

**CONTRIBUTIONS TOWARD A REVISION OF THE NEW WORLD
NOMADINE BEES. 2. THE GENUS *MELANOMADA*
(HYMENOPTERA: ANTHOPHORIDAE)**

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ABSTRACT. The cleptoparasitic bee genus *Hesperonomada* is synonymized with *Melanomada*. *Melanomada*, together with *Triopasites* and *Paranomada* in North America and *Brachynomada* and perhaps *Kelita* in South America, is a closely knit group (the *Melanomada* complex) that is morphologically distinctive, both as adults and larvae, within the tribe Nomadini as it presently is constituted. A key to the North American genera of this complex is given, as is a key to the six known species of *Melanomada*. Three new species of *Melanomada* are described and illustrated: *M. annectens* (California, U.S.A.), *M. chica* (Baja California Sur, Mexico), and *M. nimia* (Kansas, U.S.A.).

The mature larvae of *M. annectens* is described and illustrated and the relationships of the genus to other members of the complex, and to the Nomadini as a whole, are discussed in terms of larval characteristics.

As far as known, all North American members of the *Melanomada* complex are cleptoparasites of the anthophorid genus *Exomalopsis*. Known host relationships are discussed, suspected relations are mentioned, and the relationships of both the South American *Brachynomada* and *Kelita* to the Panurginae are outlined.

INTRODUCTION

Recently, we undertook a study of the nesting biology of *Exomalopsis nitens* Cockerell, near Corona, Riverside County, California, in hope of recovering information about, and immature stages of, its reported cleptoparasite *Hesperonomada melanantha* (Rozen, 1984; Rozen and Snelling, 1986). Upon examining the cleptoparasite from the nesting area, we determined that the species was not *H. melanantha*, and, although the two species were obviously similar, this new species shared a number of features with the genus *Melanomada*. These characteristics immediately placed into question the distinctiveness of the genera *Hesperonomada* and *Melanomada*. This present contribution, in which *Hesperonomada* is synonymized with *Melanomada*, results from our attempt to resolve the relationships of these two genera, and makes known a number of distinctive new species belonging to *Melanomada*. We not only describe the new species but also present information about the host relationships and immature stages of one of these.

Snelling has been primarily responsible for preparing the Systematics section of this manuscript, whereas Rozen has drafted the sections on Immature Stages and Host Associations and Bionomics.

SPECIMENS EXAMINED

Adult specimens examined during the course of this study were from the following collections: Academy of Natural Sciences of Philadelphia (ANSP), American Museum of Natural History (AMNH), California Academy of Sciences (CAS), Natural History Museum of Los Angeles County (LACM), University of Kansas (UKAN), United States National Museum of Natural History (USNM), and Utah State University (UTSU). Larval specimens are in the American Museum of Natural History.

SYSTEMATICS

The Nearctic genera *Melanomada* Cockerell, 1903b (including *Hesperonomada* Linsley, 1939, synonymized herein), *Triopasites* Linsley, 1939, and *Paranomada* Linsley and Michener, 1937, together with the South American *Brachynomada* Holmberg, 1886, form a close-knit and distinctive group within the Nomadini. An additional South American genus, *Kelita* Sandhouse, 1943, may be a part of this same complex, but possesses some unique features that are greatly at variance with this group and it is, therefore, not included in the following discussion.

The following apomorphies (many cited by Ehrenfeld and Rozen, 1977, and Rozen, 1977) define this group within the tribe Nomadini; plesiomorphic states are indicated in brackets. (1) Anterior and posterior basal angles of mandible about equally distant from eye [anterior angle more distant than

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basal angle in other Nomadini]. (2) Maxillary palpus with three to six segments and less than one-half as long as galea (except in *Melanomada chica*) [other Nomadini with six-segmented maxillary palpus more than one-half as long as galea]. (3) Metacoxa with inner, dorsal carina or lamella [absent in other Nomadini (small but present in *Hexepeolus*)]. (4) Metasomal sternum 6 of female produced posteriorly as a short, acute or rounded, hairy process (Fig. 4) [truncate or bilobed in other Nomadini]. (5) Metasomal sternum 7 of female with a pair of slender, apical lobes with a few coarse setae arising from their inner apical margins (Fig. 5) [sternum 7 subtruncate or with a pair of broad, well-separated lobes with coarse, spine-like setae at apex or along outer margins]. (6) Metasomal sternum 7 of male without basal apodeme (Figs. 8, 10, 12, 14) [basal apodeme present in other Nomadini]. (7) Gonostylus of male genitalia long and narrow (Figs. 16–18) [short and broad in most other Nomadini, but with some exceptions in *Hypochrotaenia* and *Nomada*]. (8) Integument smooth and shiny; punctures, when present, not confluent or contiguous [integument dull to shiny; punctures of head and thorax commonly confluent, at least in some areas]. (9) Mesepisternum of female, and often male as well, with dense, prostrate highly plumose pubescence on upper one-half or more, lower one-half or less with pubescence sparse and simple, or nearly so [in other Nomadini, mesepisternal pubescence usually uniform, and usually weakly plumose, but sometimes densely pubescent above and becoming less dense ventrad]. (10) Prepygidial brush of female metasomal tergum 5 suberect, the hairs acute or subacute [prepygidial brush of female suberect to prostrate, hairs, except anteriorly, spatulate or apically broadened and reflective]. (11) Mature larva³ with well-developed, paired dorsal tubercles (Fig. 19) [no dorsal tubercles in other Nomadini]. (12) Mature larva with well-developed hypostomal ridge [ridge weak in other Nomadini]. (13) Vertex of mature larva with protrusions [vertex recessed in other Nomadini]. (14) Mandibles of larva long (Figs. 22–24) [short in other Nomadini].

Although the *Melanomada* complex appears highly distinctive, we do not believe it should be accorded tribal status because of the limited number of synapomorphies defining it, because of the unclear relationship of *Kelita* to it, and because of our limited knowledge of *Brachynomada*. Nonetheless, these genera are very different from what we know of the other members of the Nomadini.

Within the complex, *Paranomada* is the most distinctive, easily recognized by the greatly flattened body and the smooth and shiny, virtually impunctate integument. The remaining genera are more similar one to another, although *Triopasites*, with its characteristic marginal cell and the patch of plumose hairs on the second metasomal sternum, is difficult to confuse with the others. *Brachynomada*, in South America, seems to be very close to *Melanomada*, but is too poorly known for an adequate assessment of its characters.

As mentioned above, *Kelita* shares some characters with the members of this complex. Of the features cited above,

3. Larval features are known only for representatives of *Melanomada*, *Triopasites*, *Nomada*, and *Hypochrotaenia*.

Kelita differs from the *Paranomada*–*Melanomada*–*Triopasites*–*Brachynomada* complex in characters 2 (maxillary palpus more than one-half as long as galea), 3 (metacoxa without inner, dorsal carina), 7 (gonostylus short and broad), 8 (integument of head and mesosoma pebbled), 9 (entire mesepisternum covered with prostrate, plumose pubescence), and 10 (prepygidial hairs short and broad). Sternum 5 of the female has a transverse ridge across the base and the ridge is produced distally along the midline as a narrow, variably acute process. Sternum 6 of the female is similar to that of the genera of the *Melanomada* complex, but bears at its apex a few very short, broad, blunt setae. Additional unusual features of *Kelita* are cited by Ehrenfeld and Rozen (1977).

As a group, the members of the *Melanomada* complex may be recognized by the following abbreviated suite of characters: anterior and posterior basal angles of mandibles almost equidistant from eye; maxillary palpus not more than one-half as long as galea (except in *M. chica*), three- to six-segmented; male gonostylus long and slender; metasomal sternum 6 of female produced posteriorly as an acute or rounded, hairy process and sternum 7 with a pair of slender apical lobes with a few coarse setae along their margins; integument smooth and shiny between fine, well-separated punctures.

KEY TO ADULTS OF THE NEARCTIC GENERA, *MELANOMADA* COMPLEX

- 1a. Mesosoma about as deep as wide; integument conspicuously punctate (exceptionally, vertex and thoracic dorsum very sparsely and minutely punctate), mesepisternum always sharply punctate; mesocoxa as long as, or a little longer than, distance from its base to base of hind wing 2
- b. Mesosoma greatly flattened, width distinctly greater than depth; integument smooth and shiny, all areas virtually without punctures; mesocoxa much longer than distance from its base to base of hind wing *Paranomada*
- 2a. Forewing with two or three submarginal cells and apex of marginal cell acute, ending on wing margin; margin of metasomal sternum 2 not abruptly depressed and without broad, dense patch of plumose hairs *Melanomada*
- b. Forewing with three submarginal cells and apex of marginal cell narrowly rounded and bent away from wing margin; margin of metasomal sternum 2 abruptly depressed and, across middle one-third, with a conspicuous, dense patch of pale, profusely plumose hairs *Triopasites*

Melanomada Cockerell

Nomada subg. *Melanomada* Cockerell, 1903b:587. Type-species: *Nomada grindeliae* Cockerell, 1903a. Monotypic and original designation. Cockerell, 1911a:649. Cockerell, 1911b:226. Swenk, 1913:8, 15. Linsley and Michener, 1937:285.

Hesperonomada Linsley, 1939:5. Type-species: *Hesperonomada melanantha* Linsley, 1939. Monotypic and original designation. Linsley and Michener, 1937:291–292. Michener, 1944:274–275. Snelling, 1986:6. NEW SYNONYMY.

Melanomada: Michener, 1944:275. Rodeck, 1945:202–203. Snelling, 1986:6.

Both Michener (1944) and Snelling (1986) separated *Hesperonomada* from *Melanomada* by its five-segmented (rather than six) maxillary palpus and the presence of two (rather than three) submarginal cells in the forewing. Michener further noted that in *Melanomada* the mesocoxa is about as long as the distance from its summit to the base of the hind wing; the mesocoxa was said to be shorter in *Hesperonomada*. Two of the new species described below exhibit intermediate states and effectively eliminate the distinctions that formerly separated these two genera.

Both of these new species described below (*M. annectens*, *M. chica*) possess two submarginal cells in the forewing, as in *Hesperonomada melanantha*, but they have a six-segmented maxillary palpus, as in *Melanomada*. In both, also, the mesocoxa is about as long as the distance from its summit to the base of the hind wing. One of the new species (*M. annectens*) (Fig. 6) in particular, is annectant between *Melanomada* and *Hesperonomada*. It has a small vein stub present on vein M that is evidently the remnant of crossvein 1st r-m (especially well developed in males), for it is in the correct position.

Rodeck (1945) united the two genera, though it is not clear whether he intended to treat *Hesperonomada* as a synonym or subgenus of *Melanomada*. However, he later treated the two genera as separate (Rodeck, 1951). In our view, *Hesperonomada* can no longer be considered separate and distinct, either as a genus or as a subgenus of *Melanomada*.

KEY TO SPECIES OF MELANOMADA

- 1a. Forewing with two submarginal cells 2
- b. Forewing with three submarginal cells 4
- 2a. Maxillary palpus six-segmented; large, triangular mediobasal area of clypeus smooth, shiny, and impunctate 3
- b. Maxillary palpus five-segmented, with segments 4 and 5 fused (Fig. 2); clypeus uniformly densely punctate, sometimes with narrow median impunctate line on basal one-half *melanantha* (Linsley)
- 3a. Maxillary palpus about one-half as long as galea, apical segment distinctly shorter than preceding segment and uniformly cylindrical (Fig. 1); mesoscutal punctures about 0.01 mm diameter or more and separated by much less than a puncture diameter in center of disc *annectens*, new species
- b. Maxillary palpus slightly longer than galea, apical segment distinctly longer than preceding segment and abruptly wider over apical one-half (Fig. 3); mesoscutal punctures minute, hardly greater in diameter (about 0.006 mm) than hairs arising from them and separated by two

or more puncture diameters across middle of disc

- *chica*, new species
- 4a. Clypeal disc weakly convex or flattened, but if flattened, then disc of mesoscutum is uniformly and densely punctate; sides of declivitous face of propodeum partially concealed by dense, prostrate, highly plumose hairs 5
- b. Clypeal disc weakly concave and disc of mesoscutum polished, punctures variable in size and variably spaced, with extensive impunctate areas; side of declivitous face of propodeum thinly covered by subappressed, short-plumose hairs that do not conceal integument *grindeliae* (Cockerell)
- 5a. Clypeal disc weakly convex; punctures in center of mesoscutum variably spaced, with some interspaces exceeding three puncture diameters; surface of mesosternum, especially near coxae, partially concealed by dense, prostrate, highly plumose pubescence; middle of propodeal triangle granulate and without evident longitudinal rugulae *sidaefloris* (Cockerell)
- b. Clypeal disc flattened; mesoscutal punctures uniform in size, evenly spaced in center with interspaces 1.5 puncture diameters or less; mesosternum not concealed by dense pubescence; middle of propodeal triangle with several fine, longitudinal rugulae *nimia*, new species

Melanomada annectens, new species

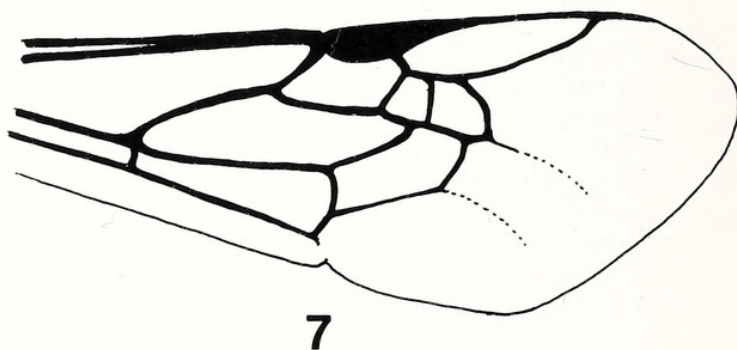
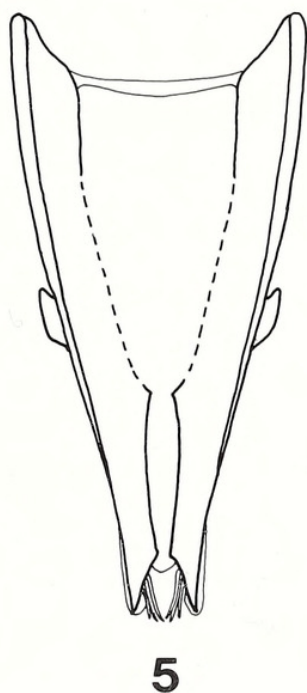
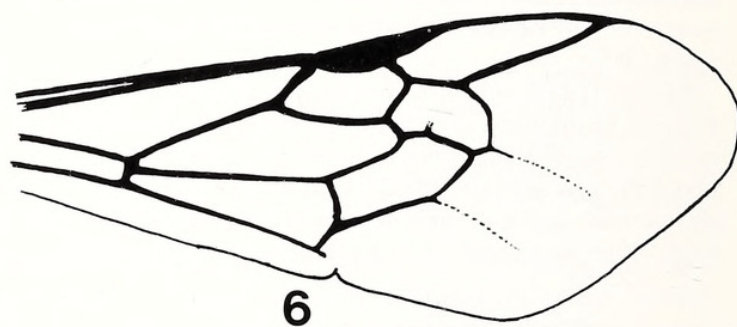
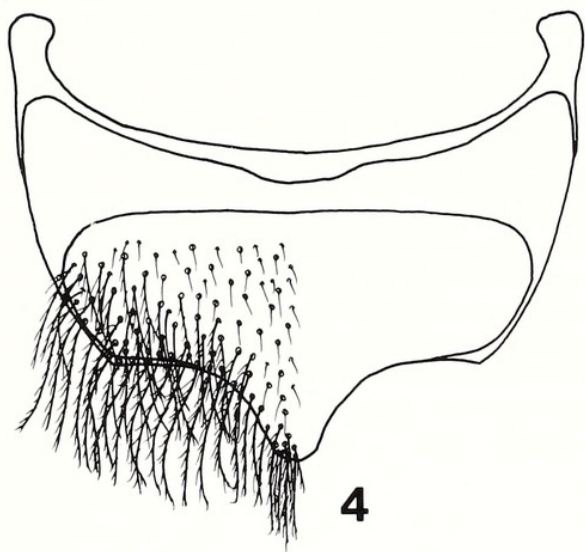
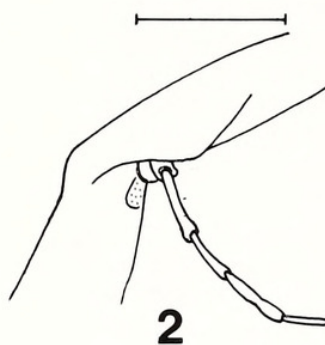
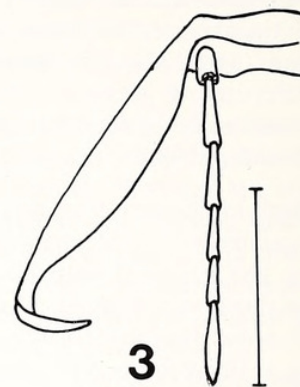
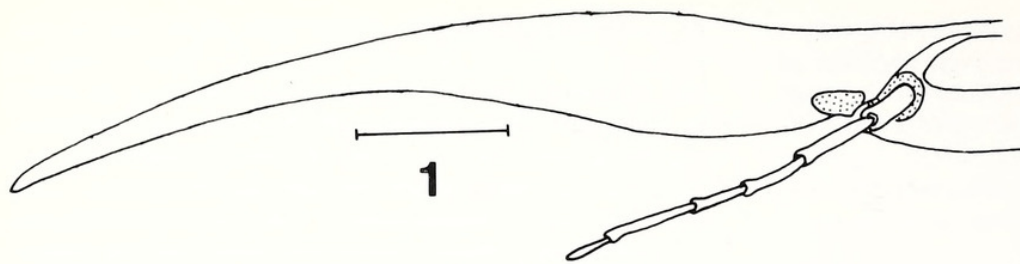
Figures 1, 6, 10, 11, 17, 25

DIAGNOSIS. This species is separable from *M. grindeliae* and *M. sidaefloris* by the presence of two, rather than three, submarginal cells in the forewing and from *M. melanantha* by the six-segmented, rather than five-segmented, maxillary palpus. It is further distinguished from all three by the presence of a distinct, median impunctate area on the clypeus. From *M. chica* it is separated by its coarser punctation, maxillary galea being about twice as long as the maxillary palpus, densely punctate mesoscutum, and larger size.

DESCRIPTION. Female. Measurements. Head width 1.86–2.05; head length 1.35–1.67; wing length 4.7–4.8; total length 6.0–6.6 mm.

Head 1.2–1.4 times broader than long; vertex strongly arched above tops of eyes; inner eye margins strongly convergent below; lower interocular distance 0.85–0.87 times upper interocular distance. Posterior ocelli separated from preoccipital margin by much less than their diameter; ocellular distance 2.6–3.8 times anterior ocellus diameter; interocellar distance 1.8–2.0 times anterior ocellus diameter. Scape about 2.7 times longer than distance between antennal sockets and, in full frontal view, its apex on level of anterior margin of anterior ocellus; first flagellar segment slightly longer than broad; second flagellar segment 1.15–1.31 times longer than first; middle flagellar segments about one-third longer than first and about one-third longer than broad.

Glossa normal, i.e., much longer than combined lengths of first two labial palpal segments; labial palpus flattened, first segment about 11.5 times longer than wide and about 2.3 times longer than second; maxillary palpus six-segmented, less than one-half as long as galea, second segment about



1.6 times longer than sixth, sixth segment normal in shape, i.e., approximately parallel-sided and narrowed at apex.

Integument smooth and shiny; clypeus with broad, impunctate median line, disc otherwise conspicuously punctate, with most punctures about 0.02–0.03 mm diameter, separated by 1–2 puncture diameters, and with smaller punctures (about 0.01 mm diameter) irregularly scattered between; frons, vertex, and preocciput similarly punctate, but much of face obscured by densely plumose, appressed pubescence. Mesoscutum and scutellum subcontiguously punctate, but with irregular interspaces up to a puncture diameter; punctures 0.02–0.03 mm diameter. Upper, densely pubescent portion of mesepisternum with punctures contiguous to subcontiguous, mostly about 0.03 mm diameter; lower, sparsely pubescent area with punctures similar but subcontiguous to dense. Metasomal tergal discs slightly roughened between punctures; those of second tergum distinct, slightly transverse, about 0.015 mm diameter; punctures becoming slightly coarser and closer on succeeding segments.

Forewing (Fig. 7) with two submarginal cells, second with 1st r-m stub arising from M.

Head and mesosoma blackish, metasoma ferruginous; mandible, labrum, apical margin of clypeus, underside of first flagellar segment, pronotal lobe, and most of legs (except irregular darker areas on femora and protibia), dusky ferruginous. Tegula ferruginous. Wings transparent brownish, marginal cell and broad apical area darker; veins and stigma dark brown.

Male. Measurements. Head width 1.84–2.13; head length 1.48–1.74; wing length 4.7–5.3; total length 5.5–6.3 mm.

Head about 1.2 times broader than long; vertex strongly convex above tops of eyes; lower interocular distance 0.85–0.88 times upper interocular distance. Posterior ocelli separated from preoccipital margin by less than their diameter; ocellocular distance 2.4–2.5 times anterior ocellus diameter; interocellar distance 2.1–2.3 times anterior ocellus diameter. Scape as described for female; first flagellar segment slightly longer than broad; second flagellar segment 1.0–1.1 times longer than first.

Otherwise about as described for female, but impunctate area of clypeus inverted-deltoid in shape, apex almost reaching apical margin. Abdomen blackish, with segment margins reddened, and legs dark reddish brown.

TYPE MATERIAL. Holotype female, allotype, and 3 female paratypes: Indian Truck Trail, 12 mi. S Corona, Riverside Co., California, 24 May 1985 (J.G. Rozen and R.R. Snelling), at nest site of *Exomalopsis nitens* Cockerell. Paratypes (all from same locality): 4 ♀♀, 19 June 1984 (R.R. Snelling); 2 ♀♀, 4 ♂♂, 20 June 1984 (R.R. Snelling and E. Williams); 1 ♀, 2 May 1985 (R.R. Snelling); 1 ♀, 4 ♂♂, 19 May 1985 (R.R. Snelling); 2 ♀♀, 1 ♂, 22 May 1985 (J.G. Rozen); 1 ♀, 1 ♂, 25

May 1985 (J.G. Rozen and R.R. Snelling); 3 ♀♀, 3 ♂♂, 26 May 1985 (J.G. Rozen and R.R. Snelling). Holotype and allotype in LACM; paratypes in AMNH, LACM, UKAN, USNM.

ADDITIONAL MATERIAL (not paratypes). *Los Angeles Co.*: 1 ♂, Hollywood, 12 Aug. 1956 (D.L. Dahlsten; LACM); 1 ♂, Westwood Hills, 27 July 1935 (paratype of *H. melanantha*; UCB). *Orange Co.*: 1 ♀, Irvine Park, 3 Sept. 1962 (M.E. Irwin; UTSU). *San Diego Co.*: 1 ♀, Laguna Beach, no date (Baker; paratype of *H. melanantha*; UCB?); 1 ♂, La Jolla, 14 Aug. 1911 (J.C. Bridwell; USNM); 1 ♀, near La Mesa, 28 June 1954 (F.X. Williams; USNM).

ETYMOLOGY. The specific name is a Latin adjective, meaning joining or linking and refers to the intermediate position of this species in revealing the relationship of *Melanomada* and *Hesperonomada*.

DISCUSSION. Both sexes of *M. annectens* closely resemble those of *M. melanantha*. The most conspicuous difference lies in the number of maxillary palpal segments, five in *M. melanantha* and six in *M. annectens*. In *M. melanantha* the fifth segment may be seen to result from the fusion of segments five and six; this combined segment is longer than the second segment (Fig. 2).

The clypeus is uniformly densely punctate in both females and males of *M. melanantha*, although there may be a very narrow median line that is free of punctures. Females of *M. annectens* have approximately the middle one-fourth to one-third of the clypeal disc impunctate or nearly so. In the males, the impunctate area is an inverted delta, with the base extending between the subantennal sutures and the apex reaching almost to the apical margin of the clypeus.

Other differences between the two species include the slightly longer first flagellar segment of *M. annectens* that is little, if any, shorter than the second; in *M. melanantha* the first segment is distinctly shorter than the second. Males of both species have the outer, dorsal margins of the pro- and mesocoxae more or less carinate, but the carinae are sharper and higher in *M. annectens* than in *M. melanantha*. Similarly, the inner dorsal carina of the metacoxa is better developed in *M. annectens*.

The second submarginal cell of the forewing is consistently different between the two species. In *M. annectens* there is a small remnant of crossvein 1st r-m (Fig. 6). This remnant is consistently lacking in the forewing of *M. melanantha*.

Genitalic structures of the males of the two species are very similar. Sternum 7 of *M. annectens* (Fig. 10) is about twice as long as broad, with its apex more broadly rounded; in *M. melanantha* (Fig. 8) sternum 7 is about as broad as long, its apex more acute. Similarly, the apical process of sternum 8 is broader and more rounded in *M. annectens* (Fig. 11) than in *M. melanantha* (Fig. 9). *Melanomada annectens* has a slight distal broadening of the gonostylus (Fig. 13), whereas

←
Figures 1–7. *Melanomada* species. 1, maxillary palpus and galea of *M. annectens*; 2, maxillary palpus of *M. melanantha*; 3, maxillary palpus and galea of *M. chica*; 4, 5, metasomal sterna 6 and 7, *M. grindeliae*, female; 6, 7, forewing of *M. annectens* and *M. grindeliae*, respectively. Scale line (Figs. 1–3) = 0.25 mm.

in *M. melanantha* it is uniformly slender (Fig. 16). The apex of the penis valve is narrower in *M. melanantha* (Fig. 16) than in *M. annectens*.

Melanomada chica, new species

Figures 3, 25

DIAGNOSIS. This species may be separated from *M. grindeliae* and *M. sidaefloris* by its small size, exceptionally fine and sparse punctures, two (rather than three) submarginal cells in the forewing, and six-segmented (rather than five-segmented) maxillary palpus. From *M. annectens* and *M. melanantha*, *M. chica* may also be distinguished by its small size and minute, sparse punctures. It is further distinguished from *M. melanantha* by the six-segmented maxillary palpus. From all species it is identifiable by the maxillary palpi being as long as the galea.

DESCRIPTION. Female. Measurements. Head width 1.16; head length 0.93; forewing length 2.9; total length 3.5 mm.

Head about 1.3 times wider than long; vertex strongly convex above summits of eyes; inner eye margins strongly convergent below; lower interocular distance 0.78 times upper interocular distance. Posterior ocelli separated from preoccipital margin by less than their diameters; interocellar distance 1.7 times anterior ocellus diameter; ocellular distance 2.4 times anterior ocellus diameter. Scape about 1.7 times longer than distance between antennal sockets and, in frontal view, short of anterior ocellus by about its apical width; first flagellar segment broader than long; second flagellar segment about 1.4 times longer than first; middle flagellar segments about as long as broad.

Glossa shorter than combined lengths of first two segments of labial palpus; labial palpus flattened, first segment about five times longer than wide and about three times longer than second; maxillary palpus six-segmented, slightly longer than galea (Fig. 3), second and sixth segments longest and subequal, sixth segment narrow and parallel-sided for about one-half its length and abruptly broader in apical one-half.

Punctures everywhere minute; clypeal punctures separated by a puncture diameter or more, a few relatively coarser punctures (up to about 0.02 mm diameter), but most much finer (about 0.006 mm diameter), punctures densest near apical margin. Lower part of face smooth and shiny, with only sparse minute punctures, most hardly greater in diameter than hairs arising from them; upper frons, vertex, and preocciput largely bare and with scattered barely perceptible punctures. Mesoscutal and scutellar punctures variably spaced across discs, but most interspaces more than two puncture diameters, most punctures about 0.006 mm diameter, a few up to 0.01 mm. Upper mesepisternum smooth and shiny between close punctures up to about 0.02 mm diameter, lower portion smooth, shiny, and sparsely pubescent, punctures sparse, most less than 0.01 mm diameter. Metasomal terga shiny, but not polished, between sparse, obscure, transverse, piligerous punctures that are best defined, densest, and coarsest (up to 0.02 mm diameter) on fourth and fifth terga.

Forewing with two submarginal cells.

Upper half of head and entire thorax blackish; lower half of head, antennae, and legs dusky ferruginous, tibiae and following segments lighter; metasoma ferruginous. Tegula clear yellowish red. Wings transparent brownish, darker along apical margins; veins and stigma dark brown.

Male. Unknown.

TYPE MATERIAL. Holotype female: vicinity of Estacion Microondas "Ligui," 425 m elev., 48 km S Loreto, Baja California Sur, MEXICO, 7 Sept. 1977 (R.R. Snelling), in LACM.

ETYMOLOGY. The specific name is a Spanish adjective meaning small, and is appropriate for this diminutive species.

DISCUSSION. The diminutive size and shortened mouthparts, except the maxillary palpus, will immediately separate *M. chica* from all other species of *Melanomada*. The short mouthparts are a common characteristic of bees associated with prostrate species of the plant genus *Euphorbia*.

Presumably the bee host of *M. chica* will prove to be one of the smaller species of *Exomalopsis*, such as *E. rufiventris*, which occurs in the vicinity of the type locality.

Melanomada grindeliae (Cockerell)

Figures 4, 5, 7, 12, 13, 18, 25

Nomada grindeliae Cockerell, 1903a:210; ♂.

Nomada (Melanomada) grindeliae: Cockerell, 1903b:587.

Nomada (Melanomada) heleniella Cockerell, 1911a:648; ♀.

♂. NEW SYNONYMY.

Melanomada grindeliae: Michener, 1944:275.

Melanomada heleniella: Rodeck, 1951:1207.

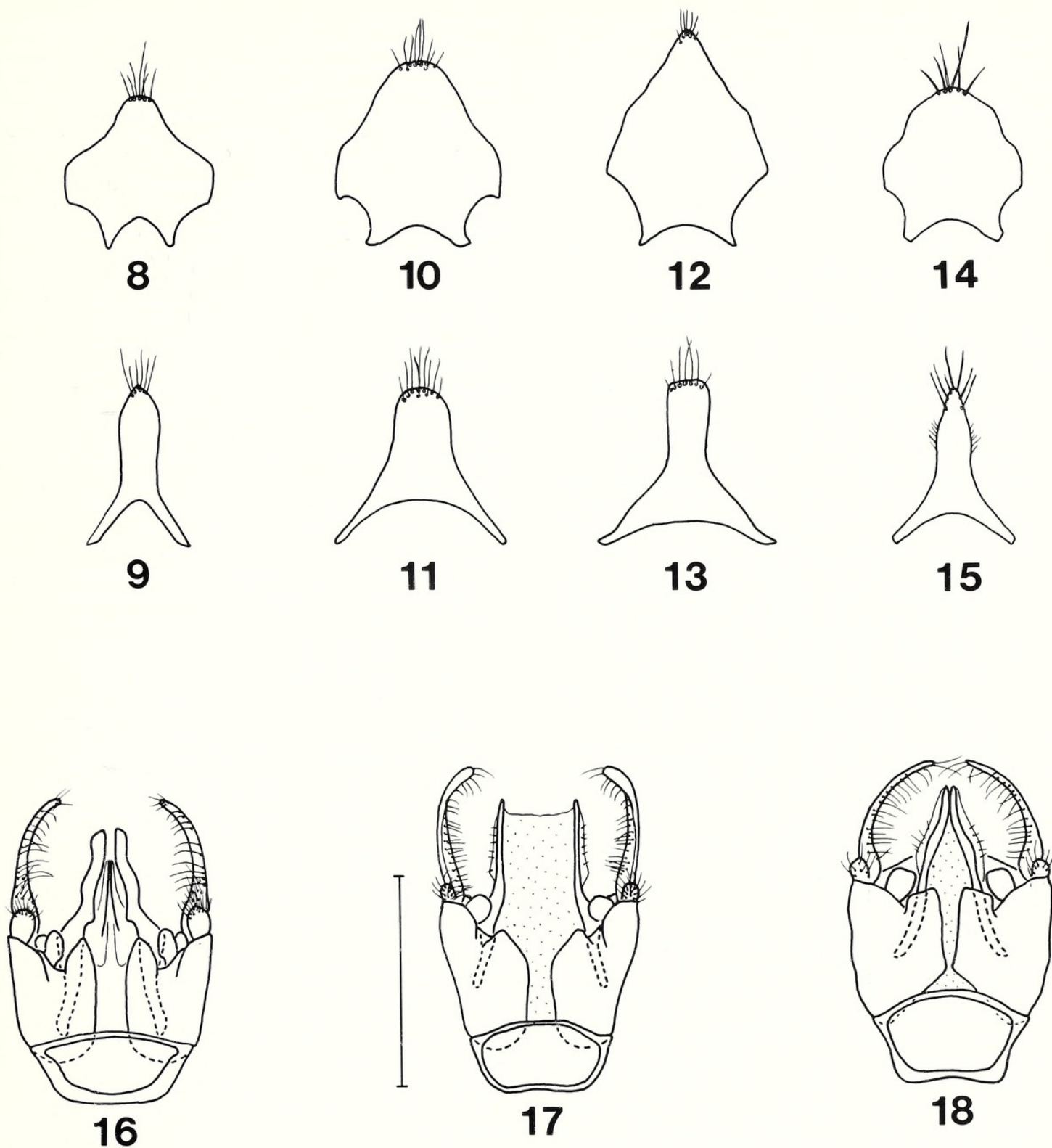
DIAGNOSIS. *Melanomada grindeliae* is separable from *M. annectens*, *M. chica*, and *M. melanantha* by the presence of three, rather than two, submarginal cells in the forewing; it is further separable from *M. chica* by the short maxillary palpus, only about one-half as long as the galea, and notably larger size (head width more than 1.25 mm); it differs from *M. sidaefloris* and *M. nimia* by the sparsely pubescent propodeal declivity and other characters noted in the key.

The types of *N. grindeliae* (ANSP) and *N. heleniella* (USNM) have been examined and compared directly with one another. Aside from the slightly smaller size of the *N. heleniella* types, there are no notable differences between the two.

In addition to the types, we have seen several specimens of both sexes from Lincoln, Nebraska, the type locality of *N. grindeliae*. Other material that we examined includes the following.

COLORADO, Pueblo Co.: 1 ♂, Pueblo, 5000 ft. elev., 19 Aug. 1960 (R.H. Dreisbach; UTSU). KANSAS, Chase Co.: 1 ♀, 2 mi. W Elmdale, 30 Sept. 1975 (Michener and Chabot; UKAN). Douglas Co.: 1 ♀, Lawrence, 5 Sept. 1954 (C.W. Rettenmeyer; UKAN), on *Solidago* sp.; 1 ♀, same locality, 7 Sept. 1954 (E.A. Cross; UKAN), on *Bidens* sp. OKLAHOMA, Alfalfa Co.: 2 ♂♂, 6 mi. S Driftwood, 27 Sept. 1969 (K.L. Johnson; UKAN), on *Aster subulatus*.

Two females collected at Lincoln, Nebraska, by J.C. Crawford (USNM) bear the notation "at *Nomia* place." We assume that this is a casual association. The true host of *M.*



Figures 8–18. Males, *Melanomada* species. Metasomal sterna 7 and 8, respectively, of: 8, 9, *M. melanantha*; 10, 11, *M. annectens*; 12, 13, *M. grindeliae*; 14, 15, *M. nimia*. Genitalia, ventral view: 16, *M. melanantha*; 17, *M. annectens*; 18, *M. grindeliae*. Scale line = 0.50 mm.

grindeliae will probably be a species of *Exomalopsis*, such as *E. pygmaea* (Cresson), which occurs throughout the known range of *M. grindeliae*.

***Melanomada melanantha* (Linsley),
new combination**

Figures 2, 8, 9, 16, 25

Hesperonomada melanantha Linsley, 1939:6-7; ♀ ♂.

DIAGNOSIS. This species is distinguished from all other *Melanomada*, except *M. annectens* and *M. chica*, by the presence of two, rather than three, submarginal cells in the forewing; from *M. annectens* and *M. chica* it may be distinguished by the five-segmented, rather than six-segmented, maxillary palpus.

The type locality of *M. melanantha* is in Monterey County, California. Paratypes were from Contra Costa, Los Angeles, and San Diego counties. The specimens from the latter two counties are not *M. melanantha*, but rather *M. annectens*. In addition to the types, we have seen the following specimens of *M. melanantha*, all from California.

Alameda Co.: 1 ♀, Pleasanton, 20 Sept. 1957 (O.A. Stevens; USNM), on *Centaurea* sp. *Contra Costa Co.*: 1 ♀, Antioch, 25 Aug. 1955 (C.D. MacNeill; UCB); 1 ♀, 1 ♂, same locality, 22 Sept. 1954 (J.G. Rozen; AMNH), on *Grindelia* sp.; 1 ♂, same locality, 5 Sept. 1936 (M.A. Embury; UCB); 2 ♀♀, same locality, 22 Sept. 1954 (P.D. Hurd, C.D. MacNeill; UCB, USNM), on *Grindelia* sp.; 4 ♀♀, 1 ♂, same locality, 14 Oct. 1954 (P.D. Hurd, M.S. Wasbauer; UCB, USNM), on *Grindelia* sp.; 3 ♀♀, 2 mi. W Pittsburg, 19 Sept. 1957 (J.A. Powell; UCB), 2 on *Grindelia camporum*, 1 on *Baccharis glutinosa*. *San Joaquin Co.*: 1 ♂, Stockton, 12 June 1916 (R. Stinchfield; UCB), on *Grindelia (camporum?)*. *Santa Clara Co.*: 1 ♂, no locality or date (Harkins; UCB).

The differences between this species and the superficially similar *M. annectens* are discussed under the latter. The host of *M. melanantha* is unknown.

***Melanomada nimia*, new species**

Figures 14, 15, 25

DIAGNOSIS. This species can be readily distinguished from others with three submarginal cells in the forewing (*M. grindeliae* and *M. sidaefloris*) by the uniformly densely punctate mesoscutum (sparsely punctate in other species).

DESCRIPTION. Female. Measurements. Head width 1.45-1.65; head length 1.22-1.36; wing length 3.9-4.3; total length 4.5-4.9 mm.

Head 1.2-1.3 times broader than long; vertex moderately arched above tops of eyes; inner eye margins strongly convergent below; lower interocular distance 0.82-0.84 times upper interocular distance. Posterior ocelli separated from preoccipital margins by much less than their diameter; ocellular distance 2.4-2.7 times anterior ocellus diameter; interocellar distance 2.0 times diameter of anterior ocellus. Scape about 1.5-1.6 times longer than distance between antennal sockets and, in frontal view, its apex distinctly short

of level of anterior ocellus; first flagellar segment broader than long; second segment 1.5-1.6 times longer than first.

Glossa much longer than combined lengths of first two labial palpal segments; labial palpus flattened, first segment more than 10 times longer than wide and more than twice longer than second; maxillary palpus six-segmented and less than one-half as long as galea.

Integument smooth and shiny; clypeus with sparse, fine punctures and irregularly distributed minute punctures; supraclypeal area mostly impunctate, with scattered fine and minute punctures laterad; frons and vertex with sparse, minute punctures; face, including clypeus, below midlength largely obscured by dense, appressed, copiously plumose pubescence. Mesoscutum and scutellum shiny between fine punctures (about 0.02 mm diameter) that are mostly separated by less than their diameters. Mesepisternal punctures fine and subcontiguous, integument largely obscured by copiously plumose, appressed hairs. Sides of propodeal disc largely obscured by copiously plumose appressed hairs; median, apubescent area of basal triangle dull, with a few fine longitudinal rugulae. Basal abdominal terga shiny between scattered, obscure, minute punctures; succeeding terga with surface increasingly roughened, hence duller.

Forewing with three submarginal cells.

Head and thorax blackish, metasoma and legs beyond coxae ferruginous; mandible (except piceous distal two-thirds), labrum, apical margin of clypeus, pronotal lobe, and tegula, also ferruginous. Underside of flagellum dark reddish brown, basal segment paler. Wings transparent, slightly brownish, marginal cell darker; veins and stigma dark brown.

Male. Measurements. Head width 1.44-1.57; head length 1.17-1.27; wing length 3.7-4.0; total length 4.4-4.8 mm.

Head 1.2 times broader than long, vertex moderately arched above tops of eyes; inner eye margins strongly convergent below, lower interocular distance 0.81-0.83 times upper interocular distance. Ocelli as described for female. Scape as described for female; first flagellar segment slightly longer than broad and about 1.3 times length of second; median flagellar segments about as broad as long.

Otherwise about as described for female, but legs and metasomal segments 3-6 dark brownish to blackish.

TYPE MATERIAL. Holotype female, allotype, and two female paratypes from 2 mi. W Elmdale, *Chase Co.*, KANSAS, 30 Sept. 1975 (Michener and Chabot); 2 ♀♀, 2 ♂♂, Yates Center, *Woodson Co.*, KANSAS, 7 Sept. 1949 (Michener and Beamer). Holotype, allotype, and most paratypes in UKAN; one female paratype in LACM.

ETYMOLOGY. The specific name is a Latin adjective, meaning too much or excessive and is in reference to the densely punctate mesoscutum.

DISCUSSION. This species is most similar to the sympatric *M. grindeliae*, but in the latter species the punctures of the mesoscutum are finer and, at least in the middle of the disc, separated by three times a puncture diameter or more. Other differences include the more convex clypeus, much denser mesepisternal and propodeal pilosity of *M. nimia*, as well as the red-marked metasoma of the *M. nimia* male.

From *M. sidaeifloris* both sexes differ in the much sparser mesosternal pubescence. Although some plumose hairs are present anterior to the mesocoxae, they are not appressed to form a dense, surface-concealing patch, as in *M. sidaeifloris*. The mesoscutal punctation of *M. nimia* is much denser than that of *M. sidaeifloris*, as noted in the key.

The finely, longitudinally rugulose median area of the propodeal triangle separates *M. nimia* from both *M. grindeliae* and *M. sidaeifloris*. From the West Coast species, *M. melanantha*, *M. annectens*, and *M. chica*, *M. nimia* is immediately separable by the presence of three submarginal cells in the forewing.

The genitalic capsule of *M. nimia* (not illustrated) is very similar to that of *M. grindeliae*, but with much sparser setae along the shaft of the gonostylus. The hidden sterna, however, are different. Sternum 7 (Fig. 14) of *M. nimia* is proportionately broader, though similar in shape. Elongate, slender, and apically acute, sternum 8 of *M. nimia* (Fig. 15) is very distinctly different from the short, broad, and truncate to subtruncate segments of most other species of *Melanomada*.

Melanomada sidaeifloris (Cockerell)

Figure 25

Nomada pennigera var. *sidaeifloris* Cockerell, 1898:59; ♂.
Melanomada sidaeifloris: Rodeck, 1945:203. Rozen, 1977:7–9; larva.

DIAGNOSIS. This species is separable from *M. annectens*, *M. chica*, and *M. melanantha* by the presence of three submarginal cells in the forewing. Although very similar to *M. grindeliae*, both sexes are readily separable by the presence of dense patches of profusely plumose, mainly prostrate pubescence on the side and venter of the thorax and on the side of the propodeal disc. The mesoscutum of *M. grindeliae* is uniformly very sparsely punctate, while in *M. sidaeifloris* the punctures are moderately dense in most areas, becoming irregularly spaced and sparse posteromedially. This species is also similar to *M. nimia*, but in that species the mesoscutum is very uniformly punctate, the punctures separated by about one-half a puncture diameter, and the propodeal triangle bears several short longitudinal rugulae.

In addition to the type, from Mesilla, New Mexico, we have seen a few specimens all from New Mexico (Hidalgo County) and Arizona (Cochise County), but presumably the range of this species will include western Texas and the northern Mexican States of Chihuahua and Sonora. Rozen (1977) found *M. sidaeifloris* to be a cleptoparasite in the nests of *Exomalopsis sidae* Cockerell.

Melanomada species A

Figure 25

Two specimens from Kingsville, Kleberg County, Texas, a female collected 30 May 1977 and a male collected 6 May 1976, both by J.E. Gillaspay (UTSU), do not agree with any of the above species and probably represent an additional species in this genus. We are reluctant to name this form from such inadequate material. In our key above, these will

run to *M. sidaeifloris*, which they somewhat resemble. The mesosternum is unlike that of *M. sidaeifloris* in that it is thinly pubescent, the smooth shiny integument fully visible and bearing minute, irregularly scattered punctures. In *M. sidaeifloris* the highly plumose hairs are dense enough to conceal the surface, which is densely and finely punctate. The hypostomal area is also minutely and sparsely punctate, unlike that of *M. sidaeifloris* in which punctures are dense and small.

Melanomada species B

Figure 25

This is known from a single male collected by P.D. Hurd at Villa Guadalupe, Jalisco, Mexico, 26 July 1951 (UCB). It closely resembles the male of *M. sidaeifloris*, but the mesoscutal punctures are more uniformly spaced. Its most outstanding feature is the presence of extensive, median, polished and apubescent areas on metasomal sterna 3–5. This characteristic will distinguish this from all other *Melanomada* we have seen. As with the preceding, we refrain from naming the species at this time because of the paucity of available material.

IMMATURE STAGES

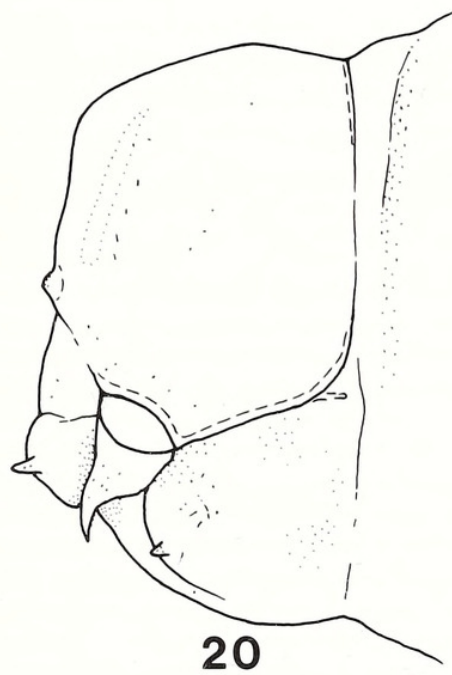
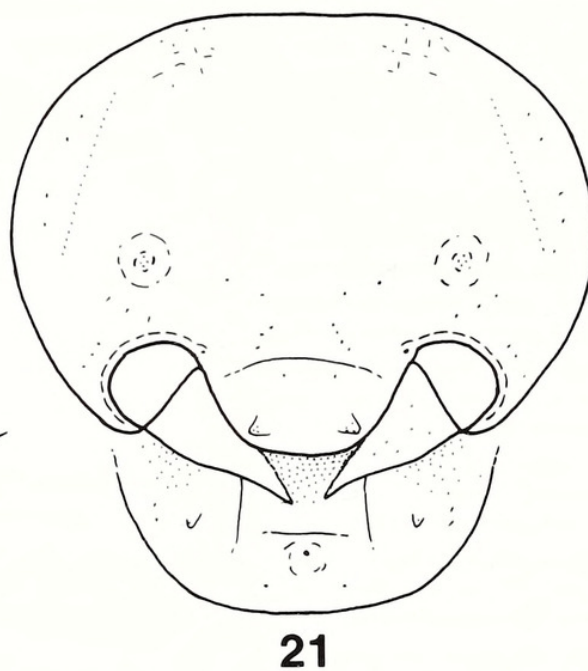
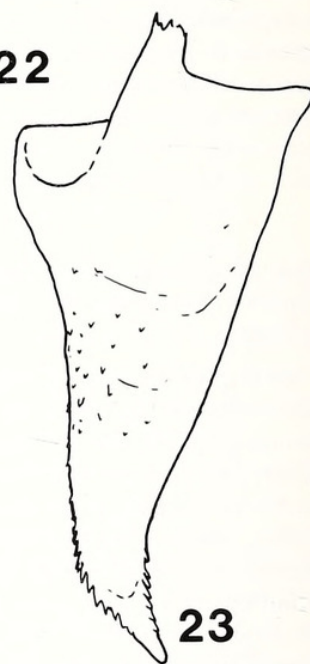
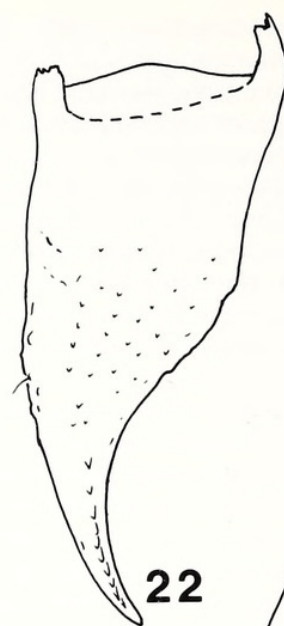
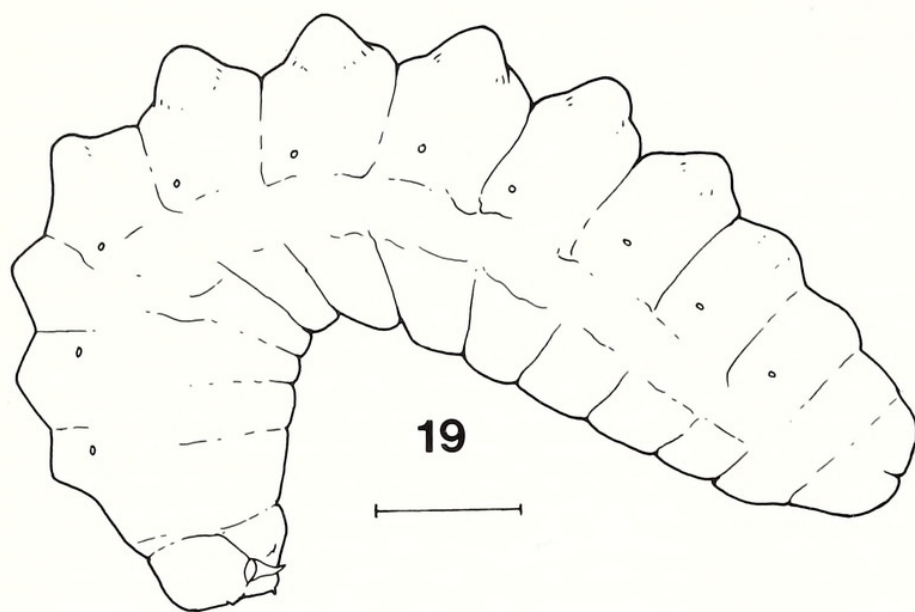
The mature larva of only *Melanomada sidaeifloris* was previously described and compared with other nomadine larvae (Rozen, 1977; Rozen et al., 1978). The larva of *M. annectens*, treated below, confirms the similarity of this species to *M. sidaeifloris* and to members of the *Melanomada* complex. The larvae of this complex are quite dissimilar to those of *Nomada* and *Hypochrotaenia*. Although pupae of the *Melanomada* complex are poorly known, those of *M. sidaeifloris* (Rozen, 1977) and *Paranomada velutina* are quite similar to one another and different from those of *Nomada*.

Mature larva of *Melanomada annectens* Snelling and Rozen

Figures 19–24

DIAGNOSIS. The mature larva of this species is very similar to that of *M. sidaeifloris* and can be distinguished from it only with some difficulty. The slightly darker head capsule, somewhat less produced vertex, and somewhat more pronounced dorsal body tubercles of *M. annectens* seem to be reliable differences.

DESCRIPTION. Head (Figs. 20, 21). As described for *M. sidaeifloris* (Rozen, 1977) except for following: Integument more darkly pigmented than in *M. sidaeifloris* so that sclerotized part of head capsule appears darker than rest of body. Vertex as seen in lateral view only slightly produced on each side above antenna, less so than in *M. sidaeifloris*; produced area somewhat wrinkled. Antennal papilla with four sensilla; antennal protuberances less developed than in *M. sidaeifloris*. Mandible (Figs. 22–24) with dorsal apical edge finely and evenly serrate; ventral apical edge perhaps somewhat more coarsely serrate, but teeth shorter and more rounded than those on dorsal edge.





25

Figure 25. Distribution of species of *Melanomada*: *M. annectens* (★); *M. chica* (○); *M. grindeliae* (●); *M. melanantha* (⊙); *M. nimia* (⊴); *M. sidaefloris* (⊕); *M. species A* (+); *M. species B* (⊴).

Body. Integument spiculate in some areas. Paired dorsal tubercles (Fig. 19) slightly more pronounced than those of *M. sidaefloris*; first four pairs of tubercles somewhat transverse rather than conical (this was particularly evident on

one specimen that had not yet entered diapause). Other features of body as described for *M. sidaefloris*.

Material studied. Four postdefecating larvae, 4 predefecating larvae, 12 mi. S of Corona, Riverside Co., California,

Figures 19–24. *Melanomada annectens*, postdefecating larva. 19, body, side view; 20, head, side view; 21, same, frontal view; 22–24, right mandible, dorsal, adoral, and ventral views. Scale line (1 mm) refers to Figure 19 only.

25 May 1985, J.G. Rozen, Jr. and R.R. Snelling. From nests of *Exomalopsis nitens* Cockerell.

HOST ASSOCIATIONS AND BIONOMICS

All known North American cleptoparasites of the *Melanomada* complex are nest associates of members of the genus *Exomalopsis* (Rozen, 1984). In *Melanomada*, *M. sidaefloris* has been associated with *Exomalopsis consobrina* Timberlake (Rozen, 1977, 1984) by collections made 26 mi. south of Animas, New Mexico in 1976, and to *Exomalopsis sidae* Cockerell at 5 mi. north of Willcox, Arizona in 1983 (Rozen, 1984). Although *M. annectens* (as *Hesperonomada melanantha*) was associated with *Exomalopsis nitens* (Rozen, 1984, table 2), the cleptoparasite had been misidentified and is in reality *M. annectens* (Rozen and Snelling, 1986). Other possible cleptoparasite-host associations are mentioned in the section on Systematics.

The bionomics of *M. sidaefloris* were presented by Rozen (1977, 1984) and of *M. annectens* by Rozen and Snelling (1986).

The South American genera *Kelita* and *Brachynomada* are nest associates of Panurginae (Andrenidae), a further distinction from the *Melanomada* complex. *Brachynomada* near *argentina* Holmberg was associated with *Psaenythia annulata* (Gerstaecker) (Rozen, 1977). *Kelita chilensis* (Friese) is a known parasite of *Lipanthus parvulus* (Friese) (Rozen, 1970), and *Kelita tuberculata* Ehrenfeld and Rozen is possibly associated with *Lipanthus alicahue* Ruz and Toro (Ehrenfeld and Rozen, 1977; Ruz and Toro, 1983).

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