecht, coll. A. Weis (SMF); 1 ♀, Algérie, Semur, coll. Ernest André (MP); 2 ♀ (one with green disk), Algérie, Teniet, coll. J. Pérez 1915 (MP); 1 ♀, Bône, coll. O. Sichel 1867, "*luctuos* suppl." (Sichel's handwriting on dark green) (MP); 1 ♀, Algérie, Arzew, avril 1888, coll. J. Vachal (MP); 1 ♀, Bône, coll. J. Pérez 1915 (MP); 1 ♂, Algérie, coll. J. de Gaulle, *M. luctuosa*, det.?; Algérie, Tebassa, 2.v.1898, J. de Gaulle (1 ♀), Biskra, coll. J. Pérez 1915 (3 ♀) (all MP); 1 ♀, Algérie, Sétif, coll. de Saussure, *M. luctuosa punctata* Lep. (old writing) (MG); 1 ♀, Algeria 1904, "Friese det." (sine nomen, NRS); 2 ♀, Algeria, Biskra, 31 Marzo 1952 & Djelfa, 10 Aprile 1952 (IEB); 2 ♀, N Algeria, Biskra, 24.iii.1894, E. Saunders coll., and Hamman Rhica, v.1911, Rothschild & Hartert (BM); 3 ♀, Algir, 593.108, 1881, *M. luctuosa*, det. Friese 1893 (MBUD, ML). — Tunisia: 2 ♂, Gafsa, P. Chrétien 1910, no. 272 (MP); 2 ♀, Tunis, coll. J. Pérez (MP); ♀, Tunesie, Metlaoui, C. Dumont 1921 (MP); 2 ♀ (on single pin), Tunis, Kairouan, coll. Santschi, *M. armata* var. mas (typewritten, NMB); 1 ♂ (together with *M. italica*!), Tunis, Kairouan, ii.—iii.1927, coll. Santschi, *M. luctuosa*, det. Alfken 1933 (NMB); 2 ♀, Kairouan, 24.iii.1908, J. de Gaulle (MP); 1 ♂ 1 ♀, Médinine, *furcata*, det.? coll. J. Pérez 1915 (♂) and Médinine, *M. luctuosa* det.? coll. J. Vachal 1911, no. 415 (♀); 1 ♂, Tunis, 3-5.12, Zobrys leg. (MNB); 2 ♀, Tunisie, Gafsa, A. Weis 1904, and Oasis Gafsa, B. v. Bodenmeyer, M. Pic 1928 (MP); 1 ♀, purple disk, Tunis (MP); 1 ♀, Tunis, *meridionalis*, det.? coll. J. Pérez 1915, and 1 ♀, Gafsa, Biró (MBUD); 3 ♂, Tunesien, Oase Gafsa, ii—iii.1977, M. Schwarz (CMS, ML); 1 ♀, Tunis 1898, Schmiedeknecht, *M. luctuosa*, det. Kohl (NMW); 5 ♀, Tunis 1911, Schmiedeknecht, A. Weis coll. (SMF, ML); 1 ♀, Tunis, April, coll. Graeffe, *M. luctuosa* Scop. var. *albovaria* det.? (NMW); 1 ♂, Oase Gafsa, 28.ii.1977, *M. luctuosa*, det.? (CMS). — Libya: 4 ♂ (1 diss., figs. 327—328), 2 ♀, Tripolitania, Bu-el-Cheràb, 6—10 aprile 1953, and 1 ♀, id., (fig. 329), Mizda, 9 aprile 1953 (IEB, ML); 1 ♂ 1 ♀, Tripolitania, same loc and Uadi Caàm, 6—10 aprile 1953 (MA); 1 ♀, Cirenaica, Zavia, Mechili, Festa (MT); 1 ♀, Cirenaica, Tecnis, Festa, *M. luctuosa* Scop. var. *leucorhynca* (sic) Grib. (Gribodo's writing, (MT). — Egypt: 2 ♀ (diss.), Egypte, Naville (MG); 1 ♀, Egypt, Hammam, 10.iii.1930, Min. Agric., coll. Andres-Priesner, Slg. Alfken (MNB); 1 ♀ (diss.), S. Sinai, ca. 1600 m, S. Atherina Area, 24—27.iv.1975, K. M. Guichard (BM). — Israel-Jordan: 2 ♀, Palestine, Jerusalem, 29.ii.1940, and Jericho, 9.iv.1943, H. Bytinski-Salz (CBS); 1 ♀, Israel/A 2100/ Judaea Mts., Jerusalem, 3.iii.1940, and A 2099/Lower Jordan Valley, Jericho, 23.ii.1941, Y. Palmoni (AID); 1 ♂ (diss.), Israel, Arad, 10.ii.1966, and 2 ♂ (diss.), Jerusalem, 29.ii.1940 & 2.iii.1940, *M. luctuosa* ♂, det. Mavromoustakis (CBS). A series of ♀, from various localities all over Israel, some of rather doubtful status, are in (CBS). — Turkey (Asia minor): 4 ♂ 1 ♀, Türkei, E. Uludere/Hakkari, 5.v.1977 & pass E Uludere Hakkri, 6.vi.1977, together with *M. festiva* m., K. Warncke (CKW, ML); 1 ♂ 9 ♀ (all diss.), Türkei, Sivas-Gürün, 3.vi. (1 ♀), Konya-Sille, 7.vi. (1 ♀), Icel-Sertavul, 1400 m, 9.vi. (1 ♂ 3 ♀), together with *M. festiva* m., and Konya-Karaman, 9—11.vi.1978 (4 ♀), all Max. Schwarz (CMS, ML); 1 ♂ (diss., fig. 351), Anatolia bor., Ayancik, vii.1961, F. Schubert (CMS); 1 ♀ (diss.), Brussa/724, *M. luctuosa*, det. Friese 1896 (MNB); 3 ♀ As. Türkei, Sille b. Konya, 17.vi.1968, J. Schmidt (CL) and

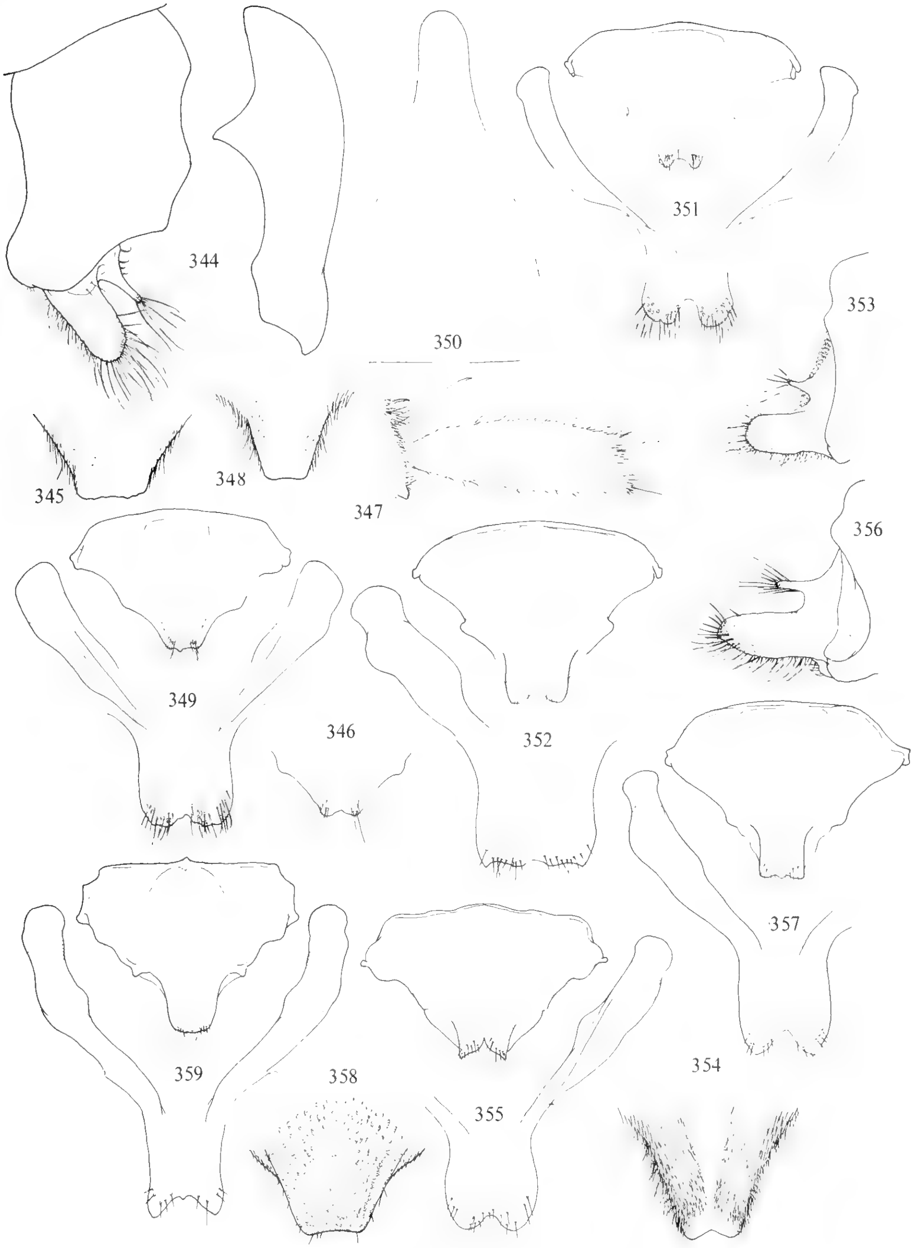
9—17.vi.1975, J. Heinrich (CJH); 8 ♀, As. Türkei, Gürün, 12—15.vi.1976, J. Heinrich (3 ♀) (CJH) and same loc., 3—9.vi.1907, J. Gusenleitner (5 ♀) (CG); 3 ♀, As. minor, Konya, 1030 m, 11.vi.1966, K. Kusdas (CJH), and same loc., 25.v.1965, M. Schwarz & 10—12.vi.1966, J. Schmidt (CMS); 2 ♀, As. Türkei, Tarsus, 30.v.1965, M. Schwarz, and Perge nr. Antalya, 3.vi.1966, J. Schmidt (CMS); 1 ♀, Akasaray, 8.vi.1964, J. Gusenleitner (CG); 1 ♀, Turkey, Havsa, 1500 ft., Samsun-Amasya Rd., 19.v.1959, K. M. Guichard (BM); several ♀ of rather doubtful status, collected in various localities all over Turkey from April to June, are in (CW, CL, CJH, CMS, ML and MP). — Rodos I. (Greece): 1 ♂ (diss., fig. 14), 3 ♀, Ixias, 23.iv.1971, and 3 ♀ Epta Piges, 24.iv.1971, all M. A. Lieftinck (ML); 13 ♂ (diss.), Ataviros, 18.v.1970 (1 ♂), and 24.iv.1976 (4 ♂, fig. 347), Profitis Ilias, 20—28.iv.1976 (7 ♂, 4 diss., fig. 344), and Falaraki, 23.iv.1976 (1 ♂), all H. Teunissen (CT, ML); 6 ♂ (diss., figs.) 2 ♀, Rodi, Agios Isodoros (4 ♂, figs. 345—346), M. Ataviro (2 ♂, figs. 348—349), Koskino (1 ♀, fig. 350), and Kattabia (1 ♀), all iii—vi.1913, E. Festa (MT, ML); 1 ♀, Monolithos, 22.iv.1970, D. C. Geijskes (ML); 1 ♂ 10 ♀, Lindos, 30.iii—1.iv.1970 (1 ♂ 1 ♀), Lindos, Marmari, 8.iv.1970 (2 ♀), Kalathos, 5 km N Lindos, 2—7.iv.1970 (4 ♀), Laerma, 14.iv.1970 (2 ♀), and 10 km N Malona, 11.iv.1970 (1 ♀), all A. C. & W. N. Ellis (MA, ML); 1 ♀ (aberrant), Mte Profeta Elia, 12.v.1935, O. Wettstein, *M. luctuosa* Scop., det. P. P. Babyi 1941 (NMW); 1 ♀, Rodus, Lindos, 6.iv.1971, V. S. v. d. Goot (MA); 2 ♀ (diss.), Rhodos, 18009 and Rhodus, Loew (MNB); 1 ♀, Rhodos, Psinthos, 29.iii.1977, A. Nilsson (DEU). — Cyprus I.: 2 ♀ (diss.), Kyrenia, 27.iii.1932, no. 553 & 20.iv.1932, no. 832, E. E. Green (BM); 5 ♂ (diss.), Ay. Neophytos, 27.iii.1971 (figs. 354—356), Nicosia, 500 ft., 5.iii.1971 (figs. 352—353), Antophonitis, 12.iii.1971 (fig 357), Kantara, 2000 ft., 11.iv.1971, and Vouni, 25.iii.1971, all K. M. Guichard (BM, ML); 1 ♂ (diss.) 3 ♀, Cyprus, Yerasa and Paramytha, 6.iv.1978, and Yermasoyia, 3.iv.1978, H. Teunissen (CT, ML); 2 ♀ (diss.), Limassol, iii.1931 & iv.1932, G. Mavromoustakis (MNB, ML); 3 ♀ (diss.), Limassol, Yermasoyia, 17.iii.1979, L. A. Janzon & 1 ♀, Governor's Beach, 16.iii.1979, same coll. (NRS, ML); — Greece: 1 ♂ (diss.), Peloponnesus, Chelmos, 1900 m, 2.vi.1962, Max. Schwarz (CMS); 1 ♂ (diss.), Parnass [= Mt. Parness 1200 m, 40 NW of Athens] (MCG); 1 ♀, Greece, Kifissis, 250 m, iv—v.1977, K. M. Guichard (BM. — S USSR: Ukraine: 3 ♂ (all diss.), Chersonskaja dist., Novaja Tjaginka, 19, 26 & 27.v.1954, one at flower of *Caragana arborescens*, two at *Robinia pseudacacia*, one with *M. luctuosa* Scop., leg. & det. A. Z. Osychniuk (CO, ML).

More doubtful ♀ specimens. — S USSR, Ukraine (see above), 5 ♀ (all diss.), Chersonskaja dist., Cherson, 14.v.1954 (1 ex.) and 19.v.1954 (4 ex.), A. Z. Osychniuk (CO, ML). The four females dated 19.v.1954, were collected the same day as a male *M. luctuosa* Scop., taken at nearby Novaja Tjaginka, viz. the locality of *M. leucorhyncha*; probably both species (which are inseparable) are included in the present series.

The revival of the name *leucorhyncha* for a relatively small-sized *Melecta,* widely and commonly distributed all over the Mediterranean region, is based upon two considerations, namely (1) the conviction that it is specifically distinct from the much earlier described *italica* Radoszkowski, and (2) that there is only a single — though inappropriate — name available to denote it. As with his "*luctuosa* Var. I. *meridionalis*", Gribodo left his readers to decide which species should be assigned to his "Var. II *leucorhyncha*", the brief Latin diagnosis giving no clue to that effect. The name was given to bees from Piemonte (stated to be very rare at Torino) and Algeria. There were, however, no examples from Piemonte to be found in his collection, the only individuals under that varietal name being the five specimens still before me. One is a female from Algeria while the remainder — like Gribodo's series of var. *meridionalis* — are labelled "Tunisi", leg. Doria. A careful investigation revealed *meridionalis* to be conspecific with *italica* Radoszkowski, see under that species. Consequently, the choice of a type locality as well as the selection of a lectotype, were also left to a future reviser. Since "Algeria (Boghari)" is given as one of the localities for *leucorhyncha*, I have designated the Algerian female lectotype, i.e. the first described sex and only specimen bearing a label in Gribodo's own handwriting (MCG). For that matter, we have seen that the author himself got confused by arranging both sexes of his Tunesian series under *meridionalis,* whereas four females passed for *leucorhyncha,*



Figs. 330—332. *M. leucorhyncha leucorhyncha*; 330, external view of right tibio-basitarsus (♂ lectotype *ebusana*, Mallorca, Baleares); 331, dorsal view of tergite 7 (♂, Mallorca); 332, sternites 7 and 8 (same specimen) — Figs. 333—340. *M. leucorhyncha taormina*; 333, dorsal view of tergite 7 (♂, Bologna, Italy); 334, sternites 7 and 8 (same specimen); 335, dorsal view of tergite 7, sculpture omitted (♂, Sassuolo, Italy); 336, left hind tarsal claw (♀, Sassuolo, Italy); 337, dorsal view of pygidial plate (same specimen); 338, sternites 7 and 8 (♂, Corsica); 339—340, sternites 7 and 8 (2 ♂, Sicily). — Figs. 341—343, *M. gracilipes* (♂ holotype, Menorca, Baleares); 341, external view of tibio-basitarsus; 342, ventral view of tergite 7; 343, sternites 7 and 8



Figs. 344—357. *M. leucorhyncha leucorhyncha*; 344, genital capsule, left lateral and partial dorsal view, showing bi-angulated gonocoxal angle (♂, Profitis Ilias, Rodos); 345, dorsal view of tergite 7 (♂, Agios Isodoros, Rodos); 346, apex of sternite 8 (same specimen); 347, external view of right hind basitarsus (♂, Attaviros, Rodos); 348, dorsal view of tergite 7 (♂, Attaviro, Rodos); 349, sternites 7 and 8 (same specimen); 350, dorsal view of pygidial plate (♀, Koskino, Rodos); 351, sternites 7 and 8 (♂, Ayancik, Anat. bor., Turkey); 352, sternites 7 and 8 (♂, Nicosia, Cyprus); 353, right exterolateral view of gonostylus (same specimen); 354, dorsal view of tergite 7 (♂, Ay. Neophytos, Cyprus); 355, sternites 7 and 8 (same specimen); 356, right exterolateral view of gonostylus (same specimen); 357, sternites 7 and 8 (♂, Antiphonitis, Cyprus). — Figs. 358—359. *M. italica*; 358, dorsal view of tergite 7 (♂, Lagoudera, Cyprus); 359, sternites 7 and 8 (same specimen)

Pending an inquiry into reliable distinctive characters for both taxa, long series of either sex had to be carefully compared, their habitations put on record one by one, and the dates of capture specified as detailed as possible. As with *italica,* only in that way it was possible to obtain a rough impression of the variation, distribution and seasonal occurrence of both. We have seen that the two keep company in many localities scattered all over their range. Added to that, structural differences between them are slight, not easy to detect and evidently far from constant. As to the vestiture, both exhibit considerable local differences, each displaying its own individual departure from the familiar *luctuosa* design, the crucial point regarding this variability being that, in places where the two species occur side by side, *leucorhyncha* may show a pattern analogous to that of *italica,* at times tending towards obscuration (melanism), then again to a marked increase of white pilosity. It must be admitted that in certain cases, where morphological differences between the dark extremes of either are unapparent, no convincing evidence could be provided that we are, indeed, dealing with a pair of sibling species. In Sicily, for instance, marginal populations of each seem to meet, become mixed and may even hybridize in certain localized spots. In any case some females are so much alike as to become inseparable (see also sub *italica*).

M. l. leucorhyncha Gribodo and **luctuosa** (Scop.)

It will be remembered that quite some controversial *luctuosa*-like females included in our locality lists had to be left unnamed, simply because reliable recognition marks were not to be detected (see also under *M. luctuosa*). The following observation may demonstrate the difficulty to distinguish between females of *leucorhyncha* and others closely resembling them, especially *luctuosa.* A good example was found among Mr. A. Z. Osychniuk's captures in the Ukraine (USSR). He came across a mixed population of two near-alike *Melecta* occurring at Novaja Tjaginka in the Chersonskaja district. On 19 May 1954, seven of these bees (3 ♂ 4 ♀), all supposed to be *luctuosa,* were taken at flowers of the papilionaceous shrub *Caragana arborescens.* Looking closely into their identity later, it was easy enough to recognize two males of *luctuosa*, whereas the third proved to be *leucorhyncha.* The four females collected in company with the latter were so much alike in every respect that even at present I am not absolutely sure which is which, or whether all belong to a single species. One week later (26 and 27 May), on visiting the same locality, two more males of *leucorhyncha* could be taken at flowers of *Robinia pseudacacia,* but no more females were caught on that occasion.

Melecta leucorhyncha taormina Strand, stat. nov.
(figs. 333—340 & pl. 8 fig. 41, map 3, p. 307)

Melecta luctuosa var. *taormina* Strand, 1919, Archiv f. Naturgeschr. 83 (11): 61—62 (♀ Taormina-Lentini, Sicilien; incl. f. *lentina* nov. f. & f. *tibiopunctata* nov. f.).

Melecta nigra Lepeletier, 1841, Hist. nat. Ins. Hym. 2: 446 (♀, "de Gênes en Italie, Musée du général Dejean"). Nom. preocc.: not *M. nigra* Spinola, 1806.

? *Melecta nigra*: Dusmet y Alonso, 1905, Bol. Real Soc. esp. Hist. nat.: 152, 153 (♂ Spain: Las Arenas, Viscaya).

Type and syntypic material. — Italy: 1 ♀ (wing tips broken off), dark green disk, "*nigra*" (old writing on vertical pin-label), lectotype (holotype?) *Melecta nigra* Lepeletier (not Spinola), by present designation (MP). — Sicilia: 3 ♀ (diss.), all with same printed label "Taormina-Lentini (Sizilien) v.1914 W. Trautman"; and "*Melecta luctuosa* v. *taormina* m. ♀" (Strand's writing), "Strand det." (print) "Typus" (print on red), lectotype *taormina* by present selection; "*Melecta luctuosa* v. *taormina* m. f. *lentina* m. ♀" (Strand's writing), "Type!" (id., written on red), paralectotype *taormina*; and "*Melecta luctuosa* Sc. v. *taormina* m. f. *tibiopunctata*" (Strand's writing), "Typus" (print on red), paralectotype *taormina* (all DEI).

Further material. — Sicily: 1 ♂ (diss., mounted, figs. 339—340 & pl. 8 fig. 41), 5 ♀ (2 diss.), Sizilien, Selinunt, 1.iv.1930, Segesta, 5.iv.1930, and Girgenti, 8.iv.1930, Troll/Hym. Inv. 31.iii Nos. 304, 305, 313, 320—322, together with 4 ♀ *M. italica* Rad.! (NMW, ML); 1 ♂ (diss.) 1 ♀, Sicilia 1858 Mann, *M. luctuosa* v. *albovaria* Er. form *calabrina* Rad. (Friese's handwriting), det. Friese 1893 (♂), *M. luctuosa* v. *rutenica* Rad. (ditto), det. Friese 1893, with nr. 155 (♀) (NMW); 1 ♀, Sicilia, Zappulla, 29.iii.1935, Mariani leg., c. Hartig (INER); 1 ♀, Sicilia, S. Nicola di Maz, 31.iii.1937, same day together with 1 ♀ *M. italica* (INER); 2 ♀, blue disk, Sicile, coll. J. Pérez 1915 (MP, ML); 1 ♀, Sicilia, Palermo, S. Martino d.Sc., 1—12.vi.1954, J. Klimesch (CMS); 1 ♀, Sizilien (Palermo), Mte Colobrino, 750 m, v.1951, Leinfest leg. (CVZ); 4 ♂ (diss.) 2 ♀, Sicilia, Castel Bueno, 6—9.v.1975 (4 ♂ 1 ♀) & Castel Mola, Monte Veneretto, 3.v.1975 (1 ♀), H. Teunissen (CT & ML); 1 ♀, Sicilia, Isola Mothia (Massala), 23.iii.1965, M. Comba (CMC). — Malta I: 1 ♀, Malta (old writing), no. 16, without drawer label in coll. Spinola (MT). — Italia (continental, S to N): 1 ♀, Calabria, Sila Grande Silvana Mansio-M. d. Porcina, 15—1850 m, 21.vi.1961, leg. Reinig (SMF); 10 ♀ (partly diss.), Manfredonia (Puglia), Paganetti 1904, 6 ex. with "v. *ruthenica*", 1 ex. with *M. luctuosa* Scop. v. *ruthenica* Rad., det. Alfken 1904 (all in Alfken's writing), and 3 ex. indet, (NMW, ML); 1 ♀, Warano (?), Mte Covero, Paganetti (NMW); 4 ♀, Apulien, Paganetti, *M. luctuosa* v. *ruthenica* Rad., det. Alfken 1904 (1 ♀), & *M. luctuosa*-Gruppe, det. Alfken (3 ♀), Slg. Alfken (MNB); 3 ♀, Apulien, Spongano, 18.iv—3.v.1933, v. Loudon, *luctuosa*, det.? (MNB); 1♀, Abruzzo (Aquila), Gran Sasso d'Italia, östl. Arsita, 525 m, 23.vi.1962, leg. Reinig (SMF); 1♀, Abruzzo, Mti Carbeolani, Castel vecchio, 1000 m, vi.1948, Bisleti leg. (CMC); 1♀ (diss.), Roma (Lazio), M. Mario, 15.v.1946, Saracchi (CMC); 1 ♀, Roma, Ostia Scavi, 10.v.1942, C.N.R., Ist. Naz. Biol./Roma (INER); 2 ♀, Centocelle, 21.iv.1932 & Caffarella (Lazio), 29.iv.1935 (INER, ML); 1 ♀, Capo Circeo (Lazio), Quarto caldo, 20.iv.1940, C.N.R. (INER); 2 ♀, Roma, 26.iv.1947 & Roma, Torraccia, Montebello, 30.iv.1853, M. Comba leg. (CMC, ML); 1 ♀, Macerata (Marche), vii (sic) 1897, v. Bezzi, coll. P. Magretti (MCG); 1 ♀, Livorno (Toscana), Mann 1872, no. 70, *M. luctuosa* v. *rutenica* Rad., det. Friese 1893 (NMW); 1 ♀ (diss.), Bologna, Gaibolo, ii.iv.1931, *M. luctuosa* f. *ruthenica* Rad., det. H. Hedicke 1931 (IEB); 1 ♀, Spilamberto-Emilia, vi.1922, C. Minozzi (MCG); 1 ♀ (diss.), Castelvetro (Emilia), 10.viii (sic) 1886, *M. luctuosa* Scop., together with 2 ♂ 1 ♀ *M. italica*, dated 12.viii (sic) 1885, 7.x. (sic) 1885 (2 ♂) and without date (1 ♀), all with *M. luctuosa* Scop. (MT, ML); 1 ♂ (diss., figs. 333—334, Bologna, Ronzano, 9.v.1948, *M. fasciculata* Spin., det.? (IEB); 1 ♀, Emilia, Gaggio Montano Estate 1939, sub *M. luctuosa*, det.? (IEB); 1 ♂ 1 ♀ (diss.), Emilia, Bazzano, 8.v.1905, sub *M. luctuosa*, det.? (♂) and 28.vii (sic) 1890, sub *M. ruthenica* Rad., det.? (IEB); 1 ♂ (diss.), Bologna (Emilia-Romagna), Cafiualbo (?), di fiori, 21.iv.1889, coll. P. Magretti (MCG); 1 ♂ 1 ♀ (diss., figs. 335—337) Emilia, Sassuola nr. Modena, 30.iv.1882, *M. armata* Pan., det.? (MT); 2 ♀, Modena (Emilia) (MCG); 1 ♀, sine patria, 122 (written on square), det. Schmiedeknecht (S's writing), coll. P. Magretti, coll. Gribodo (print), "Je crois que c'est seulement une variété de *M. luctuosa*" (Schmiedeknecht's hand?) (MCG); 1 ♀, Genova (Liguria), v.1883, coll. Fea (MCG); 1 ♀, Piemonte, under drawer label "*M. punctata* T. Lep. var. ♀ *notata* Illig. Klug. Ped.", together with 1 ♀ *M. festiva* sp.n., under same drawer- and pin-labels in coll. Spinola (MT). — Corsica: 1 ♂ (diss., fig. 338), Centr. Corsica, Col de Bavella-Larone, 600—1240 m, 27.v.1965, "on dry hill slope together with *Anthophora sicheli* Rad.[1]), at flowers of *Astragalus sirinicus* Ten. ssp. *genargenteus* (Moris) Briq.", M. A. Lieftinck (ML); 1 ♀ (diss.),

[1]) A species occurring also in Sicily.

NW Corsica, Fango-M. Estremo, 3—600 m, 6.vi.1965, M. A. Lieftinck (ML); 1 ♀ (diss.), Cors. Mann 1855 (white disk), "*luctuosa* det. Friese Type" (unknown handwriting, NMW); 1 ♀ (diss., doubtful = ? *luctuosa*), Centr. Corsica, S. Pierre de Venaco, 4—800 m, 30.v.—2.vi.1964, M. A. Lieftinck (ML). — Sardinia: 2 ♀ (diss.), Sardegna, Sassari-Sorso (together with 1 ♀ *italica*!) and Monte Limbara, maggio 1956 (IEB, ML).

Melecta gracilipes spec. nov.
(figs. 341—343)

Type material. — Balearic Is., Menorca I: 1 ♂ (diss., figs. 341—343), Mahon, Cala de Figuera, sea level, 7.v.1958, "visiting flower of *Echium* spec. growing on coastal promontory", M. A. Lieftinck. The specimen is the holotype (ML).

Male (unique, wings frayed). — Labrum square, coarsely densely punctate, punctures of different sizes, those between large, subcircular, smooth and shiny tubercles, small and contiguous, becoming larger, more impressed and partly confluent toward apex; disk little concave, surface shiny; anterior border straight with broadly rounded side-edges, not upturned but with minute, pinched midapical tubercle. Mandibles normally unidentate, outer surface smooth, sparsely minutely striato-punctate. Clypeus, frontal area and whole dorsal surface of head strongly, almost contiguously punctate on shiny ground, punctures circular, largest and most deeply impressed anterior to ocelli, leaving a small impunctate areas just in front of median ocellus. Frontal carina impunctate, sharply crested and highest anteriorly; temples and occipital area dull, contiguously punctate. Antenna long and strong, scape closely finely punctate, fringed at all sides with long raised hairs exceeding greatest diameter of the latter and mostly white externally; 3 short, widest at apex (length-breadth ratio 100 : 86), only little longer than succeeding segments 4—12, which are squarish, 13 only a trifle longer than broad; rhinaria deeply impressed, shaped similarly to those of *leucorhyncha* from Mallorca ("*ebusana*"). Texture of thoracic sclerites as in the latter: median mesonotal line extremely fine and partly obliterated (only apparent at high magnification), the short parapsidal lines, however, quite distinct, raised, impunctate and shiny; all sclerites strongly, closely punctate, the distance separating circular punctures on mesonotum and scutellum hardly exceeding one puncture width. Scutellar tubercles strong, conical, at least twice as long as broad at base, directed obliquely upward and backward, distinctly diverging and slightly downcurved. All lateral and posterior sclerites of thorax dull, extremely closely punctate, including whole propodeum.

Legs noticeably more slender than in all *leucorhyncha*; hind femora, tibiae and basitarsi distinctly more laterally compressed, all mid and hind tibiae relatively longer (cf. figs. 330 and 341), e.g. hind tibia l : b = 100 : 40, hind basitarsus l : b = 100 : 31 (type "*ebusana*"), as against 100 : 32 and 100 : 25 (type *gracilipes*). Mid tibial pad pure white, much narrower than in the former (fig. 13), completely and more broadly surrounded by black. Punctation of legs similar in the two, setiferous punctures evenly distributed throughout, the hind femur lacking impunctate area toward the end of its inner face, the median ridge less pronounced than in Mallorcan *leucorhyncha*. Wings subhyaline, fore wing membrane only slightly infuscated beyond cells; third submarginal comparatively long, exceeding its height (115 : 100), the distal side moderately strongly angled, but more so than that of the second cell. Shape and punctation of abdomen as in *leucorhyncha*; integument shiny, tergal punctures far apart, fine and of small size, those covering the broad postgradular portion of tergites still finer, more widely spaced and superficial. No indication of crowded punctures underlying compact hair spots on any of the tergites, hairs replacing the white lateral spots on 2—4 not at all depressed and hardly more condensed than those covering disk of tergites. Pubescence covering all body parts moderately long, thinner and also more disseminated than in either *italica* or *leucorhyncha*; predominantly black. Whitish are: a broad, depressed, subquadrate patch of long semierect hairs upon middle of clypeus; long raised hairs forming ill-defined collar on mesonotum anteriorly not extending beyond level of front margin of tegulae; fluffy hairs at thoracic sides; a few very long hairs behind bases of hind wing and at sides of tergite 1. Remaining pubescence entirely black, the pile covering basal half of tergite 1 not at all dense but all hairs of great length. Vestiture of legs much as in *leucorhyncha*, but hairs longer and less closely set, those fringing hind femur posteriorly shorter than greatest diameter of the latter; all black, with the exception of the tibial pad at outer face of mid tibia.

Shape and texture of tergite 7 (fig. 342, ventral view, ridges and most of the hair omitted!) hardly differing from my figure 331 of Balearic *leucorhyncha*: its dorsal surface almost flat without any indication of lateral ridges; a broad, smooth and rather shiny impunctate median area extends from base to apex, this strip broadest at extreme base, a little constricted beyond halfway length, remainder of tergite evenly closely punctate and hairy; tip narrow (0.2—0.3 mm), shallowly emarginate, the lobes scarcely upturned, rounded; ventral ridges forming pair of smooth, oblique tubercles, well visible in profile. Apex of sternite 6 slightly projecting medially; a pair of low dark tubercles on either side of the usual, oval, less sclerotized median area. Sternites 7—8 as in figs. 343. Genital capsule hardly different in shape from *leucorhyncha*, the gonocoxal enclosure a little narrower, feebly bi-angulate distally in dorsal aspect; gonostylus also similar, less than twice as long as its width at base, tapering gradually to a broadly rounded apex; dorsobasal process more slender and parallel-sided than in typical *leucorhyncha* and the form of Mallorca, identical in shape to that seen in individuals from Cyprus and Rodos (figs. 344 & 356).

Length 10.5 mm, fore wing 8.5 mm.

Female unknown.

This peculiar little species is probably most closely related to the polytypic *leucorhyncha*, but can not be treated as a subspecies of the latter on account of its strikingly more slenderly formed legs, the longer and more fluffy body pubescence, and the reduced white markings. The above description is based mainly on a comparison with "*ebusana*", from Mallorca, but the differences noted apply equally well to nominotypical examples of *leucorhyncha* from North Africa, which are quite similar (see under that species).

Remark. — The holotype of *M. gracilipes* was the only specimen of *Melecta* observed during my stay in the island. It was flying in company with *Anthophora balearica* (Friese) — originally described from Ibiza and Mallorca — on which it might be parasitic.

APPENDIX
SPECIES INCERTAE SEDIS

Melecta nigripennis Lepeletier

Melecta nigripennis Lepeletier, 1841, Hist. Nat. Ins. Hym. 2: 445 (♀ "Patrie inconnue. Musée du général Dejean"). Type lost (not in MP). Locality unknown.

The following is a translation of the French diagnosis.

Female. — Head wanting. Thorax black, its hairs white and black in places. Abdomen black, all five segments carrying a triangular snow-white spot on either side. Legs black, black-haired, except the fore coxae which are strongly tufted with white. Fore wings wholly black, shading to purplish ("violet"); hind wings much more transparent.

An enigmatic species, possibly identical with, and a synonym of, *M. albifrons nigra* Spinola, 1806, though the description also points to *M. leucorhyncha taormina* Strand, 1919, as characterized in the present work. *Nigripennis* being a nomen oblitum, it should be discarded.

Male. — Unknown.

Melecta testaceipes Lepeletier

Melecta testaceipes Lepeleter, 1841, Hist. Nat. Ins. Hym. 2: 447 (♀ "Patrie inconnue. Décrite de la collection de M. Carcel"). Type lost (not in MP). Locality unknown.

The translated French diagnosis runs as follows.

Female. — Entirely black, its pubescence black. Legs black, hairs black: all tarsal segments including the claws, ferruginous ("d'un testacé ferrugineux"). Wings slightly enfumed.

Like the former, a species of unknown status, possibly also identical with one of the species mentioned above.

Male. — Unknown.

Melecta octomaculata Radoszkowski

Melecta octomaculata Radoszkowski, 1876, Horae Soc. Ent. Ross. 12: 124 (♂ — not ♀! — Egypte).

This is another of Radoszkowski's enigmatic species whose status could not be explained. The holotype could nowhere be traced and is probably lost. Like the type of *italica* Radoszkowski, described in the same paper, evidently a wrongly sexed individual, possibly conspecific with *M. transcaspica* F. Morawitz, 1895? The invalid name *M. octomaculata* Friese, 1925, based on a male from Turkey (Asia minor), is synonymous with *transcaspica* (see under that species). Here follow Radoszkowski's original characterizations of *octomaculata*:

"Nigra; capite thoraceque pilis albis variegatis, dentibus scutellaribus subparvis, abdomine opaco, segmento 1-o dense albido-piloso, segmentis lateribus utrinque macula nivea; tibiis omnibus albo-maculatis. Alis fumatis, hyalino maculatis. Long 15 mm.

Femelle. Noire. Chaperon garni de poils argentés. Le premier article des antennes et le front faiblement garnis de poils gris. Mésothorax en dessus, prothorax en dessus et dessous ainsi qu'une partie de la poitrine sous les ailes garnis de poils hérissés, longs, gris blanchâtres; les dents de l'écusson petites. Abdomen opaque, garni de poils courts, noirs; premier segment garni de poils longs blancs, vers chaque côté les poils plus épais et plus prononcés; chacun des segments suivants portent sur leurs côtés une tache regulière allongée; la longueur de ces taches va en diminuant vers l'anus. Les jambes des pieds antérieurs du côté externe richement ciliés de poils argentés; les jambes des pieds suivants couverts du côté externe de poils très courts, couchés, argentés; les tarses de tous les pieds couverts de poils pareils. Les ailes transparentes, leurs bouts et des taches dans les cellules enfumés."

This bee, along with the types of *aegyptiaca* and *assimilis* described in the same publication, was collected by Comte Alexandre Branicki's assistant, Dr. Dziedzicki. We can only guess at its identity, so that it is best placed in the present category qualified as a *nomen oblitum*.

Melecta eversmanni Radoszkowski
(fig. 112)

Melecta Eversmanni Radoszkowski, 1893, Bull. Soc. Imp. Nat. Moscou, new ser. 7 (2—3): 180, ♀ only! (♀ Orenbourg).

Type material. — USSR: 1 ♀, labelled "Orenb." (written), "Eversmani" (different writing), "Type" (print on orange), "*Melecta Eversmanni* Radosz. Type, rev. Dr. Enderlein". Holotype, evidently recognized and designated as such by Enderlein (MNB).

Like all other species described by Radoszkowski, the female of *M. eversmanni* was unfortunately described in advance of the male, the genital organs of which were figured (R's figs. 31 a—c, i). The male obviously came from a different locality, Astrachan and Tachkend being mentioned after Orenbourg; moreover the dissected male(s) could not be found any more in the Berlin museum and may have become lost. So I feel justified to follow Enderlein's unpublished view to regard the present female as the type. Orenburg is situated due W of the southern Yuzh Ural Mts.

The specimen differs in no way from a rather small-sized *M. luctuosa* and in all probability is conspecific with that species. Its pygidial plate (fig. 112) is shaped similarly, with somewhat raised lateral margins and a swollen, bluntly carinated apex; surface dull, finely tessellate, with few punctures on the basal portion, dark chestnut coloured.

Male. — Unknown.

Melecta ashabadensis Radoszkowski
(Fig. 113)

Melecta ashabadensis Radoszkowski, 1893, Bull. Soc. Imp. Nat. Moscou, new ser. 7 (2—3): 180 (♀ — excl. ♂ ? — Ashabad). — Friese, 1895, Bienen Europa's: 164 (original descr. quoted; for notes on additional material, see *M. fulgida* spec. nov.!).

Type material. — USSR, Turkmeniya: 1 ♀, Ashkhabad (or Ashkabad), but labelled "Astr." (print on purple square)[1]), "Type" (print on red), "*ashabadensis*" (Radoszkowski's pencil writing), "*Melecta ashabadensis* Radosz. Type, rev. Dr. Enderlein". Holotype, evidently designated as such by Enderlein (MNB).

A small species. The type is a badly soiled specimen lacking its left antenna and all tarsal claws as well, save those on right fore and left hind legs. The male of *ashabadensis* could not be traced and is probably lost; there is nothing of any use in the brief diagnosis which accompanies the poor sketches of its genital organs (loc. cit., fig. 32).

The following notes on the type may serve to a future recognition of this nondescript taxon, provided that fresh topotypical examples of either sex may come to hand.

Female (type). — Labrum a little longer than broad (14 : 10), narrowed toward apex which, though rounded off, is slightly upturned and protuberant mesially; surface coarsely punctate, clothed with the usual long raised black bristles. Antenna slender; scape curved, not very hairy, all flagellar segments distinctly longer than broad, 3 slightly longer than 4. White pubescence covering clypeus, vertex and occiput white, becoming black laterally. Thoracic vestiture also white anteriorly, scutellar area black with conspicuous tufts of white behind short, pricker-shaped scutellar spines. Legs normal. Basal half of mid and hind tibiae white externally, outer face of hind tibia dull, densely hairy with short spine-like setae intermixed; tarsi all black; inner rami of mid and hind tarsal claws rather broad, about half as long as outer. Wings smoky grey-brown, much darker than in *turkestanica* (♂), third submarginal cell rather long, scarcely higher than its median length (10 : 9), the distal angle not prominent, broadly rounded.

Abdomen short, cordate. All white lateral spots of large size, those on tergite 2 almost quadrangular, far apart, on 3 more prolonged inward and separated by a distance about two-thirds their own breadth, on 4 nearer together; all spots rounded off mesially. Pygidial plate chestnut coloured, slightly downcurved, finely black-ridged laterally, apex a little broadened, black; surface somewhat shiny, microscopically tessellate (fig. 113). Total length 9.0 mm, fore wing 7.5 mm.

Friese (loc. cit.), who received a male sub nom. *ashabadensis* from Radoszkowski but failed to mention its locality, gave a brief description of it and noted that, besides specimens from Kaukasus (Helenendorf) and Syria in the Vienna museum, he had also seen a very dark male from Syria in the Budapest museum. These examples were labelled as such by Friese but are not conspecific with *ashabadensis*; all belong to a new species presently described as *fulgida* spec.

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[1]) Ashtrabad, to the west, is in northern Iran, nearer the Caspian Sea!

nov., which is altogether different from the type of *ashabadensis* (see p. 219).

Characterized by its small size, rather long third submarginal cell and relatively large abdominal spots.

Male. — Not definitely known.

Melecta kashmirensis (Nurse)

Crocisa kashmirensis Nurse, 1903, Ann. Mag. Nat. Hist. (7) 11: 548—549 (♀ "Kashmir, 5000—6000 ft., fairly common".

Type and paratypic material. — India, Kashmir: 1 ♀ (holotype), "Kashmir, 5—6000 ft., 5.01, Col. C. G. Nurse, B. M. 1920—72", with holotype label 17B 1213 (BM); 7 ♀ (paratypes), "Kashmir, 5—6000 ft., 4—5.01" (BM).

Further (doubtful) material. — Pakistan: 4 ♀, Quetta, 3.04 & 4.04 (BM); 1 ♀, Peshin, 4.03 (printed labels) (BM).

A West Himalayan species of doubtful identity.

Though very similar in general appearance and body size, these two small series, all arranged under *kashmirensis* in the general collection, are probably not conspecific, as shown by the differences. In the type and all others from Kashmir, the white tergal spots are subrectangular, widely separated by black, on 1 and 2 broader than long, on 3 placed distinctly more inward than the preceding ones and slightly oblique (the interspace still about three times wider than the diameter of one spot), those on 4 being separated by a distance one and one-third their own diameter. These Kashmir females are less hairy than those from Quetta. In the former the body pubescence is a little shorter while the tergal spots are relatively smaller, composed of more compactly set hairs; moreover, there are hardly any raised hairs midbasally which connect the spots at sides of tergite 1, the latter being also more widely separated than in the Quetta examples, thus differing from *luctuosa*. In the Quetta females, on the other hand, thin collar-like hairs are present at base of tergite 1, as in *luctuosa*: in fact I am unable to distinguish the latter from that species. However, even these *luctuosa*-like females are not quite homogeneous, the specimen from Peshin, for example, has somewhat darker wings than those from Quetta, while the outer faces of mid and hind tibiae (only basal two-thirds white in the others) are entirely white-haired, as are the tarsi. Structurally, the females of either locality are inseparable, the pygidial plates having the same form. To sum up, in the absence of any male from the above localities, the status of both taxa must unfortunately be left undecided.

Male. — Unknown.

Melecta candiae Strand

"*Melecta* sp. (*Candiae* Strand n. ad int.)" Strand, 1915, Archiv f. Naturgesch. 81A (4): 166 (♀ Candia).

Material. — Crete: 1 ♀, labelled "Candia", with additional mark "*Candiae* m. type", in E. Strand's handwriting (EIB). Holotype.

A very puzzling bee, though probably correctly identified as a species of *Melecta*. The description is detailed enough, but the insect itself is unlike anything known to me in this genus. The unique female, which lacks parts of its legs, is obviously an immature, possibly freshly emerged, almost completely hairless bee of moderate size. The body integument is dullish dark brown. A very peculiar feature is found in the colour of the posterior borders of the abdominal tergites 2—4, which bear unusually broad light brown bands, the rest of the integument being contrastingly coloured dark brown.

M. candiae is one of the numerous annoying, objectionably proposed names for a unrecognizable Strandian insect. In the writer's opinion, names like this ("Sollte diese Art neu sein, so möge sie den Namen *Candiae* bekommen . . ."), though unfortunately still considered available by the ICZN in case of an eventual validation, are best rejected.

Male. — Unknown.

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Unless indicated otherwise all specific and subspecific names are of *Melecta*. Synonyms, homonyms and otherwise invalid names are in *italics*.

Species *incertae sedis* are (bracketed). New taxa are marked with an *asterisk.

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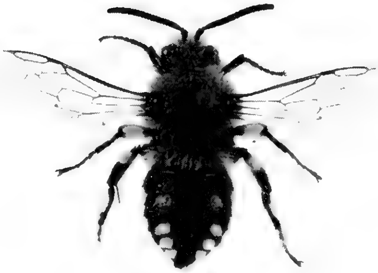

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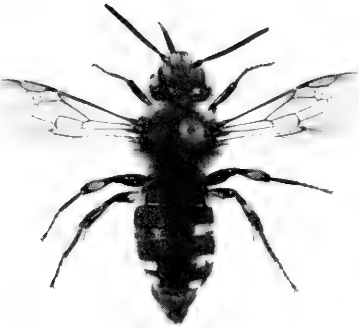

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Fig. 1, *Melecta albifrons albovaria* Erichson, ♂ Tunis (MP); fig. 2, same species, ♀ Cairo, Egypt (ML, ex MBUD); fig. 3, *M. duodecimmaculata duodecimmaculata* (Rossi), ♂ Athens, Greece (MH); fig. 4, *M. excelsa* spec. nov., ♂ holotype Jalalabad, Afghanistan (ML, ex MMB); fig. 5, *M. fulgida* spec. nov., ♂ paratype Sandanski, Bulgaria (ML); fig. 6, same species, ♂ Beirut, Lebanon (ML)

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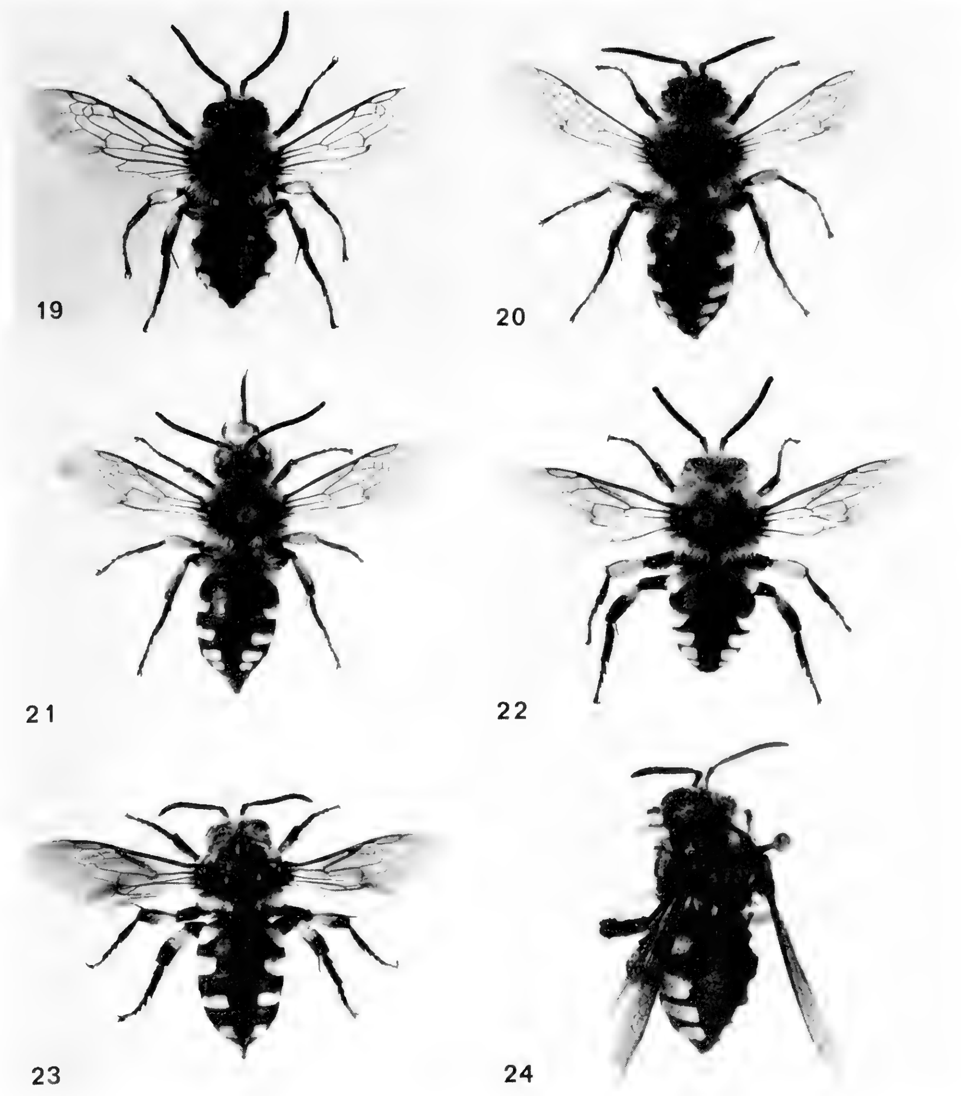

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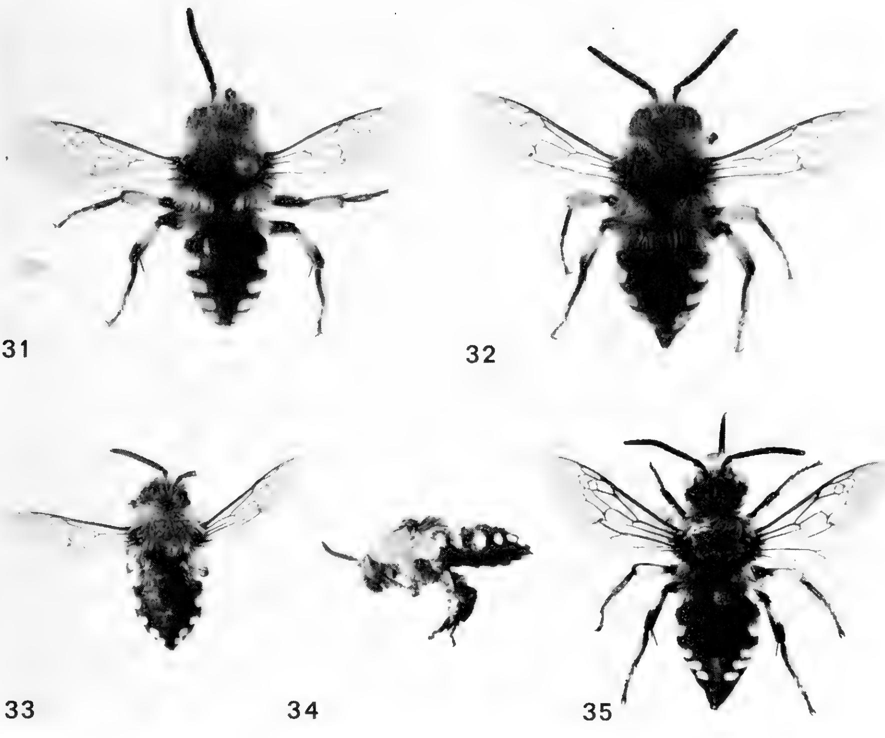
Fig. 25, *Melecta grandis* Lepeletier, ♀ lectotype, Oran, Algeria (MP); figs. 26—27, same specimen, lateral and frontal view; fig. 28, same species, ♀ Algeria (BM); fig. 29, same species, ♂ Medinine, Tunisia (MP); fig. 30, same species, ♂ Sicily (NMW)



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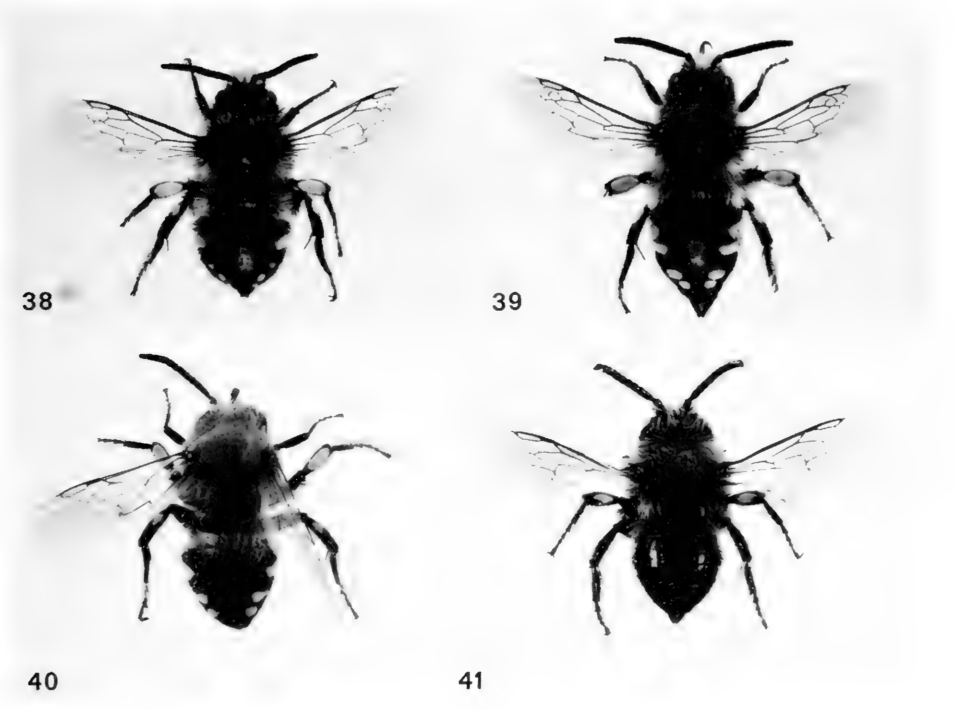

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