ZOOTAXA

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Magnolia Press
Auckland, New Zealand

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(*Zootaxa* 1144)

94 pp.; 30 cm.

10 Mar. 2006

ISBN 1-877407-56-9 (paperback)

ISBN 1-877407-57-7 (Online edition)

FIRST PUBLISHED IN 2006 BY

Magnolia Press

P.O. Box 41383

Auckland 1030

New Zealand

e-mail: zootaxa@mapress.com

http://www.mapress.com/zootaxa/

ISSN 1175-5326 (Print edition)

ISSN 1175-5334 (Online edition)

Zootaxa 1144: 1–94 (2006)
www.mapress.com/zootaxa/

ISSN 1175-5326 (print edition)
ZOOTAXA
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Revision of the Nearctic species of the genus *Pholetesor* Mason (Hymenoptera: Braconidae)

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Accepted by M. Buffington: 21 Nov. 2005; published: 10 Mar. 2006

Abstract

The nearctic species of the microgastrine braconid wasp genus *Pholetesor* are revised for the first time, based on examination of museum specimens and on the results of a broad rearing survey of leafmining moths (the recorded hosts), especially in the western U. S. Twenty one valid species are recognized, two of which (*P. viminetorum* (Wesmael) and *P. circumscriptus* (Nees) were previously recorded only from the Palearctic Region, and eleven of which are described as new: *P. caloptiliae* n. sp., *P. chiricahuensis* n. sp., *P. dixianus* n. sp., *P. longicoxis* n. sp., *P. masoni* n. sp., *P. pinifoliellae* n. sp., *P. powelli* n. sp., *P. rhygoplitoides* n. sp., *P. thuiellae* n. sp., *P. variabilis* n. sp., and *P. zelleriae* n. sp. *Teremys* Mason is tentatively placed in synonymy with *Pholetesor*, thus transferring *T. masneri* Mason (and the neotropical *T. hanniae* Valerio and Whitfield) into *Pholetesor*. *Pholetesor* is divided into eight species groups, some of which appear to be restricted to the Nearctic Region. All species of the genus are found to attack leafmining or needlemining lepidopteran larvae except *P. powelli*, which attacks concealed lepidopteran leaf skeletonizers.

Key words: Hymenoptera, Braconidae, *Pholetesor*, Nearctic species, revision

Introduction

The assortment of microgastrine Braconidae assembled in this revision under the name *Pholetesor* Mason (tribe Apantelini) has not long been considered a natural group by taxonomists. The included species are a morphologically diverse array of small microgastrine wasps most of which attack leafmining Lepidoptera.

The first species to be described but now referable to *Pholetesor* were given the generic name *Microgaster* Latreille 1804, along with all other Microgastrinae. After Foerster's (1862) erection of the genus *Apanteles* for all species of *Microgaster* lacking

vein 2r-m of the fore wing, most species were referred to the giant genus *Apanteles* for over 100 years, until Mason's (1981) division of *Apanteles* into a number of genera, one of which is *Pholetesor.* A few species were temporarily assigned to several other nominal genera during Ashmead's (1898, 1900) and Viereck's (1911) ill-fated attempts to subdivide *Apanteles*.

Due in large part to the inordinate diversity of metasomal tergite shapes found among the species, members of the genus have been confused with disparate elements of the traditional genus *Apanteles* now referable to *Glyptapanteles* Ashmead, *Sathon* Mason and *Dolichogenidea* Viereck (each of which is in a different tribe in Mason's classification). It was not until Short's (1953) study of final instar larvae that some of the species now in *Pholetesor* were recognized to be related to those species now placed in *Dolichogenidea*. A major advance in the classification of *Apanteles s. l.* came with the species-group classification of Nixon (1965). Most of the species now included in *Pholetesor* fell within his *circumscriptus*- and *bucculatricis*-groups. Mason's (1981) conception of the genus *Pholetesor* combined these two groups as well as some apparent nearctic intermediates, to produce the current classification.

Due in part to its recency and the wholesale nomenclatural changes, Mason's classification has not received universal acceptance among braconid specialists, especially in Europe. The European *Pholetesor* species were reviewed originally by Papp (1983b) under the name *Apanteles*, using Nixon's (1965, 1973) species-group concepts. Despite some disagreements over the validity or limits of some of Mason's genera, it has been generally recognized that some kind of division of the huge genus *Apanteles*, with over 1300 described species, is essential to further systematic study. Even Nixon (1965) recognized the polyphyletic nature of *Apanteles* but stopped short of proposing new genera. Mason (1981) took the first step towards a new system; Papp (1988) then adapted his own nomenclature to Mason's genera.

More recent efforts to assess Mason's (1981) classification using phylogenetic methodology or new character systems (Austin 1990; Walker *et al*. 1990; Maeto 1996; Mardulyn and Whitfield 1999; Whitfield *et al*. 2002) have failed to recover many of the deeper relationships Mason used to define tribes, while they often have confirmed some groupings of putative sister genera. As a result, most workers have since abandoned Mason's five tribes, while tentatively retaining his generic assignments until the subfamily is more comprehensively revised on a world level. The current generic assignments of nearctic species were summarized in Whitfield (1995).

Revisions such as the present one are needed to refine the new microgastrine classification in terms of generic circumscription, while more comprehensive phylogenetic studies employing both morphological and molecular data (much larger than Whitfield *et al*. 2002) will help clarify higher-level relationships. A more thorough assessment of monophyly of many genera, along with a firmer understanding of larger clades, will ultimately enable a more mature classification of Microgastrinae to be developed. This

approach, although slower, will in the long run be far more productive than recent attempts to simplify the classification by lumping many of the genera based on oversimplifications of the comparative morphology (e. g. Achterberg, 2002).

Except for the handful of species included in Muesebeck's (1920) revision of North American *Apanteles s. l.,* the Nearctic species of *Pholetesor* have never been described. The present paper recognizes 21 valid species, 11 of which are new and two of which are Holarctic species not previously reported from the New World. A number of the newly-described species represent species-groups not previously known and apparently absent from the Palearctic region. Consequently, study of the Nearctic fauna is essential to an understanding of the phylogenetic relationships within the genus and its position within the Microgastrinae as a whole. While the species groups used here will be explicitly delimited using a series of morphological characters, host specialization and cocoon features, no phylogeny is proposed until a more rigorous test of generic monophyly is available from other studies currently underway.

Materials and methods

This revision is largely based on the study of over 4000 Nearctic specimens of *Pholetesor*, with comparisons to several thousand specimens of determined Palearctic material belonging to 10 species. The institutions and individuals who provided specimens are listed below along with the abbreviations used for them in the text:

Rijksmuseum van Natuurlijke Historie, Leiden (C. van Achterberg (RMNH)
American Entomological Institute (H. K. Townes) (AEI)
American Museum of Natural History (M. Favreau) (AMNH)
British Museum (Natural History), London (T. Huddleston) (BMNH)
California Academy of Sciences (W.J. Pulawski) (CAS)
California Dept. of Food & Agriculture (M. Wasbauer) (CDFA)
Canadian National Collection (W.R.M. Mason) (CNC)
Cornell University (L.L. Pechuman) (Cornell U.)
Donald L. Dahlsten, University of California, Berkeley
Norman C. Elliott, Michigan State University
Florida State Collection of Arthropods (L. Stange) (FSCA)
John M. Heraty, University of Guelph (JMH)
Hungarian Natural History Museum (Jenö Papp) (Papp)
Michigan State University (R. L. Fischer) (MSU)
Museum of Comparative Zoology, Harvard (R.J. McGinley) (MCZ)
North Carolina State University (C. Parron) (NCSU)
Oregon State University (J.D. Lattin) (OSU)
Royal Museums of Scotland (Mark R. Shaw) (MRS)
United States National Museum (P.M. Marsh) (USNM)
University of California, Berkeley (J.A. Powell) (UCB)
University of California, Davis (R.O. Schuster) (UCD)
University of California, Riverside (J.C. Hall) (UCR)

University of Idaho (J.B. Johnson) (UID)
University of Kansas (G.W. Byers) (UKS)
University of Minnesota (P.J. Clausen) (MINN)
David L. Wagner, U. C. Berkeley (DLW)
Washington State University (R.S. Zack) (WSU)
J. B. Whitfield (JBW)—now in Illinois Natural History Survey (INHS)

Most of the author's and David Wagner's specimens were the results of a field rearing program for leafmining Lepidoptera, conducted from 1980ñ1986. Emerged parasitoid adults, emerged lepidopteran adults and immature stages were all retained and identified along with the host plant data. Adult leafminers and mine types were determined mostly by David Wagner, with additional determinations being provided by Jerry A. Powell, John DeBenedictis (University of California) and the author. Over 300 species of leafmining Lepidoptera were sampled, resulting in a relatively well-known information base on host ranges, which has been analyzed separately (Whitfield & Wagner, 1988). This study also generated a key to other braconid wasp genera attacking Holarctic leafmining moths (Whitfield and Wagner, 1991) and contributed to a more comprehensive account of parasitoid rearing records from California leafminers (Gates *et al*. 2002).

Genitalic dissections were prepared after soaking detached metasomal apices in chloralphenol overnight. The genitalia were then slide-mounted in Faure's medium with dissolved iodine to stain sclerotized tissues. Drawings were made using a compound microscope at 200–400x, fitted with an ocular grid.

Larval skins were dissected from associated cocoons and run through chloralphenol, which distends, softens and clears the skins, into Faure's medium for slide mounting. Usually 400x magnification was required to examine and record details of setation, mandibular teeth, etc.

Wing figures were prepared by slide-mounting detached wings and projecting them onto a wall, then tracing the vein outlines. Reference was made back to unmounted wings to verify details of vein pigmentation, degree of infuscation, etc.

All other figures except the SEM photos were prepared using a Leitz dissecting microscope, fitted with an ocular grid, at 50x or 100x. Measurements and proportions were taken with the use of an ocular micrometer at the same magnifications.

An ISI Super II Scanning Electron Microscope was used to make the surface sculpturing photographs, after gold sputter-coating of the specimens.

Morphology and Taxonomic Characters

Most of the morphological terminology in this revision follows Mason (1981), including his names for the abdominal tergal divisions and his adoption of the Comstock-Ross system of wing vein nomenclature. Following Michener (1944), I have referred to the

morphological thorax + propodeum as the mesosoma, and the functional abdomen, consisting of the true abdominal segments beyond the first, as the metasoma. Hence, metasomal tergite II refers to the apparent second tergite, which is technically the third abdominal tergite.

I have borrowed several terms used for other hymenopteran families. The nucha, as figured for chalcidoids in Graham (1969), is the polished medial apical propodeal boss, just above the orifice through which the internal organs pass to the metasoma. Following Townes (1969) for Ichneumonidae, the transverse, crenulate grooves between the scutellar lunules and the mesoscutum are referred to as the axillary troughs. According to Richards (1977), the axillae belong morphologically to the mesoscutum. Also following Townes (1969) is use of the terms inclivous and reclivous for transverse wing veins ending closer, or farther, respectively, from the wing bases at their anterior ends.

The descriptions of surface sculpturing are largely compatible with the terminology of Harris (1979), but it has been necessary to use some compound words and qualifying adjectives not found in his work, particularly for the complex overlays of sculpturing on the metasomal tergites and the extremely weak sculpturing on the mesoscutum. Reference should be made to the SEM photos (figs. 33–38) for comparison.

No attempt has been made to specify colors with respect to some precise standard. Colors are quite variable intraspecifically and of limited taxonomic use except where extreme color differences appear. Color *patterns*, however, are often of considerable importance, so the extent of particular colors on the legs, wing veins, metasoma, etc. has been carefully recorded.

The female genitalia (ovipositor apparati) have been described using the terminology of Mason (1981), which follows that of Snodgrass (1935) except that the third valvulae are usually called ovipositor sheaths. The sheaths are of great diagnostic value at the species level within some groups.

The terminology of Snodgrass (1941) has been used for the male genitalia, as shown in figure 8. The genital capsules are depicted in ventral view for many of the species, but they have been found to be of little diagnostic use except at the species-group level and above.

Larval features have been described using the terminology of Short (1952, 1953) except that the setae on the area surrounding the labial sclerite are simply called labial setae , rather than prelabial setae. This is consistent with Mason's usage. The larval head sclerites show few species-level characters other than subtle shape differences and the number of teeth on the mandibles. At the species-group level the distribution of setae on the labium and maxillae is important. A labeled diagram of the head region of a representative *Pholetesor* species is shown in figure 1.

I have not attempted to describe the features of the pupae. The appearance of the cocoon, however, is sometimes of use in determining parasites or their remains at least to species group.

Most measurements are accompanied by an indication of the position or endpoints of the measured dimension on a given structure. Several measured dimensions are shown in figure 2. Scale lines are not provided with the figures. Relative overall size is not, in many cases, useful diagnostically. Nevertheless, similar structures in different species can be directly compared, since all figures of the same structure are done to the same scale.

Biology

Little is known in detail of the life histories of many *Pholetesor* species. For internal parasitoids of concealed hosts it is difficult to study their behavior and development without knowing in advance when to dissect the host mine or shelter or even host insect. As a result, most rearing records include only the identity of host attacked, the stage of host from which the parasitoid emerged and (sometimes) the appearance of the parasitoid cocoon and host remains.

The known hosts of the various species of *Pholetesor* are almost exclusively leafmining Lepidoptera, from a number of often unrelated families. Whitfield & Wagner (1988) have analyzed the host ranges of the Nearctic species using some taxonomic and ecological criteria. A list of the known hosts for each species is given in the species descriptions.

The available Nearctic host records of *Pholetesor* species suggest that each species has a general pattern of restriction to (1) microlepidoptera with a particular feeding habit (e.g., tentiform blotchmining) on (2) plants belonging to several, not necessarily taxonomically related but ecologically associated families, within (3) one or several habitat types. This pattern is consistent with earlier generalizations by Cushman (1926) for parasitic Hymenoptera, by Townes (1962, 1972) for Ichneumonidae and by Shaw & Askew (1976) for Ichneumonoidea attacking leafminers in Great Britain. It appears also to be consistent with the Palearctic host records as available in Nixon (1973), Papp (1983a), Shaw & Askew (1976) and Szöcs (1965, 1979), although these have not yet been analyzed (Shaw & Whitfield, unpublished data).

In most cases it is not known what stages or ages of hosts are attacked by ovipositing *Pholetesor* females. Laing and Heraty (1981) report that in *P. pedias* (Nixon), oviposition appears to occur only into first and second instar host larvae in the field; Delucchi (1958) found the same pattern for *P. circumscriptus* (Nees). Attack of early-instar lepidopteran larvae appears to be the general tendency for Microgastrinae exploiting microlepidoptera (de Saeger, 1942). Pottinger & LeRoux (1971), however, report that *P. ornigis* (Weed) oviposits into the tissue-feeding stages (fourth and fifth instars) of *Phyllonorycter blancardella* (F.), although they did not state how they determined that oviposition did not occur earlier. For other *Pholetesor* species, I know of no definite determinations of the timing of parasitoid attack, although I have reared *P. variabilis* from larvae of *Bucculatrix* spp. collected at only half mature size. This suggests that the larvae must have been parasitized at a relatively early stage.

Limited data suggest that after several days in the egg stage, *Pholetesor* larvae pass through three instars. Overwintering usually takes place as a larva within the host larva, or as a prepupa or pupa in a cocoon (Pottinger & LeRoux, 1971; Laing & Heraty, 1981; Whitfield, unpublished rearing data). Overwintering mortality can be affected by hyperparasitoids such as perilampids, eulophids or phygadeuontine and mesochorine ichneumonids, as well as by extreme weather conditions, molds or even spring leaf burial by earthworms (Laing *et al*., 1986; Laing & Heraty, 1987). *Pholetesor* larvae emerge from the final instar host larvae or prepupae, usually before the host cocoon or silken shelter is completed but, in the case of the species attacking *Bucculatrix* larvae, often after the host cocoon is spun. In these latter cases the cocoon is spun within the host cocoon; in all others a separate cocoon is spun. Individuals overwintering within cocoons tend to spin thicker-walled, more opaque cocoons than those pupating during the warmer months (Pottinger & LeRoux, 1971; also personal observation). In the *ornigis*- and *circumscriptus*-groups, a remarkable, unique form of cocoon is spun which is smoother, more elongate and capsule-like than in other Microgastrinae. This cocoon is suspended within the host mine or shelter by a thread from each end in the manner of a hammock. The function of this suspension system is unknown, but it may enhance evasion of bird predatory behavior.

Little study has been made of the adult behavior of *Pholetesor* species. From the actions of several species I have observed within rearing lots, it appears at least some species are capable of mating and searching for hosts within minutes of emergence from their cocoons. Presumably most species find mates singly; there is indirect evidence that females possess a sex attractant (Ridgway & Mahr, 1986). At least one species of a related genus, *Apanteles coniferae* (Haliday), has been observed to form male swarms (Whitfield, 1987b); this behavior may be more common in microgastrines than is now realized.

A pair of *Pholetesor bedelliae* (Viereck) mated within an hour of emergence of the female in the laboratory, in an enclosed glass vial. The male chased the female around within the vial, periodically stopping, raising its metasoma with wings outstretched at an angle to the sides, as if emitting a pheromone. Eventually the male approached the female from behind, vibrating his antennae rapidly out to the sides. Upon contact, the female either took evasive action or (finally) allowed the male to mount her. Copulation ensued for anywhere from 1–2 seconds to over a minute. The pair coupled repeatedly with the male' s antennae vibrating outstretched over the female's head.

I have seen females of *P. bedelliae, P. bucculatricis, P. salalicus, P. salicifoliellae* and *P. variabilis* searching leaves infested with host mines within a few hours of emergence. Oviposition was not observed because the hosts were either at the wrong stage or already parasitized. The rare times I observed host attack and oviposition in the field (in *P. salalicus*), it appears the parasitoid females can only precisely locate the host larva through the leaf epidermis when the host moves.

As with many microgastrines, adults, especially males, are often found feeding at flowers (Ford, 1943). I have found clusters of small white or yellow flowers, particularly

of various Compositae and Umbelliferae species, to be good collecting sites for *P. bedelliae*, *P. masoni* and *P. variabilis*. It is known that captive adults will die within 3 days if not provided with food or water; presumably this flower feeding extends their adult life considerably.

Descriptive Taxonomy

Pholetesor Mason

Pholetesor Mason, 1981, *Mem. Entomol. Soc. Can.* **115**: 37. Type-species: *Apanteles ornigis* Weed, orig. designation.
Teremys Mason, 1981, *Mem. Entomol. Soc. Can.* **115**: 42. Type species: *Teremys masneri* Mason, orig, designation. New synonymy.

Head.—Clypeus transverse, separated from frons by indistinct impressed arched line; ventral edge concave, exposing labrum. Labrum weakly convex; exposed portion transverse-oval. Frons 1.1–1.5x broader at mid-height than long down middle; inner margins of eyes usually weakly converging. Frons, postgenae, vertex and occiput nearly smooth to distinctly punctate, often with fine radiating microsculpture producing dull satiny sheen. Antennae of typical microgastrine 18-segmented form; flagellomeres with two ranks of longitudinal placodes except apical 5–6 (females) or 3–4 (males), ranging from 2.5–3.5x longer than broad (flagellomere 2) to 1.1–1.5x longer than broad (terminal flagellomeres). Compound eyes hairy. Maxillary palpi 5-segmented; labial palpi 3-segmented; all palpi unmodified. Lateral ocelli usually about 1 ocellar diameter from anterior ocellus, about 2.0–2.5 ocellar diameters from each other. Head in dorsal view 1.8–2.1x broader than medially long.

Mesosoma.— Mesoscutum at broadest point subequal in width with head, indistinctly to distinctly punctate, punctation becoming less conspicuous posteriorly. Pronotal furrow with both dorsal and ventral arms impressed, crenulate to shallow and smooth; pronotum otherwise not strongly sculptured. Scutoscutellar scrobe fine, narrow, composed of 10–15 small, mostly distinct pits. Scutellar disc on same plane as mesoscutum, usually more sparsely punctate, slightly longer than its own maximum breadth and bounded posteriorly by a complete, narrow polished band. Scutellar lunules semicircular in outline; axillary troughs crenulate, rugose or nearly smooth. Mesopleural depression shallow, weak and broad, usually polished but occasionally with obsolescent crenulation in center; remainder of mesopleura peripherally hairy, weakly punctate. Metanotum with sharp, anteriorly projecting sublateral setiferous lobes; anterior margin weakly to strongly retracted from scutellum, often exposing portions of mesonotal postphragma; usually with partial to complete transverse carina at midlength or more anteriorly, sometimes reaching to bases of sublateral setiferous lobes, and to either side of U-shaped medial excavation. Metapleuron

centrally smooth around spiracle, peripherally variably sculptured but usually weakly punctate and hairy. Propodeum 1.7–2.2x broader at than long at longest point; background sculpturing varying from vaguely rugulopunctate to coarsely rugose; superimposed carination varying from strong, pentagonal areola with costulae and short anterior medial carina to completely absent or only posteriorly suggested by ridging or medial depression.

Legs.—Proportions typical of Microgastrinae in general but hind coxae occasionally longer than in most Nearctic Apantelini; hind tibiae with 20–35 small spines on their outer faces, usually all of one kind; hind tibial spurs subequal in lenght or inner one much longer; tarsal claws simple and small.

Wings.—Vein 2 r-m of fore wing absent; R1 somewhat shorter to 1.5x longer than stigma, 2–9x as long as distance from its distal end to end of 3Rs fold along wing edge. 2r and 1Rs usually subequal in length, meeting at rounded to distinctly 120–150-degree angled junction. Cu+cu-a of hindwing weakly reclivous (and arched) to strongly reclivous. Vannal lobe of hind wing evenly convex to weakly flattened, evenly fringed with hairs of variable length.

Metasoma.—First tergite broadening posteriorly and covering nearly entire breadth of dorsal surface to strongly narrowing posteriorly and dorsally exposing much of laterotergites near junction with second tergite; surface usually densely rugose to aciculate but occasionally virtually smooth and highly polished; anteromedially with broad, smooth excavation; lateral margins nearly straight to strongly rounded. Second tergite ranging from quadratem coarsely sculptured and slightly longer than third tergum to subtriangular, virtually sculptureless and much shorter than third tergum, never extremely transverse (i.e., more than 3x as broad as long); posterior margin usually straight but occasionally weakly concave, convex or faintly bisinuate. Third tergite raning from similar to posterior sculptureless terga (in which case a dorsal medial tergite is not differentiated from the lateral areas) to strongly sculptured as in the second tergite, either anteriorly or over entire surface; posterolateral corners occasionally rounded when tergite 3 is strongly sculptured; delineated from tergite 2 (to which it is immovably fused) by smooth to broadly crenulate furrow. Fourth and remaining terga unsculptured and partially overlapped by preceding terga except in *P. masneri*, in which the fourth tergum is fused to the third and strongly sculptured. Laterotergites of anterior terga weakly sclerotized, partially to entirely hidden in dorsal view. Hypopygium of female moderately short, evenly sclerotized to medial fold or submedially weakly creased, setting off more translucent and flexible narrow medial fold, never multiply creased and membranous medially; tip acuminate to evenly and somewhat acutely angled. Ovipositor sheaths produced at or beyond midlength of valvifers, almost always less than .75 length of hind tibiae, exserted, hairy and broadened over most of apical length; shape varying from spatulate and blunt apically to narrowly fusiform to weakly decurved, bladelike and with beveled point apically (point usually produced by a brush of short hairs at tip). Ovipositor usually strongly exserted, of moderate length and evenly decurved.

Coloration.—Body almost always black except often lighter (mostly yellowish) labrum, palpi, antennal bases, tegulae, laterotergites and very occasionally portions of the metasomal tergites. Legs variably patterned in black and honey-yellow, never reddish. Venation of fore wing mostly yellow-brown to greyish, sometimes deep brown or virtually colorless. Setae of wings usually pigmented but occasionally colorless, giving wings a milky appearance. Hind wing venation mostly weakly pigmented.

Sexual dimorphism.—Size tends to be roughly comparable in the two sexes but males tend to be darker in coloration, more weakly sculptured and shinier, with longer and more slender antennae and narrower anterior metasomal tergites. Males appear to be more variable intraspecifically than females, and consequently more difficult to separate interspecifically.

Final instar larva.—Mandibles slender, long, with bifurcate tip and 8–25 prominent, slender teeth; labium with either one pair of setae on small tubercles or 6–7 pairs of setae; maxillae each with 1, 2 or 3 setae; skin often darkly pigmented (when shed) and set with long bristles.

Diagnosis.—As is clear from the foregoing description and the figures, the species of *Pholetesor* vary widely in superficial appearance. The general features of the genus that are most diagnostic are: 1) the short, but hairy and relatively dorsally attached ovipositor sheaths; 2) the strong sublateral setiferous lobes of the metanotum; 3) the propodeal areola (when present) strongly pentagonal rather than oval or diamond-shaped; 4) the hypopygium medially folded but evenly sclerotized or only weakly translucent medially; 5) 2r-m of fore wing absent; 6) hosts almost always leafmining Lepidoptera.

Key to Females of Nearctic *Pholetesor* Species

It has not been possible to provide a reliable key to the males of all species. Many distinctive males may be run through the key easily but some coloration and metasomal tergite shape characters are unreliable or even positively misleading for males. The best strategy, assuming there are no associated females, is to use the species group diagnoses to place the males to species group, and then compare the descriptions of the included species, paying special attention to the male characters. Male genitalia are useful for distinguishing between species groups but have been found to be difficult to use in identifying species.

1) Third tergite of metasoma nearly or entirely covered in coarse sculpturing 2
- Third tergite sculptured only anteromedially or not at all 9
2) Tegulae pale yellowish-brown; ovipositor sheaths slender and usually weakly decurved (figs. 74, 75, 77); hypopygium evenly sclerotized and pigmented to medial fold 3
- Tegulae deep brown; ovipositor sheaths variable but not usually both slender and decurved; hypopygium sometimes submedially creased, setting off more weakly sclerotized and translucent medial fold 4

3) First tergite of metasoma about 1.3x longer than posteriorly broad, becoming broader posteriorly (fig. 54) ..... *caloptiliae*, n. sp.
- First tergite of metasoma more slender, usually about 2.0x as long as posteriorly broad, usually more or less parallel-sided to very weakly narrowing posteriorly (fig. 55) ..... *ornigis* (Weed), in part
4) Fourth tergite of matasoma functionally fused to third, separated from third by a crenulate furrow and strongly scultpured (fig. 39)..... *masneri* (Mason)
- Fourth tergite unsculptured, overlapped by third 5
5) Propodeum with broad, strongly carinated pentagonal areola and transverse carinae on weakly sculptured background (fig. 35)..... *bucculatricis* (Muesebeck)
- Propodeum with either weak or indistinct (usually narrower) areola, areola suggested only posteriorly, areola nearly obscured by surrounding rugosity or areola completely absent 6
6) Hypopygium evenly sclerotized, pigmented and hairy to medial fold..... *zelleriae*, n. sp.
- Hypopygium weakly creased submedially, setting off medial, more translucent (sometimes hairless) and flexible fold 7
7) Ovipositor sheaths in profile more strongly curved dorsally than ventrally (fig. 65); 2r and 1Rs of fore wing meeting at sharp angle (fig. 22); 2r often much shorter than 1Rs ..... *rhygoplitoides*, n. sp.
- Ovipositor sheaths in profile more strongly curved ventrally than dorsally (figs. 63, 64); 2r and 1Rs of fore wing meeting at a less sharp angle (figs. 20, 21; 2r rarely equal to or shorter than 1Rs 8
8) Inner hind tibial spur at least 1.2x as long as outer, reaching to or beyond middle of hind basitarsus; ovipositor sheaths broadest at about midlength of expanded hairy portions (fig. 63); propodeum sometimes with weakly carinated areola evident..... *dixianus*, n. sp.
- Inner and outer hind tibial spurs virtually equal in length, not more than 0.4x as long as hind basitarsus; ovipositor sheaths broadest nearer tip of expanded hairy portions (fig. 64); propodeum without areolar carinae ..... *pinifoliellae*, n. sp.
9) Hypopygium evenly sclerotized to medial fold, not strongly produced medially at tip 10
- Hypopygium weakly creased submedially, somewhat more transparent and flexible (often hairless) in medial fold than elsewhere, with tip often produced medially 18
10) Tegulae light yellow-brown..... 13
- Tegulae deep brown to black 11
11) Ovipositor sheaths arising near or above midheight of valvifers, strongly exserted in most specimens, with hairy, expanded distal portions weakly decurved and usually as long as or longer than hind basitarsus (fig. 74); inner hind tibial spur at least 1.2x as long as outer; first metasomal tergite weakly to strongly narrowing posteriorly (often as in fig. 57)..... *salicifoliellae* (Mason)

- Ovipositor sheaths arising low on valvifers, only partially exserted in some specimens, with expanded distal portions roughly fusiform and usually much shorter than hind basitarsus (figs. 62, 71); hind tibial spurs short, subequal in length; first metasomal tergite almost always parallel-sided to broadening posteriorly (figs. 42, 51) 12

12) Propodeum coarsely rugose, usually with superimposed carinae forming oval to narrow pentagonal areola and transverse carinae (fig. 36); maxillary palpi usually moderately darkened; fringe of vannal lobe of hind wing long (as long as posterior fringe of wing near wing apex or longer)..... *masoni*, n. sp.
- Propodeum with posterolateral corners sunken and more finely sculptured and polished than medial region, medially strongly raised in vaguely pentagonal shape, suggesting ill-defined areola; maxillary palpi almost entirely very pale yellowish; fringe of vannal lobe shorter than remaining fringe of hind wing, at least over most of distal half ..... *rohweri* (Muesebeck)

13) First and second tergites of metasoma polished, nearly sculptureless 14
- First and second tergites strongly sculptured over most of surface in granular, rugulose or aciculate pattern 15

14) ... Metacarp (R1) of fore wing shorter than or equal in length with stigma and no more than twice as long as distance from its distal end to end of 3Rs fold along wing edge (fig. 32); second metasomal tergite often yellowish ..... *pedias* (Nixon)
- Metacarp clearly longer than stigma and at least 3x as long as distance from its distal end to end of 3Rsfold along wing edge (fig. 31); second metasomal tergite dark brown to black in available nearctic material (variable in Europe)..... *circumscriptus* (Nees)

15) First tergite of metasoma less than 1.4x as long as posteriorly broad, clearly broadening posteriorly (fig. 54); third tergite usually extensively sculptured beyond anteromedial border; metacarp (R1) usually about 7x as long as distance from its distal end to end of 3Rs fold along wing edge (fig. 27); ovipositor sheaths reaching maximum breadth at about 2/3 of their lengths, usually appearing blunt-tipped (fig. 74) .... *caloptiliae*, n. sp.
- First tergite more slender, usually more than 1.7x as long as posteriorly broad, very weakly broadening to strongly narrowing posteriorly (figs. 55, 56, 57); third tergite usually anteromedially sculptured but area of sculpturing rarely extending over much of tergite; metacarp not so long, usually no more than 5x as long as distance from its distal end to end of 3Rs along wing edge (figs. 28, 29, 30); ovipositor sheaths evenly broadening to maximum breadth just before beveled, bluntly-pointed tip (figs. 75, 76, 77) 16

16) Lateral margins of first metasomal tergite nearly parallel-sided, weakly curved, rarely noticeably diverging or converging posteriorly (fig. 55); second tergite with rounded anterolateral corners and straight posterior margin, usually less than 2.4x as broad posteriorly as medially long and nearly as long as third tergum medially ... *ornigis* (Weed)
- Lateral margins of first metasomal tergite clearly converging posteriorly, at least over

posterior half (figs. 56, 57); second tergite either medially clearly shorter than third tergum and often with weakly concave posterior margin, or strongly triangular, with posteriorly diverging sides 17

17) Posterior margin of second metasomal tergite usually weakly concave; second tergite 2.3–2.7x as broad posteriorly as medially long and shorter than third tergum medially; first tergite with weakly arched lateral margins, more strongly converging posteriorly (fig. 57); stigma uniformly dark grey-brown; hind coxae mostly dark brown to black . ..... *salicifoliellae* (Mason)

- Posterior margin of second metasomal tergite straight; second tergite usually less than 2.2x as broad posteriorly as long medially, often as long as third tergum; firsat tergite often with nearly straight, evenly converging lateral margins (fig. 56); stigma nearly always suffused with extensive pale yellower areas; hind coxae nearly always yellow-brown to yellow-orange over most of distal portions..... *salalicus* (Mason)

18) Ovipositor sheaths short, broadened abruptly into asymmetrical spatulate form (fig. 73); posterior margin of second metasomal tergite medially convex; first metasomal tergite usually clearly narrowing posteriorly (fig. 53) ..... *viminetorum* (Wesmael)

- Ovipositor sheaths fusiform or at least more elongate, occasionally more or less parallel-sided and short but not broadened and spatulate (fis. 66, 67, 68, 69, 70, 72); posterior margin of second tergite usually not strongly convex medially; first tergite variable (figs. 46, 47, 48, 49, 50, 52) 19

19) First tergite of metasoma as broad at widest point as long medially, or nearly so (often broader); second tergite about 2.5x as broad posteriorly as long medially, or less broad (fig. 52); ovipositor sheaths short, with more or less fusiform expanded hairy portions (fig. 72)..... *variabilis*, n. sp.

- First tergite at least 1.4x as long as broad at broadest point; second tergite usually more than 2.5x as broad posteriorly as medially long (figs. 46, 47, 48, 49, 50); ovipositor sheaths variable (figs. 66, 67, 68, 69, 70)..... 20

20) Tegulae pale yellowish, translucent; metasoma shortened and hind coxae somewhat enlarged so that distal ends of hind coxae reach nearly to posterior end of third metasomal tergum (fig. 68); ovipositor sheaths about 2/3 length of hind basitarsi, more or less parallel-sided over most of length (fig. 68)..... *longicoxis*, n. sp.

- Tegulae dark brown, sometimes translucent but not pale; metasoma not strongly shortened; hind coxae not reaching beyond second metasomal tergite; ovipositor sheaths longer than hind basitarsi or broadest near apex and not parallel-sided 21

21) Ovipositor sheaths about 0.75 as long as hind tibiae, broadly fusiform but much more strongly convex ventrally than dorsally in profile (fig. 69); fore wing length greater than 2.5 mm. ..... *powelli*, n. sp.

- Ovipositor sheaths either much shorter, not more than half of hind tibial length or more strongly convex dorsally than ventrally in profile or not broadly fusiform (figs. 66, 67, 70); fore wing length usually less than 2.5 mm 22

22) First metasomal tergite strongly narrowing posteriorly, about 1.5x as broad anteriorly as posteriorly; second tergite transverse, subtriangular, with fine longitudinal, diverging aciculations over most of surface (fig. 47)..... *chiricahuensis*, n. sp.
- First tergite more or less barrel-shaped, not much broader or narrower posteriorly than anteriorly; second tergite, if longitudinally aciculate, at least with rounded anterolateral corners and more quadrate (figs. 46, 50)..... 23

23) Expanded portions of ovipositor sheaths clearly longer than hind basitarsi; second metasomal tergite usually about 2.2x as broad posteriorly as long medially (or broader) (fig. 50) ..... *thuiellae*, n. sp.
- Expanded portions of ovipositor sheaths shorter than hind basitarsi; second metasomal tergite usually 2.0–2.1x as broad posteriorly as long medially (fig. 46)..... ..... *bedelliae* (Viereck)

The *bucculatricis*-group

This monotypic group can be characterized by the following combination of character states: 1) metanotum weakly retracted from scutellum, barely or not exposing mesothoracic postphragma; 2) propodeum with strong, complete, broad pentagonal areola and transverse carinae; 3) metasomal tergite 1 broad, coarsely aciculorugose; 4) tergite II broad, subquadrate, strongly sculptured and about as long as III down midline; 5) tergite III also heavily sculptured, with rounded posterolateral corners; 6) tergum IV unmodified, overlapped by III, similar in appearance to succeeding terga; 7) sternites 3–6 of female not split anteromedially; 8) hypopygium evenly sclerotized to medial fold, not strongly produced at tip; 9) ovipositor sheaths arising at about midheight of valvifers; 10) volsellae of male genitalia each with 4 setae along medioventral edge; 11) gonobase (basal ring) of male genitalia transverse, about half as long as genital capsule is broad proximally; 12) final instar larva with 1 pair of labial setae, on short tubercles; 13) final instar with 1 seta on each maxilla; 14) cocoon delicate, oblong, whitish, spun within the elongate cigar-shaped cocoon of the host; and 15) hosts are *Bucculatrix* spp. (Lyonetiidae).

P. bucculatricis shows similarities with both the *zelleriae*-group, with which it shares all character states except 2, 9, 10, 14 and 15, and the *masoni*-group, with which it shares all states except 2 (and even here there is a resemblance), 3, 5, 9 and 10.

***Pholetesor bucculatricis* (Muesebeck)**
(figs. 10, 17, 33, 35, 40, 60)

Apanteles bucculatricis Muesebeck, 1921. *Proc. U.S. Nat. Mus.* **58**: 502. Holotype female, USNM no. 22512, examined.

Females. Body length 1.7–2.1 mm; forewing length 1.8–2.1 mm.

Head. Frons 1.3–1.4x broader at midheight than long down middle, shallowly but evenly punctate, with satiny sheen between punctures; inner margins of eyes weakly converging towards clypeus. Antennae entirely dark brown except paler distal portions of pedicels; length approximately 1.1x forewing length ; all but apical 5 flagellomeres with 2 ranks of placodes; flagellomere 2 2.9–3.0x longer than broad, flagellomere 14 1.5–1.7x longer than broad. Palpi distally light yellow-brown, proximally darker brown. Head in dorsal view 1.8–1.9x broader than long down midline.

Mesosoma. Mesoscutum with closely spaced, distinct punctation anteriorly, becoming more widely spaced posteriorly near scutellum; surface between punctures shiny, especially posteriorly; mesoscutal width just anterior to tegulae more or less equal to head width. Scutoscutellar scrobe striaght medially, moderately broad and composed of 10–12 deep, fine pits. Scutellar disc with distinct, widely spaced punctures (interstices about 1–2 pit diameters), shinier than mesoscutum, 1.2x as long as anteriorly broad or longer. Metanotum weakly excavated sublaterally along anterior edge just mesad sublateral setiferous projections; projections appressed to posterior edge of scutellum or nearly so; transverse carinae at midlength on either side well-developed, setting off more posterior transverse depressions crossed by 2–3 short carinae. Propodeum 1.7x as broad as long at longest point, with unusually long, nearly horizontal anterior face; anteriorly with strong, short medial longitudinal carina, posteriorly with broad, well-marked pentagonal areola and transverse carinae; otherwise usually weakly punctulorugose and shiny; posterolateral declivous regions deeply sunken, often more strongly and irregularly sculptured than anterior areas.

Legs. All legs dark testaceous to black, especially proximally, except lighter brown apices of fore and mid femora, near entirety of fore tibiae and tarsi, proximal .6–.7 of mid tibiae, rpoximal .9 of mid tarsi and proximal .2–.3 of hind tibiae. Spines on outer faces of hind tibiae usually 25–30 in number. Apical spurs of hind tibiae subequal in length, whitish, about .35–.4 length of hind basitarsus.

Wings. Tegulae dark brown, barely translucent. Forewing venation dark brown, especially stigma, R1, C+Sc=R, 2r, 1Rs, 2M stub and 2Cu1 (with immediate surrounding venation); proximal venation paler; macrotrichiae of wings pigmented (giving some smoky appearance to the wings). 2r and 1Rs subequal in length, meeting at indistinct 140–degree angle. R1 (metacarp) slightly longer than stigma, usually 3x longer than distance from its distal end to end of 3Rsfold along wing edge. Maximum width of stigma just less than half its length. Hindwing with vannal lobe very slightly flattened at midlength, fringe even, long over distal .6–.7 of lobe.

Metasoma. Tergite I broadening posteriorly to weakly rounded apex, slightly broader posteriorly than long, with deep but short mediobasal excavation (at most .25–.3 of tergite length); surface mostly very strongly rugose to logitudinally aciculorugose, strongly arched medially at midlength, sometimes with suggestion of medial depression subapically. Tergite II strongly quadrate, sculptured as on tergite I, 2.3–2.5x as broad as

medially long; posterior crenulate margin weakly concave. Tergite III medially subequal in length with II, posterolaterally rounded, coarsely rugose anteriorly, bcoming more logitudinally aciculate posteriorly and laterally. Succeeding terga of usual unsculptured, overlapping form, often strongly shrunken in under anterior 3 in dried specimens. Laterotergites dark brown, barely visible in dorsal view. Hypopygium approximately 1.5x hind basitarsus length, sclerotized and pigmented evenly to sharp medial fold; apical angle in lateral view about 45–50 degrees, not acuminate. Ovipositor sheaths about .6 length of hind tibiae; expanded portions elongate-fusiform, hairy over distal .6 or so, proximally smooth and evenly tapering. Ovipositor very weakly decurved.

Males. Body size similar to females, often appearing smaller due to greater shrinkage of male metasoma. Antennae longer than in female, as much as 1.5x length of forewing, with more elongate apical flagellomeres (flagellomere 14 2.1–2.2x as long as broad); all but apical 3 flagellomeres with 2 ranks of placodes. Leg coloration usually darker than in females but often nearly indistinguishable.

Variation. As yet, this species is known only from California (questionably also from Durango, Mexico), and shows little if any significant geographic variation. The available Sierran individuals are mostly in the small end of the size range, but this is likely due to the different host(s) attacked. If the specimen from Durango is conspecific, there is an indication that further south the coloration of the legs and wing venation becomes much lighter and the propodeal background sculpturing much stronger.

Final instar larva. Labium with one pair of large setae on short tubercles. Maxillae each with 1 seta. Mandibles set with 8–10 long teeth (not counting bifid tip).

Cocoons. All known reared individuals emerged from cocoons of *Bucculatrix* spp., within which they spin a thin cocoon of their own after emerging from the host larva (see figure 10). Thus unless one dissects the *Bucculatrix* cocoon, it does not appear that they spin a cocoon of their own at all.

Material examined. Reared from *Bucculatrix albertiella* Busck on *Quercus agrifolia* Nee: 51 females, 71 males, all coastal California, adults late March-mid June and early August-mid October. Reared from *Bucculatrix* sp. on *Quercus kelloggii* Newb.: 7 females, 3 males, El Dorado Co., Calif., adults September. Reared from *Bucculatrix* sp. on *Ceanothus integerrimus* H. & A.: 2 females, Plumas Co., Calif., adults September. Not reared: 5 females, 12 males, all California, mostly June, July; one questionable male from Durango, Mexico (July). Specimens in USNM, CNC, CAS, UCB collections.

Hosts. Probably a number of western *Bucculatrix* species, especially on oaks, can serve as hosts; the *Bucculatrix* species on Compositae appear to support mainly *Pholetesor variabilis*, *P. masoni* and (occasionally) *P. bedelliae*. By far the most records are from *B. albertiella* on coastal live oak, from which the parasite can be reared in good numbers in both the spring and fall. It is curious that this moth also serves as host (often at the same time and locality) for *P. variabilis* and *Deuterixys quercicola* Whitfield as well, occasionally in more or less equal numbers. Museum records from *Bucculatrix*

thurberiella, a possible host, appear to be misidentifications of *P. bedelliae* or *P. variabilis*.

Comments. Pholetesor bucculatricis is most distinct in combining a broad, strongly defined areola and lateral carinae, broad and coarsely sculptured anterior three metasomal tergites, an evenly sclerotized (but medially folded) hypopygium and a slender, nearly straight ovipositor. No specimen on which the propodeum is visible should be easily confused with any other *Pholetesor* species. In propodeal structure it resembles some *Austrocotesia* species, but is vastly different in structure of the metasomal tergites and hypopygium. If *Pholetesor* is ultimately found not to be monophyletic, this species will almost certainly require a new generic name.

The *zelleriae*-group

Pholetesor zelleriae, n. sp., has been placed in a group by itself, although in many respects it appears intermediate between the *bucculatricis*- and *pinifoliellae*- groups. It possesses the following combination of species-group level character states: 1) metanotum weakly retracted from scutellum, barely or not exposing mesothoracic postphragma; 2) propodeal areola and transverse carinae weak or absent; 3) metasomal tergite I broad, coarsely sculptured; 4) tergite II broad, subqradrate, coarsely sculptured and as long as III down midline; 5) tergite III heavily sculptured throughout, with rounded posterolateral corners; 6) tergite IV unmodified, overlapped by III and similar in appearance to succeeding terga; 7) sternites 3–6 of female not split anteromedially; 8) hypopygium evenly sclerotized to medial fold, not strongly produced at tip; 9) ovipositor sheaths arising below midheight of valvifers; 10) volsellae of male genitalia each with 3 setae on medioventral edge; 11) gonobase (basal ring) of male genitalia transverse, about half as long as proximal breadth of genital capsule; 12) final instar larva with 1 pair of labial setae; 13) final instar larva with 1 seta on each maxilla; 14) cocoon of typical blunt-oblong microgastrine form, whitish, with wispy, fine loose threads exteriorly, spun in host's needle mine damage on *Pinus*; 15) hosts are needle and sheath miners on *Pinus* spp.

The *zelleriae*- group differs from the *bucculatricis*- group in host specialization, cocoon-spinning behavior, position of origin of the ovipositor sheaths, the loss of the propodeal areola and transverse carinae, and in the number of volsellar setae in the male genitalia. Most similar to the *zelleriae*- group in many features is the *pinifoliellae*- group, which differs only in having the hypopygium submedially weakly creased, setting off a narrow, medial, somewhat translucent and flexible region which is usually produced apically. As I consider this hypopygial character to be of potential strong phylogenetic significance, I have not lumped the two groups. *Pholetesor masneri* is also similar, but is easily recognized by the fourth metasomal tergite being fused to the third and sculptured more or less throughout.

Holotype female. Body length 2.4 mm, forewing length 2.5 mm.

Head. Frons 1.3x broader at midheight than long down middle, distinctly but shallowly punctate; inner margins of eyes evenly and moderately converging towards clypeus. Antennae very dark brown, approximately same length as forewing; all but distal 5 flagellomeres with 2 ranks of placodes; flagellomere 2 3x as long as broad; flagellomere 14 1.6x as long as broad. Palpi light amber throughout visible portions. Head in dorsal view twice as broader as long down midline.

Mesosoma. Mesoscutum densely and distinctly punctate, becoming more shallowly so posteriorly near scutellum; surface between punctures with dull, metallic sheen; mesoscutal width just anterior to tegulae slightly broader than head. Scutoscutellar scrobe deeply and distinctly crenulate, composed of about 15 punctures; mesoscutum immediately adjacent to scrobe smooth and distinctly depressed. Scutellar disc distinctly punctate, somewhat more sparsely so centrally, approximately 1.2x as long as maximum breadth. Metanotum weakly excavated anteriorly; sublateral setiferous lobes abutting posterior face of scutellum; mesoscutal postphragma weakly if at all exposed; transverse carinae at approximately midlength on either side well- developed, setting off more posterior transverse depressions which are crossed by 3 or 4 short carinulae; posteromedial raised boss with 6–8 scattered setae. Propodeum 2.0x broader than long at longest point, coarsely rugulopunctate over entire surface, sometimes forming weak suggestion of medial longitudinal carina; sculpturing more strongly rugose posteriorly.

Legs. All coxae moderate to dark brown; legs otherwise light amber throughout except infuscate tips of the apical tarsomeres of forelegs, virtually entire tarsi of middle and hind legs and apices of hind tibiae. Spines on outer faces of hind tibiae about 35 in number, irregularly scattered, most easily distinguished from the thinner normal hairs in oblique lighting. Inner hind tibial spur just longer than outer, approximately half as long as hind basitarsus.

Wings. Tegulae dark brown, weakly translucent. Forewing venation evenly brownish; proximal portions of M-Cu and 1A–2A weakly pigmented. R1 1.1–1.2x as long as stigma, about 5x as long as distance from its distal end to end of 3Rs fold along wing edge. 2r weakly curved, slightly longer than 1Rs, meeting 1Rs at an indistinct obtuse angle. Stigma 2.6x longer than maximum breadth. Hindwing vannal lobe fringed with hairs of moderate length.

Metasoma. Tergite I 1.1x as broad posteriorly as long down midline, strongly arched along longitudinal axis, broadly excavated medially over anterior 0.3; lateral margins diverging posteriorly, especially over anterior 0.7; surface coarsely rugose, with narrow, weak, longitudinal posteromedial depression. Tergite II 2.2x as broad posteriorly as medially long, subquadrate but broadening slightly posteriorly, coarsely rugose; posterior margin weakly concave and marked by crenulate groove. Tergite III approximately of

same width as II, subequal in medial length with II but with strongly rounded posterolateral corners; surface rugose throughout. Succeeding terga of normal unsculptured overlapping form, barely protruding from under anterior 3. Laterotergites yellowish brown, virtually hidden in dorsal view by broad tergites. Hypopygium 1.2–1.3x as long medially as hind basitarsus, evenly sclerotized and pigmented to sharp medial ventral fold, evenly hairy; apical angle not acuminate, forming distinct 60–70-degree angle in lateral view. Ovipositor sheaths more or less evenly tapering to a broader tip, apically bluntly rounded, approximately same length as hind basitarsi, hairy over most of expanded distal portions, more densely so near tip. Ovipositor weakly decurved.

Males. Body length 1.8–2.0 mm, forewing length 2.2–2.4mm (slightly smaller than female ranges). Antennae longer and more slender than in females, with more slender apical flagellomeres (flagellomere 14 2.6x as long as broad); all but distal 3 flagellomeres with 2 ranks of longitudinal placodes. Coloration of legs generally darker than in females (especially in hind tibiae). Tergite I of metasoma less strongly broadened posteriorly than in females, usually without signs of posteromedial longitudinal depression. Genitalia as in fig. 79.

Variation. So far this species is known only from southeastern Canada and adjacent regions of the U.S., and therefore shows little obvious geographic variation. In addition, the season for adults seems extremely short (late June–early July), so little seasonal variability is evident. Females have a fairly large size range, considering that they mostly emerged from the same host species (body length 1.9–2.4 mm, forewing length 2.1–2.5 mm).

Final instar larva. Labium with 1 pair of setae on short tubercles. Maxillae each with one large seta. Mandibles set with 12–14 long teeth (not counting bifid tip).

Cocoons. White, nearly opaque, elongate-oval with blunt ends, relatively smooth but with irregular wisps of silk, especially near ends. Very similar to cocoons of a number of *Dolichogenidea* and *Apanteles* species, and to those of large *P. bedelliae*.

Material examined. Holotype female: ONTARIO. Basswood Lake, 13-VII-1963, ex *Zelleria haimbachi*, Forest Insect Survey no. S63-2037-01-8. Paratypes: ONTARIO. Basswood Lake, 2 females, 6 males, 4–13-VII-1963, ex *Zelleria haimbachi* (FIS). Chalmsford, 1 male, 4-VII-1963, ex *Zelleria haimbachi* (FIS). Latchford, 1 female, 1 male, 11-VII-1963, ex *Zelleria haimbachi* (FIS). Lunnel Lake, 1 female, 1 male, 12/24-VII-1963, ex *Zelleria haimbachi* (FIS). Nairn, 1 female, 21-VI-1955, ex *Zelleria haimbachi* (FIS). North Bay, 2 females, 3 males, 29-VI–7-VII-1963, ex *Zelleria haimbachi* (FIS). Sault Ste. Marie, 12 females, 22 males, 3–25-VII-1963, ex *Zelleria haimbachi* (FIS). Skead, 1 male, 6-VII-1964, ex *Zelleria haimbachi* (FIS). Thessalon, 1 female, 1 male, 9/20-VII-1963, ex *Zelleria haimbachi* (FIS). Holotype and paratypes originally from and now deposited in CNC.

Other material: MANITOBA:. Sprague, 1 female, 30-VII-1942, ex *Toumeyella* sp. (FIS). MICHIGAN: Grand Traverse Co., 2 females, 26-VI, 3-VII-1982, 2 females, 2males,

4–6-VII-1983, all ex *Zelleria haimbachi* on *Pinus banksiana* (N.C. Elliott). ONTARIO. Biscotasing, 1 female, 10-VII-1941, ex Zale sp. (FIS). Little Curr., 1 female, 6-VII-1954 (no collector given-CNC). Midhurst, 1 female, 1 male, 30-VI/17-VII-1942, ex *Zelleria haimbachi* (FIS). Nairn, 2 females, 1 male, 25–30-VI-1954 (no collector given-CNC). Sault Ste. Marie, 1 specimen (sex undetermined), 12-VII-1962, ex *Choristoneura pinus* (FIS). Skead, 1 female, 15-VII-1949, ex *Neodiprion nanulus* (FIS). Sultan, 1 female, 14-VII-1949, ex *Zelleria haimbachi* (FIS). Timmins, 2 males, 10-VII-1948, ex *Zelleria haimbachi* (FIS). Vermilion Bay, 1 female, 19-VII-1948, ex jack pine budworm (FIS). QUEBEC. Laniel, 4 females, 1 male, 24, 26-VII-1940, ex *Zelleria haimbachi* (C.E. Atwood- CNC).

Hosts. Zelleria haimbachi Busck (Yponomeutidae) is the only consistent host, despite extensive rearing of conifer-feeding microlepidoptera in eastern Canada. The other records are therefore suspect but certainly within reason, with the possible exception of *Neodiprion nanulus*, since all are from the same or similar microhabitats. *Zelleria haimbachi* feeds in needle sheaths of *Pinus* spp., a habit shared by a number of micropleidopteran species.

Comments. Pholetesor zelleriae females can be distinguished from all other *Pholetesor* species with heavily sculptured third tergites by the shape and length of the ovipositor sheaths, shape and medial structure of the hypopygium and the sculpturing of the propodeum and anterior metasomal tergites. In the males, only the sculpturing differences, as well as slight differences in the tergite shapes and coloration of the legs and forewing venation, are useful. When more material is available for species of the *pinifoliellae*- group, male genitalic differences may prove useful.

The *masneri*-group

Teremys masneri Mason and the neotropical *T. hanniae* Valerio & Whitfield share so many features with the preceding groups of *Pholetesor* that I have here included *Teremys* as a monotypic species group within *Pholetesor*, choosing to sink Mason's genus despite its distinctive autapomorphic fusion of the fourth (also fifth in *T. hanniae*) tergite to the third, and also despite my earlier (Valerio and Whitfield 2003) retention of the genus. Should a more comprehensive study of the phylogeny of the groups Mason included in Apantelini demonstrate the paraphyly or polyphyly of *Pholetesor*, *Teremys* may be resurrected as a distinct genus. Unfortunately, nothing is known of the biology or immature stages of this species to strengthen or contradict its association with the preceding groups. For the sake of comparison, the nearctic *T. masneri* possesses the following features: 1) metanotum weakly or not at all retracted from scutellum, barely exposing mesothoracic postphragma if at all; 2) areola represented by strong medial depression of propodeum, the defining carinae and transverse carinae absent; 3) metasomal tergite I broad, subquadrate, heavily sculptured and as broad as long; 4) metasomal tergite II broad, covering entire dorsal

width of dorsum and as long as III down midline; 5) tergite III strongly sculptured throughout, not posterolaterally rounded; 4) tergite IV fused to III, strongly sculptured, separated from III by crenulate furrow and posterolaterally rounded; 7) sternites 3–6 of female apparently not split anteriorly (not fully dissected however); 8) hypopygium evenly sclerotized to medial fold, not strongly produced at tip; 9) ovipositor sheaths arising below midheight of valvifers; and 10–15) male genitalia not examined, cocoon and hosts unknown.

***Pholetesor masneri* (Mason)**
(fig. 39)

Teremys masneri Mason, 1981. *Mem. Entomol. Soc. Can.* **115**: 44. Holotype female, CNC no. 15789, examined.

Females. Body length 2.1–2.4 mm; forewing length 2.2–2.4 mm.

Head. Frons 1.2–1.3x broader at midheight than long medially, raised medially, shallowly punctate, without strong satiny sheen; inner margins of eyes strongly converging towards clypeus. Antennae yellow-brown at midlength, becoming very light golden on scapes and darker brown distally; antennal length 1.1x forewing length; all but apical 5–6 flagellomeres with 2 ranks of placodes; flagellomere 2 3.5–3.8x as long as broad; flagellomere 14 1.8–2.1x as long as broad. Palpi pale yellow-brown throughout. Head in dorsal view 1.6–1.8x as broad as long down midline.

Mesosoma. Mesoscutum with dense, fine, distinct punctation (interpuncture distances much less than 1 puncture width); interstices shiny but with faint metallic reflections; width just anterior to tegulae almost identical to that of head. Scuto-scutellar scrobe nearly straight medially, moderately broad, composed of 10–12 irregular, sometimes confluent pits. Scutellar disc more sparsely punctate than mesoscutum, especially cetrally; relatively smooth and shiny between punctures, about 1.3x as long as anteriorly broad (at broadest point); scutellar lunules of even semicircular proportions. Metanotum anteriorly nearly appressed to scutellum, sublateral setiferous lobes touching posterior margin of scutellum; transverse carinae on either side much closer to anterior margin than posterior, nearly parallel to posterior edge of scutellum, well developed medially but ending before reaching sublateral setiferous lobes. Propodeum twice broader than long, densely punctulorugose anteriorly, irregularly and obliquely sculptured posterolaterally, with strong, more or less oval medial areolar indentation which is less strongly sculptured within.

Legs. All legs light amber in color except infuscate tips of the fore and mid tarsi, most of the hind tarsi and (sometimes) the extreme apices of the hind tibiae. Spines on outer faces of hind tibiae 35–40 in number, mostly much thicker than normal hairs. Inner apical spurs of hind tibiae only slightly longer than outer and 0.4x as long as hind basitarsi.

Wings. Tegulae deep brown. Forewing venation mostly pale, nearly colorless except deep brown C+Sc+R, stigma, R1 and paler brown Rs, 2r and 1Rs. 2r and 1Rs subequal in length, meeting at a distinct but not sharp 130-degree angle. R1 1.1–1.2x as long as stigma, 4–5x as long as distance from its distal end to end of 3Rs fold along wing edge. Stigma 3x as long as maximum breadth. Vannal lobe of hindwing somewhat flattened subapically, with sparse but continuous fringe of short hairs.

Metasoma. Tergite I strongly arched and medially broadly excavated anteriorly, broadening posteriorly to very weakly rounded posterolateral corners, about as long as broad but arching strongly so measurement difficult; surface densely aciculorugose; slightly raised along medial line. Tergite II more or less quadrate, 2.8x broader than medially long, with a bisinuate, crenulate hind margin (weakly concave medially and curved forward again laterally); surface mostly longitudinally aciculorugose, more irregularly so laterally, slightly raised along medial line. Tergite III subequal in length with II, slightly broader, again with medially concave, crenulate hind margin but with posterolateral corners more rectangular; surface sculptured as on II. Tergite IV immovably fused to III but delineated from it by crenulate groove, shorter and narrower than III and with strongly rounded posterolateral corners; sculpturing as in II and III. Succeeding terga of normal overlapping, unculptured form and largely overlapped by I–IV. Laterotergites light yellow-brown, mostly to entirely hidden in dorsal view. Hypopygium 1.3–1.4x as long medially as hind basitarsi, more or less evenly sclerotized and pigmented to sharp medial fold, apically sharply angled at about 50 degrees in lateral view; preceding sterna apparently not split, at least through much of length. Ovipositor sheaths 0.5–0.6x as long as hind tibiae, shorter than medial length of hypopygium, gradually broadening over proximal half but nearly parallel-sided over apical half to a blunt tip; hairy over most of apical expanded portions. Ovipositor moderately decurved, especially near apex.

Males. Very similar to females except: antennae longer, more slender (flagellomere 14 3.0x as long as broad); all but apical 3 flagellomeres with 2 ranks of longitudinal placodes; probably not appreciably smaller than females but appearing so because metasoma shrinks more posteriorly in dried specimens; metasomal tergites less broad and transverse than in females. Color not significantly different than in females.

Variation. Very little is known of the geographical range of *P. masneri*, and nothing of the hosts it attacks. The available material is quite uniform in sculpturing, ovipositor sheath lengths, etc., and varies little in color.

Cocoons. Unknown.

Material examined. Redescription based on: Paratype female (CNC)—ONTARIO. Spencerville, 15-VIII-1978 (L. Masner). Paratype male, same data. Other material: CONNECTICUT. Redding, 1 male, VIII-1939 (no collector given). ONTARIO. Hamilton, 1 female, 8–13-VIII-1981, Malaise trap (M. Sanborne). The holotype was examined but not used for the redescription measurements.

Hosts. Unknown.

Comments. The fusion of the fourth metasomal tergite to the third is unique among *Pholetesor* species, and unusual among Microgastrinae. The species is certainly distinct enough to warrant separate generic status on merely phenetic grounds, but shares so many features (not all clearly plesiomorphic) with *P. bucculatricis* and *P. zelleriae* that its separation as a distinct genus probably would leave *Pholetesor* as a paraphyletic group. Most likely it will also prove to be biologically similar to these two species. Valerio and Whitfield (2003) provide additional figures of both *T. masneri* and *T. hanniae*.

The *masoni*-group

This group is largely characterized on the basis of *Pholetesor masoni* n. sp. I have provisionally also included *P. rohweri* (Muesebeck) here for convenience, although it appears to fit uncomfortably and is not well known biologically or morphologically.

The following combination of character states is found in the group: 1) metanotum weakly retracted from scutellum, not or only slightly exposing mesothoracic postphragma; 2) areola and transverse carinae weak but usually present, areola narrower than in the *bucculatricis*-group and often nearly obscured by surrounding rugosity; 3) metasomal tergite I much longer than broad, subparallel-sided, coarsely sculptured; 4) tergite II broad, subquadrate, strongly sculptured, clearly shorter than III down midline; 5) tergite III sculptured only anteromedially, not posterolaterally rounded; 6) tergite IV unmodified, overlapped by III, similar to succeeding terga; 7) sternites 3–6 of female not split anteromedially; 8) hypopygium evenly sclerotized to medial fold, not strongly produced at tip; 9) ovipositor sheaths very short, arising low on valvifers; 10) gonobase (basal ring) of male genitalia transverse, not nearly so long as basal width of genital capsule; 11) volsellae of male genitalia each with 3 setae along medioventral edge; 12) final instar larva with 1 pair of labial setae on short tubercles; 13) final instar larva with 1 seta on each maxilla; 14) cocoon delicate, elongate-oblong and spun within the cigar-shaped host cocoon (as in the bucculatricis-group) and 15) hosts are *Bucculatrix* spp. (Lyonetiidae), except for *P. rohweri*, for which we have a few records from *Neurobathra* (Gracillariidae) on chestnut.

Pholetesor rohweri (Muesebeck) is included on the basis of sharing most of the above characteristics, as far as can be determined from the available material, which is all poorly preserved. It is possible that the hypopygium has a weak, slightly translucent medial fold and faint submedial creasing, which would ally it more closely with the *bedelliae*-group, but unfortunately this structure is difficult to examine on the type and specimens available for dissection were damaged. It did appear that sternites 3–6 in the female were not strongly split anteromedially, in contrast to the *bedelliae*-group. More reared material would greatly aid in interpreting this species, to clarify several morphological details and to determine whether the whitish cocoon found in the host shelter associated with the type series is typical for the species.

The *masoni*-group would fit within the *bedelliae*-group were it not for the evenly sclerotized hypopygium and anteromedially unsplit female sterna 3–6. From the preceding groups, it differs in having the second metasomal tergite more transverse, the third tergite only partially sculptured, and in the form of the ovipositor sheaths.

***Pholetesor masoni*, new species**
(figs. 19, 36, 42, 62, 80)

Holotype female. Body length 1.9 mm, forewing length 2.0.

Head. Frons 1.3x broader at midheight than long down midline, weakly punctate; inner margins of eyes weakly converging. Antennae very dark brown throughout, approximately same length as forewing; all but distal 5 flagellomeres with 2 ranks of placodes; flagellomere 2 3.5x as long as broad; flagellomere 14 1.5x as long as broad. Palpi light yellow-brown, basal segments slightly darker. Head in dorsal view twice broader than long.

Mesosoma. Mesoscutum shallowly but distinctly punctate except smoother near scutoscutellar scrobe, just narrower anterior to tegulae than head, surface between punctures with dull metallic sheen. Scutoscutellar scrobe moderately broad, composed of 10–12 sharp punctures. Scutellar disc distinctly punctate, hairy, shinier between punctures than mesoscutum, about 1.2x as long as maximum breadth. Metanotum weakly retracted from scutellum anteriorly, shallowly excavated mesad to sublateral setiferous projections; well-defined transverse carinae at about 0.3–0.4 of length on either side, setting off transverse, more posterior depressions which are crossed by several short carinulae. Propodeum 1.8x as broad as long at longest point, coarsely rugose, with weakly superimposed, more or less pentagonal areola and transverse carinae (areola approximately 0.3 or less as broad as entire propodeum).

Legs. All coxae dark brown to black. Trochanters and bases of femora deep brown to black; meso-and meta-thoracic femora distally darker brown than prothoracic. Tibiae and tarsi of all legs lighter yellow-brown. Spines on outer faces of hind tibiae approximately 20 in number, somewhat thinner and more difficult to distinguish from normal hairs than in most species. Apical spurs of hind tibiae subequal in length (inner very slightly longer), less than 0.4 as long as hind basitarsus.

Wings. Tegulae dark brown, translucent. Forewing venation strongly pigmented, darker brown, except virtually colorless M-Cu and 1A–2A. R1 longer than stigma, approximately 4x as long as distance from its tip to end of 3Rs fold along wing edge. 2r, 1Rs subequal in length , meeting at distinct but obtuse angle. Vannal lobe of hindwing weakly flattened subapically, with even fringe of long hairs.

Metasoma. Tergite I strongly rugose, 1.4x as long as broad at midlength; lateral margins diverging slightly posteriorly, strongly rounding at apex; medioapically with suggestion of small, longitudinal depression. Tergite II subquadrate, 2.0x broader than

long down midline, with weakly rounded anterolateral corners; surface strongly rugose (but more finely than in tergite I); hind margin marked by crenulate, nearly straight furrow. Tergum III approximately same length as II, roughened anteromedially, becoming smooth and similar to following terga posteriorly. Succeeding terga unsculptured, unmodified, overlapping. Laterotergites medium brown, concolorous with hind tibiae. Hypopygium long, 1.2–1.3x length of hind basitarsus, evenly sclerotized to medial fold, with 60-degree angled tip in profile. Ovipositor sheaths fusiform, hardly decurved (even basally), sparsely hairy, with hairs mostly on apical half of broadened portions; entire length of sheaths subequal with that of hind basitarsi. Ovipositor very weakly decurved.

Males. Body length 1.8–2.1 mm, forewing length 1.9–2.1 mm. Antennae clearly longer than forewing, with all but distal 3 flagellomeres with 2 ranks of placodes; apical flagellomeres more slender than in females (flagellomere 14 2.0–2.2x as long as broad). Propodeal and metasomal sculpturing very similar to females except porpodeal areola tends to be slightly narrower and less distinctly pentagonal. Some dark males have smoother and shinier sculpturing over the metasomal tergites, with a stronger longitudinal trend. Occasionally the second tergite is more trapezoidal (broader apically) than in associated females.

Variation. Female body length 1.9–2.1mm, forewing length 2.0–2.2mm. In all available series, there is some variation in the strength and distinctness of the propodeal areola and transverse carinae, as well as the rugose background sculpturing. Eastern specimens seem to generally have lighter leg coloration and coarser metasomal and propodeal sculpturing. I have seen a few specimens from the southwestern U.S. which have unusually strong transverse carinae; their assignment to this species is tentative.

Final instar larva. Labium with one pair of large setae on short tubercles. Maxillae each with one seta. Mandibles set with approximately 14 long teeth (not counting bifid tip).

Cocoons. All reared individuals emerged from cocoons of *Bucculatrix* spp. A thin cocoon is spun within that of the host after emergence from the host larva/prepupa.

Material examined. Holotype female: CALIFORNIA. San Mateo Co., San Bruno Mts., 31-III-1983 (J.B. Whitfield). Paratypes: CALIFORNIA: San Mateo Co., San Bruno Mts., 1 female, 4 males, 31-III-1983; 3 males, 3-IV-1982, 3 males, 14-IV-1983; 1 female, 11 males, 16-IV-1982; 1 female, 2 males, 21-IV-1982; 1 female, 1 male, 21-IV-1981, 1 female, 17-V-1981, 2 females, 1 male, 15-IV-1982, ex *Bucculatrix* on *Baccharis* (D.L. Wagner), 1 male, 28-V-1982, ex *Bucculatrix* on *Baccharis* (D.L. Wagner). All collected by J.B. Whitfield except where noted. Holoype deposited in USNM, paratypes in USNM, CNC, U. C. Berkeley collections.

Other material: ALBERTA. Lake Louise, 1 female, 29-VII-1935 (Melander). ARIZONA: Tucson, 1 male, 9-IV-1906 (collector not given). BRITISH COLUMBIA: East Kootenays, top of Moyle Mt. 6868', 1 female, 16-VII-1959 (H.B. Leech). CALIFORNIA: Alameda Co., Berkeley Hills, 1 female, 6-VIII-1982 (J.B. Whitfield), 1

female, 13-VI-1983 (JBW), 1 male, 20-IV-1982 (JBW), 1 male, 3/5-III-1983, ex *Bucculatrix* on *Baccharis pilularis* (J.B. Whitfield & D.L. Wagner), 1 male, 17-V-1962 (no collector given). Chabot Regional Park, 1 female, 12-VII-1980 (JBW). Contra Costa Co., 2 mi. SE Lafayette, 1 male, 18-IV-1968 (W.J. Turner). Moraga, 1 female, 24-VI-1971 (D.G. Denning), 2 mi. W. Pittsburg, 1 female, 19-IX-1957 (J.A. Powell). Redwood Regional Park, 1 male, 2-IX-1980 (JBW). Tilden Regional Park, 2 males, 30-VII–28-X-1980 (J. Fraser), 1 male, 11-VIII-1982, ex *Bucculatrix* on *Baccharis pilularis* (JBW), 1 male, 25-V-1983 (JBW). Inyo Co., Owens Lake Dunes, 2 females, 17-V-1978, at blacklight (D. Giuliani). Surprise Canyon, 1 female, 5-V-1961 (F.D. Parker). Kern Co., Sand Canyon, 3 mi. W Brown, 2 females, 7-IV-1966 (R.O. Schuster). Los Angeles Co., Frank Bonelli Park, 1 female, 20-II-1984, ex *Bucculatrix* on *Baccharis* (D.L. Wagner). Marin Co., nr. Alpine Lake, 1 female, 26-VI–2-VII-1970, malaise (D. Munroe). Inverness, 1 female, 25-II-1962 (C.A. Toschi). Riverside Co., Forest Home, 1 female, 25-V-1935 (Melander). Riverside, 1 female, 3 males, 15–23-IV-1948, on Artemisia (has *Bucculatrix* cocoon attached) (P.H. Timberlake), 1 female, V-1935 (Melander). San Diego Co., Borrego Springs, 1 male, 30-III-1960 (M. Wasbauer). Escondido, 1 female, 15-VII-1941 (R.H. Beamer). San Francisco Co., San Francisco, 3 females, 25-III-1933, reared from *Baccharis* (H.H. Keifer). San Luis Obispo Co., Oso Flaco Lake, 1 female, 13-VIII-1959 (P.M. Marsh). San Mateo Co., San Bruno Mts., 1 male, 18-IV-1976, on flowers *Heracleum lanatum* (P.H. Arnaud), 1 female, 10-V-1981 (JBW), 1 female, 1 male, 25-II-1984 (JBW). Santa Barbara Co., Santa Cruz Isl., Cascada, 1 female, 8-V-1968 (R.O. Schuster), Christi Beach, 1 female, 20-IV-1966 (J.A. Powell). Sonoma Co., Bodega Bay, 1 female, 21-III-1983, ex *Bucculatrix* on *Baccharis* (D.L. Wagner), 1 female, 21-III-1983 (JBW), 1 mi. SE, 1 female, 27-IV-1983, ex *Bucculatrix* on *Baccharis pilularis* (D.L. Wagner). Sutter Co., Live Oak Park, 1 female, 2 males, 24-V-1944 (no collector given).

INDIANA. Lafayette, 1 female, V-1918 (J.M. Aldrich). MARYLAND. North River, 1 female, 3 males, 25-VII-1941, ex *Bucculatrix* sp. (J.F.G. Clarke). MASSACHUSETTS. Forest Hills, 1 female, 17-V-1913 (no collector given). Franklin, 1 male, 16-V-1916 (no collector given). Greenfield, 1 female, 1-IV-1914 (Melander). MEXICO. Chiapas, San Cristobal Las Casa, 1 male, 1/2-I-1975 (D. Green, P. Craig). D.F., Desiertos de los Leones, 1 female, 27-III-1946 (J. & D. Pallister). MICHIGAN. Allegan Co., 1 female, 18-V-1959 (R. & K. Dreisbach). Berrien Co., Galien, 1 female, 28-V-1974 (D.J. Miller), 1 male, 2-VIII-1974 (D.J. Miller). Delta Co., 1 female, 8-VIII-1953 (R.R. Dreisbach). East Lansing, 1 male, 24-V-1957 (no collector given). Tuscola Co., 1 male, 30-V-1952 (R.R. Dreisbach). MINNESOTA. St. Paul, Battle Creek, 1 female, 20-V-1922 (W.E. Hoffman). NEW YORK. Chatham, 1 female, 1 male, 30-VII-1904 (A.O. Morse). Ithaca, 1 female, 1 male, 9-VII-1904 (no collector given), 1 male, 13-VI-1947 (no collector given). Lancaster, 1 female, 25-VII-1946 (R.H. Beamer). The Hook, McLean Res., 1 male, 31-VIII-1925 (no collector given). NORTH CAROLINA. Avery Co., Linville, 1 male, 12-VIII-1977 (NCDA). Swain Co., Smokemont, 1 female, 15-VI-1977 (NCDA). NOVA SCOTIA.

Halifax, 3 males, 23-VI-1952, ex *Bucculatrix* on *Aster* (J. McDunnough), 1 female, 30-IX-1951, ex *Bucculatrix* on *Aster* (J. McDunnough). OHIO. Barberton, 1 female, 8-VII-1936 (L.J. Lipovsky), 1 male, 30-VI-1936 (L.J. Lipovsky). Summit Co., 1 male, 24-VI-1937 (L.J. Lipovsky), 1 female, 9-VI-1937 (L.J. Lipovsky). ONTARIO. Aylmer West, 11 females, 4 males, 30-V-1972, malaise trap (no collector given). Crow Lake, Marmara Area, 1 female, 10-VIII-1959 (L.K. Smith). Maynooth, 1 female, 5-IX-1953 (J.F. McAlpine). McDonald Id., 2 females, IX-X-1976 (Reid). Ottawa, 1 male, 25-V-1944, ex leafminer on *Aster* (J. McDunnough), 1 male, 25-VII-1957 (J.E.H. Martin). Simcoe, 1 male, 11-IX-1957, ex *Bucculatrix* sp. (Freeman & Lewis). St. Lawrence Id. Nat. Pk., Thwartway Id., 2 females, VII-VIII-1976 (Reid). Toronto, 1 female, 31-V-1909 (M.C. VanDuzee). QUEBEC. Fairy Lake, 1 female, 1 male, 20-II-1957, ex *Bucculatrix* sp. (Freeman & Lewis). WYOMING. Teton Pass, E. side, 74-8400', 1 male, 17-VIII-1961 (B.H. Poole).

Hosts. In California, *Bucculatrix* spp. on *Baccharis pilularis* provide most of the rearing records, but I suspect other species of *Bucculatrix* on shrubby composites may also serve as hosts. There is one record (a series of 4 specimens) from *Bucculatrix* on *Artemisia* from southern California; most records from *Artemisia* are of *P. variabilis*. In the East, records from *Bucculatrix* on *Aster* spp. are widespread enough to suggest common occurrence on those hosts.

Comments. The weak areola superimposed on a rugose propodeum is diagnostic for this species; although *P. dixianus* is similar in this respect, the two are not easily confused since *P. masoni* has an evenly sclerotized hypopygium and mostly unsculptured (or weakly sculptured) third metasomal tergite. Some individuals with an indistinct areola may be difficult to separate from *P. variabilis* (with which it sometimes co-occurs on the same host species), but *P. masoni* has a much more strongly rugose propodeum, evenly sclerotized hypopygium in the female and a (usually) narrower first metasomal tergite. In addition, sternites 3–6 in the female show no anterior medial notching or splitting, but this is visible only by means of dissection in most cases.

This species is referred to as *Pholetesor* sp. 2 in Whitfield & Wagner (1988) and Gates *et al*. (2002).

***Pholetesor rohweri* (Muesebeck)**
(figs. 51, 71)

Apanteles (Pseudapanteles) nigripes Rohwer, 1914 (1913*). Proc. Ent. Soc. Wash*. **15**: 187. Preoccupied by Ratzeburg, 1844.
Apanteles rohweri Muesebeck, 1921. *Proc. U.S. Nat. Mus*. **58**: 55. New name for *nigripes* Rohwer.

The following redescription is based on the holotype and two other specimens from the same host, and is, due to the condition of the specimens, somewhat incomplete.

Holotype female. Body length approximately 2.0 mm, forewing length approx. 2.2mm.

Head. Frons 1.3–1.4x broader at midheight than medially long, weakly punctate; inner margins of eyes strongly converging towards clypeus. Antennae mostly dark brown but apical portions missing. Palpi light yellow-brown. Head in dorsal view 1.7–1.8x broader than medially long.

Mesosoma. Mesoscutum slightly broader than head, shallowly punctate, with strong satiny-metallic sheen. Scutellar disc with widely spaced punctures, otherwise similar in appearance to mesoscutum. Metanotum weakly retracted from scutellum, excavated mesad sublateral setiferous projections but not so strongly as in ornigis-group. Propodeum approximately twice as broad as long, rugulose throughout, with coarse sculpture radiating from nucha, overlaying hint of medial depression ; posterolateral corners strongly sunken, enhancing suggestion of areola and transverse carinae (which are not well-defined).

Legs. Proximal regions of all legs deep brown, tarsi apparently lighter yellow-brown but specimen is dirty, obscuring precise color. Spines on outer faces of hind tibiae about 30 in number, irregularly scattered. Hind tibial spurs subequal in length, less than half as long as hind basitarsi.

Wings. Tegulae dark brown. R1, stigma, C+Sc+R, 2r and 1Rs pigmented medium brownish; remainder of venation paler. 2r slightly longer than 1Rs, weeting at weakly rounded junction. R1 clearly longer than stigma.

Metasoma. Tergite I barrel-shaped, of about equal width at base and apex, similar to that of *P. bedelliae* but more roughly rugose; faint hint of posteromedial depression anterior to smooth raised medial boss at extreme apex. Tergite II 2.2–2.3x broader posteriorly than medially long, rugose, weakly raised along medial line. Tergum III longer than II, sculptured very weakly but over much of medial area, somewhat raised medially as well. Laterotergites moderate brown. Succeeding terga unsculptured, overlapping. Hypopygium slightly longer than hind basitarsi, not strongly acuminate but apparently slightly less pigmented medially—presence/absence of submedial crease difficult to determine. Ovipositor sheaths apparently similar to those of *P. bedelliae* but unusually straight and slightly more slender; entire length longer than hind basitarsi but expanded, hairy distal portion shorter. Ovipositor very weakly decurved.

Males. Unknown.

Variation. I have been able to associate only 2 other specimens with the type, both from the same host and locality. Neither specimen is intact; the antennae are mostly broken and the hypopygial region is obscured, shriveled or damaged. Variation exists in the strength and distinctness of the medfial propodeal areolar depression and costulae, and in the lightness of the tibial coloration.

Final instar larva. Unknown.

Cocoons. One cocoon is preserved with one of the two associated non-type specimens, spun within a small host shelter at the edge of a leaf, and similar in shape to the cocoons of

P. bedelliae and allies. The cocoon is much more delicate, flimsy and translucent than in that group. It is possible that the associated cocoon does not belong to this species, since it is cryptically placed and the only cocoon known.

Material examined. Holotype female: VIRGINIA. Falls Church, 22-VII-1913, parasite on *Gracilaria strigifinitella* Clem., 11171d Hopkins U.S. (C. Heinrich). Also labelled " *Pseudapanteles nigripes* Rohw. type male, *Apanteles rohweri* Mues. type" and type no. 16475 USNM.

Other material: 2 females, same locality, collector and host as type but 20-IX-1914, both from USNM.

Hosts. Neurobathra strigifinitella (Clemens) (Gracillariidae) on chestnut. Possibly occurring on *Neurobathra* on oaks as well.

Comments. Interpretation of the identity and placement of this species is difficult, due to the poor available material. Four species of *Pholetesor* and one of *Dolichogenidea* were found under this name in collections, perhaps due to the reliance upon color patterns and superficial appearance. An attempt was made to determine the critical hypopygial and sternal structure in one of the associated non-type females by soaking the detached metasoma on chloralhydrate (which softens, distends and partially clears the exoskeleton) and examining it at 100x. Sternites 3–5 were not split anteromedially, in contrast to the *bedelliae*- and *ornigis*-groups, but damage to the metasomal apex made it impossible to determine whether the hypopygium is creased submedially or not. Using characters which are visible, it seems reasonable to provisionally group this species with *P. masoni* n. sp.

Due to the reduction of chestnut trees by blight, rather specialized collection may be required to recover this parasite again from the same host and host plant. It is also possible that *P. rohweri* will be found to parasitize the same or related leafminer species on oaks.

The *pinifoliellae*-group

I have included three species, all new, in this group, based on the following shared character states: 1) metanotum weakly retracted from scutellum, not or only barely exposing mesothoracic postphragma; 2) propodeal areola and transverse carinae weakly indicated (in *P. dixianus*) or absent; 3) metasomal tergite 1 broad, coarsely sculptured; 4) tergite II broad, subquadrate, heavily sculptured and as long as III down midline; 5) tergite III strongly sculptured throughout, more or less rounded posterolaterally; 6) tergite IV unmodified, partially overlapped by III and similar in appearance to succeeding terga; 7) sternites 3–6 of female of uncertain condition (few specimens available for dissection); 8) hypopygium weakly creased submedially, setting off narrow, more translucent and flexible medial fold, usually produced at tip; 9) ovipositor sheaths arising below midheight of valvifers; 10–14) male genitalia not dissected and examined, larvae and cocoons not available; and 15) hosts (at least for *P. pinifoliellae*) are needleminers on *Pinus* spp.

Phenetically the *pinifoliellae*-group seems intermediate between the *bucculatricis*- and

zelleriae-groups, on the one hand, and the *bedelliae*-group, on the other. The superficial resemblance to *P. zelleriae* in particular is quite strong, but the *pinifoliellae*-group can be recognized by the medially weakly desclerotized, translucent hypopygial fold. It would be useful to obtain more material of these three species, particularly with associated host data, to allow dissection and examination of the sternites and male genitalia, as well as to determine the biological cohesiveness of the group. I expect that morphologically the unknown features will be found to resemble the *bedelliae*-group.

The *bedelliae*-group differs in having narrower first metasomal tergites, shorter second metasomal tergites, third tergites that are not posterolaterally rounded, and in attacking leafminers on broadleaf plants rather than on conifers.

***Pholetesor dixianus*, new species**
(figs. 20, 43, 63)

Holotype female. Body length 2.0 mm; forewing length 2.4 mm.

Head. Froans 1.2x as broad at midheight as long medially, indistinctly punctate laterally and near clypeus, more coarsely punctate near antennal bases, with faint metallic sheen between punctures; inner margins of eyes strongly converging towards clypeus. Antennae dark brown except lighter scape, slightly shorter than forewing; all but apical 5 flagellomeres with 2 ranks of placodes; flagellomere 2 2.9x as long as broad; flagellomere 14 1.4x as long as broad. palpi pale yellowish distally, tinged with dark brown proximally. Head in dorsal view just over 2x as broad as medially long.

Mesosoma. Mesoscutum finely, distinctly punctate, becoming more weakly and sparsely so posteriorly near scutellum; surface between punctures with faint satiny sheen; mesoscutal width just anterior to tegulae virtually identical to head width. Suctoscutellar scrobe deep, composed of about a dozen sharp, sometimes confluent crenulations; medial portion weakly arched. Scutellar disc slightly longer than anteriorly broad, with widely spaced, fine, weak punctations. Metanotum weakly retracted from scutellum, shallowly excavated mesad sublateral setiferous projections; transverse carinae on either side at about midlength parallel to anterior margin and setting off small transverse depressions, crossed by several weak carinae. Propodeum finely rugulose anteriorly, less densely sculptured posteriorly behind poorly defined transverse carinae; medially with indistinct pentagonal areola, partially obscured posteriorly by coarse longitudinal sculpturing, anteriorly by rugulosity; areola about .25 width of propodeum; propodeal width 2.2x maximum length.

Legs. All coxae mostly dark brown to black with light yellowish tinges apically; legs otherwise bright honey-orange except tips of distal tarsomeres and infuscate hind tarsi and distal 0.2 of hind tibiae. Spines on outer faces of hind tibiae widely scattered, about 25 in number. Inner hind tibial spurs at least 15% longer than outer, about 0.4 length of hind basitarsi. Hind legs slightly thickened.

Wings. Tegulae dark brown, weakly translucent. Forewing venation yellowish brown proximally, becoming evenly deep brownish at and beyond stigma. 2r longer than 1Rs, weakly arched, meeting 1Rs at distinct, approximately 130-degree angle. R1 1.4x as long as stigma, curved, 8x as long as distance from its distal tip to end of 3Rs fold along wing edge. Stigma 2.3x as long as broad. Hindwing with weakly flattened vannal lobe; vannal fringe even, somewhat sparse, short.

Metasoma. Tergite I strongly arched arched in profile, approximately as broad posteriorly as medially long, strongly rugose, with broad medial excavation over anterior third; lateral margins weakly diverging posteriorly. Tergite II subquadrate, slightly broader posteriorly, 2.7x as broad as long medially, with weakly concave hind margin; surface entirely rugose. Tergite III subequal in length and breadth with II but narrowing slightly to rounded posterolateral corners; coarsely rugose throughout, separated from II by an irregular crenulate furrow. Laterotergites yellowish, virtually hidden in dorsal view. Succeeding terga of usual unsculptured, overlapping form. Entire dorsum of metasoma appearing strongly oval in dried specimens. Hypopygium 1.1x as long as hind basitarsus, submedially weakly creased, setting off more translucent, hairless and more flexible medial fold. Ovipositor sheaths approximately equal in length with hypopygium, basally slender, broadening to broad fusiform shape over distal 0.5; in profile more strongly curved ventrally (convex) than dorsally. Ovipositor weakly decurved, becoming more strongly so apically.

Males. Unknown.

Variation. Body length 1.8–2.0 mm; forewing length 2.2–2.4 mm. The 3 examined specimens are extremely similar in coloration, sculpturing, wing venation and metasomal features despite some geographical separation. The North Carolina individual has a more well-defined areola than either of the Texas specimens, but the propodeal background sculpturing is otherwise not unusual.

Final instar larva. Unknown.

Cocoon. Unknown.

Material examined. Holotype female. TEXAS. Crosby, 27-IV-1953 (R.H. Beamer). Paratypes: NORTH CAROLINA. Macon Co., Wayah Bald, 5400', 1 female, 20-VI-1957 (W.R.M. Mason). TEXAS. Kerrvile, 1 female, 13-IV-1959 (W.R.M. Mason).

Holotype from and deposited in Snow Entomological Museum, University of Kansas; paratypes in CNC.

Hosts. Unknown.

Comments. The long R1, broad ovipositor sheaths, submedially creased hypopygium, broad and heavily sculptured basal metasomal tergites and weak propodeal areola combine to make this a distinctive species. It would be interesting to know how its biology compares to that of *P. pinifoliellae* (below).

Holotype female. Body length 2.4 mm; forewing length 2.5 mm.

Head. Frons 1.4x as broad at midheight as long medially, weakly punctate; inner margins of eyes converging towards clypeus. Antennae very dark brown throughout, slightly longer than forewing; all but distal 5 flagellomeres with 2 ranks of placodes; flagellomere 2 2.9x as long as broad; flagellomere 14 1.7x as long as broad. Palpi light yellow-golden throughout visible portions. Head in dorsal view 2.0x as broad as medially long.

Mesosoma. Mesoscutum evenly, finely and shallowly punctate, less distinctly so posteriorly, without noticeable metallic sheen; width just anterior to tegulae just barely greater than that of head. Scutoscutellar scrobe composed of approximately 15 fine crenulations, nearly straight medially. Scutellar disc slightly longer than anteriorly broad, distinctly but shallowly punctate. Metanotum weakly retracted from scutellum; sublateral setiferous lobes not prominent; transverse carinae at about midlength on either side setting off small, transverse depressions crossed by several short carinae. Propodeum mostly evenly and finely aciculorugose, with superimposed ridges posteriorly, radiating from nucha; width twice maximum length.

Legs. All coxae dark brown to black; forelegs otherwise dull yellow-brown except darkened apical tarsomeres. Mesothoracic legs mostly dark yellow-brown except lighterproximal 0.7 of tibiae. Hind legs mostly dark yellow-brown except lighter tinges along femora and proximal portions of tibiae. Spines on outer faces of hind tibiae 20–25 in number, irregularly scattered mostly posterolaterally. Apical spurs of hind tibiae whitish, subequal in length, the barely longer inner spur about 0.4 length of hind basitarsus.

Wings. Tegulae dark brown. Forewing venation evenly brownish except very dark grey-brown stigma, R1, 2r and 1Rs and slightly paler proximal venation. 2r weakly arched, somewhat longer than 1Rs, meeting it at distinct but nat aharp 155-degree angle. R1 1.2x as long as stigma, approximately 3.5x as long as distance from its distal end to end of 3Rs fold along wing edge. Stigma 2.5x as long as broad, distal edge nearly straight. Hindwing with vannal lobe evenly convex, with even, moderately long fringe.

Metasoma. Tergite I slightly broader posteriorly than medially long, broadening gradually, than rounding weakly posteriorly, evenly and finely and finely aciculorugose (strong longitudinal trend) with broad, smoother excavation medially over anterior 0.3; arched strongly in profile, with a narrow posteromedial depression evident. Tergite II subquadrate, 2.6x broader than maximum length, shortest medially, with weakly concave posterior margin; surface evenly aciculorugose throughout, weakly raised medially. tergite III as broad as II, approximately of same length as II but longest medially, aciculorugose over most of surface; posterolateral corners rounder and more weakly sculptured; separated from II by crenulate furrow. Laterotergites hidden from above, translucent deep brown. Posterior terga of normal, unsculptured, overlappiong form. Hypopygium 1.3x as

long as hind basitarsus, strongly acuminate to a sharp tip, with weak submedial crease setting off a narrow, more translucent and hairless medial fold. Ovipositor sheaths slightly shorter than hypopygium, slender basally, then tapering broader to a bluntly beveled tip; hairy throughout expanded portions. Ovipositor weakly decurved.

Males. Antennae at least 10% longer than forewing, with more slender apical flagellomeres (flagellomere 14 2.5x as long as broad), with only the distal 3 flagellomeres having 2 ranks of placodes Coloration generally slightly darker than females on legs. Variation difficult to assess from two poor male specimens available.

Variation. Body length- females 2.0–2.4 mm, males both 2.1 mm. Forewing length females 2.0–2.5 mm, males 2.2–2.3 mm. Because only a few specimens can be unequivocally associated with this species, variation is difficult to assess.

I have associated a smaller specimen from Laurel, Maryland with this species despite its slightly brighter leg coloration and coarser tergite sculpturing. These are trends to be expected in more southern individuals, judging from the trends in other species.

Far more doubtfully associated are 3 (also smaller) specimens from the Sierra Nevada in California, which appear somewhat intermediate in ovipositor sheath shape and length, wing venation and tergite sculpturing between *P. pinifoliellae* and *P. variabilis*. The third metasomal tergite is not so clearly rounded posterolaterally as in the typical *pinifoliellae*, and the first tergite lacks the longitudinal posteromedial depression (in both sexes; the depression is apparently less strongly expressed in the males in the type-series). These specimens may prove to be extreme individuals of *P. variabilis*, or an undescribed species.

Final instar larva. Unknown.

Cocoons. Unkown.

Material examined. Holotype female: ONTARIO. Ottawa, 28-VII-1950, reared ex microlepidoptera sp., no. 050-400 (Forest Insect Survey). Paratypes: QUEBEC. Berthiersville, 1 female, 2 males, "ETE 1948, host *Paralechia pinifoliella*, rearing no. 1001 (L Daviault). Other material: MARYLAND. Laurel, 1 female, 21-VI-1965, malaise trap. Questionably associated: CALIFORNIA. Placer Co., Dollar Pt., 2 mi. NE Tahoe City, 2 females, 1 male, 24/29-VI-1979, Malaise trap (P. Adams).

Holotype and paratypes in CNC collection; questionable California series in CDFA collection.

Hosts. The only determined host recorded is *Exoteleia pinifoliella* Chambers, a needle and shoot-borer on pines.

Comments. As with *P. dixianus*, interpretation of the limits of variation is difficult to impossible due to the small number of available specimens. Complicating the matter is the poor condition of the paratype series (which were chosen as paratypes only because they provide the only determined host record).

Nevertheless, separation of this species from *P. dixianus*, *P. rhygoplitoides* and *P. zelleriae*, the most similar species superficially, should not be difficult. The ovipositor sheaths of the 4 species are recognizably different in shape (see figures) and the

combination of lack of propodeal areola, subequal hind tibial spurs, submedially creased hypopygium and broad angle between 2r and 1rs of the forewing is apparently unique among these 4 (each of the other species has all but one or two of these features in common).

***Pholetesor rhygoplitoides*, new species**
(figs. 22, 45, 65)

Holotype female. Body length 2.2 mm, forewing length 2.4 mm.

Head. Frons 1.3x broader at midheight than long down midline, fine irregularity of surface partly confusing punctation pattern; inner margins of eyes weakly converging towards clypeus. Antennae approximately same length as forewing, dark brown throughout; all but apical 5 flagellomeres with 2 ranks of placodes; flagellomere 2 3.5x longer than broad; flagellomere 14 7x longer than broad. Palpi light yellow-orange throughout. Head in dorsal view 2x broader than long down midline.

Mesosoma. Mesoscutum distinctly punctate, more closely so anteriorly than posteriorly; interstices with only faint metallic sheen; mesoscutal width just anterior to tegulae 0.9x that of head. Scutoscutellar scrobe broad, composed of 8–10 coarse punctures, nearly straight medially. Scutellar disc virtually impunctate, peripherally weakly punctate, apparently with very weak longitudinal microsculpturing; disc slightly longer than maximum breadth. Metanotum nearly appressed anteriorly to scutellum, not strongly excavated mesad sublateral setiferous lobes; anterolateral regions irregularly rugulose; with transverse depressions at midlength on either side, crossed by several irregular carinulae. Metapleuron centrally smooth around spiracle, otherwise coarsely punctate, hairy. Propodeum anteriorly punctulorugose, posteriorly depressed and very coarsely rugose; rugosity extending further to anterior medially; propodeum 1.8x broader than maximum length.

Legs. Coxae of all legs dark brown to black, especially proximally; otherwise, legs strongly honey-orange with apices of hind tibiae, tarsi and femoral bases slightly infuscate. Spines on outer faces of hind tibiae 20–25 in number, sometimes difficult to distinguish from normal hairs. Apical spurs of hind tibiae subequal in length, yellow-orange, slightly over a third as long as hind basitarsus.

Wings. Tegulae moderately dark brown, translucent. Forewings narrow, tinted pale brownish with deep brown venation, especially along anterior edge (stigma, R1, 2r, 1Rs); 2r arched, slightly longer than 1Rs, meetings 1Rs at sharp 125-degree junction; R1 1.2x as long as stigma, 3.5x as long as distance from its distal tip to end of 3Rs fold along wing edge; stigma 2.3x longer than broad. Hindwing with vannal lobe distinctly flattened, vannal fringe continuous but somewhat sparser over distal half. Cu+cu-a strongly reclivous.

Metasoma. Tergite I approximately as long as posteriorly broad, 1.3x as broad

posteriorly as anteriorly; lateral margins evenly diverging over most of length, than rounded over apical 0.4; posterior margin slightly concave medially; surface coarsely aciculorugose, with small, shallow anteromedial smoother depression. Tergite II strongly quadrate, 2.1x broader than long, aciculorugose, bounded posteriorly by irregularly crenulate furrow. Tergite III aciculorugose over most of surface. posteriorly (especially posterolaterally) with thin unsculptured edge which is lighter in color; entire tergum subequal in length with tergite II, sculptured portion 0.6 (laterally) to 0.8 (medially) as long as tergite II. Laterotergites light to medium yellow-brown, nearly hidden in dorsal view by broad tergites. Succeeding terga normal, unsculptured, overlapping, mostly telescoped under anterior 3. Hypopygium subequal in length with hind basitarsus, acuminate apically, submedially weakly creased, setting off narrow, more translucent medial fold. Ovipositor sheaths virtually same length as either hypopygium or hind basitarsi, proximally slender weakly decurved, distal 0.7 hairy, strongly broadened and flattened, dorsally more strongly rounded; tip bluntly rounded, asymmetrical. Ovipositor evenly decurved.

Males. The single available male from Arizona is much lighter in leg, antennal and tegula color than more northern females. Wing venation similar to some of female paratypes but 2r much shorter than in holotype (shorter than 1Rs) and not arched. Antennae longer than in females, 1.3x as long as forewing, strongly tapering towards tip; all flagellomeres apparently with 2 ranks of placodes. Length/width of flagellomere 2 = 3.2, of flagellomere 14 = 2.4. Forewing length 2.5 mm, body length 2.2 mm.

Variation. Body length 2.0–2.4 mm; forewing length 2.1–2.7 mm. The most noticeable variation occurs in antennal coloration and the relative lengths of 2r and 1Rs in the forewing. In several specimens, the basal segments of the antennae are light yellow, becoming gradually darker distally. 2r and 1Rs always seem to meet at a sharp angle, but 2r varies from being arched and longer than 1Rs (as in the holotype) to being considerably shorter and straight (as in figure 31). I have associated the western specimens with the eastern despite the apparent disjunction; I see no morphological evidence to support their separation.

Final instar larva. Unknown.

Cocoons. Unknown.

Material examined. Holotype female: IDAHO. Valley Co., Donally, 23-VIII-1952 (S.E.Knapp). Paratypes: ARIZONA. Portal, SW Research Sta., 1 male, 2-VIII-1955, 5400' (R.R. Dreisbach). IDAHO. Valley Co., Donally, 1 female, 23-VIII-1952 (S.E. Knapp). MINNESOTA. Lyon Co., Camden State Pk., 1 female, 23-VII-1974, malaise trap (no collector given). ONTARIO. Mer Bleue, 1 female, 19-VII-1963 (J.G. Chilcott). QUEBEC. Chimo, 1 female, 17-18-VIII-1959 (W.R. Mason).

Holotype in USNM collection; paratypes in USNM, CNC, University of Minnesota and Michigan State University Collections.

Hosts. Unknown.

Comments. The form of the ovipositor sheaths and the propodeal sculpturing best distinguish this species within the *pinifollielae*-group. The geographic and habitat ranges appear to be quite broad, judging from the collection localities. The specific epithet refers to the superficial similarity to members of *Rhygoplitis*, which tend to have narrow wings, sharply angled 2r and 1Rs and (sometimes) broad, strongly sculptured anterior metasomal tergites, as in this species.

The *bedelliae*-group

Despite their diverse appearance, I have included seven Nearctic species in this groupó*P. bedelliae* (Viereck), *P. chiricahuensis* n.sp., *P. longicoxis* n. sp., *P. powelli* n.sp., *P. thuiellae* n. sp., *P. variabilis* n. sp., and *P. viminetorum* (Wesmael)—on the basis of the following shared features: 1) metanotum weakly retracted from scutellum, barely or not exposing mesothoracic postphragma; 2) propodeal areola and transverse carinae absent; 3) metasomal tergite I broad throughout to strongly narrowing posteriorly but always sculptured throughout; 4) tergite II subquadrate to transverse-subtriangular, usually strongly sculptured, slightly to much shorter than III down midline; 5) tergite III sculptured at most anteromedially, at least not with posterolateral corners rounded; 6) tergite IV unmodified, partially overlapped by III and similar in appearance to succeeding terga; 7) sternites 3–6 in female anteromedially notched or split (weakly so in *P. viminetorum*); 8) hypopygium submedially weakly creased, setting off narrow, more translucent and flexible medial fold, usually produced apically; 9) ovipositor sheaths arising below midheight of valvifers; 10) volsellae of male genitalia each with 3–5 setae along medioventral edge; 11) gonobase (basal ring) of male genitalia transverse, usually not more than half as long as its width; 12) final instar larva with 1 pair of labial setae on short tubercles; 13) final instar larva with 1 seta on each maxilla; 14) cocoon is of usual white, blunt-oblong form typical of Apantelini, with irregular, fine, loose threads exteriorly, spun within host shelter, mine or on undersides of leaves or more delicate and spun within the cocoon of the host (this varies even intraspecifically depending on the host attacked); and 15) hosts are various leafmining genera of Gracillariidae, Lyonetiidae or Elachistidae, rarely leaf skeletonizers on Ericaceae or needleminers on *Cupressus* or *Thuja*. Host ranges of even individual species may be broad, both taxonomically and ecologically.

An inordinate diversity of metasomal tergites shapes, ovipositor sheath shapes, and host habitats is represented among the species in this group, but the extremes seem to all be more or less connected my intermediate characteristics. The division between the *pinifoliellae*- and *bedelliae*-groups may be an artificial one phylogenetically; the distinction seems a useful tentative one for biological (host-preference) reasons, even if weakly defined morphologically. Should the metasomal sternites of female pinifoliellae-group species prove to be anteriorly unsplit, the separation into two groups would be strengthened.

On the basis of examination of determined material in the Canadian National collection and in British collections, I would place the Palearctic *P. maritimus* (Wilkinson), and perhaps several additional species here as well.

***Pholetesor bedelliae* (Viereck)**
(figs. 9, 23, 37, 46, 66, 81)

Apanteles (Protapanteles) bedelliae Viereck, 1911. *Proc. U.S.Nat. Mus.* **40**: 174. Holotype female, USNM No. 13501, examined.

Females. Body length 1.7–2.3 mm, forewing length 1.9–2.5 mm.

Head. Frons 1.3x broader at midheight than long down midline, weakly, shallowly punctate; inner margins of eyes weakly converging towards clypeus. Antennae dark brown throughout, slightly longer than body in dried specimens; all but distal 5–6 flagellomeres with 2 ranks of placodes; flagellomeres 2 3.4–3.6x longer than broad; flagellomere 14 1.2–1.4x longer than broad. Palpi light yellow-brown. Head in dorsal view twice broader than long down midline.

Mesosoma. Mesoscutum in dorsal view about same width as head, shallowly punctate, becoming indistinctly punctate posteriorly near scutoscutellar scrobe; surface between punctures with weak metallic sheen. Scutoscutellar scrobe weakly arched medially, composed of fine, sharp punctures, usually set in transverse, weak depression. Scutellar disc smoother than mesoscutum, indistinctly punctate, very slightly longer than its maximum breadth. Metanotum weakly retracted from scutellum; sublateral setiferous lobes nearly appressed to hind margin of scutellum; transverse carinae at about midlength on either side poorly developed, at least laterally. Propodeum 1.9–2.1x broader than long at longest points, generally weakly punctate to rugulose except near nucha, from which radiate a series of short ridges; posterolateral corners nearly smooth.

Legs. Coloration decidedly variable; usually, prothoracic and mesothoracic legs light yellow-brown except darkened coxae, trochanters, tarsal apices and (mesothoracic legs) proximal portions of femora; metathoracic legs with coxae mostly dark brown to black, trochanters and femoral bases lighter brown, femora mostly light yellow-brown except dorsal infuscation near junction with tibiae, tibiae light yellow brown, darkening apically, tarsomeres conocolorous with darkened tibial apices. Hind femora occasionally nearly entirely darkened. Outer faces of hind tibiae with approximately 30 small, scattered spines. Inner hind tibial spur slightly longer than outer.

Wings. Tegulae dark brown, translucent. C+Sc+R, stigma, R1, 2r and 1Rs evenly deep brown, other venation more weakly pigmented, especially proximally; R1 slightly longer than stigma, about 3x as long as distance from its distal tip to end of 3Rs fold along wing edge; 2r and 1Rs generally about equal in length, meeting at more or less distinct angle

(occasionally marked by a knob); 2r weakly arched. Vannal lobe of hindwing with short fringe over most of distal half.

Metasoma. Tergite I strongly rugose, 1.5–1.6x longer than basally broad, usually barrel-shaped in outline, broadest near midlength but sometimes broader apically or basally; anteromedial depression broad. Tergite II weakly aciculorugose , medially more aciculate, 1.9–22x as broad as medially long, often with weakly raised medial smoother region; anterolateral corners strongly rounded; posteriorly marked by straight to faintly bisinuate crenulate groove. Tergite III longer than II, with limited if any sculpturing. Laterotergites usually dark yellow-brown, rarely nearly as light in color as hind tibiae. Remaining terga of usual unsculptured, unmodified, overlapping form. Hypopygium about same length as hind basitarsus, submedially weakly creased, setting off translucent medial fold; tip bluntly acuminate. Ovipositor sheaths approximately same length as hind basitarsi, usually slightly shorter, broadest subapically, somewhat more convex ventrally than dorsally in profile, bluntly pointed, hairiest near tip. Ovipositor evenly decurved.

Males. Body length 1.6–2.2 mm, forewing length 1.9–2.4 mm. Males are usually easily associated with females, but could potentially be confused with males of *P. thuiellae*, *P. rohweri* and *P. powelli*. The first metasomal tergite is usually more strongly narrowed apically than in the females, and the second tergite is more transverse (2.3–2.6x as broad posteriorly as long down midline). The tibial and femoral coloration (especially in hind legs) is usually much darker than in sympatric females. There is a tendency for the forewing venation to be darker, especially in veins not strongly pigmented in the female. As in most *Pholetesor* males, the apical flagellomeres are more slender, with 2 ranks of placodes on all except the distal 3; the antennae are clearly longer than the body length.

Variation. In view of the broad geographical and host range of this species, it is not surprising that a great deal of intraspecific variability is expressed. Most of the specimens encountered should be recognizable on the basis of the above description; a few of the specimens reared from elachistids on grasses are significantly larger than usual and tend to have exceptionally broad first metasomal tergites and a long metacarp (R1). In general, most of the variation occurs in leg coloration, size, subtle differences in metasomal tergite shape and the configuration of veins 2r and 1Rs in the forewing, none of which is especially critical in recognizing this species.

Final instar larva. Labium with one pair of setae on short tubercles; maxillae each with one seta; mandibles set with 16–20 long teeth (not counting bifid tip).

Cocoon. White, elongate-oval with blunt ends, somewhat satiny with scattered loose exterior threads, spun on the undersides or bases of leaves, within the host mine (in the case of individuals attacking *Phyllonorycter* spp.) or within the host cocoon (when emerging from *Bucculatrix* spp. or other *Lyonetiidae*).

Material examined. Reared from *Anomis erosa* Huebner: 5 females, 1 male, Washington, DC (no date). Reared from *Bedellia minor* Busck: 3 females, 3 males, LOUISIANA, October. Reared from *Bedellia somnulentella* Zeller: 175 females, 126

males, CALIFORNIA, DISTRICT of COLUMBIA, IOWA, KANSAS, NEW JERSEY, OREGON, VIRGINIA, mostly August-December but some March, June, July. Reared from *Bucculatrix canadensisella* Chambers: 1 female, ONTARIO, August. Reared from *Bucculatrix thurberiella* Busck: 4 males, CALIFORNIA, September. Reared from *Bucculatrix* sp. on *Amelanchier* sp.: 1 female, NOVA SCOTIA, August. Reared from *Bucculatrix* sp. on *Artemisia tridentata*: 1 female, CALIFORNIA, July. Reared from *Bucculatrix* on *Wyethia mollis*: 1 female, 5 males, CALIFORNIA, August-September. Reared from *Bucculatrix* spp. (no plant given): 11 females, 1 male, ONTARIO, March (?), August-October. Reared from *Caloptilia diversilobiella* Opler on *Rhus diversiloba*: 2 males, CALIFORNIA, August. Reared from *Caloptilia fraxinella* (Ely) on *Fraxinus* sp.: 7 females, 8 males, ONTARIO, July–August. Reared from *Caloptilia invariabilis* (Braun): 3 females, 5 males, ONTARIO, BRITISH COLUMBIA, June–July. Reared from *Caloptilia negundella* (Chambers) on *Acer negundo*: 2 females, 1 male, CALIFORNIA, July, October. Reared from *Caloptilia* sp. on *Lithocarpus densiflorus*: 2 females, 1 male, OREGON, June-July. Reared from *Caloptilia* sp. on *Quercus nigra*: 1 male, FLORIDA, August. Reared from *Caloptilia* spp. (no plant given): 3 females, 4 males, BRITISH COLUMBIA, OREGON, May, July. Reared from *Cosmopterix* sp. on morning-glory: 5 females, 2 males, Washington, DC, October. Reared from *Elachista* spp. on grasses and sedges (mostly undetermined plant spp.): 40 females, 31 males, CALIFORNIA, coastal-February/March, Sierra- September. Reared from *Fenusa pusilla* (probably mistaken host record): 1 female, QUEBEC, August. Reared from *Leucoptera pachystimella* Busck: 1 female, BRITISH COLUMBIA, late May. Reared from *Micrurapteryx salicifoliella* (Chambers) on Salix spp.: 5 females, 2 males, ONTARIO, August. Rerared from *Phyllonorycter tremuloidella* (Braun): 2 males, ONTARIO, July. Reared from "sweet potato leafminers" : 9 females, 7 males, southern CALIFORNIA, December. Not reared: 152 females, 98 males, distributed more or less throughout North America.

Hosts. I will not repeat the above list of hosts, except to comment that the records from *Anomis erosa* and *Fenusa pusilla* are probably in error; also, despite numerous rearings from leafminers on Colvolulaceae, I have been unable to confirm that *P. bedelliae* will parasitize *Cosmopterix* spp. It appears that the host range of this species is unusually broad; on many hosts, however, it is not a dominant parasitoid—perhaps its broad usual host and geographical ranges bring it into contact with a number of potential hosts which it only rarely parasitizes. In general, most of the hosts have in common a blotchmining habit in the shrub or ground layer of vegetation.

Comments. This is one of the most widespread, abundant and variable species in the genus. It is possible that more than one species is involved, but I am unable to consistently separate them morphologically. If any material here represents a separate species it will most likely be the individuals reared from elachistids on grasses and sedges.

P. bedelliae can be separated from *P. thuiellae* and *P. powelli* on the shortness and shape of the ovipositor sheaths (compare figures) and (to a lesser extent) the shorter

metacarp (R1) in the forewing. Males of these three species are likely to be extremely difficult to associate with their respective females, without host data. *Pholetesor variabilis* and *P. chiricahuensis* are easily distinguished by their broader and narrower first metasomal tergites, respectively.

***Pholetesor chiricahuensis*, new species**
(figs. 47, 67)

Holotype female. Body length 1.7 mm, forewing length 1.8 mm.

Head. Frons 1.4x broader at midheight than long down midline, finely and weakly punctate, producing dull metallic sheen between punctures; inner margins of eyes weakly converging towards clypeus. Antennae dark brown throughout, about same length as forewing; all but distal 5–6 flagellomeres with 2 ranks of placodes; flagellomere 2 3.5x longer than broad; flagellomere 14 1.2x longer than broad. Palpi moderate yellow-brown throughout. Head in dorsal view 2.1x broader than long down midline.

Mesosoma. Mesoscutum shallowly but distinctly punctate, becoming more indistinctly so posteriorly; surface with slight metallic sheen; width just anterior to tegulae just less than head width. Scutoscutellar scrobe straight to very weakly arched medially, composed of about a dozen sharp, regular, distinct pits. Scutellar disc mostly smoother, shinier than all but extreme posterior of mesoscutum, with widely scattered fine, shallow punctures; surface nearly flat, 1.2x longer than maximum breadth. Metanotum weakly retracted from scutellum, shallowly excavated mesad sublateral setiferous projections; transverse carinae on either side at about 1/3 of length poorly defined; sunken areas posterior to transverse carinae crossed by 3–4 short carinulae. Propodeum 2.0x broader than long at longest point, mostly very weakly rugulose, becoming shinier and smoother in posterolateral corners, with short irregular ridges radiating from nucha.

Legs. All coxae dark brown to black virtually throughout; trochanters lighter yellow-brown; fore- and mid-femora very dark over basal half, gradually becoming lighter yellow-brown distally; hind femora evenly dark brown to black; all tibiae moderate yellow-brown proximally, becoming darker distally; especially so in hind tibiae; tarsi mostly deep brown. Spines on outer face of hind tibia of 2 thicknesses, approximately 20 in number (the thinner ones difficult to distinguish at times from normal hairs). Hind tibial spurs subequal in length, slightly less than half the length of the hind basitarsi.

Wings. Tegulae deep brown, translucent. Forewing venation deep brown, wings generally weakly tinted brownish. C+Sc+R, stigma, R1, 2r and 1Rs most strongly pigmented; R1 barely longer than stigma, about twice as long as distance from its tip to end of 3Rs fold along wing edge; 2r weakly arched, subequal with to slightly longer than 1Rs, the two meeting at a distinct 130-degree angle. Hindwing with weakly arched, strongly reclivous Cu+cu-a; vannal lobe weakly flattened, with very short fringe (at least near midlength of lobe).

Metasoma. Tergite I 2.4x longer than posteriorly broad, 1.5x broader anteriorly than posteriorly; lateral margins evenly curved, converging posteriorly; surface densely aciculorugose; longitudinal trend to sculpturing more obvious posteriorly; basal excavation shallowly, broadly u-shaped in cross-section, reaching to about 0.3 of length of tergite. Tergite II transverse-subtriangular, at least 2x broader posteriorly than anteriorly; lateral margins weakly arched; surface finely and longitudinally aciculate, the aciculations paralleling the lateral margins laterally; length about equal to posterior breadth of tergite I. Tergum III separated from II by crenulate furrow, unsculptured, slightly longer than II. Succeeding terga of usual unsculptured, unmodified, overlapping form. Laterotergites medium yellow-brown; in second tergum, laterotergite slightly darkened and sculptured near lateral margin of central tergite. Hypopygium about 1.3x longer than hind basitarsus, submedially weakly creased on either side; medial fold hairless, more flexible but not multiply creased. Ovipositor sheaths about same length as hypopygium, expanded distal hairy portions slightly shorter than hind basitarsi; sheaths narrow, fusiform, evenly hairy, very weakly decurved and more rounded dorsally than ventrally. Ovipositor weakly decurved over most of length, more strongly so near tip.

Males. The single associated male differs from the females in the following features: antennae longer, apically more slender (flagellomere 14 2.1x as long as broad); wing venation slightly greyer; 2r and 1Rs more distinctly angled; laterotergites very dark brown; tergite I not quite so slender or posteriorly narrowed. In the shape and sculpturing of the metasomal tergites, this male is extremely similar to the female from the same locality. Body length 1.6 mm; forewing length 1.8 mm.

Variation. Body length 1.6–2.0 mm, forewing length 1.8–2.2mm. The Arizona specimens are noticeably smaller than the others, with somewhat straighter lateral margins to the second metasomal tergite. In the Colorado specimen, the second tergite is more strongly trapezoidal, longer than in the other two and with a faintly bisinuate hind margin. Despite these differences, the scattered localities and lack of host records I associate these specimens with little hesitation due to strong similarities in winbg venation, leg coloration, propodeal sculpturing and ovipositor sheath shape.

Final instar larva. Unknown.

Cocoons. Not recorded, but likely to be hidden within the host cocoon when attacking *Bucculatrix*, and resembling those of *P. bedelliae* when attacking *Elachista*.

Material examined. Holotype female: ARIZONA. Cochise Co., SW Research Sta., 5 mi. W. Portal, 5400', Chiricahua Mts., 18-VIII-1978, malaise trap 8am–6pm (M. Wasbauer). Paratypes: 1 male, same data as holotype except 14–15-VIII-1978. CALIFORNIA: El Dorado Co., Fallen Leaf Lake, 2 females, 6-VIII-1985 (D. L. Wagner), Lot. No. 85H6, host: *Elachista* on *Elymus*. COLORADO. Clear Cr. Co., West Chicago Cr., 9800', 1 female, 11-VIII-1961 (S.M. Clark). FLORIDA: Monroe Co., Key Largo, John Pennecamp St. Park, 1 male, 14/16-XI-1986 (D. L. Wagner), Lot No. 86L33, host: *Bucculatrix* on *Bourreria*. NEW MEXICO. Tajique. 1 female, VI-25-1941 (R.H. Beamer).

Holotype from CDFA collection, deposited in USNM; paratypes in CDFA, CNC (Colorado specimen), Illinois Natural History Survey (California and Florida material).

Hosts. So far two divergent hosts have been recorded, *Bucculatrix* sp. (Bucculatrigidae) on *Bourreria* (a plant genus that in the U. S. appears to be restricted to Florida), and *Elachista* sp. (Elachistidae) on *Elymus* (Poaceae). While the two hosts are quite unrelated, other species of the *bedelliae*-group span these two host genera as well, so this is not particularly surprising or suspicious.

Comments. A single specimen from the Pinaleno Mts., Graham Co., Arizona in the CAS collection may possibly be a male of this species but differs in size (it is larger), metasomal tergite shape and sculpturing, and metanotum shape from the other (paratype) male, which is more positively associated with the females. The reared male from Florida, although geographically disjunct, is more similar to the other Arizona material. I suspect the disjunct distribution in North America only appears so because the areas further south in Mexico and the Caribbean are not well sampled.

This species has the most strongly narrowing first metasomal tergite in the *bedelliae*-group, and can be recognized on this feature easily, as well as by the short metacarp (R1) and subtriangular second tergite.

***Pholetesor longicoxis*, new species**
(figs. 48, 68)

Holotype female. Body length 1.8 mm, forewing length 2.4 mm.

Head. Frons 1.4x broader at midheight than long down midline, finely punctate, somewhat more densely and strongly so near clypeus, separated from clypeus by more distinct groove than in other species. Inner margins of eyes weakly, evenly converging towards clypeus. Antennae medium yellow-brown over proximal 0.7–0.8, becoming darker brown at tips, apparently slightly shorter than forewing (curled apically); all but distal 5 flagellomeres with 2 ranks of placodes; flagellomere 2 3.7x longer than broad; flagellomere 14 approximately 2.0x lkonger than broad (collapsed in specimen). Palpi light yellow brown throughout. Head in dorsal view twice broader than medially long.

Mesosoma. Mesoscutum finely, shallowly punctate, more sparsely so posteriorly to nearly smooth and impunctate near scutellum; surface somewhat dull, weakly satiny; mesoscutal width just anterior to tegulae just slightly less than that of head. Scutoscutellar scrobe nearly straight medially, narrow, composed of irregular, sometimes confluent sharp, fine pits, preceded anteriorly by weakly declivous portion of mesoscutum. Scutellar disc sparsely, very indistinctly punctate, appearing smooth between punctures, slightly longer than anteriorly broad with weakly concave lateral margins. Metanotum sunken well below level of scutellum, anteriorly virtually appressed to posterior edge of scutellum, weakly excavated mesad sublateral setiferous lobes; lacking well-defined transverse carinae on sides; depressions on either side anterior to broad raised posterior border crossed by

irregular short longitudinal to oblique ridges. Propodeum anteriorly finely rugulose with small polished area medially along anterior edge; posteriorly more coarsely and irregularly rugose with hints of posterior arms of areolar carinae (but areolar region not depressed); posterolateral corners not noticeably sunken; propodeal width 2.1x greatest length.

Legs. Forelegs entirely light yellow-brown except slightly darker pretarsal area; middle legs similar except coxae basally infuscate; hind legs entirely light yellow-brown except dark brown basal half of coxae; hind coxae enlarged, reaching nearly to end of third tergum of metasoma; spines on outer faces of hind tibiae regularly scattered, about 25 in number; inner apical spurs of hind tibiae slightly longer than outer, about 0.4 as long as hind basitarsi, pale yellowish.

Wings. Tegulae pale translucent yellowish. Forewings slender, tinged brownish; venation translucent medium brown; R1 1.3x as long as stigma, about 3.5x as long as distance from its distal end to end of 3Rs fold along wing edge; stigma 2.8x as long as broad; 2r exiting beyond middle of stig,a, much shorter than 1Rs and meeting it at a sharp 120-degree angle. Hindwing with Cu+cu-a weakly arched, strongly reclivous; vannal lobe weakly flattened with short, slightly sparser fringe at midlength.

Metasoma. Tergite I strongly humped, coarsely rugose, about 1.2x broader anteriorly than posteriorly, with lateral margins sharp, raised above laterotergites and weakly converging over most of length, then more strongly rounded apically; mediobasal excavation shallow, broad, reaching over anterior 0.3 of tergite and surrounded by irregular concentric sculpturing. Tergite II subquadrate, 2.8x as broad posteriorly as medially long, with rounded anterolateral corners, coarsely rugose throughout and marked posteriorly by straight, indistinctly crenulate furrow. Tergum III slightly longer than tergite II, anteromedially roughened but mostly unculptured. Laterotergites and extreme anterolateral edges of tergum III pale yellow-brown. Succeeding terga of usual unsculptured, overlapping form, strongly telescoped under anterior 3. Hypopygium slightly longer than hind basitarsi, submedially weakly creased, setting off narrow medial, more translucent fold; apex apparently sharply acuminate (stretched by ovipositor in type). Ovipositor sheaths overall slightly shorter than hind basitarsi, expanded hairy portions slender, nearly parallel-sided, straight, with blunt tips and about 2/3 length of hind basitarsi. Ovipositor weakly decurved apically.

Males. The single male is similar to the female except all but the distal 4 flagellomeres have 2 ranks of placodes; flagellomere 14 2.0x as long as broad. Labrum more conspicuously yellow than in female, antennae light yellow-brown, becoming darker distally. Tegulae pale yellow-brown. Stigma broader, less angular than in female, 2.5x as long as broad. Junction of 2r and 1Rs marked with conspicuous stub of 2Rs. Hind coxae not so conspicuously enlarged as in female, reaching only to just beyond posterior margin of tergite II. Metasomal tergites very similar to female except tergite I slightly narrower (1.5x as long as maximum width). Body length 2.1mm, forewing length 2.3 mm.

Final instar larva & cocoon. Unknown

Material examined. Holotype female: QUEBEC Old Chelsea, Summit King Mt. 1150', 8-VII-1961 (J.R. Vockeroth). Paratype male: MICHIGAN. Ann Arbor, Trap, 20–21-VI-1960 (H.& M. Townes).

Holotype deposited in CNC collection; paratype in AEI collection.

Hosts. Unknown.

Comments. No other member of the *bedelliae*-group has pale tegulae, very short parallel-sided ovipositor sheaths and long hind coxae (relative to the small metasoma). The superficial appearance is quite different from the other species, despite sharing most features with the rest of the *bedelliae*-group. It appears to be a rare species, since the general area in which it was collected has been well-surveyed.

***Pholetesor powelli*, new species**
(figs. 24, 49, 69)

Holotype female. Body length 2.7 mm, forewing length 2.7 mm.

Head. Frons 1.5x as broad at midheight as long down midline, weakly punctate with dull satiny finish; inner margins of eyes weakly converging towards clypeus. Antennae dark brown to black throughout, slightly shorter than forewing; flagellomere 2 3.5x as long as broad; flagellomere 14 1.7x as long as broad; all but apical 5 flagellomeres with 2 ranks of placodes. Palpi light yellowish except dark brown basal segments. Head in dorsal view approximately 2x broader than long down midline.

Mesosoma. Mesoscutum shallowly, very finely punctate, becoming nearly impunctate at extreme posterior edge; surface dull, satiny; width just anterior to tegulae approximately equal to tha of head. Scutoscutellar scrobe weakly arched medially, formed of 15–20 irregular but sharp, fine pits. Scutellar disc slightly longer than anteriorly broad, smooth, with fine, widely scattered shallow punctures; lateral margins unusually straight. Metanotum more or less appressed to scutellum, very weakly excavated along anterior margin mesad sublateral setiferous lobes; transverese depression at midlength on either side crossed by 3–4 short carinae; anteromedial depression broad. Propodeum shallowly rugulose except weakly sculptured in anterolateral corners, with irregular ridgeing radiating from nucha and weak transverse medial ridging.

Legs. All coxae dark brown to black; fore and middle trochanters lighter yellow-brown, at least in part; fore femora darkened proximally, especially dorsally, with light yellow-brown apices; fore tibiae and tarsi light yellow-brown except darkened apical tarsomeres; mid and hind femora mostly dark brown to black, lightening at extreme apices; mid and hind tibiae moderate yellow-brown except darker apical 0.2 of hind tibiae; mid tarsi concolorous with tibiae, hind tarsi infuscate. Spines on outer faces of hind tibiae 25-30 in number, some more slender than others and more difficult to distinguish from normal hairs. Inner hind tibial spurs of hind tibiae slightly longer than outer, 0.4x as long as hind basitarsi.

Wings. Tegulae dark brown. Wings tinted brownish; forewing venation mostly

medium brown; stigma, R1, 2r and 1Rs very dark brown, neraly opaque; R1 (metacarp) 1.2x as long as stigma, 4x as long as distance from it distal end to end of 3Rs fold along wing edge; stigma broad (length/width 2.0), edge facing 1Rs+M weakly convex; 2r slightly longer than 1Rs, weakly arched, meeting 1Rs at distinct 150-degree angle. Hindwing with Cu+cu-a weakly convex, moderately reclivous; vannal lobe barely flattened at midlength, fringed evenly with hairs of moderate length.

Metasoma. Tergite I barely broader anteriorly than posteriorly, with very weakly arched lateral margins, about 1.5x as long as posteriorly broad; surface longitudinally aciculate anteriorly surrounding shallow basal excavation, posteriorly aciculorugose with less conspicuous longitudinal element; apically with shallow depressions on either side of medial raised portion. Tergite II subequal in length with III, irregularly and longitudinally aciculate with small raised longitudinal medial ridge over anterior 0.5, posteriorly 2.5x as broad as medially long; posterior weakly crenulate margin nearly stright; lateral margins strongly arched. Third tergum unsculptured, longer than II. Succeeding terga not strongly telescoped under anterior ones in dried specimens. Laterotergites deep brown; posterior portions of metasoma entirely dark brown to black. Hypopygium nearly 1.5x as long as hind basitarsi; apically sharply acuminate, submedially weakly creased on either side, setting off narrow, more transparent and flexible medial fold. Ovipositor sheaths approximately same length as hypopygium, fully 3/4 as long as hind tibiae, broadly fusiformover most of length, ventrally more strongly curved than dorsally in profile; tip bluntly pointed; hairy over entire expanded portions; at broadest point nearly as broad as hind tibiae at midlength. Ovipositor evenly, weakly decurved.

Males. Similar in appearance to females except all but distal 3 flagellomeres with 2 ranks of placodes, flagellomere 14 longer. All femora black except distal portions of prothoracic, tibiae mostly to entirely dark brown-black. Tergite I 1.5–1.8x as long as maximum width; tergite II 2.0–2.2x as broad posteriorly as medially long, with slightly convex hind margin.

Variation. Body length 2.5–2.8 mm, forewing length 2.7–2.9 mm. All female specimens highly similar except that the specimen collected in August in Oregon from "*Lithocolletis*" on salal is considerably lighter in color, particularly in the mid and hind tibiae and wing venation.

Final instar larva. Labium with 1 pair of setae on short tubercles; maxillae each with one seta; mandibles set with 14–16 long teeth (not counting bifid tip).

Cocoon. Similar in appearance and location to that of *Pholetesor bedelliae*: white, satiny, blunt-oval, with coarse loose threads exteriorly, spun in the middle of host frass on the underside of skeletonized *Gaultheria* leaves or (I suspect) in the case of individuals reared from *Phyllonorycter* or *Cameraria*, spun within the host mine.

Material examined. Holotype female: CALIFORNIA. Santa Barbara Co., Santa Cruz Id., Canada Cervada, 4-II-1979, ex *Lithocolletis* on *Quercus wislizenii*, J.A. Powell no. 79B12, emgd. 1-III-79 (J.A. Powell). Paratypes: CALIFORNIA. Del Norte Co., Crescent

City, 1 female, 26-V-1978 (H.& M. Townes). Marin Co., Tomales Bay State Park, 1 female, 3-III-1984, ex skeletonizer on *Gaultheria shallon*, JBW bo. 84C2, emgd. 7-III-1984 (J.B. Whitfield). OREGON: Cannon Beach, 3 females, 2 males, 9-VIII-1940 (H.&.M. Townes). Seaside, 1 female, 7-VIII-1940 (H.&M. Townes). Waldport, 1 female, 6-VIII-1953, ex *Lithocolletis gaultheriella* on salal (R.G. Rosenstiel), 1 female, 22-IV-1940, ex skeletonizers on *Gaultheria shallon* (K.Gray, J. Shuh), 2 males, 1-V-1976 (H.&.M. Townes).

Holotype in CAS collection; paratypes in UCB, Oregon State University, AEI collections.

Hosts. Cameraria (?) sp. on *Quercus wislizenii* A.DC., *Cameraria gaultheriella* Walsingham on *Gaultheria shallon* Pursh, and an undetermined skeletonizer on the undersides of *Gaultheria* leaves.

Comments. The size and distinctive, large ovipositor sheaths are the best characters for recognizing this species. In other features, *P. powelli* could be confused with *P. bedelliae* and *P. thuiellae*. It is interesting that this species also attacks at least one non-leafmining host, but on the same plant species as a leafmining host it attacks. This species was referred to as *Pholetesor* species 3 in Whitfield & Wagner (1988) and Gates *et al*. (2002).

***Pholetesor thuiellae*, new species**
(figs. 50, 70)

Holotype female. Body length 1.9 mm, forewing length 2.1 mm.

Head. Frons 1.3x as broad as medially long, weakly punctate; inner margins of eyes weakly converging towards clypeus. Antennae mostly deep brown, with lighter brown pedicel; regions between placode bands appearing darker; length slightly shorter than forewing but as long as or slightly longer than body; all but distal 5–6 flagellomeres with 2 ranks of placodes; flagellomere 2 3.3x longer than broad; flagellomere 14 3.0x longer than broad. Palpi pale yellow-brown. Head in dorsal view 2x broader than medially long.

Mesosoma. Mesoscutum shallowly punctate (becoming less distinctly so posteriorly); surface between punctures dull, with weak metallic sheen; width just anterior to tegulae just narrower than head in dorsal view. Scutoscutellar scrobe narrow, composed of fine distinct pits, virtually straight medially. Scutellar disc weakly, sparsely punctate, slightly longer than anteriorly broad. Metanotum sublaterally very weakly excavated; transverse carinae at about midlength on either side well-developed, setting off narrow transverse troughs crossed by several short carinulae. Propodeum twice broader than long at longest point, anteriorly somewhat transversely sculptured medially, becoming weakly punctate laterally; posteriorly with oblique irregular ridging crossing lateral corners and short ridges radiating from nucha.

Legs. Pro- and mesothoracic legs with coxae, trochanters and femoral bases (esp. dorsally) deep brown; remainder of legs except tips of tarsi lighter yellow-brown.

Metathoracic legs mostly deep brown except light yellow-brown proximal 0.4 of tibiae. Outer faces of hind tibiae with approximately 30 scattered small spines. Inner hind tibial spur very slightly longer than outer.

Wings. Tegulae dark brown, barely translucent. Most of proximal venation of forewing very weakly brown-pigmented. 2r, 1Rs, C+Sc+R, stigma and R1 darker than remaining venation. R1 longer than stigma, about 4–5x as long as distance from its tip to end of 3Rs fold along wing edge. 2r slightly longer than 1Rs, weakly curved, meeting 1Rs at distinct obtuse angle. Vannal lobe of hindwing with even fringe of moderate length.

Metasoma. Tergite I somewhat barrel-shaped, nearly parallel-sided, broadest at just past midlength, 1.4x longer than maximum breadth, coarsely rugose except anteriorly around broad medial excavation. Tergite II subquadrate, about 2.2x broader posteriorly than medially long, with strongly rounded anterolateral corners, rugose throughout. Tergum III separated from II by crenulate straight furrow, anterolaterally with some roughened sculpturing but mostly smooth and similar in appearance to succeeding terga. Remaining terga partially overlapped by preceding 3, unsculptured and unmodified. Laterotergites deep brown, more or less concolorous with hind femora. Hypopygium at least 1.2x as long as hind basitarsi, very weakly creased sublaterally over apical half, setting off slightly more translucent medial fold; sharply acuminate apically. Ovipositor sheaths weakly decurved, thick, elongate-fusiform, broadest subapically, about same length (including basal hairless portion) as hypopygium, bluntly pointed at apex. Ovipositor weakly decurved.

Males. Not definitely associated with female (but see below under *Comments*). Probably virtually indistinguishable from males of *P. bedelliae*.

Variation. Body length 1.8–2.2 mm, forewing length 2.0–2.4 mm. The available material is relatively uniform in coloration and sculpturing, but some variability exists in the degrees of desclerotization of the hypopygium, the shape of the first metasomal tergite (from more or less parallel-sided to strongly bulging just past midlength) and the relative lengths of 2r and 1Rs (from 2r much longer to more or less equal in length).

Final instar larva. Not examined. I expect it is similar to that of the rest of the *bedelliae*-group.

Cocoon. When parasitizing *Argyresthia* spp., this species spins an elongate-oval, opaque white cocoon within the spindle-shaped cocoon of the host, after emerging from the host larva/prepupa. The form of the cocoon when parasitizing *Bucculatrix canadensisella* is probably similar (but not visible within the densely spun, ribbed, cigar-shaped host cocoon.

Material examined. Holotype female: QUEBEC. Hull, 1-VI-1960, ex *Argyresthia* sp. on western cedar (C.D. Miller). Paratypes: CONNECTICUT. New Haven, 2 females, 5-VI-1921, reared from *Argyresthia thuiella* material (M.P. Zappe). NEW BRUNSWICK. Frederickton, 1 female, 4-VI-1953, host *Argyresthia* n. sp. on arborvitae (Forest Insect Survey), 1 female, 16-VI-1952, host *Argyresthia* n. sp. on arborvitae (F.I.S.). NEW

YORK. Westbury, Long Island, 1 female, 22-V-1915, reared from *Recurvaria thujaella* (C. Heinrich).

Holotype in CNC, paratypes in CNC, USNM.

Other material: NEW BRUNSWICK. W. Haliburton, F'ton., 1 female, 10-VIII-1939, ex *Bucculatrix canadensisella* (no collector given). ONTARIO. Homepayne, 1 female, 24-VIII-1942, ex *Bucculatrix canadensisella* (F.I.S.). South Bay, 1 female, 15-VIII-1941, ex *A.*(?) *canadensisella* (F.I.S.). QUEBEC. Ste.-Foy, 1 female, 26-VIII-1956, ex *Fenusa pusilla* (F.I.S.). Locality uncertain, 1 female, found dead 27-X-1941, ex *Bucculatrix canadensisella* Chambers, F.I.S. Rec. 339 (F.I.S.).

Hosts. *Argyresthia thuiella* (Packard); apparently several other *Argyresthia* spp. (Argyresthiidae) on western cedar and arborvitae; *Coleotechnites thujaella* (Kearfott); *Bucculatrix canadensisella* Chambers. I regard the record from *Fenusa pusilla* (Lepeletier) (Hymenoptera: Tenthredinidae) to be suspect until confirmed.

Comments. This species is exceedingly similar to both *P. bedelliae* (Viereck) and *P. powelli* n. sp., differing most noticeably in the shape and length of the ovipositor sheaths, the slightly longer metacarp and the less strongly medially desclerotized and sharply pointed hypopygium.

I have associated a single male from Ontario, based mainly on the host record, similarities in tergite shape and the length of the metacarp. The legs (especially the tibiae) are darker brown generally than in the females, but the most striking sexual difference, if associated correctly, is the more colorless forewing venation in the male; only C+Sc+R, stigma, R1, 2r and 1Rs have any noticeable brown pigmentation. This male would be, by itself, considerably difficult to distinguish from males of *P. bedelliae*, which also apparently occasionally parasitize *Bucculatrix canadensisella*.

***Pholetesor variabilis*, new species**
(figs. 25, 52, 72, 82)

Holotype female. Body length 1.9 mm, forewing length 2.2 mm.

Head. Frons 1.3–1.5x broader at midheight than medially long, weakly punctate, with only faint suggestions of metallic luster; inner margins of eyes weakly converging towards clypeus. Postgenae, vertex and occiput weakly, shallowly punctate, with faint, dull metallic sheen. Antennae very dark brown throughout, somewhat stout, about as long as forewing, with all but distal 4–5 flagellomeres with 2 ranks of placodes; flagellomere 2 3.1x longer than wide; flagellomere 14 1.3x longer than wide. Palpi pale yellow-brown, proximally darker. Head in dorsal view about 1.9x broader than medially long.

Mesosoma. Mesoscutum shallowly and closely but distinctly punctate anteriorly, becoming more weakly so posteriorly near scutellum; surface otherwise slightly dull with little sign of metallic sheen; width just anterior to tegulae just slightly less than that of head. Pronotal furrow deep, indistinctly crenulate. Scutoscutellar scrobe nearly straight

medially, composed of about a dozen sharp, fine crenulations. Scutellar disc with shallow punctation, more widely spaced than on most of mesoscutum, somewhat shinier between punctures than mesoscutum, slightly longer than posteriorly broad. Metanotum weakly excavated anteriorly mesad sublateral setiferous projections, sometimes with shallow anterior indentations giving impression of stronger anterior retraction from scutellum, with transverse carinae on either side at about 1/3 of length and parallel to anterior edge, setting off transverse depressions that are crossed by 3 short carinulae. Propodeum finely, irregularly rugulose with superimposed small ridges radiating from nucha; width approximately 2x maximum length.

Legs. Front coxae, trochanters and proximal 0.3 (dorsally 0.7) of femora dark brown to black; remainder of legs fulvous with slightly infuscate tarsi. Middle legs of similar coloration except apical 0.3–0.4 of tibiae infuscate, tarsi more strongly darkened. Hind coxae, proximal trochanters dark brown to black; distal trochanters and femora infuscate yellow-brown; tibiae light yellow-brown over proximal 0.7, distal portions and tarsi dark brown. Spines on outer faces of hind tibiae about 25 in number, some difficult to distinguish from normal hairs. Inner hind tibial spurs slightly longer than outer, pale yellowish, about 1/3 as long as hind basitarsi.

Wings. Tegulae dark brown. Forewing venation pigmented dark brownish except paler proximal regions; stigma, C+Sc+R, R1, 2r and 1Rs most strongly pigmented. R1 slightly longer than stigma, about 3x as long as distance from its tip to end of 3Rs fold along wing edge; 2r slightly arched, subequal in length with 1Rs and meeting it at a distinct, approximately 125-degree angle. Stigma about 2.6x longer than broad, posterior edges nearly straight. Hindwing with vannal lobe nearly evenly convex, with even fringe of short hairs over distal 0.6 (proximally and at extreme distal end with longer fringe); Cu+cu-a of hindwing strongly reclivous, weakly arched.

Metasoma. Tergite I broadening posteriorly to a strongly rounded apex, slightly broader at widest point than long, broadly excavated anteromedially to about 0.3 of length; surface mostly strongly rugose. Tergite II subquadrate, 2.5x broader than long, slightly broader posteriorly; anterolateral corners somewhat irregularly sculptured and poorly defined; coarsely rugose throughout with weak medial longitudinal ridge. Tergum III subequal in length withII, anteriorly and medially finely sculptured. Laterotergites deep brown, nearly hidden in dorsal view. Hypopygium subequal in length with hind basitarsus, with weak submedial crease on either side; medial section hairless, more translucent and flexible but not multiply creased; tip of hypopygium bluntly acuminate. Ovipositor sheaths shorter than hind basitarsi, straight and with fusiform, expanded hairy distal 0.75 (very similar to those of *P. bedelliae*). Ovipositor moderately decurved.

Males. Leg coloration darker, with more extensive darkened portions of femora and tibiae; tergite I of metasoma narrower than in females, sometimes longer than broad; tergite III less extensively sculptured than in females. Antennae clearly longer than forewings, with more slender apical flagellomeres (flagellomere 14 2.0–2.3x longer than

broad); all but distal 3 flagellomeres with 2 ranks of placodes. Inner margins of eyes more strongly convergent than in females. Sometimes with nearly colorless M+Cu, 1M, 1Rs+M of forewing (when from Salix leafminers). Size not tending to be strongly different from females. Genitalia shown in figure 82.

Variation. Body length 1.6–2.2 mm, forewing length 1.9–2.3 mm. Variation exists in the breadth of the first metasomal tergite; some of the male specimens with narrower tergites can possibly be confused with males of *P. bedelliae*, although females of the two species tend to be more easily distinguished. A narrow, weak posteromedial depression is present on the first tergite in some individuals. The third tergum ranges from almost completely sculptured (at least medially) to virtually sculptureless except along the extreme anterior edge. A few specimens have the ovipositor sheaths as long as the hind basitarsus and/or a longer metacarp than does the type.

The specimens from leafminers on *Salix* and *Populus* are extremely similar to those from *Bucculatrix* spp. on various plants, despite the seeming contrast in host biologies. I have been unable to find consistent differences between the individuals from these hosts, so I have considered them conspecific until conflicting evidence arises.

Final instar larva. Labium with 1 pair of setae on short tubercles; maxillae each with 1 seta; mandibles set with 9–11 long teeth (not counting bifid tip).

Cocoons. On *Bucculatrix* spp., a delicate cocoon is spun as a liner within that of the host, so that its external appearance is not readily observed. I have not seen cocoons from the specimens attacking eastern gracillariids on *Salix*, but suspect the cocoon is similar to that of *P. bedelliae*. On a few occasions, I have found *bedelliae*-group type cocoons in *Phyllonorycter* mines on *Salix*, but have only reared (in the western U.S.) specimens I would assign to *P. bedelliae* from them.

Material examined. Holotype female: CALIFORNIA. Contra Costa Co., Tilden Regional Park, 20-VI-1981 (J.B. Whitfield). Paratypes: CALIFORNIA Alameda Co., Berkeley, 4 females, 7 males, 3/5-III-1983, ex *Bucculatrix* on *Baccharis pilularis*, JBW no. 83C2 (J.B. Whitfield, D.L. Wagner), 2 males, 10-IV-1983, ex *Bucculatrix* on *Baccharis*, JBW no. 83D19 (JBW), 1 female, 25-V-1983, ex *Bucculatrix* on *Baccharis* (JBW). Contra Costa Co., Tilden Reg. Pk, 2 males, 13-VI-1983, ex *Bucculatrix* on *Baccharis*, JBW no. 83F30 (JBW), 13 females, 1 male, 15-VIII-1983 (JBW), 14 females, 11 males, 25-VI-1983 (JBW).

Holotype, from JBW collection, deposited in USNM, paratypes in USNM, CNC, CAS, University of California, Berkeley, collections.

Other material: ALBERTA. Paddle Prairie, 2 females, 22-VII-1964, ex *Lyonetia* (Forest Insect Survey). BRITISH COLUMBIA. Penticton, 2 females, 6/8-VIII-1967 (J.R. Vockeroth). CALIFORNIA. Alameda Co., Berkeley Hills, 4 females, 1 male, 11-IV-1981, ex *Bucculatrix albertiella*, JBW no. 81D8 (JBW), 1 male, 7-VIII-1982 (JBW), 1 female, 13-VIII-1983 (JBW). Patternson Reserve, Del Valle Lake, 1 female, 2 males, 9-III-1974,

ex *Bucculatrix variabilis*, JAP no. 74C2 (J.A. Powell). Strawberry Canyon, 2 females, 11-IV-1968, ex *Bucculatrix albertiella*, JAP no. 68D117/8 (P.Opler). Alpine Co., nr. jct. 4 & 89, 2 females, 9-VII-1983 (JBW, DLW). Contra Costa Co., 2 mi. E. Antoich, 1 male, ex *Bucculatrix albertiella* on *Quercus agrifolia*, JAP no. 68D55 (P.Opler). Lafayette, 1 female, 6-VII-1956 (R.A. Stirton), 1 female, 20-V-1983 (JBW). Moraga, 1 female, 2 males, 21-VII-1977 (D.G. Denning). E. Mt. Diablo, nr. Clayton, 8 females, 20 males, 27-II-1982, ex *Bucculatrix* on *Baccharis pilularis* (DLW, JBW). Redwood Regional Park, 1 male, 28-VIII-1968, ex upperside blotches on *Dirca occidentalis* (P.Opler). Tilden Regional Park, 3 males, 29-IV-1981 (JBW), 1 female, 22-VII-1982 (JBW), 1 male, 29-VIII-1982 (JBW), 7 females, 10 males, 18-III-1984, ex *Bucculatrix* on *Baccharis pilularis*, JBW no. 84C34 (JBW). El Dorado Co., Fallen Leaf Lake, 3 females, 3/4-VII-1983, ex *Bucculatrix* on *Artemisia tridentata* (DLW). Kern Co., Belridge, 1 female, 20-VI-1979 (D.B. Wahl). Los Angeles Co., Santa Catalina Id., Middle Canyon, 250' el., 1 male, 2-V-1978, ex *Aristotelia* on *Salix lasiolepis*, JAP no. 78E11 (J.A. Powell). Marin Co., Lily Lake/Alpine Lake, 1 male, 14-IV-1979, ex *Bucculatrix* sp., JAP no. 79D4 (J.A. Powell). Mendocino Co., Hopland, U.C. Field Sta., 1 male, 4-IX-1976, ex *Quercus lobata* leafminers (D.S. Green). Riverside Co., Riverside, 1 male, IV-1948, ex *Bucculatrix* coccon on *Artemisia californica* (P.H. Timberlake). San Benito Co., Rock Gulch, 1 male, 10-V-1977, ex *B. albertiella* on *Q. agrifolia*, JAP no. 77E79 (D.S. Green). San Diego Co., La Jolla, 1 female, 18-II-1984, ex *Bucculatrix* on *Malacothamnus*, JAP no. 84B60 (D.L Wagner). San Diego, 1 male, 27-I-1975 (L. Hawkins). San Lius Obispo Co., 5 mi. SE Cambria, 1 male, 28-III-1984, ex *Bucculatrix* on *Q. agrifolia*, JAP no. 84C47 (DLW). San Mateo Co., Woodside, 1 female, 10-V-1977, ex *B. albertiella* on *Q. agrifolia*, JAP No. 77E102 (D.S. Green). Santa Clara Co., Stanford Univ., 1 female, 9-V-1952 (P. Arnaud). Santa Cruz Co., Santa Cruz, 2 females, 10-V-1977, ex leafminers (probably *Bucculatrix*) on *Q. agrifolia* (D.S. Green). Nr. Felton, 1 male, 31-VII-1982, ex *Bucculatrix* (from live oak?) (JBW). Siskiyou Co., 1 mi. S. Castella, 2 females, 1 male, 17-IX-1982, ex *Bucculatrix* on *Quercus garryana*, JAP no. 82J122/3 (D.L. Wagner). Tulelake, 1 female, 12-VIII-1977, black light trap (T.R. Haig). Solano Co., Cold Creek, nr. Monticello Dam, 1 male, 18-V-1975 (R.W. Brooks). Fairfield, 1 male, 20-IX-1955 (R.M. Bohart). Sonoma Co., Sebastopol, 1 female, 1-II-1933, ex *Bucculatrix variabilis* (Keifer). Sutter Co., Feather River nr. Nicolaus, 1 male, 4-X-1982, ex *Bucculatrix* on *Artemisia douglasiana* (JBW, DLW), 1 male, 1-IX-1981, ex *Paraleucoptera* on *Populus fremontii*, JAP no., 81J2 (DLW). Live Oak Park, 1 female, 1 male, 24-V-1944 (no collector given). Yolo Co., Davis, 1 female, 6-X-1961 (M.E. Irwin), 1 female, 27-IV-1959 (F.E. Strong), 1 female, 15-X-1952 (J.C. Hall). Putah Creek, 9 mi. W. Winters, 3 females, 2 males, 19-V-1968, ex *Cameraria* (?) on *Salix*, JAP no. 68E28 (P. Opler). 4 mi. NE Rumsey, 1 female, 3-VI-1960 (R.O. Schuster). COLORADO. Doolittle Ranch, Mt Evans, 9800' el., 1 male, 9-VII-1961 (S.M. Clark), 1 female, 4-VIII-1961 (S.M. Clark). IDAHO. Ada Co., 10 mi. NE Kuna, 1 female, 11-VII-1952, on *Phacelia* (W.F Barr). Boise, 1 male, 22-V-1961, on *Purshia*

tridentata (M.M. Furniss). Craters of the Moon Nat. Mon., Little Cottonwood Creek, 1 female, 23-VI-1965 (D.S. Horning). Lewiston Hill, 1 male, 3-V-1925 (A.L. Melander). Nez Perce Co., 4 mi. S. Lewiston, 1 female, 5-X-1978 (B. Sullivan). MICHIGAN. Mackinac Co., 1 male, 4-VI-1959 (R. & K. Dreisbach). Osceola Co., 1 female, 14-VI-1952 (R.R. Dreisbach). NEVADA. Elko Co., 10 mi. W. Carlin, 1 female, 6-VII-1956 (T.R. Haig). ONTARIO. Barrow Bay, 2 females, 4 males, 17-VII-1952, ex *Lithocolletis tremuloidella* (Forest Insect Survey). Christian Island, 1 female, 3 males, 16-VII-1952, ex *L. tremuloidella* (FIS). Clear Lake, 1 female, 2 males, 24-VII-1952, ex *L. tremuloidella* (FIS). Fort Frances, 1 female, 26-VII-1947, ex *L. tremuloidella* (FIS). Fort Hope, 1 female, 21-VIII-1950, ex "Gracillariidae" (FIS). Franz, 1 female, 1 male, 28-VII-1962, ex *Lithocolletis salicifoliella* (FIS). Hearst, 3 females, 3 males, 3-9-VIII-1971, ex *Micrurapteryx* on *Salix* (FIS), 3 females, 3 males, 3-VIII-1972, ex *Micrurapteryx* on *Salix* (FIS). Hornepayne, 2 females, 1 male, 2-VIII-1979, ex *Micrurapteryx* on *Salix* (FIS). Longlac, 3 females, 2 males, 28-VII-1975, ex *Micrurapteryx* on *Salix* (FIS). Ralphton, 2 females, 11-VIII-1952, ex *Lithocolletis tremuloidella* (FIS). Redvers Twp., 2 femels, 3 males, 24-VII-6-VIII-1946, ex *L. tremuloidella* (FIS). Southworth Twp., 1 female, 1 male, 29-VII-7-VIII-1946, ex *L. tremuloidella* (FIS). Wabanash L., 1 female, 2 males, 27-VII-1944, ex *Lithocolletis* sp. (FIS). Zealand, 1 female, (?)-1946, ex *L. tremuloidella* (FIS). Locality uncertain, 5 females, 2 males, no dates, ex *L. tremuloidella* (FIS). OREGON. Lake Co., 24 mi. SE La Pine, 1 male, 12-VII-1957 (G.F. Kraft). SASKATCHEWAN. Ceylon, 1 male, 4-VIII-1977, swept ex *Artemisia biennis* (G. Kelley). Elfros, 1 female, 27-VII-1977, swept ex *Artemisia biennis* (M.G. Maw). La Ronge, 1 female, VII-1977 (N.L.H. Krauss). UTAH. Provo, 1 female, 20-VIII-1962 (N.M. Jorgensen).

Hosts. *Bucculatrix albertiella* Busck on *Quercus agrifolia* Nee, *B. variabilis* Braun and *B. separabilis* Braun on *Baccharis pilularis* DC, various undetermined *Bucculatrix* spp. on *Artemisia californica* Bess., *A. douglasiana* Bess., *A. tridentata* Nutt. and *Quercus garryana* Douglas; *Paraleucoptera albella* on *Populus fremontii* Wats., *Phyllonorycter* spp. on *Populus* and *Salix* spp., and *Micrurapteryx salicifoliella* (Chambers) on *Salix* sp.

Comments. In virtually all features except width of the first metasomal tergite, length of the second tergite and (in part) choice of hosts, *P. variabilis* is extremely similar to *P. bedelliae*. I am not at all certain that all of the individuals I have placed under this name are conspecific, as the host range is fairly broad both ecologically and taxonomically. However, the same situation appears to be true for *P. bedelliae* (in fact, involving some of the same host and plant genera). Despite the parallels in the two species, the constancy of the morphological differences between the two species across a wide range of hosts impels me to regard the two as separate taxa. In addition, these differences hold up even when, in rare cases, the two attack the same host at the same locality.

This species is referred to as *Pholetesor* species 4 in Whitfield & Wagner (1988).

***Pholetesor viminetorum* (Wesmael)**
(figs. 26, 53, 73, 83)

Microgaster viminetorum Wesmael, 1837. *Nouv. Mem. Acad. Belg.* **10**: 50. Type not examined.
Microgaster fuliginosus Wesmael, 1837. *Nouv. Mem. Acad. Belg.* **10**: 52–53. Syn. by Wilkinson (1945). Type not examined. See Nixon (1973) and Papp (1983a&b) for additional synonymical information.

Females. Body length 2.0–2.5 mm, forewing length 2.2–2.5 mm.

Head. Frons 1.2–1.3x broader at midheight than medially long, weakly punctate; inner margins of eyes strongly convergent. Antennae approximately same length as forewing, very dark brown; all but apical 6 or 7 flagellomeres with 2 ranks of placodes; flagellomere 2 3.2–3.5x as long as broad; flagellomere 14 1.4–1.6x longer than broad. Palpi lighter than antennae but still deep brown. Head in dorsal view approximately 2.0x broader than medially long.

Mesosoma. Mesoscutum shallowly but distinctly punctate anteriorly, becoming more indistinctly so posteriorly; surface between punctures moderately shiny without strong metallic sheen; width just anterior to tegulae equal to that of head. Scutoscutellar scrobe relatively coarse, not set in depression. Scuellar disc much less strongly punctate than mesoscutum, shiny between punctures, approximately 1.3x longer than anteriorly broad. Metanotum weakly excavated anteriorly, nearly appressed to scutellum; transverse carinae on either side poorly developed, remnants closer to anterior edge then posterior; transverse depression on either side irregularly sculptured, not deeply impressed. Propodeum approximately 1.8x broader than long at longest point, coarsely rugose posteriorly near nucha, becoming finely rugulose anteriorly and nearly smooth in posterolateral corners; nucha with very short ridges radiating anteriorly.

Legs. All coxae nearly black, rest of legs very dark brown except lighter tibial bases; brightness and extent of lighter yellow-brown areas strongly variable geographically. Pines on outer faces of hind tibiae about 30 in number, irregularly distributed. Apical spurs of hind tibiae subequal in length, not more than 0.4 as long as hind basitarsi.

Wings. Tegulae very dark brown, weakly translucent. Venation of forewing unusually evenly dark-brown pigmented; stigma entirely dark brown. R1 slightly longer than stigma, about 3x as long as distance from its distal tip to end of 3Rs fold along wing edge; 2r slightly arched, equal to or longer than 1Rs, meeting it at a distinctly knobbed junction. Hindwing with anterior venation distinctly pigmented, posteriorly with pale veins; vannal lobe somewhat flattened but evenly fringed with hairs of moderate length.

Metasoma. Tergite I 1.7–2.1x longer than broad at midlength, weakly to strongly narrowing posteriorly, strongly rugose posteriorly, weakly and longitudinally costulate anterolaterally, with weak concentric sculpturing around basal depression; apically with small raised medial polished bump. Tergite II 2.1–2.3x broader posteriorly than medially long, weakly rugulose to costulate, becoming smoother and more polished medially; hind margin distinctly convex to weakly bisinuate. Tergum III longer than tergite II, without

obvious sculpturing. Laterotergites medium to dark brown. Succeeding terga of usual unsculptured, overlapping type. Hypopygium medially longer than hind basitarsus, submedailly weakly creased, setting off narrow, medial, more translucent fold; tip bluntly acuminate. Ovipositor sheaths decurved basally, broadly expanded apically into short, asymmetrical paddle shape (longer ventrally); hairs somewhat longer and denser apically; entire length of sheaths slightly longer than hind basitarsi; expanded portions only 0.75–0.8 length of hind basitarsi. Ovipositor weakly decurved.

Males. Similar in coloration to females; body length 1.9–2.5 mm, forewing length 2.2–2.5 mm. Antennae longer and more slender than in females, clearly longer than forewing and with all but apical 2–3 flagellomeres with 2 ranks of placodes. Tergite I narrower, smoother than in females; tergite II usually longer relative to its posterior width. Usually easy to associate with females on shape of metasomal tergites, wing venation and coloration, and somewhat slender overall proportions of body.

Variation. I have assigned to this species specimens differing strongly in color and (to a lesser degree) in ovipositor sheath breadth from the above redescription. The leg coloration can be quite light yellow-brown (especially on the femoral apices, tibial bases and tarsomeres, but occasionally more generally) in som eastern populations (esp. Michigan, Minnesota), to extremely dark brown at high elevations and/or latitudes. Several Rocky Mountain series (Colorado) have even broader, more truncate ovipositor sheaths than in the figured Alaskan material, whereas the eastern specimens in general tend to have slightly narrower sheaths. There also exists considerable variation in the width of the first metasomal tergite, but this seems to be intrapopulational more than geographical, suggesting size correlation or some other physiological cause.

Final instar larva. Described in part from European material by Short (1953). Apparently with the usual plesiomorphic *bedelliae*-group complement of one pair of labial setae and one seta on each maxilla, and has 17 teeth on the mandible, not counting the bifid tip (Short counts 18 but includes one of the tip points).

None of the nearctic specimens has been reared, so I have been unable to examine any associated cocoons and larvae.

Cocoons. The cocoons associated with palearctic material appear to be similar to those of *P. bedelliae*, but I have seen none from nearctic material.

Material examined. 110 females, 176 males: from ALASKA, ALBERTA, BRITISH COLUMBIA, COLORADO, IDAHO, MICHIGAN, MINNESOTA, NEW HAMPSHIRE, NOVA SCOTIA, SOUTH DAKOTA, UTAH (7000' elevation), WASHINGTON, WYOMING, YUKON TERRITORY; mostly July, August records but a few late May, June in some southerly localities.

I have also examined Palearctic material in the CNC and BMNH, determined by Wilkinson, Nixon and Papp, in the Royal Museums of Scotland (MRS) and from my own collections in Britain and Europe.

Hosts. Not known to have been reared in North America. In Europe and Great Britain, *P. viminetorum* appears to be mainly a parasite of various elachistid miners on grasses and sedges (Nixon, 1973). The Nearctic distribution of this species is consistent with a possible similar host range here.

Comments. The broad, asymmetrically truncate ovipositor sheaths and convex posterior margin of the second metasomal tergite are diagnostic for this species. Only *P. rhygoplitoides* comes close in ovipositor sheath shape, but it differs so strongly in metasomal tergite shapes that confusion is unlikely.

I have been unable to find consistent differences between nearctic and palearctic series, so have considered them conspecific; biological or genetic data on the nearctic populations could show this to be incorrect. In the light of its evidently northern distribution, it is not surprising that the species appears to be holarctic; this pattern is common in boreal ichneumonoids.

The *ornigis*-group

This and the following group comprise most of the *circumscriptus*-group of Nixon (1965, 1973) and Papp (1983a, b). The division between them may eventually prove to be an artificial one, but seems to be supportable so far by the maxillary setal number in the final instar larvae. The groups are fairly easily separated by the degree of sculpturing of the anterior metasomal tergites.

The *ornigis*-group can be characterized by the following combination of character states, most of which (with the exceptions noted above) are shared with the circumscriptus-group (s.s.): 1) metanotum broadly retracted from scutellum, exposing portions of the mesothoracic postphragma and with the sublateral setiferous lobes often not reaching the scutellum; 2) areola and transverse carinae of propodeum absent, replaced by two series of ridges diverging obliquely from nucha; 3) metasomal tergite I subparallel-sided to posteriorly narrowing, usually much longer than broad, coarsely sculptured; rarely broadening weakly posteriorly and not much longer than broad; 4) tergite II broadly trapezoidal to subtriangular, coarsely sculptured, slightly to much shorter than III down midline; 5) tergite III sculptured at most anteromedially, rarely over most of tergite but not rounded posterolaterally; 6) tergum IV unmodified, anteriorly overlapped by III and similar in appearance to succeeding terga; 7) sternites 3–6 of female anteromedially split or notched; 8) hypopygium evenly sclerotized to medial fold, not produced at tip; 9) ovipositor sheaths arising at or above mid-height of valvifers; 10) volsellae of male genitalia each with 2 setae along medioventral edge; 11) gonobase (basal ring) of male genitalia approximately as long as broad; 12) final instar larva with 6–7 pairs of labial setae; 13) final instar larva with 2 setae on each maxilla; 14) cocoon slender, smooth, capsule-like, often banded centrally by area of thinner silk layer, suspended within the mine of the host by a thread from each end; 15) hosts are various blotchmining genera of

Gracillariidae, Tischeriidae and Elachistidae, mostly on broadleaved trees, vines and shrubs.

I include here five nearctic species: *P. caloptiliae* n. sp., *P. glacialis* (Ashmead), *P. ornigis* (Weed), *P. salalicus* (Mason) and *P. salicifoliellae* (Mason). There are a number of closely related species throughout the Palearctic Region, some of the Asian species of which may eventually prove synonymous with some of the nearctic species treated here (see also under the individual species diagnoses and comments).

The form of the cocoon and the larval head setation patterns shared with the *circumscriptus*-group are, to my knowledge, unique among Microgastrinae.

***Pholetesor caloptiliae*, new species**
(figs. 13, 27, 54, 74)

Holotype female. Body length 2.3 mm, forewing length 2.7 mm.

Head. Frons 1.3x broader at midheight than medially long, shallowly but distinctly and finely punctate; inner margins of eyes very weakly converging towards clypeus. Antennae dark brown throughout, slightly longer than forewing; all but distal 4 flagellomeres with 2 ranks of placodes; flagellomere 2 3.5x longer than broad; flagellomere 14 1.9x longer than broad. Palpi whitish-yellow throughout visible portions. Head in dorsal view 1.8x broader than long down middle.

Mesosoma. Mesoscutum evenly, very finely and shallowly punctate, with intervening microsculpture producing dull metallic sheen; width just anterior to tegulae slightly greater than that of head. Pronotal furrow broad, shiny, with only peripheral suggestions of crenulation. Scutoscutellar scrobe composed of 8–10 (irregularly confluent) deep, narrow pits, essentially straight medially. Scutellar disc dully shining, with shallow, fine punctation; shape strongly triangular, weakly convex, slightly longer than anteriorly broad. Metanotum slightly overlapped medially by strongly raised scutellum; strongly emarginate mesad sublateral setiferous projections but retraction from scutellar phragma nearly obscured by encroachment of scutellum, especially medially; sublaterally irregularly sculptured with carinulae. Propodeum 1.9x broader than maximum length, anteriorly rugulopunctate, posterolaterally shiny with widely spaced irregular carinulae, posteromedially with carinulae diverging forward obliquely from nucha; posterolateral corners set off from anterior portions by more or less distinct costulae.

Legs. Front and middle legs entirely light yellow-brown except terminal tarsomeres. Hind coxae mostly dark brown, apically lighter yellow-brown; remainder of hind legs pale yellow-brown except infuscate apical dorsal spot on femora, apical 0.5 of tibiae and entire tarsi. Spines on outer faces of hind tibiae about 35 in number, all of one size and pale yellow-brown. Inner apical spurs of hind tibiae 1.6x as long as outer, about half as long as hind basitarsi.

Wings. Forewing venation pigmented evenly pale brown except slightly darker 2r and 1Rs and dark brown C+Sc+R, stigma and R1; macrotrichia darkly pigmented, imparting faint infuscation to wing membranes. 2r weakly arched, subequal in length with 1Rs, meeting it at distinct 155-degree angle. R1 1.2x as long as stigma, aboux 7x as long as distance from its distal tip to end of 3Rs fold along wing edge. Stigma 2.8x longer than broad, the 2 posterior edges nearly straight. Hindwing with vannal lobe evenly convex, fringed densely with hairs of moderate length.

Metasoma. Tergite I 1.3x as long as posteriorly broad, strongly arched anteriorly along longitudinal axis, posteriorly broadening slightly over most of length; apical corners weakly rounded; surface strongly rugose throughout except broad, short anteromedial depression. Tergite II broadly trapezoidal, 2.4x broader posteriorly with weakly rounded anterolateral corners; surface strongly rugose throughout; posterior breadth only 1.3x posterior breadth of tergite I. Tergum III mostly covered dorsally in strong rugose sculpture, posterolaterally becoming smooth as in succeeding terga, slightly broader medially than tergite II and separated from it by crenulate furrow. Laterotergites light yellow-brown, nearly hidden in dorsal view. Posterior terga unsculptured, overlapping, partially telescoped in under anterior 3. Hypopygium evenly sclerotized to medial fold, ventrally with evenly scattered long hairs, in holoype somewhat puckered but apparently about 1.2x as long as hind basitarsi (2/3 as long as hind tibiae). Ovipositor sheaths slender, about same length as hypopygium, hairy portions broadest at about 2/3 of length, slightly narrowing thereafter to bluntly rounded/pointed tips. Ovipositor strongly decurved, long and exserted to a length about equal to that of hind tibiae.

Males. Antennae about 1.2x as long as forewing, with apical flagellomeres more slender than in female (flagellomere 14 2.3x as long as broad); only the distal 3 flagellomeres with only a single placode band. Front and middle coxae and mid and hind femora usually darker than in female. Propodeal sculpturing similar to female but costulae usually less distinct. Metasomal tergite I parallel-sided to weakly narrowing posteriorly, with nearly straight sides, approximately twice as long as broad. Tergite II less transverse than in female (about 1.9x broader posteriorly than medially long)—otherwise similarly sculptured and shaped to female. Tergum III similar in length and sculpturing to that of female, but sometimes less strongly sculptured. Wings with colorless macrotrichia, imparting a milky appearance to wing membranes.

Variation. Females: body length 1.9–2.5 mm, forewing length 2.1–2.7 mm. Males: body length 2.1–2.5 mm, forewing length 2.4–2.6 mm. The males appear to be more variable in coloration and metasomal tergite shape than the females (as occurs in the other ornigis-group species also). One female from New York reared from *Caloptilia* on *Rhus typhina* L. is much smaller than the others (hence the appearance from the above size ranges that the females may tend to be smaller), but is otherwise similar in diagnostic features. I have no male with which to associate it from the same series.

Final instar larva. Labium with 7 pairs of setae; maxillae each with 2 setae; mandibles set with 16–18 long teeth (not counting bifid tip).

Cocoons. Large (3–4 mm), elongate-oval, capsule-like, with threads attached at the ends, opaque-whitish, with very narrow translucent medial band (0.1 or less of total length), suspended within the shelter of the host.

Material examined. Holotype female: ONTARIO. St. Lawrence Isl. Nat. Pk., McDonald Isl., 16-VII-1976 code 4-4271 (Reid). Paratypes: CONNECTICUT. East River, 1 female, 3 males, 14-VII-1915, ex *Gracilaria burgessiella* on *Cornus candidissima* (C.R. Ely), 2 females, 2 males, 23-VII-1914, ex *Gracilaria burgessiella* (C.R. Ely), 1 female, 28-VII-1912, ex *Graciallaria burgessiella* on *Cornus* (C.R. Ely), 1 male, 16-VIII-1912, ex *Gracilaria coroniella* (C.R. Ely), 1 male, 3-IX-1914, ex *Gracilaria coroniella* (C.R. Ely), 1 female, 10-VII-1911, ex *Gracilaria* sp. (C.R. Ely), 2 females, 2 males, 12-20-VII-1912, ex *Gracilaria rhoifoliella* (C.R. Ely). INDIANA. Bedford, 1 female, 1-VIII-1932, reared from leaf miner on *Rhus corallina* (G.E. Marshall). ONTARIO. Normandale, 1 female, 12/14-VIII-1956 (Freeman & Lewis). St. David's, 1 female, 16-IX-1935 (W.L. Putnam). St. Lawrence Isl. Nat. Park, Grenadier I. Centre, 1 female, 7-III-1975 (Sigler), 1 female, 21-VIII-1975 (R.J. McMillan), 1 female, 11-VIII-1975 (E. Sigler). Vineland Station, 1 female, 2-VI-1936, ex *Gracilaria* sp. on *C. paniculata* (W.L. Putnam).

Holotype deposited in CNC; paratypes in CNC, USNM collections. Additional material in University of Kansas and author's collections.

Other material: NEW YORK. St. Lawrence Co., Oak Point, 1 female, ex *Caloptilia* on *Rhus typhina*, JAP no. 83H2 (D.L. Wagner). OHIO. Barberton, 1 female, 13-VIII-1936 (L.J. Lipovsky), 1 female, 23-VIII-1936 (L.J. Lipovsky).

Hosts. *Caloptila burgessiella* (Zeller) and *C. coroniella* (Clemens) on *Cornus* spp., *C. rhoifoliella* (Chambers) on *Rhus* spp.

Comments. This species is extremely similar to *Pholetesor ornigis* (Weed) and the palearctic *P. nanus* (Reinhard), but the ovipositor sheath shape, ovipositor length, broad first metasomal tergite, large size (usually) and long metacarp should suffice to distinguish it from both species. There is some tendency in *P. ornigis* for large individuals to have broader first metasomal tergites and coarse posterior propodeal sculpturing as in this proposed new species, but I have found no large individuals of *P. ornigis* that approach *P. caloptiliae* in all of the above characters. It remains to be seen whether the two are separate biological species or simply host-associated morphotypes. This species is referred to as *Pholetesor* sp. 1 by Whitfield and Wagner (1988).

***Pholetesor glacialis* (Ashmead)**

Protapanteles glacialis Ashmead, 1902. *Proc. Wash. Acad. Sci*. **4**: 248. Included in *Pholetesor* by Mason, 1981, *Mem. Entomol. Soc. Can.* **115**.

The following notes on the holotype male are provided for the sake of comparison, although the identity of this species and its relationship with the rest of the group are uncertain (see below under *Comments*).

Holotype male. Head without unusual features for *ornigis*-group; left antenna broken after flagellomere 1; right broken after flagellomere 9.

Mesosoma. Mesoscutal punctation very indistinct posteriorly near scutoscutellar scrobe; scrobe clearly but not strongly arched medially. Scutellum 1.3x longer than wide anteriorly, sculptured as on mesoscutum. Metanotum clearly retracted from scutellum, broadly excavated anteriorly mesad of sublateral setiferous projections. Propodeum apparently moderately rugose anteriorly (cracked medially by pinhole) with radiating ridges extending anteriorly from nucha; posterolaterally nearly smooth, depressed with some semitransverse ridging in extreme corners.

Legs. All coxae, trochanters and most of lengths of femora deep brown, becoming lighter distally near junction with tibiae (especially on forelegs); tibiae much lighter than femora on pro- and mesothoracic legs, somewhat less so on metathoracic leg except near junction with femur; tarsi all concolorous with tibiae. Outer faces of hind tibiae with scattering of small spines typical of group. Inner hind tibial spur apparently much longer than outer but broken (also, right metathoracic leg missing).

Wings. Tegula moderately deep brown, translucent. Left forewing missing. Anterior venation of forewing (C+Sc+R, stigma, R1, 2r and 1Rs) distinctly more strongly brown-pigmented than remainder of venation. R1 weakly curved, barely longer than stigma, extending about 0.75 distance to end of 3Rs fold (which curves slightly to anterior over distal half). 2r shorter than 1Rs, meeting at somewhat rounded but still definable junction (similar to that of *P. salalicus*).

Metasoma. Tergite I 1.8x longer than maximum width, shallowly excavated anteriorly to about 0.4–0.5 of length; margins parallel over anterior 0.5, than converging in round curve to a narrower apex. Tergite II subtriangular, with barely curved, apically diverging lateral margins, rugose but with perceptible longitudinal trend in sculpturing medially; 1.5x broader posteriorly than medially long. Tergum III with very little sculpture and that immediately adjacent to groove separating it from II.

Label data. Muir Inlet, 6-12-99, Harriman Expedition '99, T. Kincaid, collector; male type, no. 5705 USNM; *Protapanteles glacialis* Ashm. male.

Comments. I have associated with the type a very similar male, from northwestern North America (Vedder, BC) and reportedly reared from *Hyphantria textor* (Harr.) (which is now synonymized under *H. cunea* (Drury) (Arctiidae)). The record seems almost certainly in error; a cocoon is mounted with the specimen which is virtually identical to those of *P. ornigis* and *P. salicifoliellae*, and these cocoons are, in my experience, always found within a leaf mine or shelter, and made by a larva that has parasitized a leafminer.

The difficulty in placing this species, and in applying the name, stems from the

uncertainty in associating isolated male specimens with females. Males tend to be more variable in tergite shape, coloration and size than females, and, in the ornigis-group, sexual dimorphism in coloration and tergite shape reaches the extreme found in the genus. As a result, it is often impossible to tell whether a lone male belongs to *P. ornigis* or *P. salicifoliellae* (or occasionally also *P. salalicus*). Series are usually needed, and occasionally even then placement is uncertain unless the host is known. Since the male type of *P. glacialis* is not easily assigned to one of the above three species on morphological grounds, it will likely require more collecting in the type locality or vicinity to associate the male with a female. *P. ornigis* has not been recorded from Alaska, to my knowledge, but may well occur there, since it appears widely across northern North America. *P. salalicus* and *P. salicifoliellae* are known from the region (*P. salicifoliellae* appears to be especially abundant), but the holotype of *P. glacialis* does not appear to match exactly the known and associated males of either, although it falls within the range of possible variability of both (in coloration and shape of the second tergite it more strongly resembles *P. salalicus*; in the shape of the first tergite and in leg coloration it fits *P. salicifoliellae* better). As mentioned earlier, the cocoon resembles those of both *P. salicifoliellae* and *P. ornigis* (but not *P. salalicus*). If the mistaken host were due to a mixed lot of Lepidoptera on the same host plant, it might seem possible to determine the likely host from that information; unfortunately, no host plant is given for the associated male from British Columbia and *H. cunea* is known to be a polyphagous species.

I choose for now to treat *Pholetesor glacialis* as a dubious distinct species, until more is known. The name would stand as the senior synonym of either *P. salalicus* or *P. salicifoliellae* if it were to prove conspecific; I am not prepared to sink either name on the weak available evidence.

***Pholetesor ornigis* (Weed)**
(figs. 14, 28, 55, 75, 84)

Microgaster robiniae Fitch, 1859 (1858). *Trans. N.Y. State Agric. Soc.* **18**: 836. Holotype female, USNM no. 1814 (examined). Application to International Commission of Zoological Nomenclature (Whitfield, 1986, *Bull. Zool. Nomencl.* **43**: 96–98) resulted in conservation of *ornigis* (Weed) as the valid name (*Bull. Zool. Nomencl*. **44**).

Apanteles ornigis Weed, 1887. *Bull. Ill. State Lab. Nat. Hist.* **3**: 6. Lectotype in Illinois Natural History Survey, designated by Frison (1927, *Ill. State Nat. Hist. Surv. Bull.* **16**: 137–309) (examined). Designated type species of *Pholetesor* Mason by Mason, 1981, *Mem. Entomol. Soc. Can.* **115**.

Protapanteles tortricis Ashmead, 1898 (1897). Proc. Entomol. Soc. Wash. 4: 163. Holotype female, USNM no. 12798 (examined). Synonymized by Muesebeck, 1920, *Proc. U.S.Nat. Mus.* **58**: 483–576.

Apanteles (Apanteles) braunae Viereck, 1912. *Proc. U.S. Nat. Mus.* **42**: 614. Holotype male, USNM no. 14701 (examined). Synonymized by Muesebeck, 1920, *Proc. U.S. Nat. Mus.* **58**: 483–576.

Apanteles (Apanteles) lithocolletidis Viereck, 1912, *Proc. U.S.Nat. Mus.* **42**: 615. Holotype male, USNM no. 14704 (examined). Synonymized by Muesebeck, 1920, *Proc. U.S. Nat. Mus.* **58**: 483–576.

Females. Body length 1.5–2.4 mm, forewing length 1.8–2.4 mm.

Head. Frons. 1.3–1.4x broader at midheight than medially long, distinctly but not deeply punctate; inner margins of eyes weakly converging towards clypeus. Antennae dark brown, slightly longer than body in dried specimens; junction between pedicel and flagellum lighter in color ; all but distal 4–6 flagellomeres with 2 ranks of placodes; flagellomere 2 3.7–3.8x as long as broad; flagellomere 14 1.6–1.8x as long as broad. Palpi light yellow-brown throughout. Head in dorsal view approximately 2.0x as broad as medially long.

Mesosoma. Mesoscutum in dorsal view slightly broader than head, shallowly punctate anteriorly to virtually impunctate posteriorly; microsculpture producing dull, satiny-metallic sheen between punctures. Pronotal furrow weakly crenulate. Scutoscutellar scrobe fine, narrow, arched slightly medially, not set in depression. Scutellar disc sculptured as posterior region of mesoscutum, slightly longer than anteriorly broad. Metanotum strongly retracted from scutellum, exposing mesothoracic postphragma, broadly excavated mesad sublateral setiferous projections; transverse carinae at about midlength usually weakly developed but distinct. Propodeum 1.7–1.8x broader than long at longest point, generally weakly rugulose with strong, irregular ridging radiating from nucha; sometimes with hints of weak costulae and/or transverse sculpturing anteromedially; posterolateral corners weakly to strongly sunken.

Legs. Prothoracic legs light yellow-brown except darker brown coxae and distal tarsomeres. Mesothoracic legs similarly colored except entire tarsi usually darker brown. Metathoracic coxae usually dark brown (sometimes lighter at distal end); trochanters and femora light yellow-brown except infuscate spot dorsally near distal ends of femora; tibiae and tarsi mostly infuscate yellow-brown except proximal portions of tibiae. Spines on outer faces of hind tibiae about 30 in number, irregularly scattered, whitish, all of one kind. Inner apical spurs of hind tibiae 1.2–1.4x as long as outer, nearly half as long as hind basitarsi.

Wings. Tegulae light yellow-brown, translucent. C+Sc+R, stigma, R1, 2r, 1Rs and 2M of forewing brown, strongly pigmented; other venation pale brown to colorless. 2r and 1Rs variable in relative lengths, usually more or less equal to 2r to slightly longer, meeting at distinct to slightly rounded 150-degree angle. R1 longer than stigma, 3–5x longer than distance from distal end of R1 to end of 3Rs fold along wing edge. Hindwings with only vein 1R1 strongly pigmented; all other venation colorless or pale. Cu+cu-a (nervellus) nearly straight, weakly reclivous, vannal lobe weakly flattened subapically, evenly fringed with short hairs.

Metasoma. Tergite I rugose, parallel-sided to weakly broadening or narrowing posteriorly, usually very weakly rounded posterolaterally, 1.5–1.8x longer than posteriorly

broad; anteromedial depression broad, smoother with concentric sculpturing. Tergite II sculptured as on I, 1.9–2.1x as broad posteriorly as medially long and 1.3–1.7x as broad as posterior breadth of tergite I; length subequal with that of third tergum; posterior margin marked by straight, irregularly crenulate furrow; anterolateral corners broadly rounded. Tergum III anteromedially roughened over variable area, unmarked by strong sculpturing over remaining surface. Laterotergites usually intermediate in color between that of hind tibiae and hind femora. Succeeding terga unsculptured, unmodified, overlapping. Hypopygium longer than hind basitarsi, evenly pigmented and sclerotized to medial ventral fold; apex in lateral view not strongly acuminate, forming about a 55–60-degree angle. Ovipositor sheaths longer than hind basitarsi (usually subequal with hypopygium), weakly decurved over expanded distal portions (ventral edge nearly straight), evenly and gradually broadening past narrow, decurved petioles to near distal tip; tip appearing asymmetrically beveled/pointed due to apical brush of hairs; expanded distal portions hairy nearly throughout but more densely so apically. Ovipositor evenly decurved, exserted but not usually by distance longer than length of sheaths.

Males. Body length 1.5–2.2 mm, forewing length 1.8–2.4 mm. Antennae longer, darker and more slender than in females, all flagellomeres except distal 3 with 2 ranks of placodes; flagellomere 14 2.1–2.3x as long as broad. Prothoracic legs light as in female; mesothoracic femora (often metathoracic as well) mostly much darker than in female. Tegulae darker than in female, sometimes dark brown. Forewing venation tending to be slightly darker and more grey-brown. First metasomal tergite narrower than in female, usually weakly narrowing posteriorly. Second tergite less transverse, more strongly triangular, than in female. Third tergum with little or no sculpturing. Laterotergites usually moderate brown, occasionally very dark.

Variation. This species and *P. bedelliae* are the most commonly encountered species of *Pholetesor* in the eastern U.S. and Canada. As a result, series are available from a large number of hosts and localities. A considerable amount of variability exists among these series; a few especially variable features will be mentioned.

Body size appears to be largely a function of the size of the host larva from which the wasp emerged. *P. ornigis* attacks a wide range of blotchmining Lepidoptera, from small *Phyllonorycter* and *Tischeria* to some larger *Cameraria* and *Caloptilia* species. Among the smallest individuals (usually well under 2 mm) are those reared from *Cameraria* sp. on *Carpinus*, *Phyllonorycter celtisella* on *Celtis occidentalis*, and from *Phyllonorycter* and *Leucanthiza* on *Amphicarpa bracteata*. The largest (often 2.2–2.4 mm) often emerge from *Cameraria aceriella* on *Acer* and several *Cameraria* spp. on various oaks.

A number of other characters seem to covary with size. Larger individuals tend to have proportionately broader anterior metasomal tergites, stronger mesoscutal punctation, brighter legs coloration and longer ovipositor sheaths. These correlations are by no means absolute, and may be also influenced by such factors as seasonality (especially temperature and humidity differences), geography and host physiology.

A few variations are restricted to single, or a few, reared series, and may indicate genetic isolation or differentiation. For example, specimens reared from *Cameraria* on white oak in eastern Canada have unusually broad first metasomal tergites in both sexes, a short R1, and almost completely infuscate hind femora, even in the females.

As in other *ornigis*-group species, males are more variable in coloration and metasomal tergite shape than females, and individual unreared specimens are often extremely difficult to separate from males of *P. salalicus* and *P. salicifoliellae*.

Final instar larva. Labium with 6–7 pairs of setae; maxillae each with 2 long setae; mandibles set with 16–17 long teeth (not counting bifid tip).

Cocoons. White, smooth, elongate-oval, capsule-like, almost always with a more translucent band centrally, suspended hammock-like within the host mine or shelter.

Material examined. Reared from *Acrocercops onosmodiella* (Busck): 12 males, ONTARIO, June. Reared from *Cameraria aceriella* (Clemens): 32 females, 28 males, PENNSYLVANIA, ONTARIO, May, September (also Feb.–March from overwintering cocoons). Reared from *C. corylisella* (Chambers): 7 females, 1 male, ONTARIO, March (from held overwintering cocoons). Reared from *C. guttifinitella* (Clemens) on *Rhus toxicodendron*: 16 females, 19 males, ONTARIO, QUEBEC, May, July, August. Reared from *C. hamadryadella* (Clemens) on *Quercus alba*, *Q. macrocarpa*: 22 females, 13 males, ONTARIO, July, August. Reared from *C. ostryarella* (Chambers) on *Ostrya*: 11 females, 8 males, ONTARIO, QUEBEC, August, January–March (from held overwintering coccons). Reared from *Leucanthiza amphicarpaefoliella* Clemens: 5 females, QUEBEC, July. Reared from "*Lithocolletis*" sp. on *Amphicarpa*: 2 males, QUEBEC, July, August. Reared from "*Lithocolletis*" sp. on *Carpinus*: 2 females, 1 male, ONTARIO, May. Reared from "*Lithocolletis*" sp. on sweet fern (*Comptonia peregrina*): 2 females, ONTARIO, adults January from held overwintering cocoons. Reared from "*Lithocolletis*" sp. on Hamamelis: 3 females, ONTARIO, May. Reared from "*Lithocolletis*" sp. on *Ostrya*: 1 female, 5 males, ONTARIO, QUEBEC, July, August. Reared from "*Lithocolletis*" spp. on *Quercus* spp. (mostly white oak group): 31 females, 15 males, MANITOBA, NOVA SCOTIA, ONTARIO, QUEBEC, July, August, March (from held overwintering cocoons). Reared from "*Lithocolletis*" sp. on *Ulmus americana*: 5 females, 1 male, NOVA SCOTIA, August–September. Reared from *Paraclemensia acerifoliella* (Fitch): 5 females, 5 males, ONTARIO, June, July. Reared from *Parornix conspicuella* (Dietz) on *Betula populifolia*: 1 female, 1 male, CONNECTICUT, September. Reared from *Parornix geminatella* (Packard) on *Malus*: 36 females, 12 males, ARKANSAS, PENNSYLVANIA, WISCONSIN, July–October. Reared from *Parornix* sp. on *Prunus virginiana*: 3 females, 3 males, NEW YORK, August. Reared from *Phyllonorcyter blancardella* (Fabricius) on *Malus*: 4 females, 8 males, MASSACHUSETTS, ONTARIO, July–November. Reared from *P. celtisella* (Chambers) on *Celtis occidentalis*: 27 females, 35 males, ONTARIO, July, August. Reared from *P. clemensella* (Chambers): 2 males, ONTARIO, October–November. Reared from *P. crataegella* (Clemens): 1 female, 4 males, ONTARIO, QUEBEC, May, June. Reared from

P. diversella (Braun): 1 male, NOVA SCOTIA, May. Reared from *P. emberizaepenella* (Bouche) on *Lonicera bella*: 3 females, 3 males, ONTARIO, October, November. Reared from *P. lucetiella* (Clemens): 1 female, VIRGINIA, July. Reared from *P. lucidicostella* (Clemens): 7 females, 5 males, ONTARIO, adults February, March from held overwintering cocoons. Reared from *P. malimalifoliella* (Braun) on *Malus*: 46 females, 26 males, NOVA SCOTIA, ONTARIO, QUEBEC, WISCONSIN, July–October. Reared from *P. ostryafoliella* (Clemens) on *Ostrya*: 3 females, QUEBEC, September. Reared from *P. propinqinella* (Braun): 11 females, 14 males, DISTRICT of COLUMBIA, NOVA SCOTIA, ONTARIO, VIRGINIA, May–June, August, October–November (overwintering generation). Reared from *P. robiniella* (Clemens): 11 females, 4 males, NEW HAMPSHIRE, NEW YORK, ONTARIO, WEST VIRGINIA, July, September, February (from overwintering cocoons). Reared from *Phyllonorycter* sp. on *Acer rubrum*: 2 females, NEW YORK, NORTH CAROLINA, July, August. Reared from *Phyllonorycter* sp. on *Lonicera*: 10 females, 4 males, NEW YORK, ONTARIO, May, July, August. Reared from *Phyllonorycter* sp. on *Malus*: 75 females, 88 males, NOVA SCOTIA, ONTARIO, QUEBEC, VERMONT, May–September. Reared from *Phyllonorcyter* spp. on *Prunus* spp.: 6 females, 8 males, NOVA SCOTIA, ONTARIO, July–September. Reared from *Phyllonorycter* sp. on *Tilia americana*: 14 females, 3 males, ONTARIO, QUEBEC, May, July, August. Reared from *Tischeria* sp. on *Quercus falcata*: 1 female, 2 males, TEXAS, November (emerged February indoors). Reared from "gracillariid" on *Vaccinium*: 1 male, NOVA SCOTIA, August. Reared from "tentiform leafminers" (probably *Parornix* or *Phyllonorycter*) on *Malus*: 18 females, 10 males, NEW YORK, NOVA SCOTIA, ONTARIO, QUEBEC, May–August. Reared from undetermined leafminers on *Aesculus*: 2 females, 1 male, KENTUCKY, August. Reared from undetermined leafminers on *Quercus* spp.: 21 females, 20 males, MINNESOTA, VIRGINIA, May, July, August.

Not reared or properly associated: 226 females, 144 males, more or less throughout northeastern North America west to Oregon, south in eastern U.S. to Georgia, in west to Arizona but apparently not into California.

Hosts. The above list under "Material Examined" needs no repeating; in addition, Whitfield and Wagner (1988) provide a detailed account of the host range of this species. *Pholetesor ornigis* clearly attacks a wide range of blotchminers, especially Gracillariidae, on deciduous trees, shrubs, vines, etc., throughout much of North America. It appears to be displaced from, or to not attack, the common hosts of *P. caloptiliae* and *P. salicifoliellae*, i.e., several large species of *Caloptilia* on *Rhus* and *Cornus* and a number of blotchminers on *Salix*, *Populus* and *Alnus*. *Pholetesor ornigis* and *P. salicifoliellae* apparently co-occur at some localities on *Phyllonorycter* spp. on *Lonicera*.

Comments. Pholetesor ornigis and the other *ornigis*-group members form a tight complex of species in North America. When the Palearctic species are included, the group becomes even more difficult taxonomically. *Pholetesor nanus* (Reinhard) is particularly difficult to separate from *ornigis* on morphological grounds. The two may be conspecific, but there appear to be differences in the host spectrum. *Pholetesor nanus* apparently

attacks mostly blotchminers on *Salix*, *Alnus*, and *Betula*—almost exactly matching the hosts *ornigis* does *not* attack in North America. *Pholetesor nanus* is largely, or entirely, thelytokous in England (Shaw and Askew, 1976), but apparently this is not entirely universal within mainland European populations and I am not inclined to weight this too highly, especially in light of the situation with the importation of *P. pedias* (see under that species).

***Pholetesor salalicus* (Mason)**
(figs. 11, 12, 15, 29, 56, 76, 85)

Apanteles salalicus Mason, 1959. *Canad. Entomol.* **91**: 42. Holotype female, USNM no. 64302, examined. Assigned to *Pholetesor* Mason by Mason, 1981, *Mem. Entomol. Soc. Canada* **115**.

Females. Body length 1.6–2.7mm, forewing length 1.8-2.8mm.

Head. Frons 1.2–1.3x as broad at midheight as long down midline, shallowly punctate; inner margins of eyes weakly converging towards clypeus. Antennae slightly longer than body; scape light yellow-brown proximally, darker distally; all but distal 4–5 flagellomeres with 2 ranks of placodes; flagellomere 2 3.4–3.7x as long as broad; flagellomere 14 1.6–1.9x as long as broad. Palpi pale yellow-brown throughout. Head in dorsal view approximately twice as broad as medially long.

Mesosoma. Mesoscutum in dorsal view about .95x as broad as head, shallowly punctate, becoming less strongly so posteriorly; surface with strong satiny sheen. Pronotal furrow distinctly but irregularly crenulate. Scutoscutellar scrobe sharp, narrow, composed of somewhat confluent pits, arched weakly medially, not set in depression. Scutellar disc shallowly punctate, slightly longer than maximum width. Metanotum strongly retracted from scutellum anteriorly, exposing mesothoracic postphragma; broadly excavated mesad sublateral setiferous projections; transverse carinae at about midlength poorly to moderately developed. Propodeum about 1.7x broader than long at longest point, punctate to weakly rugulose anterolaterally, smooth and depressed in posterolateral corners except for scattered irregular peripheral ridges; anteromedially with weak transverse ridging; posteriorly with a series of ridges extending obliquely on either side from nucha.

Legs. Prothoracic and mesothoracic legs entirely light yellow-brown except infuscate extreme bases of coxae, tibial apices and most of distal portions of tarsi. Spines on outer faces of hind tibiae 30–35 in number, irregularly scattered, all of one kind. Inner apical spurs of hind tibiae 1.2–1.3x as long as outer, about half as long as hind basitarsi to slightly shorter.

Wings. Tegulae pale yellowish, translucent. Forewing venation pigmented light yellow-brown; stigma usually paler proximally or over much of surface. R1 slightly longer than stigma, 2–3x as long as distance from its distal end to end of 3Rs fold along wing edge. 2r curved, usually slightly shorter than 1Rs and meeting it at an indistinct curved

angle. Hindwing with vannal lobe weakly flattened subapically, evenly fringed with hairs of moderate length.

Metasoma. Tergite 1 anteriorly longitudinally costulate around basal excavation, posteriorly rugose to aciculorugose, 2.4–2.8x as long as posteriorly broad, narrowing posteriorly, usually with lateral margins nearly straight. Tergite II rugose, subtriangular to trapezoidal, 1.8–2.2x as broad posteriorly as medially long and 1.7–2.0x as broad posteriorly as anteriorly; lateral margins straight to weakly arched, often bordered by roughened, darkened regions of laterotergites; posterior crenulate margin nearly straight. Tergum III longer than II, sculptured anteromedially but only over small area, mostly smooth and similar to succeeding terga; color often mostly yellow-brown in lighter individuals to dark brown. Laterotergites pale yellow-brown, contrasting brightly with tergites except occasionally when tergites are lighter orange-brown. Hypopygium slightly longer than hind basitarsi, evenly pigmented and sclerotized to medial fold; tip weakly acuminate, forming angle of about 60 degrees in lateral view. Ovipositor sheaths weakly decurved over expanded distal portions, tapering evenly broader to beveled/pointed tip (point produced by apical brush); entire length slightly longer than hind basitarsi; appearance similar to sheaths of ornigis and salicifoliellae but tending to be slightly broader, especially in larger individuals. Ovipositor weakly decurved.

Males. Antennae longer than in females, clearly longer than body or forewings, with more slender distal flagellomeres (flagellomere 14 2.2–2.5x as long as broad); all but distal 3 flagellomeres with 2 ranks of placodes. Coloration of legs similar to females but usually more subdued yellowish-brown; extent of dark coloration on hind coxae, tibiae often greater. Tegulae sometimes much darker than in females. Wing venation usually more darkly grey-brown. Metasomal tergites similar to those of female but less roughly sculptured (often with more longitudinal trend to sculpturing); tergite I usually with more curved lateral margins; tergite II often less transverse, about 1.2–1.3x broader posteriorly than medially long. Laterotergites varying from light as in females to considerably deeper yellow-brown.

Variation. This species as delimited is perhaps the most variable in the genus, and may include populations that may eventually prove to be biologically distinct entities. Most of the variation seems to be host-dependent, rather than geographic, in nature.

Specimens from the type-host, *Cameraria gaultheriella*, tend to be large (body length 2.2–2.7mm) and very contrastingly colored, with long extremely straight-sided first metasomal tergites. Individuals reared from *Cameraria* sp. on *Myrica californica* are very similar, but these tend to have shorter first tergites and somewhat smaller overall body size. Also extremely similar are series from *Cameraria nemoris* on *Vaccinium ovatum* and *Caloptilia ferruginella* on *Rhododendron occidentale*, except that these are generally small (especially from *C. nemoris*—body size 1.6–1.9mm) with somewhat darker brown wing venation and antennae and having less tendency for the laterotegites to be darkly pigmented and sculptured adjacent to the first tergite.

A large number of examined specimens from various blotchminers, especially

lithocolletine gracillariids, on *Quercus* spp., at first appeared to represent a distinct species, with somewhat curved lateral margins to the first tergite and more transverse second tergites (posterior width 2.0–2.2x medial length). In addition, sexual dimorphism tends to be stronger than in the other series; males are usually much darker than females, with shorter first tergites and less transverse second tergites. This complex of morphotypes exhibits a great range of color differences—from individuals with largely yellow-brown metasomata (terga III and IV may be largely yellowish, especially laterally), entirely yellow hind coxae, light antennae and wing venation, to others with mostly darkened hind coxae, largely infuscate stigmas, dark antennaem and only the laterotergites of the metasoma light in color. The color range may be largely due to seasonal or microhabitat differences in temperature and humidity (lighter individuals tend to appear in more southerly and/or low elevation localities).

Phenetically intermediate in coloration, tergite shape and, to some extent, size, are individuals reared from *Cameraria* spp. on *Castanopsis* spp. and *Lithocarpus densiflorus*. It is this intermediacy that leads me to consider the entire complex to be one variable species, in which much of the variation is host-dependent. It is also interesting that many of the host *Cameraria*, especially on *Myrica californica*, *Gaultheria shallon*, *Vaccinium ovatum*, *Castanopsis sempervirens*, *C. chrysophylla*, *Lithocarpus densiflorus* and *Quercus agrifolia*, were suggested by Opler (1974) and Opler and Davis (1981) to be each other's closest relatives. These plants and moths are all currently sympatric in northern California, providing many opportunities for host-switching on the parts of both moths and wasps.

A number of other hosts are less commonly utilized. These include leafminers on *Kalmia*, *Arctostaphylos*, *Ribes*, *Salix*, *Populus*, *Artemisia* and *Lepechinia calycina*. The general pattern appears to be a preference for gracillariid leafminers on Ericaceae and Fagaceae, with some switching onto other nearby blotchminers in the same habitats. Two females from *Cremastobombycia* sp. on *Lepechinia calycina* (Mt. Diablo, California) are very dark in leg, wing venation, and laterotergite coloration, and have more slender, straight and longer ovipositor sheaths than are typical for *P. salalicus*. In addition, the cocoons are narrowly banded as in *P. salicifoliellae*; cocoons of *P. salalicus* otherwise seem to be banded only in material from *Cameraria* spp. on *Gaultheria*, *Myrica* and *Lithocarpus* and then only with a broad central translucent band. These specimens from *Cremastobombycia* are quite tentatively assigned to *P. salalicus*.

Final instar larva. Labium with 6–7 pairs of setae; maxillae each with 2 setae; mandibles set with 16–24 long teeth, not counting bifid tip.

Cocoons. White, capsule-like, smooth, elongate-oval, from entirely translucent to opaque whitish at ends leaving broad medial translucent band. Suspended within the mine or shelter of the host by a thread from each end.

Material examined. Reared from *Caloptilia azaleella* (Brants) on ornamental azaleas: 32 females, 1 male, CALIFORNIA, OREGON, May, September–December;

from *C. ferruginella* on *Rhododendron occidentale*: 2 females, 3 males,

CALIFORNIA, September; from *C. nondeterminata* (Braun) on *Ribes sanguineum*: 1 female, CALIFORNIA, August; from *C. palustriella* (Braun) on *Salix* sp.: 2 females, CALIFORNIA, July, October; from *Caloptilia* sp. on *Quercus agrifolia*: 1 female, 1 male, CALIFORNIA, April; from *Cameraria agrifoliella* (Braun) on *Quercus agrifolia*: 54 females, 49 males, CALIFORNIA, February–October but most common April and September; from *C. gaultheriella* (Walsingham) on *Gaultheria shallon*: 9 females, 12 males, CALIFORNIA, OREGON, March–August; from *C. nemoris* (Walsingham) on *Vacccinium ovatum*: 19 females, 18 males, CALIFORNIA, March–May, July–September; from *C. sempervirensella* Opler on *Castanopsis sempervirens*: 32 females, 7 males, CALIFORNIA, March–June, October; from *C. walsinghami* Opler on *Lithocarpus densiflorus*: 6 females, 1 male, CALIFORNIA, July; from *C. wislizeniella* Opler on *Quercus agrifolia*: 29 females, 19 males, CALIFORNIA, February–April; from *C. wislizeniella* Opler on *Q. wislizenii:* 27 females,

22 males, CALIFORNIA, March–May; from *Cameraria* sp. on *Myrica californica*: 10 females, 9 males, May, July–August; from *Cameraria* sp. on *Quercus alvordiana*: 1 female, 2 males, CALIFORNIA, February, October; from *Cameraria* sp. on *Q. chrysolepis*: 2 females, CALIFORNIA, March, April; from *Cameraria* spp. on *Q. douglasii:* 2 females, 1 male, CALIFORNIA, June; from *Cameraria* spp. on *Q. dumosa:* 9 females, 10 males, CALIFORNIA, February–April; from *Cameraria* sp. on *Q. durata*: 2 females, 4 males, CALIFORNIA, March; from *Cameraria* sp. on *Q. garryana:* 2 females, 3 males, CALIFORNIA, June; from *Cameraria* sp. on *Q. kelloggii*: 2 females, CALIFORNIA, September–October; from *Cameraria* spp. on *Q. lobata:* 1 male, CALIFORNIA, September; from *Cameraria* sp. on *Q. sadleriana*: 7 females, 3 males, CALIFORNIA, OREGON, June, October; from *Cameraria* sp on *Q. vaccinifolia*: 8 females, 3 males, CALIFORNIA, April, June–October; from *Cameraria* sp. (host not given): 5 females, OREGON, September; from *Cnephasia longana* (Haw.) on crimson clover: 1 female, OREGON, June; from *Cremastobombycia* sp. on *Lepechinia calycina:* 2 females, CALIFORNIA, March; from "*Lithocolletis*" sp. on *Populus:* 2 females, CALIFORNIA, September; from "*Lithocolletis*" spp. (hosts not given): 5 females, 3 males, OREGON, BRITISH COLUMBIA, June, July; from *Phyllonorycter sandraella* Opler on *Quercus agrifolia:* 1 female, 1 male, CALIFORNIA, May, October; from *Phyllonorycter* sp. on *Arctostaphylos* spp.: 8 females, 11 males, CALIFORNIA, March–April; from *Phyllonorycter* sp. on *Castanopsis*: 1 female, 3 males, CALIFORNIA, March; from *Phyllonorycter* sp. on *Kalmia polifolia*: 1 female, CALIFORNIA, June; from *Phyllonorycter* sp. on *Lithocarpus densiflorus*: 6 females, 4 males, CALIFORNIA, June; from *Phyllonorycter* sp. on *Quercus douglasii:* 1 male, CALIFORNIA, October; from *Phyllonorycter* sp. on *Q. dumosa:* 10 females, 2 males,

CALIFORNIA, February, April; from *Phyllonorycter* sp. on *Q. durata*: 4 females, 8 males, CALIFORNIA, January, March; from *Phyllonorycter* sp. on *Q. garryana*: 1 female, 3 males, CALIFORNIA, OREGON, October–December; from *Phyllonorycter* sp. on *Q.*

kelloggii: 1 female, 2 males, CALIFORNIA, October; from *Phyllonorycter* sp. on *Q. lobata*: 5 females, 10 males, CALIFORNIA, June, September–October; from *Phyllonorycter* sp. on *Q. vaccinifolia*: 4 females, 2

males, CALIFORNIA, July–September; from *Phyllonorycter* sp. on *Q. wislizenii*: 1 female, 1 male, CALIFORNIA, May–June; from *Stilbosis dulcedo* (Hodges) on *Quercus agrifolia*: 6 males, CALIFORNIA, April; from *Tischeria* sp. on *Quercus lobata*: 2 males, CALIFORNIA, December; from undetermined leafminer on *Artemisia suksdorfi*: 1 male, CALIFORNIA, August; from undetermined leafminer on *Artemisia* sp.: 1 male, CALIFORNIA, May; from undetermined leafminer (possibly Eriocraniidae) on *Quercus douglasii*: 2 males, CALIFORNIA, June; from undetermined leafminer on *Salix* sp.: 1 female, OREGON, June. Not reared: 12 females, 5 males, CALIFORNIA, late spring, fall.

Hosts. The above list of material examined provides a full account of the known hosts; I can only add that I doubt the record from *Cnephasia longana* (Tortricidae) is accurate. Most of the hosts are blotchminers in coastal forest, oak woodland and chaparral vegetation in California and Oregon.

Comments. Many of my general comments have been expressed above under "variation". The species is often difficult to separate from *P. salicifoliellae*; the diagnostic characters given in the key are the most useful I have found.

As Nixon (1973) pointed out, *P. salalicus* bears some resemblance to the Palearctic *P. exiguus* (Haliday). The coloration of the wing veins and stigma, legs (except hind coxae), sculpturing of the metasomal tergites (but not their exact shapes—*P. exiguus* has a broader first tergite with rounded lateral margins and a somewhat longer second tergite) and cocoon are quite similar. Also showing some strong resemblance in the Palearctic fauna is *P. laetus* (Marshall), which shares a number of color and tergite features with *P. salalicus*, but has a less strongly triangular second tergite than *P. salalicus* and has a completely opaque whitish cocoon, in the material I have seen. The three species are not so similar to suggest conspecificity to the extent of the *P. nanus/P. ornigis* comparison.

The sex ratio of *P. salalicus* is partially dependent on the host attacked, apparently due to size differences. Individuals reared from the largest hosts, *Cameraria gaultheriella* and *Caloptilia azaleella*, were 88.6 and 97.0% females, respectively (n= 105, 33); from a small host in the same general habitat, *Cameraria nemoris*, individuals were 51.4% females (n= 37).

***Pholetesor salicifoliellae* (Mason)**
(figs. 16, 30, 57, 77, 86)

Apanteles salicifoliellae Mason. 1959. *Canad. Ent*. **91**: 43. Holotype female, CNC no. 669**&**, examined.

Females. Body length 1.5–2.1 mm; forewing length 1.7–2.4 mm.

Head. Frons 1.3–1.4x as broad at midheight as medially long, distinctly but not deeply punctate, with faint metallic sheen. Antennae deep brown, barely longer than body; junction between pedicel and flagellum lighter in color; flagellomeres darker between placode bands; all but distal 5–6 flagellomeres with 2 ranks of placodes; flagellomere 2 3.2–3.6x as long as broad; flagellomere 14 1.5–1.9x as long as broad. Palpi light yellow-brown throughout. Lateral ocelli separated from anterior by just less than one ocellar diameter, from each other by about 2 ocellar diameters. Head in dorsal view about 2.0x broader than medially long.

Mesosoma. Mesoscutum .95 as broad as head, shallowly punctate anteriorly, becoming almost impunctate posteriorly near scrobe; microsculpture producing satiny/ metallic sheen. Pronotal furrow weakly crenulate. Propleuron distinctly punctate, hairy except anteriorly near head. Scutoscutellar scrobe sharp, fine, slightly arched medially. Scutellar disc faintly punctate (as posterior portion of mesoscutum), 1.21.3x as long as anteriorly broad. Scutellar lunules moderately broad, semicircular; axillary troughs distinctly crenulate. Mesopleural furrow shallow, broad, smooth, met at midlength by distinct but weak impressed line running dorsally. Metanotum strongly retracted from scutellum, broadly exposing mesothoracic postphragma; anterior margin broadly excavated mesad sublateral setiferous projections; transverse carinae at midlength on either side weakly to moderately developed. Metapleuron smooth, hairless anteriorly to just beyond spiracle, then somewhat raised, punctate, hairy, becoming less strongly so posteriorly. Propodeum 1.8–1.9x broader than long at longest point, often with weak transverse ridging posterolaterally; anterolaterally weakly rugulose; nucha giving rise to anteriorly diverging ridges which break down into more or less transverse sculpturing anteromedially.

Legs. Prothoracic legs light yellow-brown except darkened coxae and apical tarsomeres. Mesothoracic legs similar except darkened femoral bases and tibial apices. Metathoracic coxae dark brown except lighter ventrally at distal end (rarely mostly light yellow-brown); trochanters and femora light yellow-brown with some infuscation dorsally, especially near femoral apices; tibiae and tarsi darker brown except tibial bases. Spines on outer faces of hind tibiae about 30 in number, irregularly scattered, all of one kind. Inner apical spur of hind tibia 1.2–1.4x as long as outer, about half as long as hind basitarsi or shorter.

Wings. Tegulae pale yellowish to medium brown, translucent. C+Sc+R, stigma, R1, 2r, lRs, 2M pigmented moderate grey-brown; other venation faintly pigmented to colorless. 2r and lRs subequal in length or 2r shorter, meeting at weak curved angle. R1 longer than stigma, 2–3x as long as distance from its distal end to end of 3Rs fold along wing edge. Vannal lobe of hindwing weakly flattened subapically, fringed evenly with moderate-length hairs. Cu+cu-a weakly arched, reclivous.

Metasoma. Tergite I mostly rugose, weakly to strongly narrowing posteriorly, 1.7–2.0x as long as posteriorly broad; lateral margins arched, especially posteriorly; smoother

in anteromedial excavation. Tergite II sculptured as in I to strongly longitudinally aciculate, 2.4–2.7x as broad posteriorly as medially long; posterior crenulate margin weakly concave; lateral margins slightly curved, meeting posterior furrow at about 50-degree angle. Tergum III sometimes weakly roughened anteromedially, otherwise resembling more posterior terga in surface texture. Laterotergites medium brown, occasionally lighter—usually somewhat darker than hind femora. Hypopygium longer than hind basitarsi, evenly pigmented and sclerotized to medial ventral fold; extreme apex weakly acuminate and forming about a 60-degree angle in lateral view. Ovipositor sheaths in entirety slightly longer than hind basitarsi, evenly tapering broader (after narrow petiole) to a beveled/ pointed tip; expanded distal portions hairy virtually throughout. Ovipositor evenly and strongly decurved.

Males. Antennae longer than in female (clearly longer than body); all flagellomeres except apical 3 with 2 ranks of placodes; flagellomere 14 2.1–2.5x as long as broad. Axillary troughs often less distinctly crenulate than in females. Propodeum somewhat shinier, less strongly sculptured than in females. Prothoracic legs colored as in females; meso- and metathoracic legs generally with femora darker than in females. Second metasomal tergite proportionately longer (posterior width 1.9–2.3x medial length), less strongly sculptured; third tergum usually sculptureless. Laterotergites usually much darker than in females. Genitalia shown in figure 86.

Variation. Most of the obvious variation occurs in coloration and sculpturing of the metasomal tergites. Very occasionally in low elevation or southern series, the wing venation, legs and laterotergites become light in color as in *salalicus*, but even then the stigma is usually more greybrown. High elevation and extreme northern material (Alaska, etc.) tends to be very dark in leg, laterotergite and wing venation coloration and the sculpturing of the metasomal tergites is shinier, finer and much more longitudinal in trend. The Alaskan specimens are particularly extreme; at first glance, they appear to represent a separate species, but intermediates cause me to doubt this.

Final instar larva. Labium with 6–7 pairs of setae; maxillae each with 2 setae; mandibles set with 16–17 long teeth (not counting bifid tip).

Cocoons. Whitish, elongate-oval, capsule-like, with translucent band medially covering .2–.3 of length; suspended by a thread from each end within the mine or shelter of the host.

Material examined. Reared from *Acrocercops* sp. on *Prunus virginiana:* 1 female CALIFORNIA, July; from *Caloptilia diversilobiella* Opler on *Rhus diversiloba:* 7 females, 11 males, CALIFORNIA, May, August; from *Caloptilia ferruginella* (Braun) on *Rhododendron occidentale*: 1 female, 1 male, CALIFORNIA, October; from *Caloptilia sp*. on *Acer macrophyllum.* 2 females. 1 male. CALIFORNIA (Sierra), September; from *Caloptilia* sp. on *Alnus tenuifolia*: 1 male, CALIFORNIA, September; from *Caloptilia* sp. on *Salix*: 2 females, CALIFORNIA, May;

from *Cameraria* sp. on *Alnus oregona:* 1 female, CALIFORNIA, July; from "elachistid" (no host given): 1 female, OREGON, June; from *Parornix* sp. on *Amelanchier*: 7 females, 2 males, CALIFORNIA, OREGON, September; from *Perittia* sp. on *Symphoricarpos albus*: 1 female, OREGON, June; from *Phyllonorycter antiochella* Opler on *Quercus agrifolia:* 5 females, 1 male, CALIFORNIA, March; from *Phyllonorycter crataegella* (Clemens) on *Crataegus* sp.: 3 females, CALIFORNIA, September, December; from *Phyllonorycter emberizaepenella* (Bouche) on *Lonicera bella:* 1 male, ONTARIO, October;

from *Phyllonorycter salicifoliella* (Clemens) on *Salix* spp.: 26 females, 28 males, ONTARIO, NEW BRUNSWICK, July–October; from *Phyllonorycter tremuloidella* (Braun) on *Populus tremuloides*: 29 females, 31 males, ONTARIO, BRITISH COLUMBIA, CALIFORNIA, UTAH, July–September; from *Phyllonorycter* sp. on *Alnus* spp.: 2 females, 2 males, CALIFORNIA, NOVA SCOTIA, August, September;

from *Phyllonorycter* sp. on *Lonicera:* 1 female, NEW YORK, (no date); from *Phyllonorycter* sp. on *Quercus lobata*: 6 females, 5 males, CALIFORNIA, October;

from *Phyllonorycter* sp. on *Ribes*: 2 females, 4 males, CALIFORNIA, September;

from *Phyllonorycter* spp. on *Salix* spp.: 2 females, 1 male, CALIFORNIA, OREGON, June; from *Phyllonorycter* sp. on *Symphoricarpos* sp.: 5 females, 1 male, CALIFORNIA, OREGON, June–September; from undetermined leafminers on apple leaves: 4 females, 1 male, OREGON, NOVA SCOTIA, September/October, March.

Not reared: 47 females, 15 males, throughout northern North America (but also Texas (!)), mostly late summer-fall.

Hosts. The above list of hosts under material examined needs no repeating; it may be mentioned that the few individuals on *Phyllonorycter* spp. on *Malus* and *Lonicera* in the eastern U. S. and *Quercus* in the western states are usually far outnumbered by individuals of *P. ornigis* and *P. salalicus*, respectively, on these hosts. In California, in the absence of *P. ornigis*, *P. salicifoliellae* occurs commonly on leafminers on Rosaceae, Caprifoliaceae and Saxifragaceae, which are usually parasitized in the east by *P. ornigis*.

Comments. As with *P. ornigis* and *P. salalicus*, there are relatives in Europe which make species separation difficult when the entire world fauna is considered. Particularly confusing is *P. ambiguus* (Papp); I can find no character in Papp's (1977, 1983b) descriptions which will reliably separate *P. ambiguus* from *P. salicifoliellae*. *Pholetesor laetus* (Marshall) is also similar, but appears usually much larger and more brightly colored and apparently does not have a concave hind margin to the second tergite (which may be true for *P. ambiguus* as well). The entire problem of Holarctic distributions of Microgastrinae needs more attention; I suspect 10–20% of the species, especially northern ones, occur on both continents.

Again, I am not positive that all of the material I have placed under the name *P. salicifoliellae* is in fact conspecific; the host range is broad, but not inconsistent with what I have seen in *P. ornigis* and *P. salalicus*. It is also possible that the name *P. salicifoliellae*

should be synonymized under *P. glacialis* (Ashmead) (see under that name); the identity of Ashmead's single male is uncertain enough that I hesitate to sink Mason's name under it.

The *circumscriptus*-group

To this group I assign two species previously known from the Palearctic region: *P. circumscriptus* (Nees), known in the Nearctic Region only from Alaska, and *P. pedias (*Nixon), introduced into Ontario for biological control of *Phyllonorycter blancardella* (Fabricius) on apple leaves. Several other Palearctic species, including *P. arisba* (Nixon) and *P. elpis* (Nixon), also appear to belong to this group.

These species are grouped together based on their common possession of the following features (most of which are shared by the *ornigis*-group): 1) metanotum broadly retracted from scutellum, exposing portions of mesothoracic postphragma; sublateral setiferous lobes often not reaching scutellum; 2) areola and transverse carinae of propodeum absent, replaced by two series of ridges diverging obliquely from nucha; 3) metasomal tergite I much longer than broad, narrowing posteriorly, polished and sculptureless or very weakly sculptured posteriorly; 4) tergite II subtriangular, unsculptured, shorter than III down midline; 5) tergum III unsculptured, not rounded posterolaterally; 6) tergum IV unmodified, anteriorly overlapped by III and similar to succeeding terga; 7) sternites 3–6 of female anteromedially split or notched; 8) hypopygium evenly sclerotized to medial fold, not produced at tip; 9) ovipositor sheaths arising at or above midheight of valvifers; 10) volsellae of male genitalia each with 2 setae along medioventral edge (in Palearctic males from bisexual populations of *P. circumscriptus*—no males are known of either species in North America); 11) gonobase (basal ring of male genitalia approximately as long as broad, not transverse (see also comment under 10); 12) final instar larva with 6–7 pairs of labial setae; 13) final instar larva with 3 setae on each maxilla; 14) cocoon smooth, slender, capsule-like, often banded by a region of thinner silk layer in middle, suspended within the mine of the host by a thread from each end; 15) hosts are various blotchmining genera of Gracillariidae, Tischeriidae and Elachistidae.

The smooth anterior metasomal tergites in the adults and 3 maxillary setae in the final instar larvae are the distinctive features of this group, separating it from the closely related *ornigis*-group. The two groups together comprise an almost certainly monophyletic lineage within *Pholetesor,* and may eventually reach generic status.

***Pholetesor circumscriptus* (Nees)**
(figs. 31, 58)

Microgaster circumscriptus Nees, 1834. *Hym. Ichn. aff. Mon.* **1**: 181.
Microgaster umbellatarum Haliday, 1834. *Ent. Mag.* **2**: 247-248.
Microgaster blancardellae Bouche, 1834. *Naturgeschichte der Insekten besonders in Hinsicht ihrer ersten Zustande als Larven und Puppen* (Berlin). p. 156.
Microgaster lividipes Wesmael, 1837. *Nouv. Mem. Acad. Belg.* **10**: 63–64.
Microgaster flavolimbatus Ratzeburg, 184&. *Ichn. deutsche Forstins.* **2**: 50.
Apanteles lautellus Marshall, 1885. *Trans. Ent. Soc. Lond.*, **1885**: 219–220.
The above synonymy adapted from Wilkinson (1938).

This apparently circumpolar species has been fully treated in the Palearctic Region by Wilkinson (1938), Nixon (1973) and Papp (1983b). I will not attempt to completely redescribe it here but instead attempt to characterize the nearctic series I associate with this name relative to examined palearctic material and to *P. pedias*.

I have seen only 4 specimens, all non-reared females, from Alaska (Naknek) and in the Canadian National Collection, that I consider to be conspecific with the Palearctic *P. cicumscriptus* series I have seen. Of all European material examined (from England, Scotland, Netherlands, Sweden, Hungary, Northern Italy, Cyprus), the specimens from northern England and Scotland most closely resemble the Alaskan series in coloration and metasomal tergite shapes. *Pholetesor circumscriptus* appears to be an extremely variable species in the Old World, especially in leg and metasomal coloration.

The following notes on the Alaskan series are provided for comparative purposes: flagellomere 2 3.6x longer than broad; flagellomere 14 1.7x as long as broad. Stigma twice as long as broad, .9 as long as metacarp (R1), pellucid centrally, darker grey-brown peripherally (especially posteriorly). Propodeum smooth, polished, with series of oblique fine ridges extending forward on either side from nucha. Tergite I of metasoma evenly narrowing posteriorly, 3.2–3.5x as long as posteriorly broad, twice broader anteriorly than posteriorly, smooth, polished except with fine longitudinal posterior aciculations; tergite II strongly triangular, 2.6x broader posteriorly than anteriorly, 1.6x broader posteriorly than medially long, entirely polished, smooth except faint peripheral sculpturing. Ovipositor sheaths slightly longer than hind basitarsi, just over half as long as hind tibiae. Body length 1.8–2.0 mm, forewing length 2.0–2.3 mm. Coloration dark for the species: all coxae dark; hind femora mostly infuscate; tergites I and II entirely dark brown to black; laterotergites moderate yellow-brown.

Short (1953) has examined the final instar larval head sclerites and reports that the labium has 7 pairs of setae, the maxillae each have 3 setae and the mandibles are each set with 12 long teeth (Short counted 13 but includes the upper tooth of the bifid tip).

None of the Nearctic material is reared, so associated cocoons are not available; cocoons I have seen associated with Palearctic specimens are white, translucent, apparently not banded, smooth, elongate-oval, capsule-like and suspended by a thread

from each end within the host mine or shelter (appearance very similar to cocoons of *P. salalicus* from oak leafminers.

***Pholetesor pedias* (Nixon)**
(figs. 32, 59, 78)

Apanteles pedias Nixon, 1973. *Bull. Ent. Res*. **63**: 211.
Assigned to *Pholetesor* by Mason (1981).

Females. Body length 1.6–2.5 mm, forewing length 2.0–2.3 mm.

Head. Frons 1.1–1.3x broader at midheight than long down midline, indistinctly punctate with dull metallic sheen. Inner margins of eyes slightly converging towards clypeus. Postgenae, vertex and occiput indistinctly punctate, with dull metallic sheen as on frons. Antennae chestnut brown, clearly lighter than head color throughout, approximately same length as to slightly shorter than forewing; all but distal 5–6 flagellomeres with 2 ranks of placodes; flagellomere 2 3.4–3.7x as long as broad; flagellomere 14 1.2–1.4x as long as broad. Palpi entirely pale yellow-brown. Lateral ocelli slightly greater than 1 ocellar diameter from medial ocellus, just over 2 ocellar diameters from each other. Head in dorsal view 1.8–1.9x as broad as medially long.

Mesosoma. Mesoscutum shallowly, finely punctate, with dull, vaguely metallic sheen between punctures; punctation becoming indistinct posteriorly near scutellum; width just anterior to tegulae barely less than that of head. Pronotal furrow shallow, indistinctly crenulate. Propleuron punctate, evenly hairy except smoother and hairless anteriorly near head. Scutoscutellar scrobe narrow, fine, deep, with 12–15 fine, occasionally confluent pits; weakly arched medially. Scutellar lunules asymmetrically semicircular (broadest point nearer medial end). Mesopleural depression very broad, indistinct. Metanotum anteriorly less strongly excavated than in most ornigis- and circumscriptus-group members, exposing only narrow sliver of mesothoracic postphragma; sublateral setiferous projections touching (or nearly so) posterior edge of scutellum; transverse carina at midlength on either side bounded by a mostly smooth, polished anterior region and a posterior, transverse depression crossed by irregular small longitudinal carinulae; posteromedial raised boss with scattered hairs. Metapleuron centrally and ventrally smooth; otherwise finely punctate and hairy. Propodeum 1.6–1.7x broader than long at longest point, mostly very weakly sculptured, with fine ridges radiating from nucha, these disappearing anteriorly into a region of more or less indistinct transverse sculpturing medially.

Legs. All legs entirely light yellow-brown except infuscate tips of fore- and midtarsi, hind coxal bases, distal .2–.3 of hind tibiae and virtually entire hind tarsi (except extreme proximal end). Spines on outer faces of hind tibiae 20–25 in number, irregularly scattered. Inner apical spur of hind tibiae 1.2–1.4 as long as inner.

Wings. Tegulae pale yellowish, translucent. Venation pale yellowish-brown, with C+Sc+R, stigma, R1, 2r and 1Rs more strongly pigmented than remainder of venation; R1 shorter than stigma (.8–.9 of stigma), at most 1.5x as long as distance from its distal end to end of 3Rs fold along wing edge. 1Rs slightly longer than 2r but meeting at rather rounded, indistinct angle; stigma 2.3–2.5x as long as broad. Hindwing with vannal lobe very weakly flattened subapically, evenly fringed with hairs of moderate length.

Metasoma. Tergite I evenly narrowing posteriorly, nearly straight but rounding somewhat at posterior end, virtually unsculptured throughout, with vague hint of longitudinal sculpturing at posterior end; broad depression anteriorly over basal .3–.4; coloration pale yellow-orange over anterior .3–.4, then becoming dark brown apically except medial yellow-orange spot at posterior tip. Tergite II subtriangular, entirely smooth, yellowish, 3x broader posteriorly than anteriorly, approximately 2x broader posteriorly than medially long. Tergum III unsculptured, longer than II and similar to succeeding terga; anteriorly yellowish, posteriorly darker brown. Laterotergites very pale yellowish; this coloration extends laterally into 4th tergum. Hypopygium 1.2–1.3x longer than hind basitarsi, sclerotized evenly to medial fold, apically angled in lateral view at about 6C degrees; tip not acuminate or truncate. Ovipositor sheaths 1.1–1.2x longer than hind basitarsi, proximally slender, decurved; distal .7 weakly decurved, evenly tapering wider to a blunt, slightly bevelled point; hairy over most of distal broader portions, more densely so apically. Ovipositor evenly and strongly decurved.

Males. Not known in introduced nearctic material (apparently unisexual).

Variation. A few specimens have been seen that are half to two-thirds "normal" size and have the metasomal tergites entirely dark. In other essential features (i.e., short R1, leg coloration, propodeal sculpturing), the specimens appear to be conspecific.

All material is from a single source of mass culturing and field release in Guelph, Ontario and shows remarkable uniformity in coloration and sculpturing.

Final instar larva. Labium with 6–7 pairs of setae (not always symmetrical); maxillae each with 3 setae; mandibles set with 16 long teeth (not counting bifid tip).

Cocoons. Pale reddish-tan, subopaque at both ends with more translucent medial band covering 0.2 of length; shape elongate-oval, capsule-like, smooth, with a thread or a few threads at each end.

Material examined. 50 females, ONTARIO: Guelph, summer and overwintering November lots, 1981, collected by J. E. Corrigan and J. M. Heraty; reared from *Phyllonoycter blancardella* (F.) on apple leaves. W. R. M. Mason (Ottawa) had previously determined the introduced cultures as *P. pedias*.

I have compared these with 7 specimens, determined by Papp, reared from leafminers on *Malus* sp. and *Alnus glutinosa* in Hungary.

Hosts. Phyllonorycter blancardella (F.) on apple, *P. restrictella* Braun on beech and *Parornix geminatella* (Packard) on apple (the latter two record supplied by J. M. Heraty, University of Guelph, personal communication, 1982). In Europe, the species apparently

attacks mostly *Phyllonorycter* spp. on *Alnus*, *Corylus*, *Malus*, *Pyrus* and *Populus* (Nixon, 1973; Papp, 1983a).

Comments. *Pholetesor pedias* was introduced into Canada in 1978 from New Zealand, where it had been introduced earlier (1957) from Italy for control of *Phyllonorycter messianella* (Zeller) on oak, amidst some confusion as to its identity (Laing and Heraty, 1981). It has apparently become locally established and may eventually spread through much of the apple-growing regions of eastern North America. The introduced strain apparently is, or has become, thelytokous, as no males have appeared in lab cultures or field populations to date.

Papp (1983a, 1983b) has synonymized *P. pedias (*Nixon) under the name *bicolor* (Nees) 1834, after examination of Wilkinson's (1938) neotype of *bicolor* and paratypes of *pedias*. He rejected Wilkinson's treatment of *Microgaster bicolor* Nees 1834 as a primary junior homonym of *Microgaster bicolor* Curtis 1830, on the argument that Curtis' name is a *nomen nudum.* Curtis originally published the name in synonymy under *Microgaster alvearius* Fabricius, now placed in the genus *Diolcogaster.* According to the International Code of Zoological Nomenclature (1964), Article 11, Provision d, "a name first published as a synonym is not thereby made available unless prior to 1961 it has been treated as an available name with its original date and authorship, and either adopted as the name of a taxon or used as a senior homonym". By my reckoning, Wilkinson's (1938) treatment of *M. bicolor* Curtis 1830 as a senior homonym satisfies these criteria for availability, even though, by modern standards, the name was not properly published originally. I choose, therefore, to accept Nixon's (1973) name, *pedias*, as the valid name for the species introduced into Canada, and to treat *Microgaster bicolor* Nees 1834 as a primary junior homonym, and hence to be rejected as a valid name. This approach seems to have been followed not only by Wilkinson and Nixon but also by most field workers in North America (although there may be others who, following Papp, use *bicolor* for this species in Europe).

Acknowledgments

This revision was originally conducted as part of a Ph. D. dissertation at the University of California, Berkeley, deposited in 1985. While the current version has been substantially updated and edited since then, the author gratefully acknowledges the members of his committee, Drs. Howell Daly, Leo E. Caltagirone and Thomas Duncan, for extensive and valuable feedback during the original writing. Later additions and versions also benefited from the comments of Andrew Austin (University of Adelaide), Sydney Cameron (University of Illinois), Michael Sharkey (University of Kentucky), Eric Grissell (U. S. D. A.—A. R. S., Washington), Mark Shaw (Royal Museums of Scotland) and David Wagner (University of Connecticut).

The revision of a genus on a continental level requires the help and generosity of a large number of curators and collectors. Those contributing to this study are listed under *Materials and Methods* but are jointly thanked here. In addition to museum material on loan, a large number of specimens was collected and reared from field-collected host larvae with the aid of Jerry A. Powell, John DeBenedictis and, especially, David L. Wagner, all then of the University of California, Berkeley. Their efforts and provision of host identifications and rearing advice are greatly appreciated.

Mark R. Shaw (Royal Museums of Scotland, Edinburgh), John M. Heraty (then Univ. Guelph, now at Univ. California, Riverside), Jenö Papp (National Natural History Museum, Budapest) and, especially, the late W. R. M. Mason (Canadian National Insect Collection, Ottawa) offered much useful information, advice and discussion on host ranges, species problems and microgastrine systematics. All are gratefully thanked for their contributions.

Funding for collecting and museum trips was provided by the Society of Sigma Xi and the CanaColl Foundation. A one-year NATO Postdoctoral Fellowship in Science awarded to the author in 1985 allowed valuable access to the Palaeratcic collections and expertise of Mark Shaw, Dick Askew (Manchester), Kees van Achterberg (Leiden) and the Natural History Museum (London). Kim A. Hoelmer (U. C. Berkeley) was of great assistance in the production of the SEM photos.

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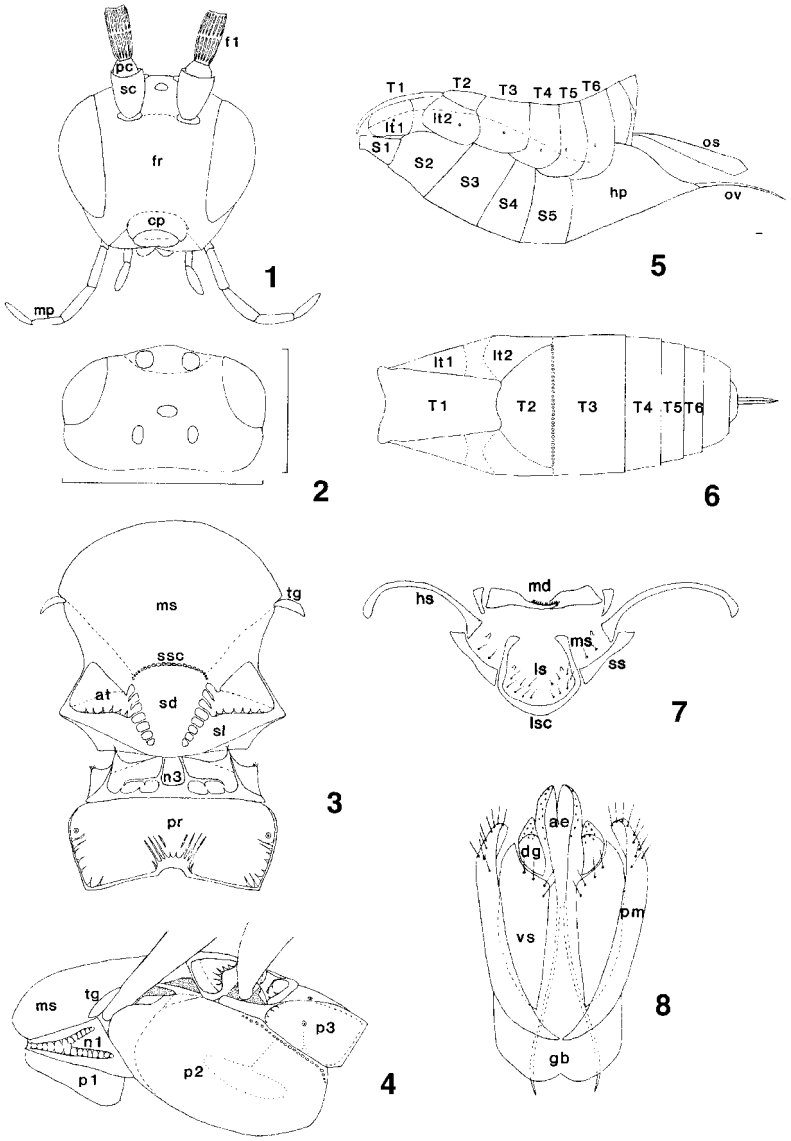
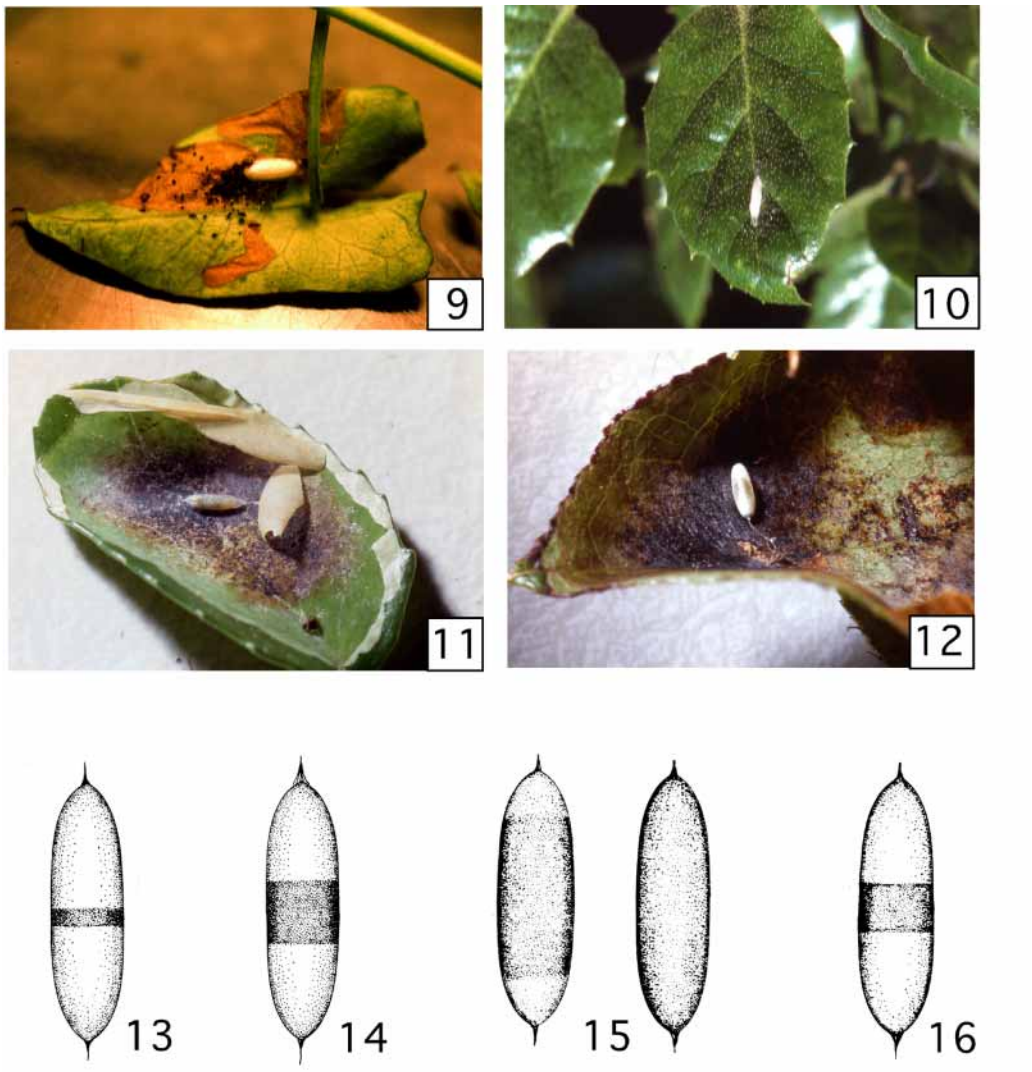
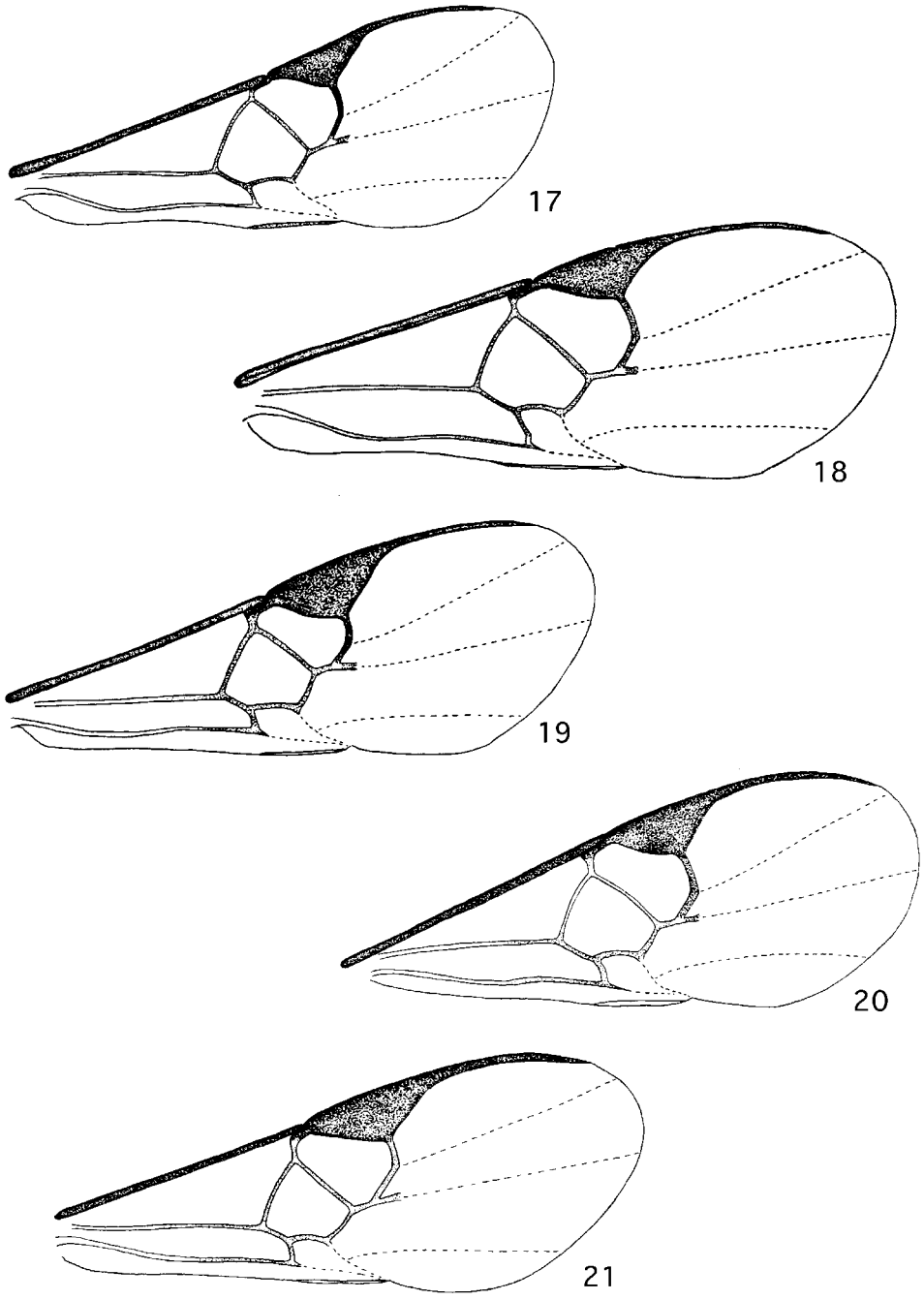


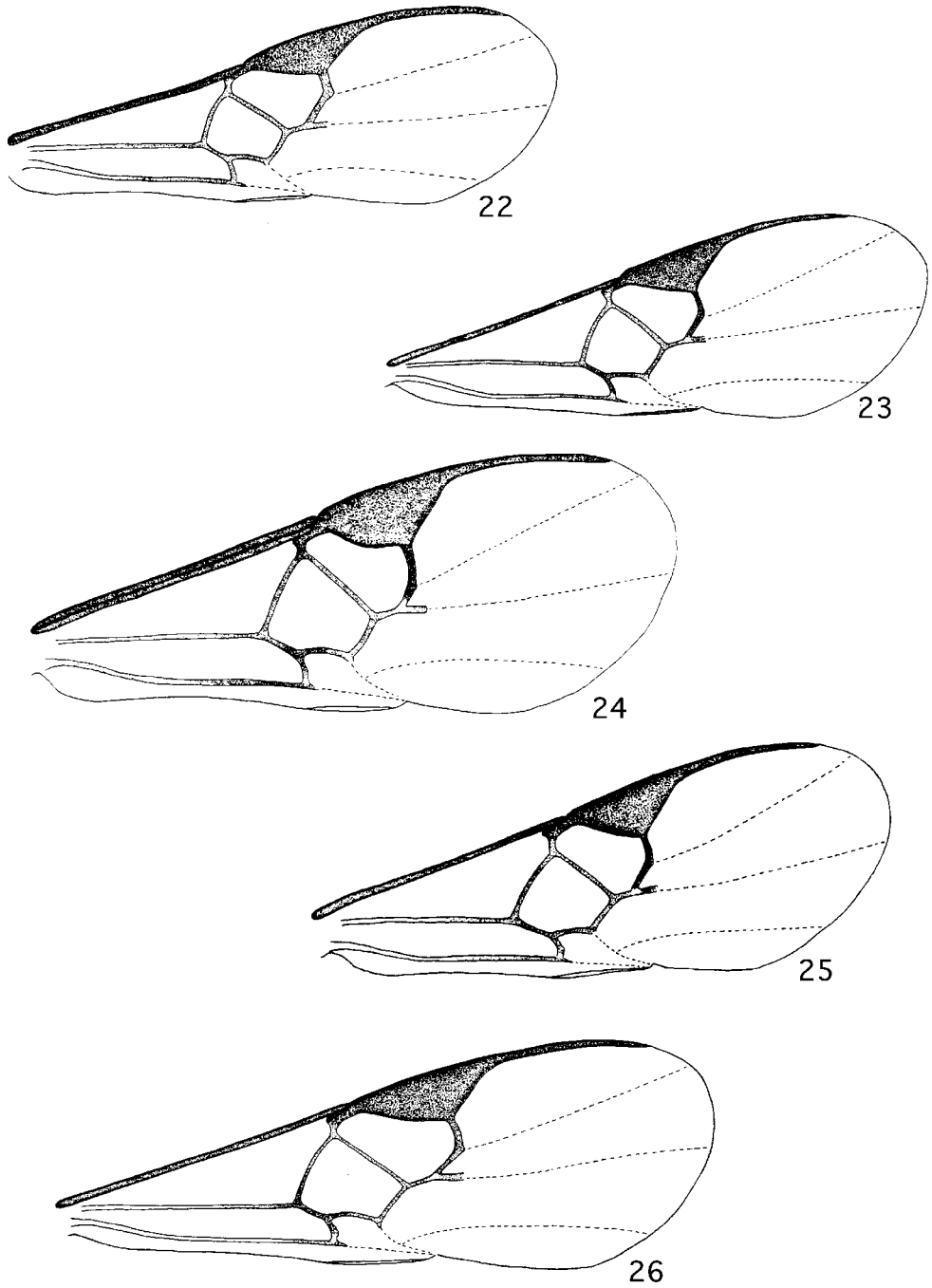
FIGURES 1–8. 1: anterior view of *Pholetesor* head. (cp—clypeus; fl—flagellomere 1; fr—frons; mp—maxillary palp; pc—pedicel; sc—scape). Length of frons measured from midpoint between antennal bases to upper edge of clypeus. **2**: dorsal view of *Pholetesor* head. Scale lines indicate measured dimensions. **3 & 4**: mesosoma of *Pholetesor:* **3**, dorsal view; **4**, lateral view. (at—axillary troughs; ms—mesoscutum; n1—pronotum; n3—metanotum; pr—propodeum; p1—propleuron; p2—mesopleuron; p3—metapleuron; sd—scutellar disc; sl—ascutellar lunule; ssc—scutoscutellar scrobe; tg—tegula). **5 & 6**: metasoma of *Pholetesor*: 5, lateral view; 6, dorsal view. (T1, T2 ....—tergites 1, 2 ...; S1, S2 ...sternites 1, 2 ...; ltl—laterotergite 1; lt2—laterotergite 2; hp—hypopygium; os—ovipositor sheath; ov—ovipositor). **7**: final instar larval head sclerites. (hs—hypostoma; ls—labial setae; lsc—labial sclerite; md—mandibles; ms—maxillary setae; ss—stipital sclerite). **8**: male genitalia, ventral view; 16—ovipositor apparatus, lateral view. (aedeagus; dg—digitus; gb—gonobase; pm—paramere; vs—volsella).



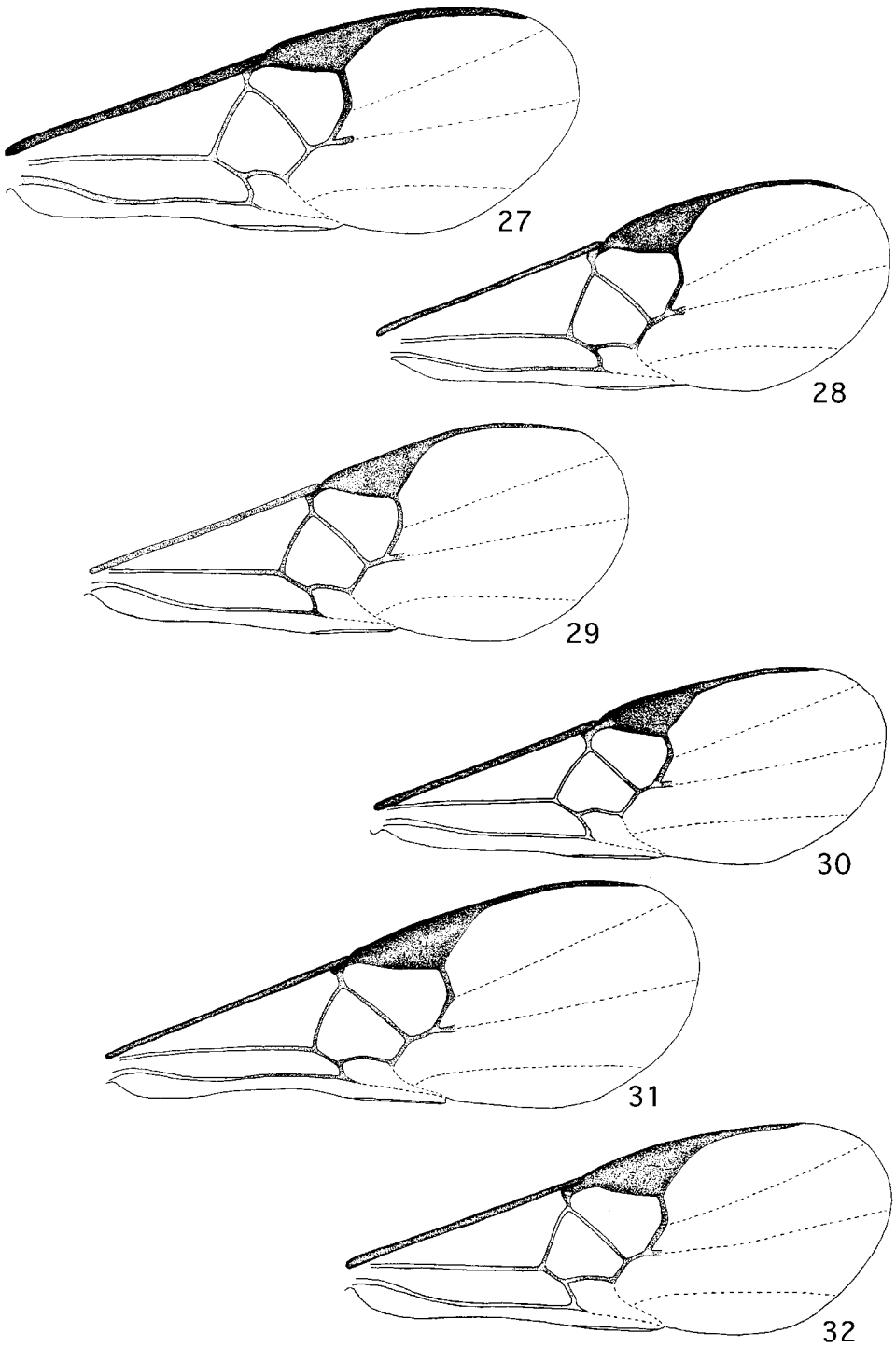
FIGURES 9–16. Cocoons of *Pholetesor.* **9:** *P. bedelliae* (Viereck), on underside of leaf with *Bedellia* mine. **10**: Cocoon of *Bucculatrix albertiella* on leaf of *Quercus agrifolia*; cocoon of *P. bucculatricis* (Muesebeck) is spun inside this cigar-shaped host cocoon. **11**: *P. salalicus* (Mason) cocoon inside opened mine of *Cameraria nemoris* on *Vaccinium ovatum*. **12**: *P. salalicus* cocoon inside opened mine of *Cameraria gaultheriella* on *Gaultheria shallon*. **13**: Cocoon of *P. caloptiliae* Whitfield. **14**: Cocoon of *P. ornigis* (Weed). **15**: Cocoons of *P. salalicus*, showing varraiation in banding pattern. **16**: Cocoon of *P. salicifoliellae* (Mason).



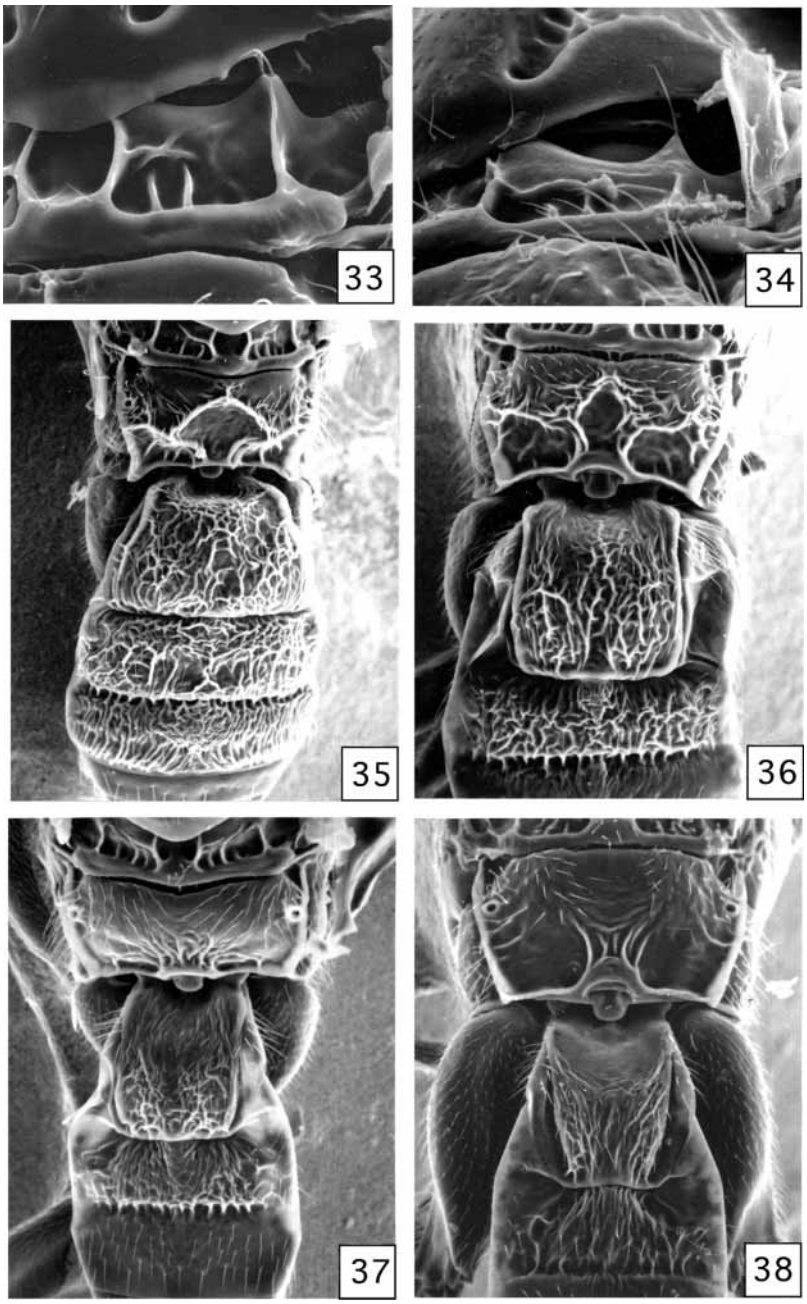
FIGURES 17–21. Forewings of**: 17,** *Pholetesor bucculatricis* (Muesebeck); **18,** *P. zelleriae* Whitfield*;* **19,** *P. masoni* Whitfield*;* **20,** *P. dixianus* Whitfield*;* **21,** *P. pinifoliellae* Whitfield.



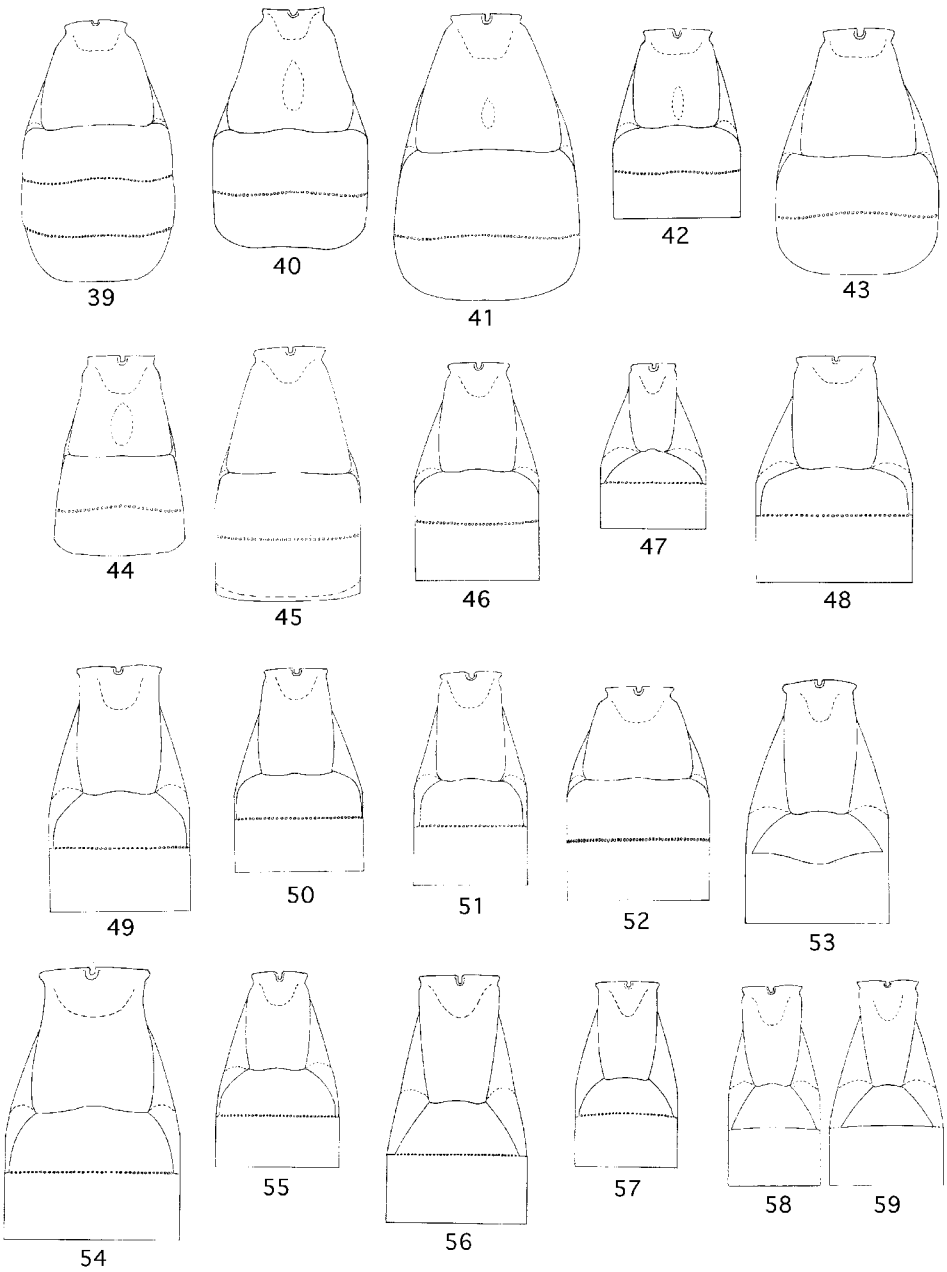
FIGURES 22–26. Forewings of: **22,** *Pholetesor rhygoplitoides* Whitfield; **23,** *P. bedelliae* (Viereck); **24,** *P. powelli* Whitfield; **25,** *P. variabilis* Whitfield; **26,** *P. viminetorum* (Wesmael).



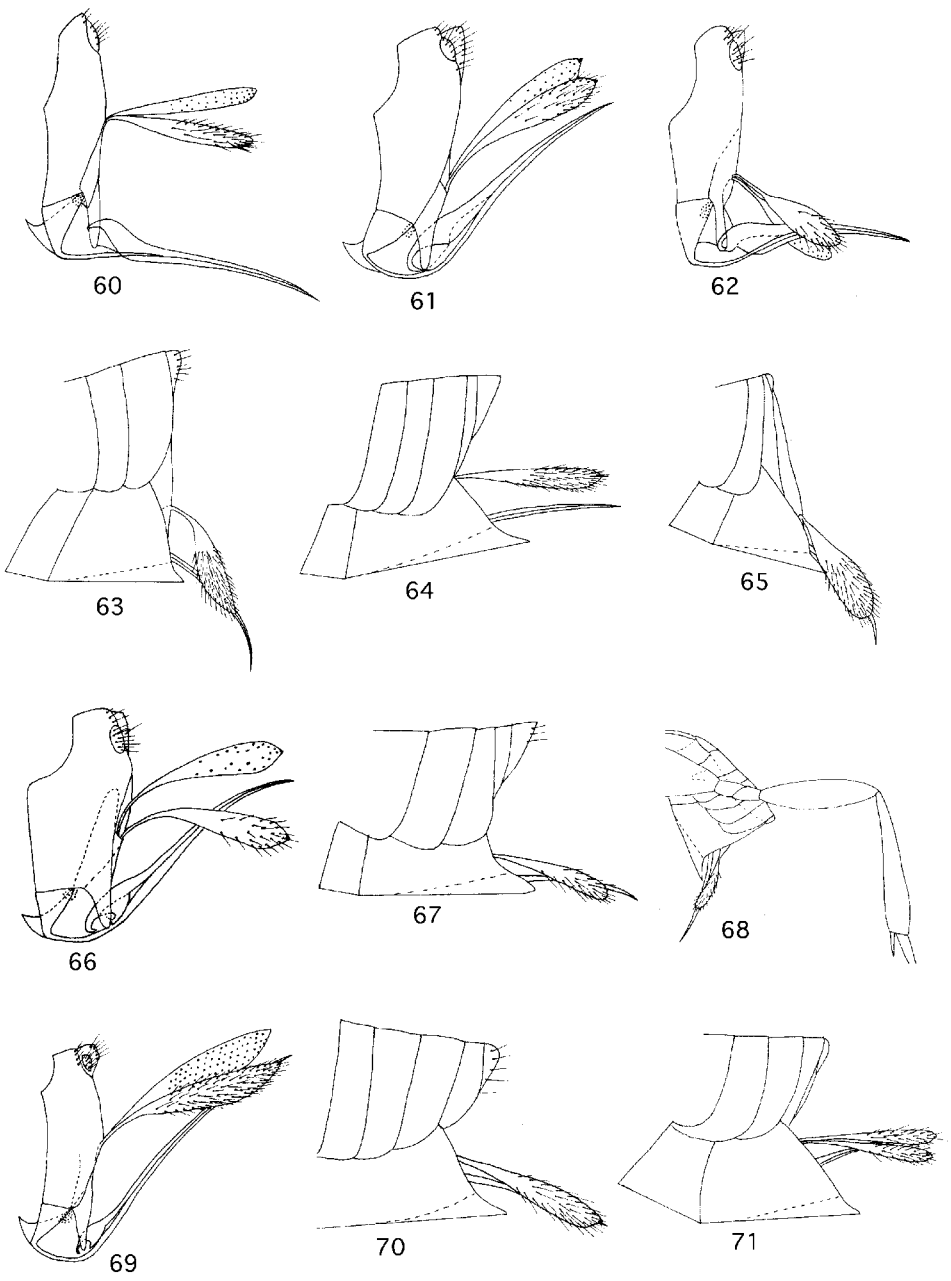
FIGURES 27–32. Forewings of: **27,** *Pholetesor caloptiliae* Whitfield*;* **28,** *P. ornigis* (Weed); **29,** *P. salalicus* (Mason)*;* **30,** *P. salicifoliellae* (Mason)*;* **31,** *P. circumscriptus* (Nees); **32,** *P. pedias* (Nixon)**.**



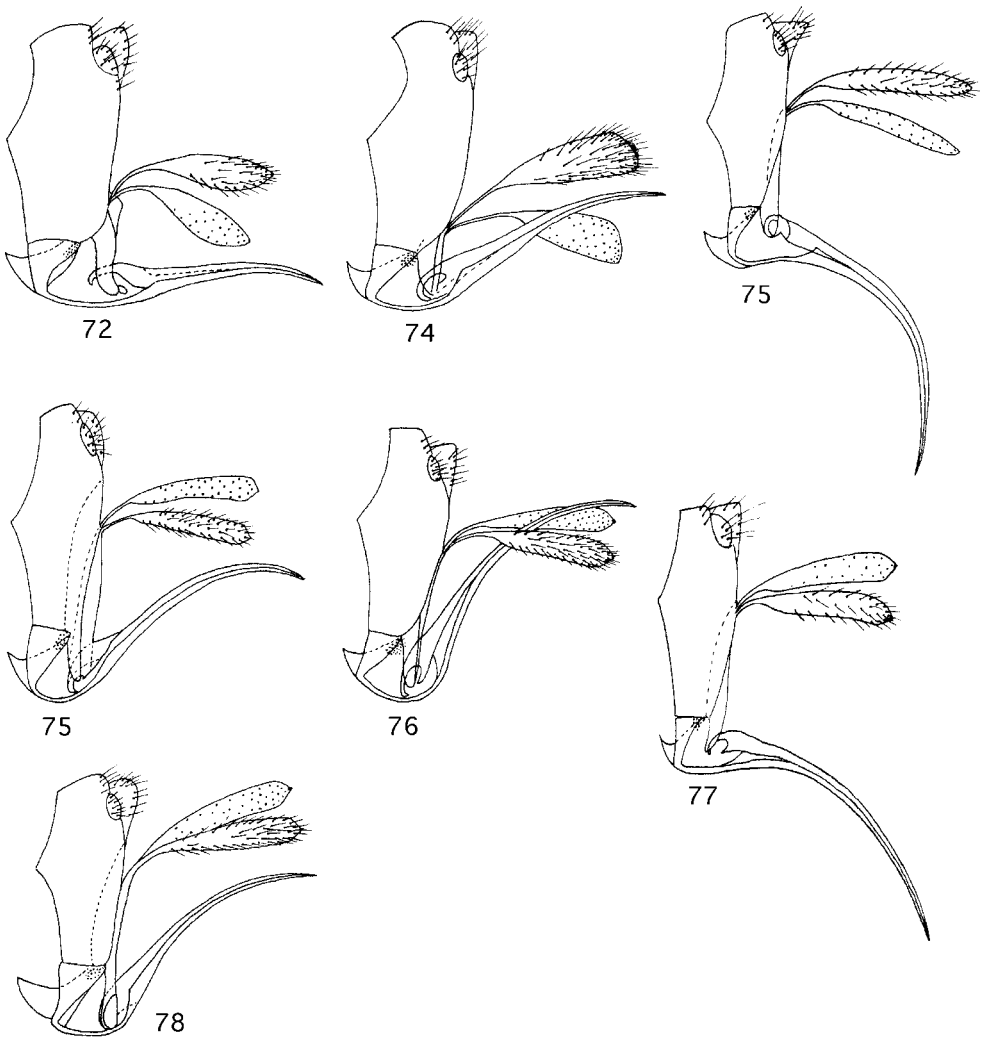
FIGURES 33–38. 33: metanotum of *Pholetesor bucculatricis* (Muesebeck), showing slight retraction from scutellum; **34**: metanotum of *P. salalicus* (Mason), showing strong retraction from scutellum. Both **FIGURES** 400x. **35:** propodeum and anterior metasomal tergites of *P. bucculatricis* (Muesebeck), dorsal view, 97.5x. **36**: propodeum and anterior metasomal tergites of *P. masoni* Whitfield, dorsal view. 120x. **37**: propodeum and anterior metasomal tergites of *P. bedelliae* (Viereck), dorsal view, 120x. **38**: propodeum and anterior metasomal tergites of *P. salalicus* (Mason), dorsal view, 120x.



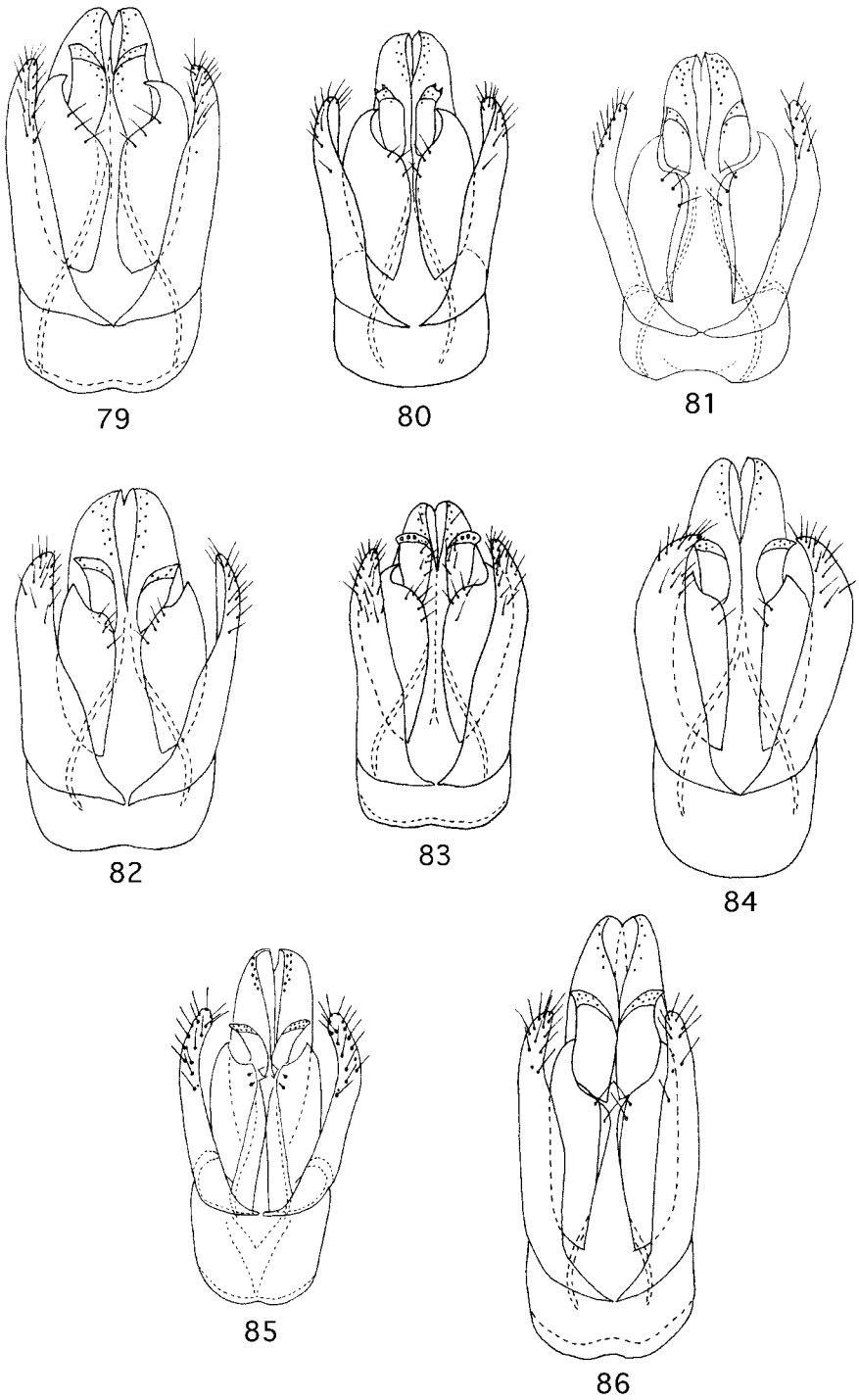
FIGURES 39–59. Anterior metasomal tergites, dorsal view, of: **39**, *Pholetesor masneri* (Mason); **40**, *P. bucculatricis* (Muesebeck); **41**, *P. zelleriae* Whitfield ; **42**, *P. masoni* Whitfield; **43**, *P. dixianus* Whitfield ; **44**, *P. pinifoliellae* Whitfield; **45**, *Pholetesor rhygoplitoides* Whitfield; **46**, *P. bedelliae* (Viereck); **47**, *P. chiricahuensis* Whitfield; **48**, *P. longicoxis* Whitfield; **49**, *P. powelli* Whitfield; **50**, *P. thuiellae* Whitfield; **51**, *P. rohweri* (Muesebeck); **52**, *P. variabilis* Whitfield; **53**, *P. viminetorum* (Wesmael); **54**, *P. caloptiliae* Whitfield; **55**, *Pholetesor ornigis* (Weed); **56**, *P. salalicus* (Mason); **57**, *P. salicifoliellae* (Mason); **58**, *Pholetesor circumscriptus* (Nees); **59**, *P. pedias* (Nixon).



FIGURES 60–71. **60–62**, Ovipositor apparati, lateral view, of: 60, *Pholetesor bucculatricis* (Muesebeck); 61, *P. zelleriae* Whitfield; 62, *P. masoni* Whitfield. **63–65**: Apex of female metasoma, lateral view, of: 63, *P. dixianus* Whitfield; 64, *P. pinifoliellae* Whitfield; 65, *P. rhygoplitoides* Whitfield. **66**: Ovipositor apparatus, lateral view, of *P. bedelliae* (Viereck). **67, 68**: Apex of female metasoma, lateral view, of: 67, *P. chiricahuensis* Whitfield; 68, *P. longicoxis* Whitfield. **69**: Ovipositor apparatus, lateral view, of *P. powelli* Whitfield. **70, 71**: Apex of female metasoma, lateral view, of: 70, *P. thuiellae* Whitfield ; 71, *P. rohweri* (Muesebeck).



FIGURES 72–78. Ovipositor apparati, lateral view, of: **72,** *Pholetesor variabilis* Whitfield; **73,** *P. viminetorum* (Wesmael); **74,** *P. caloptiliae* Whitfield**; 75,** *P. ornigis* (Weed); **76,** *P. salalicus* (Mason); **77,** *Pholetesor salicifoliellae* (Mason); **78,** *P. pedias* (Nixon).



FIGURES 79–86. Male genitalia, ventral view, of: **79,** *Pholetesor zelleriae* Whitfield; **80,** *P. masoni* Whitfield; **81,** *P. bedelliae* (Viereck); **82,** *P. variabilis* Whitfield; **83,** *P. viminetorum* (Wesmael); **84,** *P. ornigis* (Weed); **85,** *Pholetesor salalicus* (Mason); **86,** *P. salicifoliellae* (Mason).

About the author

Jim Whitfield is currently Professor of Entomology at the University of Illinois, Urbana-Champaign. Whitfield is author or coauthor on approximately 100 publications on the systematics of braconid parasitoid wasps, especially Microgastrinae and relatives, and on coevolution of the wasps with polydnaviruses, molecular phylogenetics, and parasitoid ecology. Jim received his Ph. D. from the University of California, Berkeley, in 1985. Since 2001 he has lived in Champaign, Illinois with wife Sydney Cameron, also at the University of Illinois, and who also publishes on phylogeny and biology of Hymenoptera (bees).

