A New Family of Monotrysian Moths from Austral South America (Lepidoptera: Palaephatidae), with a Phylogenetic Review of the Monotrysia

DONALD R. DAVIS

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ABSTRACT

Davis, Donald R. A New Family of Monotrysian Moths from Austral South America (Lepidoptera: Palaephatidae), with a Phylogenetic Review of the Monotrysia. *Smithsonian Contributions to Zoology*, number 434, 202 pages, 599 figures, 15 maps, 3 tables, 1986.—The general morphology, biogeography, and classification of a new family and superfamily of monotrysian moths are reviewed. To assess the proper relationships of this new taxon, the phylogeny of the infraorder Heteroneura, division Monotrysia is also summarized. The sister group of the Palaephatidae (Palaephatoidea) has been determined as the Nepticuloidea + Tischerioidea largely on the basis of their similar monotrysian, non-piercing ovipositors, with the oviporous opening between the eighth and ninth abdominal sterna. The distribution of the family is restricted largely to the temperate forests of southern Argentina and Chile, with a single genus reported from Australia. A total of 5 genera and 28 species are recognized from the New World. Four new genera, *Sesommata, Metaphatus, Plesiophatus,* and *Apophatus* are described as well as one new subgenus, *Prophatus,* of *Palaephatus* Meyrick. Twenty-five new species are named, including *Sesommata leuroptera, S. trachyptera, S. paraplatysaris, S. albimaculata, Metaphatus spatulatus, M. ochraceous, M. ichnius, M. cirrhus, M. sinuatus, M. adustus, Plesiophatus inarmigerus, Palaephatus dimorphus, P. leucacrotus, P. nielseni, P. spinosus, P. latus, P. fusciterminus, P. albiterminus, P. striatus, P. amplisaccus, P. pallidus, P. luteolus, P. albicerus, Apophatus parvus,* and *A. bifibratus*. Distribution maps and keys are provided for all South American species. Diagnostic characters of all taxa are fully illustrated by line drawings and photographs.

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A New Family of Monotrysian Moths from Austral South America (Lepidoptera: Palaephatidae), with a Phylogenetic Review of the Monotrysia

Donald R. Davis

Introduction

Approximately 99% of the Lepidoptera living today are grouped together in a single division, Ditrysia, of which the nearly 140,000 species (Heppner, in press) are principally characterized as possessing heteroneurous venation and two genital openings in the female. The remaining 1% constitute the so-called primitive Lepidoptera, an assemblage of small families that lack one or both of the above features. The taxonomic confusion that primitive moths have presented to workers over the years has more than compensated for their relatively few numbers. Much of this confusion is the result of the rather amazing array of morphological diversity that exists among the 23 families involved—a diversity either present only in the immatures, or in the adult but largely concealed by scales and, consequently, mostly ignored by earlier workers more content in naming species based on very superficial features. It has only been within the last decade or so that a concerted effort has been made to analyze this morphological diversity toward the eventual goal of stabilizing the classification and phylogeny of these families.

In my review of the Neopseustidae (Davis, 1975b), I emphasized the need for further exploratory field investigations in certain regions of the world expected to harbor primitive Lepidoptera. It was believed that the results of this fieldwork would not only provide investigators with more and better preserved material for detailed anatomical studies, but that such efforts would also lead to the discovery of possible "missing links"—groups that could fill in some of the conspicuous systematic gaps still prevalent among these taxa.

Because of unanticipated administrative duties, it was not until 1978 that I was able to initiate a cursory search for primitive Lepidoptera in the fragmentary remnants of Gondwanaland. Since then field work has been conducted in South Africa (1978), Chile (1979, 1981–1982), Taiwan (1980), Papua New Guinea (1983), the Guayana Highlands of Venezuela (1984), and New Caledonia (1984). I am indebted to S.E. and P.M. Miller for assisting with the survey in Papua New Guinea and to M.G.

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Pogue and M. Epstein for the work in New Caledonia. Further work is planned for southern Argentina, India, Nepal, and the Malagasy Republic. Similar surveys are also being pursued by microlepidopterists from CSIRO, Canberra, Australia; DSIR, Auckland, New Zealand, and the Zoological Museum of the University of Copenhagen, Denmark.

Largely isolated from the vast neotropical region by the Atacama Desert and high Andes in the north and by the Patagonian Steppe and the Monte (Map 2) of Argentina in the east, the southern temperate forests of Chile and Argentina have long been known to harbor an interesting array of relict organisms, most of which display nearest affinities to other faunas of the southern continents (Brundin (1966), Edmunds (1972), Illies (1965), Kuschel (1960), O'Brien (1971), and Schlinger (1974)). Until recently, the Microlepidoptera of this biogeographically strategic region had been poorly collected, with the result that the fauna remained mostly unknown. An attempt to remedy this situation was initiated in 1959 by J.F. Gates Clarke, who collected for one month primarily in Osorno and Llanquihue provinces, Chile. One result of that effort was a review of the Chilean Oecophoridae (Clarke, 1978). The discovery of Neopseustidae (Davis, 1975b) and of an even more primitive, mandibulate family, Heterobathmiidae (Kristensen and Nielsen, 1979, 1983), in this area greatly encouraged independent efforts by E.S. Nielsen and myself to visit the region in 1979. My interests in Patagonian moths were further kindled in 1977 after examining specimens of an unknown monotrysian family collected earlier by Clarke and L.E. Peña. From Clarke's illustrations of the Meyrick tineid types (Clarke, 1970), it was apparent that *"Tinea" holocapna* Meyrick also belonged to this group. All were suspected of being allied to *Palaephatus falsus* Butler, which was described over a century ago from a unique male and placed in the Gelechiidae. Fletcher (1929) later listed it in the Tineidae. One important result of my first Chilean trip in 1979, in which series of not only *P. falsus* were collected but also of several new and closely related genera and species, was to confirm the association of *Palaephatus* with the monotrysian complex now before me. The second trip to Chile (1981–1982) was designed to gather more data on this and other families, particularly to learn more on the extent of their distribution north toward the Chilean deserts and along the coastal mountain ranges south to Chiloé Island.

Besides the unique holotypes of *Palaephatus falsus* Butler and *Sesommata holocapna* (Meyrick), new combination, only one other representative of this new family was previously described from South America. *Sesommata platysaris* (Meyrick), new combination, was likewise thought to be a *Tinea* and was known from only two male specimens. In the present study a total of 28 species and 5 genera are recognized, most represented by long series. At least one other new species of *Palaephatus* is known (a unique male, collected 30 km NE of Villarrica) but not described, due to its poor condition. The percentage of new taxa treated in this report (approximately 90%) is typical for most of the Microlepidoptera families from austral South America. A fact of even greater significance is that most of these new taxa were never collected prior to 1979. These become more worrisome statistics when one witnesses the rate at which indigenous forests are being totally destroyed or replaced by exotic species in Chile (Figures 1, 2) and elsewhere. The opportunities to document, in order to understand, the long history of our earth's biota are becoming alarmingly limited.

Biological surveys in poorly studied areas must become a more urgent priority if we are ever to have a comprehensible idea as to what species currently share this planet with us. The accelerating destruction of natural habitats over much of the world will make surveys of the near future almost pointless, except to show what species losses have occurred (assuming, of course, that previous baseline surveys had been made). In entomology, and particularly in such poorly studied groups as Microlepidoptera, few natural areas have been properly surveyed, with the result that most of the fauna is both unknown and uncollected. The extinction of poorly sampled faunas can be of crucial importance in systematics, especially when it involves ancient, relict groups such as the Palaephatidae. Attempts to deduce relationships and biogeographical patterns about groups for which less than 10% to 20% of the extant taxa are represented in collections can prove both futile and highly misleading. Yet, as suggested by the above statistics, this is what the present systematics for much of the Microlepidoptera is founded upon, with vital components of the bulk of our missing data base capable of soon passing into oblivion without leaving so much as a fossilized trace.

ACKNOWLEDGMENTS.—The material from my two trips to Chile together with the extensive Danish collections assembled by E.S. Nielsen (1980a) during 1970–1979) and by Nielsen and O. Karsholt in 1981–1985 form the basis of the present study. I am deeply indebted to Nielsen and Karsholt and their sponsoring institution, the Zoological Museum of the University of Copenhagen, for allowing me to study their excellent collections. The gratitude I owe to Mr. Luis E. Peña G., who accompanied me in the field on both of my trips to Chile, is considerable and actually difficult to express in writing. His pioneering, lifelong effort to explore and publicize the entomofauna of Chile has been a help and inspiration to us all. In addition to Mr. Peña, several Chilean colleagues have assisted in various ways. I am especially thankful to the members of the Instituto Juan Ignacio Molina of Santiago and to the National Park Service of Chile (CONAF) for the many courtesies they provided. In the case of the latter, I wish particularly to thank Mr. Leonel Pincheira of the Parque Nacional de Nahuelbuta (Angol) and Mr. Javier Labra of the Parque Nacional de Puyehue (Entre-Lagos). The natural areas under their capable protection offer some of the finest study sites in all of Chile. I also wish to thank my wife Mignon, who assisted me on both trips, and to my former assistant, Ms. Biruta Akerbergs Hansen, who not only assisted in the field during 1979 but who is also responsible for many of the fine illustrations in this monograph. Artwork was also provided by Ms. Elaine Hodges, Mr. Vichai Malikul, and Mr. Young Sohn of the Department of Entomology, Smithsonian Institution. I am indebted to Mr. Victor Krantz of the Smithsonian Photographic Laboratory and to Ms. Susann Braden, Ms. Heidi Wolf, and Mr. Walt Brown of the Scanning Electron Microscope Laboratory for their much appreciated photographic assistance. The final draft of the manuscript was prepared by Ms. Silver West. Dr. Gaden Robinson of the British Museum (Natural History) was helpful in arranging loans of type material under his care. I am grateful to Drs. J.F. Gates Clarke, N.P. Kristensen, and E.S. Nielsen for their comments on the manuscript. Finally I wish to acknowledge the Smithsonian Institution (and the Fluid Research Fund thereof) for grant assistance on both expeditions and to the National Geographic Society for its support on the 1981–1982 expedition.

Representative specimens of Palaephatidae have been deposited in the following institutions and collections:

AMNH	American Museum of Natural History, New York City, New York, USA
ANIC	Australian National Insect Collection CSIRO, Canberra, Australia
BMNH	British Museum (Natural History), London, England
CNC	Canadian National Collection, Agriculture Canada, Ottawa, Ontario, Canada
CU	Cornell University, Ithaca, New York, USA
FSCA	Florida State Collection of Arthropods, Tallahassee, Florida, USA
LACM	Los Angeles County Museum of Natural History, Los Angeles, California, USA
LEP	collection of Luis E. Peña G., Santiago, Chile
MACN	Museo Argentino de Ciencias Naturales "Bernardino Rivadavia," Buenos Aires, Argentina
MHNS	Museo Nacional de Historia Natural, Santiago, Chile
MLP	Museo de La Plata, La Plata, Argentina
MNHP	Museum National d'Histoire Naturelle, Paris, France
NHMV	Naturhistorisches Museum, Vienna, Austria
NZAC	New Zealand Arthropod Collection, DSIR, Auckland, New Zealand

TMP	Transvaal Museum, Pretoria, South Africa
UCB	Essig Museum of Entomology, University of California, Berkely, California, USA
UOP	Entomological Laboratory, University of Osaka Prefecture, Sakai, Japan
USNM	collections of the former United States National Museum, now deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA
ZMUC	Zoologisk Museum, Universitets Kobenhaven, Copenhagen, Denmark

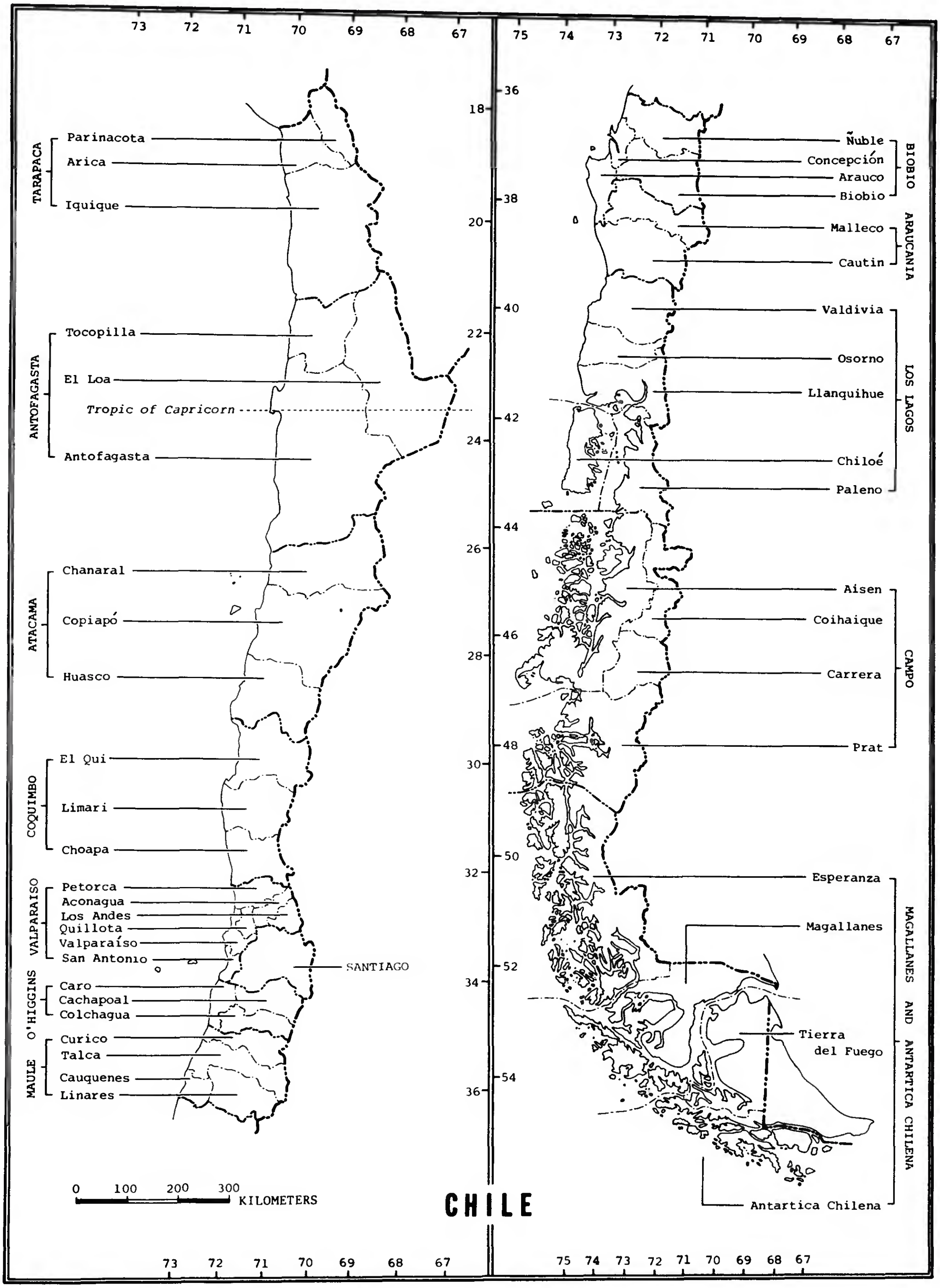
Even though the scope of the present study is actually not within the neotropical region, this contribution constitutes number 22 of the Neotropical Microlepidoptera Series of the Smithsonian Institution. A complete listing of the contributions published in this series is shown in the Appendix.

BIOGEOGRAPHY

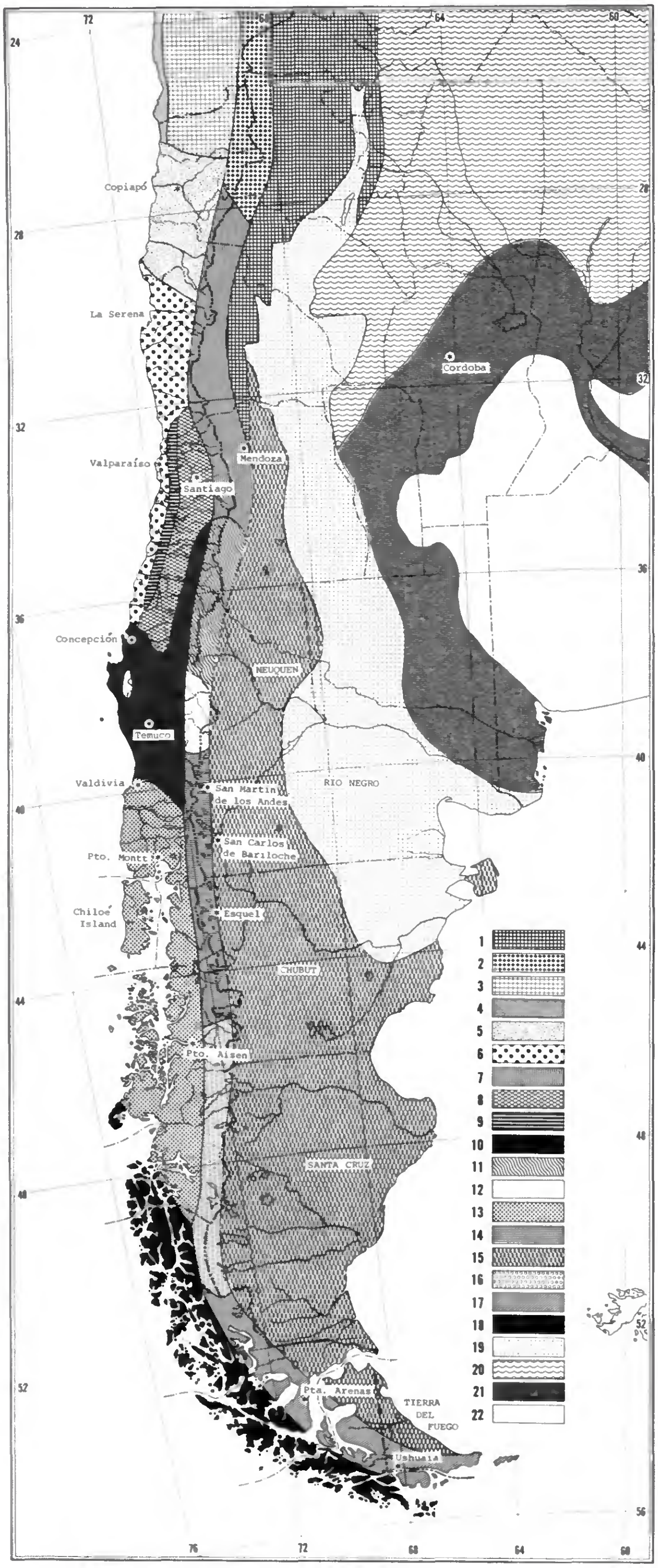
BIOTIC PROVINCES.—Numerous authors have contributed to an understanding of the phytogeography and zoogeography of austral South America. Most frequently these studies have been restricted either to Argentina or Chile and have seldom considered both countries simultaneously. The biotic provinces followed in this paper (Map 2) are derived largely from Peña (1966) and Irwin and Schlinger (in press), with some information regarding Argentina added from Cabrera (1953) and Cabrera and Willink (1973). Irwin and Schlinger based their regions principally on the findings of Peña (1966), Morello (1958), and Soriano (1949, 1956). Kuschel (1960), like Peña, primarily typified the faunal zones of Chile using certain groups of Coleoptera, with frequent references to dominant plant genera. O'Brien (1971) likewise relied basically upon Coleoptera in his more simplified version of Peña's entomofaunal regions. Probably the most detailed critique of the zoogeographical divisions of Chile is that of Artigas (1975), wherein the distribution of 903 animal species are plotted and correlated by computer methods. Our knowledge of the biotic provinces of southern Argentina are primarily based upon phytogeographical studies, among which the works of Cabrera (1953) and Soriano (1956) are particularly noteworthy. One of the most useful summaries of the phytogeography of South America, including the southern provinces, is the large multicolored map and accompanying information in Hueck and Seibert (1972).

The biotic provinces shown in Map 2 are characterized briefly below. Further description of those areas may be found in the foregoing references.

1. *Andean High Plateau* (Altiplano or Puna). Much of this province, which extends into northern Argentina, Bolivia, and Peru, consists of an undulating tableland between 3400 and 4300 meters and lying east of the Andean crests. Its vegetation is dominated by numerous Poaceae (*Festuca, Stipes*) and Asteraceae (*Baccharis, Senecio*)
2. *Northern Andean Cordillera Province.* This province, mostly above 2300 meters, extends from the Peruvian border south to 27°S. Peña states that its pattern of precipitation differs from that of the Central Andean Cordillera Province by receiving both a heavy summer rainfall and major winter snowfall. This results in a kind of dual spring: one in November–December and another in March–April. The steep mountain slopes that typify this region are dominated by grasses and shrubby vegetation (*Stipa, Baccharis*, and Cactaceae).
3. *Northern Desert Province.* This extremely dry, desolate area lies behind (east of) the coastal hills. Except for some slightly wetter east-west canyon systems, this area is practically devoid of noticeable life. Representative vegetation includes *Distichlis* (Poaceae), *Salicornia* (Chenopodiaceae), and *Tessaria* (Asteraceae).
4. *Northern Coast Province.* This narrow littoral region extending from about 20°30'S to approximately 27°S, possesses a distinctive vegetation supported by moisture derived from the fog that is constantly blown in from the ocean to enshroud the coastal hills. Among the dominant plants of this province are succulents and scattered leguminous trees.
5. *Intermediate Desert Province.* This region is wetter than the Northern Desert and extends to an elevation of about 2000 meters. There is also a much greater abundance of vegetation, particularly of Cactaceae, grasses, and annual herbs. O'Brien combines this intermediate region with the following, although the findings of Artigas supports its existence.
6. *Coquimban Desert Province* (Figures 3, 4). Near 29°30'S a gradual increase in shrubs and succulents marks the beginning of the Coquimban Desert Region. Moisture from coastal fog supports small remnants of the Northern Valdivian forest, especially along the Altos de Tali-



MAP 1.—The current regions and provinces of Chile, as used in this study.



Map 2.—The major biotic provinces of austral Argentina and Chile, largely based on Peña (1966) and Irwin and Schlinger, in press. See text for further explanation.

FIGURES 1, 2.—Disappearance of natural habitats: 1, coastal mountains east of Alto Tregualemu, Cauquenes Province, Chile. Mountain ridge to left has been cleared and replanted with exotic pine. 2, Andean foothills east of Curacautín, Malleco Province, Chile. Forest has been felled and left for conversion to pasture.

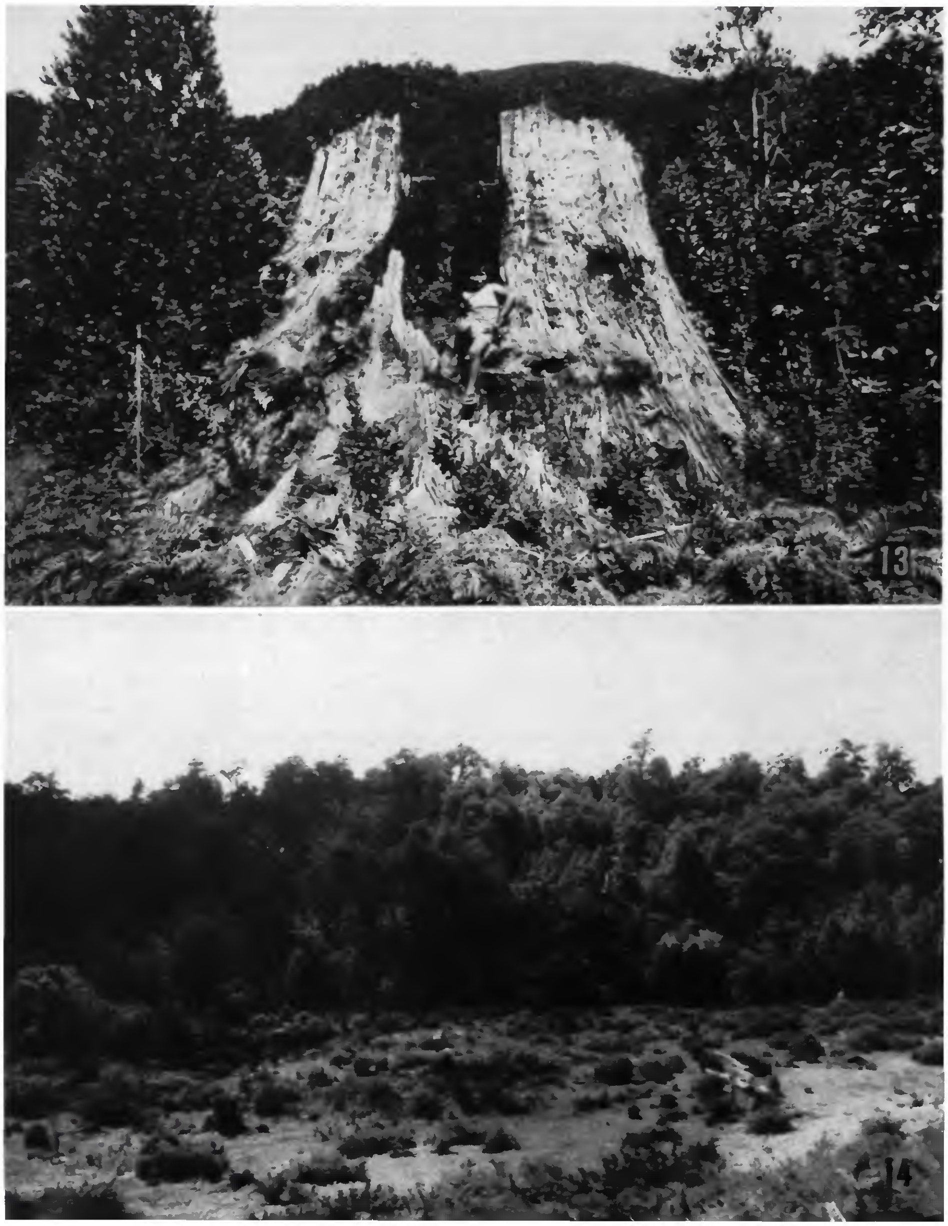
FIGURES 3, 4.—Coquimban Desert Province: 3, Ñague, 20 m, 11 km N of Los Vilos, Choapa Province, Chile. Small relict forest north (left) of coastal dunes marks northernmost record of Palaephatidae (*Palaephatus albicerus*). Dominant tree in forest is *Maytenus boaria*, with *Baccharis concava* in close association. 4, Los Molles, 25 m, ~10 km S of Pichidangui, Petorca Province, Chile. Northernmost habitat for *Metaphatus adustus*. Dominant shrubs are *Schinus latifolius* and *Lucuma valparadisca*.

FIGURES 5, 6.—Biotic provinces: 5, Central Coastal Cordillera: Cuesta la Dormida, 900–1200 m, Valparaiso Province, Chile. An isolated population of *Nothofagus obliqua macrocarpa* on the mountain slopes here marks the most northern extent of this genus in South America. Other common plants include *Lithraea caustica* and *Cryptocarya alba*. Peak on horizon (see arrow) is La Compana, climbed by Charles Darwin in 1835. 6, Central Andean Cordillera: Rio Colorado, 1100 m, ~40 km SE of Santiago, Metropolitan Region, Chile. Habitat for *Metaphatus adustus*. Dominant vegetation includes *Lithraea caustica, Colliguaya odorifera,* and *Quillaja saponaria*.

FIGURES 7, 8.—Northern Valdivian Forest Province: 7, Rio Teno, 800 m, ~40 km E of Curico, Curico Province, Chile. Most northern habitat for *Metaphatus ochraceus, M. spatulatus,* and *Palaephatus dimorphus*. The presence of *Nothofagus obliqua macrocarpa* on the mountain slopes marks the approximate northern boundary for the Northern Valdivian Forest. 8, Las Trancas, 1300 m, 21 km E of Recinto, Ñuble Province, Chile. Northernmost record for *Sesommata trachyptera*, with *Metaphatus ochraceus* also present. Dominant trees are *Nothofagus dombeyi* and *N. obliqua*.

FIGURES 9, 10.—Biotic provinces: 9, Northern Valdivian Forest: Alto Tregualemu, 500 m, ~20 km SE of Chovellen, Ñuble Province, Chile. Habitat for *Sesommata paraplatysaris, Metaphatus adustus, M. cirrhus, M. ochraceus, Palaephatus dimorphus, P. albiterminus, P. falsus,* and *P. albicerus.* Relative dry forest of *Drimys winteri, Guevina avellana,* and *Nothofagus obliqua.* 10, Coastal Araucaria forest: Los Gringos Camp, 1300 m, Nahuelbuta National Park, Malleco Province, Chile. Cool moist forest dominated by *Araucaria araucana,* with associated *Nothofagus antarctica, N. dombeyi,* and *N. pumilo.* A pale yellowish lichen, *Protousnea magellanica,* festoons most trees. Palaephatidae present include *Sesommata holocapna, S. platysaris, S. paraplatysaris, Metaphatus ochraceus, Palaephatus dimorphus, P. falsus,* and *P. pallidus.*

FIGURES 11, 12.—Biotic provinces: 11, Valdivian Forest: Aguas Calientes, 450 m, Rio Chanlefu, Parque Nacional Puyehue, Osorno Province, Chile. A cool, moist forest containing a rich mixture of vegetation (see text). In the immediate area occur *Metaphatus ochraceus*, *M. ichnius*, *Palaephatus dimorphus*, *P. leucacrotus*, *P. nielseni*, *P. spinosus*, *P. fusciterminus*, *P. albiterminus*, *P. striatus*, *P. amplisaccus*, *P. falsus*, *P. pallidus*, and *P. luteolus*. 12, Valdivian Cordillera: view of the southern Andes from Antillanca, Parque Nacional Puyehue, Osorno Province, Chile. Volcan Tronador (left) and Volcan Puntiagudo (right) are the snow-capped peaks on the horizon. *Nothofagus antarctica* and *N. pumilo* are dominant in the highest forests. In the more open areas occur *Escallonia virgata* and *Pernettya pumila*.



Figures 13, 14.—Valdivian Forest Province: 13, six km W of Lago Chapo 300 m, Llanguihue Province, Chile. A grim reminder of a magnificent forest once dominated by *Fitzroyea cupressoides*, now restricted to less accessible areas in the more southern Valdivian Forest. Palaephatidae collected here include *Palaephatus dimorphus, P. leucacrotus, P. fusciterminus, P. parvus, P. striatus*, and *P. amplisaccus*. 14, Puntra, 50 m, ~30 air km S of Ancud, Chiloé Island, Chile. Dense gallery forest habitat for *Palaephatus fusciterminus, P. albiterminus, P. amplisaccus, P. falsus, P. pallidus*, and *Apophatus bifibratus*.

nay. Present in these residual forests are such southern temperate species as ***Aextoxicon punctatum*** (Aextoxicaceae), ***Griselinia scandens*** (Cornaceae), ***Myrceugenia correolefolia*** (Myrtaceae), and ***Peumus boldus*** (Monimiaceae). The canyons of the region are often characterized by large cacti and several species of trees. Among the dominant vegetation are ***Schinus*** (Anacardiaceae), ***Copiapoa, Eulychnia, Opuntia, Trichocereus*** (Cactaceae), ***Oxalis*** (Oxalidaceae), ***Cassia*** (Leguminoseae), ***Lucuma*** (Sapotaceae), and ***Verbena*** (Verbenaceae).

7. *Central Andean Cordillera Province* (Figure 6). Near 28°S a relative abrupt increase in precipitation throughout the higher Andes marks the rather obscure transition to the Central Andean Cordillera Province. The area is subjected to a dense cloud cover, strong rainfall, and heavy winter snowfall. The canyons are often heavily forested, with ***Lithraea, Schinus*** (Anacardiaceae), ***Colliguaya*** (Euphorbiaceae), and ***Quillaja*** (Rosaceae) most common.
8. *Central Valley Province.* This is a relatively dry region with an annual precipitation of 350 to 1500 mm. All indications suggest that the region is becoming gradually drier, as desertification proceeds southward. The original thorn forest, or Chilean espinal, characteristic of this area has now been largely displaced by intense cultivation. Dominant vegetation includes ***Cassia*** (Leguminoseae), ***Cryptocarpa*** (Lauraceae), ***Quillaya*** (Rosaceae), ***Peumus*** (Monimiaceae), and ***Schinus*** (Anacardiaceae).
9. *Central Coastal Cordillera Province* (Figure 5). This narrow strip of coastal mountains extends from 32°S to 36°S. Much of the insect fauna of the intermediate and higher elevations may represent the same or similar species found in the central Andes. Similarly the fauna of the lower elevations resembles those of the Central Valley and environs. For these reasons, O'Brien (1971) did not recognize this as a distinct region, although Artigas (1975) did. The insect fauna of the higher elevations is still in great need of further study. There also exist some relationships with the Northern Valdivian Forest. For example, situated slightly northwest of Santiago (Figure 5) persist relict populations of ***Nothofagus,*** the most northern limits of this genus in South America. Plants common to this province include ***Litraea*** (Anacardiaceae), ***Puya*** (Bromeliaceae), ***Trichocereus*** (Cactaceae), and ***Cryptocarya*** (Lauraceae).
10. *Northern Valdivian Forest Province* (Figures 7–9). This relatively moist, biologically rich area extends as a narrow band along the Andean foothills from about 35°30′S until it spreads to the coast north of Concepción and continues south to the Bio Bio river. The annual precipitation of the region ranges from 1000 to 3000 mm. Some of the dominant trees are ***Aextoxicon*** (Aextoxicaceae), ***Eucryphia*** (Eucryphiaceae), ***Guerina*** (Proteaceae), ***Laurelia*** (Monimiaceae), ***Nothofagus obliqua, N. procera*** (Fagaceae), and ***Podocarpus*** (Podocarpaceae).
11. *Southern Andean Cordillera Province.* Similar to the Central Andean Cordillera Region but more humid, this region commences at approximately 34°S and extends southward to 38°S, where ***Araucaria araucaria*** first appears. At its lower elevations (700–800 meters) a rich forest dominated by ***Nothofagus*** exists, but this disappears gradually with increasing altitude.
12. *Araucarian Province* (Pehuenar) (Figure 10). This region is divided into two disjunct portions (a small coastal zone and a much larger Andean zone) by the lower Northern Valdivian Forest. The coastal zone roughly corresponds to the Cordillera de Nahuelbuta, although the habitat of this area has seriously dwindled in recent times. Its lower altitudinal limit is approximately 1000 meters. Rainfall in the region ranges from 600–1800 mm per annum. The forests are characterized by ***Araucaria araucana*** (Araucariaceae), ***Nothofagus antarctica, N. dombeyi, N. pumilio*** (Fagaceae), and ***Chusquea*** (Poaceae).
13. *Valdivian Forest Province* (Figures 11, 13, 14). This region extends from 39°30′S to 48°S and from the Chilean coast to and probably beyond the Argentine border in several places. It is a very humid area with an annual rainfall from 2000 to 4000 mm. The typically cool, wet forests are rich in animal and plant life. Characteristic plant genera include ***Aextoxicon*** (Aextoxicaceae), ***Drimys*** (Winteraceae), ***Eucryphia*** (Eucryphiaceae), ***Fitzroya*** (Cupressaceae), ***Guerina*** (Proteaceae), ***Laurelia*** (Monimiaceae), ***Myrceugenella, Myrceugenia*** (Myrtaceae), ***Nothofagus*** (Fagaceae), and ***Podocarpus*** (Podocarpaceae).
14. *Valdivian Cordillera Province* (Figure 12). Even more so than in the other regions, the actual boundaries of this area are much more irregular than outlined in Map 2. With several breaks (valleys) where it is transsected by the lower Valdivian Forest, the Valdivian Cordillera Province extends from 39°S to 45°S at altitudes above 700 meters. According to Almeyda and Saez (1958), annual precipitation varies between 2000 and 4000 mm. The predominantly deciduous forests are characterized by ***Nothofagus antarctica, N. betuloides, N. dombeyi,*** and ***N. pumilo.***
15. *Patagonian Steppe Province.* This extensive area, stretching from 31°S to nearly 55°S, constitutes by far the largest biotic zone in Patagonia. Always lying east of the Andean crest, it covers much of southern Argentina, overlapping into Chile in only a few places in Malleco, Coihaique, Carrera, Prat, Ultima Esperanza, Magallanes, and Tierra del Fuego provinces. Depending upon the locality, precipitation may vary between 100 and 600 mm per annum. The vegetation consists largely of grasses, ***Agrostis, Bromus, Deschampsia, Festuca, Poa, Stipa,*** and dwarf shrubs, ***Adesmia*** (Leguminoseae), ***Berberis*** (Berberidaceae), and ***Mulinum*** (Umbelliferae).
16. *Aysen Cordillera Province.* Peña (1966) reports the north-

ern boundary of this region to be near 45°S, where the lower altitudinal limit is around 500 meters. It extends southward to nearly 51°S in Ultima Esperanza. The region is characterized by sparse bushy or grassy slopes and extensive snow fields and glaciers.

17. *Magellanic Interoceanic Province* (The Magellanic Forest). This area largely corresponds to what Kuschel (1960) has referred to as the Magellanic Forest. Peña (1966) described it as a transitional forested region between the Patagonian Steppe and the Southern Pacific Province. It is a relatively arid zone, with an annual precipitation between 400 and 500 mm. The vegetation is little differentiated from the much more northern Valdivian Forest. As Kuschel has observed, the region does not possess a unique fauna of its own; instead, all species also occur in the Valdivian Forest. The Magellanic Forest is characterized by a preponderance of *Nothofagus* (McQueen, 1976). As an indication of the depauperate biota of this province, only six species of trees have been reported (Kuschel, 1960) south of the Strait of Magellan: *Nothofagus betuloides, N. Pumilio, N. antarctica, Drimys winteri, Embothrium coccineum,* and *Maitenus magellanica.*
18. *Southern Pacific Province* (The Magellanic Moorland). Bounded by the Pacific Ocean on the west and largely by the Magellanic Forest on the east, this well-defined region extends from the Golfo de Peñas (46°S) to Cape Horn. It consists primarily of numerous islands and continental peninsulas. It is an extremely wet, inhospitable land, subjected to strong winds and an annual rainfall ranging from 3500 to more than 9000 mm. Small forests of *Nothofagus antarctica* and *N. betuloides* exist in sheltered ravines. Dominant vegetation includes *Donatia* (Stylidiaceae), *Gaimardia* (Centrolepidaceae), *Oreobolus* (Cyperaceae), and *Tetroncium* (Scheucheriaceae).
19. *Monte Province.* This relatively large province extends from approximately 26°S to 44°S. It is the most arid region in Argentina, with an annual precipitation of only 80 to 250 mm. The topography is diverse, consisting of low hills, plateaus, and sandy plains. The vegetation tends to be rather homogenous over extensive areas, with the biotype known as matorral (dense, shrubby vegetation) predominating (Morello, 1958). Prevalent in this association are certain genera of Zygophyllaceae, particularly *Bulnesia, Larrea,* and *Plectrocarpa.*
20. *Chaqueña Province.* This large region extends from the vicinity of Cordoba (about 34°S) north into southern Bolivia. It is bounded on the west by the Andes and to the east partially by the moist valley of the Rio Paraná. The Chaqueña is a relatively dry area with an annual precipitation ranging from 500 mm in the west to 1200 mm in the east. The vegetation is dominated by a xerophytic forest interspersed with grassy savanas and shrub-covered steppes. Some of the dominant plants include *Aspidospermum* (Apocynaceae), *Caesalpinea, Cercidium* (Leguminoseae), *Chorisia* (Bombaceae), *Patagonula* (Ehretiaceae), *Tabebuia* (Bignoniaceae), *Ximenia* (Olacaceae), *Zizyphus* (Rhamnaceae), *Cereus,* and *Opuntia* (Cactaceae).
21. *Espinal Province.* The Espinal of Argentina extends as a relatively narrow, irregular arch around much of the Argentina Pampas. The climate varies from relatively warm and humid in the north to temperate and dry in the south. Annual precipitation ranges from 1170 to 340 mm. The characteristic vegetation is that of a xerophytic thorn forest with genera such as *Acacia, Geoffraea, Prosopis* (Leguminoseae), *Allophyllus* (Sapindaceae), *Aspidasperma* (Apocynaceae), *Schinus* (Anacardiaceae), and *Scutia* (Rhamnaceae) prevailing.
22. *Pampeana Province* (The Argentine Pampas). This area comprises the well-known grassy plain, or Pampas, of southeastern Argentina. Annual precipitation ranges from 600 to 1200 mm. Among the grasses that dominate this region are *Aristida, Briza, Bromus, Melica, Piptochaetium, Poa,* and *Stipa.* Marginal forests exist along river courses and through ravines and gorges.

DISTRIBUTION OF PALAEPHATIDAE.—All 28 species of Palaephatidae described to date are restricted to southern Argentina and Chile, between 32°S and approximately 55°S latitudes. Although recent efforts have failed to reveal the family's presence in either New Caledonia or New Zealand (Dugdale, in litt.), Nielsen (in press) has reported Palaephatidae from Australia.

In austral South America, palaephatids have been collected in eight major biotic provinces in the frequency shown in Table 1. Their center of distribution is concentrated in those regions characterized by a cool, moist climate and temperate forest dominated by *Nothofagus* and associated vegetation; namely, the Northern Valdivian Forest, Valdivian Forest, and Valdivian Cordillera. The high number of species recorded in the latter is undoubtedly exaggerated by the very generalized limits followed in Map 2 for this province. Some of the Argentine localities below 900 meters, for example, would probably be more typified as Valdivian Forest. Furthermore, Nielsen reports (pers. comm.) that some of his Argentine material was collected in a lower and drier transitional zone between forest and steppe, a region he refers to (Nielsen and Robinson, 1983) as the *Austrocedrus* zone. Because this area is also overlaid by the boundaries of the higher Valdivian Cordillera in Map 2, all records of Palaephatidae from the *Austrocedrus* zone are unfortunately lumped under the former province in Table 1. Similarly, at least one (*Palaephatus albicerus*) of the two species reported from the Coquimban Desert Province was collected in a small relict forest more typical of the Northern Valdivian Forest.

Possessing a greater development of moist, temperate forests, Chile also hosts more species of Palaephatidae than does Argentina. Six species (*Metaphatus ichnius, M. cirrhus, M. sinuatus, Palaephatus leucacrotus, P. latus,* and *P. albicerus*) are known only from Chile, whereas only a single, seemingly rare species (*Sesommata albimaculata*) from Argentina has yet to be found in Chile.

Life History

Little is known regarding the life history of Palaephatidae. A single larva of *Sesommata holocapna* was discovered by O. Karsholt on 15 September 1981 near Colonia Suiza, San Carlos de Bariloche, Argentina. The larva spins together the twigs of *Diostea juncea* Miers (Verbenaceae), a small, green, woody shrub that ranges in Chile from Santiago south to Valdivia and in Argentina from Neuquen Province south into Chubut. Karsholt (in litt.) has suggested that the larva may also feed on the dead leaves of this plant, because so little fresh host material was added during the month-long confinement of the larva. Pupation occurred during mid-October in a loose shelter between the spun twigs. The adult emerged around the first of November, or slightly before the earliest appearance of the first wild captured adults (Table 2). How typical this basic biology is for the family can only be determined as more species are reared.

Collecting records show that the adults of approximately half of all palaephatid species are active at least 4 to 5 months a year (Table 2). The latest fall flight records remain unknown owing to the termination of collecting efforts around mid-March. Adults of *Metaphatus ochraceus* were collected as early as mid-August and more or less continuously until after mid-March. It is possible that more than one brood is repre-

TABLE 1.—Species density of Palaephatidae according to biotic province.

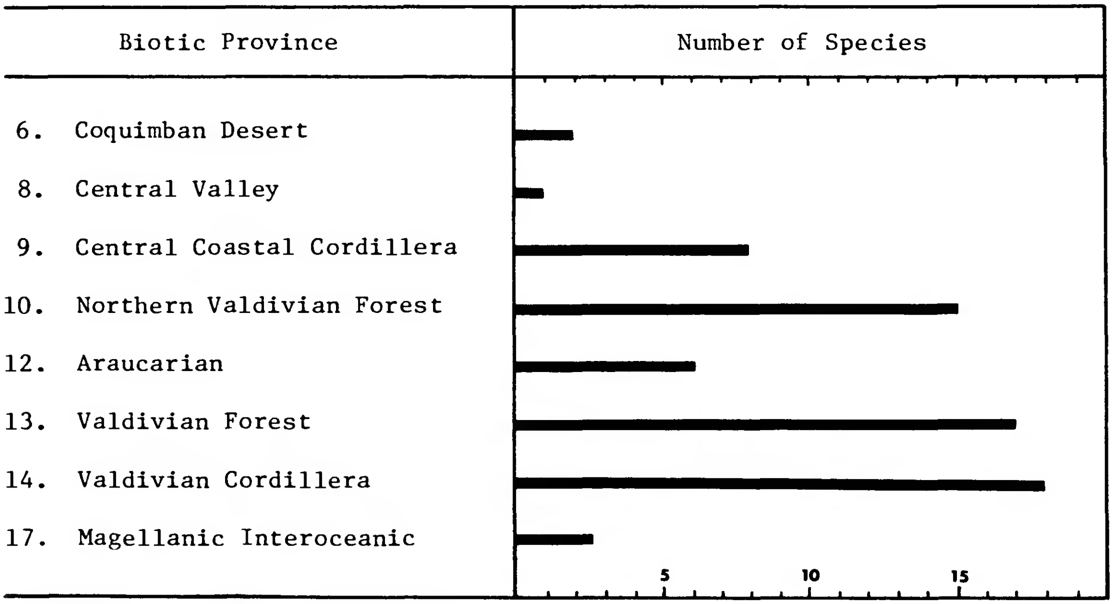
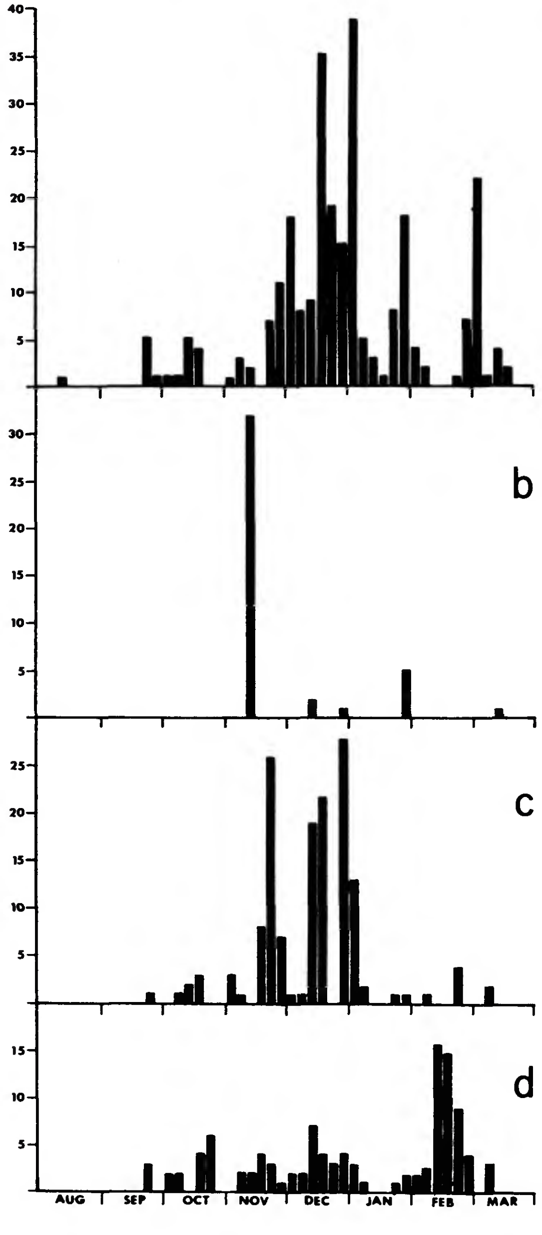


TABLE 2.—Checklist of the species of Palephatidae with a summary of their flight periods.

Checklist	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Sesommata, new genus								
leuroptera, new species				■	■	■	■	■
trachyptera, new species				■	■	■	■	■
holocapna (Meyrick, 1931)				■	■	■		
paraplatysaris, new species				■	■	■		
platysaris (Meyrick, 1931)				■	■	■		
albimaculata, new species					■			
Metaphatus, new genus								
spatulatus, new species			■	■	■	■		
ochraceus, new species	■	■	■	■	■	■	■	■
ichnius, new species					■	■	■	
cirrhus, new species					■	■		
sinuatus, new species				■				
adustus, new species		■	■	■	■	■	■	■
Plesiophatus, new genus								
inarmigerus, new species							■	
Palaephatus Butler, 1883								
Prophatus, new subgenus								
dimorphus, new species		■	■	■	■	■	■	■
leucacrotus, new species			■	■	■			
nielseni, new species			■	■				
spinosus, new species							■	
latus, new species			■					
fusciterminus, new species			■	■	■	■	■	■
albiterminus, new species		■	■	■	■	■	■	
striatus, new species		■	■	■	■	■	■	
amplisaccus, new species				■	■	■	■	
Palaephatus Butler, 1883, subgenus								
falsus Butler, 1883		■	■	■	■	■	■	■
pallidus, new species					■	■	■	■
luteolus, new species			■	■	■	■	■	■
albicerus, new species		■	■	■	■	■	■	■
Apophatus, new genus								
parvus, new species							■	
bifibratus, new species					■			

sented. However, present records do not clearly indicate multiple brooding for this or other species whose flight records extend over several months (Table 3). Conversely, it is probably safe to assume that some species (e.g., *Palaephatus leucacrotus* and *P. nielseni*) are single brooded, because intensive collecting within their range has been conducted over a period of several

TABLE 3.—Summary of adult capture records, grouped in 5-day intervals, for 4 species of Palaephatidae; numbers in left-hand column represent numbers of individuals: *a, Metaphatus ochraceus,* new species; *b, Sesommata leuroptera,* new species; *c, Palaephatus (Prophatus) dimorphus,* new species; *d, Palaephatus (Palaephatus) falsus* Butler.



months, thus insuring adequate sampling.

This discovery of one larva in early spring (mid-September) and the late flying period of several species suggest either an extended egg diapause during the winter or, possibly, overwintering by immature larvae.

The presence of a rich array of sex scaling in the males of several Palaephatidae strongly suggests not only possible courtship displays by the males but also the likely production of long-range sex attractants. If sexual role reversal, with the males calling the females, proves to occur in the Palaephatidae, then this would support the hypothesis of Mallet (1984) that the reversed calling system of some Hepialidae represents the ancestral condition for Lepidoptera. Observations on captured live adults of those species of Palaephatidae with elaborate male sex scaling needs to be conducted and could prove most interesting.

Comparative Morphology

Some of the major morphological features important in understanding the systematic relationships of the Palaephatidae are summarized below. Comparisons with closely allied taxa are also included.

ABBREVIATIONS.—Following is a list of abbreviations used in the illustrations:

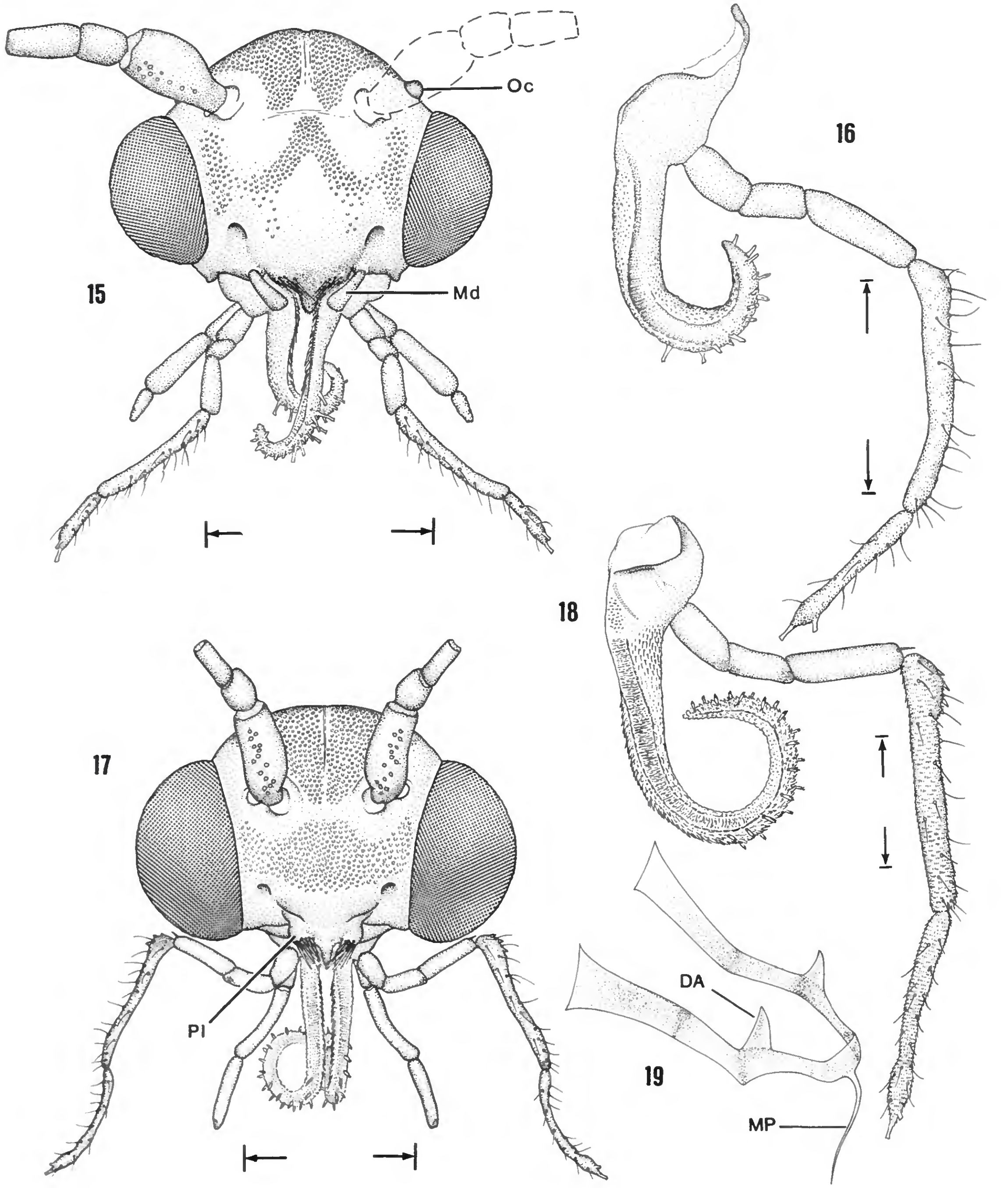
A	abdomen (abdominal segment)
AA	anterior apophysis
AAm	anterior arm of first axillary sclerite
AC	anapleural cleft
AdR	anterodorsal ridge of metafurca
Ae	aedoeagus
ALC	anterior lobe of colliculum
Am	anepisternum
An	anellus
AnFM	androconial fold of medial area of forewing
AnPA	androconial pocket of anal area of hind wing
AnPR	androconial pocket of radial area of hind wing
Ant	antenna
ApL	apical lobe of valva
APM	anteromedial process of metafurcasternum
Ar	arolium
As	anus
ASc	anal sclerite of hind wing
Ax	axillary sclerite
B	basalare
BG	basal gland(?) of second abdominal sternite

BS	basement sex scale of androconial pocket
CB	corpus bursae
Cdo	cardo
CG	colleterial gland
Cm	colliculum
CmS	campaniform sensilla
CO	common oviduct
CS	coxal suture
Cx	coxa
DA	dorsal arm of tentorium
DSpa	ductus spermathecae
Ea	eucoxa
EC	exterior canal of spermatheca
En	epimeron
FA	furcal apophysis
FS	flap sex scale of androconial pocket
G	galea (haustellum)
Gn	gnathos
HP	humeral plate of forewing
IAAn	inner arm of anellus
IC	interior canal of spermatheca
IL	intercoxal lamella of basisternum
IS	intercalary sclerite of antenna
J	juxta
JF	jugal fold
K	katepisternum
L	leg
LA	lateral arms of mesofurcal apophysis
LAAn	lateral arms of anellus
Lb	labrum
LCS	lateral cervical sclerite
Lg	legula of haustellum
LL	lateral lagena
LP	labial palpus
Lpa	laterophragma
LRV	lateral rod of vestibulum
LSF	lamina of secondary furcal arms
MA	median arm of hind wing base
Md	mandible
ML	mesal lamella of metafurcasternum
Mn	meron
MKC	midventral keel of colliculum
MP	medioposterior process of tentorium
MPl	median plate of forewing base
MSR	medial sensory ridge of ovipositor
MtS	metascutal spines
MxP	maxillary palpus
Oc	ocellus
Os	oviporus (= ostium oviductus)
PA	posterior apophysis
PaS	paracoxal suture
PeS	pseudempodial seta of pretarsus
Pf	pilifer
PLC	posterior lobe of colliculum
Pha	phragma (postnotum)
PlS	pleural suture
Pm	patagium
PnWP	postnotal wing process
PoS	proprioreceptor sensilla
Prm	pre-episternum
PrS	Prothoracic spina
PS	proleg scar
PsA	prescutal apodeme
Psm	prosternum
Pu	pulvillus
PWP	pleural wing process
Px	pollex of valva
RG	receptacular gland
RPl	radial plate
RSpa	reservoir of spermatheca
S	sternum of abdomen
Sa	anterior sternite of sternum
SAF	secondary arms of furcasternum
SC	sensillum coeloconicum
Se	subalare
Slm	scutellum
Sm	scutum
Spe	spiracle
St	stipes
STa	sensillum trichodeum
Sub	subtegula
T	tergum of abdomen
Ta	tegula
TC	tarsal claw (ungues)
TpA	tergopleural apodeme
TPC	tergopleural connection
U	uncus
UP	unguitractor plate
Us	utriculus
Va	valva
Ve	vesica
VF	V-shaped ventral fold of colliculum (V-fold)
Vm	vinculum
Vn	venula (of 2S)
VSAn	ventrolateral sclerite of anellus

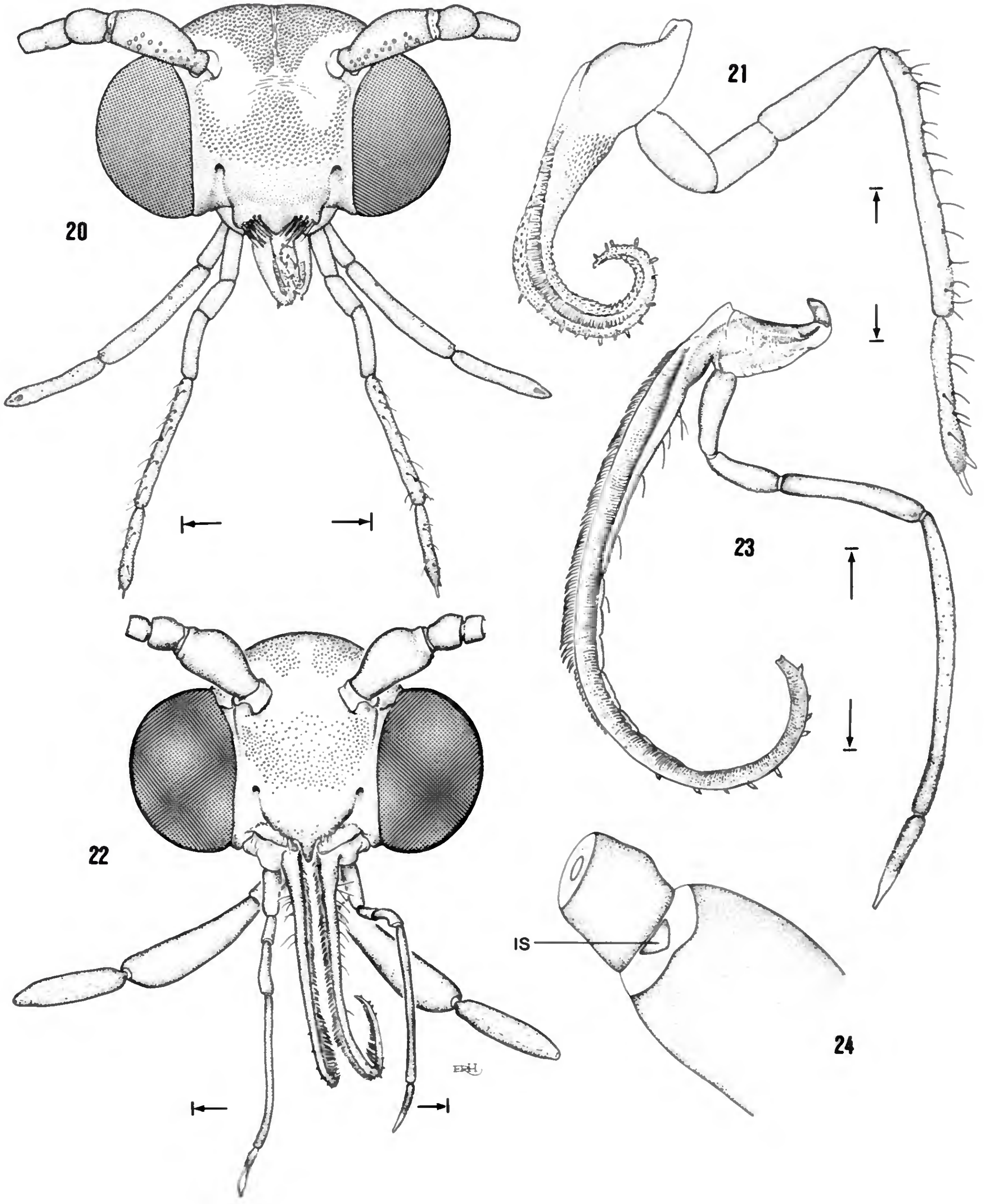
HEAD

The vestiture of the head is typically rough and densely covered with erect, piliform scales possessing acute apices (Figure 317). In the subgenus *Palaephatus*, scales of the vertex tend to be more appressed and slightly broader with bidentate apices. Scales of the upper frons are directed dorsally and often mesally as well. The lower half of the frons is mostly naked. Chaetosemata are absent.

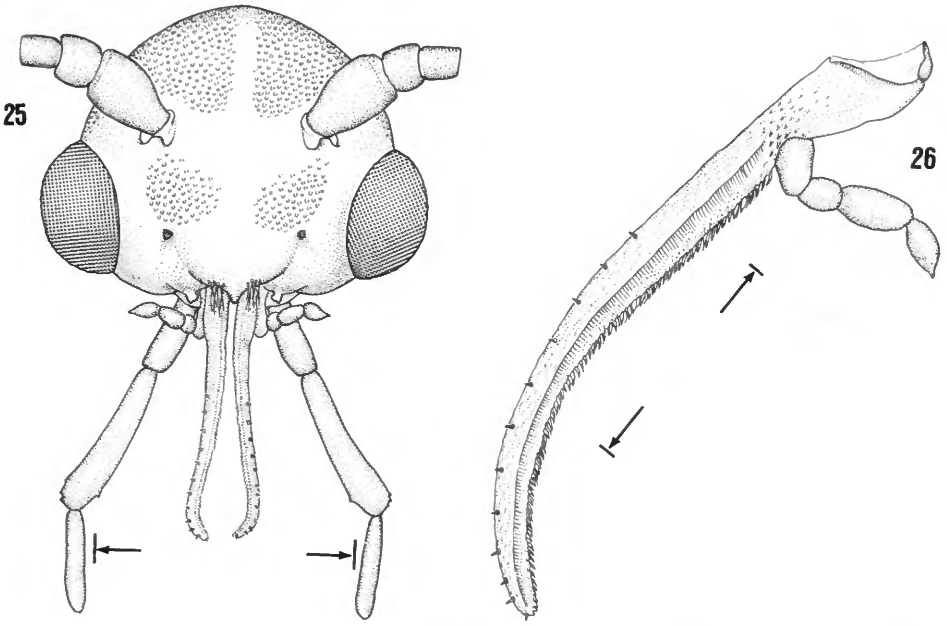
The compound eyes vary appreciably in size,



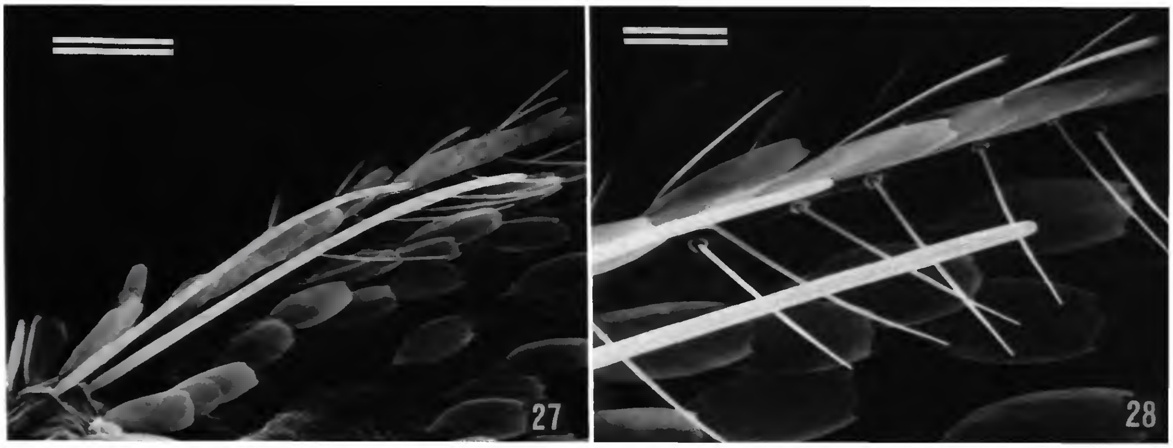
FIGURES 15–19.—Adult head structure: 15, *Sesommata trachyptera*, new species, anterior view (0.5 mm); 16, maxilla (0.2 mm); 17, *Metaphatus ochraceus*, new species, anterior view (0.5 mm); 18, maxilla (0.2 mm); 19, tentorium. (Scale lengths in parentheses.)



FIGURES 20–24.—Adult head structure: 20, *Plesiophatus inarmigerus*, new species, anterior view (0.5 mm); 21, maxilla (0.2 mm); 22, *Palaephatus (Palaephatus) falsus* (Butler), anterior view (0.5 mm); 23, maxilla (0.2 mm); 24, basal two segments of antenna. (Scale lengths in parentheses.)

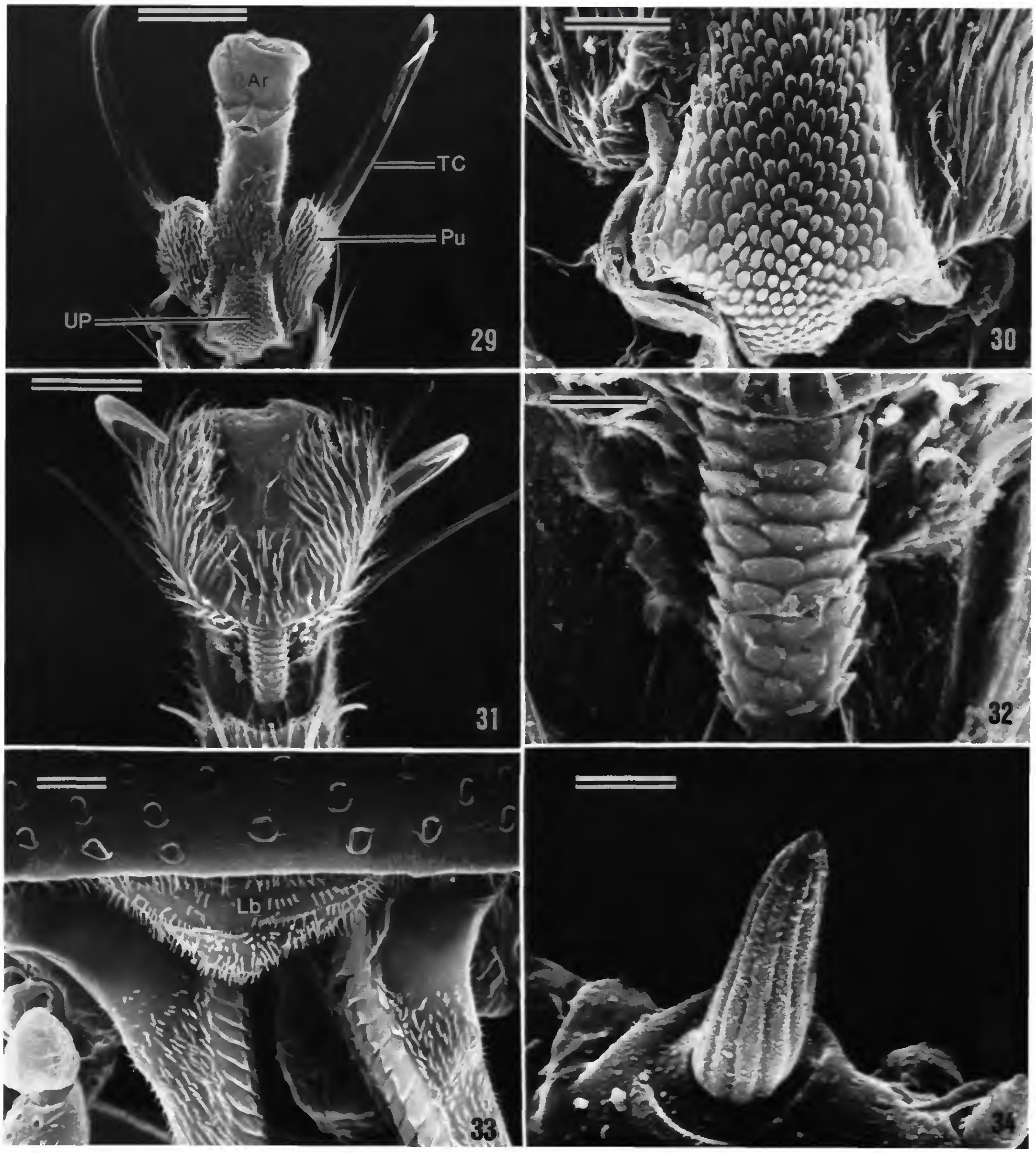


FIGURES 25, 26.—Adult head structure, *Apophatus bifibratus*, new species: 25, anterior view (0.5 mm); 26, maxilla (0.2 mm). (Scale lengths in parentheses.)

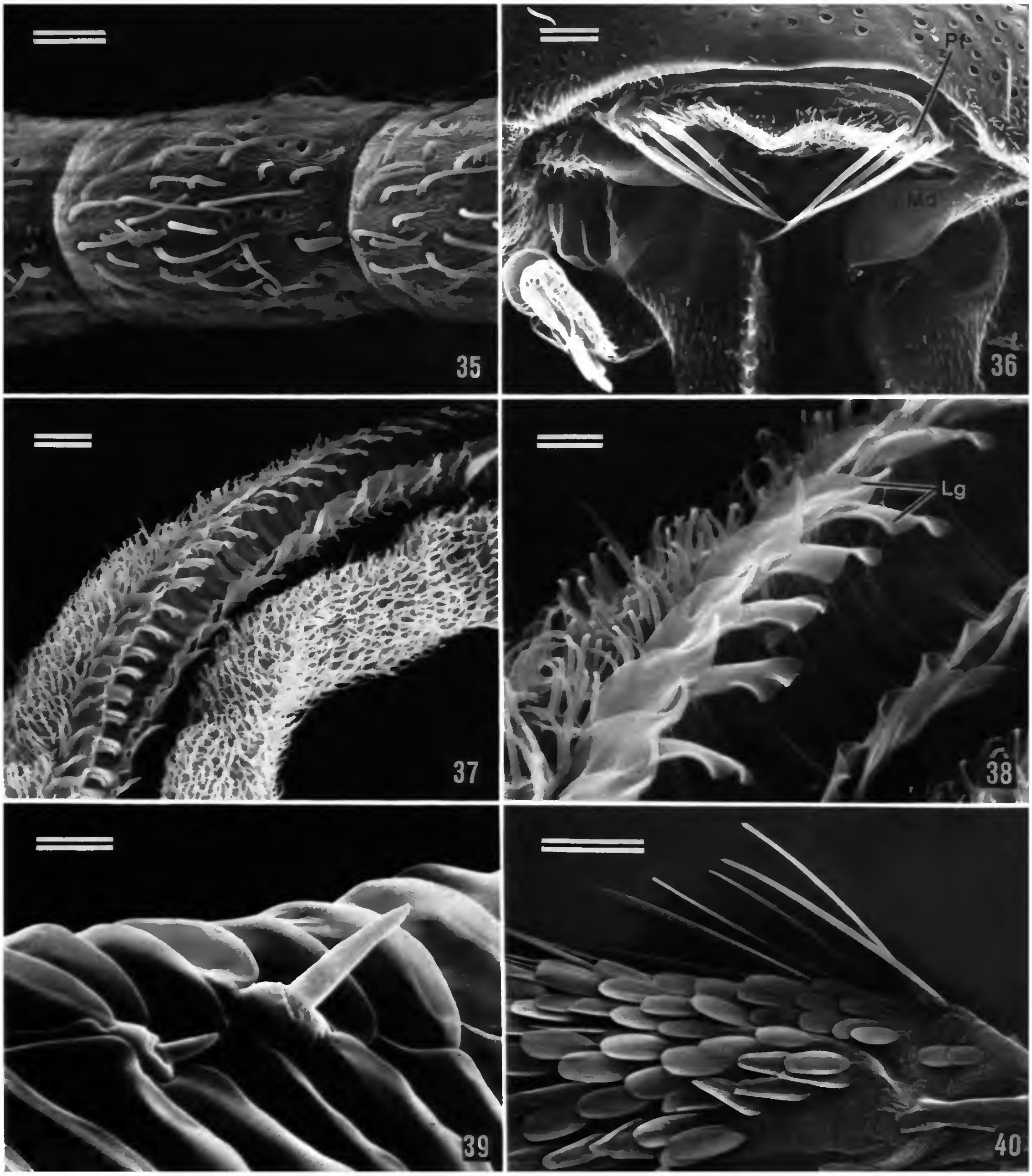


FIGURES 27, 28.—*"Acanthopteroctetes" unifascia* Davis: 27, female frenulum (80 µm); 28, detail of 27 showing pseudofrenular setae partially restraining frenulum (40 µm). (Scale lengths in parentheses.)

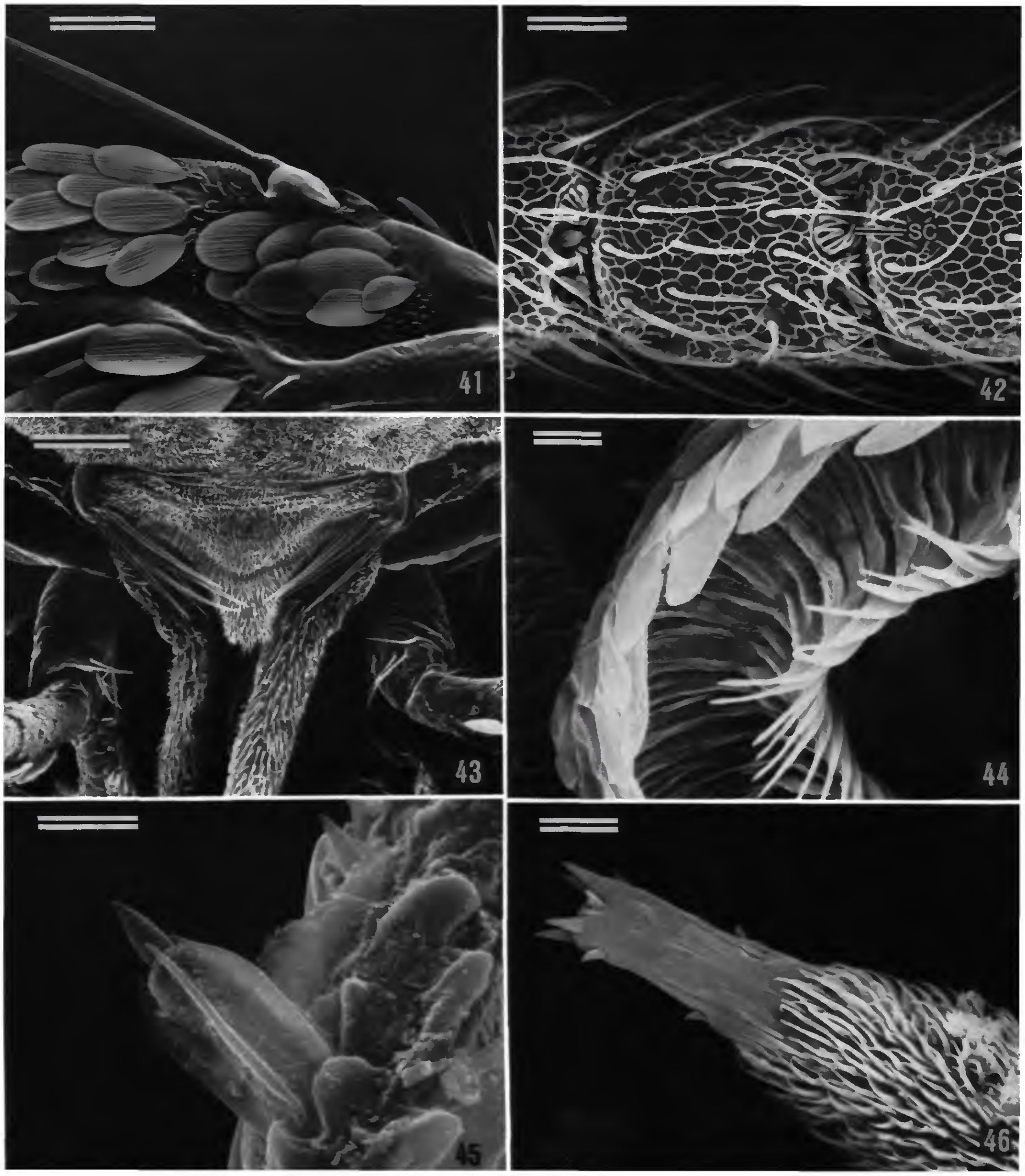
but are usually well developed in most genera. In all six species of *Sesommata*, a decidedly diurnal group, the eyes are relatively reduced, with an interocular index (Davis, 1975a:5) of 0.7–0.8 and an eye index (Powell, 1973:8) of 0.8–0.9. Adults of *Metaphatus, Plesiophatus,* and *Palaephatus* are commonly attracted to ultraviolet light and possess relatively large eyes. The interocular indices of these genera range from 1.0 to 1.2 and their eye indices from 0.95 to 1.2. The most



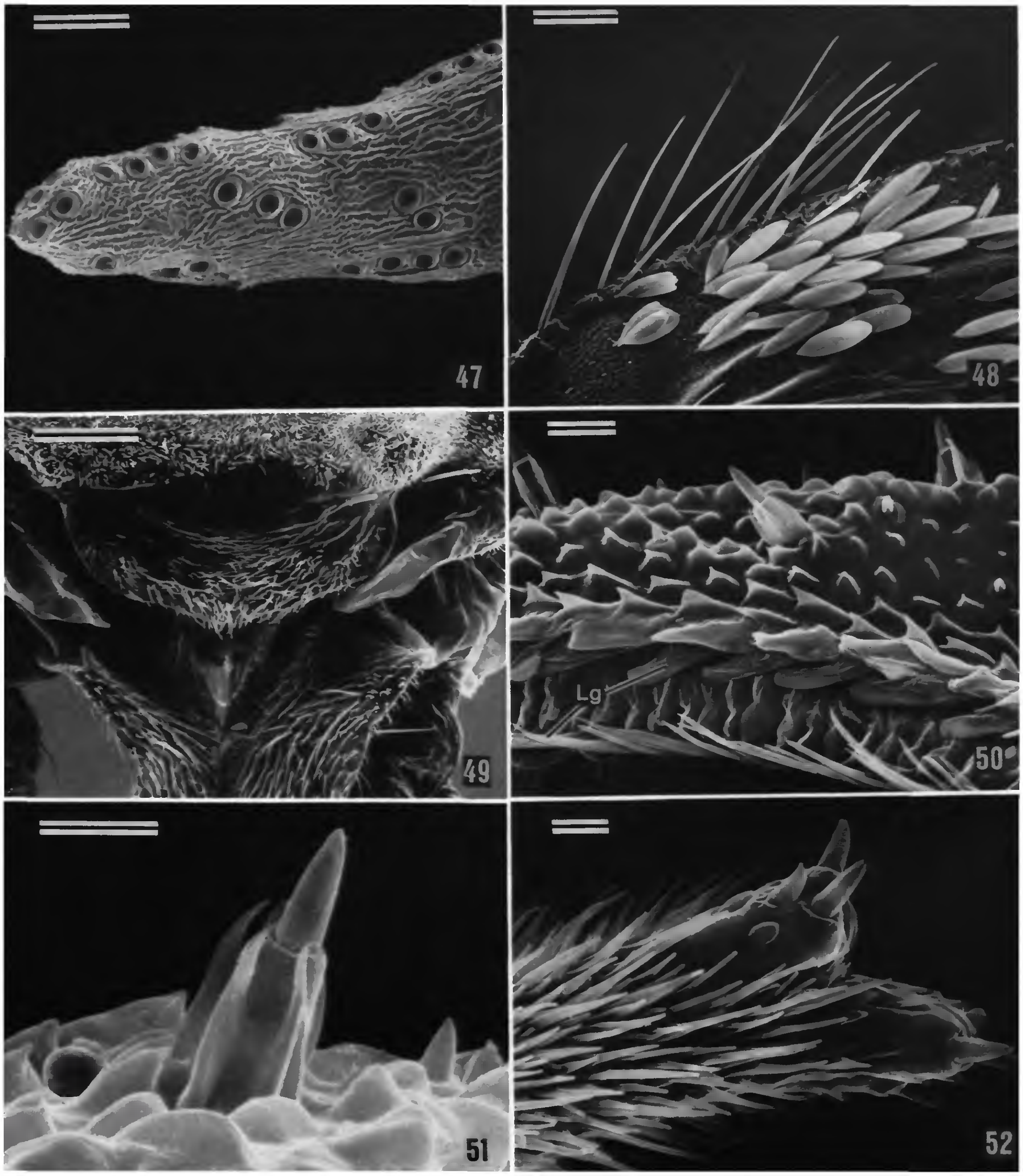
Figures 29–34.—Morphological details: 29, Hepialidae, *Dalaca pallens* (Blanchard), ventral view of mesothoracic pretarsus (100 μm); 30, detail of unguitractor plate (25 μm); 31, Eriocraniidae, *Dyseriocrania grisecapitella* (Walsingham), ventral view of prothoracic pretarsus (25 μm); 32, detail of unguitractor plate (5 μm); 33, Heliozelidae, *Antispila nysaefoliella* Clemens, labrum and base of galeae (haustellum) (20 μm); 34, sensillum styloconicum of haustellum, sessile type (2 μm). (Scale lengths in parentheses.)



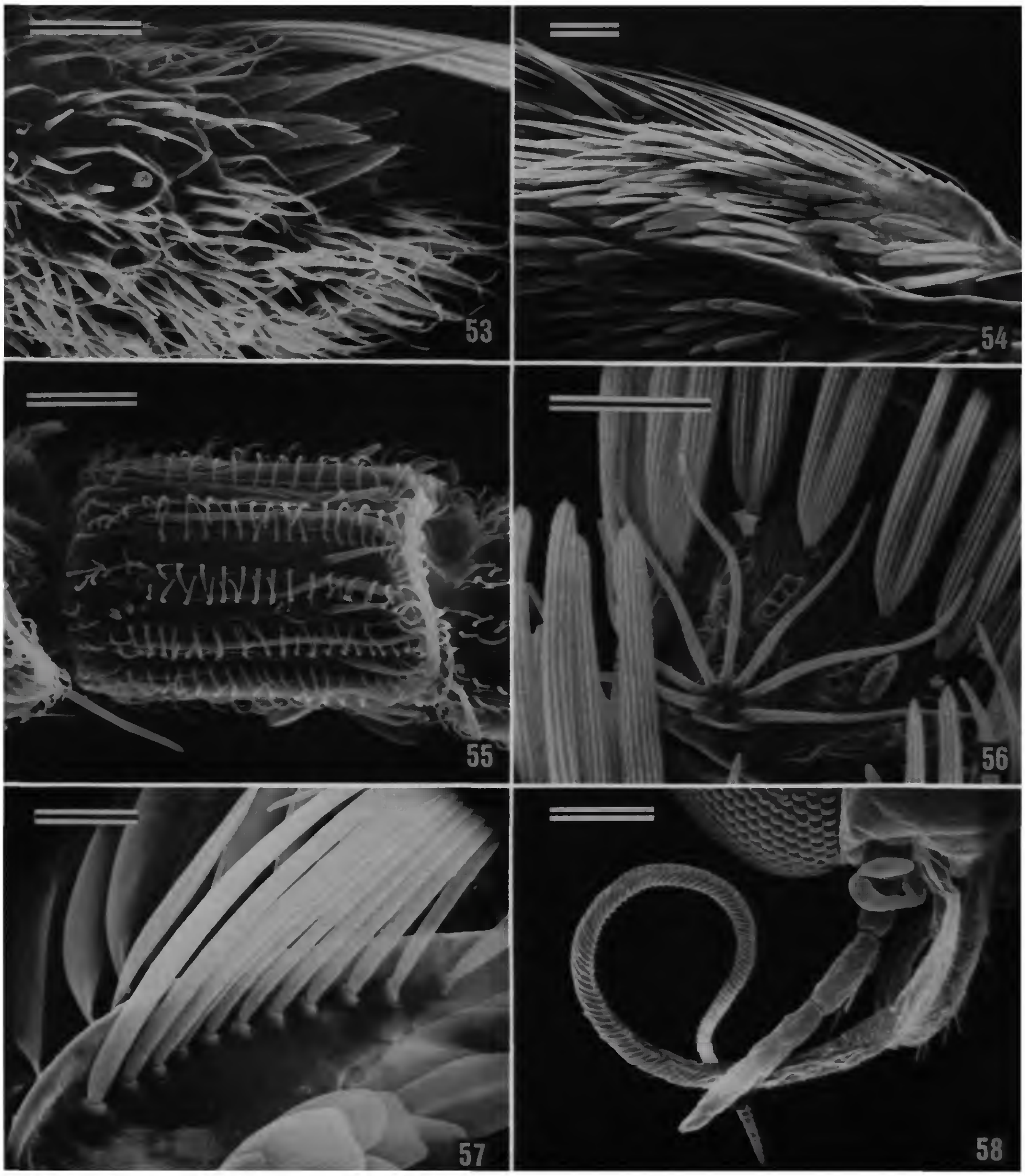
FIGURES 35–40.—Morphological details, Heliozelidae, *Heliozela aesella* Chambers: 35, antennal sensilla (10 μm); 36, labrum and base of galeae (haustellum) (20 μm); 37, mesal and lateral views of haustellum (10 μm); 38, detail of food channel (4 μm); 39, sensilla styloconica of haustellum (4 μm); 40, pseudofrenular setae of female hind wing (100 μm). (Scale lengths in parentheses.)



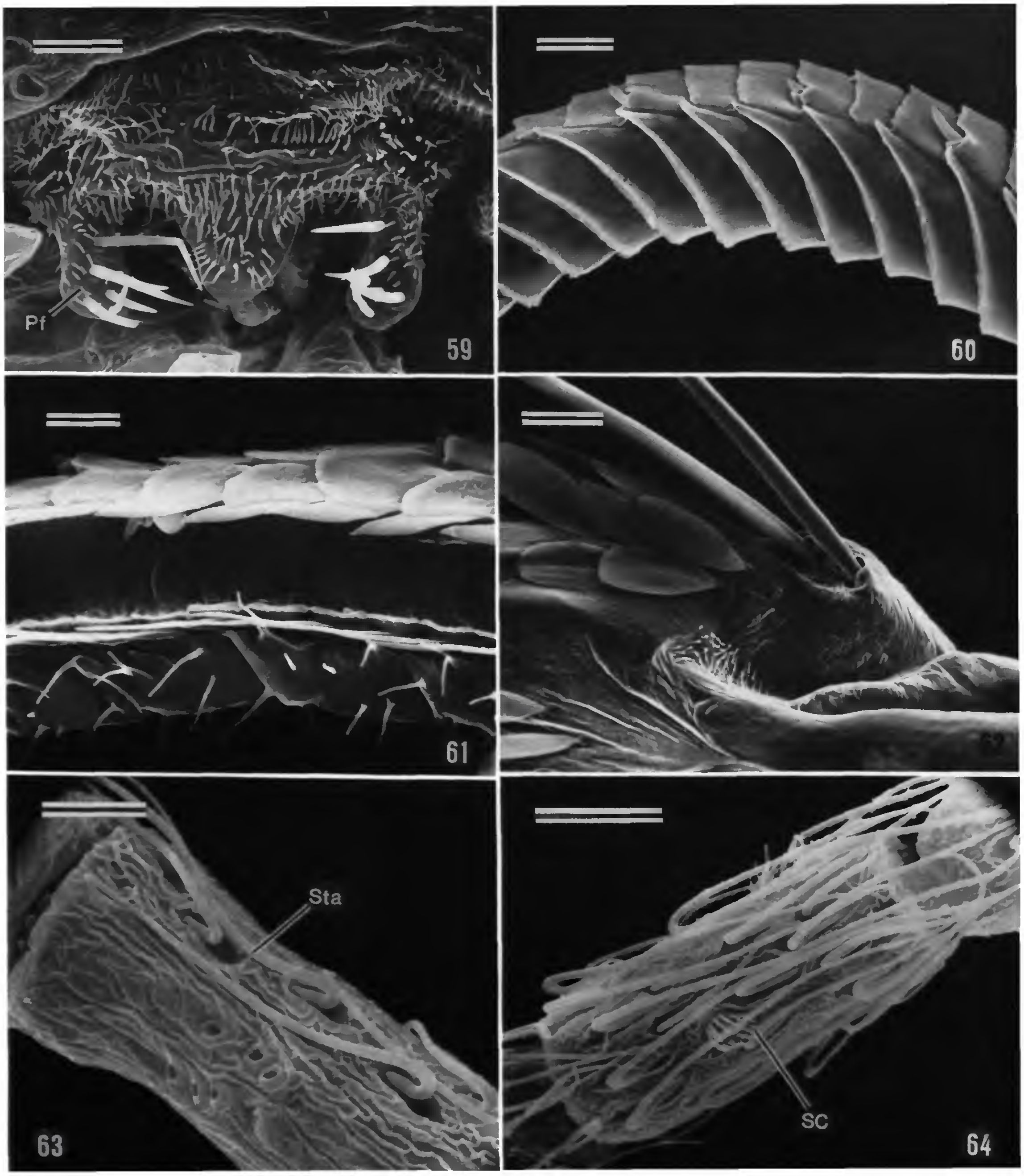
FIGURES 41–46.—Morphological details: 41, Heliozelidae, *Heliozela aesella* Chambers, male frenulum (50 µm); 42, Incurvariidae, *Basileura elongata* Nielsen and Davis, antennal sensilla (20 µm); 43, labrum and base of galeae (haustellum) (50 µm); 44, detail of food channel (10 µm); 45, sensillum styloconicum with ribbed base (on haustellum) (5 µm); 46, apex of maxillary palpus (10 µm). (Scale lengths in parentheses.)



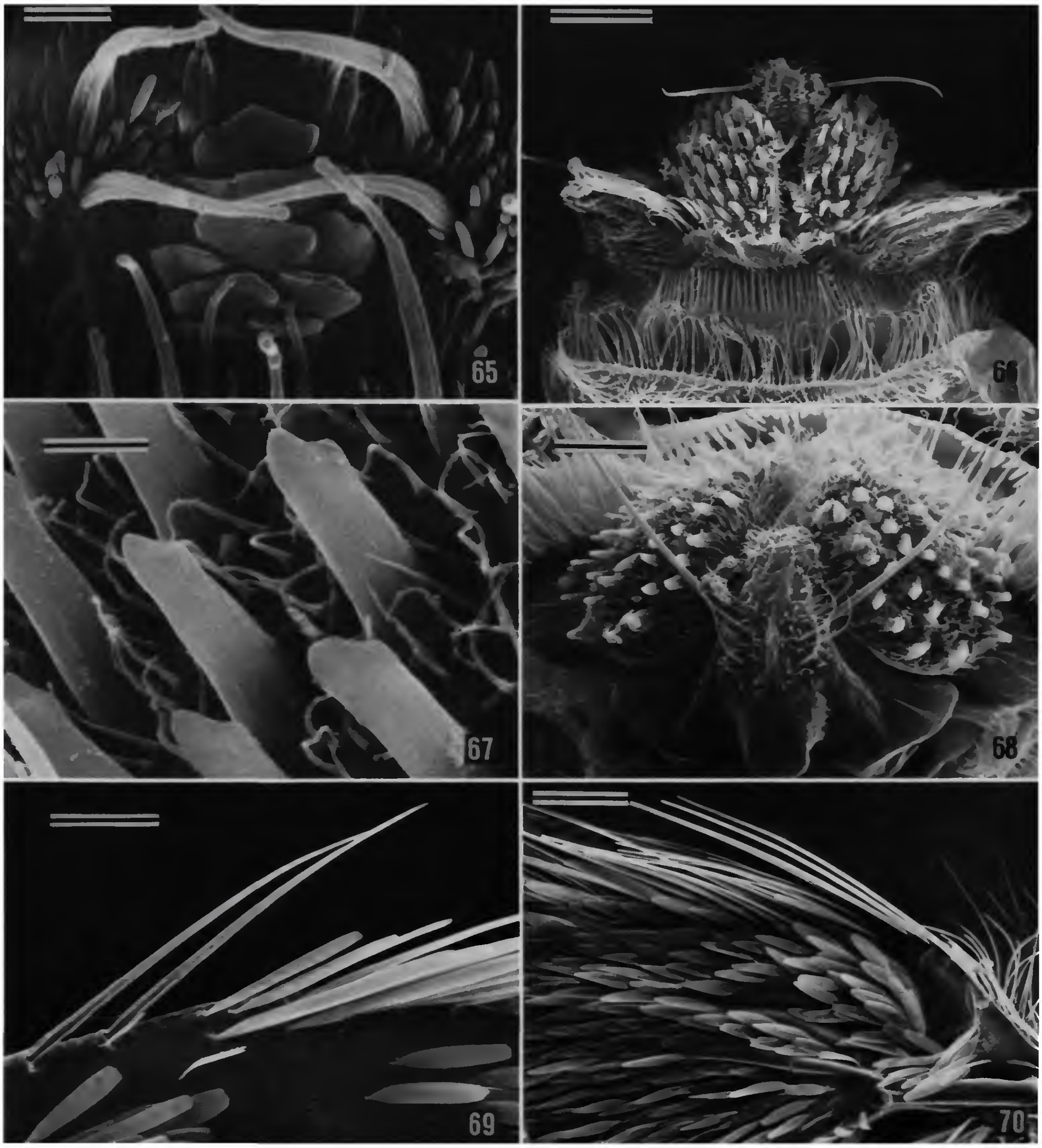
FIGURES 47–52.—Morphological details, Incurvariidae: 47, *Basileura elongata* Nielsen and Davis, apex of labial palpus (20 μm); 48, pseudofrenular setae of female hind wing (15 μm); 49, *Paraclemensia acerifoliella* (Fitch), labrum and base of galeae (haustellum) (50 μm); 50, haustellum (10 μm); 51, sensillum styloconicum with ribbed base (on haustellum) (5 μm); 52, apex of maxillary palpus (4 μm). (Scale lengths in parentheses.)



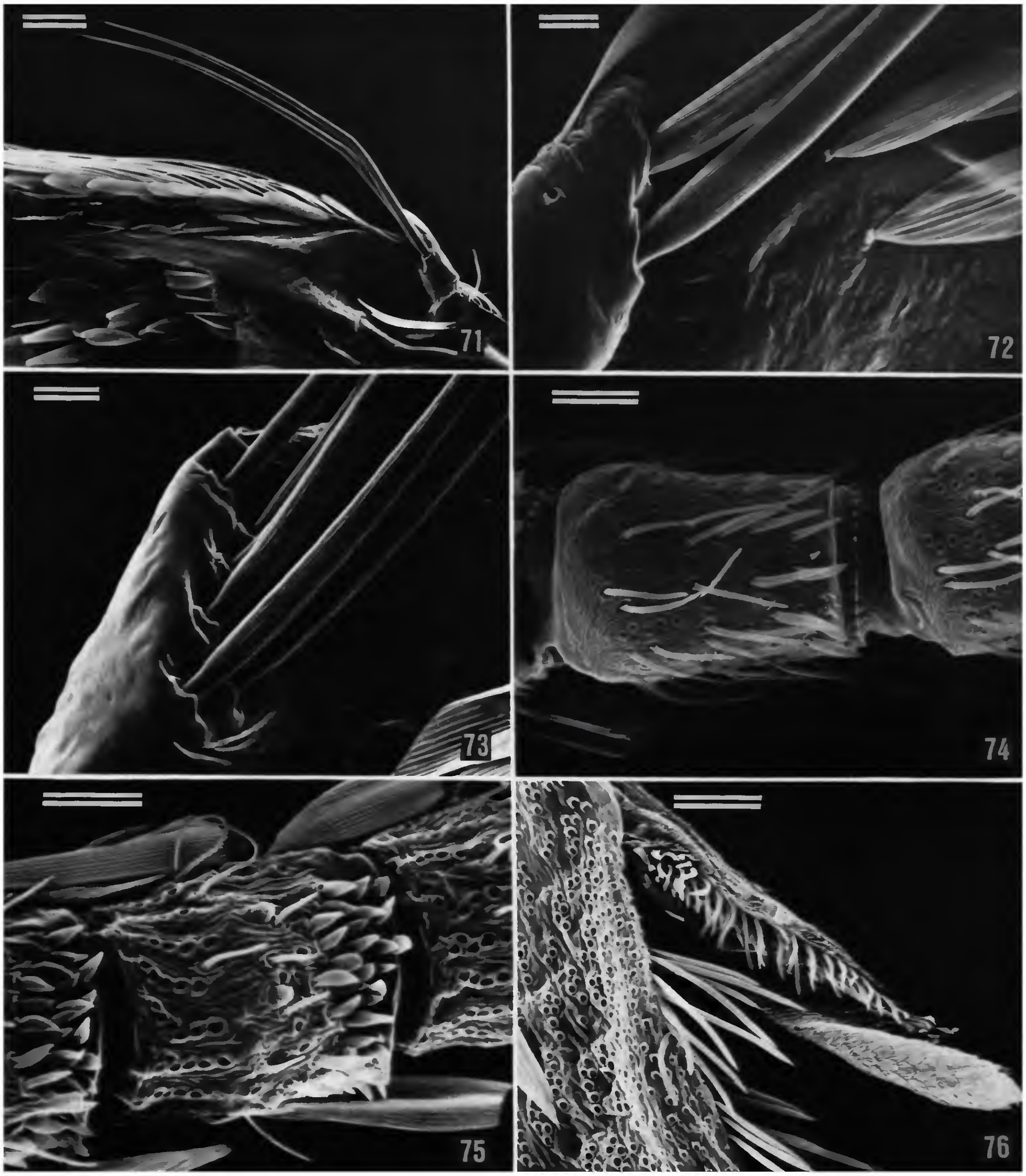
FIGURES 53–58.—Morphological details: 53, Incurvariidae, *Paraclemensia acerifoliella* (Fitch), sensory pit at apex of labial palpus (10 μm); 54, pseudofrenular setae of female hind wing (100 μm); 55, Nepticulidae, *Stigmella juglandifoliella* (Clemens), antennal sensilla (10 μm); 56, Opostegidae, *Opostega bistrigulella* Braun, antennal sensilla (20 μm); 57, pseudofrenular setae of male hind wing (40 μm); 58, Tischeriidae, *Tischeria zelleriella* Clemens, mouthparts (100 μm). (Scale lengths in parentheses.)



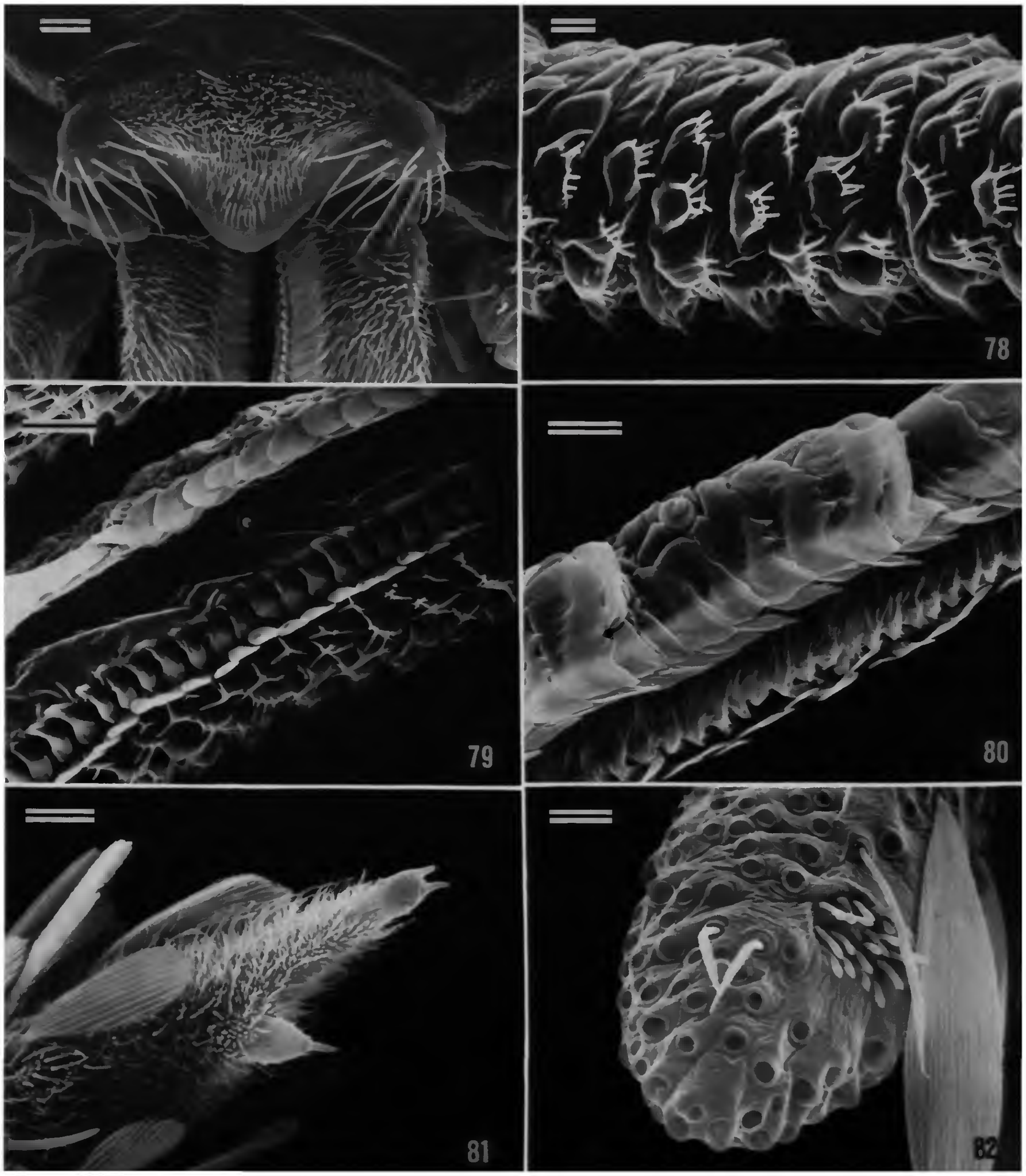
FIGURES 59–64.—Morphological details, Tischeriidae: 59, *Tischeria zelleriella* Clemens, labrum (20 μm); 60, haustellum (10 μm); 61, food channel of haustellum (8 μm), 62, female frenulum (40 μm); 63, *Ticheria inexpectata* Braun, antennal sensilla (10 μm); 64, antennal sensilla (20 μm). (Scale lengths in parentheses.)



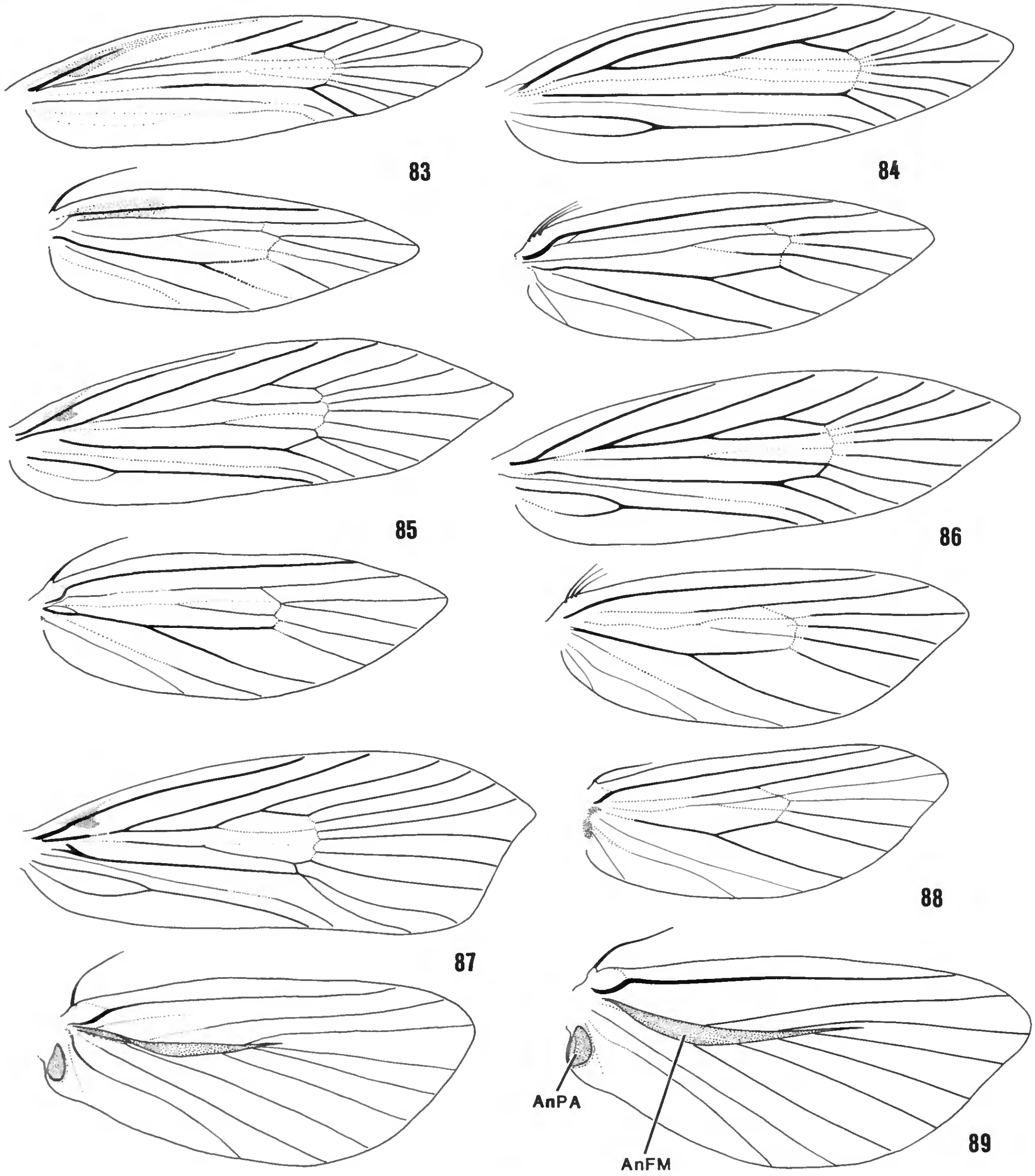
FIGURES 65–70.—Morphological details: 65, Tischeriidae, *Tischeria malifoliella* Clemens, unguitractor plate of prothoracic pretarsus (2 μm); 66, ventral view of female ovipositor (50 μm); 67, detail of ovipositor "peg setae" (5 μm); 68, caudal view of ovipositor (venter up) (25 μm); 69, Prodoxidae, *Tegeticula yuccasella* (Riley), female frenulum (200 μm); 70, Adelidae, *Adela trigrapha* Zeller, female frenulum (200 μm). (Scale lengths in parentheses.)



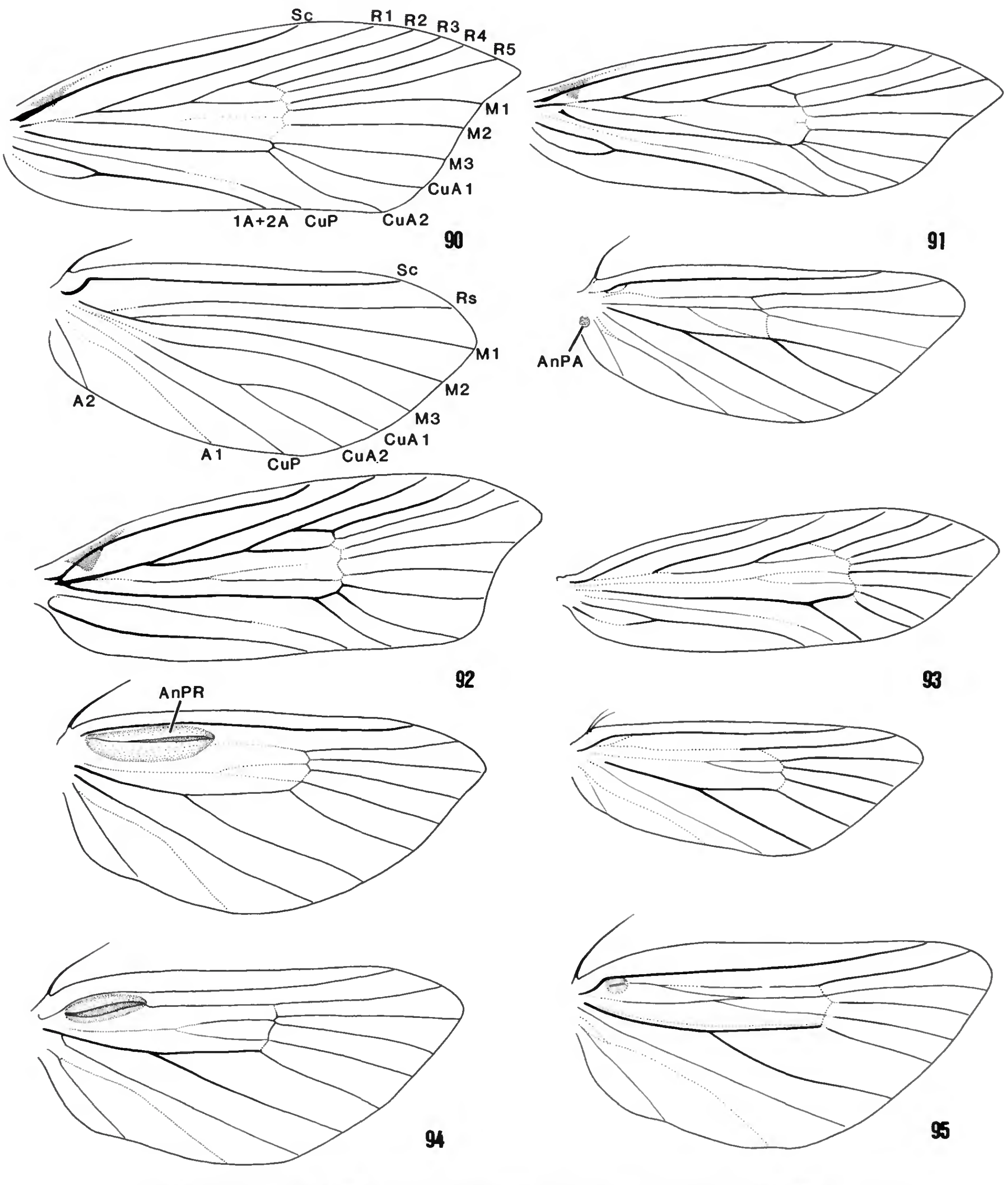
FIGURES 71–76.—Morphological details: 71, Tineidae, *Nemapogon granella* (Linneaus), female frenulum (100 μm); 72, detail of frenular base (20 μm); 73, Psychidae, *Kearfottia albifasciella* Fernald, base of female frenulum (20 μm); 74, Tineidae, *Nemapogon granella* (Linnaeus), antennal sensilla (20 μm); 75, *Tineola bisselliella* (Hummel), antennal sensilla (20 μm); 76, *Scardia approximatella* Dietz, epiphysis (40 μm). (Scale lengths in parentheses.)



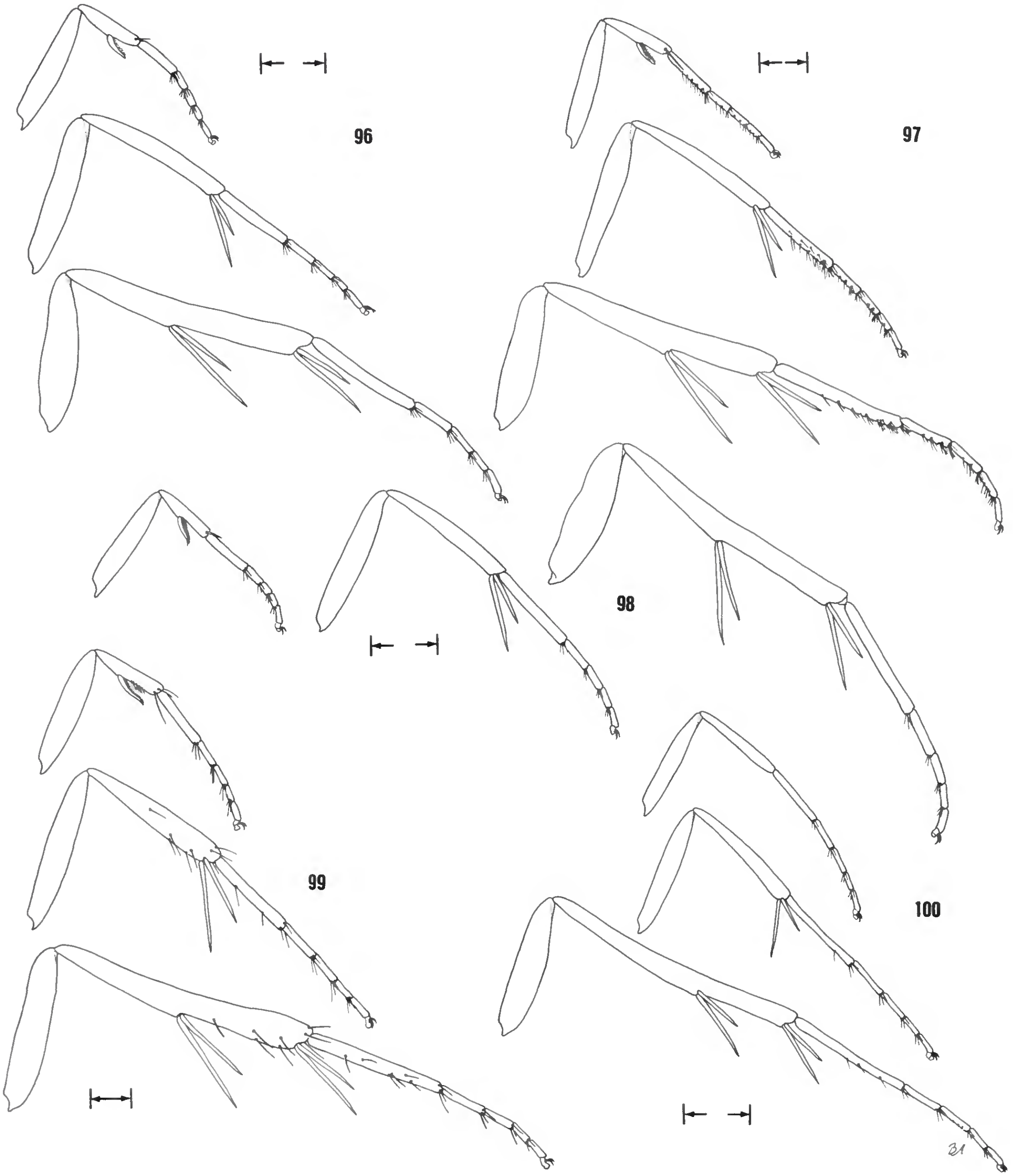
FIGURES 77–82.—Morphological details, Tineidae: 77, *Nemapogon granella* (Linnaeus), labrum and base of galeae (haustellum) (20 μm); 78, lateral surface of haustellum (4 μm); 79, mesal surface of haustellum and food channel (4 μm); 80, *Scardia approximatella* Dietz, haustellum and food channel (10 μm); 81, *Nemapogon granella* (Linnaeus), apex of maxillary palpus (10 μm); 82, apex of labial palpus and sensory pit (10 μm). (Scale lengths in parentheses.)



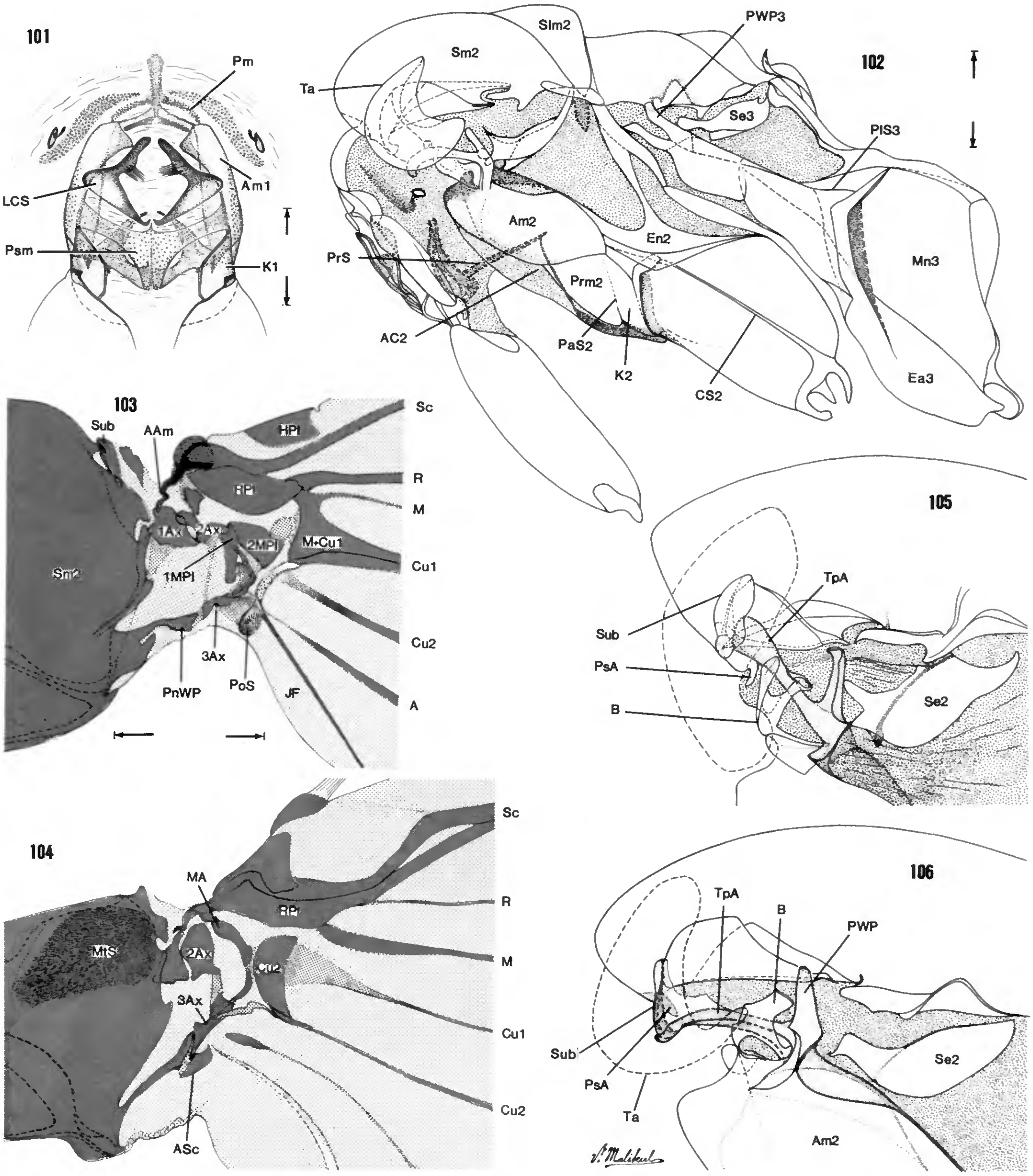
FIGURES 83–89.—Wing venation: 83, *Sesommata trachyptera*, new species, male; 84, same, female; 85, *Metaphatus ochraceus*, new species; 86, *Plesiophatus inarmigerus*, new species; 87, *Palaephatus (Prophatus) albiterminus*, new species; 88, *Palaephatus (Prophatus) leucacrotus*, new species; 89, *Palaephatus (Prophatus) fusciterminus*, new species.



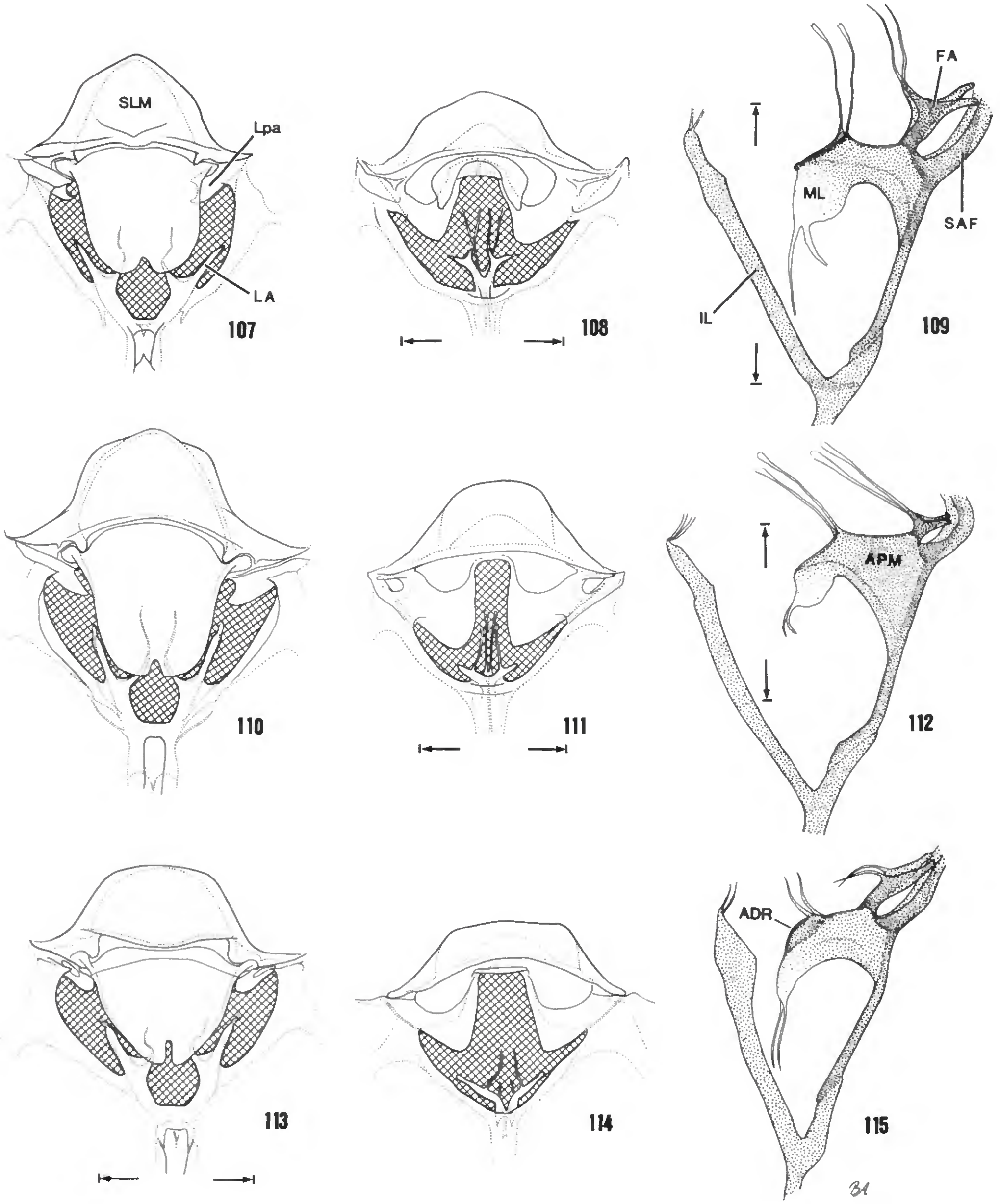
FIGURES 90–95.—Wing venation: 90, *Palaephatus (Prophatus) striatus*, new species; 91, *Palaephatus (Prophatus) amplisaccus*, new species, 92, *Palaephatus (Palaephatus) falsus* Butler; 93, *Apophatus bifibratus*, new species; 94, *Palaephatus (Palaephatus) pallidus*, new species; 95, *Palaephatus (Palaephatus) luteolus*, new species.



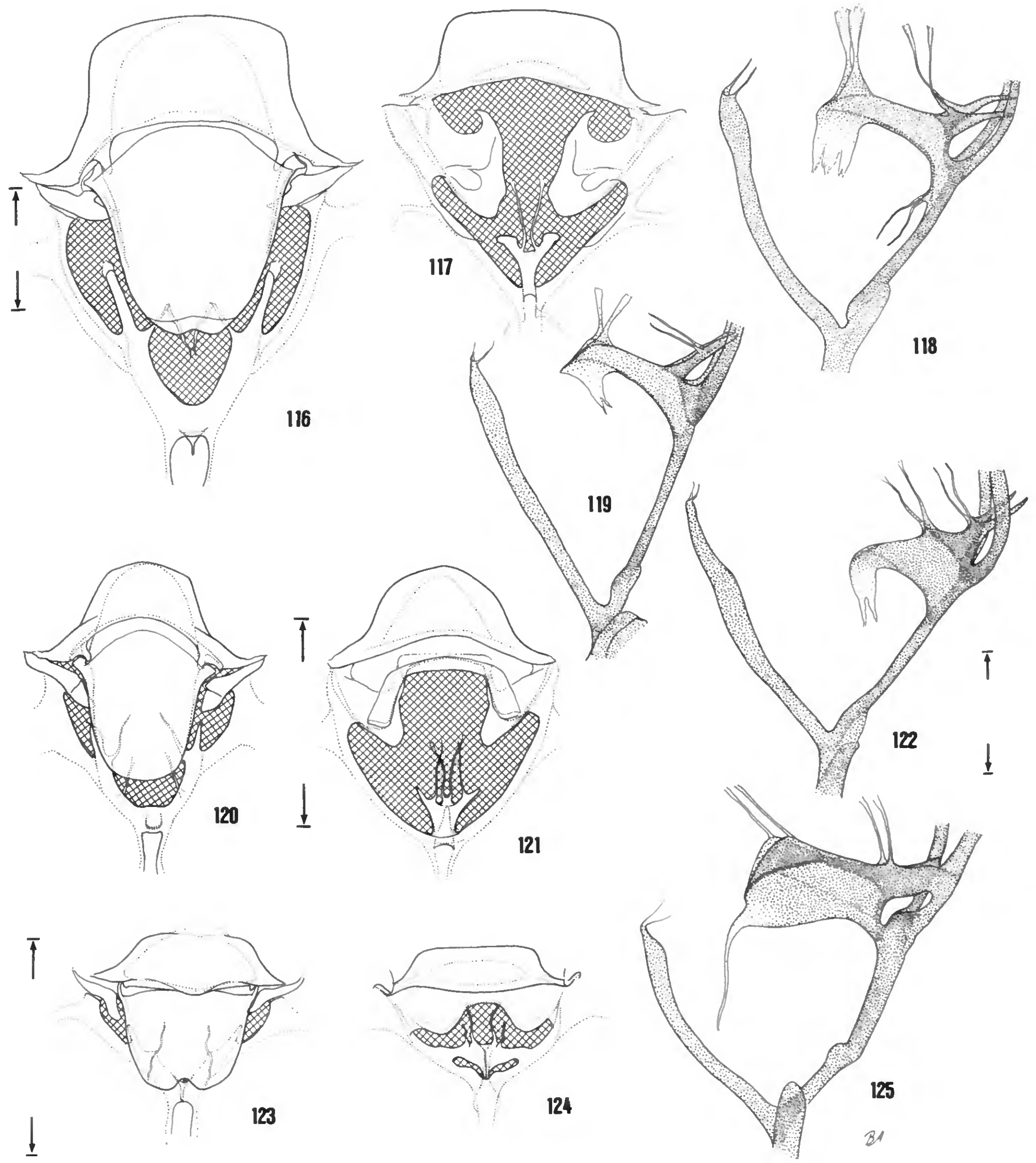
FIGURES 96–100.—Leg structure: 96, *Sesommata trachyptera*, new species; 97, *Metaphatus ochraceus*, new species, 98, *Plesiophatus inarmigerus*, new species; 99, *Palaephatus (Palaephatus) falsus* Butler; 100, *Apophatus bifibratus*, new species. (All scales = 0.5 mm.)



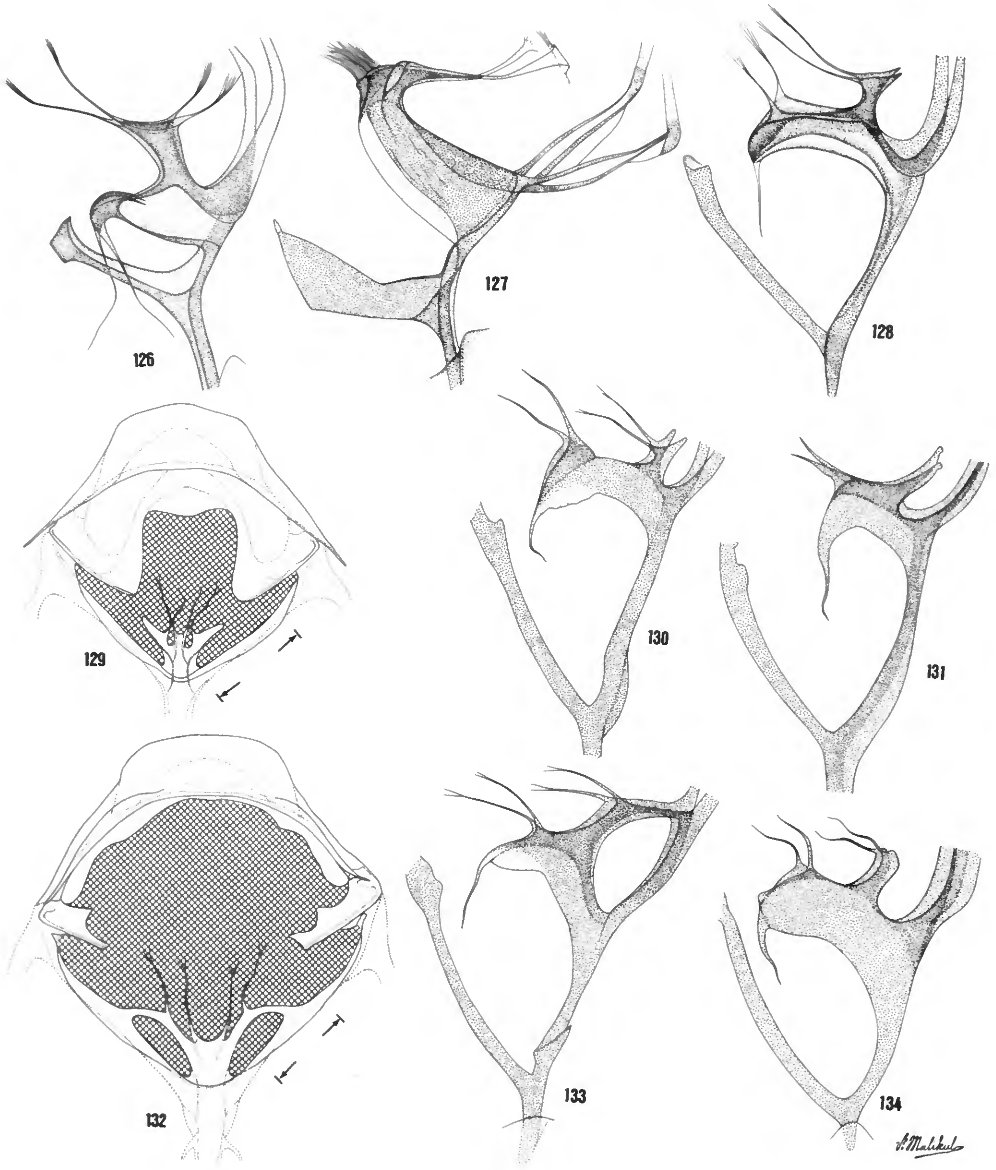
FIGURES 101–106.—Thoracic structure: 101, *Sesommata trachyptera*, new species, anterior view of prothorax; 102, same, lateral view of thorax; 103, *Palaephatus (Prophatus) albiterminus*, new species, dorsal structure of forewing base; 104, same, dorsal structure of hind wing base; 105, *Palaephatus (Palaephatus) falsus* Butler, lateral detail of mesothorax; 106, Tineidae, *Fernaldia coloradella* (Dietz), lateral detail of mesothorax. (All scales = 0.5 mm.)



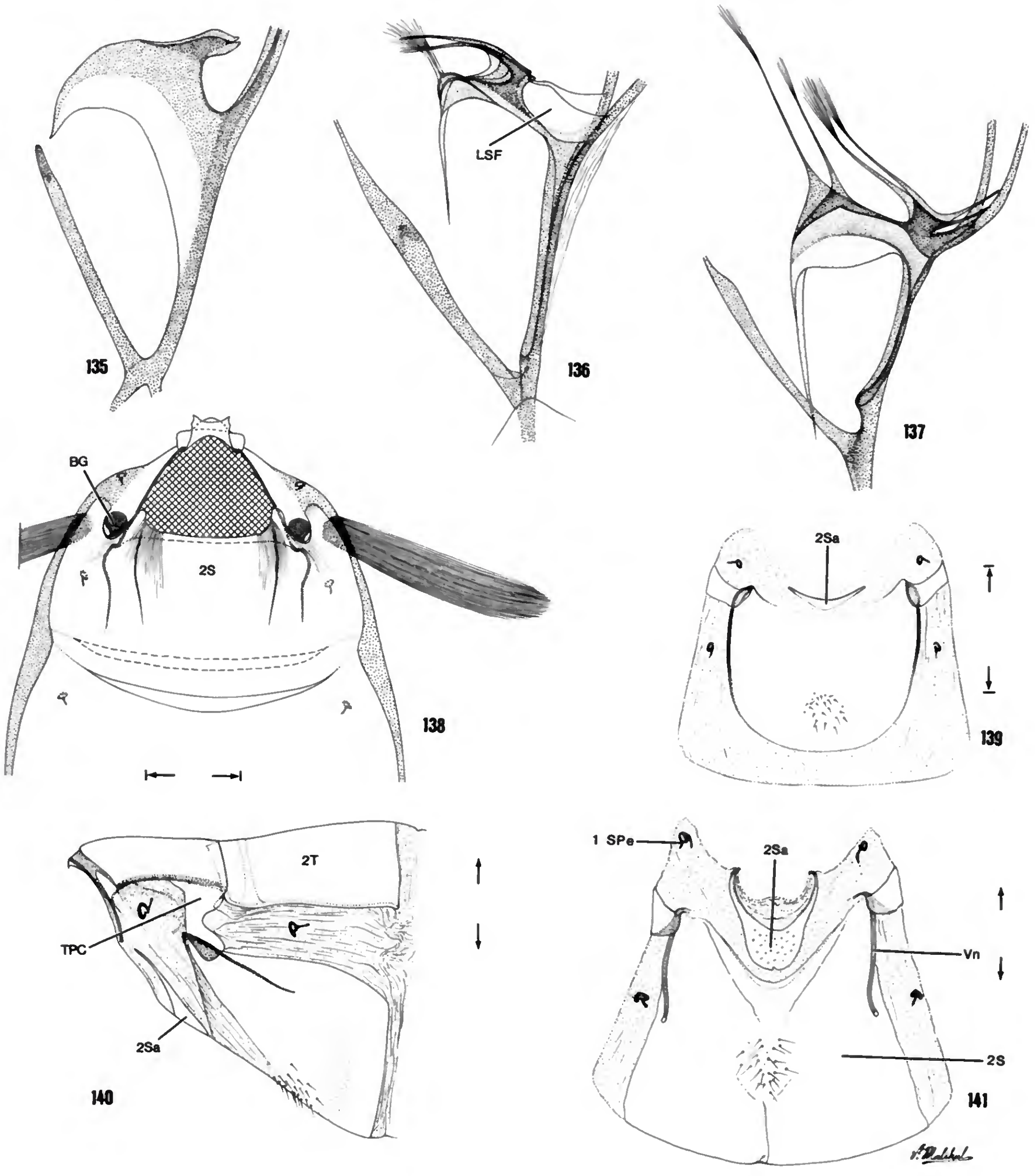
Figures 107–115.—Thoracic structure of Palaephatidae. *Sesommata trachyptera,* new species: 107, posterior view of mesothorax (0.5 mm); 108, posterior view of metathorax (0.5 mm); 109, lateral view of metafurcasternum (0.2 mm). *Metaphatus ochraceus,* new species: 110, posterior view of mesothorax (0.5 mm); 111, posterior view of metathorax (0.5 mm); 112, lateral view of metafurcasternum (0.2 mm). *Plesiophatus inarmigerus,* new species: 113, posterior view of mesothorax (0.5 mm); 114, posterior view of metathorax (0.5 mm); 115, lateral view of metafurcasternum (0.2 mm). (Scale lengths in parentheses.)



FIGURES 116–125.—Thoracic structure of Palaephatidae and Tischeriidae. ***Palaephatus (Palaephatus) falsus*** Butler: 116, posterior view of mesothorax (0.5 mm); 117, posterior view of metathorax (0.5 mm); 118, lateral view of metafurcasternum (0.2 mm). ***Palaephatus (Prophatus) albiterminus***, new species: 119, lateral view of metafurcasternum (0.2 mm). ***Apophatus bifibratus***, new species: 120, posterior view of mesothorax (0.5 mm); 121, posterior view of metathorax; 122, lateral view of metafurcasternum (0.2 mm). ***Tischeria malifoliella*** Clemens: 123, posterior view of mesothorax (0.5 mm); 124, posterior view of metathorax; 125, lateral view of metafurcasternum (0.2 mm). (Scale lengths in parentheses.)



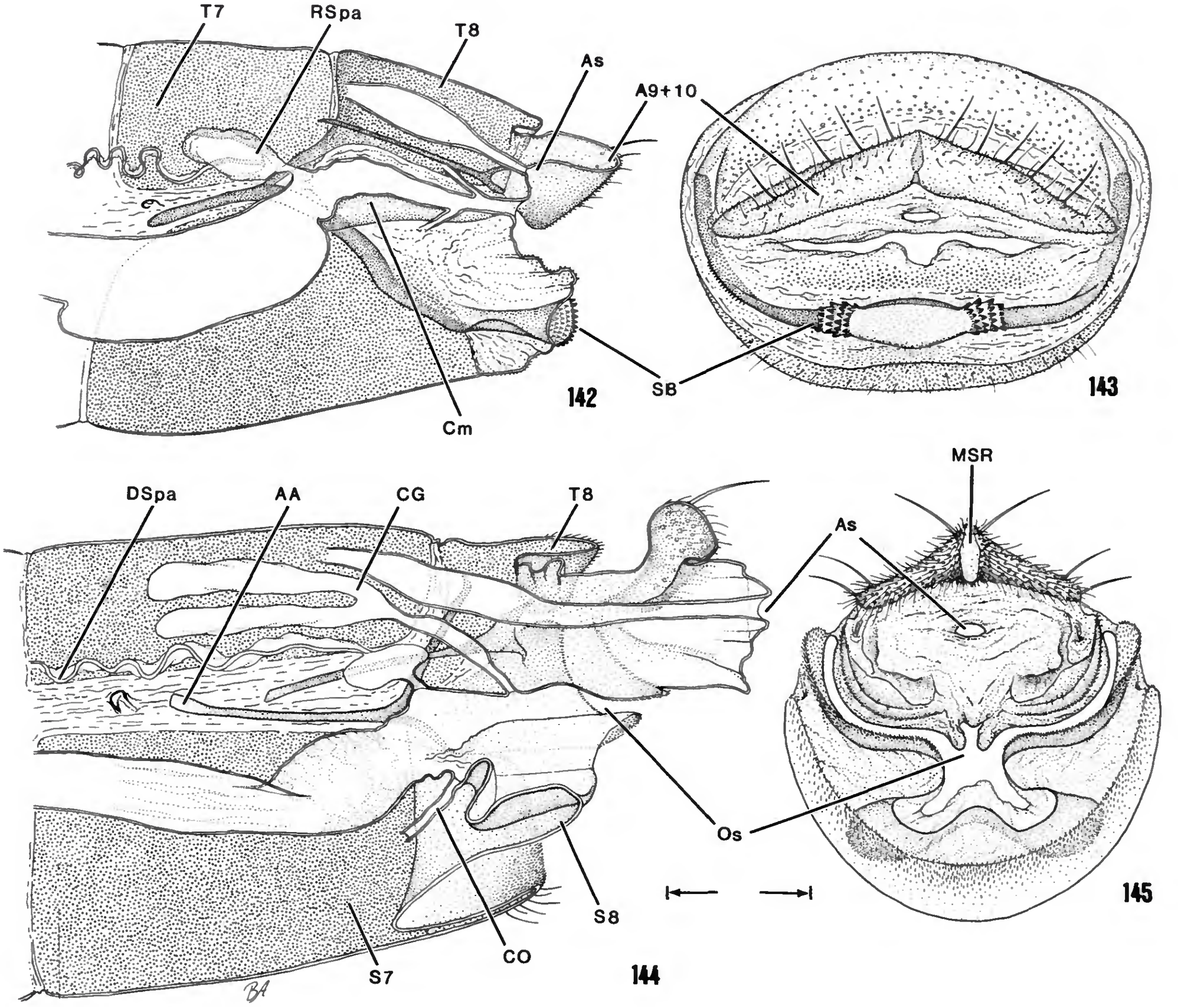
Figures 126–134.—Thoracic structure: 126, Lophocoronidae, *Lophocorona pediasia* Common, lateral view of metafurcasternum; 127, Hepialidae, *Dalaca pallens* Blanchard, lateral view of metafurcasternum; 128, Heliozelidae, *Heliozela aesella* Chambers, lateral view of metafurcasternum; 129, Incurvariidae, *Lampronia russatella* (Clemens), posterior view of metathorax (scale = 0.3 mm); 130, same, lateral view of metafurcasternum; 131, Cecidosidae, *Cecidoses eremita* Curtis, lateral view of metafurcasternum; 132, Prodoxidae, *Prodoxus quinquepunctellus* (Chambers), posterior view of metathorax (scale = 0.3 mm); 133, same, lateral view of metafurcasternum; 134, Nepticulidae, *Ectoedemia phleophaga* Busck, lateral view of metafurcasternum.



FIGURES 135–141.—Thoracic and abdominal structure: 135, Opostegidae, *Opostega scioterma* Meyrick, lateral view of metafurcasternum; 136, Tineidae, *Fernaldia coloradella* (Dietz), lateral view of metafurcasternum; 137, Tineidae, *Eudarcia eunitariaeella* Chambers, lateral view of metafurcasternum; 138, Palaephatidae, *Metaphatus ochraceus*, new species, ventral view of base of abdomen; 139, *Apophatus bifibratus*, new species, ventral view of second abdominal sternites; 140, *Palaephatus (Palaephatus) falsus* Butler, lateral view of base of abdomen; 141, same, ventral view of second abdominal sternites. (All scales = 0.5 mm.)

derived genus, *Apophatus*, possesses the smallest eyes, with an interocular index of only 0.6 and eye index of 0.8. The habits of the apparently rare members of this genus are believed to be diurnal, as their relative eye development indicates. The surface of the eye is completely naked, without any interfacetal microsetae. These small setae are present but sparsely distributed in Eriocranioidea, Incurvarioidea, and in numerous families in Ditrysia, where they sometimes become greatly lengthened. The corneal nipple array (Figure 321) is typical for Lepidoptera. Resolution of the corneal subnipples (Davis, 1978a) has been difficult, but evidence of this structure has been detected (Figure 322). Lateral ocelli are present only in *Sesommata* (Figure 198). Ocelli are absent in all other Monotrysia but reappear frequently through several ditrysian families. Lateral ocelli, however, occur in only a few genera of the Tineoidea.

The antennae are moderate in length, usually 0.5–0.6 the length of the forewing, with 32–58 segments. The antennae of *Apophatus* are unusually long, about 0.9 the length of the forewing. The scape is 2–3 times the size of the second segment (pedicel), cylindrical, and slightly curved. A pecten, consisting of 10–14 piliform scales (Figure 319) is normally present, but it has been secondarily lost in *Palaephatus (Prophatus) striatus* and in all members of the subgenus *Palaephatus*. The precise number of setae in the pecten can sometimes be difficult to determine if some of the setae are broken or lost. Although the counts in this paper were almost entirely based on in situ setae, counting the actual scale sockets (Figures 199, 227) in denuded specimens provides a more accurate tally. The scales of the pecten arise in a bare strip along the anterior margin of the scape from enlarged sockets with tympaniform bases (Figure 200). Usually the sockets are arranged in a staggered series consisting of 1–2 rows. An antennal pecten is present in several families of Ditrysia, and it is the primitive condition in the Monotrysia, with a secondary loss occurring in the Nepticuloidea but not in Tischerioidea. At the extreme base of the scape is a dense concentration of very small, spinose sensilla, which arise from relatively large, sometimes ridged sockets (Figures 201, 228). These proprioreceptor sensilla apparently assist the moth in coordinating antennal movements and are probably widely distributed in the Lepidoptera. Closely associated with the basal, posterior rim of the pedicel lies a broadly triangular intercalary sclerite. The presence of this sclerite is considered a lepidopteran autapomorphy and is also preserved in the Adelidae (Nielsen, 1980b), Incurvariidae, and at least some Tineidae. The flagellomeres are relatively simple, without highly modified sensilla or processes. Antennal scales (Figure 323) are biannulate with 1–3 tightly packed rows compromising each ring. The venter is devoid of scales but densely covered with sensilla chaetica (Figures 229, 353). In *Metaphatus spatulatus*, the sensilla chaetica of the male are noticeably longer than those of the female. Also present on each flagellomere are one or more pairs of sensilla coeloconica, each equipped with a central, striated sensilla basiconica arising from a shallow pit, which is almost always encircled by a ring of spines. Usually the basiconic seta does not surpass the encircling spines, but in *Sesommata* (Figure 203) this sensillum is unusually lengthened. The number of sensilla coeloconica varies considerably between genera and in some instances between species within genera. In *Palaephatus falsus* (Figure 353) they tend to be densely packed toward the distal half of each flagellomere. Sensilla coeloconica are greatly reduced in *P. albiterminus*, both in number and in structure. All that remain of the sensillum in this species are a central basiconic seta and a shallow pit. Those of *Sesommata paraplatysaris* (Figure 202) are numerous as in *P. falsus* but are more evenly scattered over the segment. In *Sesommata trachyptera* (Figure 152) the number is considerably reduced. The sensilla coeloconica of *Metaphatus ochraceus* (Figures 229, 230) are also reduced in number and confined to a single row along the anteroventral margin of each flagellomere. Next to sensilla chaetica, sensilla coeloconica are probably one of



FIGURES 142–145.—Female reproductive system: 142, *Sesommata trachyptera*, new species, parasagittal view of A7–9; 143, same, caudal view of abdomen; 144, *Palaephatus (Prophatus) dimorphus*, new species, parasagittal view (scale 0.5 mm); 145, same, caudal view of abdomen.

the most common sensory structures found on the antennae of Lepidoptera. They have been reported in Heterobathmiidae (Kristensen and Nielsen, 1979), and I have observed them in Prototheoridae. They occur in all families (Figures 42, 64) of Monotrysia except the Opostegidae. They are restricted to the anterior margin of the segment in *Nemapogon* (Figure 74) and secondarily lost in *Tineola* (Figure 75). In the latter, a dense cluster of relatively short and broad sensilla trichodea are instead developed. In general the antennae of Palaephatidae closely resemble those of the Incurvariina with regard to their sensilla. They possess none of the highly specialized sensilla trichodea present in the Nepticulina or Tischeriina. Those of the Opostegidae and Tischeriidae are characteristic for their respective families, thus constituting important autapomorphies thereof. The branched sensilla trichodea (here defined sensu Wirth and Navai, 1978) of Opostegidae (Figure 56) are very similar to the "ascoid" sensilla of the Micropterigidae (Kristensen and Nielsen, 1979). They consist of paired lateral sensilla and one dorsal member, each with 6 to 10 free arms. In Tischeriidae, the sensilla trichodea (Figures 63, 64) consist of elongate solitary filaments that are strongly recurved distally. Each flagellomere possesses several of these sensilla evenly scattered over the lateral and dorsal surfaces. The sensilla trichodea of Nepticulidae are much more varied and exhibit characteristic forms for most genera (van Nieukerken, pers. corres.). The typical form in *Stigmella* (Figure 55) consists of an opposable pair of sensilla per segment, each possessing five parallel, digitate branches extending from a truncated base. Each branch of the sensillum is firmly appressed and possibly attached to the segment and sparsely covered by a loose network of overlapping spines. Superficial dissimilarities suggest that the unusual sensillae of Nepticulidae and Opostegidae are not homologous and perhaps should not be termed sensillae trichodea. Except for their recurved bases, the sensilla trichodea of Tischeriidae, however, appear to differ in no appreciable way from the typical lepidopterous form. Histological studies are needed on all three types, especially since the results of such studies might provide further information on the relationships of the three families involved.

The palaephatid tentorium (Figure 19) resembles that found in the Incurvarioidea (Nielsen, 1980b). A short dorsal process is present in all five genera immediately posterior to the middle of the anterior arms. This probably represents a vestige of the dorsal tentorial arms so prevalent in many of the most primitive Lepidoptera and Trichoptera. Likewise, the development of the medioposterior process from the corporotentorium is similar to that possessed by many Lepidoptera. This process has been considered one of the basic autapomorphies for the order (Nielsen, 1982; Kristensen, 1984).

The labrum is produced medially as a triangular process (Figures 15, 17, 20, 22), which in some species can be relatively elongate. Examination of the medial extension with the SEM (Figures 204, 232, 320) shows this to be a continuation of the labrum and not the more posterior and typically elongate epipharynx. Pilifers are moderately developed in the Palaephatidae (Figures 204, 232, 320) as they are in most Incurvarioidea (Figures 36, 43) and Tineidae (Figure 77). Although their presence is the plesiomorphous state in the Monotrysia, pilifers have been secondarily reduced or lost in some representatives of nearly every family (Figures 33, 49). Within the Heliozelidae, they have been observed only in *Heliozela aesella* (Figure 36). Even though the lobes in Palaephatidae are never so pronounced as they are in the Tischeriidae (Figure 59), the associated clusters of setae are well developed in most genera. In *Palaephatus* (Figures 320, 355) and *Apophatus* the pilifers have become reduced to absent and the associated setae are barely discernible.

The vestigial, non-articulated mandibles are relatively well preserved in all genera except *Apophatus*. In most genera, they approach the basal segment of the maxillary palpus in length. In *Apophatus* (Figure 25) they resemble small knobs protruding from the ventral margin of the head.

The haustellum is moderately developed in Palaephatidae, usually exceeding or equalling the labial palpi in length, depending upon the relative development of the latter. In *Apophatus* the haustellum is reduced and slightly shorter than the labial palpi. The food channel is relatively smooth (except for occasional, small styloconic sensilla) and lined with narrow cords (Figure 360). Bordering either side of the channel and frequently more developed on the anterior edge is a single row of flattened, often acutely tipped, outgrowths (Figure 359), or legulae (from the Latin *legula* (earlap)). These were referred to simply as lamellae by Börner (1939), lance-shaped plates by Eastham and Essa (1955), and are similar to the "zip scales" of Neopseustidae (Davis and Nielsen, 1980). As shown by Eastham and Essa (1955), the legulae serve to link the paired galeae together. Galeal legulae have been noted in other families although they may differ greatly in structure. In most Monotrysia they appear rather similar, differing mostly in width (Figures 42, 50, 61). The legulae of *Heliozela aesella* Clemens (Figures 37, 38) are interesting in that they consist of two somewhat convoluted rows, the inner legulae being more slender. Double rows are also present in *Nemapogon granella* (L.) (Figure 79) and to a lesser degree in *Scardia approximatella* Dietz (Figure 80).

The external surface of the palaephatid haustellum is usually rugose, spinose, and without scales. Similar surfaces appear typical for all other Monotrysia except Tischeriidae. A more derived haustellum in which the distal half is largely covered by sclerotized, overlapping plates (Figures 58, 60), is characteristic of the Tischeriidae. Similar plates have evolved independently in *Scardia* (Figure 80) but not in *Nemapogon* (Figure 78), showing how diverse haustellar structure can be within a large family. Shorter, ridge-like plates have been observed near the extreme apex of the haustellum in Heliozelidae (Figure 39). Prominent sensilla styloconica are normally present over the distal half of the Lepidoptera haustellum (Börner, 1939). Two major types of sensilla styloconica have been observed in Palaephatidae, and both types occur widely in many families of Lepidoptera. The smooth wall form (Figure 361) appears in varying sizes, from small, nearly sessile sensilla to those supported by elongate, cylindrical bases. The base of the other form is typically elongate with longitudinal ridges (Figure 154). Within the Monotrysia the ribbed form has been found in the Incurvariidae (Figures 45, 51) and in most Palaephatidae (Figures 154, 325). In *Apophatus* and the subgenus *Palaephatus*, this form is replaced by the smooth form (Figure 361). Nearly sessile sensilla styloconica without ribbed walls also occur in Heliozelidae (Figure 39), Prodoxidae, Opostegidae, Nepticulidae, and Tischeriidae (Figure 60). The terminal sensilla in Heliozelidae are unusually long and finely grooved (Figure 34).

The maxillary palpi are usually geniculate and elongate in Palaephatidae, with five segments, of which the fourth (penultimate) is the longest. In *Apophatus* the palpi are greatly reduced to four short segments (Figure 26). The apex of the fifth segment is minutely bilobed in *Sesommata* (Figure 155), *Metaphatus* (Figure 233), and *Plesiophatus*, with one lobe slightly smaller and subapical. Each lobe bears from four to six small sensilla basiconica. In *Palaephatus* (*Prophatus*) the subapical lobe is much reduced (Figure 328), and in *Palaephatus* (*Palaephatus*) there is essentially no subapical lobe (Figure 357). Similar modifications occur in the Incurvariidae. The maxillary palpi of *Basileura elongata* Nielsen and Davis possess a simple apex (Figure 46), whereas that of *Paraclemensia acerifoliella* (Fitch) shows a moderately bilobed condition (Figure 52).

The labial palpi are three-segmented in all Palaephatidae, being relatively short in *Sesommata* and *Mataphatus* and longer in *Plesiophatus* and *Apophatus*. The presence of bristle-like, piliform scales on the second segment is the plesiomorphous condition in the Monotrysia. Such scales, often clustered near the apex of the segment, are present in Incurvariidae, Adelidae, Prodoxidae, and Palaephatidae (Figure 318), and are also preserved in the Tineidae. They are lacking in Heliozelidae, Nepticuloidea, Tischeriidae, and in all members of the subgenus *Palaephatus*. A sensory pit (organ of vom Rath) is located near the apex of the third labial palpal segment in all palaephatids examined. In *Sesommata* (Figure 156) and *Metaphatus* (Figure 237) it is situated subapically as compared to apically in *Palaephatus* (Figure 358). One specimen of *M. ochraceus* examined demonstrated an interesting condition that probably exists in most Palaephatidae as well as in other moths possessing similar organs with large apertures. The entire organ is capable of being everted (Figures 239, 240), thus better exposing the sensilla to external stimuli. The aperture of the sensory pit in *Basileura* (Figure 47) is subapical, minute, and not easily detectable. However, a moderately large internal chamber in the apical segment can be resolved with light microscopy (Nielsen and Davis, 1981:32). It would be impossible for such an organ to be everted.

THORAX

Wings of Palaephatidae (Figures 83–95) are moderately broad and similar in general size and structure to those of most Incurvarioidea. Wings of a few of the largest species of *Palaephatus* span over 30 mm, thus making them the largest of all the monotrysian Heteroneura. The radial system of the forewings is five-branched, with each branch arising separate from the discal cell in all species except *Palaephatus amplisaccus*, which has R4 and 5 stalked. The fifth radial always terminates on the costa near the apex of the forewing. An accessory cell is present in all species. Likewise the base of the medial vein is usually preserved and branched. The base of 1A + 2A is separate in all species except members of the subgenus *Palaephatus*, where it is completely fused. The latter subgenus also possesses the broadest wings in the family and has the tornus of the forewing produced slightly so as to form a falcate outline of the termen. A falcate termen is also present in varying degrees in *Prophatus*. A jugal fold, with no lobe projecting beyond the wing membrane, exists in Palaephatidae (Figure 103) as generally described for the Monotrysia and primitive Ditrysia by Sharplin (1963a). The male retinaculum consists of a well-developed ventral fold from the costal margin, which varies in length from elongate in *Sesommata* (Figure 83) to relatively short in the other genera (Figures 85, 87, 92, 372). In *Palaephatus* the apex of the retinaculum is slightly extended and curved so as to better retain the frenulum. A retinaculum is barely evident in the female and usually involves only a row of relatively stiff scales from the venter of the subcostal vein. In addition to scales, a slight subcostal ridge is sometimes present.

Scale vestiture of the dorsal surface of the forewings is smooth in all Palaephatidae except most male *Sesommata*. Within this genus the males of *S. trachyptera* possess an area of rough scaling over the anal region (Figure 163) consisting of semi-erect, elongate scales without underlying piliform scales. The ultrastructure of these scales is unique in possessing minutely dentate apices (Figure 160) and relatively high, undulating longitudinal ridges. Elevation of the ridges varies except near the apex (Figure 161), with adjacent ridges alternating in height (Figure 162). Superficially this type "b" scale resembles the non-perforated (i.e., solid) wing scale so characteristic of the primitive families below the Myoglossata grade (except Acanthopteroctetidae), particularly by the absence of areolae and the presence of serrated apices. The absence of an internal lumen cannot be confirmed, however, until cross sections of these scales have been examined. This scale type (Figure 158*b*) continues as far as the apex of the discal cell, where it is gradually replaced by shorter, broader scales with more coarsely dentate apices (Figure 158*a*). Type "b" scales are lacking in females of *S. trachyptera*, which instead possess only type "a" scales of varying lengths. The basal anal region in *S. holocapna, S. platysaris,* and *S. paraplatysaris* is more highly modified. The sex scales are produced into a rounded mass of broad scales with rounded apices and thickened cross ribs (Figures 211, 212). The outermost layer of these consists of dark scales similar to the general forewing color. These are frequently lost in flown specimens, thus exposing the underlying mass of broad white scales. Immediately beneath those lay dense masses of easily deciduous, piliform scales arising from closely packed, elevated sockets (Figure 214). The demarcation between normal wing cuticle and that of the sex scale area is abrupt under high magnification (Figure 213) and readily apparent under low magnification as an elliptical fovea. The surface of the piliform scales is densely covered with minute globular outgrowths (Figure 215), which increase the surface area considerably.

In the males of the other genera and *Sesommata leuroptera*, as well as in all female Palaephatidae, most forewing scales are usually broad with coarsely dentate (most frequently tri- to septidentate) apices. These often overlap shorter scales with rounded apices (Figure 367). Rarely are the scales perforated, and if they are then the areolae are greatly reduced (Figure 369). The dorsal scale cover over much of the forewings in *Metaphatus* demonstrates greater variety, with three common types of ultrastructure present as well as dimorphic ridge patterns (Figures 242, 244, 245).

Microtrichia are more or less evenly scattered in Palaephatidae over both surfaces of the fore and hind wing. In the forewings of *Sesommata* and *Metaphatus*, however, the basal four-fifths of the dorsal surface is almost entirely free of microtrichia (Figures 148, 243). Microtrichia are also absent from much of the undersides of the forewings in those species of *Sesommata* with ventral sex scaling and adjacent bare areas (Figure 170). Nearly all wing surfaces also possess densely scattered microtubercules (Figures 248, 370). These have also been observed associated with microtrichia in Adelidae (Nielsen, 1980a), Incurvariidae, Prodoxidae, and Nepticulidae, as well as near the bases of the wings (especially the venter) in other moth families.

The underside vestiture of the forewings is unmodified in all Palaephatidae except for male *Sesommata* of the *platysaris* group. In the males of this complex (*S. holocapna, S. platysaris, S. paraplatysaris*, and probably *S. albimaculatus*), a prominent row of elongate sex scales with rounded apices have developed along a shallow fold immediately posterior and parallel to CuA. The ultrastructure of these sex scales is characteristic although slightly variable depending upon the exact region of the scale. Over the distal half of each scale (Figures 217, 218), the longitudinal ridges and scutes are uniform. Over the basal half, the ridges tend to be sinuate largely due to irregular lateral swelling of every fourth to sixth scute (Figures 219, 220). Much of the wing surrounding the ventral sex scales is devoid of both scales and microtrichia as well as microtubercules (Figures 173, 174). Although the presence of sockets in the bare area anterior to the sex scales suggests deciduous scales, close examination of these reveals their vestigial, nonfunctional structure (Figure 175). The bare area posterior and basad of the sex scales shows no trace of scale sockets (Figure 173).

Also present along the ventral anal margin of the forewings of all Palaephatidae is an area of dense, enlarged microtrichia (Figures 176, 177). They are straight in *Sesommata* and directed toward the wing apex. These spine patches were shown by Common (1969) to be present in most Lepidoptera as well as many Neuroptera, where they normally constitute a wing-locking mechanism when the wings are folded. A corresponding area also exists on the anterolateal margin of the metascutum (Figure 104), which engages the forewing area, much like velcro snaps, when the forewing is retracted over the thorax. Davis and Nielsen (1984) show this coupling apparatus to be part of the Lepidoptera ground plan by noting its presence in the most primitive Lepidoptera, with loss occurring in the Neopseustidae (*Apoplania*).

The basal structure of the wing bases in Palaephatidae (Figures 103, 104) generally agrees with that summarized for the Incurvarioidea by Sharplin (1963a,b, 1964). In the forewings, the anterior arm of the first axillary sclerite appears more curved and flexible than is generally the case in Monotrysia (Sharplin, 1963a:1026). A small spinose plate (PoS, Figure 103) occurs immediately distad to the third axillary sclerite in *Palaephatus albiterminus* but not in *Metaphatus ochraceus*. This structure, possibly a proprioreceptor organ, may only exist in the former (and its sister species, *P. fusciterminus*) and is probably absent in all other Lepidoptera, including other palaephatids. In the hind wings the second cubital plate is enlarged and well defined in *P. albiterminus*, with the median arm abutting against it. In *M. ochraceus*, plate Cu2 is considerably more reduced. The anal sclerite is shortened in Palaephatidae and closely associated with the posterior notal wing process and third axillary sclerite. Because of the development of the androconial pocket in the males of *P. albiterminus*, the posterior margin of the hind wing is well caudad of the anal plate. In other palaephatids the posterior margin is much closer.

Together with the reduction of the radial system in the hind wings, the development of the frenulum-retinaculum system of wing coupling has long been regarded a major evolutionary departure for the Heteroneura from the more primitive, jugate Lepidoptera (Comstock, 1892). It is now known, however, that the first evidence of a frenulum occurs not in the Heteroneura but in the homoneurous family Acanthopteroctetidae (Davis and Frack, in prep.). Although the other members of the family (Davis, 1978a) possess a well-defined jugal lobe and no frenular setae, both male and female of *"Acanthopteroctetes" unifascia* Davis have the jugal lobe greatly reduced and instead posess an prominent frenulum composed of a pair of elongate setae with rounded apices (Figures 27, 28). I find no valid reason for not considering these greatly enlarged setae as anything but true frenula, even though, with no trace of a retinaculum apparent, their coupling function seems questionable. Also in doubt is the significance of the development of a frenulum in the most evolved member of Acanthopteroctetidae, because present evidence suggests that this structure has arisen independently in the Heteroneura. The only vestige of pseudofrenular setae present in *unifascia* are in slender bristle-like setae stationed along and partially restraining the distal third of the frenulum in both sexes.

The coupling mechanism in male Palaephatidae is comprised of the forewing retinaculum, described previously, and a single, stout, compound seta (frenulum) arising from a small swelling at the base of the costa. A similar system is present in all families of Monotrysia except Opostegidae, which possess multiple pseudofrenular setae similar to those of the female (Figure 57). The frenulum is known to have been secondarily lost at least once in the Prodoxidae (Davis, 1967) and in all members of Cecidosidae. A compound frenulum may also have been lost in the males of Opostegidae, with the enlarged, closely set pseudofrenular setae actually representing a derived condition. The composite nature of the male frenulum is obvious from a close examination of their divided bases. Marshall (1922) and recently Richards (1981) described the multicellular origin of the male frenulum, stating that the structural differences between the two sexes in most moths are caused by the male frenulum originating from protuberances of a tight cluster of a dozen or more cells, whereas that of the female is formed from usually two or three larger cells, which are spaced farther apart. The number of setae combining in the male frenulum of Palaephatidae can vary, usually depending upon the relative size of the moth, from as few as 10 to over 30 (Figures 252, 347, 371, 384). These numbers represent only minimal, peripheral estimates and are not actual counts based upon cross-sectional examination. The frenulum base in *Heliozela aesella* Chambers (Figure 41) is of some interest in demonstrating very little consolidation. Also variable, sometimes within species, is the degree of basal fusion. In most species the fusion is nearly complete (Figure 252), whereas in *Palaephatus leucacrotus* deep fissures persist (Figure 305).

Female Monotrysia exhibit an almost complete range of wing coupling variation, from the uniform series of multiple pseudofrenular setae possessed by the females of Opostegidae (Figure 57) and Nepticulidae to a two- or three-frenular condition identical to that encountered in most Ditrysia (Figures 71, 72). Undifferentiated pseudofrenular setae are also present in Heliozelidae (Figure 40), Incurvariidae (Figure 48), and some Prodoxidae. The proportionately smaller and often more dispersed pseudofrenular setae in those families are believed to be more representative of the plesiomorphic condition than are the larger, more closely set setae occurring in Opostegiae and Nepticulidae. In the Adelidae, three to five of the basal setae have become much larger (Figure 70) and, thus, distinct from the pseudofrenular setae. At this stage of differentiation, I consider the basal setae as a true frenulum, even though they still arise from relatively simple, well-separated sockets along the costal margin as do the pseudofrenular setae. In some *Tegeticula* (Davis, 1967) the female frenulum is further differentiated as two enlarged setae that are well separated from the only slightly modified pseudofrenular scales (Figure 69). Final specialization within the Monotrysia is observed in the Palaephatidae (Figure 395) and Tischeriidae (Figure 62), where as few as two closely associated and greatly enlarged setae are preserved with no adjacent pseudofrenular setae. Both setae, however, still arise from separate sockets (which is also the primitive state in Ditrysia), and not from a single socket (Nielsen, 1985). The distance between the two sockets is usually no greater than the diameter of an individual socket. Although two frenular setae appear to be the normal number for tischeriid females (Braun, 1924) and sometimes three (Minet, 1984), the number may vary from two to four within the Palaephatidae, with some variation possible within a single species. Three setae appear to be the most common condition in this family as well as in most Ditrysia (Richards, 1981). The spacing of the frenular setae likewise varies in Palaephatidae, from a distance of one to as much as three socket diameters. The surface structure of all frenular setae examined still retained longitudinal ridges (Figure 374), which, besides being a vestige of their original scale form, also strengthens the seta considerably.

As already pointed out, the basic form of the female frenulum in ditrysian moths differs in no appreciable way from that possessed by Tischeriidae and some Palaephatidae. Most females of Tineidae (Figure 71) possess two or three closely associated frenular setae. These arise from a slightly swollen, twisted costal base, which results in one seta lying partially upon the other (Figure 72). A similar situation can be observed in *Metaphatus adustus* (Figure 286). Within female Ditrysia several frenular specializations can be observed, including clustered, supernumerary setae (Arrhenophanidae, many *Acrolophus*, and in most fully alate Psychidae (Figure 73)), reduction to a single seta (Epipyropidae, most euteline Noctuidae, Phycitidae, some Pterophoridae, and Sesiidae), and complete loss (a few Geometridae, Lasiocampidae, and Papilionoidea).

A rather remarkable variety of sex scales has developed on the hind wings of many male Palaephatidae that is without parallel in any other monotrysian family. Within *Sesommata*, hind wing sex scaling occurs only in *S. holocapna, S. platysaris*, and *S. paraplatysaris*, where it consists of whitish hair pencils from the base of the subcostal area. In *S. holocapna* the costal margin is expanded (Figure 179) to support the most basal setae. The pencils extend along the costa approximately half the length of the wing and are capable of being raised when exposed (Figure 181). The apices of a majority of the setae are widened (Figures 182, 222) and provided with closely set, raised scutes (Figures 223, 224).

Three different sets of androconial organs (Figures 89, 90, AnFM, AnPA, AnPR) containing specialized sex scales are present in *Palaephatus*. Two of these (AnFM, AnPA) exist in the subgenus *Prophatus* but are only developed in varying degrees within the *albiterminus* group. Both types are well developed in the sister species *P. albiterminus* (Figure 87) and *P. fusciterminus* (Figure 89). The medial androconial fold is very similar in both species and consists of an elongate, tubular fold coinciding with much of M2. Enclosed inside the fold are numerous, extremely elongate and delicate piliform setae (Figure 308). The surface of each seta is rugose, with irregular ridges and a small apical pore (Figure 309). The development of the medial fold has considerably modified the venation of the hind wing by pulling down the base of Rs and obliterating the discal cell (Figures 87, 89). Although the male of *P. striatus* no longer possesses a medial fold (i.e., presumed to have been present), similar venational modifications of the hind wing still persist.

On the undersides of the hind wings of *P. albiterminus, P. fusciterminus*, and *P. amplisaccus* near the anal fold are located even more complex androconial organs (Figures 87, 89, AnPA). These consist of a pyriform to oval pocket with a flap-like cover that opens ventrally (Figure

334). The outer margin of the flap is relatively broad, completely smooth, and normally is tightly pressed against a similar, opposite surface on the underside of the wing. The exterior surface of the ventral flap is densely covered with microtubercules and much larger papillae, which arise from shallow pits (Figure 332). The papillae are believed to correspond to the socket position of tiny sex scales (i.e., flap scales) lining the inner wall of the flap (Figure 335). The mechanism for opening and closing the pocket is not known. Perhaps this is accomplished in an inverse manner by opening and folding the wing (i.e., when the wing is folded, or closed, the pocket can be forced open, and vice versa). The inner lining of the flap is highly wrinkled, free of microtubercules, and richly supplied with minute, highly specialized flap scales (Figures 336–338). Longitudinal, fluted ridges with apparently fused scutes are clearly evident but irregular. As suggested above, their socket structure is believed to create the papillose surface evident on the exterior wall. Lining the opposite wall (i.e., the dorsal wall of the androconial pocket) are larger, even more modified and densely packed sex scales (or basement "scales," Figures 339, 340). The surface of these scales is rather amorphous with only a faint vestige of longitudinal ridges. Based largely upon their respective structure, it is possible that the basement scales may function as reservoirs for pheromone secretions, with the smaller, more deeply ridged flap scales serving as disseminators. The external features of the same pocket in *P. fusciterminus* are identical to that just described; however, the ultrastructure of the internal sex scales differs. The flap scales possess highly irregular contorted ridges (Figures 314, 315). They also arise from somewhat swollen sockets scattered over a relatively unwrinkled epidermis, densely covered with microtubercules (Figure 316). The opposing layer of basement sex scales are again larger, but are more scale-like in form and still retain distinct longitudinal ridges (Figures 311–313). In this respect the basement scales in *P. fusciterminus* more resemble the flap scales of *P. albiterminus*. Although an anal androconial pocket is absent in *P. striatus*, a vestigial one is preserved in *P. amplisaccus* (Figure 91). Its external structure, although much smaller, is similar to that of *P. albiterminus* and *P. fusciterminus*. A broad marginal band closes the aperture and the epidermis over the pocket is densely covered with microtubercules (Figure 50). Internally, flap scales were not detected, and there was no external indication of any sockets (i.e., no papillae present). Furthermore, only one distinct scale form was discovered inside the pocket, and this type appeared to be attached to the basement membrane (Figure 50). As was true in *P. fusciterminus*, the inner wall of the flap is covered by microtubercles. Ultrastructural details of the basement scales in *P. amplisaccus* reveal only faint evidence of transverse ridges (Figure 52).

The third type of hind wing androconial organ occurs only in three of the four members of the subgenus *Palaephatus*. This structure consists of an elongate pocket located at the base of Rs (Figures 92, 94, 95). The radial androconial pocket is best developed in *P. falsus*, where it extends approximately half the length of the discal cell. It opens and closes by means of a median, longitudinal slit that extends the entire length of the pocket. The opening appears to be capable of literally snapping shut because of the presence of a unique tongue-and-groove design (Figure 376), similar to that incorporated into the well-known "zip-lock" bags, invented only recently by humans. The base of Rs seems to be involved in closing the slit, possibly functioning as a clasper (groove). Inside, attached to the basal end is a large hair pencil (Figure 377), which extends the full length of the pocket. When the slit is opened, the moth then is probably capable of raising the pencil, in what must be a rather elaborate display. Unfortunately, this behavior has never been observed in this species. The sponge-like ultrastructure of each seta in the pencil (Figure 378) reminds one of a minute wick. Scutes are barely discernible and the longitudinal ridges are highly irregular, tending to intersect one another obliquely and at random.

A myriad of tiny areolae reveals an internal lattice-like network more visible from a cross-sectional view (Figure 379). The overall structure of the hair pencil suggests a very efficient means of first absorbing and then disseminating a pheromone. Underlying the hair pencil and firmly anchored to the bottom of the pocket is a dense array of ovoid sex scales. Longitudinal ridges without scutes are clearly evident (Figures 380, 381). Openings in the upper lamella, cross ribs, or fluting are lacking.

A relatively large radial androconial pocket is also present in *P. pallidus*, the sister species of *P. falsus*. The morphology of this organ, however, was not examined. In *P. luteolus* the pocket is greatly reduced (Figures 95, 385) but equipped with a similar longitudinal slit. The hair pencil is correspondingly shortened and composed of sponge-like piliform scales (Figures 386–388). The longitudinal ridges of these are much more uniform than in *P. falsus*, and the scutes are well defined and normal. The underlying basement scales (Figure 389) are more oblong but possess ultrastructural details similar to *P. falsus*. No evidence of a radial androconial pocket remains in *P. albicerus*.

Probably associated with some of the diverse androconial organs previously mentioned are elongate hair pencils found in male Palaephatidae at the junction of the body and dorsal margin of the hind wings. The pencil arises from the connective membrane and is often left attached to the body following wing removal. These pencils are particularly well developed in the *falsus* group of *Palaephatus* but are probably present to some degree in all males of the family.

As is generally true for all Monotrysia, an anal sclerite (Figure 104) is present in the anal area of the hind wings between the posterior notal wing process and the axillary cord. Sharplin (1963b, 1964) also lists the presence of this small sclerite in all homoneurous moths as well as in the primitive Ditrysia.

As noted by Brown and Miller (1984:276), two more or less distinct groups of campaniform sensilla occur dorsally at the base of Sc + Rs in diverse families of Lepidoptera. I have observed these in all of the monotrysian Heteroneura examined (Figures 254, 290) and have found only slight divergences from the basic tineid pattern illustrated by Brown. In *Metaphatus ochraceus* the field is nearly continuous but separated into three closely associated areas. A few scattered campaniform sensilla also occur on the ventral surface of the hind wing at the base of the costa in all moths examined. A small cluster of 5 to 10 sensilla is also present at the base of Sc + Rs.

The legs of Palaephatidae (Figures 96–100) are relatively uniform in structure with a basic tibial spur formula of 1-2-4. An epiphysis is present in all genera except *Apophatus*. The outer surface of the epiphysis is densely covered with flattened, squamiform spines (Figure 262), which gradually lengthen to form the standard epiphysial comb (Figures 261, 363) present in most moths. Arising from the tibia immediately opposite the epiphysis are usually found stiff, slender scales (Figures 261), which probably assist the cleaning function of the epiphysis. A single, relatively large campaniform sensilla, approximately 10 μm in diameter, is present at the extreme base of at least one member of each tibial spur pair (Figures 263, 264). None were observed on the epiphysis. This organ probably occurs throughout the order, and it was first found by M. Pogue (pers. comm.) in the Cochylidae. The tarsi and to a lesser extent tibia bear numerous secondary spines usually concentrated at the distal end of each segement. The number and placement of these spines can vary greatly between species and even within species. A tibial hair pencil (Figure 225) occurs only on the hind legs of the males in the *platysaris* group of *Sesommata*. Other than being extremely long (equalling the length of the hind tibia) and piliform, the pencil setae do not appear to be especially modified. Their ultrastructure (Figure 226) closely resembles that of most piliform setae distributed elsewhere over the body.

The basic structure of the pretarsus appears similar throughout most of the families of monotrysian Heteroneura as well as most Lepidoptera. As in Palaephatidae (Figures 359, 364, 365), the tarsal claws are simple, slightly furrowed, and symmetrical. Arising apically and between the claws from an elevated socket is a stout, curved, pseudempodial seta (Figure 259). A pseudempodial seta is present in most Lepidoptera as well as Trichoptera and is considered an autapomorphy of the superorder Amphiesmenoptera (Kristensen, 1984). The arolium is a large median pad, with a dense array of extremely minute microtrichia (~1 μm in length) possessing rounded tips. These are arranged in tightly packed, irregular rows, which are placed from 0.1 to 0.5 μm apart. The ultrastructure of the palaephatid arolium is essentially identical to that observed in Tineidae and is probably fairly uniform throughout most of the Lepidoptera. A bilateral pair of densely spined pulvilli are present. In *Sesommata, Metaphatus* (Figure 260), and *Palaephatus* (Figure 366), the unguitractor plate is elongate and covered with flat, imbricate spines. Similar plates with different spine patterns were observed in all monotrysian families (Figure 65), as well as in Dacnonypha (Figure 32), Exoporia (Figure 30), and Tineidae. No evidence of an empodium was found in any monotrysian family.

The lateral sclerites of the palaephatid thorax (Figure 102) exhibit a general reduction that typifies much of the Heteroneura. The lateral lobes of the laterocervical sclerites (Figure 101) are relatively broad, as they are in most Monotrysia, except Adelidae (Nielsen and Davis, 1985). The prosternum and precoxal bridge (Figure 101) are relatively well developed and similar to that shown for *Incurvaria* by Minet (1984, fig. 1). The spina is well sclerotized and broadest midway along the anterior half. Both mesepimeron and metepimeron are especially reduced. Another specialization shared among at least the lower Heteroneura but absent in the Dacnonypha is the curling of the antero-dorsal margin of the mesepimeron over a small portion of the mesepisternum, thereby obscuring the dorsal end of the pleural suture as well as forming a shallow ventral groove. Shepard (1930) shows a similar reduction of the epimeron in Hepialidae. He also proposed that a small, triangular, mesothoracic "sclerite" immediately caudad to the katepisternum and bounded by the pleural and "marginopleural" sutures was autapotypic for the Incurvarioidea. Although distinctly triangular in Heliozelidae and Adelidae, this sclerite is poorly defined and more trapezoidal in *Prodoxus*, variable in Palaephatidae, and indistinct in Tischeriidae and Tineidae.

Sharplin (1964:944) listed a significant apomorphy for the Ditrysia that requires some modification. She observed that the tergopleural apodeme (TpA) of the mesothorax is separated from the prescutal apodeme (PsA) in the more primitive Lepidoptera (Figure 105), compared to their characteristically fused condition in Ditrysia. One of the essential features involved, however, is not the prescutal apodeme (at least not in Tineidae) but instead the subtegula (St, Figure 106). In Tineidae the tergopleural apodeme is fused to the subtegula, which in turn is firmly attached to the mesoscutum. The only connection between the tergopleural apodeme and the prescutal apodeme observed in this family was the presence of a thin ligament. In Palaephatidae and in all other Monotrysia examined, the tergopleural apodeme may touch either or both the prescutal apodeme and subtegula, but the elements are never fused. In some species of *Palaephatus* the subtegula appears to form a loose pocket for accommodating the enlarged distal end of the tergopleural apodeme (Figure 105).

The mesofurcasternum is very similar among all five genera of Palaephatidae. Both inner and lateral arms of the apophyses are well developed, with the lateral arms more elongate. The metafurcasternum demonstrates more variability in form between genera, as well as between species in some cases, but it possesses a basic structure characteristic of nearly all families of Monotrysia (Figures 109, 123, 128, etc.). The metafurcasternum in these moths demonstrates a well-developed anteromedial process (APM), to which are attached two pairs of dorsal tendons. The anterior dorsal tendons arise from separate, parallel, anterodorsal ridges that vary in size between genera. The posterior tendons originate usually midway along prominent furcal apophyses (FA). Within the Palaephatidae (Figures 109, 110, 113, 116, 120) as well as in most other monotrysian families, the metafurcal apophyses vary in length but remain free of the secondary arms of the metafurcasternum (SAF). Only in the Tischeriidae (Figure 123), where it is a major synapomorphy, the Prodoxinae (Figure 133), and in *Opostega bistrigulella* Braun, are the apophyses fused to the secondary arms. The metafurcal apophyses, however, were free in all other Opostegidae examined (Figure 135). A similar junction of the apophyses to the secondary arms is also characteristic of the ditrysian families Psychidae and Arrhenophanidae (Brock, 1971). Within the Monotrysia, the opostegid metafurcasternum is the most modified, lacking any trace of dorsal tendons. The metafurcasternum of *Cecidoses* (Cecidosidae) also displays some specialization in that the posterior dorsal tendons have been lost (Figure 131). As in many families, the anteromedial process of Palaephatidae terminates ventrally in an irregular sheet of connective tissue. The monotrysian metafurcasternum demonstrates more similarity to, and could be derived from, that of Dacnonypha. The latter differs from that the monotrysian type by possessing two sets of tendons from the apex of each furcal apophysis and in lacking the paired anterodorsal tendons, with a pair of elongate, anteroventral tendons instead (Figure 126; Davis 1978a). Although the relative position of the Acanthopteroctetidae to the Eriocraniidae has been questioned (Kristensen, 1984), the structure of their rather unusual, synapomorphic metafurcasterna are essentially identical. Differing only in the possession of a pair of low, rounded, anterodorsal ridges, the metafurca of Lophocoronidae is likewise very similar to the preceding. The dacnonyphous metafurca of this once questionably placed family, together with morphological details of the newly discovered lophocoronid female (teste Nielsen), further suggest this family as a member of the infraorder Dacnonypha. The somewhat variable metafurcasternum of Exoporia (Figure 127; Davis, in prep.) exhibits little structural similarity to those of either Dacnonypha or Monotrysia. As would be expected in such a large divergent group, the metafurcasternum has undergone considerable diversification within the Ditrysia (Brock, 1971). The more generalized genera of Tineidae (e.g., *Fernaldia, Scardia, Nemapogon*) possess a rather distinctive metathoracic furca (Figure 136; Davis, 1978b) in which the furcal apophyses are more appressed and with a longer base than in Monotrysia. The apophyses also project forward in Tineidae rather than posteriorly. Another major difference is the presence of laminae of the secondary furcal arms (LSF), which extend from the furcal apophyses to the secondary arms in most Tineidae but which are absent in Monotrysia. The metafurca of the tineid *Eudarcia* (Figure 137) represents an interesting, somewhat intermediate form in the absence of the lamina (LSF) and the presence of widely branched apophyses with extended, posterior arms.

ABDOMEN

According to Kristensen and Nielsen (1980), the first abdominal sternum is absent in all Lepidoptera above the homoneurous grade. The presence of often one, and rarely two, small sclerites immediately anterior to the large second sternum (2S) in most monotrysian families is believed, instead, to represent fragmentation of 2S. This was concluded on the basis of longitudinal muscle-ventral diaphragm connection, as well as evidence of some secondary fusion of 2Sa and 2S (Kristensen and Nielsen, 1980). Two such fragments have been observed in Tischeriidae, one in Incurvariidae, Adelidae, and Nepticulidae, and none in Heliozelidae and Opostegidae. This condition varies between genera of Palaephatidae, as it might with better sampling in some of the above families. A small, often V-shaped sclerite (2Sa) is present in *Palaephatus* (Figure 141), which is even more reduced and more transverse in *Apophatus* (Figure 139), but completely absent in *Sesommata*, *Metaphatus* (Figure 138), and *Plesiophatus*. The development of 2Sa in Palaephatidae is clearly associated with the degree of excavation of 2S; those in which the anterior margin of 2S is deeply incised (Figure 141) tend to possess a more developed 2Sa. The second sternum possesses a pair of thickened anterolateral ridges (venula, sensu Minet, 1981), which do not extend as apodemes beyond the margin of the sternum, as they do in the Tineoidea (Kyrki, 1983).

The palaephatid tergosternal connection (Figure 140) between the first tergum and the second abdominal sternum is similar to that described for Incurvariidae. The major difference in this type of connection and that possessed by ditrysian moths is that it is postspiracular in the former and prespiracular in the latter (Kyrki, 1983). A tergosternal connection appears to be absent in Nepticuloidea, according to Kyrki.

Other than sex scaling, very few specialized structures have developed on the abdomen of Palaephatidae. Large patches of pale orange to cream white sex scales are present along the pleural area of A2 and A3 in the males of *Sesommata platysaris* and *S. paraplatysaris*. Similar but smaller patches of reddish orange sex scales have also developed on the side of A2 in *Palaephatus albiterminus* and *P. fusciterminus* (Figure 341). The much larger patches in *Sesommata* are fully exposed, but those in *Palaephatus* are normally covered by dark, abdominal scales. The ultrastructure of the abdominal sex scales is only slightly modified.

Another interesting sexual development has appeared on the second abdominal segment in *Metaphatus*, where it is present only in males of the *ochraceus* species group (*M. spatulatus*, *M. ochraceus*, and *M. ichnius*). A pair of small, glandular nodules (Figure 138) are located near the anterolateral margin of 2S in these species, near the tergosternal connection. Immediately dorsal of this supposed gland arises an elongate hair pencil (Figures 138, 255) from the pleural membrane. The ultrastructure of the piliform pencil scales is highly modified (Figures 257, 258), with sinuate longitudinal ridges and highly irregular transverse ribs. Spaced along the scale at indefinite intervals between the ridges are irregular fenestrae through which the sponge-like interior of the scale is apparent. Although the second abdominal glands are not known to occur in any other monotrysian moth, vestiges of the associated hair pencils have been observed in other Palaephatidae (e.g., *Plesiophatus*).

The seventh segment is slightly modified in all Palaephatidae, with 7S extended to 1.5 to 2 times the length of 7T. The spiracle is fully developed on A7 but vestigial on A8 with usually no trace of a peritreme. Tracheal rudiments, however, are still evident. The eighth segment is frequently shortened with 8S highly modified, reduced, and largely hidden by 7S. The posterior margin of 8S is entire with lateral spinose areas in *Sesommata* and *Metaphatus* but naked in *Plesiophatus*. The deeply cleft condition of 8S in *Palaephatus* and *Apophatus* is believed the most derived.

MALE GENITALIA

The tergum (tegumen) and sternum (vinculum) of the ninth abdominal segment are well defined in Palaephatidae. The tegumen is usually developed as a narrow dorsal ring with no clear separation from the tenth tergite (uncus). The uncus fluctuates considerably from a strongly bilobed condition in *Sesommata*, simple or secondarily cleft in *Metaphatus*, simple in *Plesiophatus*, to broadly truncate or superficially bilobed in *Palaephatus* and *Apophatus*. The vinculum varies greatly in form, but the anterior margin is never excavated or bilobed as it is within several homoneurous families.

A gnathos is variably developed in all genera except *Metaphatus* and *Plesiophatus*. Within the latter genera, the only structures preserved in the gnathos area are one or two patches of dense, short spines (Figure 460).

Diverse, sclerotized structures of uncertain homology have developed dorsal and/or lateral to the aedoeagus, and they have simply been referred to the anellus in this study. Anellar sclerites are present in *Sesommata* and *Metaphatus* but are lost in *Plesiophatus*, *Palaephatus*, and *Apophatus*. In *Sesommata* the anellus is extremely asymmetrical in all species, with a basic form typical for each of the two species groups (Figures 439, 447). The anellar sclerities are symmetrical in *Metaphatus*, with a larger lateral arm (LAAN) closely associated with the inner surfaces of the valvae (Figures 460, 461). The smaller, inner arms (IAAN) nearly form a yoke around the aedoeagus. As in *Sesommata*, the structure of the anellar sclerites is characteristic for each of the two species groups.

A median, often sagittate juxta, so characteristic of the Incurvarioidea, is reduced or absent in other monotrysian groups, including Palaephatidae. Located ventrolaterally to the base of the aedoeagus in *Sesommata* is a pair of slender sclerites that usually remained attached to the inner wall of the vinculum by membrane after removal of the aedoeagus (Figure 439). These widely divided sclerites are believed to represent additional fragmentation of the anellar sclerites, but, because of their ventral position, they could be derivatives of the juxta. Most likely their true homology will never be understood. Considering their paired, widely separated condition as well as the otherwise scarcity of a juxta in the Palaephatidae, I have preferred to refer to them simply as the ventrolateral sclerites of the anellus (VSA). The only palaephatid genus in which a median sclerite ventrad to the aedoeagus occurs, which could be considered a juxta, is *Plesiophatus*. The juxta in this monotypic genus consists of an extremely short but broad, transverse sclerite barely visible above the posterior rim of the vinculum (Figure 488).

The aedoeagus has become remarkably diversified among the five genera of Palaephatidae. In *Sesommata* the venter is enclosed by a relatively broad, tapered plate through which the vesica protrudes in *S. holocapna* (Figure 458). The aedoeagus of *Metaphatus* in great contrast possesses an attenuated, asymmetrical base. That of *Plesiophatus* is relatively simple and abbreviated. The aedoeagus of *Palaephatus* is frequently characterized by several large exogenous spines or serrated plates. The phallobase is unusually deeply furcate, as is the condition in *Apophatus*. A pair of elongate slender spines arises medially from the aedoeagus of *A. bifibratus* (Figures 555, 556). Possibly these filamentous appendages are homologous to the inner anellar arms of *Metaphatus*. In the few dissections available, however, they appear intimately associated with the aedoeagus.

FEMALE GENITALIA

The monotrysian reproductive system of Palaephatidae is most similar to that of the Nepticuloidea and perhaps Tischerioidea in that the oviporus (ostium oviductus) opens between 8S and A9 + 10 (Figures 142, 144) separately from the anal opening. Dugdale (1974) shows some evidence that 9S might be preserved in Tischeriidae and lie ventral to the oviporus. In most if not all Incurvarioidea the alimentary canal and reproductive tract are joined, forming a common cloaca, as is present in the Dacnonypha. Dugdale illustrates one possible exception in "*Tinea*" *monophthalma* Meyrick in which both oviporus and anus open separately at the termination of A9 + 10, but this needs to be confirmed. Richards (1933) similarly described separate apertures in *Lampronia russatella* (Clemens), but my examinations have revealed only a single, cloacal opening in this species.

The terminal segment of the abdomen in Palaephatidae does not appear subdivided, and most frequently in other families this has been considered the fused A9 + 10. The only trace of a sternum for this segment could be indicated by a pair of lightly sclerotized fragments immediately dorsal to the oviporus. These are easiest observed in the larger species of *Palaephatus* with more extended ovipositors (Figure 592). The apex of the palaephatid ovipositor (A9 + 10) is unlike that of any other group of Lepidoptera. That of the more generalized genera (*Sesommata* and *Metaphatus*) bears closest resemblance to the broadly rounded termination of the abdomen present in most Nepticuloidea. Centrally located at the apex of A9 + 10 in Palaephatidae is an autapomorphous structure that I have termed the medial sensory ridge (MSR, Figure 145, 185, 299). The surface of this organ is devoid of spines or setae but is richly supplied with campaniform sensilla (Figures 185, 274, 275, 292, 300). The apex of the ovipositor in *Plesiophatus*, *Palaephatus*, and *Apophatus* is more attenuated and frequently with the medial sensory ridge more elevated. The sensory ridge of *Plesiophatus* is unusual in being aligned transversely (Figure 291). In the female of Tischeriidae the apex of A10 (Figures 66, 68) bears a less definitive median ridge, accompanied by a pair of ventral lobes densely covered with short peg-like setae (Figure 67). The medial area in Tischeriidae, however, bears no campaniform sensilla and is largely covered with setae of diverse sizes.

The oviporus is normally a broad transverse slit that narrows to a poorly defined, relatively thin-walled vestibulum. The vestibulum of *P. dimorphus* is the most highly modified with a prominent pair of lateroventral pockets (Figure 145). Entering mid-dorsally into the vestibulum are the ducts of the furcate and more posterior, colleterial gland and the spermatheca. Near its termination the spermathecal duct is dilated to form a small reservoir (Figures 142, 144, RSpa). The duct is coiled and supplied with both a filamentous internal canal and a larger, more membranous external canal (Figure 557). The utriculus varies in development from relatively small in *Sesommata* to nearly equalling the size of the corpus bursae in some species of *Metaphatus* and *Palaephatus*. The appearance of small, sclerotized spicules within the utriculus is a derived condition, at least within the monotrysian Heteroneura, where they have been observed only in the Palaephatidae. Utricular spicules are lacking in *Sesommata*. In *Metaphatus* they are randomly scattered over the inner walls of the utriculus but are again absent in *Plesiophatus* and *Apophatus*. The situation in *Palaephatus* is both interesting and unique with the basal half of the utriculus lined with elongate spicules radiating from the basal end (Figures 591, 592). The arrangement in *P. dimorphus* is of a more generalized random type, whereas in *P. albicerus* the spicules have been secondarily lost. A relatively large, saccate lateral lagena is present in *Sesommata leuroptera* and *S. trachyptera*. The correlation of this feature together with the greatly lengthened spermathecal duct and broad ovipositor helps not only to typify this particular species group, but it also suggests the plesiomorphic states of this suite of characters. A lateral lagena is lost, the spermathecal duct more reduced, and the ovipositor more narrow in the *platysaris* group. Arising near the base of the utriculus in *Palaephatus*, *Metaphatus*, and medially in *Plesiophatus* is an elongate, filamentous tube, which either represents the often filamentous receptacular gland (Figure 592) or a highly modified lateral lagena.

The common oviduct joins the anterior margin of the vestibulum ventrally as it does in all non-ditrysian moths except the Exoporia (Dugdale, 1974). In Palaephatidae this connection can occur very close to the invagination of the oviporus and may be difficult to detect in most KOH macerated dissections. Immediately anterior to the junction of the common oviduct begins the much enlarged ductus bursae. In Palaephatidae the walls of this tract are usually thickened, partially folded, and covered internally with relatively broad, sclerotized spicules (Figures 301, 343, 344, 581). A major portion of the ductus bursae in *Sesommata*, *Metaphatus*, and *Plesiophatus* is even more thickened and folded so as to warrant a definitive term, colliculum (Figure 557). A colliculum is frequently present in the females of Nepticulidae, but it is absent in other Monotrysia. The development of the colliculum in Palaephatidae is sometimes specific in form. This is particularly true in *Metaphatus* (Figures 572–579), where the internal spiculate lining (i.e., denticulation) varies considerably. Internal examination of the denticulation within the colliculum of *S. holocapna* (Figures 187–191) and *Plesiophatus inarmigerus* (Figures 293–296) demonstrates not only how dense the spicules can be but also the variability they exhibit between closely adjacent areas. A shallow but elongate, V-shaped fold (VF) is present on the outer ventral surface of the colliculum in *Sesommata* (Figure 557). A similar but more modified V-fold is also present in *Metaphatus* and *Plesiophatus* (Figures 574, 575). In these latter genera the anterior apex of the fold is raised into a midventral keel (MKC). In preparing Figures 572–580 most of the V-fold has been removed in order to better illustrate the internal denticulation. Present along the sides of the colliculum in *Metaphatus* is a pair of posterior, and usually smaller, anterior lobes (Figure 572). These vary in size between species and probably serve as muscle attachments.

Beyond the colliculum, or ductus bursae, the corpus bursae enlarges either gradually or abruptly. Spicules continue into the corpus bursae in all genera except *Apophatus*. The spicules of the corpus bursae, however, are spaced farther apart and tend to be more slender. The form of the spicules can vary greatly between species, as witnessed by comparing those of *S. holocapna* (Figure 192), *M. ochraceus* (Figure 271), *M. cirrhus* (Figure 281), *Plesiophatus inarmigerus* (Figure 297), *Palaephatus dimorphus* (Figure 303), and *P. albiterminus* (Figure 345). A signum is often present, varying sometimes within a genus between 0 to 1 (rarely 2) (*Sesommata*), always 2 (*Metaphatus*), 1 (*Plesiophatus*), 0 to 1 (*Palaephatus*), or 0 (*Apophatus*). The signum frequently projects into the cavity of the corpus as an irregular spinose plate (Figure 298) or as a heavily knobbed tubercule (Figure 272). Occasionally the signum is poorly defined and may only consist of a dense concentration of enlarged spicules.

Spermathophores are sometimes encountered within the bursa copulatrix of Palaephatidae. These vary greatly in form and number, with those of a few species possessing a diagnostic shape. One of the more unusual spermatophores is to be found in *P. dimorphus* (Figure 582), whose slender, elongate corpus bursae appears well suited for storing its equally slender spermatophore. The maximum number of spermatophores discovered within a single female (*P. albiterminus*) was six.

Phylogeny

PHYLOGENY OF HETERONEURA

The monophyly of the infraorder Heteroneura has been well documented (see Kristensen, 1984:165, for review of principal characters). The relationships of the major divisions within the Heteroneura, although much debated, still present some inconsistencies and uncertainties that often require more assumptions than one would like to accept. The basic problem concerns the phylogeny of the various monotrysian heteroneurous families and their relationship to the well-defined division Ditrysia. Previously, these families along with all the homoneurous families were grouped together under the subordinal name Monotrysia (Börner, 1939:1403). The Monotrysia were later redefined by Hinton (1946), who removed all of the homoneurous groups except the Hepialoidea. Dugdale (1974) further restricted Monotrysia by placing the Hepialoidea and Mnesarchaeoidea in a separate taxon, the endoporian Ditrysia. Subsequently, most authors have followed the suggestion of Common (1975) by considering the Exoporia as a distinct infraorder. Recent workers have refrained from using Monotrysia as a formal group name, mostly because no synapomorphy could be found to define such a taxon. Instead, certain divisional names (e.g., the Incurvariina Börner, 1939 (= Incurvariiformes, Adelomorpha) and Nepticulina Meyrick, 1928 (= Nannolepidoptera, Nepticulomorpha) have been resurrected and used on a coordinate level (Kristensen and Nielsen, 1980) with Ditrysia. Nielsen (1985) outlines the problems and monophyly of each of these divisions and proposes the Tischeriina as the sister group for the Ditrysia. However, the basis for this relationship, their similar frenular setae in the female, is not so unique as once thought. As discussed in the previous section, reduction of the female frenulum to a similar state has evolved independently in at least two other monotrysian families, the Prodoxidae and Palaephatidae.

A recent review by Minet (1984) of the prothoracic sclerites has resulted in the removal of the Nepticulina (Nepticulidae and Opostegidae) from the infraorder Heteroneura. Largely on the basis of the reduction of the prosternum, including the precoxal bridge, Minet proposes the Nepticulina as a separate infraorder that arose earlier than either the Exoporia or Incurvariina. To support this phylogeny, Minet dismisses the more commonly mentioned heteroneurous synapomorphies (radial reduction in the hind wing, development of a frenulum, as well as presence of a precoxal bridge) as not true autopomorphies. Although it is true that some exceptions in the development or distribution of these major features are known to occur, at least some of this variation could be due either to independent development (e.g., the frenulum in one species of *Acanthopteroctetidae*) or subsequent modification (e.g., variation of the hind wing radial system). Similarly, the prosterna of Minet's Nepticulina demonstrates variation, with that of Nepticulidae being somewhat intermediate in development between the primitive condition shown in Opostegidae and the much more developed form in Incurvariina. The existence of a precoxal bridge in Nepticulidae (absent in all families below the heteroneuran grade) strongly suggests that reduction of the basisternum is a secondary specialization in this family and not the plesiomorphic condition. Because it is difficult at present to decide which of these variant characters may have arisen independently or subsequently regressed, I prefer to recognize the Heteroneura on the basis of the greater number of possible synapomorphies as outlined by Kristensen (1984) and earlier workers.

I recognize the infraorder Monotrysia as a monophyletic group primarily on the basis of a single feature, the similar morphology of their metathoracic furcasternum. The monotrysian metafurcasternum represents a distinct departure from that developed in either Dacnonypha (Figure 126) or Exoporia (Figure 127). The absence of secondary arm laminae (LSF) in those groups as well as Monotrysia, compared to their presence in all Ditrysia (Brock, 1971:46), further indicates the monotrysian type to represent the plesiomorphic form within the Heteroneura. I am aware of only two tineid genera (*Phaeoses*, Davis, 1978b, and *Eudarcia*) in which these laminae are undeveloped, but undoubtedly more exceptions occur, as a result of secondary modifications.

Although the Monotrysia encompasses only about 0.8% of the Heteroneura, major morphological differences occur within this relatively small division. The section Incurvariina is partially characterized by a lanceolate piercing ovipositor, a common cloaca that terminates on A9 + 10, as well as by several autapomorphies (Figure 146, nodes 10–14). The other primary split in the Monotrysia consists of the Nepticulina, an assemblage of three superfamilies with soft, nonpiercing ovipositors and a separate oviporus opening between 8S and 9S (or possibly on 9S in Tischerioidea). Nielsen (1985) has recently restated the hypothesis proposed by Börner (1939) and later Mutuura (1972) that the piercing ovipositor may actually represent an autapomorphy of the Glossata, which subsequently was lost in the Exporia and above the Incurvariina grade in the Heteroneura. As outlined in Figure 146, I also subscribe to this hypothesis. The presence of a cloaca and its termination at the end of A10 in the females of Incurvariina further reinforces this lineage. The relative position of the oviporus in primitive Glossata should not be confused with the debate on its original position for the Lepidoptera (see discussion of Kuznetsov and Stekolnikov, 1978:608). The cladogram in Figure 146 requires, in addition, the assumption that ancestral Heteroneura possessed endophagous larvae and lacked pectinifers on the male valvae, as well as that non-piercing ovipositors evolved independently in both the Nepticulina and Ditrysia (nodal points 15 and 53 respectively), and that ocelli were lost at nodes 10 and 18. Another alternative, that the Palaephatidae and Ditrysia are monophyletic (node 60) is suggested by numerous plesiomorphic similarities and only questionable synapomorphies (e.g., externally feeding larvae, reduced frenular setae in female, pectinifers lost in male).

Listed below are several characters proposed in support of the cladogram (Figure 146) of the major heteroneuran taxa. Some of these have been discussed by previous authors and need not be elaborated here. Other characters, however, require further discussion. The numerical sequence refers to those on the cladogram.

1–7. The monophyly of the Heteroneura is summarized by Kristensen (1984). Features of greatest significance include the reduction of the radial system of the hind wings to a single vein (Rs), the development of a retinaculum-frenulum coupling system in the wings, loss of the first abdominal sternite, the fusion of the anterolateral angles of the prosternum with the pleuron through the development of a precoxal bridge (secondarily reduced or lost in Nepticuloidea?), and three specializations of the wing articulation discussed by Sharplin (1963a,b, 1964).

Thus far only two possible synapomorphies are known for the Monotrysia. Both were discussed in the previous section, "Morphology."

8. *Metafurcasternum.* The diagnostic structure of the monotrysian metafurca actually involves a suite of characters of significance here. These include the absence of secondary arm laminae (LSF) and the presence of two pairs of dorsal tendons, one pair originating from anterodorsal ridges and a second pair arising subapically from relatively slender, dorsocaudally projecting apophyses. Secondary specializations of this basic structure have appeared in Prodoxinae, Cecidosidae, Opostegidae, and Tischeriidae. Because this type of metafurca has not been found in any non-monotrysian family, it is recognized as a synapomorphy for the Monotrysia.

9. *Presence of pectinifers on the male valvae.* Concomitant with the acceptance of the Incurvariinae as the most primitive section of the Monotrysia, the presence of spine combs (i.e., pectinifers) in both the Incurvariina and Nepticulina become a significant monotrysian synapomorphy. The pectinifer has been secondarily lost in several incurvarioid genera, in most Nepticulidae (Scoble, 1982), and in all Tischeriidae and Palaephatidae.

Monophyly of the section Incurvariina has been well documented with several synapomorphies. Principal among these are the following:

10. *Larva with portable leaf case in last instar* (Nielsen, 1980b). Within the Lepidoptera, this marks the first appearance of a larval case. Portable cases subsequently appeared independently in a few ditrysian families. The case-making behavior of the Incurvariina has been lost in the more advanced, boring larvae of Prodoxidae and Cecidosidae.

11. *Pupation inside larval case.* The absence of larval case construction below the heteroneuran grade also determines this behavior as apotypic. In more advanced boring Incurvariina, which no longer construct cases, pupation occurs inside larval galleries or galls.

12. *Female with A8 withdrawn into A7.* This unusual specialization, developed in conjunction with the piercing ovipositor, is not known to occur in any other Lepidoptera. Apparently A8 can be extruded from the much larger A7, but I have observed this extrusion only once in museum material.

13. *Female genitalia with two pairs of retractor tendons* ("guy wires," sensu Dugdale, 1974). The retractor tendons, attached to the vestibulum, are another specialization for a more efficient piercing ovipositor that has not developed in other Lepidoptera.

14. *Male genitalia with slender, sagittate juxta* (Nielsen, 1985; Nielsen and Davis, 1985). Surprisingly little divergence in the basic sagittate form has developed among the six families comprising the Incurvarioidea, and in no species has the juxta been lost. The structure of the juxta diverges the most in those species of Incurvariidae that possess well-separated posterior juxtal arms.

The sister group of the section Incurvariina is believed to be the Nepticulina, whose monophyly is suggested by the following:

15. *Non-piercing ovipositor* (Busck, 1931). The piercing ovipositor is believed to be a primitive glossaten feature (Börner, 1939) that has been subsequently lost in Exoporia and most Heteroneura. This is suggested by its presence in all Dacnonypha, Neopseustidae, as well as Incurvariinae (Nielsen, 1985). The retention of the single cloacal opening on A10 of the Incurvariina also supports this hypothesis. Piercing ovipositors with a much different morphology also develop much later in a few ditrysian families.

16. *Cloaca absent, oviporus located between A8 and 9* (Mutuura, 1972; Dugdale, 1974). The development of a non-piercing ovipositor has resulted in a reduction of A9 + 10 accompanied by the movement of the oviporus at least one segment forward. Because of the shortened condition of the last two segments, the oviporus still occupies a terminal position. The precise location of the oviporus in Tischeriidae is uncertain because of the presence of a bilateral pair of tiny, sclerotized rods that could represent vestigial reminants of 9T.

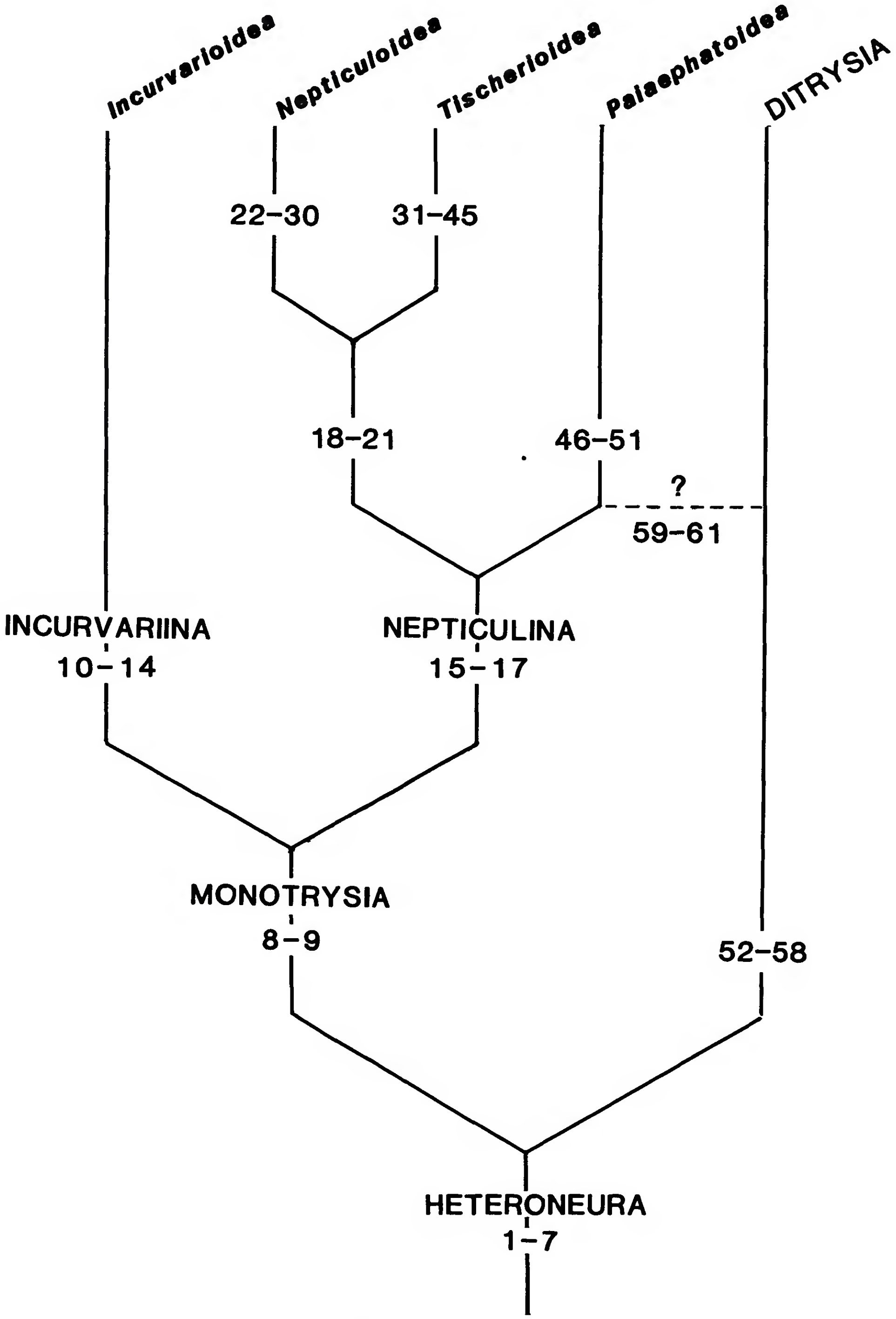


FIGURE 146.—Hypothetical phylogeny of the infraorder Heteroneura.

17. *Juxta reduced or lost* (Kuznetsov and Stekolnikov, 1978). A relatively membranous plate-like juxta persists in many Nepticulina, with total loss occurring in the Opostegidae and most Palaephatidae. A juxta is almost entirely lacking in the Tineoidea (present in some *Acrolophus*).

The Tischerioidea have long been closely associated with Nepticuloidea by several authors (Busck, 1914; Heinrich, 1918), most often because of their endophagous, leaf-mining habit (actually a plesiomorphic trait). Most nepticuline larvae, however, do demonstrate further morphological specializations (i.e., synapomorphies) associated with the leaf-mining habit, which have not appeared earlier in the Heteroneura. Principal among these is the flattening of the head capsule, which has also modified the stemmata from the generalized circular pattern to a more linear series. This has also affected stemmatal reduction from 6 to 4 pairs in Tischeriidae down to a single pair in Nepticuloidea. Similar but greater specialization of the head capsule in association with leaf mining has appeared independently in the sap-feeding instars of Gracillariidae. Heinrich regarded the larval hypostoma of Tischeriidae to be developed far forward in a position similar to the Nepticuloidea, but I could not confirm this (Davis, 1986). Only questionable synapomorphies link the adults of this clade. Each of the three families possess unique or unusual antennal sensillae, but it is doubtful if these are homologous. In contrast, the prosterna of Nepticuloidea and Tischerioidea differ greatly (Minet, 1984), with that of the latter well developed as is true for the other monotrysian families and Ditrysia. However, as discussed previously, the prosternum of Nepticulidae shows evidence of secondary reduction from a more sclerotized form. Possible synapomorphies linking these two superfamilies are listed below.

18. *Larval head strongly depressed* (Heinrich, 1918; Davis, 1986). All larvae in this clade show specialization in this regard compared to the much less depressed form in Heliozelidae.

19. *Larva with thoracic legs greatly reduced or lost* (Davis, 1986). Thoracic legs are lost in all Nepticuloidea as well as in many Tischerioidea; in some tischeriids the legs are reduced to two vestigial segments (Emmet, 1976). In Incurvariina, fully developed legs are present in the most generalized members, including Heliozelidae.

20. *M2 lost in both wings.* In conjunction with a narrowing of the wings, a general venational reduction has occurred throughout this clade, which reached its culmination in the Opostegidae. The loss of M2 has occurred in all members and has been lost independently in the Heliozelidae as well.

21. *Hind wing lanceolate.* Reduction of the hind wing also occurs in the Heliozelidae, although to a lesser degree.

The monophyly of the Nepticuloidea has been thoroughly demonstrated based on the following synapomorphies:

22. *Larval stemmata reduced to one pair.* (See discussion this page.)

23. *Larval crochets lost.* Crochets are usually present in Tischeriidae and Incurvariina, except where they have been secondarily lost in the more endophagous species.

24. *Larva with hypostoma developed far forward* (Heinrich, 1918; Davis, 1986). The forward development of the hypostoma reaches its greatest specialization in the Opostegidae, where it lies opposite the labrum. It is positioned less forward in Nepticulidae but still more so than in most other groups of Lepidoptera.

25. *Pupa with all coxae enlarged and exposed* (Davis, 1986). The normal condition in Lepidoptera and particularly in the Heteroneura is for only the forecoxae to be clearly visible.

26. *Antenna with enlarged scape* (Heinrich, 1918). A classic synapomorphy for this superfamily, which is secondarily reduced in the most advanced Nepticulidae.

27. *Antenna with sensilla coeloconica reduced or lost.* These sensilla are well represented in all other Monotrysia but are reduced (only the central basiconic sensillum remaining) or absent in Nepticulidae and absent in Opostegidae.

28. *Pseudofrenular setae enlarged and in a nearly contiguous row below costal margin.* Nowhere else in the Lepidoptera are these setae so enlarged in the female. Normally, the pseudofrenular setae (if present) are also more scattered along the costal margin.

29. *Prosternum reduced* (Minet, 1984). The basisternum is weakly developed in both Nepticulidae and Opostegidae, with the latter also lacking the precoxal bridge. The basisternum is well developed in all other Monotrysia as well as Ditrysia.

30. *Metatibia densely spinose* (Nielsen, 1982). Dense, semierect spinose setae are absent on the metatibia of other Monotrysia.

The Tischerioidea, with only one family, display numerous unusual specializations of which the following are only a sample.

31. *Larva with tentorial bridge greatly reduced* (Jayewickreme, 1940). In other monotrysian larvae, the bridge is

approximately transverse and equal to the anterior arms in diameter. The tischeriid tentorial bridge is extremely small in diameter and deeply invaginated.

32. *Larva with setae D1 and D2 nearly contiguous* (Davis, 1986). This is one of the most diagnostic characters for not only the tischeriid larva but also the pupa. The typical condition in Lepidoptera is for those setae to be widely separated.

33. *Pupation inside mine* (Braun, 1972). This behavior marks another leafmining specialization. The larvae of Nepticuloidea pupate in cocoons outside the mine, and those of the Incurvarioidea most often pupate inside the larval case.

34. *Adult with prominent scale tuft at vertex* (Braun, 1972). The vestiture of the tischeriid head, with its smooth frons and tufted vertex, is diagnostic. The vertex in Nepticuloidea is generally rough over all of its surface.

35. *Antennal sensilla trichodea filamentous, recurved.* This sensilla form has not been observed in any other Lepidoptera.

36. *Maxillary palpus reduced, 3-segmented.* The plesiomorphic condition in Lepidoptera is five segments. This is true for all Nepticuloidea, although reductions occur independently in other families of Monotrysia.

37. *Distal half of haustellum with scutiform, sclerotized plates externally.* The primitive condition for the external surface of the haustellum is to be rough and spinose and to be less sclerotized. External plates also have been observed at the very apex of the heliozelid haustellum and in some Tineidae.

38. *Reduction of microtrichia over wings* (Braun, 1972). Microtrichia are confined primarily to the bases of both wings in Tischeriidae. The plesiomorphic condition is to have these tiny spines randomly scattered over all wing surfaces, as in Nepticulidae. Within the Monotrysia they have also been reduced in a few other families.

39. *Female with 2–3 frenular setae* (Braun, 1972; Nielsen, 1982). Enlargement and isolation of the basal-most setae of the primitive pseudofrenular series represents an important synapomorphy for the Tischeriidae. A similar specialization has also evolved in a few Incurvariina and Palaephatidae.

40. *Metafurcal apophysis joined to secondary arms of the furcasternum.* Within the Monotrysia this specialization has developed only in most Prodoxinae and in one species of Opostegidae. The plesiomorphic condition is for the furcal apophyses to extend free.

41. *Second abdominal sternite with two anterior fragments* (Kristensen and Nielsen, 1980). Although the presence of two small sternites anterior to and part of 2S clearly represents a derived, autapomorphous state, it is not certain at present which of two other conditions is plesiomorphic. Even though most monotrysian genera appear to possess one small 2S fragment, it may be possible that the less modified, more quadrate 2S is the most plesiomorphous form.

42. *Female ovipositor terminating in a pair of ventral, setigerous lobes* (Braun, 1972). Except for minute, paired, dorsal lobes independently evolved in many Opostegidae, no more than a single, usually broad ovipositor lobe occurs in Monotrysia.

43. *Male genitalia with muscle M1 from tegumen* (Kuznetsov and Stekolnikov, 1978). According to these authors, M1 normally extends from the vinculum or the fused anellus.

44. *Pectinifer absent from male valva.* Because a pectinifer is present in Incurvariina, Opostegidae, and in at least some Nepticulidae (Scoble, 1982), it is assumed to have been lost independently in both Tischeriidae and Palaephatidae, as well as in several genera of Incurvarioidea.

45. *Aedoeagus terminating in a pair of furcate sclerotized rods* (Braun, 1972). This form of aedoeagus does not occur in any other Monotrysia.

The sister group of the Nepticuloidea + Tischerioidea is the Palaephatoidea. Although the latter appears abundantly distinct from other Monotrysia, only one autapomorphy (see 48) has been discovered for this new taxon. Its monophyly is established as follows:

46. *Larva an external feeder.* Based upon the external feeding behavior of a single species of *Sesommata*, it is assumed that this is the basic habit for the Palaephatidae. All other monotrysian larvae are either entirely endophagous or feed externally from within portable cases.

47. *Female with 2–4 frenular setae.* See previous discussion under 39.

48. *Female ovipositor with median sensory ridge.* This unique structure has not been observed in any other Lepidoptera, although a raised medial area has developed on A10 in Tischeriidae, which is not believed to be homologous.

49. *Female utriculus with minute spicules.* Although spicules have developed inside the spermathecal utriculus in some ditrysian families, this marks their only appearance in the Monotrysia.

50. *Female colliculum with a ventral V-shaped fold (VF) and a midventral keel (MVK).* These structures are not known to occur in any other Lepidoptera. Their presence (at least in part) in the three lower palaephatid genera indicates that they have been secondarily lost in *Palaephatus* and *Apophatus*.

51. *Pectinifer absent from male valvae.* See previous discussions under 9 and 44.

Although the very large and diverse division Ditrysia is easily defined by the synapomorphies listed below, its precise sister group relationship remains questionable. As presented here, the first Ditrysia, among the extant families most typified by Tineidae, arose from some incurvarioid ancestor. As explained earlier in this section, some evidence supporting a palaephatoid sister group relationship (node 59) also exists.

52. *Larva an external feeder.* If the immediate sister group of the Ditrysia is the Incurvariina, then external feeding would have to be considered a specialization here.

53. *Mesothorax with tergopleural apodeme and subtegula fused.* This condition represents the most specialized of at least two distinct character states in the lepidopteran mesothorax. The tergopleural apodeme may sometimes touch but is never fused to the subtegula in Monotrysia. Sharplin (1964) considered the fusion of the tergopleural apodeme to be with the prescutal apodeme. As pointed out previously in the "Morphology" section, it is instead with the subtegula, at least in the Tineidae.

54. *General reduction of microtrichia over all wing surfaces* (Busck, 1914, 1931). Although reduction of microtrichia occur in a few monotrysian families, they are absent from the general wing surface in all Ditrysia.

55. *Female with separate openings for (a) alimentary canal (terminal on A10); (b) oviposition (terminal on A10); and (c) copulation (ventral, usually between 7S and 8S)* (Busck, 1931; Börner, 1939). This is the classic characteristic of the Ditrysia, which has undergone surprisingly little modification in over 140,000 species. A somewhat similar system has developed in the Exoporia (Dugdale, 1974).

56. *Female with a non-piercing ovipositor comprised of paired lobes (i.e., papillae anales).* Although a non-piercing ovipositor has developed independently within the Monotrysia, only the Ditrysia among the Heteroneura possess paired papillae anales. Small, paired dorsal lobes have developed in Opostegidae, as well as larger, more ventral lobes in Tischeriidae, but these are not believed to be homologous to the more terminal, ditrysian structures.

57. *Development of ductus seminalis.* The presence of an internal duct to transport sperm from the bursa copulatrix to the vagina is a ditrysian autapomorphy, not found in any other Lepidoptera.

58. *Common oviduct dorsal to bursa copulatrix* (Dugdale, 1974). Although the dorsal condition of the oviduct in Ditrysia is apotypic when compared to the ventral position in its immediate sister group (Monotrysia), and all Lepidoptera below the Neolepidoptera grade, it would have to be considered plesiotypic when compared to the supposed sister group of the Heteroneura, Exoporia.

Questionable synapomorphies linking the Ditrysia to the Palaephatidae include the following:

59. *Larva an external feeder.*
60. *Reduced frenular setae in female.*
61. *Pectinifers absent on male valvae.*

PHYLOGENY OF PALAEPHATIDAE

The phylogenetic sequence for the genera of Palaephatidae in the cladogram in Figure 147 has been arranged according to the synapomorphic characters listed below. The basal position of the genus *Sesommata* in the family was determined by the following criteria: (1) the presence of ocelli (the only monotrysian genus known to retain ocelli); (2) the generalized outline of the termen of the forewings (the falcate termen in *Palaephatus* is clearly apomorphous); (3) the broad, abbreviated condition of A9 + 10 in the female (this is most similar to the condition that exists in Nepticuloidea); (4) the development of the colliculum in the female (a colliculum is also developed to some extent in the Nepticulidae); (5) female with 8S entire (the deeply cleft 8S of *Palaephatus* and *Apophatus* constitutes a specialization); and (6) the presence of a saccate lateral lagena in the more generalized females of *Sesommata* (a lateral lagena is absent in the more advanced *platysaris* species group of *Sesommata*). In other genera the lateral lagena (if present) is elongate and filamentous and of uncertain homology). The evaluation of the character states of the second sternite is also questionable. The presence of a deeply concave anterior margin with a small associated sclerite (2Sa) has been considered plesiomorphic herein because this represents the general condition encountered in most Incurvariina examined thus far. However, a more simple, quadrate 2S (as possessed by *Sesommata* and *Metaphatus*) could be plesiomorphic, because 2Sa is absent in Heliozelidae.

The sister group relationship of *Sesommata* and *Metaphatus* is supported by the following synapomorphies:

1. *Microtrichia reduced on dorsal surface of male forewings.* The presence of randomly scattered microtrichia over the wings is a well-known plesiomorphic trait among the non-ditrysian Lepidoptera (Busck, 1931), with only a few families showing any reduction at all. Among the Palaephatidae, only the males of *Sesommata* and *Metaphatus* have lost the microtrichia over most of the dorsal surface of the forewing.

2. *Second abdominal sternite without accessory sclerite* (2Sa). As mentioned above, the polarity of this character is ques-

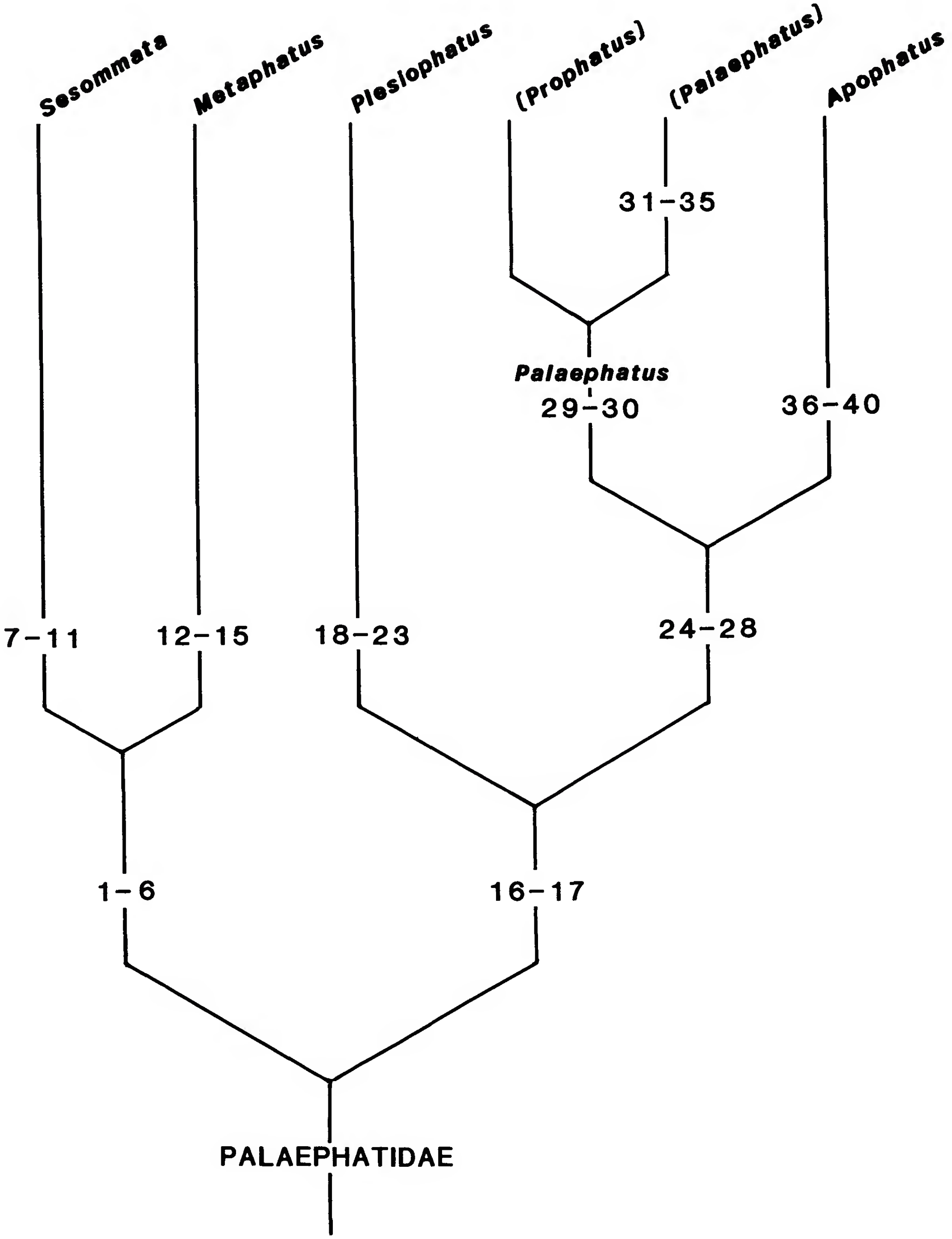


FIGURE 147.—Hypothetical phylogeny of the genera of Palaephatidae.

tionable. Because of the general presence of 2Sa in most Incurvariina and Nepticulidae, as well as its absence in Ditrysia, it seems most likely that 2Sa has been lost in *Sesommata* and *Metaphatus*.

3. *Juxta lost.* A prominent juxta is present in Incurvariina and is developed to some extent in Nepticuloidea. Because of its presence in *Plesiophatus*, it is assumed to have been lost in this lineage.

4. *Anellar sclerites present.* A sclerotized anellus is absent in all other monotrysian families. This feature has developed only in this clade in the Palaephatidae.

5. *Eighth sternite of female with a bilateral pair of spinose patches.* The presence of these specialized areas constitutes an autapomorphy for this lineage.

6. *Posterior apophyses reduced, much smaller than anterior pair.* The posterior apophyses are relatively well developed in Nepticulidae and the other genera of Palephatidae.

The species of *Sesommata* form a very distinct, unusual group and comprise the only genus of Monotrysia known to possess ocelli. Possible synapomorphies for this genus include the following:

7. *Male with anellar sclerites highly asymmetrical.* Symmetrical sclerites are present in the sister genus *Metaphatus*.

8. *Anellus with ventrolateral sclerites.* The homology of these paired sclerites is uncertain, but they have not been noted in any other moth.

9. *Female with anterior apophyses fused midventrally.* One of the results of this specialization is the formation of a flat median plate bordered laterally by spinose ridges. Both the plate and the spines represent specializations not found in any other genus. The anterior apophyses of *Metaphatus* are less developed and not fused medially. The sternal spines likewise are usually less developed and do not arise directly from the sclerotization of the anterior apophyses.

10. *Utriculus without spicules.* Because of the presence of utricular spicules in the females of *Metaphatus* and most other palaephatid genera, it is apparent that these small spines have been lost in *Sesommata*.

11. *Loss of midventral keel on colliculum.* The presence of MKC in both *Metaphatus* and *Plesiophatus* suggest it to be the plesiomorphic condition for the family.

All members of *Metaphatus* are monophyletic, as evidenced by the following characters:

12. *Ocelli lost.* Ocelli are present in the sister group *Sesommata*.

13. *Second sternite of male with bilateral glandular swellings.* A pair of supposed glands are present on 2S of the *ochraceus* species group. They are not known to occur in any other group of moths and are believed to have been secondarily lost in the more advanced members of *Metaphatus*.

14. *Male gnathos reduced to spinose areas.* A well-defined, sclerotized gnathos is present in *Sesommata* and most other genera of Palaephatidae. The precise homology of these spinose areas in *Metaphatus* (as well as in *Plesiophatus*) is unknown, but they do exist in lieu of the normal gnathos.

15. *Female with paired signa.* A single signum is present in all other Palaephatidae (except for a single aberrant example with paired signa in *Sesommata*), thus suggesting this to be the plesiomorphic state in this family. Paired signa appear to be the most primitive state for most monotrysian families.

Largely because of the similar development of their ovipositors, the three genera *Plesiophatus*, *Palaephatus*, and *Apophatus* are believed to be monophyletic. Possible synapomorphies include the following:

16. *Ocelli lost.* See comments under 11.

17. *Ovipositor relatively slender, extended.* The plesiomorphic state is believed to be a broader, more truncated ovipositor, a condition most similar to that found in Nepticuloidea.

The genus *Plesiophatus* occupies a somewhat intermediate position between *Metaphatus* and *Palaephatus*, but shares more similarities with the latter. The monobasic genus can be defined by the following specializations:

18. *Second abdominal sternite without accessory sclerite.* See comment under 2.

19. *Gnathos of male reduced to spinose areas.* See comments under 13.

20. *Aedoeagus greatly shortened.* The aedoeagus is elongate in all other Palaephatidae.

21. *Female with bilateral pair of sclerotized rods in vestibulum.* The presence of these rods constitute an autapomorphy for this genus.

22. *Female without utricular spicules.* See comment 11.

23. *Female with transverse medial sensory ridge.* This ridge is aligned vertically in all other Palaephatidae.

The close relationship of *Palaephatus* and *Apophatus* is clearly shown by the following synapomorphies:

24. *Pilifers reduced.* Pilifers with prominent setae are moderately well developed in all other Palaephatidae and in most other Monotrysia.

25. *Male with a prominent pollex (i.e., costal lobe) on valva.* This is a very characteristic autapomorphy for this lineage.

26. *Female with eighth sternite partially divided.* The plesiomorphous condition, present in all other Palaephatidae, is to have the caudal margin of 8S entire.

27. *Colliculum reduced, V-fold and midventral keel lost.* The colliculum, so well developed in the lower palaephatids, is reduced to the point of being indistinct in this clad. Also lost are the ventral V-shaped fold and midventral keel (see 11).

28. *Female with apex of ovipositor acuminate.* In *Palaephatus* and *Apophatus* the medial sensory ridge is more elevated than in other Palaephatidae, resulting in a very produced apex to the ovipositor.

Although considered a monophyletic group, the genus *Palaephatus* as a whole possesses few synapomorphies. The most diagnostic are as follows:

29. *Forewing with falcate termen.* All other Palaephatidae possess more slender wings with the apex produced, much as is the case with other Monotrysia.

30. *Female with utricular spicules arranged in radiating lines over caudal half.* This unusual pattern exists in all female *Palaephatus* except *P. dimorphus* and *P. albicerus.* The situation in the latter (i.e., loss of spicules) is obviously a secondary specialization. The spicule arrangement in *P. dimorphus,* however, represents the primitive pattern, which could be explained as a character reversal. A question remaining, consequently, is at what point did the radiating pattern arise—before the appearance of *P. dimorphus* or afterwards?

The genus *Palaephatus* can be readily divided into two subgenera. Although no synapomorphies are known for the subgenus *Prophatus,* several serve to characterize the nominal subgenus.

31. *Antennal pecten lost.* Pecten are usually present throughout the Monotrysia.

32. *Labial palpus without bristle-like setae on second segment.* Similar comment as 31.

33. *Forewing with 1A and 2A completely fused.* The presence of an anal loop (base of 1A and 2A furcate) is another common plesiomorphy for Monotrysia.

34. *Hind wing with androconial pockets at base of Rs.* These pockets, containing hair pencils and other sex scales, are an autapomorphic development in this subgenus.

35. *Valva of male with an apical lobe distad to pollex.* The presence of this "accessory" lobe is unique for the Palaephatidae.

Apophatus is an obvious derivative of *Palaephatus* and represents the most specialized genus in the family. Most of its synapomorphies reflect a generally reduced morphology.

36. *Eyes reduced.* The interocular index of *Apophatus* (0.6) is the smallest in the family.

37. *Mandibles reduced.* Similarly, this represents the greatest extreme in reduction for the family.

38. *Maxillary palpus reduced, 4-segmented.* All other Palaephatidae possess elongate, 5-segmented palpi.

39. *Foretibia without epiphysis.* This is the only palaephatid genus that has lost the epiphysis.

40. *Female without utricular spicules.* Utricular spicules have been lost four different times within the family (see 10, 21, and 29).

PALAEPHATIDAE, new family

TYPE GENUS.—*Palaephatus* Butler, 1883.

ADULT.—Moths ranging in size from very small to moderately large, with a forewing length of 3.8 to 16 mm; wings slender to moderately broad. Venation heteroneurous. Microtrichia generally present over all surfaces of both wings. Males with a single, stout frenular bristle. Females with 2–4 frenular bristles arising close together; ovipositor of the monotrysian type, with a single genital opening and ventral oviduct.

Head: Vestiture rough to semi-rough, consisting of long piliform scales with acute to minutely bidentate apices. Antennae filiform, without pectinations, approximately 0.5–0.9 the length of forewing, 32–58 segmented; scape slightly enlarged, 2.4–2.8 the length of pedicel; pecten usually present, absent in subgenus *Palaephatus*; each flagellar segment usually with two rings of broad scales dorsally and a narrow naked strip ventrally, which is densely covered with hair-like sensillae chaetica (Figure 229); also with one or more pairs of sensillae coeloconica (Figures 202, 230, 353) located in various positions. Compound eyes round, smooth, small to moderately large; interocular index 0.6–1.2, eye index 0.8–1.0; corneal nipples present, subnipples apparently present. Ocelli usually absent, present in *Sesommata*. Tentorium with dorsal arms vestigial, nearly absent. Pilifers poorly to moderately well developed, often with small, setose bilateral lobes (Figures 204). Mandibles vestigial, varying in size from minute to moderately large. Maxillary palpi usually long, 5-segmented, with penultimate segment the longest; reduced to 4 short segments in *Apophatus;* apex of fifth segment with two small lobes more or less developed, each lobe bearing 3–6 minute sensillae basiconica. Haustellum short to moderate in length, seldom exceeding length of maxillary palpi; distal half of haustellum with numerous, relatively large sensillae with either smooth sides or possessing 6–7 lateral ridges (Figure 154); both margins of galeae lined with thin, relatively broad and flexible, strap-like spines. Labial palpi 3-segmented, slightly up-curved; apical segment with a small apical to subapical sensory pit containing numerous, slender sensillae.

Thorax: Forewings moderately broad to slender, length ranging from 2.8–3.5 the width. Radius 5-branded, all veins usually separate, R4 and 5 rarely stalked; R5 terminating on costa before apex; accessory cell present. Medius 3-branched, all veins usually separate, M2 and 3 rarely connate; base of medius forked within discal cell. Cu 1A and Cu 2A usually separate, rarely connate. 1A and 2A usually separate at base, forming a basal loop; completely fused in subgenus *Palaephatus*. Forewing usually tapering gradually to apex; termen more developed, falcate in *Palaephatus*. Microtrichia generally distributed over all surfaces of both wings, restricted on dorsal surfaces of forewing of *Sesommata* and *Metaphatus* to apical fifth. Forewing scales unsually smooth, but with raised sex scales in some *Sesommata*. Retinaculum, consisting of a ventral costal fold (Figure 330), more developed in male than female. Hind wing as broad or broader than forewings, length ranging 2.2–3.2 the width. Male frenulum consisting of a single, stout bristle; female frenulum with 2–4 but usually 3 bristles arising close together. Radial system reduced to Rs with R1 fused to Sc. Medius 3–branched; all branches usually separate, rarely with M2 and 3 connate. Medius usually forked within cell. Males of some *Palaephatus* with specialized sex scaling and hair pencils concealed in folds or pockets; exposed hair pencils present in males of some *Sesommata* along costal margin; discal cell absent in those males with medial hair pencil fold. Mesofurcasternum with elongate, well-developed lateral arms and slender, much reduced mesal arms. Metafurcasternum usually with elongate, free apophyses; a second pair of tendons arising dorsally from a pair of low, anterior furcal ridges (Figures 109, 115). Forelegs reduced in size, foretibia about 0.24–0.34 the length of hind tibia; tibial spurs usually 1-2-4; epiphysis pectinate, absent in *Apophatus*.

Abdomen: First tergite moderately developed; first sternite (Figure 138) absent. Second sternite without apophyses; with a lateral pair of thickened rods, or venulae, totally contained within sternite; occasionally with lateral clusters of sex scales or hair pencils. Without specialized spines or processes on T1–8. Spiracles well developed on A1–7, vestigal on A8 with peritreme usually absent.

Male Genitalia: Uncus indistinctly separated from tegumen, either acute, rounded, or bilobed. Tegumen variable, weakly to moderately developed dorsally. Gnathos usually present, sometimes absent, if present then highly variable. Vinculum weakly to rarely well developed, usually broadly triangular in outline; saccus seldom distinct. Valvae variable in form, usually broadly rounded in *Plesiophatus*, *Palaephatus*, and *Apophatus;* more elongate and slender in *Metaphatus* and *Sesommata* and with apical lobes or processes; a prominent curved process (or pollex) arising midway along costal margin in *Palaephatus* and *Apophatus*. Juxta usually absent, present only in *Plesiophatus* and *Sesommata*, where it is represented by a pair of small sclerites ventral to base of aedoeagus. Anellus present in *Sesommata* and *Metaphatus*, complex and asymmetrical in *Sesommata*, consisting of paired lateral and inner arms in *Metaphatus*. Aedoeagus highly variable in structure, usually large, often equalling or slightly exceeding length of genital capsule; base usually strongly furcate ventrally; exogenous spines or lobes and endogenous spines (cornuti) variably developed or absent.

Female Genitalia: Ovipositor of the nonpiercing type, short to nearly truncate and barely extending beyond eighth segment. Eighth segment short with caudal margin of sternite variously modified, either divided and with small to large median pockets (*Apophatus, Palaephatus*), or entire and with bilaterally paired clusters of stout spines (*Sesommata, Metaphatus*), or without specialized spines (*Plesiophatus*). Two pairs of moderately long apophyses present; anterior pair arising from A8 and usually stouter; posterior apophyses arising from A9 + 10 and usually more slender. A single genital opening present between A8 and A9 + 10 leading into a relatively broad vagina; a forked colleterial gland arising from dorsal wall of vagina. Spermatheca elongate, frequently as long or longer than bursa copulatrix; spermatheca arising dorsally near junction of vagina and ductus bursae; a small, saccate reservoir present at extreme caudal end; spermathecal duct between reservoir and vesicle consisting of coiled internal and external canals; utriculus slender to greatly inflated, often with internal spicules; a lateral lagena usually present, either short and more or less saccate, or greatly lengthened and tubular. Ductus bursae with thickened walls, densely covered with placoid spicules; walls sometimes heavily folded forming a rather complex colliculum (*Sesommata, Metaphatus, Plesiophatus*). Corpus bursae usually large and ovoid to elongate, with or without signa; internal walls of bursa usually with scattered, minute spicules, either arranged singly or in small serrated rows (pectinations). Ninth and tenth segments fused (or with A10 completely membranous and surrounding anal opening), with a single broad to narrow ovipositor lobe bearing a median ridge, richly supplied with campaniform sensillae (Figures 185, 300). Sternite of A9 + 10 weakly sclerotized and more or less divided.

Key to the Genera of Palaephatidae

1. Ocelli present . . . . **Sesommata**, new genus
   Ocelli absent 2
2. Epiphysis absent. Eyes reduced [Figure 25]; interocular index less than 0.8. Maxillary palpi reduced, 4-segmented. . . . **Apophatus**, new genus
   Epiphysis present. Eyes well developed [Figure 15]; interocular index greater than 0.8. Maxillary palpi elongate, 5-segmented 3
3. Male genitalia with complex anellus consisting of paired lateral and inner anellar arms [Figures 459–462]. Female genitalia with broad, bluntly tipped ovipositor [Figure 564] . . . . **Metaphatus**, new genus
   Male genitalia without discernible, sclerotized anellus. Female ovipositor with relatively slender, more acute apex [Figure 581] 4
4. Male genitalia with relatively simple valva lacking prominent, uncinate pollex [Figure 490]. Female with relatively long eighth segment; bursa copulatrix with well-developed colliculum and short corpus bursae [Figure 571]; spermatheca with slender utriculus, lacking spicules. . . . . **Plesiophatus**, new genus
   Male genitalia with a prominent, uncinate pollex from costal margin of valva [Figures 494, 534]. Female with shortened eighth segment; bursa copulatrix without colliculum but with elongate ductus bursae and corpus bursae [Figures 581, 592]; spermatheca with enlarged utriculus usually possessing radiating rows of spicules over caudal half. . . . . **Palaephatus**

Sesommata, new genus

TYPE-SPECIES.—*Tinea platysaris* Meyrick, 1931.

ADULT.—Moderately small to medium size, fuscous-colored moths occasionally with small white spots or scattered white to cream scales over forewings. Male with highly modified asymmetrical anellus and valvae with lobed apices. Female with broad ovipositor and well-developed colliculum. Length of forewing 4.8–7 mm.

Head: Vestiture rough, consisting of long piliform scales with simple, acute apices. Antennae approximately 0.5–0.7 the length of forewing, 38–45-segmented; pecten present, consisting of 6–12 dark hairs. Eyes round, smooth, moderately reduced in size; interocular index approximately 0.7–0.8; eye index approximately 0.8–0.9. Ocelli present. Pilifers well developed, moderately lobed, with 7–9 large piliform scales directed mesally and partially touching at midline. Mandibles vestigial, nearly equalling length of third maxillary palpal segment. Maxillary palpi 5-segmented, nearly 1.6 the length of labial palpi; ratio of segments from base approximately 0.4:0.4:0.7:1.4:1; apex of V bifid with slender apical lobe bearing 5 minute setae and a subapical lobe with 4 minute setae. Haustellum reduced, approximately 0.7 the length of palpi. Labial palpi 3-segmented, relatively short, approximately equalling length of haustellum; ratio of segments from base about 2.7:2.8:1; apex of III with a subapical sensory pit containing 10–12 elongate sensillae (Figure 156).

Thorax: Forewings moderately slender, often slightly broader in female, tapering gradually to a subacute apex; length approximately 3.4–3.9 the width. Radius 5-branched, medius 3-branched; all veins arising separate from cell; 1A and 2A separate at basal 0.3–0.4, forming an anal loop; accessory cell present; base of medius forked within discal cell. Microtrichia largely absent from dorsal surface, present only over distal fifth; also largely absent from ventral surface in those males with prominent sex scaling (*platysaris* group) but present ventrally in all females. Dorsal and ventral sex scales present in most males. Hind wings as broad as forewings; length approximately 3.1–3.2 the width in both sexes. Female frenulum with 3 bristles. Medius 3-branched, all veins separate; base of medius branched within cell. Males sometimes with elongate, white hair pencil extending about 0.5 along coastal margin. Microtrichia densely scattered over both surfaces. Forelegs with pectinated epiphysis approximately 0.4 the length of tibia; tibia about 0.5 the length of femur. Midlegs with a single large pair of apical, tibial spurs of unequal lengths. Hind legs with two pairs of large tibial spurs of unequal lengths; one pair apical and other pair arising near middle of tibia. Mesothoracic furcal apophyses prominent, well set off from secondary furcal arms; lateral apophyses elongate, approximately 3 times the length of mesal apophyses. Metathoracic furcal apophyses elongate; tendon arising slightly above middle of apophysis. A second pair of tendons arising dorsally near middle of anteromedial process. Base of anteromedial process broad, extending about 0.4–0.5 the length of the furcal stem. Anterior furcal ridges greatly reduced, slightly flared.

Abdomen: Usually without specialized integumental modifications, but males of *S. platysaris* and *S. paraplatysaris* with dense clusters of cream to pale orange sex scales along pleuron of A2–3.

Male Genitalia: Uncus bilobed. Gnathos well developed, an elongate triangular sclerite bearing 1 to several, short, apical spines; if several then these arranged in a dense cluster. Tegumen a narrow dorsal ring fused to much larger uncus. Vinculum well developed, usually broad, without conspicuous saccus; anterior margin usually broadly rounded. Valvae relatively slender, sometimes broad at base; apex variously lobed; pollex absent. Transtilla absent. Anellus complex, asymmetrical, of two distinct types: (a) a thin dorsal sheet bearing a large, digitate lobe from left side with numerous apical spines; or (b) an irregular shaped sclerite at extreme dorsal base of aedoeagus bearing a long slender rod from left side; both types with a pair of small, relatively slender sclerites closely associated and ventral to base of aedoeagus. Aedoeagus highly modified, flattened, of two distinct forms: (a) with a dense cluster of elongate spines from dorsal left side; (b) without dorsal spines, but with one to several short spines at apex. Endogenous cornuti absent.

Female Genitalia: Ovipositor broad, apex 0.4–1 mm wide; a median ridge present richly supplied with sensillae; anterior apophyses strongly arched, considerably longer and heavier than posterior apophyses. Ductus bursae highly modified into a well-developed colliculum with thickened, folded walls bearing numerous placoid spicules internally. Corpus bursae elongate, 1.5–2.0 times the length of colliculum; internal walls densely covered with minute spicules; signum usually present, single, consisting of a spinose cone arising from an irregularly circular plate (Figure 193). Spermatheca moderately to extremely long, 1.0–2.0 the length of bursa copulatrix; utriculus without spicules; lateral legena present or absent.

ETYMOLOGY.—The generic name is derived from the Greek *ses* (moth) plus *ommatos* (eye), in reference to the presence of ocelli. It is considered feminine in gender.

DISCUSSION.—*Sesommata* is the only genus of Palaephatidae to have retained ocelli. Largely for this reason it is believed to represent the most primitive genus in the family. Several other features help to distinguish this group, such as the generally dark color of both wings, the extremely complex, asymmetrical anellus with only the left anellar arm preserved, and the unique, flat, terminal plate between the paired spinose clusters on the eighth sternite (Figures 184, 186) of the female. The genus shares significant similarities with *Metaphatus*, particularly in the bifid apex to the maxillary palpi, male with complex anellus, and female ovipositor with a broad apex, well-developed colliculum, and spinose eighth sternite.

The males of *Sesommata* are generally darker than the females and have slightly less forewing markings. The males of all species except *S. leuroptera* possess clusters of sex scales near the base of the forewings, with additional sex scales often present on the ventral surface of the forewings. The males of some species also possess lateral clusters of sex scales on the first few abdominal segments, as well as prominent hair pencils along the costa of the hind wings.

The degree of sexual dimorphism prevalent in this genus has made it difficult to associate the sexes for the several species now known to exist. Recent collecting by E.S. Nielsen, O. Karsholt, L.E. Peña, and myself has largely resolved this problem to the extent that the male and females of all species are now properly associated, with the exception of *S. albimaculata*, which is known from only two females.

The six species of *Sesommata* are easily aligned into two groups. The *platysaris* species group, including *S. platysaris*, *S. paraplatysaris*, *S. albimaculata*, and *S. holocapna*, is readily recognized by the prominent sex scaling on both the upper and lower sides of the male forewing (Figures 166, 170), the more narrow female ovipositor (Figures 560–563), and a shorter spermatheca, which lacks a lateral lagena. The male genitalia of the *platysaris* group are very similar in their possession of a densely spinose gnathos, valvae with a single digitate lobe, and a single rodlike lateral anellar arm.

Only two species, *S. trachyptera* and *S. leuroptera*, comprise the *leuroptera* group. The forewings of these males are either lacking in sex scales (*S. leuroptera*) or have the scales only slightly developed dorsally (*S. trachyptera*). The male genitalia differ greatly from the preceding in possessing a gnathos bearing a single apical spine, valvae with an irregularly trilobed apex, and a much different anellus with a shorter, stockier, lateral anellar arm bearing a dense mass of apical spines. The female members of this group exhibit a much broader ovipositor and a spermatheca approximately twice as long as that of the foregoing group, with a utriculus equipped with a relatively short, saccate, lateral lagena (Figures 557, 558).

All adult *Sesommata* are believed to be strictly diurnal. On no occasion have I personally encountered any member of this genus attracted to ultraviolet lights. Specimens collected by me or L. Peña were found either in malaise traps or, more commonly, by sweeping vegetation. Some adults of *S. holocapna* collected from Cauquenes Province, Chile, were swept from *Nothofagus*, although this does not appear to represent the host. A single male of *S. holocapna* was reared by O. Karsholt from a shrubby member of the Verbenaceae, *Diostea juncea* Miers. This presently constitutes the only host record for the family.

Key to the Species of *Sesommata*

1. Forewings black with 5–6 relatively large white spots [Figure 406] . . . . **_Sesommata albimaculata_**, new species

   Forewings brownish fuscous to nearly black, either immaculate or with a scattering of white to cream or brown scales over distal half; rarely with 1–2 large white spots present 2

2. Male with a prominent, rounded mass of broad sex scales near anal angle of forewing; genitalia without a dense cluster of elongate spines arising from aedoeagus. Female genitalia with a single, small circular signum situated near anterior end of corpus bursae 3

   Male either with forewing entirely smooth or with a concentration of slightly erect, slender sex scales near anal angle [Figure 163]; genitalia with a dense spine cluster arising midway along aedoeagus. Female genitalia either without signum or with a single signum situated midway along corpus busae 5

3. Male genitalia with lobes of uncus narrow and broadly separated; width of lobes much less than width of separation [Figure 455]. Apex of ovipositor relatively broad, width exceeding 0.6 mm [Figure 560] . . . . **_Sesommata holocapna_**

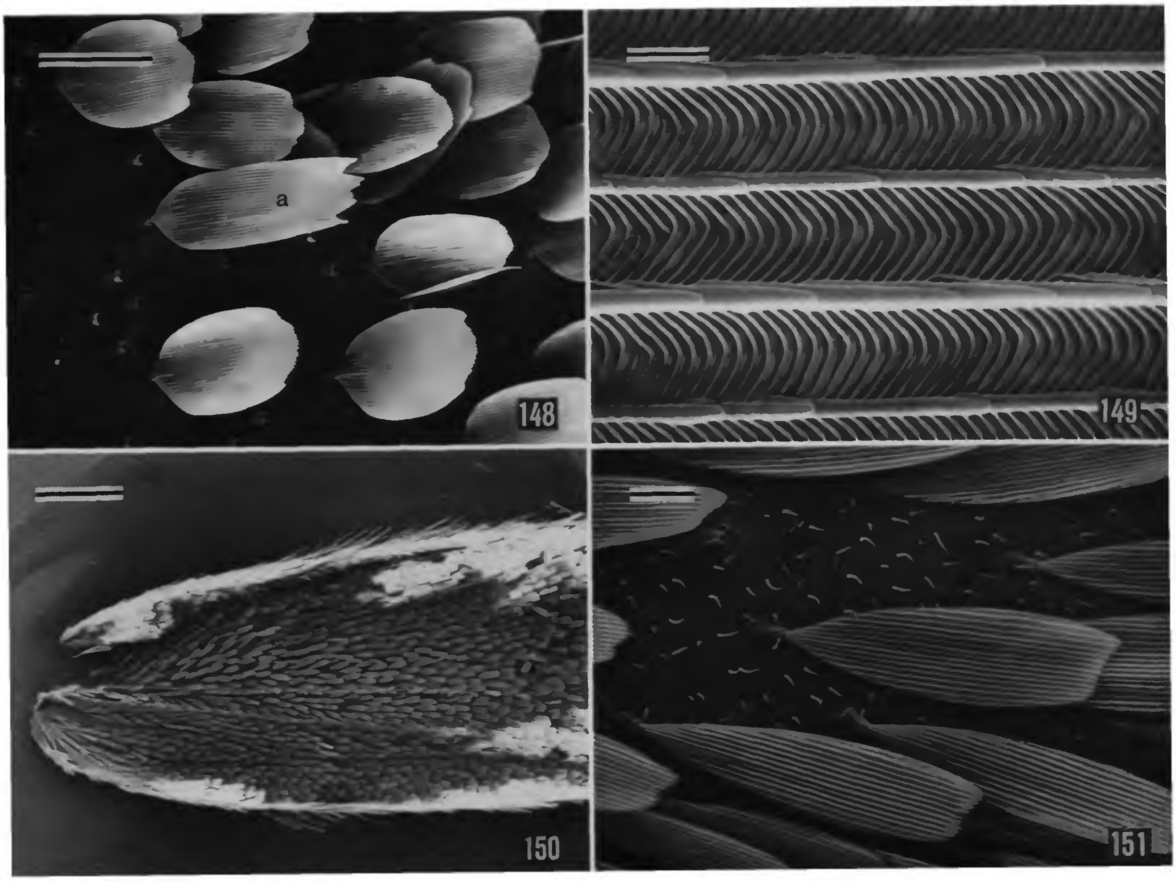
   Male genitalia with lobes of uncus broad and narrowly separated; width of lobes greater than separation [Figure 447]. Female with apex of ovipositor relatively narrow, width less than 0.5 mm [Figure 561] . . . 4

4. Male genitalia with apex of aedoeagus round, slightly curved ventrally; anterior apex of saccus subacute, with a short apical process; apex of lateral anellar arm twisted slightly [Figures 453, 454] . . . . **_Sesommata platysaris_**

   Male genitalia with apex of aedoeagus subacute, sharply reflexed ventrally; saccus rounded anteriorly, without apical process; apex of lateral anellar arm simple, smoothly cylindrical [Figures 448, 449] . . . . **_Sesommata paraplatysaris_**, new species

5. Male with a concentration of rough, suberect, slender sex scales near anal angle of forewing; apex of aedoeagus subtruncate, flattened [Figure 446]. Female genitalia with a single, small circular signum situated near middle of corpus bursae . . . . **_Sesommata trachyptera_**, new species

   Male with forewing entirely smooth; apex of aedoeagus irregular, twisted [Figure 441]. Female genitalia without signum . . . . **_Sesommata leuroptera_**, new species



FIGURES 148–151.—*Sesommata leuroptera*, new species, scale structure: 148, dorsal forewing near distal third of discal cell, note absence of microtrichia (50 μm); 149, detail of scale "a" in 148 (1 μm); 150, ventral forewing (0.5 mm); 151, detail of 150, note microtrichia (20 μm). (Scale lengths in parentheses.)

Sesommata leuroptera, new species

FIGURES 148–151, 397, 398, 439–442, 557; MAP 3

ADULT (Figures 397, 398).—Length of forewing: ♂, 5–7 mm; ♀, 6.5–7 mm. A moderately small moth with smooth, brownish fuscous to black forewings in the male, rarely with a few scattered white scales; forewings of female usually light in color, with white scales along costa and scattered over distal half.

Head: Vestiture fuscous to gray in male; pale buff in female. Antennae approximately 0.6–0.7 the length of forewing, 42-segmented; scape black to brownish fuscous dorsally, dull white to cream ventrally; pecten consisting of 6–8 dark hairs; flagellum black to brownish fuscous dorsally, white to pale buff ventrally. Maxillary palpi white to cream. Labial palpi mostly white; apical segment fuscous over lateral-ventral surfaces; second segment with 6–8 dark hairs mostly concentrated at distal end.

Thorax: Pronotum black in male, more brown in female. Venter white to cream. Forewings black to brownish fuscous in male, rarely with scattered white scales over distal third; vestiture entirely smooth, without rough scaling over base of Cu; ventral surface without specialized sex scales; forewings of female generally lighter, more brown in color, with white along costal margin or scattered over distal half; fringe black to brown, often irrorated with white in female. Hind wings as dark as forewings, pale gray to white along basal two-thirds of costal margin; costal hair pencil absent. Forelegs dark fuscous to brown dorsally, pale gray to white ventrally; tarsi banded with pale buff. Midlegs and hind legs generally paler in color, with tarsal banding and ventral surfaces more white.

Abdomen: Black to brownish fuscous dorsally; pale buff to white ventrally. Male without lateral sex scales.

Male Genitalia: As shown in Figures 439–442. Uncus bilobed; lobes broadly conical, widely separated. Gnathos a relatively large, median lobe bearing a single large spine. Valvae slender, terminating in a complex, irregularly trilobed apex. Anellus highly asymmetrical, with a broad prominent lobe bearing a dense cluster of apical spines arising on left side. Aedoeagus with apex relatively narrow and somewhat twisted in a spiral, a prominent lobe bearing numerous large spines arising from left side.

Female Genitalia: As shown in Figure 557. Apex of ovipositor broad, approximately 0.8 mm wide. Colliculum with thickened, folded, densely spiculated walls. Corpus bursae covered internally with evenly distributed minute spicules; signum absent. Spermatheca extremely long, approximately twice the length of bursa copulatrix; utriculus elongate, slender, and without spicules; a slender lateral lagena arising near posterior end.

IMMATURE STAGES.—Unknown.

HOLOTYPE.—♂. Rincon de la Piedra, 20 km S Valdivia, 180 m, Valdivia Province, Chile, 15 Nov 1981, Nielsen and Karsholt (ZMUC).

PARATYPES.—ARGENTINA. *Neuquen Prov.:* Junin de los Andes, 1000 m, Laguna Verde: 1♂, 11 Mar 1979, E.S. Nielsen. Lago Lacar, Pucará, 750 m, 1♂, 26 Dec 1978, E.S. Nielsen. *Tierra del Fuego Prov.:* Ushuaia, Lapatafa, 20 m, 5♂, 30 Jan 1979, E.S. Nielsen.

CHILE. *Osorno Prov.:* Parque Nacional Puyehue, Antillanca, 1100–1300 m, 2♂, 11 Dec 1981, Nielsen & Karsholt. *Valdivia Prov.:* Valdivia, 20 m, 1♂, 15 Nov 1981, Nielsen & Karsholt. Rincon de la Piedra, 180 m, 20 km S Valdivia, 4♂, 3♀, 14 Nov 1981; 18♂, 5♀, 15 Nov 1981, Nielsen & Karsholt.

Paratypes in ANIC, BMNH, MACN, MHNS, USNM, and ZMUC.

HOST.—Unknown.

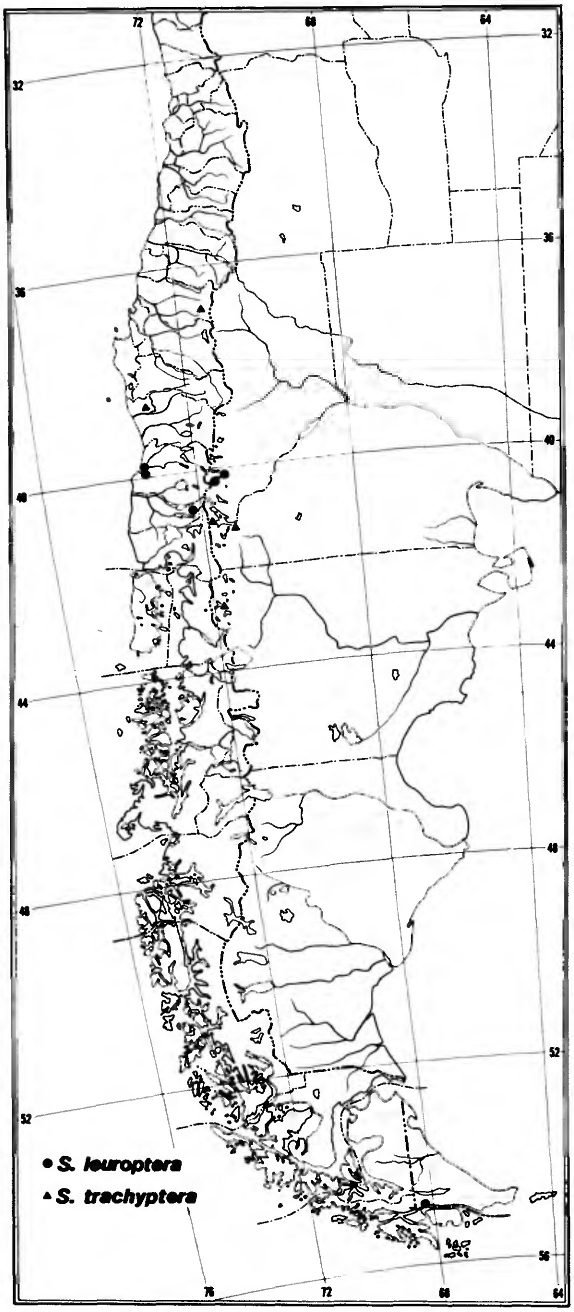
FLIGHT PERIOD.—14 November to 11 March; univoltine?

DISTRIBUTION (Map 3).—The range of this species appears to be centered in the more southern temperate forests of Argentina and Chile, suggesting a biology that is more cool adapted than most Palaephatidae. In Argentina it has been collected in the montane forests of Neuquen Province and as far south as the extreme tip of Tierra del Fuego. It has been encountered from only two rather diverse sites in Chile, from the higher elevations of Puyehue National Park and at a low coastal elevation near Valdivia.

ETYMOLOGY.—The specific epithet is derived from the Greek *leuros* (smooth, level) plus *pteron* (feather, wing) and refers to the smooth scale vestiture over the entire forewing of the male.

DISCUSSION.—The males of *Sesommata leuroptera* are readily distinguishable as being the only member of the genus with uniformly dark, entirely smooth forewings. The females can be recognized by a combination of three genital features: (a) ovipositor nearly as broad as eighth segment; (b) spermatheca extremely long, approximately twice the length of the bursa copulatrix; and (c) the absence of a signum.

The sister species of *S. leuroptera* is *S. trachyptera*, as clearly indicated by the very similar male and female genital structure. In addition to the possession of smooth scaled forewings, *S. leuroptera* may be separated from *S. trachyptera* by the twisted apex of the aedoeagus in the former. The females of both species are similar in possessing a greatly lengthened spermatheca with a tightly coiled ductus spermathecae and a lateral lagena arising from the utriculus. A lateral lagena is



MAP 3.—Distribution of species of *Sesommata*.

absent in the other members of *Sesommata*. The females of *S. leuroptera* are best distinguished by the absence of a signum.

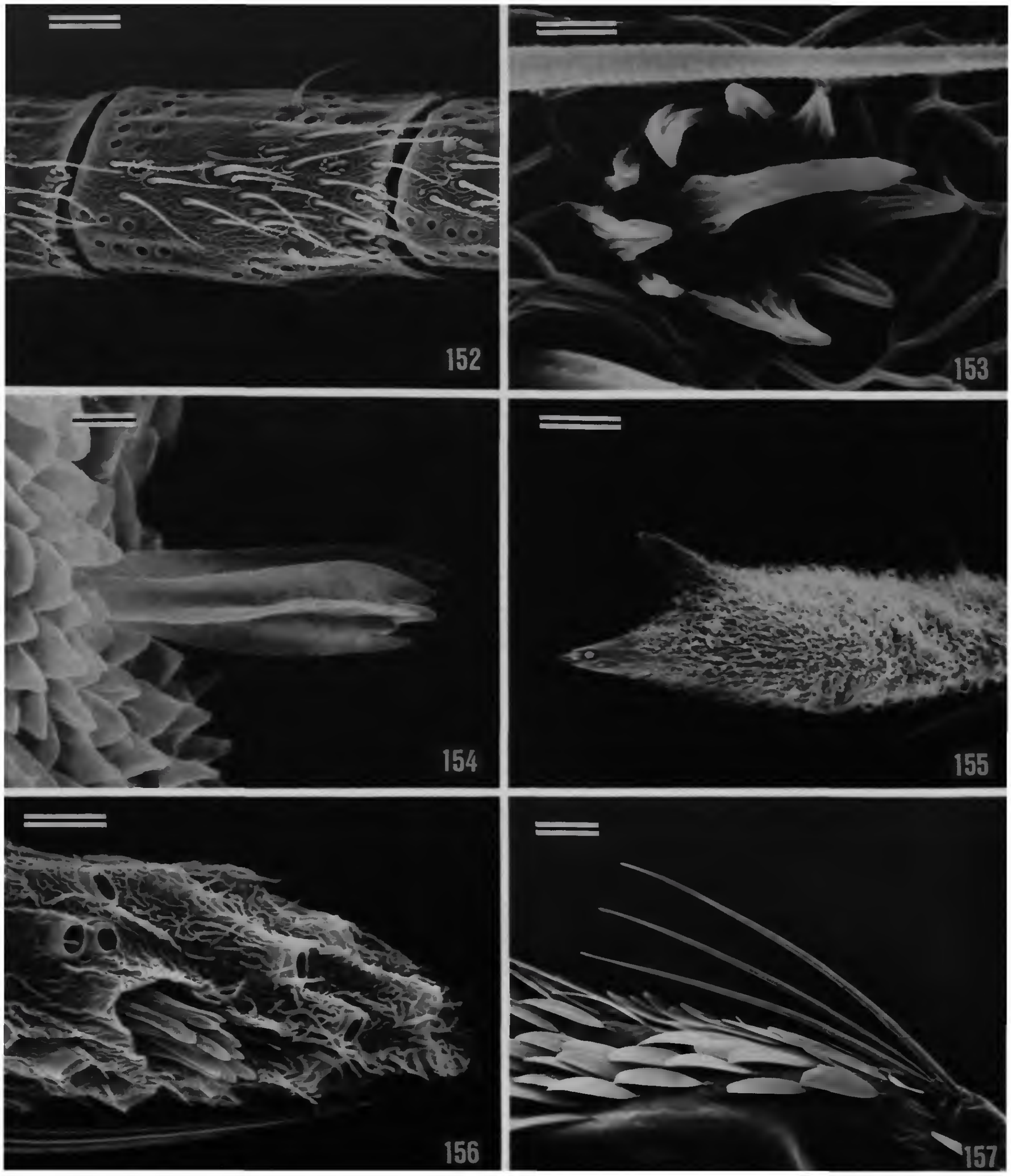
Sesommata trachyptera, new species

FIGURES 15–16, 83, 84, 96, 101, 102, 107–109, 142, 143, 152–163, 399, 400, 443–446, 558, 559; MAP 3

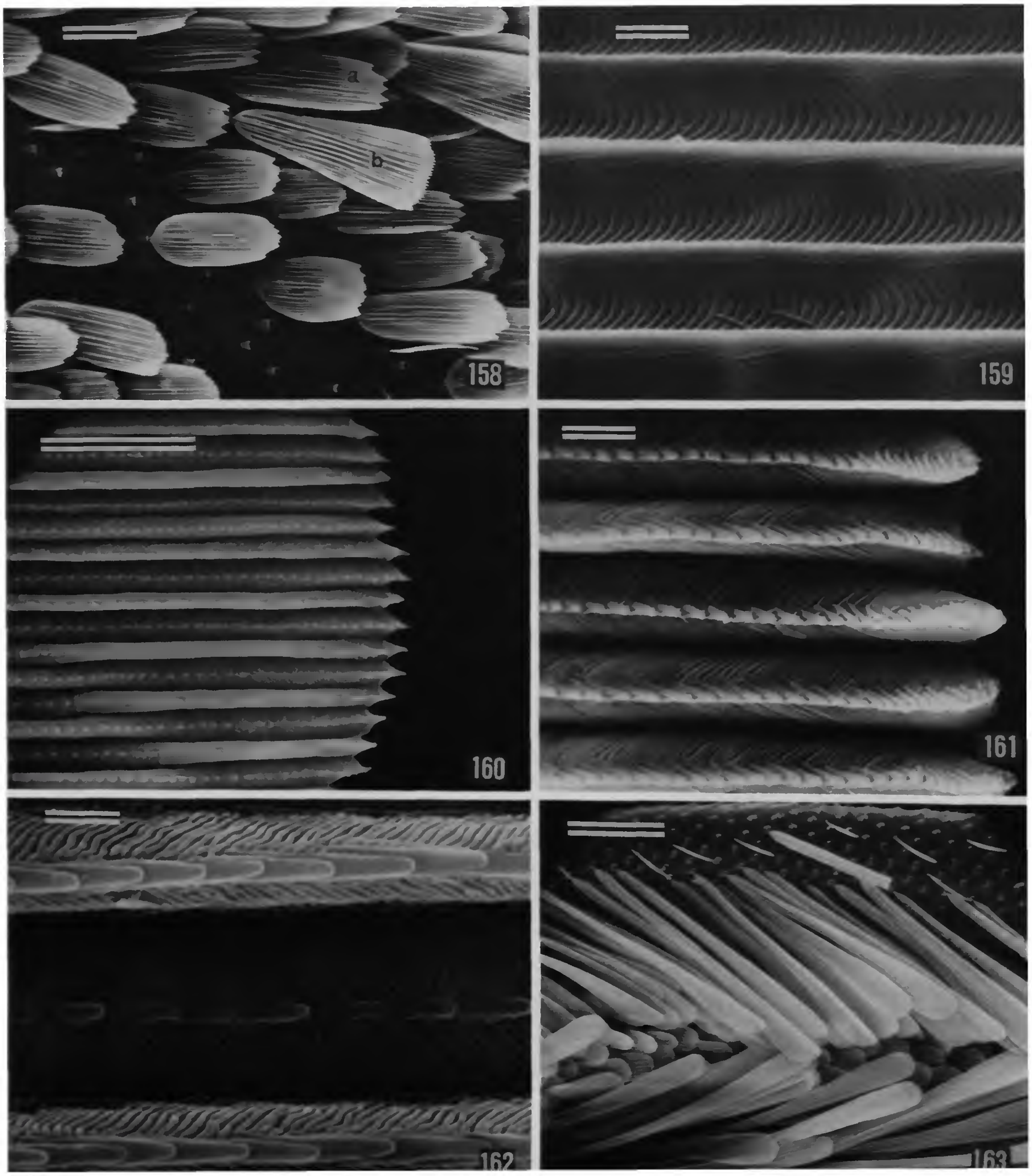
ADULT (Figures 399, 400).—Length of forewing: ♂, 5.7–6.3 mm; ♀, 6–7 mm. A moderately small species with dark fuscous forewings in the male and an elongate patch of rough, semi-erect, slender sex scales along the base of Cu; forewings of female paler, more brown, and irrorated with scattered white scales.

Head: Vestiture fuscous in male, pale buff in female; often with white piliform scales arising on lower frons near inner rim of eye. Antennae approximately 0.5–0.6 the length of forewing, 38–42-segmented; scape fuscous (in male) to light brown (female) dorsally, white ventrally; pecten consisting of 6–9 dark hairs; flagellum fuscous to brown dorsally, banded with buff; white to pale buff ventrally. Maxillary palpi white to cream. Labial palpi mostly dull white, with lateral ventral surfaces of apical segment fuscous; second segment with 10–13 dark hairs arising laterally.

Thorax: Pronotum dark fuscous to brown. Venter white to cream. Forewings dark fuscous in male, rarely with scattered white scales over distal third; an elongate patch of rough, semi-erect and relatively slender sex scales along base of Cu, ventral surface without specialized sex scales; forewings of female generally lighter, more brown with a rather heavy irroration of white and black scales over distal third; two cream-white costal spots sometimes present beyond middle; fringe fuscous in male, brown streaked with white in female. Hind wings dark fuscous in male, paler fuscous in female. Costal hair pencil absent. Forelegs fuscous dorsally and ventrally, except for cream-white ventral surfaces of femur; tarsal banding indistinct, buff. Midlegs light fuscous to brown with more white



FIGURES 152–157.—*Sesommata trachyptera*, new species: 152, antennal sensilla (20 μm); 153, detail of 152, sensillum coeloconicum (2 μm); 154, sensillum styloconicum of haustellum with ridged base (5 μm); 155, apex of maxillary palpus (20 μm); 156, apex of labial palpus with sensory pit (10 μm); 157, female frenulum (100 μm). (Scale lengths in parentheses.)



FIGURES 158–163.—*Sesommata trachyptera*, new species, scale structure: 158, dorsal forewing near middle of discal cell (50 μm); 159, detail of scale "a" in 158 (1 μm); 160, apex of scale "b" in 158 (10 μm); 161, apex of scale "b" in 158 (2 μm); 162, detail of scale "b" in 158, note scale ridge dimorphism (1 μm); 163, semi-erect sex scales at dorsal base of cubitus in male (100 μm). (Scale lengths in parentheses.)

ventrally; tarsal banding more distinct. Hind legs light brown dorsally, cream white ventrally.

Abdomen: Dark fuscous to brown dorsally; nearly so in male ventrally but mostly cream in female ventrally. Male without lateral sex scales.

Male Genitalia: As shown in Figures 443–446). Uncus bilobed; lobes broadly conical, widely separated. Gnathos a relatively large, median lobe bearing a single small spine. Valvae slender, terminating in a complex, irregularly trilobed apex, as in *S. leuroptera*. Anellus highly asymmetrical, with a broad lobe bearing a dense cluster of apical spines arising from left side; spine patch more sinuate than in *S. leuroptera;* aedoeagus with apex broad and flat, nearly truncate; a large spine cluster arising dorsally near middle.

Female Genitalia: As shown in Figure 558. Apex of ovipositor broad, approximately 0.9 mm wide. Colliculum with thickened, folded walls densely covered internally with placoid spicules. Corpus bursae more lightly covered with smaller, more slender spicules; a single spinose signum present midway along bursa. Spermatheca greatly lengthened, approximately twice the length of bursa copulatrix; ductus spermathecae tightly coiled; utriculus more spherical in outline, without spicules; a relatively large lateral lagena arising near posterior end.

IMMATURE STAGES.—Unknown.

HOLOTYPE.—♂. Esquel, Lago Menéndez, Sagrario Puerto, 550 m, Chubut Province, Argentina, 21 Feb 1979, E.S. Nielsen (ZMUC).

PARATYPES.—ARGENTINA. *Chubut Prov.:* Esquel, Lago Menéndez, El Sagrario Puerto, 550 m, 9♂, 21 Feb 1979, E.S. Nielsen. *Rio Negro Prov.:* Lago Nahuel Huapi, Puerto Blest, 770 m, 1♀, 3–8 Dec 1981, Nielsen & Karsholt; 6♂, 28 Feb 1979, E.S. Nielsen. San Carlos de Bariloche, Colonia Suiza, 800 m, 1♀, 22–23 Nov 1981; 2♀, 24 Nov 1981; 1♀, 2 Dec 1981; 2♀, 3 Dec 1981; 2♀, 23 Dec 1981; 1♂, 5–7 Jan 1982, Nielsen & Karsholt; same locality, 810 m, 5♂, 1♀, 15 Jan 1979, E.S. Nielsen.

CHILE. *Cautin Prov.:* Fundo Chacamo, 600–700 m, 35 km NW of Neuva Imperial, 5♂, 18♀, 17–23 Feb 1981, L. Peña. *Ñuble Prov.:* Las Trancas, 1300 m, 21 km E of Recinto, 1♂, 17 Jan 1979, D. & M. Davis & B. Akerbergs, malaise trap; 1♂, 2 Mar 1968, Flint & Peña.

Paratypes in ANIC, BMNH, MACN, MHNS, USNM, and ZMUC.

HOST.—Unknown.

FLIGHT PERIOD.—22 November to 2 March; univoltine?

DISTRIBUTION (Map 3).—This species occurs in the temperate Valdivian forest region of southern Argentina and Chile. In Argentina it has been found from Lago Nahuel Huapi south to Lago Menéndez. In Chile it was encountered at two localities near Volcan Chillan in Ñuble Province and farther south in the coastal range in Cautin Province.

ETYMOLOGY.—The species name is derived from the Greek *trachys* (rough) plus *pteron* (wing, feather), in reference to the presence of roughened sex scales near the base of the male forewing.

DISCUSSION.—On the basis of both male and female genital morphology, this species is closely related to *S. leuroptera*. The males of *S. trachyptera* may be distinguished by the presence of slender, semi-erect sex scales at the anal angle of the forewings, as well as by the broad flattened apex at the aedoeagus. The female genitalia of these two species are very similar, with that of *S. trachyptera* unique for the genus in possessing a single signum near the middle of the corpus bursae. A single spermataphore was found in one female. The spermataphore (Figure 559) was relatively slender, short and somewhat T-shaped, with a stout clavate, subapical lobe.

Sesommata holocapna (Meyrick), new combination

FIGURES 164–196, 401, 402, 455–458, 560; MAP 4

Tinea holocapna Meyrick, 1931:414.—Clarke, 1970:96, pl. 48: figs. 4–4c.

Ceromitia pucarensis Pastrana, 1961:197 [misidentification, in part].

ADULT (Figures 401, 402).—Length of forewing: ♂, 5–6.5 mm; ♀, 6–7 mm. A relatively small moth with dark fuscous forewings in the male and a rounded mass of broad sex scales over the bases of Cu and A; forewings of female slightly lighter in color and often irrorated with white over distal half.

Head: Vestiture fuscous in male to buff in female. Antennae approximately 0.5–0.6 the length of forewing, 38–45-segmented; scape fuscous dorsally, mostly fuscous to occasionally cream ventrally, pecten consisting of 6–7 dark hairs; flagellum fuscous dorsally, cream ventrally. Maxillary palpi buff to cream. Labial palpi cream-white, apical segment with lateral-ventral surfaces fuscous; second segment with 8–12 fuscous to cream hairs laterally.

Thorax: Pronotum dark fuscous. Venter white to gray. Forewings dark fuscous in male, nearly black, with a rounded mass of broad sex scales over bases of Cu and A; outer dark scales often missing over mass thus exposing broad, white sex scales beneath; ventral side with an elongate patch of dull white sex scales extending parallel to basal third to one-half of Cu; forewings of female slightly lighter in color but nearly as dark as male, usually with a light scattering of white scales over distal half; fringe typically fuscous in both sexes. Hind wings fuscous, nearly as dark as forewings; basal half of costal area of male white, with an elongate white to cream hair pencil. Forelegs dark fuscous dorsally, cream to white ventrally; tarsal segments ringed with white, though indistinct in some specimens. Midlegs similar to forelegs in color. Hind legs paler, brownish fuscous dorsally, with an elongate, grayish white hair pencil in male arising along tibia and equalling the tibia in length.

Abdomen: Dark fuscous dorsally, cream to white ventrally; male without lateral sex scales.

Male Genitalia: As shown in Figures 445–458. Uncus bilobed, lobes slender, widely separated by a distance much greater than their width. Gnathos a rather long, triangular plate bearing a dense cluster of short, stout spines at caudal apex. Vinculum-saccus broad, nearly twice as wide as long. Valvae broad at base, narrowing considerably toward apex; an elongate, digitate process arising subapically and directed mesally. Anellus with lateral arm relatively short, approximately equalling aedoeagus in length. Aedoeagus with a relatively broad apex possessing an irregularly serrated-lobed margin; vesica emerging from a ventral subapical opening at apical third.

Female Genitalia: As shown in Figure 560. Apex of ovipositor broad, 0.6–0.75 mm wide. Colliculum with thickened, folded, densely spiculated walls; spicules varying in shape (Figures 188–191) according to position within colliculum from circular with serrated margins to spinose. Corpus bursae densely covered internally with relatively broad, acute spicules; a single, irregularly circular signum present at anterior end of bursa. Spermatheca relatively short, approximately equalling total length of bursa copulatrix; utriculus relatively slender, with completely membranous, unspiculated walls.

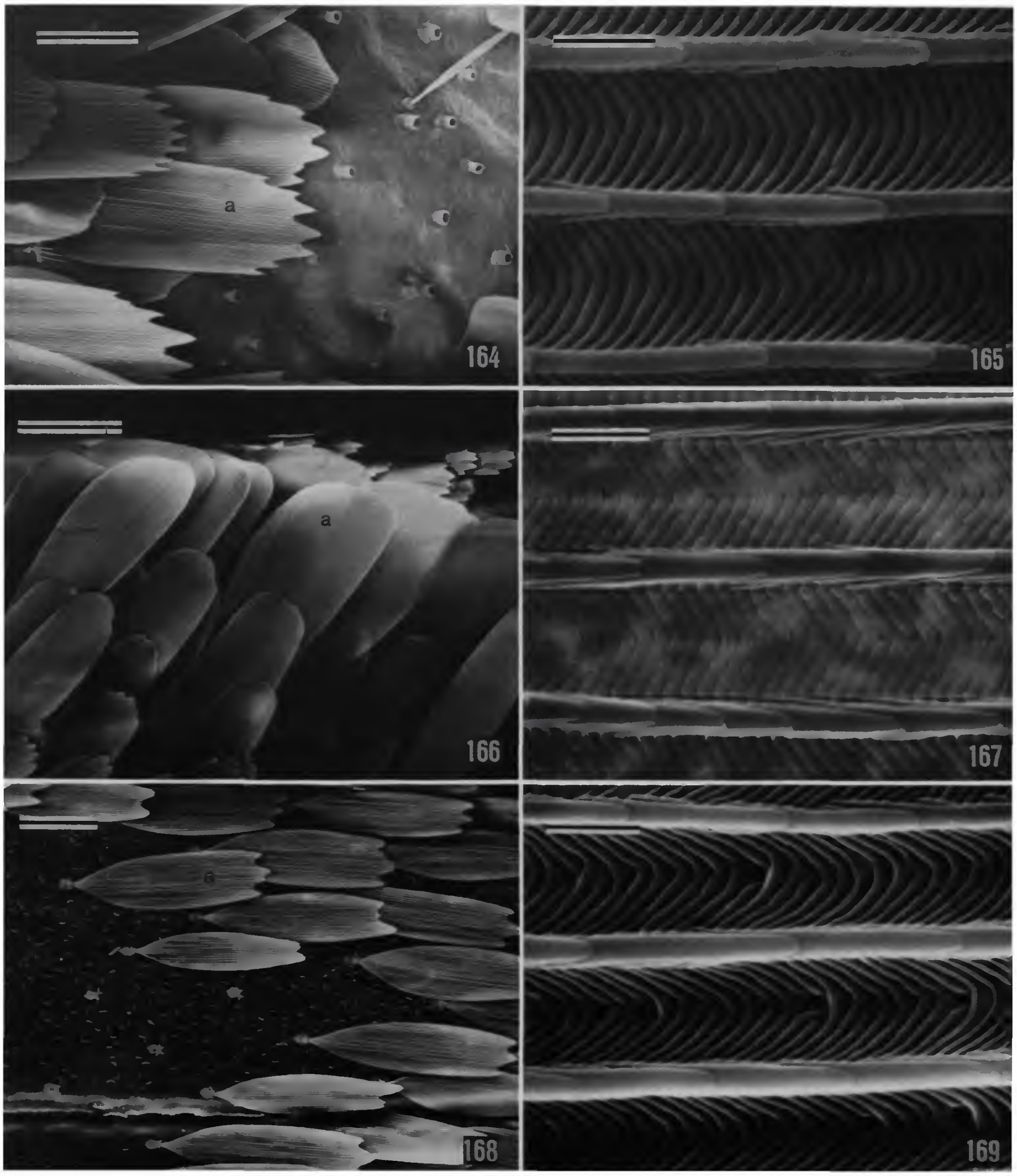
MALE PUPA (Figures 194–196).—Length 6.7 mm; diameter 1.4 mm. Light brown in color. Vertex relatively smooth, with only a slight indented ridge laterally. One pair of setae present at vertex, one pair on frons between eyes, and two pairs of clypeal setae present. Mandible visible as a small trapezoidal sclerite below labrum. Sheaths for antennae and midlegs of approximately same length and extending almost to A4. Wings extending almost to A5. Venter of A3–6 with paired proleg scars. Spiracles well developed on A1–8. A single anterior row of short, stout spines present on tergites of A2–9 + 10; tabulation of abdominal spines as follow: A1 = 0; A2 = 10; A3 = 20; A4 = 16; A5 = 18; A6 = 17; A7 = 14; A8 = 14; A9 + 10 = 10. Dorsum of A9 + 10 also with one pair of larger, stout lateral spines and one pair of caudal spines.

TYPE.—Holotype ♂ (BMNH).

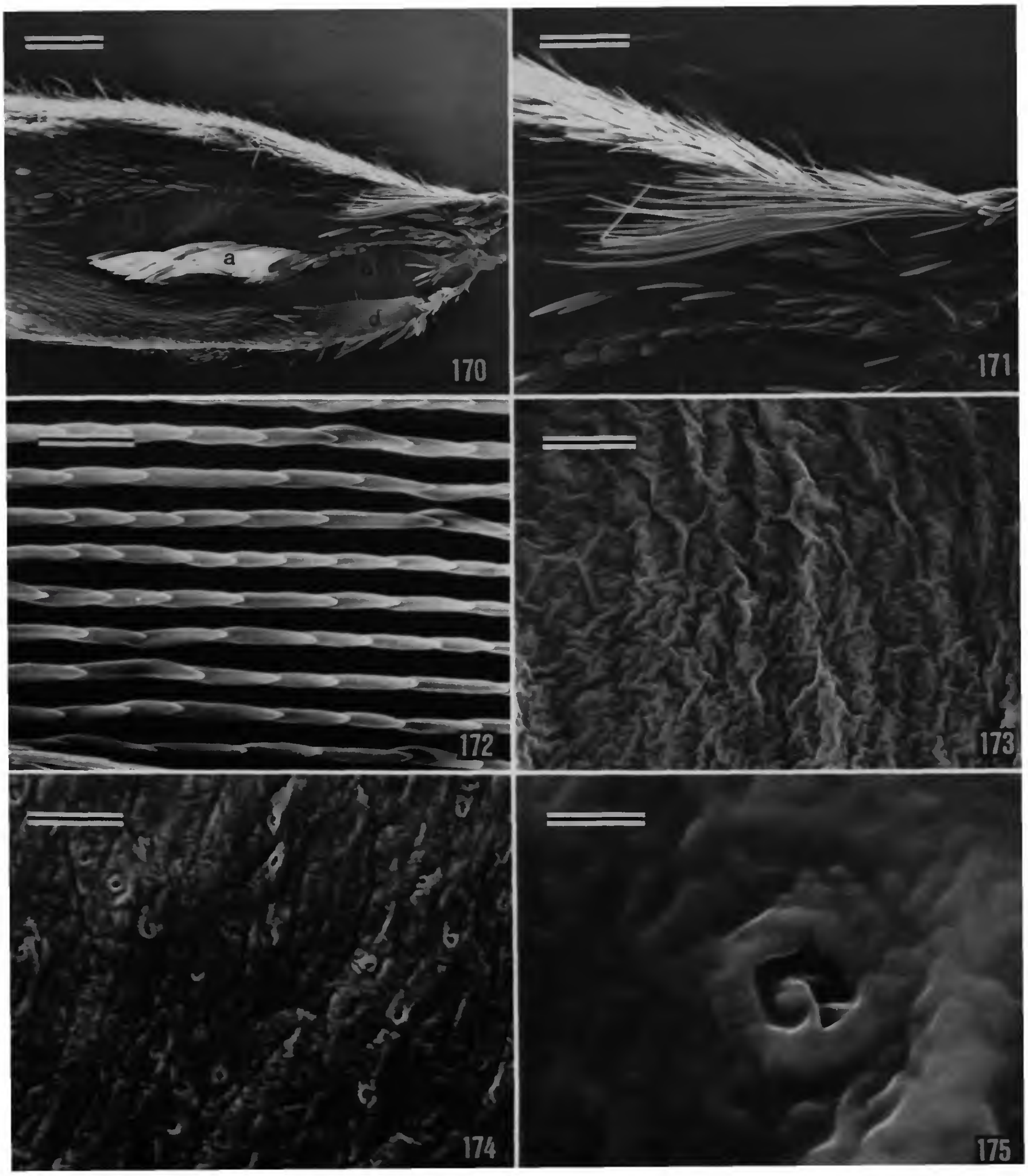
TYPE-LOCALITY.—Lake Correntoso, Rio Negro Prov., Argentina.

HOST.—Verbenaceae: *Diostea juncea* Miers.

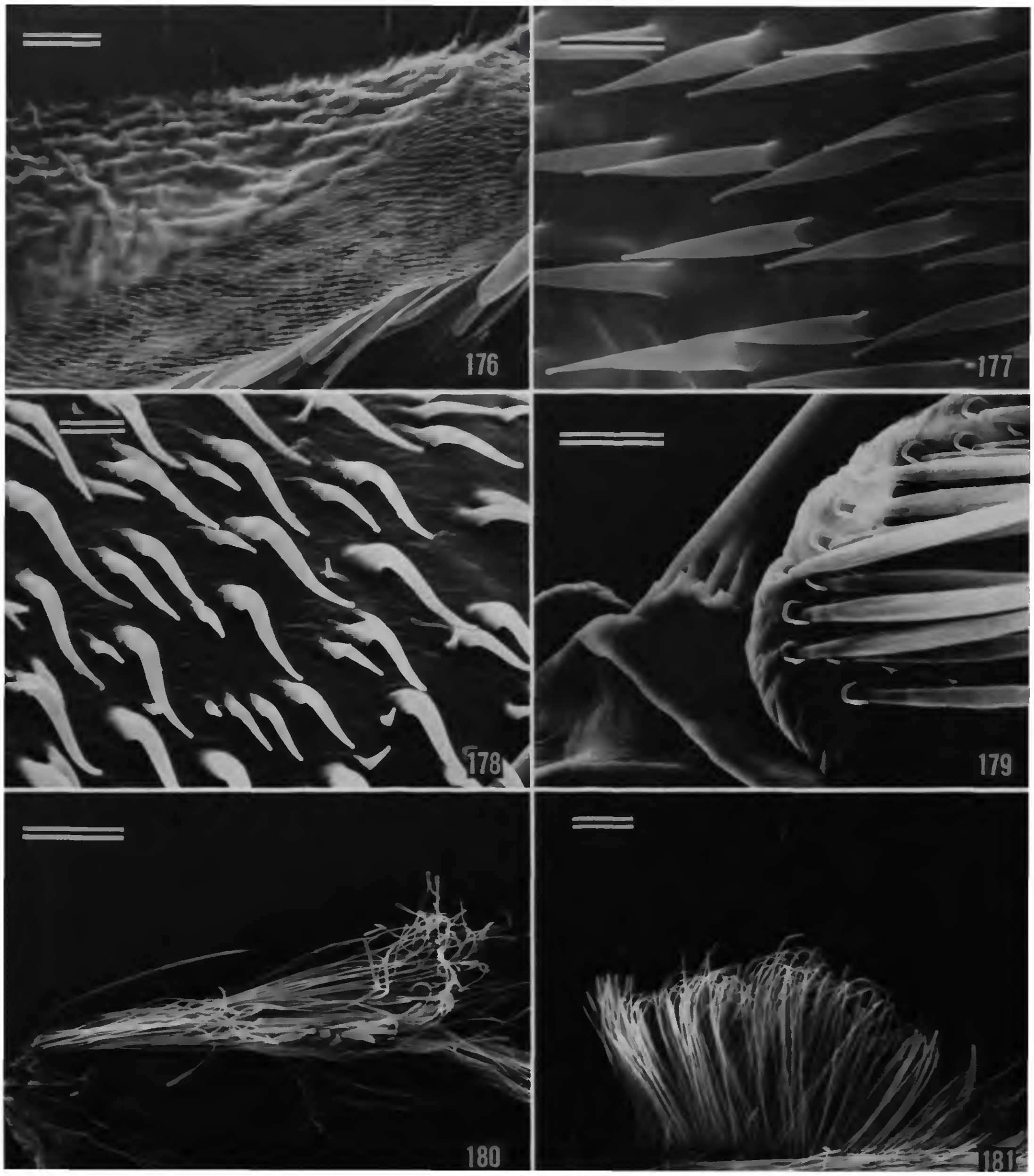
FLIGHT PERIOD.—6 November to 11 January; univoltine.



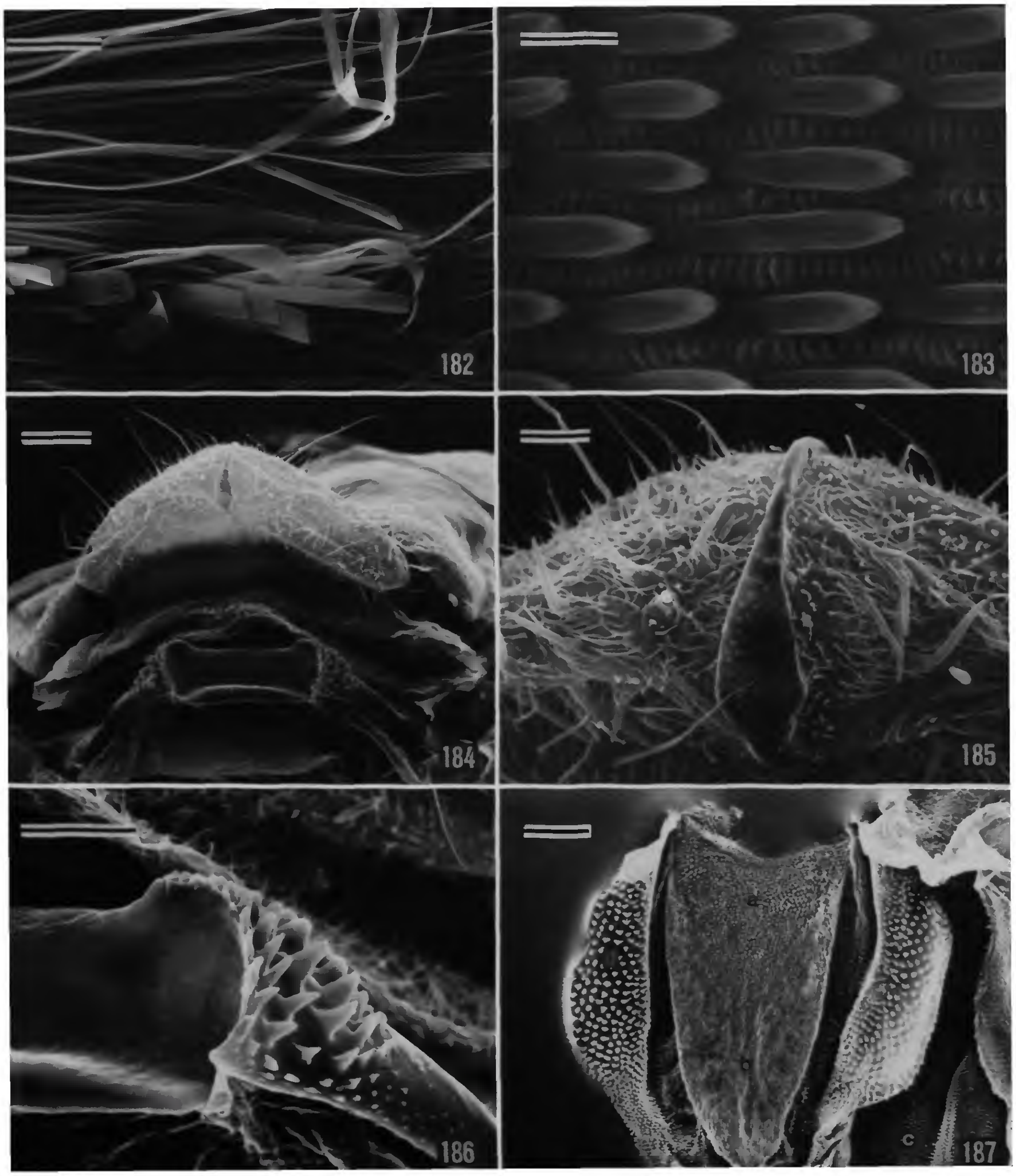
Figures 164–169.—*Sesommata holocapna* (Meyrick), scale structure: 164, dorsal forewing near middle of discal cell (40 μm); 165, detail of scale "a" in 164 (1 μm); 166, broad sex scales at dorsal base of male forewing (100 μm); 167, detail of scale "a" in 166 (1 μm); 168, dorsal hind wing near middle of discal cell, note microtrichia (50 μm); 169, detail of scale "a" in 168 (1 μm). (Scale lengths in parentheses).



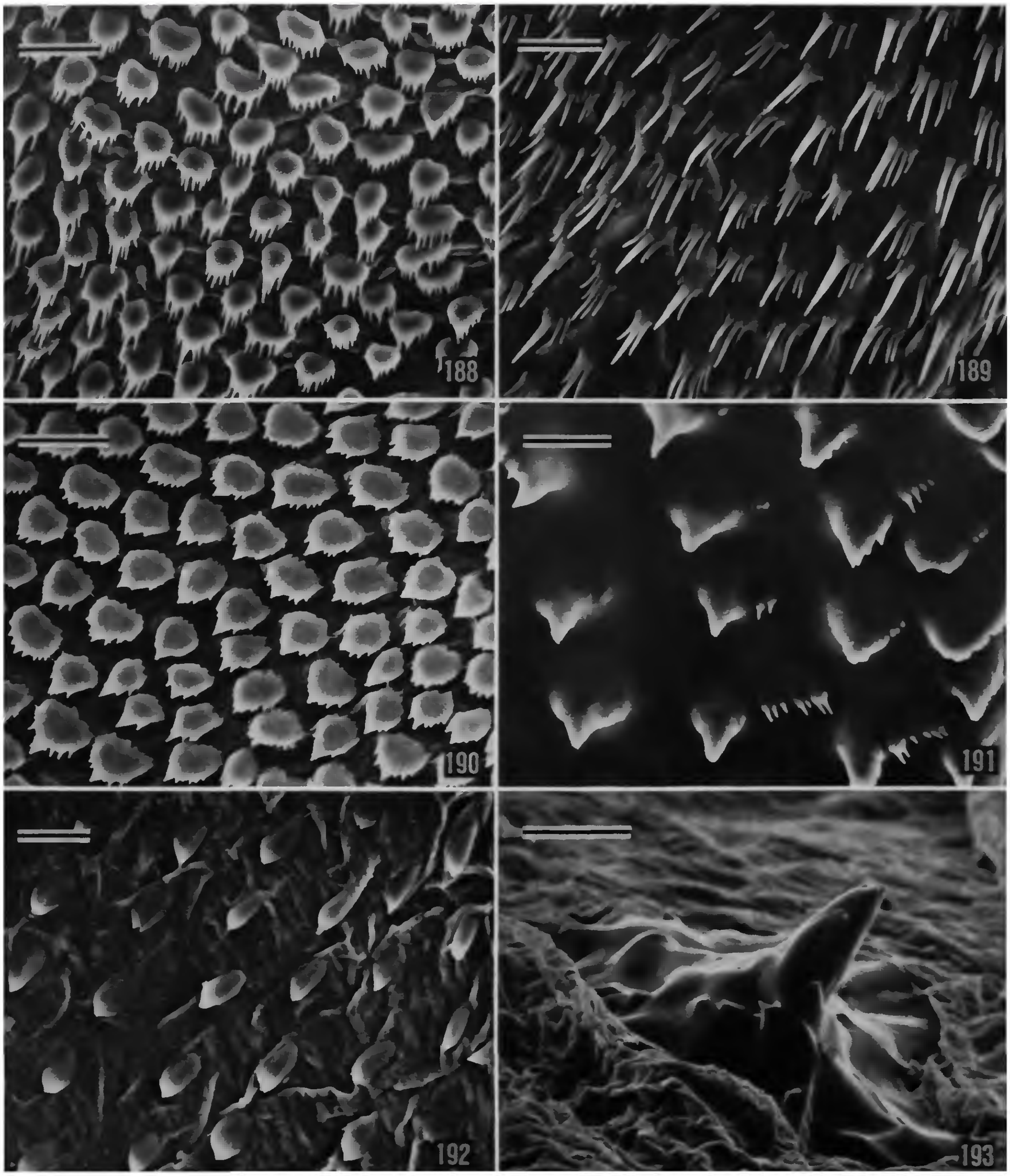
FIGURES 170–175.—*Sesommata holocapna* (Meyrick), forewing structure: 170, ventral forewing showing cubital sex scaling in male (0.5 mm); 171, detail of ventral hair tuft at base of costa (200 μm); 172, detail of sex scale "a" in 170 (5 μm); 173, detail of area "b" in 170, note absence of scale follicles (20 μm); 174, detail of area "c" in 170, note rudimentary follicles (20 μm); 175, detail of follicle in 174 (2 μm). (Scale lengths in parentheses.)



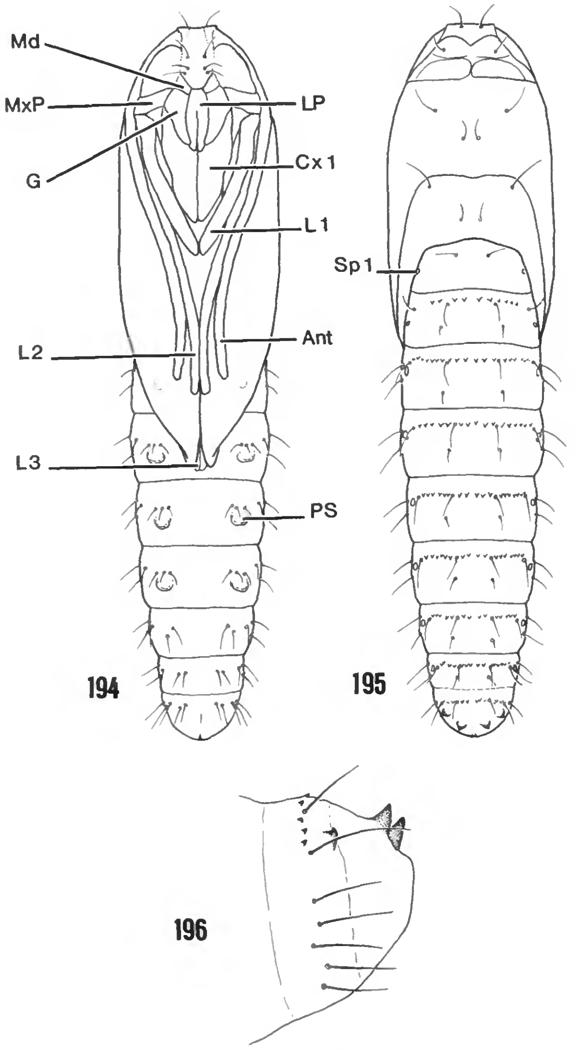
FIGURES 176–181.—*Sesommata holocapna* (Meyrick): 176, detail of area "d" of Figure 170 showing dense microtrichia along anal margin of ventral forewing (50 μm); 177, detail of microtrichia in 176 (5 μm); 178, microtrichia of metascutum into which anal microtrichia (Figure 175) interlock (4 μm); 179, detail of 180 showing swollen hair pencil base (33 μm); 180, male dorsal hind wing with costal hair pencil (0.5 mm); 181, hind wing with costal hair pencil raised (400 μm). (Scale lengths in parentheses.)



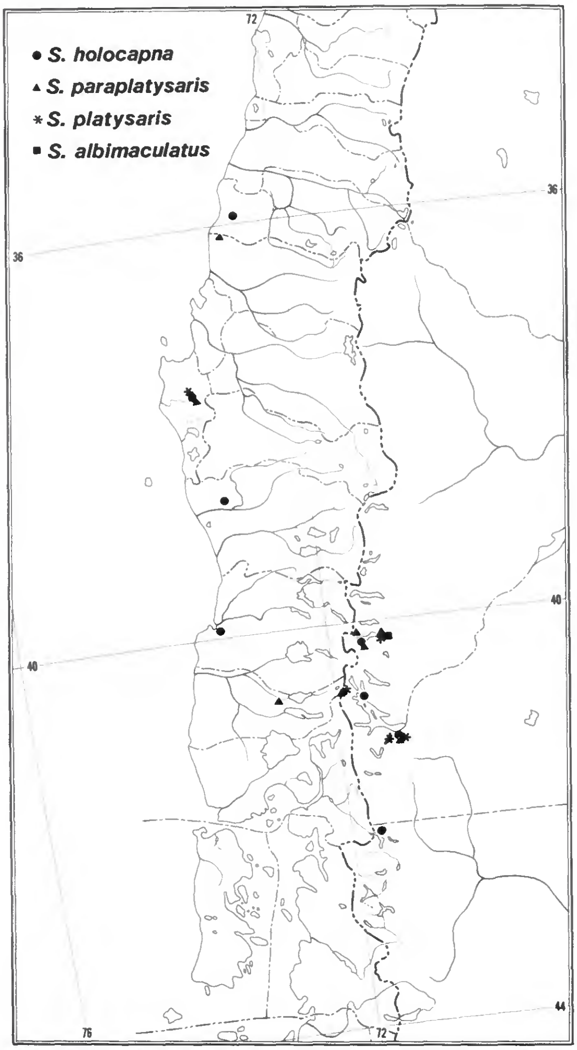
Figures 182–187.—*Sesommata holocapna* (Meyrick): 182, detail of costal hair pencil in Figure 180 showing broaden apices of pencil scales (100 μm); 183, detail of scale "a" in 182 (1 μm); 184, caudal view of female ovipositor (100 μm); 185, detail of 184 showing medial sensory ridge (MSR) (20 μm); 186, detail of 184 showing spine concentration on 8S (40 μm); 187, inner lining of female colliculum with dorsal wall peeled back to right side (10 μm). (Scale lengths in parentheses.)



FIGURES 188–193.—*Sesommata holocapna* (Meyrick), inner lining of female bursa copulatrix: 188, detail of area "a" of Figure 187, midventral caudal end of colliculum (10 μm); 189, detail of area "b" of Figure 187, midventral cephalic end of colliculum (10 μm); 190, detail of area "c" of Figure 187, dorsal wall of colliculum (10 μm); 191, detail of area "d" of Figure 187, lateral wall of colliculum (20 μm); 192, spicules of corpus bursae (10 μm); 193, signum inside corpus bursae (20 μm). (Scale lengths in parentheses.)



FIGURES 194–196.—*Sesommata holocapna* (Meyrick), male pupa: 194, ventral view; 195, dorsal view; 196, lateral view of caudal end.



MAP 4.—Distribution of species of *Sesommata*.

DISTRIBUTION (Map 4).—This species occurs rather widely through the temperate, Valdivian forest region of southern Argentina and Chile and has been collected in the coastal mountains of Chile from Cauquenes Province south to Valdivia; in Argentina it has been found in montane Neuquen, Rio Negro, and Chubut Provinces, a distributional range closely approximating that of its host.

MATERIAL EXAMINED.—16 males and 9 females.

ARGENTINA. *Chubut Prov.:* El Bolsón, Lago Puelo, 220 m, 1♂, 21 Nov 1978, E.S. Nielsen. *Neuquen Prov.:* Pucará, 1♀ [paratype of *Ceromitia pucarensis* Pastrana, misidentification], Dec 1956, J.A. Pastrana. Pucará, 650 m, Lago Lacar, 1♀, 28–29 Nov 1981, Nielsen & Karsholt. *Rio Negro Prov.:* Lake Correntoso, 1♀ (holotype), 18–25 Nov 1926. San Carlos de Bariloche, Colonia Suiza, 810 m, 1♂, 6 Nov, 1978; 2♂, 21 Nov 1978, E.S. Nielsen; same locality, 800 m, 1♂ with pupa, larva, 15 Sep 1981, reared from *Diostea junceum;*

1♂, 22–23 Nov 1981; 1♂, 23 Nov 1981; 1♂ 24 Nov 1981; 1♀, 4 Dec 1981; 1♂, 21–22 Dec 1981, Nielsen & Karsholt.

CHILE. *Cauquenes Prov.:* Paso Garcia, 300 m, ~23 km NW of Cauquenes, 1♂, 29–30 Nov 1981, D.R. Davis. *Cautin Prov.:* Fundo Chacamo, 600 m, 35 km NW of Nueva Imperial, 3♂, 1♀, 5–8 Dec 1981, D.R. Davis, sweeping & malaise traps. Fundo La Selva, 700 m, 48 km NW of Nueva Imperial, 1♂, 3♀, 9–11 Dec 1981, D.R. Davis, sweeping. *Malleco Prov.:* Near Los Gringos Camp, 1300 m, Nahuelbuta National Park, 1♀, 6–11 Jan 1982, D.R. Davis, sweeping. *Valdivia Prov.:* Rincon de la Piedra, 180 m, 20 km S of Valdivia, 1♂, 14 Nov 1981; 1♂, 15 Nov 1981, Nielsen & Karsholt.

Specimens deposited in ANIC, BMNH, MACN, MHNS, USNM, and ZMUC.

DISCUSSION.—*Sesommata holocapna* was described from a single female collected near Lake Correntoso, Rio Negro Province, Argentina. Although an imperfect specimen with the head missing (Clarke, 1970), the holotype does provide sufficient characters to establish its identity. A combination of three characters distinguishes the female genitalia of this species from the other, very similar females of this genus: (a) apex of ovipositor nearly as broad as eighth segment; (b) total length of spermatheca approximately equalling the length of bursa copulatrix; and (c) a single circular signum at the anterior end of the corpus bursae.

A single female bearing the paratype label "*Ceromitia pucaraensis* Pastrana" and now deposited in the National Museum of Natural History (USNM) has been examined and found to possess all of the characters of the preceding diagnosis. It is possible that additional misidentified specimens of *S. holocapna* may exist in the rather large type series of *C. pucaraensis.*

Sesommata holocapna, S. platysaris, and *S. paraplatysaris* are closely related as evidenced particularly by their very similar males. The male of each possesses a prominent, round mass of broad sex scales at the anal angle of the forewings and genitalia with similar valvae and aedoeagi. The genitalia of *S. holocapna* are distinguishable by the more slender, widely separated lobes of the uncus and by the peculiar protrusion of the vesica from a subapical opening of the aedoeagus. The abdomen of the male also lacks the prominent cluster of cream to pale-orange sex scales present in *S. platysaris* and *S. paraplatysaris.*

A single larva of *S. holocapna* has been reared from *Diostea juncea* Miers, a green, woody shrub averaging about one meter in height. The plant normally occurs in open sunny areas in Argentina and Chile from about 30°S to approximately 43°S. On 15 September 1981, Mr. Ole Karsholt (ZMUC) discovered the larva lowering itself on a silken thread from a twig of *Diostea juncea.* The larva was placed in a vial along with a few twigs from the host, with additional food being added only once or twice during its confinement. The larva continued feeding for about a month, spinning the twigs together as it fed. Mr. Karsholt has suggested (in litt.) that the larva may even prefer dry leaves and twigs, because so little fresh plant material was added. Around mid-October the larva pupated in a loose shelter between the spun twigs. A few weeks later (exact date uncertain), the adult emerged.

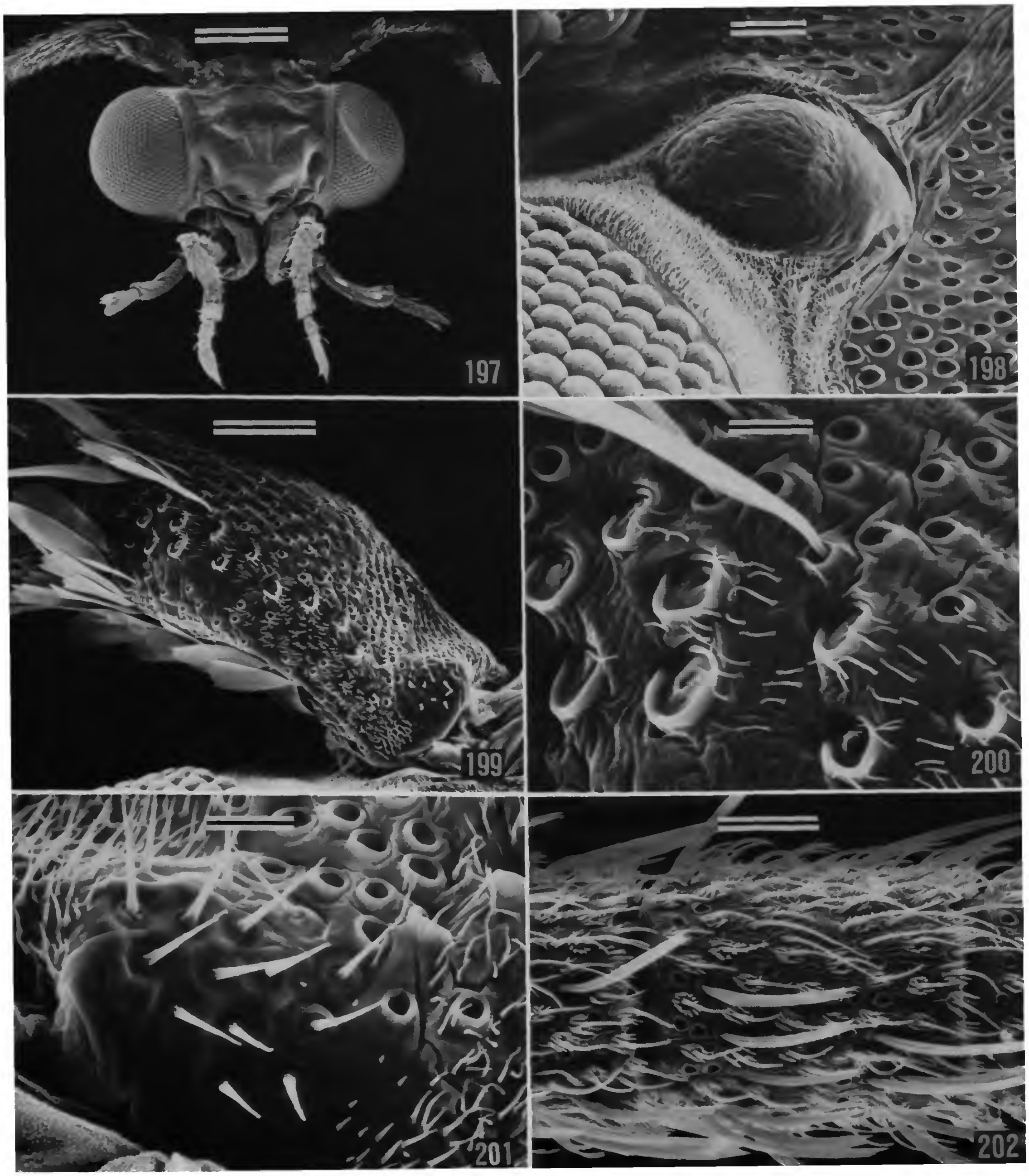
The pupa of *S. holocapna* is adecticous, obtect, and incomplete, with a single anterior row of short dorsal spines present on abdominal segments 2–9 + 10. The frons is round and without a frontal cutting process. The copious presence of dorsal spines suggest that the pupa is partially extruded from its pupation site prior to adult emergence.

***Sesommata paraplatysaris*, new species**

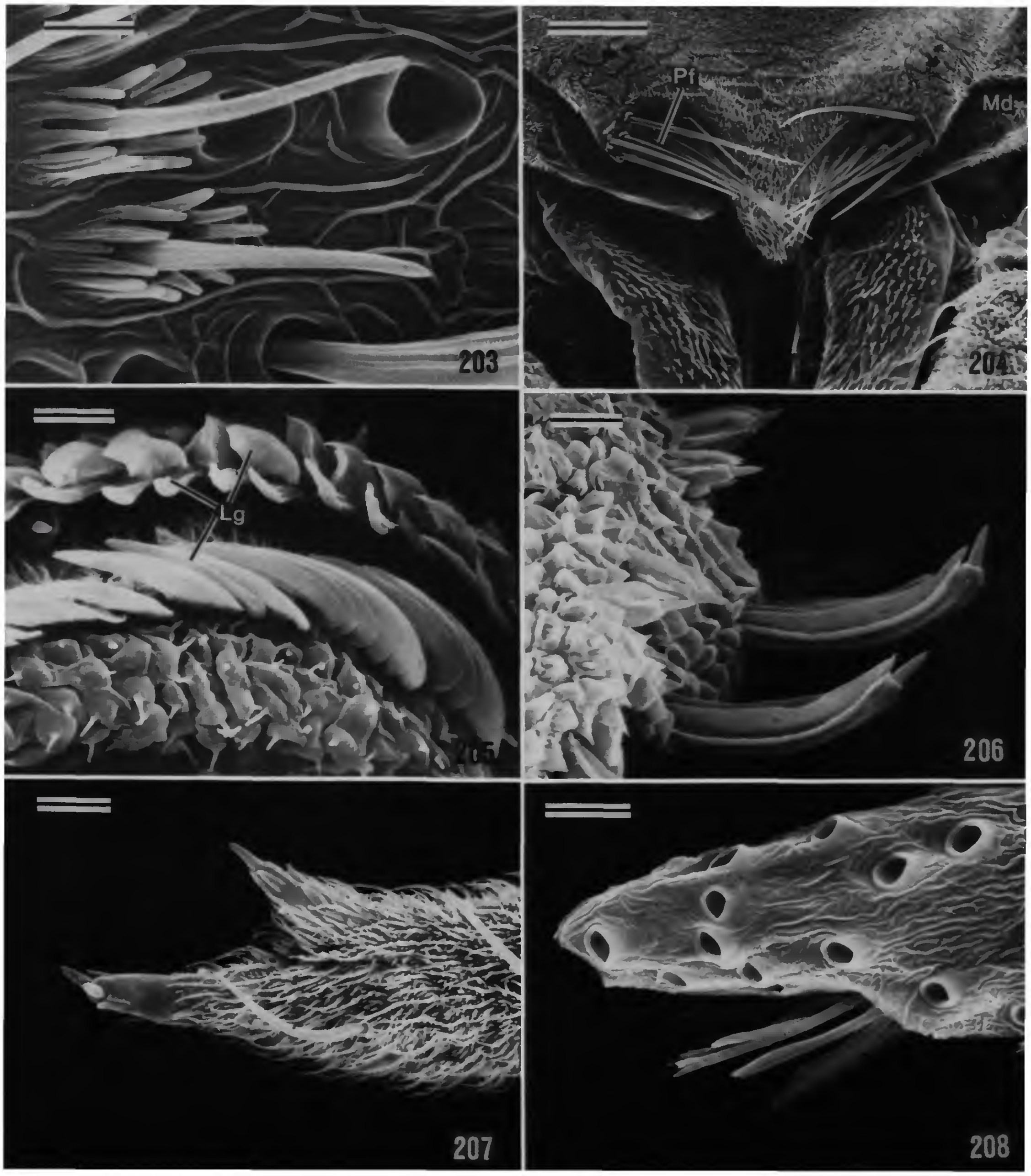
FIGURES 197–226, 403, 404, 447–450, 561; MAP 4

Adult (Figures 403, 404).—Length of forewing: ♂, 5–6.2 mm; ♀, 5–6.5 mm. A small species possessing dark fuscous forewings in the male, lightly irrorated with white apically, and with a rounded mass of broad sex scales over bases of Cu and A; forewings of female more brown, irrorated with white scales; costal margin usually with two cream spots beyond middle.

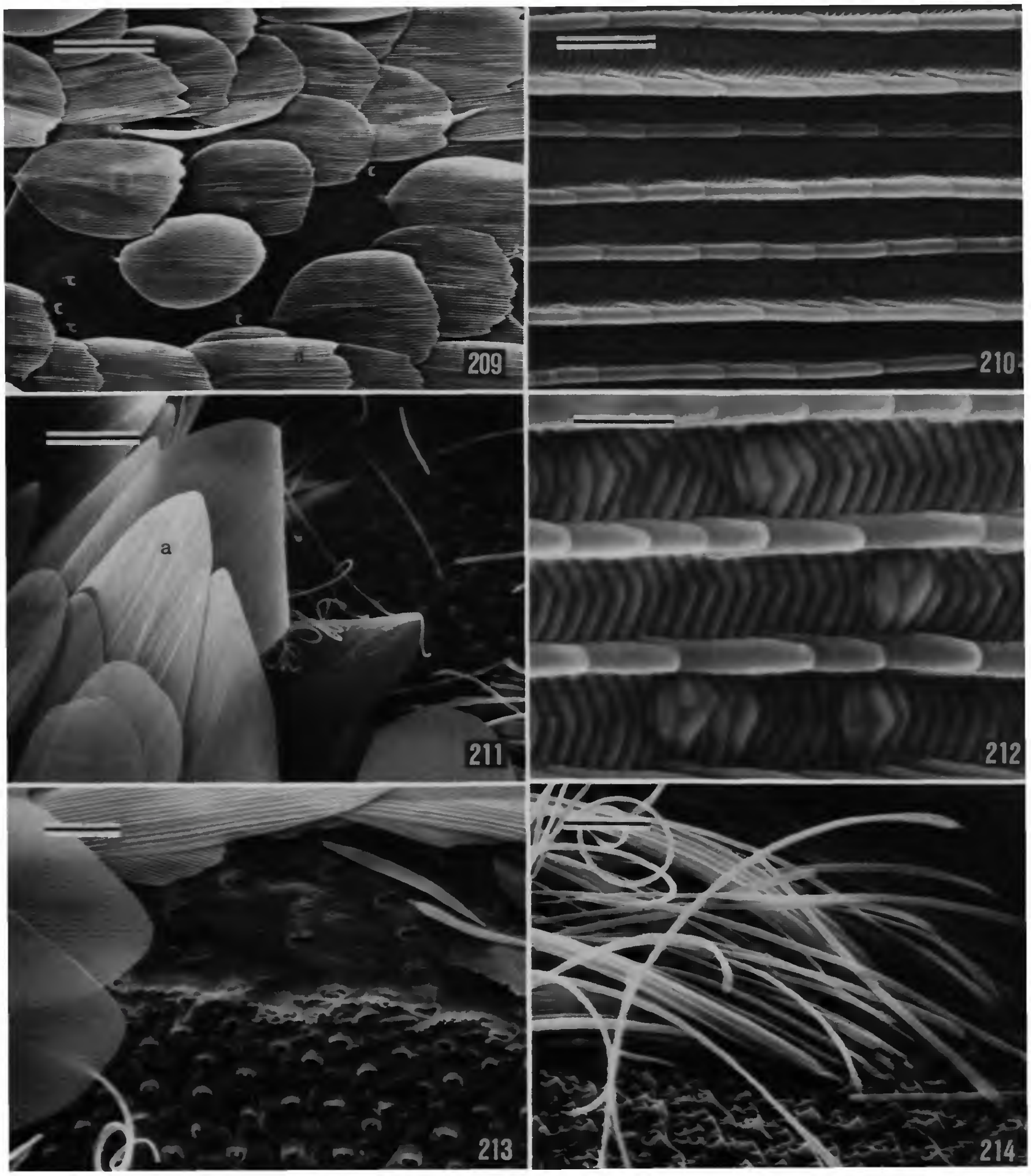
Head: Vestiture black in male to light brown or dull white in female; lower frons with grayish



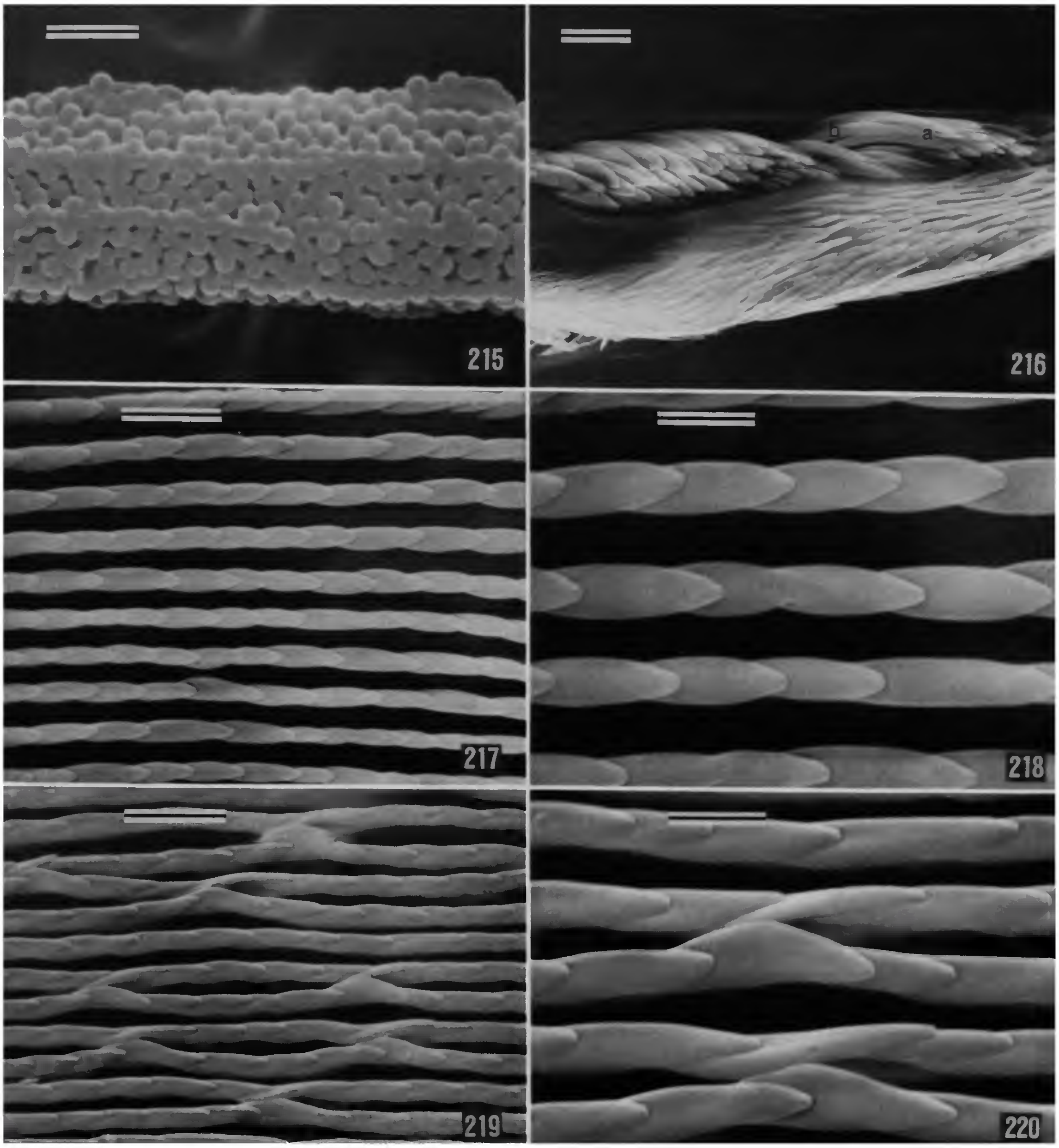
Figures 197–202.—*Sesommata paraplatysaris*, new species: 197, frontal view of head (250 μm); 198, lateral ocellus (25 μm); 199, antennal scape showing follicles of pecten (50 μm); 200, detail of pecten follicles (larger) and normal scale follicles (smaller) (10 μm); 201, detail of proprioreceptor plate at base of scape (10 μm); 202, sensory sensilla of antenna (25 μm). (Scale lengths in parentheses.)



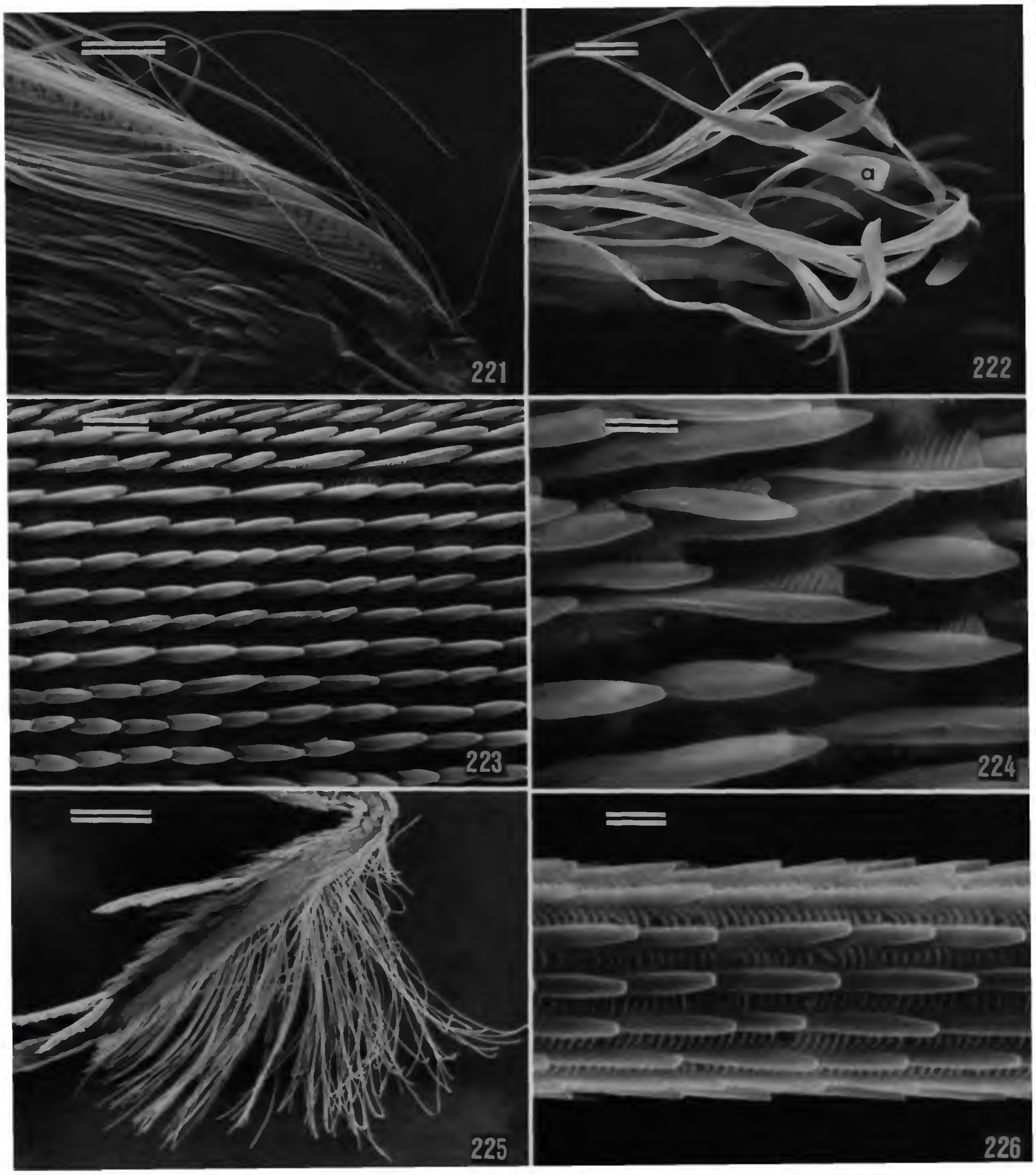
FIGURES 203–208.—*Sesommata paraplatysaris*, new species: 203, sensilla coeloconica of antenna (4 μm); 204, labrum and base of galeae (haustellum) (50 μm); 205, food channel of haustellum (10 μm); 206, sensilla styloconica of haustellum with ridged bases of variable lengths (10 μm); 207, apex of maxillary palpus (20 μm); 208, sensory pit at apex of labial palpus (10 μm). (Scale lengths in parentheses.)



FIGURES 209–214.—*Sesommata paraplatysaris,* new species, scale structure: 209, dorsal forewing near apex of discal cell (50 μm); 210, detail of scale "a" in 209, note variable ridge dimorphism (2 μm); 211, broad sex scale at base of forewing in male (40 μm); 212, detail of scale "a" in 211 (1 μm); 213, partially denuded male forewing base (same site as 211) showing contrast between site with normal scale follicles (above) and that with piliform sex scale follicles (below) (20 μm); 214, piliform sex scales from male forewing base (20 μm). (Scale lengths in parentheses.)



FIGURES 215–220.—*Sesommata paraplatysaris*, new species, scale structure: 215, detail of piliform sex scale "a" in Figure 214 (1 μm); 216, ventral forewing of male showing elongate sex scales (200 μm); 217, detail of apex of sex scale "a" in 216 (5 μm); 218, detail of 217 (2 μm); 219, detail of base of sex scale "b" in 216 with irregular swelling of scutes (5 μm); 220, detail of 219 (2 μm). (Scale lengths in parentheses.)



Figures 221–226.—*Sesommata paraplatysaris,* new species: 221, dorsal base of male forewing showing unmodified base of costal hair pencil (200 μm); 222, apex of costal hair pencil showing enlarged scale apices (50 μm); 223, detail of apex of scale "a" in 222 (2 μm); 224, detail of 223 showing raised scutes (1μm); 225, metathoracic leg of male showing tibial hair pencil (400 μm); 226, detail of single hair pencil scale in 225 (1 μm). (Scale lengths in parentheses.)

buff to white piliform scales. Antennae approximately 0.5–0.6 the length of forewing, 38–43-segmented; scape black to brown dorsally, white ventrally; pecten consisting of 6–12 dark hairs; flagellum fuscous to brown dorsally, thinly covered with buff to white scales ventrally. Maxillary palpi buff to white. Labial palpi mostly cream to white; apical segment with lateral-ventral surfaces fuscous; second segment with 8–12 brownish hairs laterally.

Thorax: Pronotum black to dark brown; rarely heavily suffused with cream white. Venter white. Forewings dark fuscous in male, slightly irrorated with white toward apex; a relatively large, rounded mass of broad sex scales present near base of Cu and A; outer dark scales often missing and exposing underlying broad, white sex scales beneath; ventral side of forewing with two elongate patches of cream sex scales parallel to Cu; female more brown, irrorated with white over distal half; two cream-white elongate spots usually present along costal margin, one at middle and another at subapex; fringe fuscous, irrorated or streaked with white. Hind wings dark fuscous with basal two-thirds to one-half of costal area white in both sexes; male with a long white hair pencil from base to almost half way along costal margin. Forelegs fuscous dorsally, white ventrally; tarsi indistinctly banded with white. Midlegs somewhat paler, more gray dorsally, white ventrally; tarsi more distinctly banded. Hind legs similar to midlegs in color; male with elongate, white to buff hair pencils arising from dorsum of tibiae.

Abdomen: Dark fuscous dorsally, cream to white midventrally, with grayish suffusion near sides. Pleuron of A2–3 in male with dense cluster of short, rounded, pale-orange to cream sex scales.

Male Genitalia: As shown in Figures 447–450. Uncus bilobed; lobes as broad or broader than relatively narrow separation. Gnathos a relatively large, elongate triangular plate bearing a dense cluster of short, stout spines at caudal apex. Vinculum-saccus relatively narrow, only slightly broader than long; length greater than that of *S. platysaris*, approximately 0.8–1 that of valva; anterior apex of saccus evenly rounded. Valvae broad at base, tapering rather abruptly to a slender, attenuated apex; an elongate digitate process arising subapically and directed mesally; length of process 0.9–1.0 the maximum width of valva. Anellus with lateral arm elongate, slender, slightly curved to a simple, smooth apex; length exceeding that of *S. platysaris*, approximately 1.5 the length of aedoeagus. Aedoeagus with caudal fifth abruptly bent ventrally 90°; dorsum of refexed portion densely covered with numerous short spines; apex subacute; aedoeagus without a ventral, subapical perforation for vesica.

Female Genitalia: As shown in Figure 561. Apex of ovipositor relatively narrow, approximately 0.4 mm wide. Colliculum with heavily thickened, folded walls bearing a dense concentration of mostly broad spicules. A rather distinct, approximately triangular, sclerotized plate present in dorsal wall of vaginal passage immediately caudad of colliculum. Corpus bursae with numerous, evenly dispersed spicules on inner wall; a single, spinose signum, arising from an irregularly circular base, present near anterior end of corpus. Spermatheca relatively short, only slightly exceeding length of bursa copulatrix; utriculus relatively small and slender, without spiculated walls; lateral lagena absent.

IMMATURE STAGES.—Unknown.

HOLOTYPE.—♂, Pucará, 650 m, Lago Lacar, Neuquen Province, Argentina, 28–29 Nov 1981, Nielsen & Karsholt, DRD genitalia slide 3505 (ZMUC).

PARATYPES.—ARGENTINA. *Neuquen Prov.:* Lago Lacar, Pucará, 3♂, 25 Nov 1978, E.S. Nielsen; same locality, 650 m, 3♂, 2♀, 28–29 Nov 1981, Nielsen & Karsholt; same locality, 750 m, 1♂, 1 Dec 1978; 1♀, 2 Dec 1978; 4♂, 1♀, 3 Dec 1978; 1♀, 26 Dec 1978, E.S. Nielsen. Lago Lacar, 5 km E of Hua-Hum, 640 m, 3♂, 25 Nov 1981, Nielsen & Karsholt. Paso Puyehue, 1300 m, 2♂, 10 Dec 1981, Nielsen & Karsholt. San Martin de los Andes, Cerro Chapelco, 1400–1600 m, 1♀, 27 Nov 1981; 1♀, 20–25 Dec 1981, Nielsen & Karsholt. *Rio Negro Prov.:* San Carlos de Bariloche, Colonia Suiza, 800 m, 1♂, 4 Dec 1981, Nielsen & Karsholt; same locality, 810 m, 5♂, 9 Dec 1978, E.S. Nielsen. San Carlos de Bariloche, Pampa del Toro, 900 m, 1♂, 9–10 Nov 1981, Nielsen & Karsholt; same locality, 1000 m, 1♂, 21 Nov 1978, E.S. Nielsen.

CHILE. *Malleco Prov.:* Near Los Gringos Camp, 1300 m, Nahuelbuta National Park, 1♂, 1♀, 6–11 Jan 1982, D.R. Davis, sweeping. *Ñuble Prov.:* Alto Tregualemu, 500 m, ~20 km SE of Chovellen, 2♂, 1–3 Dec 1981, D.R. Davis, sweeping. *Osorno Prov.:* 20 km. W of Entre Lagos, 100 m, 1♀, 17 Nov 1981, Nielsen & Karsholt.

Material deposited in ANIC, BMNH, MACN, USNM, and ZMUC.

HOST.—Unknown.

FLIGHT PERIOD.—9 November to 11 January; univoltine.

DISTRIBUTION (Map 4).—This species is restricted to the mostly montane, temperate forests of southern Argentina and Chile. In Argentina it has been collected near Lago Lacar and Lago Nahuel Huapi in western Neuquen and Rio Negro provinces. In Chile it is known to occur in the coastal ranges from Ñuble Province south to Malleco Province and along the Andes near Puyehue National Park.

ETYMOLOGY—The specific epithet is derived from the Greek *para* (near, close) as a prefix to the name of the following species, *S. platysaris,* to indicate the close affinities of these two species.

DISCUSSION.—Although some uncertainties involving the female still persist with regard to the relationships of this insect and the following, *S. platysaris,* available evidence suggests the existence of two closely related, largely sympatric species. *Sesommata paraplatysaris* differs from its sister species in being generally larger and with less uniformly colored forewings. The forewings of both sexes consistently exhibit a light scattering of white scales over the distal third as well as a relatively elongate, white to cream costal spot in the female. More diagnostic are the male genitalia, with that of *S. paraplatysaris* differing in the following features: (a) base of valvae broader and apex more attenuated; (b) vinculum-saccus with anterior margin more round; (c) aedoeagus with caudal apex more acute and strongly relexed ventrally; and (d) lateral anellar spine longer, with a simple (not twisted) apex.

Two females examined (slide 3502, Cerro Chapelco, Argentina, and slide 3493, 20 km W Entre Lagos, Chile) differed from all other *Sesommata* in possessing two signa. In both examples the adventitious signum was smaller and situated at the extreme anterior apex of the corpus bursae. In all other respects the morphology of these two females agree with *S. paraplatysaris,* particularly in the possession of the peculiar triangular vaginal sclerotization.

Sesommata platysaris (Meyrick), new combination

FIGURES 405, 451–454, 562; MAP 4

Tinea platysaris Meyrick, 1931:411.—Clarke, 1970:100, pl. 50: figs. 4–4b.

ADULT (Figure 405).—Length of forewing: ♂, 4.8–6.2 mm; ♀, 5.4–5.6 mm. A small moth with dark fuscous to black wings in the male with a relatively large, rounded mass of broad sex scales over the bases of Cu and A; forewings of female smooth and sometimes with a few scattered white scales.

Head: Vestiture fuscous in male, distinctly paler, buff to cream in female. Antennae approximately 0.6 the length of forewing, 43-segmented; scape white to buff ventrally, fuscous dorsally; pecten with 6–10 dark hairs; flagellum fuscous dorsally, white to buff ventrally. Maxillary palpi white to cream. Labial palpi mostly cream white except for heavy suffusion of dark fuscous over lateral surfaces of apical segment; second segment with 12–15 dark hairs laterally.

Thorax: Pronotum light to dark fuscous. Venter white. Forewings uniformly dark fuscous to black in male, with a relatively large, rounded mass of broad sex scales covering bases of Cu and A; underlying sex scales white; ventral side of forewing with an elongate row of sex scales along Cu; female almost entirely fuscous except for a few scattered white scales over distal half, especially on costa at subapex; fringe uniformly fuscous. Hind wings dark fuscous, nearly as dark as forewings, with basal two thirds of costal area white in both sexes and a long white hair pencil in male extending along costal margin. Forelegs and midlegs fuscous dorsally, white ventrally; tarsi without distinct bands. Hind legs similar to midlegs in color except paler, more gray dorsally; male with long buff to white hair pencils arising dorsally from tibiae.

Abdomen: Fuscous dorsally, white ventrally. Pleuron of A2–3 in male with dense cluster of short, rounded, cream sex scales.

Male Genitalia: As shown in Figures 451–454. Uncus shallowly bilobed; lobes as broad or broader than relatively narrow separation. Gnathos a relatively large, elongate triangular plate bearing a dense cluster of short, stout spines at caudal apex. Vinculum-saccus relatively narrow and short, only slightly broader than long, length less than 0.5 that of valva; anterior apex of saccus subacute, and tapering to a short process. Valvae moderately broad at base, tapering slightly to a rather broad, bluntly rounded apex; an elongate digitate process arising subapically and directed mesally; length of process variable, 0.65–1.0 the maximum width of valve in length. Anellus with lateral arm elongate, slender, approximately 1.1–1.2 the length of aedoeagus, straight for most its length, then slightly curved and twisted at distal fourth. Aedoeagus gradually narrowing caudally to a rounded apex partially covered dorsally with numerous blunt spines; aedoeagus without a ventral, subapical perforation for vesica.

Female Genitalia: As shown in Figure 562. Apex of ovipositor relatively narrow, approximately 0.4 mm wide. Colliculum with heavily thickened, folded walls bearing a dense concentration of mostly broad spicules. A pair of circular pad-like thickenings in dorsal wall of vaginal passage immediately caudad of colliculum; triangular plate absent. Corpus bursae moderately slender, reduced in size, with numerous, evenly dispersed, minute spicules scattered over inner wall; spicules absent from extreme anterior end; signum absent. Spermatheca relatively short, only slightly exceeding length of bursa copulatrix; utriculus relatively small, without spiculated walls; lateral lagena absent.

IMMATURE STAGES.—Unknown.

TYPE.—Lectotype ♂; designated by Clarke (1970).

TYPE-LOCALITY.—[San Carlos de] Bariloche, Rio Negro Province, Argentina.

HOST.—Unknown.

FLIGHT PERIOD.—28 November to 11 January; univoltine.

DISTRIBUTION (Map 4).—This species is mostly known from the Argentina lake region from Lago Lacar and especially Lago Nahuel Huapi. Its presence in Chile is represented by a single questionable specimen from the coastal Nahuelbuta Mountains.

MATERIAL EXAMINED.—8 males and 2 females.

ARGENTINA. *Neuquen Prov.:* Paso Puyehue, 1300 m, 1♂, 10 Dec 1981, Nielsen & Karsholt. San Martin de los Andes, Cerro Chapelco, 1400–1600 m, 1♂, 2–19 Dec 1981; 1♂, 20–25 Dec 1981, Nielsen & Karsholt. *Rio Negro Prov.:* [San Carlos de] Bariloche: 1♂ (lectotype), 28 Nov–1 Dec 1926, F. & M. Edwards. Lake Gutierrez [S of San Carlos de Bariloche], 1♂ (paralectotype), Nov. San Carlos de Bariloche, Cerro Otto, 930 m, 1♂, 5 Dec 1981, Nielsen & Karsholt. San Carlos de Bariloche, Colonia Suiza, 810 m, 2♂, 9 Dec 1978, E.S. Nielsen. San Carlos de Bariloche, Nirihuau, 1♀, 10 Dec 1978, E.S. Nielsen.

CHILE. *Malleco Prov.:* Near Los Gringos Camp, 1300 m, Nahuelbuta National Park, 1♀, 6–11 Jan 1982, D.R. Davis, sweeping.

Material deposited in ANIC, BMNH, USNM, and ZMUH.

DISCUSSION.—By virtue of the reasonably well-preserved male lectotype, the identity of this species has been firmly established. Although the diagnostic male genitalia are very similar to the apparently more common *S. paraplatysaris*, a number of consistently reliable characters easily distinguish the two. Major among these are the more acute saccus, more rounded apex of the aedoeagus, and twisted apex of the lateral anellar arm in *S. platysaris.*

Even though the males of *platysaris* and *paraplatysaris* are readily distinguishable, the lack of associated females of the former partially obscure the species distinction of this sex among the *platysaris* complex. Only two female specimens have been associated with *platysaris,* and both only questionably so. They agree with the males of *platysaris* in being relatively small and in possessing almost uniformly dark forewings. Their genital morphology most resemble that of *S. albimaculata.* It is possible that the females of *albimaculata* are actually *platysaris,* but the broader forewings and conspicuous markings of *albimaculata* appear to preclude this. A more definite association of the female of *platysaris* must await the collection of additional material, representing both sexes, of it and *albimaculata.*

Sesommata albimaculata, new species

FIGURES 406, 563; MAP 4

ADULT (Figure 406).—Length of forewing: ♀, 5.5–6 mm. A relatively small moth possessing dark fuscous to black wings with 5–6 yellowish white, equally spaced spots of similar size on the forewings. Male unknown.

Head: Vestiture light brown. Antennae approximately 0.5 the length of forewing, 42-segmented; scape dark fuscous to black; pecten consisting of 8–12 dark brown hairs; flagellum uniformly dark fuscous to black. Maxillary palpi light brown. Labial palpi with apical segment mostly dark fuscous and suffusion of buff mesally; second segment uniformly pale buff with 4–6 brown hairs at apex of second segment.

Thorax: Pronotum dark fuscous to black. Venter whitish buff. Forewings dark fuscous to black with 5–6 yellowish white spots of approximately similar size arranged as follows: 3 costal spots equally spread from subapex to basal third and 3 equally positioned spots along hind margin from tornus to basal third; basal spot on costa and tornal spot slightly smaller than rest; termen mostly black with suffusion of white at middle. Hind wings uniformly dark fuscous, nearly as dark as forewings. Forelegs dark fuscous dorsally, buff to white ventrally; apices of tarsal segments slightly tipped with white. Midlegs similar to forelegs in color, spurs buff. Hind legs similar to midlegs except slightly paler, more gray dorsally.

Abdomen: Dark fuscous dorsally, heavily suffused with buff ventrally.

Female Genitalia: As shown in Figure 563. Apex of ovipositor relatively narrow, approximately 0.5 mm wide. Colliculum with thickened, heavily folded, densely spiculated walls; a symmetrical pair of large internal, lateral folds present with densely spinose walls; a similarly large V-shaped, external fold immediately ventrad to internal folds. A pair of elliptical pad-like thickenings in dorsal wall of vaginal passage immediately caudad of colliculum. Corpus bursae slender, with finely scattered spicules; spicules absent from extreme anterior end; signum absent. Spermatheca with utriculus moderately enlarged and without spicules or lateral lagena; total length of spermatheca only slightly exceeding length of bursa copulatrix.

IMMATURE STAGES.—Unknown.

HOLOTYPE.—♀. 36: San Martin de los Andes, Cerro Chapelco, 1400–1600 m, Neuquen Province, Argentina, 20–25 Dec 1981, Nielsen & Karsholt (ZMUC).

PARATYPES.—ARGENTINA. Same data as holotype: 1♀, 1 Dec 1981 (ZMUC).

HOST.—Unknown.

FLIGHT PERIOD.—December; univoltine.

DISTRIBUTION (Map 4).—Known only from the type-locality, which is located on the eastern side of Parque Nacional Lanin, slightly southwest of San Martin de los Andes and Lago Lacar, in a predominantly *Nothofagus pumilio* habitat.

ETYMOLOGY.—The species name is derived from the Latin *albus* (white) plus *maculatus* (spotted, speckled), in reference to the spotted forewing pattern.

DISCUSSION.—This moth is unique among the species of *Sesommata* in possessing a distinctly spotted forewing pattern. Although the male is unknown, most likely that sex possesses a pattern similar to the female but less pronounced. The female genitalia are apparently morphologically inseparable from those of *S. platysaris*. This would suggest that *albimaculata* might merely represent the female of *platysaris*, except the forewings of the former are broader and differently marked.

***Metaphatus*, new genus**

TYPE-SPECIES.—*Metaphatus ochraceus*, new species.

ADULT.—Relatively small to medium size moths with yellowish to brown forewings. Male genitalia with paired lateral and inner anellar arms. Female genitalia with highly modified, well-developed colliculum and broad ovipositor. Length of forewing 7.5–11 mm.

Head: Vestiture mostly rough, somewhat smoother posterior to vertex, consisting of long piliform scales with bidentate to tridentate apices. Antennae approximately 0.5–0.7 the length of forewing, 38–48-segmented; pecten always present, consisting of 6–12 piliform scales. Eyes round, smooth, relatively large; interocular index approximately 1.0–1.1; eye index approximately 1.0–1.2. Ocelli absent. Pilifers well developed, moderately lobed, with 10–14 large piliform scales directed mesally and partially overlapping. Mandibles vestigial, but relatively large, equalling length of third maxillary palpal segment. Maxillary palpi 5-segmented. Approximately 2 times the length of labial palpi; ratio of segments from base approximately 0.3:0.3:0.5:1.1:1; apex of V bifid, bearing a slender apical lobe with 5 short apical setae and a subapical lobe with 3 short apical setae. Haustellum relatively short, about 0.7 the length of maxillary palpi. Labial palpi 3-segmented, relatively short, less than length of haustellum; ratio of segments from base 0.8:1.2:1; a sensory pit situated subapically on III, with approximately 16 sensillae arising from an eversible pocket (Figures 239, 240).

Thorax. Forewings moderately slender, gradually tapering to a subacute apex; length approximately 3.5 the width. Radius 5-branched; medius 3-branched; all veins arising separate from discal cell except M3, which is sometimes connate with CuA1; 1A and 2A separate at basal third, forming an anal loop; accessory cell present; base of medius forked within discal cell. Microtrichia mostly absent from basal ⅘ of dorsal surface of forewing, present over distal ⅕ and over entire ventral surface of forewing and both surfaces of hind wing. Hind wings relatively slender; length approximately 2.8 the width. Female frenulum normally with 3 bristles, ranging from 2–4. Medius 3-branched; all veins arising separate from cell except M1 and 2, which are connate. Androconial pockets and hair pencils absent. Forelegs with pectinated epiphysis approximately 0.4 the length of tibia; tibia about 0.6 the length of femur. Midlegs with a single large pair of apical tibial spurs of unequal lengths. Hind legs with two pairs of large tibial spurs of unequal lengths; one pair apical and other pair arising slightly beyond middle of tibia. Mesothoracic furcal apophyses prominent, well set off from secondary furcal arms; lateral apophyses elongate, over 3 times the length of mesal apophyses. Metathoracic furcal apophyses relatively short; tendon arising below middle of apophysis. A second pair of tendons arising dorsally from anterior third of anteromedial process. Base of anteromedial process broad, extending 0.3–0.5 the length of the furcal stem. Anterior furcal ridges greatly reduced.

Abdomen: Usually without specialized integumental modifications, but with a pair of small lateral glands present on A2 of *M. spatulatus*, *M. ochraceus*, and *M. ichnius*, associated with large, bilateral hair pencils.

Male Genitalia: Uncus either acute or minutely bilobed. Gnathos largely absent, represented by only 1–2 large paired or median patches of dense, minute spines. Tegumen moderately developed, lightly sclerotized. Vinculum relatively narrow, often with a distinct, rather short saccus, thus imparting a V- to Y-shape form to sternite. Valvae variable, either broad and simple or slender and variously supplied with costal or apical spines. Transtilla absent. Juxta absent. Anellus present, highly modified and complex, consisting of a usually large pair of lateral arms closely appressed against valvae, and a much smaller pair of inner arms partially encircling aedoeagus. Aedoeagus variable in form, although generally compressed, without cornuti, and broader at the distal end.

Female Genitalia: Ovipositor extremely short; apex broad, 0.5–0.8 mm wide, and with a medium ridge richly supplied with campaniform sensillae. Anterior apophyses strongly arched, considerably longer and heavier than posterior apophyses. Ductus bursae highly modified into a well-developed colliculum with thickened, folded walls bearing numerous placoid spicules internally. Corpus bursae elongate, 2.5–3.0 the length of colliculum; internal walls densely covered with minute spicules; signa paired, usually consisting of a spinose cone arising from an irregularly circular plate (Figure 272). Spermatheca short to long, 0.5 to 1.0 the length of corpus copulatrix; utriculus variable in size, covered internally with minute spicules; an elongate, tubular lateral lagena usually present.

ETYMOLOGY.—The generic name is derived from the Greek *meta* (near, among, change) added to the stem of the generic name *Palaephatus*, in reference to the close relationship of this genus. It is considered masculine in gender.

DISCUSSION.—Several synapomorphies link this genus to *Sesommata*. Principal among these are: (1) apex of the maxillary palpus bifid, (2) most of dorsal surface of forewing without microtrichia, (3) male with complex anellus, (4) aedoeagus without cornuti, (5) female ovipositor with a broad apex, (6) anterior apophyses strongly curved, (7) caudal margin of eighth sternite with specialized spines, and (8) colliculum well developed. Features that distinguish *Metaphatus* from all other genera are the presence of (1) paired lateral and inner anellar arms in the male, (2) paired specialized spinose areas at caudal margin of eighth sternite of female, and (3) paired signa.

The members of *Metaphatus* can be associated into two more or less distinct species groups based upon male genital morphology. The *ochraceus* group (*M. ichnius*, *M. ochraceus*, and *M. spatulatus*) is characterized by a simple, acute uncus, furcate or lobed lateral annellar arms, well-developed, spinose inner anellar arms, and relatively broad but simple valvae. Members of the *adustus* group, including *M. cirrhus* and *M. sinuatus*, possess a bifid uncus, slender and unbranched lateral anellar arms, reduced inner anellar arms without spinose processes, and more slender valvae with costal and/or apical spines. The latter group, primarily on the basis of the reductions in the anellar arms, is considered the most derived.

Key to the Species of *Metaphatus*

1. Male genitalia with uncus simple, acute; valvae relatively broad and simple, without specialized processes or spines [Figure 462] 2
   Uncus bifid or notched; valvae more slender, with subapical process or apical spines 4
2. Male genitalia with caudal end of lateral anellar arms spatulate, not divided [Figure 461]. Female genitalia with corpus bursae sharply angulate at junction with colliculum [Figure 564] . . . . **_Metaphatus spatulatus_**, new species
   Male genitalia with caudal end of lateral anellar arms bifid or trifid. Corpus bursae only slightly angled at junction with colliculum 3
3. Forewings pale yellow, with little or no distinct pattern evident. Caudal

end of lateral anellar arms trifid in male [Figure 469] . . . . **Metaphatus ochraceus**, new species

Forewings with a distinct pattern, dark brown, streaked with a rather broad sinuate, whitish line along hind margin [Figure 411]. Caudal end of lateral anellar arms bifid [Figure 472]. Female with posterior lateral lobes of colliculum reduced [Figure 567] . . . . **Metaphatus ichnius**, new species

4. Valvae of male genitalia with a large subapical, curved process arising from costal margin [Figure 476]. Eighth sternite of female with 2–3 rows of relatively large blunt spines [Figures 276–278] . . . . **Metaphatus cirrhus**, new species

Valvae without costal process. Eighth sternite of female with more than 3 rows of small blunt spines 5

5. Valvae of male genitalia with lateral anellar process nearly as long as valva; apex sinuate [Figure 478] . . . . **Metaphatus sinuatus**, new species

Valvae with lateral anellar process reduced, approximately half the length of valva and straight [Figure 483] . . **Metaphatus adustus**, new species

Metaphatus spatulatus, new species

FIGURES 407, 459–463, 564, 572; MAP 5

ADULT (Figure 407).—Length of forewing: ♂, 8–10 mm; ♀, 9–10.5 mm. A medium-size species with light to medium brown forewings faintly marked with dark brown and a few scattered white scales.

Head: Vestiture uniformly light brown. Antennae approximately 0.6 the length of forewing, 47–48-segmented; scape brown dorsally, buff ventrally; pecten consisting of approximately 8–10 brown hairs; flagellum brown dorsally, paler brown ventrally, mostly naked except for dense sensillae. Maxillary palpi pale buff to cream. Labial palpi cream to white dorsally; brown ventrally; second segment with a cluster of 6–8 brown spines at apex and 2–3 arising more mesad.

Thorax: Pronotum medium brown. Venter dull white. Forewings light to medium brown, irregularly marked with faint, sinuate streaks and spots of dark brown that sometimes impart an indistinct pattern; a few scattered white scales persistent in better preserved specimens; termen predominantly light brown with most scales tipped with dull white. Hind wings uniformly cream. Forelegs brown dorsally, cream ventrally; tarsal segments dark brown dorsally, with pale buff apices. Midlegs light brown dorsally, cream to white ventrally; tarsi tipped with cream. Hind legs predominantly cream, tarsal annulations usually indistinct or absent.

Abdomen: Uniformly cream. A2 of male without lateral hair pencils but with lateral glands as in *M. ochraceus.*

Male Genitalia: As shown in Figures 460–463. Uncus subacute. Gnathos reduced to a pair of minutely spinose oval patches. Valvae relatively broad, simple. Lateral anellar arms spatulate, terminating in a prominent spine curved dorsally. Inner annelar arms consisting of a single pair of relatively stout, strongly curved spines.

Female Genitalia: As shown in Figures 564, 572. Caudal margins of eighth sternite with bilateral pair of elongate, spinose patches; each patch consisting of 1–5 rows of minute peg-like spines arranged in an oblique pattern; number of rows decreasing laterally. Colliculum with posterolateral lobes moderately developed, anterolateral lobes slightly smaller; internal denticulation well developed, covering most of internal walls of colliculum; a bilateral pair of round lobes, densely covered with placoid spicules, present at caudal end of colliculum. Corpus bursae with a pair of small, irregularly ovoid signa, each bearing a small, irregular, acentric spine; walls of bursa with minute, evenly scattered spicules; ductus bursae sharply bent laterally at right angles to colliculum and corpus bursae. Spermatheca well developed; utriculus nearly 0.5 the length of corpus bursae; walls lightly spiculated.

IMMATURE STAGES.—Unknown.

HOLOTYPE.—♂. San Carlos de Bariloche, Colonia Suiza, 800 m, Rio Negro Province, Argentina, 5–6 Dec 1981, Nielsen & Karsholt (ZMUC).

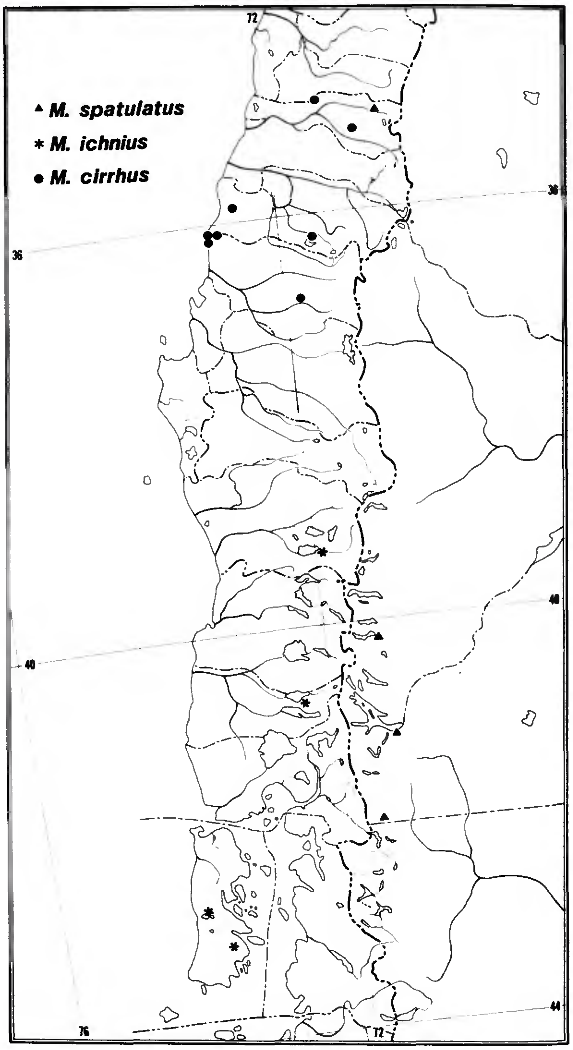
PARATYPES.—ARGENTINA. *Neuquen Prov.:* San Martin de los Andes, 640 m, 1♂, 1♀, 7–15 Nov 1981, Nielsen & Karsholt. *Rio Negro Prov.:* El Bolsón, Cerro Pittriquitron, 1♂, 31 Oct 1961; 7 Nov 1961, Gy Topal. San Carlos de Bariloche, Colonia Suiza, 800 m, 2♂, 29–30 Nov 1981; 2♂, 2 Dec 1981; 2♂, 3 Dec 1981; 3♂, 5–6 Dec 1981; 4♂, 2♀, 7 Dec 1981; 1♂, 11 Dec 1981; 1♀, 20 Dec 1981; 2♂, 21–22 Dec 1981; 1♂; 1♀, 24 Dec 1981; Nielsen & Karsholt. Same locality, 810 m, 1♂, 6 Dec 1978; 1♂, 1♀, 7 Dec 1978; 6♂, 1♀, 9 Dec 1978; 2♂, 1♀, 10 Dec 1978; 1♂, 11 Dec 1978; 3♂, 12 Dec 1978; 2♂, 15 Dec 1978; 1♀, 24 Dec 1978; 1♀, 31 Dec 1978; 1♀, 1 Jan 1979; 2♀, 2 Jan 1979, E.S. Nielsen.

CHILE. *Curico Prov.:* Rio Teno, 800 m, ~40 km E of Curico, 1♀, 25–27 Nov 1981, D.R. Davis, UV light trap.

Paratypes deposited in ANIC, BMNH, MACN, USNM, and ZMUC.

HOST.—Unknown.

FLIGHT PERIOD.—31 October to 2 January; univoltine.



MAP 5.—Distribution of species of *Metaphatus*.

DISTRIBUTION (Map 5).—Collecting records to date show this species to be rather restricted in distribution and concentrated in the temperate forests of the Argentine lake region, particularly in Parque Nacional Nahuel Huapi. Surprisingly, no records are known from the well-surveyed Chilean forests most adjacent to the Argentine sites. Apparently the species is restricted to more xeric habitats. Most if not all of the Argentine specimens were collected in a markedly drier transitional area between steppe and forest, referred to as the Austrocedrus zone (Nielsen and Robinson, 1983). A single specimen has been collected at light from somewhat disjunct Andean *Nothofagus* forest (Figure 7) in Curico Province, Chile.

ETYMOLOGY.—The specific name is derived from the Latin *spatula* (a broad, flat stirring tool), in reference to the spatulate form of the lateral anellar arms of the male genitalia.

DISCUSSION.—*Metaphatus spatulatus* is related to those members of the genus (*M. ochraceus* and

M. ichnius) whose males possess a simple, undivided uncus, broad valvae, and robust, highly modified anellar arms. Rubbed specimens may be confused with *M. adustus* and *M. sinuatus*. The latter, however, possess a divided uncus and greatly reduced, slender anellar arms. *Metaphatus spatulatus* may be distinguished from all species by its very robust and spatulate lateral anellar arms. The female genitalia are destinctive in having the corpus bursae sharply set off at right angles to the heavily spiculated colliculum.

Metaphatus ochraceus, new species

FIGURES 17–19, 85, 110–112, 138, 227–272, 408–410, 464–469, 565, 566, 573–575; MAP 6

ADULT (Figures 408–410).—Length of forewing: ♂, 7.5–9.5 mm; ♀, 8–10.5 mm. A relatively small- to medium-size moth with a predominantly pale yellow body and forewings, the latter occasionally with an indistinct pattern of light brown to fuscous scales, especially in the male.

Head: Vestiture uniformly cream to pale yellow. Antennae approximately 0.6–0.7 the length of forewing, 48-segmented; scape brown dorsally, white ventrally, pecten consisting of 8–10 dark hairs; flagellum brown dorsally, sometimes banded with cream; cream to white ventrally, mostly naked. Maxillary palpi mostly cream. Labial palpi white to cream, heavily irrorated with brown laterally and ventrally; apical segment mostly dark brown; second segment with 3–6 dark hairs mostly at apex.

Thorax: Pronotum pale yellow to cream. Venter mostly white. Forewings predominently pale yellow, often with scattered fuscous scales and very faint, relatively broad, longitudinal streaks of pale golden buff to light brown; pattern more distinct in male; termen pale buff to brown. Hind wings uniformly pale cream. Forelegs pale brownish fuscous dorsally with apices of tarsal segments faintly tipped with cream, pale buff to white ventrally. Midlegs similar to forelegs except pale brown dorsally. Hind legs uniformly cream to white.

Abdomen: Uniformly cream. Anterolateral margin of second sternite of male with a bilateral pair of elongate hair pencils (Figure 138) arising adjacent to small, spherical glands.

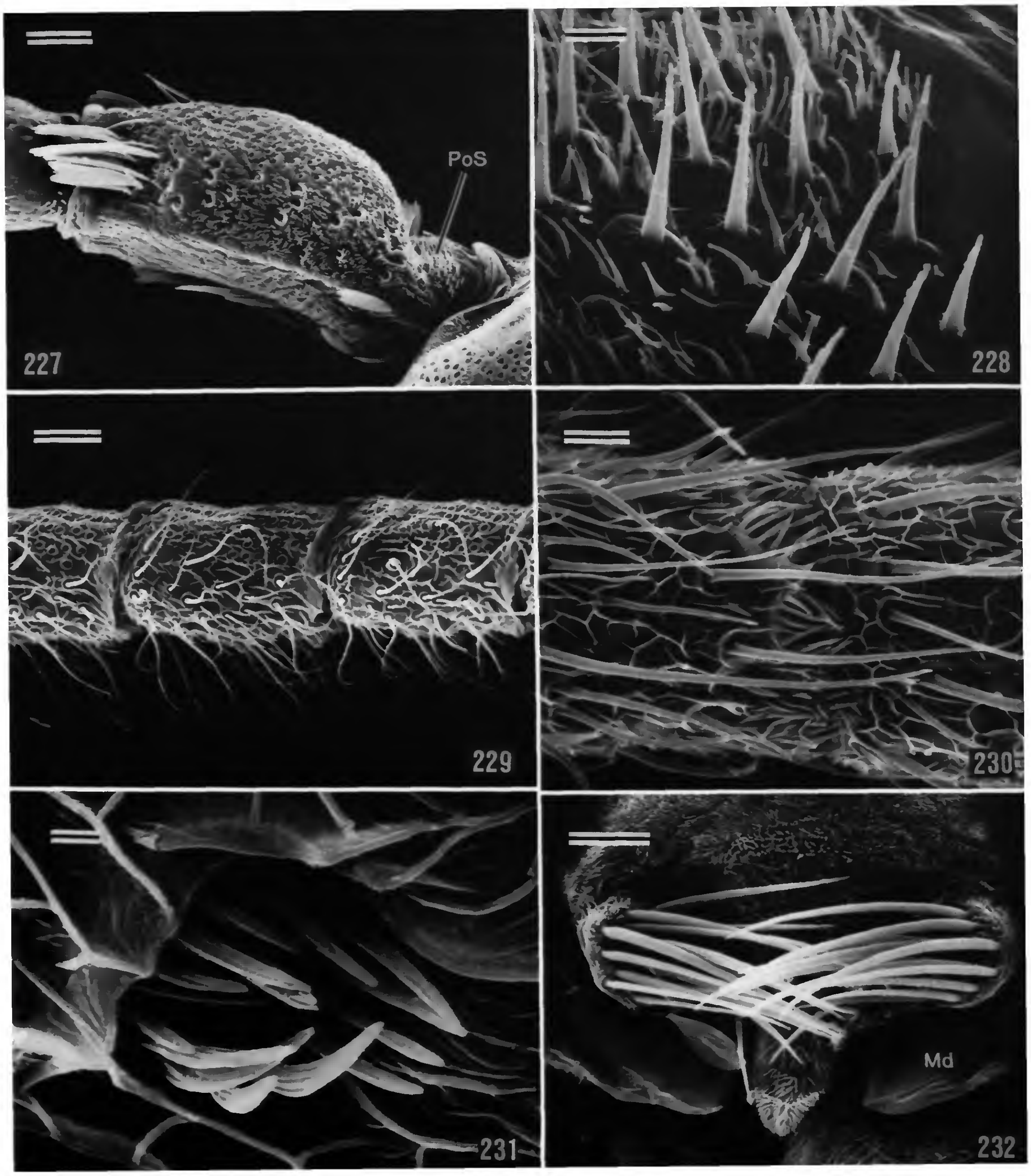
Male Genitalia: As shown in Figures 464–469. Uncus acute. Gnathos poorly developed, consisting of a median patch of very numerous, minute spines. Valvae simple, relatively broad and tapering to apex. Lateral annellar arms stout, terminating in a rather broad, trifid apex. Inner annellar arms consisting of two pairs of slender, curved spines; ventral arm nearly twice the length of dorsal arm.

Female Genitalia: As shown in Figures 565, 573. Caudal margin of eighth sternite with a bilateral pair of broad spinose patches; each patch subdivided into a posterior region of larger spatulate spines arranged in 4–5 oblique rows and an anterior region of 12–14 scattered rows of minute blunt spines. Colliculum with posterolateral lobes well developed; anterolateral lobes present but minute; internal denticulation moderately developed, largely restricted to inner lateral margins of colliculum; dorsal walls densely covered with minute, placoid spicules. Corpus bursae with a pair of small, irregularly ovoid signa, each bearing a minute, acentric, knobby spine; walls of bursa with minute, evenly scattered spicules. Spermatheca moderately developed; utriculus less than 0.3 the length of corpus bursae; walls lightly spiculated.

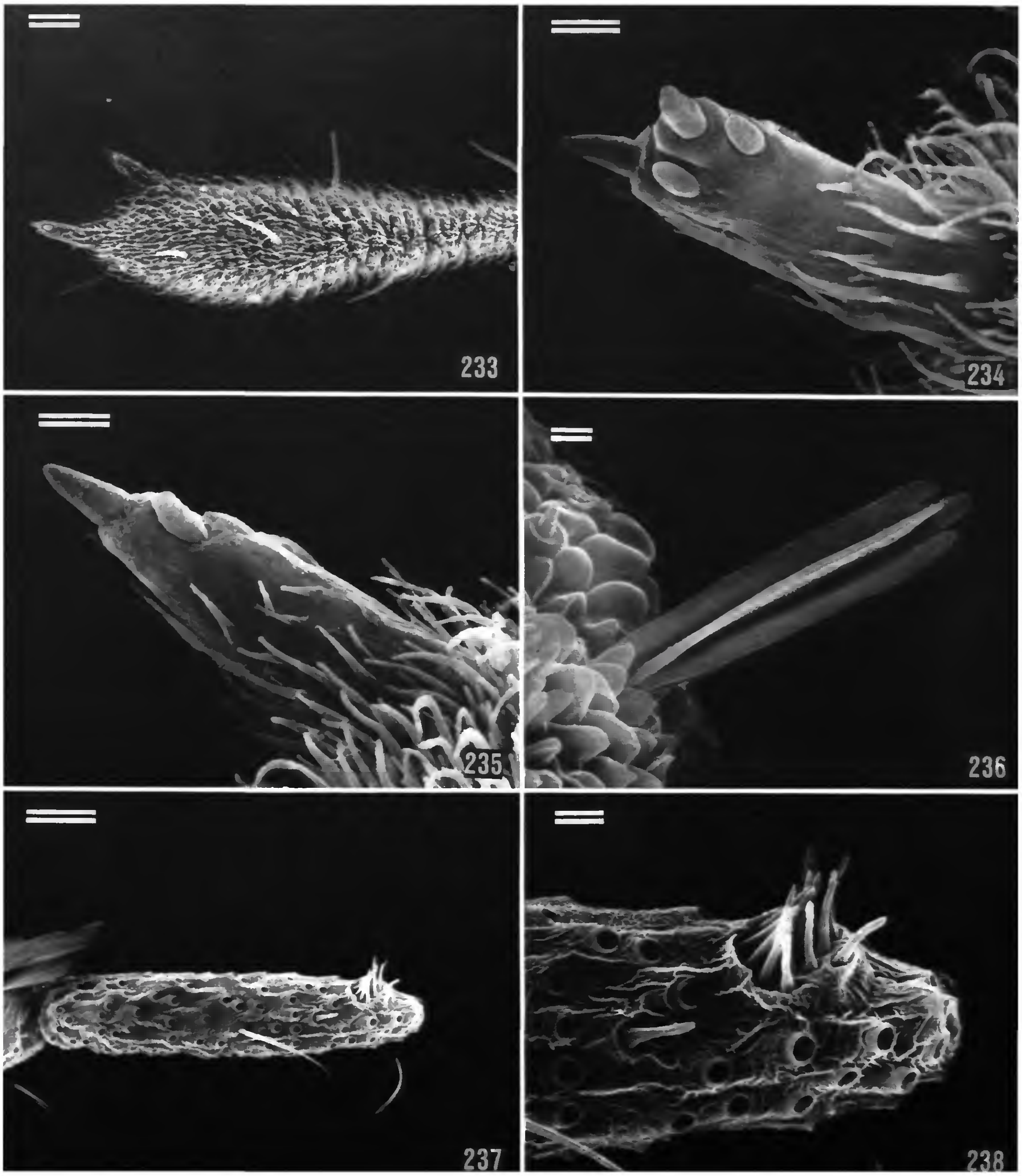
IMMATURE STAGES.—Unknown.

HOLOTYPE.—♂. Aquas Calientes to 3 km W, 450–500 m, Parque Nacional Puyehue, Osorno Province, Chile; 12–20 Dec 1981, D.R. Davis, UV light trap, type no. 101185 (USNM).

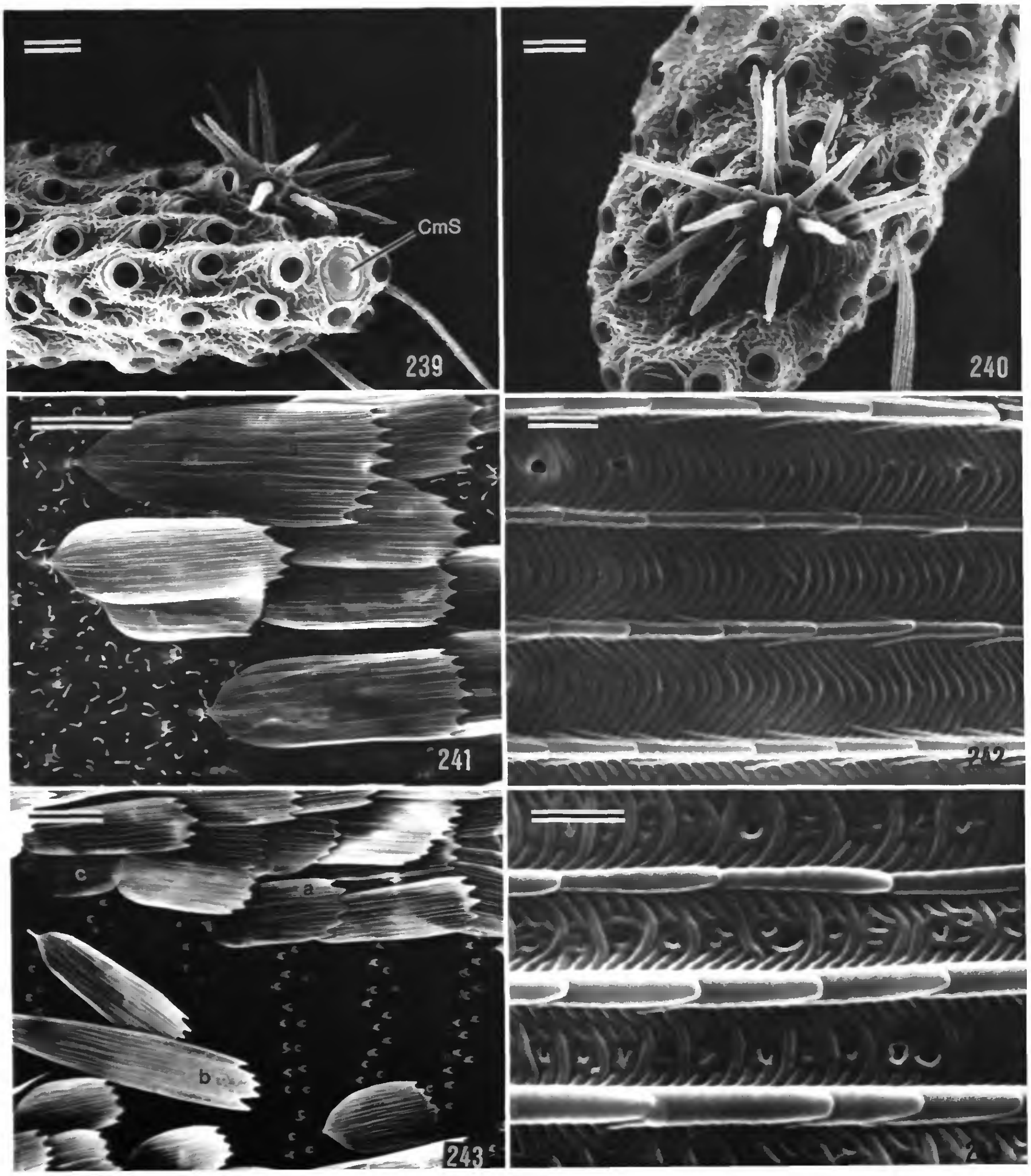
PARATYPES.—ARGENTINA. *Chubut Prov.:* Esquel, Lago Menéndez, Sagrario Puerto, 600 m, 8♂, 29♀, 2–4 Jan 1982, Nielsen & Karsholt. *Neuquen Prov.:* Lago Lacar, 5 km E of Hua-Hum, 640 m, 3♂, 14 Oct 1981; 2♂, 2♀, 16 Oct 1981; 1♂, 5–6 Nov 1981; 2♂, Nov 1981; 3♂, 25 Nov 1981; 1♀, 26–27 Dec 1981, Nielsen & Karsholt. Lago Lacar, Pucará, 750 m, 1♂, 1♀, 10 Nov 1978; 1♂, 25 Nov 1978; 1♂, 1♀, 2 Dec 1978; 1♂, 1♀, 3 Dec 1978; 1♂, 4♀, 26 Dec 1978, E.S. Nielsen. Same locality, 650 m, 2♂, 1♀, 28–29 Nov 1981;



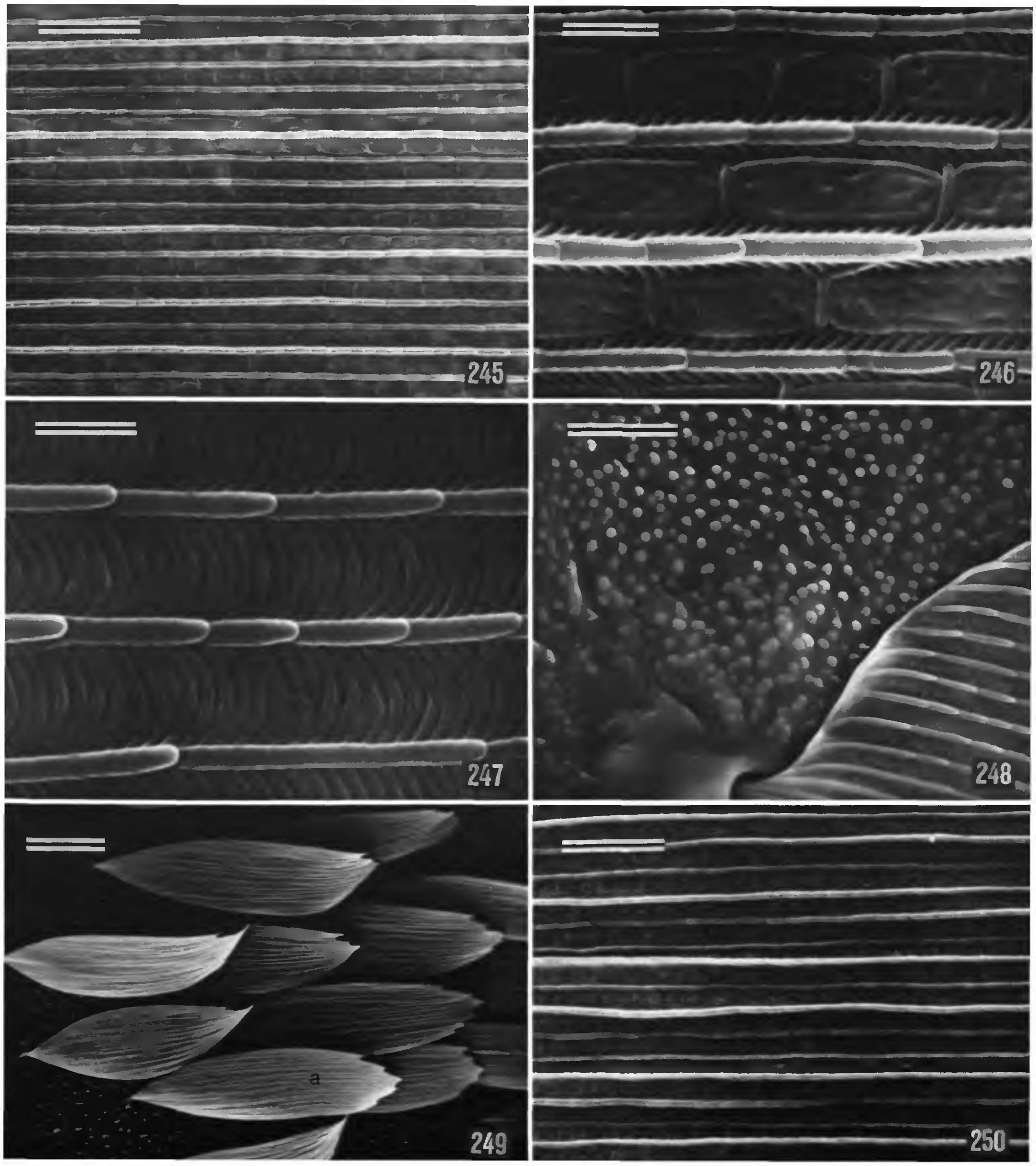
Figures 227–232.—*Metaphatus ochraceus*, new species: 227, antennal scape showing enlarged follicles of pecten (50 μm); 228, detail of proprioreceptor sensilla at base of scape (4 μm); 229, antennal sensilla (40 μm); 230, detail of 229 (10 μm); 231, sensillum coeloconicum from antenna (2 μm); 232, labrum with prominent pilifers (40 μm). (Scale lengths in parentheses.)



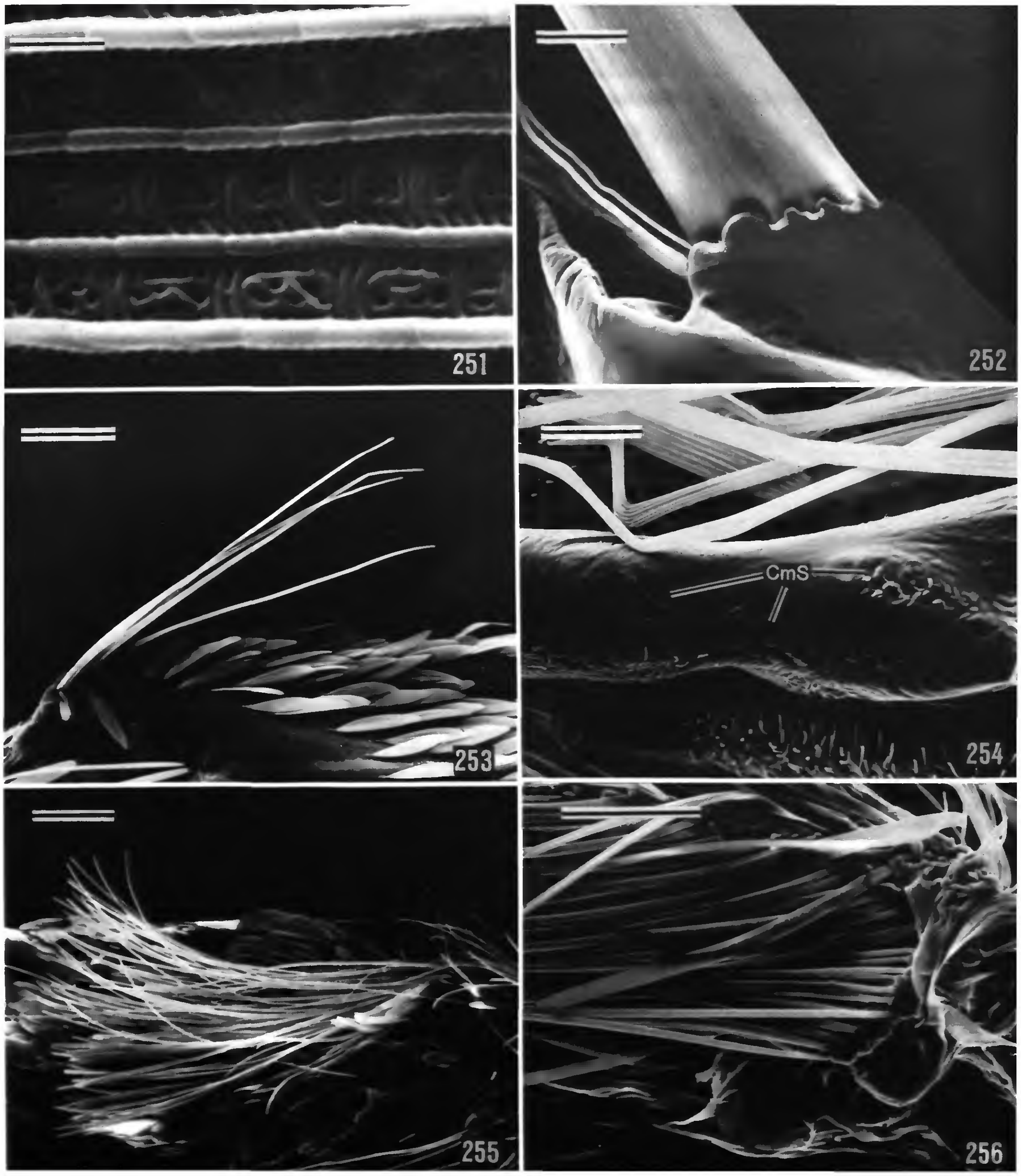
FIGURES 233–238.—*Metaphatus ochraceus*, new species: 233, apex of maxillary palpus (20 µm); 234, detail of ventral lobe of maxillary palpus (4 µm); 235, detail of dorsal lobe of maxillary palpus (4 µm); 236, sensillum styloconicum of haustellum with elongate, ribbed base (4 µm); 237, apical segment of labial palpus with subapical sensory pit (40 µm); 238, detail of sensory pit with sensilla retracted (10 µm). (Scale lengths in parentheses.)



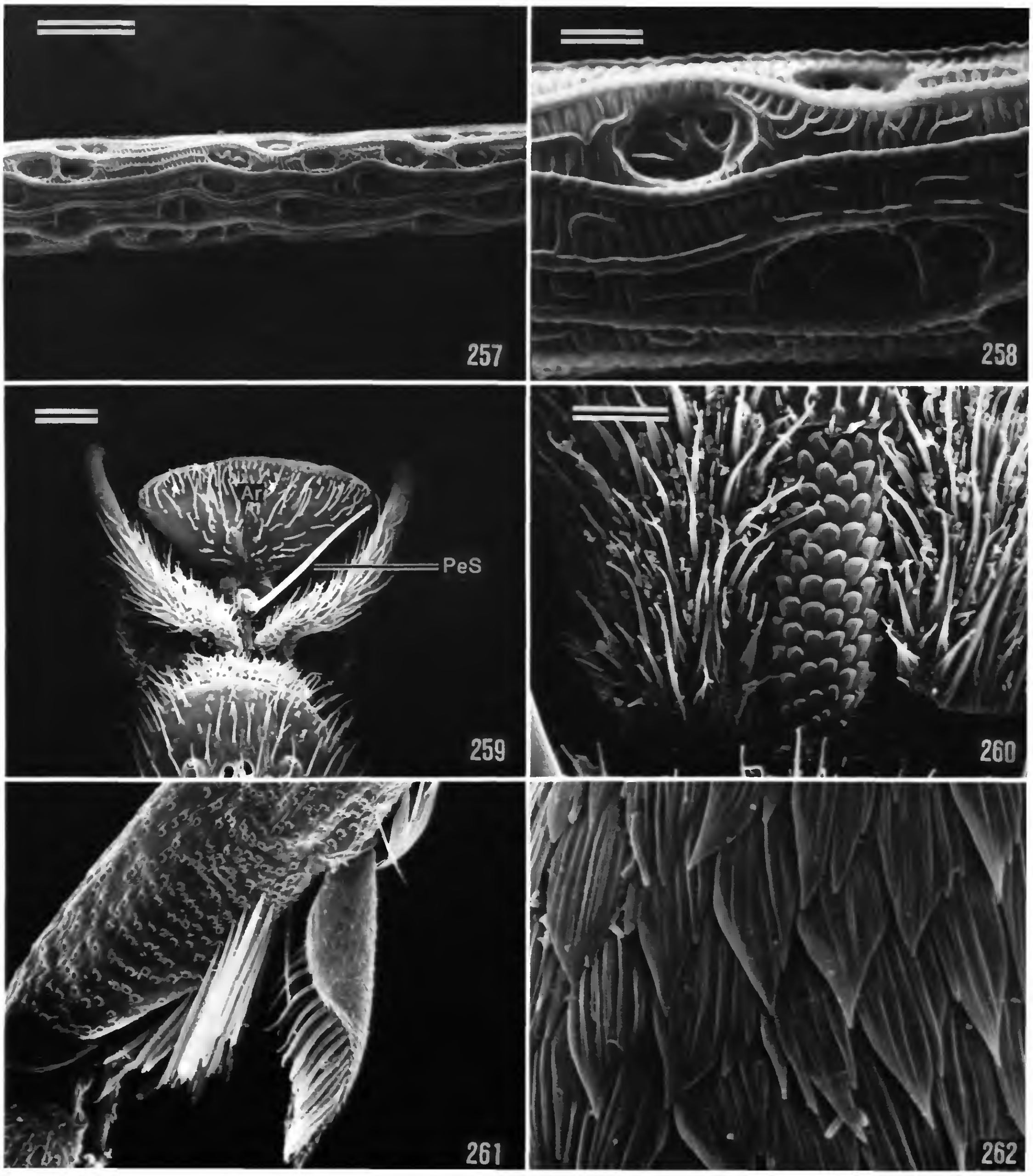
FIGURES 239–244.—*Metaphatus ochraceus*, new species: 239, detail of everted sensory pit and apical companiform sensilla (10 μm); 240, dorsal view of everted sensory pit (10 μm); 241, dorsal forewing in cell M2 near apex of wing, microtrichia present (50 μm); 242, detail of scale "a" in 241, note variable ridge dimorphism (1 μm); 243, dorsal forewing near base of discal cell at basal third of wing, microtrichia absent (50 μm); 244, detail of scale "a" in 243 (1 μm). (Scale lengths in parentheses.)



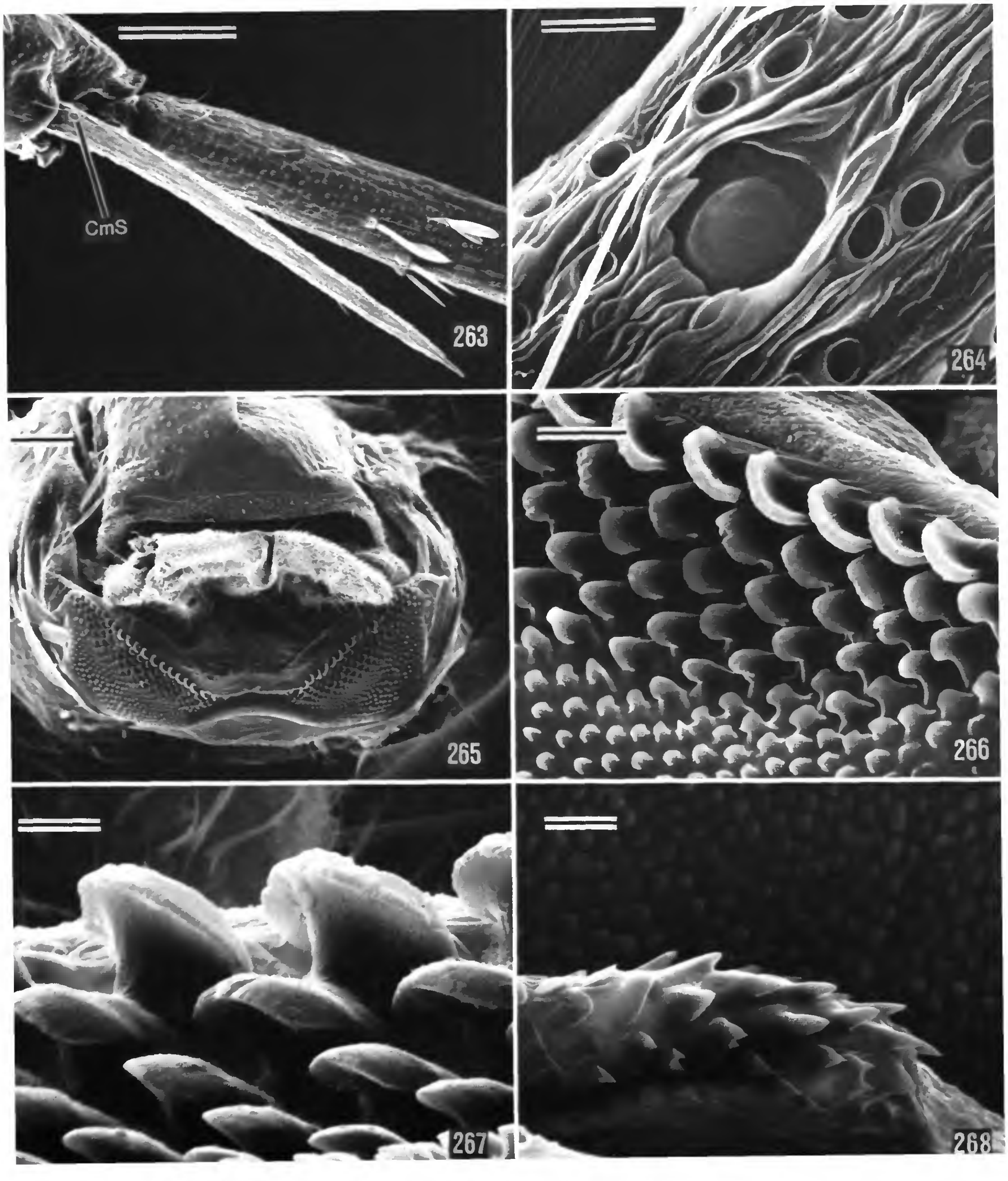
Figures 245–250.—*Metaphatus ochraceus*, new species, scale structure: 245, detail of scale "b" in Figure 243 (5 μm); 246, detail of 245 (1 μm); 247, detail of scale "c" in Figure 243 (1 μm); 248, detail of dorsal forewing membrane, middle of discal cell, showing microtubercules (5 μm); 249, dorsal hind wing near middle of discal cell, microtrichia present (50 μm); 250, detail of scale "a" in 249, note variable ridge dimorphism (5 μm). (Scale lengths in parentheses.)



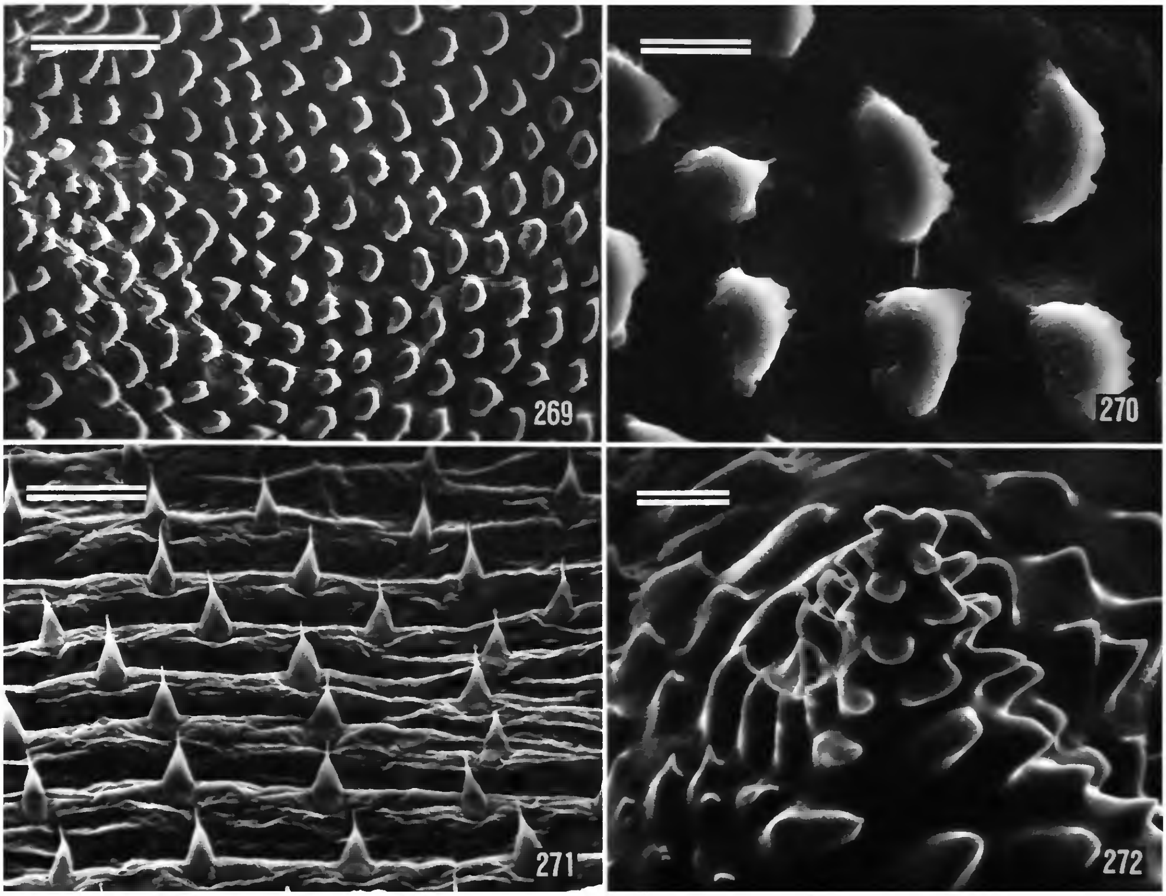
FIGURES 251–256.—*Metaphatus ochraceus*, new species: 251, detail of Figure 250 (1 μm); 252, base of male frenulum (20 μm); 253, female frenulum (200 μm); 254, dorsal base of Sc + Rs (hind wing) showing numerous campaniform sensilla (40 μm); 255, ventrolateral view of base of abdomen showing lateral hair pencil (200 μm); 256, detail of 255 showing base of hair pencil (100 μm). (Scale lengths in parentheses.)



FIGURES 257–262.—*Metaphatus ochraceus*, new species: 257, detail of hair pencil scale in Figure 255 (4 μm); 258, detail of 257 (1 μm); 259, dorsal view of mesothoracic pretarsus showing pseudempodial seta (20 μm); 260, unguitractor plate of pretarsus (10 μm); 261, epiphysis with specialized tibial setae (40 μm); 262, outer squamiform spine covering of epiphysis (10 μm). (Scale lengths in parentheses.)



Figures 263–268.—*Metaphatus ochraceus*, new species: 263, metathoracic tibial spur showing basal campaniform sensillum (200 μm); 264, detail of campaniform sensillum in 263 (10 μm); 265, caudal view of female ovipositor (200 μm); 266, detail of 265 showing spine structure of 8S (20 μm); 267, detail of spines of 8S in 265, 266 (8 μm); 268, spicules of inner lateral wall of colliculum (20 μm). (Scale lengths in parentheses.)



FIGURES 269–272.—*Metaphatus ochraceus*, new species, structure of bursa copulatrix: 269, spicules of inner dorsal wall of colliculum (20 µm); 270, detail of 269 (4 µm); 271, spicules of inner wall of corpus bursae (20 µm); 272, signum inside corpus bursae (10 µm). (Scale lengths in parentheses.)

2♀, 26–27 Dec 1981; Nielsen & Karsholt. San Martin de los Andes, 1♀, Nov–Dec 1980, S. Shachovskoj. San Martin de los Andes, 640 m, 1♂, 18 Aug 1981; 1♀, 21–27 Sep 1981; 1♂, 29 Sep 1981; 1♀, 5 Oct 1981; 2♂, 1♀, 7–15 Nov 1981, Nielsen & Karsholt. *Rio Negro Prov.:* Lago Nahuel Huapi, Puerto Blest, 770 m, 6♂, 3♀, 17 Dec 1978; 4♂, 2♀, 18 Dec 1978; 3♂, 20 Dec 1978; 1♂, 22 Dec 1978; 1♂, 4♀, 23 Dec 1978; 1♀, 1 Jan 1979, 1♂, 2 Mar 1979, E.S. Nielsen; same locality; 3♂, 1♀, 3–8 Dec 1981; 2♂, 22 Dec 1981, Nielsen & Karsholt. San Carlos de Bariloche, Colonia Suiza, 810 m, 1♂, 5 Dec 1978; 1♂, 1 Jan 1979, E.S. Nielsen; same locality, 800 m, 1♂, 5–6 Dec 1981, Nielsen & Karsholt.

CHILE. *Bio Bio Prov.:* Caledonia, E of Mulchen, 700–900 m, 1♂, 6–15 Feb 1981, L. Peña. Lago El Barco, Guallali, Sta. Barbara, 1200 m, 1♀, 25–28 Feb 1981, L. Peña. *Cauquenes Prov.:* Paso Garcia, 300 m, ~23 km NW of Cauquenes, 3♂, 29–30 Nov 1981, D.R. Davis, UV light trap. Rio Tutuven, 300 m, 10 km NW of Cauquenes, 1♀, 3–4 Oct 1983, E.S. Nielsen. *Cautin Prov.:* Cerro Nielol, Temuco, 200 m, 1♀, 9 Feb 1979, D. &

M. Davis & B. Akerbergs, UV light trap. El Secreto Bog, 44 km NW of Nueva Imperial, 650 m, 1♂, 8–9 Dec 1981, D.R. Davis, UV light trap. Fundo Chacamo, 35 km NW of Nueva Imperial, 600 m, 2♂, 13♀, 17–23 Feb 1981, L. Peña; 1♂, 4♀, 5–8 Dec 1981, D.R. Davis, UV light trap. Fundo El Coigue, 27 km NE of Villarrica, 500 m, 1♂, 3♀, 28 Feb–3 Mar 1979, D. & M. Davis & B. Akerbergs, UV light trap. Fundo Neltume, 200 m, 3 km N of Villarrica, 3♂, 1♀, 27 Feb 1979, D. & M. Davis & B. Akerbergs, UV light trap. Fundo La Selva, 700 m, 48 km NW of Nueva Imperial, 2♂, 9–11 Dec 1981, D.R. Davis, UV light trap. 15 km SE of Pucón, 1♀, 22 Dec 1982, R. Brown. 3 km NE of Tolten, 3 m, 1♀, 26 Feb 1979, D. & M. Davis & B. Akerbergs. Volcan Villarrica, 1090 m, 2♂, 25 Jan 1978, C. & O. Flint. *Chiloé Prov.:* Chiloé Island, Hueque Trumao, 22 km N Quellon, 50 m, 2♂, 1♀, 26–27 Dec 1981, D.R. Davis, UV light trap. 1 km E Lago Tepuhueco, 100 m, ~40 air km SW Castro, 1♂, 1♀, 23–25 Dec 1981, D.R. Davis, UV light trap. *Curico Prov.:* El Coigo, 1♂, 1 Mar 1968, Flint & Peña. Rio Teno, 800 m, ~40 km E Curico, 1♀, 25–27 Nov 1981, D.R. Davis, UV light trap. *Linares Prov.:* Tranque de Bullileo, 800 m, 2♂, 10–12 Jan 1979, D. & M. Davis & B. Akerbergs, UV light trap. *Llanquihue Prov.:* Hornohuinco, 300 m, 11 km SW Lago Chapo, 4♂, 1♀, 29–31 Dec 1981, D.R. Davis, UV light trap. Petrohue, 4♂, 12 Mar 1959, J.F.G. Clarke. Peulla, 1♀, 9 Mar 1959, J.F.G. Clarke. Puerto Varas, 4♂, 11♀, 5 Mar 1959, J.F.G. Clarke. *Malleco Prov.:* Near Los Gringos Camp, Nahuelbuta National Park, 1300 m, 5♂, 1♀, 6–11 Jan 1982, D.R. Davis, UV light trap. Los Alpes, 650 m, Angol, 1♂, 17 Mar 1979, E.S. Nielsen. Termas de Manzanar, 700 m, Curacautin, 1♀, 19 Mar 1979, E.S. Nielsen. *Ñuble Prov.:* Alto Tregualemu, 500 m, ~20 km SE of Chovellen, 4♂, 4♀, 1–3 Dec 1981, D.R. Davis, UV light trap; 10♂, 7♀, 26–27 Jan 1979, D. & M. Davis & B. Akerbergs, UV light trap. Las Trancas, 1300 m, 21 km E of Recinto, 1♀, 17 Jan 1979, D. & M. Davis & B. Akerbergs; 1♂, 2 Mar 1968, Flint & Peña. Piedra de la Iglesia, 5 m, 8 km N of Cobquecura, 1♂, 24 Jan 1979, D. & M. Davis & B. Akerbergs, UV light trap. Recinto, 800 m, 2♂, 3♀, 22–23 Jan 1979, D. & M. Davis & B. Akerbergs, UV light trap; 1♀, 4–6 Mar 1968, Flint & Peña. *Osorno Prov.:* Parque Nacional Puyehue, Aguas Calientes to 3 km W, 450–500 m, 5♂, 5♀, 12–20 Dec 1981, D.R. Davis, UV light trap. Aguas Calientes, 450 m, 1♀, 25 Sep 1981; 1♂, 13 Nov 1981; 1♂, 10 Dec 1981; 1♀, 11 Dec 1981; 3♂, 12 Dec 1981; 1♀, 13 Dec 1981, Nielsen & Karsholt. Parque Nacional Puyehue, Anticura, 350 m, 1♂, 15 Dec 1981; 1♀, 17 Dec 1981, Nielsen & Karsholt. *Talca Prov.:* El Pantanillo, 17 km SE of Constitución, 350 m, 2♀, 28 Nov 1981, D.R. Davis, UV light trap. Forel, Carrizalillo, 250 m, 2♂, 3♀, 30 Jan–5 Feb 1981, L. Peña. *Valdivia Prov.:* Rincon de la Piedra, 180 m, 20 km S Valdivia, 3♀, 24 Sep 1981; 1♀, 15 Nov 1981, Nielsen & Karsholt; same locality; 30 m, 1♂, 2♀, 24–25 Feb 1979, D. & M. Davis & B. Akerbergs, UV light trap. Valdivia, 5 m, 1♂, 22 Feb 1979, D. & M. Davis & B. Akerbergs, UV light trap.

Paratypes in AMNH, ANIC, BMNH, CNC, CU, FSCA, LACM, LEP, MACN, MHNS, MLP, MNHP, MNNH, NZAC, TMP, UCB, USNM, and ZMUC.

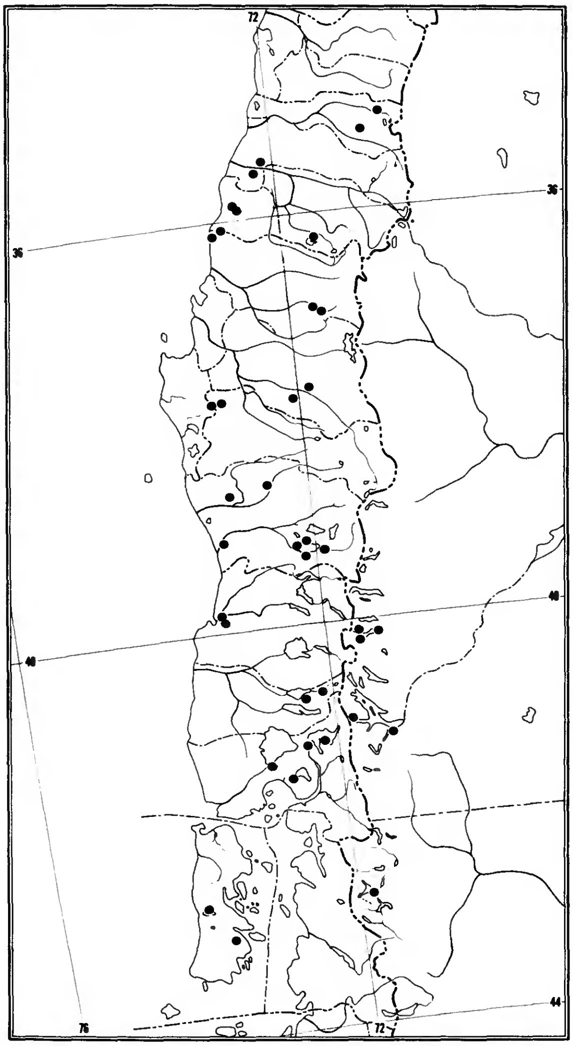
HOST.—Unknown.

FLIGHT PERIOD.—18 August to 19 March; perhaps multivoltine.

DISTRIBUTION (Map 6).—*Metaphatus ochraceus* is one of the most common species of Palaephatidae, occurring widely from near sea level to 1300 m and from Talca Province, Chile (35°50′S) south to Chiloé Island, Chile, and Esquel, Argentina (~43°S). It has been encountered in a number of different habitats but usually in association with *Nothofagus*.

ETYMOLOGY.—The specific epithet is derived from the Greek *ochros* (pale yellow), in reference to the predominently pale yellow color of this species.

DISCUSSION.—The adults of this species are normally light yellow but can be variously marked with brownish fuscous. A few, more heavily marked specimens even possess a forewing pattern approaching rubbed or lightly



MAP 6.—Distribution of *Metaphatus ochraceus*.

marked examples of *M. ichnius*. The latter unquestionably is the most closely allied to *M. ochraceus*, and they may be distinguished by their different forewing color and by several genital characters. With regard to the latter, the more robust lateral anellar arms and paired inner anellar arms in the males of *M. ochraceus* are particularly diagnostic. As many as three spermatophores have been found inside the corpus bursae of a single female. The spermatophore (Figure 566) of this species is more elongate than that of *M. cirrhus* and possesses a prominent digitate lobe, which arises subapically from the sharply curved apical neck.

Metaphatus ichnius, new species

FIGURES 411, 470–473, 567, 576; MAP 5

ADULT (Figure 411).—Length of forewing: ♂, 8.5–9 mm; ♀, 9–9.6 mm. A moderately small moth with dark brown forewings irregularly streaked with heavy, sinuate, white to pale buff lines.

Head: Vestiture pale buff; a slight suffusion of dark brown scales at lower part of frons. Antennae approximately 0.5 the length of forewing, 38–39-segmented; scape light brown; pecten with 6–8 buff hairs; flagellum more heavily scaled and darker brown over basal third; most segments with distal half dark brown and basal half pale buff. Maxillary palpi pale buff. Labial palpi with dorsomesal vestiture pale buff, heavily irrorated with dark brown laterally and ventrally; a few dark hairs at apex of second segment.

Thorax: Pronotum pale buff. Venter white. Forewings variably marked, predominantly dark brown with a broad buff colored anal margin that continues as a crescentric white streak to discal cell and nearly extending to termen; a smaller, somewhat crescentic white to pale buff subapical streak; termen brown to gray. Hind wings pale buff along costal margin, nearly white over remainder of wing and cilia. Forelegs dark brown to fuscous dorsally; white to pale buff ventrally; tarsi indistinctly ringed with pale buff. Midlegs pale brown dorsally, whitish to pale buff ventrally. Hind legs uniformly white to pale buff.

Abdomen: Mostly pale buff, sometimes with a narrow mid dorsal streak of brown. A2 of male with a pair of lateral hair pencils arising near small, spherical glands.

Male Genitalia: As shown in Figures 470–473. Uncus acute. Gnathos poorly developed, represented by a pair (partially coalesced) of dense patches of minute spines. Valvae moderately broad, elliptial in outline, simple. Lateral antellar arms bifurcate with dorsal branch sinuate. Inner anellar arms consisting of a single pair of elongate, slender, strongly curved spines.

Female Genitalia: As shown in Figures 567, 576. Caudal margin of eighth sternite with a bilateral pair of elongate, spinose patches; each patch consisting of 1–5 rows of relatively stout spines arranged in an oblique pattern; number of rows decreasing laterally. Colliculum with posterolateral lobes moderately developed, anterolateral lobes minute but present; internal denticulation well developed, covering most of inner walls of colliculum. Corpus bursae with a pair of small, irregularly round signa, each bearing an acentric spine; walls of bursa with minute, evenly scattered spicules. Spermatheca moderately developed; utriculus relatively small, approximately 0.25 the length of corpus bursae; walls lightly covered by scattered spicules.

HOLOTYPE.—♂. 15 km SE Pucón, Cautin Province, Chile; 22 Dec 1982, UV light, R.L. Brown, type no. 101172 (USNM).

PARATYPES.—CHILE. *Cautin Prov.:* Same data as holotype, 2♂, 2♀, *Chiloé Prov.:* Chiloé Island, Hueque Trumao, 22 km N Quellon, 50 m, 2♂, 1♀, 26–27 Dec 1981, D.R. Davis, UV light trap. 1 km E Lago Tepuhueco, ~40 air km SW Castro, 100 m, 2♀, 23–25 Dec 1981, D.R. Davis, UV light trap. *Osorno Prov.:* Parque Nacional Puyehue, Aguas Calientes to 2 km S, 450 m, 3♀, 10–22 Feb 1979, D. & M. Davis & B. Akerbergs, UV light trap. Aguas Calientes to 1 km W 450 m, 1♂, 1♀, 2–5 Jan 1982, D.R. Davis, UV light trap. Paratypes in ANIC, USNM, MNHS, and ZMUC.

HOST.—Unknown.

FLIGHT PERIOD.—22 December to 22 February; univoltine.

DISTRIBUTION (Map 5).—Present records show this species to occur within the temperate Andean forests of southern Chile from Malleco Province (38°30′S) south to Chiloé Island (42°30′ S).

ETYMOLOGY.—The specific name is derived from the Greek *ichnion* (a small track or trail), in reference to the pale, sinuate streak on the forewing.

DISCUSSION.—This species is easily recognized by the predominantly dark brown forewings bearing a large, sinuate, whitish streak along the hind margin. It is most allied to the more widespread *M. ochraceus* but may be readily distinguished by its characteristic forewing pattern and male genitalia. In *M. ichnius* the lateral anellar arms possess a bifid apex, whereas in *M. ochraceus* they are more robust and trifid.

Metaphatus cirrhus, new species

FIGURES 273–282, 412, 474–477, 568, 569, 577; MAP 5

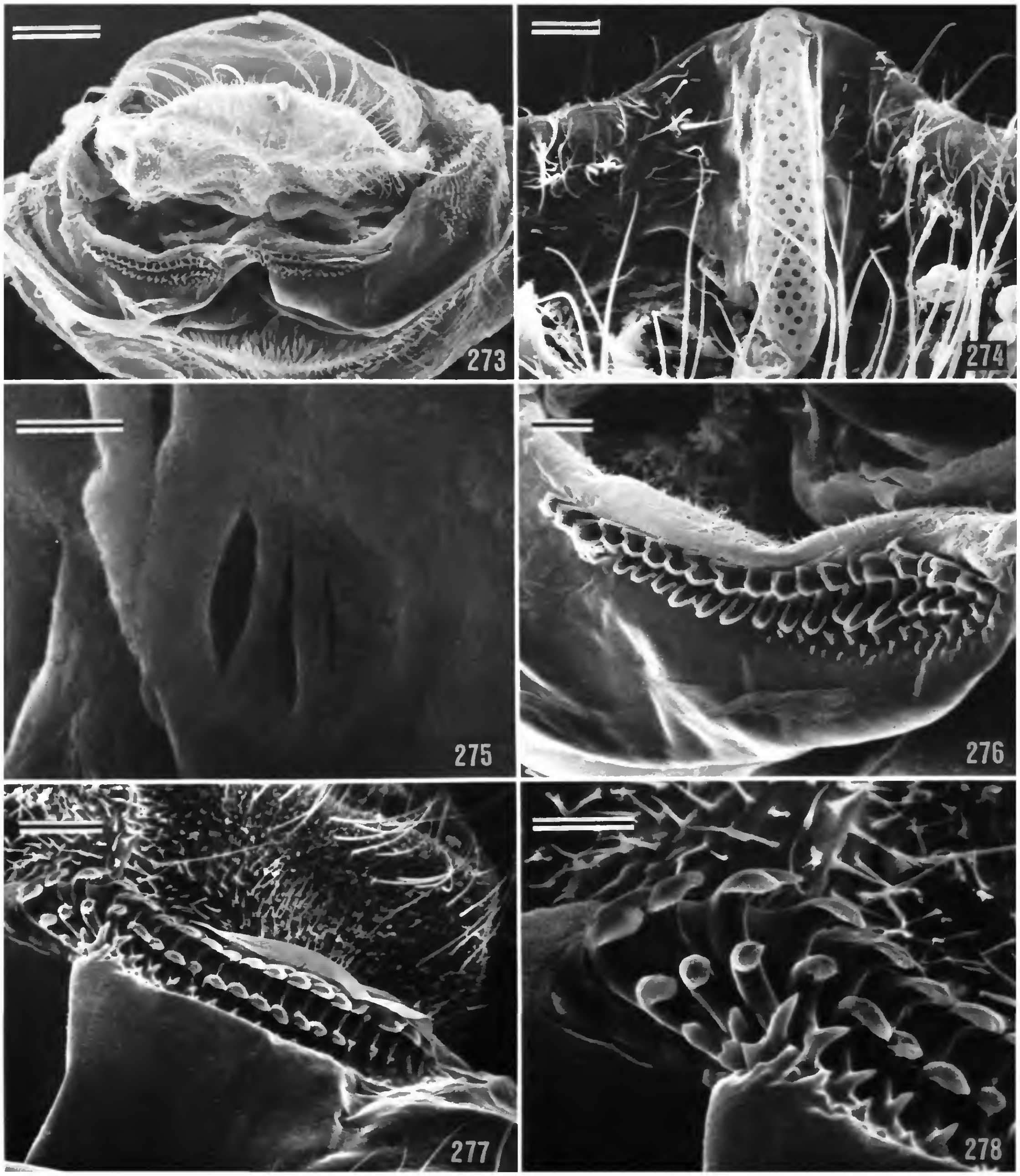
ADULT (Figure 412).—Length of forewing: ♂, 8–10 mm; ♀, 8.5–11 mm. A relatively medium-size species with yellowish brown forewings lightly marked with brown.

Head: Vestiture light brownish yellow. Antennae approximately 0.6 the length of forewing, 46-segmented, scape light reddish brown dorsally, white ventrally; pecten consisting of 10–12 brown hairs; flagellum faintly banded with buff and darker brown dorsally, naked ventrally except for numerous sensory setae. Maxillary palpi cream to white. Labial palpi white dorsally, brown ventrally; second segment with 6–8 brown hairs from apex.

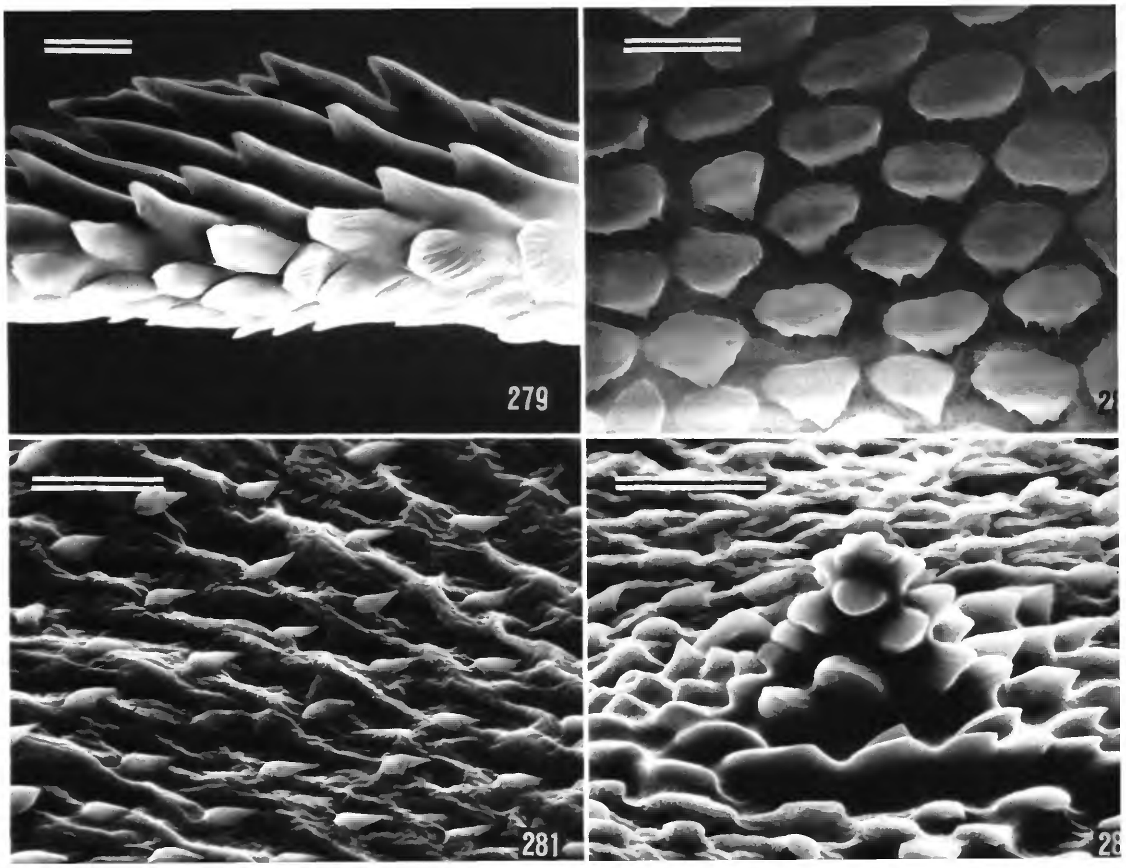
Thorax: Pronotum light brownish yellow. Venter pale cream to white. Forewings predominantly yellowish buff to darker yellowish brown, faintly marked with small patches of dark brown as follows: a small discal spot usually present in middle of cell, an oblique fascia often evident near apex of cell, and short fascia or spot sometimes present at outer fourth of costa; termen buff to medium brown. Hind wings dull white to pale brownish gray. Forelegs light brown to cream dorsally, white to cream ventrally; tarsi brownish fuscous dorsally, tipped with buff to white. Midlegs with femur uniformly cream, tibiae and tarsi buff dorsally, and faintly tipped with buff, cream to white ventrally. Hind legs uniformly cream to nearly white.

Abdomen: Pale brownish yellow to buff dorsally, buff to white ventrally. A2 of male without lateral hair pencils or associated glands.

Male Genitalia: As shown in Figures 474–



FIGURES 273–278.—*Metaphatus cirrhus*, new species, female ovipositor: 273, caudal view of ovipositor (200 μm); 274, detail of median sensory ridge with campaniform sensilla (20 μm); 275, detail of campaniform sensillum in 274, (1 μm); 276, detail of 273 showing spines of 8S (50 μm); 277, detail of 273 showing spines of 8S (80 μm); 278, detail of 277 (40 μm). (Scale lengths in parentheses.)



Figures 279–282.—*Metaphatus cirrhus*, new species, inner lining of bursa copulatrix: 279, spicules of lateral walls of colliculum (20 μm); 280, spicules of dorsal wall of colliculum (10 μm); 281, spicules of corpus bursae (20 μm); 282, signum of corpus bursae (20 μm). (Scale lengths in parentheses.)

477. Uncus slightly bilobed. Gnathos poorly developed, mostly consisting of a large medium patch of minute and very numerous spines. Valvae with a prominant, sinuate, subapical lobe from costa. Lateral annellar arms well developed, curved and extremely sinuate at apex. Inner annellar arms slender, fused ventrally. Aedoeagus approximately 0.8 the length of valva.

Female Genitalia: As shown in Figures 568, 577. Caudal margin of eighth sternite with a bilateral pair of elongate, spinose patches; each patch consisting mostly of 2 rows of stout blunt spines; posterior spines largely bidentate. Colliculum with posterolateral lobes well developed, broad; anterolateral lobes not present; internal denticulation only moderately developed, largely restricted to inner lateral margins of colliculum; most of dorsal inner walls of colliculum densely covered with placoid spicules. Corpus bursae with a pair of small, irregularly circular signa bearing knobby projections; walls of bursa with minute, evenly scattered, relatively broad spicules. Spermatheca well developed; utriculus approximately 0.5 the length of corups busae; walls lightly spiculated.

Immature Stages.—Unknown.

HOLOTYPE.—♀. Alto Tregualemu, 500 m, ~20 km SE Chovellen, Ñuble Province, Chile; 1–3 Dec 1981, D.R. Davis, UV light trap, type no. 101184 (USNM).

PARATYPES.—CHILE. *Cauquenes Prov.:* Paso Garcia, ~23 km NW Cauquenes, 300 m, 1♂, 29–30 Nov 1981, D.R. Davis, UV light trap. *Curico Prov.:* 10 km NW Rauco, 34°52'S, 71°21'W, 1♂, 2♀, 2 Dec 1982, R.L. Brown, UV light. Potrero Grande, 35 km SE Curico, 35°12.5'S, 71°W, 1♀, 6 Dec 1982, R.L. Brown, UV light. *Linares Prov.:* Tranque de Bullileo, 800 m, 1♂, 1♀, 10–12 Jan, UV light trap. *Ñuble Prov.:* Alto Tregualemu, 500 m, ~20 km SE Chovellen, 5♂, 7♀, 26–27 Jan 1979, D. & M. Davis and B. Akerbergs, UV light trap; 6♂, 2♀, 1–3 Dec 1981, D. Davis, UV light trap. 17.5 km S Caranipe, near costal stream, 50 m, 1♂, 25 Jan 1979, D. & M. Davis and B. Akerberg, UV light trap. Piedra del Iglesia, 5 m, 8 km N Cobquecura, 1♂, 24 Jan 1979, D. & M. Davis and B. Akerbergs, UV light trap. Recinto, 800 m, 2♂, 22–23 Jan 1979, D. & M. Davis and B. Akerbergs, UV light trap. Paratypes in the ANIC, BMNH, LEP, MACN, MHNS, USNM, and ZMUC.

HOST.—Unknown.

FLIGHT PERIOD.—1 December to 27 January; univoltine.

DISTRIBUTION (Map 5).—This species commonly occurs in the relatively dry *Nothofagus* forests of central Chile, from near sea level to 800 meters elevation and between 35°S and 37°S. Most records to date are from the coastal mountains, but the species has been collected at a moderate elevation (800 m) at a few Andean sites.

ETYMOLOGY.—The specific name is derived from the Greek *kirrhos* (tawny, brownish yellow), in reference to the general color of this insect.

DISCUSSION.—The typically dark, tawny color of the forewings of this species readily distinguishes it from most Palaephatidae. Some specimens, however, are paler and more yellow and may resemble *M. ochraceus* superficially. The male genitalia of *M. cirrhus*, with their peculiar, sinuate lateral anellar arms and costal process of the valvae, are unique. The species appears most allied to the *M. adustis* and *M. sinuatus* group, as evidenced by the somewhat similar, bifurcate uncus.

As many as three spermatophores have been observed within the corpus bursae of a single female. These are nearly spherical in form, abruptly narrowing to a slender, slightly coiled terminal appendage (Figure 569), which lacks a subapical process.

Metaphatus sinuatus, new species

FIGURES 413, 478–482; MAP 7

ADULT (Figure 413).—Length of forewing; ♂, 7 mm. A medium-size species, closely allied to *M. adustus*, and with light brown forewings. Female unknown.

Head: Vestiture buff with whitish apices. Antennae approximately 0.6 the length of forewing, 40-segmented; scape light brown, flecked with white dorsally; silvery white ventrally; pecten with 7–8 brown hairs; flagellum light to dark brown dorsally, tending to be darker at base of each segment; pale pubescent ventrally. Maxillary palpi pale buff. Labial palpi pale buff with darker brown vestiture laterally and ventrally; apex of second segment with a few brownish hairs.

Thorax: Pronotum buff. Venter white. Forewings light brown with a few scattered dark brown scales, mostly near base of discal cell; scales over distal fourth of wing with darker brown apices; fringe predominantly light brown with mixture of white. Hind wings uniformly whitish buff. Forelegs brown dorsally, white ventrally; tarsi with white bands. Midlegs buff dorsally; tarsal banding indistinct. Hind legs mostly white with suffusion of buff over distal tarsal segments.

Abdomen: Light brown dorsally, white ventrally. A2 of male without lateral hair pencils or associated glands.

Male Genitalia: As shown in Figures 478–482. Uncus slightly cleft, bilobed. Gnathos poorly developed, with only a largely membranous, pubescent, medial area. Vinculum-saccus relatively broad, U-shaped. Valvae elongate, moderately broad at base and then constricted at distal third; apex with a short spine directed inward. Lateral annellar arms elongate, nearly equalling length of valvae, slender, straight for most of their length, then sinuate at distal end. Inner annellar arms poorly developed, very slender, largely encircling the aedoeagus. Aedoeagus equalling length of genital capsule; anterior third extended beyond ejaculatory duct into a slender rod, arising slightly to right of midline; distal two-thirds relatively broad, simple, with a pair of moderately elongate apical spines and mesal cluster of 6–7 short spines.

IMMATURE STAGES.—Unknown.

HOLOTYPE.—♂. El Pantanillo, 17 km SE Constitución, 350 m, Talca Province, Chile; 28 Nov 1981, D.R. Davis, UV light trap, type no. 101188 (USNM).

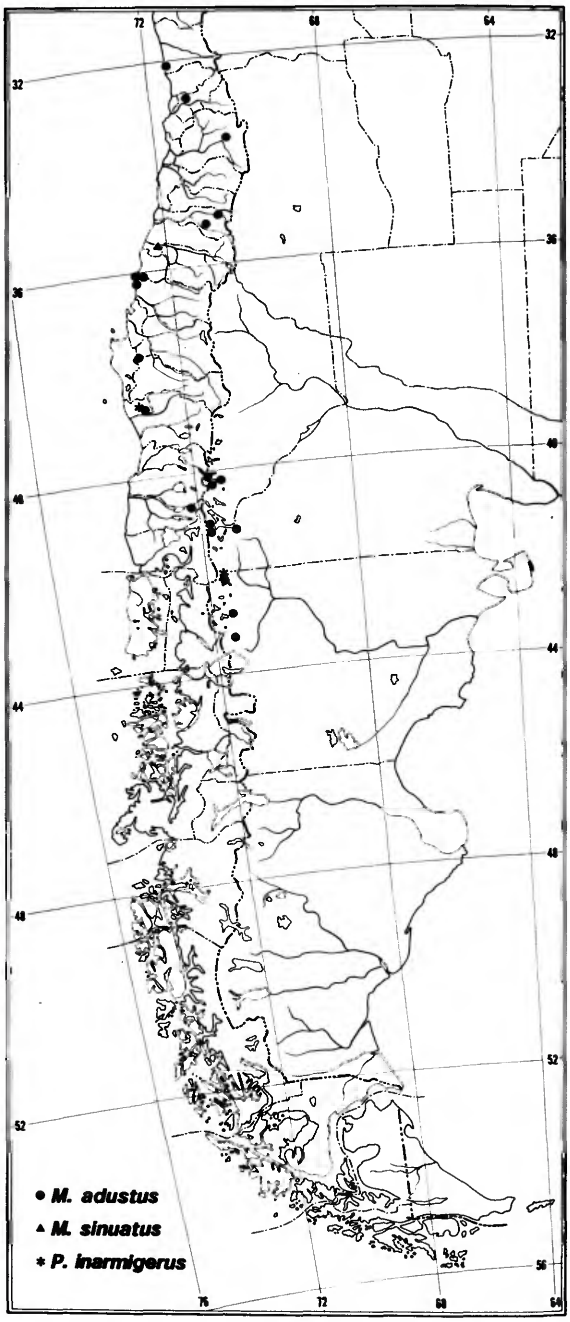
HOST.—Unknown.

FLIGHT PERIOD.—November; probably univoltine.

DISTRIBUTION (Map 7)—Known only from the type-locality, which consists of a small nature preserve situated in the coastal hills of central Chile at approximately 35°30′S. The preserve, owned by the University of Chile, encompasses only a few hectares of natural, predominantly *Nothofagus* forest, encircled by extensive pine plantations.

ETYMOLOGY.—The species name is derived from the Latin *sinuatus* (bend, curve), in reference to the sinuate apex of the lateral anellar arms in the male.

DISCUSSION.—As apparent from their very similar male genitalia, this species is closely allied to *M. adustus*. It differs from the latter in the broader vinculum-saccus, the longer, more sinuate lateral anellar arms, and by the absence of a dorsal pocket in the aedoeagus. *Metaphatus sinuatus* is known from only a single, somewhat worn specimen, the forewings of which are probably darker in fresher specimens. Also, one of the lateral anellar arms is largely missing, prob-



MAP 7.—Distribution of species of *Metaphatus* and *Plesiophatus*.

ably as a result of being broken during copulation.

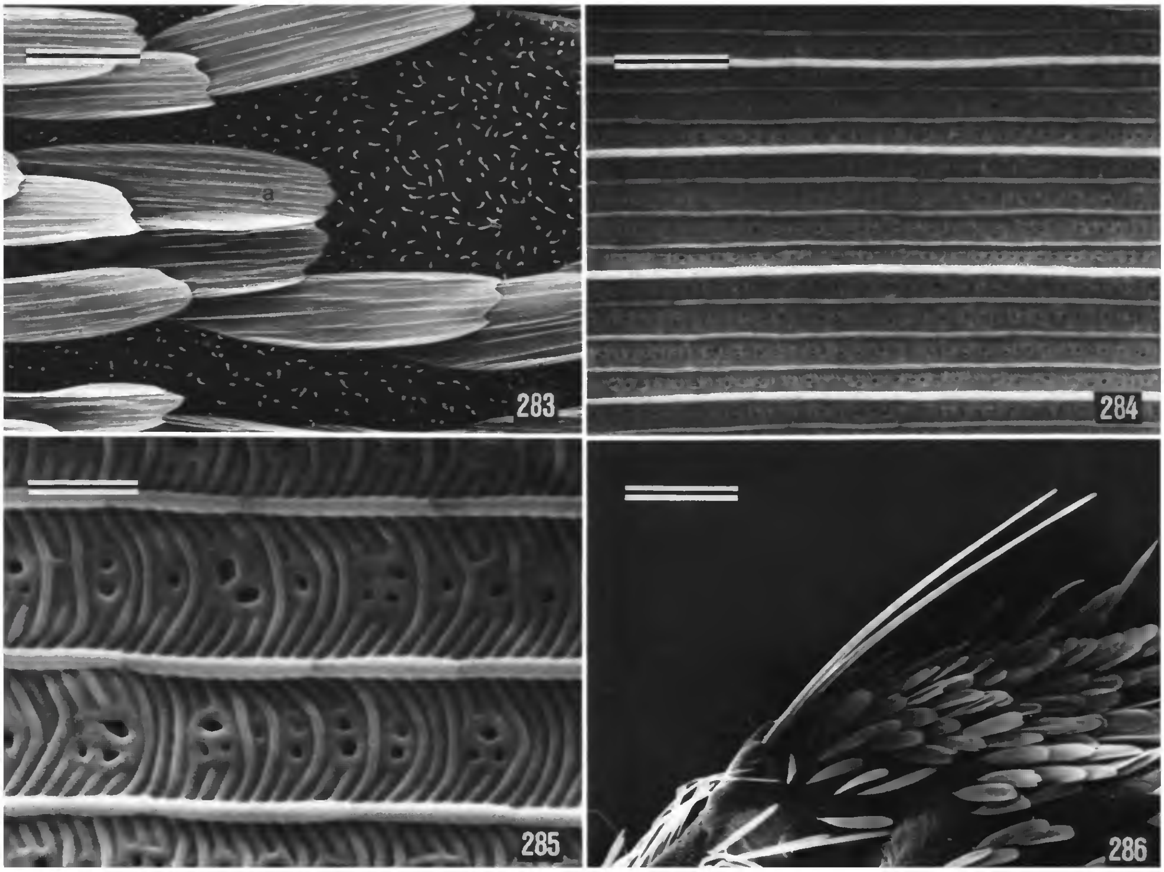
Metaphatus adustus, new species

FIGURES 283–286, 414, 483–487, 570, 578, 579; MAP 7

ADULT (Figure 414).—Length of forewing: ♂, 7.5–9.5 mm; ♀, 9–11 mm. A medium-size species possessing medium to dark brown forewings with typically two small, dark brown discal spots.

Head: Vestiture uniformly light brown to buff. Antennae approximately 0.6 the length of forewing, 46-segmented; scape light brown dorsally, white ventrally; pecten consisting of 10–12 brown hairs; flagellum light brown dorsally; naked ventrally except for pale pubescent sensory setae. Maxillary palpi pale buff. Labial palpi white dorsally, brown ventrally; apex of second segment with a cluster of 4–6 brown hairs.

Thorax: Pronotum light to medium brown. Venter pale cream to white. Forewings uniformly medium to dark brown except for a pair of small, dark brown discal spots arranged in a longitudinal row, occasionally on rubbed specimens only a single spot evident; under 10×–20× magnifi-



FIGURES 283–286.—*Metaphatus adustus*, new species, wing structure: 283, dorsal hind wing near middle of discal cell (50 μm); 284, detail of scale "a" in 283, note variable ridge dimorphism (5 μm); 285, detail of inter-ridge structure (1 μm); 286, female frenulum (200 μm). (Scale lengths in parentheses.)

cation, forewing can be observed to consist of a mixture of light and dark brown scales with one or the other dominating; termen usually dark brown with white-tipped scales. Hind wings pale cream to white. Forelegs light to dark brown dorsally, white ventrally; tarsi tipped with white. Midlegs similar to forelegs in color except often lighter brown dorsally. Hind legs uniformly cream to nearly white.

Abdomen: Uniformly pale buff to white. A2 of male without lateral hair pencils or associated glands.

Male Genitalia: As shown in Figures 483–487. Uncus slightly cleft, bilobed. Gnathos poorly developed, with only a largely membranous, slightly pubescent medial area. Vinculum-saccus slender, Y-shaped. Valvae long and slender, approximately 0.5 the length of valva. Inner annellar arms extremely slender, largely encircling the aedoeagus. Aedoeagus equalling genital capsule in length; anterior third extended beyond ejaculatory duct into a long, slender rod arising slightly to the right of midline; a prominent subapical notch present; apex with a pair of slender, spines of different lengths.

Female Genitalia: As shown in Figures 570, 578, 579. Caudal margin of eighth sternite with a bilateral pair of broad, spinose patches; each patch consisting of numerous oblique rows of small, broad spines, the most posterior 4–5 rows the largest, with spines decreasing in size anteriorly. Colliculum with posterolateral lobes reduced in size; anterolateral lobes absent; internal denticulation greatly reduced, restricted to inner lateral walls of colliculum; dorsal wall covered with placoid spicules. Corpus bursae with a pair of small, irregularly circular signa bearing knobby projections; walls of bursa with minute, evenly scattered spicules. Spermatheca well developed; utriculus approximately 0.7 the length of corpus bursae; walls lightly spiculated.

IMMATURE STAGES.—Unknown.

HOLOTYPE.—♂. San Carlos de Bariloche, Colonia Suiza, 800 m, Rio Negro Province, Argentina; 2 Jan 1981, Nielsen & Karsholt (ZMUC).

PARATYPES.—ARGENTINA. *Chubut Prov.:* El Bolsón, Lago Puelo, 250 m, 1♂, 22 Oct 1981; 1♂, 23 Oct 1981, Nielsen & Karsholt. Esquel, 2–4 Jan 1982, Nielsen & Karsholt. Tecka, Corcovado, 750 m; 2♂, 17 Feb 1979, E.S. Nielsen. *Neuquen Prov.:* Lago Lacar, 5 km E of Hua-Hum, 640 m, 1♂, 25 Nov 1981, Nielsen & Karsholt. Lago Lacar, Pucará, 650 m, 1 ♂, 25 Nov 1978, E.S. Nielsen; same locality, 1♂, 28–29 Nov 1981, Nielsen & Karsholt. San Martin de los Andes, 640 m, 1♂, 21–27 Sep 1981; 7–15 Nov 1981, Nielsen & Karsholt. *Rio Negro Prov.:* Lago Frias, Puerto Frias, 780 m, 1♂, 7 Dec 1981, Nielsen & Karsholt. Lago Nahuel Huapi, Puerto Blest, 770 m, 1♀, 18 Dec 1978; 1♀, 20 Dec 1978; 23 Dec 1978, E.S. Nielsen. San Carlos de Bariloche, Colonia Suiza, 800 m, 1♂, 12–20 Nov 1981; 1♂, 23 Nov 1981; 1♂, 24 Nov 1981; 3♂, 29–30 Nov 1981; 2♀, 2 Dec 1981; 3♂, 3 Dec 1981; 1♂, 4 Dec 1981; 6♂, 5–6 Dec 1981; 8♂, 4♀, 7 Dec 1981; 4♂, 2♀, 20 Dec 1981; 1♂, 1♀, 21–22 Dec 1981; 1♂, 1♀, 22 Dec 1981; 2♀, 23 Dec 1981; 4♂, 29–30 Dec 1981; 3♂, 1♀, 5–7 Jan 1982, Nielsen & Karsholt; same locality, 810 m, 1♂, 23 Nov 1978; 1♂, 4 Dec 1978; 1♂, 7 Dec 1978; 1♂, 9 Dec 1978; 3♂, 10 Dec 1978; 1♂, 11 Dec 1978; 1♂, 12 Dec 1978; 1♂, 31 Dec 1978; 1♂, 1 Jan 1979; 1♂, 2 Jan 1979; 1♂, 11 Jan 1979, E.S. Nielsen.

CHILE. *Cautin Prov.:* El Secreto Bog, 650 m, 44 km NW of Nueva Imperial, 2♂, 8–9 Dec 1981, D.R. Davis. Fundo Chacamo, 600 m, 35 km NW of Nueva Imperial, 1♂, 1♀, 17–23 Feb 1981, L. Peña. *Cordillera Prov.:* Rio Colorado, 1100 m, ~40 km SE of Santiago; 1♂, 29–31 Oct 1981, D. & M. Davis, UV light trap. *Curico Prov.:* Potrero Grande, 35 km SE of Curico, 35°12.5′S, 71°W, 1♂, 3♀, 6 Dec 1982, R.L. Brown, UV light. Rio Teno, 800 m, ~40 km E of Curico, 1♂, 3♀, 25–27 Nov 1981, D.R. Davis, UV light trap. *Malleco Prov.:* Angol, Los Alpes, 650 m, 1♂, 17 Mar 1979, E.S. Nielsen. *Ñuble Prov.:* Alto Tregualemu, 500 m, ~28 km SE of Chovellen, 1♂, 1♀, 1–3 Dec 1981, D.R. Davis. 17.5 km S of Curanipe, near coastal stream, 50 m, 1♀, 25 Jan 1979, D. & M. Davis and B. Akerberg, UV light trap. Piedra de la Iglesia, 5 m, 8 km N of Cobquecura, 1♂, 24 Jan 1979, D. & M. Davis and B. Akerbergs, UV light trap. *Osorno Prov.:* Parque Nacional Puyehue, Anticura, 350 m, 1♀, 18 Dec 1981, Nielsen & Karsholt; same locality, 300 m, 1♂, 7–9 Mar 1979, E.S. Nielsen. *Petorca Prov.:* Los Molles, 25 m, ~10 km S of Pichidangui, 1♀, 15–17 Nov 1981, D. & M. Davis, UV light trap. *Quillota Prov.:* Cuesta El Melón, 500 m, ~8 km N of La Calera, 1♀, 2–3 Nov 1981, D. & M. Davis, UV light trap.

Paratypes deposited in ANIC, BMNH, LEP, MACN, MHNS, MLP, NZAC, USNM, and ZMUC.

HOST.—Unknown.

FLIGHT PERIOD.—21 September to 17 March; multivoltine?

DISTRIBUTION (Map 7).—This species occurs commonly throughout much of the temperate forests and outlying areas of southern montane Argentina and south-central Chile. In the coastal ranges it has been found to range from near sea level from the southern margin of the Coquimbo Desert in Petorca Province (~32°S) south to Cautin Province (38°30′S). In the Andes it occurs from Cordillera Province (~30°S) south to Chubut Province, Argentina (~43°30′S).

ETYMOLOGY.—The specific epithet is derived from the Latin *adustus* (brown, tanned), in reference to the uniformly brown forewings of this species.

DISCUSSION.—*Metaphatus adustus* is a common, rather nondescript moth with brownish forewings and cream-white hind wings. It is very closely related to *M. sinuatus,* its sister species. Examination of the male genitalia is required for separating these two, with the male of *M. adustus* characterized by its more narrow vinculum-saccus and shorter lateral annellar arms. Rubbed specimens can also be confused with *M. spatulatus* and even *M. cirrhus* and *M. ochraceus;* but examination of the male genitalia will readily identify each.

Plesiophatus, new genus

TYPE-SPECIES.—*Plesiophatus inarmigerus,* new species.

ADULT:—Moderately small moths with fuscous forewings and light gray hind wings. Male genitalia with broad, simple valvae; ovipositor of female moderately extended. Length of forewing 6–6.5 mm.

Head: Vestiture generally rough; suberect over vertex, consisting of long piliform scales with bidentate apices. Antennae approximately 0.6 the length of forewing, 46-segmented; pecten present, consisting of 5–8 dark hairs. Eyes round, smooth, relatively large; interocular index approximately 1.0; eye index 1.0. Ocelli absent. Pilifers well developed, moderately lobed, with 14–16 large piliform scales directed partially mesally and nearly meeting at midline. Mandibles vestigial, approximately 0.6 the length of third maxillary palpal segment. Maxillary palpi 5-segmented, nearly 1.5 the length of labial palpi; ratio of segments from base 0.5:0.4:0.8:1.6:1; apex of V bifid with slender apical and subapical lobes, each bearing minute, apical setae as in *Metaphatus.* Haustellum reduced, about 0.6 the length of maxillary palpi. Labial palpi 3-segmented, elongate, approximately 1.1 the length of haustellum; ratio of segments from base 0.6:1.3:1; apex of III with a subapical sensory pit.

Thorax: Forewings moderately slender, tapering to a subacute apex; length approximately 3.3 the width. Radius 5-branched; medius 3-branched; all veins arising separate from cell; 1A and 2A separate at basal third, forming an anal loop; accessory cell present; base of medius forked within discal cell. Microtrichia scattered over dorsal and ventral surfaces of both wings. Hind wings as broad as forewings; length approximately 2.6 the width. Female frenulum with 3 bristles. Medius 3-branched; all veins arising separate from cell. Androconial pockets and hair pencils absent. Forelegs with pectinated epiphysis approximately 0.5 the length of tibia; tibia about 0.6 the length of femur. Midlegs with a single large pair of apical, tibial spurs of unequal lenths. Hind legs with two pairs of large tibial spurs of unequal lengths; one pair apical and other pair arising at middle. Mesothoracic furcal apophyses prominent, well set off from secondary furcal arms; lateral apophyses enlarged, over 3 times the length of mesal apophyses. Metathoracic furcal apophyses elongate, nearly touching secondary arms; tendon arising near middle of apophysis. A pair of tendons arising from posterior end of anterior furcal ridges situated at dorsal anterior end of anteromedial process. Base of process extending 0.3 the length of furcal stem.

Abdomen: Without specialized integumental modifications such as glands or sex scales.

Male Genitalia: Uncus simple, subacute. Gnathos greatly reduced to a broad, median patch of minute spinules. Tegumen moderately developed as a relatively narrow, lightly sclerotized hood. Vinculum-saccus well developed, broad, anterior margin rounded. Valvae broad, hirsute, relatively simple except for a small spine arising at middle of outer margin. Transtilla absent. Juxta present, reduced to a narrow, transverse sclerite. Anellus absent. Aedoeagus relatively short and broad, less than length of valvae, with caudal end irregularly lobe, and without prominent endogenous or exogenous spines.

Female Genitalia: Ovipositor relatively slender and extended, terminating in a narrow, bluntly rounded apex and transverse sensory ridge; posterior apophyses straight, relatively elongate, over 1.5 the length of anterior apophyses. Eighth sternite smoothly rounded, without spines. Ductus bursae highly modified into a well-developed colliculum with thickened, folded walls bearing numerous placoid spicules internally. Corpus bursae relatively short, only slightly longer than colliculum; internal walls densely covered with minute spicules, becoming larger and more placoid around signum; a single signum present with numerous, short, radiating lobes, situated slightly beyond middle of corpus. Spermatheca elongate; utriculus extremely slender, without spiculated walls, and with a slender, tubular lateral lagena.

ETYMOLOGY.—The generic name is derived from the Greek *plesio* (near) added to the stem of the generic name *Palaephatus,* in reference to the close kinship of this genus and *Palaephatus.* It is considered masculine in gender.

DISCUSSION.—Although similar to *Metaphatus,* this genus appears somewhat intermediate between the former and *Palaephatus.* With most *Metaphatus* it shares a bifid apex on the maxillary palpi; a very similar, acute uncus, simple valvae, and rudimentary, hirsute gnathos in the male; and a very similarly developed colliculum in the female. It resembles *Palaephatus* in having lost all evidence of a sclerotized anellus and in possessing a more attenuated ovipositor with relative straight, posterior apophyses. This particular suite of characters, together with the unusually shortened corpus bursae, transverse sensory ridge, and simple, unspined eighth sternite of the female, easily distinguishes *Plesiophatus* from all other Palaephatidae.

The genus is represented by a single species, *P. inarmigerus,* new species, restricted to the southern temperate forests of Argentina and Chile.

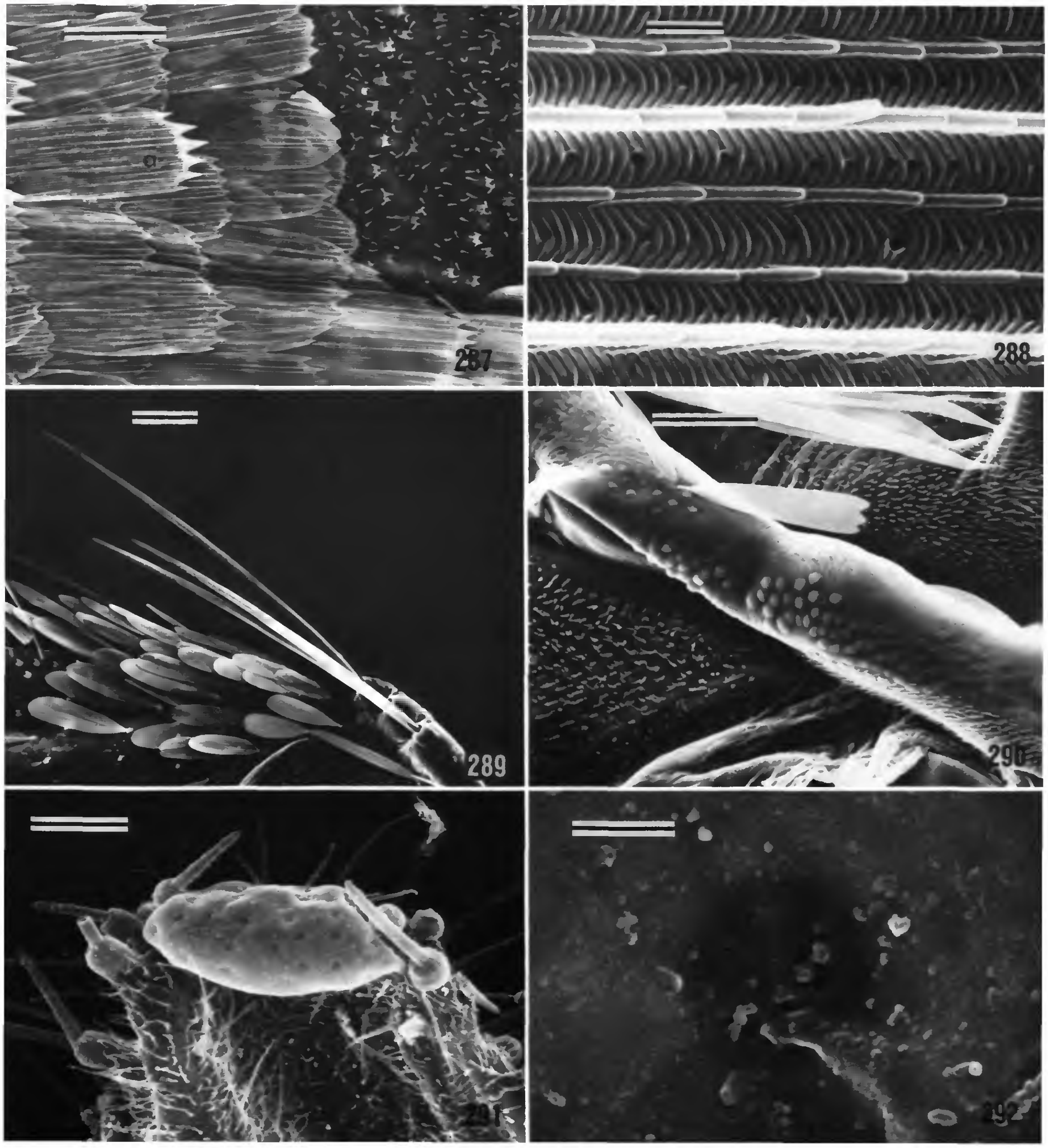
Plesiophatus inarmigerus, new species

FIGURES 20, 21, 86, 98, 113–115, 287–298, 415, 488–491, 571, 580; MAP 7

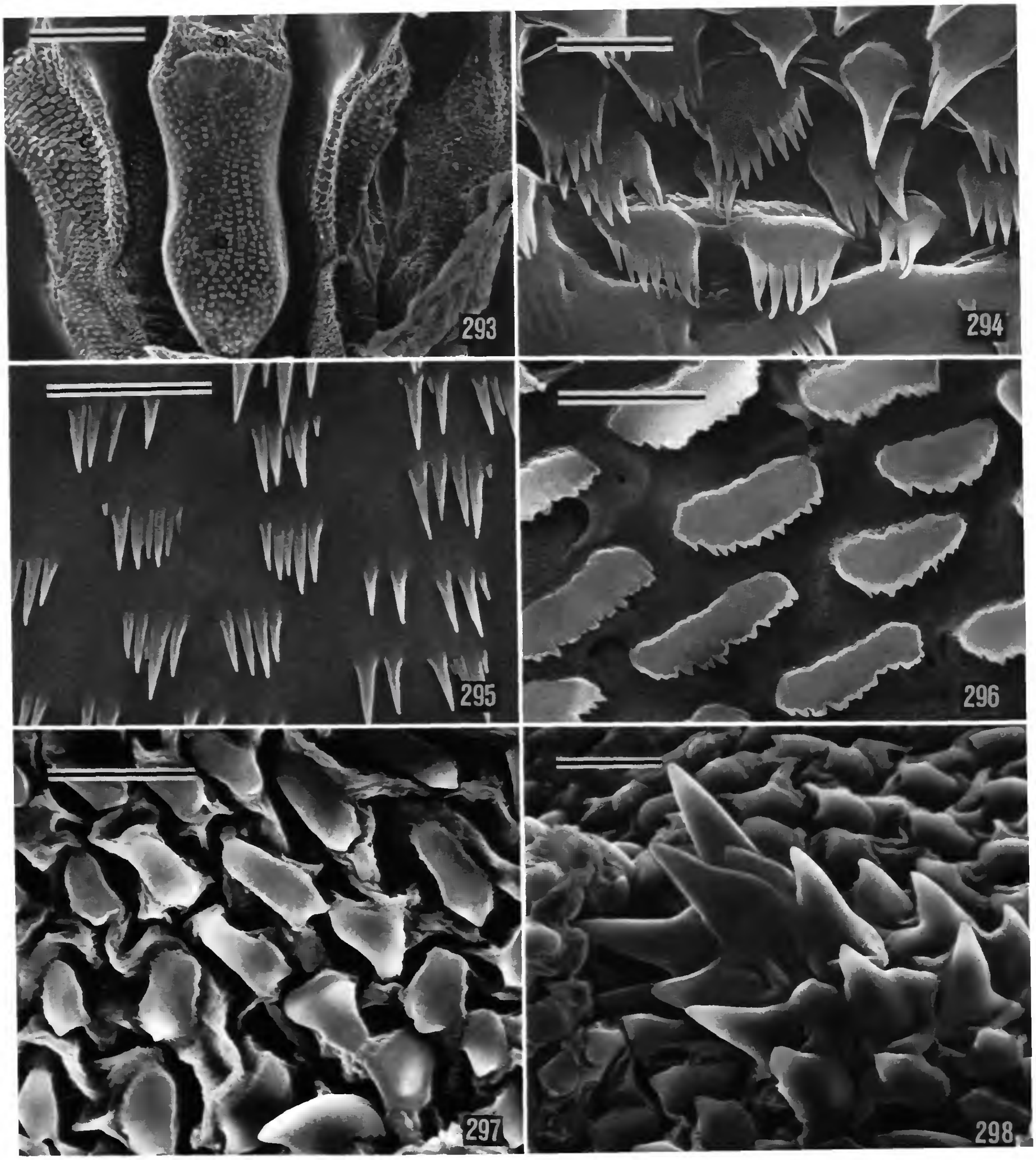
ADULT (Figure 415).—Length of forewing: ♂, 6 mm; ♀, 6–6.5 mm. A relatively small species with dark fuscous forewings and light gray hind wings.

Head: Vestiture pale gray to pale buff. Antennae approximately 0.6 the length of forewing, 46-segmented; scape pale buff to cream white; pecten consisting of 5–8 dark brown hairs; flagellum covered with cream white scales over dorsal half, naked except for dense pubescence over apical half and venter. Maxillary palpi pale buff to cream white. Labial palpi mostly cream with gray to dark brown scales laterally; second segment with 4–6 dark brown hairs laterally.

Thorax: Pronotum brown to fuscous. Venter dull white. Forewings dark fuscous with grayish scale bases visible in some areas, especially along costa; termen dark fuscous mixed with slender gray scales. Hind wings uniformly light gray to buff, occasionally with a slight golden luster. Forelegs dark fuscous dorsally with tarsal segments faintly tipped with white; cream white



FIGURES 287–292.—*Plesiophatus inarmigerus*, new species: 287, dorsal forewing near middle of discal cell (50 μm); 288, detail of scale "a" in 287 (1 μm); 289, female frenulum (100 μm); 290, dorsal base of Sc + Rs (hind wing) showing numerous campaniform sensilla (50 μm); 291, apex of ovipositor showing transverse median sensory ridge (MSR) (20 μm); 292, detail of 291 showing single companiform sensillum (1 μm). (Scale lengths in parentheses.)



FIGURES 293–298.—*Plesiophatus inarmigerus*, new species, inner lining of female bursa copulatrix: 293, inner lining of colliculum with dorsal wall peeled back to right side (100 μm); 294, detail of area "a" (cephalic end of midventral wall) in 293 (10 μm); 295, detail of area "b" in 293 (10 μm); 296, detail of area "c" (lateral wall) of 293 (10 μm); 297, detail of inner wall of corpus bursae showing irregular placoid spicules (20 μm); 298, signum inside corpus bursae (20 μm). (Scale lengths in parentheses.)

ventrally. Midlegs mostly pale buff to cream white with a suffusion of fuscous dorsally; tarsi banded with cream at apex. Hind legs uniformly pale buff to cream; tarsal banding indistinct but present.

Abdomen: Dark fuscous dorsally, cream ventrally.

Male Genitalia: As shown in Figures 488–491 and described for genus.

Female Genitalia: As shown in Figures 571, 580 and described for genus.

IMMATURE STAGES.—Unknown.

HOLOTYPE.—♂. El Bolsón, Lago Puelo, Chubut Province, Argentina; 26 February 1979, E.S. Nielsen (ZMUC).

PARATYPES.—CHILE. *Cautin Prov.:* Fundo Chacamo, 35 km NW, Nueva Imperial, 600–700 m, 2♂, 4♀, 17–23 Feb 1981, L. Peña (USNM).

HOST.—Unknown.

FLIGHT PERIOD.—17 to 26 February; univoltine.

DISTRIBUTION (Map 7).—This species is known only from the type-locality in the Andean lake region of Argentina and a somewhat disjunct site near the Chilean coast. The climate around Lago Puelo is unusually mild because of its low elevation. The Chilean locality consists of a relatively cool, moist *Nothofagus* forest situated in the mountains west of Temuco. Most of this area is in the process of being clear cut and replanted with exotic pine.

ETYMOLOGY.—The species name is derived from the Latin *inarmiger* (unarmed), in reference to the relatively simple male genitalia.

DISCUSSION.—*Plesiophatus inarmigerus* superficially resembles a few of the smaller, dark fuscous species of *Palaephatus*, particularly *P. latus*. Several features of the genitalia, as summarized in the generic description, readily distinguishes this species.

The rather scant collecting records to date suggest that *P. inarmigerus* flies only in late summer. The author collected at the Chacamo site from 5 to 11 November 1981, but did not encounter this species, although examples of three other Palaephatidae were collected. Nielsen collected at the El Bolsón locality only one day, 26 February.

Palaephatus Butler

Palaephatus Butler, 1883:82.—Fletcher, 1929:159.

TYPE-SPECIES.—*Palaephatus falsus* Butler, 1883, by monotypy.

ADULT.—Small to relatively large moths, with moderately broad, often falcate forewings. Male genitalia with an uncinate pollex from costal margin of valvae. Female with eighth sternite bilobe. Length of forewing 4.8–16 mm.

Head: Vestiture generally rough, usually consisting of long piliform scales with acute apices; scales slightly broader in subgenus *Palaephatus*, more appressed over vertex and frons, and with bidentate apices. Antennae approximately 0.5–0.9 the length of forewing, 32–58-segmented; pecten usually present in subgenus *Prophatus*, absent in subgenus *Palaephatus*. Eyes round, smooth, relatively large; interocular index approximately 1.2; eye index approximately 0.95–1.1. Ocelli absent. Pilifers poorly developed, without lobes, usually with a few small, piliform scales. Mandibles vestigial, but relatively large, about 0.8 the length of third maxillary palpal segment. Maxillary palpi 5-segmented, slender, slightly reduced, approximately 1.0–1.1 the length of labial palpi; ratio of segments from base approximately 0.8:0.7:1.4:2.9:1; apex of V nearly simple, slightly bilobed, with 4–7 minute connate setae arising from each lobe. Haustellum moderately developed, approximately equalling length of maxillary palpi. Labial palpi 3-segmented, well developed, approximately equalling length of haustellum; ratio of segments from base 0.5:1.3:1. A small sensory pit located at apex of III containing 25–30 slender sensillae.

Thorax: Forewings moderately broad, usually with a falcate apex; length approximately 2.8–3.0 the width. Radius 5-branched, medius 3-branched; all veins arising separate from cell, except in *P. amplisaccus* with R4 and 5 stalked; 1A and 2A separate at basal third to one-half in subgenus *Prophatus* (Figure 90), completely fused in subgenus *Palaephatus* (Figure 92); accessory cell present; base of medius forked within cell. Specialized sex scales absent. Microtrichia evenly scattered over both surfaces of both wings. Hind wings moderately broad, equalling or slightly exceeding width of forewings; length approximately 2.2–2.7 the width. Female frenulum normally with 3 bristles. Medius 3-branched; base of medius usually forked within cell; hind wing either unmodified in male or with one or more types of sex scale structures: (a) a dorsal hair pencil pocket at the base of Rs; (b) a slender dorsal fold containing a hair pencil parallel to the base of the medial vein; and (c) an elliptical, ventral pocket containing minute, highly modified sex scales; venation greatly modified and discal cell obliterated in those males possessing medial fold (b). Forelegs with pectinated epiphysis approximately 0.5 the length of tibia; tibia about 1.7 the length of femur. Midlegs with a single large pair of apical tibial spurs of unequal lengths. Hind legs with two pairs of large tibial spurs of unequal lengths; one pair apical and other pair arising midway along tibia. Mesothoracic furcal apophyses prominent, well set off from secondary furcal arms; lateral apophyses large, about 2.5–3 the length of mesal apophyses. Metathoracic furcal apophyses elongate; tendon arising from middle to near base of apophysis. A second pair of tendons arising dorsally from anterior end of anteromedial process. A third pair of tendons present in *P. falsus* at ventral base of anteromedial process near junction with furcal stem. Anterior furcal ridges triangular, tapering to form anterior tendons.

Abdomen: Usually without specialized integumental modifications, but with a bilateral pair of an oval cluster of broad sex scales on A2 in *P. albiterminus* and *P. fusciterminus*.

Male Genitalia: Uncus usually slightly bilobed, sometimes subtruncate to subacute. Gnathos usually present, highly variable in form. Tegumen reduced to a narrow dorsal ring. Vinculum variable in form, usually reduced and short, with little or no evidence of a saccus, occasionally broad and elongate, or even Y-shaped. Valvae broad with a prominent, digitate, strongly uncinate lobe (pollex) arising about midway along costal margin; base of pollex with a basal process in subgenus *Palaephatus;* a prominent apical process also present on valva in subgenus *Palaephatus*. Transtilla absent. Juxta absent. Anellus absent. Aedoeagus relatively stout, longer than genital capsule, with a bifid base; armature highly variable, with or without endogenous or exogenous spines.

Female Genitalia: Ovipositor short, apex with a small median, subacute lobe bearing numerous campaniform sensillae. Posterior apophyses relatively elongate, slender, straight. Ductus bursae elongate with thickened, densely spiculated walls, relatively straight and without internal folding or modifications for a colliculum. Corpus bursae well developed, usually equalling length of ductus bursae; internal walls densely covered with minute spicules variously arranged; spicules usually larger and more concentrated in one or two areas, especially around signum, when present. A single signum often present, but absent in some species. Spermatheca well developed, as long or longer than bursa copulatrix; utriculus usually enlarged, with short, scattered rows of spicules lining caudal half; an elongate, filamentous, lateral lagena usually present.

DISCUSSION.—Including some 13 species, and at least one other species in too poor condition to name, this genus is the most successful group in the family. Some of its members also comprise the largest and most conspicuous species of Palaephatidae, with wing spans of up to 32 mm. Most *Palaephatus* can be recognized by the somewhat falcate outer margin of the forewing. This feature, however, tends to be less produced in a few of the smaller species. Along with its sister group, *Apophatus*, new genus, the male genitalia are characterized by a strongly curved pollex on the costal margin of the valvae. In addition to the development of falcate forewings, *Palaephatus* differs from *Apophatus* in retaining several pleisomorphies also present in other palaephatids, such as the presence of an epiphysis, five-segmented maxillary palpi, and normal (i.e., non-reduced) compound eyes.

Two major divisions within *Palaephatus* are well documented. The more derived subgenus *Palaephatus* is characterized by the complete fusion of the first and second anal veins in the forewing; the loss of antennal pecten; the loss of the large piliform scales (or bristles) of the second labial palpal segment; and by the development in the males of a highly specialized, dorsal pocket near the base of the hind wings. The latter serves to store a hair pencil consisting of usually several elongate piliform scales of sponge-like structure (Figures 378, 379). A gradual reduction in the size of this pocket, and its accompanying hair pencil, is clearly evident through the four known species of this subgenus, with its total loss achieved in the fourth and most divergent species, *P. albicerus*.

Within the other, more generalized division of the genus, the subgenus *Prophatus*, other androconial organs develop on the hind wing of the male. These appear only within the *albiterminus* group, which is believed to include, in addition to *P. albiterminus*, *P. fusciterminus* as well as *P. striatus* and *P. amplisaccus*. Both an anal pocket and a medial fold are well developed in the two sister species, *P. albiterminus* and *P. fusciterminus* (Figures 87, 89). *Palaephatus striatus* has lost all trace of the anal pocket, but it still retains some vestige of a medial fold. As is true for the other two species possessing the medial fold, the male hind wings of *P. striatus* display a much modified venation and absence of a discal cell (Figure 90). A medial fold is similarly assumed to have once existed in *P. amplisaccus* but subsequently lost. A vestigial anal pocket, opening ventrally and supplied with a reduced number of specialized sex scales, is still retained in this species.

Key to the Subgenera of *Palaephatus*

Forewing with anal loop present [Figure 90]. Antennal scape usually with pecten. Second labial palpal segment with erect bristles. Male genitalia without apical process on valva [Figure 521] . . . ***Prophatus***, new subgenus

Forewing with anal loop absent, 1A and 2A completely fused [Figure 92]. Antennal scape smooth, without pecten. Second labial palpal segment smooth, without erect bristles. Male genitalia with apical process on valva in addition to prominent subapical pollex [Figure 534] . . . . subgenus ***Palaephatus***

Prophatus, new subgenus

TYPE-SPECIES.—*Palaephatus albiterminus*, new species.

ADULT.—Length of forewing 4.8–15 mm.

Head: Vestiture generally rough, consisting of long piliform scales with acute species; scales of *P. dimorphus* slightly broader and with bidentate apices. Antennae 32–58-segmented. Scape usually with a pecten consisting of 3–10 erect bristles; pecten absent in *P. striatus*. Second segment of labial palpi with 3–10 erect bristles arising from latero-ventral surfaces, typically more clustered at distal end.

Thorax: Forewings with 1A and 2A separated at basal third to half, forming an anal loop. Hind wings of male without a dorsal pocket enclosing a hair pencil; a ventral pocket containing numerous highly modified sex scales sometimes present on anal lobe of male as well as an elongate, slender fold containing a hair pencil at basal half of medial vein; fold obliterates discal cell in those males possessing such features.

Abdomen: Usually without integumental specialization; a small, lateral cluster of sex scales present on A2 in a few species.

Male Genitalia: Uncus variously modified, rounded to truncate, sometimes with shallow median cleft or depression. Gnathos variously modified, usually well developed, sometimes absent. Valvae with prominent, subapical, uncinate pollex but usually without prominent basal modification thereof; apical process absent.

ETYMOLOGY.—The subgeneric name is derived from the Greek *pro* (before) added to the stem of the generic name *Palaephatus*, in reference to the probably earlier appearance of this group as compared to the later derivation of its sister subgenus *Palaephatus*. It is considered masculine in gender.

Key to the Species of the Subgenus *Prophatus*

1. Forewing 12 mm or more in length. Sexes strongly dimorphic [Figures 416, 417]. Valva of male with apex produced [Figure 494]; pollex with basal lobe. Spermatheca of female with scattered spicules in utriculus .... ***Palaephatus (Prophatus) dimorphus***, new species

   Forewing usually less than 12 mm. Sexes differing slightly or not at all in appearance. Valva of male with rounded apex; pollex without basal lobe. Spermatheca with caudal half of utriculus lined with irregular rows of spicules [Figure 585] 2

2. Male hind wing with ventral anal androconial pocket and/or an elongate medial fold enclosing a slender hair pencil; if medial fold present, venation modified and discal cell absent [Figures 87, 89]. Pollex not directed strongly meso-ventrally 6

   Male hind wing without androconial pockets or folds; discal cell always distinct in male. Pollex directed sharply meso-ventrally [Figures 498, 508] 3

3. Male with a short ridge-like lobe immediately distad to base of pollex [Figures 509, 513]. Aedoeagus variously modified, without a single prominent cornutus 4

   Male without short lobe near base of pollex. Aedoeagus with a single large cornutal spine [Figure 500] 5

4. Forewing mostly fuscous, heavily marked with pale yellowish white [Figure 420]. Gnathos well sclerotized, roughly T-shaped [Figures 505, 507] .... ***Palaephatus (Prophatus) spinosus***, new species

   Forewing uniformly fuscous. Gnathos weakly developed, broadly U-shaped [Figure 511] ..... ***Palaephatus (Prophatus) latus***, new species

5. Forewing predominantly golden brown [Figure 419]. Male with broad subtruncate uncus [Figure 501] .... ***Palaephatus (Prophatus) nielseni***, new species

   Forewing predominantly dark fuscous [Figure 418]. Male with simple, subacute uncus [Figure 496] .... ***Palaephatus (Prophatus) leucacrotus***, new species

6. Forewing predominantely fuscous with a variably accented brownish to cream colored irregular streak along hind margin [Figures 422, 423]. Male hind wing with a relatively large, ventral anal pocket [Figures 87, 89 7

   Forewing predominantly pale brown to buff, variously streaked with dark lines or spots parallel to major veins [Figures 424, 425]. Male hind wing either without anal pocket or with pocket greatly reduced [Figure 90] 8

7. Forewing usually with very distinct, creamy white border along hind margin; termen uniformly fuscous [Figure 422]. Male with prominent, sinuate gnathos [Figure 515] . . . . **Palaephatus (Prophatus) fusciterminus**, new species

   Forewing with indistinct, brownish border along hind margin; termen with a conspicuous white apex [Figure 423]. Male without gnathos [Figure 519] . . . . . **Palaephatus (Prophatus) albiterminus**, new species

8. Antennal pecten absent. Forewing 9–11.5 mm in length; R4 and 5 separate. Hind wing of male with modified venation, discal cell absent [Figure 90] . . . . **Palaephatus (Prophatus) striatus**, new species

   Antennal pecten present. Forewing 6–8.5 mm in length; R4 and 5 stalked. Venation of hind wing unmodified, discal cell present [Figure 91] . . . . **Palaephatus (Prophatus) amplisaccus**, new species

***Palaephatus (Prophatus) dimorphus*, new species**

FIGURES 144, 145, 299–304, 416, 417, 492–495, 581, 582; MAP 8

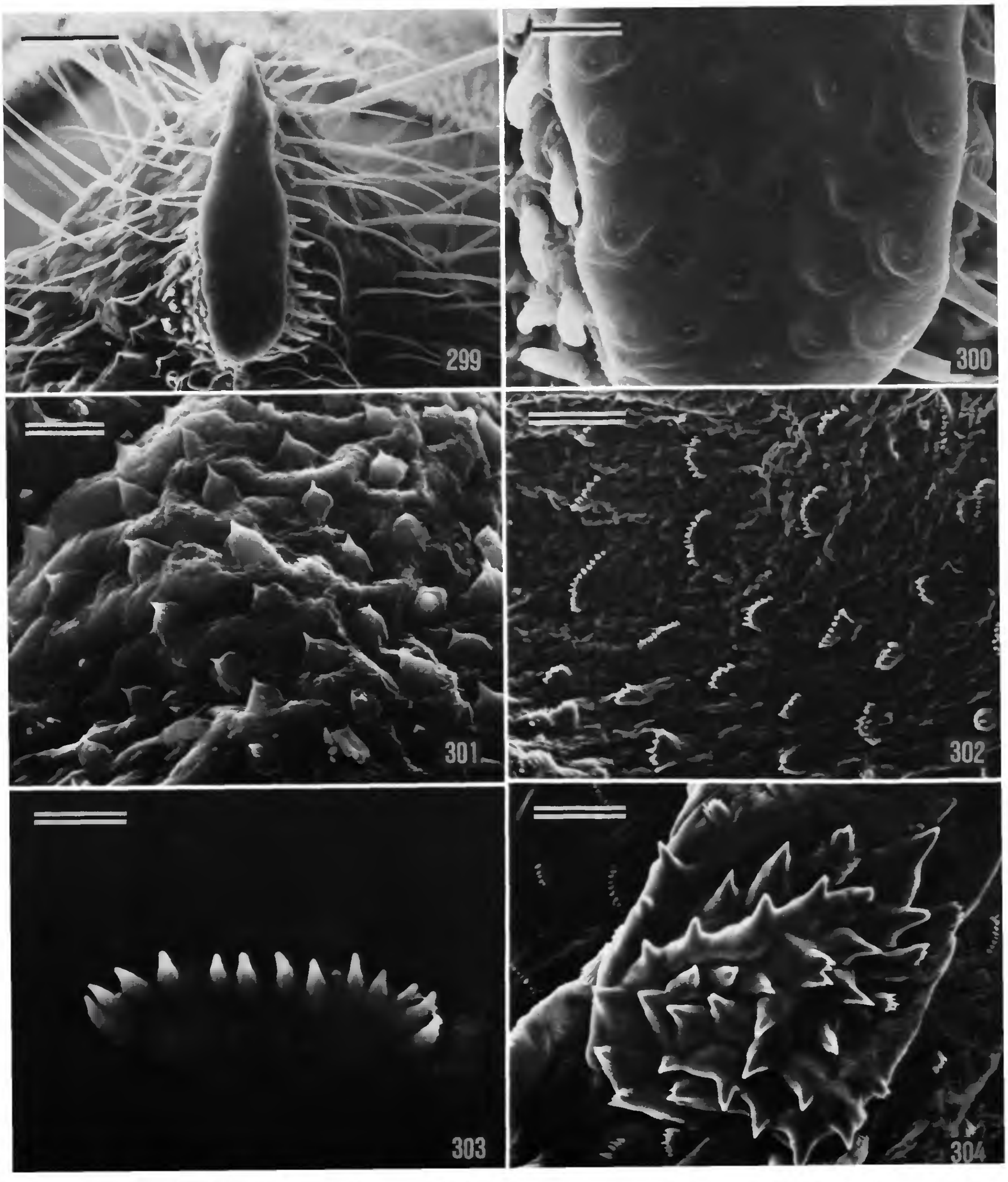
ADULT (Figures 416, 417).—Length of forewing: ♂, 12–13 mm; ♀, 13–15 mm. A moderately large moth with brownish forewings in male mottled with darker brown to fuscous; female larger, with whitish buff forewings and similar markings as in male, except female pattern with much more contrast.

Head: Vestiture light brown in male with pale buff on lower frons; whitish buff in female. Cuticle pale bluish green. Antennae approximately 0.6–0.7 the length of forewing, 42–52-segmented; scape reddish brown dorsally in male; brown to buff ventrally; pale whitish buff in female; pecten consisting of 5–7 brownish hairs; flagellum light brown to buff in male, nearly white in female. Maxillary palpi white. Labial palpi pale whitish buff, heavily irrorated laterally with dark brown scales in male, lightly irrorated in female. Second segment with a series of 6–12 whitish buff hairs laterally.

Thorax: Pronotum mostly reddish brown in male, with some scales buff-tipped; female with buff scales tipped with white. Venter predominantly dull white. Forewings light brown in male, mottled with darker brown to fuscous streaks and spots, a relatively broad, oblique brown band extending from distal third of costa halfway to tornus, sometimes linked to even fainter brown from middle of hind margin; an extremely small, white, subapical spot present; anal fold with a dark brownish fuscous patch of raised scales; fringe mottled buff and brown; female with whitish buff forewings and contrastingly darker markings similar to male; fringe mostly reddish brown. Hind wings dark gray in male, dull white to light gray in female, lightly mottled with very fine gray to fuscous markings over distal third from apex to anal angle; androconial pockets or folds absent in male. Forelegs fuscous, mottled with pale buff; apices of tibial and tarsal segments pale buff; mostly whitish buff ventrally in female. Midlegs similar to forelegs in color in male; mottled more with whitish buff in female. Hind legs pale buff mottled with fuscous; spurs ringed with fuscous on all legs.

Abdomen: Grayish fuscous irrorated with buff dorsally in male; venter heavily irrorated with buff; much paler in female, predominantly buff irrorated with fuscous.

Male Genitalia: As shown in Figures 492–495. Uncus relatively broad, with a pair of minute inner lobes and a pair of slightly larger lateral lobes. Gnathos with a prominent median process



Figures 299–304.—*Palaephatus (Prophatus) dimorphus*, new species, structure of female genitalia: 299, median sensory ridge at apex of ovipositor (50 μm); 300, detail of 299 showing campaniform sensilla (10 μm); 301, spicules lining inner walls of ductus bursae (10 μm); 302, spicules lining inner walls of corpus bursae (20 μm); 303, detail of spicule in 302 (4 μm); 304, signum inside corpus bursae (20 μm). (Scale lengths in parentheses.)

directed caudally and a pair of much smaller processes directed ventrally. Valvae with pollex only slightly curved, with a basal lobe; apex of valva produced slightly to a rounded lobe. Aedoeagus with a pair of large, subapical cornuti and a single small apical one.

Female Genitalia: As shown in Figure 582. Eighth sternite deeply divided and with a large midventral pouch. Corpus bursae densely covered with minute pectinations consisting of 6–14 spicules (Figures 302, 303); a single, small round signum at anterior end. Ductus bursae slender, with thickened, densely spiculate walls (Figures 301, 582). Spermatheca with a sparse scattering of minute spicules over inner walls of utriculus.

IMMATURE STAGES.—Unknown.

HOLOTYPE.—♂. Aguas Calientes to 2 km S, 450 m, Parque Nacional Puyehue, Osorno Province, Chile; 10–22 Feb 1979, D. & M. Davis and B. Akerbergs, UV light trap, type no. 101178 (USNM).

PARATYPES.—ARGENTINA. *Chubut Prov.:* Esquel, Lago Menéndez, Sagrario Puerto, 600 m, 4♂, 6♀, 2–4 Jan 1982, Nielsen & Karsholt; same locality, 550 m, 1♂, 1♀, 21 Feb 1979, E.S. Nielsen. *Neuquen Prov.:* Lago Lacar, 5 km E of Hua-Hum, 640 m, 1♂, 8 Oct 1981; 2♂, 14 Oct 1981; 3♂, 16 Oct 1981; 3♂, 5–6 Nov 1981; 15♂, 9♀, 25 Nov 1981; 12♂, 6♀, 26–27 Dec 1981, Nielsen & Karsholt. Lago Lacar, Pucará, 750 m, 3♂, 26 Dec 1978, E.S. Nielsen; same locality, 650 m, 1♀, 28–29 Nov 1981; 4♂, 1♀, 26–27 Dec 1981, Nielsen & Karsholt. Rio Nonthue, Estacíon Forestal Pucará, 1♀, 24 Feb 1978, C. & O. Flint. Rio Negro *Prov.:* Lago Nahuel Huapi, Puerto Blest, 770 m, 1♀, 3–8 Dec 1981; 1♀, 1–6 Jan 1982, Nielsen & Karsholt.

CHILE. *Cauquenes Prov.:* Paso Garcia, 300 m, ~23 km NW Cauquenes, 3♂, 29–30 Nov 1981, D.R. Davis, UV light trap. La Arboleda, 200–250 m, W of Cauquenes, 1♀, 22 Jan 1981, L. Peña. *Cautin Prov.:* Fundo Chacamo, 600 m, 35 km NW Nueva Imperial, 1♂, 5–8 Dec 1981, D.R. Davis, UV light trap. *Curico Prov.:* Rio Teno, 800 m, ~40 km E Curico, 1♀, 25–27 Nov 1981, D.R. Davis, UV light trap. *Llanquihue Prov.:* Hornohuinco 300 m, 11 Km SW Lago Chapo, 1♂, 1♀, 29–31 Dec 1981, D.R. Davis, UV light trap. *Malleco Prov.:* Nahuelbuta National Park, near Los Gringos Camp, 1300 m, 2♀, 6–11 Jan 1981, D.R. Davis, UV light trap. *Nuble Prov.:* Alto Tregualemu, 500 m, ~20 km SE Chovellen, 1♀, 26–27 Jan 1979, D. & M. Davis and B. Akerbergs, UV light trap. *Osorno Prov.:* Parque Nacional Puyehue, Aquas Calientes, 450 m, 1♀, 25 Sep 1981; 1♀, 25 Nov 1981; 1♀, 12 Dec 1981; 6♀, 13 Dec 1981, Nielsen & Karsholt; same locality, Aquas Calientes to 3 km W, 450–500 m, 2♂, 6♀, 12–20 Dec 1981; Aquas Calientes to 1 km W, 450 m, 1♂, 1♀, 2–5 Jan 1982, D.R. Davis, UV light trap. Parque Nacional Puyehue, Anticura, 350 m, 1♂, 18 Nov 1981; 1♂, 6♀, 19 Nov 1981; 1♀, 14 Dec 1981; 2♂, 7♀, 15 Dec 1981; 4♂, 1♀, 16 Dec 1981; 3♂, 5♀, 17 Dec 1981; 1♀, 18 Dec 1981, Nielsen & Karsholt; same locality, 300 m, 1♂, 1♀, 7–9 Mar 1979, E.S. Nielsen. Parque Nacional Puyehue, Rio Anticura, 1♀, 31 Jan–13 Feb 1978, C. & O. Flint. Pucatrihue, 1♂, 26–31 Jan 1980, L. Peña. *Talca Prov.:* El Pantanillo, 350 m, 17 km SE Constitutión, 2♂, 28 Nov 1981, D. Davis UV light trap. *Valdivia Prov.:* Ricon de la Piedra, 180 m, 20 km S of Valdivia, 1♀, 4 Nov 1981, Nielsen & Karsholt.

Paratypes in AMNH, ANIC, BMNH, LEP, MACN, MHNS, MLP, MNHP, NZAC, TMP, UCB, USNM, and ZMUC.

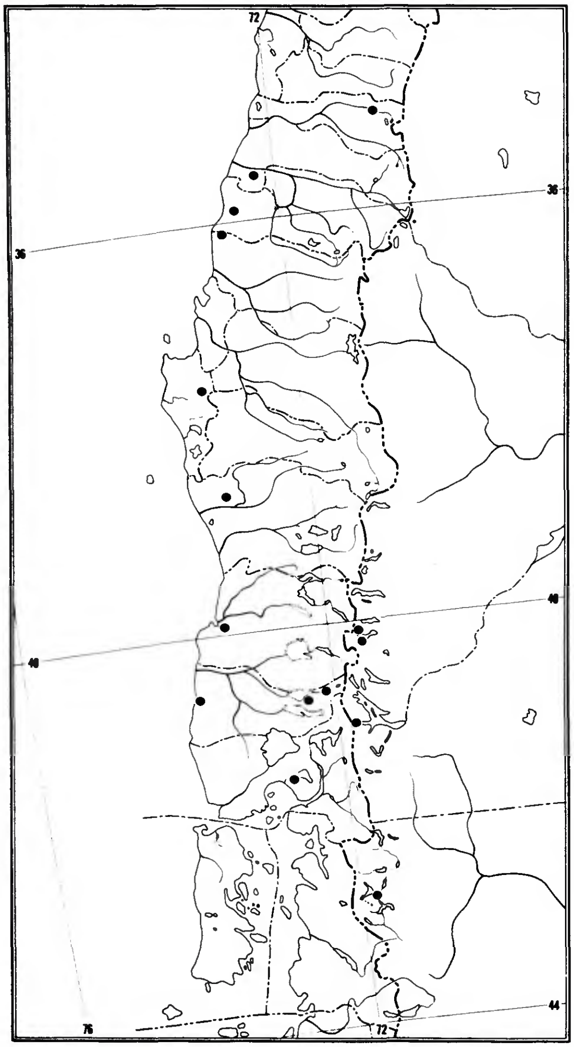
HOST.—Unknown.

FLIGHT PERIOD.—25 September to 9 March; multivoltine?

DISTRIBUTION (Map 8).—This common species occurs over much of the southern temperate forests of montane Argentina and Chile. In Argentina, it occurs primarily in the lake region from Lago Lacar south to Esquel. In Chile it has been found as far north as the Rio Teno (Curico Province) and south to Lago Chapo (Llanquihue Province).

ETYMOLOGY.—The species name is derived from the Greek *di* (two) plus *morphe* (form), in reference to the distinctive sexual dimorphism of this insect.

DISCUSSION.—*Palaephatus dimorphus* is one of the largest known members of the family, with the wing span of some females extending to 32



Map 8.—Distribution of *Palaephatus (Prophatus) dimorphus.*

mm. It also exhibits the strongest degree of sexual dimorphism in a family largely devoid of such differences. As a result, it stands relatively alone in this genus, with no obvious sister species relationships. It seems to be a valid member of the subgenus *Prophatus*, as indicated by the possession of an anal loop in the forewing and in the presence of the antennal pecten and the hair brush on the labial palpi. It may represent the ancestral stock that gave rise to the subgenus *Palaephatus*, as suggested by its pronounced sexual dimorphism and modifications of the male valvae. Another peculiarity of this species is the generalized, scattered arrangement of the spicules in the female utriculus. This feature, along with others previously mentioned, is believed to justify its current position near the base of the genus.

One to two spermatophores may be present within the corpus bursae of a single female. The spermatophore of *P. dimorphus* (Figure 582) is the most elongate and slender of any palaephatid examined. It resembles a slender, slightly sinuate rod, with little or no differentiation in width throughout its length.

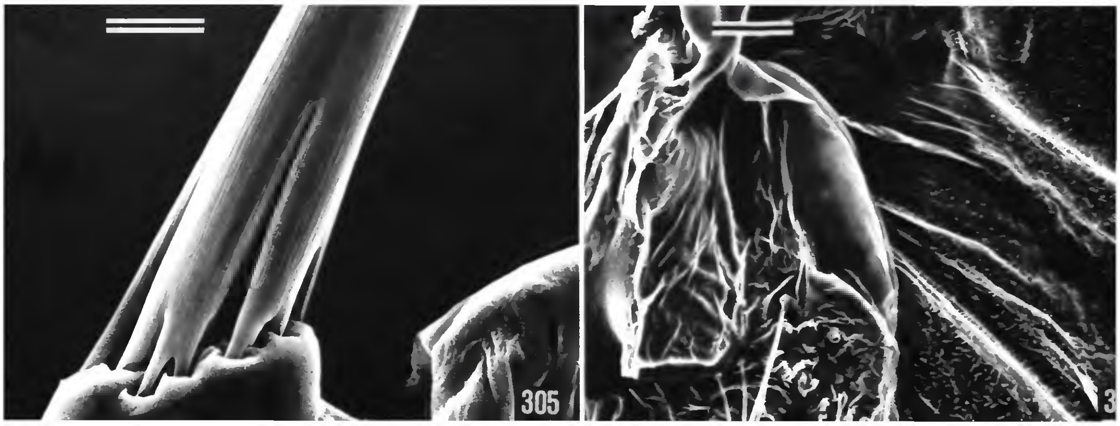
Palaephatus (Prophatus) leucacrotus, new species

Figures 88, 305, 306, 418, 496–500, 583; Map 9

Adult (Figure 418).—Length of forewing: ♂, 6–7 mm; ♀, 6.5–7 mm. A moderately small species with dark fuscous forewings irregularly mottled with light brown and white; termen with a large white spot extending from M1 to CuA1.

Head: Vestiture light brown. Antennae approximately 0.55–0.6 the length of forewing, 32–33-segmented; scape brown, tipped with white dorsally, whitish buff ventrally; pecten consisting of 8–18 brown hairs; flagellum light brown dorsally with apex of each segment ringed with dark brown, uniformly whitish buff ventrally. Maxillary palpi predominantly light brown. Labial palpi dark brown, suffused with whitish buff mesally and on basal segment; apex of second segment with a cluster of 6–8 dark brown hairs.

Thorax: Pronotum dark brownish fuscous. Venter dull white. Forewings predominantly dark fuscous, irregularly mottled with light brown and white; a very irregular, sometimes indistinct, light brown fascia at basal third; a small white spot at apex of discal cell; a similar white spot of equal size on costa near apex; a large white area on termen extending from M1



FIGURES 305, 306.—*Palaephatus (Prophatus) leucacrotus*, new species, wing structure: 305, male frenulum (20 μm); 306, dorsal hind wing, unusually prominent axillary sclerotization (anal plate?) in anal area (50 μm). (Scale lengths in parentheses.)

to CuA1; remainder of fringe fuscous. Hind wings uniformly dark gray; without androconial folds or pockets in male. Forelegs fuscous dorsally, pale whitish buff ventrally; tarsi ringed with white. Midlegs similar to forelegs except slightly paler fuscous dorsally. Hind legs pale gray dorsally, whitish buff ventrally; tarsal annulations less distinct.

Abdomen: Fuscous dorsally, whitish buff ventrally.

Male Genitalia: As shown in Figures 496–500. Uncus evenly rounded. Gnathos weakly developed as a slender, slightly curved, bridge. Valvae with simple, strongly uncinate pollex; apical process absent. Aedoeagus with a single large cornutus near apex.

Female Genitalia: As shown in Figure 583. Eighth sternite deeply cleft. Corpus bursae with two concentrations of pectinations, with each pectination consisting of rows or clusters of minute spicules; one area more concentrated and with relatively large spines forming a somewhat indistinct signum. Ductus bursae with thickened and slightly folded walls densely covered with spicules. Spermatheca of large diameter, with irregular, lightly sclerotized spinose ridges over posterior third of utriculus.

IMMATURE STAGES.—Unknown.

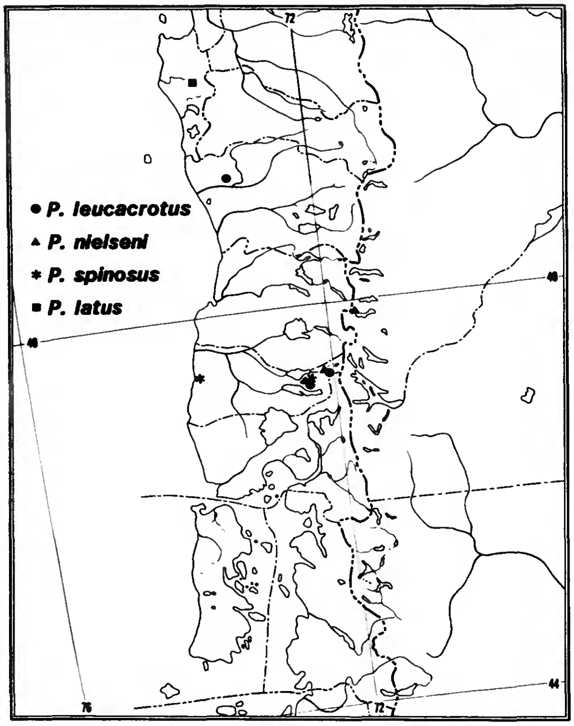
HOLOTYPE.—♂. Aquas Calientes to 3 km W, 450–500 m, Parque Nacional Puyehue, Osorno Province, Chile; 12–20 Dec 1981, D.R. Davis, UV light trap, type no. 101182 (USNM).

PARATYPES.—CHILE. *Cautin Prov.:* Fundo La Selva, 700 m, 48 km NW Nueva Imperial, 1♀, 9–11 Dec 1981, D.R. Davis. *Llanquihue Prov.:* Hornohuinco, 300 m, 11 km SW Lago Chapo, 1♂, 29–31 Dec 1981, D.R. Davis. *Osorno Prov.:* Parque Nacional Puyehue, Aguas Calientes, 450 m, 3♂, 11 Dec 1981; 5♂, 2♀, 12 Dec 1981; 4♂, 13 Dec 1981, Nielsen & Karsholt; same locality, Aguas Calientes to 3 km W, 450–500 m: 1♀, 12–20 Dec 1981, D.R. Davis. Parque Nacional Nacional Puyehue, Anticura, 350 m, 1♂, 18 Nov 1981; 1♂, 15 Dec 1981; 1♂, 1♀, 17 Dec 1981; 2♂, 18 Dec 1981, Nielsen & Karsholt. Paratypes deposited in ANIC, MHNS, MLP, USNM, and ZMUC.

HOST.—Unknown.

FLIGHT PERIOD.—18 October to 31 December; univoltine.

DISTRIBUTION (Map 9).—The range of *Palaephatus leucacrotus* appears to be rather restricted within the wetter areas of the Valdivian forest region of south-central Chile. With the exception of unique records near the coast of Cautin Province and from farther south near Lago Chapo,



MAP 9.—Distribution of species of *Palaephatus (Prophatus).*

this species has been encountered only within Puyehue National Park.

ETYMOLOGY.—The species name is derived from the Greek *leuko* (white) plus *akrotes* (extremity, tip), in reference to the large white terminal spot on the forewings.

DISCUSSION.—The forewing pattern of this species with its terminal white spot superfically resembles that of *P. albiterminus*, but the latter may be readily distinguished by its larger size and very distinct genital morphology. The sister species of *P. leucacrotus*, as shown by their similar genital morphology, appears to be *P. nielseni.* The latter can be easily recognized by its lighter, more bronzy wing pattern, as well as by the broader valvae and truncate uncus in the male genitalia.

The male frenulum is somewhat unusual in possessing prominent separations at the base (Figure 305), the most pronounced observed in any species of this family. The degree of basal setal separation, however, might be individually variable.

Palaephatus (Prophatus) nielseni, new species

FIGURES 419, 501–504, 584; MAP 9

ADULT (Figure 419).—Length of forewing: ♂, 5.2–7 mm; ♀, 6–7 mm. A relatively small moth with slightly lustrous, light bronzy forewings, irregularly marked with various shades of brown, fuscous and white.

Head: Vestiture dull white to buff. Antennae approximately 0.6–0.65 the length of forewing, 41–44-segmented; scape light brown dorsally, whitish buff ventrally; pecten consisting of 4–6 brownish hairs; flagellum banded dark brown and whitish buff dorsally; uniformly pale buff ventrally. Maxillary palpi dull white to pale buff. Labial palpi dull white to pale buff mesally, heavily suffused with light to dark brown laterally; apex of second segment with a cluster of 3–4 long brown hairs.

Thorax: Pronotum dark brown, tegulae mostly light brown to whitish buff. Venter dull white. Forewings generally light golden to bronzy brown, variously marked with patches of fuscous, reddish brown, and white scales; dark fuscous to brown scaling often present at base of costa and in an indistinct, usually interrupted, oblique band from basal third of hind margin across to middle of costa; distal third of costa with 3–4 dark brown spots separated by pale buff; termen with a dark fuscous margin; fringe brown at base, dull white distally. Hind wings uniformly gray; androconial folds or pockets absent in male. Forelegs fuscous to brown dorsally, pale buff ventrally; apices of tibial and tarsal segments tipped with whitish buff. Midlegs brown dorsally, whitish buff ventrally; tarsi darker with white apices. Hind legs pale golden brown dorsally, dull white ventrally; tarsi darker and with white apices.

Abdomen: Brown dorsally, pale buff ventrally.

Male Genitalia: As shown in Figures 501–

504. Uncus nearly truncate. Gnathos poorly developed, with a slender, median process directed ventrally. Valvae broadly rounded; pollex short and strongly uncinate; apical process absent. Aedoeagus with a single, relatively large, strongly curved cornutus situated medially.

Female Genitalia: As shown in Figure 584. Eighth sternite deeply cleft. Corpus bursae sparsely covered internally with small clusters of minute spicules; spicules rather densely concentrated near apical end. Ductus bursae with thickened, densely spiculated walls. Spermatheca with short rows of sclerotized spinose ridges over posterior half of utriculus.

IMMATURE STAGES.—Unknown.

HOLOTYPE.—♂. Lago Lacar, 5 km E of Hua-Hum, 640 m, Neuquen Province, Argentina; 14 Oct 1981, Nielsen & Karsholt (ZMUC).

PARATYPES.—ARGENTINA. *Neuquen Prov.:* Lago Lacar, 5 km E of Hua Hum, 640 m, 13♂, 2♀, 8–14 Oct 1981, Nielsen & Karsholt.

CHILE. *Osorno Prov.:* Parque Nacional Puyehue, Aguas Calientes, 450 m, 5♂, 3♀, 12–25 Nov 1981, Nielsen & Karsholt. Parque Nacional Puyehue, Anticura, 350 m, 4♂, 4♀, 18–19 Nov 1981, Nielsen & Karsholt.

Paratypes deposited in ANIC, BMNH, MACN, MHNS, USNM, and ZMUC.

HOST.—Unknown.

FLIGHT PERIOD.—8 October to 25 November; univoltine.

DISTRIBUTION (Map 9).—Present records suggest the range of this species to be restricted within the wetter areas of the Valdivian forest region of southern Argentina and Chile. Thus far it has been found only in Puyehue National Park, Chile, and in the nearby Lanin National Park, Argentina.

ETYMOLOGY.—This species is named in honor of Dr. E.S. Nielsen, in recognition of the extensive fieldwork on this and other families of primitive Lepidoptera that he has conducted in austral South America.

DISCUSSION.—This species is most allied to *Palaephatus leucacrotus*, sharing with the latter a rather early flight period and somewhat similar distribution. It may be separated from the latter by its paler, more bronzy color and by the broader valvae and more truncate uncus. The male genitalia of both species are similar in having the pollex of the valvae strongly reflexed and in the similar form of the aedoeagus, which bears a single large cornutus.

Nielsen reports (pers. comm.) that most specimens from Hua-Hum were netted at dusk while flying over fallen dead logs.

Palaephatus (Prophatus) spinosus, new species

FIGURES 420, 505–510; MAP 9

ADULT (Figure 420).—Length of forewing: ♂, 5–6 mm. A small moth with dark fuscous forewings marked by scattered, pale yellowish white scales concentrated mainly over middle third. Female unknown.

Head: Vestiture pale brownish fuscous, becoming gradually paler, more buff ventrally on frons. Antennae approximately 0.7 the length of forewing, 42-segmented; scape fuscous dorsally, with white scales ventrally; pecten with 5–6 fuscous hairs; flagellum uniformly fuscous. Maxillary palpi dull white to pale buff. Labial palpi pale buff with heavy suffusion of fuscous ventrolaterally; apex of second segment with 2–3 fuscous hairs.

Thorax: Pronotum fuscous. Venter pale buff. Forewings dark fuscous with a slight bronzy luster; a scattered series of dull white to pale yellowish white scales concentrated across middle third of wing, forming a very irregular oblique band; a small concentration of scattered pale yellowish scales also near tornus; termen fuscous, with a prominent white median segment and very small, whitish apical and tornal spots. Hind wings uniformly dark gray. Forelegs fuscous dorsally, pale buff ventrally; tibiae and tarsi distinctly banded with pale buff. Midlegs similar to forelegs in color. Hind legs much paler, grayish dorsally, pale buff ventrally, banding indistinct.

Abdomen: Fuscous dorsally, buff ventrally.

Male Genitalia: As shown in Figures 505–510. Uncus rather prominently bilobed; lobes subacute. Gnathos of highly irregular but nearly symmetrical in outline and darkly sclerotized; posterior margin serrate to spinose; anteromedial lobe of gnathos rounded and extending to saccus; a single pair of large, asymmetrical spines projecting laterally. Apex of valvae rounded, without apical process.

IMMATURE STAGES.—Unknown.

HOLOTYPE.—♂. Aguas Calientes to 2 km S, Parque Nacional Puyehue, 450 m, Osorno Province, Chile; 10–22 Feb 1979, UV light trap, D. and M. Davis, B. Akerbergs, type no. 101173 (USNM).

PARATYPES.—CHILE. *Osorno Prov.:* Same data as holotype, 3♂, UV and malaise traps. Pucatrihue, 1♂, Feb 1980, L. Peña. Paratypes in USNM.

HOST.—Unknown.

FLIGHT PERIOD.—February; univoltine

DISTRIBUTION (Map 9)—*Palaephatus spinosus* has been found at only two forested sites in Osorno Province of southern Chile, one situated in the coastal ranges (Pucatrihue) and the other in the Andes (Puyehue National Park).

ETYMOLOGY.—The specific name is derived from the Latin *spinosus* (thorny), in reference to the irregular, spinose processes of the gnathos.

DISCUSSION.—This species is generally recognized by its small size and dark forewings, which are lightly marked with pale yellowish white. Rubbed specimens are easily confused with similarly small species such as *P. latus*, but the male can be easily distinguished by the unique form of the spinose gnathos.

In Puyehue National Park, this species was encountered only in the darkest, wettest part of the forest. Two specimens were collected in UV traps and two were found in Malaise traps.

Palaephatus (Prophatus) latus, new species

FIGURES 421, 511–514; MAP 9

ADULT (Figure 421).—Length of forewing: ♂, 4.8–5 mm. A small moth with uniformly fuscous wings reflecting a slight bronzy iridescence. Female unknown.

Head: Vestiture of vertex light brown; occiput and lower frons with whitish buff scales. Antennae approximately 0.9 the length of forewing, 58-segmented; scape brownish fuscous; pecten with 3–5 brownish hairs; flagellum uniformly brownish fuscous. Maxillary palpi white. Labial palpi dull white to whitish buff, with apical segment predominantly fuscous; apex of second segment with 4–5 fuscous hairs.

Thorax: Pronotum uniformly fuscous. Venter pale buff. Forewings uniformly fuscous with a slight bronze luster; fringe with a section of dull white scales between M1 and Cu1. Hind wings pale gray with slightly darker apices. Forelegs fuscous dorsally, whitish buff ventrally; tarsal segments not annulated. Midlegs light brown dorsally, whitish buff ventrally. Hind legs light brown dorsally, dull white ventrally.

Abdomen: Brownish fuscous dorsally, pale buff ventrally.

Male Genitalia: As shown in Figures 511–514. Genital capsule very broad, nearly as broad as long; uncus with rather widely spread, indistinct lobes. Gnathos broadly U-shaped, weakly sclerotized. Valvae with a strongly recurved pollex and a broad rounded lobe immediately distad. Aedoeagus with paired anterior lobes well developed, slender, and extending approximately two-thirds the length of the aedoeagus.

IMMATURE STAGES.—Unknown.

HOLOTYPE.—♂. Caramavida, ~100 m, Arauco Province, Chile; 17–19 Oct 1969, Flint and Baria, type no. 101171 (USNM).

PARATYPES.—CHILE. Same data as holotype, 2♂ (USNM).

HOSTS.—Unknown.

FLIGHT PERIOD.—October; univoltine.

DISTRIBUTION (Map 9).—Known only from the type-locality, which consisted of an overgrown pasture with scattered *Nothofagus*, approximately 10 km SE of Los Alamos.

ETYMOLOGY.—The specific name is derived from the Latin *latus* (broad, wide), in reference to the unusually broad male genital capsule.

DISCUSSION.—*Palaephatus latus* is distinguished by its relatively small size, broad male genital capsule and valvae possessing a relatively large subapical lobe, and by the characteristic aedoeagus. The antennae are also unusual in being one of the longest developed in any known species of the family. This species may be easily separated from its nearest relative, *P. spinosus*, by several features of the male genitalia, as mentioned in part above and as illustrated.

Palaephatus (Prophatus) fusciterminus, new species

FIGURES 89, 307–316, 422, 515–518, 585, 586; MAP 10

ADULT (Figure 422).—Length of forewing: ♂, 10–12 mm; ♀, 10.5–11.5 mm. A medium-size moth with a buff to brown head and thorax, and dark brownish fuscous forewings bearing a pale buff hind margin.

Head: Vestiture of vertex buff, usually slightly darker below antennae. Antennae approximately 0.5–0.6 the length of forewing, 45–46-segmented; scape dark brownish fuscous dorsally, dull white to buff ventrally; pecten with 8–10 whitish hairs; flagellum dark brownish fuscous dorsally, pale buff to white ventrally. Maxillary palpi pale whitish buff, fourth segment with brown scaling dorsally. Labial palpi brownish fuscous laterally, buff mesally; basal segment entirely whitish buff; 5–7 large brownish hairs arising apically and laterally along second segment.

Thorax: Pronotum dark brownish fuscous. Venter dull white. Forewings predominantly dark brownish fuscous with a prominent pale buff, slightly sinuate border extending along the hind margin to tornus; a series of 8–12 faint buff spots scattered along costa; a faint, light brown fascia extending obliquely from distal third of costa halfway to tornus; cell with a single, rather large irregular spot of light brown sometimes visible; termen and fringe mostly fuscous except for a small, whitish buff spot at apex of M2. Hind wings uniformly gray; male with a longitudinal fold near base of M containing elongate hair pencil as in *P. albiterminus*; venation of male consequently modified with discal cell obliterated; a second androconial area at anal lobe of male, consisting of an oval pocket containing two distinct types of small androconial scales. Forelegs grayish to dark brownish fuscous dorsally, buff ventrally; tarsal segments darker dorsally and prominently banded with whitish buff. Midlegs dark gray dorsally with tarsi darker and more fuscous; pale buff ventrally; tarsal banding conspicuous. Hind legs pale grayish buff dorsally except for last 4 tarsal segments, which are fuscous and banded with pale buff; dull white ventrally.

Abdomen: Pale buff to gray dorsally and ventrally; slightly darker laterally; frequently with a dark brownish fuscous midvental line; an oval patch of reddish orange androconia at lateral margin of second tergite in male; male also with long buff-colored hair tufts from pleuron over tergites A3–6.

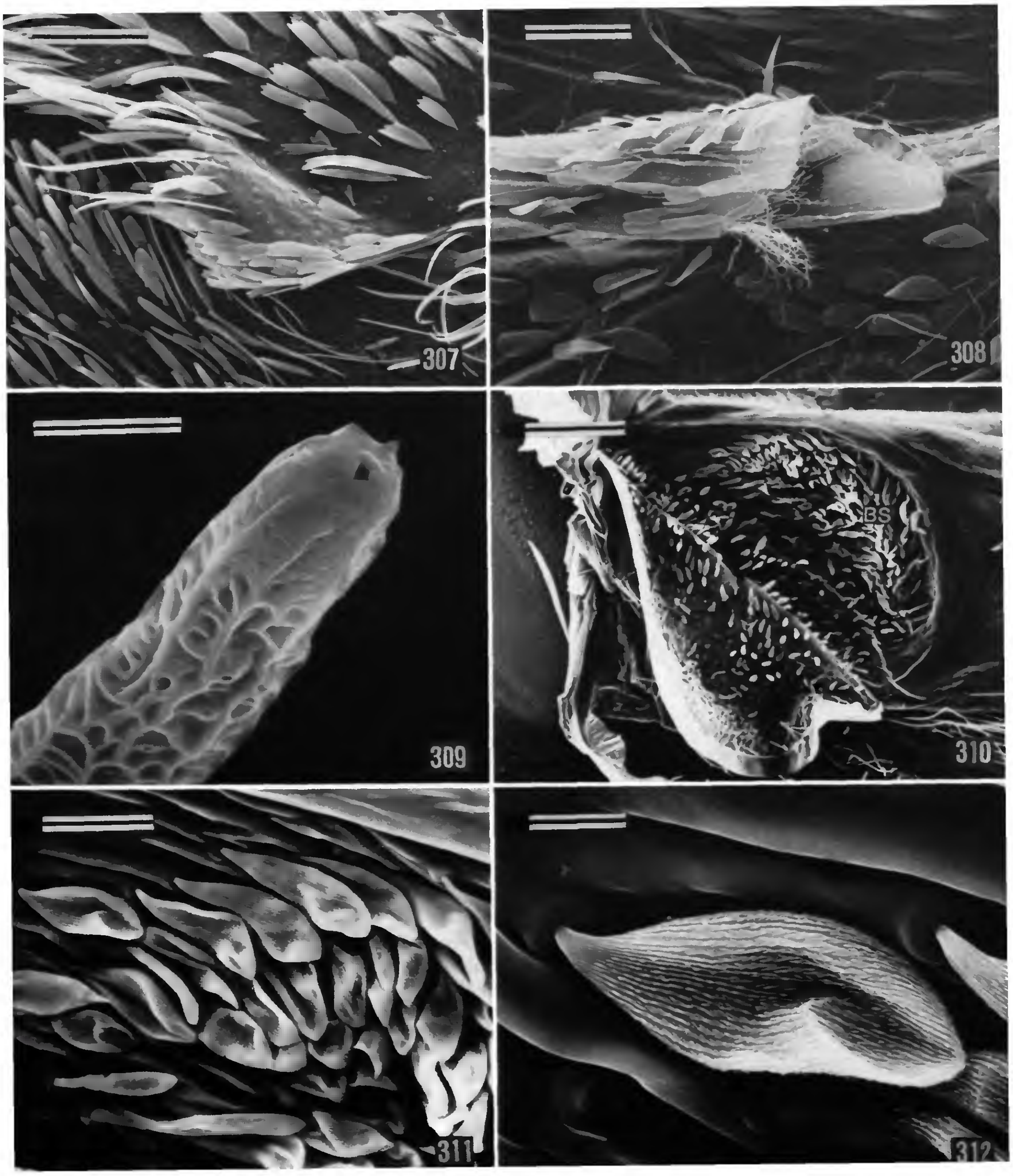
Male Genitalia: As shown in Figures 515–518. Uncus relatively broad, truncate. Gnathos well developed, produced medially into a posterior lobe; base of gnathos with an elongate, curved process with a spinose acute tip; process arises from right side and curves medially and posteriorly. Valvae without apical process. Aedoeagus bifurcate at base and bearing 4 stout spines over distal half.

Female Genitalia: As shown in Figure 585. Eighth sternite moderately bilobed. Gonopore without lobes. Corpus bursae densely covered with oval clusters of minute spicules concentrated in two large areas at middle of corpus and at anterior end; spicules particularly dense at median concentration and gradually coalescing to form an irregular placoid signum; walls of ductus bursae thick and folded, densely spiculated. Posterior half of spermathecal walls with longitudinal rows of sclerotized bands and spicules.

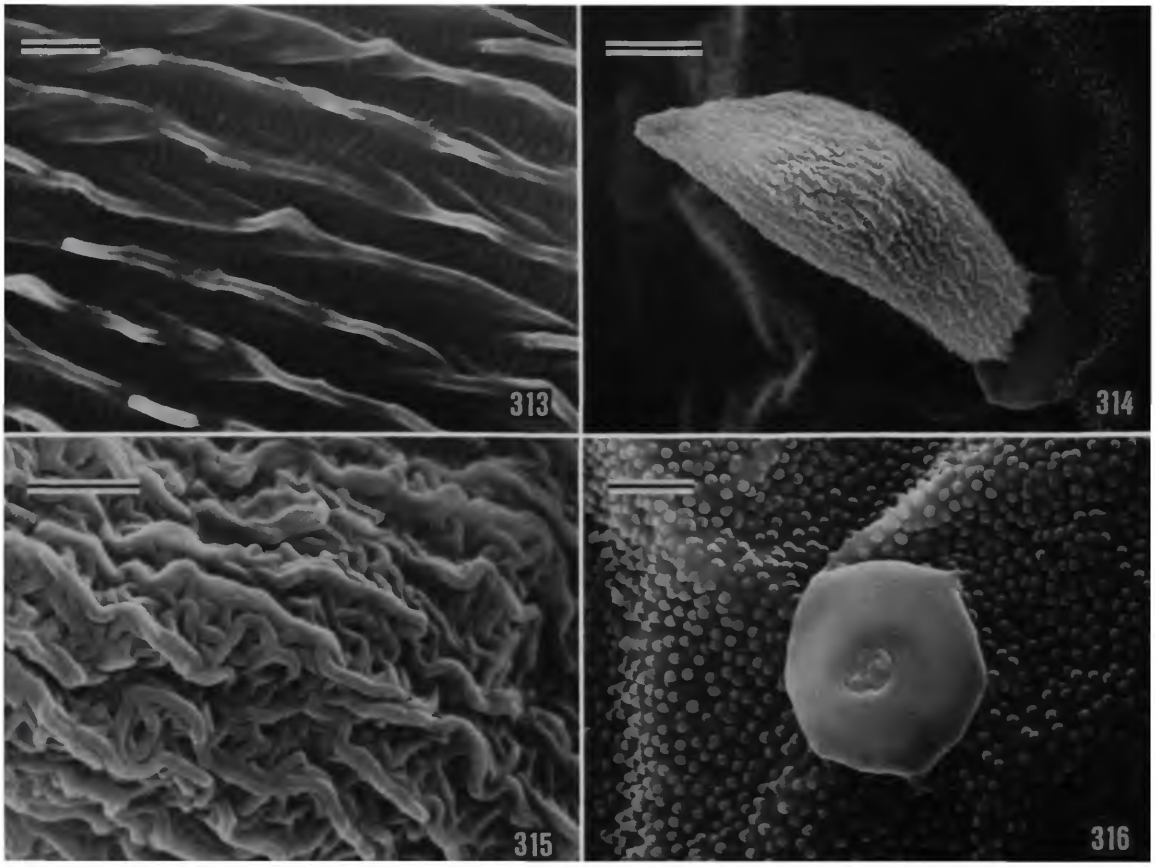
IMMATURE STAGES.—Unknown.

HOLOTYPE.—♂. Aguas Calientes to 2 km S, Parque Nacional Puyehue, 450 m, Osorno Province, Chile; 10–22 Feb 1979, UV light trap, D. & M. Davis and B. Akerbergs, type no. 101176 (USNM).

PARATYPES.—ARGENTINA. *Neuquen Prov.:* Lago Lacar, 5 km E of Hua-Hum, 640 m, 14 Oct 1981, Nielsen and Karsholt.



FIGURES 307–312.—*Palaephatus (Prophatus) fusciterminus*, new species, wing structure: 307, ventral forewing showing male retinaculum (200 μm); 308, dorsal forewing showing broken distal end of androconial fold (AnFM) with projecting hair pencil (200 μm); 309, detail of hair pencil scale (apex) in 308 (2 μm); 310, ventral hind wing, androconial pocket with ventral flap open (200 μm); 311, detail of 310 showing basement sex scales (40 μm); 312, detail of 311 of basement sex scale (10 μm). (Scale lengths in parentheses.)



Figures 313–316.—*Palaephatus (Prophatus) fusciterminus*, new species, scale structure: 313, surface detail of Figure 312 (1 μm); 314, flap scale of androconial pocket of anal area (5 μm); 315, surface detail of 314 (1 μm); 316, swollen socket of flap scale surrounded by microtubercules (2.5 μm). (Scale lengths in parentheses).

CHILE. *Chiloé Prov.:* Chiloé Island, Puntra, ~30 air km S of Ancud, 50 m, 4♂, 21–22 Dec 1981, D.R. Davis, UV light trap. 1 km E of Lago Tepuhueco, 100 m, ~40 air km SW of Castro, 1♂, 23–25 Dec 1981, D.R. Davis, UV light trap. *Llanquihue Prov.:* El Chinque, N of Correntoso (S of Volcan Calbuco), 300 m, 2♂, 20–25 Jan 1980, L. Peña. Hornohuinco, 300 m, 11 km SW Lago Chapo, 1♂, 29–31 Dec 1981, D.R. Davis, UV light trap. *Osorno Prov.:* Parque Nacional Puyehue, Anticura, 350 m, 2♂, 18 Nov 1981, Nielsen and Karsholt; same locality, 300 m, 1♂, 7–9 Mar 1979, E.S. Nielsen. Parque Nacional Puyehue, Aguas Calientes to 1 km W, 450 m, 2♂, 2–5 Jan 1982, D.R. Davis, UV light trap; Aguas Calientes to 2 km S, 450 m, 10♂, 3♀, 10–27 Feb 1979, D. & M. Davis and B. Akerbergs, UV light trap and Malaise trap. Pucatrihue, 3♂, 26–31 Jan 1980; 1♂, Feb 1980, L. Peña. Puente Hermoso, 3 km E of Pucatrihue, 1♀, 29 Jan 1978, C. & O. Flint. *Valdivia Prov.:* Rincon de la Piedra, 180 m, 20 km S Valdivia, 3♂, 2♀, 14 Nov 1981; 13♂, 3♀, 15 Nov 1981, Nielsen and Karsholt.

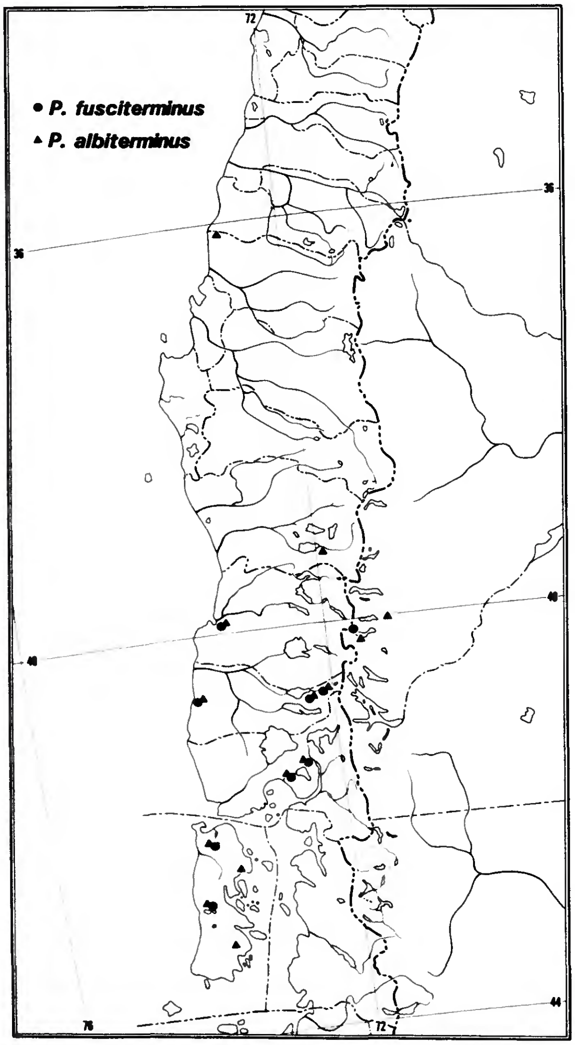
Paratypes in ANIC, BMNH, MACN, MHNS, USNM, and ZMUC.

Host.—Unknown.

FLIGHT PERIOD.—14 October to 9 March; perhaps multivoltine.

DISTRIBUTION. (Map 10).—A rather common species occurring in the Valdivian forests of southern Argentina and mostly Chile, from Lago Lacar and Valdivia (approximately 40°S) south to Chiloé Island. The Argentine record consists of a single specimen collected at a small Valdivian forest site near Hua-Hum.

ETYMOLOGY.—The specific name is derived from the Latin *fuscus* (dark, swarthy) plus *terminus* (end, limit), in reference to the predominantly dark termen of the forewings.



MAP 10.—Distribution of species of *Palaephatus (Prophatus)*.

DISCUSSION.—The very unusual sex scaling in the hind wing of the males of this species is very similar to that of *P. albiterminus* and amply demonstrates the close relationship of these two taxa. *Palaephatus fusciterminus* can be distinguished from its sister species by the fuscous termen of the forewings and by their very different male and female genitalia. This species was commonly collected with ultraviolet lights and much less so in malaise traps or by sweeping.

Two spermatophores were observed within the corpus bursae of a single female. The spermatophore (Figure 586) is slender with a tightly coiled anterior end, which possesses a prominent pair of subapical, corneate branches.

Palaephatus (Prophatus) albiterminus, new species

FIGURES 87, 103, 104, 119, 317–346, 423, 519–522, 587, 588; MAP 10

ADULT (Figure 423).—Length of forewing: ♂, 6.8–10 mm; ♀, 9–10 mm. A moderately small species with white to fuscous head and thorax and dark fuscous forewings bearing a slender, pale yellowish white spot extending along most of termen.

Head: Vestiture variable; vertex and occiput sometimes dull white, but most often fuscous; lower frons almost always fuscous. Antennae approximately 0.5 the length of forewing, 40–49-segmented; scape fuscous with a suffusion of whitish buff ventrally; pecten consisting of 4–6 fuscous hairs; flagellum fuscous dorsally; pale whitish buff ventrally. Maxillary palpi buff to brownish fuscous. Labial palpi fuscous laterally; whitish buff on inner surfaces; apex of second segment with 5–7 fuscous hairs.

Thorax: Pronotum variable; whitish buff to mostly fuscous; tegulae usually buff with dark fuscous laterally. Venter whitish buff. Forewings mostly dark fuscous, sparingly marked with pale brown to white scales; a series of 10–12 small buff spots along costal margin; a very faint brownish fascia extending obliquely from outer third of costa about halfway to tornus; a second, more basal oblique white to brownish fascia sometimes present from hind margin midway to costa; hind margin below anal vein faint brownish fuscous to buff; termen and associated cilia mostly pale yellowish white; entire wing faintly irrorated with small brownish to white spots. Hind wings uniformly gray; male with a longitudinal fold near base of M containing elongate hair pencil; venation of male consequently modified, with discal cell obliterated; a second androconial area at anal lobe consisting of an oval pocket containing two distinct types of small androconial scales. Forelegs light to dark fuscous dorsally except for grayish femur, whitish buff ventrally; apices of tibial and tarsal segments ringed with white. Midlegs similar to forelegs in color. Hind legs much paler, mostly grayish buff dorsally and dull white ventrally; dorsum of tibia with long hair fringe.

Abdomen: Brownish fuscous to gray dorsally, pale buff ventrally with a narrow, interrupted, midvental line of fuscous; an oval patch of dark reddish orange androconia at lateral margins of second tergite of male; patch usually covered by brownish abdominal scales.

Male Genitalia: As shown in Figures 519–522. Uncus narrow, with a small pair of closely adjacent lobes. Gnathos absent. Apex of valvae rounded; apical process absent. Aedoeagus complex, with 3 sets of exogenous spines and a relatively large spatulate lobe.

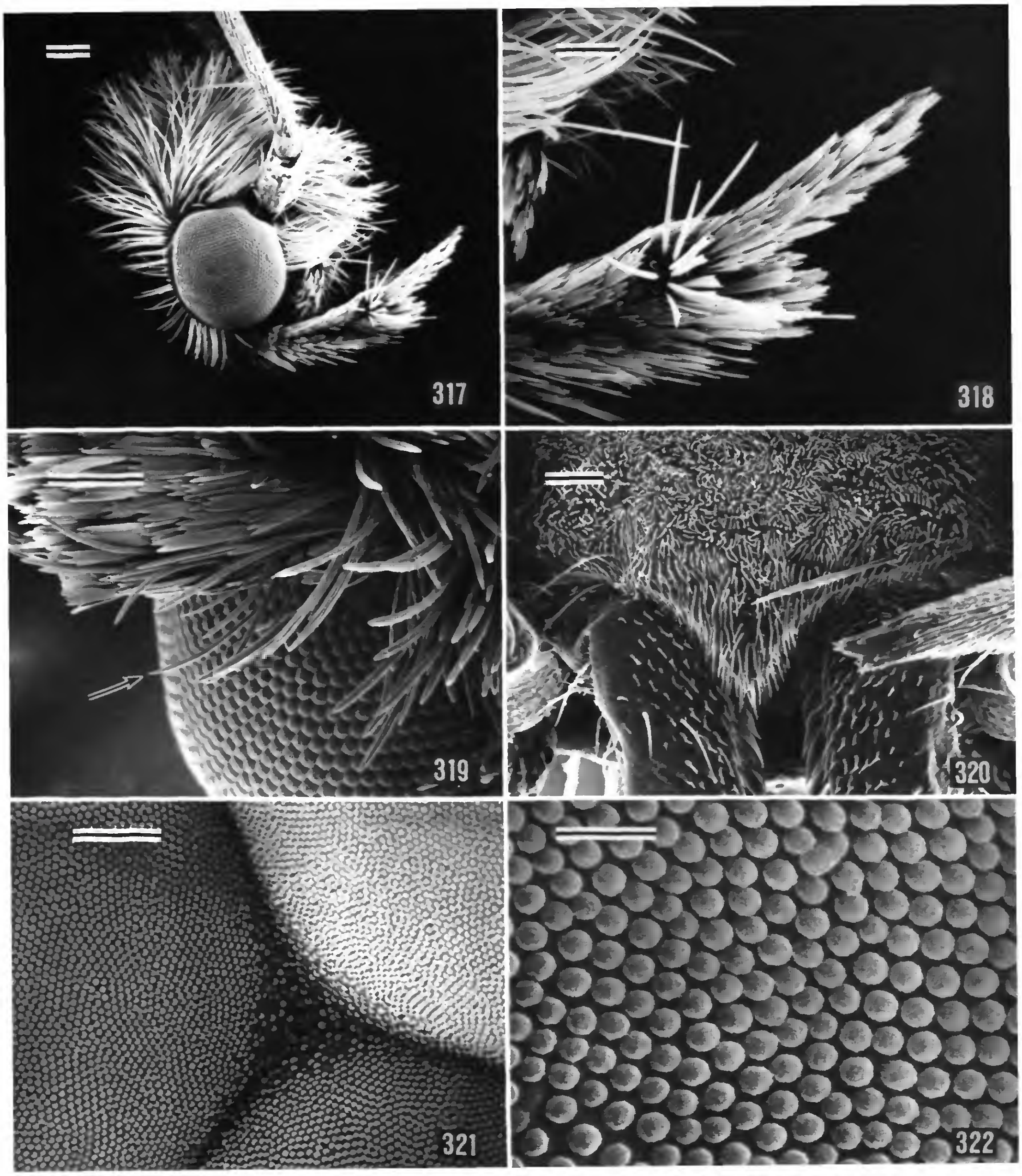
Female Genitalia: As shown in Figure 587. Eighth sternite strongly bilobed, with a prominent median excavation. Gonopore with a prominent rounded lobe from right side of opening. Corpus bursae densely lined with tiny pectinations; each row of pectination consisting of usually 6–9 minute spicules; pectinations concentrated in two large areas at middle of corpus and at anterior end; spicules particularly concentrated and enlarged around the single median signum; walls of ductus bursae thick and folded, densely spiculated. Posterior half of spermathecal walls with longitudinal rows of sclerotized bands and spicules.

IMMATURE STAGES.—Unknown.

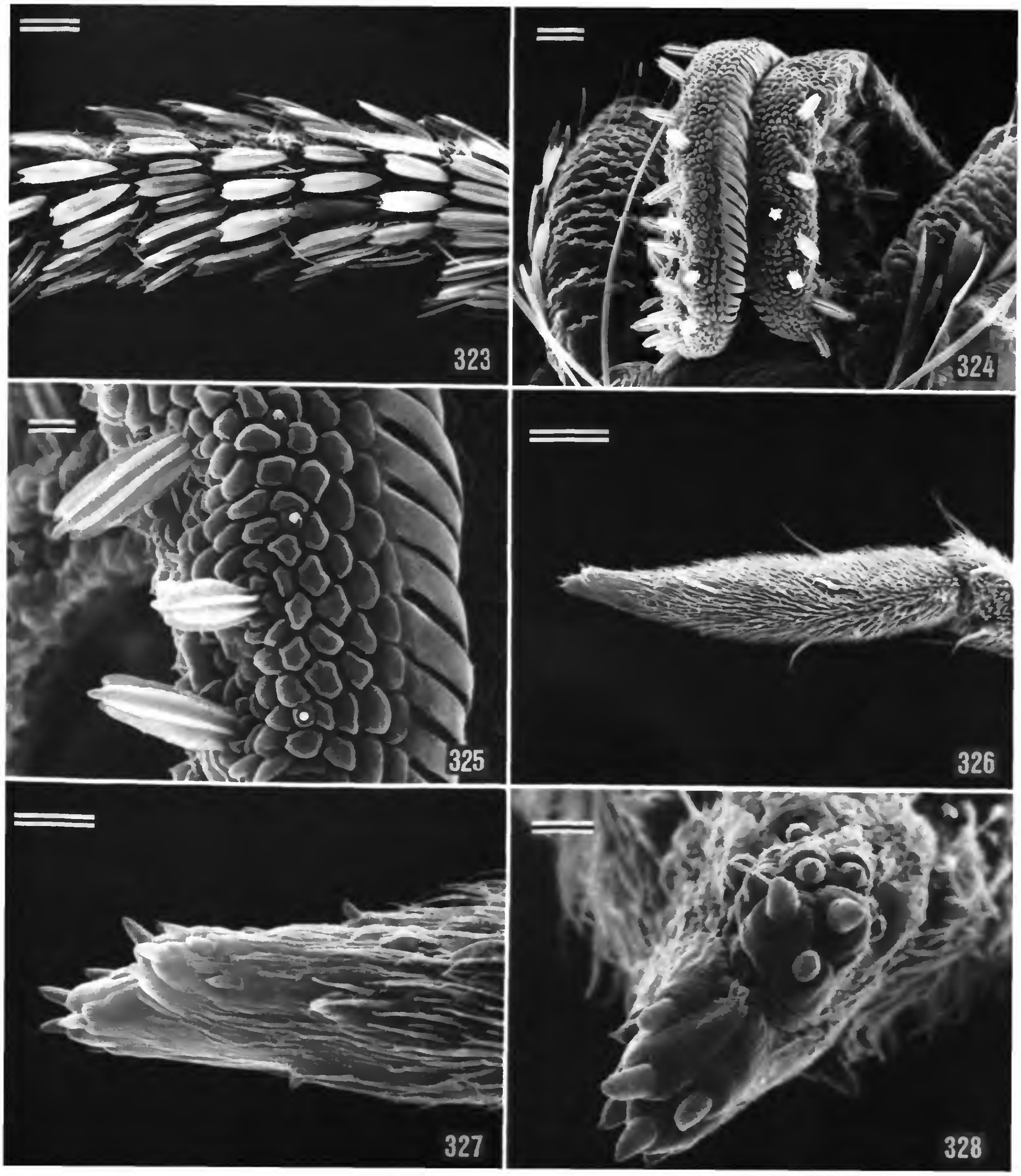
HOLOTYPE.—♂. Aguas Calientes to 3 km W, 450–500 m, Parque Nacional Puyehue, Osorno Province, Chile; 12–20 Dec 1981, UV light trap, D.R. Davis, type no. 101170 (USNM).

PARATYPES.—ARGENTINA. *Neuquen Prov.:* Junin de los Andes, Laguna Verde, 1000 m, 1♂, 25 Nov 1981, M.O. Gentili. Lago Lacar, 5 km E of Hua-Hum, 640 m, 1♂, 14 Oct 1981, Nielsen and Karsholt. Lago Lacar, Pucará, 750 m, 1♂, 25 Nov 1978; 1♂, 3 Dec 1978; 1♂, 20 Dec 1978, E.S. Nielsen.

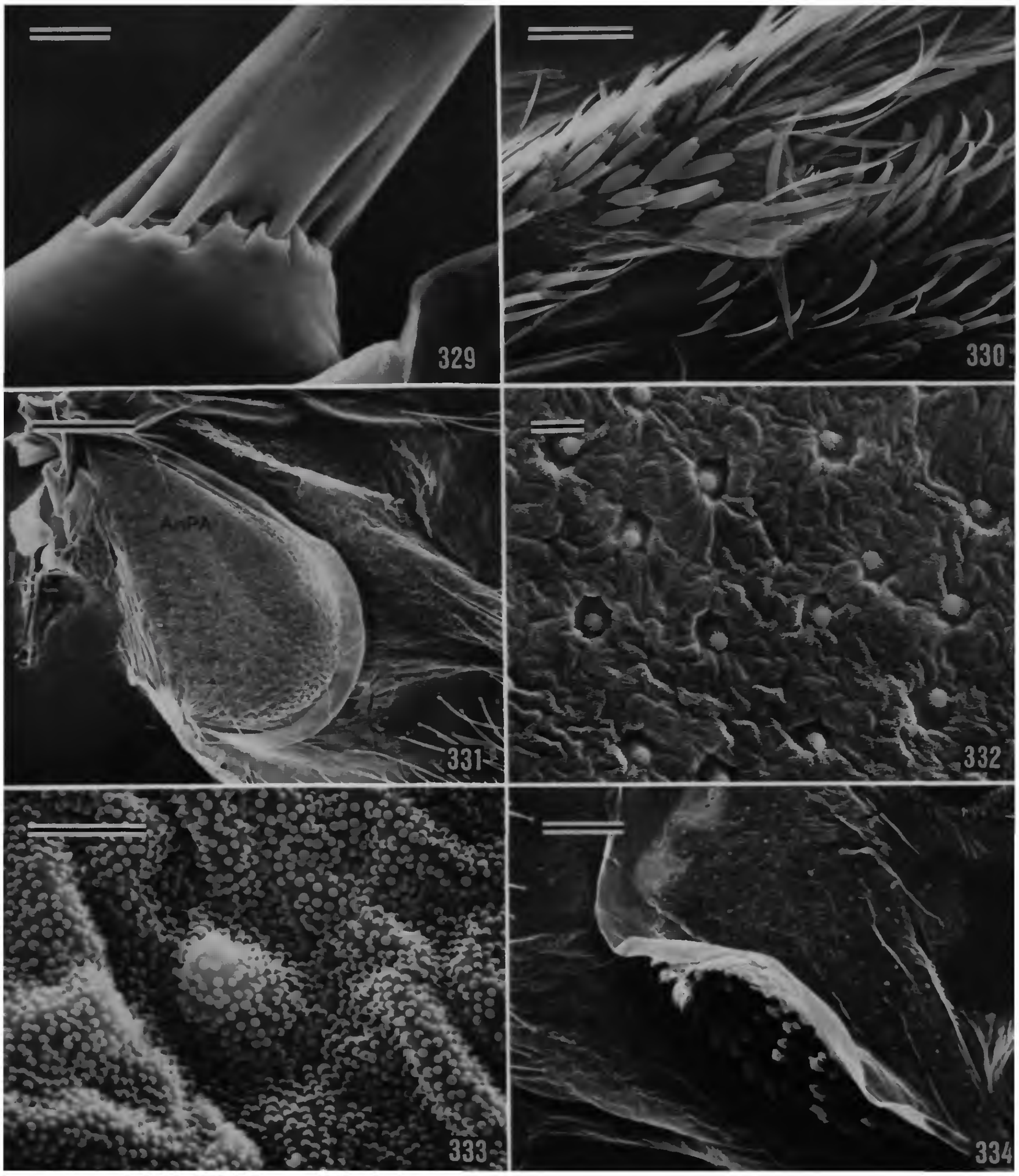
CHILE. *Cautin Prov.:* 14 km SE of Pucón, 1♂, 21 Dec 1982, R. Brown. 30 km NE of Villarrica, 1♂, 1–30 Jan 1965, L. Peña. *Chiloé Prov.:* Chiloé Island, Dalcahue, 2♂, 21–23 Oct 1969, Flint and Barria. Hueque Trumao, 22 km N of Quellon, 50 m, 24♂, 26–27 Dec 1981, D.R. Davis. Puntra, ~30 air km S of Ancud, 50 m, 5♂, 21–22 Dec 1981, D.R. Davis, 1 km E of Lago Tepuhueco, ~40 air km SW of Castro, 100 m, 1♂, 23–25 Dec 1981. *Llanquihue Prov.:* El Chinque, N of Correntosa (S of Volcan Calbuco), 300 m, 15♂, 2♀, 20–25 Jan 1980, L. Peña. Hornohuinco, 11 km SW Lago Chapo, 19♂, 1♀, 29–31 Dec 1981, D.R. Davis. *Ñuble Prov.:* Alto Tregualemu, ~20 km SE of Chovellen, 500 m, 6♂, 2♀, 1–3 Dec 1981, D.R. Davis. *Osorno Prov.:* Parque Nacional Puyehue, Aguas Calientes, 450 m, 5♂, 1♀, 11 Dec 1981, 8♂, 12 Dec 1981; 7♂, 13 Dec 1981, Nielsen and Karsholt. Parque Nacional Puyehue, Aguas Calientes, 1♂, 2♀, 6 Feb 1978, C. & O. Flint; same locality, Rio Chanlefu, 1 km S of Aguas Calientes, 1♂, 8–9 Feb 1978, C. & O. Flint; same locality, Aguas Calientes to 3 km W, 450–500 m, 15♂, 12–20 Dec 1981, D.R. Davis, same locality, to 1 km W, 450 m, 10♂, 2♀, 2–5 Jan 1982, D.R. Davis; same locality, to 2 km S, 450 m, 28♂, 3♀, 10–22 Feb 1979, D. & M. Davis & B. Akerbergs. Parque Nacional Puyehue, Anticura, 350 m, 3♂, 2♀, 18 Nov 1981; 1♂, 2♀, 19 Nov 1981; 2♂, 1♀, 17 Dec 1981; 3♂, 18 Dec 1981, Nielsen and Karsholt; same locality, Rio Anticura, 1♂, 31 Jan–13 Feb 1978, C. & O. Flint. Pucatrihue, 1♂,



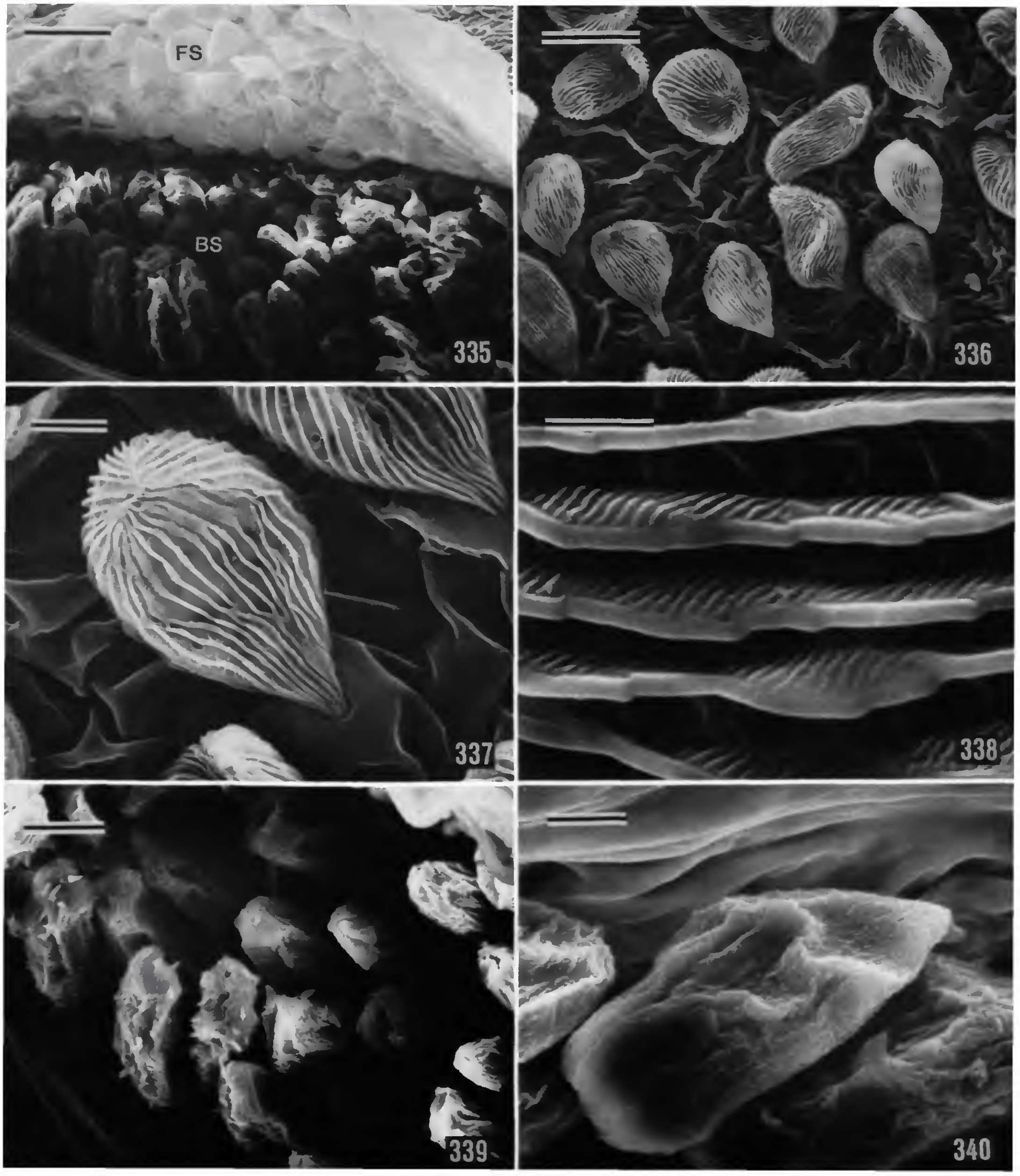
FIGURES 317–322.—*Palaephatus (Prophatus) albiterminus*, new species, head structure: 317, lateral view of head (200 μm); 318, detail of piliform setae (bristles) at apex of second segment of labial palpus (100 μm); 319, antennal pecten (see arrow) (100 μm); 320, labrum and base of galeae (haustellum) (25 μm); 321, detail of three facets showing corneal nipple array (2 μm); 322, detail of corneal nipples showing faint indication of subnipples (0.5 μm). (Scale lengths in parentheses.)



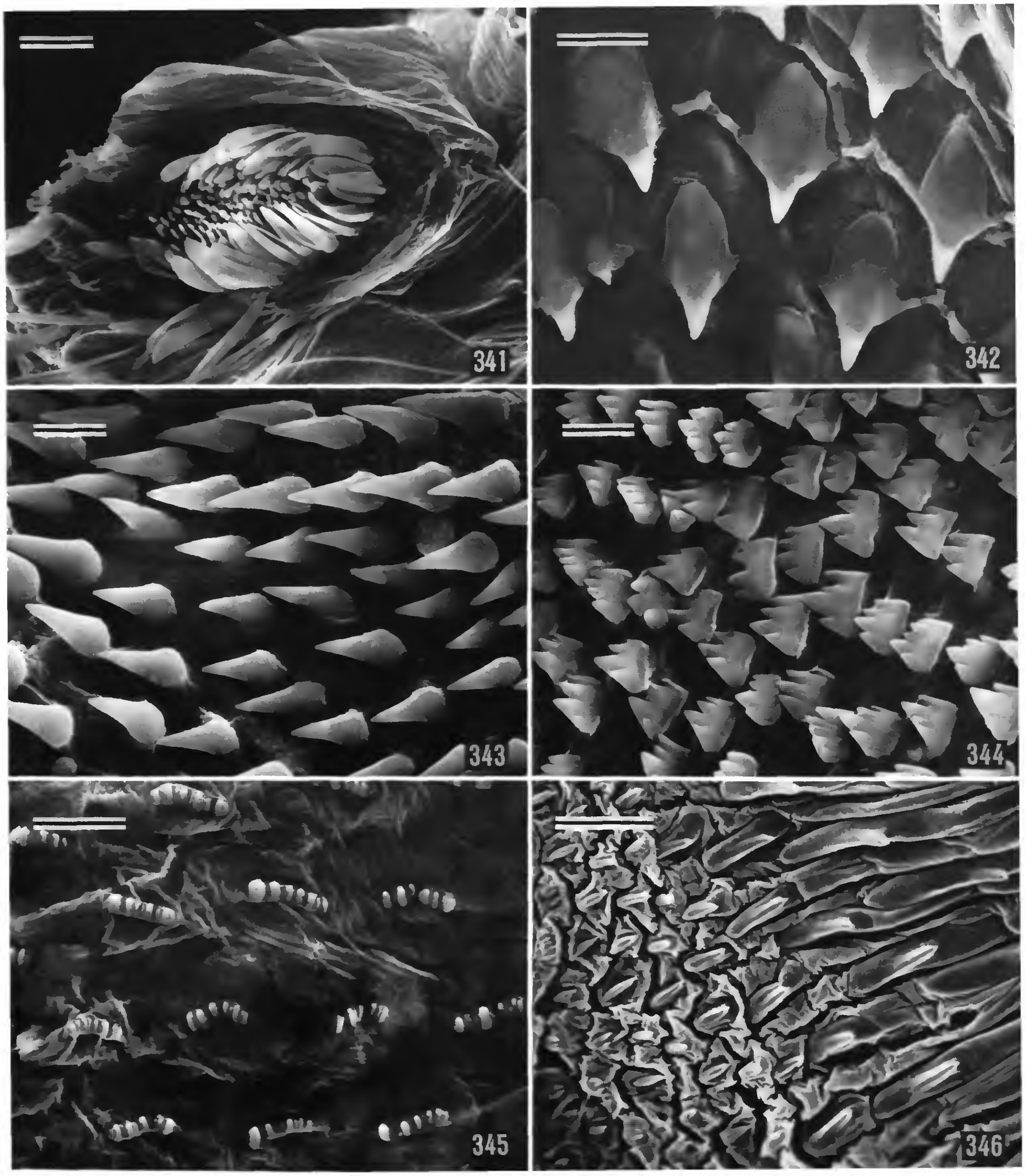
FIGURES 323–328.—***Palaephatus (Prophatus) albiterminus***, new species, head structure: 323, antennal scale pattern (40 μm); 324, haustellum (40 μm); 325, detail of haustellum showing legulae and sensilla styloconica with ridged bases (10 μm); 326, apical segment of maxillary palpus (40 μm); 327, apex of maxillary palpus (10 μm); 328, apex of maxillary palpus, anterior view (4 μm). (Scale lengths in parentheses.)



FIGURES 329–334.—*Palaephatus (Prophatus) albiterminus*, new species, wing structure: 329, base of male frenulum (20 μm); 330, ventral forewing, male retinaculum (200 μm); 331, base of hind wing, ventral flap of androconial pocket of anal area (200 μm); 332, ventral surface detail of androconial pocket in 331, sunken papillae represent sockets of inner sex (flap) scales (10 μm); 333, detail of single papilla in 332, note dense array of microtubercules (4 μm); 334, androconial pocket with ventral flap partially open revealing inner sex scales (100 μm). (Scale lengths in parentheses.)



FIGURES 335–340.—***Palaephatus (Prophatus) albiterminus***, new species, male scale structure: 335, detail of Figure 334, showing arrangement of flap scales and basement scales (40 μm); 336, flap scales, attached to inner side of flap (20 μm); 337, flap scale (5 μm); 338, surface detail of flap scale (1 μm); 339, basement sex scales attached to floor of androconial pocket (20 μm); 340, basement scale (10 μm). (Scale lengths in parentheses.)



Figures 341–346.—*Palaephatus (Prophatus) albiterminus*, new species: 341, lateral sex patch on A2 of male (100 μm); 342, spicules of anterior end of corpus bursae (20 μm); 343, spicules of dorsolateral wall of ductus bursae (10 μm); 344, spicules of ventral wall of ductus bursae (10 μm); 345, spicules of corpus bursae (20 μm); 346, spicules of inner wall of utriculus, near middle (40 μm). (Scale lengths in parentheses.)

26–30 Jan 1978, C. & O. Flint. *Valdivia Prov.:* Rincon de la Piedra, 180 m, 20 km S of Valdivia, 1♀, 24 Sep 1981; 2♂, 15 Nov 1981, Nielsen and Karsholt.

Paratypes deposited in AMNH, ANIC, BMNH, CNC, LACM, MACN, MHNS, MNHP, NZAC, UCB, UOP, USNM, and ZMUC.

HOST.—Unknown.

FLIGHT PERIOD.—24 September to 13 February; multivoltine?

DISTRIBUTION (Map 10)—This common species is apparently restricted to the wetter areas of the temperate, Valdivian forests of southern Chile and Argentina. Records to date indicate that it is less abundant in Argentina. It is known to occur in the coastal ranges from Ñuble Province (~36°S) south to Chiloé Island (43°S) and in the Andes from Cautin Province (~39°20′S) south to Puyehue National Park in Osorno.

ETYMOLOGY.—The specific name is derived from the Latin *albus* (white) plus *terminus* (end, limit), in reference to the narrow white band on the termen.

DISCUSSION.—*Palaephatus albiterminus* is closely allied to *P. fusciterminus*, as indicated by their similar color patterns and, more important, by the identical presence of two specialized androconial areas in the hind wing of the male, with their accompanying venational modification. Both species possess a slender longitudinal fold along the base of the medial vein, which contains an elongate hair pencil. Also present in both species is an oval pocket in the anal lobe. This opens ventrally, exposing two distinct types of sex scales, one attached to the inner dorsal walls (i.e., floor) of the pocket and the other type to the inner ventral wall. The two species may be easily distinguished by the different color of the forewing termen and fringe; that of *P. albiterminus* being mostly white and that of *P. fusciterminus* fuscous. The two species are further distinguished by their radically different genitalia, as illustrated.

As many as six spermatophores have been discovered within the corpus bursae of a single female of this species. The spermatophore (Figure 588) possesses a slender base, which tapers slightly to an uncinate apex. A prominent, slightly curved digitate process arises shortly below the apex.

Palaephatus (Prophatus) striatus, new species

FIGURES 90, 424, 523–526, 589, 590; MAP 11

ADULT (Figure 424).—Length of forewing: ♂, 9–11.2 mm; ♀, 10–11 mm. A relatively large species with buff-colored forewings streaked with darker brown spots and lines.

Head: Vestiture of vertex dark brown; occipital area on either side and posterior to vertex white to buff; frons pale buff. Antennae approximately 0.5–0.6 the length of forewing, 41–49-segmented; scape fuscous dorsally; pale whitish buff ventrally; pecten absent; flagellum uniformly buff. Maxillary palpi whitish buff. Labial palpi mostly whitish buff; second segment fuscous laterally; apex of second segment with 5–6 dark hairs.

Thorax: Pronotum pale buff with a narrow fuscous median streak; tegulae with brownish suffusion. Venter dull white. Forewings predominantly pale buff, irregularly marked with slender streaks and spots of various shades of brown; a relatively prominent but irregular streak of brown from near base of wing through discal cell to apex; streak interrupted in cell by a small white spot bordered externally by fuscous; outer third of streak beyond cell the best defined and fuscous; fringe pale buff. Hind wings uniformly pale gray. Ventral androconial pocket absent from anal lobe; androconial medial fold also absent in male (Figure 90); discal cell absent and CuA1 and CuA2 stalked in male. Forelegs fuscous dorsally; pale buff ventrally; tarsi not annulated. Midlegs rather uniformly pale buff; sometimes with a light suffusion of brown dorsally. Hind legs uniformly pale buff.

Abdomen: Buff colored dorsally and ventrally; a narrow, fuscous midventral line extending the length of abdomen.

Male Genitalia: As shown in Figures 523–526. Vinculum-saccus broadly rounded. Gnathos broad, extending well beyond apex of moderately bilobed uncus; a pair of spinose pads at base of gnathos. Apex of valvae rounded, without apical process. Aedoeagus with a pair of serrated internal plates; exogenous spines absent.

Female Genitalia: As shown in Figure 589. Eighth sternite nearly truncate with a median cleft. A symmetrical pair of membranous, hirsute lobes arising ventral of gonopore. Corpus bursae densely covered with rows and oval clusters of minute spicules, concentrated particularly at anterior end and near middle; latter area with an irregular, poorly defined, placoid signum bearing 5–6 elongate, spinose processes; ductus bursae with heavily thickened and folded, spiculated walls; caudal portion of ductus with a heavily sclerotized, spinose, trough-shaped sclerite internally.

IMMATURE STAGES.—Unknown.

HOLOTYPE.—♂. Aguas Calientes to 1 km W, Parque Nacional Puyehue, 450 m; 2–5 Jan 1982, UV light trap, D.R. Davis, type no. 101177 (USNM).

PARATYPES.—ARGENTINA. *Rio Negro Prov.:* Lago Nahuel Huapi, Puerto Blest, 770 m, 1♂, 1♀, 7 Nov 1978; 1♀, 27 Nov 1978; 1♂, 18 Dec 1978; 1♀, 21 Dec 1978; E.S. Nielsen.

CHILE. *Chiloé Prov.:* Chiloé Island, Hueque Trumao, 50 m, 22 km N of Quellon, 1♂, 1♀, 26–27 Dec 1981, D.R. Davis, UV light trap. 1 km E of Lago Tepuhueco, 100 m, ~40 air km SW of Castro, 2♂, 23–25 Dec 1981, D.R. Davis, UV light trap. *Llanquihue Prov.:* El Chinque, N of Correntoso (S of Volcan Calbuco), 300 m, 1♀, 20–25 Jan 1980, L. Peña. Hornohuinco, 300 m, 11 km SW of Lago Chapo, 2♂, 29–31 Dec 1981, D.R. Davis, UV light trap. *Osorno Prov.:* Parque Nacional Puyehue, Aguas Calientes, 450 m, 1♂, 25 Nov 1981; 1♂, 1♀, 11 Dec 1981; 1♂, 1♀, 12 Dec 1981, Nielsen & Karsholt; same locality, Aguas Calientes to 3 km W, 450–500 m, 2♂, 12–20 Dec 1981, D.R. Davis; same locality, Aguas Calientes to 1 km W, 450 m, 9♂, 2♀, 2–5 Jan 1982, D.R. Davis, UV light trap; same locality, Aguas Calientes to 2 km S, 450 m, 11♂, 1♀, 10–22 Feb 1979, D. & M. Davis & B. Akerbergs, UV light trap & malaise trap. Parque Nacional Puyehue, Anticura, 350 m, 1♂, 17 Nov 1981; 1♂, 19 Nov 1981; 1♂, 15 Dec 1981, Nielsen & Karsholt. Pucatrihue, 1♂, 26–31 Jan 1980, L. Peña. Puente Hermoso, 3 km, E of Pucatrihue, 1♀, 29 Jan 1978, C. & O. Flint. *Valdivia Prov.:* Rincon de la Piedra, 180 m, 20 km S of Valdivia, 1♀, 24 Sep 1981; 1♀, 14 Nov 1981, Nielsen & Karsholt.

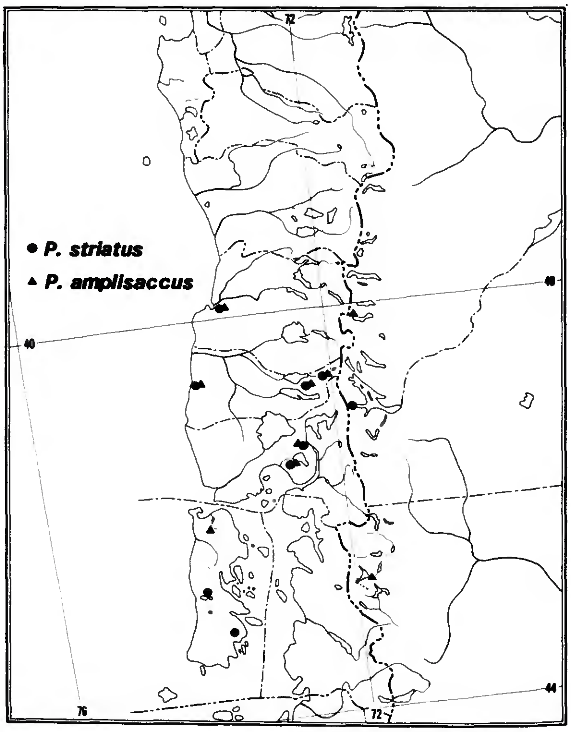
Paratypes in ANIC, BMNH, MACN, MHNS, NZAC, USNM, TMP, and ZMUC.

HOST.—Unknown.

FLIGHT PERIOD.—24 September to 22 February; univoltine?

DISTRIBUTION (Map 11).—This species occurs rather commonly in the wetter Valdivian forests of central Argentina and Chile from Lago Puyehue and Lago Nahuel Huapi south to Chiloé Island.

ETYMOLOGY.—The specific name is derived from the Latin *striatus* (channel, groove, furrow),



MAP 11.—Distribution of species of *Palaephatus (Prophatus)*.

in reference to the striated pattern of the forewings.

DISCUSSION.—*Palephatus striatus* is easily recognized by the fine, longitudinal streaks on the forewings. In wing pattern it resembles a much smaller but related species, *P. amplisaccus.* The different sizes of the two species and particularly the great differences in their male genitalia readily distinguish them.

Although a medial, androconial fold is absent in the hind wing of the male, its associated venational modifications still persist. This suggests that *P. striatus* is a member of the *albiterminus* species group. Another unusual specialization of this species is the loss of the antennal pecten, an event that is typical of the subgenus *Palaephatus* but otherwise unknown in *Prophatus.*

The spermatophore (Figure 590) of this species is mostly slender with an elongate sinuate neck, which bears a prominent subapical uncinate process near the apical coil.

Palaephatus (Prophatus) amplisaccus, new species

FIGURES 91, 347-352, 425, 527-531, 591; MAP 11

ADULT (Figure 425).—Length of forewing: ♂, 6–8 mm; ♀, 7–7.5 mm. A moderately small moth with light brown forewings variably marked with white and dark brown streaks; a relatively prominent dark brown spot situated at middle of costa.

Head: Vestiture white to pale buff with a few dark hairs arising from lower frons near rim of eye. Antennae approximately 0.6 the length of forewing, 37–38-segmented; scape white to pale buff; pecten usually consisting of 4–6 brownish hairs; flagellum white to pale buff over basal half; slightly darker, more brown over distal half. Maxillary palpi white to pale buff. Labial palpi mostly pale buff dorsomedially, dark brown laterally; apex of second segment with 4–6 dark hairs.

Thorax: Pronotum white to buff heavily streaked with dark brown; tegulae mostly brown. Venter whitish buff. Forewings light brown variously streaked with different shades of brown; a rather prominent dark brown spot present midway along costa; a less prominent and more irregular concentration of dark brown near tornus; termen variously marked white to dark brown. R4 and 5 stalked about half their length. Hind wings uniformly gray; a small androconial pocket present in anal lobe of male; pocket opens ventrally, with dorsal half covered with minute, highly modified sex scales (Figures 349–352). Forelegs gray to dark fuscous dorsally; pale buff ventrally; tarsi faintly tipped with white. Midlegs mostly brown dorsally; white to pale buff ventrally. Hind legs pale brown dorsally; white to pale buff ventrally.

Abdomen: Pale fuscous to gray dorsally; white to buff ventrally.

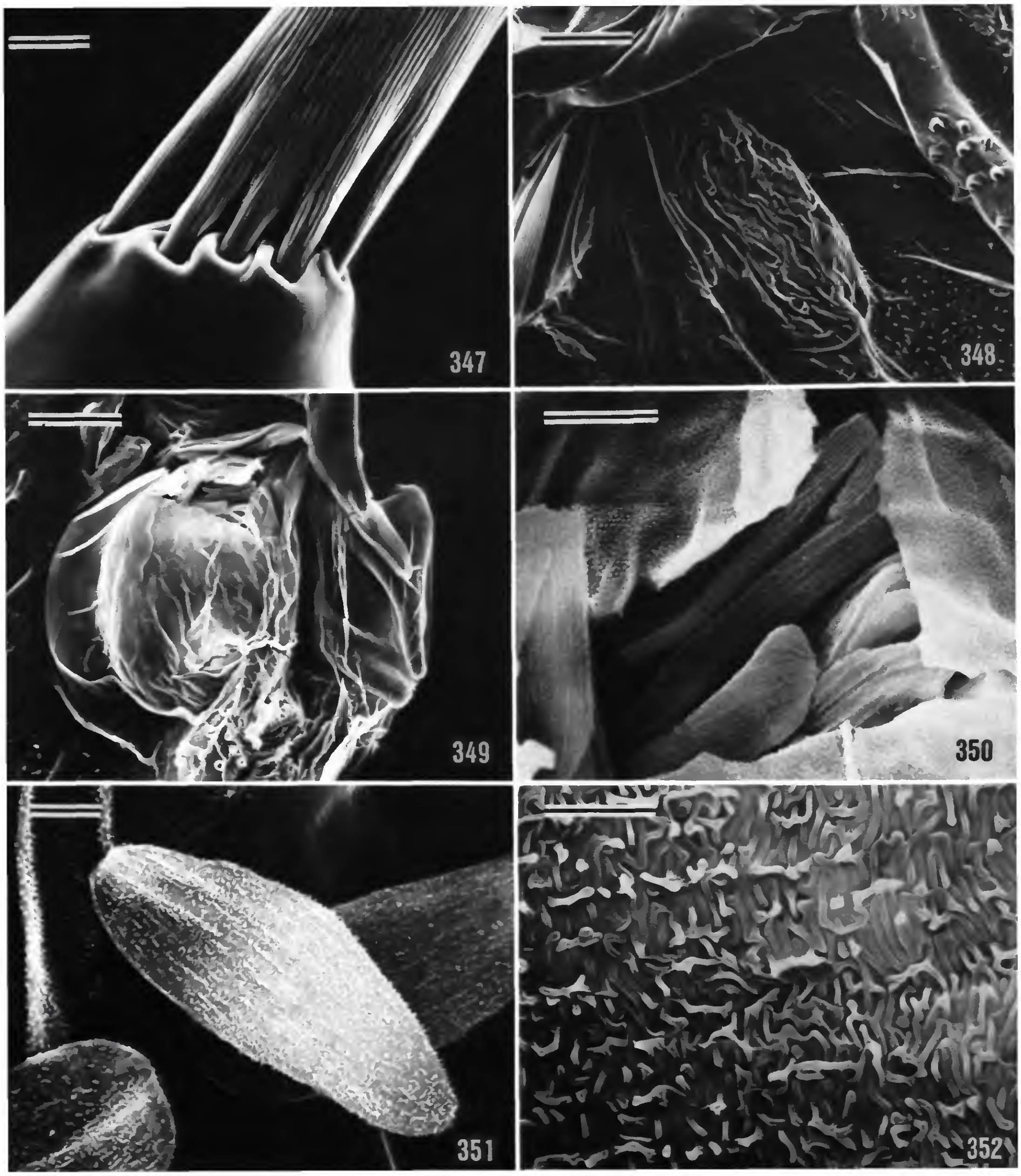
Male Genitalia: As shown in Figures 527–531. Vinculum with well-developed saccus; length nearly equal to width. Apex of valvae rounded, without apical process. Aedoeagus with paired, subapical rows of pectinate spines; each row containing approximately 20–25 spines.

Female Genitalia: As shown in Figure 591. Corpus bursae without signa; inner walls with hundreds of evenly distributed linear segments of pectinations; each row consisting of 4–8 spicules. Ductus bursae with thickened, folded walls bearing circular pectinations.

HOLOTYPE.—♂, Hornohuinco, 11 km SW Lago Chapo, 300 m, Llanquihue Province, Chile; 29–31 Dec 1981, UV light trap, D.R. Davis, type no. 101174 (USNM).

PARATYPES.—ARGENTINA. *Chubut Prov.:* Esquel, Lago Menéndez, Sagrario Puerto, 600 m, 5♂, 2–4 Jan 1982, Nielsen and Karsholt. *Neuquen Prov.:* Lago Lacar, 5 km E Hua-Hum, 650 m, 2♂, 26–27 Dec 1981, Nielsen and Karsholt.

CHILE. *Chiloé Prov.:* Chiloé Island, Puntra, ~30 air km S Ancud, 50 m, 2♂, 21–22 Dec 1981, D.R. Davis. *Llanquihue Prov.:* Same data as holotype, 1♂, 1♀; El Chinque, N of Correntoso (S of Volcan Calbuco), 300 m, 1♂, 20–25 Dec 1980, L. Peña. *Osorno Prov.:* Parque Nacional Puyehue, Aguas Calientes to 2 km S, 450 m, 2♂, 2♀, 10–22 Feb 1979, D. & M. Davis & B. Akerbergs; to



FIGURES 347–352.—*Palaephatus (Prophatus) amplisaccus*, new species, male structure: 347, base of male frenulum (10 μm); 348, dorsal base of hind wing showing androconial pocket (33 μm); 349, ventral base of hind wing showing androconial pocket (50 μm); 350, detail of 349 showing sex scales within pocket (10 μm); 351, sex scale within pocket (5 μm); 352, surface detail of sex scale in 351 (2 μm). (Scale lengths in parentheses.)

3 km W, 450 m, 1♂, 12–20 Dec 1981, D.R. Davis; to 1 km W, 450 m, 2♂, 2–5 Jan 1982, D.R. Davis; Aguas Calientes, 450 m, 2♂, 1♀, 10–18 Dec 1981, Nielsen & Karsholt. Anticura, 350 m, 3♂, 1♀, 17–18 Dec 1981, Nielsen & Karsholt. Pucatrihue, 1♂, 26–31 Jan 1980, L. Peña. *Valdivia Prov.:* 20 km S Valdivia, Rincon de la Piedras, 180 m, 1♀, 14 Nov 1981, Nielsen & Karsholt.

Paratypes in ANIC, MLP, MACN, MHNS, USNM, and ZMUC.

FLIGHT PERIOD.—14 November to 22 February; probably univoltine.

DISTRIBUTION (Map 11).—This species ranges widely through the Valdivian forests of the lake region in southern Chile and Argentina. It occurs most commonly in the lower elevations of the Andes, but it has been collected near the Pacific coast as far south as Chiloé Island.

ETYMOLOGY.—The specific name is derived from the Latin *amplus* (large) plus *saccus* (sack, bag), in reference to the enlarged vinculum-saccus of the male.

DISCUSSION.—The forewing pattern of this species superfically resembles that of *P. striatus* with regard to the presence of fine longitudinal markings. The two species differ greatly in size and in genital morphology. The vinculum-saccus of *P. amplisaccus* is the most developed of any member of the family. The aedoeagus is also very diagnostic in possessing two pectinate rows of fine spines near the apex. The species is further unique in being the only palaephatid with R4 and 5 stalked.

The vestige of the ventral anal pocket in the hind wing of the males suggests that this species is a member, though somewhat distantly related, of the *albiterminus* species group. A hind wing medial fold is assumed to have once been present in the male (as in *P. striatus*) but subsequently lost.

Subgenus *Palaephatus* Butler

TYPE-SPECIES.—*Palaephatus falsus* Butler, 1883.

ADULT.—Length of forewing 8.5–16 mm.

Head: Vestiture rough over occipital region, smoother at vertex and frons, consisting of very slender scales with minutely bidentate to rarely truncate apices. Antennae 47–51-segmented; scape smooth, without pecten. Second segment of labial palpi smooth, without ventrolateral bristles.

Thorax: Forewings with 1A and 2A fused throughout their length, anal loop absent. Hind wings of males usually with an elongate to oval pocket containing a dense hair pencil located on dorsal surface at base of Rs; pocket absent in *P. albicerus;* androconial pocket on anal lobe or fold at base of medial vein absent.

Abdomen: Without specialized integumental modifications.

Male Genitalia: Uncus with a shallow, relatively narrow, median cleft. Gnathos terminating in a prominent spine or truncate process. Valvae with a prominent, subapical, uncinate pollex with an acute, basal lobe; a smaller, acute to bluntly rounded process arising more distad from apex of costal margin.

Key to the Species of the Subgenus *Palaephatus*

1. Male genitalia with apex of gnathos acute [Figure 532] 2

   Male genitalia with apex of gnathos truncate to slightly bilobed [Figures 540, 544] 3

2. Forewing without short white line along lower margin of discal cell. Hind wing of male with large dorsal pocket extending over one half the length of discal cell. Aedoeagus with a small cluster of 5–6 apical cornuti [Figure 535] . . . . ***Palaephatus falsus***

   Forewing with a short white line bordering lower margin of cell [Figure

426]. Hind wing of male with dorsal pocket reduced, approximately one-third the length of cell. Aedoeagus without cornuti [Figure 539] .... ***Palaephatus pallidus,*** new species

3. Forewing mostly pale to bright yellow; length 12–16 mm [Figures 431–433]. Hind wing of male with a greatly reduced dorsal pocket less than one-tenth the length of discal cell. Aedoeagus with two dense spine clusters, one slightly smaller, borne at apex of elongate, internal rods [Figure 543]. Corpus bursae of female with single signum .... ***Palaephatus luteolus,*** new species

Forewing mostly white to pale yellow; length 8.5–11 mm [Figures 434, 435]. Hind wing of male without dorsal pocket. Aedoeagus with cornuti fewer in number, differently arranged, and much different in relative size [Figure 547]. Corpus bursae without signum .... ***Palaephatus albicerus,*** new species

Palaephatus (Palaephatus) falsus **Butler**

FIGURES 22–24, 92, 99, 105, 116–118, 140, 141, 353–382, 427–430, 532–535, 592, 593; MAP 12

Palaephatus falsus Butler, 1883:82.—Fletcher, 1929:159.

ADULT (Figures 427–430).—Length of forewing: ♂, 8.5–12 mm; ♀, 11–13 mm. A relatively large species with light buff to light fuscous forewings variably marked with darker brown specks and oblique lines in the male; female much paler with whitish hind wings.

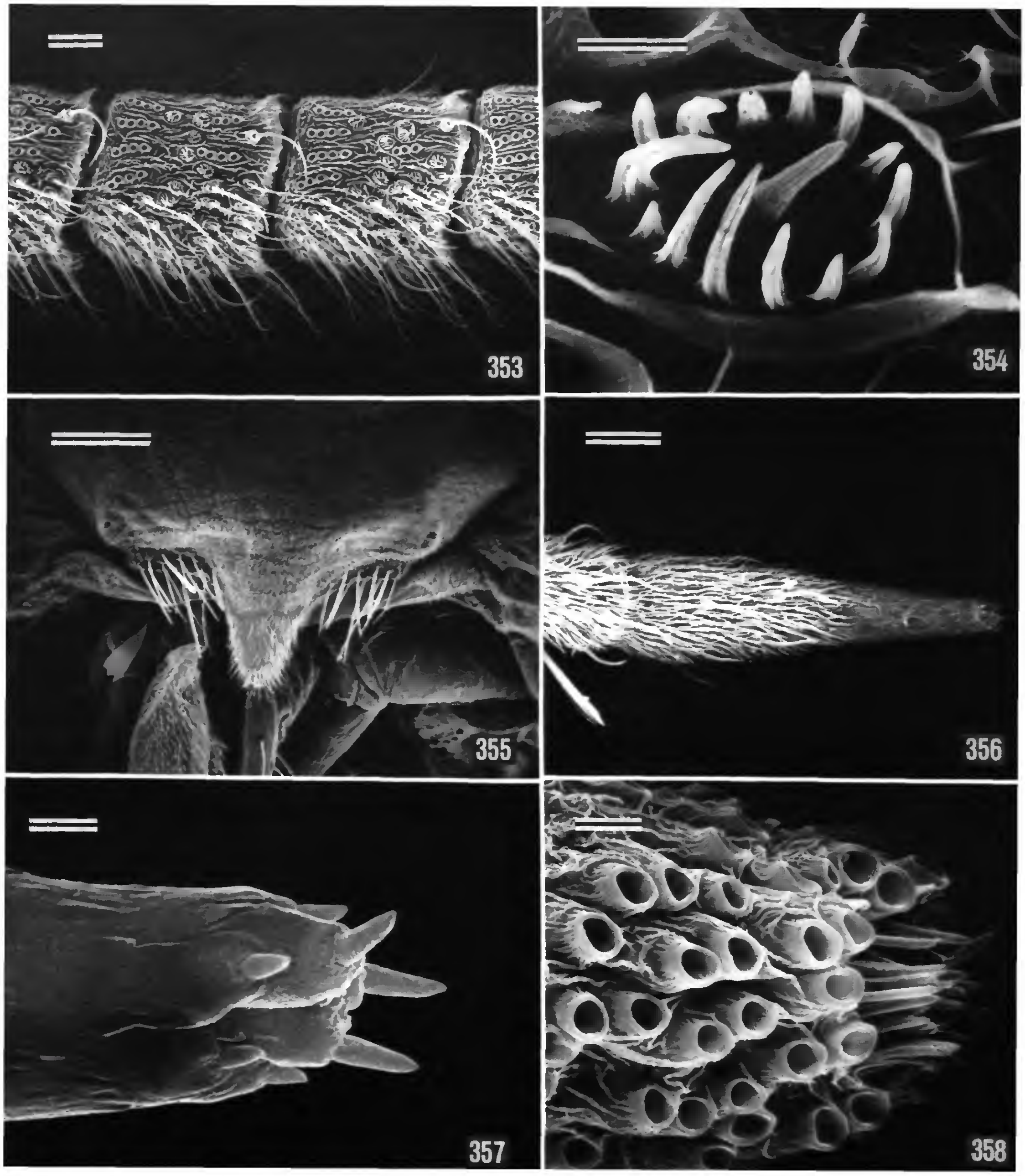
Head: Vestiture white to grayish buff in male; white in female. Cuticle a pale blue green color. Antennae approximately 0.6 the length of forewing, 48-segmented; scape usually white, rarely buff dorsally; mostly white ventrally but with a variable amount of dark fuscous scales; pecten absent; flagellum pale buff to white, occasionally with scattered fuscous scales dorsally over basal sixth. Maxillary palpi white. Labial palpi white to pale buff mesally and over apical segment; dark fuscous laterally on second segment and apex of basal segment; second segment without latero-apical hairs.

Thorax: Pronotum brownish buff to white in male, white in female; tegulae with fuscous suffusion anteriorly. Venter white. Forewings in male: light buff to light fuscous mottled with variable spots and lines; most prominent line in the form of a broad V or Y extending obliquely across basal half of wing; fringe buff to dark brown; forewings much paler in female, pale buff to nearly white with far less darker scaling; a single, oblique fuscous band extending from basal third of hind margin toward middle of costa, band usually incomplete or indistinct. Hind wings light to dark gray in male; dull white in female; male with a large androconial pocket containing an elongate hair pencil along basal third of Rs. Forelegs dark fuscous dorsally, whitish buff ventrally; tarsal segments usually ringed with whitish buff. Midlegs pale fuscous dorsally, dull white ventrally; tibiae and tarsi ringed with white. Hind legs predominantly dull white; apical half of tibia with pale fuscous suffusion dorsally; tarsi with fuscous annulations.

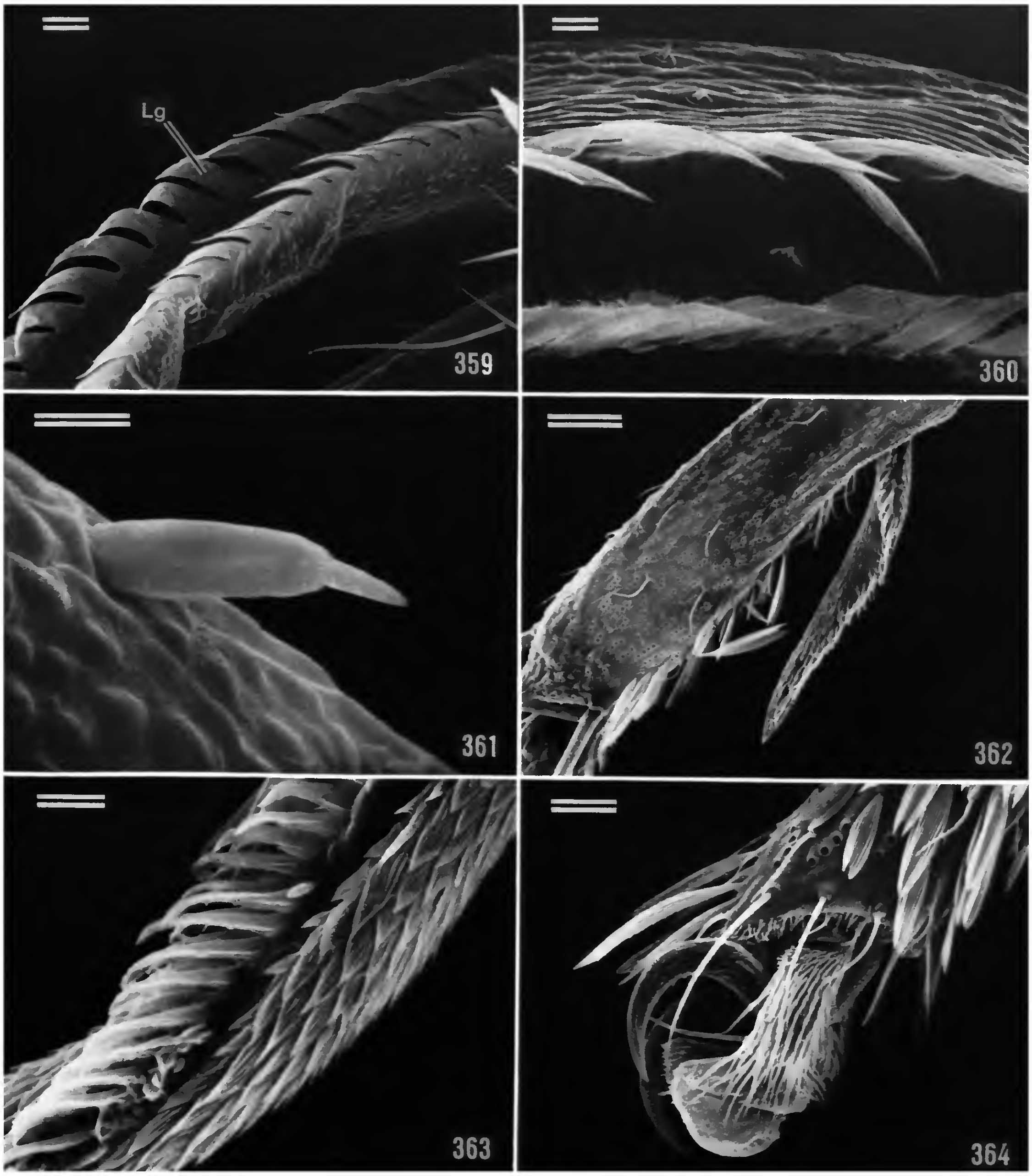
Abdomen: Gray to buff dorsally in male; white to whitish buff ventrally; female uniformly white.

Male Genitalia: As shown in Figures 532–535. Uncus rounded, with a shallow median cleft. Gnathos prominent, with a darkly sclerotized median acute process. Valvae with a prominent, broadly acute apical process distad of pollex. Aedoeagus with an apical cluster of 5–6 exogenous spines.

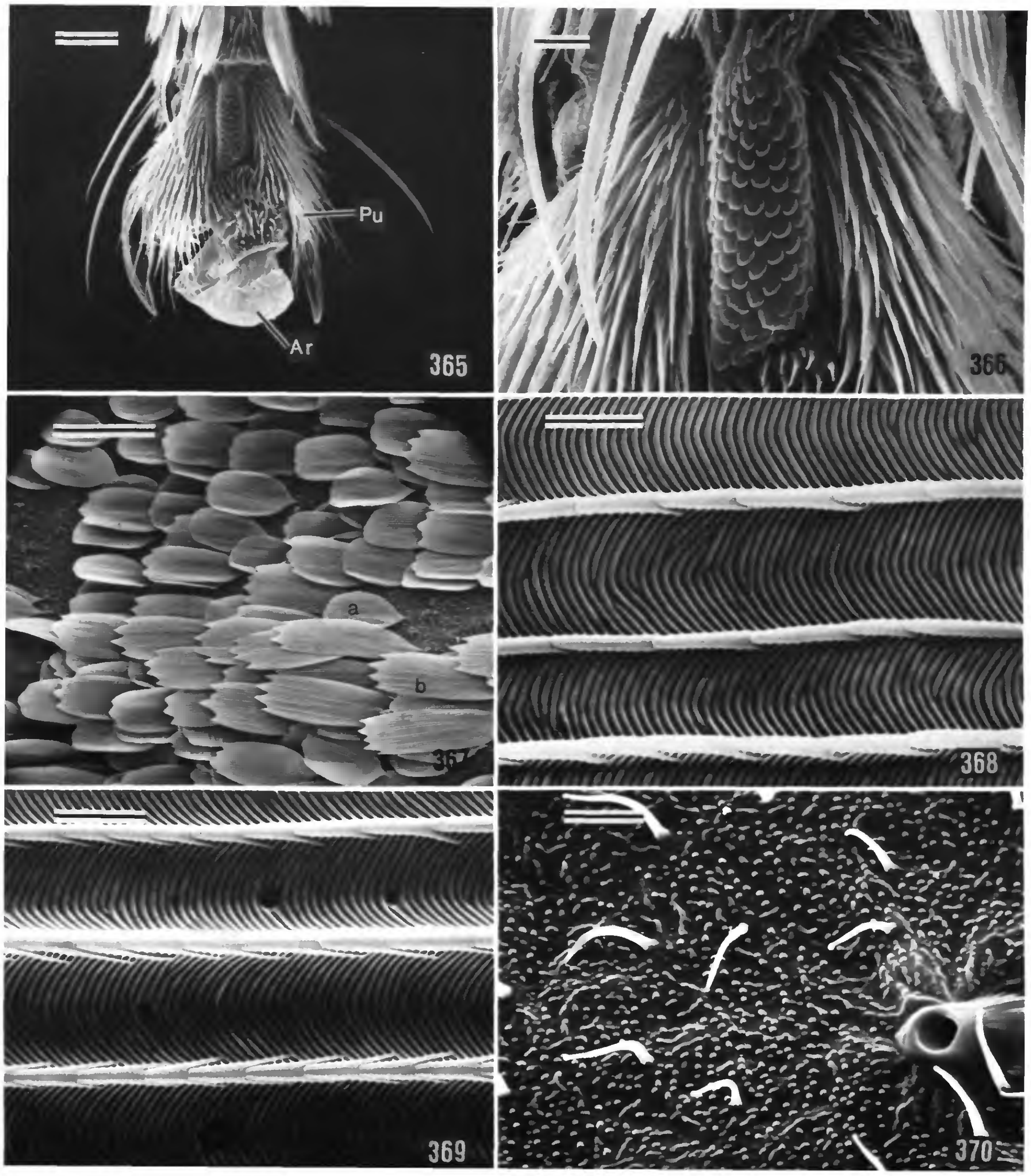
Female Genitalia: As shown in Figure 592. Eighth sternite deeply cleft; lobes densely hirsute. Corpus bursae almost entirely membranous, with scattered pectinations consisting mostly of 1–2 minute spicules, occasionally with 3–4 spicules. Ductus bursae with nearly straight,



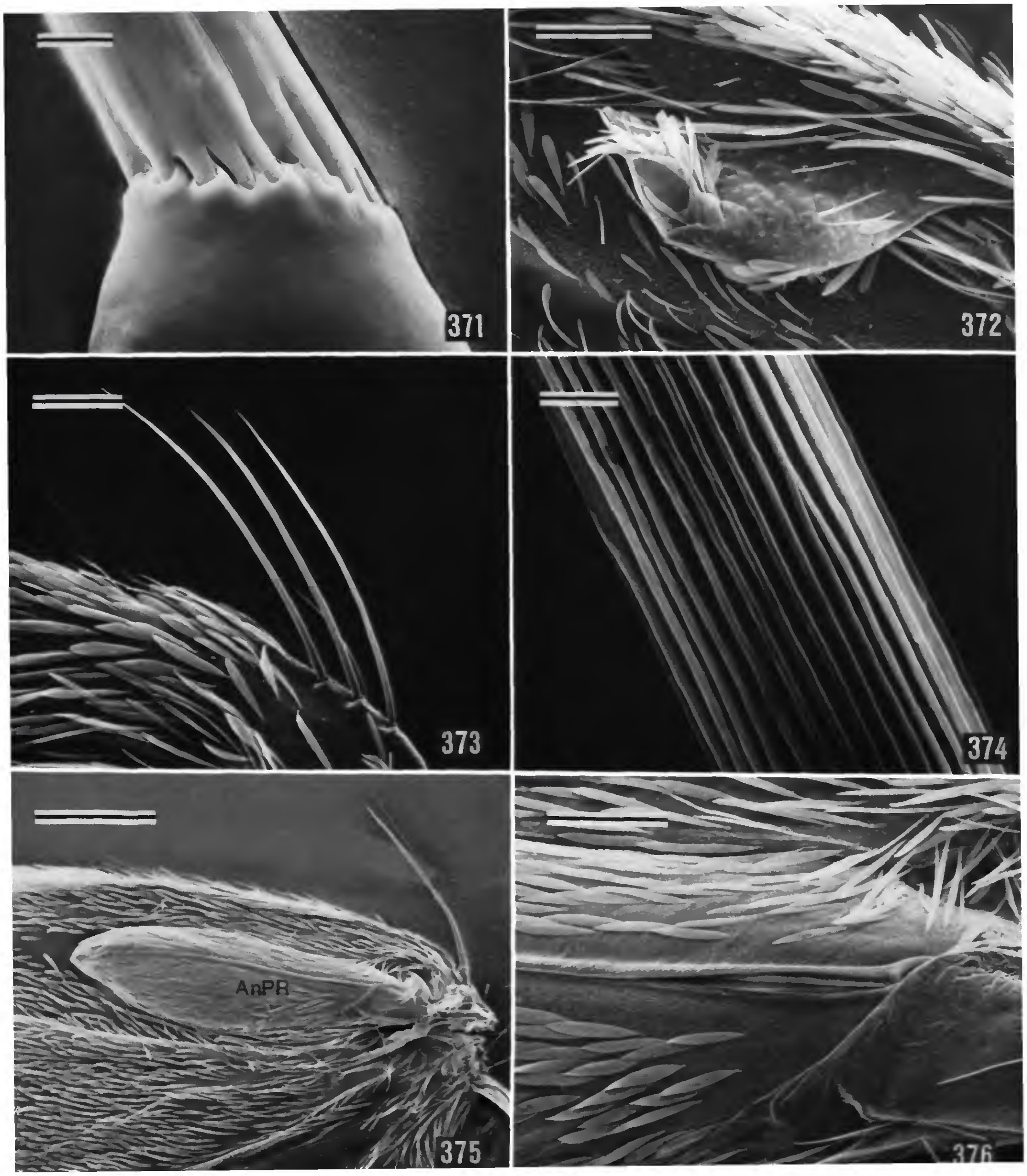
FIGURES 353–358.—*Palaephatus (Palaephatus) falsus* Butler, head structure: 353, antennal sensilla (40 μm); 354, sensilla coeloconica of antenna (4 μm); 355, labrum with vestigial pilifers (100 μm); 356, apical segment of maxillary palpus (40 μm); 357, apex of maxillary palpus (5 μm); 358, apical sensory pit of labial palpus (10 μm). (Scale lengths in parentheses.)



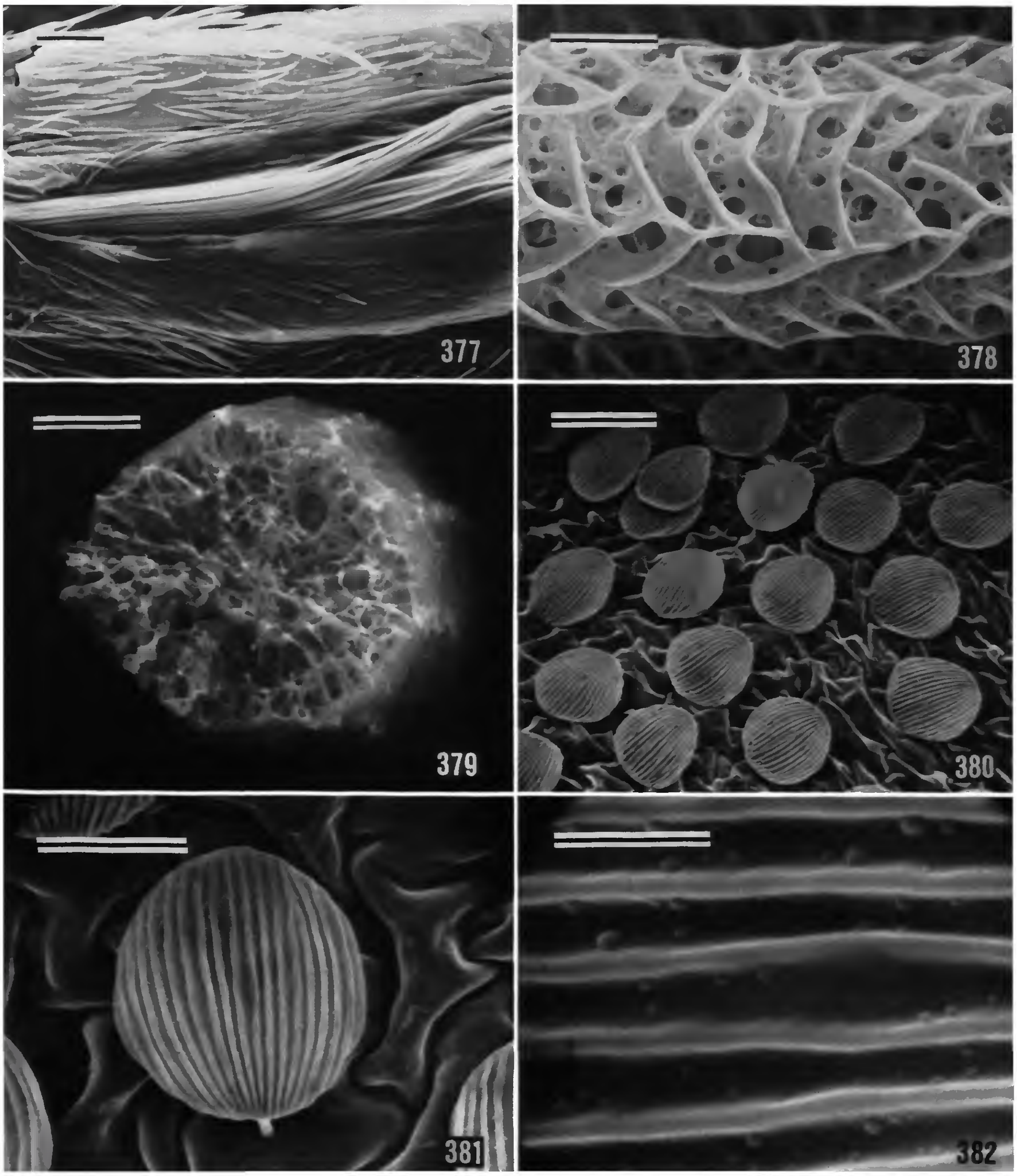
Figures 359–364.—*Palaephatus (Palaephatus) falsus* Butler: 359, haustellum (20 μm); 360, detail of food channel (haustellum) (10 μm); 361, sensillum styloconicum of haustellum with smooth wall base (10 μm); 362, tibial epiphysis (100 μm); 363, detail of 363 showing comb (20 μm); 364, prothoracic pretarsus, lateral view (40 μm). (Scale lengths in parentheses.)



FIGURES 365–370.—*Palaephatus (Palaephatus) falsus* Butler: 365, prothoracic pretarsus, ventral view (40 μm); 366, detail of 365 showing detail of unguitractor plate (10 μm); 367, scales of dorsal forewing near middle of discal cell (100 μm); 368, detail of scale "a" in 367 (2 μm); 369, detail of scale "b" in 367 (2 μm); 370, wing surface detail of 367 showing microtrichia and microtubercules (5 μm). (Scale lengths in parentheses.)



FIGURES 371–376.—*Palaephatus (Palephatus) falsus* Butler, wing structure: 371, base of male frenulum (20 μm); 372, ventral forewing, male retinaculum (200 μm); 373, female frenulum (200 μm); 374, detail of single seta of female frenulum (5 μm); 375, dorsal hind wing of male showing androconial pocket (AnPR) (1 mm); 376, detail of 375 showing tongue-and-groove design of slit opening (200 μm). (Scale lengths in parentheses.)



FIGURES 377–382.—*Palaephatus (Palaephatus) falsus* Butler, male wing scale structure: 377, detail of Figure 375 with androconial pocket open and hair pencil exposed (200 μm); 378, detail of hair pencil scale in 377 (4 μm); 379, cross section of hair pencil scale in 378 (4 μm); 380, basement sex scales at bottom of androconial pocket (40 μm); 381, detail of 380 (20 μm); 382, surface detail of 381 (4 μm). (Scale lengths in parentheses.)

thickened walls densely covered with minute spicules. Spermatheca with short rows of spicules over posterior third to fourth of utriculus.

IMMATURE STAGES.—Unknown.

TYPES.—Holotype, ♂ (BMNH).

TYPE-LOCALITIES.—Chile: specific locality unknown.

HOST.—Unknown.

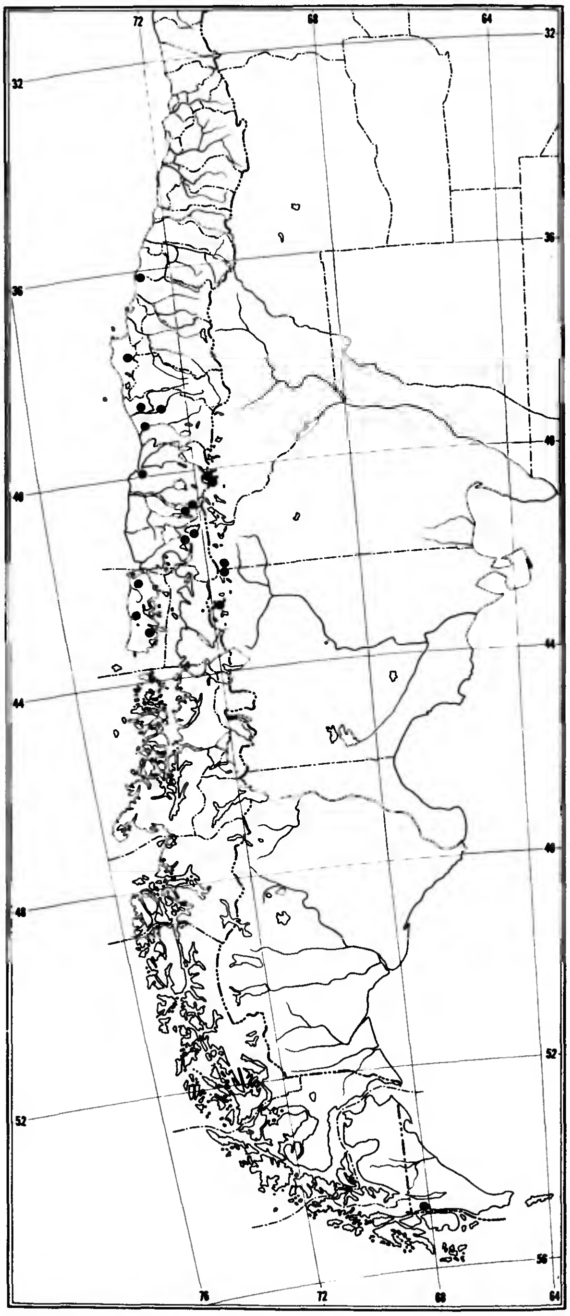
FLIGHT PERIOD.—24 September to 9 March; multivoltine?

DISTRIBUTION (Map 12).—This species occurs over much of the Valdivian forest region of southern Chile from the Nahuelbuta Mountains south to Chiloé Island and from sea level to 1300 meters. In southern Argentina it ranges from the adjacent Andean forests of Neuquen Province south to the Interoceanic Magellanic region of southern Tierra del Fuego.

MATERIAL EXAMINED.—78 males and 23 females.

ARGENTINA. *Chubut Prov.:* El Bolsón, Lago Puelo, 250 m, 1♀, 22 Oct 1981; 3♂, 2♀, 23 Oct 1981, Nielsen and Karsholt; same locality, 220 m, 1♂, 21 Nov 1978, E.S. Nielsen. Esquel, Lago Menéndez, El Sagrario Puerto, 600 m, 1♂, 2–4 Jan 1982, Nielsen and Karsholt; same locality, 550 m, 14♂, 1♀, 20–21 Feb 1979, E.S. Nielsen. *Neuquen Prov.:* Lago Lacar, 5 km E of Hua-Hum, 640 m, 2♂, 5 Oct 1981; 1♀, 8 Oct 1981; 4♂, 16 Oct 1981; 2♂, 6 Nov 1981; 2♂, 25 Nov 1981; Nielsen and Karsholt. Lago Lacar, Pucará, 750 m, 1♀, 3 Dec 1978; 2♂, 26 Dec 1978, E.S. Nielsen; same locality, 650 m, 1♂, 28–29 Nov 1981; 2♂, 26–27 Dec 1981; Nielsen and Karsholt. *Rio Negro Prov.:* El Bolsón, Arroyo Negro, 420 m, 1♂, 7 Oct 1961, G. Topál. *Tierra del Fuego:* Ushuaia, Laptaia, 20 m, 1♀, Jan 1979; 1♂, 2 Feb 1979, E.S. Nielsen.

CHILE. Specific locality unknown: 1♂ (holotype). *Cautin Prov.:* Cerro Nielol, 200 m, Temuco, 1♂, 9 Feb 1979, D. & M. Davis and B. Akerbergs, UV light trap. Fundo Chacamo, 600 m, 35 km NW of Nueva Imperial, 2♂, 5–8 Dec 1981, D.R. Davis, UV light trap. 3 km NE Tolten, 3 m, 3♂, 1♀, 26 Feb 1979, D. & M. Davis and B. Akerbergs, UV light trap. *Chiloé Prov.:*



MAP 12.—Distribution of *Palaephatus (Palaephatus) falsus.*

Chiloé Island, Hueque Trumao, 50 m, 22 km N Quellon, 2♀, 26–27 Dec 1981, D.R. Davis, UV light trap. Puntra, 50 m, ~30 air km S of Ancud, 1♂, 21–22 Dec 1981, D.R. Davis, UV light trap. 1 km E of Lago Tepuhueco, 100 m, ~40 air km SW of Castro, 1♂, 1♀, 23–25 Dec 1981, D.R. Davis, UV light trap. *Llanquihue Prov.:* El Chinque, N of Correntoso (S of Volcan Calbuco), 300 m, 1♂, 20–25 Jan 1980, L. Peña. Peulla, 1♀, 8 Mar 1959, J.F.G. Clarke. Rio Maullin, 1♀, 6 Jan 1966, Flint & Cekalovic. *Malleco Prov.:* Nahuelbuta National Park, near Los Gringos Camp, 1300 m, 1♀, 29 Jan–5 Feb 1979, D. & M. Davis and B. Akerbergs, UV light trap. *Ñuble Prov.:* Alto Tregualemu, 500 m, ~20 km SE Chovellen, 1♂, 1–3 Dec 1981, D.R. Davis, UV light trap. *Osorno Prov.:* Parque Nacional Puyehue, Aguas Calientes, 450 m, 1♂, 25 Sep 1981; 1♂, 12 Nov 1981; 1♂, 1♀, 11 Dec 1981; 1♂, 2♀, 13 Dec 1981, Nielsen and Karsholt; same locality, Aguas Calientes to 3 km W, 450–500 m, 2♂, 12–20 Dec 1981, D.R. Davis, UV light trap; Aguas Calientes to 1 km W, 450 m, 2♂, 2–5 Jan 1982, D.R. Davis, UV light trap; Aguas Calientes to 2 km S, 450 m, 12♂, 4♀, 10–22 Feb 1979, D. & M. Davis and B. Akerbergs, UV light trap. Parque Nacional Puyehue, Anticura, 350 m, 1♂, 17 Nov 1981; 2♂, 1♀, 19 Nov 1981; 1♂, 15 Dec 1981; 3♂, 17 Dec 1981, Nielsen and Karsholt; same locality, 300 m, 2♂, 7–9 Mar 1979, E.S. Nielsen. *Valdivia Prov.:* Rincon de la Piedra, 180 m, 20 km S of Valdivia, 1♂, 1♀, 24 Sep 1981; 1♂, 14 Nov 1981, Nielsen and Karsholt.

Specimens deposited in ANIC, BMNH, MACN, MNHS, USNM, and ZMUC.

DISCUSSION.—*Palaephatus falsus* is not likely to be confused with any other member of the Palaephatidae, with the possible exception of its sister species, *P. pallidus.* Both share the unusual synapomorphy of having lost the antennal pecten and lateral hair brush of the labial palpi, by having the adult female paler than the male, and in the presence of hair pencil pockets in the hind wing of the male. *Palaephatus falsus* differs in possessing darker forewings without a white discal bar and in having a larger hair pencil pocket in the male. The two pockets also are readily separated by their different male genitalia, particularly by the characteristic form of the gnathos, aedoeagus, and valvae as illustrated.

The spermatophore (Figure 593) of this species is relatively slender, with a small uncinate process arising from the apical third.

Palaephatus (Palaephatus) pallidus, new species

FIGURES 94, 426, 536–539, 594; MAP 13

ADULT (Figure 426).—Length of forewing: ♂, 9–12 mm; ♀, 11–12 mm. A moderately large species with pale whitish buff forewings variously mottled by small brownish fuscous spots and a large oblique medial fascia; lower distal angle of discal cell with a short white streak that spreads out into cubital area.

Head: Vestiture white. Antennae approximately 0.6 the length of forewing, 47-segmented; scape white dorsally, with a dark fuscous patch ventrally; pecten absent; flagellum uniformly cream to white. Maxillary palpi white. Labial palpi light cream to white, with dark fuscous scaling laterally along first and second segments; second segment without latero-apical hairs.

Thorax: Pronotum white; tegulae dark brown to dark fuscous, occasionally with suffusion of white and buff laterally and posteriorly. Venter white. Forewings pale whitish buff variously mottled by brownish fuscous spots and bands; a light brown oblique band variously developed from distal third of costa midway to tornus; a darker, fuscous fascia usually present from basal third of hind margin obliquely across middle of wing to middle of costa; a slender, short streak of white, ventrally edged by fuscous, at lower distal angle of cell, which spreads into cubital area; fringe mostly whitish buff, mottled with brownish fuscous. Hind wings uniformly pale cream to white. Basal sixth of Rs with an elongate pocket containing a hair pencil in male. Forelegs fuscous dorsally, pale cream to white ventrally; tarsi almost entirely dark fuscous. Midlegs pale cream to white; dorsum of tibia with two fuscous bands; tarsi prominently tipped with white. Hind legs pale cream to white; tarsi fuscous tipped with white.

Abdomen: Uniformly pale cream to white; small scattered patches of fuscous sometimes present midventrally.

Male Genitalia: As shown in Figures 536–539. Uncus with a very shallow, median depression. Gnathos well developed, with a prominent median process directed caudally; apex of process turned sharply dorsad. Valvae with a prominent, acute, apical process distad to pollex. Aedoeagus lacking in cornuti but with an elongate external spine extending nearly the entire length of the aedoeagus.

Female Genitalia: As shown in Figure 594. Eighth sternite deeply cleft; lobes densely hirsute. Corpus bursae with minute scattered pectinations arranged in short transverse rows of 3–6 spicules; spicules becoming larger, in rows of 2–3, near anterior end; signum absent. Ductus bursae with more thickened, densely spiculated walls. Spermatheca with short longitudinal rows of spicules over posterior third.

HOLOTYPE.—♂. Aguas Calientes to 3 km W, Parque Nacional Puyehue, 450 m, Osorno Province, Chile; 12–20 Dec 1981, D.R. Davis, UV light trap, type no. 101179 (USNM).

PARATYPES.—ARGENTINA. *Rio Negro Prov.:* Lago Nahuel Huapi, Puerto Blest, 770 m, 1♂, 18 Dec 1978, E.S. Nielsen.

CHILE. *Cautin Prov.:* 3 km NE of Tolten, 3 m, 2♂, 26 Feb 1979, D. & M. Davis & B. Akerbergs, UV light trap. *Chiloé Prov.:* Chiloé Island, Puntra, 50 m, ~30 air km S Ancud, 1♀, 21–22 Dec 1981, D.R. Davis, UV light trap. *Malleco Prov.:* Nahuelbuta National Park, near Los Gringos Camp, 1300 m, 1♂, 6–11 Jan 1982, D.R. Davis, UV light trap. *Osorno Prov.:* Parque Nacional Puyehue, Aguas Calientes, 450 m, 2♂, 12 Dec 1981; 2♀, 13 Dec 1981, Nielsen & Karsholt; same locality, Aquas Calientes to 3 km W, 450 m, 5♂, 12–20 Dec 1981, D.R. Davis, UV light trap; Aguas Calientes to 2 km S, 450 m, 3♂, 1♀, 10–22 Feb 1979, D. & M. Davis & B. Akerbergs, UV light trap. Parque Nacional Puyehue, Anticura, 300 m, 1♂, 7–9 Mar 1979, E.S. Neilsen.

Paratypes in ANIC, MNHS, USNM, and ZMUC.

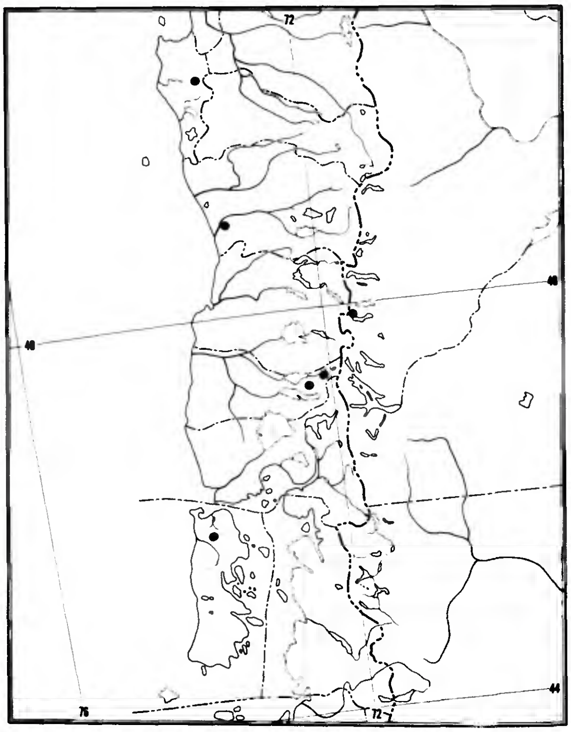
HOST.—Unknown.

FLIGHT PERIOD.—12 December to 9 March; univoltine.

DISTRIBUTION (Map 13).—Although relatively uncommon, this species is widely distributed through the southern temperature forest (Valdivian) of Chile, with only a single record known from the adjacent Andean frontier of Argentina. In Chile it has been found from the coastal Nahuelbuta Mountains south to Puyehue National Park and Chiloé Island.

ETYMOLOGY.—The specific epithet is derived from the latin *pallidus* (ashen, wan), in reference to the pale ground color of the wings.

DISCUSSION.—*Palaephatus pallidus* is closely allied to the type of the genus, *P. falsus*, and rubbed



MAP 13.—Distribution of *Palaephatus (Palaephatus) pallidus*.

specimens, particularly of females, may be difficult to distinguish without dissection. The two species agree in having lost the antennal pecten and labial hair brush and in the possession of specialized hair pencil pockets in the male hind wing and very similar male genitalia. *Palaephatus pallidus* may be distinguished from its sister species by its paler, almost white ground color and by the presence of a short white longitudinal bar at the lower margin of the discal cell in the forewings. The male genitalia of this species differs from that of *P. falsus* by the different form of the gnathos, aedoeagus, and valvae shown in Figures 536–539.

***Palaephatus (Palaephatus) luteolus*, new species**

FIGURES 95, 383–390, 431–433, 540–543, 595; MAP 14

ADULT (Figures 431–433).—Length of forewing: ♂, 12–14.5 mm; ♀, 14–16 mm. A relatively large moth with pale to bright yellow forewings usually marked with variable spots and oblique bands of brownish fuscous.

Head: Vestiture pale cream to light yellow with a small patch of fuscous hairs on either side of frons beneath antennae and rows of fuscous hairs along posterior rim of eye. Antennae approximately 0.6 the length of forewing, 50-segmented; scape uniformly pale cream; pecten absent; flagellum uniformly pale cream. Maxillary palpi white to pale cream. Labial palpi pale cream mesally, heavily irrorated with dark brown scales laterally on second and third segments; second segment without lateral brush of hairs.

Thorax: Pronotum pale cream to yellow. Venter pale cream to white. Forewings pale to bright yellow, variably marked with brownish fuscous, rarely with heavy brownish orange suffusion; typically with numerous, small, brownish fuscous spots scattered over forewing, sometimes forming 2–3 curved, transverse rows beyond middle; a faint, strongly oblique brownish fuscous fascia occasionally present across middle; base of costal margin fuscous, continuing as a patch of long fuscous hairs ventrally; fringe mottled with patches of pale cream, yellow, and brownish fuscous scales. Hind wings much paler, nearly white. A small pocket containing a short hair pencil (Figures 95, 385–386) present at the base of Rs in the male. Forelegs with femur predominantly pale cream with brownish suffusion dorsally; tibiae and tarsi brownish fuscous to brownish orange dorsally, pale cream to brownish orange ventrally; tarsi not ringed. Midlegs mostly brownish orange to fuscous dorsally, rarely with a purple luster; cream ventrally; tarsi not ringed. Hind legs relatively uniformly cream to pale yellowish orange.

Abdomen: Uniformly pale cream with a narrow interrupted streak of fuscous midventrally.

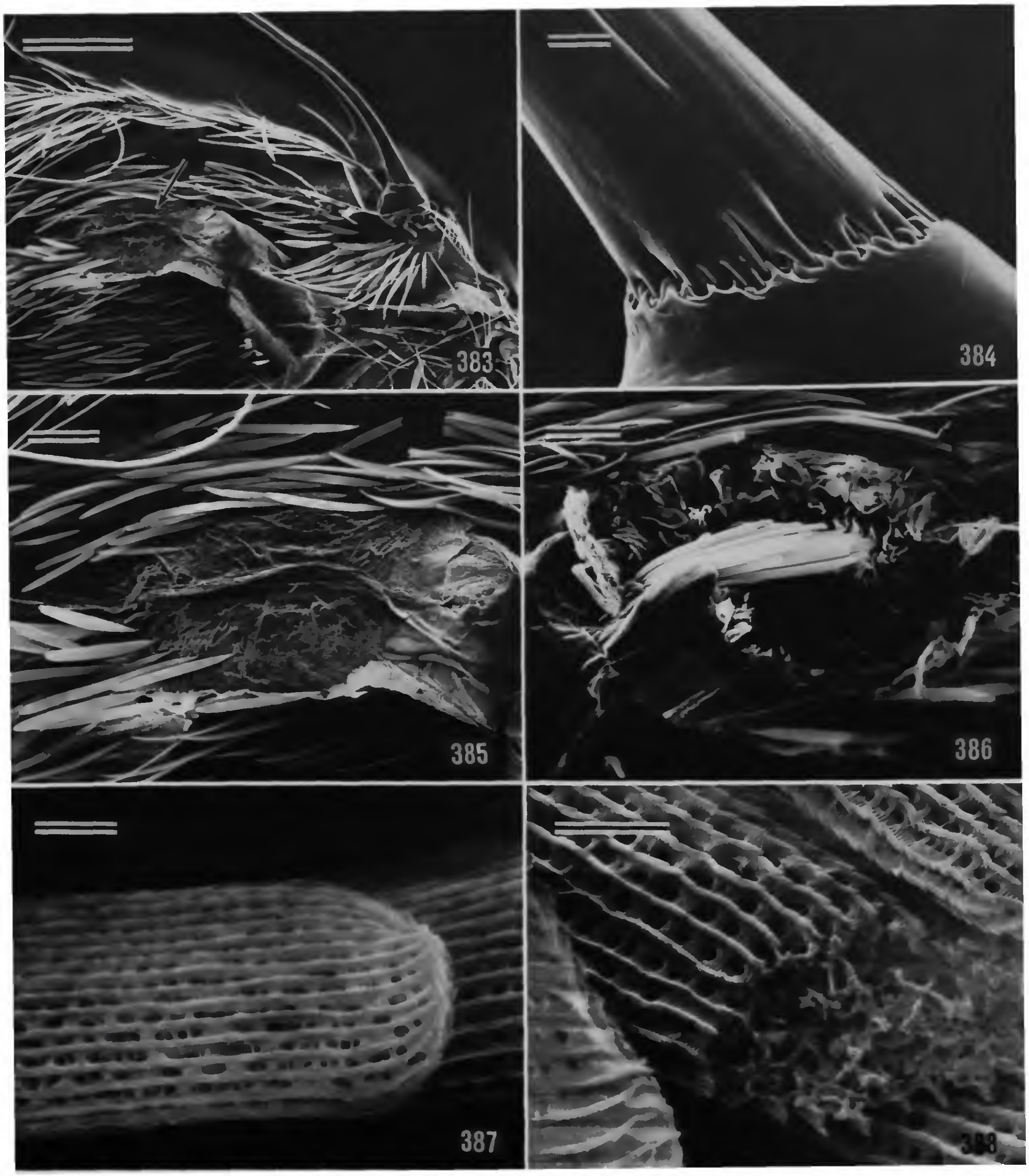
Male Genitalia: As shown in Figures 540–543. Uncus shortly bilobed. Gnathos well developed; median lobe truncate, posterior margin irregular. Valvae with a relatively broad apical process; pollex with a short basal lobe and a secondary lobe to main dorsal lobe. Aedoeagus with an elongate, clavate internal lobe bearing a dense cluster of slender spines.

Female Genitalia: As shown in Figure 595. Eighth sternite shallowly cleft. Corpus bursae with numerous, finely scattered spicules becoming slightly more concentrated near elliptical signum at anterior end. Ductus bursae with thickened, folded walls densely covered with circular spicules. Spermathaca with numerous, scattered, longitudinal rows of spicules over posterior third of utriculus.

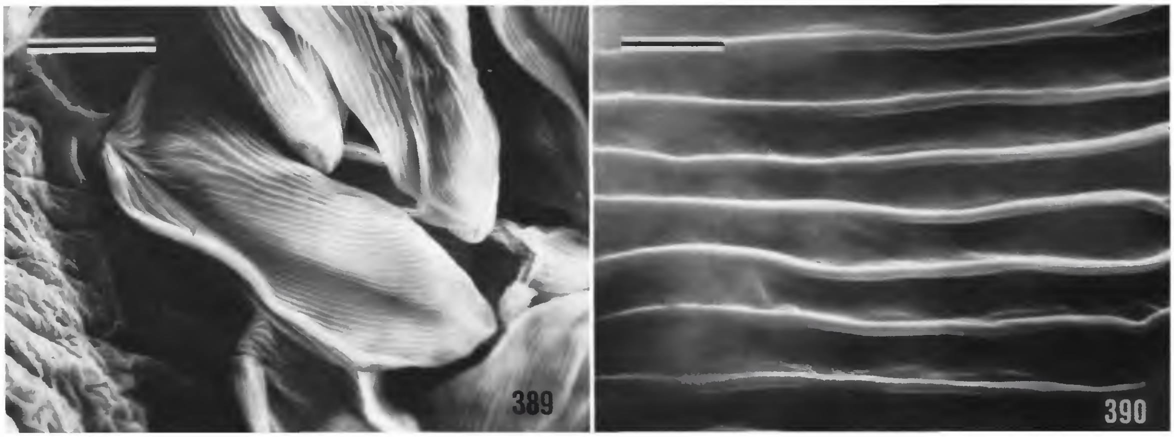
IMMATURE STAGES.—Unknown.

HOLOTYPE.—♂. Fundo Chacamo, 600 m, 35 km NW Nueva Imperial, Cautin Province, Chile; 5–8 Dec 1981, D.R. Davis, UV light trap, type no. 101181 (USNM).

PARATYPES.—ARGENTINA. *Chubut Prov.:* Esquel, Lago Menéndez, El Sagrario Puerto, 600 m, 1♂, 1♀, 2–4 Jan 1982, Nielsen and Karsholt; 3♂, 20 Feb 1979; 3♂, 21 Feb 1979, E.S. Nielsen. *Neuquen Prov.:* Junin de los Andes, Laguna Verde, 1000 m, 1♂, 11 Mar 1979, E.S. Nielsen. Lago Lacar, 5 km E of Hua-Hum, 640 m, 2♂, 8 Oct 1981; 3♂, 14 Oct 1981; 15♂, 1♀, 16 Oct



FIGURES 383–388.—*Palaephatus (Palaephatus) luetolus*, new species, male wing structure: 383, dorsal hind wing with androconial pocket (see arrow) (400 μm); 384, base of male frenulum (20 μm); 385, detail of androconial pocket in 383 (100 μm); 386, androconial pocket with dorsal cover removed to expose reduced hair pencil (100 μm); 387, detail of apex of hair pencil (4 μm); 388, cross sectional view of hair pencil (4 μm). (Scale lengths in parentheses.)



FIGURES 389, 390.—*Palaephatus (Palaephatus) luteolus,* new species, male scale structure: 389, basement sex scales in Figure 386 (scale = 20 μm); 390, surface detail of 389 (scale = 3 μm).

1981; 3♂, 1♀, 5–6 Nov 1981; 7♂, 1♀, 6 Nov 1981; 9♂, 6♀, 25 Nov 1981; 1♀, 26–27 Dec 1981; 1♂, 1♀, 28–29 Nov 1981, Nielsen and Karsholt. Lago Lacar, Pucará, 750 m, 1♂, 10 Nov 1978; 1♀, 2 Dec 1978; 2♂, 1♀, 26 Dec 1978, E.S. Nielsen. *Rio Negro Prov.:* Lago Nahuel Huapi, Puerto Blest, 770 m, 1♂, 1♀, 15 Nov 1978; 1♂, 20 Nov 1978; 1♂, 27 Nov 1978; 3♂, 1♀, 17 Dec 1978; 2♂, 1♀, 18 Dec 1978; 3♂, 20 Dec 1978; 2♂, 21 Dec 1978; 4♂, 2♀; 22 Dec 1978; 2♂, 23 Dec 1978; 2♂, 28 Feb 1979, E.S. Nielsen; same locality; 1♂, 21 Oct 1981, 1♂, 22 Nov 1981; 9♂, 2♀, 3–8 Dec 1981; 2♀, 9–21 Dec 1981; 5♂, 2♀, 22 Dec 1981, Nielsen and Karsholt. *Tierra del Fuego:* Ushuaia, Lapataia, 20 m, 1♂, 2 Feb 1979, E.S. Nielsen.

CHILE. *Cautin Prov.:* Fundo Chacamo, 600 m, 35 km NW Nueva Imperial, 2♂, 1♀, 5–8 Dec 1981, D.R. Davis, UV light trap; same locality: 2♀, 17–23 Feb 1981, L. Peña. *Chiloé Prov.:* Chiloé Island, Hueque Trumao, 50 m, 22 km N of Quellon, 1♀, 26–27 Dec 1981, D.R. Davis, UV light trap. *Magallanes Prov.:* Punta Arenas, Puerto del Hambre, 500 m, 1♂, 8 Feb 1979, E.S. Nielsen. *Malleco Prov.:* Curacatin, Termas de Manzanar, 700 m, 1♀, 19 Mar 1979, E.S. Nielsen. *Osorno Prov.:* Parque Nacional Puyehue, Aguas Calientes to 3 km W, 450 m, 1♀, 12–20 Dec 1981, D.R. Davis, UV light trap. Parque Nacional Puyehue, Anticura, 350 m, 1♂, 17 Nov 1981; 1♂, 18 Nov 1981, Nielsen & Karsholt.

Paratypes deposited in ANIC, BMNH, MACN, MHNS, USMN, and ZMUC.

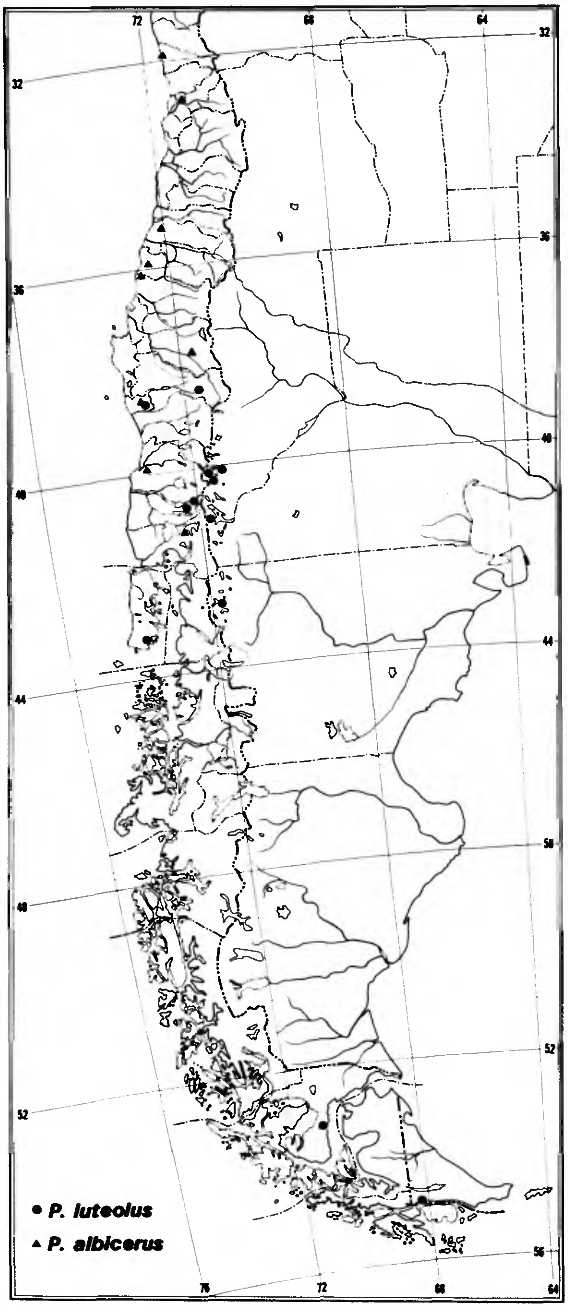
HOST.—Unknown.

FLIGHT PERIOD.—8 October to 19 March; multivoltine?

DISTRIBUTION (Map 14).—This species occurs widely over much of the Valdivian forest region of southern Chile and Argentina, from Cautin Province, Chile, and Neuquen Province, Argentina, south to the Interoceanic Magellanic region of Tierra del Fuego. The limits of its range appears to correspond roughly with that of *Nothofagus.*

ETYMOLOGY.—The species name is derived from the Latin *luteolus* (yellowish), in reference to the predominantly yellowish color of the forewings.

DISCUSSION.—The generally bright yellow color of this species together with its rather large size readily distinguishes it from all other Palaephatidae. Together with its sister species *Palaephatus albicerus,* and other members of the subgenus *Palaephatus, P. luteolus* shares the peculiar specialization of having lost both the antennal pecten as well as the lateral brush of hairs on the labial palpi. Its affinity to *P. albicerus* is



MAP 14.—Distribution of *Palaephatus (Palaephatus)*.

demonstrated by their very similar genital morphology. The males of *P. luteolus* differ from *P. albicerus* in possessing a vestigial hair pencil pocket near the base of the hind wing, homologous to the more-developed pockets in the males of *P. falsus* and *P. pallidus*.

This species exhibits less sexual dimorphism than any of the four species of the subgenus *Palaephatus*. Furthermore, what color differences exist are obscured by the great amount of color variation present within each sex. Besides being larger, females are generally more bright yellow in color; however, the most heavily marked specimen examined, in the large series available, was a female (Figure 433). Most males possessed a somewhat indistinct brownish streak through the middle of the forewing but most evident at the distal third of the wing. None of the females examined clearly exhibited this pattern.

Palaephatus (Palaephatus) albicerus, new species

FIGURES 434, 435, 544–547, 596; MAP 14

ADULT (Figures 434, 435).—Length of forewing: ♂, 8.5–10 mm; ♀, 10–11 mm. A moderately large species with white (in male) to yellowish white forewings (in female) lightly suffused with gray over distal half of wing, and a faint, pale fuscous oblique fascia across middle of wing.

Head: Vestiture white with a small patch of fuscous hairs on either side of frons beneath antennae and rows of fuscous hairs along posterior rim of eye. Antennae approximately 0.65–0.7 the length of forewing, 50–51-segmented; scape entirely white; pecten absent; flagellum uniformly white. Maxillary palpi white. Labial palpi white mesally, heavily irrorated with fuscous scales laterally; second segment without lateral brush of hairs.

Thorax: Pronotum white. Venter white. Forewings white in male lightly suffused with gray over distal half; small patches of fuscous scales also scattered over forewings with a small, subapical black spot usually distinct; middle of wing crossed by a slender, sometimes indistinct, oblique fascia of pale fuscous; base of costal margin dark fuscous; forewings of female with similar although usually fainter markings and a pale yellowish white ground color; fringe pale grayish white. Hind wings white to pale yellowish white. Androconial pockets or folds absent. Forelegs brownish fuscous dorsally, white ventrally; tarsi not annulated (i.e., without paler apices). Midlegs similar to forelegs in color. Hind legs uniformly white except for fuscous on tarsi 2–5 and apices of tibial spurs.

Abdomen: Vestiture uniformly white; cuticle sometimes appearing pale bluish green.

Male Genitalia: As shown in Figures 544–547. Uncus shortly bilobed. Gnathos well developed, with a broad medium process possessing a somewhat irregular posterior margin. Valvae with a slender, elongate apical process; pollex with a short basal lobe. Aedoeagus with a prominent cluster of approximately 8 stout spines of descending lengths situated apically on a large, dorsal digitate lobe; a second pair of more slender interior arms with a row of small, hair-like spines arising apically from the right arm only.

Female Genitalia: As shown in Figure 596. Eighth sternite with deeply divided, rounded lobes; posterior margin of lobes minutely hirsute. Ductus bursae densely covered internally with minute, placoid spicules throughout its length. Corpus bursae sparsely covered internally with extremely minute pectinations, each consisting of 2–3 spicules in a transverse row; signa absent. Spermatheca with an elongate, spindle-shaped utriculus with completely membranous, unspiculated walls.

IMMATURE STAGES.—Unknown.

HOLOTYPE.—♂. Fundo Chacamo, 600 m, 35 km NW of Nueva Imperial. Cautin Province, Chile; 5–8 Dec 1981, D.R. Davis, UV light trap, type no. 101180 (USNM).

PARATYPES.—CHILE. *Bio Bio Prov.:* Rio Quenco, E of Sta. Barbara, 1♂ 17 Mar 1984, L. Peña. *Cauquenes Prov.:* Paso Garcia, 300 m, ~23 km NW Cauquenes, 5♂, 29–30 Nov 1981, D.R. Davis, UV light trap. *Choapa Prov.:* Ñague, 11 km N of Los Vilos, 20 m, 1♀, 4–5 Nov 1981, D. & M. Davis, UV light trap. *Llanquihue Prov.:* Petrohue, ~600 m, 1♀, 1 Jan 1982, D.R. Davis, UV light trap. *Ñuble Prov.:* Alto Tregualemu, 500 m, ~20 km SE Chovellen, 1♀, 29–30 Nov 1981, D.R. Davis. *Quillota Prov.:* Cuesta El Melón, ~8 km N of La Calera, 500 m, 1♂, 2–3 Nov 1981, D. & M. Davis, UV light trap. *Talca Prov.:* El Pantanillo, 350 m, 17 km SE of Constitucíon, 1♀, 28 Nov 1981, D.R. Davis, UV light trap. Forel, Carrizalillo, 250 m, 1♂, 30 Jan–5 Feb 1981, L. Peña. *Valdivia Prov.:* Rincon de la Piedra, 180 m, 20 km S of Valdivia, 1♂, 24 Sep 1981, Nielsen & Karsholt; 1♀, 21 Nov 1959, E. Krahmer. Paratypes in ANIC, MNHS, USNM, and ZMUC.

HOST.—Unknown.

FLIGHT PERIOD.—24 September to 17 March; multivoltine?

DISTRIBUTION (Map 14).—This species occurs farther north than any other member of the family. It ranges from the southern limits of the Coquimbo Desert in Choapa Province (~32°S) south largely through the coastal ranges to Valdivia and Petrohue (~41°S). Although extensive collections have been made from the temperate Andean forests, only one record (Petrohue) is known from this region, and none have been reported thus far from Argentina.

ETYMOLOGY.—The species name is derived from the Latin *albicerus* (yellowish white), in reference to the forewing ground color, especially of the female.

DISCUSSION.—*Palaephatus albicerus* demonstrates a slight degree of sexual dimorphism, as do most members of the subgenus, with the males being predominantly white and the females pale yellow. It is most related to *P. luteolus,* with which it shares conspicuous simularities in the male genitalia, particularly in the presence of clustered spines in the aedoeagus and in the form of the pollex on the valvae. It is easily differentiated from *P. luteolus* by its smaller size and paler color, as well as by several genital characters as illustrated.

The present distributional data suggest that *P. albicerus* is more adapted to drier-warmer habitats than any other Palaephatidae. The most northern habitat for this species at Ñague is interesting in that it consists of a small remnant forest (Figure 3) approximately 2 to 3 kilometers in length, which has developed along a wet seepage, surrounded by characteristic Coquimbo Desert vegetation (Peña, 1966:215). The small forest ended approximately 100 meters short of some rather extensive coastal sand dunes. The El Melón site slightly farther south consists of more extensive forests, also devoid of *Nothofagus*, which extend as a slender belt south along the Central Coastal Cordillera (Figure 5).

***Apophatus*, new genus**

TYPE-SPECIES.—*Apophatus bifibratus*, new species.

ADULT.—Small moths with light brown to fuscous forewings, variably marked with pale cream to white. Maxillary palpi reduced to 4 short segments; epiphysis absent. Length of forewing 3.8–5.5 mm.

Head: Vestiture rough, consisting of long, piliform scales with acute apices. Antennae approximately 0.9 the length of forewing, 50–52-segmented; pecten present, consisting of 3–4 brownish hairs. Eyes round, smooth, reduced in size; interocular index approximately 0.6; eye index 1.3. Ocelli absent. Pilifers reduced, consisting of approximately 5–6 pairs of long setae arising close to median from unlobed bases. Mandibles extremely reduced, less than 0.5 the length of third maxillary palpal segment. Maxillary palpi 4-segmented, greatly reduced, less than 0.3 the length of labial palpi; ratio of segments from base approximately 1:0.5:1.2:1. Haustellum relatively short, nearly 3.0 the length of maxillary palpus; Labial palpi 3-segmented, well developed, about 1.25 the length of haustellum; ratio of segments from base 0.9:1.5:1.

Thorax: Forewings moderately slender, somewhat abruptly tapering to a subacute apex; length approximately 3.2 the width. Radius 5-branched; medius 3-branched; all veins arising separate from discal cell; 1A and 2A separate at basal third, forming an anal loop; accessory cell present; base of medius branched within discal cell. Microtrichia evenly scattered over dorsal and ventral surface of both wings. Hind wings moderately slender, length approximately 2.6 the width. Female frenulum with 2 bristles. Medius 3-branched, all veins arising separate from cell. Androconial pockets and hair pencils absent. Forelegs without epiphysis; tibia 0.8 the length of femur. Midlegs with a single large apical pair of tibial spurs of unequal lengths. Hind legs with two pairs of large tibial spurs of unequal lengths, one pair apical and other pair at distal third. Mesothoracic furcal apophyses prominent and well set off from secondary furcal arms; lateral apophyses moderately enlarged, considerably thicker and about 2.0 the length of mesal apophyses. Metathoracic furcal apophyses elongate, slender; tendon arising near middle of apophysis. A pair of tendons also arising dorsally from middle of anteromedial process.

Abdomen: Without specialized integumental modifications such as glands or sex scales.

Male Genitalia: Uncus slightly bilobed. Gnathos present, variously developed; either slender and elongate with terminal spines, or broadly U-shaped and naked. Tegumen weakly developed, poorly sclerotized. Vinculum moderately to well developed; anterior margin either broad and rounded, or constricted to form a distinct, slender, acute saccus. Valvae broad, with a prominent, subapical to medial, uncinate pollex arising from costal margin. Transtilla absent. Juxta absent. Anellus absent. Aedoeagus variously developed, longer than genital capsule, either with or without long, filamentous, exogenous spines; cornuti absent.

Female Genitalia: Ovipositor relatively slender, with apex extended into a minute, median lobe; posterior apophyses straight, approximately equalling anterior apophyses in length. Eighth sternite with caudal margin hirsute and deeply cleft. Ductus bursae only slightly swollen, interior walls lightly spiculated, not folded. Corpus bursae moderately large; interior walls without spicules; signum absent. Spermatheca as long as bursa copulatrix; utriculus extremely slender, without spicules or lateral lagena.

ETYMOLOGY.—The generic name is derived from the Greek *apo* (from, separate, after) added to the stem of the generic name *Palaephatus,* in reference to the more recently derived origin of this genus.

DISCUSSION.—There seems little doubt that *Apophatus* represents the latest evolved, most derived member of the Palaephatidae. The head demonstrates several specializations, particularly in having the most reduced eyes, mandibles, and maxillary palpi in the family. *Apophatus* is also the only member to have lost the epiphysis. It demonstrates its affinities with *Palaephatus* by sharing such synapomorphies as the presence of a subapical pollex on the valvae of the male and the cleft condition of the eighth sternite in the female.

Only two, apparently rare, species are known (*A. bifibratus,* new species, and *A. parvus,* new species) both restricted to the southern temperature forests of Chile and the adjacent borders of Argentina.

It is not known if any of the 6 specimens collected thus far of this genus were attracted to lights. The pronounced reduction of the eyes strongly suggests that both species are diurnal.

Key to the Species of *Apophatus*

Length of forewing approximately 4 mm or less. Male genitalia as in Figures 548–551; aedoeagus relatively simple, without elongate filaments . . . . ***Apophatus parvus,*** new species

Length of forewing approximately 5–5.5 mm. Male genitalia as in Figures 552–556; aedoeagus with a pair of long filaments directed caudad . . . . ***Apophatus bifibratus,*** new species

Apophatus parvus, new species

FIGURES 436, 548–551, 597; MAP 15

ADULT (Figure 436).—Length of forewing: ♂, 3.8 mm; ♀, 4.0 mm. One of the smallest species in the family, possessing uniformly fuscous wings. The eyes and mouthparts are generally reduced.

Head: Vestiture of vertex light brownish fuscous; frons pale buff to white. Antennae approximately 0.6 the length of forewing, 29+(broken)-segmented; scape bown; pecten consisting of 3–4 brownish hairs; flagellum uniformly brownish fuscous. Maxillary palpi pale buff. Labial palpi pale buff with scattered dark brown scales ventrolaterally; apex of second segment with 3–4 light brown hairs.

Thorax: Pronotum brownish fuscous. Venter pale buff to dull white. Forewings uniformly brownish fuscous with a slight bronzy luster with only a few, minute, dull white spots visible bordering subapex of costa and termen. Hind wings uniformly brownish fuscous with a slight purplish bronze luster, nearly as dark as forewings. Forelegs brownish fuscous dorsally, whitish buff ventrally; pale banding on tarsi indistinct. Midlegs brownish dorsally, pale buff ventrally. Hind legs brownish dorsally, pale buff ventrally.

Abdomen: Brownish fuscous dorsally; buff ventrally.

Male Genitalia: As shown in Figures 548–551. Uncus indistinct, with low rounded lobes. Gnathos a slender U-shaped bar. Apex of valvae rounded, without apical process; pollex arising below middle of costa. Aedoeagus relatively simple, without prominent spines or pecten.

Female Genitalia: As shown in Figure 597. Corpus bursae reduced, without signa; walls completely membranous. Ductus bursae relatively broad, with thickened walls densely covered internally with minute, circular spicules.

IMMATURE STAGES.—Unknown.

HOLOTYPE.—♂. Aguas Calientes to 2 km S,

Parque Nacional Puyehue, 450 m, Osorno Province, Chile; 10–22 Feb 1979, D. and M. Davis, B. Akerbergs, type no. 101175 (USNM).

PARATYPE.—CHILE. Same data as holotype, 1♀ (USNM).

HOST.—Unknown.

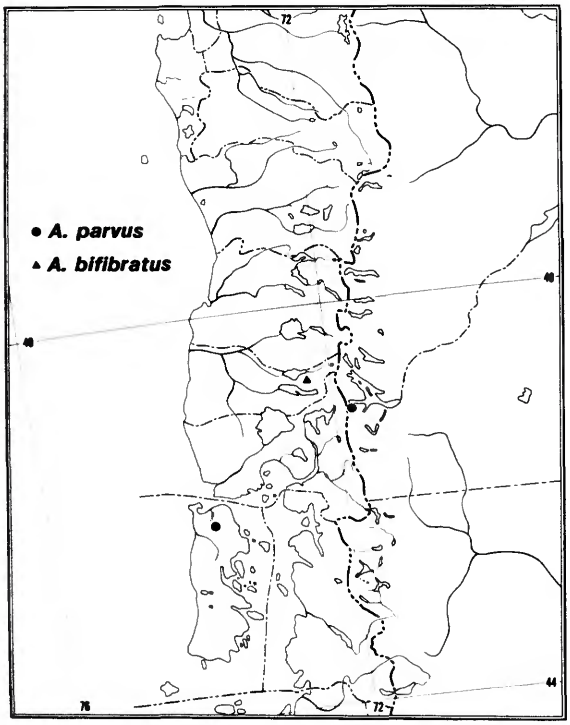
FLIGHT PERIOD.—February; univoltine.

DISTRIBUTION (Map 15).—Known only from the type-locality, which is located in the Valdivian forest zone of southern Chile.

ETYMOLOGY.—The specific name is derived from the Latin *parvus* (little), in reference to the small size of this moth.

DISCUSSION.—This is the smallest species of Palaephatidae known. Other features that serve to distinguish it, particularly from its closest relative, *A. bifibratus*, are several characteristic modifications of the male genitalia. The genital capsule is relatively narrow, with a rather broadly rounded vinculum-saccus. The aedoeagus is relatively simple in structure and lacks the paired filamentous spines present in *A. bifibratus*.

A single spermatophore was observed in the corpus bursae of the sole female available for study. The spermatophore was slender and forked at the posterior end, with one branch short and the other greatly extended and gradually enlarged toward the anterior end (Figure 598).



MAP 15.—Distribution of species of *Apophatus*.

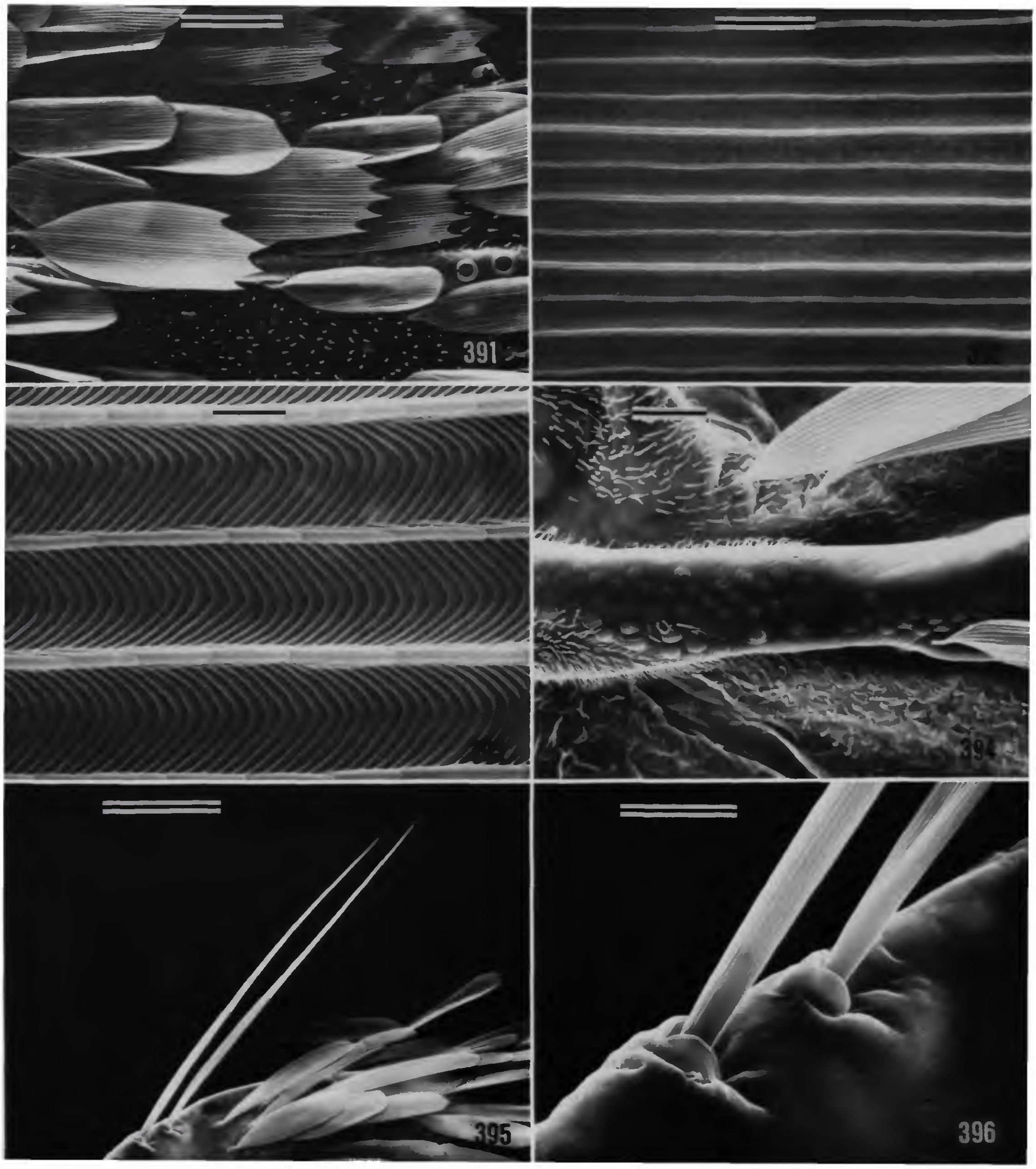
Apophatus bifibratus, new species

FIGURES 25, 26, 93, 100, 120–122, 139, 391–396, 437, 438, 552–556, 599; MAP 15

ADULT (Figures 437, 438).—Length of forewing: ♂, 5–5.2 mm; ♀, 5.3–5.5 mm. A small moth with dark fuscous to light brown forewings reflecting a slight purplish to golden luster, variably marked with streaks and small patches of pale cream to white scales. The eyes and mouthparts are generally reduced.

Head: Vestiture of vertex light yellowish brown; frons pale white to cream. Antennae approximately 0.9 the length of forewing, 50–52-segmented; scape brownish fuscous to light brown dorsally, whitish buff ventrally; pecten consisting of a few dark hairs; flagellum uniformly light brown to brownish fuscous, with a slight golden luster. Maxillary palpi dull white. Labial palpi white dorsally, lightly suffused with buff ventrally; apex of second segment with a few dark hairs.

Thorax: Pronotum dark fuscous to light brown. Venter whitish buff. Forewings dark fuscous to light brown with a slight purplish to golden hue; pattern variable, complex, sometimes with an almost equal amount of cream to white scaling as streaks or patches over wing; costal margin with 3–7 small cream white patches or strigulae; termen fuscous equally mixed with buff and white scales. Hind wings uniformly dark to light gray; male without androconial folds or pockets. Forelegs fuscous to brown dorsally, whitish buff ventrally; tarsi not annulated. Midlegs similar to forelegs except paler, more gray dorsally. Hind legs similar to above except pale brown dorsally.



FIGURES 391–396.—*Apophatus bifibratus*, new species, wing structure: 391, dorsal forewing near apex (50 μm); 392, detail of scale "a" in 391 (5 μm); 393, detail of 392 (1 μm); 394, dorsal hind wing showing campaniform sensilla at base of Sc + Rs (25 μm); 395, female frenulum, dorsal hind wing (100 μm); 396, base of female frenulum (20 μm). (Scale lengths in parentheses.)

Abdomen: Dark fuscous to light golden brown dorsally, pale gray to buff ventrally.

Male Genitalia: As shown in Figures 552–556. Uncus slightly bilobed. Gnathos a median, elongate lobe, sometimes extending beyond uncus. Valvae rounded, without apical lobe but with a strongly curved subapical pollex. Aedoeagus elongate, with a pair of long filamentous appendages arising near middle immediately anterior of junction of ejaculatory duct; appendages sharply curved posteriorly at their bases; anterior half of aedeagus deeply furcate; posterior half membranous and swollen.

Female Genitalia: As shown in Figure 599. Corpus bursae relatively long, slightly exceeding length of ductus bursae; signa and spicules absent. Ductus bursae slender, with relatively few spicules. Spermatheca equalling length of bursa copulatrix.

IMMATURE STAGES.—Unknown.

HOLOTYPE.—♂. Puntra, 50 m, approximately 30 air km S of Ancud, Chiloé Island, Chiloé Province, Chile; 21–22 Dec 1981, D.R. Davis, type no. 101183 (USNM).

PARATYPES.—ARGENTINA. *Rio Negro Prov.:* Lago Frias, Puerto Frias, 780 m, 1♂, 1♀, 7 Dec 1981, Nielsen & Karsholt. CHILE. Same data as holotype, 1♀.

Paratypes in USNM and ZMUC.

HOST.—Unknown.

FLIGHT PERIOD.—7 to 22 December; univoltine.

DISTRIBUTION (Map 15).—This species has been found at only two somewhat disjunct localities in the temperate Valdivian forests of southern Argentina and Chile. The locality in Argentina is in the western montane portion of Rio Negro Province. The Chilean type-locality is situated in a lowland wooded ravine approximately 300 yards east of the Pan American Highway on Chiloé Island.

ETYMOLOGY.—The specific name is derived from the latin *bi* (two, double) plus *fibra* (filament), in reference to the two filamentous appendages arising from the aedoeagus.

DISCUSSION.—Several specializations in the male and female genitalia easily distinguish this species from all other Palaephatidae, including its nearest ally, *A. parvus*. The aedoeagus of the male is unique in the presence of a pair of elongate, filamentous spines arising ventrally near the base. The ductus bursae of the female is unusual in being the most reduced in the family.

Appendix

Neotropical Microlepidoptera Series

(Most papers were prepared with the aid of National Science Foundation Grants)

Proceedings of the United States National Museum

Paper	*Author*	*Subject*	*Year*	*Volume*	*Number*
I, II	Clarke	Blastodacnidae and Aegeriidae	1962	113	3457
III	Clarke	*Gonionota melobaphes* and Relatives	1964	115	3480
IV	Duckworth	A New Genus of Stenomidae	1964	116	3497
V	Obraztsov	The Tortricid Genus *Proeulia*	1964	116	3501
VI	Clarke	The Genera *Orsotricha* and *Palinorsa*	1964	116	3502
VII	Obraztsov	The Tortricid Genus *Pseudomeritastis*	1966	118	3527
VIII	Duckworth	The Stenomid Genus *Falculina*	1966	118	3531
IX	Obraztsov	The Tortricid Genus *Pseudatteria*	1966	118	3535
X	Duckworth	Taxa Erroneously Placed in Stenomidae	1966	119	3540
XI	Obraztsov	The Tortricid Genus *Idolatteria*	1966	119	3543
XII	Duckworth	The Stenomid Genus *Lethata*	1967	122	3585
XIII	Duckworth	The Stenomid Genus *Loxotoma*	1967	122	3590
XIV	Clarke	Chilean Microlepidoptera Described by Blanchard	1967	123	3591
XV	Duckworth	The Stenomid Genus *Thioscelis*	1967	123	3620
XVI	Clarke	New Species of Oecophoridae	1968	125	3654
XVII	Clarke	New Species of Phaloniidae	1968	125	3660

Smithsonian Contributions to Zoology

XVIII	Duckworth	Oecophorid Genus *Peleopoda*	1970		48
XIX	Clarke	Notes and New Species of Oecophoridae	1971		95
XX	Duckworth	Revision of the Genus *Setiostoma*	1971		106
XXI	Clarke	New Genera and Species of Oecophoridae from Chile	1978		273
XXII	Davis	A New Family of Monotrysian Moths from Austral South America (Lepidoptera: Palaephatidae), with a Phylogenetic Review of the Monotrysia	1986		434

References

Almeyda A., E., and F. Saez S.

1958. *Recopilacion de datos climaticos de Chile y mapas sinopticos respectivos.* 195 pages. Santiago: Ministerio de Agricultura, Departmento Technico Interamericano de Cooperacion Agricola. [Proyecto 14: Investigaciones Económicas Agricolas.]

Anonymous

1981. *Atlas de Chile.* 48 pages. Santiago: Editorial Antartica S.A.

Artigas, J.N.

1975. Introduccion al estudio por computacion de las areas zoogeograficas de Chile Continental Basado en la distribucion de 903 species de animales terrestres. *Gayana Miscelanea*, 4:3–25, 32 maps.

Börner, C.

1939. Die Grundlage meines Lepidopterensystems. In *Verhandlungen der VII. Internationaler Kongress für Entomologie,* 2:1372–1424, figures 1–51.

Braun, A.F.

1924. The Frenulum and Its Retinaculum in the Lepidoptera. *Annual of the Entomological Society of America*, 17(3)234–257, plate 23: figures 1–9.

1972. Tischeriidae of America North of Mexico (Microlepidoptera). *Memoirs of the American Entomological Society,* 28:1–148, figures 1–146.

Brock, J.

1971. A Contribution towards an Understanding of the Morphology and Phylogeny of the Ditrysian Lepidoptera. *Journal of Natural History,* 5:29–102, figures 1–53.

Brown, R.L., and P.R. Miller

1984. Studies of Lepidoptera Hindwings with Emphasis on Ultrastructure of Scales in *Cydia caryana* (Fitch) (Tortricidae). *Entomography,* 2:261–295.

Brundin, L.

1966. Transantarctic Relationships and Their Significance, as Evidenced by Chironomid Midges. *Kunglica Svenska Velenskapsakademiens Handlingar,* series 4, 11(1):1–472, 30 plates.

Busck, A.

1914. On the Classification of the Microlepidoptera. *Proceedings of the Entomological Society of Washington,* 16:46–54.

1931. On the Female Genitalia of the Microlepidoptera and Their Importance in the Classification and Determination of These Moths. *Bulletin of the Brooklyn Entomological Society,* 26(5):199–216, figures 1–18.

Butler, A.G.

1883. Heterocerous Lepidoptera Collected in Chili by Thomas Edmonds, Esq., Part IV—Pyrales and Micros. *Transactions of the Entomological Society of London,* 1:49–90, plate XI.

Cabrera, A.L.

1953. Esquema fitogeografico de la Repubica Argentina. *Revista del Museo de la Ciudad Eva Peron,* new series, *Botany,* 8(33):87–168, figures 1–15.

Cabrera, A.L., and A. Willink

1973. *Biogeografia de America Latina.* vi + 120 pages, 25 figures. Washington, DC: Organizacion de los Estados Americanos.

Clarke, J.F. Gates

1970. *Catalogue of the Type Specimens of Microlepidoptera in the British Museum (Natural History) Described by Edward Meyrick.* Volume 8, 261 pages, 60 plates.

1978. Neotropical Microlepidoptera, XXI: New Genera and Species of Oecophoridae from Chile. *Smithsonian Contributions to Zoology,* 273: 80 pages, 54 figures, 6 plates.

Common, I.F.B.

1969. A Wing-locking or Stridulatory Device in Lepidoptera. *Australian Entomological Society,* 8:121–125, figures 1, 2, plate 1.

1975. Evolution and Classification of the Lepidoptera. *Annual Review of Entomology,* 20:183–203.

Comstock, J.H.

1892. The Descent of the Lepidoptera: An Application of the Theory of Natural Selection to Taxonomy. *Proceedings of the American Association for the Advancements of Science,* section F (Biology), 1892:199–201.

Davis, D.R.

1967. A Revision of the Moths of the Subfamily Prodoxinae (Lepidoptera: Incurvariidae). *United States National Museum Bulletin,* 255:1–170, figures 1–155, maps 1–17.

1975a. A Review of the West Indian Moths of the Family Psychidae with Descriptions of New Taxa and Immature Stages. *Smithsonian Contributions to Zoology,* 188: 66 pages, 206 figures.

1975b. Systematics and Zoogeography of the Family Neopseustidae with the Proposal of a New Superfamily (Lepidoptera: Neopseustoidea). *Smithsonian Contributions to Zoology,* 210: 45 pages, 98 figures.

1978a. A Revision of the North American Moths of the

Superfamily Eriocranioidea with the Proposal of a New Family, Acanthopteroctetidae (Lepidoptera). *Smithsonian Contributions to Zoology,* 215: 131 pages 344 figures, 6 maps.

1978b. The North American Moths of the Genera *Phaeoses, Opogona,* and *Oinophila,* with a Discussion of Their Supergeneric Affinities (Lepidoptera: Tineidae). *Smithsonian Contributions to Zoology,* 282: 39 pages, 128 figures.

1984. Family Tineidae. *In* J.R. Heppner, editor, Atlas of *Neotropical Lepidoptera,* volume 2 (Checklist), part 1 (Micropterigoidea to Immoidea), pages 4–5, 19–24. The Hague: Dr. W. Junk.

1986. Micropterigidae, Eriocraniidae, Acanthopteroctetidae, Heliozelidae, Incurvariidae, Adelidae, Prodoxidae, Opostegidae, Nepticulidae, Tischeriidae, Tineidae, Psychidae, Ochsenheimeriidae, Gracillariidae, Lyonetiidae, and Epipyropidae. *In* F. Stehr, editor, *Immature Insects,* 1. Dubuque, Iowa: Kendall/Hunt Publishing Co.

In press. Biological Investigations on the Microlepidoptera of Chile. *Revista Chilena de Entomologia.*

Davis, D.R., and E.S. Nielsen

1980. Description of a New Genus and Two New Species of Neopseustidae from South America, with a Discussion of Phylogeny and Biological Observations (Lepidoptera: Neopseustoidea). *Steenstrupia,* 6:253–289.

1984. The South American Neopseustid Genus *Apoplania* Davis: A New Species, Distribution Records and Notes on Adult Behavior (Lepidoptera: Neopseustina). *Entomologica Scandinavica,* 15:497–509.

Dimitri, M.J.

1972. La region de los bosques Andino-Patagonicos—sinopsis general. *Coleccion cientifico* (INTA), 10:1–381.

Dugdale, J.S.

1974. Female Genital Configuration in the Classification of Lepidoptera. *New Zealand Journal of Zoology,* 1(2):127–146, figures 1–30, 2 maps.

Eastham, L.E.S., and Y.E.E. Eassa

1955. The Feeding Mechanism of the Butterfly *Pieris brassicae* L. *Philosophical Transactions of the Royal Society of London,* series B, 239(659):1–43, figures 1–44.

Edmunds, G.F.

1972. Biogeography and Evolution of Ephemenoptera. *Annual Review of Entomology,* 17:21–42, figure 1, table 1.

Emmet, A.M.

1976. Tischeriidae. *In* J. Heath, editor, *The Moths and Butterflies of Great Britain and Ireland,* 1:272–276, figure 76, plate 13: figures 20–24, maps 118–122.

Fletcher, T.B.

1929. A List of the Generic Names Used for Microlepidoptera. *Memoirs of the Department of Agriculture in India, Entomological Series,* 11: ix + 246 pages.

Friese, G.

1969. Zur Phylogenie der ältern Teilgruppen der Lepidopteren. *Bericht über die 10 Wonderversammlung Deutscher Entomologen Tagungsberichte, 80,* 2:203–222.

Heinrich, C.

1918. On the Lepidopterous Genus *Opostega* and Its Larval Affinities. *Proceedings of the Entomological Society of Washington,* 29(2):27–38.

Heppner, J.R.

In press. *Lepidoptera Family Classification: A Guide to the Higher Categories, World Diversity and Literature Resources of Butterflies and Moths.* Medford, N.J.: Plexus Publishing Co.

Hinton, H.E.

1946. On the Homology and Nomenclature of the Setae of Lepidopterous Larvae, with Some Notes on the Phylogeny of the Lepidoptera. *Transactions of the Royal Entomological Society of London,* 97:1–37, figures 1–24.

Hueck, K.

1966. *Die Walder sudamerikas.* xviii + 422 pages, 253 figures. Stuttgart: Gustav Fischer Verlag.

Hueck, K., and P. Seibert

1972. *Vegetationskarte von Sudamerika.* 69 pages, 1 map. Stuttgart: Gustav Fischer Verlag.

Illies, J.

1965. Phylogeny and Zoogeography of the Plecoptera. *Annual Review of Entomology,* 10:117–140.

Irwin, M.E., and E.I. Schlinger

In press. A Gazetteer for the 1966–1967 University of California—Universidad de Chile Arthropod Expedition to Chile and Parts of Argentina. *Proceedings of the California Academy of Sciences.*

Jayewickreme, S.H.

1940. A Comparative Study of the Larval Morphology of Leafmining Lepidoptera in Britain. *Transactions of the Royal Entomological Society of London,* 90:63–105, figures 1–12.

Kristensen, N.P.

1984. Studies on the Morphology and Systematics of Primitive Lepidoptera (Insecta). *Steenstrupia,* 10:141–191, figures 1–33.

Kristensen, N.P., and E.S. Nielsen

1979. A New Subfamily of Micropterigid Moths from South America: A Contribution to the Morphology of the Micropterigidae, with a Generic Catalogue of the Family (Lepidoptera: Zeugloptera). *Steenstrupia,* 5:69–147.

1980. The Ventral Diaphragm of Primitive (Non-Ditrysian) Lepidoptera: A Morphological and Phylogenetic Study. *Zeitschrift für Zoologische Systematik und Evolutionsforschung,* 18(2):123–146, figures 1–51.

1983. The *Heterobathmia* Life History Elucidated: Immature Stages Contradict Assignment to Suborder Zeugloptera (Insecta, Lepidoptera). *Zeitschrift für Zoologische Systematik und Evolutionsforschung,* 21:101–124, figures 1–36, 1 table.

Kuschel, G.
1960. Terrestrial Zoology in Southern Chile. *Proceedings of the Royal Society,* series B, 152:540–550, figure 48.

Kuznetsov, V.I., and A.A. Stekolnikov
1978. The System and Evolution of the Infraorders in the Lepidoptera (Micropterigomorpha-Papilionomorpha) in the Light of the Functional Morphology of the Genitalia. *Entomological Review,* 57(4):601–622, figures 1–13. [English translation of *Entomologicheskoye Obozreniye,* 57(4):870–890.]

Kyrki, J.
1983. Adult Abdominal Sternum II in Ditrysian Tineoid Superfamilies—Morphology and Phylogenetic Significance (Lepidoptera). *Annales Entomologici Fennici,* 49(4):89–94.

Mallet, V.A.
1984. Sex Roles in the Ghost Moth *Hepialus humuli* (L.) and a Review of Mating in the Hepialidae (Lepidoptera). *Zoological Journal of the Linnean Society,* 79:67–82, figures 1, 2.

Marshall, W.S.
1922. The Development of the Frenulum of the Wax Moth, *Galleria mellonella* Linn. *Transactions of the Wisconsin Academy of Science, Arts and Letters,* 20:199–205.

McQueen, D.R.
1976. The Ecology of *Nothofagus* and Associated Vegetation in South America. *Tuatara,* 22:38–68.

Meyrick, E.
1928. *Revised Handbook of British Lepidoptera.* vi + 914 pages. London: E.W. Classey Ltd. [Reprinted 1968.]
1931. Micro-Lepidoptera from South Chile and Argentina. *Anales del Museo Nacional de Historia Natural* (Buenos Aires), 36:377–415.

Minet, J.
1981[1982]. Les Pyraloidea et leurs principales divisions systematiques. *Bulletin de la Societe Entomologique de France,* 86:262–280, figures 1–5.
1984. Contribution a l'analyse phylogénétique des Néolepidopteres (Lepidoptera, Glossata). *Nouvelle Revue d'Entomologie,* 1(2):139–149.

Morello, J.
1958. La provincia fitogeográfica del monte. *Opera Lilloana,* 11: 155 pages, 58 plates. Instituto Miguel Lillo.

Mutuura, A.
1972. Morphology of the Female Terminalia in Lepidoptera and Its Taxonomic Significance. *Canadian Entomologist,* 104:1055–1071.

Nielsen, E.S.
1980a. Entomology. *In* H.B. Madsen, E.S. Nielsen, and S. Odum, The Danish Scientific Expedition to Patagonia and Tierra del Fuego 1978–79. *Georgrafisk Tidsskrift,* 80:9–13, figures 1–29.
1980b. A Cladistic Analysis of the Holarctic Genera of Adelid Moths (Lepidoptera: Incurvarioidea) *Entomologica Scandinavica,* 11:161–178, figures 1–29.
1982. Review of the Higher Classification of the Lepidoptera, with Special Reference to the Lower Heteroneurans. *Tyo to Ga,* 33(1):98–101, figures 1, 2.
1985. The Monotrysian Heteroneuran Phylogeny Puzzle: A Possible Solution (Lepidoptera). *Proceedings of the Third European Lepidopterology Congress,* 3:138–143.
In press. Primitive (Non-ditrysian) Lepidoptera of the Andes: Diversity, Distribution, Biology, and Phylogenetic Relationships. *Journal of Research on the Lepidoptera.*

Nielsen, E.S., and D.R. Davis
1981. A Revision of the Neotropical Incurvariidae s. str., with the Description of Two New Genera and Two New Species (Lepidoptera: Incurvarioidea). *Steenstrupia,* 7(3);25–57, figures 1–55.
1985. First Southern Hemisphere Prodoxid and the Phylogeny of the Incurvarioidea (Lepidoptera). *Sytematic Entomology,* 10(3):307–322.

Nielsen, E.S., and G.S. Robinson
1983. Ghost Moths of Southern South America (Lepidoptera: Hepialidae). *Entomonograph,* 4: 192 pages, 431 figures.

O'Brien, C.W.
1971. The Biogeography of Chile through Entomofaunal Regions. *Entomological News,* 82:197–207, 2 maps.

Pastrana, J.A.
1961. La familia Adelidae (Lep.) en la Republica Argentina. *Physis,* 22(63):191–201, 4 figures.

Peña G., L.E.
1966. A Preliminary Attempt to Divide Chile into Entomofaunal Regions, Based on the Tenebrionidae (Coleoptera). *Postilla,* 97:1–17, figures 1–8, table 1.

Powell, J.A.
1973. A Systematic Monograph of New World Ethmiid Moths (Lepidoptera:Gelechioidea). *Smithsonian Contributions to Zoology,* 120: iv + 302 pages, 294

figures, 22 plates.

Richards, A.G., Jr.

1933. Morphology of the Female Reproductive System of *Incurvaria russatella* Clemens (Lepid). *Journal of the New York Entomological Society,* 41:167–186.

1981. The Frenulum of Moths. *Entomological News,* 92(3):111–114, figures 1–6.

Saiz, F.

1971. Notas ecologicas sobre los estafilinidos del Parque Nacional Fray Jorge, Chile. *Boletin Museo Nacional Historia Natural* (Santiago), 32:69–97, figures 1–14.

Schlinger, E.I.

1974. Continental Drift, *Nothofagus,* and some Ecologically Associated Insects. *Annual Review of Entomology,* 19:323–343, maps 1–5, tables 1, 2.

Scoble, M.J.

1982. A Pectinifer in the Nepticulidae (Lepidoptera) and Its Phylogenetic Implications. *Annals of the Transvaal Museum,* 33(7):123–129, figures 1–5.

Sharplin, J.

1963a. Wing Base Structure in Lepidoptera, I: Fore Wing Base. *The Canadian Entomologist,* 95:1024–1050, figures 1–67.

1963b. Wing Base Structure in Lepidoptera, II: Hind Wing Base. *The Canadian Entomologist,* 95:1121–1145, figures 1–44.

1964. Wing Base Structure in Lepidoptera, III: Taxonomic Characters. *The Canadian Entomologist,* 96:943–949, figures 1–4.

Shepard, H.H.

1930. The Pleural and Sternal Sclerites of the Lepidopterous Thorax. *Annals of the Entomological Society of America,* 23(2)237–260, figures 1–50.

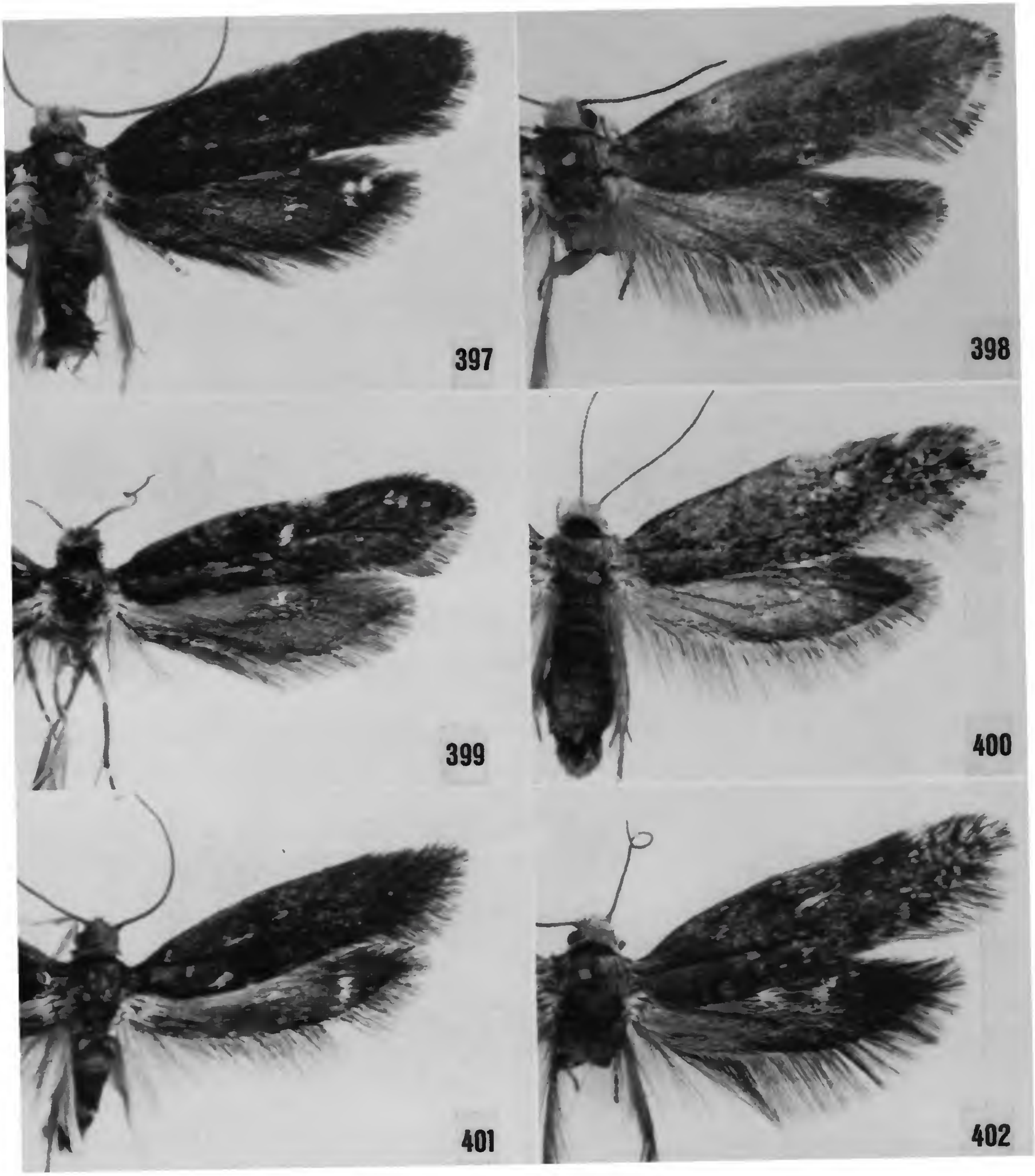
Soriano, A.

1949. El limite entre las provincias botanicas Patagonica central en el territorio del Chubut. *Lilloa,* 20:193–202.

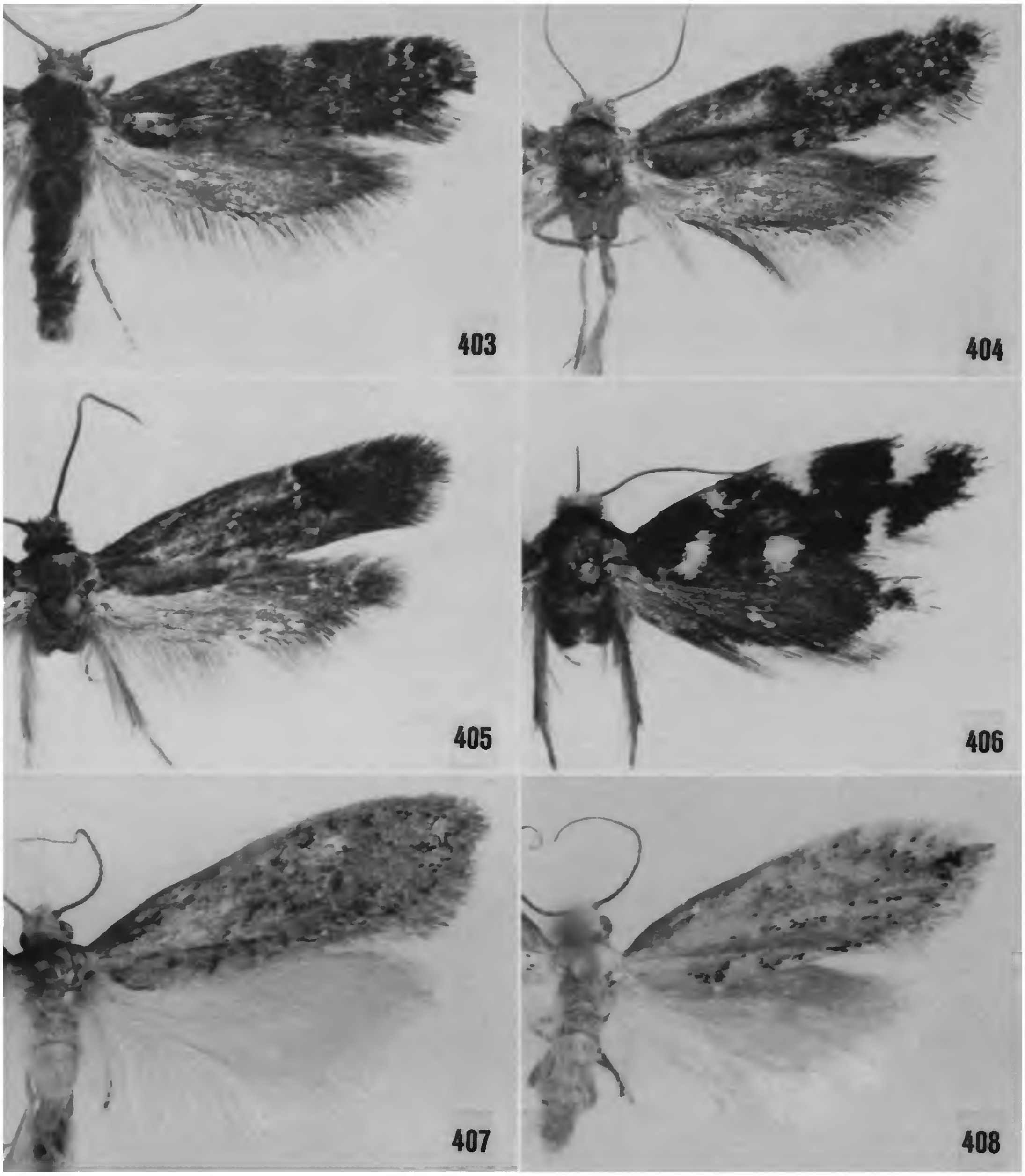
1956. Los districtos floristicos de la Provincia Patagonica. *Revista de Investigaciones Agricolas,* 10:323–347.

Wirth, W.W., and S. Navai

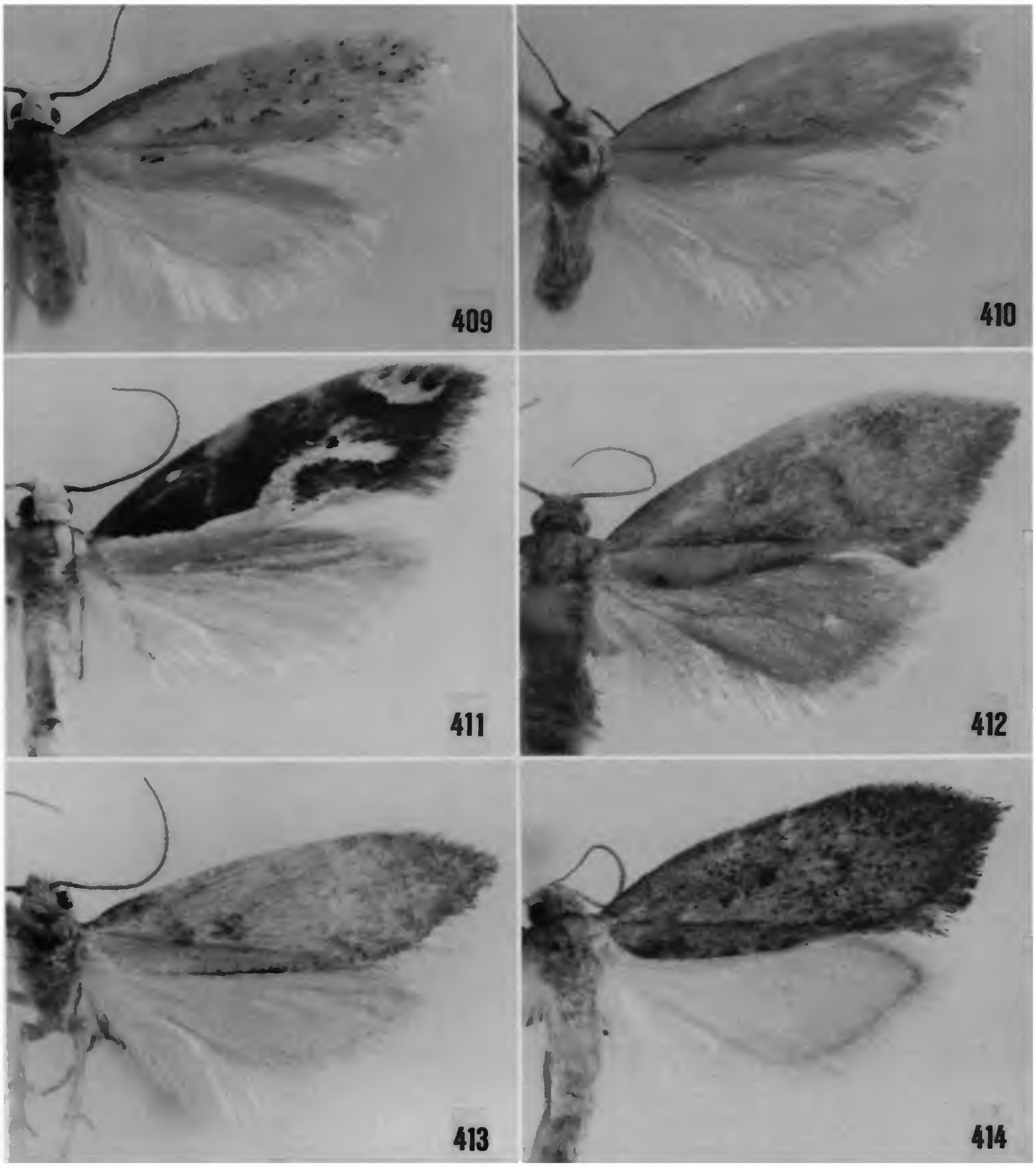
1978. Terminology of Some Antennal Sensory Organs of *Culicoides* Biting Midges (Diptera: Ceratopogonidae). *Journal of Medical Entomology,* 15(1):43–49.



FIGURES 397–402.—Adult moths: 397, *Sesommata leuroptera*, new species, ♂, holotype, forewing length 5.6 mm; 398, *S. leuroptera*, new species, ♀, paratype, forewing length 6.8 mm; 399, *S. trachyptera*, new species, ♂, holotype, forewing length 6.6 mm; 400, *S. trachyptera*, new species, ♀, paratype, forewing length 7.3 mm; 401, *S. holocapna* (Meyrick), ♂, forewing length 6.4 mm; 402, *S. holocapna* Meyrick, ♀, forewing length 6.3 mm.



FIGURES 403–408.—Adult moths: 403, *Sesommata paraplatysaris*, new species, ♂, paratype, forewing length 5.8 mm; 404, *S. paraplatysaris*, new species, ♀, paratype, forewing length 6.1 mm; 405, *S. platysaris*, new species, ♂, forewing length 6.1 mm; 406, *S. albimaculata*, new species, ♀, holotype, forewing length 6 mm; 407, *Metaphatus spatulatus*, new species, ♂, holotype, forewing length 9 mm; 408, *M. ochraceus*, new species, ♂, paratype, forewing length 9 mm.



FIGURES 409–414.—Adult moths: 409, *Metaphatus ochraceus*, new species, ♂, paratype, forewing length 8.8 mm; 410, *M. ochraceus*, new species, ♀, paratype, forewing length 8.5 mm; 411, *M. ichnius*, new species, ♂, holotype, forewing length 8.5 mm; 412, *M. cirrhus*, new species, ♀, holotype, forewing length 10.5 mm; 413, *M. sinuatus*, new species, ♂, holotype, forewing length 7 mm; 414, *M. adustus*, new species, ♂, holotype, forewing length 9 mm.

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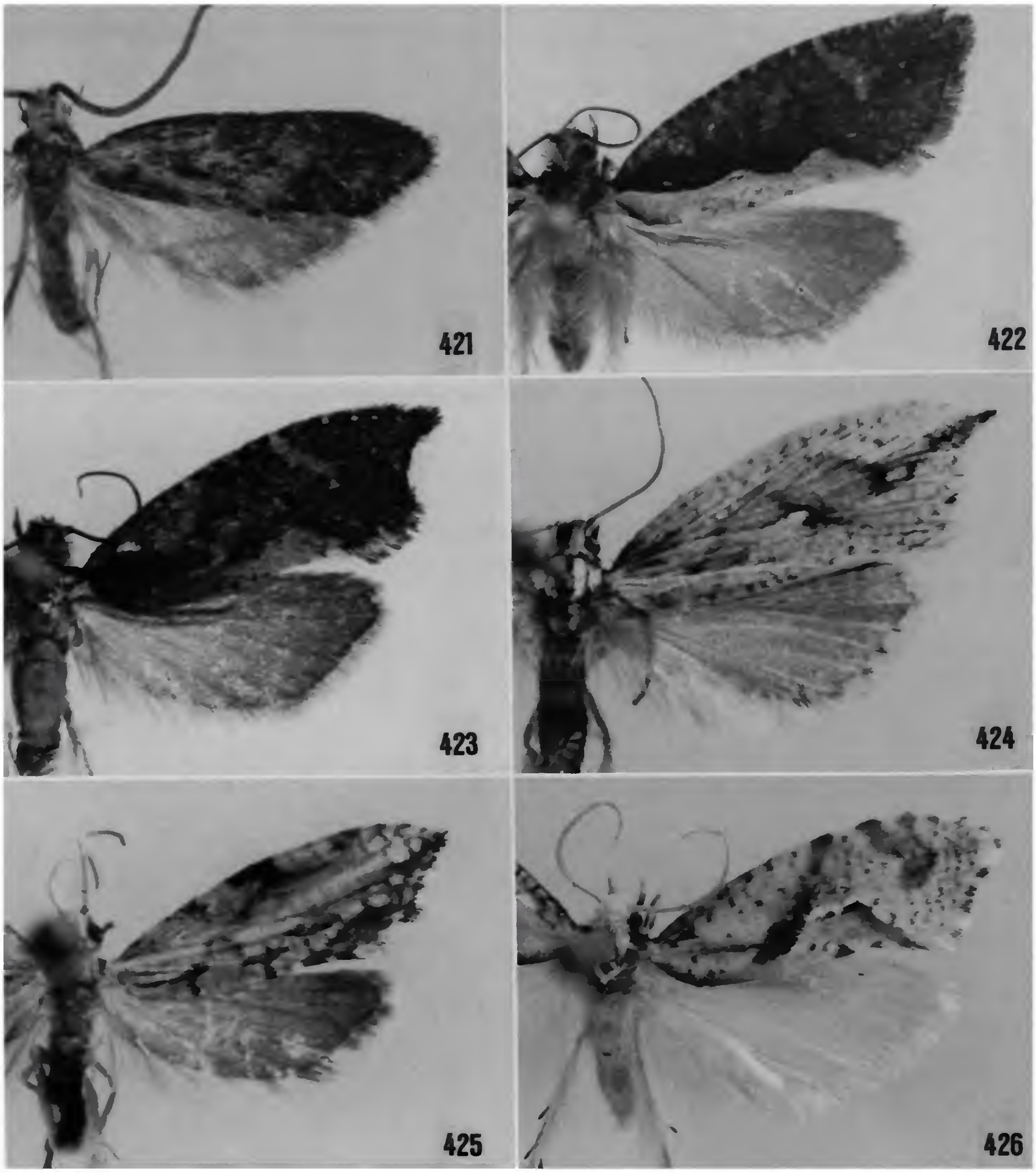
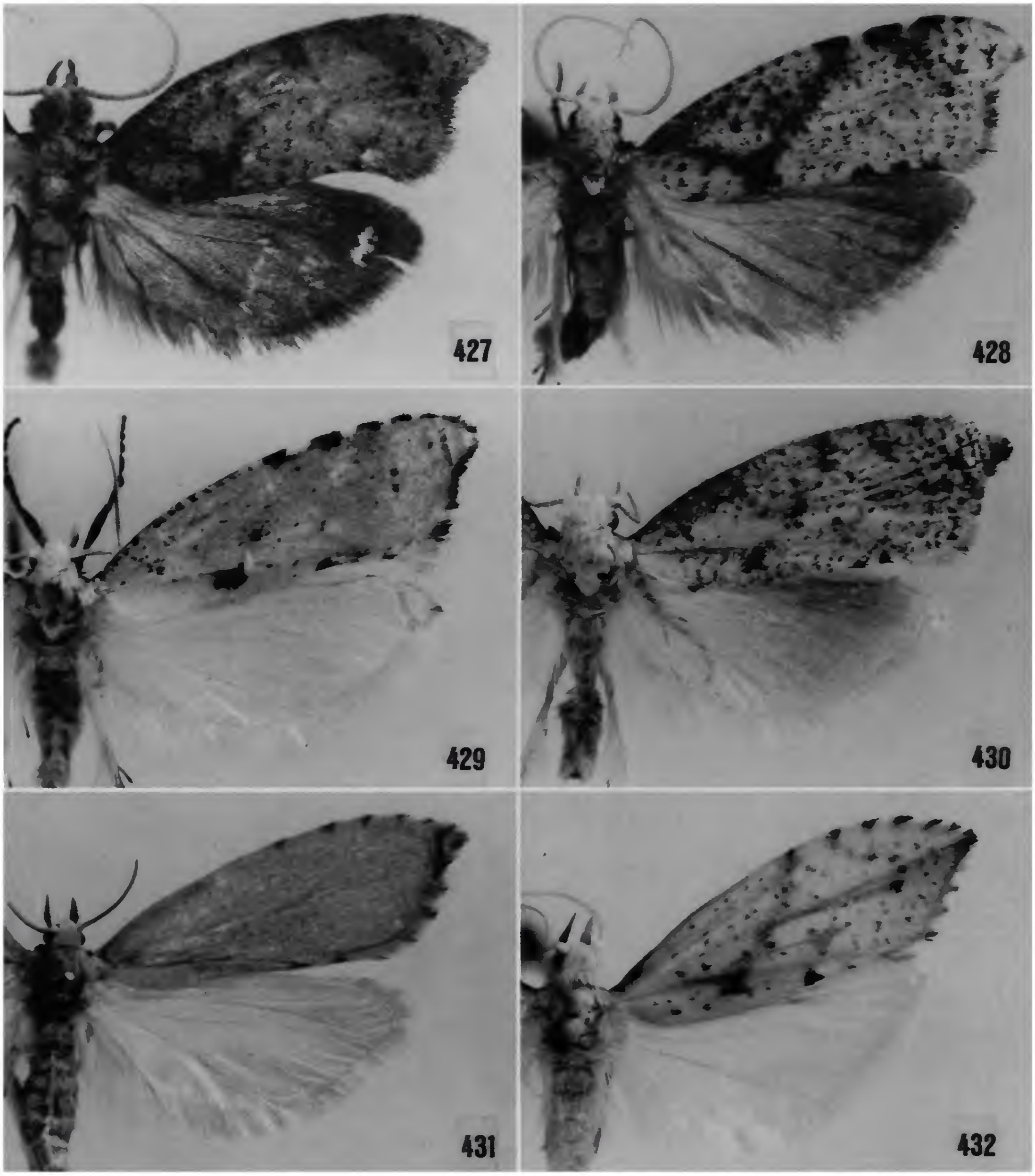
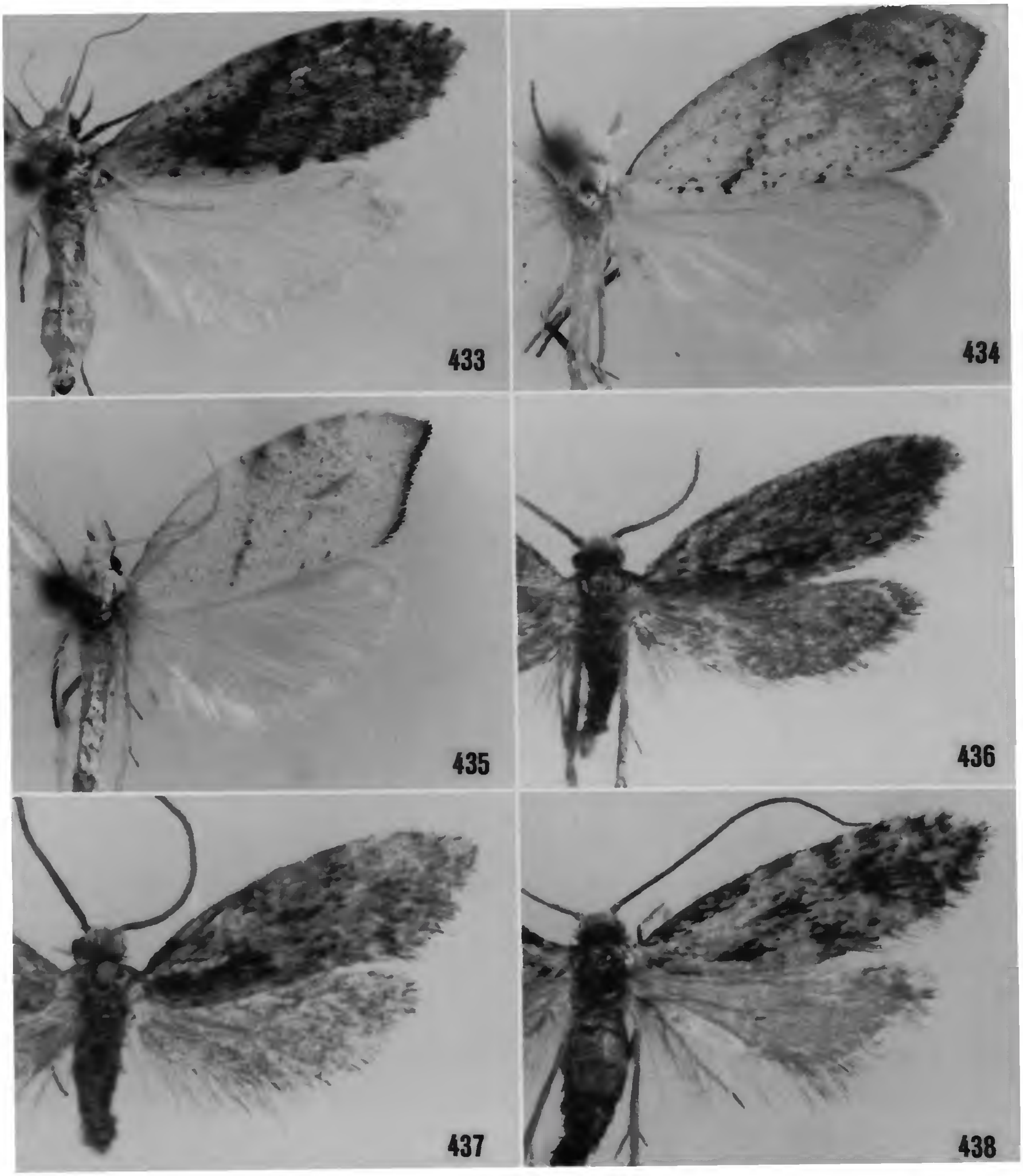
FIGURES 415–420.—Adult moths: 415, *Plesiophatus inarmigerus*, new species, ♂, holotype, forewing length 5.9 mm; 416, *Palaephatus (Prophatus) dimorphus*, new species, ♂, holotype, forewing length 12.8 mm; 417, *P. (Prophatus) dimorphus*, new species, ♂, paratype, forewing length 14.5 mm; 418, *P. (Prophatus) leucacrotus*, new species, ♂, holotype, forewing length 7.5 mm; 419, *P. (Prophatus) nielseni*, new species, ♂, holotype, forewing length 6 mm; 420, *P. (Prophatus) spinosus*, new species, ♂, holotype, forewing length 5.8 mm.



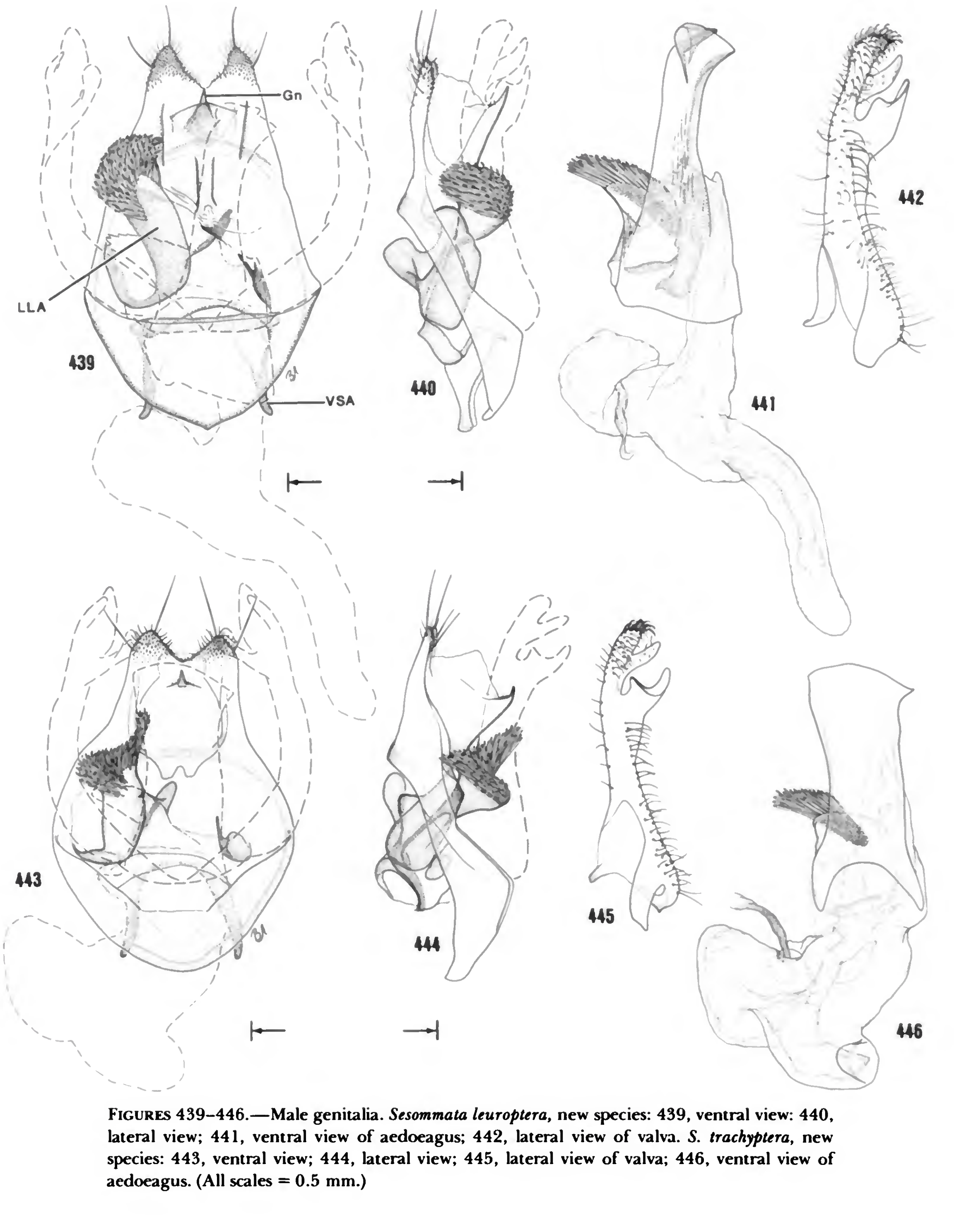
Figures 421–426.—Adult moths: 421, *Palaephatus (Prophatus) latus,* new species, ♂, holotype, forewing length 4.8 mm; 422, *P. (Prophatus) fusciterminus,* new species, ♂, holotype, forewing length 12 mm; 423, *P. (Prophatus) albiterminus,* new species, ♂, paratype, forewing length 9.5 mm; 424, *P. (Prophatus) striatus,* new species, ♂, holotype, forewing length 11 mm; 425, *P. (Prophatus) amplisaccus,* new species, ♂, paratype, forewing length 7.4 mm; 426, *P. (Palaephatus) pallidus,* new species, ♂, holotype, forewing length 12 mm.



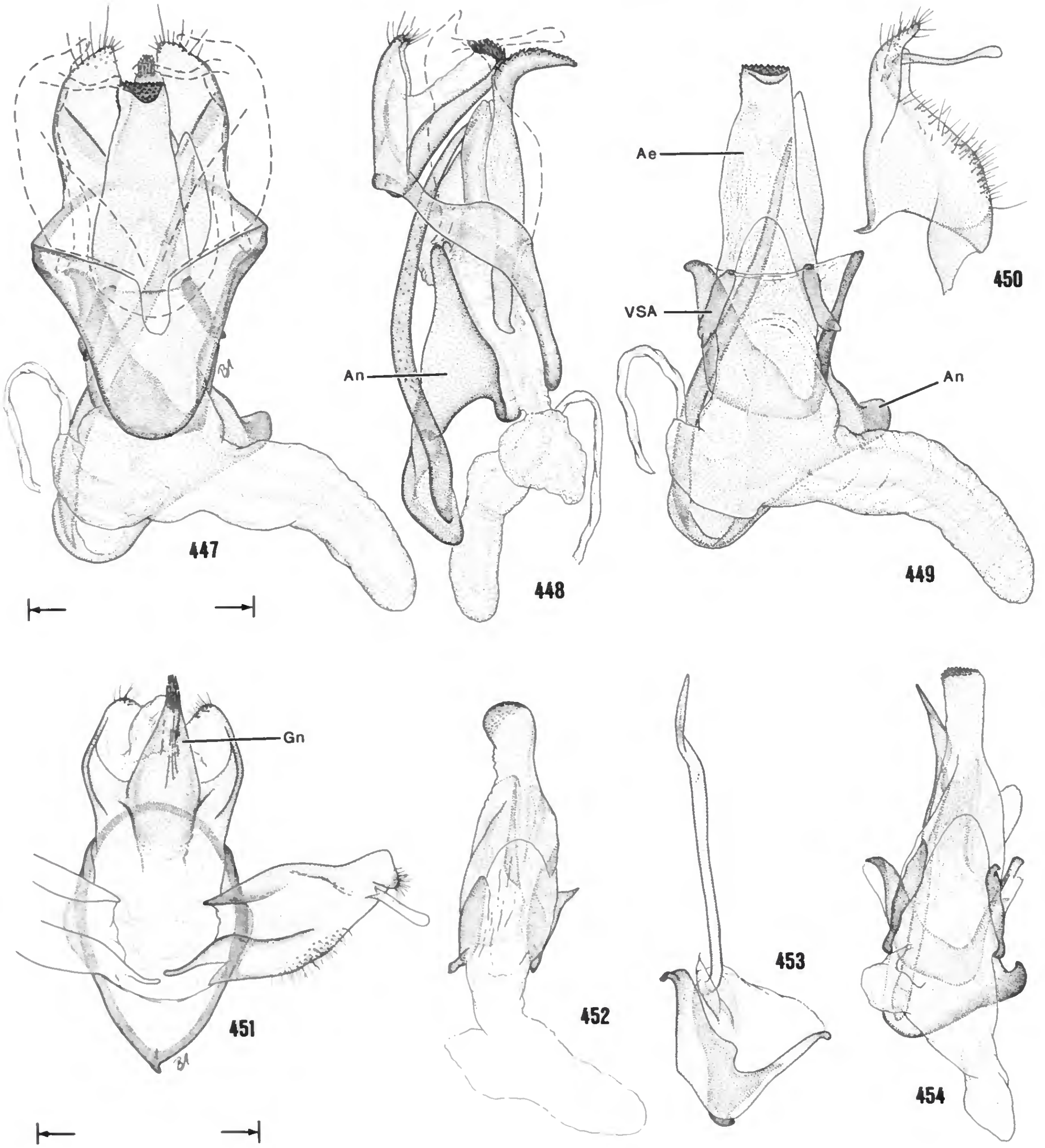
FIGURES 427–432.—Adult moths: 427, *Palaephatus (Palaephatus) falsus* (Butler), ♂, forewing length 11 mm; 428, *P. (Palaephatus) falsus* (Butler), ♂, forewing length 10.8 mm; 429, *P. (Palaephatus) falsus* (Butler), ♀, forewing length 12.1 mm; 430, *P. (Palaephatus) falsus* (Butler), ♀, forewing length 12.9 mm; 431, *P. (Palaephatus) luteolus*, new species, ♀, paratype, forewing length 13.5 mm; 432, *P. (Palaephatus) luteolus*, new species, ♂, holotype, forewing length 12 mm.



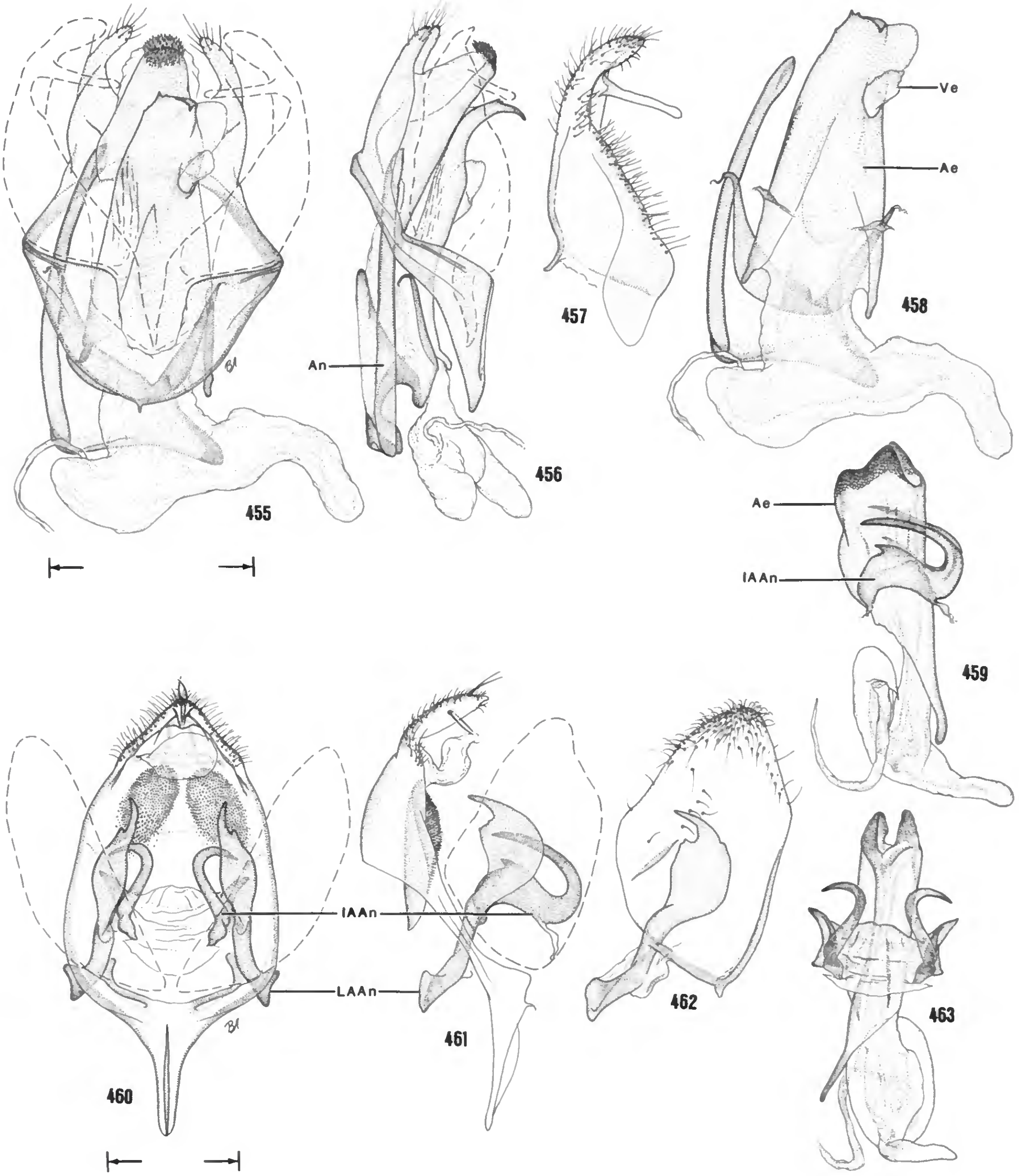
FIGURES 433–438.—Adult moths: 433, *Palaephatus (Palaephatus) luteolus,* new species, ♀, paratype, forewing length 15 mm; 434, *P. (Palaephatus) albicerus,* new species, ♂, holotype, forewing length 10 mm; 435, *P. (Palaephatus) albicerus,* new species, ♀, paratype, forewing length 10.8 mm; 436, *Apophatus parvus,* new species, ♂, holotype, forewing length 3.8 mm; 437, *A. bifibratus,* new species, ♂, holotype, forewing length 5 mm; 438, *A. bifibratus,* new species, ♂, paratype, forewing length 5.5 mm.



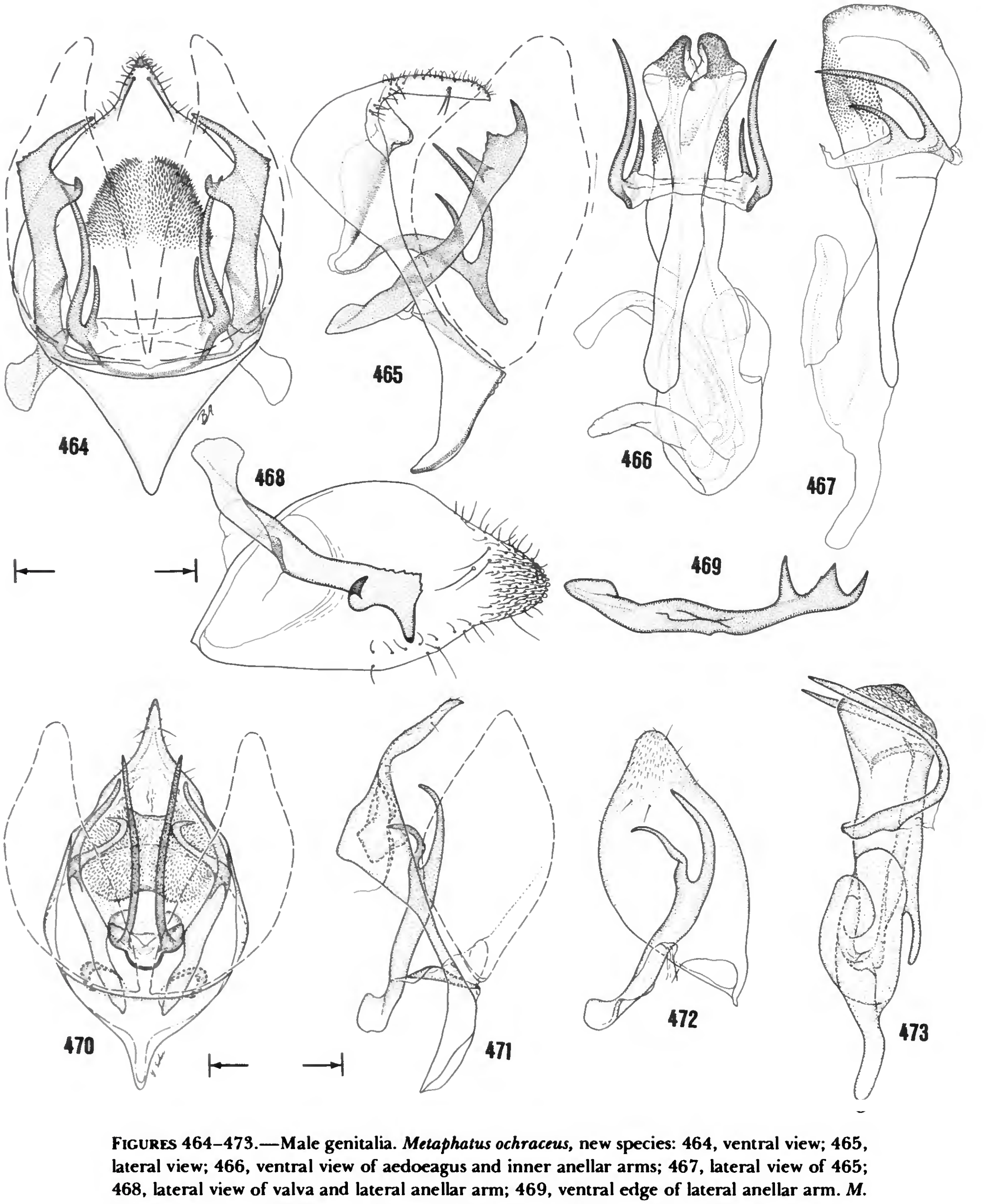
FIGURES 439–446.—Male genitalia. *Sesommata leuroptera*, new species: 439, ventral view: 440, lateral view; 441, ventral view of aedoeagus; 442, lateral view of valva. *S. trachyptera*, new species: 443, ventral view; 444, lateral view; 445, lateral view of valva; 446, ventral view of aedoeagus. (All scales = 0.5 mm.)



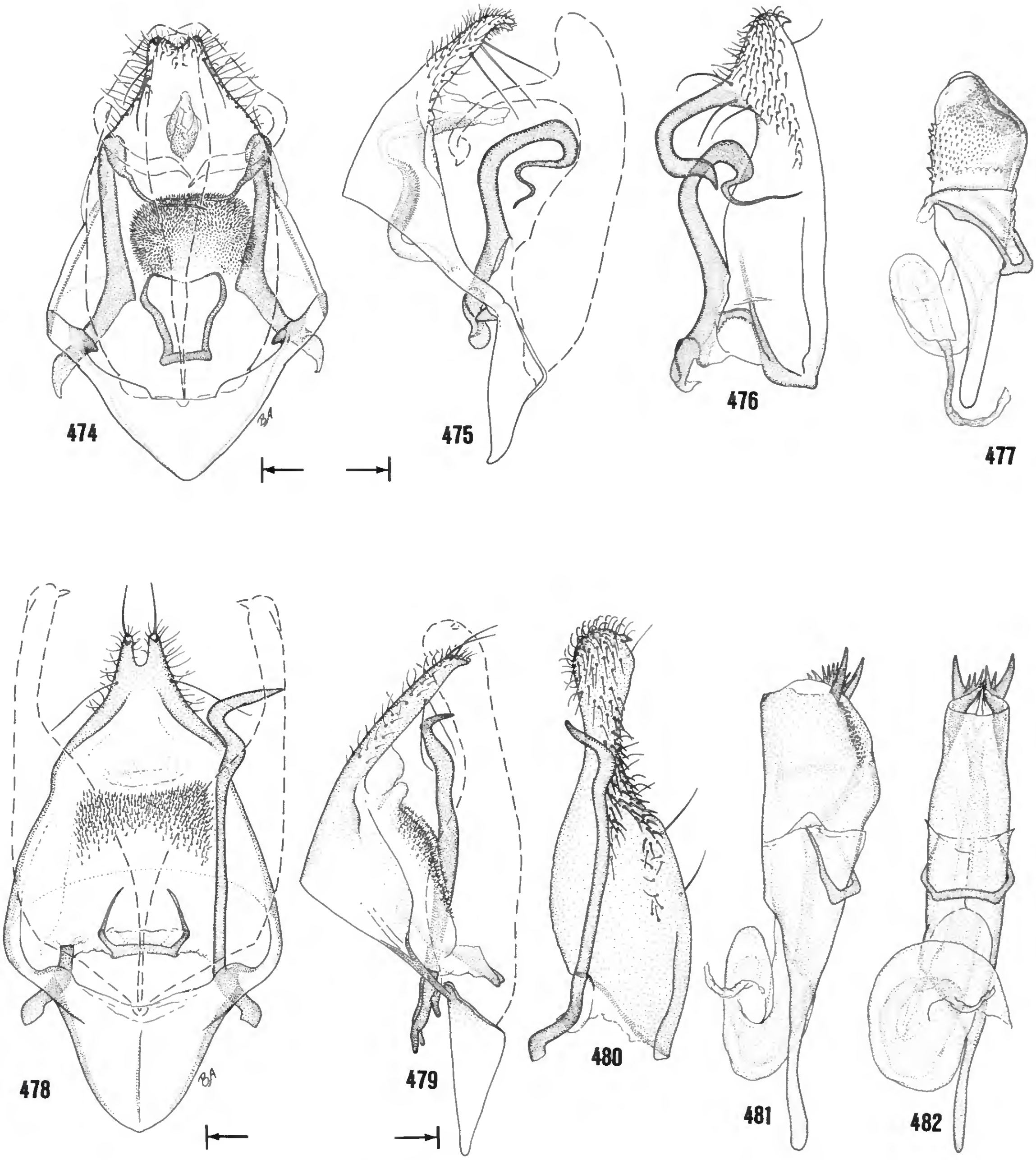
FIGURES 447–454.—Male genitalia. *Sesommata paraplatysaris*, new species: 447, ventral view; 448, lateral view; 449, ventral view of aedoeagus and anellar sclerites; 450, lateral view of valva. *S. platysaris* (Meyrick), holotype: 451, ventral view; 452, ventral view of aedoeagus; 453, ventral view of anellar sclerites; 454, ventral view of aedoeagus and anellar sclerites. (All scales = 0.5 mm.)



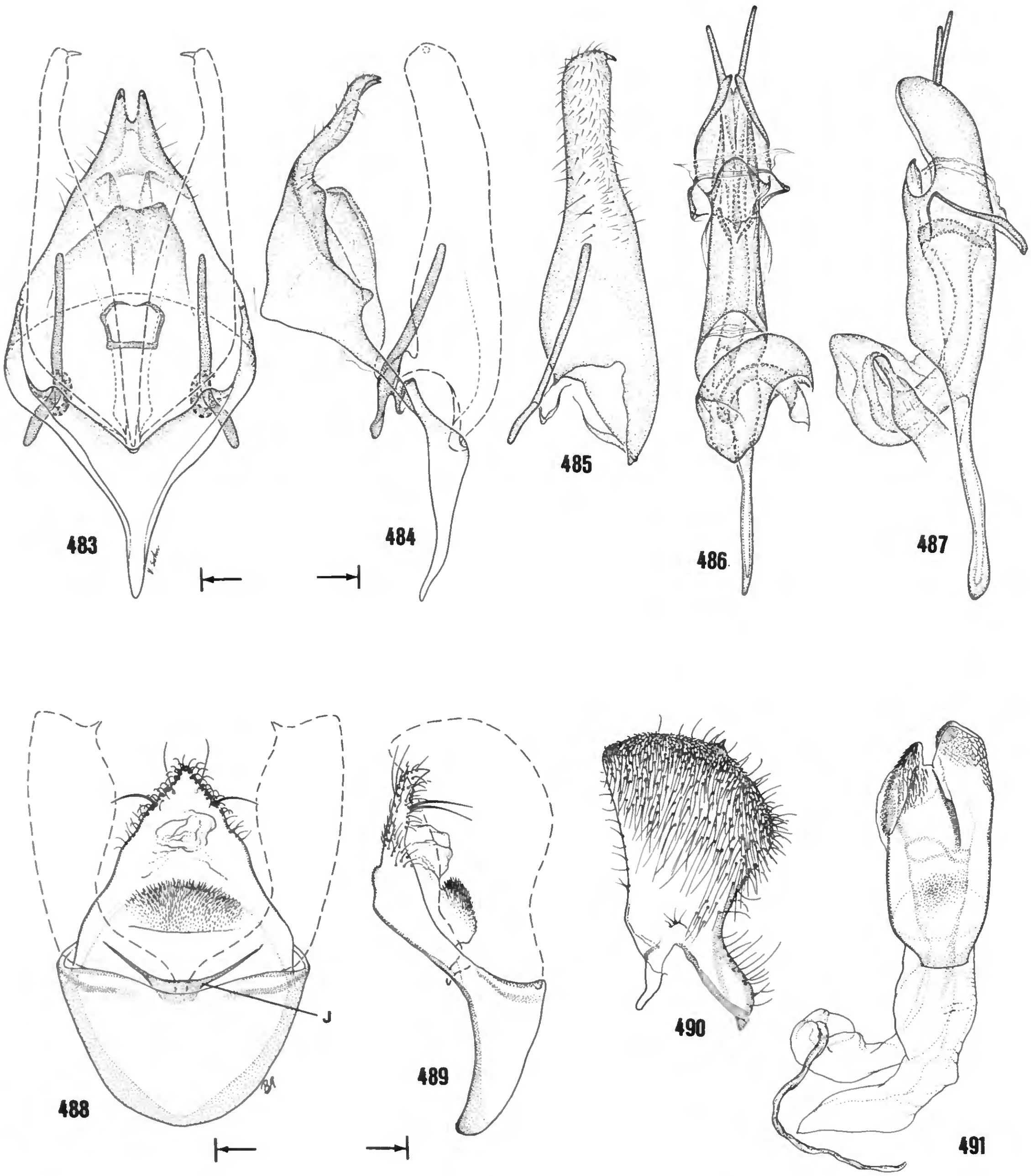
FIGURES 455–463.—Male genitalia. *Sesommata holocapna* (Meyrick): 455, ventral view; 456, lateral view; 457, lateral view of valva; 458, ventral view of aedoeagus and anellar sclerites. *Metaphatus spatulatus*, new species: 459, ventral view; 460, lateral view; 461, lateral view of valva and lateral arm of anellus; 462, lateral view of aedoeagus and inner arms of anellus; 463, ventral view of 462. (All scales = 0.5 mm.)



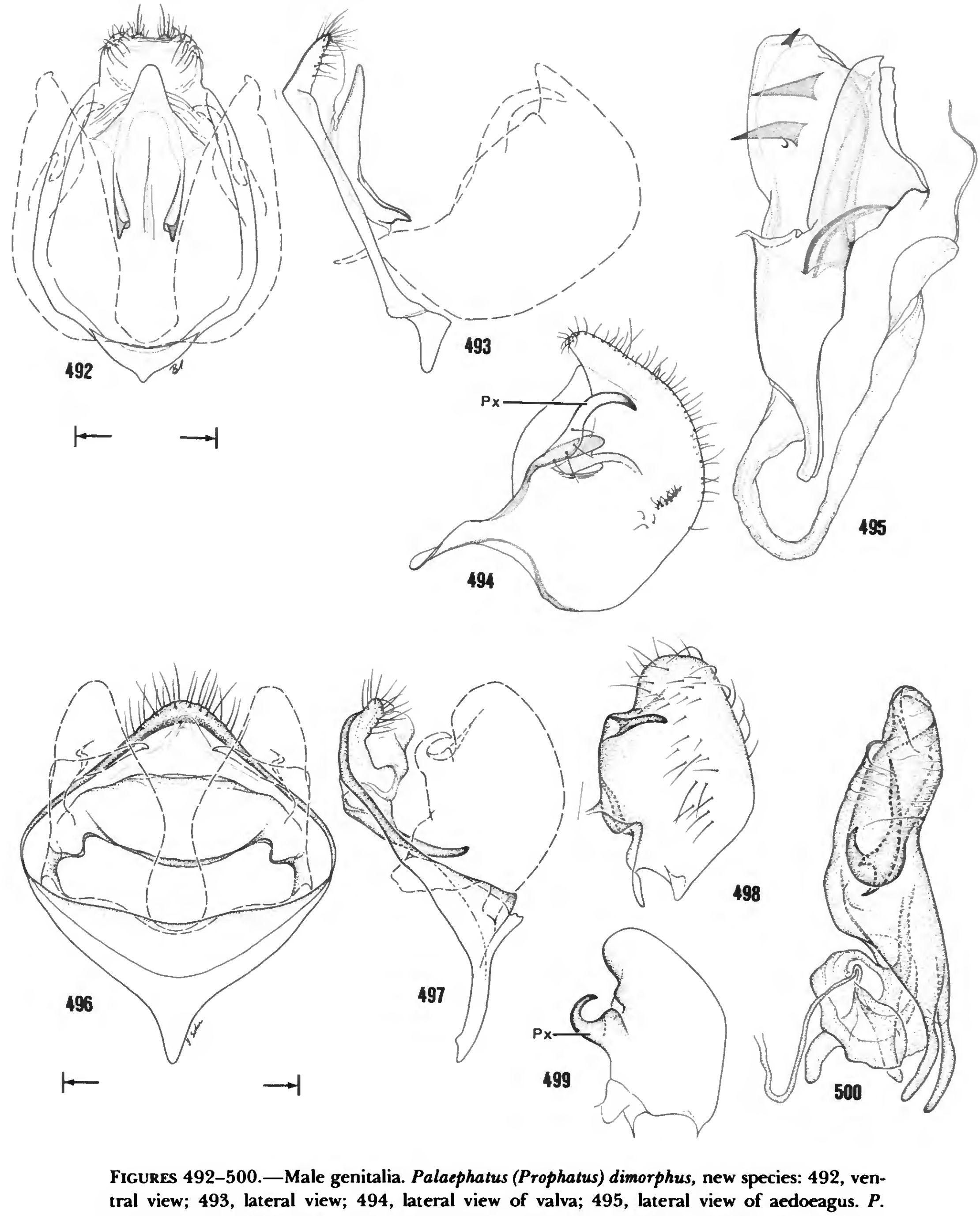
FIGURES 464–473.—Male genitalia. *Metaphatus ochraceus*, new species: 464, ventral view; 465, lateral view; 466, ventral view of aedoeagus and inner anellar arms; 467, lateral view of 465; 468, lateral view of valva and lateral anellar arm; 469, ventral edge of lateral anellar arm. *M. ichnius*, new species: 470, ventral view; 471, lateral view; 472, lateral view of valva and lateral anellar arm; 473, lateral view of aedoeagus and inner anellar arms. (All scales = 0.5 mm.)



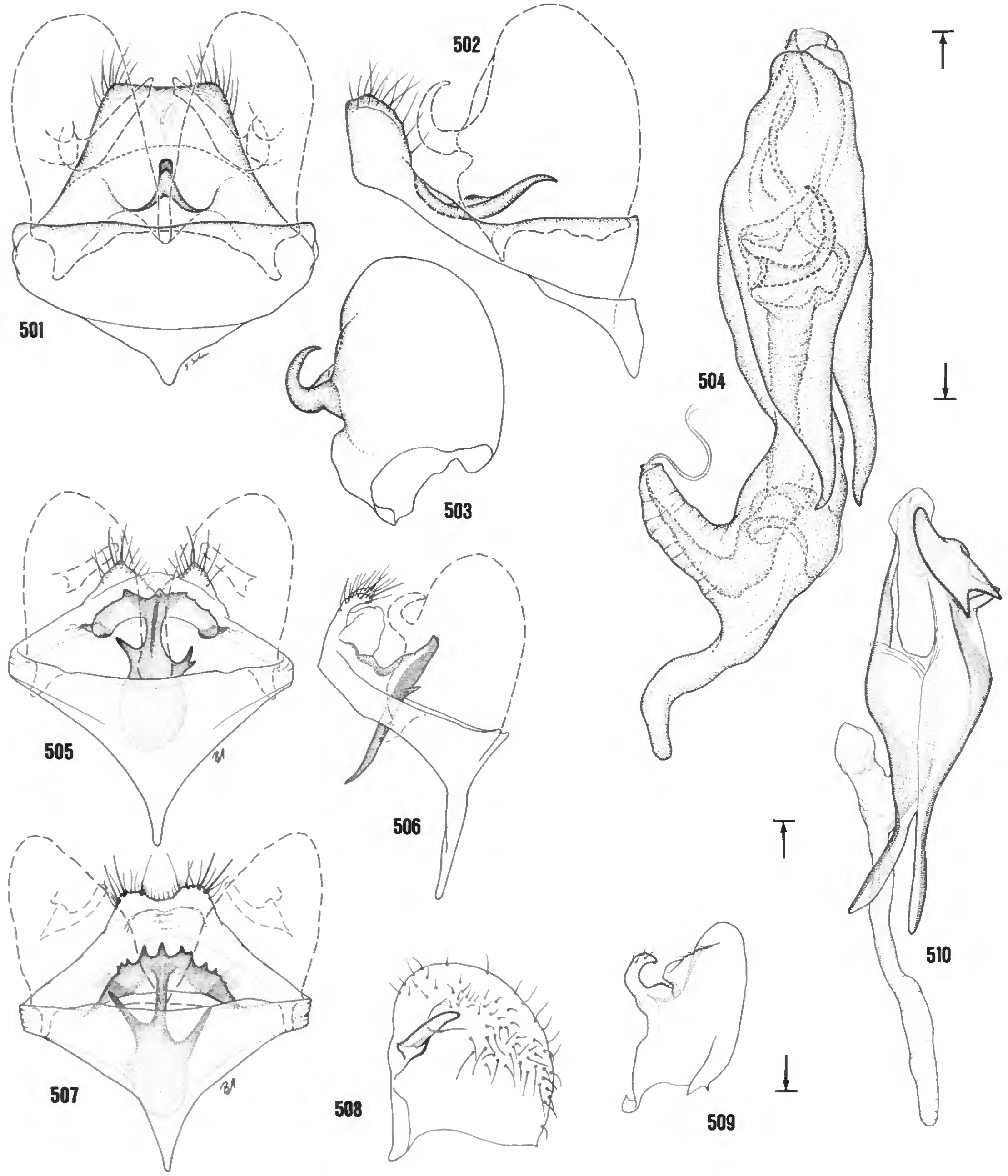
FIGURES 474–482.—Male genitalia. *Metaphatus cirrhus*, new species: 474, ventral view; 475, lateral view; 476, lateral view of valva and lateral anellar arm; 477, lateral view of aedoeagus and inner anellar arms. *M. sinuatus*, new species: 478, ventral view; 479, lateral view; 480, lateral view of valva and lateral anellar arm; 481, lateral view of aedoeagus and inner anellar arms; 482, dorsal view of 481. (All scales = 0.5 mm.)



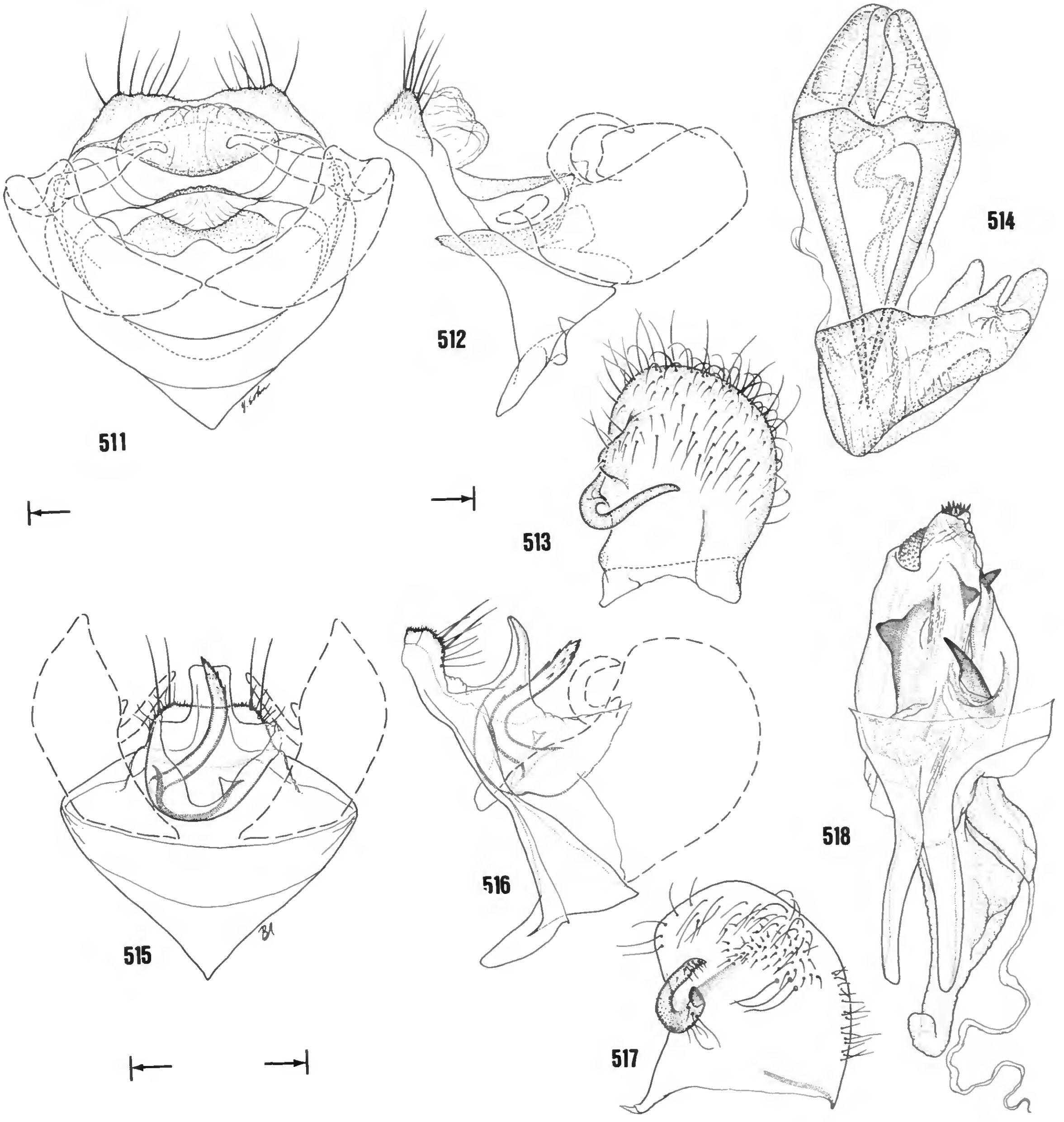
FIGURES 483–491.—Male genitalia. *Metaphatus adustus*, new species: 483, ventral view; 484, lateral view; 485, lateral view of valva and lateral arms of anellus; 486 dorsal view or aedoeagus and inner arms of anellus; 487, lateral view of 486. *Plesiophatus inarmigerus*, new species: 488, ventral view; 489, lateral view; 490, lateral view of valva; 491, ventral view of aedoeagus. (All scales = 0.5 mm.)



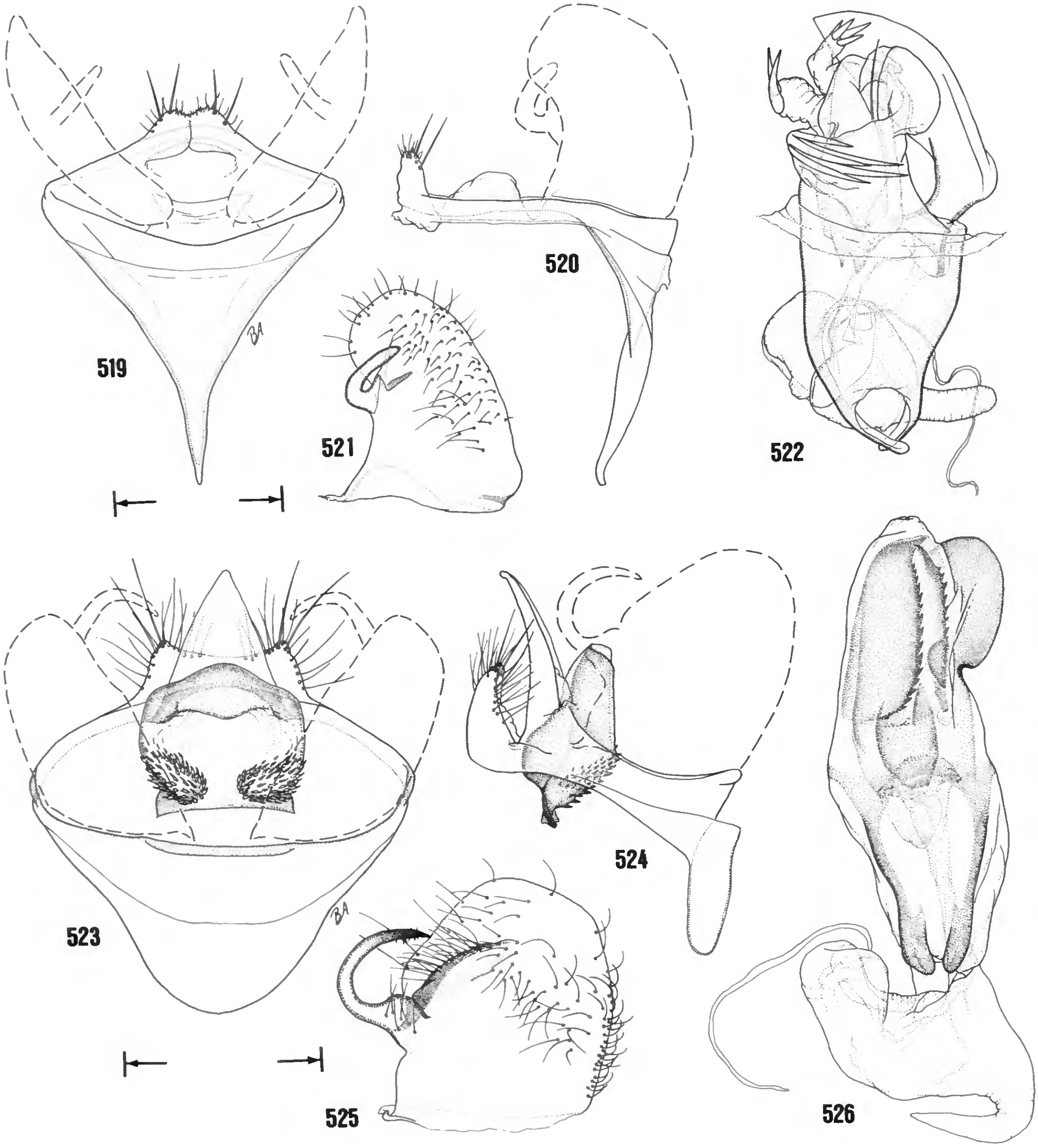
FIGURES 492–500.—Male genitalia. ***Palaephatus (Prophatus) dimorphus*, new species**: 492, ventral view; 493, lateral view; 494, lateral view of valva; 495, lateral view of aedoeagus. ***P. (Prophatus) leucacrotus*, new species**: 496, lateral view; 497, lateral view; 498, lateral view of valva; 499, lateroventral view of valva; 500, lateral view of aedoeagus. (All scales = 0.5 mm.)



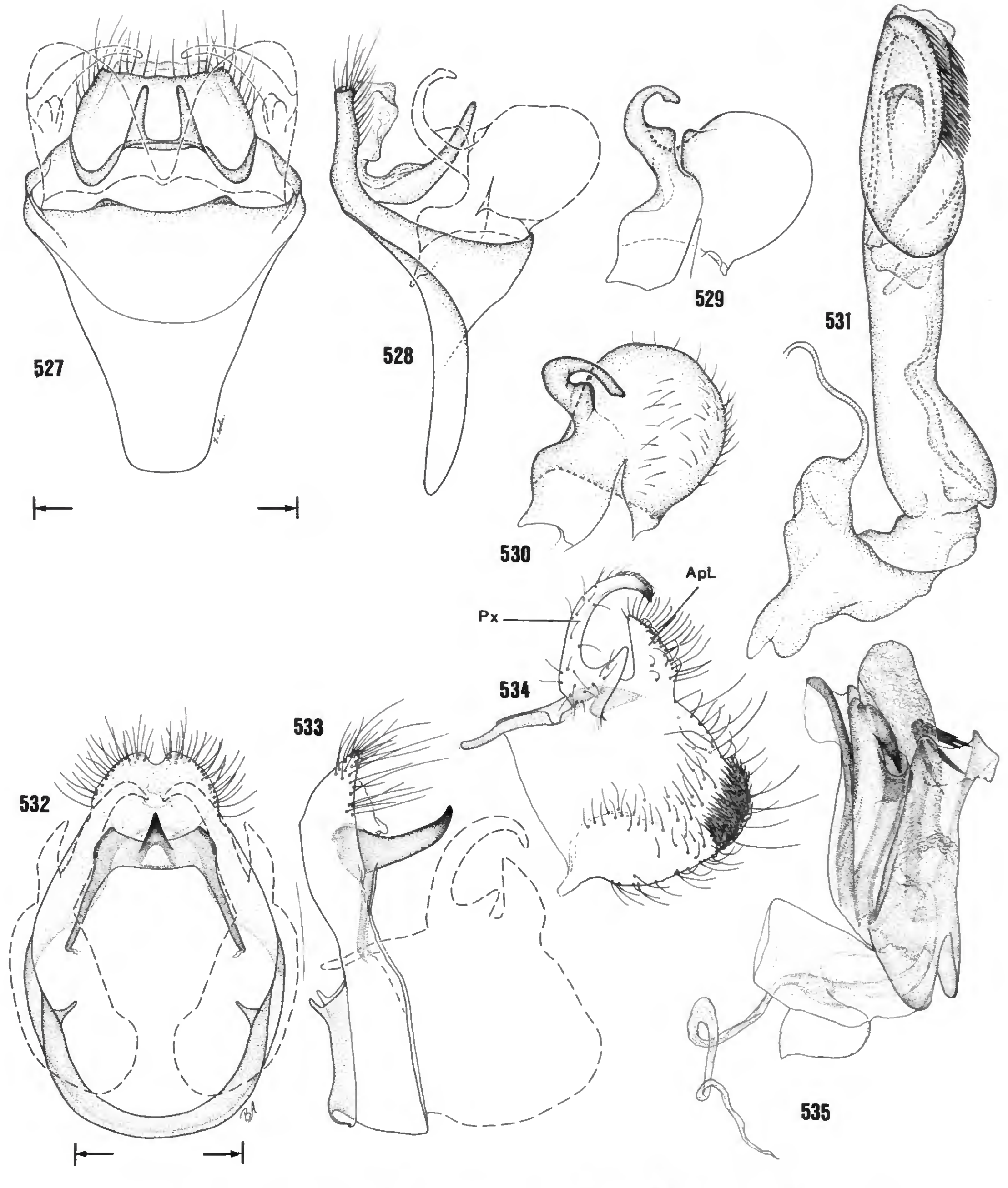
FIGURES 501–510.—Male genitalia. *Palaephatus (Prophatus) nielseni*, new species: 501, ventral view; 502, lateral view; 503, lateral view of valva; 504, lateroventral view of aedoeagus. *P. (Prophatus) spinosus*, new species: 505, ventral view; 506, lateral view; 507, ventral view; 508, lateral view of valva; 509, lateroventral view of valva; 510, ventral view of aedoeagus. (All scales = 0.5 mm.)



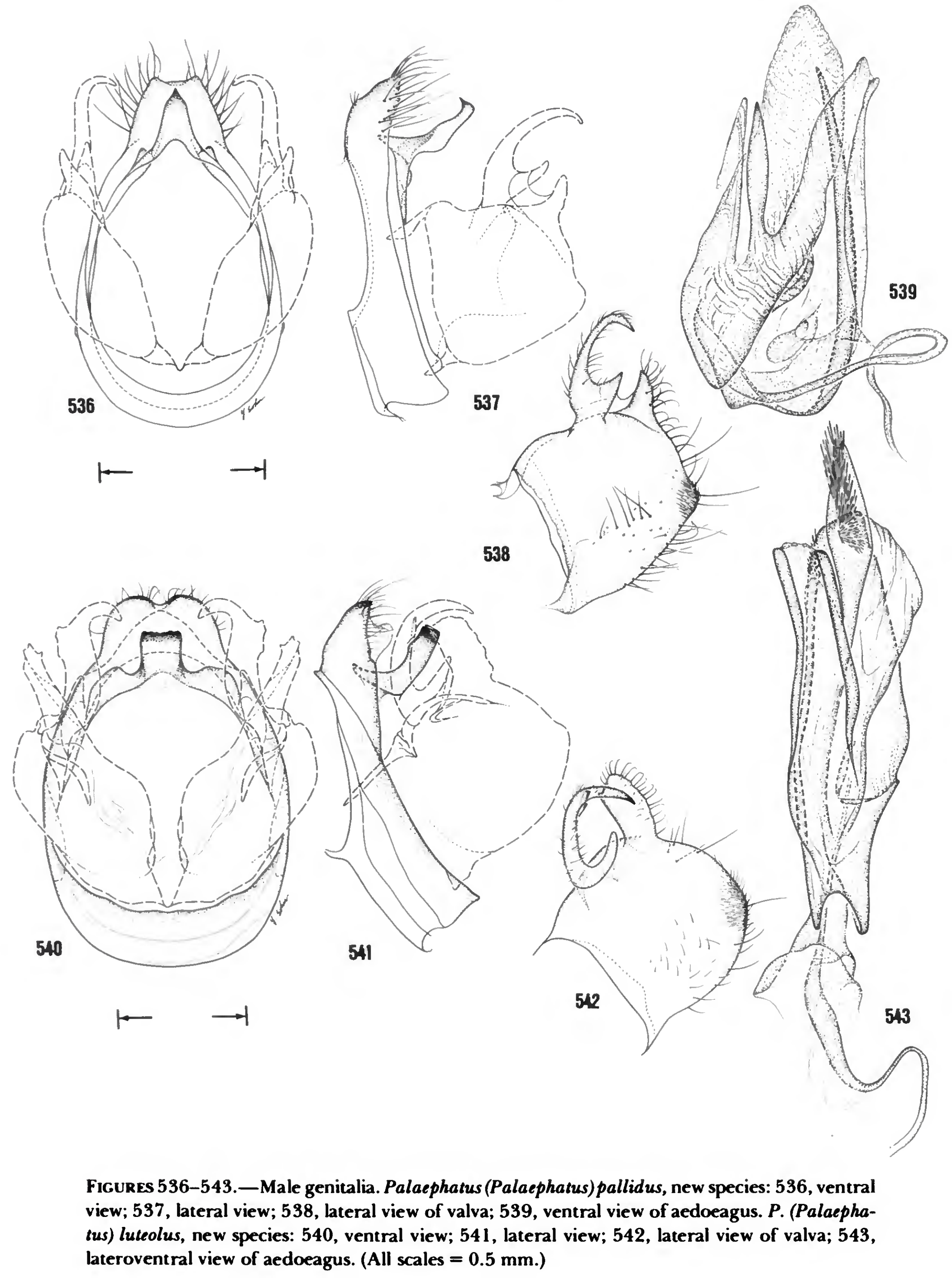
FIGURES 511–518.—Male genitalia. *Palaephatus (Prophatus) latus,* new species: 511, ventral view; 512, lateral view; 513, lateral view of valva; 514, dorsal view of aedoeagus. *P. (Prophatus) fusciterminus,* new species: 515, ventral view; 516, lateral view; 517, lateral view of valva; 518, ventral view of aedoeagus. (All scales = 0.5 mm.)



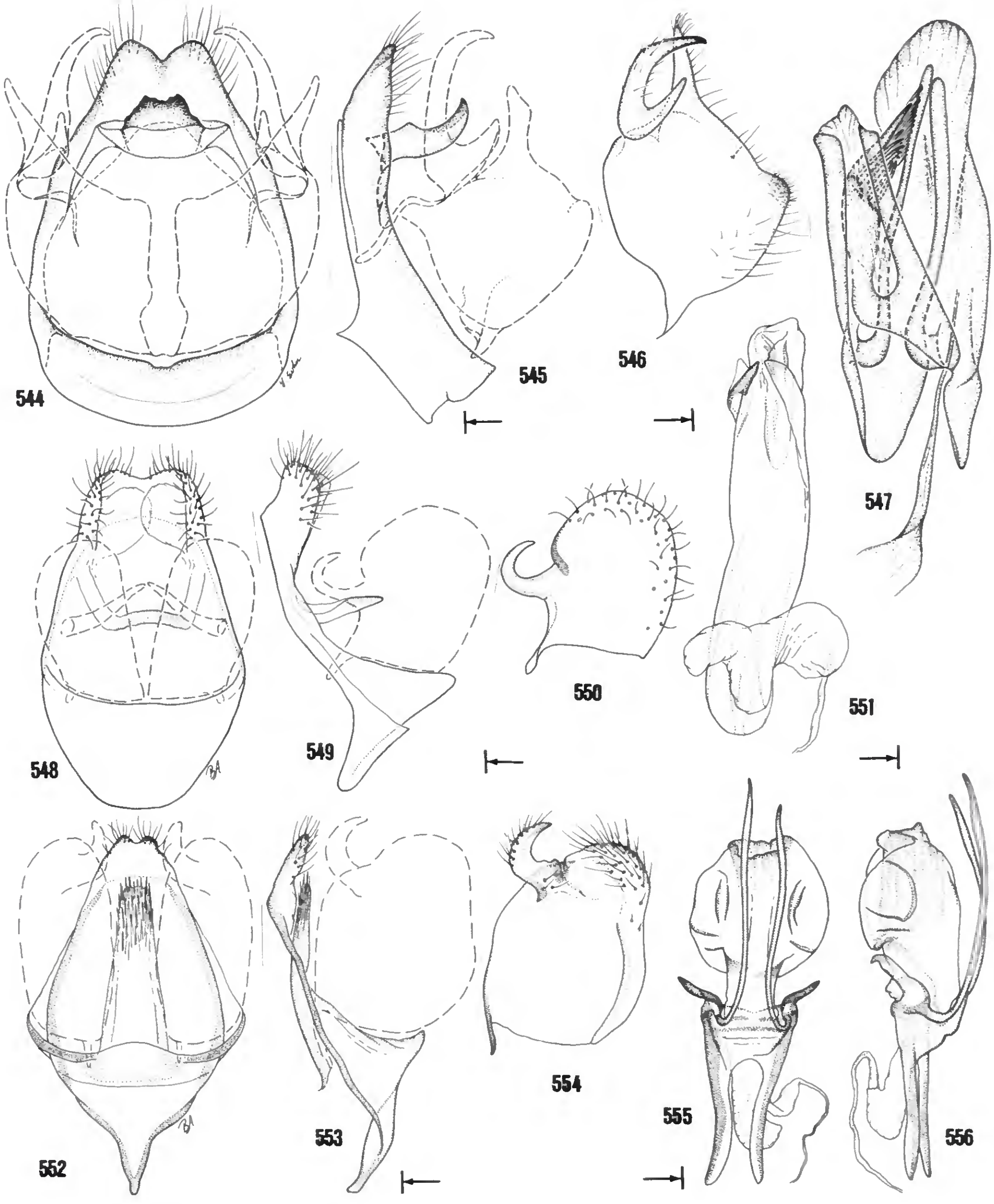
FIGURES 519–526.—Male genitalia. *Palaephatus (Prophatus) albiterminus*, new species: 519, ventral view; 520, lateral view; 521, lateral view of valva; 522, ventral view of aedoeagus. *P. (Prophatus) striatus*, new species: 523, ventral view; 524, lateral view; 525, lateral view of valva; 526, ventral view of aedoeagus. (All scales = 0.5 mm.)



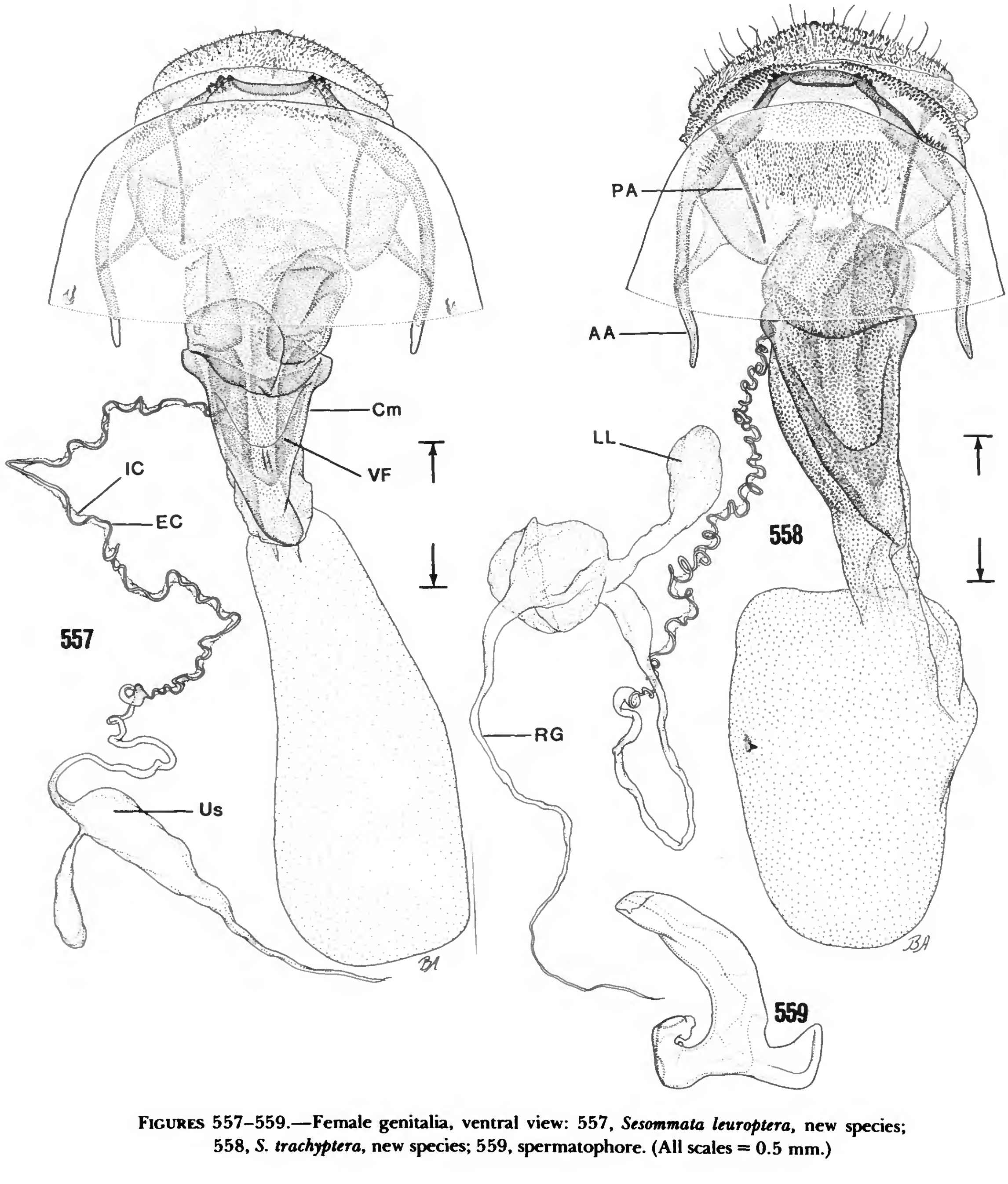
FIGURES 527–535.—Male genitalia. ***Palaephatus (Prophatus) amplisaccus***, new species: 527, ventral view; 528, lateral view; 529, lateroventral view of valva; 530, lateral view of valva; 531, lateroventral view of aedoeagus. ***P. (Palaephatus) falsus*** (Butler): 532, ventral view; 533, lateral view; 534, lateral view of valva; 535, lateroventral view of aedoeagus. (All scales = 0.5 mm.)



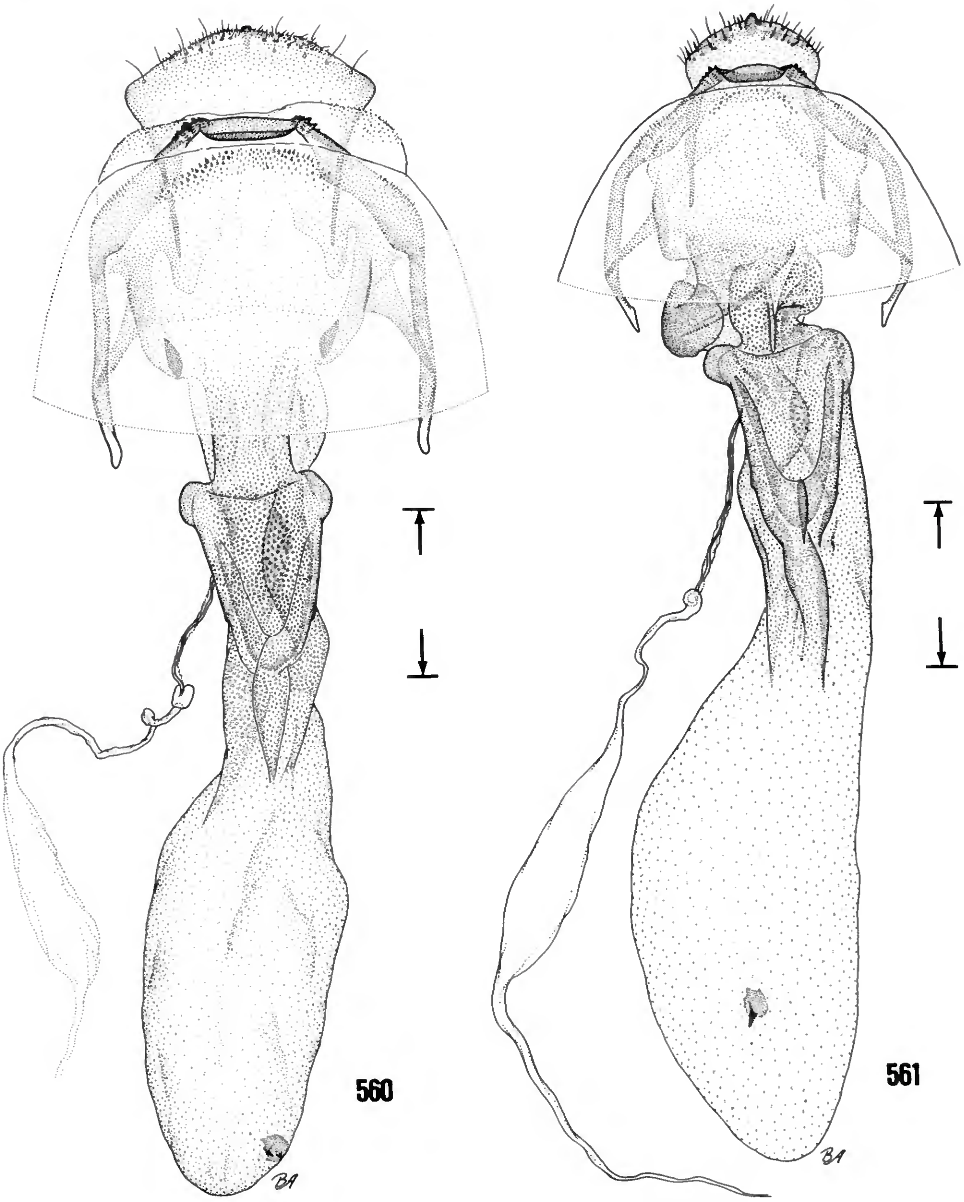
FIGURES 536–543.—Male genitalia. *Palaephatus (Palaephatus) pallidus*, new species: 536, ventral view; 537, lateral view; 538, lateral view of valva; 539, ventral view of aedoeagus. *P. (Palaephatus) luteolus*, new species: 540, ventral view; 541, lateral view; 542, lateral view of valva; 543, lateroventral view of aedoeagus. (All scales = 0.5 mm.)



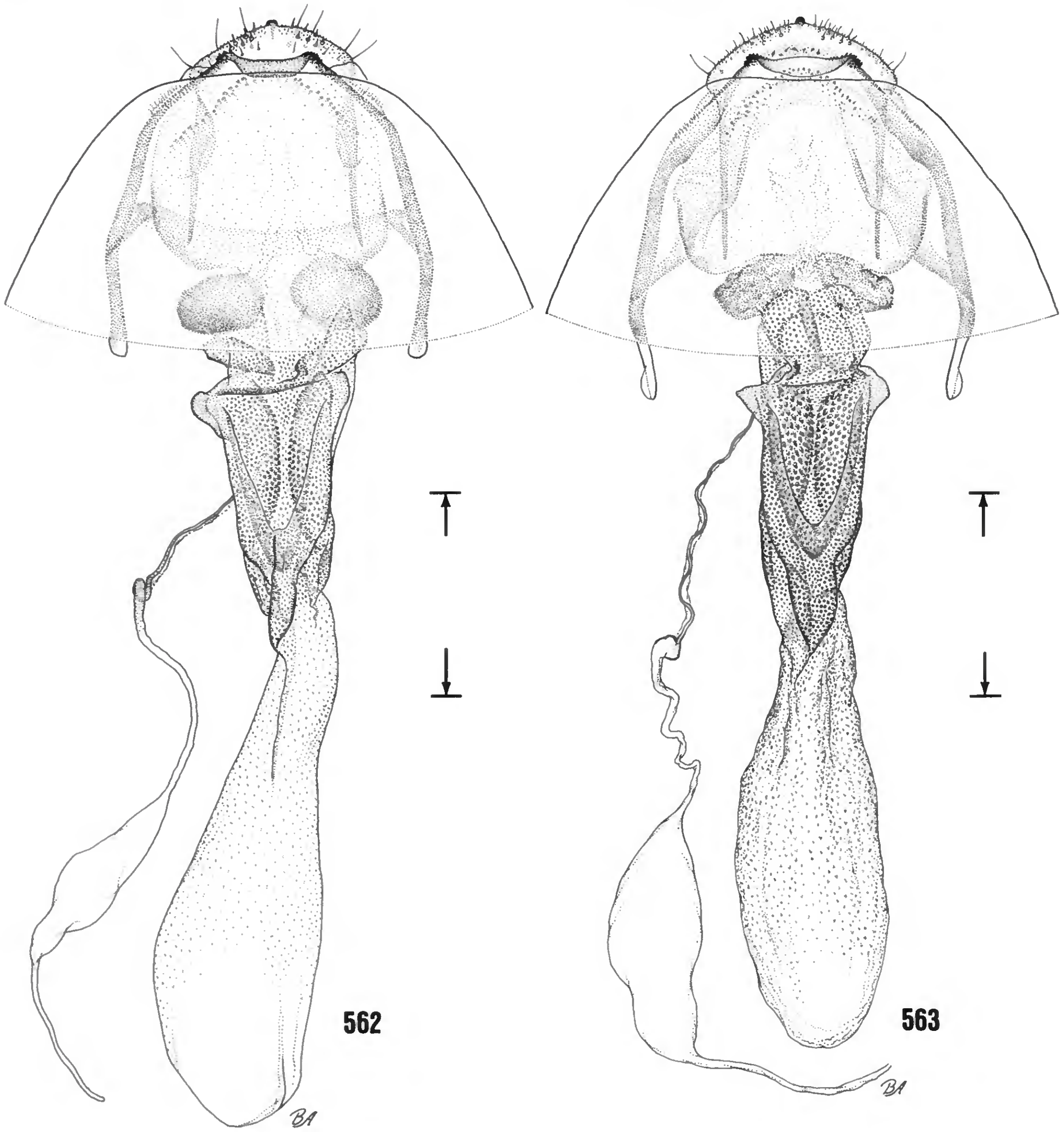
FIGURES 544–556.—Male genitalia. *Palaephatus (Palaephatus) albicerus*, new species: 544, ventral view; 545, lateral view; 546, lateral view of valva; 547, lateroventral view of aedoeagus. *Apophatus parvus*, new species, holotype: 548, ventral view; 549, lateral view; 550, lateral view of valva; 551, dorsal view of aedoeagus. *A. bifibratus*, new species, holotype: 552, ventral view; 553, lateral view; 554, lateral view of valva; 555, ventral view of aedoeagus; 556, lateral view of aedoeagus. (All scales = 0.5 mm.)



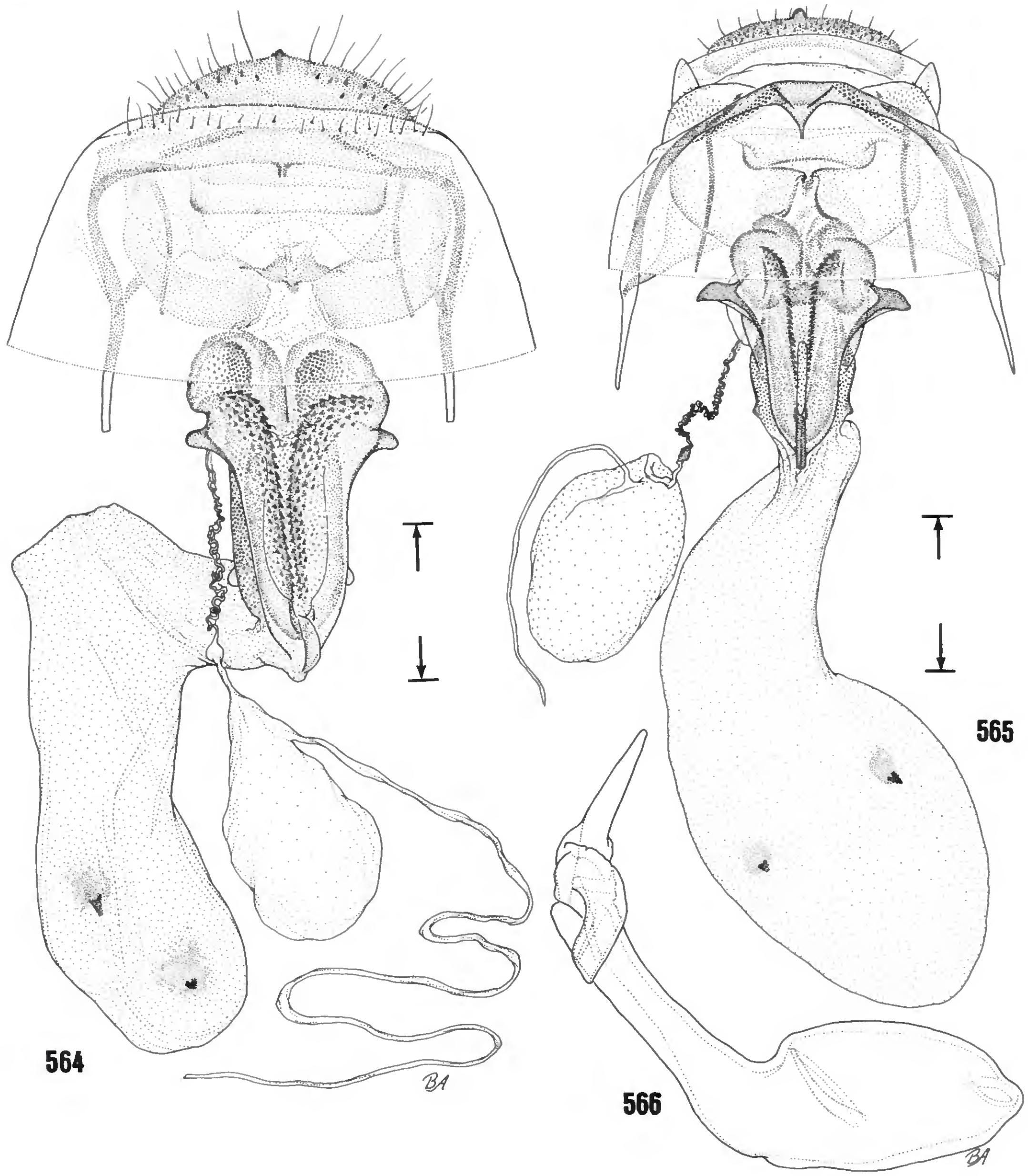
FIGURES 557–559.—Female genitalia, ventral view: 557, *Sesommata leuroptera*, new species; 558, *S. trachyptera*, new species; 559, spermatophore. (All scales = 0.5 mm.)



FIGURES 560, 561.—Female genitalia, ventral view: 560, *Sesommata holocapna* (Meyrick); 561, *S. paraplatysaris*, new species. (All scales = 0.5 mm.)



FIGURES 562, 563.—Female genitalia, ventral view: 562, *Sesommata platysaris* (Meyrick); 563, *S. albimaculata*, new species. (All scales = 0.5 mm.)



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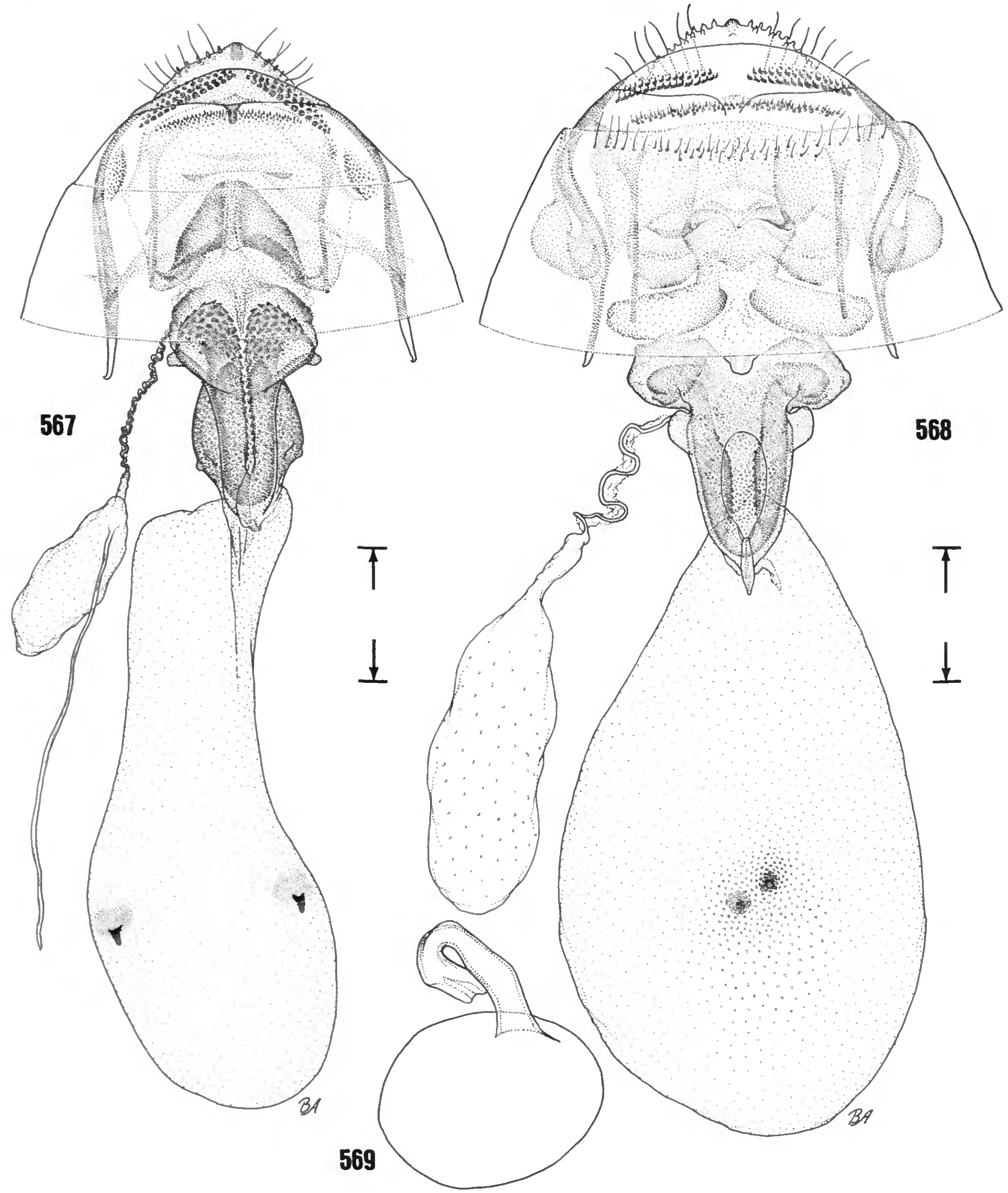
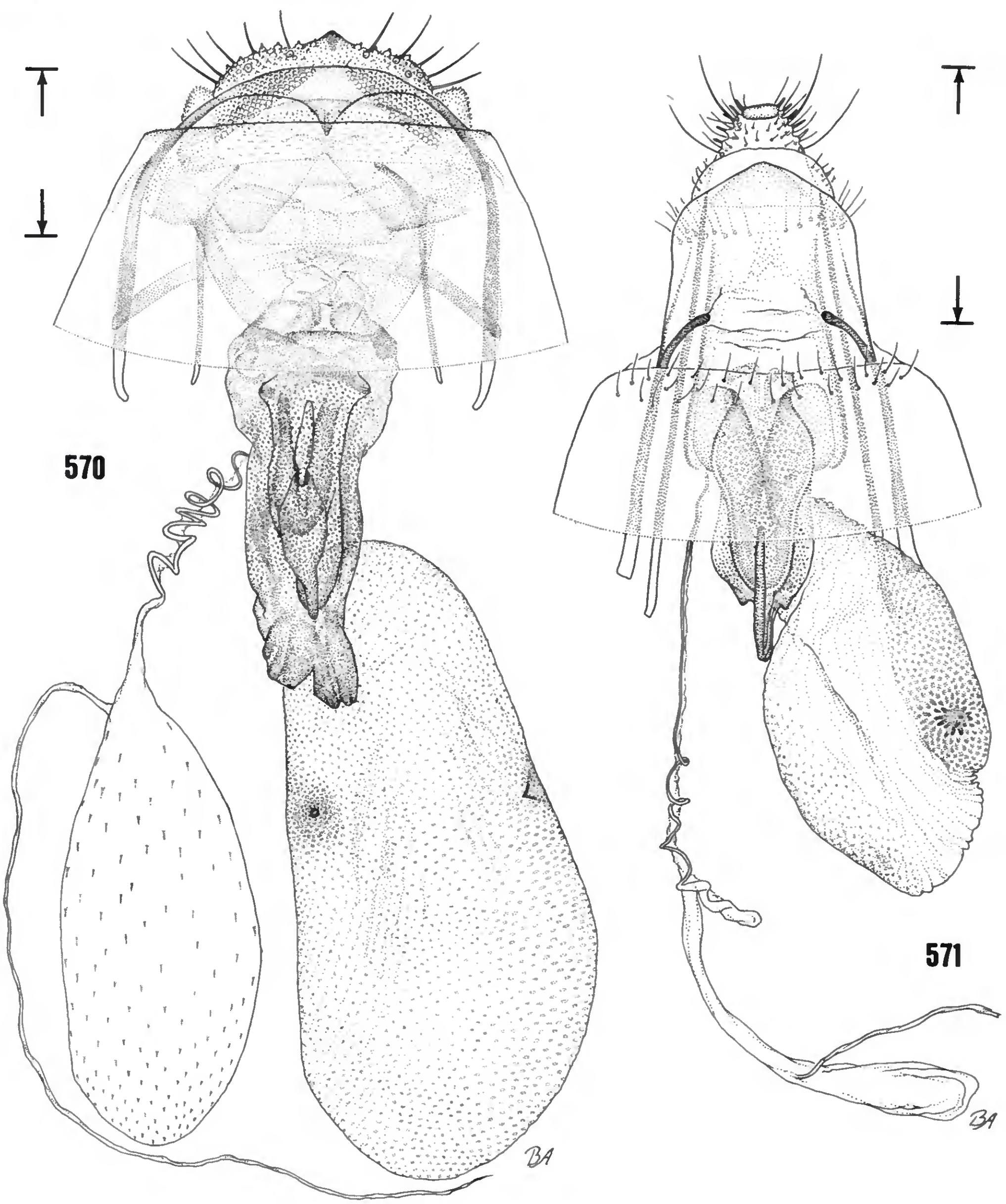
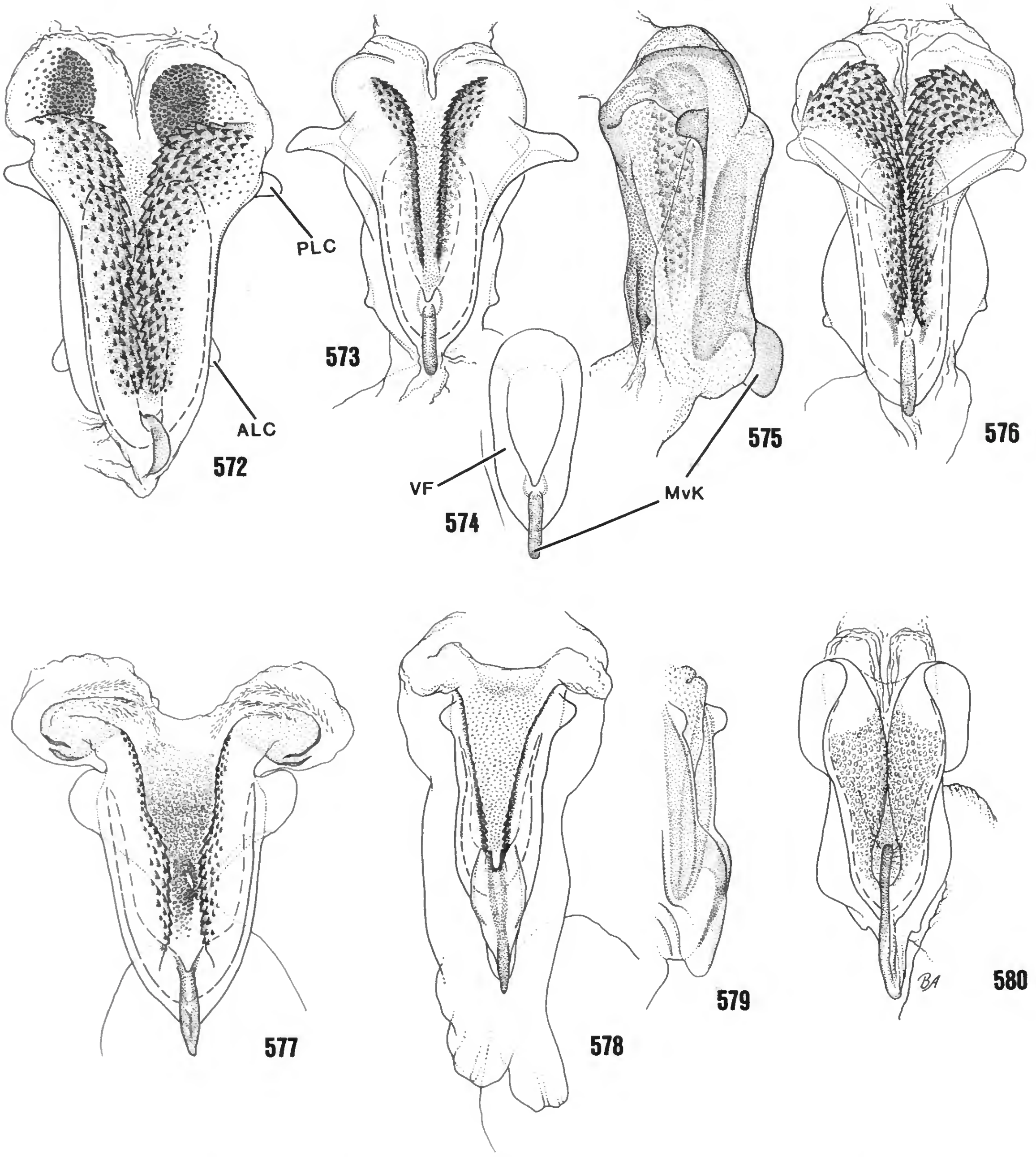
FIGURES 564–566.—Female genitalia, ventral view: 564, *Metaphatus spatulatus*, new species; 565, *M. ochraceus*, new species; 566, same, spermatophore. (All scales = 0.5 mm.)



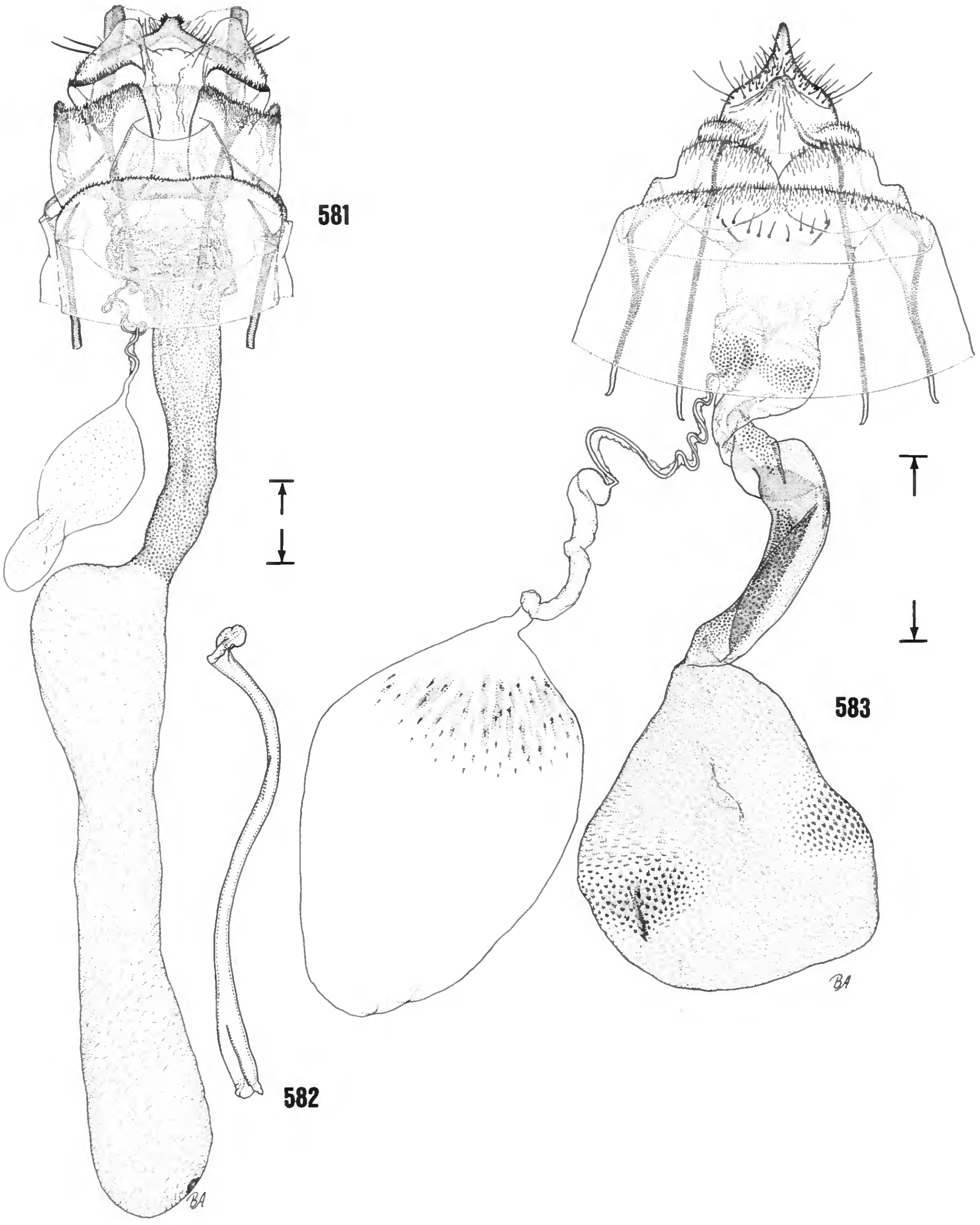
FIGURES 567–569.—Female genitalia, ventral view: 567, *Metaphatus ichnius*, new species; 568, *M. cirrhus*, new species; 569, same, spermatophore. (All scales = 0.5 mm.)



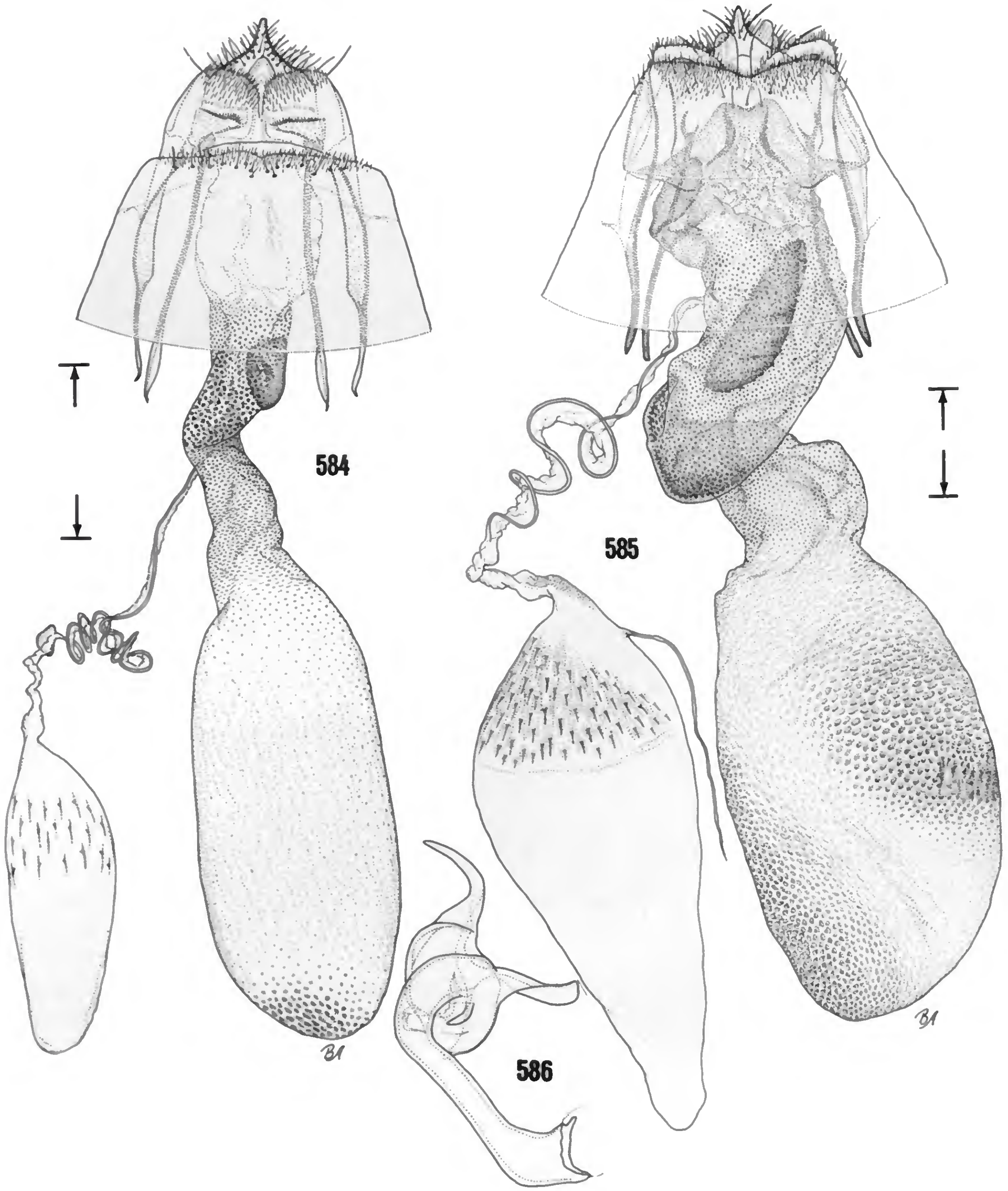
FIGURES 570, 571.—Female genitalia, ventral view: 570, *Metaphatus adustus*, new species; 571, *Plesiophatus inarmigerus*, new species. (All scales = 0.5 mm.)



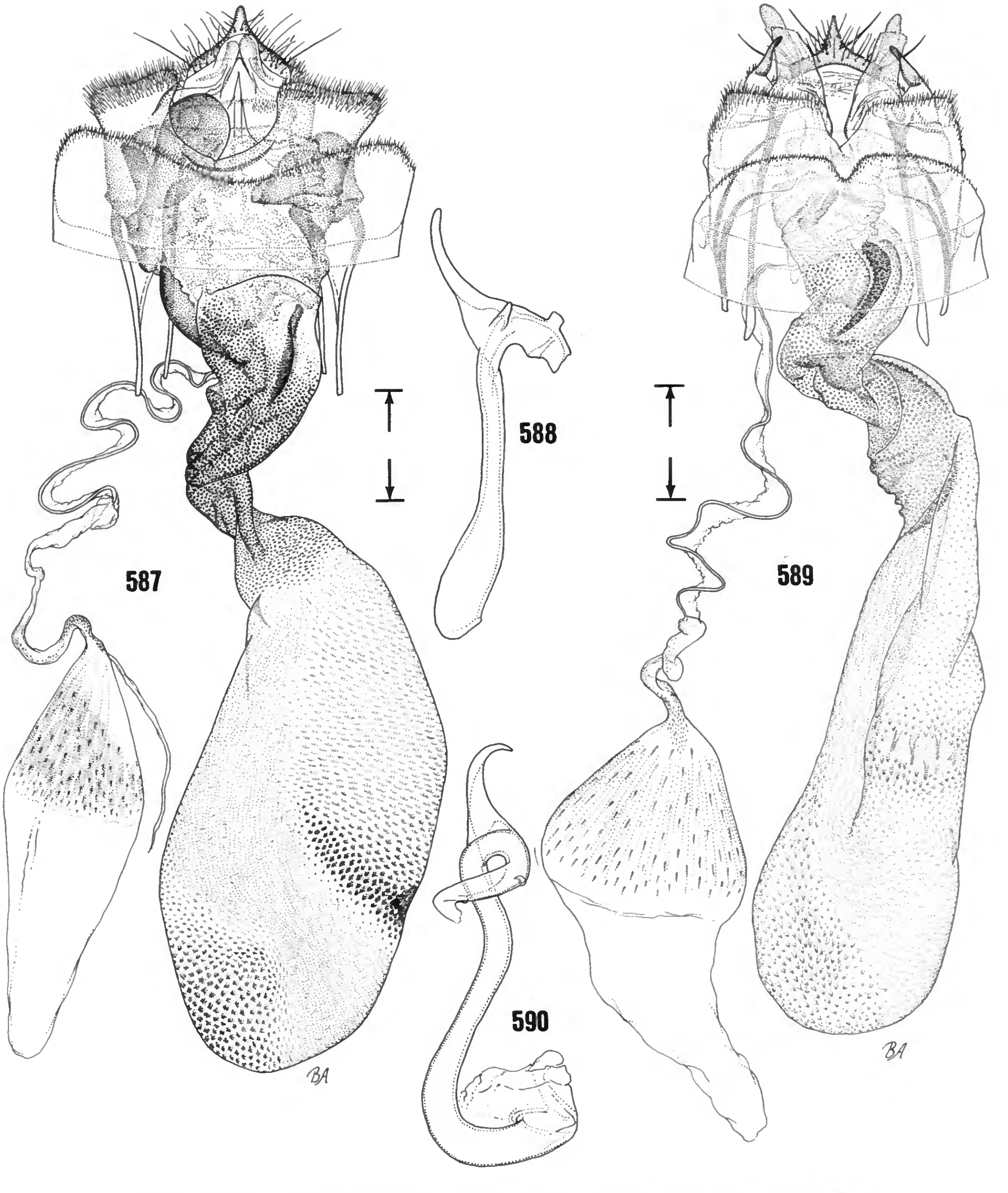
FIGURES 572–580.—Ventral view of female colliculum (with V-fold partially removed): 572, *Metaphatus spatulatus*, new species; 573, *M. ochraceus*, new species; 574, same, V-fold; 575, same, lateral view; 576, *M. ichnius*, new species; 577, *M. cirrhus*, new species; 578, *M. adustus*, new species; 579, same, lateral view of V-fold; 580, *Plesiophatus inarmigerus*, new species. (All scales = 0.5 mm.)



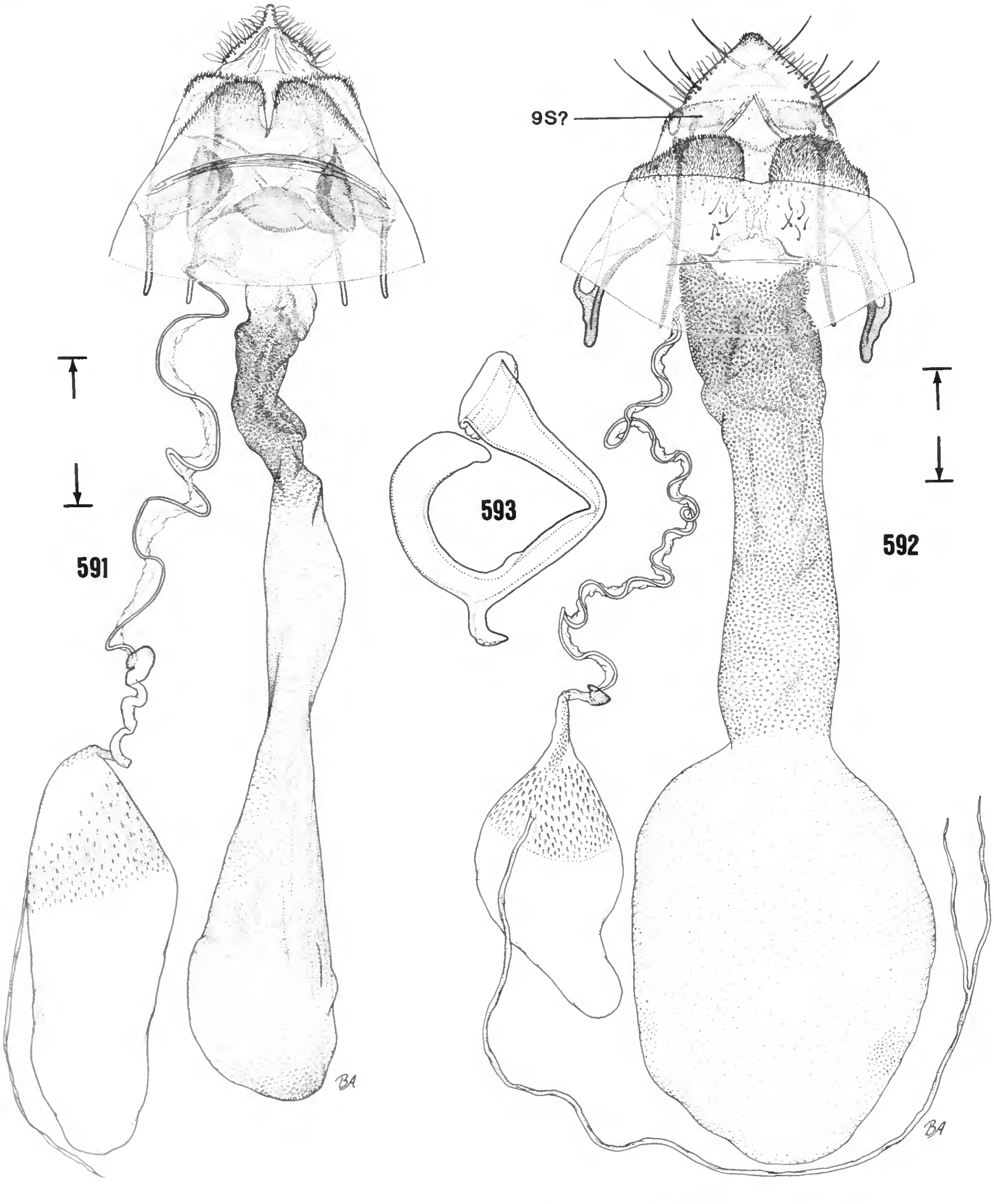
FIGURES 581–583.—Female genitalia, ventral view: 581, ***Palaephatus (Prophatus) dimorphus*,** new species; 582, same, spermtophore; 583, ***P (Prophatus) leucacrotus*,** new species. (All scales = 0.5 mm.)



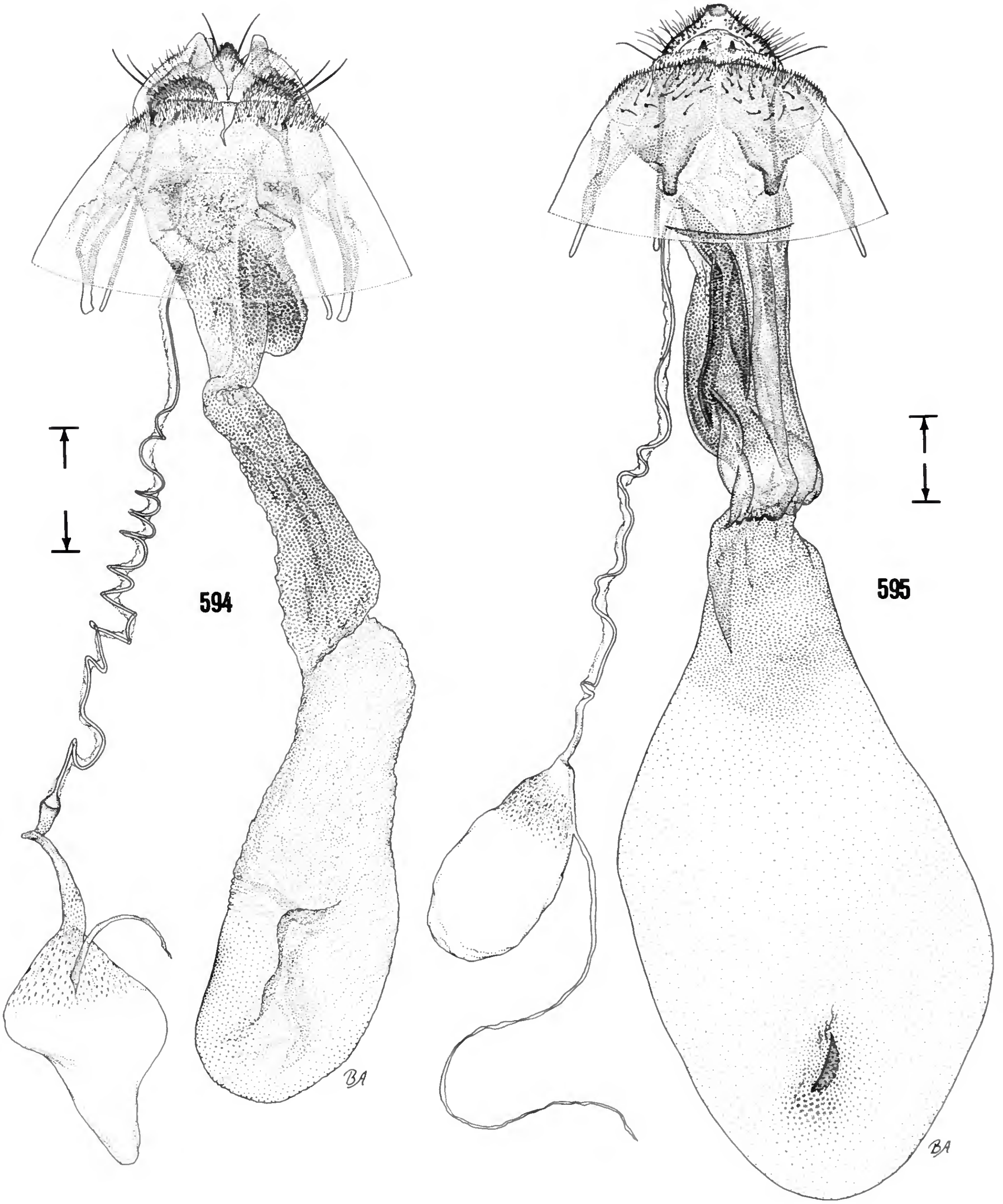
FIGURES 584–486.—Female genitalia, ventral view: 584, *Palaephatus (Prophatus) nielseni*, new species: 585, *P. (Prophatus) fusciterminus*, new species; 586, same, spermatophore. (All scales = 0.5 mm.)



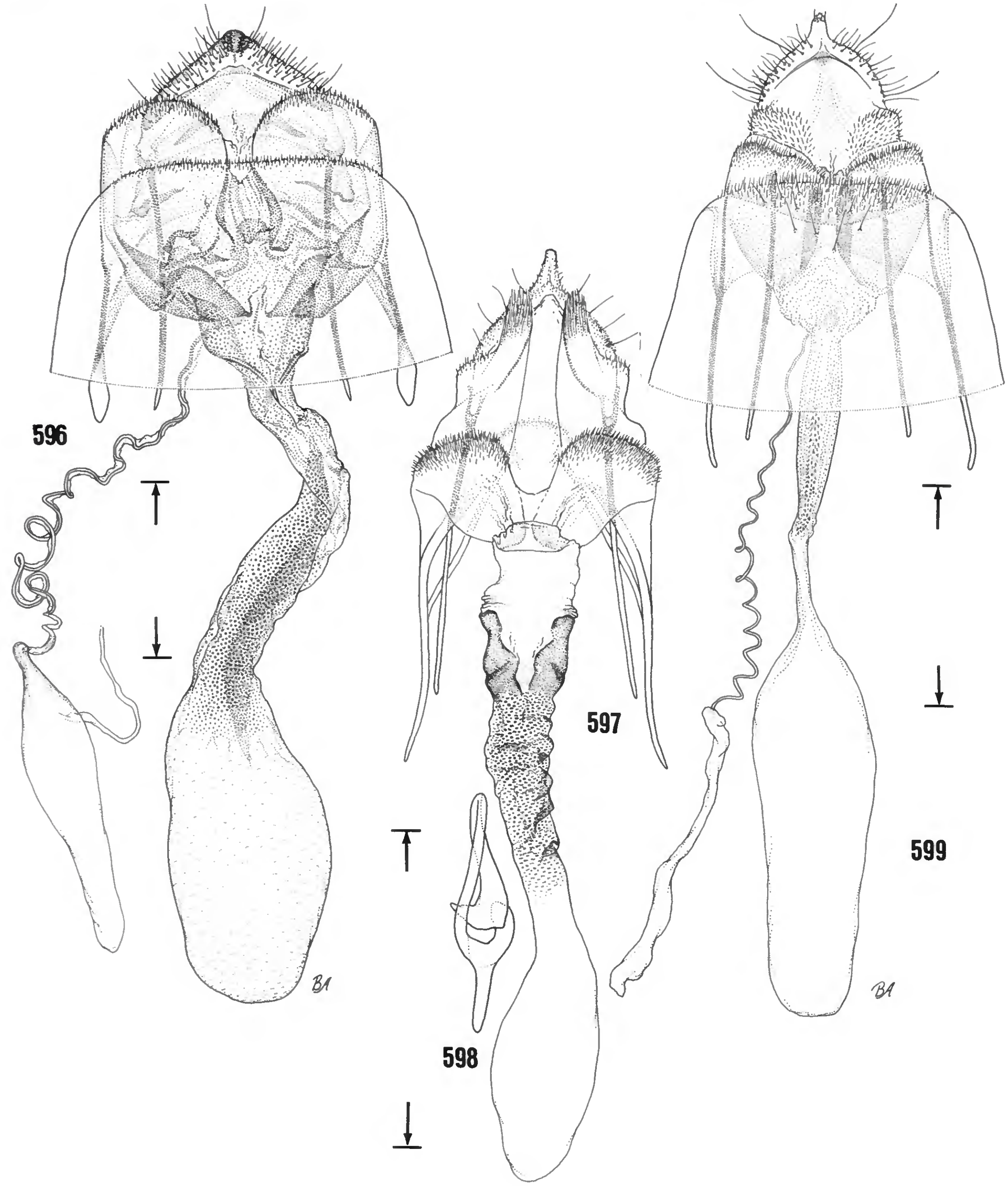
FIGURES 587–590.—Female genitalia, ventral view: 587, *Palaephatus (Prophatus) albiterminus*, new species; 588, same, spermatophore; 589, *P. (Prophatus) striatus*, new species; 590, same, spermatophore. (All scales = 0.5 mm.)



FIGURES 591–593.—Female genitalia, ventral view: 591, *Palaephatus (Prophatus) amplisaccus*, new species; 592, *P. (Palaephatus) falsus* Butler; 593, same, spermatophore. (All scales = 0.5 mm.)



FIGURES 594, 595.—Female genitalia, ventral view: 594, *Palaephatus (Palaephatus) pallidus*, new species; 595, *P. (Palaephatus) luteolus*, new species. (All scales = 0.5 mm.)



FIGURES 596–599.—Female genitalia, ventral view: 596, *Palaephatus (Palaephatus) albicerus*, new species; 597, *Apophatus parvus*, new species; 598, same, spermatophore; 599, *A. bifibratus*, new species. (All scales = 0.5 mm.)

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