THE POLYPHYLETIC NATURE OF *APANTELES* FOERSTER (HYMENOPTERA: BRACONIDAE): A PHYLOGENY AND RECLASSIFICATION OF MICROGASTRINAE

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THE POLYPHYLETIC NATURE OF *APANTELES* FOERSTER (HYMENOPTERA: BRACONIDAE): A PHYLOGENY AND RECLASSIFICATION OF MICROGASTRINAE[1]

W. R. M. MASON

Abstract

The subfamily Microgastrinae is redefined; Cardiochilinae and Miracinae are placed as separate subfamilies. The Microgastrinae are divided into five tribes and 51 genera, 23 of which are new. The first two tribes, Apantelini and Microgastrini, have characteristically long ovipositor and are almost all solitary parasites of Microlepidoptera. The other three tribes, Forniciini, Cotesiini and Microplitini, have short ovipositor and are almost all parasites of Macrolepidoptera, usually gregarious. The genera *Pseudapanteles*, *Parapanteles*, *Glyptapanteles* and *Protapanteles* of Ashmead, *Cotesia* Cameron, *Dolichogenidea* and *Diolcogaster* Viereck are revived from synonymy, and the following new genera are described: *Alphomelon*, *Choeras*, *Clarkinella*, *Deuterixys*, *Distatrix*, *Exix*, *Exoryza*, *Exulonyx*, *Iconella*, *Illidops*, *Nyereria*, *Papanteles*, *Paroplitis*, *Pelicope*, *Pholetesor*, *Rasivalva*, *Rhygoplitis*, *Sathon*, *Teremys*, *Venanides*, *Venanus*, *Wilkinsonellus*, *Xenogaster*. Twenty new species are described and about 350 new combinations are given.

The genus *Apanteles* is well known and readily recognized by most entomologists, and with good reason. The species of *Apanteles* are abundant everywhere in terrestrial habitats and very few species of Lepidoptera escape their attack; adults are evident by their characteristically thick-set, small and black appearance, and in life by their saltatory escape; furthermore entomology texts have familiarized them by choosing *Apanteles* as one of the chief examples of Braconidae.

The latest catalog of *Apanteles* (Shenefelt 1972) lists 1118 valid species and nearly 200 more have been described since then for a total of about 1300 species. However, that is only a fraction of the real number. Even in the best known areas, undescribed species apparently comprise nearly half the fauna: Nixon (1965, '72, '73, '74, '76) lists 98 new species out of a total of 216 (45%) in his revisions of the species of northwest Europe. Less studied faunas obviously will have a lower proportion of described species, so a world total of 5000 to 10,000 species is a reasonable estimate.

Such an overwhelming mass of species must be subdivided if any useful progress is to be made and, in fact, several attempts have been made, starting almost a century ago.

HISTORICAL REVIEW

(Table I)

The first attempt at splitting *Apanteles* was made by Reinhard (1880), who recognized three numbered groups that are still considered the basic common groups of the European fauna. Considering his time, and the restricted fauna he treated, the quality of work is excellent. The same divisions, with a fourth group added, were used by Marshall (1885) and by Wilkinson (1932) who split Reinhard's second group and added two more groups to accommodate the tropical species he was describing. Wilkinson's groups were also used by de Saeger (1944), Granger (1949), and Risbec (1951) in works on the African fauna.

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[1]Only a few authors (Brues 1926, 1933; Riek 1975) have used the correct stem of "gaster", i.e. "*gastr-*" (Rules, Art. 29 and Appendix D, VII, Table 2 B, 14) to form family group names based on *Microgaster*: Since recent additions to the code (Bul. Z.N. 34: 170, 1977) give no support to continued use of incorrectly formed stems for family group names I am using Microgastrinae.

There is an alternative stem "*gaster-*" but its use in classical Greek is limited to poetry and it is never found in compound words containing "*gaster*". On this evidence I doubt if the use of the stem "*gaster-*" can be defended on linguistic grounds.

Table I. History of subdivisions of *Apanteles* Foerster

Reinhard 1880	Marshall 1885	Wilkinson 1932	Short 1953 larvae	Nixon-groups 1965-72	Mason - genera
				paradoxus	*Parapanteles* Ashm.
2	2	S U	I	ultor, laevigatus longipalpis	*Dolichogenidea* Vier.
				crassicornis (part)	*Apanteles* Foer.
		S	I	ater, taeniaticornis	
2	2	U	I	metacarpalis mycetophilus trifasciatus caesar, lacteus grandiculus	= *Urogaster* Ashm. = *Xestapanteles* Cam. = *Allapanteles* Brèthes
—	—		—	nigriceps	*Alphomelon* nov.
				bucculatricis	*Pholetesor* nov.
3	2-4	A?	I	circumscriptus	
	—		—	schoenobii	*Exoryza* nov.
	—		—	camma	*Exulonyx* nov.
	2		I	butalidis	*Illidops* nov.
				———	*Teremys* nov.
	2			parasitellae vipio, validus	*Choeras* nov.
	2	A	I	falcatus sesiae	*Sathon* nov.
—	—		—	annulicornis nerion (part)	*Pseudapanteles* Ashm.
	2		—	merula sundanus	*Ikonella* nov.
	1	A or F	I	carbonarius	*Deuterixys* nov.
				aciculatus	*Rhygoplitis* nov.
—	—	—	—	terminalis	
—	—	M		insolens	*Xenogaster* nov.
3	4-3	A	IIA	vitripennis, siderion octonarius, fraternus pallipes triangulator ? demeter	*Glyptapanteles* Ashm.
1	3	E	IIF	popularis	*Protapanteles* Ashm.
1	1	F M	IIF	glomeratus pistrinariae	*Cotesia* Cam. = *Cryptapanteles* Vier. = *Stenopleura* Vier.
—	—		—	henicopus daira	*Wilkinsonellus* nov.
—	—	F	—	mlanje	*Nyereria* nov.
—	4	G	IIA	formosus	*Distatrix* nov.
—	—	—	—	congoensis	*Venanides* nov.

On the other hand, Muesebeck (1920) and Telenga (1955) recognized no subdivisions although in their keys the same general groupings appear.

Beginning in 1898, Ashmead started describing segregate genera for parts of *Apanteles* (and also *Microgaster*), publishing a reclassification in 1900. However,

his very superficial knowledge of the group resulted in a classification that, on the balance, was a retrograde step compared with the arrangements of Reinhard and Marshall. Between 1891 and 1915 several workers described 11 new genera for parts of *Apanteles* but of the 11 names only six (four of them Ashmead's) are considered valid in this revision. What had been threatening to become a flood of microgastrine generic names was halted by Muesebeck (1920) whose statement that *Apanteles* was not subject to division won general acceptance for half a century.

Short (1953), by using cast larval skins from the cocoons of reared species, defined three groups corresponding very closely to Reinhard's original three, thus corroborating that early work by the independent evidence of larval morphology.

In 1965 Nixon published a monumental reclassification of the Microgastrinae based mainly on the huge collections from all over the world accumulated by the late D. S. Wilkinson. He revised the entire subfamily, describing many new genera, mostly for sections of *Microgaster* Auct., but dividing *Apanteles* only into species groups, 44 in number. He subsequently published his opinion (Nixon 1972) that *Apanteles* is clearly polyphyletic and will eventually have to be divided. He is correct, but to understand this polyphyly one must consider the relatives of the species placed in *Apanteles* (sensu Foerster).

LIMITS OF MICROGASTRINAE

For almost exactly a century (Foerster 1862 to Nixon 1965) Microgastrinae was considered to include the three genera into which Foerster split *Microgaster* Latreille, i.e. *Microgaster*, *Microplitis* and *Apanteles*, with the addition of *Adelius* Haliday 1833, *Mirax* Haliday 1833, and *Dirrhope* Foerster 1851. *Fornicia* Brulé was variously treated, but often added to Microgastrinae. Nixon (1965) made a correct analysis in excluding *Adelius*, *Paradelius*, *Dirrhope*, and *Oligoneurus*. He suggested that three tribes might be formed for 1, *Cardiochiles* and its close relatives, 2, *Mirax*, and 3, the traditional genera *Microgaster*, *Microplitis*, and *Apanteles*. However he added a caveat that the "tribes" were united by nothing but the location of the spiracle of tergum I on the "lateral membranous margin" (correctly stated, spiracle I is on a laterotergite, see note on laterotergites, p. 15).

The situation of this spiracle is unlike that of all other Apocrita (except Aulacidae, in which the spiracle is probably not functional), but is shared with many groups of sawflies. The spiracles of all abdominal segments of the most primitive sawflies (Xyelidae, Pamphiliidae) lie on the laterotergites and only the spiracles of abdomen I (propodeum of Apocrita) have migrated dorsally in most other sawflies (e.g. Xiphydriidae). Clearly the situation of this spiracle (metasoma I) is a plesiomorphic feature and thus cannot be used to unite these tribes if one follows Hennigian methodology.

The three Nixon "tribes" share a few other symplesiomorphies seldom or never found in other braconids: 1, the median connecting part of the pronotum is flat, or bulging and without obvious modifications except for a small transverse anterior groove, much as in most sawflies; 2, distal abscissa of Radius (forewing) is basally convex anteriorly, at least in the primitive members of all three tribes (see discussion under Radius below); 3, fully grown larvae have porrect, sclerotized, 1-jointed palpi (maxillary palpi of *Microplitis* reduced).

There are a few derived characters separating the three tribes (sensu Nixon) from most braconids but since all are reductional features I distrust them as indicators of relationship (Hecht 1976). They are: 1, loss of occipital carina; 2, desclerotization of apical venation; 3, loss of spiracle on metasoma VII. The first two reductions occur so commonly in Braconidae as to be of no value in interpreting phylogeny.

The third character, loss of the last metasomal spiracle, is distinctive in Braconidae although it occurs also in Cheloninae combined with loss of the spiracle of metasoma VI. My judgment is that there are not strong enough synapomorphic characters to group *Mirax*, *Cardiochiles*, and Microgastrini in one subfamily; therefore I prefer to recognize three subfamilies: Cardiochilinae, Miracinae, and Microgastrinae.

Although I cannot now find any convincingly strong synapomorph to unite these three subfamilies, they do share four rather unusual plesiomorphic features. As Bock (1977) remarks, symplesiomorphs are homologues and are thus a valid test of classificatory hypotheses. The available evidence, weak as it is, suggests that the three groups are somehow related to one another more closely than to any other braconids. It is only prudent to consider all three when making any hypothesis about the phylogeny of any one of them.

One puzzling feature is the presence of a rigidly fixed number of flagellar articles in Microgastrinae and Miracinae. It is not an overgeneralization to state that all Hymenoptera fall into two groups: those with a small but strongly intraspecifically fixed number of flagellomeres, and those with a larger and intraspecifically variable number of articles. The great majority of Hymenoptera fall in the first group; the second group includes Megalodontoidea, Xyeloidea, Siricoidea, and in the Apocrita, only Ichneumonoidea and the families Stephanidae, Agriotypidae, Sclerogibbidae, and Trigonalidae. The Microgastrinae and Miracinae, but not the Cardiochilinae, are exceptional among Ichneumonoidea in the constancy of the number of flagellomeres. (Many of the small species of Aphidiinae and *Microchelonus* approach this condition but the number of articles, although often intraspecifically constant or nearly so, varies among species of a genus.) Because both fully fixed and partly fixed numbers of flagellomeres are found in different sections of the braconids, I suspect that the variable number is a plesiomorphic character and the fixed an apomorphic one within Ichneumonoidea. Probably a broader study of this would be useful; certainly the subject must not be neglected in studies of Hymenoptera evolution.

MICROGASTRINAE

The subfamily includes the three traditional (1862–1965) genera *Microgaster*, *Microplitis* and *Apanteles*, and also *Snellenius* and *Fornicia*. It excludes *Mirax*, *Cardiochiles*, their close relatives and various small groups that have at times been attached (*Adelius*, *Dirrhope*, *Muesebeckia*, *Oligoneurus*, etc.).

Microgastrinae, thus restricted, is recognizable as follows:

1. Flagellum invariably with 16 articles.
2. Most of the flagellar articles with placodes in 2 ranks of half the length of the article, giving a gross appearance of a transverse constriction in the middle of each article (a few exceptions, especially among species with very short antennae) (Fig. 10).
3. Second cubital cell absent or small and triangular or quadrangular but never longer than width of stigma (except in *Pelicope* and *Semionis*).
4. Apical margin of clypeus concave, revealing a flat, broad, hairy labrum (Fig. 9).
5. Metasoma I with a strongly defined tergite that does not include the spiracles: these situated on separate laterotergites.
6. Hind tarsus with a median ventral ridge formed by a single row of closely appressed or connate hairs (Fig. 14).

The foregoing characters are all non-reductional and apomorphic compared with their homologues in Cardiochilinae. Two of them alone, the 16-jointed flagellum and the spiracle on laterotergite I, are enough to distinguish any members of Microgastrinae from all other Hymenoptera.

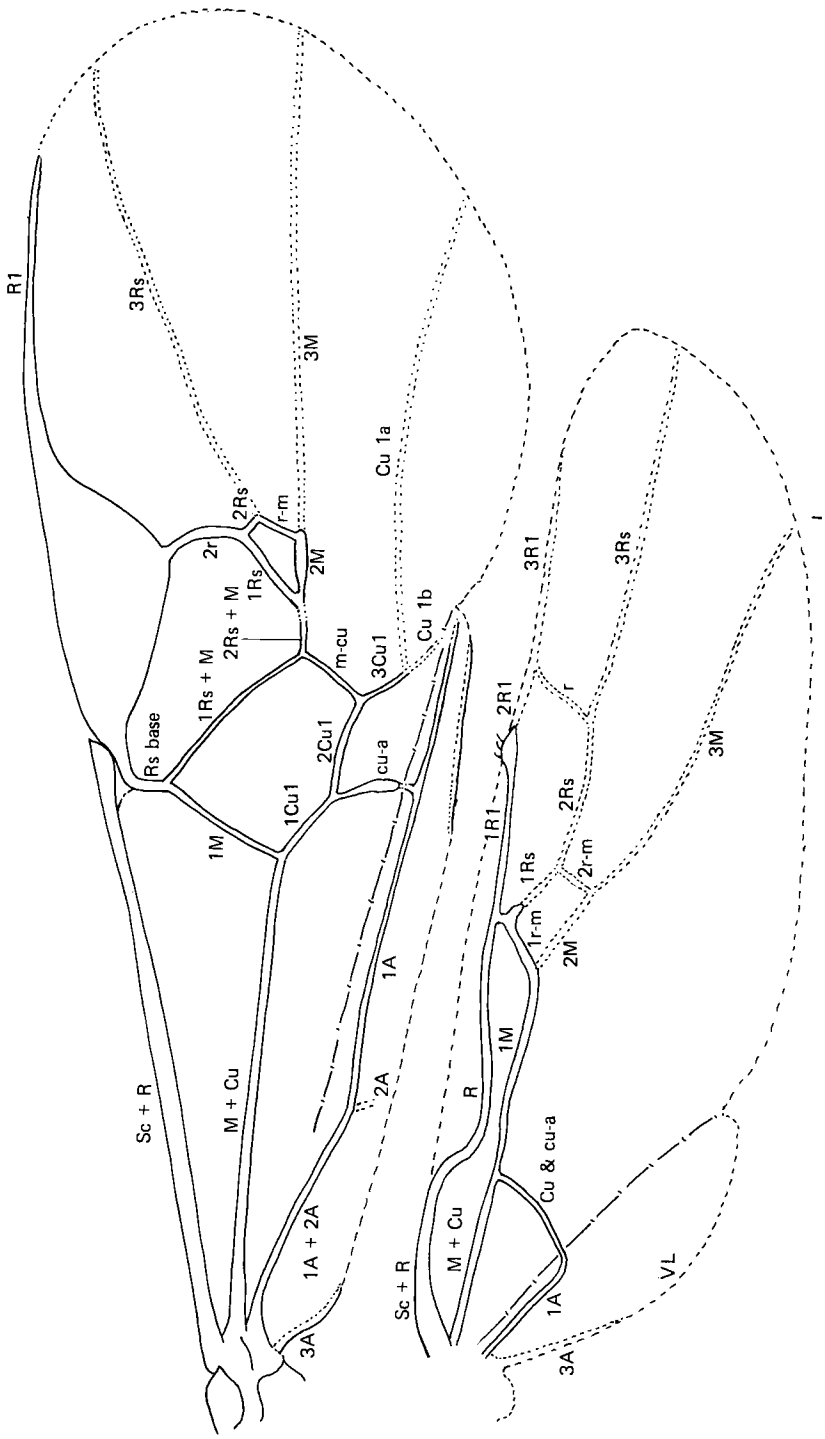


FIG. 1. Wings of *Choeras tiro* to show nomenclature of veins according to Comstock-Ross system. Equivalent terms in the Gahan and Rohwer system, forewing: Costa (Sc+R), Metacarpus (R1), Basal (1M and Rs base), Radius (2r and 2Rs and 3Rs), Medius (M+Cu), Submedius (1A), Cubitus (Rs+M and 2M and 3M), Discoideus (Cu1 and Cu1b), Brachius (distal part of 1A), Subdiscoideus (Cu1a), Intercubitals (1Rs and r-m), Recurrent (m-cu), Nervulus (cu-a), Interanal (2A). Hind wing: Subcostella (Sc+R and R and 1R1), Metacarpella (2R1 and 3R1), Basella (1r-m), Radiella (Rs), Mediella (M+Cu and 1M), Cubitella (2M and 3M), Submediella (1A), Interradiella (r), Intercubitella (2r-m), Nervellus (Cu and cu-a).

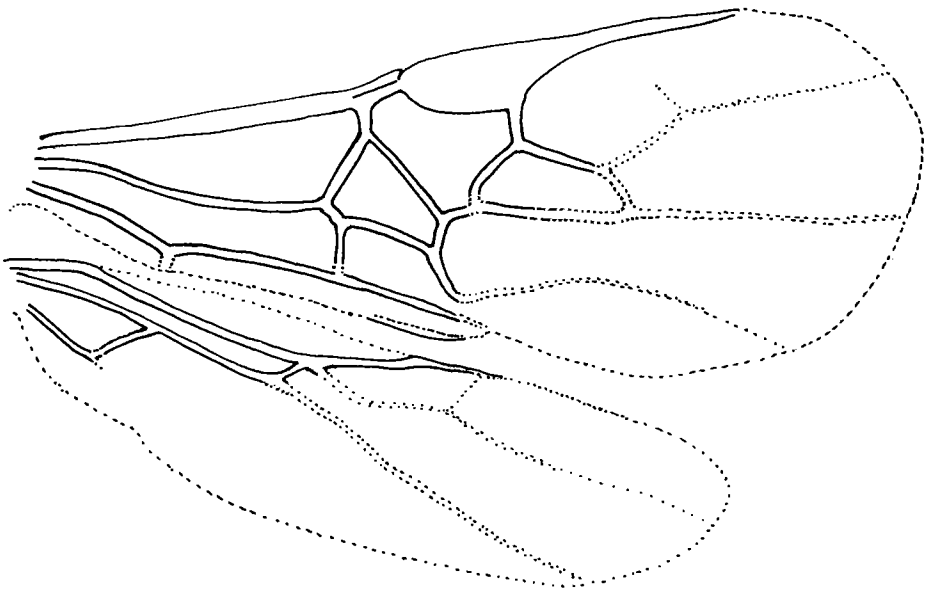


FIG. 2. Wings of *Cardiochiles minutus* (Cardiochilinae) to show the large areolet, free spur of 2A in the forewing, and anteriorly bent Rs with a trace of a forward-directed vein that may be either 3r or another branch of Rs. The forward bend is characteristic of *Cardiochilinae* but the spur (3r) appears in only a few species.

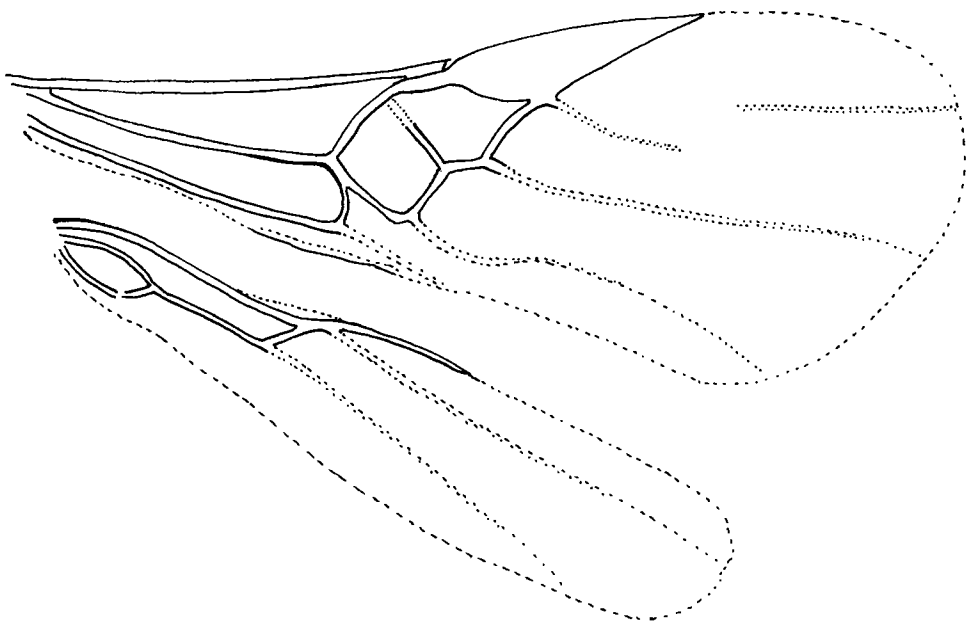


FIG. 3. Wings of *Centistidea lithocolletidis* (Miracinae) to show the absence of hindwing cross-veins and obliteration of 2r by Rs touching the stigma. The two distal sections of Rs are not connected; in fact they do not directly approach. I take this as a relict of the strongly curved Rs found in Cardiochilinae (Rs is a continuous curve in the more derived miracine *Mirax*, and a similar shape of Rs can be seen in *Miropotes* and *Pelicope*).

The next set of characters are reductional apomorphic features relative to their homologues in most primitive braconids, considerably less definitive in phylogenetic studies but useful taxonomically.

7. Occipital carina absent.
8. Palpal formula 5-3 (5-4 in the small Nearctic group of *Microplitis croceipes* (Cresson)).
9. Prepectal carina absent (except in *Fornicia* and *Snellenius*).
10. Spiracles on metasoma I–VI only; absent on VII.
11. Apical venation desclerotized and usually transparent (Fig. 1).
12. Interanellan (2A) absent.
13. Discoidellan (2Cu1a) absent.
14. 2nd interanal (a) absent.

The balance of useful distinguishing characters are plesiomorphic for the Braconidae. I give only those that seem useful in separating Microgastrinae from other braconids:

15. Vannal lobe of hindwing large and delimited distally by a notch (some rare exceptions in *Prasmodon* and *Larissimus*).
16. Intercubitellan (2r-m) present (except in *Miropotes*, *Semionis*, and *Pelicope*).
17. Interradiellan (r) present (except in *Pelicope*).
18. Transverse, median, part of pronotum essentially simple, flat, and lorate except for a weak anterior marginal suture that connects two shallow, submedian depressions.
19. Larval palpi developed as 1-jointed sclerotized appendages (except for maxillary palpi of Microplitini).

Character Analysis

My phylogenetic hypothesis for the Microgastrinae (Fig. 22) is based on an analysis of the characters listed below. They are listed by organs or features of organs written as boldface headings. Following the heading are transformation series or morphoclines with the plesiomorphic condition first, then increasing stages of apomorphy. Parallel transformation series are not duplicated in the listings, though they are numerous: non-homologous morphoclines acting on the same organ but leading to different apomorphic features are separated by the word *or*.

I have included Cardiochilinae and Miracinae in the listings because I think them the closest relatives of Microgastrinae (see above). My hypothetical ancestor of the Microgastrinae could differ from some Cardiochilinae only in having a complete prepectal carina, an intercubitella (2r-m of hind wing), and a basal median carina on the propodeum. If extant it would probably be placed in Cardiochilinae as a distinct genus if it had a high and variable flagellar count, or in Microgastrinae if it had a constant number of 16 flagellomeres.

Flagellomeres of high and variable number; constant number of 16 (Microgastrinae) *or* 12 (Miracinae).

Longitudinal placodes (Fig. 10) of flagellomeres irregularly distributed: placodes regularly arranged in 2 ranks per article on a few middle articles up to as many as all articles: apical articles often shortened and set with only one rank of placodes; sometimes (only in ♀) all articles short and with a single rank of placodes; *or* placodes arranged more or less in 3 or 4 ranks per article.

Placodes uniformly distributed on all sides of each article; placodes (in ♀ only) excluded from ventral basicone fields (Fig. 11) on the middle and subapical flagellomeres (*Fornicia*, *Exix*, *Diolcogaster*, etc.).

Bent-tipped basiconic sensilla (Figs. 12, 13) present on apical flagellomeres of ♀ on the ventral side (Norton and Vinson 1974); basiconic sensilla with truncate tips and a small twisted appendage; *or* these sensilla apparently lost (*Cotesia*, *Microplitis*).

Maxillary palpi with 6 articles (Cardiochilinae); 5 (Microgastrinae); 4 (Miracinae); *or* modified into a drinking tube (*A. longipalpis* Reinhard).

Labial palpi with 4 articles (Cardiochilinae and some *Microplitis*); 3 articles (all others).

Maxilla and labium short, galea truncate; mouthparts elongated, galea bifurcate (*Promicrogaster*, *Pseudapanteles*).

Upper and lower pronotal grooves both present; only lower groove present; no pronotal grooves; *or* lower margin excavated (Miracini).

Lower outer corner of propleuron simple; this corner with an upwardly projecting lobe that overlaps the lower pronotal margin (*Hypomicrogaster*, *Buluka*, *Wilkinsonellus*, *Fornicia*).

Notauli complete; reduced through various stages to nothing.

Prepectal carina complete (some Cardiochilinae, *Fornicia*); incomplete (*Snellenius*, some Miracinae); *or* absent (most Microgastrinae).

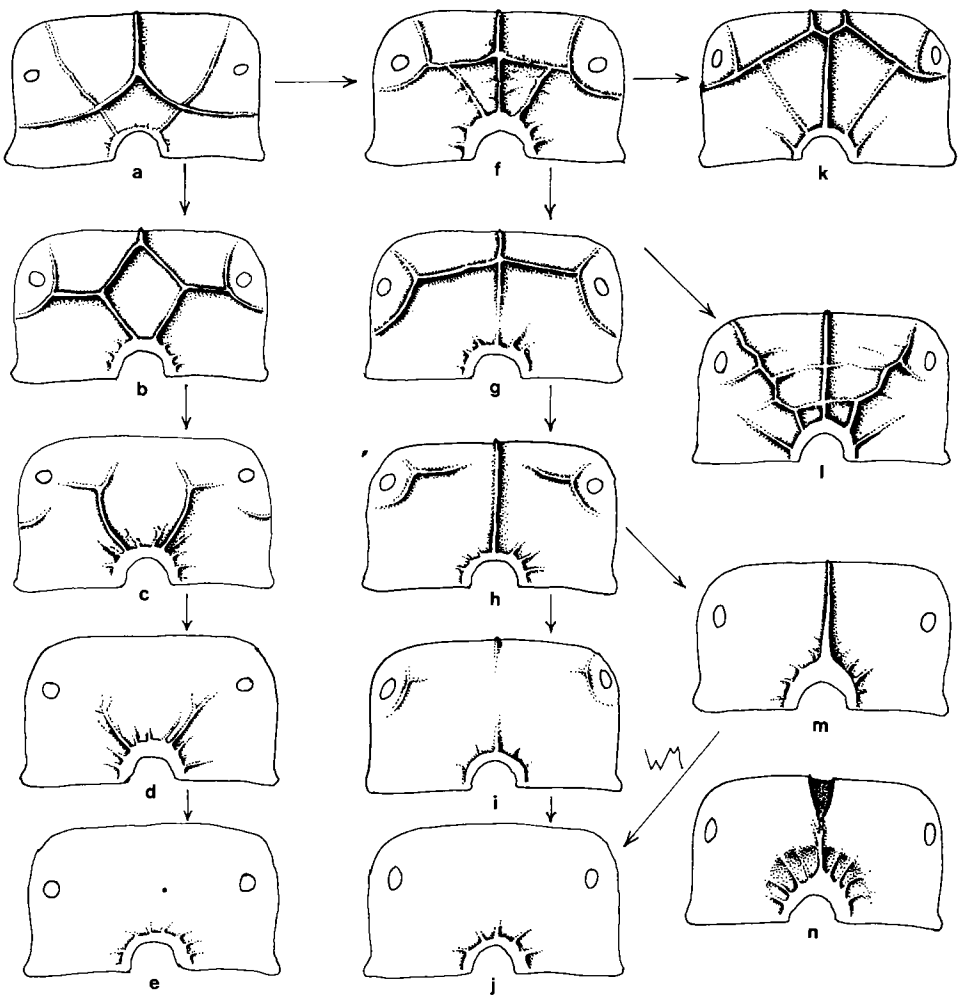


FIG. 4. Evolution of propodeal carinae (diagrammatic). a, a generalized structure found in *Miropotes* and *Exulonyx*; b–e, parallel stages of reduction found in *Dolichogenidea*, *Apanteles*, and *Pholetesor*; f represents the condition in *Hypomicrogaster*, k the condition in *Fornicia*, and l the condition of *Wilkinsonellus*; f–j and m are stages of reduction found in Microgastrini and Cotesiini, most common stages being m and j; h and i are characteristic of *Cotesia*; n, m, and j represent conditions found in *Promicrogaster*.

Where present the transverse carina lies along the junction of the horizontal and vertical faces of the pronotum. There is a strong tendency for a long horizontal face in primitive genera and a short horizontal face or no distinguishable faces in derived genera.

Metanotum (Figs. 5, 6, 7) with anterior margin straight and closely appressed beneath apical margin of scutellum; anterior margin withdrawn laterally exposing phragma II; *or* anterior margin with sharply projecting lateral lobe that bears a tuft of hairs (many Apantelini and Microgastrini).

Propodeum (Fig. 4) areolated, bearing a mediobasal longitudinal carina, an areola extending from the median carina to the foramen, costulae and lateral longitudinal carinae, median anterior carina obscured by extension of areola forward; *or* median carina extended posteriorly to foramen; *or* any combination of these carinae weakened until propodeum becomes ecarinate and smooth *or* punctate *or* rugose.

General sculpture of thorax probably coriaceous with extremes of coarse *or* smooth surfaces being apomorphic.

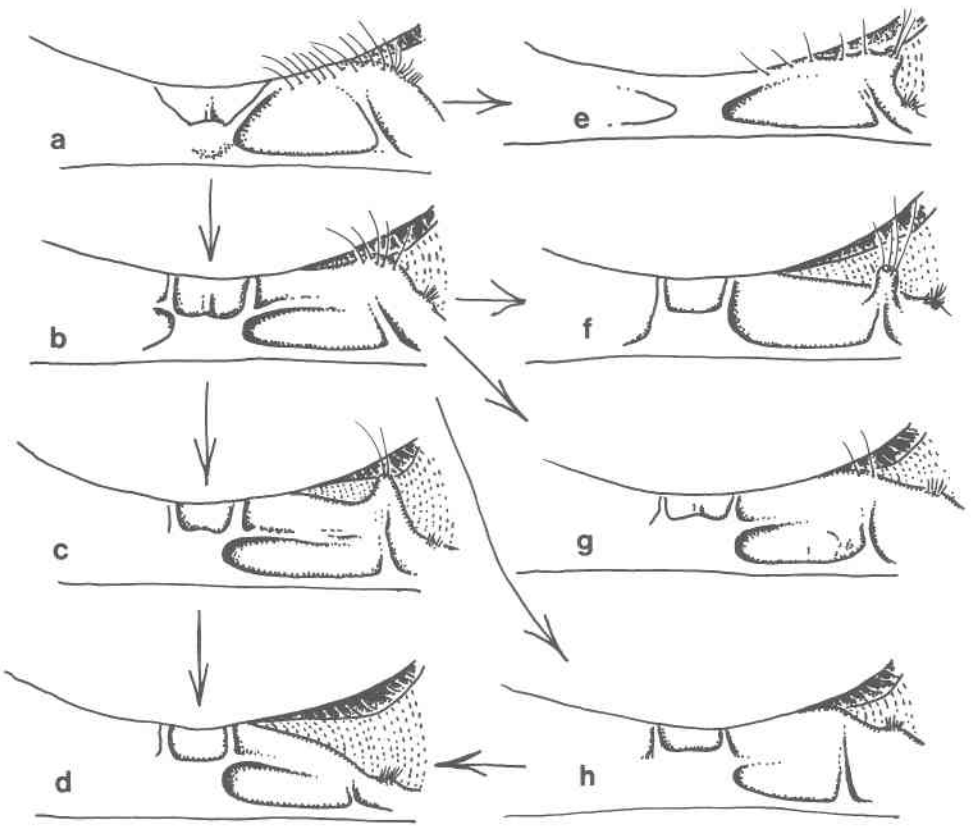
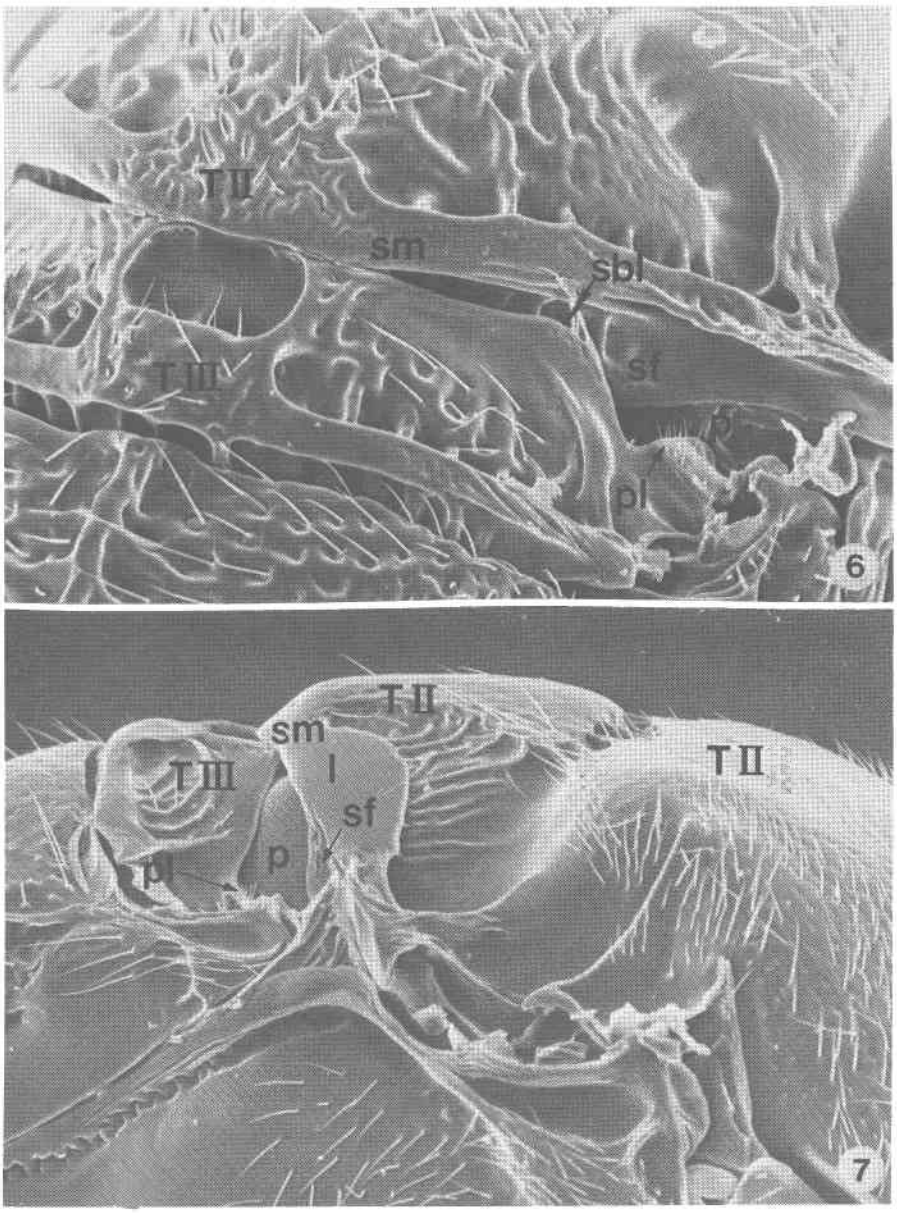


FIG. 5. Diagrammatic scheme of evolution of anterior margin of metanotum. Scutellar phragma represented by concentric dotted curves; between the phragma and the polished margin of the scutellum a flange projects downward and outward from below the scutellar margin; this flange is sculptured, usually crenulate and lies between the mesonotum and the phragma. a, *Cardiochiles* with hairs along most of the anterior margin, setose and pilose lobes not differentiated, phragma concealed; b, condition in a majority of Microgastrinae, the metanotal margin bearing a broad, gently rounded setose sublateral lobe concealing the phragma, and a small lateral pilose lobe with short hairs that may have a proprioceptive function connected with wing folding; c, condition typical of *Apanteles*, *Dolichogenidea*, *Pholetesor*, and many other Apantelini as well as *Eikonella* and *Clarkinella*; d, the most derived condition, characterized by flattened and glabrous sublateral lobe and widely exposed phragma, found in *Glyptapanteles*, *Protapanteles*, *Sathon*, and a few other genera; e, Miracinae, differing from Cardiochilinae mainly in having differentiated lateral and sublateral lobes; f, peculiar condition of *Alloplitis* and *Philoplitis* only; g, subdued lobes as found in *Distatrix*, *Venanus*, and relatives; h, this condition, the sublateral lobe hairless is, together with 5d, characteristic of *Cotesia*.

Abdominal spiracles 7, on propodeum and metasoma I-VI, spiracle of metasoma I on the laterotergite — a group character only modified in *Fornicia*, where the spiracle of laterotergite I is vestigial.

Tergite I probably fairly broad and somewhat wider apically; basally with a sharp median groove; *or* apically with a broad median trough; *or* strongly narrowed throughout; *or* narrowed apically; *or* broadened to cover entire dorsum of tergum I.



FIGS. 6, 7. SEM photos of thoracic nota II and III. Anatomical features: TII, TIII, thoracic nota II and III; 1, lunule of scutellum; sm, apical margin of scutellum; sf, lower flange of scutellum; p, phragma of scutellum; sbl, sublateral lobe of metanotum; pl, pilose lobe of metanotum. 6, *Diolcogaster facetosa*, 7, *Glyptapanteles compressiventris*.

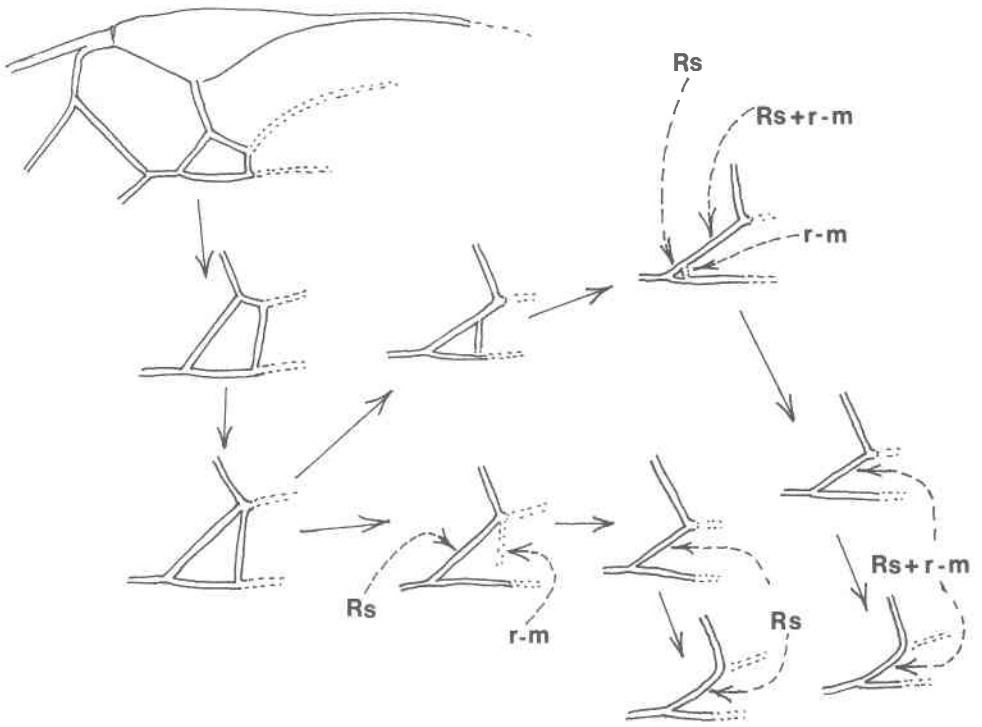


FIG. 8. Stages in the reduction of a large areolet and two methods of elimination of the 2nd intercubital (r-m) vein to form the open areolet characteristic of the traditional genus "*Apanteles*".

Tergum II bearing a slightly raised median area that is wider posteriorly; median area becoming marked by lateral grooves; median area changing shape to become narrowed into a triangle, *or* rectangle, *or* inverted triangle, *or* other shape; *or* median area becoming wider to form a broad pentagon *or* rectangle. Other morphoclines lead toward loss of the median differentiated area. Aciculate *or* punctate sculpture *or* a combination is normally apomorphic compared with a smooth surface but I suspect there are frequent minor reversals in these morphoclines.

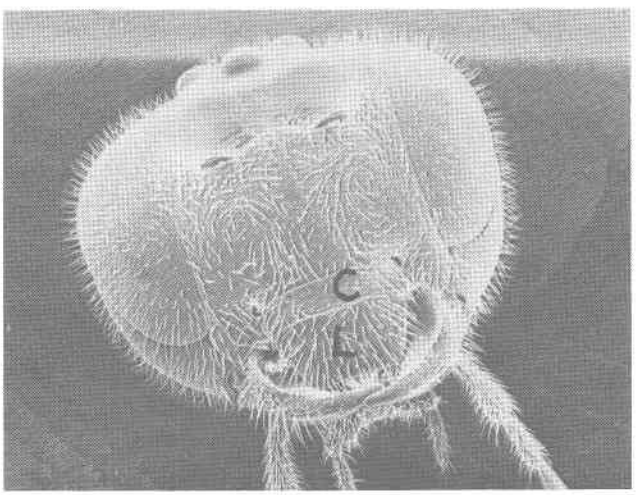


FIG. 9. Facial view of a microgastrine (without antennae) to show transverse clypeus (C) with large hairy labrum (L) projecting below it to fill the space between the mandibles.

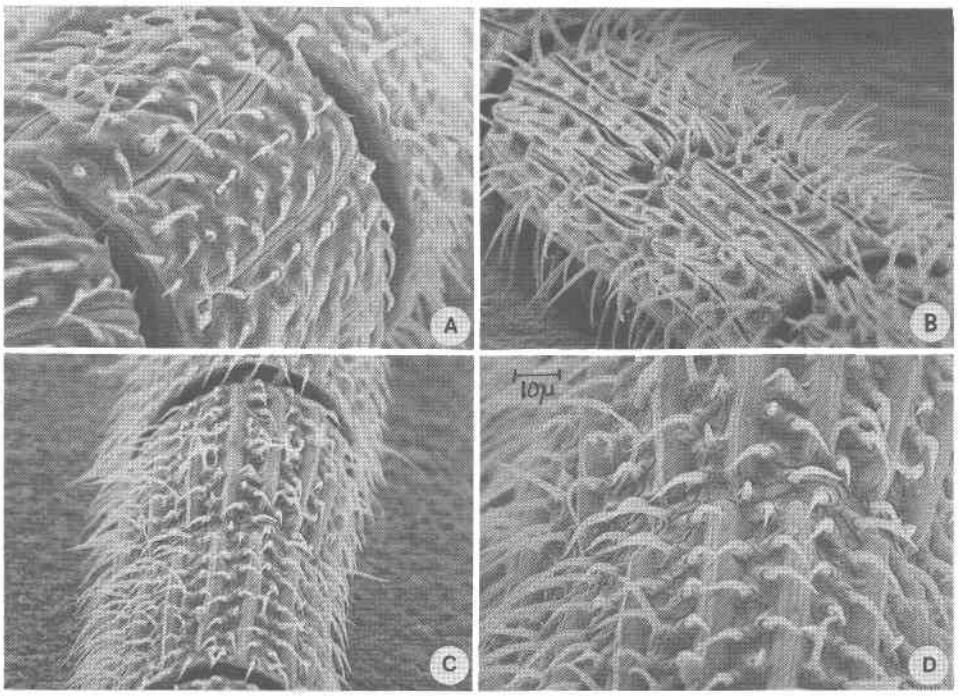


FIG. 10. Distribution of longitudinal placodes on the flagellomeres. A, short flagellomeres with a single row of placodes, *Venanus pinicola* ♀; B, C, D, normal flagellomeres with 2 ranks of placodes; B, *Rhygoplitis* sp.; C, D, *Fornicia jarmilae* showing central, false division formed between 2 ranks of placodes.

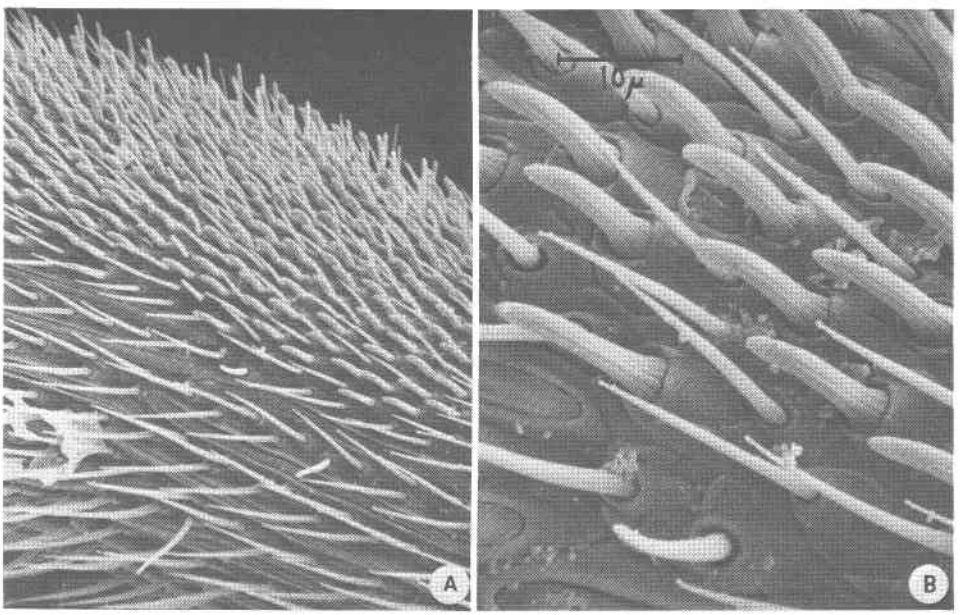


FIG. 11. Ventral basicone fields on antenna of *Fornicia* sp. ♀; A, about half a flagellomere showing normal antennal surface below and basicone field above; B, edge of basicone field showing mutually exclusive distribution of placodes (lower left) and large basiconic sensilla; note two sizes of basicones that project at different angles.

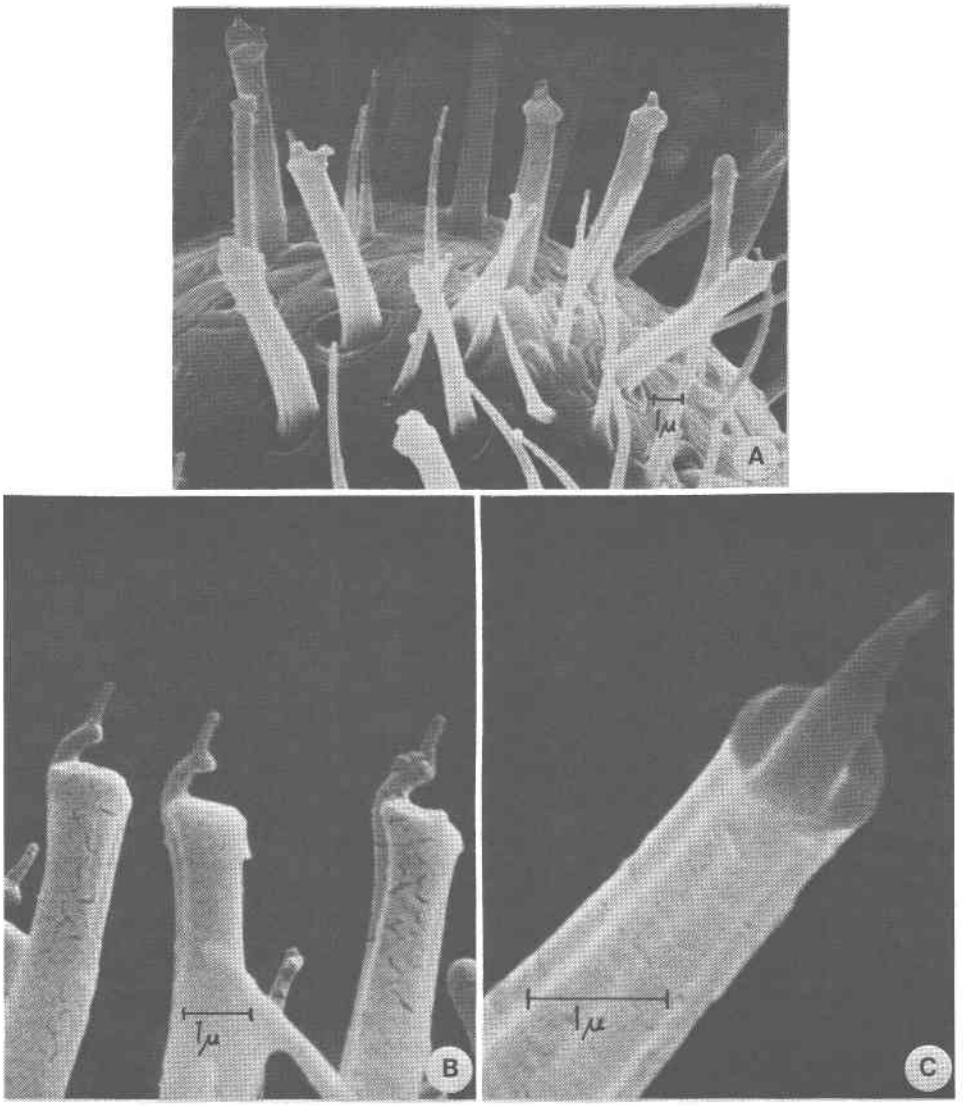


FIG. 12. Bent-tipped basiconic sensilla on antenna of *Apanteles fumiferanae* Viereck. A, concentration of bent-tipped sensilla at apex of flagellum; B, C, sensilla showing bent-tipped appendages on the special basiconic sensilla. See also Norton and Vinson (1974).

Suture between fused terga II and III marked by a transverse groove; groove stronger and deeper and finally large and transcostate; *or* groove becoming weak, incomplete, and finally completely absent (*Microplitis*).

Tergum III and following terga smooth to coriaceous, similar to one another, successively, but gradually, smaller posteriorly; tergum III enlarged and resembling II more than IV in sculpture; terga II and III greatly enlarged, remaining terga markedly weaker in sculpture and partly telescoped beneath III (*Deuterixys*, *Rhygoplitis*); terga IV–IX completely withdrawn beneath a carapace formed by II and III (*basimacula* group of *Diolcogaster*, *Buluka*, some *Deuterixys*) but terga I and II articulated; *or* tergites II, III, and IV fused into a carapace (*Teremys*).

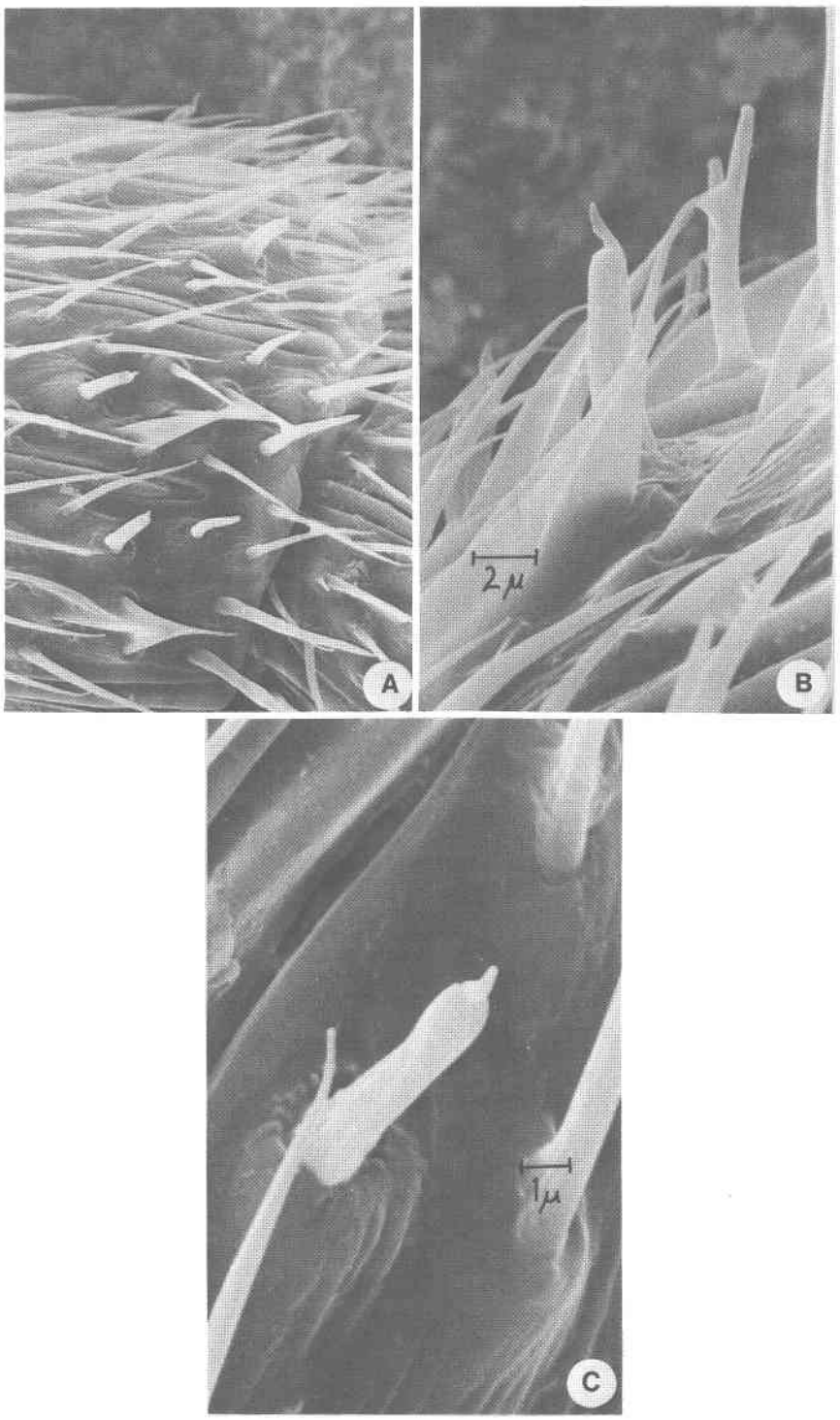


FIG. 13. Bent-tipped basiconic sensilla on antenna of female *Venanus pinicola* Mason. A, apex of flagellomere 7 showing 5 bent-tipped sensilla; B, C, closer views of individual sensilla.

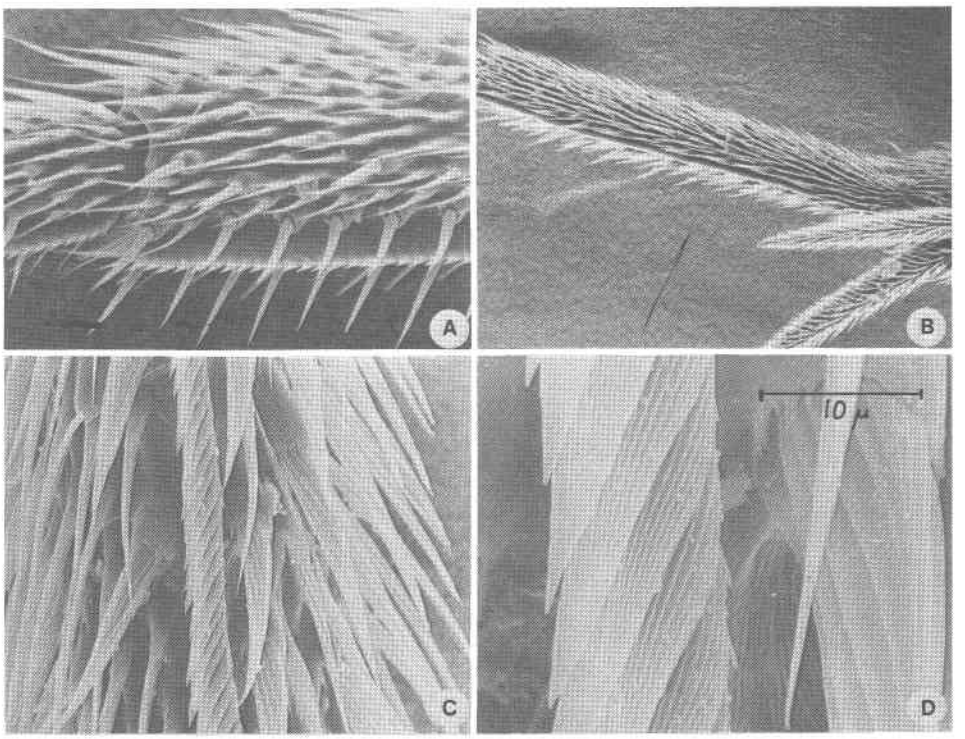


FIG. 14. Median ventral ridge on hind tarsus. A, *Fornicia jarmilae* Mason, a specialized condition in which individual hairs are fused into a ridge with only tips free; B-D, *Exix mexicana* Mason: B, hind basitarsus and tibial spurs; C, D, enlarged views of the ridge showing a generalized condition with individual hairs free but closely appressed.

Terga I and II freely articulated; terga I, II, and III fused into a carapace with other segments withdrawn beneath them (*Fornicia*).

Laterotergites I and II not clearly delimited from their respective tergites (*Cardiochiles*); laterotergites I and II clearly separated from tergites, the anterior margin of laterotergite II and tergite II forming a straight line in dorsal aspect (*Cardiochiles*); laterotergite II extending forward so that anterior margin of tergum II is markedly concave in dorsal aspect.

Hairs of terga (behind II) abundant, all pointing caudad and rather completely and evenly dispersed; hairs less numerous and grouped into various patterns or lateral clumps; *or* transverse bands; *or* pointing in various directions to form patterns (*Illidops*).

Hypopygium of moderate size, uniformly sclerotized, longer medially than laterally; shortened and truncate medially (*Cotesia*); emarginate medially *or* weakened mediobasally but not apically to become posteriorly collapsed (*Cardiochiles*); *or* lengthened and folded medially; desclerotized, striate, and pleated medially (most Apantelini and Microgastrini).

Tergum IX much taller than long, dorsolateral apodemes small and much wider than long; tergum IX with large dorsolateral apodemes so that the tergum is about as tall as long.

Second valvifers tall, lorate, and not expanded apically; valvifers shortened and broadened apically.

Third valvulae (ovipositor sheaths) attached to valvifers apically, subapically, medially, subbasally.

Ovipositor sheaths probably about as long as hind tibia; much shorter than hind tibia *or* much longer.

Sheaths with dull surface (caused by microsculpture) and uniformly hairy throughout their sclerotized length (the immediate attachment to the valvula is soft hairless integument); sheaths

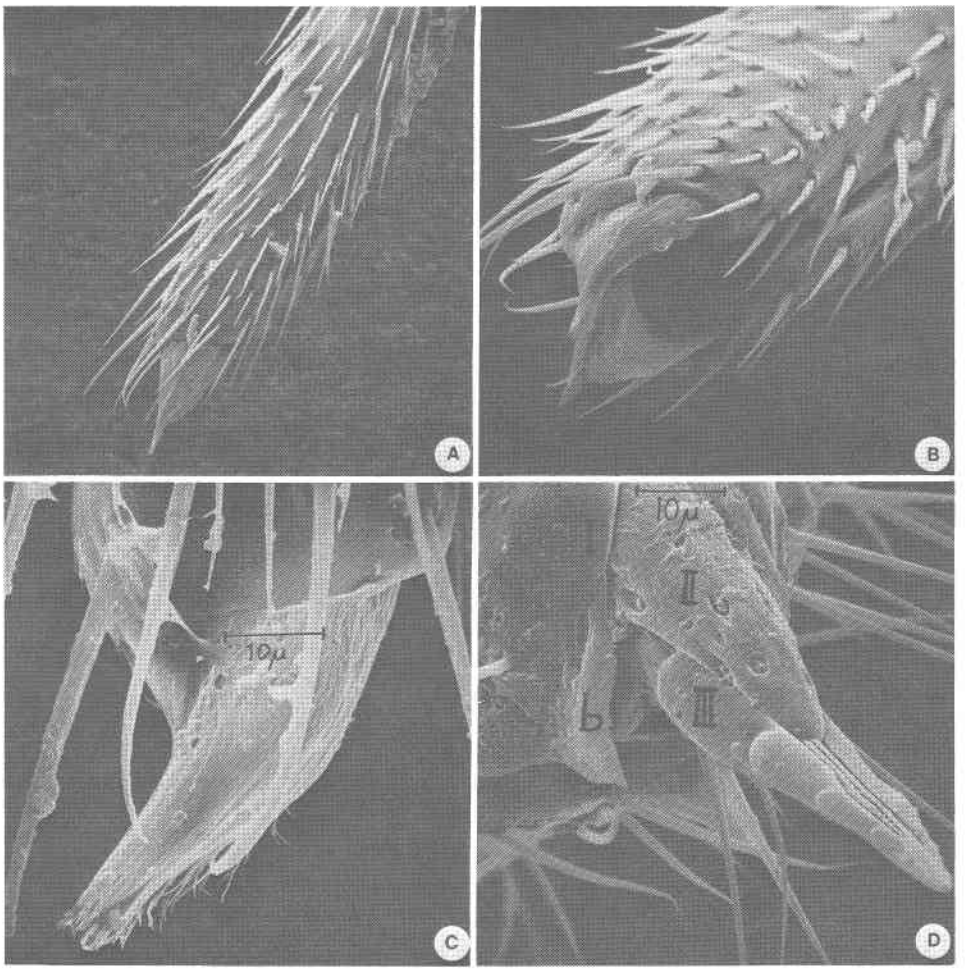


FIG. 15. Apical brush on ovipositor sheath. A-C, *Dolichogenidea californica* (Mues.); D, *Cotesia laeviceps* (Ashm.), I, ovipositor sheath; II, III, valvulae; b, brush; note sensilla on valvulae II and interlocking grooves on valvulae III.

polished and hairs sparse or absent in some areas (*Sathon*) *or* hairs concentrated near apex; hairs on apical part much smaller than normal hairs of abdominal sterna and terga (Figs. 17, 18); reduced hairs too small for visibility by usual stereomicroscopy and some or all replaced by dome-shaped sensilla (Figs. 18, 19) *or* a few sheath hairs thickened and apically truncate (Fig. 16).

Ovipositor long and evenly tapered; very long with sinuate apex; *or* short; *or* ovipositor short and very thick basally with an abrupt attenuation near middle or a little beyond (Fig. 80) (Cotesiini); curved strongly downward through 90° or more.

Hind coxae moderately small; hind coxae large; coxae even larger than abdomen (*Diolcogaster ippis* Nixon); *or* coxae complexly sculptured.

Tarsal claws probably pectinate; number of pecten-teeth reduced to 1; claws simple.

Fore tarsus simple; females with an emargination and basal large hair on inner side of front distal tarsomere (*Protapanteles*).

Legs of medium proportions; legs unusually stout *or* unusually long.

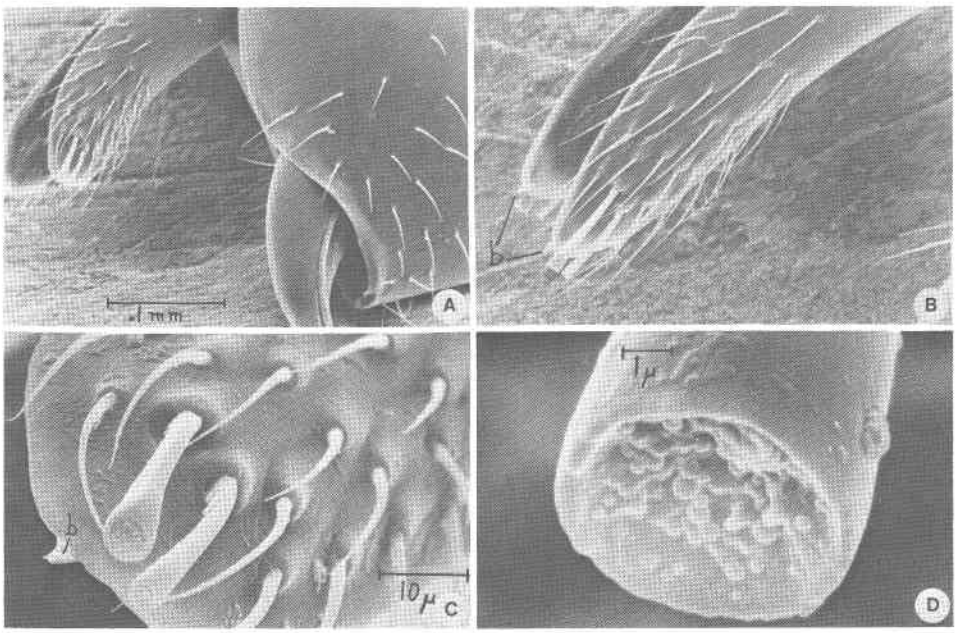


FIG. 16. Large hairs at apex of ovipositor sheath of *Diolcogaster auripes* (Prov.). A, genitalia and hypopygium; B, C, apex of sheath showing normal and enlarged hairs and small brush (b); D, concave and truncate apex of enlarged hair containing deposits of unknown material.

Hind tarsus without special modifications ventrally (most Cardiochilinae); hind tarsus with a median ventral palisade of hairs (Fig. 14).

Radius (3Rs) sharply bent in its last abscissa (Fig. 2) and giving rise to an anteriorly directed spur (3r); 3Rs basally convex anteriorly (Cardiochilinae, *Pelicope*); 3Rs missing in the middle, and the separated distal section directed so that if prolonged basad it would pass far in front of the proximal section (Fig. 3) (Miracinae); *or* 3Rs forming a continuous straight or slightly curved line (Fig. 1).

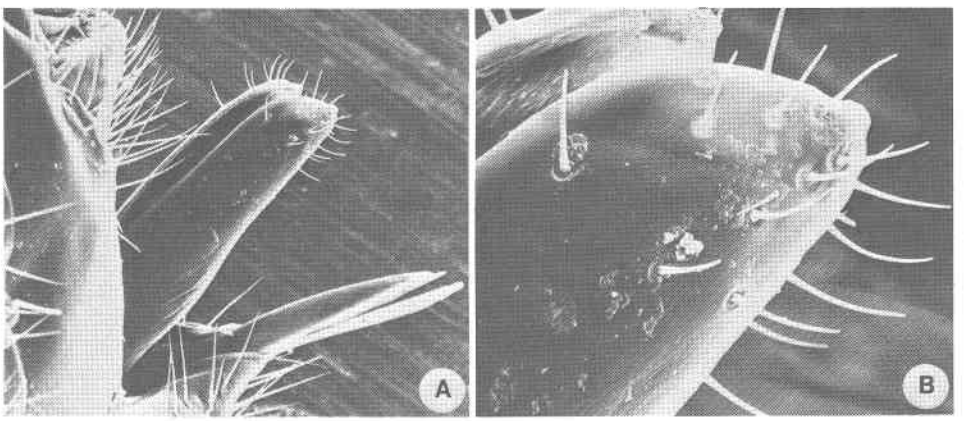


FIG. 17. *Rasivalva stigmatica* (Mues.) to show reduced hairs on ovipositor sheath. A, genitalia showing hairs on sheath about 1/3 as long as normal body hairs (about 2-3μ × 50μ); B, apex of sheaths showing reduced hairs (1-1.4μ × 13-17μ).

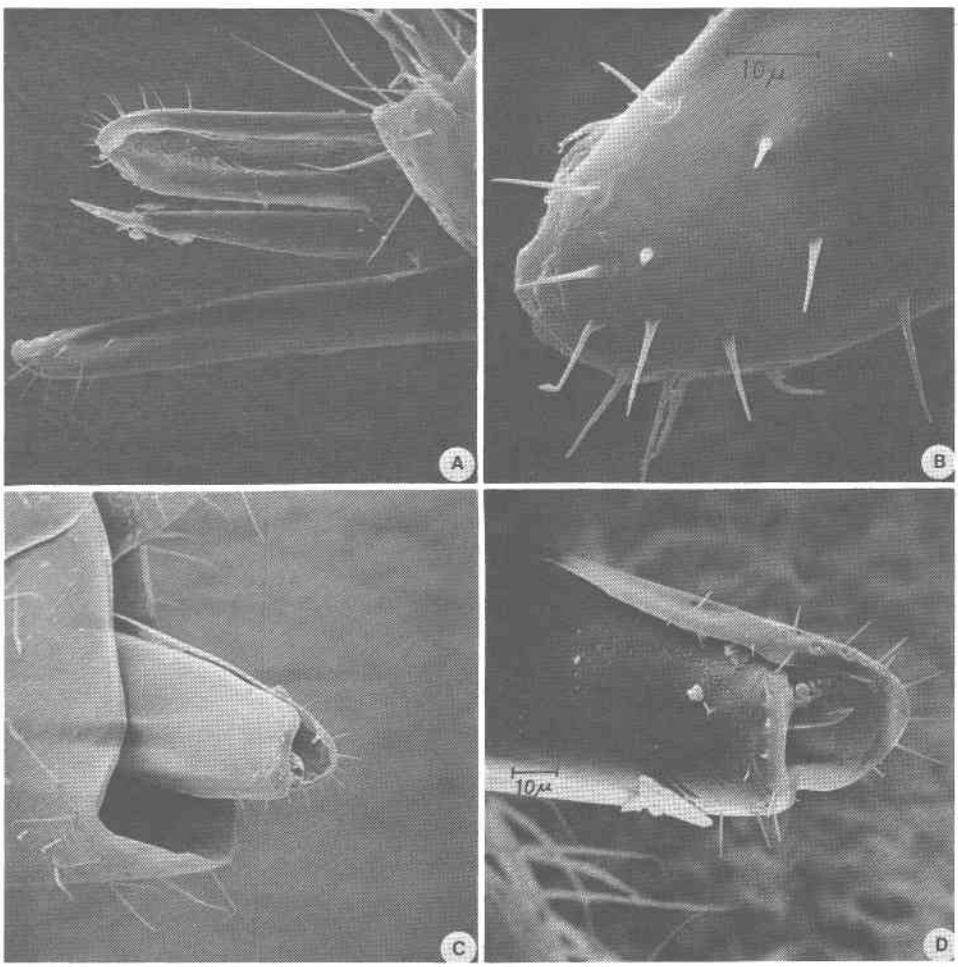


FIG. 18. Ovipositor sheath hairs of *Distatrix*. A, B, *D. teapae* (Nixon), genitalia and reduced hairs (about 1μ × 11-15μ); C, D, *D. papilionis* (Vier.), genitalia and reduced hairs (about 1μ × 7-10μ) and associated peg-like sensilla.

Basal vein bent so that the upper abscissa (Rs) meets the lower (M) at a strong angle (Fig. 32); basal vein (Rs&M) straight.

Second cubital cell (Fig. 8) rectangular, large, wider than long (Cardiochilinae); reduced to a small areolet about as wide as long but still quadrangular; first and second intercubitus connected by elimination of 2Rs, making the areolet triangular; junction of first and second intercubiti migrating basad reducing size of areolet to a point (*Promicrogaster*, *Hypomicrogaster*); second intercubitus disappearing; *or* second intercubitus disappearing from a quadrangular areolet in situ, leaving a knob at the junction of radius and first intercubitus (*Protapanteles*, *Choeras*).

Interanal vein (2A) present and the anal vein (1A) bent at this point; anal vein bent but interanal absent; anal straight.

Interradiella (r) present (Fig. 1); this vein absent (Miracinae, *Pelicope*).

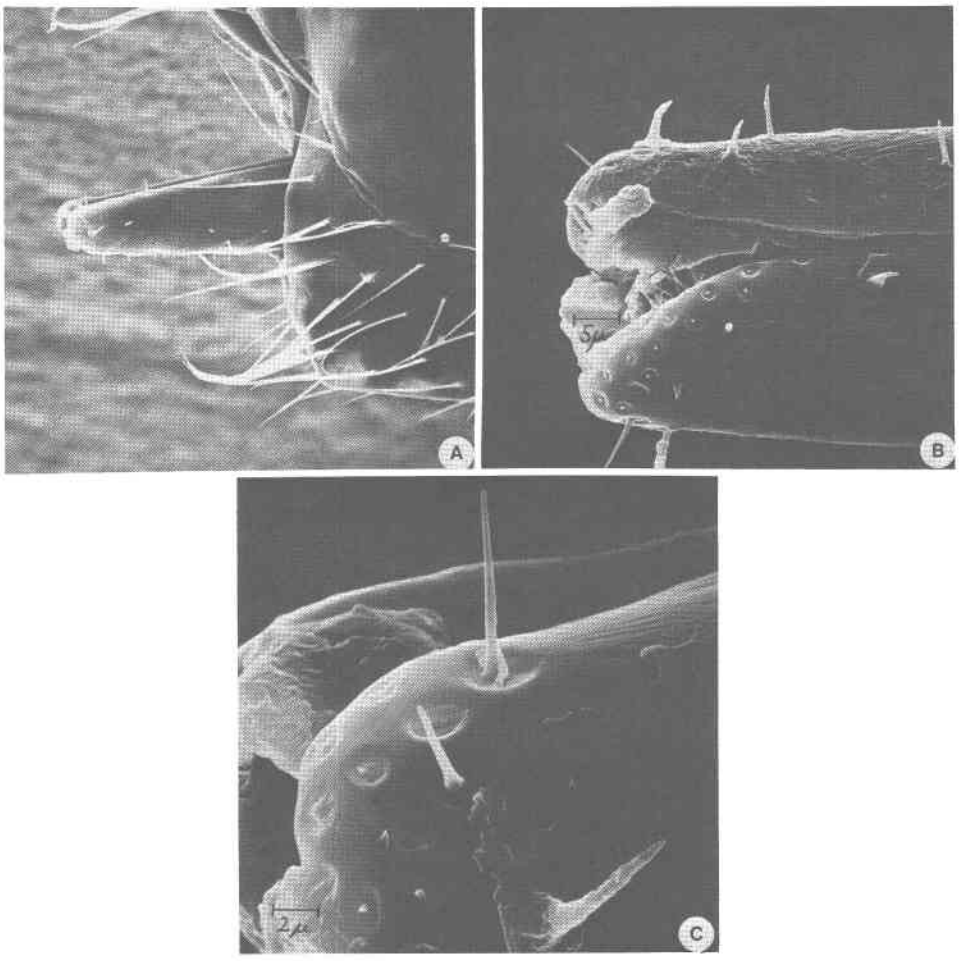


FIG. 19. *Venanides xeste* Mason. A, genitalia showing greatly reduced hairs of the ovipositor sheath; B, C, apices of sheaths showing minute hairs (0.6μ × 9μ) and associated sensilla.

Intercubitella (2r-m) present (Fig. 1); this vein absent (Figs. 2, 3) (Cardiochilinae, Miracinae, *Miropotes*, *Semionis*, *Pelicope*).

Brachiella ((2)1A) present as a sclerotized vein (most Cardiochilinae); only a stump of brachiella present (*Pelicope*, *Prasmodon*); brachiella absent.

Nervellus sinuate or partly concave toward wing tip (I interpret this structure as a trace of the presence of a discoidella (Cu1a)) (*Iconella*, *Xanthomicrogaster*); nervellus straight but meeting submediella (1A) at a right angle more or less; nervellus broadly curved into the submediella.

Vannal lobe convex and thickly hairy on the margin; margin more or less straight; *or* hairs sparse or short; margin concave and sparsely hairy; quite hairless.

Vannal lobe much longer than submediellan cell and separated from balance of hind wing by a strong incision; vannal lobe shorter and incision reduced; lobe and incision almost absent and shorter than submediellan cell.

Larval antennae present (Cardiochilinae, some *Microgaster*); antennae absent.

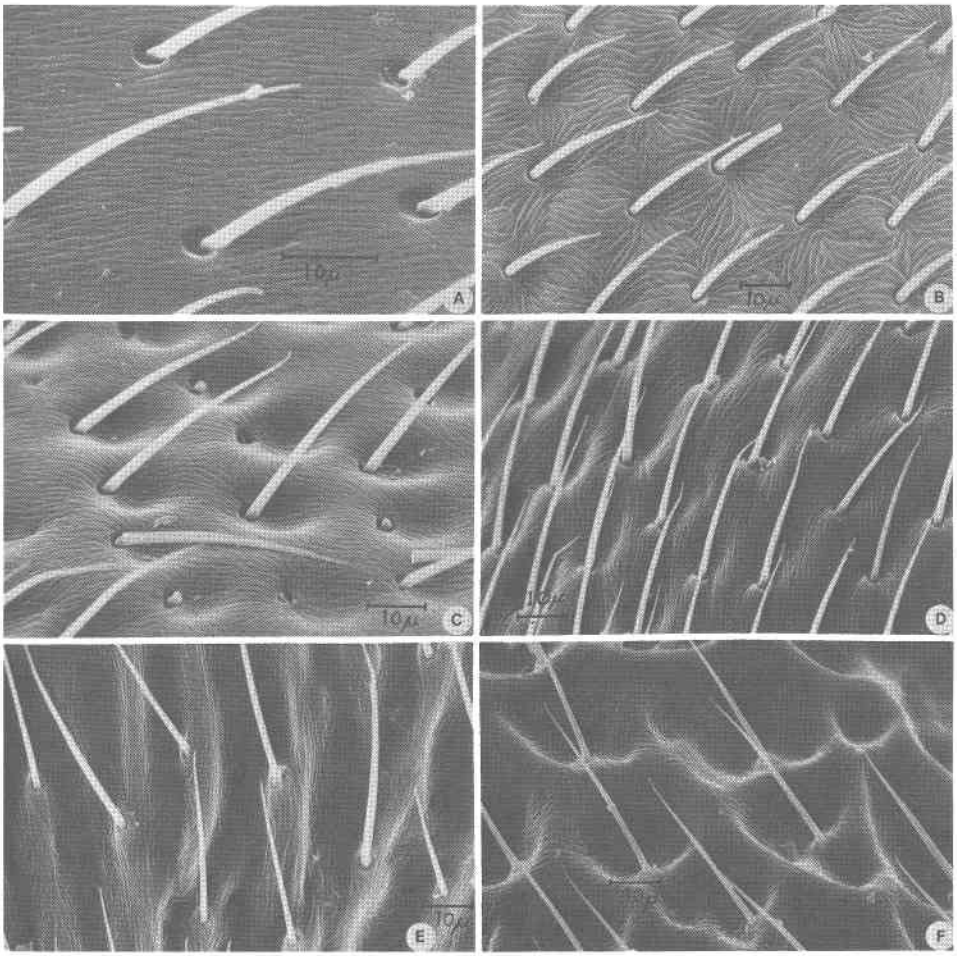


FIG. 20. Microsculpture and macrosculpture of Microgastrinae; the minute ridges lie at intervals of 0.5-1.5μ and act as diffraction gratings, producing colored reflections, i.e. metallic or satiny sheen by visible light. A, scutum of *Venanides xeste* Mason, 'smooth impunctate surface with metallic reflections'; B, scutum of *Pholetesor ornigis* (Walsh), 'dull surface with strong satiny reflections, punctures weak and poorly defined'; C, scutum of *Dolichogenidea lacteicolor* (Vier.), 'surface shiny with metallic reflections, punctures strong and distinctly separated'; D, scutum of *Glyptapanteles militaris* (Walsh), 'surface with strong confluent puncturation'; E, tergite II of *Rhygoplitis aciculatus* (Ashmead), 'aciculate surface' (the metallic reflections are obscured by the very coarse sculpture); F, tergite I of *Rhygoplitis terminalis* (Gahan), 'surface strongly rugose'.

Larval mandible with a long blade carrying a row of about 25 long teeth along its whole length (Cardiochilinae, Microgastrini); size of teeth, especially basally, reduced; only a few small teeth present near apex (many Cotesiini); no teeth at all (some Cotesiini); *or* blade bent at a right angle and a few teeth concentrated at apex (Microplitini); *or* long teeth fewer than 15 and confined to apical half of mandible blade (*Protapanteles*).

Larval palpi 1-jointed and sclerotized, with a few apical sensilla and about twice as long as wide; palpi shorter, only about as long as wide (Miracinae, some Cardiochilinae, *Distatrix*); or maxillary palpi reduced and desclerotized, represented only by a small group of sensilla (Microplitini).

Maxillary setae 2 on each side; only 1 seta on each maxilla; *or* the 2 setae elongated to about the length of the mandibles (*Distatrix*).

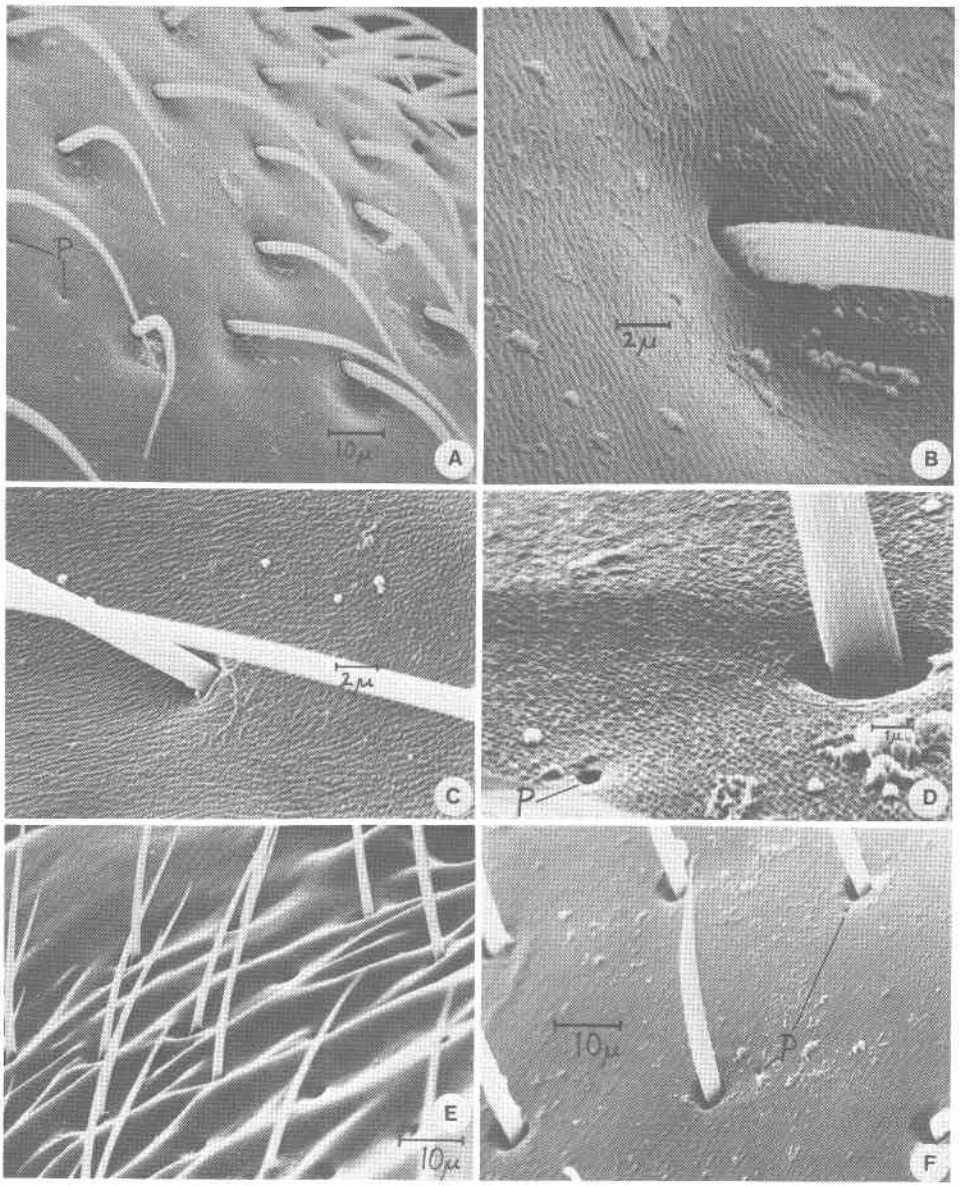


FIG. 21. Sculpture of mesonotal surfaces that do not show metallic reflections, apparently because they lack parallel ridges at intervals near 1μ. Ridges and granulations have intervals of about 0.3μ or less in these species. A few show minute (ca. 0.5 μ) pores (P) of unknown function. A, B, *Alphomelon nigriceps* (Ashm.); C, D, *Prasmodon* sp.; E, *Iconella etiellae* (Vier.); F, *Protomicroplitis calliptera* (Say).

Labial setae 4; setae 2; *or* setae many, over 10 (*Pholetesor*).

Larval skin closely covered with papulae, each with a long central spine; spine short; spine absent.

Larvae solitary; larvae gregarious.

Hosts Microlepidoptera larvae; hosts Macrolepidoptera larvae.

Special Considerations

Further comments are needed on some of the features listed.

Palpi. The maxillary palpi lose an article by fusion of the proximal 2 to produce a 5-jointed palpus. A further reduction in Miracinae involves loss or fusion of the penultimate article. In the labial palpi the 3rd article becomes reduced among Cardiochilinae and disappears in most Microgastrinae (except a few *Microplitis*).

Metanotum (Figs. 5, 6, 7). The anterior margin invariably bears a very small pilose lobe at the extreme lateral margin just above the wing base. This should not be confused with a larger sublateral lobe on the anterior margin just below, and usually touching, the lateral posterior margin of the scutellum. This lobe bears only a few (usually 2-6) large hairs and varies from a broadly rounded to a narrow sharp projection with a tuft of 1-3 hairs. In many Cotesiini (e.g. *Glyptapanteles*) the sublateral lobe and its hairs disappear and the anterior margin of the metanotum withdraws from the scutellum laterally, exposing a broad part of the mesonotal phragma. A convergent, but almost identical, development is seen in *Sathon* (Microgastrini). In other genera the sublateral lobe is flattened and closely appressed to the scutellar margin and would be indistinguishable save for the margin hairs.

Propodeum. Application of the commonality principle (Schaeffer *et al.* 1972) convinces me that the plesiomorphic type of propodeum in braconids is that shown in Fig. 4a. This essentially is the structure found in Diospilinae, Exothecinae, Doryctinae, Ichneutinae, Aphidiinae, Euphorinae, Microgastrinae, Cardiochilinae, and other groups of braconids. In Microgastrinae there are two major kinds of morphocline evident in propodeal structure. One, in at least three parallel morphoclines in Apantelini, involves shortening and elimination of the basal median carina (Fig. 4b-e): the other involves caudad extension of the median carina and reduction of other carinae (Fig. 4f-j). It is found in several non-homologous morphoclines in the other tribes of Microgastrinae. The propodea of *Fornicia* (Fig. 4k), *Alloplitis* and *Wilkinsonellus* (Fig. 4l) are each unique but can be derived from the *Hypomicrogaster* type (Fig. 4f). The propodeal patterns of *Promicrogaster* (Fig. 4m, n) are varied and anomalous. I cannot fit them into any major pattern group.

Tergite I. The mediobasal groove is sharply defined with the descending sides convex in profile. Do not confuse this apomorphic feature with the normal broadly concave mediobasal part of the first tergite found in almost all microgastrines (except the few genera with mediobasal groove). The medioapical depression is an apomorphic feature in Microgastrinae generally, but within the genera *Apanteles* and *Dolichogenidea* the presence of this depression is plesiomorphic and its absence apomorphic.

Laterotergites I and II. In Cardiochilinae typically they are poorly or not at all differentiated (plesiomorphic) but when differentiated (Microgastrinae) they always contain the spiracles. These spiracles of tergum I are never in the lateral membranous areas (except in Miracinae) as is traditionally stated in braconid keys. The laterotergites can be distinguished from the surrounding membranous, unsclerotized, areas by the presence of trichiae, and often by color and texture. In Miracinae there are no laterotergites on metasoma I and the spiracles are in the membrane.

Tergum IX to ovipositor (Table II). The next six characters that I have listed show such a high correlation that they should be regarded as a single complex autapomorphic suite for the tribes Forniciini, Microplitini, and Cotesiini. The suite seems to be associated with a change from parasitism of Microlepidoptera to parasitism of Macrolepidoptera. The Microlepidoptera larvae usually are hidden inside plant tissue and a long thin ovipositor is needed to reach them. The Macrolepidoptera larvae are typically exposed and much larger so they can be attacked with a short ovipositor. The long ovipositor is supported laterally by the surrounding plant tissue and so can still function efficiently if it is long and thin, whereas the short ovipositor passing through no substrate must provide its own mechanical support as it pierces the host integument, necessitating a stout but tapered structure. The larva of Microlepidoptera, living enclosed in a small burrow, has limited freedom of movement when pierced by the parasite; at any rate it cannot strike or dislodge the attacker through plant tissue. The Macrolepidoptera larva is often far larger and stronger than its parasite and can thresh about to strike or dislodge the attacker. Moreover, living in an exposed situation and being large it has, I suppose, a thicker and tougher integument to be pierced.

All these factors explain the short, stout, and strongly tapered ovipositor, and the associated greater muscular development manifest in the stouter and spatulate first valvifer, and wider ninth tergum with large anterior apodeme for muscles to hold it firmly to the more basal terga.

The associated changes in attachment, length, and hairiness of the sheaths (3rd valvulae) are, I think, explicable in terms of mechanical efficiency. If the sheath is to cover the short ovipositor (as it always seems to do) it can better do the job if its origin is close to that of the ovipositor, hence the advantage of a proximad shift in its attachment to the second valvifer. Since the shortness of the sheath allows only the apex to protrude into the open, the hairs on the basal, concealed, part are eliminated as functionally useless and probably mechanically detrimental.

The advantages of gregarious parasitism in larger host larvae are obvious but here the correlation is not strong, because of the many solitary parasites of Macrolepidoptera. I would guess that there are associated differences in structure and function of the ovarioles and associated reproductive organs because gregarious species can lay 10–100 eggs in a few seconds.

The correlated changes in larval structure, namely reduction and elimination of teeth on the mandible blade and reduction and elimination of the skin spinulae, are simply matters of observation. I cannot suggest their function.

Hind coxae. Many microgastrines have a strong saltatory escape response that is especially well developed in tropical species. The only structural change correlating with this is the enlarged coxae frequently found in tropical species. I suspect that the large mass of muscle needed for saltation is housed in the hind coxa: at the extreme of enlargement a single hind coxa is larger than the abdomen (some *Diolcogaster*).

Second cubital cell. The disappearance of this cell has traditionally been the sign of "*Apanteles*" but as Fig. 8 shows, the loss can come about in at least two ways. The remaining vein, called first intercubitus by Gahan and Rohwer nomenclature can actually be either 2Rs or 2Rs + r-m. This situation is a particularly clear example of convergence and of the unreliability of reductional apomorphisms.

Interradiella (r). The presence of this hind wing cross-vein is one of the most uncomfortable facts of Hymenoptera phylogeny. It is found in several subfamilies of Braconidae (Cheloninae, Cardiochilinae, Microgastrinae, and some unrelated genera, *Homolobus* and *Zele* (= *Zemiotes*) whose taxonomic position is nowadays in dispute). Elsewhere the vein is found only in one rare species of Tenthredinidae (Smith 1979). The unexpected thing is that it is not known in the extant primitive sawfly families and has never been reported from any hymenopterous fossil (Rasnitsyn 1969, 1975).

At present two main hypotheses can be proposed. First, the radial cross-vein of the hind wing can be regarded as a plesiomorphic condition, i.e. it is a real, although somewhat weakened vein following its ancestral course. It follows that the ancestral sawfly group from which braconids developed is extinct and has left no fossil record yet discovered. As an alternate it may be that the vein in the ancestral sawfly group was too weakly developed to leave an impression in the fossilizing substrate. The second main hypothesis could be to regard the radial cross-vein of the hindwing as one of several non-homologous apomorphic features, i.e. the vein was not present in the ancestral sawfly group but has evolved only in some braconids and *Adelomos*.

The tenthredinid *Adelomos* seems to me to fit the second hypothesis well. It is a very rare member of a modern and rather strongly evolved group of sawflies and no trace of interradiella (r) is found in any relative. The course of "r" is unlike that found in braconids, for the junction with R is proximal and that with Rs distal.

The situation of the interradiella in braconids is very different. The vein is of widespread occurrence in many genera in four or five different subfamilies. It occurs almost exclusively in braconids believed primitive on other grounds and in a majority of primitive groups of Braconidae. It is never found in the advanced groups. The only possible exception to these generalizations is the Microgastrinae, where the vein is nearly universally present from the most primitive genera to the most advanced. In the braconid subfamilies in which it is found the structure and position of the vein is constant, the junction with Rs being proximal and

situated at the basal 30-40% of its length. I think the evidence strongly supports the hypothesis of plesiomorphy for this character in Braconidae, mainly on the commonality principle (Kluge and Farris 1969).

To return to my earlier mention of the absence of a possible ancestor for Braconidae, especially Microgastrinae, there is additional evidence in hindwing venation that the sawfly group ancestral to Braconidae is unknown. This brings us to the next vein in the discussion.

Intercubitella (2r-m). As many as three intercubitellan (r-m) cross-veins are present in sawfly hindwings but in all the Apocrita only Microgastrinae and a few taxonomically scattered genera in other subfamilies of Braconidae have more than one. In his excellent analysis of the rich Mesozoic fossil fauna from Siberia Rasnitsyn (1975) hypothesizes that Karatavitidae, which he places in Siricoidea, has been the ancestor of all Apocrita through the large extinct family Ephialtitidae. This seems to be too broad a statement because, among other features, a 2-branched Rs is present in Mutillidae, Plumariidae, and Pelecinidae but not in Karatavitidae or Ephialtitidae. In the Microgastrinae the hindwing has two r-m cross-veins, apparently 1r-m and 2r-m, whereas all Ephialtitidae for which Rasnitsyn figures the hindwing has lost 1r-m and retained 2r-m. So also have the Ichneumonidae and many Aculeata, such as Vespoidea, Sphecoidea, Apoidea, and Pompilidae. These groups do, as Rasnitsyn says, have a venation that can be derived from Ephialtitidae but many other Apocrita have venation that can not be so derived.[2]

The Braconidae, unlike most other Apocrita (including Ephialtitidae), have retained a strong 1r-m in the hindwing and have only a weak 2r-m (Microgastrinae) or none at all (almost all other Braconidae). The illustration of which r-m cross-veins are lost in Apocrita and which retained is supplied by Microgastrinae, which have both 1r-m and 2r-m.

Phylogeny and Classification

Fig. 22

Formation of a phylogenetic hypothesis, i.e. construction of a "tree", is a necessary preliminary to the construction of a natural classification (Bock 1977). However, a natural classification can only be a compromise at fitting a complex and rather sloppy approximation represented by a phylogenetic hypothesis (with all its imperfections caused by missing data and faulty judgments) into a limited number of precise Linnean heirarchies. I think one has a better chance of discovering the one true phylogeny of a group (or, at least, some parts of it) by working with a few well analyzed morphoclines than by using a multiplicity of less understood characters that may conceal many false clues caused by undiscovered parallelisms and convergences. The latter mostly serve to obscure the picture by creating "noise", so to speak, in the signal being analyzed (Hecht and Edwards 1977).

There is one very strong apomorphic suite of characters (Hecht 1976) apparently associated with adaption to a change from microlepidopterous to macrolepidopterous hosts (Table II). It is an autapomorph for the tribes Forniciini, Microplitini and Cotesiini, separating them from the other Microgastrinae. The complete median longitudinal carina on the propodeum (Fig. 4) seems to be a new feature developed early in the evolution of the subfamily. I have interpreted it as a strong apomorphism and used it as basis of a tribal division separating Apantelini (genera plesiomorphic for this morphocline) from Microgastrini. Another fairly strong apomorphic development is the apical median depression of tergite I (*Dolichogenidea*, *Apanteles*, etc.). The mediobasal sharp groove on tergite I apparently evolved twice, once in Microgastrini (*Pseudapanteles*, etc.) and once in Cotesiini (*Diolcogaster*, etc.).

When I have found discordant morphoclines I have favored the one that seems more complex genetically in the construction of my phylogenetic hypothesis because the probability of evolving a simple genetic change is higher. Thus I favored the

[2]It is true that this statement implies a polyphyletic origin for the Apocrita but the question is too large to be further discussed here.

Table II. "Macrolepidoptera suite" of characters in Microgastrinae

	Plesiomorph	Apomorph
	Characters of ♀ genitalia (Fig. 80)	
Height/Length of tergite IX	2.4-4.0	1.0-2.0
Anterior apodeme of tergite IX	Weak	Prominent
Apex of 2nd valvifer	Tapered	Widened
Origin of 3rd valvulae	On distal half, usually near apex of 2nd valvifer	Near base of 2nd valvifer
Length of 3rd valvulae	Medium to long, seldom shorter than apex of abdomen	Short, rarely extending beyond apex of abdomen
Hairs of 3rd valvulae	Many, hairy throughout the entire length	Few, near apex only
Length of 2nd valvulae	Almost always extending beyond apex of tergite IX	Rarely extending beyond apex of tergite IX
Taper of 2nd valvulae	Even taper	Abruptly narrowed at apical 0.6-0.7
Hypopygium	Usually medially desclerotized in fan-like folds or sometimes sharply folded medially; rarely without median fold	Evenly sclerotized and without a sharp median fold except at the apical 0.1
	Characters of both sexes	
Anterolateral margin of metanotum	Usually with a more or less conspicuous lobe bearing a few setae in a tuft	Evenly curved and often without a tuft of setae
	Characters of immatures	
Skin of last instar larva	Small papules each bearing a spinule that is as long as the papule	Papules smooth or bearing short spinules
Mandibles of last instar larvae	Blade completely set with about 18–25 long teeth	Blade with teeth so small they are difficult to count or teeth fewer than 15 and confined to apical half or less or no teeth at all
Propagation	Larvae seldom gregarious, usually solitary	Larvae usually gregarious seldom solitary
Choice of host	Microlepidoptera with rare exceptions	Macrolepidoptera, including Rhopalocera, rarely Microlepidoptera

"Macrolepidoptera suite" when it appeared to be discordant with the basal sharp groove on tergite I. My phylogeny therefore requires the latter feature to be evolved twice, in Cotesiini and in Microgastrini. I have given lowest priority to the reductional apomorphs such as loss of an article of the palpi or of the prepectal carina or of the 2nd intercubitus (the last reduction of course, produces "*Apanteles*" in the traditional sense).

My classification still retains several large and diverse genera. It is probable that more knowledge will enable some splitting here but I have been unable to spend enough time or see enough species to do better. These genera are *Dolichogenidea*, *Apanteles*, *Choeras*, *Glyptapanteles*, and *Diolcogaster*; possibly *Promicrogaster* and *Microplitis* could be added. Some other large genera are remarkably compact and as far as I can see not subject to reasonable generic division. *Cotesia* is the largest example but also *Alphomelon*, *Hypomicrogaster*, *Microgaster*, and *Pseudapanteles* belong here.

A few genera are so aberrant that I cannot place them to my satisfaction. *Semionis* and *Pelicope* both combine specialized features with very primitive ones. They and the fossil *Eocardiochiles* are simply placed together in Apantelini for convenience. *Promicrogaster* is a large and variable Neotropical genus that needs far more material and study for satisfactory analysis. Whether it and its close relative *Sendaphne* should be in Apantelini or Microgastrini I cannot now say, for much depends upon what is plesiomorphic among the species of *Promicrogaster*, which are mostly unnamed and unstudied: many, I expect, are not yet collected.

Unknown Genera

Holcapanteles Cameron 1905

The curators of the Amsterdam museum assure me that the type is not there: I have failed to locate it elsewhere. Judging by the description the species may well be an *Apanteles* s.s.

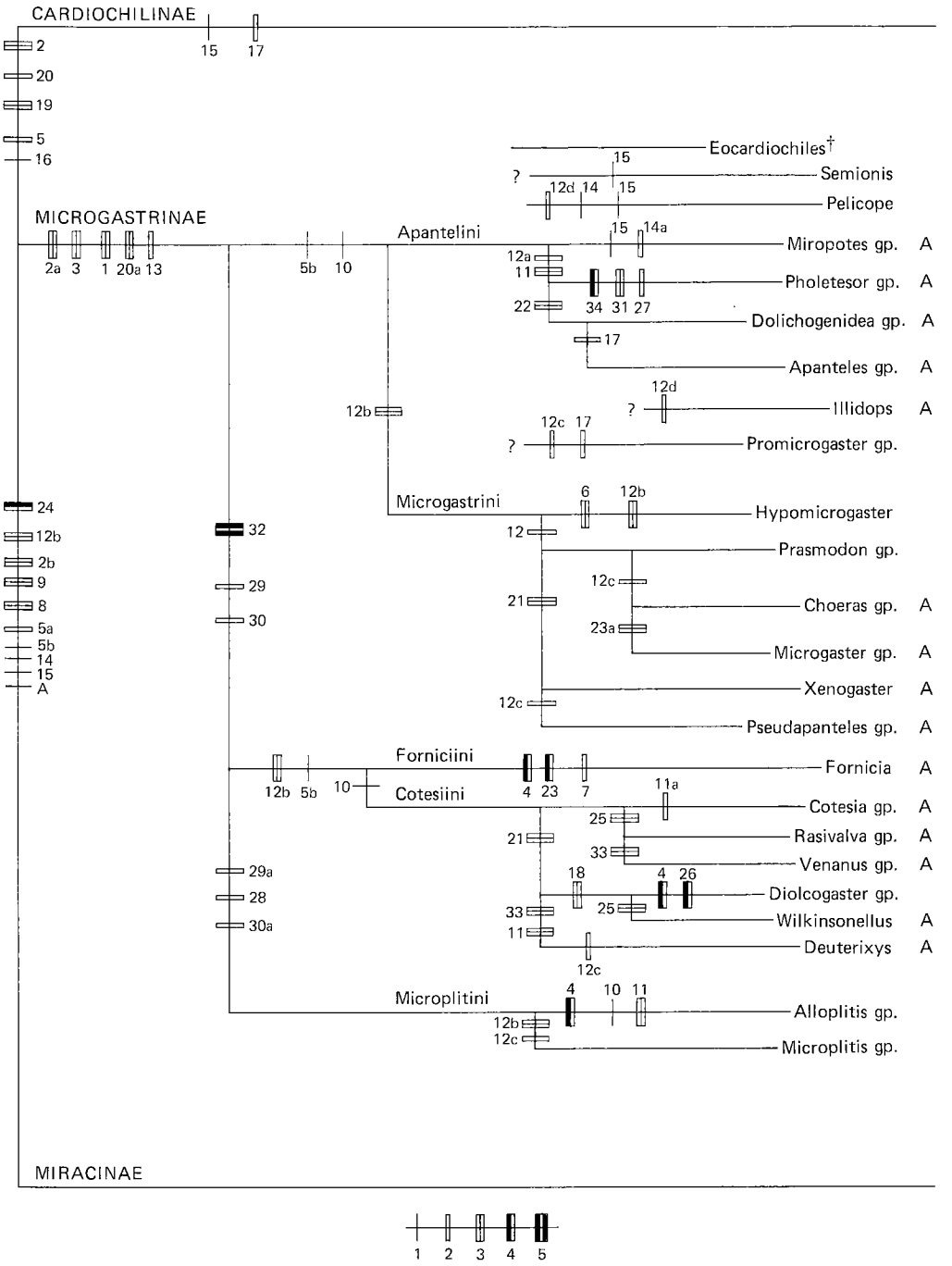
FIG. 22. Phylogenetic tree for Microgastrinae and their probably nearest relatives. To avoid clutter only apomorphic poles of transformation series are marked. A fuller discussion is found in the text. The transverse bars are coded to indicate differing amounts of information content, the system modified from Hecht (1976). In order of increasing phylogenetic significance and probably increasing genetic complexity they are: 1, absence by unknown developmental path; 2, reduced or absent by a known pathway; 3, growth or change of a simple character; 4, development of a complex and integrated structure or behavior; 5, a unique and innovative development opening new adaptive trends.

Legend for individual apomorphys: 1, clypeal margin concave, revealing a broad hairy labrum; 2, flagellomeres constant in number; 2a, flagellomeres 16; 2b, flagellomeres 12; 3, most flagellomeres with 2 ranks of long placodes; 4, medioapical flagellomeres of females (only) bearing a ventral patch of basiconic sensilla to the exclusion of the placodes; 5, first two articles of maxillary palpi fused to give a count of 5; 5a, maxillary palpi with 4 articles, one of the apical 3 articles missing; 5b, labial palpi reduced to 3 articles by loss of the 3rd; 6, upper postocciput hollowed and glabrous; 7, head becoming smaller; 8, lower margin of pronotum doubly emarginate; 9, apex of scutellum with a pair of side by side cavities; 10, prepectal carina lost; 11, anterior margin of metanotum laterally withdrawn from scutellum and the sublateral setose lobe projecting acutely; 11a, anterior margin of metathorax laterally withdrawn from scutellum exposing the postnotum and with no sublateral setose lobe; 12, lateral carinae of the propodeal areola absent; 12a, median carina anterior to propodeal areola shortened or absent; 12b, median carina of propodeum percurrent; 12c, transverse propodeal carina absent; 12d, all propodeal carinae absent; 13, second abscissa of Radius (2Rs) shortened; 14, loss of interradiella (r of hind wing); 14a, second radial cell of hind wing greatly narrowed; 15, loss of intercubitella (2r-m of hind wing); 16, hamuli reduced to 3; 17, vannal lobe of hindwing reduced in size; 17a, margin of vannal lobe concave; 18, hind coxa enlarged; 19, hind tarsomeres with a median ventral ridge or palisade of closely appressed hairs; 20, tergite I fully defined with sharp definite sides and not including the spiracles; 20a, spiracles of tergum I in separate laterotergites; 21, basal half or more of tergite I with a sharp median groove; 22, apical part of tergite I with a broad, shallow median groove; 23, tergites I-III fused into a large carapace concealing all other abdominal structures which are reduced and telescoped beneath it; 23a, basal tergites enlarged, concealing laterotergites; 24, basal terga of a special construction with tergite I long and narrow, laterotergites I absent, tergite II shaped like an inverted "T" with its laterotergites large and separated, tergum III broadly membranous medially and all membranous parts of basal terga strongly striate; 25, hairs of ovipositor sheaths reduced in size and/or converted to peg-like basiconic sensilla or campaniform sensilla; 26, a few apical hairs of ovipositor sheath enlarged and obconical with a truncate, concave tip; 27, ovipositor and sheaths shortened, less than half as long as third tibia; 28, maxillary palpus of full-grown larva reduced to a few sensilla; 29, larval mandible with teeth concentrated apically; 29a, mandible of full-grown larva with blade bent at a right angle; 30, papulae on skin of full-grown larva with small central spines; 30a, papulae on larval skin with no trace of spines; 31, labial setae of larva numerous; 32, Macrolepidoptera suite of characters (Table II); 33, hosts are Microlepidoptera; 34, hosts are leaf-miners; A, loss of 2nd intercubital vein (2rm) giving an open areolet; the series of "A's" on the right margin indicate evolutionary lines in which this change has taken place, in other words, remnants of the traditional genus *Apanteles* Foerster.

The genus *Parapanteles* is missing from the chart. It should be attached to the Cotesiini stem near the word "Cotesiini".

Cecidobracon Kieffer and Jorgensen 1910

I cannot locate the type of this genus, although it may yet be discovered in a South American Museum. The description leads me to believe it to be another synonym of *Apanteles* s.s.



Genera Wrongly Assigned to Microgastrinae

Ectadiaphatnus Cameron 1913

Mr. Tom Huddleston, of the British Museum (N.H.), recently discovered the unmarked type of *E. tachardiae* Cameron and has pronounced it to be probably one of the Blacinae, but certainly not Microgastrinae.

Oligoneuroides Brues 1910 from Florissant shales (Miocene)
Miracoides Brues 1933 from Baltic Amber (Oligocene)

Both these fossils belong to the small tribe Muesebeckiini of the subfamily Ichneutinae.

ACKNOWLEDGMENTS

Taxonomists normally build on foundations laid by earlier generations but I have built mainly on the series of papers by Nixon (1965, '67, '68, '70, '72, '73, '74, '76). It is a pleasure to acknowledge my indebtedness to him, not only for his published papers but also for the many consultations by mail and in person. I also thank Mr. C.F.W. Muesebeck of Washington for much helpful advice and innumerable kindnesses over the years. I should further mention the invaluable catalogs by R.D. Shenefelt (1972, 1973). In addition, many curators have made useful loans of critical material and should be jointly thanked.

The late Sheila M. Clark of Ottawa was most helpful in making numerous dissections of ovipositors. More recently Mr. H.E. Bisdee has made many more dissections and slides, especially of larval skins, and has spend many hours preparing specimens for S.E.M. study and processing the resulting photographs. He is also the maker of numerous drawings of larval head and skin features and of female genitalia used in this paper. It is a great pleasure to thank these skilled technicians for their help. The numerous photographs were made by the AMR 1000 Scanning Electron Microscope maintained by the Electron Microscope Unit of the Cell Biology Research Unit, Canada Agriculture, in Ottawa. I am very grateful for the many hours of instruction and assistance offered by the technicians of this Unit.

Key to Tribes of Microgastrinae

Adults

* indicates couplet halves containing only few individuals with restricted distribution.

1. Ovipositor sheath usually (95%) longer than half the hind tibia and always hairy throughout its length, even if shorter (Table II) (Figs. 31, 42, 63) 2
- Ovipositor sheath almost always (99%) short, rarely protruding much beyond the hypopygium; sheath never uniformly hairy, the few hairs (occasionally very small or invisible) concentrated near its apex. (see Table II for amplification of this couplet) (Figs. 79, 82, 103) 6
2. Propodeum with a percurrent median carina, although there may be a diamond-shaped areolet also .....(most Microgastrini) . . . 3
- Propodeum with median carina absent or confined to the horizontal part of the propodeum anterior to an areola .....(most Apantelini) 4
3. *Neotropical; ovipositor at least 1.5× as long as hind tibia and apically sinuate; lateral lunules of scutellum large and triangular (Fig. 38b); head elongated and strongly transverse, malar space 0.5 width of face (Fig. 38c, d); glossa divaricate and long, about 0.5 width of face; areolet closed but small and triangular, 2r at least 5× length of 2r-m .....(*terebrator* group of *Promicrogaster*, Apantelini)
- Ovipositor without apical sinuation or malar space shorter or glossa short or areolet larger or open but not agreeing with all above alternates ..... Microgastrini

4. *Species of Australian or Chilean regions with triangular or quadrangular areolet and no trace of propodeal areola (scutellar lunule arcuate, margin of vannal lobe convex and hairy) ..... (some species of *Choeras*, Microgastrini)
- Areolet open (2r-m absent) or propodeum with partial or complete areola or otherwise not agreeing completely with alternate 5
5. *Holarctic species, claspers of male greatly enlarged and truncate; female hypopygium without medial fold or striae; ovipositor sheath decurved, as long as hind tibia and shiny with sparse hair; propodeum with no trace of areola; anterior margin of metanotum laterally withdrawn from scutellar rim and without setiferous lobes .... (some specimens of *Sathon*, Microgastrini)
- Partial or complete propodeal areola visible or hypopygium with median creases or anterior margin of metanotum with setiferous lobes (Fig. 41d) ..... Apantelini
6. *Tergites I, II, and III fused into a strongly arched carapace beneath which all other abdominal structures are concealed; head unusually small; areolet open (2r-m absent); (scarce tropical genus) ..... Forniciini
- Terga I and II always articulated; soft parts of abdomen visible or areolet closed (2r-m present) 7
7. Areolet closed (2r-m present), although sometimes very small 8
- Areolet open (2r-m absent) ..... majority of Cotesiini
8. Areolet always obviously closed (2r-m present); hind coxa small, rarely longer than tergite I; longer hind tibial spur less than 1/2 basitarsus; terga II and III almost always (99%) forming a smooth uninterrupted surface that is neither divided by a suture nor sculptured ..... Microplitini
- Hind coxa large and usually much longer than tergite I; longer hind tibial spur more than 1/2 basitarsus; terga II and III usually sculptured or clearly separated by a suture ..... Cotesiini

APANTELINI

Ovipositor sheath almost always (97%) longer than half the hind tibia (about 85% ≥ length of hind tibia) and always hairy throughout (except for the extreme basal, unsclerotized part). Even when sheaths are short, they are still uniformly hairy and arise from the valvifers distally. Hypopygium usually large and usually (95%) medially desclerotized, longitudinally striate, and often folded.

Tergite I usually (95%) longer than broad (L/W = 1.5-3.0) and often (70%) with a median broad groove on the apical half; tergite II usually wider or much wider (L/W = 1.5-4.0) than long and usually much shorter (0.6-0.3) than tergum III.

Propodeum often (60%) with a partial to complete areolet; the bounding carinae often reduced anteriorly so that the areolet has the appearance of a "U" or "V" and sometimes (30%) the propodeum is entirely ecarinate; a complete median carina never present except in a few Neotropical species of *Promicrogaster*. Anterior margin of metanotum usually (95%) withdrawn from scutellar margin laterally and there armed with an acute setose forwardly directed lobe. Prepectal carina never present; pronotum almost always with both upper and lower grooves laterally; notauli absent or weakly indicated by denser sculpture.

Antennal articles mostly with 2 ranks of placodes, at least on the central articles.

Larval mandibles with a long blade bearing usually 20-25 long teeth, but never fewer than 15; integument thickly covered by contiguous papulae armed with central spines that are at least as long as the width of the papulae.

Hosts almost always (95%) Microlepidoptera larvae, very few species with gregarious larvae.

QUICK DIAGNOSIS. Hypopygium usually long and medially striate; ovipositor sheath usually long and always completely hairy. If hypopygium is short and not striate or if sheath is short, or both, then sheath is always completely hairy. Propodeum often (75%) with complete or partial areola, never with complete median longitudinal carina. Tergite I often (70%) with a shallow median trough on apical half.

KEY TO GENERA OF Apantelini

* indicates couplet halves containing only few individuals with restricted distribution.

1. *Intercubitella (2r-m of hindwing) absent; even as a crease in the membrane; areolet closed 2
- Intercubitella present, though usually visible only in light reflected from the wing membrane; areolet usually (95%) open 4
2. *Areolet subtriangular, 2nd abscissa of Radius (2Rs) absent or very short (Australian Region) ..... (1) *Miropotes*
- Areolet widely quadrangular, 2nd abscissa of Radius (2Rs) longer than 1st abscissa (2r); propodeum without areola 3
3. *Interradiella (r) absent; mandible long and narrow; completely yellow (California) ..... (15) *Pelicope*
- *Interradiella (r) present; mandible strongly tapered; mostly black (South African) ..... (16) *Semionis*
4. Margin of vannal lobe evenly convex (sometimes slightly flattened) and uniformly hairy 5
- Margin of vannal lobe convex but flattened subapically, or straight, or concave and usually hairless or sparsely and irregularly hairy 10
5. *Abdomen very short, only 1.5× as long as wide; tergites I and II completely rugose and occupying entire dorsal surface so that the laterotergites are scarcely visible from above; tergite I wider than long and with no apicomedial trough; propodeum coarsely rugose and strongly swollen laterally (North America) ..... (5) *Exoryza*
- Abdomen longer; laterotergites I usually visible from above; propodeum without lateral swellings 6
6. *Tergites I-IV coarsely aciculorugose; tergites II, III, and IV fused into a rectangular plate with 2 transverse grooves (North America) ..... (6) *Teremys*
- Terga III and IV normally articulated and overlapping 7
7. *Propodeum elongated, only 1.2× wider than long, with a median longitudinal carina on the anterior, horizontal part, and a large, poorly defined areola on the vertical face (South Africa) ..... (2) *Exulonyx*
- Posterior, declivous, face of propodeum not longer than the horizontal face or both merged; propodeum at least 2× as wide as long 8
8. Eyes obviously converging below; medioapical 0.2-0.4 of terga III to VII weakly sclerotized, glabrous, translucent and pale colored; balance of terga normally sclerotized and colored (black) with abundant hairs that usually point posteromedially; propodeum and first two tergites usually uniformly sculptured and without carinae ..... (13) *Illidops*
- Inner margins of eyes subparallel or tergites with apicomedial areas not differentiated or propodeum areolated 9
9. Ovipositor sheath short, no more than half as long as hind tibia; hypopygium short, medially folded but without striae; tergite I often narrowed apically; mesonotum almost always (99%) with subdued punctation and strong metallic reflections; always parasitic on leaf-miners ..... (4) *Pholetesor*

- Ovipositor longer, rarely (2%) as short as above; hypopygium longer and usually (95%) with median striations; tergite I only slightly or not at all narrowed apically (large, worldwide genus) ..... (3) *Dolichogenidea*

10. Areolet open (2r-m absent) 11
- Areolet closed (2r-m present) though often minute (mostly Neotropical) 14

11. *Tergites I and II very large, rectangular, and occupying entire dorsal surface so that laterotergites can scarcely be seen from above; tergites I and II and propodeum (except for a large weak areola) completely rugose; basal vein (Rs&M) bent at almost a right angle (Old World Tropics) ... (5) *Exoryza*
- Terga I and II and propodeum rarely uniformly sculptured; tergite II subtriangular or truncate pyramidal; basal vein (Rs&M) straight or only weakly bent 12

12. *Eyes obviously converging below; apical 0.2–0.4 of terga III–VII weakly sclerotized, glabrous, translucent, and pale; balance of terga normally sclerotized and bearing abundant hairs usually pointing posteromedially; propodeum with no trace of areola ..... (13) *Illidops*
- Inner margins of eyes subparallel or terga III–VII uniformaly sclerotized; propodeum often with complete or partial areola 13

13. Propodeum with very strong areola and costulae; tergite I broad and widening posteriorly, mostly smooth and bearing a median apical longitudinal trough that is margined anteriorly with a pair of carinae that unite anteriorly to form a median ridge; hypopygium neither folded nor striate medially; cheeks bearing a large and conspicuous, whitish, translucent spot (New World) .... (12) *Alphomelon*
- Tergite I usually rough and often narrowed posteriorly; trough, if present not so bordered by carinae; hypopygium usually striate medially and always with a sharp median fold (very large, worldwide genus) ..... (11) *Apanteles*

14. *Propodeum with a strong areola and costulae; mouthparts normal, glossa truncate 15
- Propodeum with irregular carinae or none or a median carina; mouthparts elongated, glossa divaricate 16

15. Tergite I rugose and bearing a medioapical trough; scutellar lunules arcuate ..... (10) *Papanteles*
- Tergite I smooth, broad, and without apical trough; scutellar lunules large and triangular ..... (7) *Dasylagon*

16. *Abdomen long and thin, tergite II longer than wide; ovipositor not sinuate; usually xanthic ..... (9) *Sendaphne*
- Abdomen less elongated, tergite II wider than long; ovipositor sinuate apically; rarely xanthic ..... (8) *Promicrogaster*

1. *Miropotes* Nixon 1965

Figs. 23, 24

Type: *M. creon* Nixon 1965.

Ovipositor of medium length, stout, and often decurved apically; sheath about half as long as hind tibia, the hairs mostly on apical half. Hypopygium long and with at least a few median striae. Tergite I 2–3× longer than wide, slightly widened apically and usually constricted between base and middle; surface aciculorugose. Tergite II subtriangular, slightly to decidedly longer than wide and usually aciculate; usually about as long as tergum III and clearly delimited from it by a straight transverse suture; tergum III usually basally aciculate.

Propodeum with a large pentagonal areola and anterior median carina; costulae and spiracular carina more or less obscured by irregular rugosity; in some species all propodeal

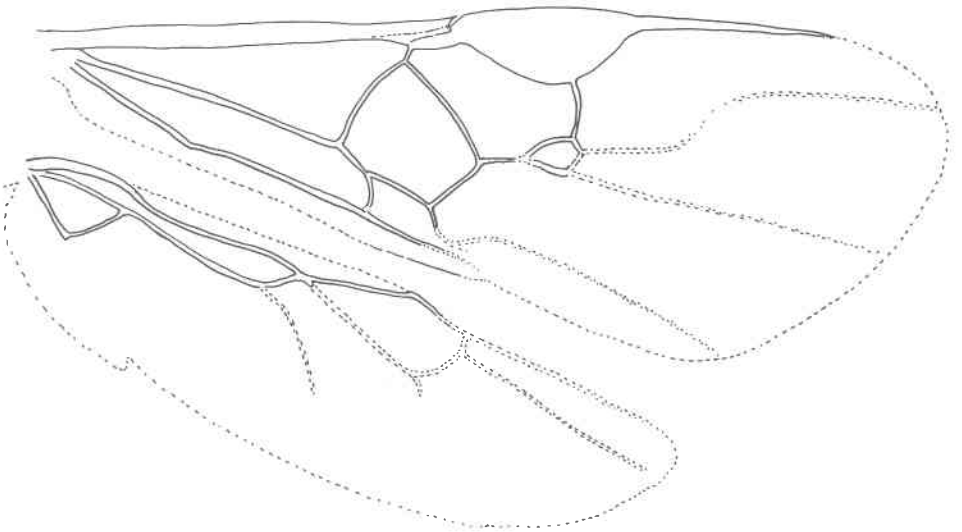


FIG. 23. Wings of *Miropotes*.

sculpture subdued and the surface mostly smooth. Metanotum with small setiferous lobes sublaterally. Lateral lunules of scutellum absent. Pronotum with one broad carinate groove, apparently the ventral one.

Ocelli rather small, in a high triangle with external anterior angle 80–100°. Face of female extremely narrowed below, of male less narrowed; clypeus narrow and strongly convex.

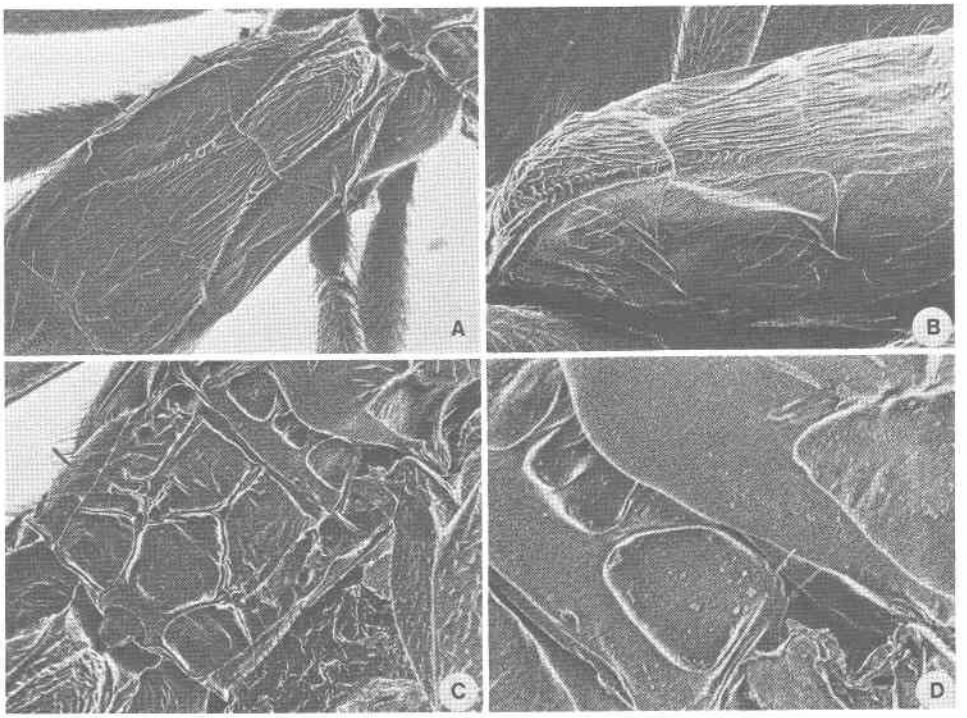


FIG. 24. *Miropotes* sp. A, B, basal part of abdomen; C, propodeum; D, metanotum.

Areolet present and triangular; second intercubitus interstitial with radius; apical, unsclerotized part of radius (Rs) bowed forward, sometimes much as in *Cardiochiles* (Fig. 23) and sometimes traceable only in the apical half (cf. Miracinae). Radiellan (Rs) with basal abscissa strongly convex posteriorly and apical abscissa straight and close to wing margin; interradiellan (2r) perpendicular to wing margin; intercubitella (2r-m) absent; vannal lobe convex and hairy. A small spur, visible only as a crease, is often present distally on 1Rs; its significance is uncertain. Hind tibia spurs small.

LARVA AND HOSTS. Unknown.

RANGE AND CONTENTS. *Miropotes* is known only from the Australian Region. Included species are *Miropotes creon* Nixon from Tasmania, *Microgaster petiolaris* Szepligeti from Australia (N.S.W.), and a few undescribed species from Australia and New Guinea.

REMARKS. The peculiar configuration of the radiellan vein and of the propodeal carinae relates *Miropotes* to small group of undescribed genera found in Australia and New Guinea and probably also to *Exulonyx camma* (Nixon) of South Africa.

2. *Exulonyx* new genus

Figs. 25, 26

Type: *Apanteles camma* Nixon 1965.

The name refers to the isolation of this species, both geographic and taxonomic, and its beauty, that of a gem stone.

Ovipositor sheath about 3/4 as long as hind tibia, hairy throughout; hypopygium evenly sclerotized, large, and acutely pointed. Tergite I rugose, sides subparallel, L/W = 1.5, weakly elevated across the center; tergite II rugose, rectangular L/W = 0.4 (♂ = 0.6); tergum III about 1.4× longer than II, smooth; terga III-VI each with one row of sparse hairs and a partial second.

Propodeum rather flat and only a little wider than long, mostly irregularly rugose; areola large, pentagonal, occupying posterior half, a strong median carina the anterior half; costulae, lateral longitudinal carinae, and sides of areola weaker than other carinae and sometimes hard to trace; posterolateral areas only about half as long as anterolateral. Anterior margin of metanotum closely appressed to scutellum; lateral lunules of scutellum small; scutellum and scutum with coarse, distinct, and mostly contiguous punctures; mesopleural furrow long, wide, and straight; pronotum with large ventral and small dorsal groove. Antenna long and slender, that of male less so, a very unusual relationship in Microgastrinae; female antenna with a white band on flagellar articles 5-7.

Radius about 2/3 length of intercubitus and meeting it at about 125°; 2nd intercubitus absent. Anteroposterior extent of 1st radiellan cell about 1.5× that of 2nd; first abscissa of radiellan convex posteriorly, 2nd straight and close to wing margin (cf. *Miropotes*). Nervellus strongly (45°) sloping toward wing base; vannal lobe convex and hairy. Legs rather long and slender; tibial spurs short.

LARVA AND HOSTS. Unknown.

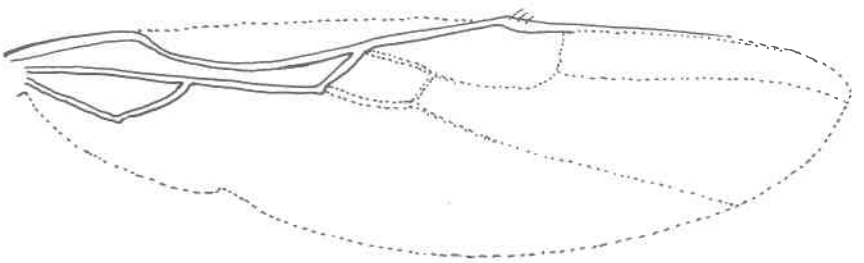


FIG. 25. Hind wing of *Exulonyx camma* (Wilkn.).

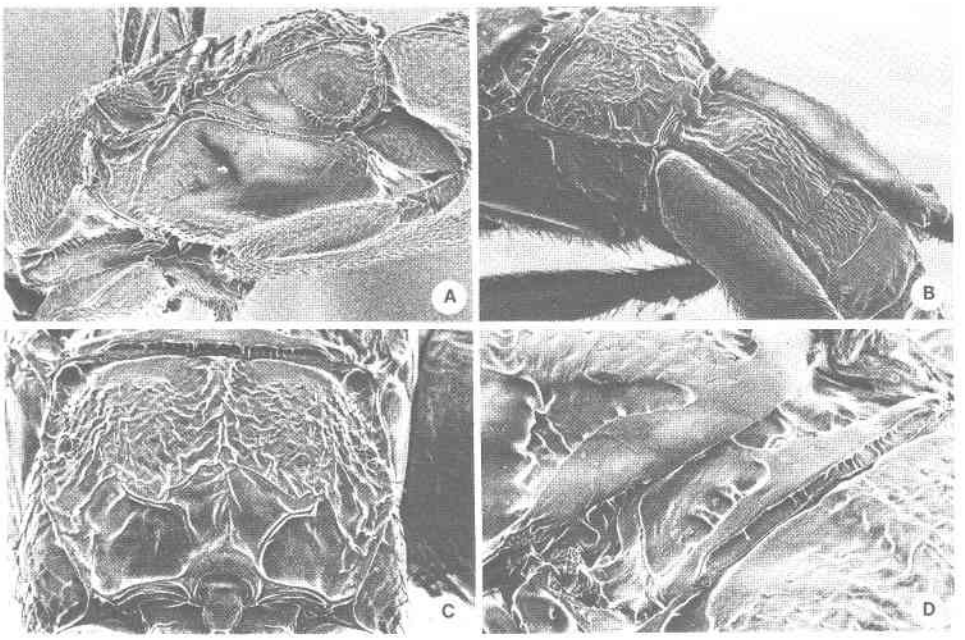


FIG. 26. *Exulonyx camma* (Wilkn.). A, profile of alitrunk to show extremely long horizontal part of propodeum; B, propodeum and base of abdomen; C, propodeum; D, metanotum.

RANGE AND CONTENTS. This genus has only one species, the South African *A. camma* Nixon.

REMARKS. In a number of features, especially the structure of the propodeum and radiellan vein, *Exulonyx* shows some affinity to the Australian *Miropotes*. The type specimen has the carinae at the sides of the areola vague and irregular, but a series taken in South Africa by Henry and Majorie Townes shows that typically a recognizable pentagonal areola is present.

3. *Dolichogenidea* Viereck 1911

Figs. 27, 28, 29

Type: *A. (D.) banksi* Viereck 1911.

Hypopygium moderate to large, usually bearing a series of median longitudinal striae but at least sharply folded medially; ovipositor sheath usually long, hairy throughout, and arising near or at apex of valvula but sometimes short and originating on distal half of valvula; ovipositor straight to gently decurved (Fig. 29). The short ovipositor, sheath attached preapically on valvula, and short hypopygium with only a sharp median fold usually correlate.

Tergite I much longer than wide, usually parallel-sided or barrel-shaped, but occasionally slightly wider or narrower apically and almost always bearing a median apical longitudinal depression; tergite II always wider than long and usually a little or much shorter than tergum III.

Propodeum coarsely sculptured to smooth and never with a median longitudinal carina; often with a more or less well-defined areola (Fig. 27c) and costulae, this carination often reduced to a U-shaped area or median depression extending forward from the abdominal fovea or carination completely suppressed, leaving a uniformly sculptured or smooth surface (Fig. 28c, d). Mesonotum typically shiny with coarse, distinctly separated punctures but when propodeal carination is suppressed the mesonotal punctation is also, the mesonotum then tending toward a satin-like sheen (because of microsculpture) and weak or indefinite punctures.

Margin of vannal lobe uniformly convex and hairy, rarely the curve slightly flattened.

Larva. Mandible long-bladed with 15–25 long teeth; labium with 2 hairs, maxillae with 1 each; skin thickly set with papulae armed with prickles at least as long as diameter of papulae (Fig 104A).

HOSTS. Larvae typically solitary and attacking Microlepidoptera but occasionally gregarious or living in Macrolepidoptera, or both.

RANGE AND CONTENTS. The genus is abundant and ubiquitous, probably containing about 1000 species.

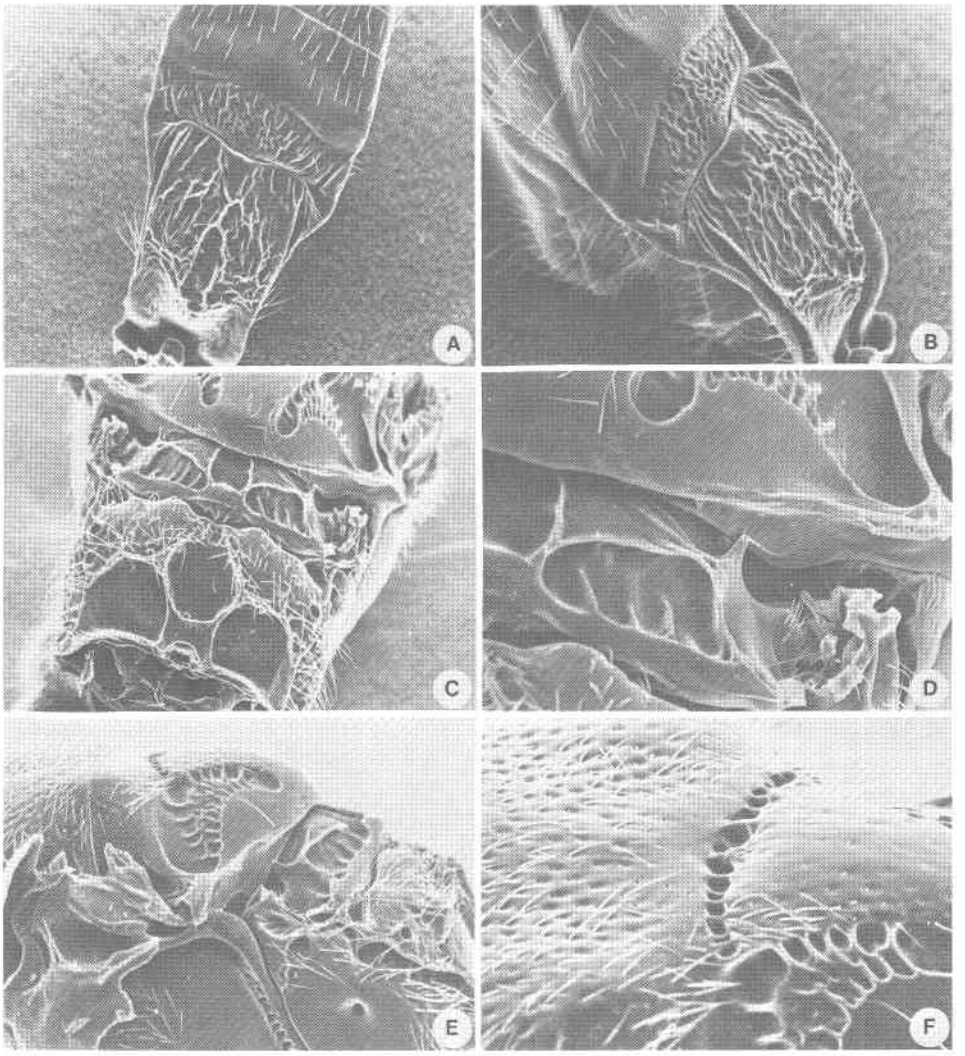


FIG. 27. *Dolichogenidea lacteicolor* (Vier.) a primitive species. A, B, basal parts of abdomen, note median subapical trough on tergite I; C, propodeum; D, metanotum showing protruding setose lobe and below it exposed mesonotal phragma; E, profile of alitrunk to show short horizontal and long vertical parts of propodeum; F, mesonotum with strong, separated punctures and no trace of aciculation.

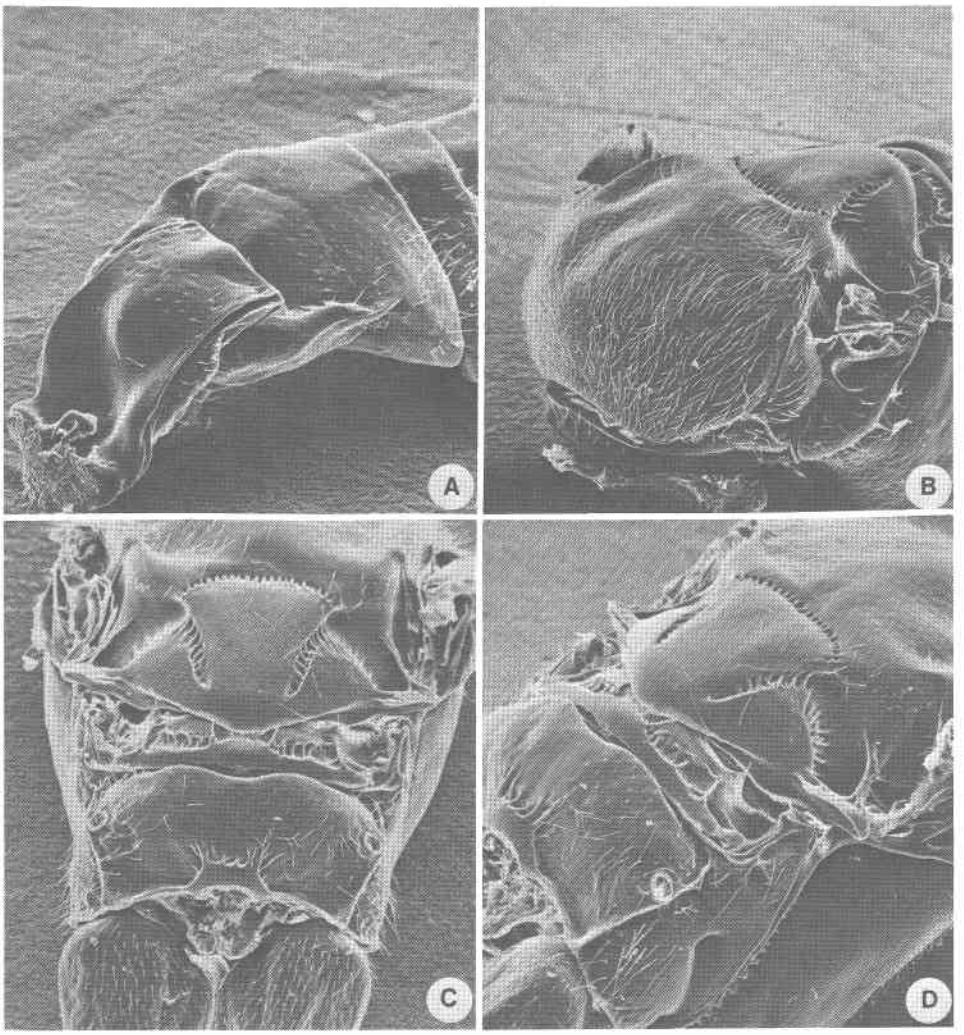


FIG. 28. *Dolichogenidea longicauda* (Wesm.) a derived species. A, base of abdomen without medioapical trough on tergite I; B, mesonotum with suppressed sculpture; C, propodeum with greatly reduced sculpture; D, scutum to propodeum, partly depilated.

I place the following species in *Dolichogenidea*: (***ultor* group**) Nearctic — *A. acrobasidis* Muesebeck, *A. phthorimiae* Mues., *A. tischeriae* Mues. Palearctic — *A. coleophorae* Wilkinson, *A. lacteicolor* Viereck, *M. ultor* Reinhard. (***laevigata* group**) Nearctic — *A. absonus* (-*a*) Mues., *A.* (*D.*) *banksi* Vier., *A. betheli* Vier., *A. bushnelli* Mues., *A. cacoeciae* Riley, *A. californicus* (-*a*) Mues., *M. clavatus* (-*a*) Provancher, *A. dolichocephalus* Mues., *A. homeosomae* Mues., *A. laspeyresiae* Vier., *A. melanopus* Vier., *A. miantonomoi* Vier., *A. oidematophori* Mues., *A. paralechiae* Mues., *A. pterophori* Mues., *A. renaulti* Mason, *A. thujae* Mues. Palearctic — *M. annularis* Haliday, *M. dilectus* (-*a*) Hal., *M. emarginatus* (-*a*) Nees, *M. gagates* Nees, *A. gracilariae* Wilkn., *A. halidaii* Marshall, *A. imperator* Wilkn., *M. infimus* (-*a*) Hal., *M. laevigatus* (-*a*) Ratzeburg, *A. lemariei* Nixon, *M. lineipes* Wesmael, *M. longicauda* Wesm., *A. mesoxanthus*

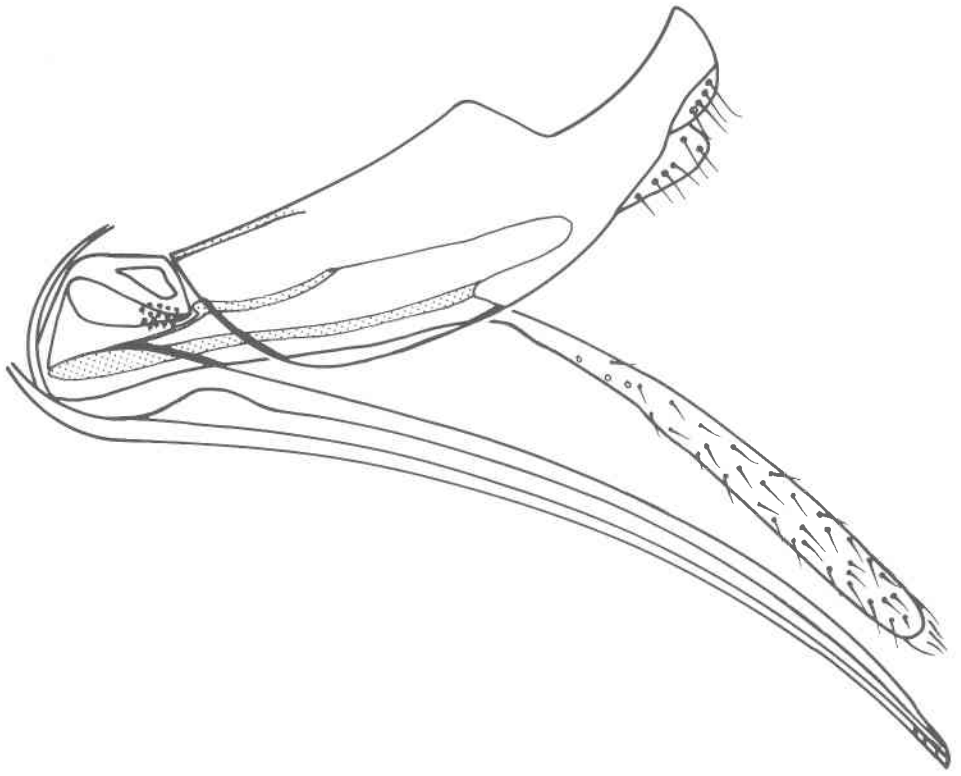


FIG. 29. *Dolichogenidea lacteicolor* (Vier.), female genitalia.

Ruschka, *A. phaloniae* Wilkn., *A. praetor* Marshl., *A. princeps* Wilkn., *A. sicarius* Marshl., *A. sodalis* Marshl., *A. sophiae* Papp, *A. szelenyii* Papp, *A. victor* Wilkn. All these names (except *Dolichogenidea banksi* Viereck) are new combinations.

REMARKS. Viereck described *Dolichogenidea* as a subgenus of *Apanteles* merely because of its elongated genae and included only *A.* (*D.*) *banksi* Viereck. Except for the long cheeks this is a typical species of Nixon's *laevigata* group. However, Nixon (1965) placed *D. banksi* in his *crassicornis* group without having seen any specimens.

Dolichogenidea is distinguished from *Apanteles* by 1, punctures of mesonotum typically distinctly separated and never breaking into aciculations posterolaterally; 2, margin of vannal lobe convex and evenly thickly hairy; 3, first tergite parallel-sided or slightly wider apically; 4, apicolateral areas of propodeum (if distinct) wider than high. In the *laevigata* group, however, both the propodeal areolation and the mesonotal puncturation are reduced to the point at which they are indistinguishable from the same characters of the *metacarpalis* group of *Apanteles*, so the separation must be made by the shapes of vannal lobe and first tergite (see discussion under *Apanteles* below).

4. *Pholetesor* new genus

Figs. 30, 31

The name is masculine and means one who eats those that lurk in holes and is suggested by the host selection. All members of this genus attack leaf-mining larvae.

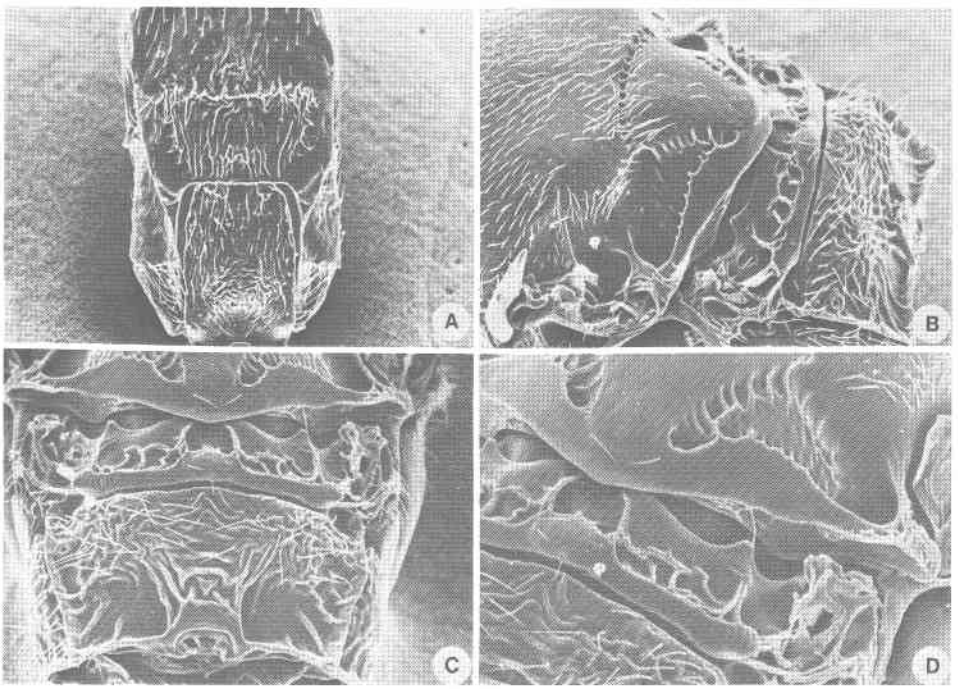


FIG. 30. *Pholetesor ornigis* Weed. A, base of abdomen; B, alitrunk showing subdued punctures of mesoscutum; C, propodeum; D, metanotum showing sharply projecting sublateral setose lobe and phragma beneath it.

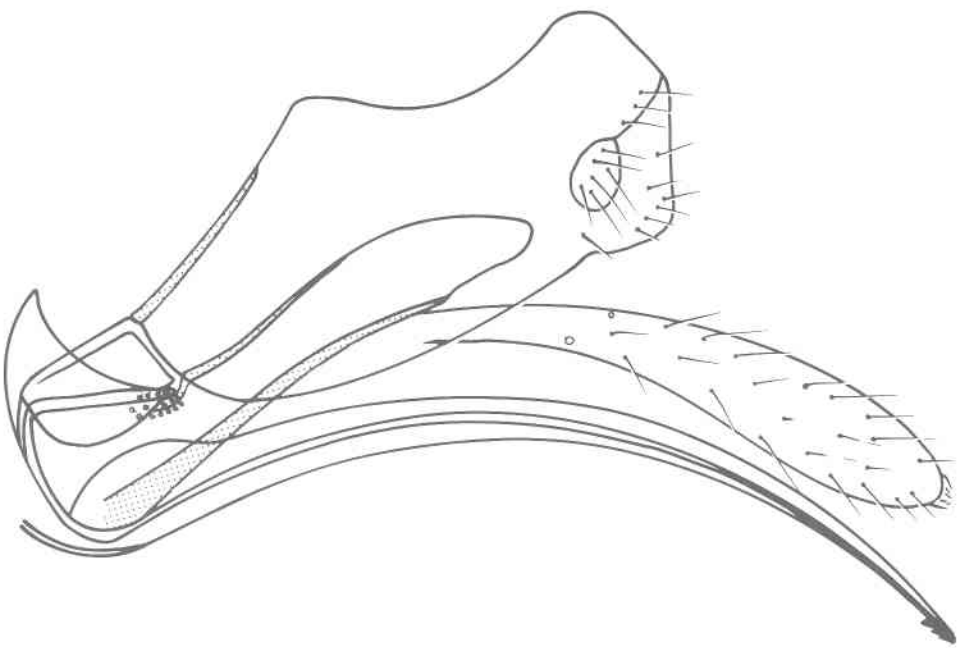


FIG. 31. *Pholetesor salalicus* (Mason), female genitalia.

Type: *Apanteles ornigis* Weed 1887.

Hypopygium short, usually pointed apically and without median striae although usually folded along the mid-line. Ovipositor sheaths hairy throughout and arising about or beyond the middle of the apically tapered valvifers; ovipositor sheath not longer than hind tibia but usually extending much farther out from the hypopygium than in most *Cotesia* species. Ovipositor gradually tapered from base to apex (Fig. 31).

Tergite I usually parallel-sided or narrowed toward apex and longer than wide but occasionally (*bucculatricis* group in the New World) wider at apex and little longer than wide; surface usually densely rugose, rarely shiny centrally; a median longitudinal shining depression sometimes indicated on broad first tergite. Tergite II wider than long, the sides either diverging apically or parallel; in the latter case the tergite occupying almost full width of abdomen; surface rugose or dull and partly rugose, sometimes polished medially. Tergum III often smooth but sometimes basally or completely rugose.

Propodeum typically with two fields of irregular aciculations diverging forwards from the polished apical boss, the remainder of the surface variously sculptured; a more or less well-defined areola and costulae present in members of the *bucculatricis* group, but the carinae often obscured in dense rugosities. Anterior margin of metanotum with a pair of sublateral setiferous projections. Mesoscutum usually with weak and ill-defined punctures and strong microsculpture giving metallic reflections; some species of *bucculatricis* group with coarse, separately defined punctures.

Hind tibia with the large spines on its outer face smaller and fewer than in most microgastrines. Vannal lobe of hind wing convex and hairy along the margin.

Larva. Mandibles with long blade and numerous large teeth, typical of the Apantelini, but showing a derived character in having numerous (12–14) hairs on the labium and 2 or 3 on each maxilla. However *P. viminetorum* (Wesm.) is exceptional in having the normal complement of 2 and 1 hairs on the labium and maxilla respectively. The larval skin is closely set with long prickles, another characteristic of the Apantelini (Fig. 104B).

HOSTS. Larvae apparently always solitary parasites of lepidopterous leaf-miners. The cocoons are usually smooth and suspended like a hammock by threads attached to each end.

RANGE AND CONTENTS. There are a few dozen species in the Holarctic Region and a very few in the tropics.

I place the following species in *Pholetesor*: *Apanteles bucculatricis* Muesebeck, *A. ornigis* Weed, *A. bedelliae* Viereck, *A. rohweri* Mues., *A. salalicus* Mason, *A. salicifoliellae* Mason, *A. glacialis* Ashmead, *A. robiniae* Fitch, *Microgaster circumscriptus* Nees, *A. laetus* Marshall, *A. maritimus* Wilkinson, *M. viminetorum* Wesmael.

REMARKS. This genus has always been one of the trouble spots in subdividing the traditional genus *Apanteles*. Most of the European species are apomorphic for the genus and the commonest, *circumscriptus* Nees, is atypical in its mostly polished tergites. Because of its abundance it has tended to dominate concepts of its group, causing the species usually to be placed in Wilkinson's group A. In the Nearctic fauna, however, there are undescribed species that illustrate a series of evolutionary steps between *P. bucculatricis* (Mues.) with its areolated propodeum, quadrate first tergite, and sculptured rectangular 2nd and 3rd tergites (conditions I believe to be plesiomorphic for the genus), to typical *Pholetesor*, by gradual obscuring of the propodeal areola, narrowing of tergite I, and loss of sculpture on tergum III. Because of these connecting "stages", and because the more plesiomorphic *Pholetesor*, such as *bucculatricis*, have the mesonotum set with separated, strong punctures and the margin of the vannal lobe convex and hairy, I believe the affinities of the genus lie with *Dolichogenidea* Viereck (*ultor* group of Nixon).

Adults are difficult for a beginner to recognize but with practice the habitus can be learnt. The rigid adherence to leaf-mining hosts, numerous labial hairs of the larva, and hammock-like suspension of the cocoon are characteristic apomorphic features compared with their homologs in *Dolichogenidea*, although they are not universal in *Pholetesor*.

5. *Exoryza* new genus

Figs. 32, 33

The name is feminine and means "from rice" in reference to the habits of the type.

Type: *Apanteles schoenobii* Wilkinson, 1932.

Ovipositor long and decurved, sheath hairy and about as long as hind tibia. Hypopygium large, medially with a series of striae. Tergites I and II rugose-aciculate and occupying almost entire dorsum of their segments; tergite I short, broadening apically, center higher than sides; tergite II much wider than long, rectangular; tergum III about as long as II, weakly sculptured. Terga densely and rather uniformly hairy.

Propodeum mostly rugose and bearing a conspicuous median trough or areola which is open anteriorly; outlines of areola, and costulae, more or less obscured by coarse rugose sculpture. Anterior margin of metanotum with moderately projecting sublateral setiferous lobes. Lateral lunules of scutellum arcuate. Mesopleural furrow extending forward from mid-coxa to about one third length of mesopleuron, then curving upward to join pleural suture near the middle. Pronotum with upper and lower grooves present; area between densely punctate. Thorax mostly densely punctate. Ocelli not large, the anterior external angle of the triangle close to 90°.

Radius and intercubitus about equally long; radius slanting strongly outward and meeting intercubitus at about 135° with a knob at the junction. Basal vein (RS&M) strongly angulate. Vannal lobe convex, the margin weakly to strongly hairy.

Larva. Unknown to me.

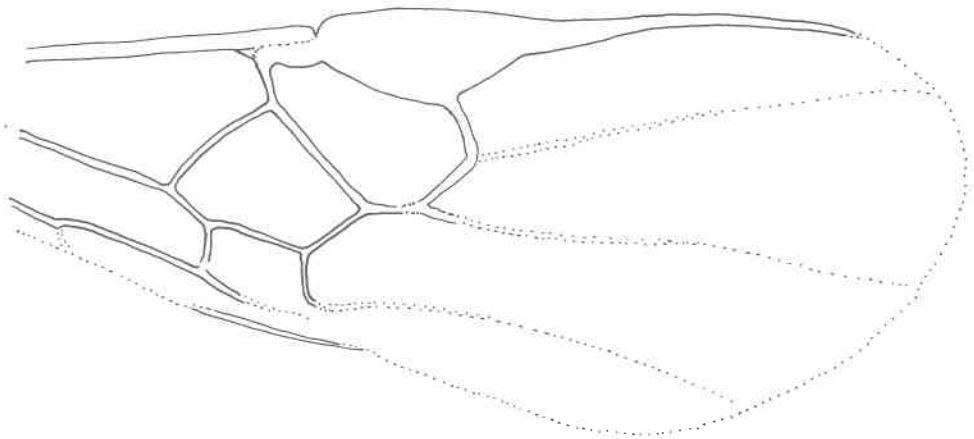


FIG. 32. *Exoryza schoenobii* (Wilkn.), forewing.

HOSTS. Pyraloidea boring in rice stems.

RANGE AND CONTENTS. I include in this genus the Oriental *A. schoenobii* Wilkinson and a new species from North America, described below.

Exoryza minnesota new species

Fig. 34

Holotype: female, length 2.4 mm, forewing 2.8 mm, antenna 2.7 mm.

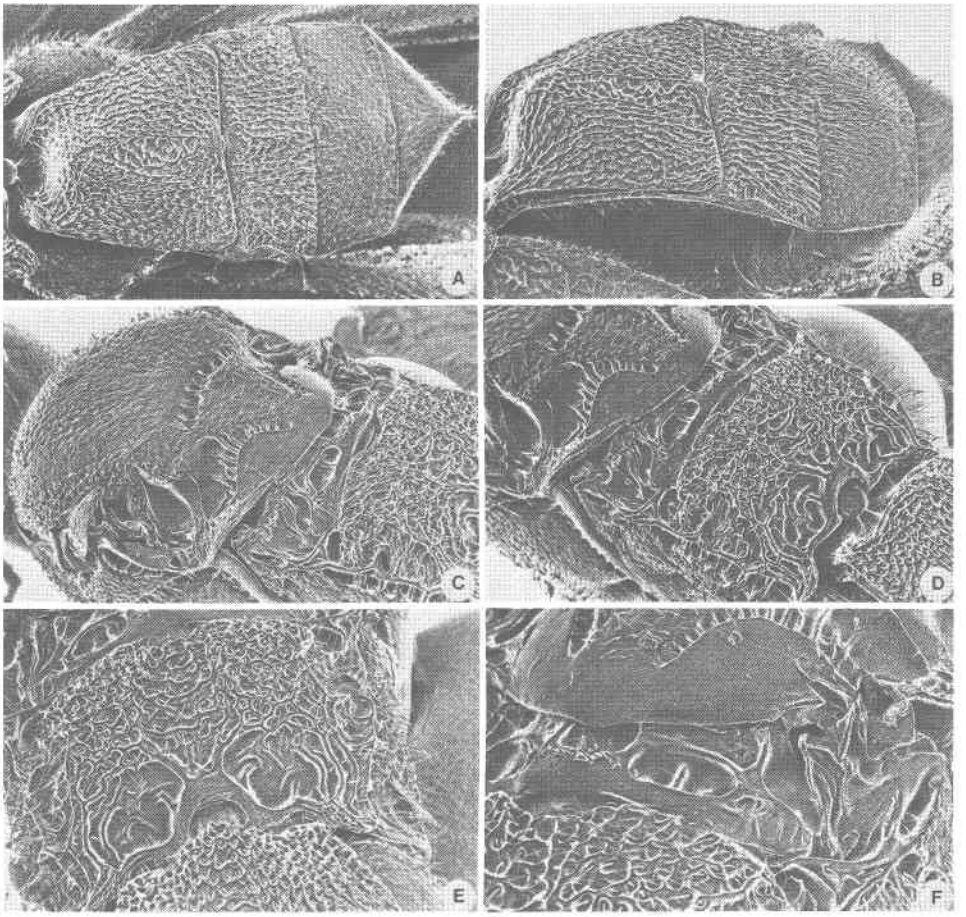


FIG. 33. *Exoryza schoenobii* (Wilkn.). A, B, abdomen; C, D, alitrunk, oblique views; E, propodeum; F, metanotum.

Ovipositor sheath 1.1× as long as hind tibia. Tergite I broadened apically L/W = 0.8; terga II and III about equally long and each 4× wider than long; rest of abdomen slightly shorter than terga II and III. Terga I and II completely coarsely rugose, tergum III with scattered large punctures.

Propodeum with the median 0.2 occupied by a deep, rounded, and irregularly rugose trough which is narrowed anteriorly and is posteriorly delimited by a pair of strong carinae diverging from the foramen; posterior declivity of propodeum well marked, sparsely and irregularly rugose; horizontal part strongly and evenly rugose and tumescent; lateral 0.1 less regularly rugose and delimited by a vague, irregular longitudinal carina. Mesonotum dull with deep, medium to large, separate punctures except along notauli and anterior margin where the punctures are contiguous.

Edge of vannal lobe convex and hairy. Tarsal claws simple.

Punctures of vertex deep and distinctly separate except medially and above where they become contiguous and smaller. Flagellar formula: 14 L/W = 1.2, 8 L/W = 2.8, 2 L/W = 3.4, L 2/14 = 2.8, W 2/14 = 1.0.

Color: black with mouthparts and legs ferrugineous; hind coxa, tibia, and all tarsi darkened; wings weakly infuscated with brown veins.

Holotype: ♀, **U.S.A., Minnesota**, Lake Itasca, Westside across from Biological Station, D.L. Deonier, 28 July 1963 (U.S.N.M.).

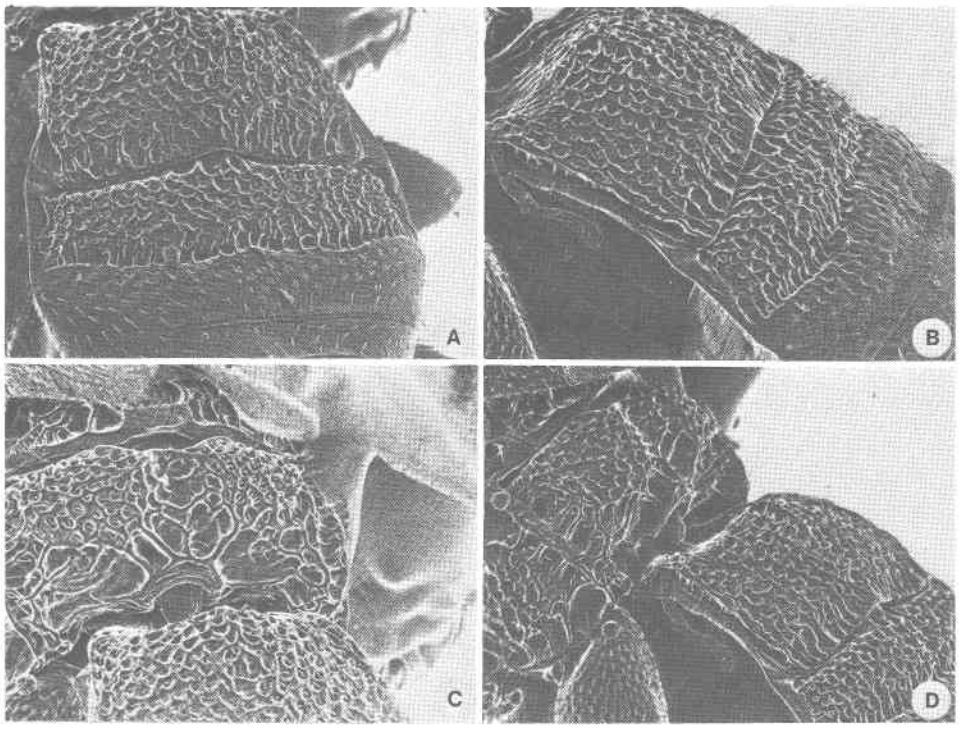


FIG. 34. *Exoryza minnesota* Mason, holotype, A, B, basal part of abdomen; C, D, propodeum and base of abdomen.

6. *Teremys* new genus

Figs. 35, 36

The name is feminine and alludes to the carapace formed by three tergites.

Type: *Teremys masneri* n. sp.

Hypopygium evenly sclerotized, apically acute; ovipositor evenly decurved; sheath about half as long as hind tibia and completely hairy. Tergite I a little wider than long and widening apically; tergites II-IV solidly fused into a rugose carapace with 2 transverse grooves; laterotergites I-IV all distinct; remaining terga partly to completely withdrawn under II-IV and of normal soft coriaceous appearance.

Propodeum rugulose, with a poorly defined, depressed weakly sculptured median apical area that probably represents an areola. Metanotum touching scutellum and with low sublateral setose lobes on anterior margin; lateral lunules of scutellum fairly large but not triangular. Mesopleuron smooth; pronotum with upper and lower grooves.

Inner margins of eyes strongly convergent below in both sexes, mouth and clypeus small. Antenna long and slim, all but apical few flagellomeres with placodes in 2 ranks.

Second intercubitus absent; radius and 1st intercubitus meeting at a sharp angle with a small knob; vannal lobe weakly convex and hairy. Hind tibia with numerous large stout bristles; hind tibial spurs about $^1/_3$ as long as basitarsus, outer spur almost as long as inner.

LARVA AND HOSTS. Unknown.

RANGE AND CONTENTS. I know of only one species, the type, in this genus.

REMARKS. Although *T. masneri* has a unique combination of characters it may be related to *Dolichogenidea* or the *bucculatricis* group of *Pholetesor*.

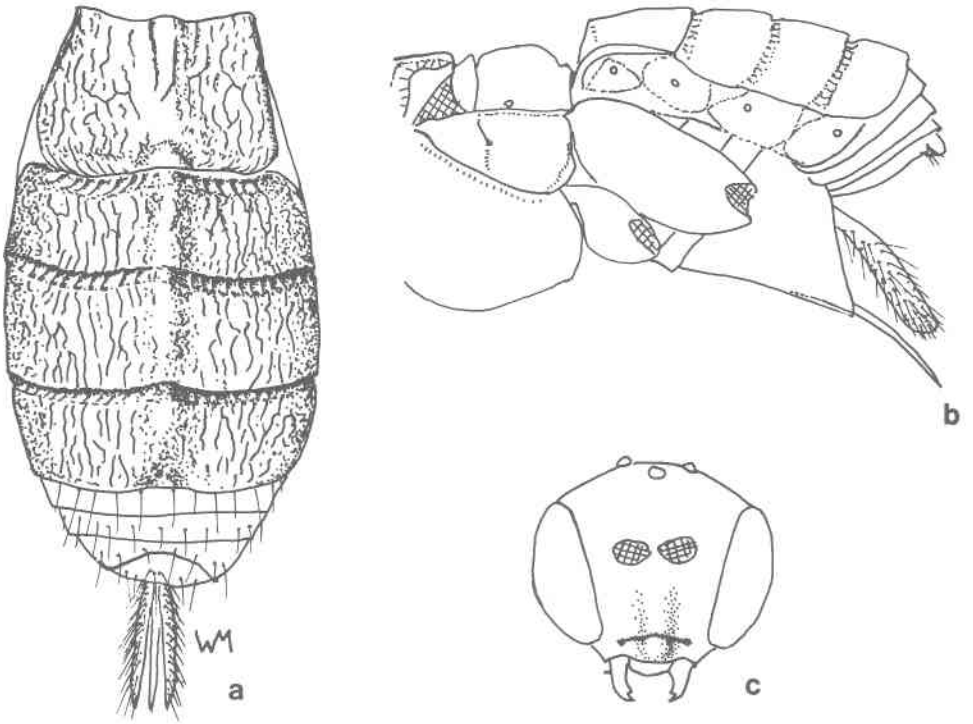


FIG. 35. *Teremys masneri* Mason. A, abdomen of ♀; B, abdomen of ♀, lateral aspect; C, head.

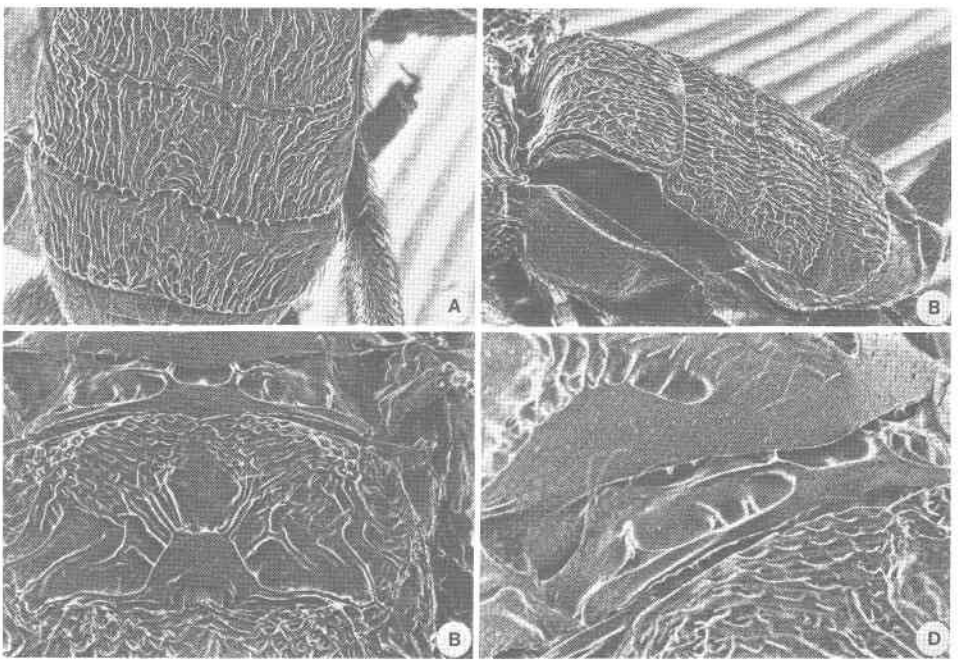


FIG. 36. *Teremys masneri* Mason. A, tergites II-IV, all fused; B, abdomen, oblique; C, propodeum; D, metanotum.

Teremys masneri new species

Holotype, female: length 2.0 mm, forewing 2.5 mm, antenna 2.5 mm.

Tergites I-IV aciculorugose; base of tergite I broadly concave with granular sculpture; sutures II-III and III-IV deep, transcostate, with a ridge on anterior margin; carapace (TII-IV) with 3 tergites about equal, combined length equals width; remaining terga together about as long as IV. Hypopygium 0.6 as long medially as hind tibia, acute at apex; sheaths 0.5 as long as hind tibia, broadest on apical 0.4.

Mesonotum uniformly and densely, but not contiguously, punctate; scutellar scrobe narrow; scutellum smooth, sparsely finely punctate.

Inner margins of eyes converging below at 30-35°; face closely rugulopunctate laterally, sharply raised to a broad median punctate ridge. Mouth opening small, only 0.35 as wide as head. Anterior external angle of ocelli 120°, ocelli separated from one another by their own diameter and from eye by 2.3× their own diameter. Flagellomeres 1-10 with 2-ranked placodes; antennal formula 2 L/W = 3.6, 8 L/W = 3.5, 14 L/W = 2.0, L 2/14 = 2.3, W 2/14 = 1.3

Color black, the following fulvous: scape basally, mouthparts (except black labrum, clypeus, and base of mandibles), all legs except dark apical tarsomeres (but hind tarsi and inner apical 0.1 hind tibia dark brown), laterotergites I-IV, sides of hypopygium. Basal hollow of tergite I and mandible tips reddish. Wings hyaline with fulvous veins and brown stigma.

Males resemble female except: flagellomeres 1-13 with 2 ranks of placodes, tergite I slightly longer than wide, tergites II-IV together slightly longer than wide, terga V-IX sometimes completely telescoped under IV.

Holotype: female, ***Canada***, **Ontario**, Spencerville, 15 Aug. 1978, swept in wet mixed forest, L. Masner (CNC No. 15789).

Paratypes: 2♂♂, 1♀, ON, same data (CNC).

7. *Dasylagon* Muesebeck 1958

Fig. 37

Type: *Dasylagon aegeriae* Muesebeck 1958.

Ovipositor much longer than hind tibia, strongly decurved near apex; sheath completely hairy. Hypopygium long, acute, and striate medially. Tergite I large, apically broadened, and mostly smooth; tergite II strongly transverse, rectangular, and smooth.

Propodeum fully carinated, the areola closed anteriorly, in front of that 1 or 2 short median carinae; anterior margin of metanotum with sharp, sublateral setiferous lobes; lateral lunules of scutellum very large and triangular. Pronotum with upper and lower grooves. Thorax much wider than head.

Face flat, broad; neither head nor mouthparts elongated.

Radius long and convex outwardly, apex strongly decurved; intercubitus less than 1/3 length of radius; areolet very small, triangular (Fig. 37c). Nervellus concave outwardly and sinuate near the submediella; first cubitellan cell short (1RS = 3r-m±); vannal lobe concave and hairless (Fig. 37b).

Larva. Unknown but apparently solitary.

HOSTS. Aegeriidae and Thyrididae, probably stem-borers.

RANGE AND CONTENTS. This is a small genus confined to the Neotropical Region. *D. aegeriae* Muesebeck and *D. simulans* Mues. belong here and also a few species from Brazil.

8. *Promicrogaster* Brues and Richardson 1913

Fig. 38

Type: *P. terebrator* Brues and Richdn. 1913.

Ovipositor long to very long, straight, or sometimes abruptly decurved near apex; the tip always sinuate in a vertical plane; sheath hairy and long, 1.0-2.1 times length of hind

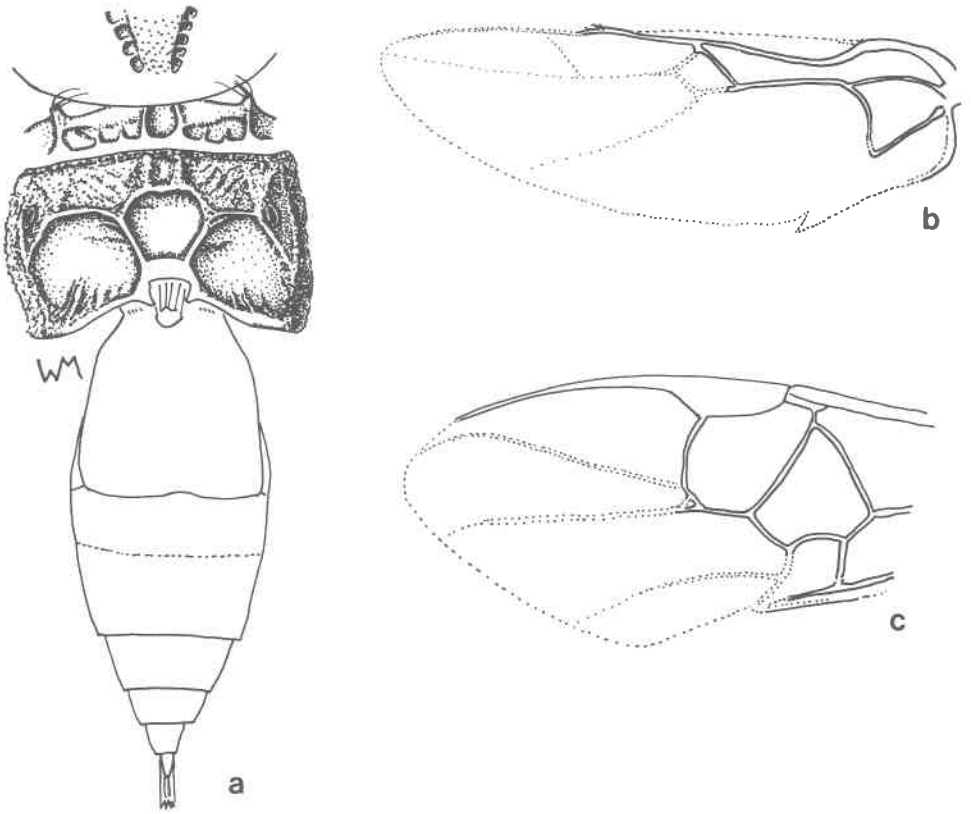


FIG. 37. *Dasylagon* sp. A, abdomen, propodeum, and metanotum; B, hindwing; C, part of forewing.

tibia. Hypopygium sharply folded and striate medially, very long, often surpassing apex of abdomen; tip of hypopygium in lateral view very acute, the top and bottom converging at 20°-30°.

Tergite I smooth to rugulose, the sides parallel or moderately converging (rarely widening) apically; tergite II of similar sculpture, much wider than long and longer medially than laterally; tergum III sometimes sculptured dorsally; abdomen usually rather long and slim for a microgastrine, but not compressed.

Propodeum with or without a median carina or with a median carina posteriorly and a median sharp groove anteriorly, otherwise variously sculptured; metanotum with poorly developed setiferous anterolateral lobes; scutellar disc longer than wide and usually sparsely punctate, the polished lateral lunules large and triangular, leaving only a narrow crenulate groove alongside the scutellar disc; scutum polished and closely set with distinct punctures; sides of pronotum with both dorsal and ventral grooves.

Head usually thin anteroposteriorly, the temples almost always strongly receding and narrow; cheeks usually long to very long; clypeus strongly emarginate; mouthparts usually protruding, i.e. galea long and glossa protruding and apically bilobate.

Radius curved, very much longer than intercubitus which it meets in a gentle curve, second intercubitus weak and attached to first, thus areolet small or very small, occasionally completely absent; margin of vannal lobe usually strongly concave and hairless but sometimes straight and rarely weakly convex and bearing some hairs; nervellus outwardly concave or straight and meeting the submediella at approximately a right angle.

LARVA AND HOST. Unknown, but one species, *P. polyporicola* Muesebeck, was reared from a lepidopterous larva in a bracket fungus, *Fomes*.

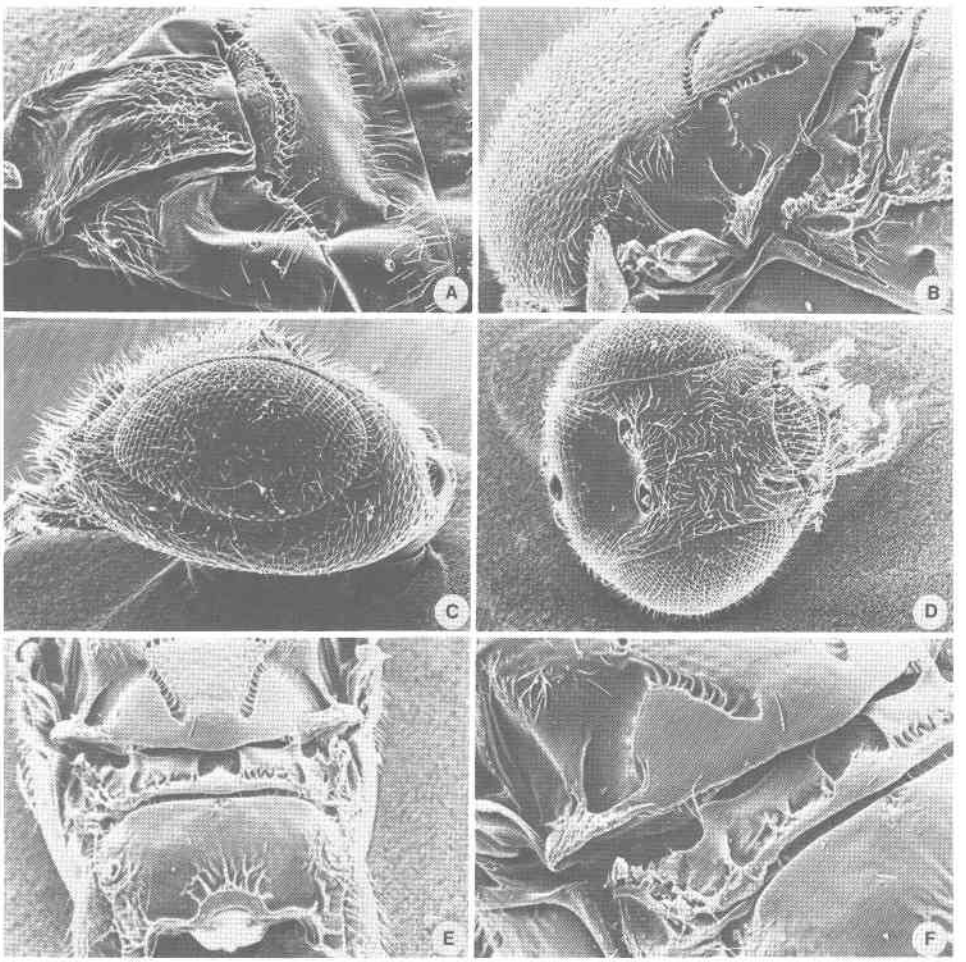


FIG. 38. *Promicrogaster* sp. A, base of abdomen; B, mesonotum showing large triangular scutellar lunules; C, D, head to show thin profile and divaricate glossae; E, propodeum; F, metanotum and scutellar lunule.

RANGE AND CONTENTS. This is a large genus of the Neotropical Region where there may be over 100 species, but individuals are generally scarce in collections. A few rare species enter the southern U.S.A.: I have seen five specimens representing at least four new species from Arizona, Florida, and Virginia. Shenefelt (1973) lists the described species.

REMARKS. The affinities of this genus and *Sendaphne* are obscure. The head is strikingly like that of *Pseudapanteles* but most other anatomical features resemble those of *Dasylagon*. I have placed *Promicrogaster* near *Dasylagon* in Apantelini but this placement is little more than a guess. Many of the largest species have a strong median propodeal carina, a feature characteristic of the Microgastrini, but the smaller species lack this feature. In many other features the smaller species appear, on brief study, to be plesiomorphic compared with their larger sisters. I have therefore taken the view, possibly mistakenly, that the median propodeal carina in this genus is an independent development and only converges toward the state found

in Microgastrini. I think the two Australian species (*P. dissors* Nix., *P. calacte* Nix.) doubtfully assigned here by Nixon (1965) are better placed in *Choeras* (new combinations). They (Australian species) lack the chief characteristics of *Promicrogaster*, e.g. large triangular scutellar lunules, thin head, divaricate and elongated glossa, concave and hairless vannal lobe, sinuate ovipositor.

9. *Sendaphne* Nixon 1965

Fig. 39

Type: *S. olearus* Nixon 1965.

Ovipositor and sheaths long to very long, the former never sinuate near apex, the latter hairy; hypopygium medially striate, very long, and acute. Tergite I longer than wide, tapered strongly toward apex, smooth; tergite II longer than wide, broadening toward apex, smooth; entire abdomen long, slim, and often compressed apically; terga behind II usually with a single row of hairs subapically.

Propodeum evenly rounded and smooth; metanotum with low rounded sublateral setose lobes on anterior margin; scutellar lunules large and triangular; pronotum with both dorsal and ventral grooves.

Head thin anteroposteriorly, the vertex elevated; mouthparts lengthened, the glossa especially long and bifid.

Radius curved and as long as, or longer than intercubitus, areolet triangular and small to very small, sometimes absent or hard to see. Vannal lobe small, its margin straight or weakly convex but hairless; nervellus almost straight, its lower end slanting strongly basad. Hind coxa almost as long as thorax; tibial spurs moderately large; claws simple.

LARVA AND HOSTS. Unknown.

RANGE AND CONTENTS. The genus contains only *S. olearus* Nixon, *S. sulmo* Nixon, and over half a dozen undescribed species, all Neotropical.

REMARKS. Members of the genus share so many features with *Promicrogaster* that I think there is little doubt of the two being related, but a very clear break exists between them. After studying nearly 100 species of *Promicrogaster* I have not seen the slightest tendency for the genera to merge. As in several other Neotropical genera, the species are dominantly xanthic.

10. *Papanteles* new genus

Fig. 40

The name is a contraction from the Greek a father, and "*Apanteles*".

Type: *Papanteles peckorum* n. sp.

Hypopygium large, with median folds; ovipositor sheath long and hairy throughout, arising distally on the valvifer.

Tergite I with sides parallel but curving inward apically, 1.5-2.0× longer than wide, longer in the males, surface rugose with a median depression on apical half; tergite II about twice as wide as long, longer in the male, the sides diverging apically; tergum III smooth, about 1.5× as long as II.

Propodeum coarsely rugose and fully areolated, scutum coarsely rugose or punctate with some longitudinal aciculations near the posterior margin; mesopleuron with a strong pleural furrow; metanotum with lateral setiferous lobes on the anterior margin; upper and lower grooves present on sides of pronotum.

Radius 2 or 3 times longer than first intercubitus; second intercubitus small and unpigmented, making a minute second cubital cell that is only about as wide as the veins around it; vannal lobe concave and hairless on distal half; nervellus straight, meeting the submediella at a rounded right angle.

Tarsal claws with one large basal pecten-tooth on each.

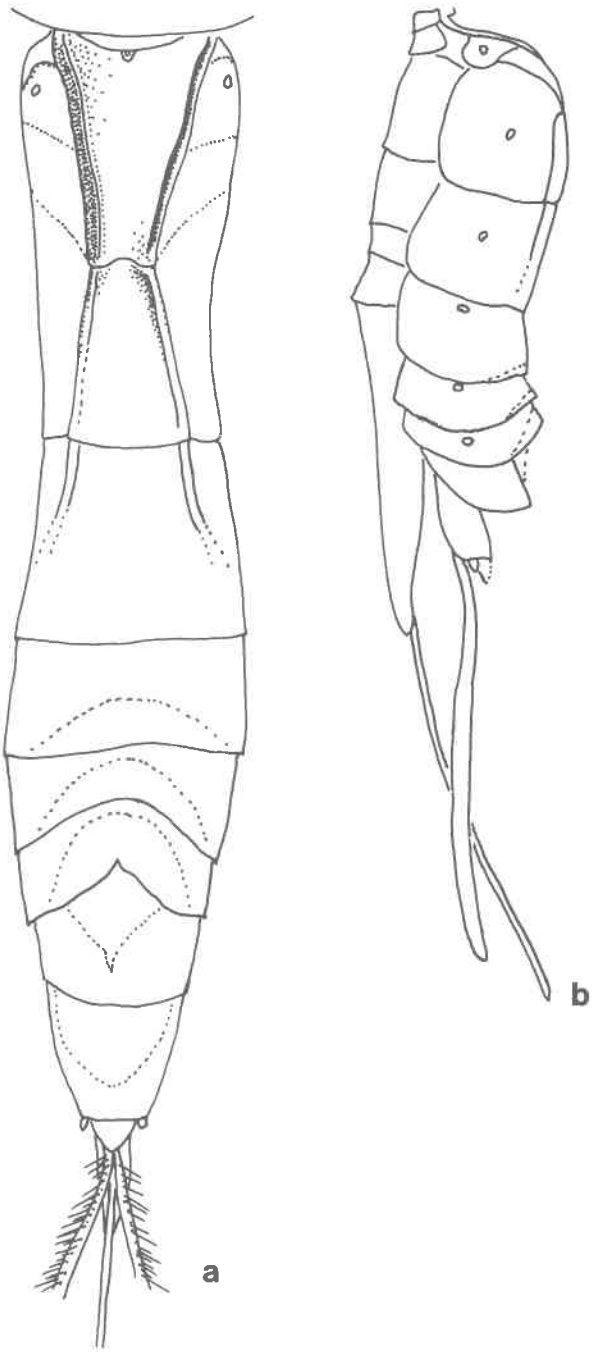


FIG. 39. *Sendaphne* sp. a, b, abdomen, dorsal and lateral aspect.

Occipital region behind ocelli neither hollowed nor glabrous and polished; its sculpture and convexity the same as that of the temples.

LARVA AND HOSTS. Unknown.

RANGE AND CONTENTS. Only the type-species and the rare *P. virbius* (Nixon), both Neotropical, are known.

REMARKS. In every feature except the presence of a second intercubital vein this genus is a perfect match for species of the *vulgaris* group of *Apanteles*. It has the closest resemblance to typical *Apanteles* species such as *vulgaris* (Ashm.) (= *xanthopus* Ashm.), *forbesi* (Vier.), *ensiger* (Say), *crassicornis* Prov., and *obscurus* (Nees).

Papanteles peckorum new species

Fig. 40

Holotype, female: length 3.7 mm (excl. ovipositor); forewing length 4.0 mm.

First tergite aciculate basally but coarsely longitudinally aciculopunctate on posterior 0.7, the sculpture uninterrupted over the weak median apical depression and median elevation in front of it. Tergite II smooth, with strong metallic reflections and large, but distinctly separated and shallow punctures; sides of tergite II limited by sharp grooves diverging from corners of first tergite at about 30° to the body axis; apical width twice median length; suture between terga II and III straight and narrow, but not crenulate. Tergum III smooth, 1.5× longer than II.

Mesoscutum very densely and deeply rugose-punctate, becoming aciculate just before scutellar scrobe. Scutellum densely and strongly punctate, slightly less so medially; lateral grooves of scutellum parallel-sided but very wide, as broad as polished apical band.

Antenna about 0.9 as long as forewing, only weakly tapered; flagellomere proportions: 2 L/W = 2.7; 14 L/W = 1.3; L 2/14 = 2.4; W 2/14 = 1.2. Ocelli large, separated by

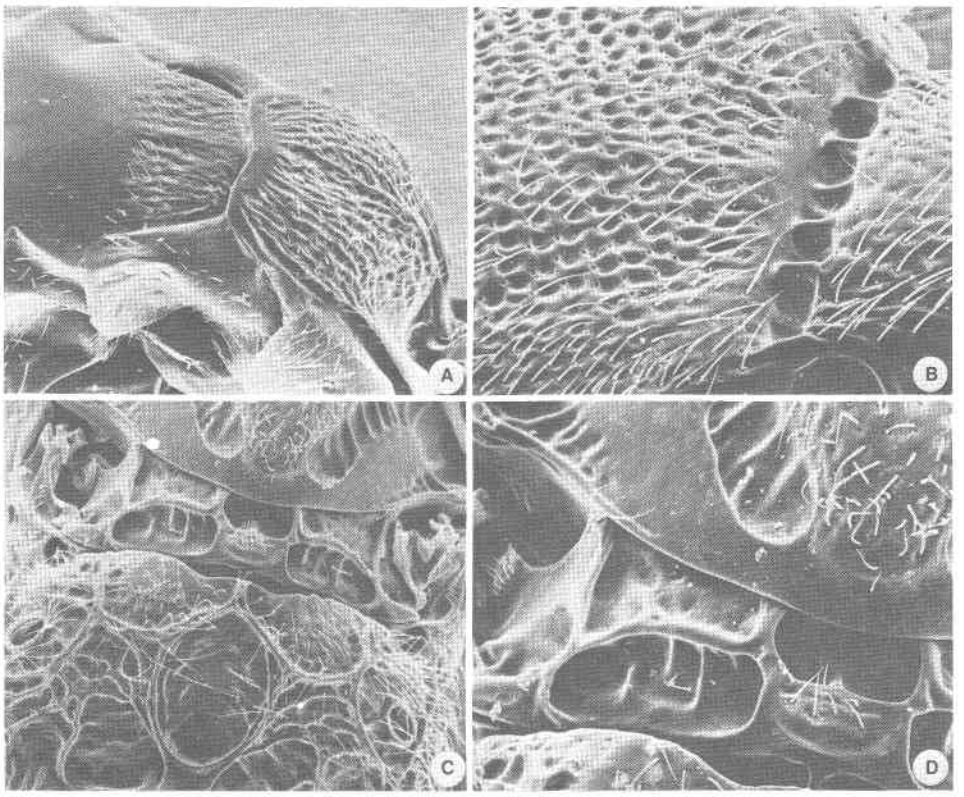


FIG. 40. *Papanteles peckorum* Mason. A, abdomen, terga I-III; B, mesonotum, showing aciculorugose sculpture cephalad of the scutellar fovea; C, propodeum; D, metanotum.

about 1/3 their own diameter; ocell-ocular distance = 1.2× ocellar diameter; apex of ocellar triangle including an angle of about 135°. Face rather flat and shiny, with strong metallic reflections and numerous medium-sized punctures that are shallow and well separated; area behind ocelli rounded and with metallic sheen and fine shallow punctures, no smooth glabrous concavity here such as occurs in *Hypomicrogaster*.

Color black, the following parts fuscous to pale yellow: clypeus, mouthparts, scape below, tegula and wing bases, fore- and middle legs (including coxae), sides and venter of abdomen, third tergum. Hind legs black, but yellow as follows: apical 0.3–0.5 of coxa, trochanter, basal 0.3 of femur, basal 0.6 of tibia, spurs, basal 0.4 of basitarsus.

Variation, females: individuals from extremes of the range tend to be darker, in particular the middle femur and apical half of mid tibia are brown; only basal 0.1 of hind femur and apical 0.1–0.3 of hind coxae are yellow; tergum III variegated yellow and dark brown.

Males: resembling females in color variation but averaging a little less yellow; antenna 1.1× as long as forewing with F1 14 L/W = 2.0.

The species appears common and widespread in the Neotropical lowland rainforest. It ranges from southern Mexico to Rio de Janeiro.

Holotype: ♀, ***Ecuador***, **Pichincha**, Tinalandia, a resort 16km. southeast of Sto. Domingo at 680 m. June 1975 S.&J. Peck (CNC No. 15776).

Paratypes: ***Mexico***, **Chis.**, 7♂♂, 2♀♀, 440 m, Muste near Huixtla, Oct. 1970, E. Welling; ***Belize***, 1♂, 1♀, 125 m, Middlesex, Apr. 1965, E. Welling; ***Panama***, **C.Z.**, 2♂♂, Gamboa, July 1967, W.&M. Wirth; 1♀, Barro Colorado 19 July 1965; ***Ecuador***, **Pich.** 3♂♂, 6♀♀, same data as type; 15♂♂, 27♀♀, 200m, Rio Palenque Stn. Sto. Domingo; 1♀, **Napo**, Limoncocha, June 1976, S. Peck. **Peru** (or **Ecuador**), 2♂♂, 2♀♀, 1963, L.E. Pena; ***Trinidad***, 2♂♂, 1♀, Simla [Arima] 18-20 Aug. 1969, H.F. Howden; ***Brazil***, **Guanabara** 2♂♂, 8♀♀, Represa Rio Grande; **R. de J.** 1♀, Mangaritiba, Muriqui. Types in CNC, Amer. Ent. Inst.

P. virbius (Nixon) new comb., the only other species of the genus, differs in its much more transverse tergite II with granular surface and arcuate hind margin and in the hind leg color, the entire coxa, and basal 0.9 of hind femur being yellow.

11. *Apanteles* Foerster 1862

Figs. 41, 42

Type: *Microgaster obscurus* Nees 1834.

Synonyms: *Urogaster* Ashmead 1898. Type: *U. vulgaris* Ashm., 1900
Allapanteles Brèthes 1915. Type: *A. cecidiptae* Brèthes, 1915
Xestapanteles Cameron 1910. Type: *X. latiannulatus* Cameron, 1910

I have studied the holotypes of *vulgaris*, *cecidiptae*, and *latiannulatus*.

Hypopygium large, pointed, and usually bearing a series of longitudinal striae medially but at least always sharply folded medially; ovipositor sheath usually long and always hairy throughout, arising near or at apex of valvifer, rarely as short as half the hind tibia; ovipositor long and usually gently decurved and gradually tapered. Short hypopygium without folds usually correlated with short ovipositor.

Tergite I much longer than wide and approximately parallel-sided or barrel-shaped to strongly tapered apically, usually bearing a longitudinal apical depression medially; tergite II wider than long, the sides weakly to strongly diverging apically; tergum III a little, to much, longer than II.

Propodeum coarsely sculptured to smooth, never showing even a trace of a median longitudinal carina but instead with a more or less well-defined areola and costulae (the costulae are frequently absent but usually the areola is traceable as a U-shaped area or median depression extending forward from the abdominal fovea); in extreme cases propodeum is uniformly smooth or sculptured and ecarinate. Anterior margin of metanotum bearing a conspicuous pair of lateral setiferous projections. Mesonotum coarsely to finely sculptured,

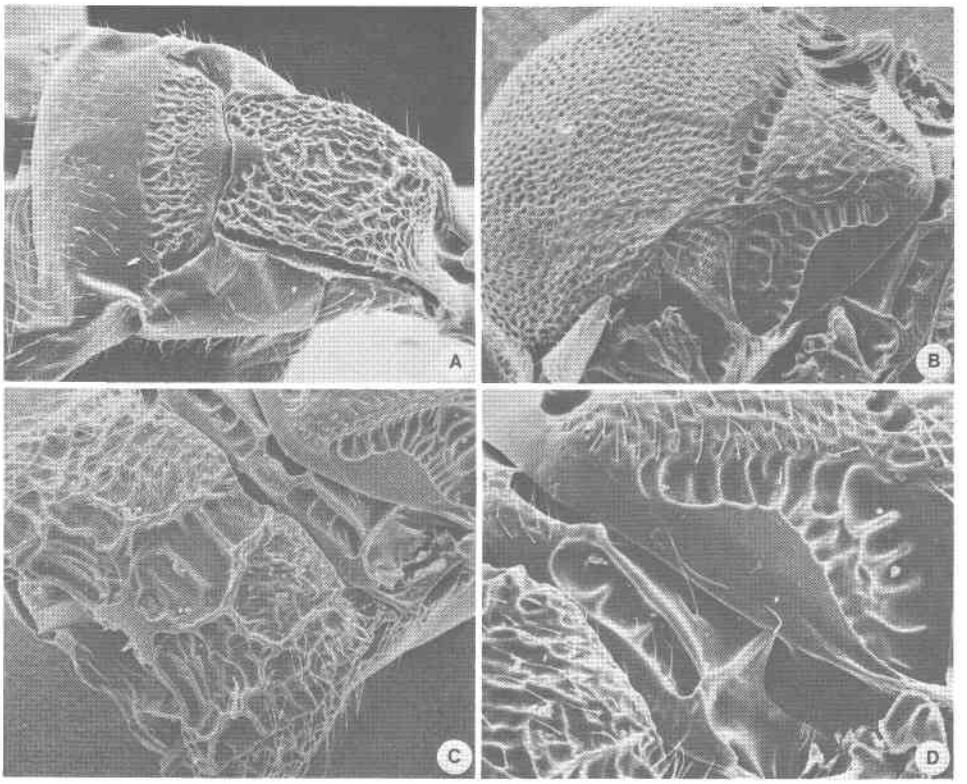


FIG. 41. *Apanteles ensiger* (Say). A, base of abdomen; B, mesonotum showing patches of aciculorugose sculpture in front of scutellar scrobe; C, propodeum; D, metanotum showing acute sublateral setose lobe.

usually the posterior part of the notauli, just in front of the scutellum, defined by sublateral areas of denser sculpture that usually break into patches of longitudinal striae.

Margin of vannal lobe typically concave and hairless on the posterior part but often nearly straight or bearing a few short hairs or both and, in extreme cases convex, though the curve is somewhat flattened and sparsely hairy.

Larva. Last instar with a long-bladed mandible bearing a row of 15–25 large teeth that arise along the whole length of the blade; labial hairs 2, each maxilla with 1 hair; skin covered with papulae that bear spinules about as long as the width of the papule.

HOSTS. The larvae are solitary in Microlepidoptera with a few exceptions to both generalities. Nixon (1965) lists four gregarious species: *A. clita* Nix., *sagax* Wilkn., *taragamae* Vier, *ater* Ratz., and I know of two others in North America, *A. megathymi* Riley and *cacoeciae* Riley. Nixon (1965) also lists nine species said to have been reared from Macrolepidoptera but some of the associations are based on single rearings and need to be confirmed. Others, having been repeated, seem to be reliably established: *A. taragamae* Vier., *eublemmae* Nix., *edwardsi* Riley, and *megathymi* Riley.

RANGE AND CONTENTS. Even in this narrowed concept *Apanteles* is still a huge genus. I estimate about 2000 species in all parts of the world. I assign the following species to *Apanteles*: (***ater* group**) Nearctic — *A. aristoteliae* Viereck, *A. baldufi* Muesebeck, *Microgaster carpata* (*-us*) Say, *A. canarsiae* Ashmead, *A. conanchetorum* Vier., *M. crassicornis* Provancher, *A. depressariae* Mues., *A. edwardsii*

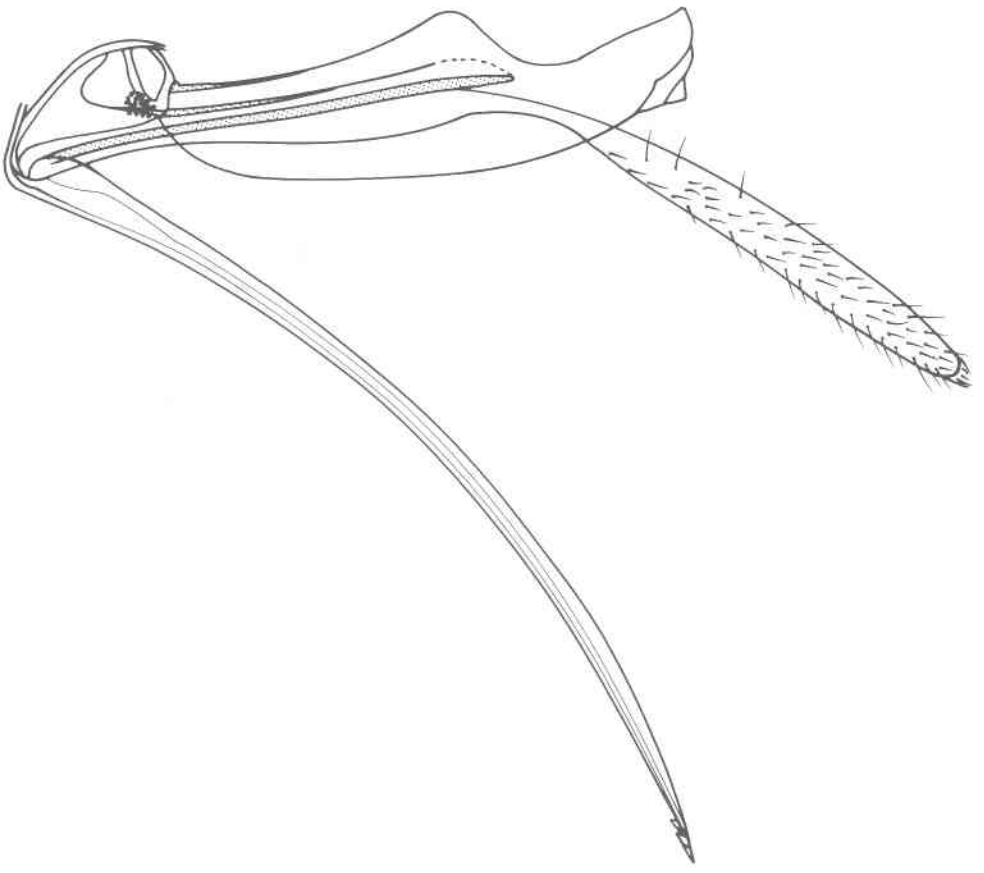


FIG. 42. *Apanteles obscurus* (Nees). Female genitalia.

Riley, *M. ensiger* Say, *A. epinotiae* Vier., *A. forbesi* Vier., *A. fumiferanae* Vier., *A. harti* Vier., *A. laevicoxis* Mues., *Urogaster leucostigmus* Ashm., *A. megathymi* Riley, *A. milleri* Mason, *A. mimoristae* Mues., *A. morrisi* Mason, *M. nephopterícis* Packard, *A. paranthrenidis* Mues., *A. plesius* Vier., *A. polychrosidis* Vier., *A. pseudoglossae* Mues., *A. starki* Mason, *A. thurberiae* Mues. Palearctic — *M. ater* Ratzeburg, *A. calpurnia* Nixon, *A. galleriae* Wilkinson, *A. lenea* Nix., *M. obscurus* Nees, *M. xanthostigma* Haliday. Neotropical — *A. vulgaris* Ashm. (= *A. xanthopus* Ashm.). (***metacarpalis* group**) Nearctic — *A. cockerelli* Mues., *A. dakotae* Mues., *A. feltiae* Vier., *A. laricellae* Mason, *A. monticola* Ashm., *A. niger* Mues., *A. petrovae* Walley, *A. pequodorum* Vier., *A. scutellaris* Mues., *A. stagmatophorae* Gahan, *A. victoriae* Mues. Palearctic — *A. brittanicus* Wilkn., *M. coniferae* Hal., *A. firmus* Telenga, *M. laevissimus* Ratz., *A. metacarpalis* Thomson, *A. murinanae* Capek and Zwoelfer, *A. turkmenus* Tel. (**other groups**) *M. lacteus* Nees, *M. longipalpis* Reinhard, *A. caesar* Wilkn., *A. trifasciatus* Mues., *A. calycinae* Wilkn., *A. phaenna* Nix., *A. pycnos* Nix.

REMARKS. This is the nominate group of the old *Apanteles s.l.* but unfortunately the larger (and, in temperate areas, much commoner) group F (now called *Cotesia*) has usually been regarded in textbooks as "typical" *Apanteles*; in fact that is how Ashmead (1900) treated them when he subdivided *Apanteles*, using *Apanteles* for

what I now call *Cotesia*, and applying *Urogaster* to the group properly called *Apanteles*.

As I now define it, *Apanteles* comprises chiefly the very large, diverse, and worldwide "*ater*" group of Nixon (1965). In addition I include the small, mostly Old World tropical groups that Nixon (1965) called *taeniaticornis*, *mycetophilus*, *trifasciatus*, *caesar*, and *grandiculus*. *Apanteles* also includes *A. crassicornis* (Provancher) and probably most of the *metacarpalis* group.

Apanteles is characterized by 1, long hairy ovipositor sheath; 2, medially folded and striate hypopygium; 3, areolate propodeum; 4, posterolateral punctation of scutum breaking down into aciculations; 5, margin of vannal lobe concave and hairless; 6, first tergite with apex as wide as, or narrower than, base and bearing a median apical trough; 7, second tergite wider than long. Unfortunately these characters break down to greater or lesser extent in this large and variable genus, making some species difficult to separate from members of other genera, especially *Dolichogenidea*. I discuss the phylogeny and separation of *Dolichogenidea* and *Apanteles* in the next section.

Phylogeny of *Apanteles* and *Dolichogenidea*

Fig. 43

Nixon (1965) defined two species groups within his *Apanteles* which he called *ater* and *ultor*: the former contains *obscurus*, type of *Apanteles* Foerster. The *ultor* group grades, through many intermediate forms, into the *laevigata* group which contains *banksi*, the type of *Dolichogenidea* Viereck. Both the *ater* and *ultor* groups are typically made up of species with fully carinated propodeum, a feature that I hold to be plesiomorphic in the subfamily. These two groups are amply distinguished by the table below.

	Dolichogenidea (*ultor* group)	*Apanteles* (*ater* group)
Margin of vannal lobe: shape	Convex, rarely flattened	Concave to straight
hair	Uniformly hairy	Hairless or sometimes sparsely hairy
Punctures on scutum	Well separated, never aciculate posteriorly	Often confluent, usually aciculate posteriorly
Shape of tergite I	Slightly broader apically to parallel-sided	Parallel-sided to strongly tapered apically
Posterolateral areas of propodeum	Wider than tall	About as wide as tall

I know of no immediate relatives of the *ultor* group that show any more plesiomorphic condition. The *ater* group seems to be comparatively apomorphic at least in regard to the vannal lobe and sculpture of the scutum but it has a very close relative, *Papanteles*, that is more plesiomorphic than either *Apanteles* or *Dolichogenidea* in having 3 orbital cells in the forewing. The large Neotropic genus *Hypomicrogaster* cannot be ancestral to the *ultor* group because the former has 3 apomorphic features not found in *Dolichogenidea*: 1, concave, hairless vannal lobe margin; 2, a polished concave postoccipital area; 3, a complete median propodeal carina.

Both *ater* and *ultor* groups have a tendency to lose the propodeal carination or to reduce the strength of sculpture on the scutum or to have both reductions. In fact the many extant species represent an almost continuous range of reductions, the

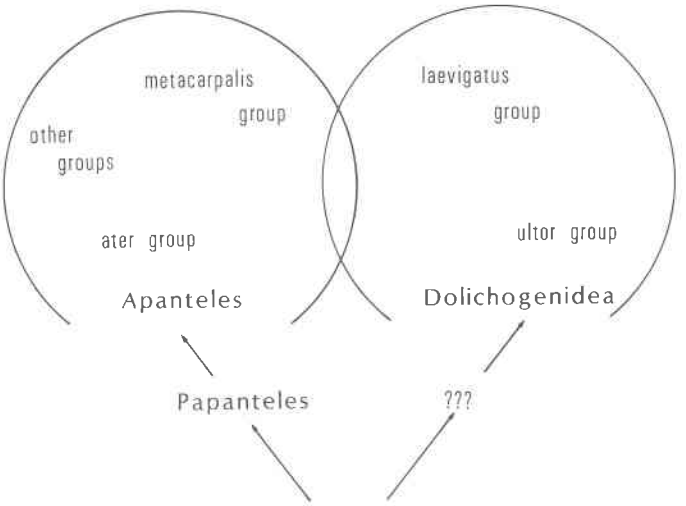


FIG. 43. Phylogenetic relationship between *Apanteles* and *Dolichogenidea*.

most reduced species in both *Apanteles* (*metacarpalis* group) and *Dolichogenidea* (*laevigata* group) having a smooth, almost featureless propodeum and smooth scutum with punctures subdued throughout, sometimes to the vanishing point posteriorly. In spite of this convergence, members of the *metacarpalis* group usually have an apically narrowed tergite I (rarely, and never strongly, narrowed in the *laevigata* group) and the margin of the vannal lobe hairless to sparsely hairy and weakly concave to flattened convex (convex and always hairy in *laevigata* group).

The distinctions mentioned above, in practice, boil down to deciding: 1, how much narrowed apically is the first tergite; 2, how densely hairy is the vannal lobe, and 3, how strongly convex. The answers to these questions come more easily with experience but they are still arbitrary decisions in practice. Unfortunately this is the grey area to which the convergence in evolution seems to lead, and I can see no better solution until new characters are found or a new hypothesis can be developed. My ideas on these relationships are shown diagrammatically (Fig. 43).

Another way to handle the convergence between the groups of *laevigata* and *metacarpalis* might be to unite them as one genus but then there would be two continua, one leading to the *ultor* group, the other to the *ater* group: not, I think, an improvement. Furthermore, I believe the group thus created would be artificial.

12. *Alphomelon* new genus

Fig. 44

The name is neuter, and refers to the white spot on the cheek, a characteristic feature.

Type: *Urogaster nigriceps* Ashmead 1900.

Hypopygium of female short, evenly sclerotized from side to side without a series of longitudinal creases near the middle but often with a sharp median fold at the apical 0.1. Ovipositor sheath short to medium length, but not longer than hind tibia, hairy throughout and arising from the distal end of the valvifer; ovipositor weakly, evenly decurved.

Tergite I a little longer than wide, nearly parallel-sided, the apical width 0.8-1.3× basal width. Tergite II much wider than I and much shorter than III, subrectangular and 3-4× wider than long. Tergite I almost always with a narrow longitudinal median groove on the apical half; sides of the groove elevated to sharp ridges anteriorly, the ridges meeting in

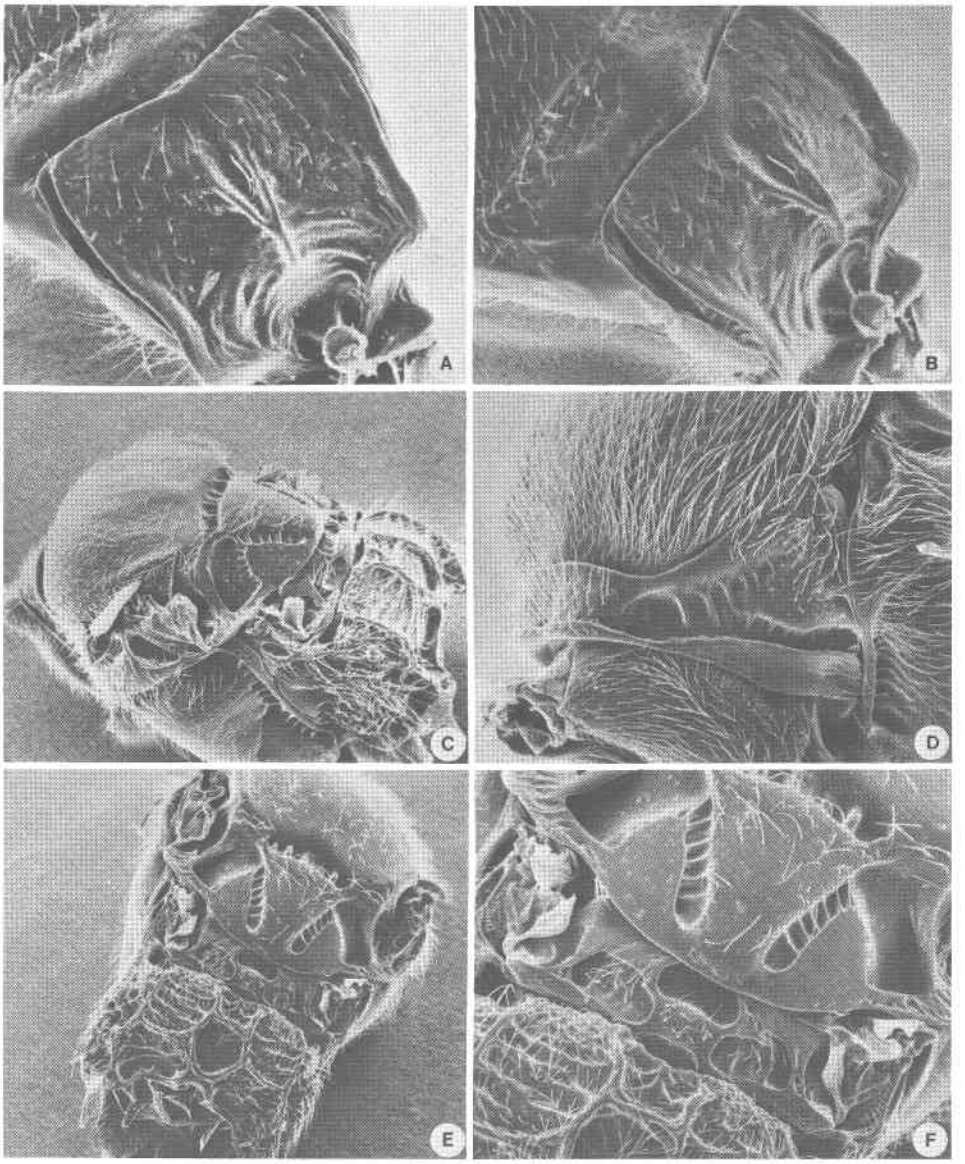


FIG. 44. *Alphomelon nigriceps* (Ashm). A, B, base of abdomen to show median groove and ridges on tergite I; C, alitrunk showing smooth mesonotum and large triangular scutellar lunules; D, pronotum; E, propodeum; F, metanotum to show low setiferous lobe.

front of the groove but not continuing far cephalad (some Central American species have the groove and ridges subdued almost to vanishing point). Sculpture of tergites I and II usually subdued, rarely coarse.

Propodeum coarsely sculptured and strongly areolated; areola elongated, its lateral carinae continuing cephalad to enclose a more or less parallel-sided area extending to the anterior margin of the propodeum; costulae and lateral longitudinal carinae strong.

First abscissa of radius curved, convex on outer side, about twice as long as first intercubitus; submedian vein deflected downward near its mid-length and there giving rise

to a faint anellan. Margin of vannal lobe hairless, usually concave, but sometimes almost straight. Tarsal claws usually pectinate, with 1-3 strong basal teeth.

Cheek with a whitish, partly translucent, spot. The spot normally extending from edge of mandible cavity to lower edge of eye and to tentorial pit but rarely smaller. Lower part of head often elongated.

Larva. Unknown.

HOSTS. Two of the described species have been reared from Hesperiidae. If this is a general habit among *Alphomelon* their choice of host is unusual for the tribe in as much as Hesperiidae (and other butterfly larvae) behave as Macrolepidoptera so far as the parasites they attract.

RANGE AND CONTENTS. The species are numerous, mostly Neotropical and undescribed, but a few enter the Nearctic Region, one (*disputabile* Ashmead) being widespread from the West Indies to Quebec. I assign here *Urogaster nigriceps* Ashmead, *U. disputabilis* (*-e*) Ashmead and *A. talidicida* Wilkinson.

REMARKS. Members of the genus are large (3-6 mm) and highly distinctive. The white cheeks are not exclusively found in *Alphomelon*. They are rare but are found sporadically in several unrelated genera, especially in the Indo-australian fauna.

13. *Illidops* new genus

Fig. 45

The name is from Greek, meaning squint-eyed, in reference to the characteristic convergence of the lower eye margins. Ending in *-ops* the name must be masculine (Art. 30).

Type: *Apanteles butalidis* Marshall 1883.

Ovipositor sheath long and hairy throughout; hypopygium large, centrally with a series of striae. Tergite I rugose, parallel-sided, barrel-shaped, or apically narrowed, often with indication of a median apical trough; tergite II weakly to strongly transverse, almost rectangular to broadly triangular or almost lenticular, the surface usually rugose but sometimes weakly sculptured. Terga densely hairy, the hairs mostly pointing posteromesad; posterior terga with broad medioapical desclerotized areas that often give dry specimens the appearance of having the terga pushed forward medially.

Propodeum usually mostly uniformly rugose but a few species weakly sculptured, mostly shining; propodeum never with trace of areolet or median carina. Anterior margin or metanotum with low, rounded sublateral setiferous lobes. Apical polished band of scutellum interrupted medially by sculpture. Lateral lunules flat, widest at posterior end.

Ocelli in a flat (170°) to moderate (110°) triangle; inner margins of eyes usually strongly (occasionally, especially in males, weakly) convergent below; eyes usually strongly bulging above malar space.

Radius always distinctly slanting outward, about as long as intercubitus and meeting it at an angle of 130°±; metacarpus short; margin of vannal lobe almost straight to weakly convex and usually sparsely hairy.

Larva. I have not seen larvae of this genus but Short (1953) assigns larvae of *A. butalidis* Marshall to group S or U, that is to say to the tribe Apantelini. Apparently the larvae are solitary.

HOSTS. Reared from Psychidae and Scythridae.

RANGE AND CONTENTS. *Illidops* seems to be especially well adapted to arid regions; about half the species I know come from desert or arid regions in the southwestern U.S.A., the Mediterranean area, and Middle Asia. I place here *Apanteles butalidis* Marshall, *A. szaboi* Papp, *A. urgo* Nixon, and about nine undescribed species from northern Mexico and southwestern U.S.A. as well as one or two from the Canadian Arctic and Rocky Mountains.

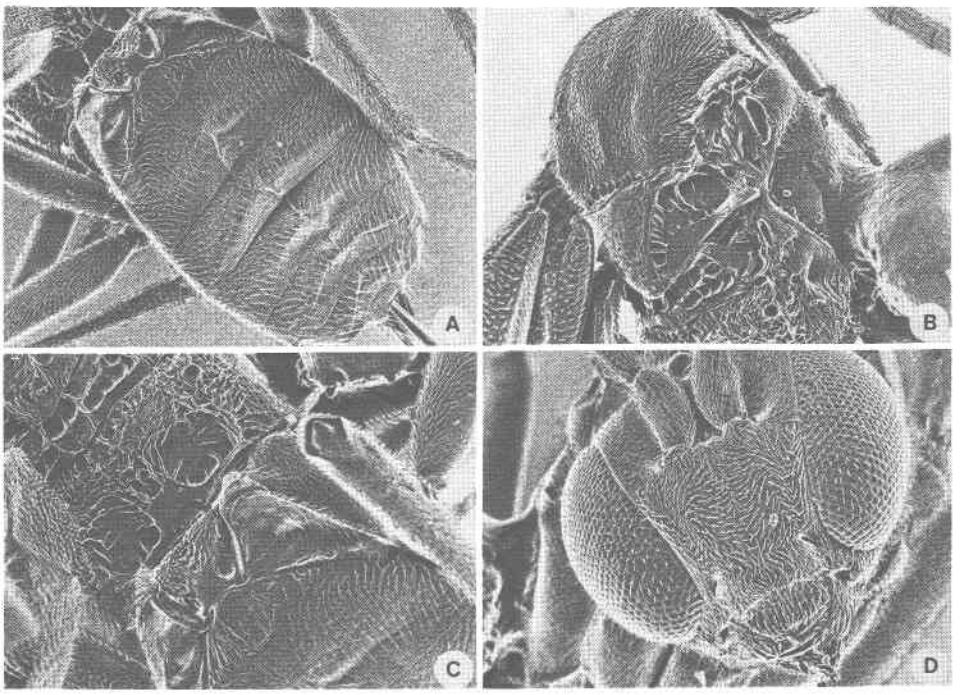


FIG. 45. *Illidops* sp. A, abdomen to show hair pattern and desclerotized margins of terga; B, mesonotum and metanotum; C, propodeum to show traces of areolation, and tergite I to show weak medioapical hollow; D, head to show convergent eyes.

REMARKS. The propodeum having neither median carina nor areolet makes placement of this genus difficult. However, many species show a shallow medioapical depression on tergite I — a feature common among Apantelini but not found in Microgastrini.

14. *Eocardiochiles* Brues 1933

Type: *E. fritschii* Brues 1933.

I have not seen this fossil (Baltic amber) and can add nothing to the description.

REMARKS. The "18-jointed antennae" are a very strong indication that this is Microgastrinae and not Cardiochilinae. Furthermore there is nothing in the description contraindicative to microgastrine affinities. The interradiellan (r) is unlikely to be visible in a fossil so I think its absence can be discounted. I have grouped this genus near *Pelicope* and *Semionis* only because of the large areolet. I doubt if the three are at all closely related.

15. *Pelicope* new genus

Figs. 46, 47

The name is feminine and is derived from Greek, meaning "how large a hole" in reference to the second cubital cell: the largest I know in any microgastrine.

Type: *Pelicope yuccamica* n. sp.

Hypopygium large, with median folds; ovipositor sheaths long and hairy throughout, arising distally on the valvifers.

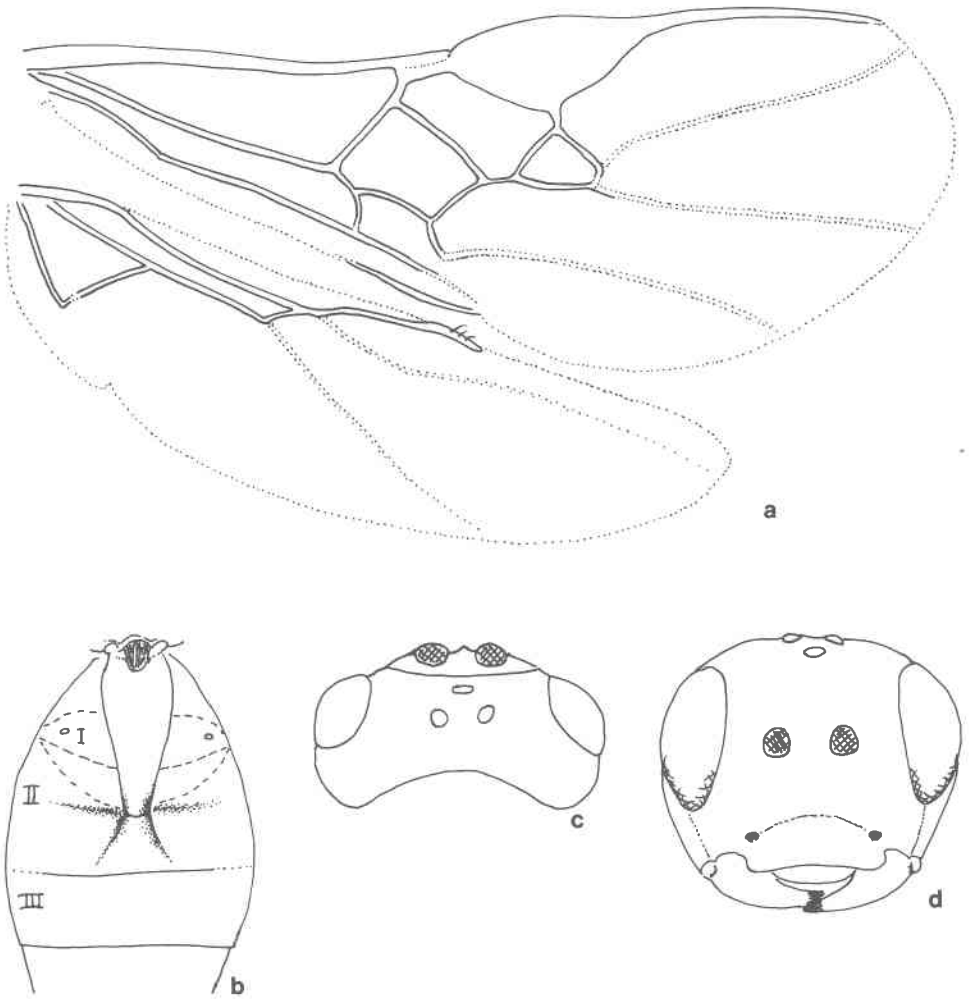


FIG. 46. *Pelicope yuccamica* Mason. a, wings; b, base of abdomen; c, d, head.

First tergite smooth, tapering apically; a subtriangular second tergite weakly defined by shallow, apically divergent grooves; tergum III about 1.5× as long as II; all terga smooth and polished.

Propodeum completely polished and unsculptured, strongly declivous. Notauli long but shallow; sides of pronotum without trace of any grooves.

Second cubital cell irregularly quadrangular and extremely large, more than half as large as stigma; submedius with a strong deflection at basal third. Intercubitella and interadiella absent without even a trace visible by reflected light. Distal half of vannal lobe with the margin weakly convex and bearing only a few hairs. First abscissa of discoideus about half as long as second abscissa.

Tibial spurs short, those of middle leg about half as long as basitarsus, those of hind leg equal to one another and about .3 as long as basitarsus; tarsal claws simple.

LARVA AND HOSTS. Unknown but adults have all been taken on Yucca flowers indicating a possibility that *Pronuba* larvae could be the host.

REMARKS. The two outstanding characteristics of the genus are both rare in Microgastrinae but make a unique combination, because the very large second cubital

cell is plesiomorphic whereas the loss of intercubitellan and interradiellan veins is apomorphic within the subfamily. The almost totally yellow coloration is, as far as I know, shared by only one other species, *Distatrix teapae* (Nixon), in the Nearctic microgastrine fauna.

The venation (forewing) resembles that of *Eocardiochiles* (Brues 1933) from Baltic amber but generic identity is precluded by several characters of the fossil such as: eyes very large and almost contiguous with mandibles; notauli narrow, distinct; middle mesonotal lobe raised; body and legs very hairy; face and clypeus rugose; first and second abscissae of discoideus about equal.

Pelicope yuccamica new species

Figs. 46, 47

Holotype, female: length 3.3 mm (excluding ovipositor); forewing length 3.2 mm; antenna 2.2 mm.

Ovipositor sheath about 10% longer than hind tibia and ⅔ as deep, tapering a little toward base and apex; apically rounded and without an evident paintbrush-like appendage. Exserted part of ovipositor straight. Hind tibia without any larger bristles on outer surface except a few near apex.

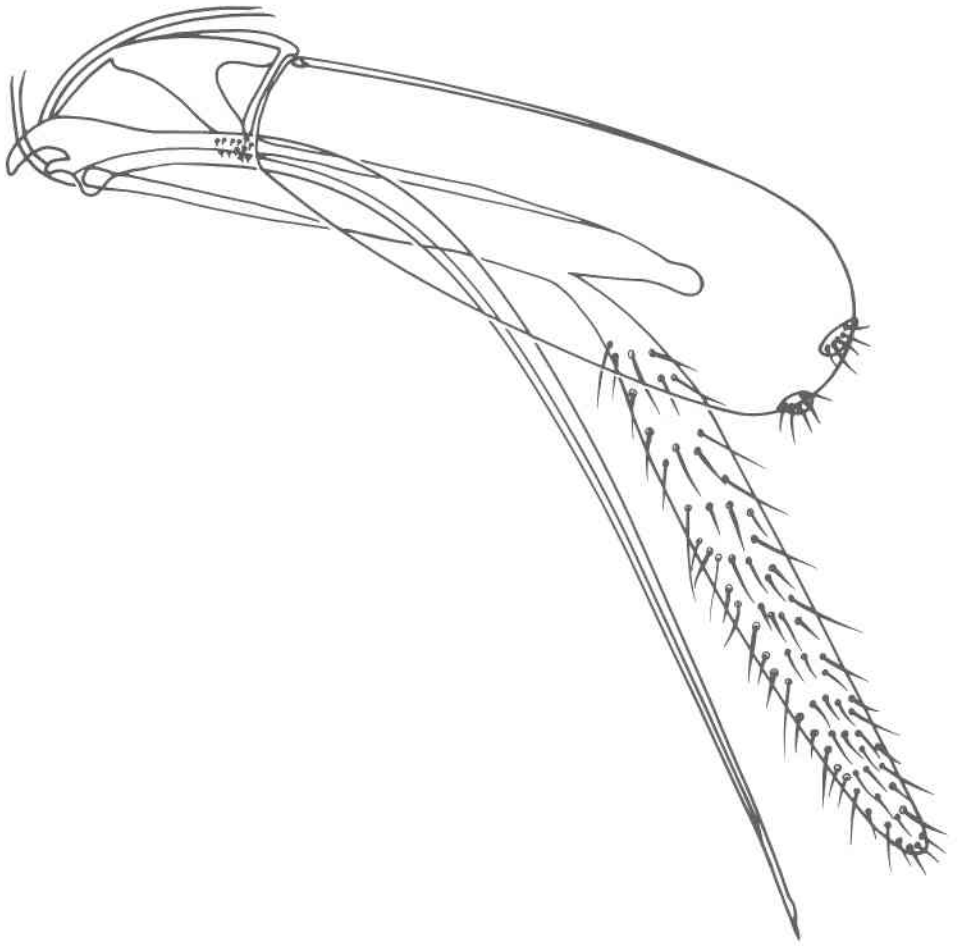


FIG. 47. *Pelicope yuccamica* Mason, female genitalia.

Tergite I about twice as long as its basal width, the sides apically converging, more strongly so in the apical third; apical width about 1/3 of basal width; surface of first tergite completely smooth and hairless, convex apically, flat centrally and concave basally. Tergum II about 4 1/2 times wider than long medially and with a small central raised area defined by strong grooves diverging from the apical corners of tergite I; the truncate pyramidal area thus formed about 1.7× wider than long and about 40% as wide as entire tergum. Third tergum almost twice as long as tergum II and completely smooth, as is the rest of the abdomen.

Notauli very shallow and unsculptured but about half as long as mesoscutum; mesoscutum with the posterior and median half flat, highly polished, and almost completely hairless and impunctate, the lateral quarters and anterior half densely but not deeply, punctate and hairy. Prescutellar scrobe very shallow, the suture a chain of pits that is strongly convex anteriorly and includes a larger compound median pit. Scutellum rather flat and polished, finely and moderately punctate, its posterior band completely polished, lateral faces with very low lunate areas. Propodeum completely polished and glabrous, the surface composed almost entirely of the rather flat posterior declivity, the anterior part merely a rounded rim.

Head unusually wide and thin, width/median length = 2.5. Antenna showing no taper, the hairs very short, giving a rather smooth appearance to the flagellum. Flagellomere porportions: 2 L/W = 3.2; 14 L/W = 2.0; L 2/14 = 1.6; W 2/14 = 1.0. Apex of ocellar triangle including an angle of 100°; ocelli small, separated from eyes by about 3 times their own diameter. Mouth opening obviously wider than face.

Color: totally yellow except for eyes, ommatidium, antennae (except scape), ovipositor sheaths, apex of hind femur above, hind tibia and hind tarsus, which are black to piceous. Wings hyaline, veins and basal third of stigma translucent yellow, balance of stigma brown.

Variations: antenna of male about as long as forewing, articles longer than those of female.

Holotype: ♀, **U.S.A., CA**, Riverside Co., Upper Deep Canyon at Horsethief Creek, 3400 ft [1000 m] 11 June 1965, E. Schlinger (USNM). Paratypes: 3♂♂ CA same data but taken on *Yucca*; 2♀♀, San Jacinto Mts., Pinon Flat, 4 June 1939, E.G. Linsley (USNM).

16. *Semionis* Nixon 1965

Fig. 48

Type-species: *S. rarus* Nixon.

Known from a unique male specimen only. Tergite I strongly narrowed apically, completely smooth and polished except for a small area of hairs and roughening apically; tergum II with a partly defined subtriangular median area; terga II and III smooth and polished, the suture between them scarcely visible; terga behind II uniformly and densely hairy.

Propodeum smooth, a partial transverse carina laterally behind the spiracles; many fine striations radiating from the foramen and a transverse band of striations medially, extreme base sparsely punctate. Anterior margin of metanotum slightly retracted laterally, the lateral setose lobe broad; scutellar margin smooth, lunules normal; notauli absent. Areolet very large; intercubitella (2m-cu) absent; brachiella (2nd 1A) present.

Mouth resembling that of a cyclostome braconid (figured by Nixon 1965), the clypeus strongly transversely swollen, its apical half reflexed inward and strongly concave along the margin.

LARVA AND HOSTS. Unknown.

RANGE AND CONTENTS. Known from only the type specimen collected near the south coast of South Africa.

REMARKS. The large areolet and brachiellan vein mark this as a primitive genus but there are enough unique or unusual derivative features that it is obviously phylogenetically isolated.

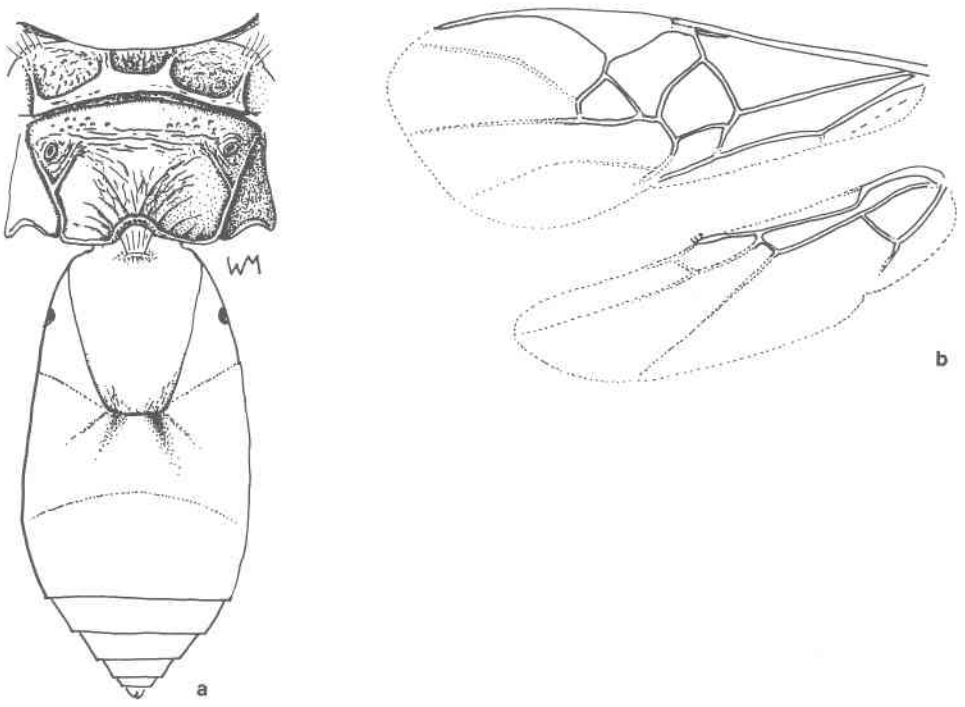


FIG. 48. *Semionis rarus* Nixon. a, abdomen and part of thorax; b, wings.

MICROGASTRINI

Ovipositor sheath longer than half the hind tibia and always hairy throughout its length (except for extreme, unpigmented, proximal part; arising from valvifers distally). Hypopygium usually large and usually (95%) desclerotized medially and there striate and often folded.

Tergite I usually (85%) longer than broad (L/W = 1.5-2.5) but sometimes approximately as long as wide, in which cases the laterotergites can scarcely be seen from above; without an apical median depression but a few (20%) almost all in the New World, have a sharp longitudinal groove on the basal half or more. Tergite II variable, most often rectangular and little shorter than tergum III but occasionally small and subtriangular or square and larger than tergum III.

Propodeum almost always (99%) with a strong, percurrent median carina; sometimes (25% in New World, rarely in Old World fauna) propodeum with transverse carinae or wrinklings in addition to the median carina, these sometimes forming a variably distinct areola. Metanotum almost always (97%) with the sublateral setose lobes low and closely appressed to the hind margin of the scutellum, but the phragma broadly exposed in two scarce genera (*Sathon* and *Clarkinella*). Prepectal carina always absent; notauli strong in a few small genera. Pronotum almost always with both upper and lower grooves but rarely smooth.

Antennal articles mostly with 2 ranks of placodes, but one genus (*Hygroplitis*) with placodes in 3-4 ranks or irregular.

Larval anatomy and choice of hosts similar to Apantelini.

QUICK DIAGNOSIS. Hypopygium usually long and usually medially striate; ovipositor sheath long and completely hairy. Propodeum almost always with complete median longitudinal carina, seldom with other carinae.

KEY TO GENERA OF Microgastrini

*Couplet halves containing only a few individuals with restricted distribution.

1. Propodeum with a transverse carina or a variably developed areola or transverse band of rugosity in addition to the usual median carina 2
– Propodeum with only a median carina or, rarely, none at all 6
2. *Notauli deep and smooth, reaching scutellar scrobe separately; vannal lobe very small and lanceolate (xanthic neotropical species) .. (18) *Prasmodon*
– Notauli absent or very inconspicuous, rarely (1%) present posteriorly; vannal lobe normal 3
3. Propodeum usually with an areola bisected by a median carina; vannal lobe concave; back of head with a sharply defined large concave area that is constrastingly polished and glabrous; tergite I wider apically with large separate punctures; hypopygium striate medially (New World) ..... (17) *Hypomicrogaster*
– *Propodeum without areola; vannal lobe convex; hypopygium not striate 4
4. *Anterior margin of metanotum withdrawn from scutellum and bearing sharply protruding lateral setose lobes; areolet minute, triangular; tergite I strongly tapered apically (New World) ..... (19) *Clarkinella*
– Anterior margin of metanotum closely appressed to scutellum; areolet open or larger; tergite I weakly or not tapered apically 5
5. *Tergite I with basal sharp median groove; areolet open (2r-m absent); mesonotum coarsely punctate (South Africa) ..... (21) *Xenogaster*
– *Tergite I with no basal groove; areolet usually closed (2r-m present); mesonotum smooth and almost impunctate posteriorly (Holarctic and Oriental mountains) ..... (20) *Paroplitis*
6. Basal hollow of tergite I broadly U-shaped in cross-section: thus no sharp basal median groove 7
– Basal part of tergite I resembling the cusp of a cycloid curve in cross-section: thus a sharp basal groove present 13
7. Areolet open (2r-m missing) 8
– Areolet closed (2r-m present) 11

NOTE: *Choeras* will run through both sides of couplet 7

8. Margin of vannal lobe straight or concave and hairless or sparsely hairy; nervellus (Cu&Cu-a) sinuate; scutellar lunule large, triangular ..... (23) *Iconella*
– Margin of vannal lobe convex and evenly hairy; nervellus convex; scutellar lunule arcuate 9
9. Male claspers widening posteriorly and usually apically truncate, sometimes grossly enlarged; hypopygium without median striation; ovipositor sheaths polished and sparsely hairy; anterior margin of metanotum without setose lobes, withdrawn from scutellum exposing the phragma, or postnotum (Holarctic, mostly W. North America) ..... (25) *Sathon*
– Male claspers normal, rounded apically; hypopygium usually striate; metanotum almost always appressed to scutellum and always bearing setose lobes which are plainly visible if the scutellar phragma is exposed 10
10. *Scutellar band interrupted medially by sculpture; notauli strongly marked posteriorly by deep indentations or special sculpture (Nearctic) ..... (27) *Rhygoplitis*
– Scutellar band continuous; notauli scarcely traceable, mesonotum usually smooth posteriorly ..... (24) *Choeras*

11. Tergite I parallel-sided or narrowed posteriorly, the laterotergites usually visible from above; tergite II shorter than III and its sides often sloping so that it does not appear rectangular ..... (24) *Choeras*

– Tergite I broadened posteriorly and occupying full width of the tergum so that the laterotergites are scarcely visible from above; tergite II rectangular, longer than tergum III 12

12. *Horizontal faces of propodeum and tergite I very much longer than their respective vertical faces and their directions sharply different; mesonotum posteriorly depressed and coarsely rugose punctate; apical tarsomeres greatly enlarged, about twice as wide as preceding articles; longitudinal placodes of flagellomeres irregularly arranged or sometimes partly in 3 ranks (Holarctic) ..... (22) *Hygroplitis*

– Propodeum and tergite I with respective horizontal and vertical faces about equal and gradually merging through a long curve; mesonotum relatively smooth and not depressed posteriorly; apical tarsomeres of normal size; placodes mostly arranged in 2 clearly defined ranks on each flagellomere (mostly Holarctic, common) ..... (26) *Microgaster*

13. *Tergite I widened posteriorly and occupying full width of the tergum; nervellus (1Cu&Cu-a) strongly sinuate; areolet closed (2r-m present) (Neotropical) ..... (28) *Xanthomicrogaster*

– Tergite I usually narrowed posteriorly; nervellus straight or convex outwardly; areolet open (2r-m absent) (New World) ..... (29) *Pseudapanteles*

17. *Hypomicrogaster* Ashmead 1898

Fig. 49

The name is feminine.

Type: *Microgaster zonaria* Say.

Hypopygium large, but sometimes short, always folded and with median striae; ovipositor sheaths 0.3–1.3× as long as hind tibia and hairy throughout.

Tergite I broadly excavated basally, longer than wide and broadened apically, the laterotergites scarcely visible from above; surface usually smooth with few to abundant coarse separate punctures and a few apical aciculations, often with a poorly marked median subapical impression. Tergite II subrectangular, with apical margin arcuate, 2–4× wider than long, the surface smooth to weakly sculptured and punctate; third tergum much longer than second.

Propodeum rounded and rugulose to punctate with more or less defined areola, costulae and median carina (the areola and median carina make a very unusual and diagnostic combination). Anterolateral corners of metanotum with a hair tuft; apical band of scutellum smooth and uninterrupted. Mesonotum smooth and appearing to be without microsculpture between the coarse separate punctures. Sides of pronotum with upper and lower grooves present.

Occipital region of head with polished, impunctate, glabrous, concave area occupying about half the width of the head, touching the ocelli and contrasting strongly with the convex, punctate and hairy occiput either side. Ocelli large and lying in a low triangle with apical angle at least 135°.

Second intercubital vein (2r-m) very small, meeting the first intercubitus far from the junction of the radius (2r) and 1st intercubitus (Rs) (Fig. 49e); the areolet triangular and small, often very small and easily overlooked because of the transparency and shortness of the 2nd intercubitus (2r-m). First cubitellan cell (1Rs) longer than wide; nervellus (cu-a) meeting submediella (1A) at a distinct, approximately right, angle. Vannal lobe concave and hairless or sparsely hairy.

Larva. Mandibles with a long blade bearing about 20 long teeth; palpi long; labium with 2–4 setae, each maxilla with 1 seta; skin papulae with long spines (Fig. 105A).

HOSTS. Microlepidoptera in leaf-mines or other burrowing habitats.

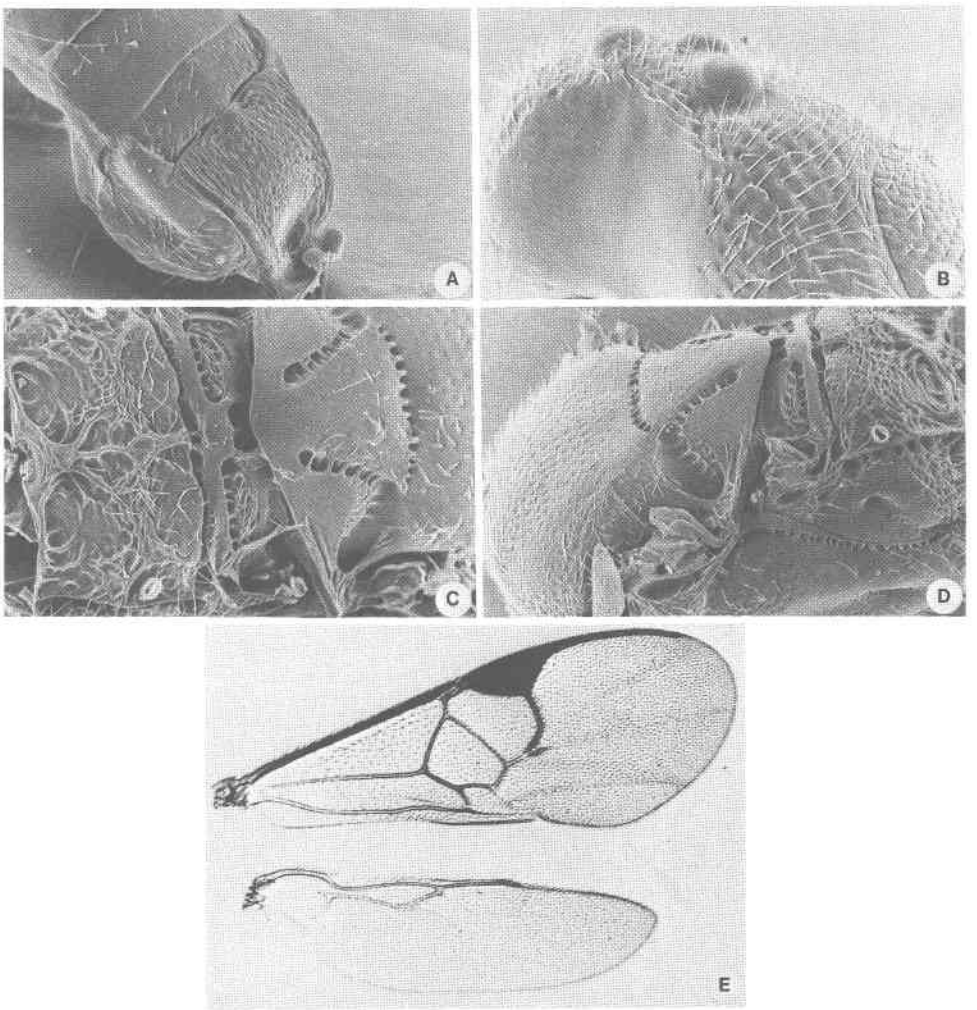


FIG. 49. *Hypomicrogaster zonaria* (Say). A, base of abdomen; B, postocciput showing large concave, glabrous area; C, propodeum showing typically poorly defined areola; D, alitrunk dorsolateral aspect; E, wings to show poorly defined, minute, areolet.

RANGE AND CONTENTS. This is a large genus in the Neotropical Region, where nearly all the species are undescribed, but four species, only two of which have names, are found in eastern North America. The species I assign here are: *Hypomicrogaster acarnas* Nixon, *H. acontes* Nix., *Microgaster ecdytolophae* Muesebeck, *H. ecus* Nix., *Urogaster imitator* Ashmead, *H. mefis* Nix., *H. moscus* Nix., *H. solox* Nix., *H. tydeus* Nix., *M. zonaria* Say, *M. diaphaniae* Mues., *M. jocarae* Mues. The last two names are new combinations.

REMARKS. *Hypomicrogaster* is one of the most strongly characterized microgastrine genera and is not likely to be confused with anything else except, perhaps, *Dolichogenidea* if the very small areolet and concave vannal lobe are overlooked. I do not think it is directly ancestral to any other genus, in fact it seems to me rather isolated.

18. *Prasmodon* Nixon 1965

Figs. 50, 51

Type: *P. eminens* Nixon 1965.

Ovipositor sheath 0.4–0.7 as long as hind tibia, hairy throughout its length; ovipositor rather thick, decurved and not tapered. Hypopygium completely sclerotized, apex broadly acute in lateral view (60–80°). Tergite I smooth, long, and tapering evenly toward apex; with strong lateral marginal carinae; tergite II transverse, subrectangular, and smooth; terga II and following densely and rather uniformly hairy. Membranous sides of tergum I covered by dense, regular, parallel striations resembling those of Miracinae.

Propodeum with very strong, laminate, carinae and smooth fields; strong median longitudinal, irregular costulae and anterior part of lateral longitudinal, and often weaker posterior part of lateral longitudinal carinae present. Metanotum closely appressed to scutellum; sublateral setose lobe very low. Lateral lunules of scutellum low; mesonotum with large, deeply rounded and faintly transcostate notauli that reach the scutellar scrobe distinctly separated from one another. Pronotum with only a lower, broad, shallow transcostate groove.

Ocelli in an equilateral triangle; vertex elevated; face long and narrow, inner margins of eyes weakly convergent.

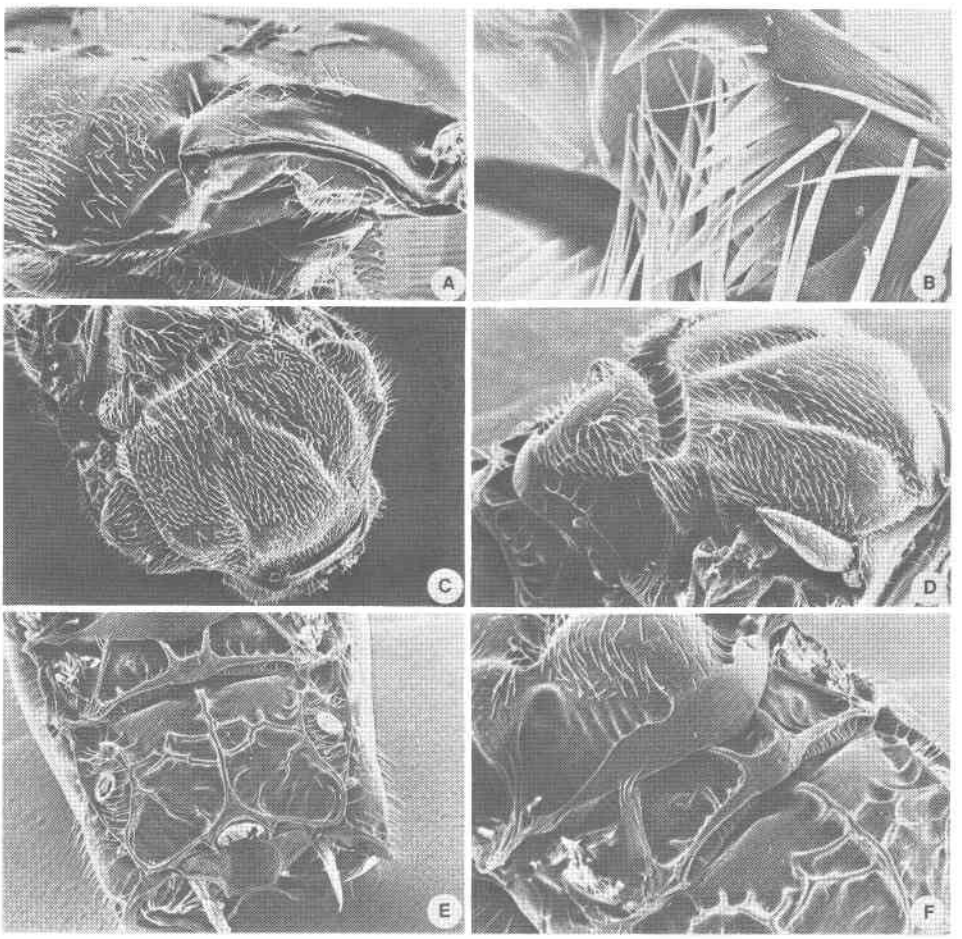


FIG. 50. *Prasmodon* sp. A, base of abdomen; B, tarsal claw; C, D, mesonotum showing conspicuous notauli; E, propodeum; F, metanotum.

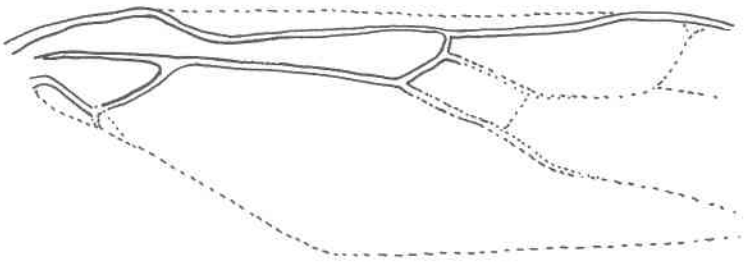


FIG. 51. *Prasmodon* sp. Hind wing to show reduced vannal lobe.

Radius sloping outward, longer than 1st intercubitus; areolet large, triangular, 2nd intercubitus less than half as long as first; submedius (1A) curving down near its middle and nearly touching hind margin of wing, no trace of interanal (2A). Vannal lobe reduced, no longer than submediellan cell, its outer margin essentially straight and almost hairless except basally (Fig. 51).

LARVA AND HOSTS. Unknown.

RANGE AND CONTENTS. I have seen 5 or 6 species, all from lowland tropical forests of South America. Only the type-species is described. All known species are xanthic.

19. *Clarkinella* new genus

Figs. 52, 53

This genus is named to honor the collector of the type, the late Shiela M. Clark of the Entomology Research Institute, Ottawa.

Type: *Clarkinella canadensis* n. sp.

Hypopygium about half as long as abdomen, not striate along median line but often sharply folded there; apex in profile acute. Ovipositor sheaths hairy throughout, 0.6–0.9 as long as hind tibia. Ovipositor long, uniformly decurved, and evenly tapered.

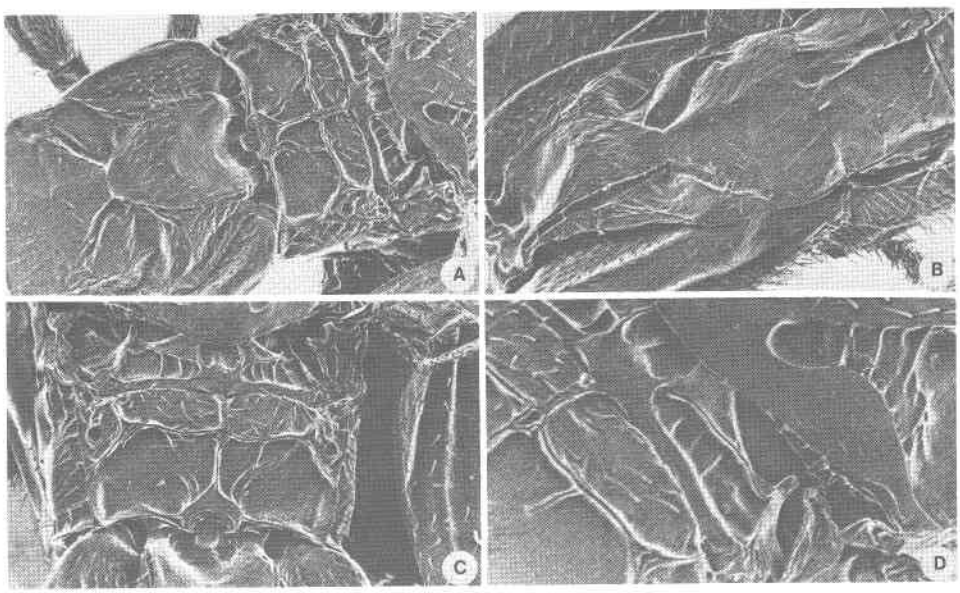


FIG. 52. *Clarkinella edithae* Mason. A, propodeum and base of abdomen; B, base of abdomen; C, propodeum; D, metanotum to show strongly projecting setose lobe.

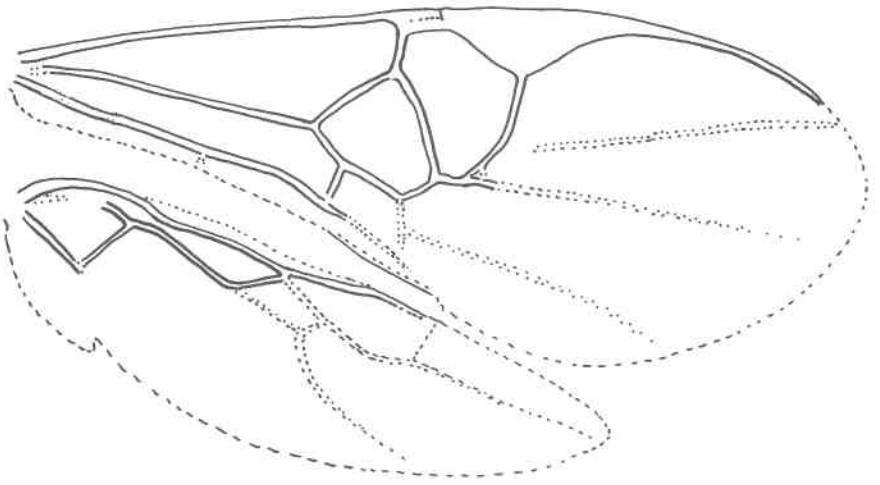


FIG. 53. *Clarkinella edithae* Mason, wings.

Tergite I parallel-sided on basal half, thence strongly tapered to a narrow apex, mostly smooth except for small areas of finely aciculate or granular sculpture centrally. Tergite II triangular and almost completely smooth, apical width about twice its length, sides and posterior margin defined by deep carinae.

Propodeum with a complete median carina and a transverse carina separating the horizontal and declivous sections, and sending a fork on either side of the spiracle, the surface otherwise mostly smooth. Metanotum with a conspicuous acute anterolateral setiferous projection, phragma of the scutellum broadly exposed. Scutellum rather broad and flat, lunules small, apical margin broad and smooth. Pronotum with upper and lower grooves.

Radius much longer than 1st intercubitus, both forming a long gradual curve of only about 30°; 2nd intercubitus rising from first almost at its lower end so that the areolet is reduced to a cell no wider than the surrounding veins and easy to overlook. Submediellan cell unusually short and broad, nervellus not much shorter than 1st abscissa of submediellan; vannal lobe with margin mostly straight and set with a few sparse hairs.

LARVA AND HOSTS. Unknown.

RANGE AND CONTENTS. I have seen only the two species described here and a few others from the Neotropical Region.

REMARKS. This genus appears at first sight related to *Choeras* but differs in some important features, namely the transverse carina of the propodeum, the broadly exposed scutellar phragma, the acute anterolateral projections on the metanotum and the non-striate hypopygium.

Clarkinella canadensis new species

Holotype, female: length (excl. ovipositor) 1.7 mm; forewing 2.0 mm; antenna 2.0 mm.

Ovipositor sheath thin and hairy, 2/3 length of hind tibia; hypopygium 0.6 as long as hind tibia; apical and ventral margins, in profile, making an angle of 65°. Tergite I with sides curved, strongly tapered apically, apex 0.6 as wide as base which is 0.7 as wide as length of tergite; surface smooth except for a transverse band of rugulosities across the center at the "turnover". Tergite II subtriangular, with straight grooves delimiting sides and apex; length 0.4 length of tergite I and 0.8 length of tergum III; apical width 2.5× length; basal width = length; surface smooth but with weak aciculation basally.

Propodeum with transverse carina at basal 1/3; declivous portion behind it mostly shiny, with a few carinulae (and the median carina) radiating from the foramen and a few irregular rugulae elsewhere; anterior part shiny with only weak irregular sculpture except for the median carina. Scutellum very weakly convex, the surface shiny with sparse, shallow punctures. Mesonotum shiny and smooth in the posteromedial third, elsewhere with distinctly separate large punctures that become contiguous anteriorly. Both upper and lower grooves of side of pronotum deep and crenulate; the area between them smooth.

Vertex smooth; ocelli separated from one another by their own diameter and from the eye by 3× that; anterior angle of ocellar triangle 120°. Antennae very bristly, slender, and distinctly tapered; flagellar formula: 2 L/W = 2.6, 14 L/W = 2.0, 8 L/W = 2.7, L 2/14 = 2.0, W 2/14, = 1.5; articles 1-9 with 2 ranks of placodes.

Color: black with brown coxae and fulvous legs and mouthparts; apex of hind tibia and hind tarsus brown; wings hyaline with brown veins and stigma.

Holotype: ♀, **Canada**, **ON**., Ottawa, 28 July 1959, S.M. Clark (CNC No. 15769).

Clarkinella edithae new species

Fig. 53

Named for my wife, Edith, in appreciation of her help in collecting the type series in Trinidad.

Holotype, female: length (excl. ovipositor) 1.6 mm, forewing 1.8 mm, antenna 1.8 mm. Similar to *C. canadensis* except: ovipositor sheath 0.8 as long as hind tibia; tergite I with apex 0.4 width of base, surface smooth; tergite II smooth, apex 1.7× basal width; propodeum virtually without sculpture except for median and transverse carinae; antennae less bristly and less tapered, article 2 L/W = 2.7, 14 L/W = 1.7, 8 L/W = 2.5, L 2/14 = 1.8, W 2/14 = 1.2.

Color: black with 4 anterior legs beyond coxa (except mid femur basally) fulvous; hind legs piceous except for tibial spurs (whitish) and basal suffusion (fulvous) on tibia.

Holotype: ♀, ***Trinidad***, Curepe, 9-12 Dec. 1977, W.&E. Mason (CNC No. 15770). Paratypes: ***Trinidad*** 2♀, same data; 2♀, same data but Feb. 1979; ***Brazil***, 1♀, **Min. G.**, Pocos de Caldas, July 1972; 1♀, **Gnbr.**, Represa R. Grande, July 1972 (CNC).

20. *Paroplitis* new genus

Figs. 54, 55

Type: *Paroplitis beringianus* n. sp.

The name (masc.) is an allusion to the striking, but superficial, similarity of these specimens to small species of *Microplitis* such as *M. coactus* Lundbreck and *M. kewleyi* Muesebeck.

Hypopygium small, fully sclerotized, but sharply folded medially. Ovipositor evenly tapered and weakly decurved; sheath about half as long as hind tibia and hairy throughout. Tergite I about twice as long as wide, parallel-sided, or a little broadening apically; weakly sculptured or mostly polished; tergum II often with a pair of weakly divergent grooves from apical corners of tergite I delimiting a smooth subrectangular area, but grooves absent in *P. beringianus*, tergum II completely smooth; tergum III slightly longer than II and weakly divided from it.

Propodeum mostly smooth to mostly rugulose, with a median carina that often becomes vague posteriorly; often a transverse carina more or less strongly indicated. Anterior margin of metanotum with very low sublateral lobes, appressed to scutellum. Entire thorax strongly flattened dorsoventrally, wider than high. Scutum and scutellum polished and at most sparsely, weakly punctate, lunules small; mesopleuron almost completely shining and smooth, the mesopleural furrow reduced to a central pit. Pronotum smooth, with both upper and lower grooves.

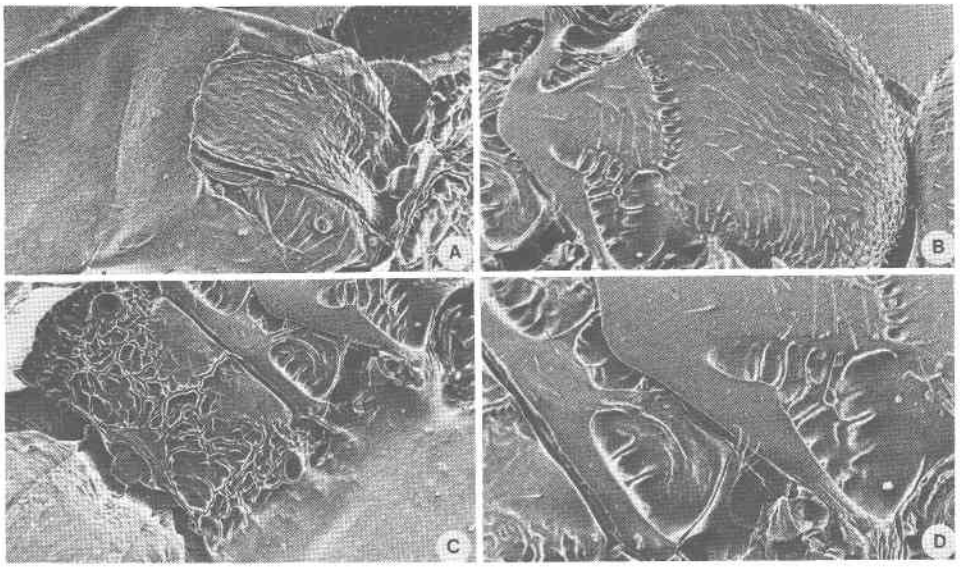


FIG. 54. *Paroplitis beringianus* Mason. A, base of abdomen showing very weak suture II-III; B, smooth mesonotum; C, propodeum; D, metanotum.

Head thick, ocelli small, in a nearly right-angled triangle. Antenna of male normal; of female short and stout with little taper; flagellomeres of female with only a single rank of placodes, hence no false divisions. Face broad, bulging, polished, and weakly punctate.

Wing usually with areolet, its size large to moderate; stigma large and deep, first abscissa of discoideus 0.7-0.8 as long as 2nd abscissa; proximal abscissa of submediella (M-Cu) evanescent on basal $^2/_3$; submediellan cell short, not over 1.5× longer than wide; vannal lobe with convex and hairy margin.

Legs of both sexes short and stout, especially the hind femora of females; tibial spurs of hind leg about 0.4 as long as basitarsus; spurs of middle leg nearly as long as basitarsus.

Larva. Unknown to me.

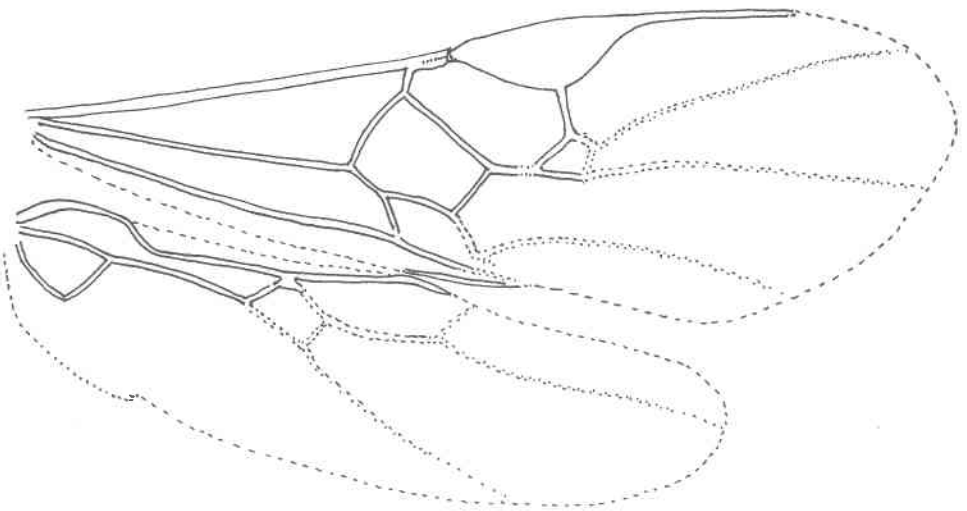


FIG. 55. *Paroplitis beringianus* Mason, wings.

HOSTS. Probably Microlepidoptera; *P. wesmaeli* (Ruthe) is said to have been reared from Gelechiidae.

RANGE AND CONTENTS. I know of three widely scattered rare species in the Holarctic Region only one of which, *Microgaster wesmaeli* Ruthe, is described.

REMARKS. The affinities of this genus appear to be with *Choeras*, from which it differs in the specialized body form, short antenna, smooth basal terga and metanotum. *Paroplitis* is, I think, a specialized group but nevertheless, the transverse carina of the propodeum is an important plesiomorphic feature separating it from *Choeras*, but not necessarily showing close relationship to *Clarkinella* or *Prasmodon*.

Paroplitis beringianus new species

Holotype, female: length 2.5 mm, forewing 2.7 mm, antenna 1.8 mm.

Tergite I barrel-shaped, about 20% wider at about apical 0.6, surface punctate-aciculate apicolaterally and rugulose basally. Tergum II and following completely smooth and shining; tergum III about 1.2× as long as II; tergum II with 2 irregular rows of hair, terga III-V each with 1 row. Ovipositor broadening to the rounded apex, about 0.6 as long as hind tibia. Hypopygium with apical margin rounded in lateral aspect.

Propodeum rugulose with irregular median carina; metapleuron similarly rugulose. Areolet of forewing large and quadrangular, 2nd intercubitus only faintly indicated by brown pigment; radius (2r) and 1st intercubitus (Rs) about equally long, meeting at an angle of 120°, 2nd abscissa of radius forming a long spur at point of junction; metacarpus (R) 2× as long as distance from its apex to apex of radial cell. Hind coxa smooth, shining and impunctate.

Ocelli small, separated from one another by about 1/4 more than their own diameter and from the eyes by about 3× their diameter; anterior external angle 100°. Vertex shining, almost impunctate; face shining and shallowly but closely punctate, 2× wider than long to base of clypeus; cheeks bulging, 5% wider than eyes in dorsal view. All flagellomeres with only a single rank of placodes; antennal formula: 2 L/W = 1.5, 8 L/W = 1.3, L 2/14 = 1.2, W 2/14 = 1.1.

Color: black; legs fulvous-brown with basal half or more of femora dark brown; mouthparts dark brown; wings hyaline with brown veins and stigma.

Male. Similar to female but antenna longer, 3.2 mm; flagellomeres with 2 ranks of placodes; antennal formula 2 L/W = 2.1, 8 L/W = 2.3, 14 L/W = 2.8, L 2/14 = 1.1, W 2/14 = 1.4.

Variation, females: strength of median carina of propodeum varying, sometimes partly absent; 2nd intercubitus absent to strongly pigmented.

Holotype: ♀, **U.S.A.**, **Alaska**, Mile 213 Richardson Highway, 17 June 1951, W.R.M. Mason (CNC No. 15790).

Paratypes, **AK.** 1♂, 1♀, Mile 206 Richardson Highway, Isabella Pass at 2900 ft., 17 July 1962, P.J. Skitsko; **BC.** 1♀, Liard Hot Springs, Mile 496 Alaska Highway at 1500 ft., 9-10 July 1959, E.E. MacDougall (CNC).

Paroplitis luzonicus new species

Holotype, female: length 2.5 mm, forewing 2.7 mm, antenna 1.8 mm.

Tergite I widening apically, width of apex 1.3× basal width and 0.5 length; surface mostly smooth with only a few shallow punctures. Tergum II with a trapezoidal area, its apical width 1.8× the basal, almost completely smooth, tergum III 1.4× as long as II. Terga II-VI each with a row of sparse hairs. Genitalia resembling those of *beringianus*.

Propodeum with a median longitudinal and a transverse carina, the latter incomplete; surface mostly polished with a little scattered sculpture; metapleuron smooth and glabrous. Mesoscutum highly polished and sparsely hairy posteriorly.

Areolet large, triangular, 2nd intercubitus sclerotized and interstitial with radius; metacarpus less than 1.5× as long as distance from its apex to apex of radial cell.

Ocelli small, separated from one another by their own width and from eyes by 2× their diameter; anterior external angle 100°. Vertex polished and almost glabrous; face polished and hairy but not punctate; 1.4× wider than long to base of clypeus; cheeks slightly narrower than eyes in dorsal aspect. All flagellomeres with a single rank of placodes; antennal formula: 2 L/W = 1.4, 8 L/W = 1.2, 14 L/W = 1.3, L 2/14 = 1.3, W 2/14 = 1.2.

Color black, the following bright fulvous: mouthparts, basal half of antenna, tegula and wing bases, all legs except basal half of hind coxa, sides of terga I and II, all tergum III but a median brown suffusion, basal sterna. Wings hyaline with brown veins.

Male. Resembling female except for normal antenna, length 2.5 mm; formula: 2 L/W = 2.2, 8 L/W = 2.2, 14 L/W = 2.2, L 2/14 = 1.2, W 2/4 = 1.2. Transverse carina of propodeum indefinite and rugose.

Color: like that of female except antenna brown with fulvous scape and pedicel, tergum III and sides of IV fulvous.

Holotype: ♀, ***Philippine Is.***, **Luzon I.**, Mt. Data, 7800 ft. [2400 m], Oak forest, 31 December 1952, Townes family (Amer. Ent. Inst.).

Paratype: ♂, **Luzon I.**, Mt. S. Tomas, 7200 ft. [2200 m], near Baguio, 27 Dec. 1952, Townes family (Amer. Ent. Inst.).

Paroplitis wesmaeli (Ruthe)

Microgaster picipes Wesmael 1837 (preoccupied).

Microgaster wesmaeli Ruthe 1860 (new name).

Differs from *P. luzonicus* by: generally more punctate and hairy, propodeum rugulose across middle but without a transverse carina, tergite I sparsely aciculopunctate apically, tergite II more rectangular, apex only 1.4× as wide as base, areolet triangular and small, the opening not much wider than width of surrounding veins, color darker, legs, antenna and sides of abdomen brown to black.

Scarce but widespread in Western Europe.

21. *Xenogaster* new genus

Fig. 56

The name is feminine and alludes to the strange structure of the propodeum and basal tergites.

Type: *Apanteles insolens* Wilkinson 1930.

Hypopygium short, evenly sclerotized but sharply folded medially. Ovipositor evenly decurved, shorter than hind tibia; sheaths hairy throughout their pigmented part. Tergite I nearly twice as long as wide, basally parallel-sided, broadly rounded on the apical 0.4; surface weakly roughened; a sharp median groove basally. Tergite II broadly subtriangular, medially with a raised, shiny subcircular area, laterally roughened; tergum III about 1.5× as long as II.

Propodeum mostly shining, bearing a strong median longitudinal carina, and, at basal third, a transverse carina forking around spiracle; propodeum moderately declivous behind transverse carina. Anterior margin of metanotum close to scutellum, with a broad, setose, sublateral lobe. Lateral lunules of scutellum absent, area above them almost completely smooth. Upper groove of pronotum stronger than lower; propleuron with a lateral carina and poorly developed lobe at lower end.

Tibial spurs long. A small spur at junction of radius and intercubitus; 2nd intercubitus (r-m) missing; distal abscissa of radius (Rs) convex posteriorly on the proximal part. Length of cubitellan cell over twice its height; margin of vannal lobe very slightly convex and weakly hairy.

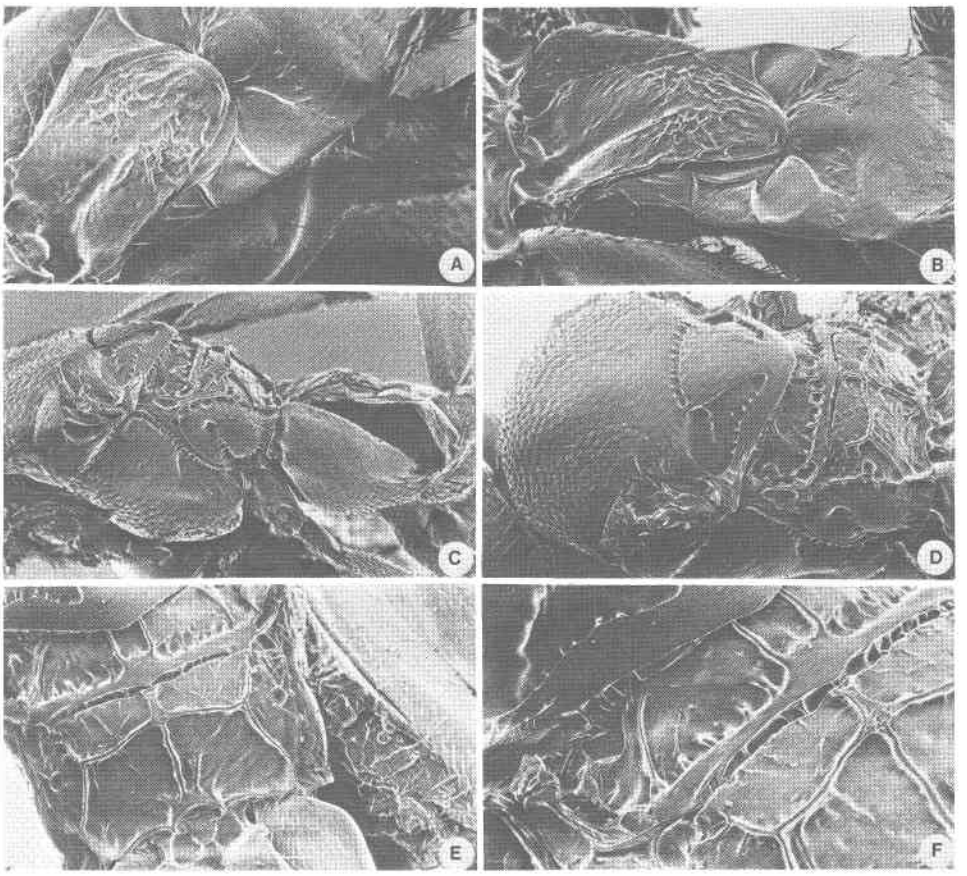


FIG. 56. *Xenogaster insolens* (Wilkn.). A, B, base of abdomen showing grooved tergite I; C, D, alitrunk; E, propodeum; F, metanotum.

LARVA AND HOSTS. Unknown.

REMARKS. I erect this genus for a single very peculiar species from South Africa. Taxonomically it is isolated as Wilkinson and Nixon both noted, but the sharp basal groove on tergite I may indicate some relationship to *Pseudapanteles*.

22. *Hygroplitis* Thomson 1895

Fig. 57

Type: *Microgaster russatus* Haliday 1834.

Hypopygium large, sclerotized evenly across the middle and not folded; ovipositor sheath arising distally from valvifer and entirely hairy, about half as long as hind tibia.

Tergite I large, strongly humped at anterior corners, the posterior horizontal part about twice as long as the abruptly declivous anterior part; sides diverging posteriorly, the laterotergites completely turned under and invisible from above; surface of tergites I and II completely coarsely rugulose; tergite II 1.5–2× as wide as long and much longer than tergum III.

Propodeum strongly rugose to rugulose; with a strong median carina and scarcely any declivous part; anterior margin of metanotum with no setiferous sublateral lobe; scutellum rather flat and polished, the apical band sometimes interrupted by sculpture. Notauli marked by much coarser sculpture, especially posteriorly, and often somewhat depressed; mesopleural

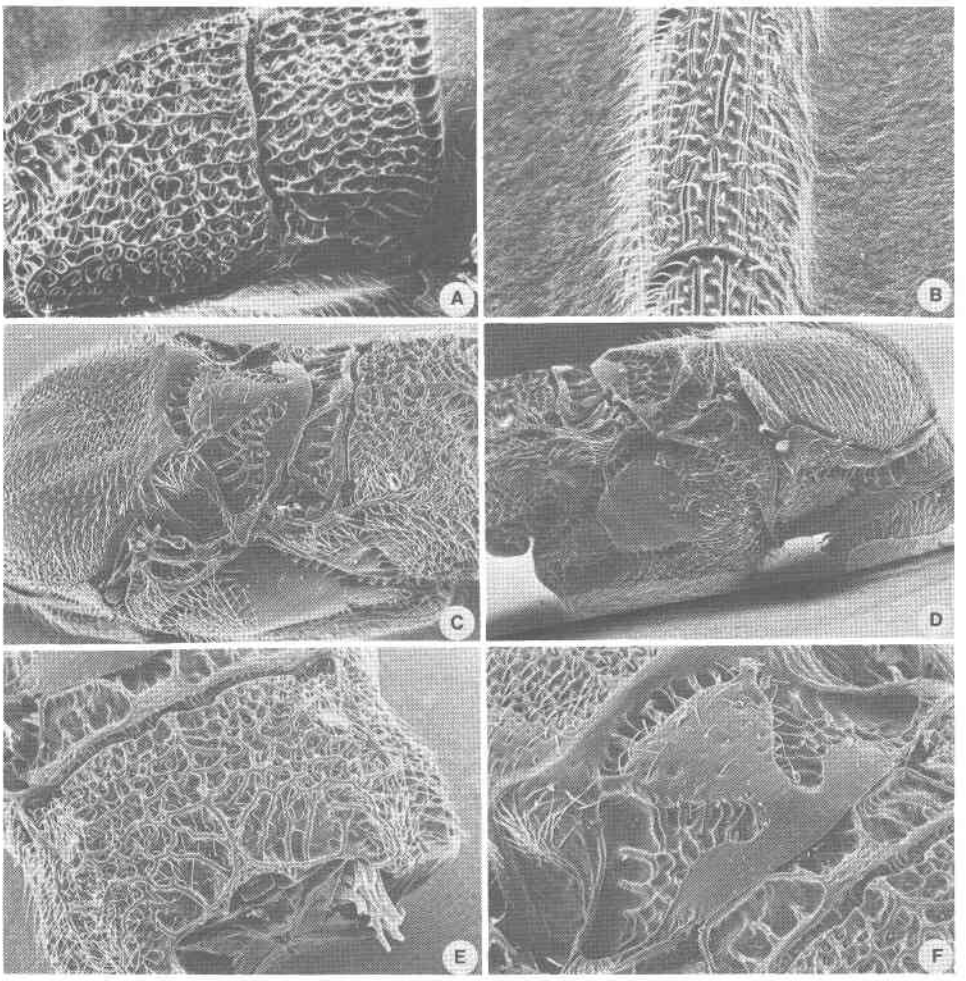


FIG. 57. *Hygroplitis melligaster* (Prov.). A, base of abdomen; B, flagellomere showing placodes arranged in 3 ranks; C, alitrunk showing notauli; D, profile of alitrunk showing flattened outline dorsally and 2 mesopleural grooves; E, propodeum; F, metanotum.

furrow nearly horizontal, large and crenulate with a perpendicular dorsal branch; pronotum with strong dorsal and ventral grooves. In profile the mesonotum, scutellum, propodeum, and basal terga form a very characteristic, almost straight, line (Fig. 57d). This shape is probably an adaptive feature of parasites pupating in grass stems and similar sites.

Radius strongly slanted outward, meeting both intercubiti at a strong angle and forming a large triangular to quadrangular areolet; vannal lobe convex and hairy. Distitarsi of all legs enlarged and bearing very large simple claws. Flagellomeres without false central divisions, the placodes irregularly arranged, often in 3 ranks (Fig. 57b).

Larva. Unknown to me.

HOSTS. Appear to be pyraloids that bore in aquatic reeds and similar plants.

RANGE AND CONTENTS. It contains *Microgaster russatus* Haliday, *M. rugulosus* Nees and *M. melligaster* Provancher, all from the Holarctic Region.

REMARKS. This small group has been variously treated as a genus or group of *Microgaster*.

23. *Iconella* new genus

Figs. 58, 59

Type: *Apanteles etiellae* Viereck 1911.

The name is feminine and alludes to the finely molded forms of the genus.

Hypopygium large, folded and striate medially; ovipositor sheath long and hairy, attached apically to the valvifer; ovipositor tapering gradually.

Tergite I moderately to strongly narrowed apically, without a median depression; tergite II much wider than long, with strongly diverging lateral margins and much shorter than tergum III.

Propodeum with a strong median longitudinal carina, but this occasionally weak anteriorly and sometimes absent. Anterior margin of metanotum with prominent lateral lobes bearing a tuft of setae. Lateral grooves of scutellum parallel-sided.

Submedius deflected posteriorly and often there giving rise to a crease representing an anal vein; nervellus straight or sinuate near posterior end and meeting submediella at ap-

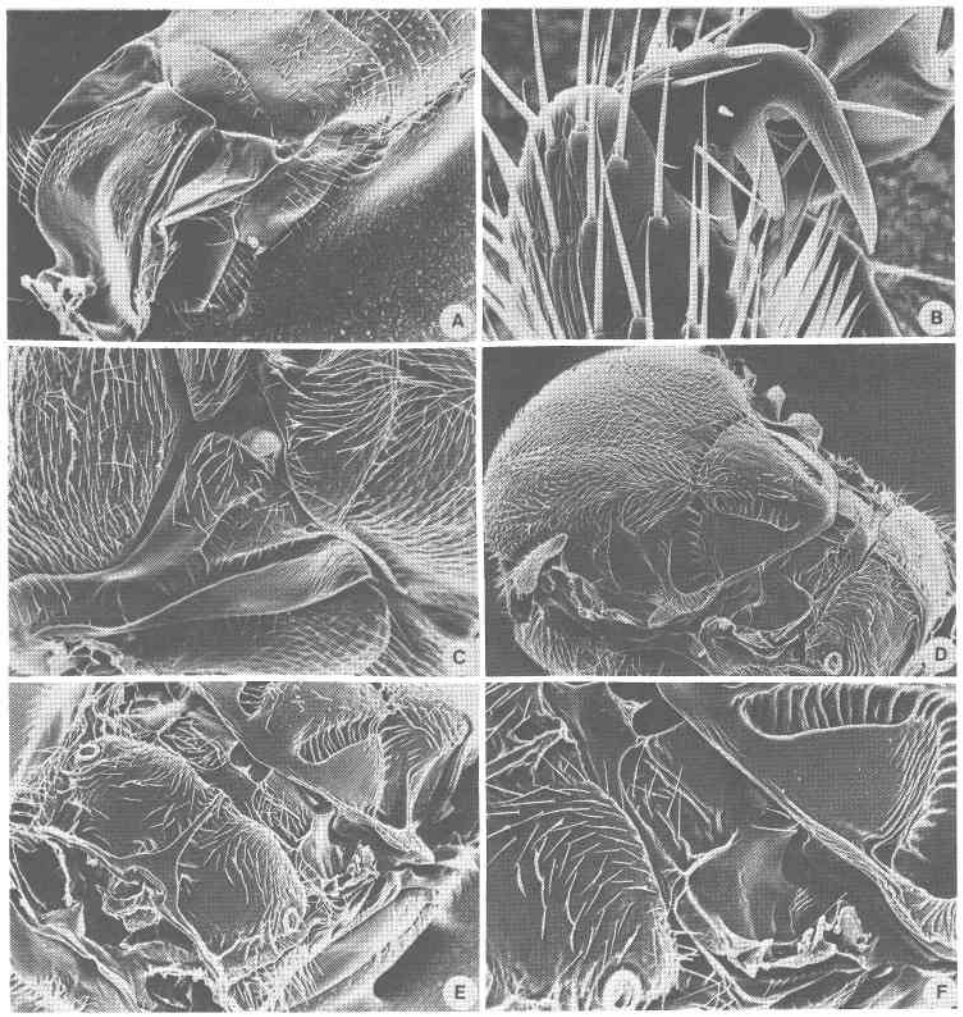


FIG. 58. *Iconella etiellae* (Vier.). A, base of abdomen; B, tarsal claw; C, pronotum; D, alitrunk; E, propodeum; F, metanotum.

proximately a right angle; margin of vannal lobe concave and hairless to nearly straight and margined with numerous short hairs but never strongly convex and hairy.

Larva. Mandibles with long blades armed with over 20 long teeth; papules of body skin armed with long straight spines; setae on body few (Fig. 105C).

HOSTS. Apparently all are solitary parasites of Microlepidoptera, mostly borers.

RANGE AND CONTENTS. This genus is not large but a few species are found in most parts of the Old World and the Nearctic. I have seen none from the Neotropical region although *I. etiellae* (Vier.) occurs in the West Indies, where it may have been spread by commercial trade. I place here most of the species of Nixon's *merula* and *sundanus* groups but I suspect that some of the former (e.g. *A. tedanius* Nix.) belong elsewhere. For the moment I can include only *A. sundanus* Wilkinson, *A. ariadne* Nixon, *A. etiellae* Viereck, *A. myeloenta* Wilkinson, *A. alfalfae* Nixon, and *A. merula* Reinhard (all new combinations).

REMARKS. I have recognized this genus partly because I interpret the sinuate nervellus as an important plesiomorphic character. I believe the abrupt distad deflection represents all that remains of the attachment of the missing discoidellan

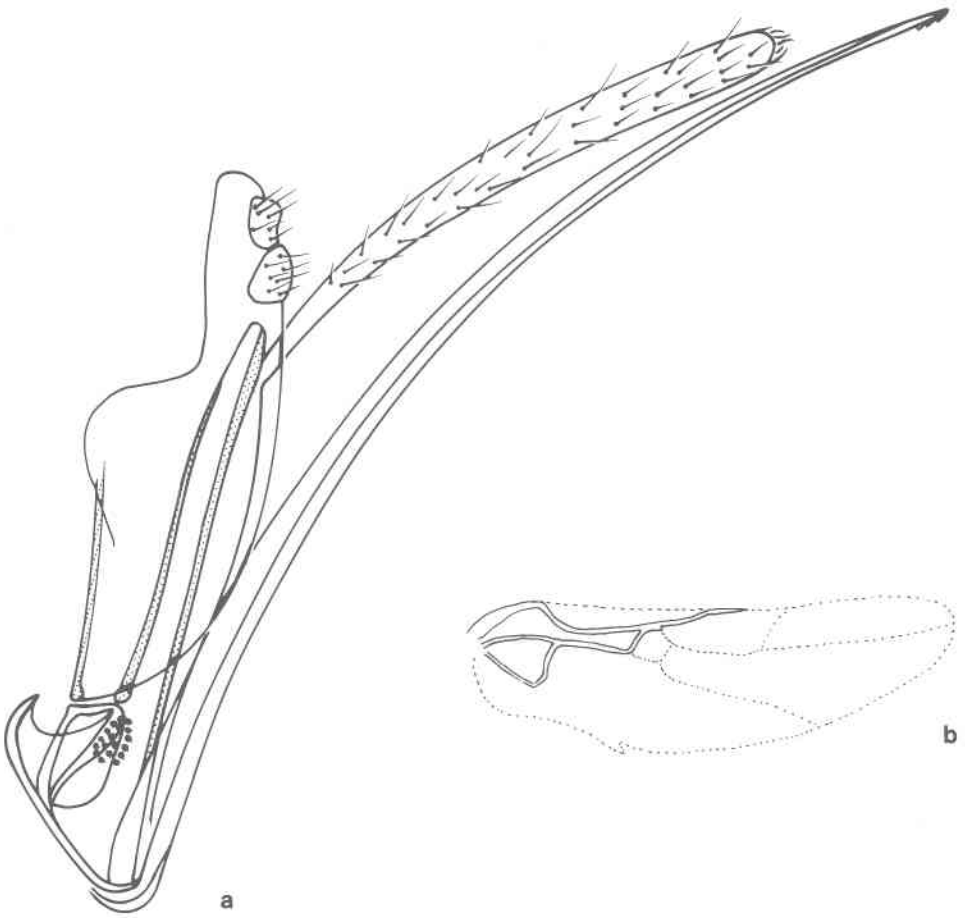


FIG. 59. *Iconella etiellae* (Vier.), a, female genitalia; b, hindwing.

(2Cu) vein. A similar deflection of the nervellus exists in *Dasylagon*, *Xanthomicrogaster*, *Fornicia*, and some *Promicrogaster* species. I am sure it signifies no relationship of *Iconella* to the former three but it is interesting that several of the species placed in the *merula* group by Nixon have the ovipositor apically sinuate, an apomorphic condition characteristic of *Promicrogaster*. The common apomorphic condition of the nervellus in most Microgastrinae is a vein that curves strongly proximad and merges imperceptibly into the submediella.

24. *Choeras* new genus

Figs. 60, 61

The name is from the Greek meaning a hog's-back ridge, and refers to the characteristic median carina of the propodeum.

Type: *Apanteles* (*Pseudapanteles*) *consimilis* Viereck 1911.

Hypopygium large, medially folded in several striae; ovipositor sheath from about half as long as hind tibia to a little longer; entirely hairy (Fig. 61).

Tergite I parallel-sided or apically tapered, sides almost always straight, broad with a shallow basal excavation, never with a mediobasal sharp groove; tergite II usually transverse rectangular but sometimes subtriangular, broadly pentagonal or very broad, almost linear, width 1.5–7× length; tergites I and II variable in sculpture, smooth to densely rugose; tergum III smooth and longer than II.

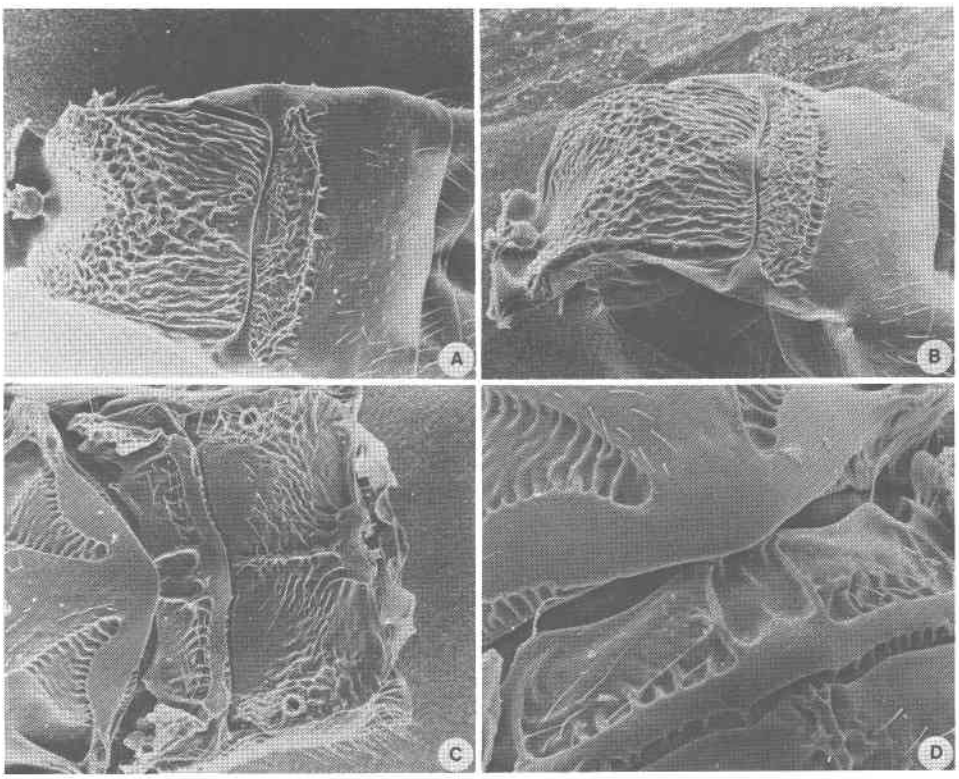


FIG. 60. *Choeras consimilis* (Vier.). a, b, base of abdomen; c, propodeum; d, metanotum.

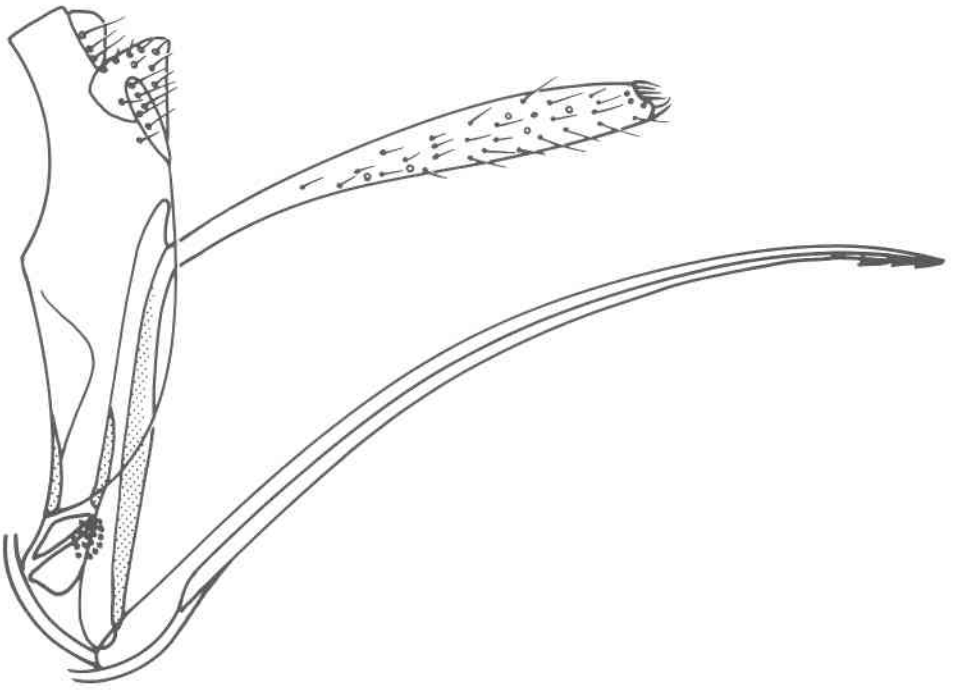


FIG. 61. *Choeras tiro* (Reinhard). Female genitalia.

Propodeum usually bearing a strong median carina but never with any indication of areola, surface smooth to coarsely rugose; metanotum without projections but bearing a few hairs on the anterolateral corners; pronotum with both upper and lower groove.

Radius (2r) and 1st intercubitus (Rs) straight, about equally long and meeting at an abrupt angle, with a knob or stump if 2nd intercubitus is absent; 2nd intercubitus (2r-m) absent, faint, or strong, its anterior end meeting other veins proximad, at, or distad of, junction of radius and 1st intercubitus; the areolet (1Rs) absent, indefinite, triangular and small or large, or quadrangular and large; vannal lobe usually convex and hairy, but flat or even concave and hairless in the oriental *psarae* group.

Larva. Mandible long-bladed and bearing about 20 teeth; labium with 4–6 hairs, each maxilla with 1; skin papulae with long straight spines (Fig. 105B).

HOSTS. Microlepidoptera, often Pyraloidea.

RANGE AND CONTENTS. The genus is especially common and diverse in the South Temperate zones of Australia and Chile. It is widespread, though not common, in the rest of the world. I place the following species here: Nearctic — *Apanteles consimilis* Viereck, *A. insignis* Muesebeck, *Microgaster tiro* Reinhard. Palearctic — *M. suffolkiensis* Morley, *A. parasitellae* Bouché, *A. validus* Thomson. Other areas — *M. apo* Wilkinson, *M. papua* Wilkn., *M. psarae* Wilkn., *H. epaphus* Nix., *Promicrogaster dissors* Nixon.

REMARKS. This is the best genus to illustrate the untenability of the old concept of *Apanteles*, defined solely by the absence of 2nd intercubitus. Many stages of gradual disappearance of this vein can be found here; sometimes differing in two wings of a single specimen. Nevertheless I think the genus is natural, although diverse. The oriental *psarae* group might be misplaced and more material from the Indo-australian Region could give reason to alter the present arrangement.

25. *Sathon* new genus

Figs. 62, 63, 64

The name is derived from the Greek, meaning one with a large penis, an allusion to the size of the male genitalia.

Type: *Apanteles neomexicanus* Muesebeck 1921.

Hypopygium large and curved medially, without a series of median longitudinal creases. Ovipositor sheaths long, polished, and bearing sparse hairs on all but the dorsal part. Male genitalia large to extremely large, the parameres expanded apically and usually truncate at right angles to the axis (Fig. 64).

Tergite I rugulose and weakly narrowed apically, the sides usually curved; second tergite with a pair of more of less well-defined grooves diverging from the apical corners of tergite I; the central area of tergite II sculptured and apically as wide or wider than its length, the central sculptured area often extending laterad of the diverging grooves; tergum III smooth and longer than II.

Propodeum densely sculptured, rugulose and dull to densely punctate and shiny; median carina strong and complete to weak or only indicated apically; apical corners of propodeum usually rugose and shiny. Anterior margin of metanotum without a lateral lobe or setae.

Legs and wings rather long and large; hind tibial spurs generally about half as long as basitarsus. Radius and intercubitus about equal and meeting at an angle of 110–130°, usually with a knob at the junction. Vannal lobe with convex and hairy margin; intercubitellan cell wider than high.

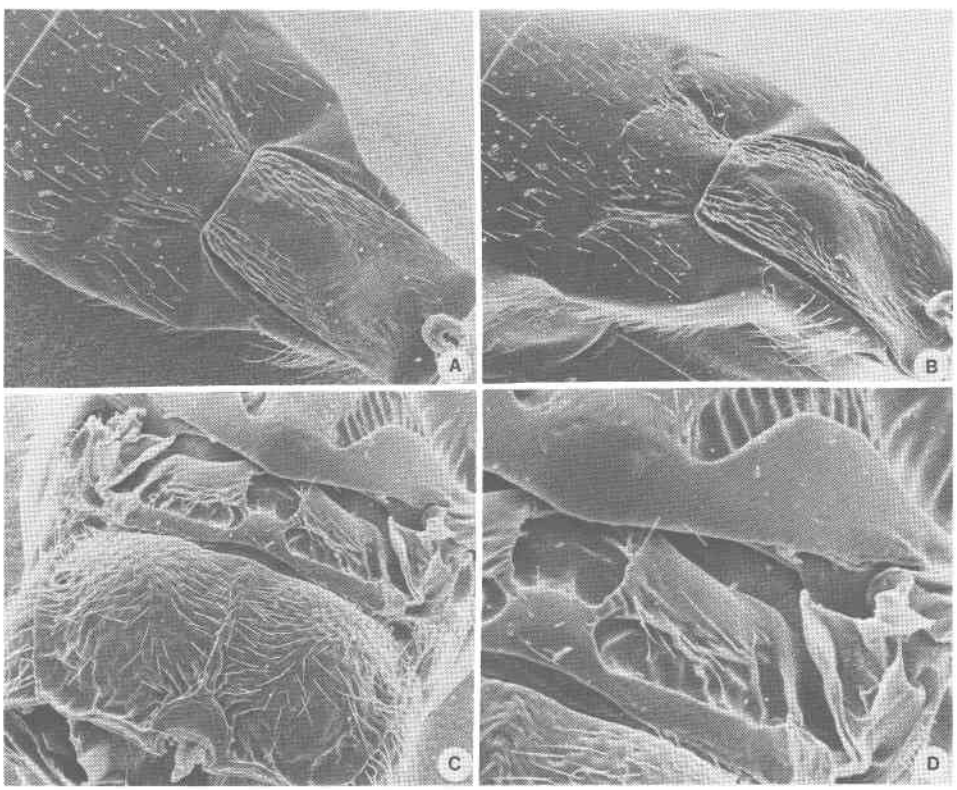


FIG. 62. *Sathon neomexicanus* (Mues.). A, B, base of abdomen; C, propodeum; D, metanotum showing glabrous lobes and widely exposed phragma.

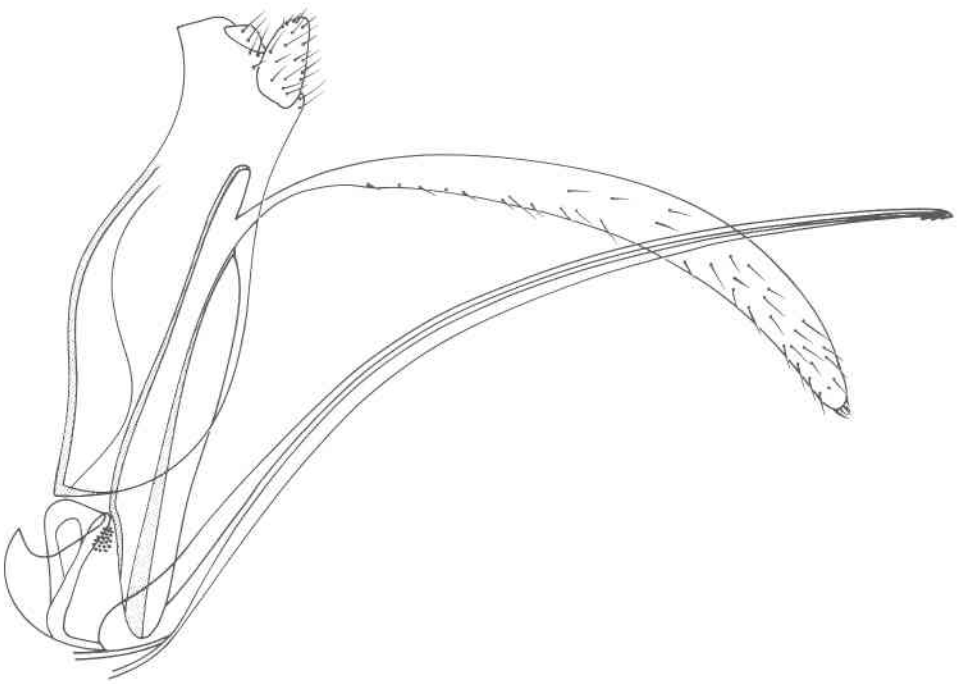


FIG. 63. *Sathon neomexicanus* (Mues.); female genitalia.

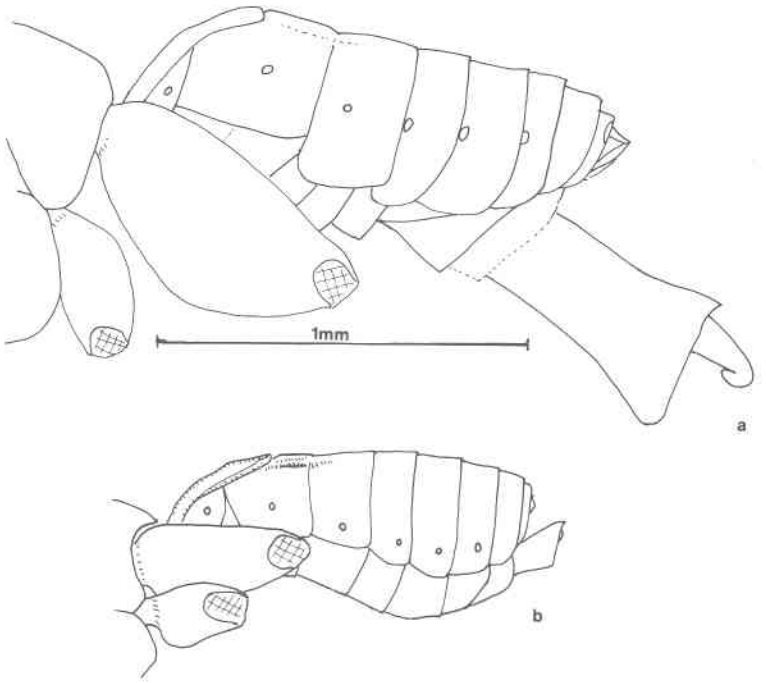


FIG. 64. *Sathon* spp., male genitalia, hind coxae and abdomen. A, *S. neomexicanus*; B, *S. papaipemae* (Mues.) to show normal sized but apically widened and truncate claspers.

Larva. Mandible long and blade-like; with numerous short truncate teeth; the teeth are exceptional for braconids in lying more or less in 2 rows; 2 hairs on labium, 1 on each maxilla; papulae of skin low and without spines (Fig. 105D).

HOSTS. The larvae are gregarious parasites of Noctuidae.

RANGE AND CONTENTS. *Sathon* is a small Holarctic genus. I know of only *Microgaster falcatus* Nees, *M. lateralis* Haliday, and *A. fausta* Nixon from Europe, *Apanteles neomexicanus* Muesebeck, *A. papaipemae* Mues., *A. cinctiformis* (Viereck) from North America, and a few undescribed species from western North America and high altitudes in Mexico and the Andes.

REMARKS. Although *Sathon* is obviously one of the Microgastrini it is anomalous in several respects. The shining and sparsely hairy ovipositor sheaths and the large, truncate male claspers are unique features whereas the retracted and glabrous metanotal margin and the gregarious larvae reared from Noctuidae are reminiscent of Cotesiini. The European species *S. lateralis* (Hal.) and *S. fausta* (Nixon) lack the truncate male claspers and are parasites of Microlepidoptera. They might fit among the diverse elements of *Choeras* but agree well with *Sathon* in the structure of the propodeum and metanotum.

26. *Microgaster* Latreille 1804

Figs. 65, 66

Type: *Ichneumon deprimator* Fabricius 1798.

Synonyms: *Liganira* Walker 1860. Type: *M. detractus* Walker 1860.

Lissogaster Bengtsson 1926. Type: *M. politus* Marshall 1885.

Hypopygium large and bearing several median folds or striae but these folds absent in a few (less than 10%) species. Ovipositor sheaths hairy throughout, about 0.3-1.0 as long as hind tibia; arising near apex of valvifer which is tapered apically. Ovipositor gradually tapered throughout its length.

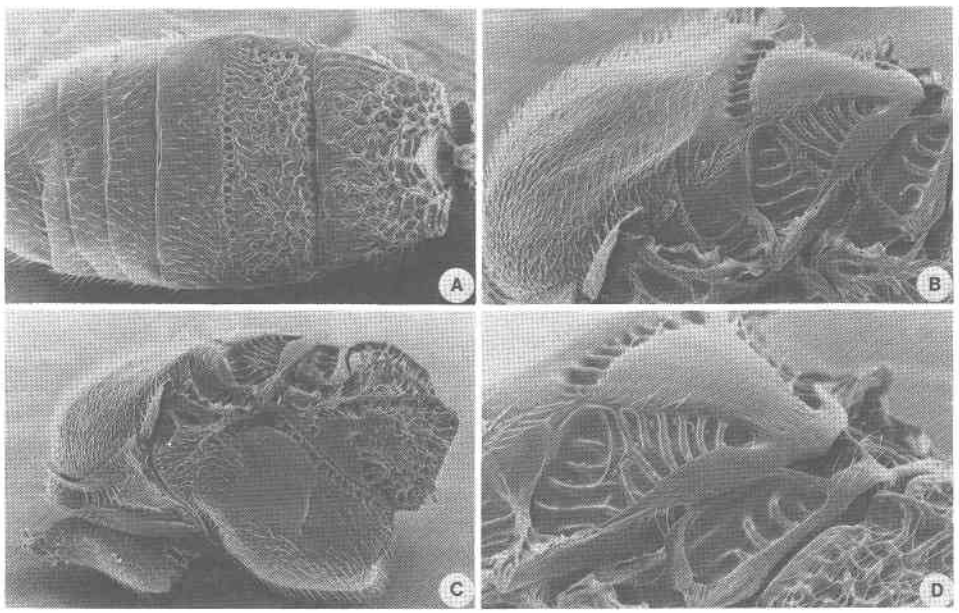


FIG. 65. *Microgaster canadensis* Mues. A, abdomen; B, mesonotum; C, profile of alitrunk; D, metanotum.

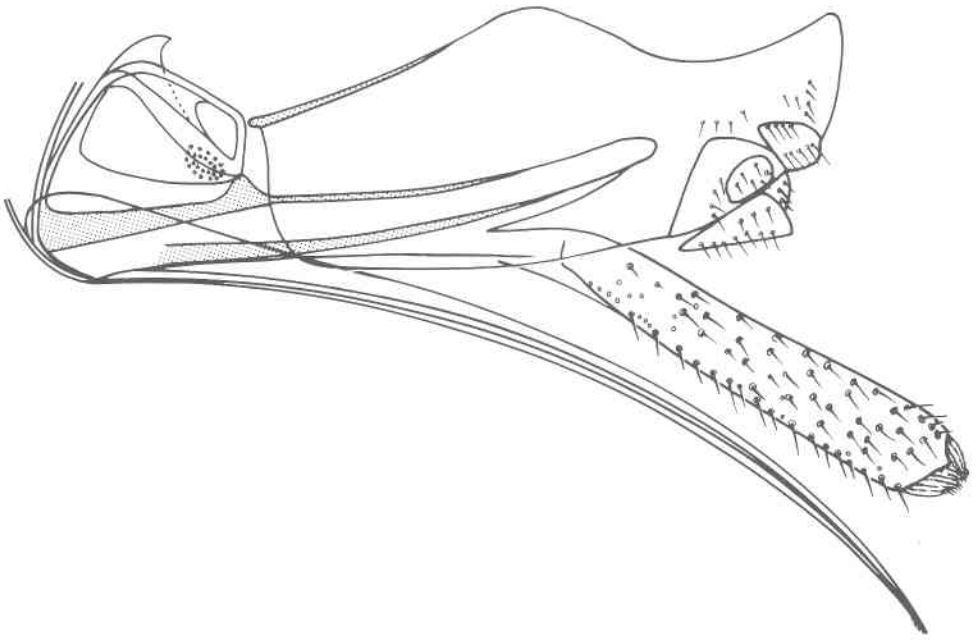


FIG. 66. *Microgaster canadensis* Mues.; female genitalia.

Tergite I short, broad, a little wider apically and occupying almost the entire dorsal surface of tergum I; its surface mostly coarsely rugose. Tergite II occupying full width of tergum II, rectangular and without any delimited central area, the surface rugulose (smooth only in two Old World species); tergum III more or less rugose, shorter than tergum II. Propodeum usually strongly rugose all over and with a more or less distinct median carina.

Areolet of forewing fairly large, subtriangular, the second intercubitus at least half as long as the first and meeting the radius very near or at its junction with the first intercubitus. Vannal lobe rounded and hairy.

Larva. Mandible long and blade-like, bearing a row of about 20–25 teeth; palpi long; 4 hairs on labium, 1 on each maxilla; skin covered with minute papillae that bear long terminal spines; antennae visible as flat discs in at least one species (Fig. 104C).

HOSTS. Normal hosts are Microlepidoptera but two species have been reared from Geometridae and Nymphalidae. All species but one (*subcompleta* Nees) are solitary.

RANGE AND CONTENTS. The great majority of species are Holarctic but a few have been found in the Indo-australian Region: there are none known from subsaharan Africa or South America. Nixon (1968) has reviewed the Old World species.

REMARKS. Most of the species from the Old World tropics that were described in *Microgaster* since 1862 belong elsewhere, especially in *Diolcogaster* and *Choeras*, but their correct dispositions must await study of the types.

27. *Rhygoplitis* new genus

Figs. 67, 68

The generic name is masculine, an anagram of *Hygroplitis*, which it resembles.

Type: *Apanteles* (*Pseudapanteles*) *terminalis* Gahan 1912.

Hypopygium very large, medially folded, and striate; ovipositor sheath arising distally on second valvifer, hairy throughout its length and slightly shorter than hind tibia.

Tergite I strongly transversely arched above the soft lateral margins (lateroterga), sides weakly to strongly tapering apically, a little, or much, longer than wide; surface of tergite I completely, coarsely rugulose except for a small mediobasal trough; tergite II similarly arched and completely coarsely rugulose to aciculate, subrectangular and 2 or 3× wider than long; tergum III often partly aciculate and a little longer or a little shorter than II. Anterior corners of tergite I often strongly and characteristically rounded and humped; the posterior horizontal part of first tergite 2–3× longer than the strongly declivous anterior part.

Propodeum with a strong complete median carina; surface coarsely rugulose but posterolateral corners shiny and irregularly transcostate; anterior margin of metanotum without small projection or hair-tuft; scutellum coarsely punctate, the sculpture posteriorly (rarely partially) across the polished apical band; mesonotum with strongly marked notauli, the posterior courses of which are defined by markedly coarser sculpture and sometimes depressed grooves; mesopleural furrow nearly horizontal, long, transcostate, and with a dorsal branch; side of pronotum with strong dorsal and ventral grooves.

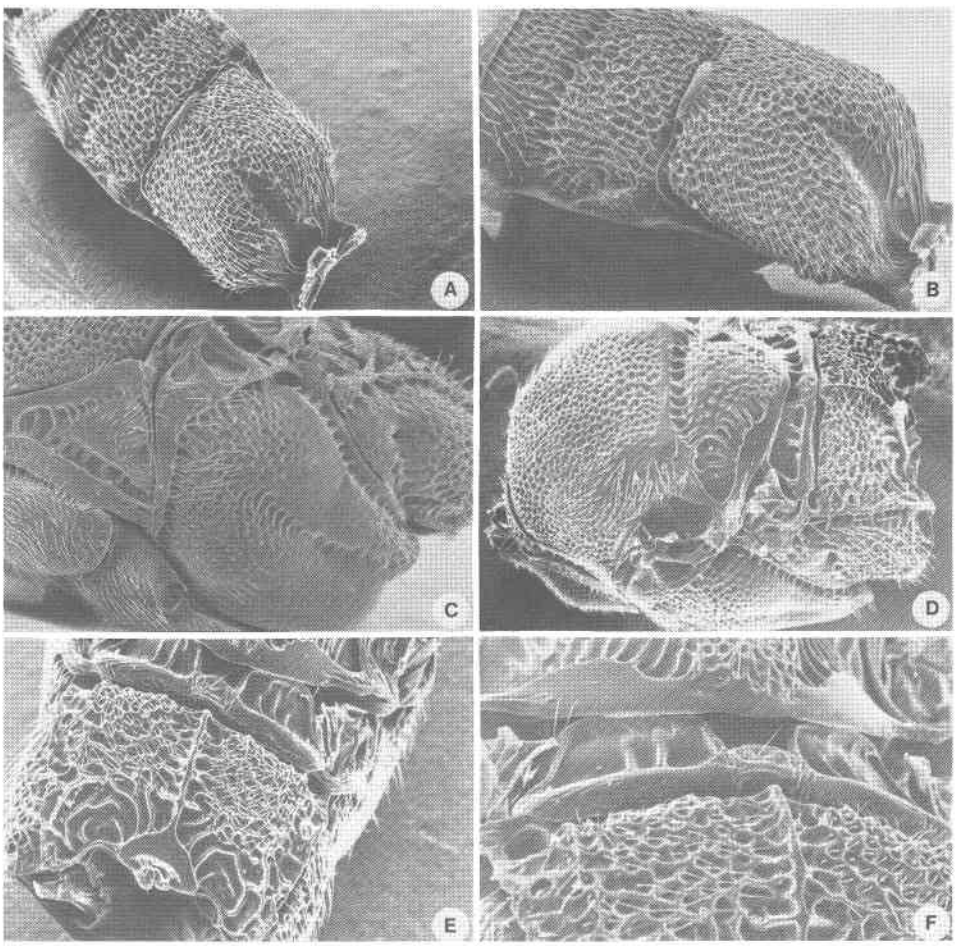


FIG. 67. *Rhygoplitis terminalis* (Gahan). A, B, abdomen; C, pronotum and mesopleuron; D, mesonotum to show courses of notauli; E, propodeum; F, metanotum.

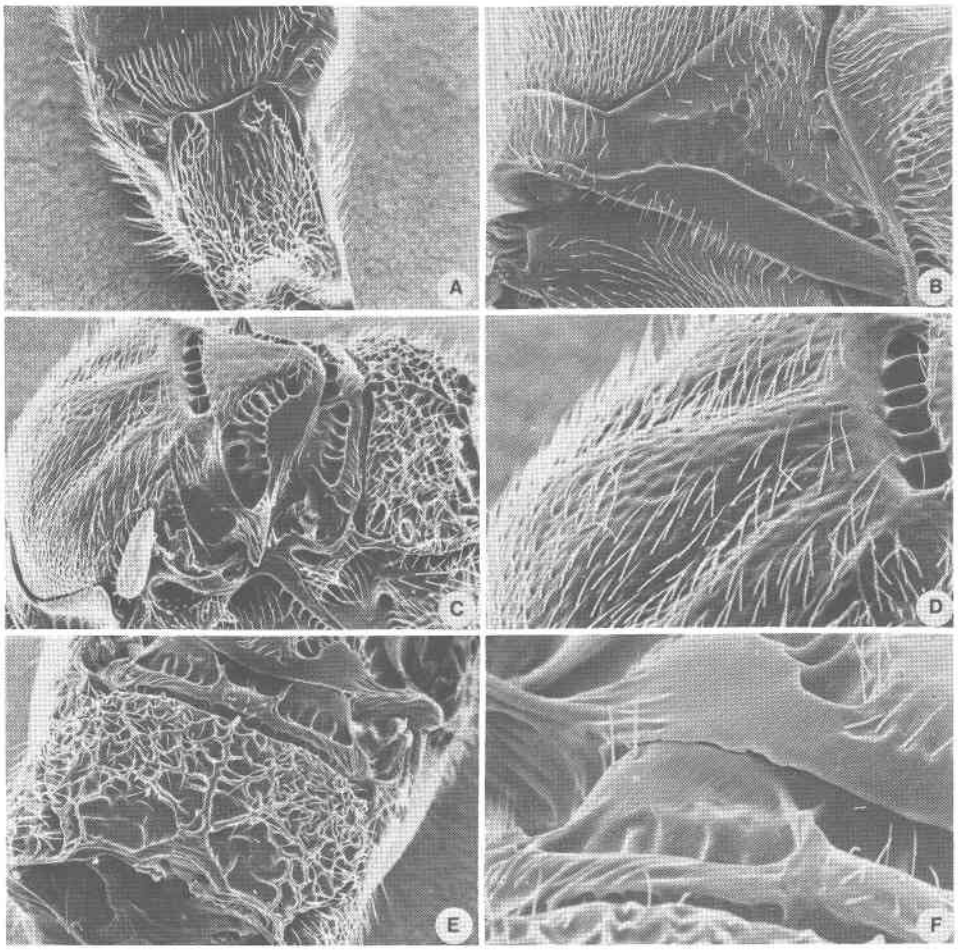


FIG. 68. *Rhygoplitis aciculatus* (Ashm.). A, base of abdomen; B, pronotum; C, alitrunk; D, notauli; E, propodeum; F, metanotum.

Radius usually curved and strongly slanting outwards, meeting the intercubital at a strong angle, the two veins about equally long or the radius shorter; radius rising about the apical quarter of the stigma; vannal lobe weakly convex and bearing abundant long hairs. Legs rather long and slim, tarsal claws simple.

Larva. Mandible with a long blade bearing about 25 long teeth; 2 hairs on labium, 1 on each maxilla. Body skin set with long spiniferous papules and numerous long hairs (Fig. 105E).

HOSTS. As far as known Pyraloidea and Microlepidoptera; larvae solitary.

RANGE AND CONTENTS. This small genus of seven species is confined to eastern North America, Mexico, and the Caribbean Region. I include here *Apanteles terminalis* Gahan, *A. choreuti* Viereck, *Urogaster aciculatus* Ashmead (all new combinations), and several new species from the Nearctic Region.

REMARKS. The closest relative may be *Hygroplitis* which differs in lacking the median striae of the hypopygium and in having a complete second intercubital vein.

28. *Xanthomicrogaster* Cameron 1911

Figs. 69, 70

Type: *X. fortipes* Cameron 1911.

Ovipositor sheath hairy, 0.3-1.0 as long as hind tibia, ovipositor evenly tapered and weakly decurved; hypopygium evenly sclerotized but fairly large and usually acute. Tergite I about as wide as long and apically broadened; surface usually coarsely sculptured apically and always bearing a deep median groove basally; tergite II rectangular, wider than long and usually coarsely rugose or punctate, both anterior and posterior edges defined by deep, wide, crenulate grooves, tergum III longer than II and smooth; abdomen short and stout.

Propodeum usually smooth but with some strong sculpture and a conspicuous median carina; anterior margin of metanotum appressed to scutellum and bearing only the weakest indication of sublateral setose lobes; scutellar lunules small; scutellum and mesonotum mostly smooth and weakly, sparsely punctate; pronotum with smooth and poorly defined grooves.

Radius much longer than intercubitus; areolet moderately small and triangular, the common intercubiti about as long as first intercubitus; intercubitellan cell small, higher than wide; nervellus concave externally, sinuate posteriorly; vannal lobe straight with a few hairs to concave and hairless. Tibial spurs large; hind coxae very large.

LARVA AND HOSTS. Unknown.

RANGE AND CONTENTS. This is a purely Neotropical genus containing only three described species: *X. fortipes* Cameron, *X. seres* Nixon, *X. pellides* Nixon, and at least a dozen undescribed.

REMARKS. There are no obviously related groups among genera with areolet but the Neotropic genus *Pseudapanteles* may represent a more specialized relative, sharing with *Xanthomicrogaster* the narrow and tall first cubitellan cell and the sharp median groove on the basal half of tergite I.

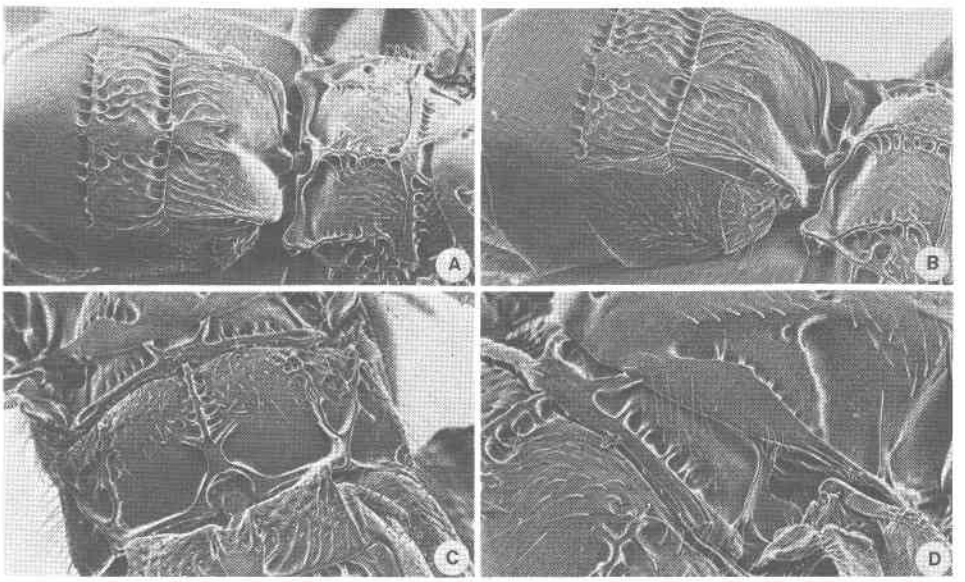


FIG. 69. *Xanthomicrogaster fortipes* Cameron. A, B, abdomen; C, propodeum; D, metanotum.

29. *Pseudapanteles* Ashmead 1900

Fig. 71

Type: *Pseudapanteles annulicornis* Ashmead 1900.

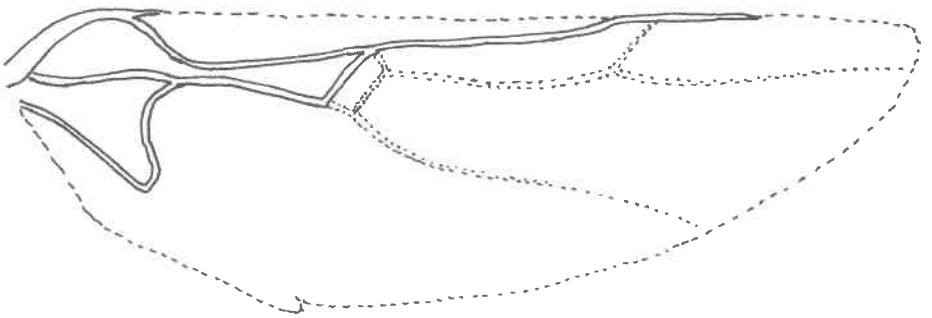


FIG. 70. *Xanthomicrogaster fortipes* Cameron, hind wing.

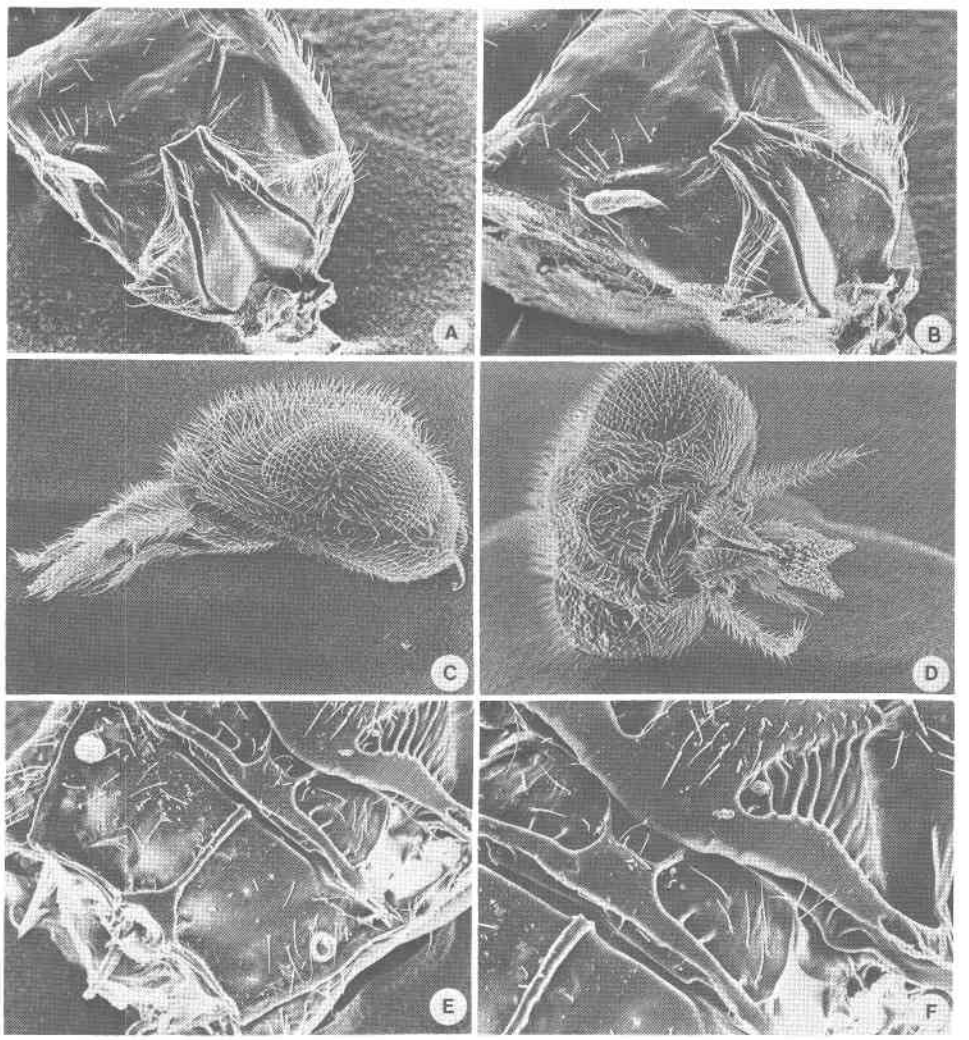


FIG. 71. *Pseudapanteles* sp. A, B, base of abdomen; C, D, head to show anterodorsal profile and elongated mouthparts with divaricate glossa; E, propodeum; F, metanotum.

Hypopygium large, with median longitudinal fold and striae; ovipositor sheaths long and hairy throughout their length, arising distally from the valvifers.

First tergite tapering apically and with a sharp median groove on the basal half or more but never with a shallow median apical depression; second tergite much wider than long and moderately to strongly widened posteriorly; third tergum much longer than second. Tergites I and II smooth or sculptured, tergum III smooth.

Propodeum smooth or variously rugose, but always with a strong percurrent median longitudinal carina; never areolated but occasionally with a multiple or indefinite subbasal transverse carina.

Position of intercubitellan vein variable but often close to basella, thus the first cubitellan cell usually about as tall as wide but varying from much taller than wide to wider than tall. Margin of vannal lobe with variable amount of hair; margin usually nearly straight but sometimes weakly concave or weakly convex. Radius and intercubitus about equal and usually meeting at a conspicuous angle; metacarpus very long, extending almost to apex of radial cell.

Larva. Unknown.

HOSTS. Boring Microlepidoptera.

RANGE AND CONTENTS. The genus, as I recognize it, is confined to the New World, including the species falling in Nixon's groups *annulicornis* and *sesiae*, and the American members of his *nerion* group. It is a large genus in the New World tropics, a few species occur in North America. I include here: *P. annulicornis* Ashmead, *P. brunneus* Ashmead, *A. (P.) sesiae Viereck*, *A. lipomeringis* Muesebeck, *Xanthomicrogaster ruficollis* Cameron, *A. nigrovariatus* Mues., *A. abantidus* Nixon, *A. nerion* Nix., *A. dignus* Mues. All but the first three are new combinations.

FORNICIINI

The tribe contains only the genus *Fornicia* Brullé.

30. *Fornicia* Brullé 1846

Figs. 72, 73

Type: *F. clathrata* Brullé 1846.

Synonyms: *Odontofornicia* Enderlein 1912. Type: *O. arata* Endl. 1912.

Monofornicia Fahringer 1938. Type: *F. africana* Wilkn. 1930.

Ovipositor short and decurved; sheath arising proximally on the valvifer, shiny and with only a few hairs near apex; hypopygium fully sclerotized and with an acute point. Tergites I-III completely fused into a carapace; all other abdominal structures withdrawn under carapace; tergites I-III completely coarsely rugose with 2 transverse grooves indicating segmentation and a strong single or double median carina. Terga IV-IX reduced to narrow, weakly sclerotized bands and completely telescoped beneath carapace; laterotergite I with only a vestigial spiracle, but other spiracles (II-VI) apparently normal.

Propodeum with a very unusual type of carination: median part occupied by a Y-shaped carina with median stem extending over apical $^2/_3$ and arms of the "Y" enclosing a small marginal area that is more or less open anteriorly; a pair of costulae running from arms of "Y" laterocaudally to side of propodeum behind spiracle; a pair of more or less defined lateral longitudinal carinae often running from middle of costula to posterior margin of propodeum, these sometimes delimiting a large petiolarea split through middle by median carina; a short lateral longitudinal carina running cephalad from costula delimiting a small spiracular area. Metanotum usually with median apical spine; anterior margin appressed under scutellum. Lateral lunules of scutellum moderate in size; apical band interrupted by median sculpture; disc of scutellum projecting backwards and upwards as a short to long, 1-, or

2-lobed structure that is almost spinose in extreme species. Scutellum and scutum with complex sculpture varying greatly between species. Mesopleuron with strong prepectal carina continuous on sides and ventrally. Pronotal groove broad and coarsely sculptured, usually with an obvious epomia running more or less vertically across groove. Propleuron laterally carinate and bearing a posterior lobe that overlaps the posterior corner of the pronotum (Fig. 72c).

Radius meeting intercubitus at a strong angle with knob at junction; 2nd intercubitus absent; nervellus strongly sinuate; 1st cubitellan cell small, about as high as wide; vannal lobe with concave and hairless margin.

Head transverse and small; width of thorax at tegulae about 1.5× width of head. Most of flagellar articles with false subdivisions caused by 2-ranked placodes; apical half of female flagellum bearing large ventral fields of densely placed, thick chemoreceptors ventrally, these fields excluding longitudinal placodes (Figs. 11, 72d).

Larva. Although Capek (1970) said *Fornicia* larvae are Microgastrinae he neither figured nor described them.

HOSTS. Apparently *Fornicia* are exclusively parasitic on larvae of Limacodidae.

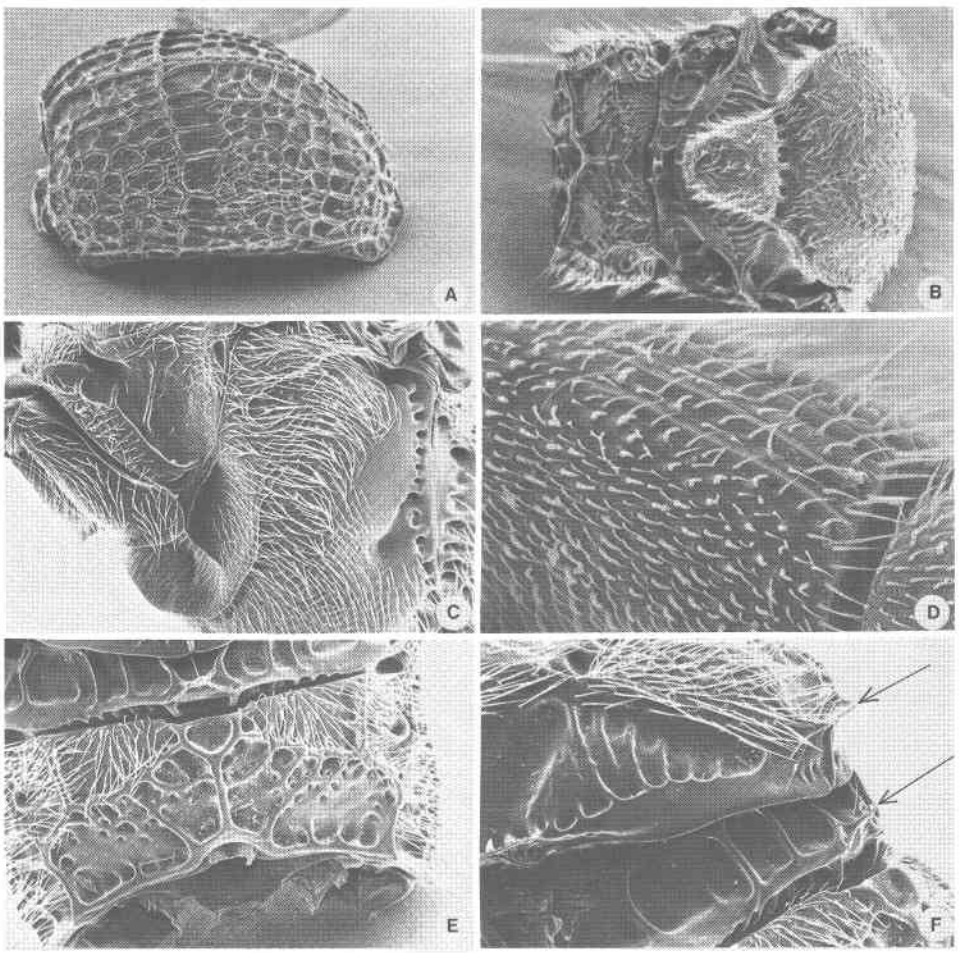


FIG. 72. *Fornicia jarmilae* Mason. A, abdominal carapace, terga I-III; B, alitrunk; C, anteroventral view of thorax to show prepectal carina, epomia of pronotum and posterolateral lobe of propleuron; D, flagellomere of female showing dorsal placodes and ventral field of basicones; E, propodeum; F, metanotum and scutellum showing median spines (arrows).

RANGE AND CONTENTS. This pantropical genus contains many species but is rare in collections.

REMARKS. The complete prepectal carina, epomia of the pronotum, fused tergites I and II and III and disproportionately small head are unique characteristics. It is almost impossible to mistake *Fornicia* for anything else. Species are best distinguished from one another by the sculpture of the mesoscutum and scutellum and by structure of the scutellar spine.

Fornicia jarmilae new species

Figs. 72, 73

Dedicated to Dr. Jarmila Kukalova-Peck, who has collected large quantities of invaluable material for the CNC.

Holotype, female: length 3.5 mm, forewing 3.9 mm, antenna 4.2 mm.

Ovipositor sheath with only about 6 apical hairs; hypopygium shiny, with hairs concentrated near median apex. Carapace covered by coarse, rather regular reticulation; L/W = 1.0 in dorsal aspect.

Propodeum with the longitudinal carinae defining sides of petiolarea lost in rugose-reticulate sculpture anteriorly; length of median spine of metanotum about 0.4 width of anterior areola. Spine of scutellum glabrous, unsculptured, dorsoventrally flattened, twice as wide as long, bilobate and extending at about 45° dorsally to long axis of body; disc of scutellum rugose, tending to longitudinal ridges; scutellum medially slightly depressed and weakly sculptured, smooth and concave immediately in front of spine. Mesoscutum densely granular with small punctures, notauli indicated by strong reticulate sculpture which is continued in a broad band between notauli just anterior to scutellum; a median longitudinal carina with small, adjacent rugosities running forward from scutellar scrobe for about 0.7 of length of scutum. Mesopleuron, except for upper posterior quarter, with mixed rugose,

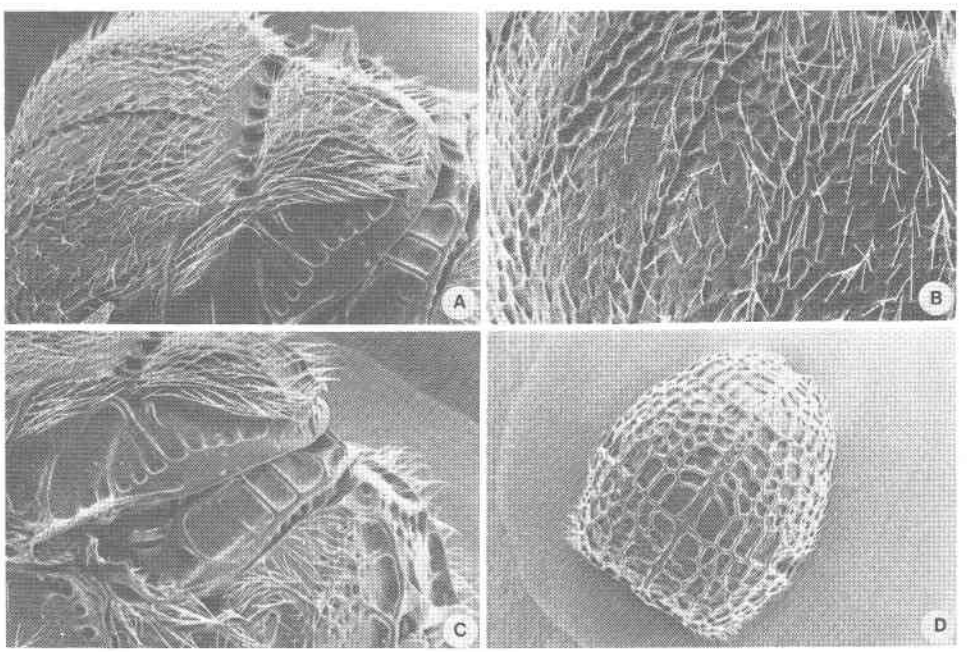


FIG. 73. *Fornicia jarmilae* Mason, species characters, A, B, sculpture of mesoscutum and scutellum; C, scutellum and metanotum; D, abdominal carapace.

punctate, and diagonally aciculate sculpture. Vertex, head behind ocelli, and upper third of eyes, perfectly smooth and glabrous.

Color: black, basal part of antenna yellow up to and including article 7 of flagellum ventrally; extending dorsally and on sides of a few more articles; most of four anterior legs fulvous to yellow but their coxae black; clypeus and mandibles yellow. The following parts white: palpi, tibial spurs, basal 0.3–0.4 of all tibiae. Hind coxae, trochanters and femur black, femur rufescent above; hind tibia black except for whitish base and rufous on inner apical 0.3; hind basitarsus black, basal 0.2–0.3 whitish, remaining tarsomeres brown to fulvous. Veins white basally, brown apically.

Variation: Male paratypes: similar to females but antenna slightly longer, apical articles thinner, and specialized ventral cone-patches missing. Color like that of females but basal yellowish of proximal 6–9 flagellomeres fading gradually to black of apical articles; hind leg with femur red except for extreme apical blackening, tibia with basal 0.3± white, middle 0.3± dark brown, apical 0.4± red, basitarsus brown with basal 0.3 whitish.

Female paratypes: series is unusually uniform; only lateral carinae of propodeal petiolarea vary in length and strength.

Holotype: ♀ ***Ecuador***, **Pichincha**, Rio Palenque Station at 200 m, 47 km South of Sto. Domingo, 18-30 May 1975, Malaise trap, Jarmila Peck (CNC No. 15777). Paratypes: 3♂ 11♀ ***Ecuador***, same data; 1♂ 1♀; **Pichincha**, Tinalandia at 680 m, 16 Km Southeast of Sto. Domingo, June 1975, S.&J. Peck (CNC).

COTESIINI

Ovipositor sheath almost always (98%) shorter than half hind tibia and its hairs few and concentrated near the apex; sometimes hairs small or very small, nearly invisible; ovipositor short, stout basally, and abruptly tapered near the mid-length. Hypopygium evenly sclerotized and short, usually about as long as tall in side view. If, rarely (1%) the sheath is nearly as long as the hind tibia, the hairs are concentrated apically and the sheath arises, as always in this tribe, proximally on the valvifer; additionally the hypopygium in these cases is longer, so the sheath projects little.

Tergites extremely variable and thus of little diagnostic value on the tribal level; tergite I sometimes (20%) with a sharp median groove occupying the basal half or more.

Propodeum often (50%) with a median longitudinal carina; rarely (1%) with other strong carinae except for frequent short traces laterobasally near the spiracle. Metanotum often lacking setae on the sublateral lobes, the phragma more or less exposed. Prepectal carina always absent; pronotum with one or two grooves laterally.

Antennal articles mostly with 2-ranked placodes but rarely these all irregularly arranged. In females with very short antennae placodes are arranged in a single rank on each article. Females of some genera have ventral basicone patches replacing the regular placodes on the central articles.

Larval mandibles variable, often without teeth but sometimes with a few apical teeth or a row of small teeth; if a row of large teeth occurs (2%) the teeth are apical and number less than a dozen. Integument covered by thickly set papulae that have a short spine, or only an acute point or no point at all.

Hosts almost always (98%) Macrolepidoptera and most often (60%) the larvae are gregarious, coming from a single oviposition that deposits many eggs.

QUICK DIAGNOSIS. Hypopygium short and evenly sclerotized; ovipositor short, stout basally, and abruptly tapered about mid-length; sheath short with hairs concentrated apically, arising proximally from valvifer. Propodeum with median carina or none; very rarely areolate. Areolet usually open, but if closed hind coxa longer than tergite I and tibial spurs longer than half basitarsus.

KEY TO GENERA OF Cotesiini

*Couplet halves containing only a few individuals with restricted distribution.

1. Basal half (±) of first tergite broadly U-shaped in cross-section; ovipositor sheath never with large, apically broadening and truncate hairs; areolet usually (95%) open (2r-m usually absent) 2
- Basal half or more of first tergite with a longitudinal median groove, the tergite in cross-section V-shaped or like the cusp of a cycloid curve; ovipositor sheath often with 1–4 large, apically broadening and truncate hairs (Fig. 16); areolet seldom (5%) open (2r-m usually present) 10
2. Hairs of ovipositor sheath normal, about the same size as hairs on terminal abdominal segments; areolet never closed (2r-m always absent) 3
- Hairs of ovipositor sheath smaller than normal abdominal hairs, sometimes almost or quite invisible at 50× (Figs. 18, 19) 7
3. Tergum II with a pair of strong longitudinal grooves delimiting a median area that is longer than wide and usually wider anteriorly, though sometimes parallel-sided or oval but never wider posteriorly (almost exclusively African, rarely in East Asia) ..... (38) *Nyereria*
- If any area is delimited on tergum II it is broadly rectangular or wider posteriorly 4
4. *Propodeum with strong to moderately well-defined areola and strong costulae or at least rugose with a strong and complete transverse carina (New World) ..... (35) *Parapanteles*
- Propodeum with no areola but often with a median longitudinal carina; never with a complete transverse carina although there may be widely separated traces of a transverse carina near the spiracles 5
5. Tergite I always tapering apically; tergite II usually subtriangular and wider posteriorly (very common and widespread) ..... (36) *Glyptapanteles*
- Tergite I parallel-sided or broadening apically, rarely (1%) narrowest at the mid-length 6
6. Propodeum rather smooth, without carinae, the sculpture limited to small areas (small Holarctic genus) ..... (37) *Protapanteles*
- Propodeum mostly rugose, usually with a median carina and a short transverse carina running mesad from near the spiracle (very common ubiquitous genus) ..... (39) *Cotesia*
7. Areolet closed (2r-m present) 8
- Areolet open (2r-m absent) 9
8. *Size small (2 mm ± 0.3 mm long); thorax dorsoventrally flattened; legs and antennae of female short and stout, the flagellomeres each with only a single rank of placodes; hind coxae deep and flattened, about as high as long and often with dorsal edge rugose; metapleuron smooth (New World) ..... (33) *Venanus*
- Size larger (3.6 mm ± 0.9 mm long); body and appendages of usual proportions; most flagellomeres with 2 ranks of placodes; hind coxae longer than high; metapleuron rugose-punctate ..... (31) *Rasivalva*
9. Tergum II with a subtriangular median area defined by a pair of grooves diverging at less than 100°; flagellomeres of female with no false divisions and only a single rank of placodes; legs, especially femora, short and stout (mostly tropical) ..... (34) *Venanides*
- Tergum II usually chevron-shaped with partial, widely diverging (over 120°) anterior grooves and concave posterior margin; antennae and legs normal (mostly tropical) ..... (32) *Distatrix*

10. Flagellomeres with placodes arranged irregularly, often in 3 or more ranks; abdomen very smooth; wings with colored pattern (New World) 11
- Flagellomeres mostly with placodes in 2 ranks (rarely the antenna very short and all flagellomeres with only 1 rank of percurrent placodes); abdomen smooth or coarsely sculptured; wings usually hyaline 12
11. *Tergum II with a large central area delimited by diverging grooves; vannal lobe very small and not delimited by a preaxillary excision (South America) ..... (47) *Larissimus*
- *Tergum II almost completely smooth; vannal lobe normal for the subfamily; tergite I at least 4× longer than wide (mostly North America) .... (46) *Protomicroplitis*
12. *Areolet open (2r-m absent) 13
- Areolet closed (2r-m present) 14
13. *Tergite I at least 4× longer than wide; terga II and III polished; propodeum very coarsely reticulate with 3 irregular carinae diverging from the apical foramen (Old World tropics) ..... (44) *Wilkinsonellus*
- Tergite I much less narrow; terga II and III rimulose; propodeum smooth and polished with a strong median carina (Holarctic and Neotropical) .... (45) *Deuterixys*
14. *Second abscissa of mediella (1M) about 2.5× longer than first (M-Cu); apical band of scutellum uninterrupted; terga II and III smooth, undivided (New Guinea and Melanesia) ..... (41) *Parenion*
- Hind wing vein 1M about 1.5× length of M-Cu; otherwise not agreeing 15
15. *Tergites II and III united into a rather uniformly rugose carapace concealing balance of abdomen; tergite II with no differentiated median field (Africa) ..... (43) *Buluka*
- No such carapace present or if there is one, then tergites II and III both have a median field defined by strong grooves 16
16. *Pronotum with strong dorsal groove as well as a ventral one; tergites I and II polished and moderately punctate; tergite II rectangular, transverse and without delimited median field (New World) ..... (42) *Exix*
- Pronotum rarely with dorsal groove; tergite II usually with a triangular or other median field or tergites strongly rugose ..... (40) *Diolcogaster*

31. *Rasivalva* new genus

Figs. 74, 17

The generic name is feminine, from the latin meaning a shaved valve, an allusion to the almost clean-shaven appearance of the ovipositor sheath.

Type: *Microplitis stigmaticus* Muesebeck 1922.

Hypopygium short and evenly sclerotized; ovipositor short and decurved; sheath shiny with a rounded apex upon which are a few short hairs, no longer than half the depth of the sheath (Figs. 74a, b, 17).

Tergite I longer than wide (L/W = 1.5-2.0) and without a sharp median longitudinal groove, at most the anterior half broadly hollowed but the posterior half always convex and rugose; sides evenly converging apically, barrel-shaped, or parallel and rounded apically. Tergum II with an elongated median area, usually defined by a pair of subparallel or apically converging grooves; dorsal part of tergum mostly punctate to rugose, the central area with less, or a different, sculpture, sometimes smooth; apical margin of tergum II well marked and concave posteriorly.

Propodeum coarsely rugose to rather densely punctate and shining; median carina usually complete but sometimes weak or completely absent. Metanotum without anterolateral projec-

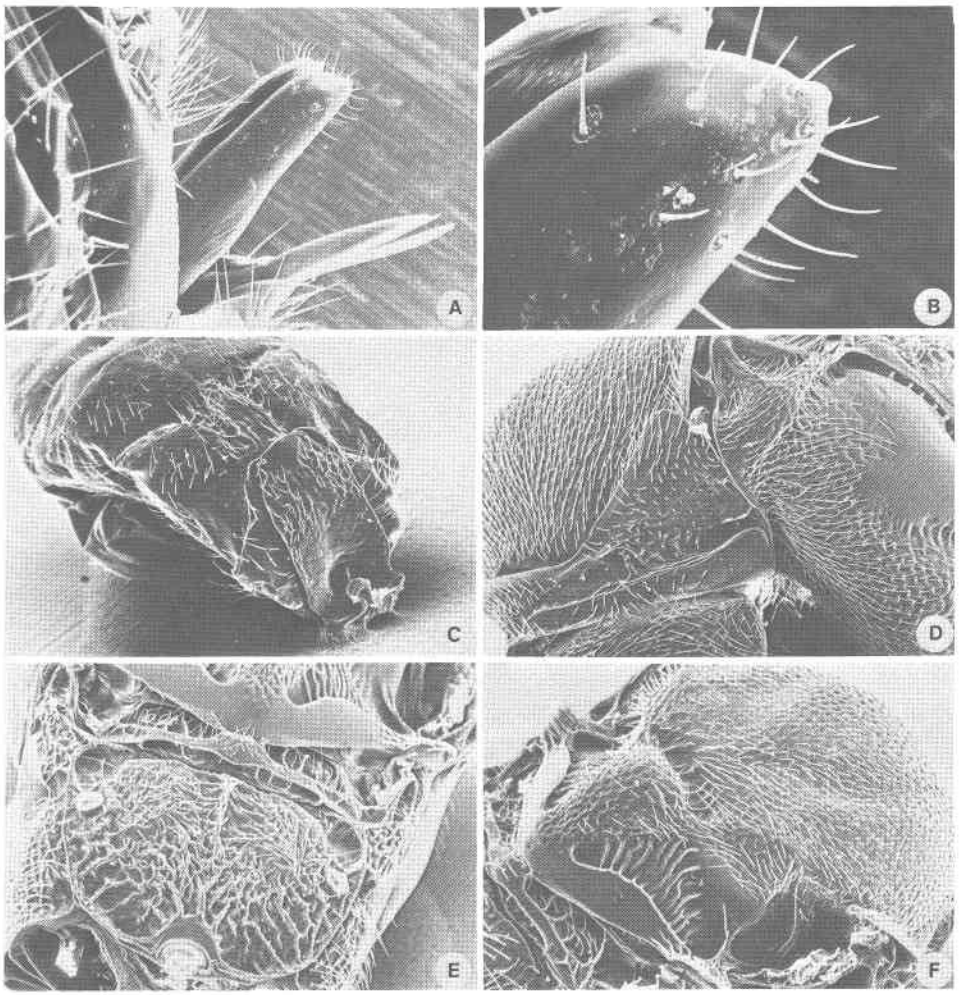


FIG. 74. *Rasivalva stigmatica* (Mues.). A, B, reduced size of hairs on ovipositor sheaths; C, abdomen; D, pronotum; E, propodeum; F, mesonotum and metanotum.

tions; the anterior margin closely appressed to scutellum but sometimes widely separated laterally; apical band of scutellum usually interrupted medially by sculpture, lateral lunules not enlarged. Sides of pronotum with no upper groove. Flagellomeres of female with no specialized sensory patches.

Areolet quadrangular, the 2nd abscissa of radius and 2nd intercubitus both short, less than half as long as 1st intercubitus; vannal lobe convex and hairy.

Larva. Mandible without teeth; labium with 4 hairs, each maxilla with 2; skin covered with spineless papulae (Fig. 106a).

HOSTS. As far as known solitary parasites of Macrolepidoptera (Geometridae, Noctuidae, and Arctiidae).

RANGE AND CONTENTS. The genus is small and species are most numerous in the New World, but I have seen representatives from all continents except Australia. I assign here the following species (all new combinations): *Microgaster calceatus* (-*a*) Haliday, *M. marginatus* (-*a*) Nees, *Microplitis stigmaticus* (-*a*) Muesebeck,

M. rugosus (-*a*) Mues. (= *coloradensis* Mues. NEW SYN.), *M. perplexus* (-*a*) Muesebeck, *M. lepelleyi* Wilkn., *Diolcogaster circumvectus* (-*a*) Lyle, and undescribed species from Nepal, Java, Africa, Mexico, Brazil, and Chile.

REMARKS. The minute hairs of the ovipositor sheath (apomorphic) and the broadly concave first tergite (plesiomorphic) of *Rasivalva* contrast with the normal long hairs of the sheath (plesiomorphic) and median groove on the first tergite (apomorphic) in *Diolcogaster*. Otherwise the genera are reasonably similar. Nixon (1965, p. 256) remarks on the similarity of *R. calceata* (Hal.) and *G. vitripennis* (Curtis), but I think that the resemblance is merely another of the convergences that bedevil the study of the microgastrines because *calceata* and its relatives have two features apomorphic compared with the state found in *vitripennis*, namely, specialized minute hairs on the ovipositor sheath and a toothless mandible in the larva.

NOMENCLATURAL NOTE. The name *Microplitis stigmaticus* Muesebeck is preoccupied in *Microgaster* and in *Microplitis* by *Microgaster stigmaticus* Ratzeburg 1844; a replacement name, *M. muesebecki* was proposed by Marsh (1974). The homonymy within the genus *Microplitis* is secondary, and since it was discovered after 1961, the name *stigmaticus* Muesebeck 1922 must be restored when either species is removed from *Microplitis* (Art. 59c).

32. *Distatrix* new genus

Figs. 75, 18

The name is feminine, meaning she who stands alone.

Type: *Apanteles papilionis* Viereck 1912.

Hypopygium short and evenly sclerotized, apex sometimes acute and protruding; ovipositor short, straight, and gradually tapered. Sheath short, smooth, and bearing only a few minute, almost invisible hairs near apex (Figs. 18, 75b).

Tergite I parallel-sided and rounded apically or weakly narrowed apically, 1.5-2× longer than wide, surface smooth or weakly sculptured. Tergum II mostly smooth and usually chevron-shaped with partial and widely diverging (120°) anterior grooves and concave posterior margin, sometimes with an elongate and elevated median area.

Propodeum smooth, without carinae and weakly curved; side of pronotum smooth, with a poorly marked ventral groove only.

Antennae of normal length, most articles with a false division.

Legs normal to slender; tibial spurs very long and sometimes curved, inner spur of hind tibia much more than half length of basitarsus; females of some species with an excavation and enlarged hair medioventrally on distal front tarsomere. Vannal lobe with margin straight or weakly concave and hairless; radius longer than intercubitus, the two veins meeting at about 135° with a small knob at the junction.

Larva. Mandibles of larva falcate with a few terminal teeth (Fig. 106b); labium with 4 hairs, each maxilla with 1 or 2 extremely long hairs (almost as long as mandible); palpi sclerotized but about as long as wide; skin densely papular, each papula with a short spine.

HOSTS. A wide range of Macrolepidoptera; larvae of most species gregarious.

RANGE AND CONTENTS. This genus is equivalent to Nixon's *formosus* group. I have seen types or reliably identified material of the following species, here included: *Apanteles belliger* (-*ra*) Wilkinson, *A. teapae* Nixon, *A. iglesiasi* Viereck, *A. malloi* Blanchard, *A. papilionis* Vier., *Microgaster formosus* (-*a*) Wesmael, *A. gratiosus* (-*a*) Wilkn., *A. pallidocinctus* (-*a*) Gahan, *A. ugandaensis* Gahan (all new combinations). The genus is moderate in size and widespread in tropical regions with only a few species reaching temperate zones.

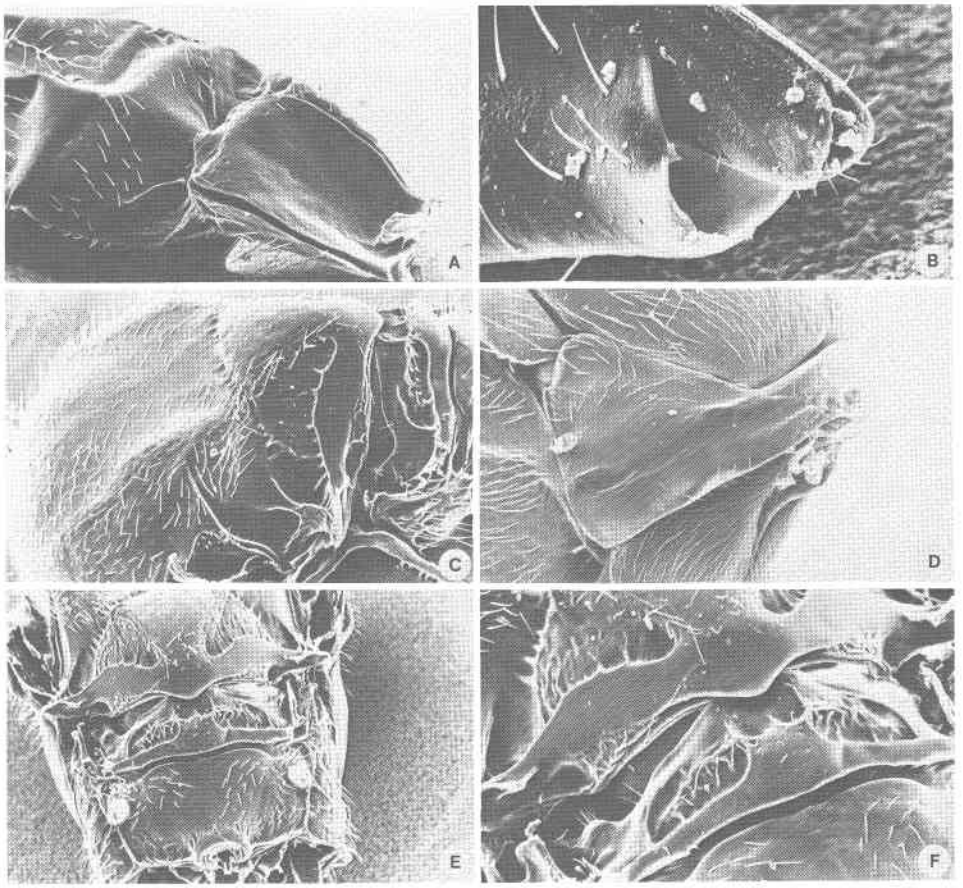


FIG. 75. *Distatrix papilionis* (Vier.). A, base of abdomen; B, reduced hairs on ovipositor sheaths; C, mesonotum; D, pronotum; E, propodeum; F, metanotum and widely exposed phragma.

REMARKS. The closest relatives are species of *Rasivalva*, which differ in the closed areolet, convex hairy vannal lobe, much stronger body sculpture, and strongly differentiated median area of tergum II. All these characters are plesiomorphic in relation to those of *Distatrix*, suggesting an ancestral group.

The species are readily confused with those of the much commoner *Glyptapanteles*, but even males of *Distatrix* may be distinguished by the lack of upper groove on the pronotum and straight or concave, hairless edge of vannal lobe.

33. *Venanus* new genus

Figs. 76, 77, 10A, 13

The name (masc.) is greek for very small, referring to the size of individuals of this genus.

Type: *Venanus pinicola* Mason.

Hypopygium short, neither folded nor bearing creases medially. Ovipositor sheath gradually tapered and polished, bearing a few very small apical hairs which are much shorter than normal body hairs; their length being no more than half the depth of the ovipositor sheath.

Tergite I about 2× longer than wide (sometimes longer) and usually nearly parallel-sided, i.e. slightly broadened or narrowed apically or slightly constricted at the center; surface extensively finely sculptured or smooth but without any notable median groove; tergite II defined by 2 strong, subparallel grooves that delimit a finely sculptured or polished area that is subtriangular, square, or slightly longer than wide. Remainder of abdomen, including sides of tergum II, smooth and sparsely hairy.

Propodeum rather flat, variously, but mostly finely, sculptured and with little indication of strong surface features except an irregular and incomplete apical transverse carina or a partial and weak median carina. Metanotum with anterolateral setiferous lobes that are difficult to see because the margin is appressed to the scutellum, concealing the phragma. Scutellum flat, broad and shiny, with a very broad apical margin; together with the flat and polished scutum and the propodeum forming an even curve in profile. Pronotum smooth, with only a ventral groove.

Stigma deeper than length of radius, which has two sclerotized abscissae; areolet large and 4-sided; vannal lobe convex, the margin with an even fringe of long hairs; nervellus meeting submediella at nearly a right angle; first cubitellan cell rectangular and about twice wider than long. Legs of female very short and stout; of male, less so; hind coxa deep, extending back to tergum II and usually with a conspicuous dorsobasal rugulose area; inner hind tibial spur less than 1.5× length of outer one and about half as long as basitarsus; anterior tarsi of female with distal tarsomere enlarged but otherwise unmodified.

Antennae of male normal, of female very stout and short with some flagellomeres about square in profile and none with the normal false divisions, the placodes all being the same length as the flagellomere. Ocelli small and forming an almost equilateral triangle; face of female strongly bulging.

Larva. Mandible falcate and bearing several apical teeth; palpi normal; labium with 4 hairs, each maxilla with 2. Skin papulae with very short spines (Fig. 106c).

HOSTS. Various microlepidopterous leaf-miners and needle-miners.

RANGE AND CONTENTS. New World, mostly Andean Region and Chile. Besides the species treated here there are many others from South America represented by only odd specimens.

REMARKS. Because of many resemblances this genus is probably closely related to *Venanides*. *Venanus* can be distinguished by the following characters (apomorphic condition found in *Venanides* in parentheses): 2nd intercubitus present, enclosing a large, 4-sided, areolet (2Icu absent); vannal lobe with a convex and hairy margin (margin straight or concave and often hairless); propodeum with abundant sculpture and weakly developed transverse or median carinae (propodeum smooth and ecarinate); propodeum only weakly transverse, W/L = 1.3-1.5 (propodeum definitely transverse W/L = 1.8-2.1); tergites I and II usually extensively sculptured (these tergites smooth).

There may also be a relationship to the species of *Rasivalva*, for these all have the unusual feature of very short hairs on the ovipositor sheath. Otherwise there is no close resemblance.

Venanus and *Venanides* (as well as the unrelated *Deuterixys*) apparently confine themselves to Microlepidoptera, being thus exceptional within the Cotesiini.

Venanus pinicola new species

Figs. 76, 77a

Holotype, female: length 1.8 mm, forewing 1.8 mm, antenna curled but length estimated at 1.0 mm.

Lower and apical margins of hypopygium in profile meeting at an angle of 60°. Tergite I widened apically; apical/basal width = 2.0; length/max. width = 1.6; surface entirely rugulose, somewhat raised medially. Tergum II with median area delimited by deep grooves, raised, and rugulose-granular with median part polished and smoother; length = maximum

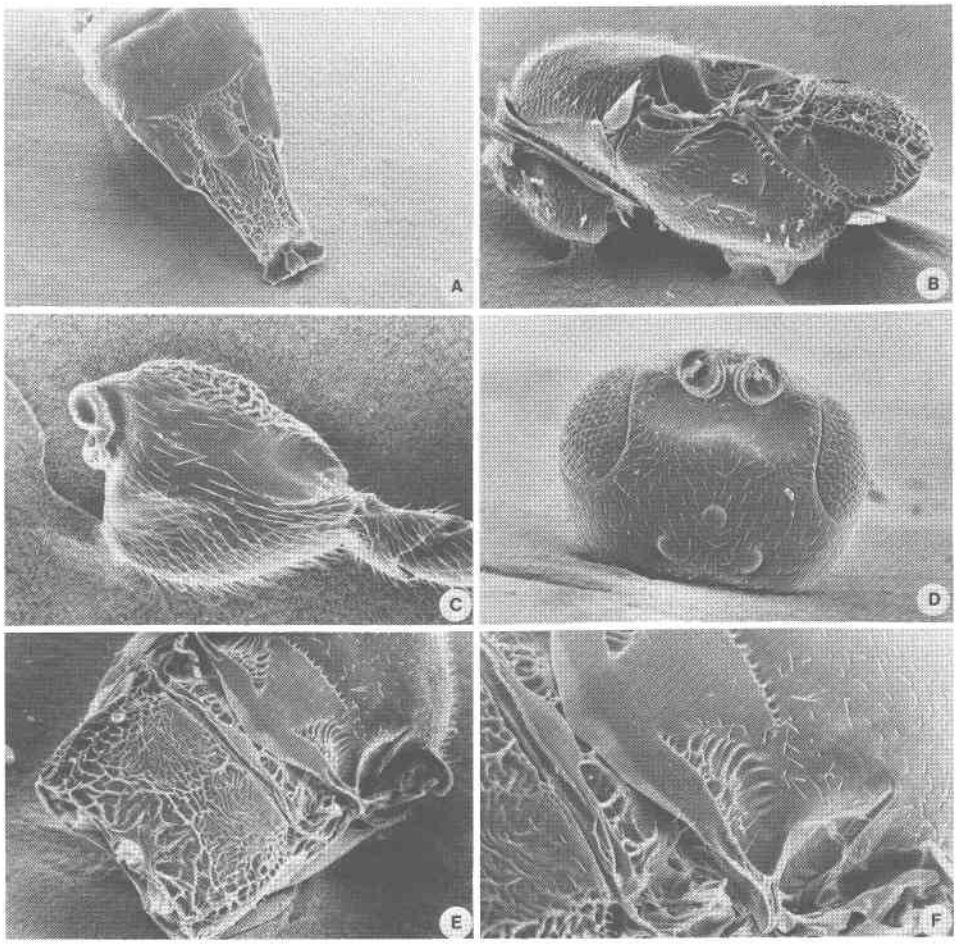


FIG. 76. *Venanus pinicola* Mason. A, base of abdomen; B, profile of alitrunk; C, hind coxa; D, head of female; E, propodeum; F, metanotum.

width = 0.5 length of TI; basal width about 3/4 of apical width; sides smooth; carina II-III concave toward apical side. Tergum TII smooth; length TIII/TII = 1.4. Terga III-V each with an irregular transverse row of 8-12 setae.

Propodeum uniformly rugulose but a little more coarsely so on apical 0.3 behind the indefinitely marked transverse carina; median longitudinal carina absent. Medioapical third of mesoscutum smooth and shiny, with sparse minute punctures separated by about the length of their hairs. Hind coxae short and deep with a small, strongly rugose patch on dorsobasal margin.

Vertex smooth; ocelli very small, separated from one another by about 1 3/4× their own diameter and from eyes by about 3 1/2× forming a triangle with apical angle about 100°. Flagellum short and stout with little taper; article 2 L/W = 1.1, 8 L/W = 0.9, 14 L/W = 1.3, L 2/14 = 1.0, W 2/14 = 1.3; some of the middle articles (6-10±) with L/W = 1.0; only a single rank of placodes (these percurrent) on each of flagellomeres 2-15. Front of head strongly protruding (W/L = 1.05).

Black with brown tibiae and tarsi; pale brown basal band on hind tibia; wings hyaline with pale brown veins.

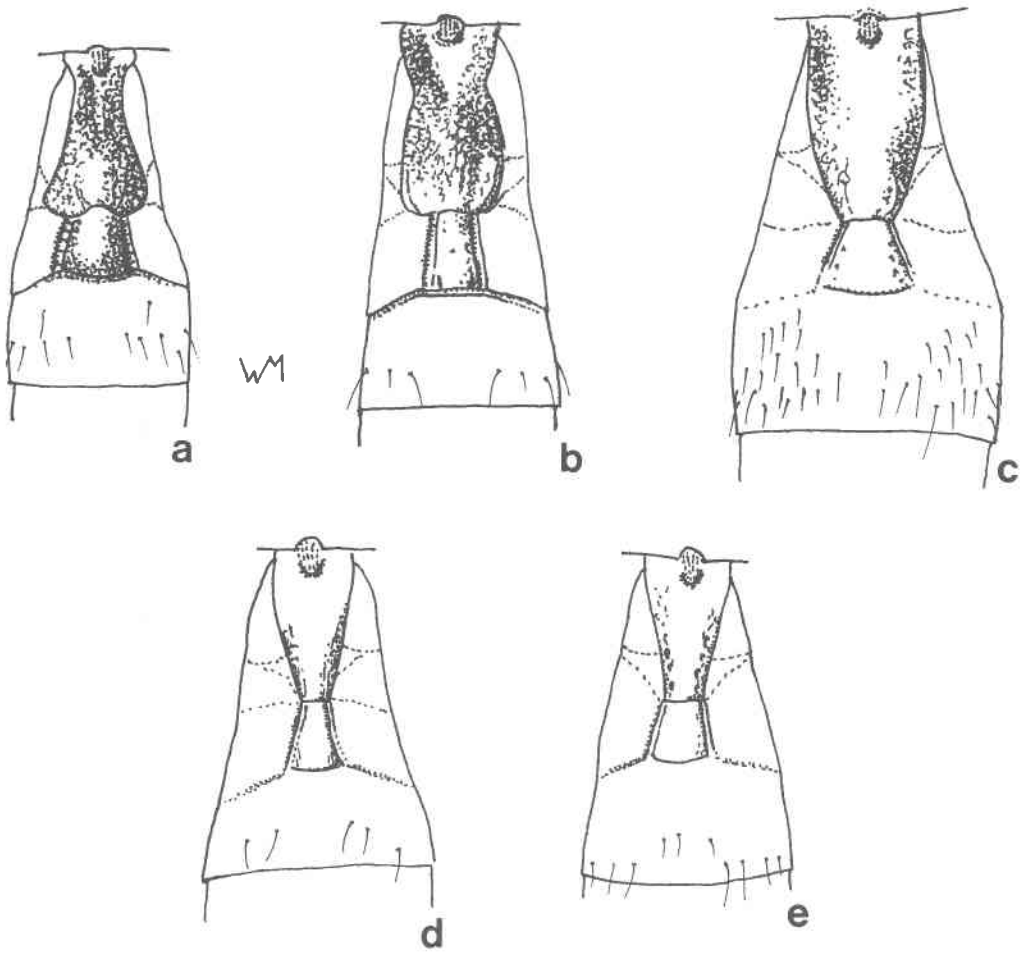


FIG. 77. *Venanus* spp., terga I-III. a, *V. pinicola*; b, *V. helavai*; c, *V. chilensis*; d, *V. minutalis*; e, *V. peruensis*.

Males. Very similar to female except for head, which is less strongly protuberant (W/L = 1.3); ocelli larger, separated by about their own diameter and from eyes by about 2½× their own diameter; antenna much longer, about 1.2× length of forewing, articles 1–14 each with a double rank of placodes; 2 L/W = 2.0, 14 L/W = 2.5, L 2/14 = 1.2, W 2/14 = 1.5. Western males with wings colored as in female: eastern males with milky wings and veins, except for costa, areolet and stigma, almost hyaline.

Holotype: ♀, ***Canada***, **Alberta**, Mt. Eisenhower, Banff National Park, 19 July 1958, reared from Lodgepole Pine Needle Miner, *Recurvaria starki* Freeman by R.W. Stark (CNC No. 15771).

Paratypes: 14♂♂, 16♀♀; ***Canada***, **B.C.** Robson, Hixon, Summit L. at mile 392 Alaska Hwy., Victoria (reared from *Gracillaria invariabilis*); **AB.** Johnston Canyon near Banff at 4700 ft. [1430 m]; **PQ.** Kazabazua; **NS.** Bridgetown, Sable I., Halifax (reared from *Gracillaria asplenifoliella*), Annapolis (from microlepidoptera on *Gaylussacia*); **U.S.A., ID.** Burley (mass reared from *Pinus contorta*). Dates of capture are July and August in the West, August and September in the East. Paratypes in CNC and USNM.

Venanus helavai new species

Fig. 77b

Holotype, male: length 2.5 mm, forewing 2.5 mm, antenna 2.8 mm.

Tergite I constricted at basal 0.4; apex/narrowest part = 1.4, apex/base = 1.2, length/apical width = 1.9; surface completely rugulose, mediobasal part weakly hollowed, medioapical 0.6 broadly convex. Tergite II elongate rectangular L/W = 1.5; width = 0.6 apex of tergite I; length = 0.5 length of tergite I and 0.75 length of tergite III; surface convex, polished, and weakly rugulose laterally. An irregular row of 4-6 hairs on dorsal side of terga III-V.

Propodeum rugulose and partly polished anteriorly, rugose posteriorly; median carina strong and percurrent. Remainder of thorax and coxae as in *V. pinicola*.

Antenna with a very bushy, bristly appearance; flagellomere 2 L/W = 1.4 14 L/W = 2.6, L 2/14 = 0.7, W 2/13 = 1.3. Ocelli making an anterior angle of 70°, separated from one another by 3/4 of their own diameter and from the eyes by 2.3×.

Black with anterior tarsus and tibia brown; wings lightly infuscated with brown veins and stigma.

Holotype: ♂, ***Colombia***, **Antioquia** province 1800 m, 7°05′ N, 76°30′ W, 18-22 April 1973, J. Helava (CNC No. 15772).

Paratype: 1♂, same data.

Venanus minutalis (Muesebeck) (new comb.)

Fig. 77d

Microplitis minutalis Muesebeck 1958.

Female. Length 1.6-1.8 mm, forewing the same length, antenna 1.1 mm.

Lower and apical margins of hypopygium in profile meeting at 70°. Tergite I narrowed apically; apical/basal width = 0.4; length/max. width = 1.5; surface smooth except for slight sculpture apicolaterally; sides parallel for basal half, then curving mesad apically. Tergite II smooth, 0.6 as long as TI and 0.8 as long as TIII: width of apex/base = 2.0; width of apex/length = 0.8; sides delimited by strong diverging grooves. Terga III-V with an irregular row of 4-5 hairs dorsally on each side.

Propodeum mostly weakly transversely aciculorugulose or granular with two vaguely indicated courses of aciculations forming a "V" with the point at the foramen. Thorax like that of *V. pinicola* but hind coxae smooth above.

Vertex and ocelli like those of *V. pinicola*. Antenna short, stout, and curled, but distinctly tapered; flagellar article 2 L/W = 1.0-1.1, 14 L/W = 1.1-1.2, 8 L/W = 1.1-1.2, L 2/14 = 1.2, W 2/14 = 1.4; basal articles (2-6±) about as wide as long.

Color almost totally black with legs tending to be dark brown. Wings hyaline except for brown venation.

Males. Resemble the female except for the head, which is less protruding; ocelli larger, separated by slightly more than their own diameter and from eyes by 2½×; antennae longer (1.1× forewing) and with articles 1-15 each with 2 ranks of placodes; article 2 L/W = 1.8, 14 L/W = 2.5, L 2/14 = 1.1, W 2/14 = 1.5; color black like that of female but wings sometimes tend to be milky with pale veins.

Redescribed from some paratypes and other specimens.

DISTRIBUTION. ***Chile***; Santiago, Maule, Malleco.

Venanus chilensis new species

Fig. 77c

Holotype, male: length 2.5 mm, forewing 2.5 mm, antenna 3.0 mm.

Most closely resembles male of *V. minutalis* (Mues.) but differs notably by its larger size and by the much more extensive sculpture of tergite I, by tergite II being wider than long, by median carina and coarser sculpture of propodeum, and by different hair pattern on abdomen.

Tergite I smooth centrally, lateral third or more granular-rugulose on all but the apical 0.1 or .2; apical/basal width = 0.6, length/max. width = 1.7. Tergite II 0.4 as long as TI and 0.6 as long as TIII; apical width/base = 1.8; apical width/length = 1.4. Terga III-V each with a patch of 10-20 hairs on each side but the center glabrous.

Propodeum with a median carina that is strong posteriorly but weaker and irregular anteriorly; apical half strongly rugose, basally rugulogranular.

Antenna like those of *V. minutalis* ♂ but article 14 thinner, 14 L/W = 3.2. Color black like that of *V. minutalis* but the hind tibia with basal 0.4 contrastingly fulvous.

Variation, paratypes: propodeal median carina varying from complete to present only at posterior end. Wings hyaline with brown veins to milky with yellowish veins.

Holotype: ♂, ***Chile***, **Malleco** Prov., Malcahuelo at 1100 m., 20-22 Jan. 1977, S.&J. Peck (CNC No. 15773).

Paratypes: 1♂, ***Chile***, **Osorno**, Port. de Puyehue, 13-19 Mar. 1955, L.E. Pena; 2♂♂, **Linares**, Cordillera Parral, Bulileo, 15 Dec. 1960. L.E. Pena; 1♂, **Arauco**, Butamalal, 23 Jan. 1958, L.E. Pena (CNC).

Venanus peruensis new species

Fig. 77e

Holotype, female: length 2.0 mm, forewing 2.0 mm, antenna 1.3 mm.

Lower and apical margins of hypopygium making an angle of about 50°. Tergite I with sides converging posteriorly but straight, surface smooth but a few punctures and fine aciculation on lateral margins; apical/basal width = 0.6 length/max. width = 2.0. Tergite II smooth, 0.4 as long as TI and 0.4 as long a TIII, apical width/basal = 1.6; apical width/length = 1.2. Terga III-V each with an irregular row or patch of 5-8 hairs on each side.

Propodeum weakly aciculogranular but mostly smooth on the mediobasal third or more; the strongest feature being a stub of median carina from the foramen. Thorax and legs otherwise like *V. minutalis*.

Vertex smooth, ocelli very small, separated by nearly 2× their diameters and separated from eye by 4½× their diameter. Flagellar article 2 L/W = 1.5, 14 L/W = 1.6, 8 L/W = 1.5, L 2/14 = 1.1, W 2/14 = 1.1. None of the articles has width = length and taper is minimal; all but basal articles have 1 rank of percurrent placodes.

Color: almost totally black but tarsi and basal 0.3 of hind tibia fuscous. Wings hyaline with brown venation.

Male paratypes: resemble the female except for the longer slimmer antennae and larger ocelli: flagellar article 2 L/W = 2.7, 14 L/W = 2.8, L 2/14 = 1.1. Ocelli separated by about their own diameter and separated from the eye by about 3× their diameter.

Holotype: ♀, ***Peru***, **Pasco**, 10°30′ S, 75°30′ W, 4050 m. 28 Dec. 1972, J. Helava (CNC No. 15774).

Paratypes: 2♂♂, same data (CNC).

34. *Venanides* new genus

Figs. 78, 79

The name (masculine) means sons of *Venanus*.

Type: *Venanides xeste* new species.

Hypopygium short, evenly sclerotized, ovipositor sheath short, smooth, and bearing minute hairs near apex or apparently hairless. Even the apparently hairless sheaths have minute apical sensilla and minute subapical hairs that are invisible by ordinary stereomicroscopy (Fig. 19).

Tergite I usually evenly tapering to apex, 2-3× longer than wide, but sometimes parallel-sided and rounded apically and less than 2× longer than wide; surface smooth or almost so. Tergum II with a partial or complete subtriangular area that is about as long as wide at apex and is laterally marked by grooves that diverge at less than 100°.

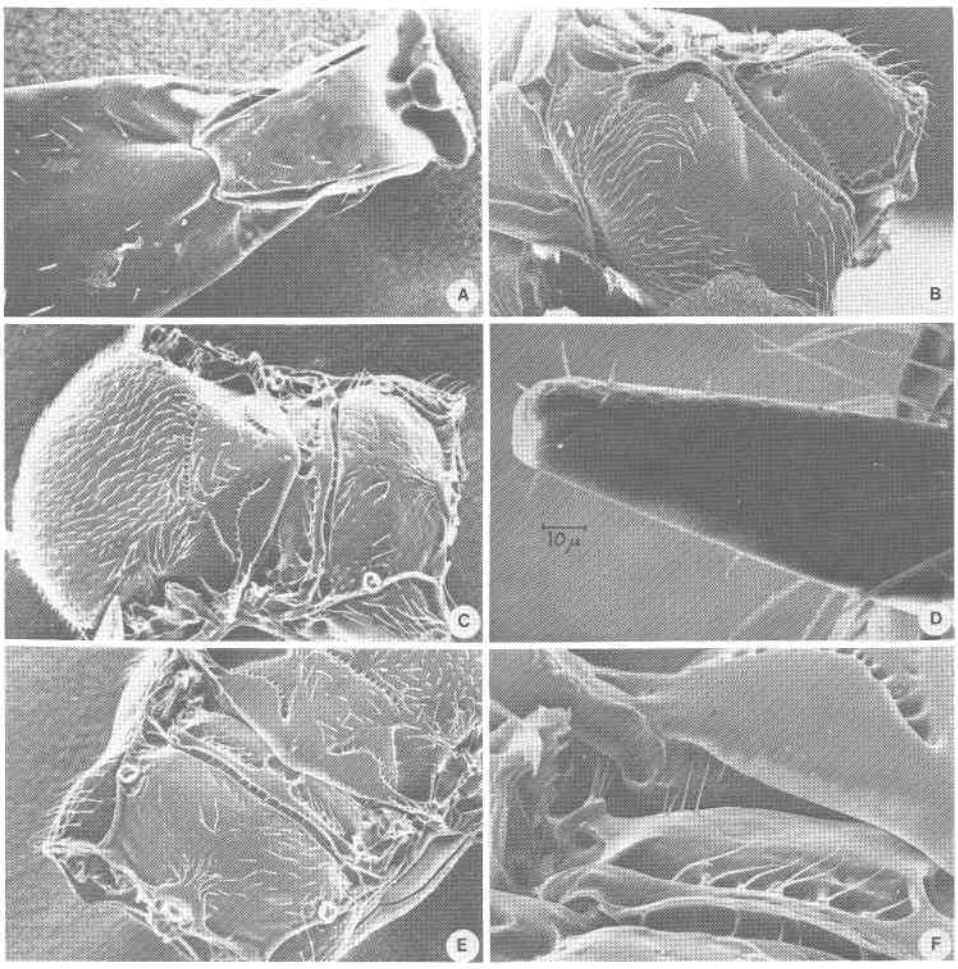


FIG. 78. *Venanides xeste* Mason. A, base of abdomen; B, hinder alitrunk in profile; C, mesonotum to propodeum; D, ovipositor sheath to show minute hairs and sensilla; E, propodeum; F, metanotum.

Propodeum almost smooth, ecarinate, weakly convex, and without noticeable posterior declivity. Scutum and scutellum shiny, weakly punctate, together forming an evenly flattened surface interrupted only by a very narrow scutellar scrobe. Pronotum smooth, with only a poorly defined lower groove.

Antenna of males normal; those of females short and thick, the articles without false divisions, placodes mostly extending full length of article.

Legs short and stout, especially femora; tibial spurs very long, inner spur of hind leg much more than half the basitarsus; fore tarsus of ♀ with distal article swollen and usually bearing a large spine and emargination ventrally; hind coxa deep and compressed above, the upper outer side usually flat, shiny, and impunctate. Vannal lobe straight, proximally hairy, distally bare.

Larva. With a falciform mandible bearing a few apical teeth; palpi short; labium with 4 hairs, each maxilla with 2 extremely long hairs; skin papules each with a short central spine; skin with numerous trichiae (Fig. 106B).

HOSTS. Microlepidoptera, especially Pyraloidea and Tortricoidea; larvae usually gregarious.

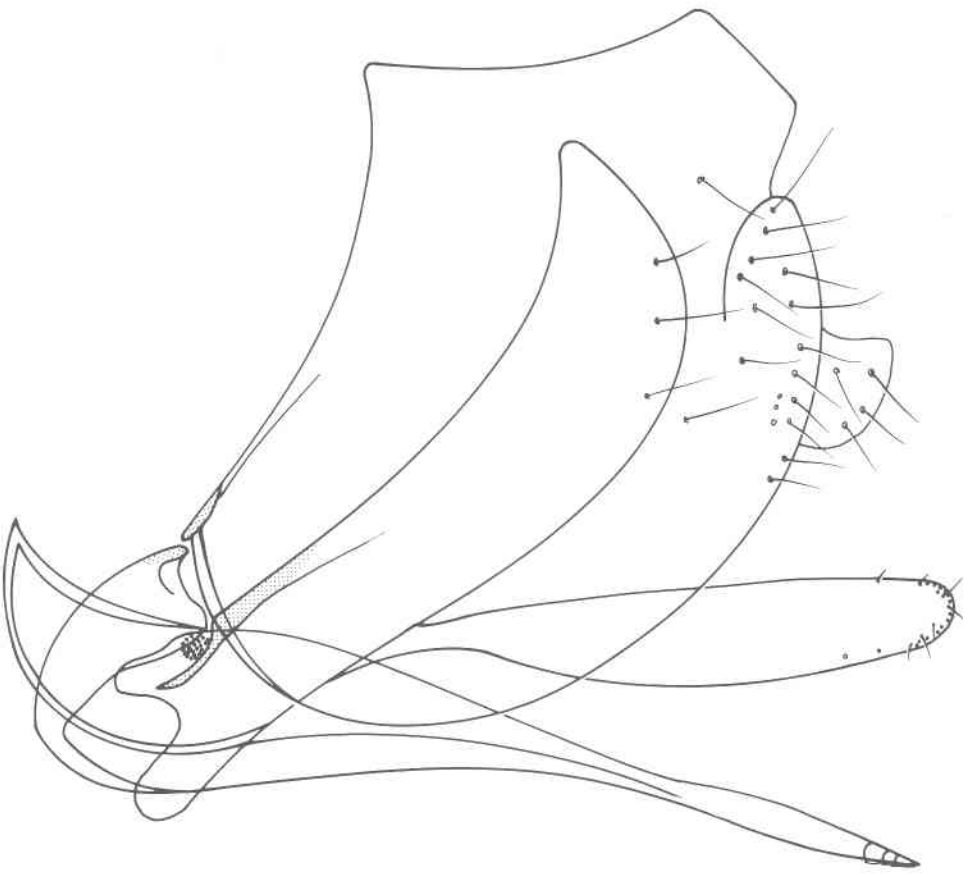


FIG. 79. *Venanides xeste* Mason, female genitalia.

RANGE AND CONTENTS. I place here the type-species, *A. pyrogrammae* Nixon and *A. congoensis* de Saeger. The genus is the same as Nixon's *congoensis* group. It is very widespread but not rich in species.

REMARKS. The closest relative is *Venanus*, probably an ancestral group that shares similar anatomy and choice of hosts, both aberrant within the Cotesiini. *Venanus* differs in its complete areolet, sculptured propodeum, more definitely defined 2nd tergite and dorsally rugose hind coxa, all plesiomorphic characters in relation to those of *Venanides*. The resemblance to *Distatrix* is striking but I think the relationship is that of cousins, not sisters. *Venanus* and *Rasivalva* are probably sister groups: *Venanides* and *Distatrix* their respective descendants.

Venanides xeste new species

Holotype, female: length 2.4 mm, forewing 2.8 mm, antenna 1.6 mm.

Tergite I with sides very weakly convex, tapering gradually toward apex; length almost 3× basal width, which is twice apical width; surface smooth except for a few small punctures and striae at sides apically. Tergum II with central area marked by grooves that diverge at 80° and only extend half the length of the tergum; surface smooth with a few hairs on each side; length of tergum II twice the basal width of the median plate and about half length of tergum III. Dorsal parts of third and following terga each with 10 or fewer scattered hairs.

Mesonotum densely and uniformly hairy on the flat part, the hairs separated by about half their own lengths; no median glabrous area on scutum; scutellum very much less densely hairy. Fore tarsus short, articles 2, 3, 4 together about as long as 5 and also much narrower than 5; distal tarsomere with a medioventral large curved spine, this structure weakly repeated on hind tarsus; middle and hind tarsal claws with large basal lobe; hind coxa extended dorsally almost to a ridge, the outer side flat, almost hairless, and highly polished, the upper part weakly concave and bearing a few large shallow punctures.

Antennae short, less than 0.6 as long as forewing; strongly tapered, apical article less than $^2/_3$ as wide as basal ones; antennal formula: 2 L/W = 1.1; 8 L/W = 1.2; 14 L/W = 1.2; L 2/14 = 1.5; W 2/14 = 1.6.

Color: black, the following parts fulvous: scape and basal flagellomeres below, clypeus, mouthparts, four anterior coxae and legs, tegula, wing veins, apical suffusion on hind coxa, hind leg except the brown apical 0.2 of tibia, lateral and ventral parts of base of abdomen, medioventral suffusion on hypopygium. Wings hyaline with dark brown stigma; antenna brown.

Males. Differ from females chiefly in the much longer antennae, which are about 10% longer than forewing, have all flagellomeres 2× longer than wide and flagellomeres 1–15 with 2 ranks of placodes and false divisions. The legs are slightly less stout and the specialized tarsal spine is lacking. Brown band on hind tibia occupies apical 0.4 and hind tarsi are brown.

Holotype: ♀, ***Canada***, **Ontario**, Simcoe, 28 June 1939, reared from *Dichomeris ligulella* Hbn. (Gelechiidae) by G.M. Freeman (CNC No. 15775).

Paratypes: ***Canada***, **ON.** 9♀♀ same data as holotype, a gregarious series reared from one larva; 5♂♂, same data but collected 1 July by G.S. Walley; 1♂, 1♀, Vineland, 2 July 1938, reared from *Trichotaphe flavocostella* by W.L. Putman; 1♂, 1♀, Chambers Corner, 5 July 1940, ex *Gelechia vernella* by Forest Insect Survey; 1♂, 1♀, Rondeau Park, 8 July 1940, same host; 1♀, St. Williams, 8 July 1940, same host; **U.S.A.**, **MN.** 1♀, St. Paul, 1 July 1939, John T. Medlar, **MI.** 1♀ Midland Co. 24 June 1952, R.R. Dreisbach; **NY.** 1♂, 1♀, Derby, 3 July 1956, ex Gelechiidae, K.V. Krombein; **CT.** 1♀, East River, 11 July 1912, from leaf roller in chestnut, C.R. Ely; **IA.** 1♀, Ames, 23 June 1912, R.L. Webster; **NC.** 2♀♀, Raleigh 10 August 1948, at light, M.W. Wing; **AR.** 1♂, 2♀♀, Washington Co. 20 July 1942, reared from Redbud Leafroller; 1♂, Bentonville, June 1918, ex *Canarsia*, D. Isely; **TX.** 1♀, Dallas, 3 July 1908, at light, E.S. Tucker; **AZ.** 1♀, Portal, 18 June 1956, R.R. Dreisbach; ***West Indies***, 2♀♀, **St. Lucia**, 1972, Malaise Trap; ***Brazil***, 2♀♀, **Sta. Cath.**, Nova Teutonia, 17 June 1961 and 20 Nov. 1957, Fritz Plaumann. Paratypes in CNC and USNM.

REMARKS. In spite of the enormously wide range (Canada to Brazil) I cannot find even the slightest difference between Neotropic and Nearctic specimens. The species is surprisingly similar to *Glyptapanteles politus* (Riley), but *politus* differs in having both upper and lower grooves on the pronotum, and, in females, normal hairs on the ovipositor sheath and only weakly tapered antenna.

35. *Parapanteles* Ashmead 1901

Fig. 80

Type: *Apanteles aletiae* Riley 1881.

Ovipositor short and decurved, strongly tapered at about its mid-length; sheath smooth with a few hairs on the apical 0.2, arising proximally from the valvifer. Hypopygium short and evenly sclerotized. Tergite I coarsely sculptured, broader apically or parallel-sided to curving and narrower apically; tergite II rectangular or broadening apically, mostly rugulose.

Propodeum smooth to rugose, bearing a large but not always well-defined areola on the declivous face and a median carina on the anterior, horizontal, face; strong costulae lie between the horizontal and declivous faces, often forming, with the anterior arms of the

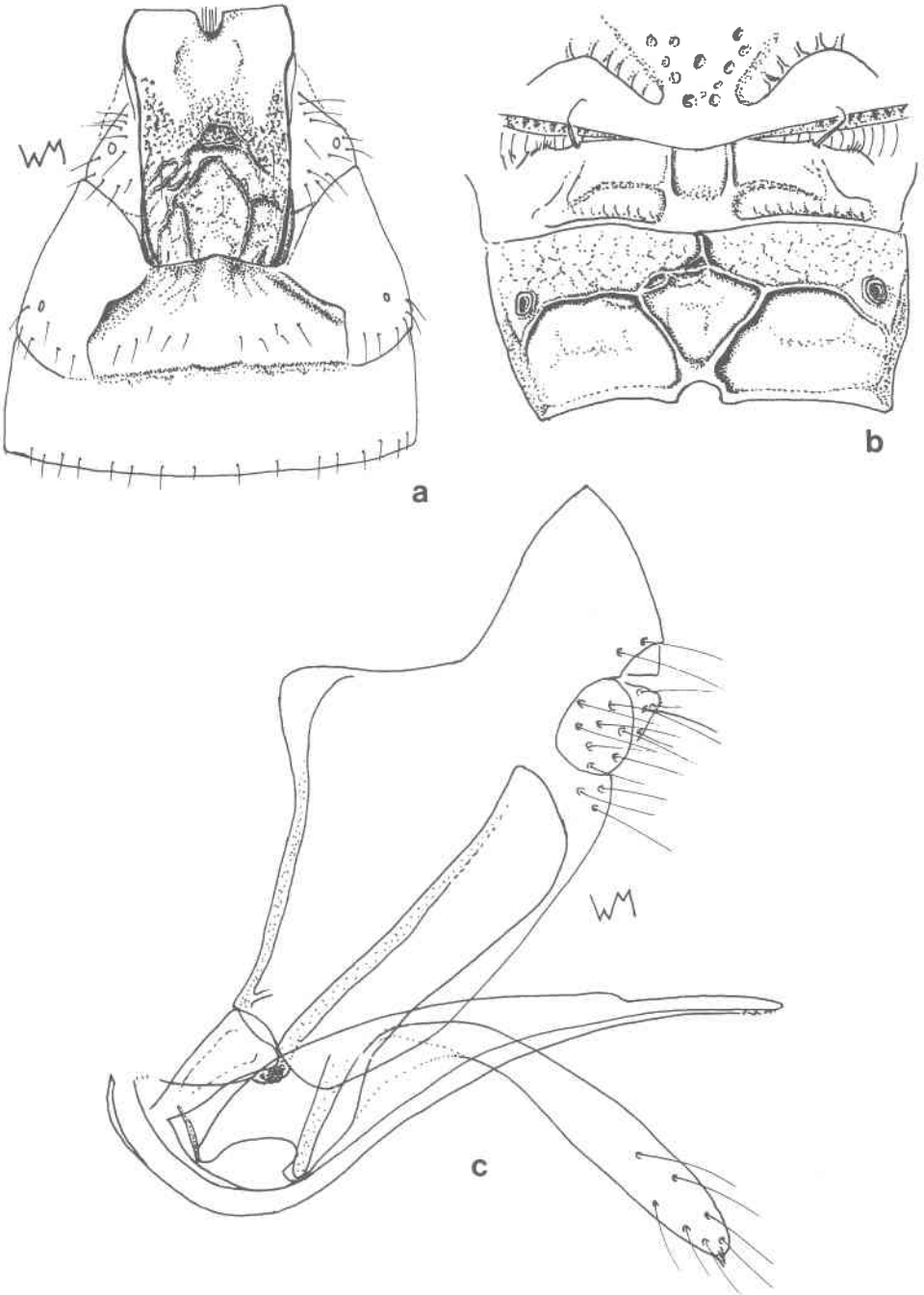


FIG. 80. *Parapenteles aletiae* (Riley). a, terga I-III; b, propodeum and metathorax; c, female genitalia.

areola, a conspicuous transverse ridge. Anterior margin of metanotum withdrawn from scutellum, exposing the phragma laterally and sometimes with 1 or 2 hairs on a weak lateral lobe. Pronotum with strong upper and lower grooves.

Areolet open (2r-m absent); basal vein conspicuously angled at junction of cubitus (RS+M); nervellus (cu-a) meeting submediella (1A) at an angle; margin of vannal lobe convex or nearly straight and uniformly hairy.

Larva. Unknown, but gregarious.

HOSTS. Noctuidae and Notodontidae.

RANGE AND CONTENTS. I place here the type, *A. aletiae* Riley from the southeastern U.S.A., and a few Neotropical species of which only *A. paradoxus* Muesebeck (new comb.) from Costa Rica has a name.

REMARKS. Nixon (1965, p. 127) placed *aletiae* in his *ultor* group but the ovipositor structure assigns it definitely to Cotesiini and the macrolepidopterous host confirms it. I think the highly aberrant feature of an areolate propodeum shows its very primitive position within the tribe.

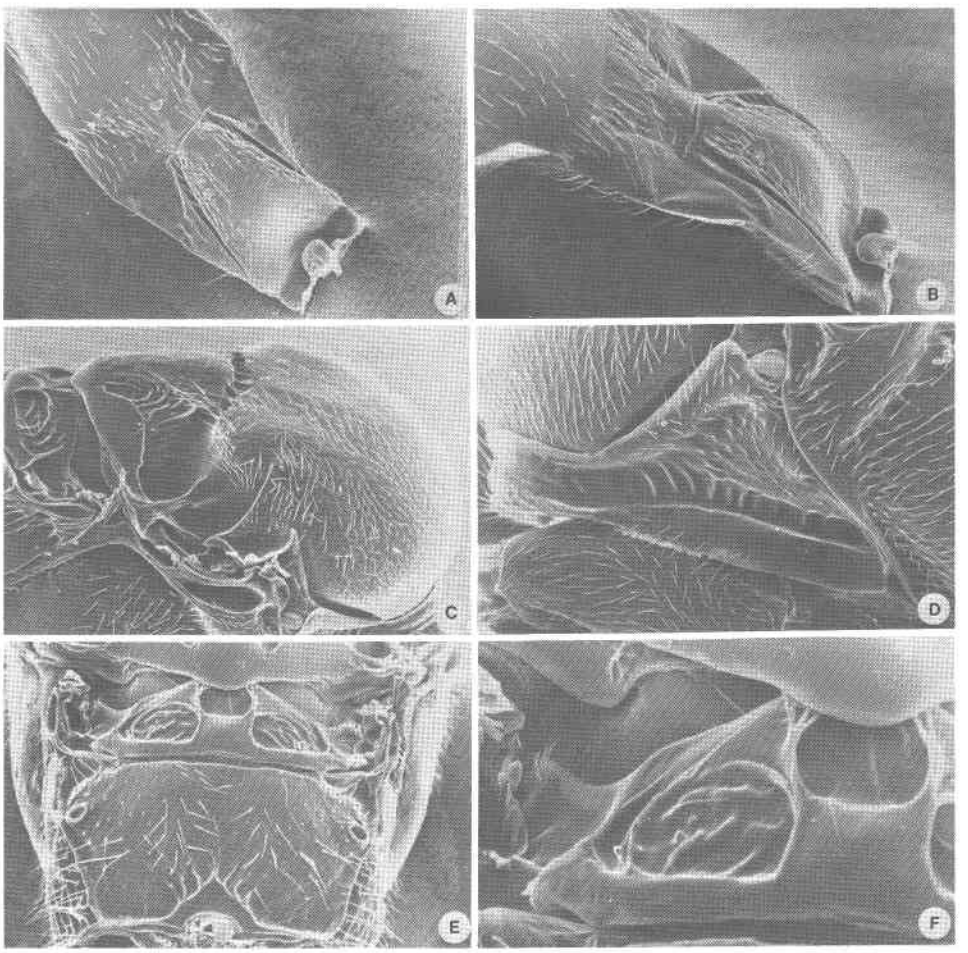


FIG. 81. *Glyptapanteles compressiventris* (Mues.). A, B, base of abdomen; C, mesonotum; D, pronotum; E, propodeum; F, metanotum.

36. *Glyptapanteles* Ashmead 1905

Figs. 81–83, 110

Type: (*G. manilae* Ashmead 1905) = *Apanteles ashmeadi* Wilkinson 1928.

Wilkinson proposed *A. ashmeadi* as a new name for the secondary homonym *G. manilae* (Ashm.) 1905 (not *A. manilae* Ashm. 1904) when he transferred the former species to *Apanteles*. The replacement name is permanent (Art. 59 (b) (i), amended 1972, Bul. zool. Nom. 29: 180).

Hypopygium of female evenly sclerotized from side to side, never with a series of parallel longitudinal creases. Ovipositor sheath short and mostly concealed by hypopygium, its length not over half that of hind tibia (rarely longer, but if so hypopygium is large and acutely pointed, concealing most of the ovipositor); sheath with only a few hairs and these concentrated near the apex.

Tergite I never wider at apex, at least 1.5 times as long as its greatest width, the sides either gradually converging apically or parallel for the basal 0.8± and strongly rounded to apex. Tergum II with a pair of grooves diverging apically and delimiting a tergite that is subtriangular or truncate-pyramidal, but with apical width about equal to length; sometimes lateral grooves are lost among many diverging aciculations. Tergite II 0.5–1.0 as long as tergum III. Basal two tergites often completely smooth and polished but varying from that to mostly rugulose or rugoaciculate.

Propodeum usually completely or mostly smooth but often with coriaceous, punctate, or rugulose sculpture covering all or part of surface; rarely with a median longitudinal carina but never with even a trace of areola. Distal half of margin of vannal lobe of hindwing convex, with or without a fringe of hairs; areolet always open.

Larva. Blade of mandible varying greatly; toothless or with a group of large or small terminal teeth or a full row of small wide teeth (Figs. 107A, B, 108D).

HOSTS. A wide variety of Macrolepidoptera. Many of the species are gregarious.

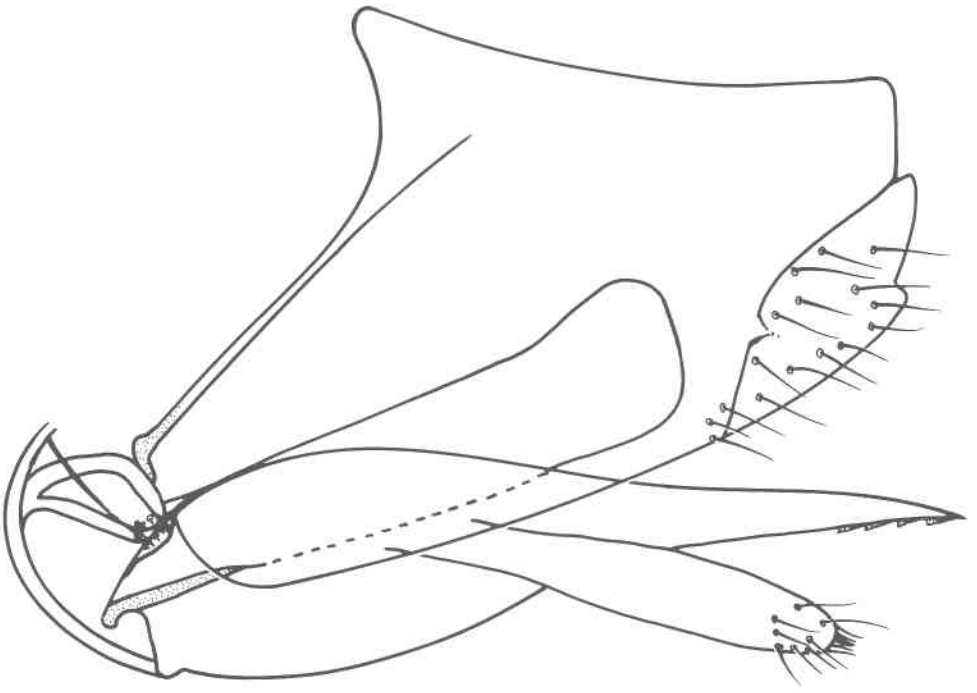


FIG. 82. *Glyptapanteles militaris* (Weed), female genitalia.

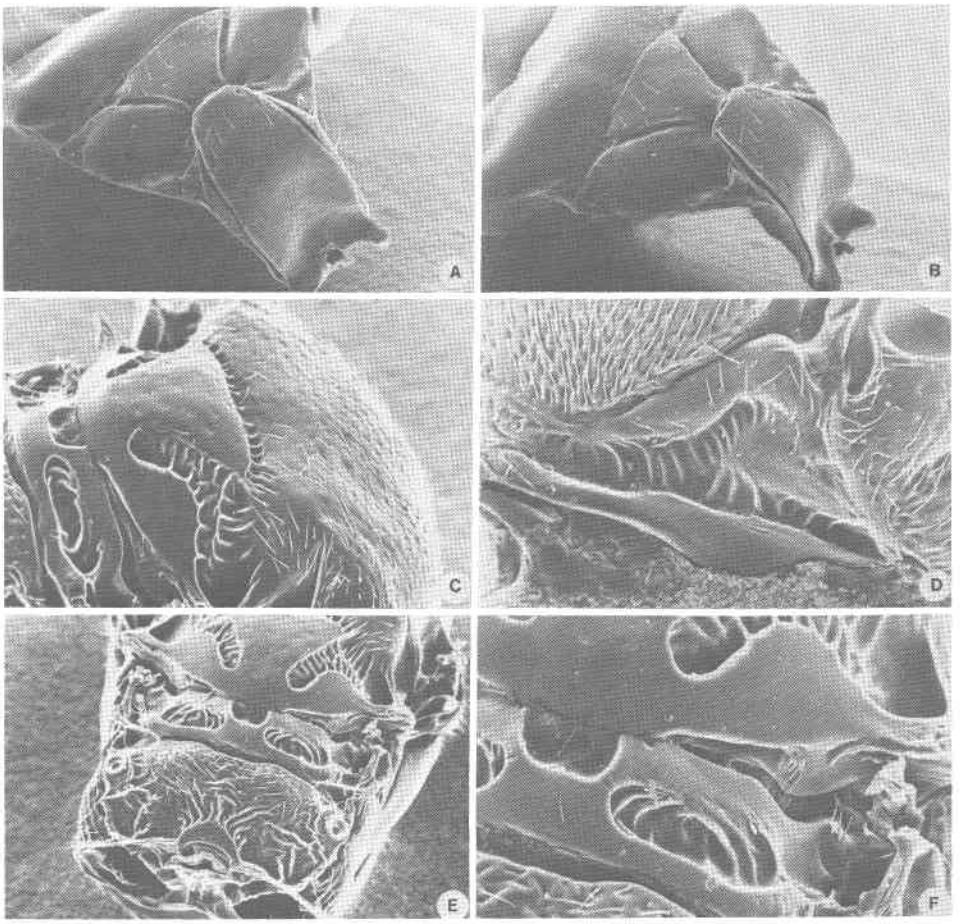


FIG. 83. *Glyptapanteles militaris* (Weed) (a species closely related to the genotype). A, B, base of abdomen; C, mesonotum; D, pronotum; E, propodeum; F, metanotum.

RANGE AND CONTENTS. *Glyptapanteles* is one of the larger segregates of the old "*Apanteles*" including 5-10% of the species in temperate regions but up to 25% in the tropics, probably 1000 species or more. It includes most of the species in Wilkinson's group A or Nixon's species groups *vitripennis*, *octonarius*, *pallipes*, *siderion*, *demeter*, *fraternus*, and *triangulator*. The first two of Nixon's groups hold the great bulk of the species; the first (*vitripennis*) being especially well developed in cool and humid temperate climates, the second (*octonarius*) in humid warm-temperate and tropical climates. The genus is less well represented in dry climates.

The following Nearctic species belong in *Glyptapanteles* (new combinations): (***octonarius* group**), *Apanteles caffreyi* Muesebeck, *A. cassianus* Riley, *A. floridanus* Mues., *A. herbertii* Ashmead, *Microgaster militaris* Walsh, *A. nigricornis* Mues., *A. politus* Riley, *A. websteri* Mues. (***vitripennis* group**) *Protapanteles alticola* Ashm., *A. compressiventris* Mues., *A. compressus* Mues., *A. flavovariatus* Mues., *A. luteipennis* Mues., *A. pallipes* Reinhard, *A. sarrothripae* Weed. There are many undescribed species in North America; the list above represents no more than 30% of the total Nearctic fauna. I have also seen types or trustworthy determined material

of the following exotic species: *Microgaster vitripennis* Curtis, *M. fulvipes* Haliday, *M. inclusus* Ratzeburg, *M. liparidis* Bouché, *A. porthetriae* Mues., *A. fraternus* Reinhard, *A. thompsoni* Lyle, *M. triangulator* Wesm., *A. vafer* Nixon, *A. sagmaria* Nixon, *A. malthacae* Mues., *A. concinnus* Mues., *A. africanus* Viereck, *A. beneficus* Vier., *A. eucosmae* Wilkinson, *A. gowdeyi* Gahan, *A. laxatus* Wilkn. I also transfer *A. demeter* Wilkn. provisionally to this genus. *M. lateralis* Hal. and *A. fausta* Nixon, placed in the *vitripennis* group by Nixon (1973), are transferred to *Sathon* where their characters are more harmonius.

REMARKS. I am not fully satisfied that this asssemblage is a natural genus. For one thing the larval mandibles show an inordinate range of variation which does not correlate with adult characters. Perhaps when more is known of the immature stages it will become possible to remove disturbing elements now placed in the *vitripennis* group and attach them to *Protapanteles*, a group to which they seem closely related through species such as *A. anchisiades* Nixon and *P. alaskensis* Ashmead.

37. *Protapanteles* Ashmead 1898

Figs. 84, 85

Type: (*P. ephyrae* Ashmead 1897) = *Apanteles paleacritae* Riley.

Hypopygium of female evenly sclerotized from side to side, never with a series of longitudinal striae near middle. Ovipositor sheath short and mostly concealed by hypopygium, its length (including concealed part) not over half that of hind tibia, the few hairs concentrated near apex.

Tergite I broadening slightly distally or parallel-sided but strongly rounded apically, its length 1-2× greatest width. Tergite II with a pair of complete or incomplete discal grooves diverging posteriorly at 60° to about 150°, the acute angles delimiting a subtriangular area, the obtuse a subrectangular one; length of tergite II 1-2× its apical width and over half, usually about two-thirds length of tergum III. Apical half or more of tergite I and the part of tergite II between the diverging grooves rugulopunctate or ruguloaciculate; tergum III mostly or entirely smooth.

Propodeum usually mostly smooth, never with a median carina or even trace of an areola; even if parts of the propodeum are rugulose the sculpture always markedly smoother than in *Cotesia*. Side of pronotum with both a dorsal and a ventral carinate groove.

Radius and intercubitus both long and meeting at a sharp angle; areolet open; vannal lobe of hindwing convex and nearly always with a conspicuous fringe of hairs. Apical segment of fore tarsus of female usually with a conspicuous lateroventral curved hair and a weak distal excavation.

Larva. Solitary (except for one species), the last instar with a blade-like mandible, bifid at the tip and bearing 6-12 large teeth on the apical half; skin with small spines (Fig. 108e).

HOSTS. Macrolepidoptera, usually Geometridae.

RANGE AND CONTENTS. This is a small genus containing no more than two or three dozen species, but individuals are common in the forested parts of the Holarctic Region, to which the group is almost completely confined. The species I place here are *Apanteles paleacritae* Riley, *P. alaskensis* Ashmead, *A. phlyctaeniae* Muesebeck, and *A. phigaliae* Mues. from North America (the last two new combinations) and the eight European species placed in the *popularis* group by Nixon (1965).

REMARKS. Although *Protapanteles* is distinctive the beginner may have trouble separating its members from species of *Cotesia*. Particular attention should be paid to the smoothness of the propodeum and laterodistal excavation of the ♀ fore-tarsi. The structure of the larval mandible is aberrant among the genera of Cotesiini, because of the row of large teeth on the blade; however these number 12 or fewer, are concentrated on the apical 0.5-0.7, and not arranged along the whole length of the blade. This larval structure marks the genus off from *Cotesia*.

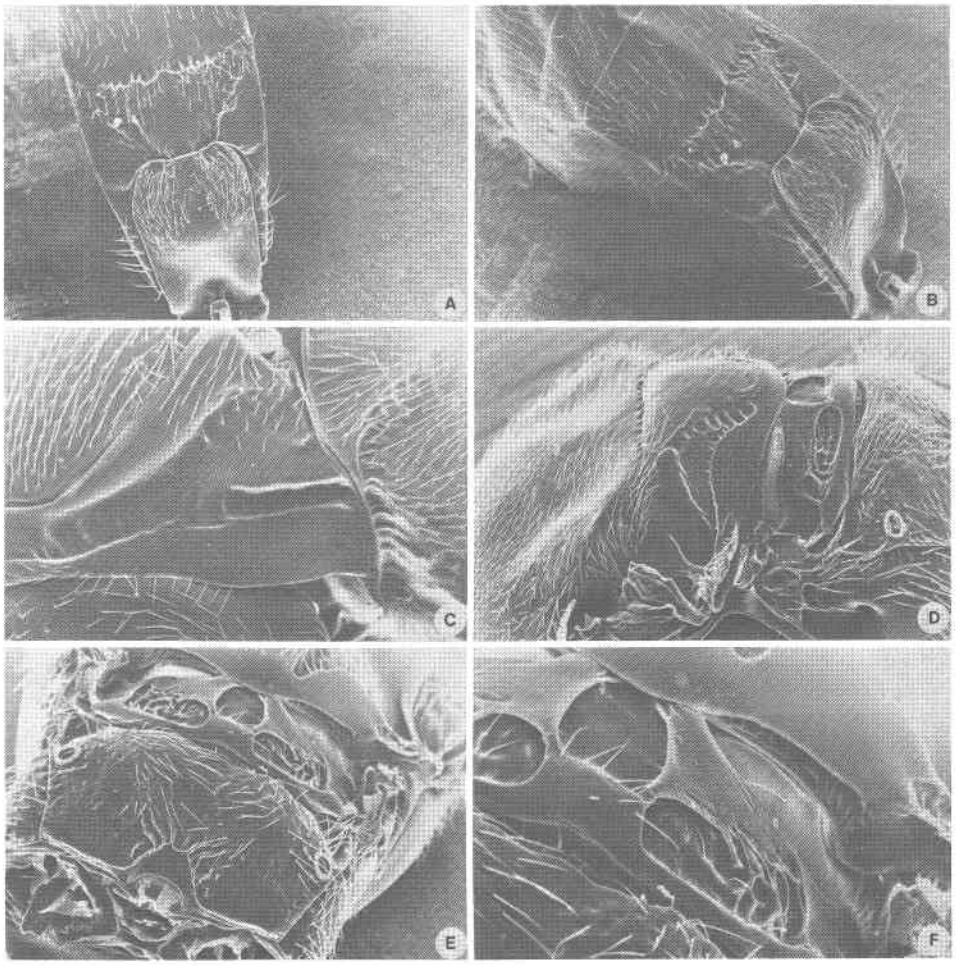


FIG. 84. *Protapanteles paleacritae* (Riley). A, B, base of abdomen; C, pronotum; D, mesonotum; E, propodeum; F, metanotum.

38. *Nyereria* new genus

Fig. 86

This African genus is dedicated to a great African leader as an appreciation of the enlightened conservation policies practiced in his country.

Type: *Apanteles mlanje* Wilkinson 1929.

Hypopygium short, often with a median fold but without creases; ovipositor short, thick and rapidly tapered near its mid-length; sheath short and arising proximally from the valvifer, hairs clustered near the apex of sheath.

Tergite I longer than wide, parallel-sided to obviously wider apically. Tergite II transverse, not more than about twice as wide as long, divided into 3 sections by a pair of deep, usually crenulate, longitudinal grooves delimiting a raised central area that is narrowed posteriorly, parallel-sided or barrel-shaped but is never wider than long; base (anterior end) of this central area never wider than apex of tergite I. Tergum III slightly or not at all longer than II.

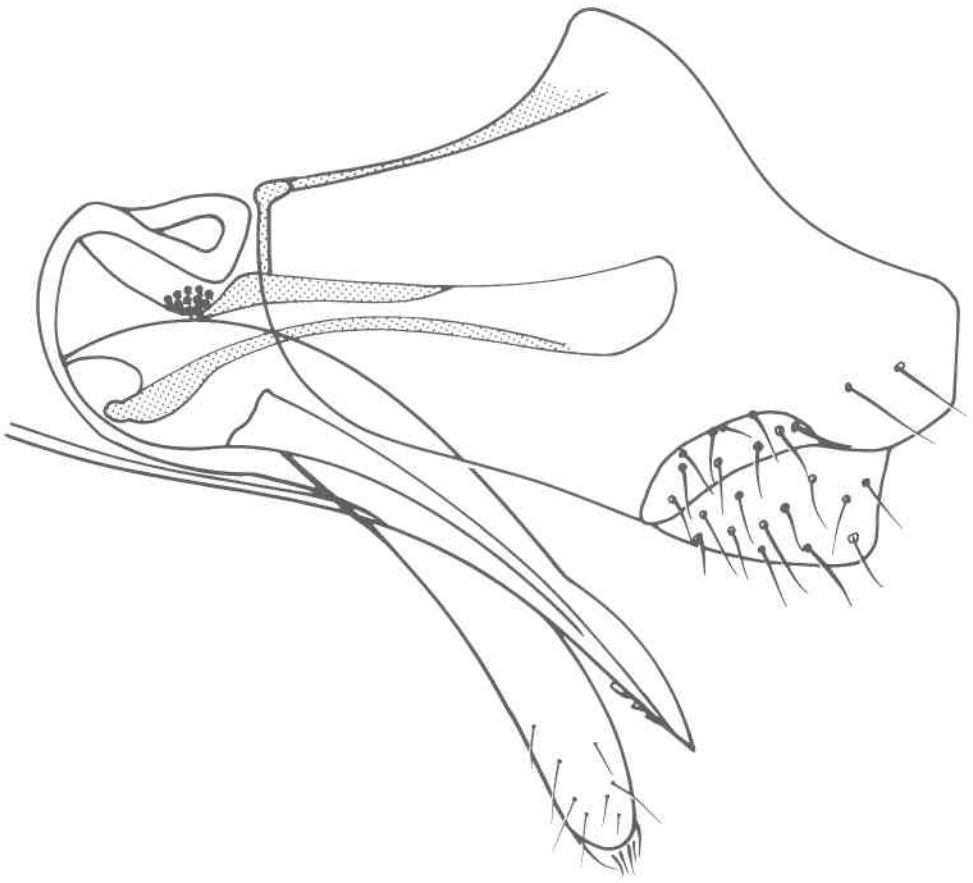


FIG. 85. *Protapanteles paleacritae* (Riley), female genitalia.

Propodeum usually rugulose and with a complete or incomplete median longitudinal carina; pronotum with both dorsal and ventral grooves, but the dorsal often weak or greatly shortened.

Second intercubitus (r-m) absent; vannal lobe convex and hairy along the margin.

Larva. Gregarious (Nixon 1965).

HOSTS. Macrolepidoptera.

RANGE AND CONTENTS. As far as I can tell from the descriptions, the following species (all described in *Apanteles* and all new combinations) belong here: *mlanje* Wilkinson, *neavi* Wilkn., *osiris* de Saeger, *achaeus* de S., *heiro* de S., *neleus* (*-a*) de S., *bifissus* (*-a*) de S., *circinus* (*-a*) de S., *epaphus* (*-a*) de S., *tereus* (*-a*) de S., *triptolemus* de S., *ankaratrensis* Granger, *flavotorquatus* (*-a*) Granger, *geometrae* Granger, *menuthias* Granger, *areatus* (*-a*) Granger.

Recently one Palearctic species from the Maritime Province of eastern Siberia was assigned to this group, *A. forensis* Tobias (1976). I have seen other new species I would assign here from Malaya and from Nepal (2000 m). Apparently this genus occurs rarely in Asia although it is dominantly African.

REMARKS. Except for the striking and characteristic structure of tergite II, members of the genus are very much like *Cotesia* in appearance and habits. However,

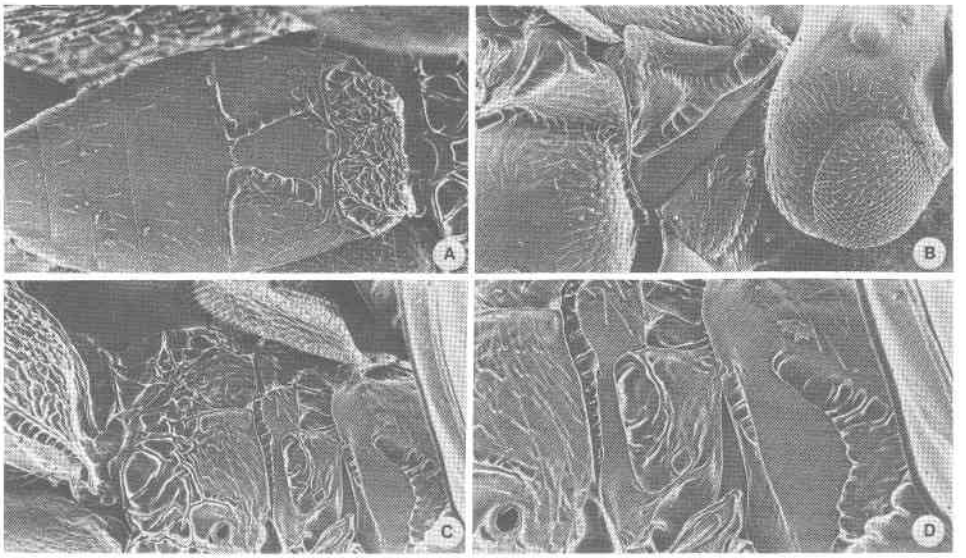


FIG. 86. *Nyereria mlanje* (Wilkn.). A, abdomen; B, pronotum; C, propodeum; D, metanotum.

I think weight could be given to the peculiar structure of tergite II which, in the Microgastrinae, is shared only with the *xanthaspis* group of *Diolcogaster*, also abundant in Africa. *Nyereria* may have evolved from some African species of the *xanthaspis* group by the loss of the second intercubital vein, loss of the median rugosity on the apical scutellar band, and loss of the median groove on tergite I. It is also plausible that they may have evolved from an extinct group ancestral to *Rasivalva* but without reduced sheath hairs.

39. *Cotesia* Cameron 1891

Figs. 87, 88

Type: *Cotesia flavipes* Cameron 1891.

Synonyms: *Cryptapanteles* Viereck 1910. Type: (*C. rileyanus* Viereck 1910) = *Apanteles congregatus* var. *scitulus* Riley 1881.

Stenopleura Viereck 1911. Type: *Apanteles sesamiae* Cameron 1906.

Hypopygium of female usually short, evenly sclerotized from side to side, never with a series of longitudinal creases near middle, rarely sharply creased along median line and then only near apex. Ovipositor sheath short and mostly concealed by hypopygium, its length (including concealed part) not more than half that of hind tibia (rarely as much as 0.6); mostly smooth and shiny, the few hairs concentrated near apex; sheath attached at base of valvifer. Second valvifer broadened apically.

Tergite I occasionally wider than long but usually a little longer than wide and broadened apically, occasionally somewhat barrel-shaped or parallel-sided, but never narrowed apically; never with a median apical depression. Tergite II at least half as long as III and usually subrectangular; if, because of posteriorly diverging lateral sulci, tergite II has the shape of a truncate pyramid or semicircle, then basal width greater than its median length and the apical width nearly, or more than, twice the median length. Tergite I frequently smooth basally but the posterior part almost invariably rugose or rugopunctate; tergite II almost always rugose to rugoaciculate and the sculpture of tergite III varying from smooth to as coarse as that of tergite II.

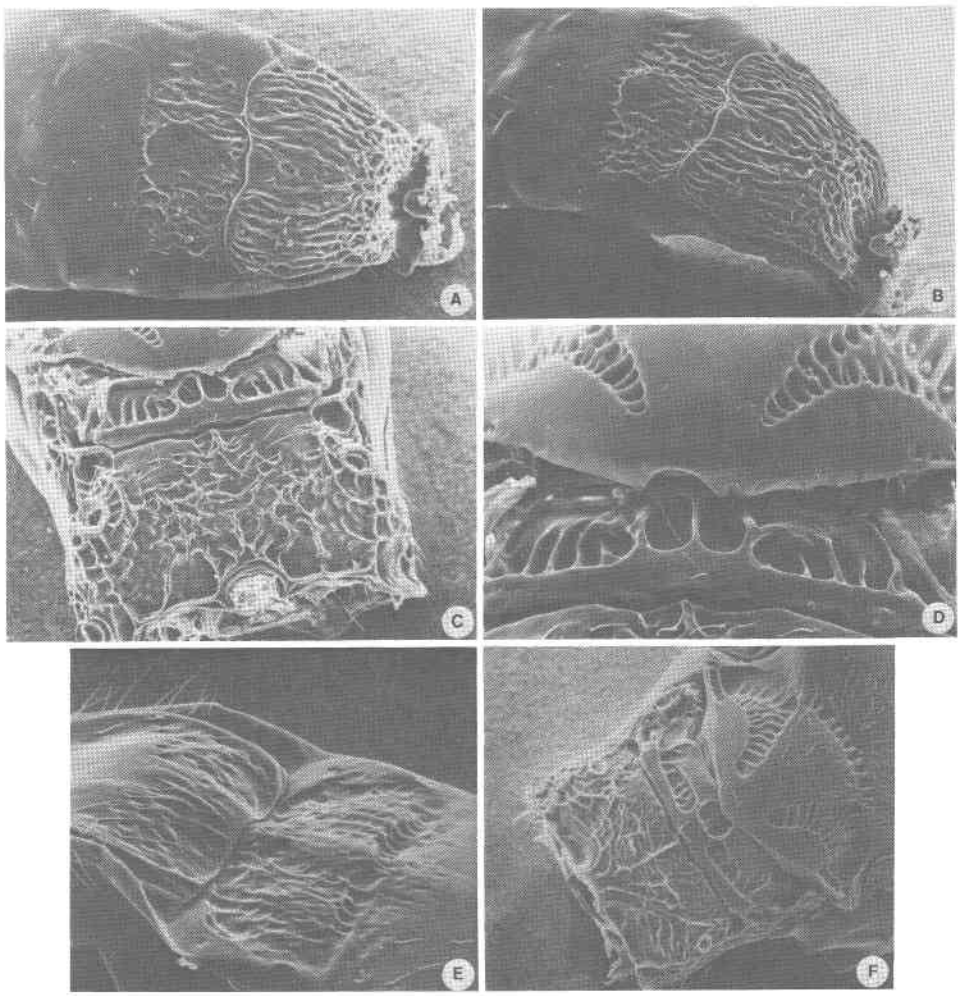


FIG. 87. *Cotesia* spp. A-D, *C. flavipes* Cameron. A, B, base of abdomen; C, propodeum; D, metanotum showing glabrous sublateral lobes; E, F, *C. mahoniae* (Mason), a more typical species: E, base of abdomen; F, scutellum, metanotum and propodeum.

Propodeum invariably rugose and never with an areolet; usually with a median longitudinal carina that may be partially obscured by rugosity and usually an incomplete transverse carina laterally separating the rugose declivity from a smoother anterior area.

Vannal lobe of hind wing with an obviously convex margin varying from bare to evenly hairy.

Larva. Usually gregarious, the last instar with a toothless mandible or the blade bearing reduced teeth (Figs. 107C, 108F).

HOSTS. Larvae of Macrolepidoptera.

CONTENTS. I include the following species in *Cotesia*. All are new combinations except *C. flavipes* Cameron. The corrected endings to make adjectival names agree with the feminine genus *Cotesia* are added in parentheses. (Nearctic species) — *Microgaster acaudus* (*-a*) Provancher, *Apanteles acronyctae* Riley, *A. agricola*

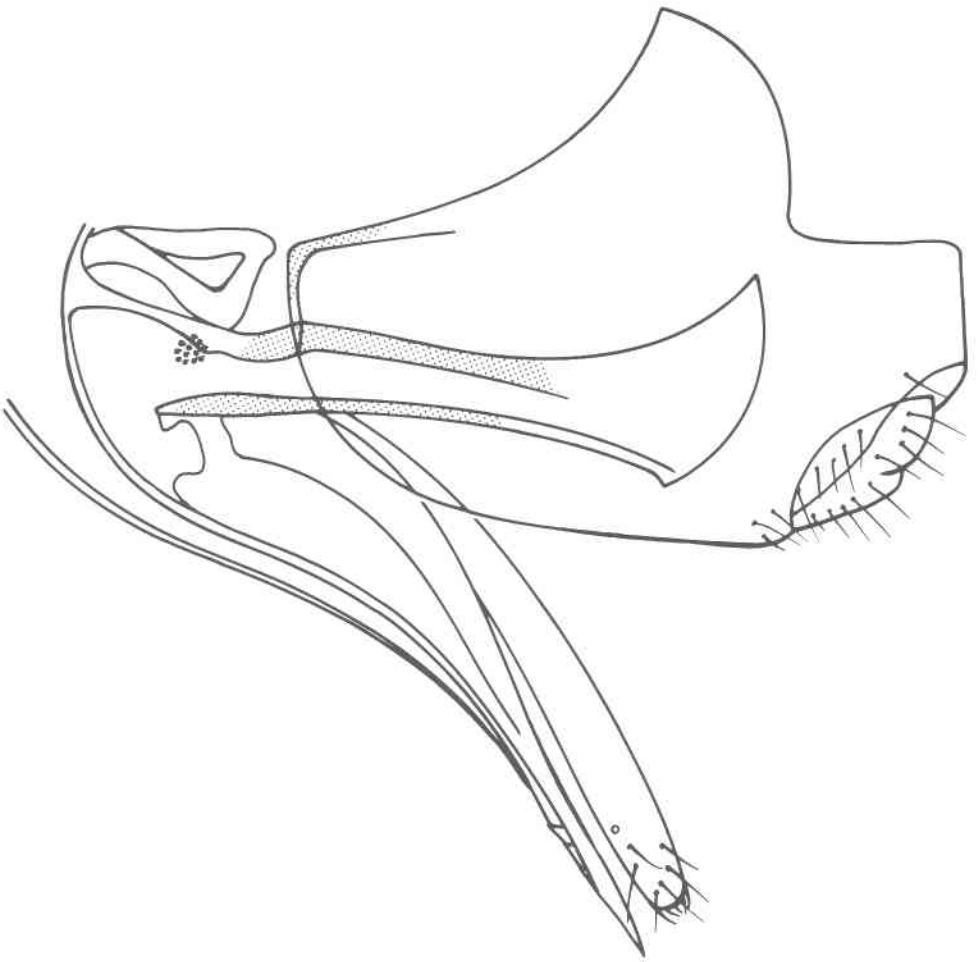


FIG. 88. *Cotesia congregata* (Say), female genitalia.

Viereck, *A. alonquinorum* Vier., *A. alypiae* Muesebeck, *M. americanus* (-*a*) Lepeletier, *A. ammalonis* Mues., *A. anisotae* Mues., *A. argynnidis* Riley, *M. atalantae* Packard, *A. autographae* Mues., *M. carduicola* Pack., *A. cerurae* Mues., *A. charadrae* Mues., *A. cingiliae* Mues., *A. clisiocampae* Ashmead, *M. congregata* Say, *A. crambi* Weed, *A. cyaniridis* Riley, *A. delicatus* (-*a*) Howard, *A. depressus* (-*a*) Vier., *A. diacrisiae* Gahan, *A. diversus* (-*a*) Muesebeck & Walkley, *A. electrae* Vier., *A. empretiae* Vier., *A. enypiae* Mason, *A. euchaetis* Ash., *A. euphydryidis* Mues., *A. fiskei* Vier., *A. flaviconchae* Riley, *A. flavicornis* Riley, *A. gillettei* Baker, *Ichneumon glomeratus* (-*a*) Linnaeus, *A. gordii* Mues., *A. griffini* Vier., *A. halisidotae* Mues., *M. hallii* Pack., *A. hemileucae* Riley, *A. hesperidivorus* (-*a*) Vier., *A. hyphantriae* Riley, *A. junoniae* Riley, *A. koebelei* Riley, *A. laeviceps* Ash., *A. langei* Mues., *M. limenitidis* Riley, *M. lunatus* (-*a*) Pack., *A. lyciae* Mues., *A. mahoniae* Mason, *M. marginiventris* Cresson, *A. medicaginis* Mues., *M. melanoscelus* Ratzeburg, *A. murtfeldtae* Ash., *A. nemoriae* Ash., *A. nitens* Mues., *A. noctuidiphagus* (-*a*) Mues., *A. obscuricornis* Vier., *A. olenidis* Mues., *A. orobenae* Forbes, *A. parastichtidis* Mues., *A. phobetri* Rohwer, *A. pholisorae*

Riley, *A. plathypenae* Mues., *A. podunkorum* Vier., *A. prenidis* Mues., *A. pyralidis* Mues., *A. pyraustae* Vier., *A. pyrophilae* Mues., *A. rubecula* Marshall, *A. rufocoxalis* Riley, *A. schaffneri* Mues., *A. schizurae* Ash., *A. scitulus* (*-a*) Riley, *A. smerinthi* Riley, *A. teleae* Mues., *A. theclae* Riley, *A. tmetocerae* Mues., *M. unicolor* Curtis, *A. winkleyi* Vier., *M. xylina* Say, *A. yakutatensis* Ash. Other areas — *Cotesia flavipes* Cameron, *A. sesamiae* Cameron, *A. pistrinariae* Wilkinson, *A. plutellae* Kurdjimov, *M. ruficrus* Haliday, *A. chrysippi* Vier., *A. flagellator* Wilkn., *A. aluis* Mues., *A. ayerzae* Brèthes, *A. kraussi* Mues., *A. mayaguezensis* Vier., *A. ornatricis* Mues., *A. schini* Mues.

REMARKS. In temperate regions this is the largest segregate of the old "*Apanteles*", including 30–40% of the species. In the tropics, however, *Cotesia* is partly displaced, ecologically, by *Glyptapanteles* and comprises only 10–20% of the "*Apanteles*" fauna. At any rate *Cotesia* is the commonest and the ubiquitous genus of Microgastrinae, probably comprising 1500–2000 species. Although most of the species are gregarious as larvae, about one-quarter of them are solitary. The larvae of gregarious species all emerge from the host in a short time through many different cuts and make a common mass of cocoons. The form and location of the cocoon mass varies greatly interspecifically but is relatively constant within each species. The characteristics of the cocoon-mass are very useful for identifying reared series. For example *Cotesia phobetri* (Rohwer) and *C. halisidotae* (Mues.) are difficult to distinguish as adults and both species attack hairy larvae of Arctiidae in eastern North America. However *C. phobetri* larvae kill the host larva before the end of the last instar and form their cocoons in an irregular mass on the back of the host larva, which is killed before it spins its own cocoon, whereas the larvae of *C. halisidotae* wait until the host has spun its dark, hairy cocoon and then emerge, forming their cocoons inside the large host cocoon. The complete cocoon masses associated with host remains are very distinct, but the individual parasite cocoons are identical. Workers who discard cocoons of reared parasites or who dissect the cocoon mass to put one cocoon with each pinned parasite cause a deplorable loss of useful information.

This group is the most consistently and most easily recognized of the segregates of "*Apanteles*". It is group I of Reinhard and Marshall, F of Wilkinson and de Saeger, and the *glomeratus* and *pistrinariae* groups of Nixon. Reinhard and Wilkinson included *Protapanteles* Ashm., but Marshall and Ashmead separated it. Wilkinson (1932) and de Saeger (1944) recognized a "*mlanje*" subgroup of group F for a number of African species, but I regard this subgroup as generically distinct from *Cotesia*.

40. *Diolcogaster* Ashmead 1900

Figs. 89, 90, 16

Type: *Microgaster brevicaudus* Provancher 1886.

Synonym: *Zadiolocogaster* Viereck 1913 (NEW SYNONYM).

Type: *Z. anomus* Viereck 1913.

I have studied the types of both genera above.

Hypopygium short, continuously sclerotized medially. Ovipositor short, stout basally, strongly tapered near the middle; straight to strongly decurved; sheaths short, the hairs usually crowded near the apex; sheaths of most species with a few large, obconical hairs that have a terminal concave area (Fig. 16).

Tergite I typically parallel-sided, about twice as long as wide and bearing a sharp median longitudinal groove through most of its length; but varying from short and expanded apically (*abdominalis*, *spreta*, and *basimacula* groups) to strongly narrowed, lorate (*lelaps* and *ippis* groups). Tergum II extremely variable, usually with a submedian pair of grooves or depressions delimiting a more or less elevated median area that is parallel-sided or narrowed apically;

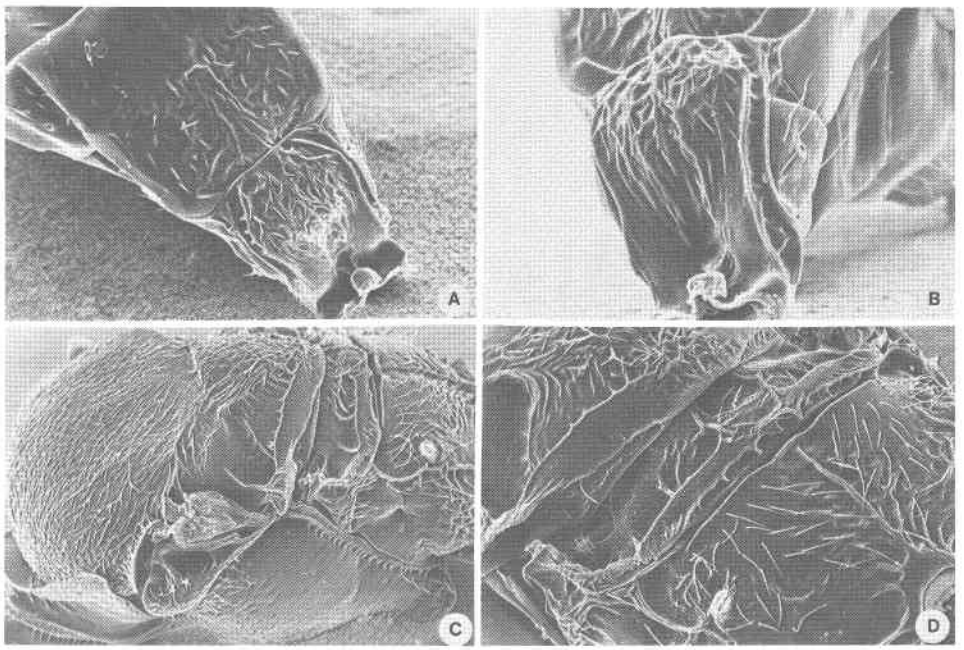


FIG. 89. *Diolcogaster alvearius* (Fabricius). A, base of abdomen; B, tergite I to show weak basal median groove; C, alitrunk; D, metanotum and propodeum showing traces of transverse carina.

carinae forming anterior boundary of tergite II (not to be confused with submedian carinae) very weak to strong and strongly to weakly divergent; when the median area is poorly or not at all defined the anterolateral carinae may delimit a smooth subtriangular area that is wider apically. Tergum III smooth to strongly rugose, the latter condition only when tergum II is similarly sculptured.

Propodeum usually rugose but occasionally smooth; median longitudinal carina strong and complete; metanotum with no sharp projecting anterolateral lobes; apical polished band of scutellum almost always interrupted medially by a punctate or rugose area (Fig. 90d, e, f); pronotum with upper crenulate groove usually absent; lower groove always present.

Areolet of forewing always present, large or small, quadrangular or triangular; vannal lobe with margin usually convex and hairy but sometimes varying to straight and hairy and exceptionally concave and hairless.

Larva. Mandible without teeth; labium with 4 hairs, each maxilla with 2. Skin with pointed papules that are about as high as wide, but are without apical spines. The genus contains both solitary and gregarious species (Fig. 108C).

HOSTS. Macrolepidoptera, Noctuidae, Geometridae, and a few species (*spreta* group) on Pyraloidea.

RANGE AND CONTENTS. *Diolcogaster* is almost worldwide, but the species are not often common. The Nearctic species I place here are: *Microgaster brevicaudus* Provancher, *M. auripes* Prov., *M. facetosa* Weed, *M. scotica* Marshall, *M. bakeri* Muesebeck, *M. schizurae* Mues., *Protomicroplitis garmani* Ashmead, *M. iridescens* Cresson. Species from other regions: *M. abdominalis* Nees, *Ichneumon alvearius* (-*a*) Fabricius, *Apanteles basimacula* Cameron, *M. connexus* (-*a*) Nees, *M. curticornis* Granger, *P. duris* Nixon, *M. faciipennis* Gahan, *P. ippis* Nix., *P. lelaps* Nix., *M. mayae* Shestakov, *P. periander* Nix., *M. perniciosa* Wilkn., *M. reales* Wilkn., *M. spretus* (-*a*) Marshall, *A. xanthaspis* Ashm., *Zadiolcogaster anomus* Viereck. All except *brevicaudus* are new combinations.

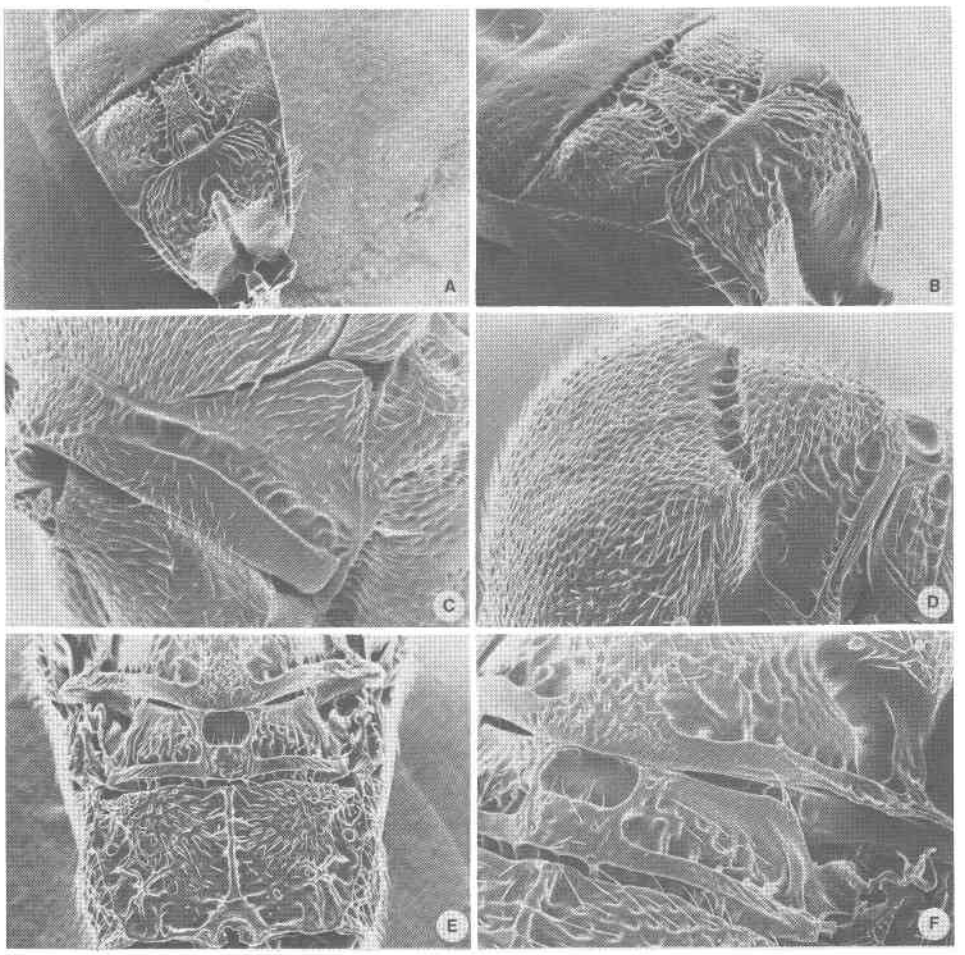


FIG. 90. *Diolcogaster facetosa* (Weed). A, B, base of abdomen; C, pronotum; D, mesonotum; E, propodeum; F, metanotum.

REMARKS. I am placing here the bulk of those species grouped by Nixon (1965) under *Protomicroplitis*, in fact I exclude only the groups of *calceata*, *marginata*, *lepelleyi*, *calliptera*, *schunkei*, and some New World species not known to Nixon. The name *Protomicroplitis*, of course, goes with *mediatus* in the *calliptera* group, leaving *Diolcogaster* the next available name. The marginal groups removed, however, are small (only 20–30 species) and still leave *Diolcogaster* as a large and unusually variable genus. Although the groups defined by Nixon are recognizable for the most part, there are numerous intermediate species and I think, as Nixon did, that they truly form little more than artificial segregates.

41. *Parenion* Nixon 1965

Fig. 91

Type: *Microgaster kokodana* Wilkinson 1936.

Ovipositor short, decurved, and strongly tapered; sheath hairy on the apical 0.3; hypopygium short, fully sclerotized. Tergite I subparallel-sided and much longer than wide, with

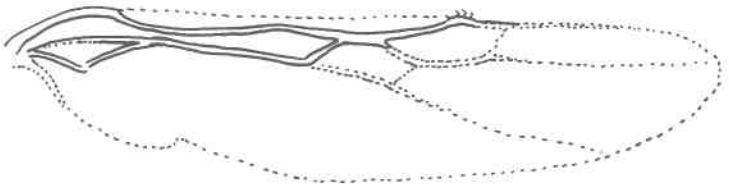


FIG. 91. *Parenion kokodana* Nix., hind wing.

a sharp median groove on the basal 0.7 or more; tergite II smooth, with a pair of divergent grooves cutting off the anterior corners and scarcely or not separated from tergum III, which is also smooth. Terga IV-VII each with a sparse subapical row of hair.

Propodeum smooth, with a strong median carina; metanotal sublateral lobes not visible, closely appressed to scutellum. Polished margin of scutellum continuous, lunules low. Side of pronotum with a weak ventral, and no dorsal, furrow.

Radius strongly slanting outward, meeting the intercubitus at a strong curved angle of 100°-120°, the two veins about equal in length; areolet small, narrow, and triangular. Vannal lobe weakly convex and hairy; submediellan cell unusually short, the nervellus slanting straight back from the mediella at about 45°. Hind coxae large, inner tibial spurs very large and long.

LARVA AND HOSTS. Unknown.

RANGE AND CONTENTS. Only the type-species from New Guinea bears a name, but there are other species in New Britain and New Caledonia.

42. *Exix* new genus

Fig. 92

The name is feminine, from Greek, meaning that which comes out of a larva.

Type of the genus: *Exix mexicana* n. sp.

Length of all species, 3-4 mm. Hypopygium short, not folded medially; ovipositor short, thick and weakly decurved with a strong taper about midway. Ovipositor sheath short, polished, without any terminal brush, hairy only near the apex.

Tergite I 1.1-1.4× longer than wide, broadest at apex; occupying almost entire dorsal surface of tergum I, the pleura usually invisible from above; surface punctate and partly aciculate on posterior half and bearing a sharp median furrow on the anterior $^2/_3$ or more. Tergite II rectangular, about 2-3 times broader than long and occupying almost entire dorsal side of tergum II; surface shining and punctate, the apical transverse groove in the form of a very widely open inverted "V" such that the 2nd tergite is concave posteriorly. Tergum III smooth and about 50% longer than II.

Propodeum with a strong, complete median carina; surface anteriorly punctate and variously rugose. Metanotum appressed to scutellum, no phragma visible. Scutellum punctate to rugulose, the sculpture continued broadly across the polished apical band; scutum densely punctate, the notauli indicated by closer duller sculpture. Pronotum with a carinate dorsal groove as well as the usual ventral one; glabrous and polished between the grooves.

Antennae long and slender, those of the female bearing special sensory areas without longitudinal placodes on or about flagellomeres 8-14. Ocelli large, separated by less than their own diameters and in a very flat triangle with an apical angle of about 145°.

Hind coxae densely punctate laterally, rugose above and apically, very large, at least $^3/_4$ as long as abdomen. Radius much longer than first intercubitus; second intercubitus short, transparent, and meeting first at about its middle so that the areolet is small, triangular, and inconspicuous. Vannal lobe weakly concave and hairless on the margin; nervellus concave externally, meeting submediella at a right angle.

LARVA AND HOSTS. Only one specimen, that from British Columbia, has been reared: it is apparently a solitary parasite of *Syngrapha* (Noctuidae) (Fig. 108b).

REMARKS. *Exix* is superficially like *Cotesia* except for the obvious areolet, but the propodeum lacks any trace of the subbasal transverse carina so typical of *Cotesia*, the terminal brush is lacking on the ovipositor sheath, and the nervellus, unlike that of *Cotesia*, is outwardly concave. In addition *Exix* has several apomorphic features lacking in *Cotesia*: a concave and hairless vannal lobe margin, specialized sensory areas on the female flagellum, special thick hairs on the ovipositor sheath, and a basal median groove on tergite I.

Exix is related to, but differs from, *Diolcogaster* in its large smooth tergite II lacking the characteristic submedian grooves, and in the concave, hairless vannal lobe and externally concave nervellus.

KEY TO SPECIES OF *Exix*

1. Scutum, except posteromedially, and often scutellum, with minute granular-coriaceous sculpture between punctures (clearly visible at 40× but not at 20×); propodeal sculpture usually dominated by a triangle of transverse carinae and rugosities with apex toward scutellum (South America) 2
- Scutum and scutellum shining and smooth between punctures; propodeum mostly densely and rather uniformly punctate, but posterior third rugose (Mexico and North America) 5
2. Ovipositor sheath with only normal hairs, fewer than 10 3
- Ovipositor sheath with 15–20 apical hairs, of which 2 or 3 are thick and blunt-tipped 4
3. Apical part of tergite I with numerous subparallel aciculations that occupy an area about as long as tergite II; anteriorly, at the "turn-over" of the tergite is a narrow band of aciculopunctate sculpture; remaining anterior two-thirds of tergite smooth; scutellum without granular-coriaceous sculpture ..... *schunkei* (Nixon)
- Apical part of tergite I with a punctate-aciculate area about half as long as tergite II, the aciculations converging strongly (30°–45°) toward median apex; anteriorly a broad band of separate punctures, leaving only the anterior half of tergite smooth; scutellum granular-coriaceous between the punctures ..... *tinalandica* n. sp.
4. Antennae of ♀ 1.2 as long as forewing, ♀ flagellomere 14 L/W = 2.5. Tergite II impunctate; scutellar disc slightly wider than long, the sides converging at about 60° ..... *colorados* n. sp.
- Antenna of ♀ 1.0 as long as forewing, ♀ flagellomere 14 L/W = 2.0. Tergite II with 20–30 large sparse punctures; scutellar disc slightly longer than wide, the sides converging at about 45° ..... *bahia* n. sp.
5. Tergite II with large punctures separated by 1–3 times their own diameters; the anterior transverse groove weakly developed ..... *mexicana* n. sp.
- Tergite II contiguously aciculopunctate medially and anteriorly with median aciculations; anterior transverse groove of tergite II very deep, transcostate and as conspicuous as the posterior transverse groove ..... *columbica* n. sp.

Exix schunkei (Nixon) (new combination)

Ovipositor sheaths greasy and perhaps damaged, but apparently with only a few long hairs and no specialized thick ones. Tergite I smooth on basal 0.6±, behind the smooth area an aciculopunctate zone that posteriorly becomes a field of fine aciculations extending to the apex but leaving a narrow smooth medial band; the lateral aciculations are parallel to the body axis but the more medial ones converge (up to 30°) toward the median apex of the tergite. Tergite II smooth and bearing only slight indications of sculpture.

Several asymmetrical short transverse carina branching off the median propodeal carina; half of propodeum and areas around spiracles strongly and irregularly rugose; anterior half medially rugose, otherwise smooth and bearing distinct, separate punctures. Scutellum smooth and sparsely punctate medially but not granular, the sides densely punctate but the individual punctures discernible; punctures of scutum all distinct and sharply defined, although contiguous along course of notaulus, separated by as much as twice their own diameters centrally; scutum, but not scutellum, with a general granular-coriaceous sculpture.

Flagellomere 14 L/W = 3.0; antenna 1.1 as long as forewing.

Color: black, abdomen fuscous except for dorsal surface; scape, mouthparts, labrum, four anterior legs and hind trochanter fulvous; tegula, hind tibial spurs, and basal annulus on hind tibia and basitarsus whitish yellow.

Redescribed from the holotype: ***Peru***, Chanchamayo [11°S 75°30′W, 700-1000m] J.M. Schunke (British Museum 3C1410).

Exix tinalandica new species

Ovipositor sheath with fewer than 10 simple hairs and no specialized thick hairs. Tergite I with anterior 0.4 (laterally) to 0.6 (medially) smooth, behind this a broad zone of isolated large punctures that become aciculopunctate apically; the extreme posterolateral corners with aciculations converging strongly (45°) toward the center; medioapical elevation with a few weak punctures. Tergite II smooth with vague indications of sculpture.

Rugose areas of propodeum occupying apical 0.4 and a lateral band of about 0.1 or 0.2 on each side; transverse carinae branching from the median carina weak and melting into the rugulopunctate medial surface; the latter sculpture gradually becoming separate punctures laterally and smooth and shining anteriorly.

Entire surface of scutellum minutely granular coriaceous (easily seen at 40×); large punctures sparse centrally; becoming denser laterally and rugulopunctate at the edges; punctures of scutum distinct and clearly separated, especially mesally but also laterally; puncturation contiguous on the notaulic courses, especially posteriorly where the sculpture becomes rugulose; surface of scutum generally densely granular-coriaceous except posteromedially. Mesonotum generally more densely sculptured than that of *schunkei*.

Flagellomere 14 L/W = 2.3; ♀ antenna about as long as forewing.

Head, thorax and hind coxa black; abdomen fulvous with tergites I, II, and central suffusions on III and following terga black; laterotergites I and II yellowish; hypopygium medially and ovipositor sheath blackish; four anterior legs, tegula, labrum, mouthparts, scape and pedicel fulvous, flagellum black; hind legs with black coxa, fulvous trochanters, red femur with dark suffusion apically, tibia and tarsus black with whitish basal annuli on tibia and basitarsus; middle and hind tibial spurs whitish.

Holotype: ♀, ***Ecuador***, **Pichincha**, 680 m., Tinalandia, 16 km. S.E. of Sto. Domingo de los Colorados. 15-30 June 1976, S.&J. Peck (Malaise trap) (CNC No. 15682).

Paratype, 1♀, same data but 1975.

Exix colorados new species

Ovipositor sheath with about 17 hairs, 3 apicoventral hairs thick and blunt-tipped. Tergite I aciculopunctate posteriorly, the sculpture becoming mostly scattered punctures in front of the "turn-over" and smooth on the anterior half; apical sculpture converging medio-posteriorly at about 30°. Tergite II smooth with vague irregularities.

Transverse carinae of propodeum successively longer posteriorly, the transcostate area thus appearing triangular with the apex toward the scutellum; posterior half and sides of propodeum rugose; anterior part shining and smooth with minute, sparse punctures. Scutellum sparsely punctate centrally, aciculopunctate to rugulose laterally and mostly caused by minute granular-coriaceous sculpture. Scutum more densely punctate than those of the other species, the discal punctures mostly contiguous; courses of notauli rugulopunctate to aciculopunctate; scutum mostly granular-coriaceous among other sculpture.

Color: similar to that of *E. tinalandica* except that hypopygium and all terga are uniformly fulvous.

Holotype: ♀, ***Ecuador***, **Pichincha**, 680 m., Tinalandia, 16 km. S.E. of Sto. Domingo de los Colorados. 15-30 July 1976, S.&J. Peck (Malaise trap) (CNC No. 15683).

Exix bahia new species

Ovipositor sheath with about 15 hairs, two of which are thick and blunt-tipped. Tergite I smooth on basal half, behind sparsely punctate, then gradually aciculopunctate posteriorly, the aciculations converging toward the median apex, more strongly convergent laterally. Tergite II polished but with scattered large shallow punctures.

Sculpture of propodeum resembling that of *schunkei* and *colorados* but anterior part smooth (except medially) and with a few punctures near the rugose part; scutellum sparsely punctate medially, becoming rugulopunctate laterally; scutum with closely spaced but distinct medial punctures and rugulopunctate along the notauli courses; both scutum and scutellum extensively granular-coriaceous among the other sculpture.

Antenna about as long as forewing: flagellomere 14 L/W = 2.0.

Head and thorax black, abdomen fulvous with dark medial suffusions on terga II and III; sheaths brown; mouthparts, clypeus, 4 anterior legs fulvous, antenna fulvous basally, gradually darker apically; hind legs with black coxa, fulvous trochanters, red femur and brown tibia and tarsus with whitish yellow basal annuli on tibia and basitarsus; middle and hind tibial spurs and tegulae whitish yellow with basal annuli on tibia and basitarsus; middle and hind tibial spurs and tegulae whitish yellow.

Holotype: ♀, ***Brazil***, **Bahia**, Encruzilhada, 960 m., Nov. 1972, M. Alvarenga (CNC No. 15684).

Paratype, 1♀, same data but 1974.

Exix mexicana new species

Fig. 92

Holotype, female: ovipositor sheath with 20 or more hairs, 3 of which are thick and blunt. Tergite I smooth on anterior 0.6, behind this densely punctate, the apical 0.1 with converging aciculopunctate sculpture; tergite II smooth with distinct punctures separated by about their own diameters; tergum III with a few, more widely spaced punctures.

Propodeum mostly strongly contiguously punctate, these large punctures merging into rugulose areas along the middle and sides and on the apical 0.2. Scutellum sparsely punctate centrally, contiguously at the sides; scutum rather uniformly punctate, the punctures separated by about their own widths medially and almost contiguous along the notaulic courses; no trace of granular-coriaceous sculpture anywhere although the mesonotal integument shows metallic reflections, indicating microsculpture.

Antenna about as long as forewing; flagellomere 14 L/W = 2.4.

Head and thorax black, abdomen fulvous with blackish suffusions medially on the hypopygium and all terga but the first; sheaths blackish, antenna brown; four anterior legs, labrum, and mouthparts fulvous; tibial spurs and tegulae whitish yellow; hind legs black coxae, fulvous trochanters and femur except for the dark suffusion on the apical 0.3, hind tibia and tarsus dark brown with pale basal annuli on tibia and basitarsus.

Paratypes, variation: surprisingly little, considering that the type series comprises specimens collected over 1500 km apart in localities as diverse as lowland tropical rain forest (Musté) and mild temperate pine-oak forest over 2000 m (La Ciudad). Antennae of males about 1.3 times length of forewing; extent of dark color on abdomen varying from only small median marks on terga II and III (southern females) to almost completely black behind tergite I (northern males); darkest males have fulvous areas only at sides of terga II and III; all males and northern females with a subapical median dark spot on tergite I.

Holotype: ♀, ***Mexico***, **Sin.** 5000 ft. [1500 m], El Palmito, 15 mi. [24 Km] West [near village of Potrerillos], 16 July 1964, W.R.M. Mason (CNC No. 15685).

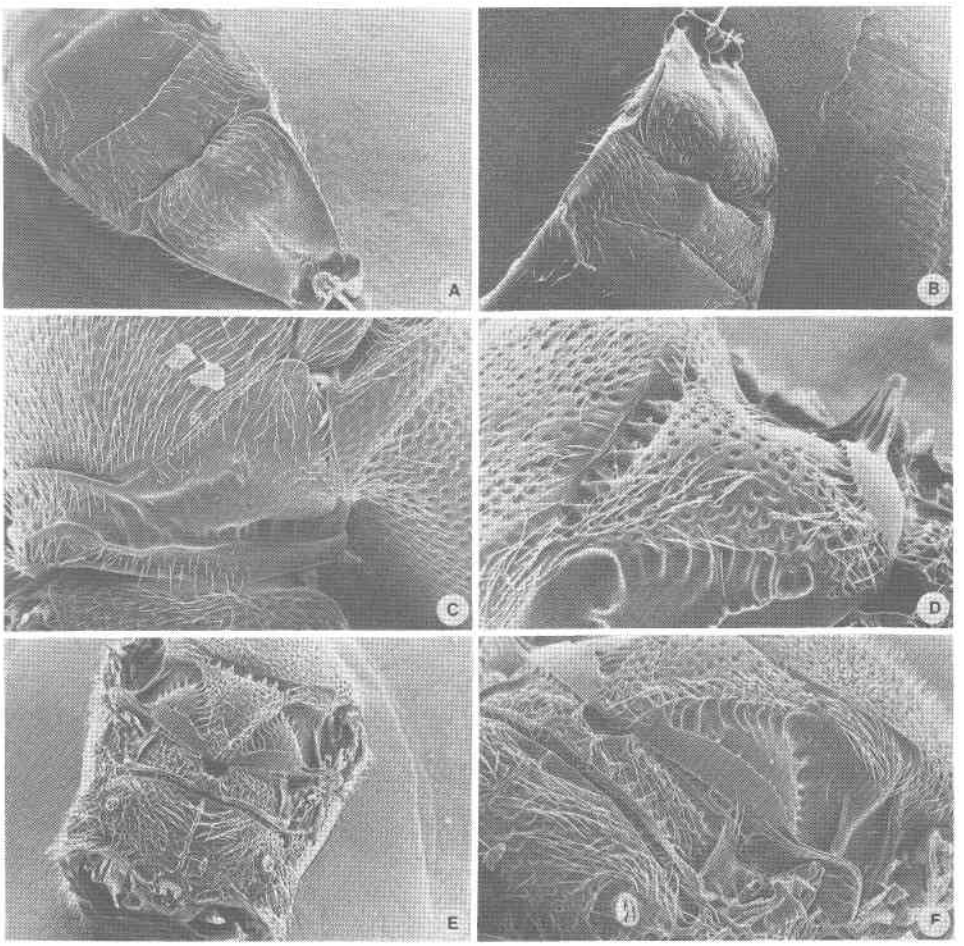


FIG. 92. *Exix mexicana* Mason. A, B, base of abdomen; C, pronotum; D, scutellum; E, propodeum; F, metanotum.

Paratypes: ***Mexico***, **Dgo.** 7000 ft. [2150 m], La Ciudad, 24 mi. [39 km] West 6-16 July 1964 1♂, 1♀; same data as holotype but 16 July to 12 Aug. 8♂♂; **Chis.** 5700 ft [1750 m], Bochil, 20 mi [32 Km] North, Yerba Buena, 8 June 1964, 1♂; 440 m, Musté near Huixtla, Oct. 1970, 6♂♂, 2♀♀, E. Welling (Malaise trap). Paratypes in CNC, USNM, BMNH.

Exix columbica new species

Ovipositor sheath with almost 20 hairs, 3 of which are thick, blunt-tipped, and dark brown. Tergite I smooth on anterior 0.5, densely, partly contiguously, punctate posteriorly with a few coarse, apically converging, aciculations on the apical 0.1; tergite II with both anterior and posterior margins defined by deep, transcostate grooves, the disc with sparse punctures except medially where there are longitudinal aciculations, and on the rugulose anterior declivity; tergum III smooth.

Propodeum mostly densely punctate, the punctures becoming smaller and less dense anteriorly, and merging into rugulose sculpture posteriorly and laterally; median carina weak for the genus, though still well defined. Scutellum with punctures separated by their own

diameters medially, contiguous laterally; scutum with comparatively uniform distinct punctures, these contiguous only on the posterior notaulic courses; fine granular-coriaceous sculptures absent.

Flagella broken off at the first or third joint; left hind leg missing.

Head and thorax black; abdomen black except for first three laterotergites and sterna; antenna brown; labrum, mouthparts, tegula, 4 anterior legs (including coxae) fulvous; hind leg with black coxa fulvous trochanter and basal annulus of tibia; hind femur, tibia and tarsus dark brown, basal 0.5 of basitarsus and tibial spurs whitish yellow.

Cocoon not ribbed, ovoid, and densely woven purplish grey; with a few strands of lumpy golden-colored silk closely adhering to the outside.

HOST. *Syngrapha* sp. (Noctuidae).

Holotype: ♀, ***Canada***, **British Columbia**, Verde Creek, [northeast from Copper Mtn.] 21 July 1949, F.I.S. no. BC49-443A (CNC No. 15686).

43. *Buluka* de Saeger 1948

Fig. 93

Type: *B. straeleni* de Saeger 1948.

Ovipositor short, sheath hairy only at apex; hypopygium short and sclerotized evenly. Tergites I-III occupying entire dorsal surface of abdomen and all rugose; balance of abdomen withdrawn beneath them so that a carapace resembling that of *Sigalphus* or *Aliolus* is formed. Tergite I articulating with II and bearing a median basal sharp groove.

Propodeum rugose, with a median carina; metantotum closely appressed to scutellum. Apical band of scutellum broadly interrupted by a rugose area; lateral lunules low; scutellum and scutum densely rugose. Propleuron with a small apical lobe overlapping the pronotum.

Areolet large, quadrangular; vannal lobe convex and hairy.

LARVA AND HOSTS. Unknown.

RANGE AND CONTENTS. The only known species is found from eastern Zaire to South Africa. It seems related to *Diolcogaster*.

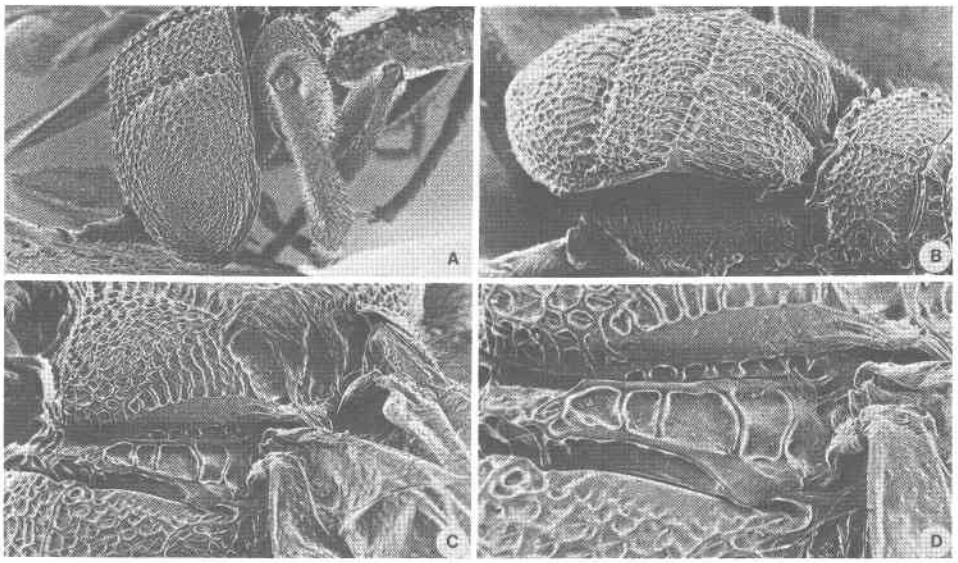


FIG. 93. *Buluka straeleni* de Saeger. A, tergites II, III; B, abdomen and propodeum; C, scutellum and metanotum; D, metanotum.

44. *Wilkinsonellus* new genus

Fig. 94

The genus (masc.) is dedicated to D.S. Wilkinson, whose untimely death in World War II ended a brilliant career devoted to study of the Microgastrinae.

Type: *Apanteles iphitus* Nixon 1965.

Hypopygium short, not folded medially; ovipositor short, the sheath short and bearing only minute hairs apically.

Tergite I about 5× longer than wide, bearing a medial furrow for most of its length and somewhat narrower in the middle. Tergum II polished and with a rectangular or triangular median plate that is longer than wide and more or less defined by a pair of subparallel or posteriorly diverging sulci.

Propodeum strongly declivous and rugose, with a strong median carina and a pair of more or less percurrent diagonal carinae that converge toward the posterior orifice. Scutellum elevated and strongly sculptured, with a transverse apical carina (except in *daira*), behind which is a declivous sculptured area that intercepts the apical polished band. Mesonotum dull and densely aciculate to punctate. Lower margin of pronotum with a central, downwardly pointing tooth caudad of which the propleuron has a broad, dorsally directed lobe that overlaps the lower corner of the pronotum, a structure that is rare in the microgastrines, though common in other braconids. Ocelli in an almost equilateral triangle; head coarsely sculptured.

Hind coxae very large and very strongly and coarsely rugose above, variously punctate to rugulose laterally and below. Radius and intercubitus about equally long and meeting at an angle of about 135°; submedius bowed posteriorly so that it almost touches the hind margin of the forewing. Vannal lobe convex to nearly straight, hairy on the margin.

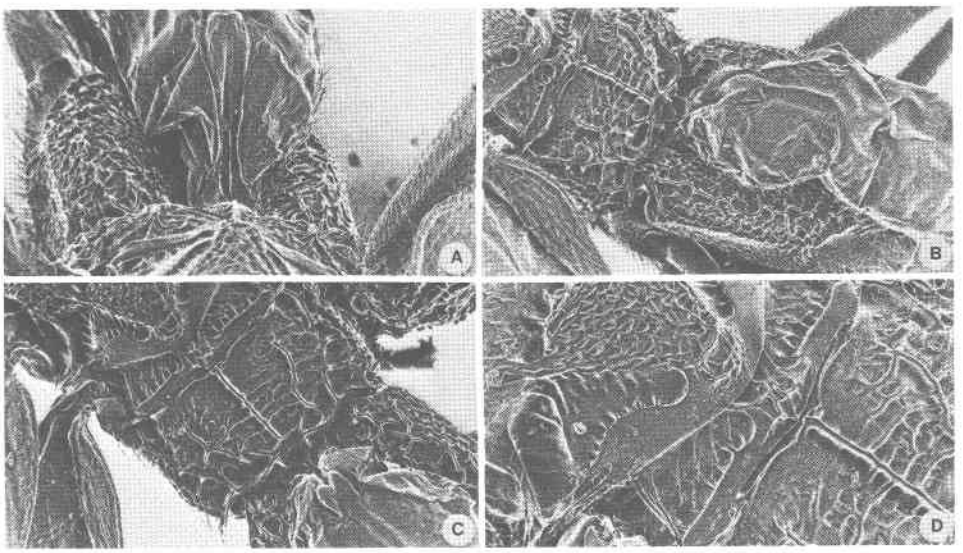


FIG. 94. *Wilkinsonellus henicopus* (de Saeger). A, tergite I and hind coxae; B, propodeum, coxae, and base of abdomen; C, propodeum; D, scutellum and metanotum.

LARVA AND HOSTS. Unknown.

RANGE AND CONTENTS. This small genus of the Old World tropics includes the *henicopus* and *daira* groups of Nixon. I place here *Apanteles henicopus* de Saeger, *A. iphitus* Nixon, *A. thyone* Nix., *A. daira* Nix., and a few undescribed species from Africa, India, and Papua.

REMARKS. The genus has a similarity to *Rasivalva* and *Distatrix* because of the reduced ovipositor hairs. However there are strong contraindications of relationships: the lack of a median groove on tergite I and strong sculpture of tergite II in *Rasivalva*; the smooth propodeum and lack of a median groove on tergite I in *Distatrix*. The relationships of *Wilkinsonellus* probably lie with the *fasciipennis* group of *Diolcogaster*. The reduced hairs of the ovipositor sheath are apparently independently derived.

45. *Deuterixys* new genus

Fig. 95

The name is feminine, and refers to the secondary "waist", that is, the characteristic constriction between terga II and III.

Type: *Microgaster carbonarius* Wesmael 1835.

Hypopygium of female short, evenly sclerotized and without any longitudinal creases. Second valvifer tapering apically. Ovipositor sheath short, hairy only on the apical half of the pigmented portion and arising near the base of valvifer; ovipositor short, weakly decurved, strongly narrowed at the basal quarter.

Tergite I varying from 1.2 to 2.5× as long as wide, weakly tapering or broadening apically but narrowest at the middle in one species; basally with a longitudinal groove. Tergites II and III broad, rectangular, and noticeably constricted or abruptly widened at the suture between them (no other Microgastrinae show this structure); first three tergites almost completely covered with an unusually finely-textured and dense aciculorimulose sculpture not found in other Microgastrinae.

Propodeum highly polished, bearing a strong, complete, median carina and a pair of smaller longitudinal carinae running forward from the apical corners; a variable amount of rugosity on the apical half or less.

Hind tibial spurs subequal and short; hind tibia with only a very few (about 3–6) larger spines on the outer side and these spines only slightly larger than the usual tibial hairs. Radius and intercubitus about equal, meeting at an angle of about 135° and usually with a knob at the junction; margin of vannal lobe of hind wing hairy and convex; intercubitellan cell twice as long as high.

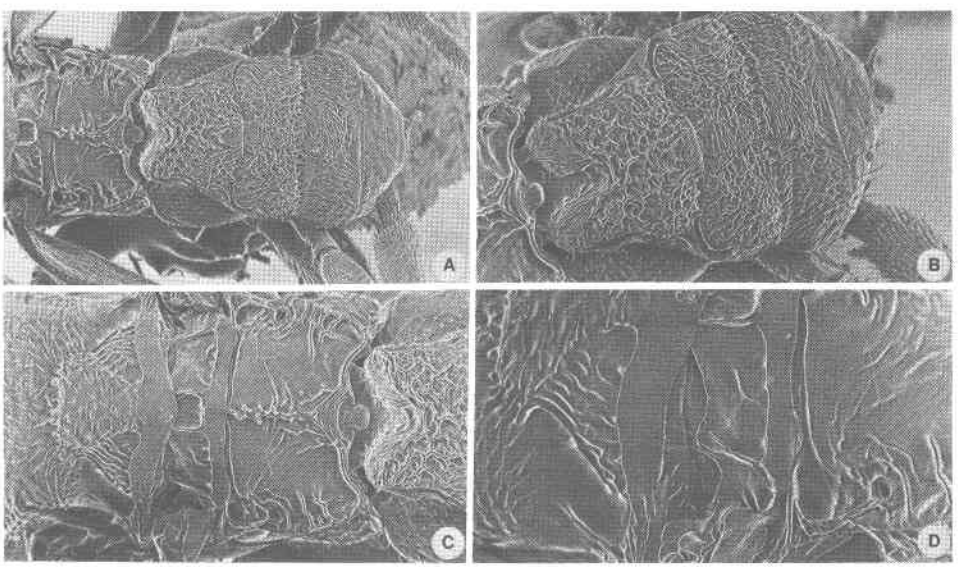


FIG. 95. *Deuterixys carbonarius* (Wesm.). A, B, abdomen and propodeum; C, propodeum; D, metanotum showing exposed phragma.

Larva. The larva of *D. carbonaria* (Short 1953) resembles that of *Protapanteles* in having a long mandible with 14 teeth on the blade.

HOSTS. The larvae are solitary, as far as known, and pupate inside the cocoon of their host, *Bucculatrix* (Lyonetidae). All other Microgastrinae, as far as I know, pupate outside the host cocoon.

RANGE AND CONTENTS. This is a small but widely distributed group. I have seen a few species from all major faunal regions except the Australian and African. The species I assign here are: *Microgaster carbonarius* (-*a*) Wesmael, *A. rimulosus* (-*a*) Niezabitowski (= *A. comes* Wilkinson), *A. patro* Nixon, and a few undescribed species from North and South America.

REMARKS. The genus is very easy to recognize but poses problems for its higher classification. Both Short (1953) and Wilkinson (1940) were puzzled where to place the species of *Deuterixys*. They both regarded the group as anomalous but came to different conclusions on the placement, mainly, I think, because they mistakenly felt it had to be forced into some group that they had already established. The structure of the female genitalia (Wilkinson 1940) clearly demonstrates the "Macrolepidoptera suite" of characters so I have no hesitation in assigning *Deuterixys* to the tribe Cotesiini. The basal groove of the first tergite may relate it to *Diolcogaster* but the mandible of the larva (Short 1953) is very plesiomorphic and reminiscent of *Protapanteles*. The habit of pupating inside the host cocoon is unique for solitary Microgastrinae and undoubtedly a strong apomorphic feature. The choice of a microlepidopterous host is anomalous, and there is little evidence to suggest how to interpret it. I guess it to be a secondary development from ancestors that attacked Macrolepidoptera.

46. *Protomicroplitis* Ashmead 1898

Figs. 96, 97

Type-species: *Microgaster mediatus* Cresson.

Hypopygium short and not pleated medially; ovipositor short, decurved and abruptly tapered near the middle, sheaths also short with hairs clustered near apex.

Tergite I long, surface smooth to aciculopunctate and bearing a sharp median furrow through most of its length; length 4-5× its width, slightly narrowed near middle; tergum II smooth but bearing a very poorly defined narrow median area that is clearly indicated only anteriorly. Tergum III longer than II.

Propodeum strongly declivous and very strongly rugose, with a percurrent median carina; metanotum with a few hairs on the anterolateral corners; apical polished rim of scutellum interrupted medially by sculpture; mesoscutum smooth to finely punctate, but with separate punctures and little or no trace of notauli; side of pronotum with a very broad and transcostate lower groove and a poorly indicated and short dorsal groove.

Ocelli large, separated by less than their own diameters; lying in a flat triangle, the anterior angle about 135°. Flagellomeres with the longitudinal placodes short and irregularly arranged so that the flagellomeres lack the median constriction characteristic of most Microgastrinae. Margin of clypeus concave below in a wide arc, the mouth opening (measured across the outer edge of the mandible cavities) wider than the least width of the face (which, itself, is always wide) and about 0.6 of the total head width. Face dull and coarsely punctate, wider than its length from antennal sockets to apex of clypeus.

Radius directed outward, usually curved and about 50% longer than the first intercubitus; 2nd intercubitus meeting it interstitially, areolet triangular and large; second abscissa of cubitus (2Cu1) twice as long as first abscissa (1Cu1); vannal lobe strongly convex, the margin with very short inconspicuous hairs that are less than half as long as normal marginal hairs of the hind wing.

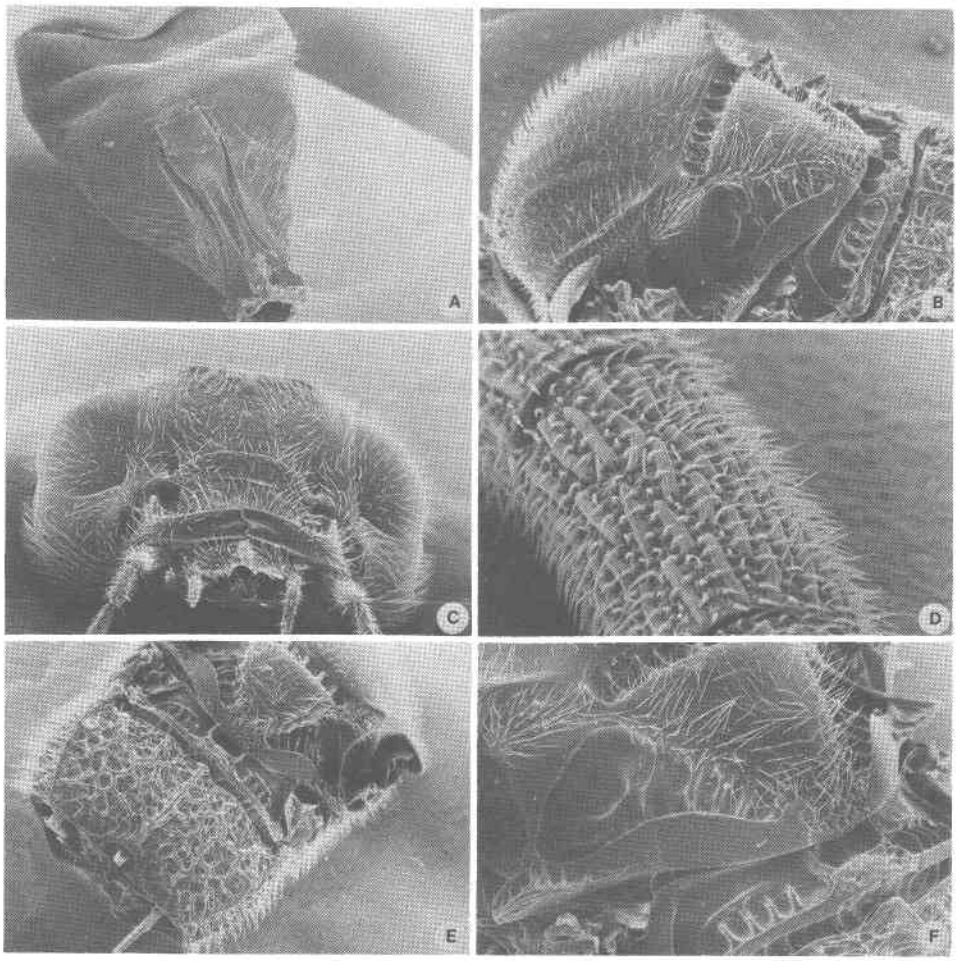


FIG. 96. *Protomicroplitis calliptera* (Say). A, abdomen; B, mesonotum; C, head to show wide mouth opening; D, flagellomere showing irregular arrangement of placodes; E, propodeum; F, metanotum.

Larva. Mandible without teeth; each maxilla with 2 hairs, labium with 4. Skin papules without spines (Fig. 108a).

HOSTS. Noctuidae.

RANGE AND CONTENTS. *Protomicroplitis* is known from only two Nearctic species (with range extensions into Mexico and the West Indies), *Microgaster mediatus* Cresson and *M. calliptera* Say.

REMARKS. The outstanding characteristic lies in the distribution of longitudinal placodes of the antennae. In this genus they are comparatively short (0.2–0.4 as long as a flagellomere) and scattered irregularly along the length of the flagellomere so that the appearance of a middle constriction is lacking (Fig. 96d). In most other Microgastrinae (except *Larissimus* and *Hygroplitis*) most of the flagellomeres (except a few, short apical ones and often the basal 1 or 2) have the longitudinal placodes 0.5 as long as the article and set in 2 non-overlapping ranks, leaving a constriction around the middle of the flagellomere (Fig. 10). The subapical shorter flagellomeres

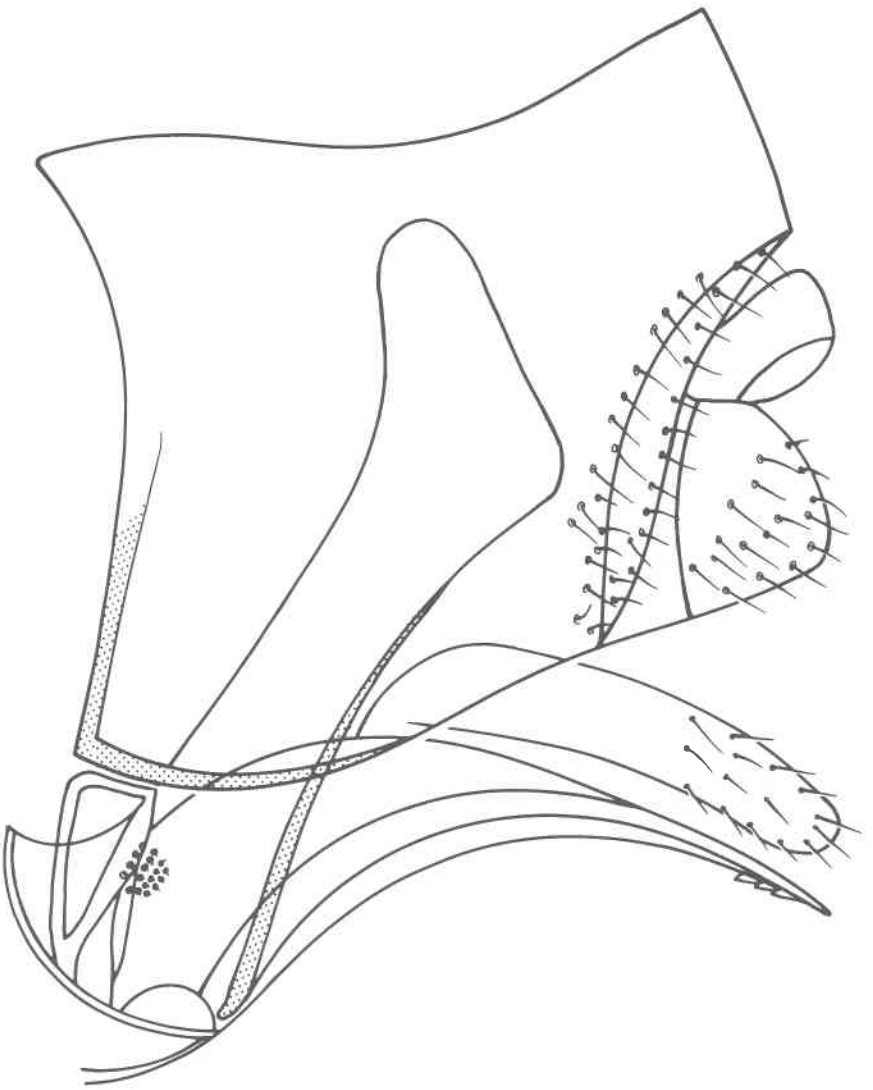


FIG. 97. *Protomicroplitis calliptera* (Say), female genitalia.

have only 1 rank of placodes about as long as the article and thus no constriction. In a few exceptional species (*Venanides*, *Venanus*, *Diolcogaster spretus*) in which the females have extremely short flagella, almost all the articles bear only a single rank of placodes, but the males have normal antennae. It seems to me that the specialized, 2-ranked, arrangement of flagellar placodes must have been genetically firmly "locked" into the microgastrine genome early in their evolution to be so nearly universally present. That three small specialized groups (*Protomicroplitis*, *Larissimus*, *Hygroplitis*) have "escaped" seems to be worth generic segregation. The two former genera are similar enough that they may well be a monophyletic group but the differences are too great to allow them to be united in a single genus. I think that *Protomicroplitis* may have been derived from the *lelaps* group of *Diolcogaster* because of many resemblances in structure.

47. *Larissimus* Nixon 1965

Fig. 98

Type: *L. cassander* Nixon 1965.

Ovipositor short, strongly tapered and decurved; sheath smooth with hairs mostly near apex but a few along dorsal side; hypopygium short and evenly sclerotized. Tergite I smooth, longer than wide and usually bearing a sharp median groove basally; tergite II delimited laterally by grooves diverging posteriorly, smooth and a little wider than long; suture between terga II and III strong, though not carinate. Terga II to III or IV with large dorsolateral patches of hair; terga IV or V–VII densely hairy.

Propodeum smooth and convex, with strong median carina. Metanotum with flat setose lobes appressed to scutellum. Scutellum smooth, with low lunules; mesonotum smooth. One undescribed species with rugose propodeum and scutellum (including apical band medially) and punctate scutum and face.

Ocelli in a low triangle; head smooth with long thin mandibles. Flagellar articles without the usual divisions into two parts caused by 2-ranked placodes; the placodes instead short and arranged irregularly, sometimes more-or-less in 3 ranks but never very regularly aligned; some species with more-or-less obvious ventral sensory areas on the distal seven flagellomeres of the females.

Areolet triangular, moderate in size, the radius sometimes with a short 2nd abscissa. Submediellan cell very short and vannal lobe greatly reduced, shorter than submediellan cell, though margin is still hairy; preaxillary excision absent. Tibial spurs large.

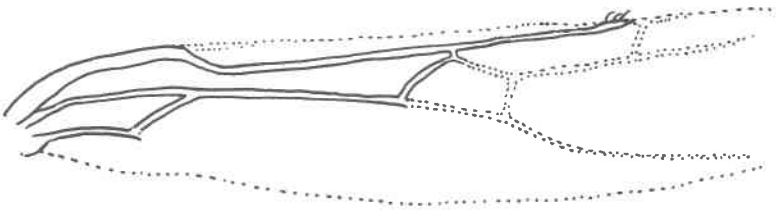


FIG. 98. *Larissimus cassander* Nixon, hind wing.

LARVA AND HOSTS. Unknown.

RANGE AND CONTENTS. I have seen four species from South America, of which only the type has a name.

REMARKS. The peculiar arrangement of the antennal placodes allies this genus to the Nearctic *Protomicroplitis*, which differs mainly in its normally developed submediellan cell and vannal lobe and in its long and narrow first tergite, undefined second tergite, and large areolet.

MICROPLITINI

Ovipositor sheath almost always (99%) short; hairs concentrated at apex even in the few species that have long ovipositor sheath; ovipositor short, stout basally, abruptly tapered about mid-length; hypopygium completely sclerotized, usually about as long as high in lateral view.

Tergite I squarish to much longer than wide, almost always sculptured; tergite II rarely (2%) sculptured or separated from tergum III by a suture, although sometimes defined laterally by shallow grooves; terga II and III usually forming a smooth undivided plate.

Propodeum almost always (99%) rugose and bearing a median longitudinal carina; only 3 rare species (*Alloplitis*) with an areola more or less developed.

Metanotum almost always (99%) with large setose sublateral lobe that touches the scutellar rim. Prepectal carina occasionally (5%, genus *Snellenius*) present in part; notauli sometimes (30%) present, occasionally (10%) very strongly marked. Hind coxae shorter than tergite I; tibial spurs short, the hind ones about half as long as the basitarsus.

Antennal articles mostly with 2 ranks of placodes; a few females with ventral basicone fields replacing the placodes on central articles.

Larval mandibles with a few apical teeth or none, blade of the mandible protruding from the base at a sharp, right-angled bend; labial palpi porrect and sclerotized but maxillary palpi greatly reduced, represented only by a small cluster of sensilla.

HOSTS. Almost always Macrolepidoptera, usually Noctuidae, the larvae often gregarious.

QUICK DIAGNOSIS. Hypopygium short and evenly sclerotized; sheath of ovipositor short and its hairs concentrated apically. Terga II and III usually uniformly smooth and not separated by a suture. Propodeum rugose with a median carina; notauli often well marked. Tibial spurs short; hind coxa shorter than tergite I; areolet of forewing always closed.

KEY TO GENERA OF Microplitini

*Couplet halves containing only a few individuals with restricted distribution.

1. *Propodeum more or less areolate, at least with a conspicuous transverse carina and several oblique carinae; tergite II rectangular, rugulose and separated from tergum III by a groove (Oriental) ..... (48) *Alloplitis*
- Propodeum with only a median longitudinal carina; tergum II poorly or not at all separated from III and rarely sculptured 2
2. *Scutellum enormous, conically prolonged backward above the propodeum and as long as mesoscutum (Oriental) ..... (49) *Philoplitis*
- Scutellum of normal size 3
3. Prepectal carina often complete, but at least partly developed about anterior end of mesopleural groove; notauli very deep, separated posteriorly only by a median carina, between them an elevated, shield-like middle lobe (Oriental and Neotropical) ..... (50) *Snellenius*
- No prepectal carina; notauli less developed or absent (worldwide, common) ..... (51) *Microplitis*

48. *Alloplitis* Nixon 1965

Fig. 99

Type: *A. guapo* Nixon 1965.

Hypopygium short, evenly sclerotized; ovipositor sheath short, with hairs near apex. Tergite I short, subrectangular, slightly wider apically, mostly sculptured; tergite II rectangular, wider than long and completely sculptured, the apical suture well defined; tergum III slightly, to much, shorter than II. Terga III–VI with a single band of sparse hairs.

Propodeum short and strongly declivous, more or less areolated and dull; but, never with a median longitudinal carina on the declivous part nor rugose all over. Anterior margin of metanotum far behind margin of scutellum laterally, exposing a wide section of the scutellar phragma; laterally the metanotum bearing a long cylindrical process with a few apical hairs; the type, *A. guapo*, is exceptional, having metanotum closely appressed to scutellum. Scutellum elevated; the disc with an apical concavity bordered by a carina; marginal polished band interrupted medially by sculpture. Mesoscutum usually with strong notauli on

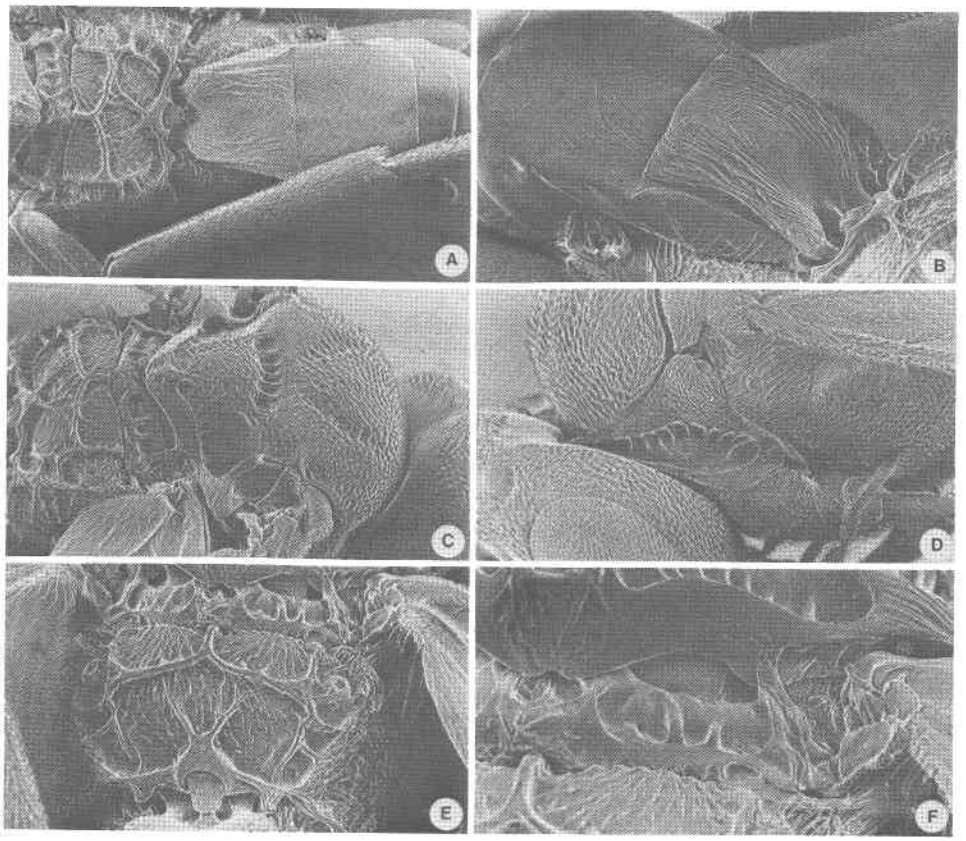


FIG. 99. *Alloplitis completus* Mason. A, propodeum and abdomen; B, base of abdomen; C, mesonotum; D, pronotum; E, propodeum; F, metanotum.

posterior half and a weak marginal carina above the tegula. Pronotum with a wide, crenulate median groove and a small ventral groove.

Distal flagellomeres of female with special ventral sensory areas; at least some flagellomeres with 2 ranks of placodes; other flagellomeres with placodes scattered or partly organized in 3 or 4 ranks.

Hind tibia swollen, the spines on its outer side few and small; tarsal claws with several comb-like teeth; tibial spurs short. Areolet with 3 or 4 sides, the 2nd intercubitus and 2nd Rs about equal. Nervellus sinuate, meeting submediella at a right angle and there producing a short brachiella; vannal lobe with margin nearly straight and hairless.

LARVA AND HOSTS. Unknown.

RANGE AND CONTENTS. Nixon (1965) included two species from the Philippine Is., *A. guapo* Nixon and *A. typhon* Nixon; I add a third from Malaya.

REMARKS. The areolated propodeum places this genus rather far from *Microplitis*. Another distinguishing feature is the strongly apomorphic structure of the metanotum of two species, *typhon* and *completus*: this structure shared by *Philoplitis*. Many other similarities leave little doubt that *Philoplitis* and *Alloplitis* have a common ancestor despite the striking differences in propodeum and scutellum. I am not satisfied with my arrangement of Microplitini, but so little of the critical oriental fauna is available that I can not offer anything better.

Alloplitis completus new species

Fig. 99

Holotype, female: length 3.2 mm, forewing 3.5 mm, antenna 4.3 mm.

First tergite about 1.5× longer than wide, mostly longitudinally aciculate; tergite II similarly sculptured, but the aciculations medially converging and fading out posteriorly, L/W = 2.0; tergum III about 0.9 as long as II, smooth and polished.

Mesoscutum, scutellum, propleuron, and most of mesopleuron similarly densely punctate; posterior apex of scutellum depressed with raised marginal carinae laterally and posteriorly; propodeum with dull finely sculptured surface and very strong, complete carination.

Entire head, except postocciput, densely coarsely punctate, but area above antennal bases transversely striate. Distal 5 flagellar articles with ventral sensory areas and 2 ranks of placodes above.

Black; scape and pedicel ferrugineous, a median yellowish band on flagellomeres 6-8; both palpi black, but distal 3 articles of maxillary palpi whitish; anterior tibia and tarsi and middle tarsi mostly fulvous; extreme base of mid- and hind tibiae whitish; abdominal sterna and laterotergites I-III also whitish. Wing veins black to brown, the membrane hyaline with slightly infumate apex and a stronger brown suffusion below stigma and near apex of submedian cell; wing bases whitish, but tegula black.

Males. Resembling females, but antenna longer and more tapered; placodes at no place grouped in 2 ranks, but usually in 3 or 4 ranks; yellowish median band of antenna absent in males.

Holotype: ♀, ***Malaya***, **Selangor**, Univ. of Malaya Field Station, Ulu Gambok, 14 Nov. 1977, Barry Bendell (CNC No. 15779).

Paratypes: 2♂♂, 2♀♀, same data (CNC).

49. *Philoplitis* Nixon 1965

Fig. 100

Type: *P. coniferens* Nixon 1965.

Hypopygium short, evenly sclerotized; ovipositor sheath short, hairs only near apex. Tergite I rectangular, 1.5-2.5× longer than wide and finely sculptured; tergite II with a truncate pyramidal area that is smooth or sculptured; terga II-VI with 1 or more rows of sparse hairs.

Propodeum strongly rugose and bearing a complete median longitudinal carina; surface rather flat and completely declivous. Metanotum withdrawn from scutellum, broadly exposing the scutellar phragma; anterior margin bearing laterally a long, cylindrical apically setose, process. Scutellum coarsely rugose and grossly prolonged backward over the propodeum, being as long as the mesoscutum when measured from the anterior margin of the scutellar scrobe. Mesoscutum with a small carinate lateral margin above the tegula; notauli long and deep, but not meeting posteriorly, extending from scrobe almost to anterior margin. Pronotum with a broad, crenulate middle groove and narrow ventral one. Propleura with a lobe just above coxae extending up and back over lower corner of pronotum. Tarsal claws with 2-3 teeth. Vannal lobe convex, long-hairy basally, hairless apically. Head almost completely densely rugopunctate except frons, which is transversely striate. All but the proximal flagellomere with 2-ranked placodes, giving a false division of the article. Both palpi dark, apical articles of maxillary palps whitish.

LARVA AND HOSTS. Unknown.

RANGE AND CONTENTS. The genus contains only two species, the type from Philippine Is. and a new species from South India.

REMARKS. In spite of the extraordinary scutellum this genus is, I think, most closely allied to *Alloplitis completus* and *A. typhon* with which it shares almost all its structures except that of the propodeum and scutellum. Especially strong synapomorphic features are the structure of the metanotum, pronotum and scutellum, and the color of the palpi.

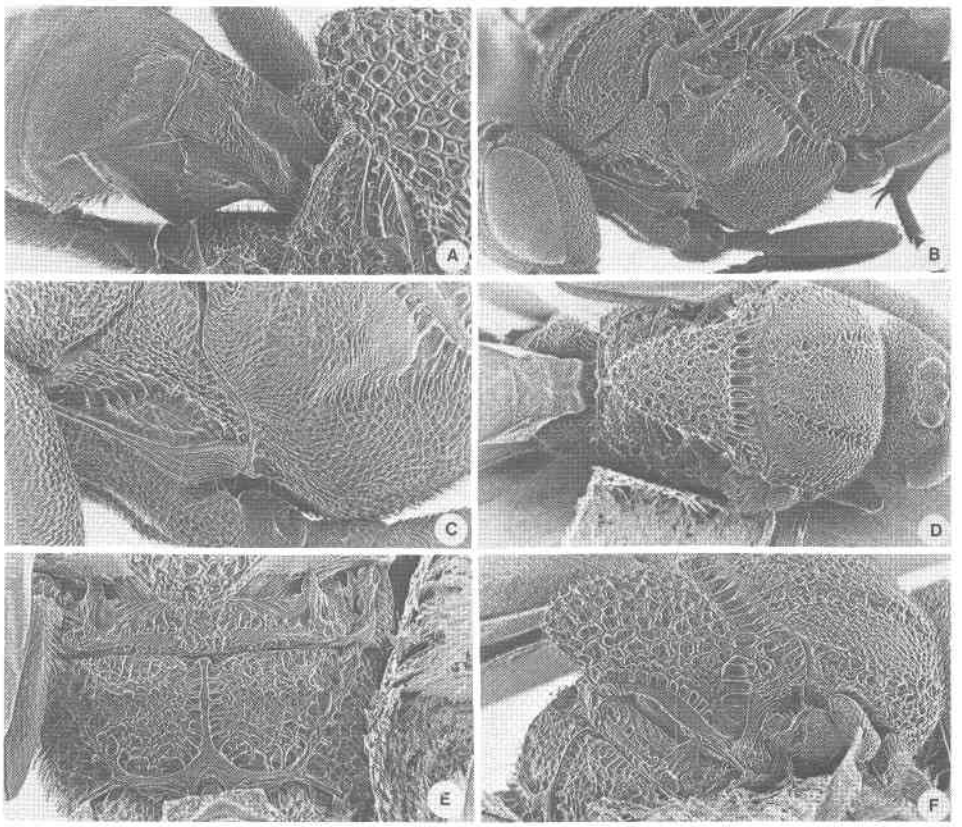


FIG. 100. *Philoplitis* sp. A, base of abdomen; B, pleura; C, pronotum and propleura showing overlapping apicolateral lobe; D, mesoscutum and scutellum; E, propodeum; F, scutellum and metanotum.

50. *Snellenius* Westwood

Fig. 101

Type: *S. vollenhoveni* Westwood 1882.

Hypopygium short, evenly sclerotized; ovipositor sheath short, with a few apical hairs. Tergite I sculptured, 1.5-4× longer than wide and subrectangular; terga II and III smooth, weakly or not at all separated from one another; abdomen short and stout.

Propodeum coarsely rugose and strongly declivous; with a median longitudinal carina. Anterior margin of metanotum with broad lateral lobes lying close to scutellum; apical margin of scutellum smooth and rather narrow, virtually without lunules, medially interrupted by strong sculpture; disc of scutellum elevated and rugose, usually with carinate margins. Mesoscutum with strong, complete notauli separated posteriorly by a median carina; lateral margins carinate; mesopleuron with a partial or complete, usually irregular, prepectal carina. Pronotum with a single, wide, transcostate groove.

Antennae sometimes strongly compressed, up to 4× wider than deep in cross-section, but without specialized ventral sensory areas. Areolet large, triangular, or quadrangular; vannal lobe convex and hairy. Hind tibia enlarged medially, narrowed toward apex; tarsal claws simple.

Larva. Figured by Capek (1970). His figure appears similar to one of *Microplitis* but an epistoma is indicated. I have not seen an epistoma in any other microgastrine.

HOSTS. Two species have been reared from Sphingidae.

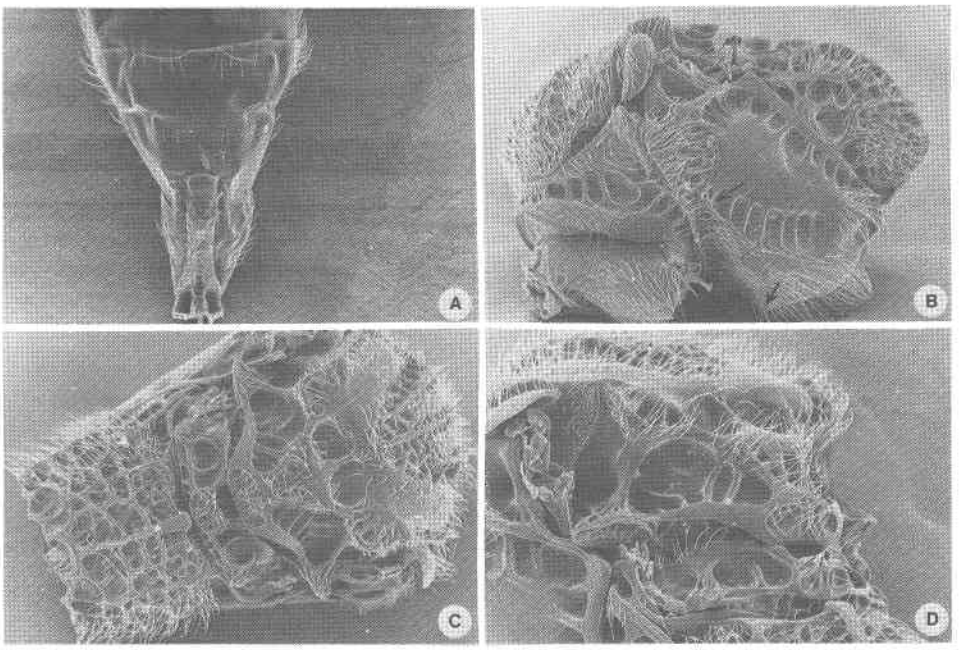


FIG. 101. *Snellenius atratus* Shenefelt. A, base of abdomen; B, profile of alitrunk (arrows indicate partial prepectal carina); C, propodeum to mesoscutum; D, metanotum.

RANGE AND CONTENTS. Shenefelt (1973) lists nine species from the Oriental and Neotropical regions, but I estimate it as less than a quarter of the total number.

REMARKS. As Nixon (1965) remarks, *Snellenius* and *Microplitis* appear to grade almost imperceptibly into one another, and this is as true in the New World as in the Old. It is tempting to regard *Snellenius* as a bizarre offshoot of *Microplitis*, but I do not think it so because *Snellenius* have retained a prepectal carina, a plesiomorphic feature always absent in *Microplitis*. Much more knowledge of the tropical faunas is needed to understand the relationship.

Snellenius succinalis Brues, 1933 is not even a microgastrine as the 16-jointed antennae testify. I would guess it is related to the many species he placed in *Microtypus*.

51. *Microplitis* Foerster 1862

Figs. 102, 103

Type: *Microgaster sordipes* Nees 1834.

Synonym: *Dapsilotoma* Cameron, 1906.

Type: (*D. testaceipes* Cam. 1906) = *M. spectabilis* Haliday 1834.

Hypopygium usually rather small but sometimes elongated medially, rarely conspicuously so; occasionally truncate or medially emarginate; the median line never bearing longitudinal creases. Ovipositor and sheaths projecting only a short distance beyond apex of hypopygium, thus long when hypopygium is long but usually short; sheaths arising proximally from 2nd valvifers and bearing only a few hairs distally.

Tergite I variable, widening to narrowing apically and usually sculptured; remaining terga almost always smooth, tergum II rarely weakly sculptured, though often with a weakly delimited trapezoidal median area; tergum III always longer than II, the transverse groove separating them frequently not, or only poorly, defined.

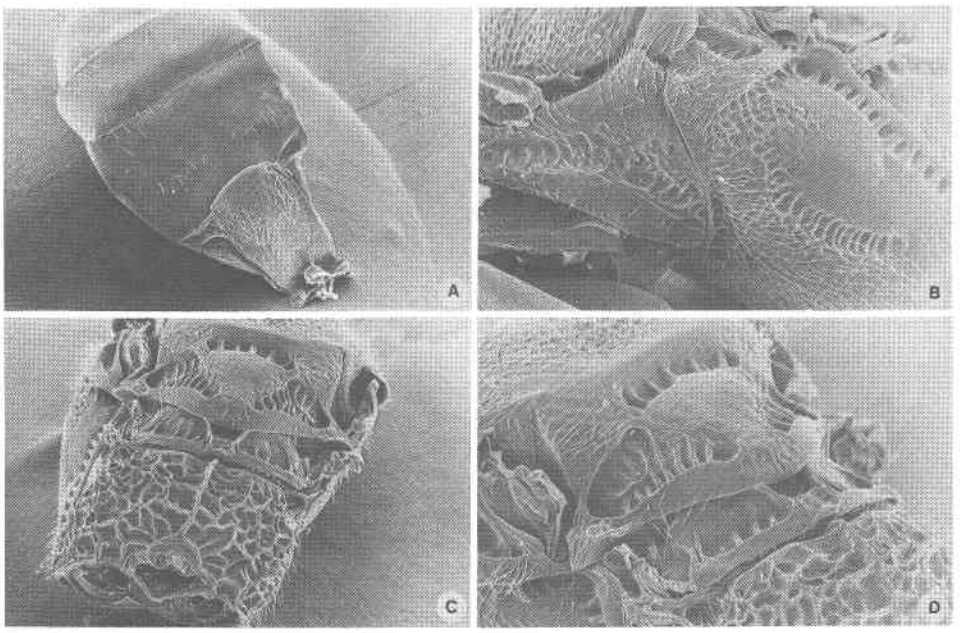


FIG. 102. *Microplitis kewleyi* Mues. A, abdomen; B, pronotum and mesopleuron; C, propodeum; D, metanotum.

Propodeum rather evenly curved in profile and almost always completely rugose; often with a median longitudinal carina but never with any indication of areola. Mesoscutum densely sculptured and seldom shining, often with notauli, sometimes strongly defined. Posterior declivity of scutellum rugulose or punctate and this sculpture interrupting the apical polished band.

Forewing always with an areolet; this with inner and outer sides typically symmetrical and curved so that the areolet usually forms a D-shaped cell with the cubitus (2M) forming the straight side; first abscissa of discoideus (1Cu1) much shorter than 2nd (2Cu1); metacarpus (R1) short, usually not extending more than .6 the way from apex of stigma to apex of radial cell; vannal lobe convex and hairy. Hind coxa small, not longer than tergite I; hind tibial spurs shorter than half basitarsus; middle tibial spurs shorter than mid-basitarsus.

Head usually rather thick from front to back; densely and dully sculptured. Labial palpi 3-jointed, but with 4 joints in the American species *M. croceipes* Cresson, *M. longicaudus* Muesebeck, and several undescribed relatives.

Larva (Fig. 109). Mandibles with a straight blade protruding at almost a right angle from the squarish base and bearing a few small apical teeth; labial palpi sclerotized and papilliform as usual for the microgastrines, but maxillary palpi reduced to flat discs with a few sensilla; labium with 4 trichiae, each maxilla with 2; skin papulae without even a trace of spines.

HOSTS. Larvae solitary or gregarious, usually in Noctuidae, less often other Macrolepidoptera and rarely in butterflies. One species, *M. plutellae* Mues., reliably and repeatedly reared from *Plutella maculipennis*, a microlepidopteran.

REMARKS. Ever since its description *Microplitis* has been generally recognized with little doubt over its limits, so there is no point listing included species here. The genus and its tropical relatives are the most apomorphic microgastrines because they exhibit the specializations of the Cotesiini plus a few more in the larval stage — the specialized mandibles, the reduced maxillary palpi, and elimination of even a trace of the spines on the skin papulae. Yet strangely the *croceipes* group are the

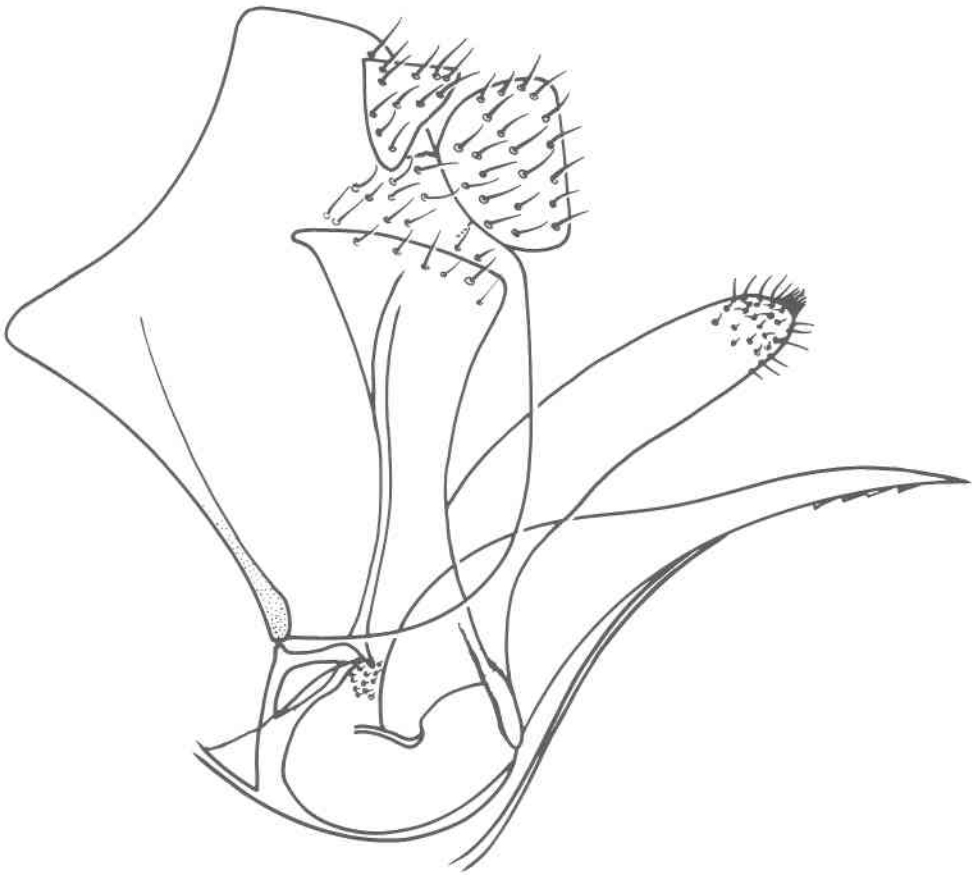


FIG. 103. *Microplitis ceratomiae* Riley, female genitalia.

only Microgastrinae with the obviously plesiomorphic feature of 4-jointed labial palpus. So similar are they to typical *Microplitis* that I cannot believe them generically distinct. Possibly there has been a case of reversal of an original loss of a palpal article.

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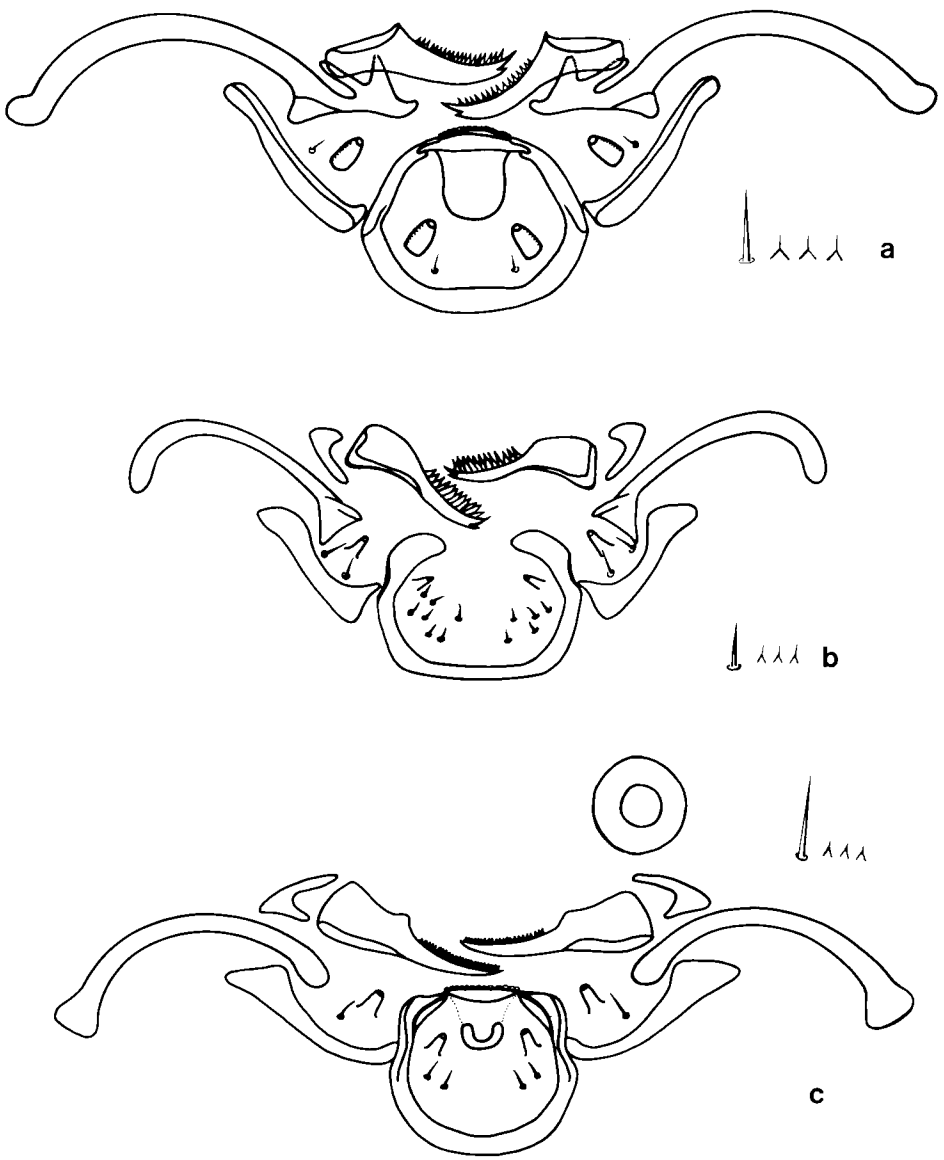

FIG. 104. Larval head and integument of Apantelini and Microgastrini. A, *Dolichogenidea lacteicolor* (Vier.); B, *Pholetesor ornigis* (Weed); C, *Microgaster gelechiae* Riley (note antenna). A small section of the integumentary papules and a seta are drawn to scale beside their respective head capsule.

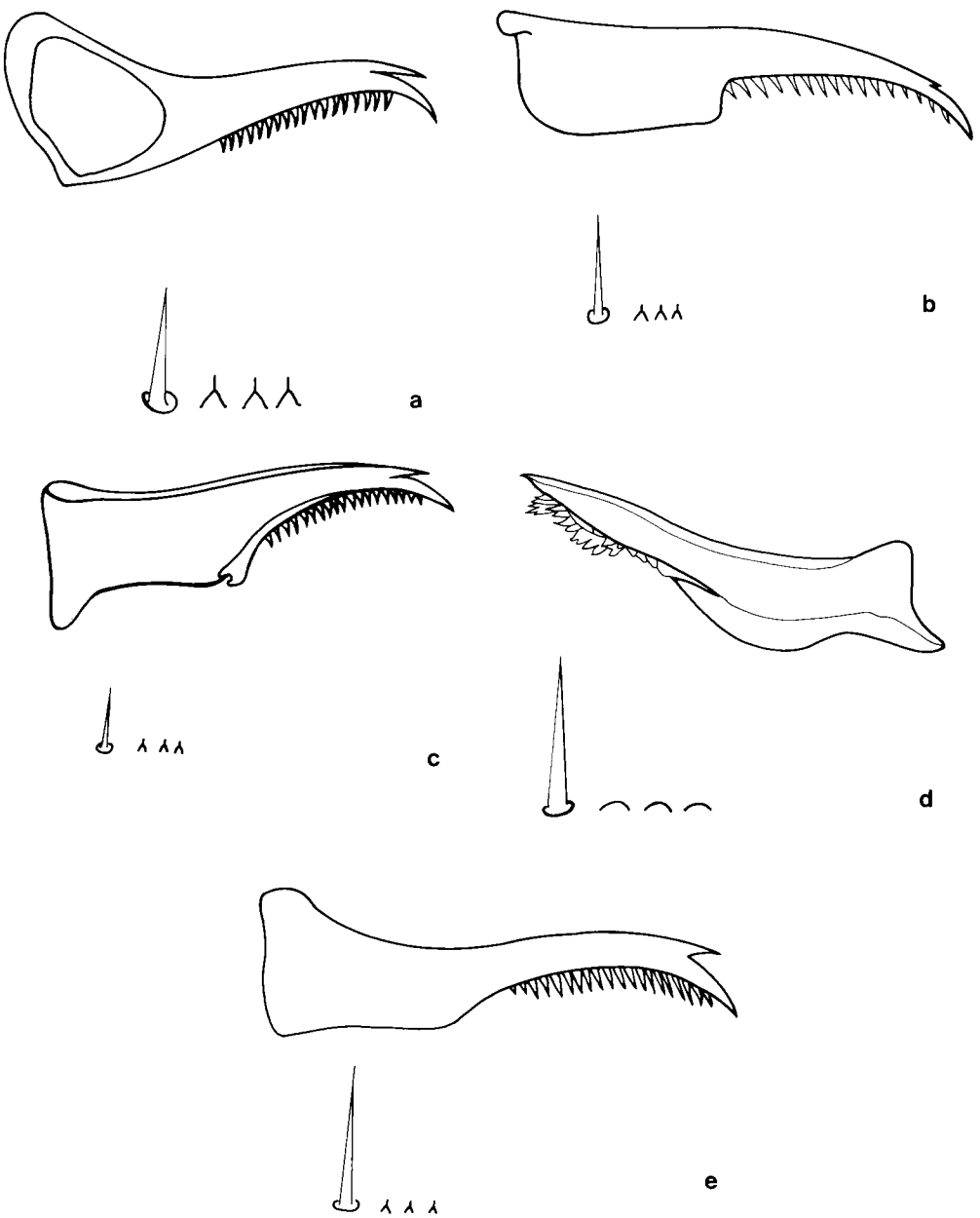

FIG. 105. Larval mandible and part of integument (to scale) of Microgastrini. A, *Hypomicrogaster zonaria* (Say); B, *Choeras tiro* (Reinh.); C, *Iconella etiellae* (Vier.); D, *Sathon neomexicana* (Mues.); E, *Rhygoplitis terminalis* (Gahan).

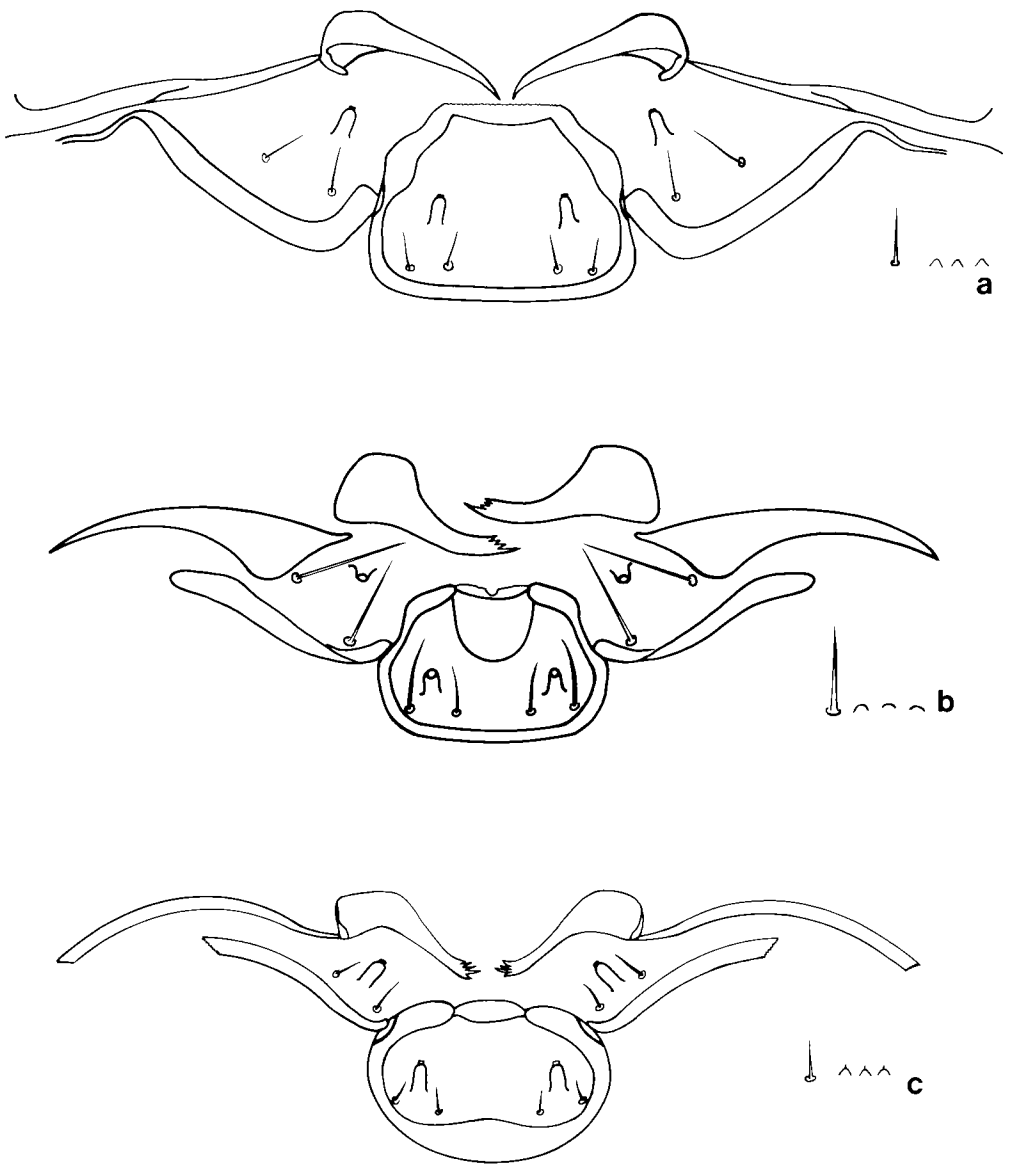

FIG. 106. Larval head and integument of Cotesiini. A, *Rasivalva* sp.; B, *Venanides xeste* Mason; C, *Venanus pinicola* Mason.

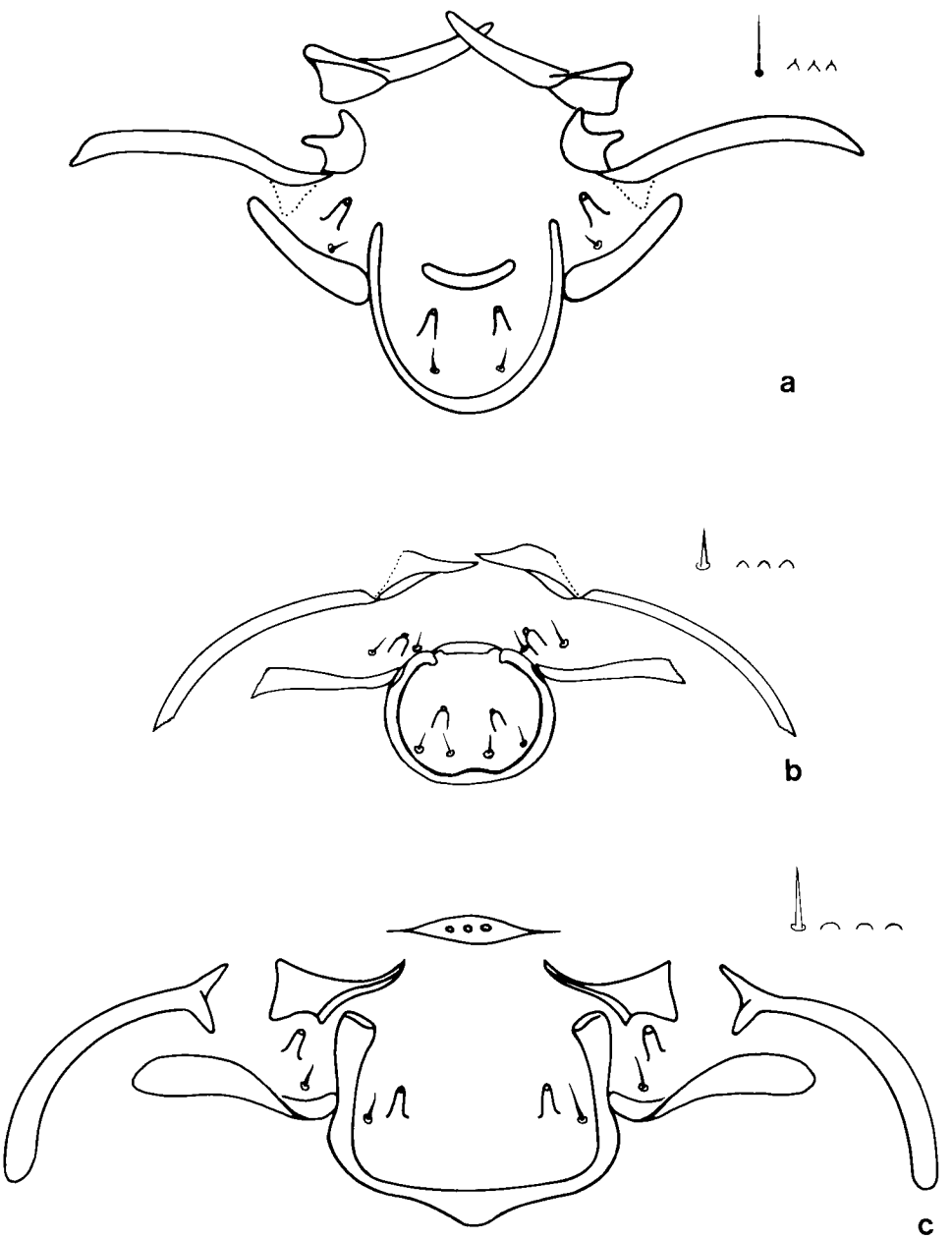

FIG. 107. Larval head and integument of Cotesiini. A, *Glyptapanteles militaris* (Weed); B, *G. demeter* (Wilkn.); C, *Cotesia congregata* (Say).

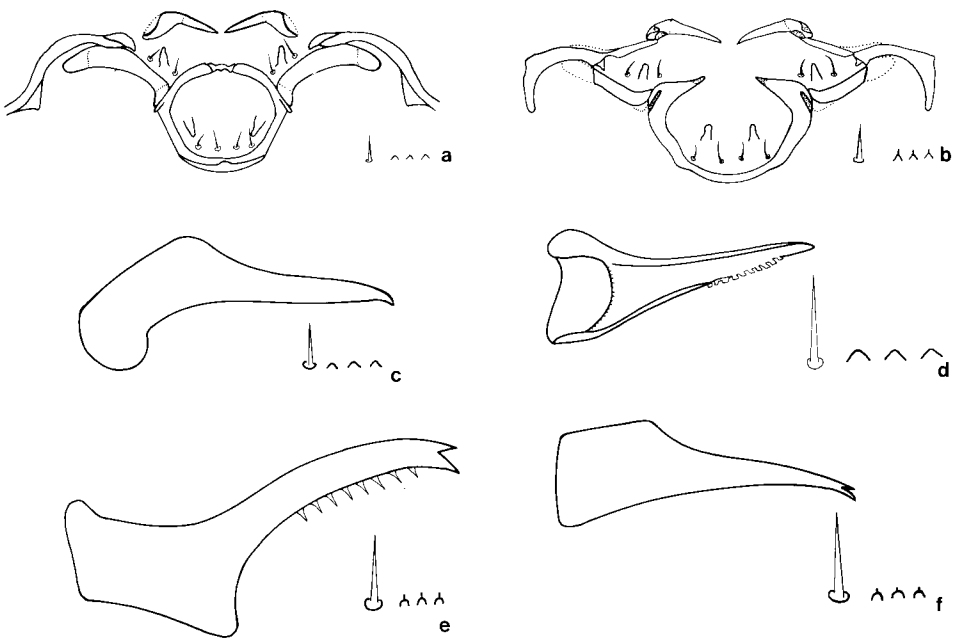

FIG. 108. Larval head or mandible and integument of Cotesiini. A, *Protomicroplitis calliptera* (Say); B, *Exix columbica* Mason; C, *Diolcogaster schizurae* (Mues.); D, *Glyptapanteles compressiventris* (Mues.); E, *Protapanteles paleacritae* (Riley); F, *Cotesia flavipes* Cameron.

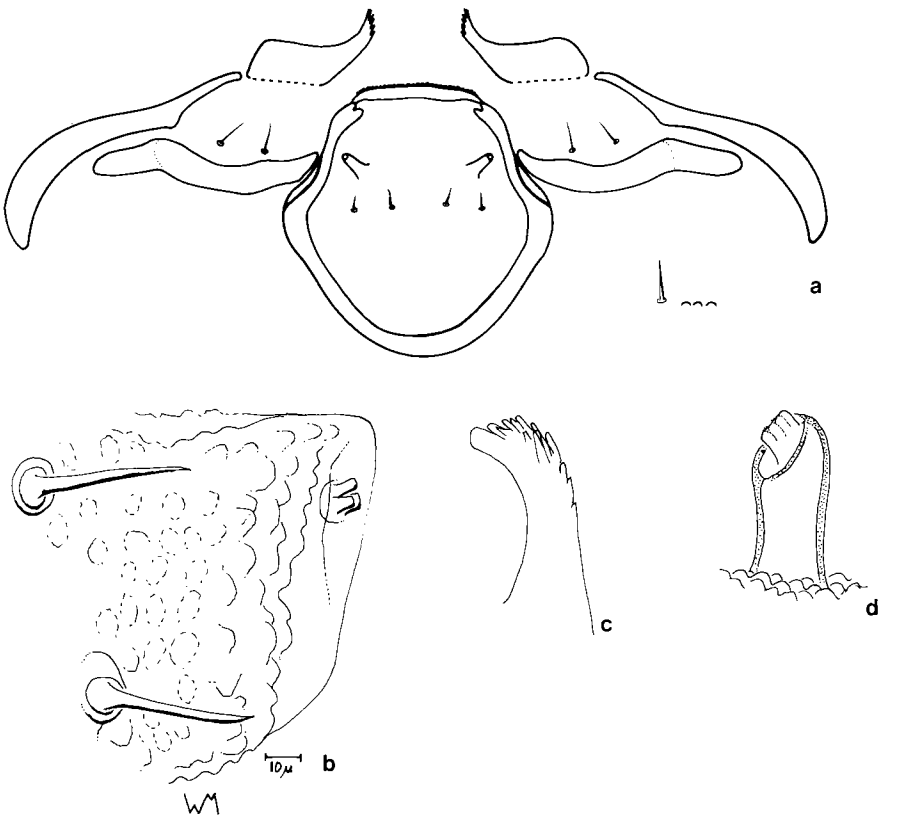

FIG. 109. *Microplitis ceratomiae* Riley, larva. A, head capsule; B, C, D, details of mouthparts to scale: B, maxilla with reduced palpus consisting of only 3 sensilla; C, tip of mandible; D, labial palpus with 1 sclerotized article.

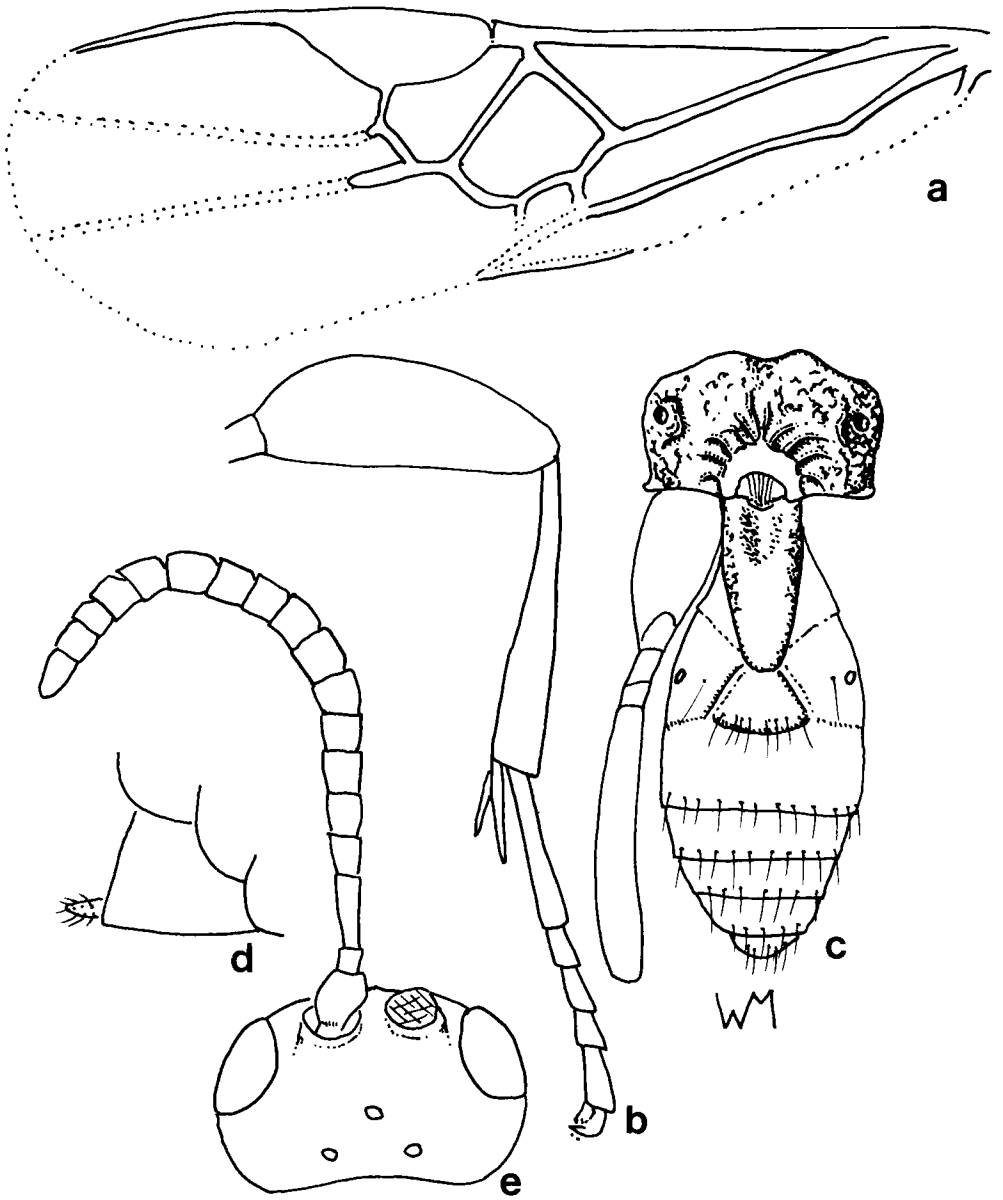

FIG. 110. *Glyptapanteles demeter* (Wilkn.). A, forewing; B, hind leg; C, propodeum, abdomen, and hind leg; D, hypopygium and ovipositor sheath; E, head (all these figures drawn from the type ♀).

GENERIC INDEX

SPECIES INDEX