University of Queensland Papers

DEPARTMENT OF ENTOMOLOGY

VOLUME I 1958 NUMBER 7

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Price: Two Shillings

THE UNIVERSITY OF QUEENSLAND PRESS
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Wholly set up and printed in Australia by
WATSON, FERGUSON AND COMPANY
Brisbane, Q.
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The new species, *Omania marksae*, is described from the Great Barrier Reef (Low Is. and Heron I.). The species is adapted to life in the intertidal zone, where it occurs under water within porous coral rocks and at low tide mainly beneath them. Adults are tiny and flightless, with elytron-like fore wings and without hind wings. The nymphal instars are described and figured.

Acknowledgments

I wish to thank Dr. E. N. Marks, Department of Entomology, University of Queensland, for the first two specimens of this most interesting species, and Mr. R. Domrow, Queensland Institute of Medical Research, for identifying the mites associated with it.

Introduction and Discussion

In 1954 Dr. E. N. Marks collected two males of this peculiar little Saldid at Low Isles, toward the northern end of the Great Barrier Reef. They were seen emerging from holes in intertidal beach rock as the tide receded. In 1957 I searched for further specimens on Heron I., near the southern end of the Barrier Reef. Examination of slabs of porous coral rock in the intertidal zone of the beach yielded a good series of both adults and nymphs. When the rocks were exposed, the Saldids were found mainly on the moist undersurface and on the sand and rock beneath, together with several species of Collembola, mites (*Microtrombidium* sp. and *Eupodes* sp.) and small beetles. With the incoming tide, the bugs retreated into the fine system of cavities within the rocks. They were then found by lifting out and breaking open the submerged rocks, from the interstices of which they were collected together with the other Arthropods mentioned above. The Collembola and mites also occurred on exposed surfaces of the fringing reef at low tide, and although no Saldids were found there it is quite possible that they do extend out to this zone. Because of wind and waves, conditions at this time were not suitable for collecting marine insects, although several species of marine Heteroptera are known to occur there. On this occasion one specimen of *Halovelia* was found sheltering against a crevice in the coral.

Omania is flightless, but like other Saldids is capable of jumping. Feeding was not observed, but in view of the apparently predacious habits of other Saldidae quite likely it feeds on small Arthropoda, either living or dead, such as the Collembola and mites which abound in the same localities, and perhaps also on other dead organic matter.

Air-bubbles are most probably held beneath the overhanging, elytron-like fore-wings (beneath which the spiracle-bearing abdominal terga are thin and soft) and possibly among the fine hairs of the venter of the adults. Some air bubbles are also probably trapped within the ramifying interstices of the rocks at high tide, though their importance, if any, as a source of oxygen, would require careful study. There is evidently ample scope for investigations of the biology and physiology of these little bugs. The vestigial ovipositor seems to indicate an unusual type of egg-laying, not involving insertion of the eggs into the substratum. Presumably they are merely attached to rock surfaces, perhaps within the internal cavities.

The Saldidae provide interesting examples of varying degrees of adaptation to a marine habitat, and illustrate some of the ways in which insects could have become aquatic. While perhaps most species inhabit the shores or margins of fresh water or damp situations on land, many have extended their range or become restricted to salt-marshes or muddy, sandy or stony stretches of the sea-coast. Some of these bugs are periodically submerged by the high tide. Large numbers of both adult and nymphal stages of *Saldula woodwardi* Drake were found in Samoa running about on large intertidal boulders some distance below high tide mark. Some of these boulders were already isolated by the incoming tide, and it seems certain that at least the flightless nymphs must have been submerged when the rocks were covered. This species presents no obvious structural adaptations to submergence, but must be adapted in physiology and behaviour; like many other temporarily submerged insects it presumably makes use of the hair covering to retain air bubbles and becomes relatively quiescent.

Saldula saltatoria (L.) was reported by Mason (1889) to be submerged by the tide for about an hour, and to remain inactive so long as it was wet; he described behavioural adaptations tending to ensure quiescence. Brown (1948) gives experimental and observational details of the zoning and capacity for withstanding submergence of *Halosalda lateralis* (Fallen) and *Saldula pallipes* (F.) and discusses at some length the problems of water-colonization by insects. He emphasises the importance, at this level of adaptation, of inactivity during submergence, and considers there are strong indications that while the adults of *S. pallipes* are then dependent on atmospheric oxygen held in bubbles on their bodies, the nymphs, having a softer and more hydrophile cuticle, can utilize water-dissolved oxygen by cutaneous respiration. This may well be the case also with *Omania*. As Leston (1956) remarks, in discussing such adaptations, "many saldid genera are exhibiting parallel trends towards a partial or more nearly complete aquatic life." The reported habits of many Saldids in retreating to resting places under stones and in cracks in mud or rocks during dull periods or when disturbed could be regarded as a partial "preadaptation" of behaviour from which more aberrant habits might develop when the need arose.

The minute size of *Omania* has enabled it to utilize a particular part of the littoral environment unavailable to most other Saldidae. Until now, only one species of this genus has been recorded, *O. coleoptrata* Horvath (1915), from the coasts of Egypt and Arabia. This species apparently has similar habits to *O. marksae*, having been recorded from among marine algae (a single female) (Horvath, 1915) and from rock crevices below high water level (China, 1938, *Mem. Inst. Egypte*, **37** : 255). Further species can evidently be expected, particularly on or near coral reefs in the tropics and subtropics.

The reduction in width of the pronotum and size of the scutellum and loss of the lateral pronotal flanges and carinae of *Omania* may be partly correlated with small size, but probably mainly with loss of the hind wings and reduction and modification in function of the fore wings. Such correlation is frequent among brachypterous bugs. The strongly convex and entirely coriaceous fore wings, overhanging and closely covering the sides of the abdomen, are very different from typical saldid hemelytra, and are probably adaptations to subaquatic life. However, they represent the extreme development of a trend apparent in other genera of Saldidae. Many species are entirely subbrachypterous, with much reduced hemelytral membranes; others are dimorphic with a subbrachypterous form. *Pentacora mexicana* (Van Duzee) (figured in Drake and Hottes, 1954: 4) and *Orthophrys pygmaea* (Reuter, 1910) show an advanced stage in such reduction, and the hemelytra nowhere overlap.

China (1955) has presented evidence for the separate origins of the Hydrocorisae (subaquatic bugs) and the Amphibicorisae (surface bugs) and derives the latter from

a Proto-saldid ancestry, the former from a Proto-ochterid. Thus subaquatic tendencies such as those noted above in some present-day Saldids apparently have not yet led to diversified evolution of under-water groups of bugs of Saldoid affinities. We have the opportunity, however, of being able to observe such diversification in its early stages. *Aepophilus bonnairei* Signoret is an interesting example of a Saldoid which is apparently at about the same level of subaquatic adaptation as *O. marksae* but which structurally has diverged from the typical Saldid facies along different lines (reduction of eyes, loss of ocelli, softening of cuticle, extreme shortening of fore wings) to become nymphoid. This is probably related to type of respiration, which China (1927) suggests is cuticular during submergence. This species would therefore seem to have greater potentialities than *Omania* for becoming truly subaquatic in all stages. *A. bonnairei* has usually been placed in the monotypic family

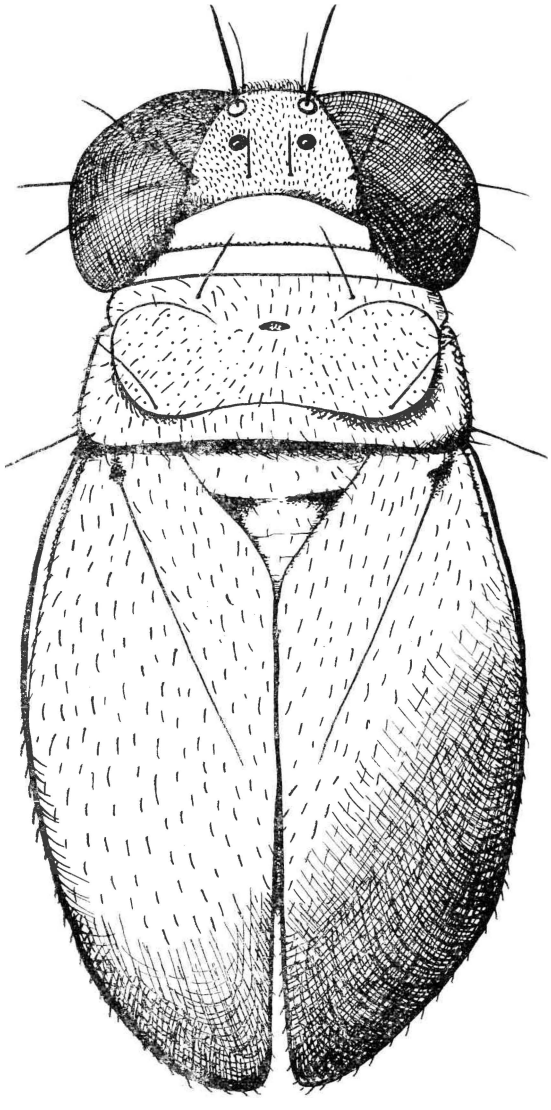

FIG. 1.—*Omania marksae* sp. n., ♂

Aepophilidae Puton, the Saldoid affinities of which have been stressed by Reuter (1910), Singh-Pruthi (1925: 181), China (1927) and Pendergrast (1957). Leston (1956), collating old and new structural evidence, has reduced the family to the rank of a tribe within the Saldinae. Except for the extension of the hair covering, all the obvious differences between *Aepophilus* and typical Saldids are due to reduction or loss of structures.

By comparison with the two suprageneric groups which up to now have been distinguished from typical Saldinae—the Saldoidinae Reuter (1912) and the Aepophilini (Puton, 1879) Leston (1956)—the combination of aberrant features of the head, pronotum, wings and genitalia of *Omania* might suggest separation at the tribal level. However, until the affinities of *Omania* have been ascertained, and the status of the Saldoidinae clarified, it would seem premature to erect an additional taxon at this level.

In proportionate measurements, 75 units = 1 mm.

Omania marksae sp. n.

Length.—♂ 1.27-1.37 mm. (to 1.43 mm. with pygophor extended), ♀ 1.44-1.63 mm.; *width* of head across eyes, ♂ 0.57-0.61 mm., ♀ 0.60-0.63 mm.; width of pronotum at base, ♂ 0.51-0.55 mm., ♀ 0.57-0.61 mm.; maximum width across hemelytra, ♂ 0.65- 0.69 mm., ♀ 0.80-0.85 mm.

Colour.—Velvety black; hemelytra marked with grey along costal margin, broadly at apex and along a transverse band near middle; eyes reddish brown; ocelli and anterior trichobothrial tubercles of head pale; long setae of body and antennae and spines of legs black; short recumbent hairs pale; antennal segments III and IV and apex of II brownish black; femora above and coxae infuscated reddish brown, femora below lighter brown; trochanters, tibiae, femora at apex, and first two tarsomeres yellowish brown; third tarsomere, claws and apex of tibiae above brownish black; abdominal sterna shining black.

Head in front vertical, strongly deflexed, not projecting beyond eyes. Posterior hairless collum minutely granular, in median line $\frac{1}{3}$ total length of head (5.5 : 16.5), cut off in front by an arcuate incision. Rest of crown with a close covering of short, bent, silken hairs. Mesial dorsal margins of eyes very shallowly sinuate, not strongly emarginate posteriorly; each eye with three long erect setae positioned as in fig. 1; a tuft of fine hairs on postero-mesial angle. Ocelli raised, a little more than two ocellus-widths apart (6.5 : 3), separated from eyes by rather more than one ocellus-width (3.5). Setae of cephalic trichobothria long. Bases of anterior pair of trichobothria swollen, raised, larger than ocelli, longitudinal diameter about $\frac{1}{3}$ greater than transverse. Outer post-ocellar trichobothria set close to mesial margins of eyes; inner pair between and in line with the outer, just inside level of mesial margins of ocelli. Clypeal region and undersurface of head with fine suberect pale hairs longer than hairs of crown; former with a pair of long setae. Labrum short, pale, apex rounded, not reaching apex of first rostral segment. Relative length of antennal segments: I 10, II 13, III 10, IV 17; II-IV with suberect hairs mostly longer than width of segments; I with few hairs. Rostrum reaching middle coxae.

Pronotum about half as long as wide at base (19 : 39); base about $\frac{1}{3}$ wider than anterior collar and rather narrower than or subequal to width of head; lateral margins, except on collar, bluntly angled but not acutely carinate or explanate; collar about $\frac{1}{6}$ total length (3 : 19). Callus $\frac{3}{4}$ of median length excluding collar (12 : 16), not raised but clearly demarcated by a sulcus at sides and behind, and occupying most of pronotum; median fovea a little before middle of pronotum. Three pairs of long erect setae, one pair behind collar, one posteriorly on callus, and one on posterior angles.

Scutellum scarcely raised, $\frac{1}{4}$ as wide again as long (20 : 16); about half as wide as base of pronotum; basal third flat; apical part convex, below level of base at sides, with shallow transverse grooves; extreme apex shining brown.

Fore wings strongly convex, completely covering sides of abdomen and extending about to level of sterna; dark, opaque, entirely coriaceous, elytron-like, nowhere overlapping, without trace of membranes; costal margins broadly convex; apices acutely rounded, somewhat diverging, surpassing abdomen. Claval suture present, though weakening apically. Costal margin narrowly

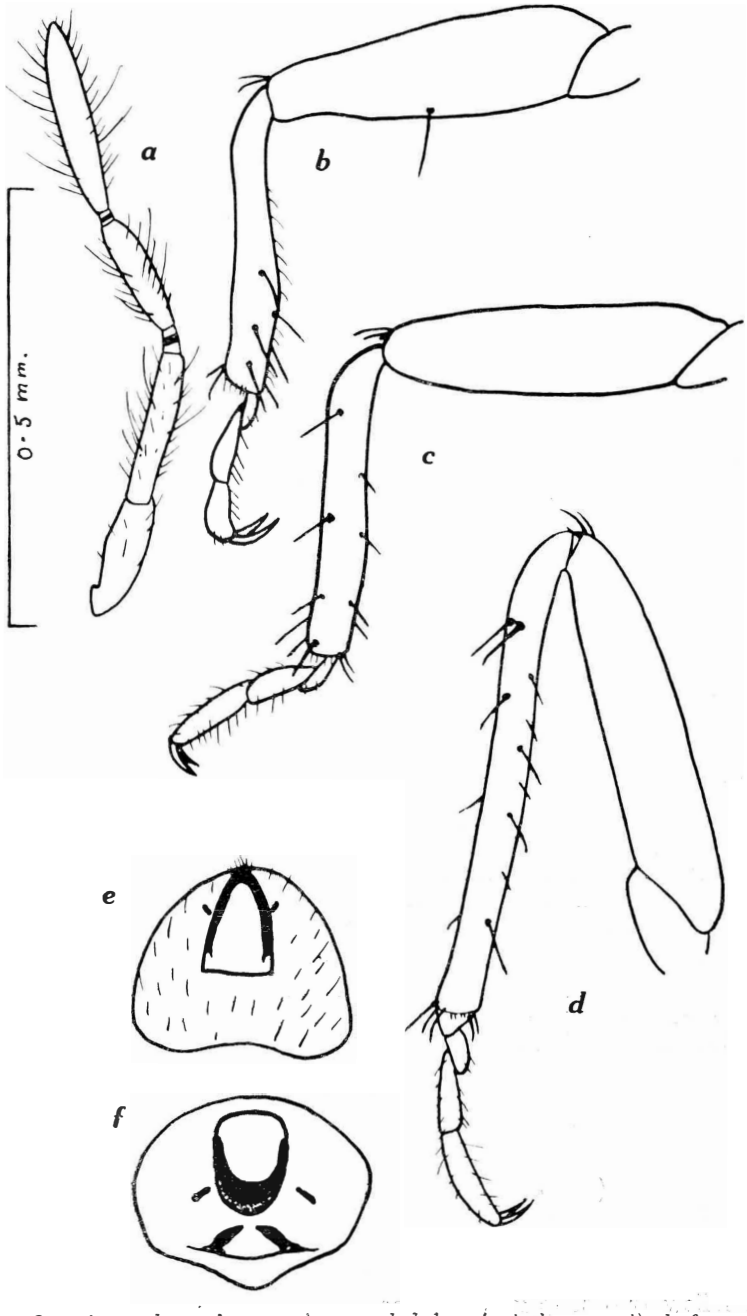

FIG. 2.—*Omania marksae*, ♂. *a*, antenna. *b-d*, legs (anterior aspect); *b*, fore; *c*, middle; *d*, hind. *e*, *f*, pygophor and anal tube; *e*, dorsal (apex above), *f*, apico-dorsal (apex below).

explanate at base and carinately deflexed for more than half its length basally. Only the "outer" vein of corium (R + M) developed, becoming obsolete toward apex. Hind wings absent.

Pronotum, scutellum and hemelytra impunctate, except for micropunctures on pronotal callus; with a rather sparse covering of short, curved, recumbent hairs.

Legs.—Relative lengths of segments (maximum straight measurements; hence individual tarsomere lengths total up to more than straight length of entire tarsus): fore coxa 20, trochanter 10, femur 30, tibia 27, tarsus 13 (I 3.5, II 7, III 5); middle coxa 21, trochanter 10.5, femur 31, tibia 28, tarsus 15 (I 3.5, II 5.5, III 7.5); hind coxa 27, trochanter 14, femur 36, tibia 43, tarsus 18 (I 4, II 8, III 10). Coxae and trochanters without spines. Front femur with a pair of dorsal subapical spines, several long fine ventral setae and a single stouter one at about half length antero-ventrally. Middle and hind femora with three subapical spines, a large dorsal pair and a small one anterior and dorso-lateral. Tibiae with numerous setae. Front tibia with a subapical dorsal pair of spines and on each side three ventral spines within apical half. Middle tibia with a subapical dorsal pair of spines; four large and stout dorsal spines; three less strong antero-ventrally; one ventral toward apex; a subapical ventral pair. Hind tibia with a pair of very strong dorsal spines toward base; five subapical (1 dorsal, 2 dorso-lateral, 2 ventro-lateral); about seven strong spines and a number of weaker ones between the basal and apical sets. Orientation of legs is in the position of extension at right angles to the body.

Abdomen.—Claspers of male minute, simple (fig. 2, *f*). Ovipositor vestigial; last visible sternum of female (seventh) with posterior margin broadly rounded, very slightly produced in middle. Sterna with fine hairs.

Localities.—N. QUEENSLAND: Low Isles, Great Barrier Reef (2 males, 19.viii.1954, E. N. Marks); S. QUEENSLAND: Heron I., Great Barrier Reef (holotype male, allotype female, 34 paratype males, 26 paratype females, 41 nymphs, 10-14.xi.1957, T. E. Woodward).

Deposition of Types.—Holotype (T 5690), allotype (T 5691) and 2 paratypes in Queensland Museum, Brisbane. Other paratypes in Australian Museum, Sydney; British Museum (Natural History); C.S.I.R.O., Division of Entomology, Canberra; National Museum of Victoria, Melbourne; South Australian Museum, Adelaide; U.S. Dept. of Agriculture, Washington; U.S. National Museum, Washington; University of Kansas, Dept. of Entomology; University of Queensland, Brisbane, Dept. of Entomology.

Named after Dr. E. N. Marks, the discoverer of the original specimens.

Omania marksae is readily distinguished from the only other recorded species, *O. coleoptrata* Horvath (1915), by the posterior hairless collum of the head being not triangular but demarcated anteriorly by an arcuate incision, by the apically less produced head, the relatively longer third antennal segment, the demarcated pronotal callus, and the greater body width.

It is seen that there are some discrepancies from Horvath's generic description, but such are to be expected with an originally monotypic genus, and it seems wisest to refrain from erecting new generic or subgeneric names for forms apparently so closely allied and so different from other Saldidae.

NYMPHS

As would be expected, the nymphs are much more typically Saldid-like than the adults, and, *e.g.*, run out readily to Saldidae in the key to British Heteroptera of Leston and Scudder (1956). The abdominal terga are readily identified by reference to the scent-gland orifice, as in all Saldid nymphs single and median, between the third and fourth terga. Its anterior margin is marked by a transverse pigmented peritreme close to the posterior border of the third tergum.

The following descriptions have been made from specimens fixed in Carnoy's solution and subsequently kept in alcohol.

Instar V (23 specimens).

Length 1.23-1.67 mm. (The maximum length for this instar slightly exceeds that of the adult. This is due to distension of the softer abdomen of many of the nymphs and to stretching of the intersegmental membranes of the thorax and anterior part of the abdomen previous to moulting, when the median ecdysial line of head and thorax is also well developed and broad.)

Width of head 0.55-0.59 mm. Pronotum equal or subequal to head in length and in maximum width. Mesonotum about 0.75-0.80 times as long in median line as pronotum (*e.g.*, 13 : 16.5); metanotum scarcely half as long as mesonotum (6 : 13). Fore-wing pads about six times as long as metanotum, reaching to or almost to base of abdominal tergum III (distended abdomen) or about half way along, rarely to apex of III (abdomen less distended). Hind wing pads concealed. Body widest across the front wing pads.

Relative length of antennal segments: I 8, II 12, III 10, IV 16; setae similar to those of adults.

Rostrum reaching about to level of posterior margins of middle coxae.

Relative lengths of tibiae and tarsi: fore, 24 : 14; mid, 27 : 14; hind, 39 : 16.

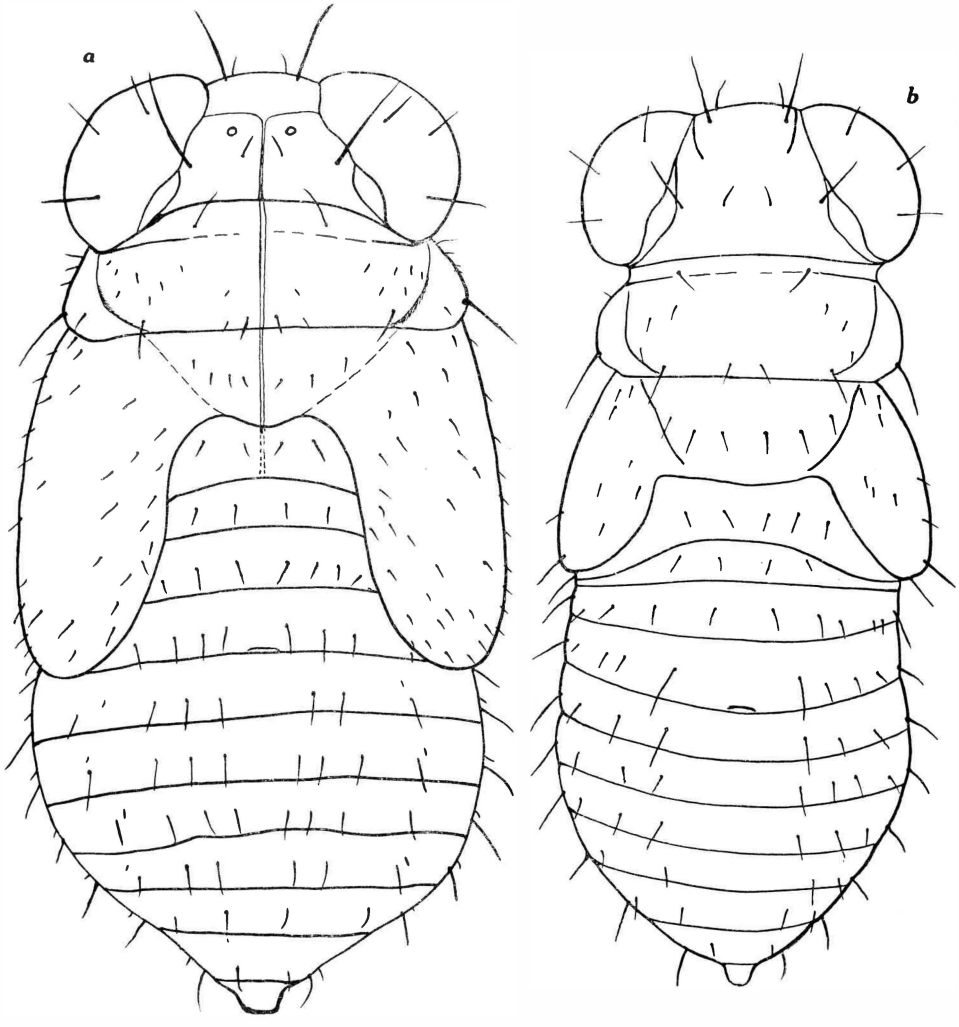

FIG. 3.—*Omania marksae*, nymphs. *a*, instar V; *b*, instar IV.

The last nymphal instar shows, as usual, closer resemblances to the adult than do all earlier instars, from which, besides the other features listed, it differs in the presence of ocellar rudiments, flanged and carinate lateral margins of pronotum, the larger fore-wing pads sharply deflexed ventro-laterally to cover sides of thorax and of base of abdomen.

Colour above brown; wing pads, meso- and metanotum and sides and base of pronotum darker than rest. Eyes and ocellar rudiments red. Frons, clypeus, labrum, gula, apical rostral segment, thoracic pleura, and the claws brown; antennae, maxillary plates, rest of rostrum and legs pale, slightly tinged with light brown; sterna of abdomen very pale, VII and VIII with brownish transverse markings. Dorsal setae black; those of legs dark brown; those on venter of abdomen paler brown. Spiracular peritremes brown.

Chaetotaxy.—The 3 pairs of cephalic trichobothria with spacial relations similar to those of adult; the frontal pair without swollen, ocellus-like bases; the inner vertical pair much shorter than outer vertical, and set much closer together than each inner from the outer. Each eye with 3 postero-dorsal setae as in adult. *Pronotum:* An anterior pair of strong setae near hind margin of incipient collar, as distant from each other as each from lateral margin; a very large marginal pair near postero-lateral angle; mesad of these and behind their level, a pair near posterior margin, just mesad of line separating lateral flange. Other much smaller setae present, of which the most conspicuous is a short pair near posterior margin, one on each side of ecdysial cleavage line. *Meso-* and *metanotum:* Metanotum with a transverse row of 4 setae. Scutellum with a transverse row of 6 or 7 main setae just behind middle. Fore-wing pads with scattered short setae. Pleurae without setae. Anterior coxae with one strong seta (rarely 2) antero-ventrally behind mid-length and a few finer ones toward apex; other coxae with a few fine setae. Femora with rather sparse and mostly rather short setae, a few longer ones ventrally. Tibiae with long strong spines. Tarsi with fine hairs. *Abdomen*.—Terga III-IX with a large marginal seta on each side, included in the total. Number of principal setae on each side of mid-line: I, 2; II, 3 or 4; III, 5; IV, 4 or 5; V, 5; VI, 5; VII, 4; VIII, 3; IX, 2; X, 0. Terga III-IX with an additional small seta in front of each marginal seta, and IV-VII also with a small seta near each submarginal. Sterna each with a single row of fine, mostly short setae, longest on VII and VIII; II-VII with a sensory seta (trichobothrium) behind spiracle and, on III-V, a little above its level, on II and VII a little below it, on VI at same level, those on II and III very small.

Instar IV (10 specimens).

Length 1.05-1.33 mm.

Width of head 0.48-0.52 mm. Pronotum a little shorter and narrower than head. Mesonotum about 0.57-0.75 times as long in median line as pronotum (*e.g.*, 10 : 15); metanotum about two-thirds as long as mesonotum (6.5 : 10). Fore-wing pads about three times as long as metanotum, reaching to or usually almost to apex of metanotum. Posterior margin of metanotum excavated and laterally projecting as incipient hind-wing pads. Body about equally as wide across abdomen and across fore-wing pads.

Relative length of antennal segments: I 8, II 10, III 8, IV 15; setae as in instar V.

Rostrum reaching middle coxae.

Relative lengths of tibiae and tarsi: fore, 21 : 10; mid, 21 : 10; hind, 31 : 15.

Also differs from V in the fore-wing pads not being sharply deflexed ventro-laterally and in the absence of visible ocellar rudiments.

Colour: Paler than V; above yellowish brown; eyes red; venter of abdomen white with no dark markings; otherwise similar to V.

Chaetotaxy of head, pronotum and mesoscutellum similar to instar V, except that posterior mesial trichobothria of head nearly as remote from lateral as from each other. Metanotum with 4 or 5 setae. Front wing pads with sparse short setae; front and hind wing pads with a strong seta near each outer posterior angle. Number of setae on each side of abdominal terga: I, 2; II, 5 or 6; II$_1$-VI, 4 or 5; VII, 3 or 4; VIII, 3; IX, 2; X, 0; including a strong marginal seta on II-IX. Ventral surface and legs as in instar V.

Instar III (5 specimens).

Length 0.99-1.13 mm.

Width of head 0.42-0.46 mm. Pronotum about one-tenth narrower than head and a little shorter to subequal in length. Mesonotum about 0.5-0.6 times as long in median line as pronotum (7 : 14, 8 : 13); metanotum but little shorter than mesonotum (7 : 8, 6.5 : 7). Fore-wing pads rudimentary, present only as short postero-lateral expansions of mesonotum, barely overlapping base of metanotum. Metanotum excavated posteriorly as in IV. Body usually widest across metanotum, which is usually a little broader than mesonotum or abdomen.

Relative length of antennal segments: I 6, II 9, III 8, IV 15.

Rostrum reaching hind coxae.

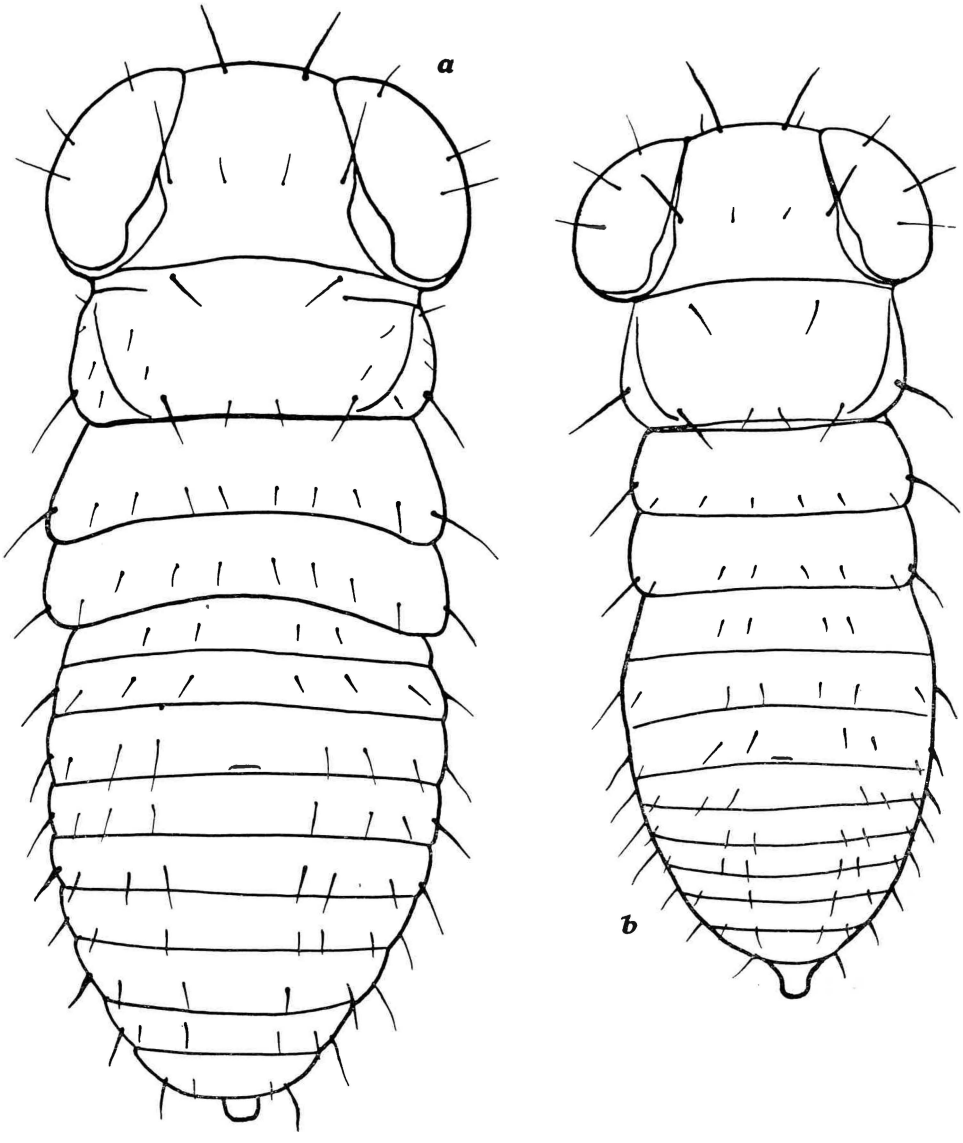

FIG. 4.—*Omania marksae*, nymphs. *a*, instar III; *b*, instar II.

Relative lengths of tibiae and tarsi: fore, 17 : 10; mid, 19 : 10; hind, 25 : 13.

Colour: Pale straw-brown above, darkest on thoracic terga. Eyes red. Antennae pale cream. Rostrum, legs, thoracic pleura and sterna pale yellowish brown. Venter of abdomen white.

Chaetotaxy: Mesonotum and metanotum with 5 setae on each side, including the large lateral. Number of setae on each side of abdominal terga: II-V, 4; VI, 3 or 4; VII, 3. Otherwise similar to instar IV.

Instar II (3 specimens).

Length 0.96-0.97 mm.

Width of head 0.39-0.40 mm. Pronotum about 1/5-1/6 narrower than head. Mesonotum about 0.45-0.58 times as long in median line as pronotum (4.5 : 14, 7 : 12.5); metanotum subequal to or longer than mesonotum. No paranotal processes; hind margins of meso- and metanota nearly straight. Widest across the head.

Relative length of antennal segments: I 6, II 8, III 7.5, IV 14.

Rostrum reaching level of hind coxae.

Relative lengths of tibiae and tarsi: fore, 16 : 9; mid, 16 : 10; hind, 20 : 11.

Colour: Similar to III but even paler; dorsal surface and legs cream with only slight brownish markings.

Chaetotaxy: Mesonotum and metanotum with 4 setae on each side; otherwise similar to instar III.

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