

A Revision of North American
Capitophorus Van der Goot and
Pleotrichophorus Börner
(Homoptera: Aphididae)

LEONILA ALZATE CORPUZ-RAROS
and
EDWIN F. COOK

SERIAL PUBLICATIONS OF THE SMITHSONIAN INSTITUTION

The emphasis upon publications as a means of diffusing knowledge was expressed by the first Secretary of the Smithsonian Institution. In his formal plan for the Institution, Joseph Henry articulated a program that included the following statement: "It is proposed to publish a series of reports, giving an account of the new discoveries in science, and of the changes made from year to year in all branches of knowledge." This keynote of basic research has been adhered to over the years in the issuance of thousands of titles in serial publications under the Smithsonian imprint, commencing with *Smithsonian Contributions to Knowledge* in 1848 and continuing with the following active series:

Smithsonian Annals of Flight
Smithsonian Contributions to Anthropology
Smithsonian Contributions to Astrophysics
Smithsonian Contributions to Botany
Smithsonian Contributions to the Earth Sciences
Smithsonian Contributions to Paleobiology
Smithsonian Contributions to Zoology
Smithsonian Studies in History and Technology

In these series, the Institution publishes original articles and monographs dealing with the research and collections of its several museums and offices and of professional colleagues at other institutions of learning. These papers report newly acquired facts, synoptic interpretations of data, or original theory in specialized fields. These publications are distributed by mailing lists to libraries, laboratories, and other interested institutions and specialists throughout the world. Individual copies may be obtained from the Smithsonian Institution Press as long as stocks are available.

S. DILLON RIPLEY
Secretary
Smithsonian Institution

SMITHSONIAN CONTRIBUTION TO ZOOLOGY • NUMBER • 156

A Revision of North American
Capitophorus Van der Goot and
Pleotrichophorus Börner
(Homoptera: Aphididae)

Leonila Alzate Corpuz-Raros
and *Edwin F. Cook*



SMITHSONIAN INSTITUTION PRESS

City of Washington

1974

Corpus-Raros, Leonila Alzate
Revision of North American Capitophorus van der
Goot and Pleotrichophorus Börner (Homoptera: Aphididae)
Washington
Smithsonian Institution Press
1974
Smithsonian Contributions to Zoology; no 156
p-2
640871
ENT

(not on IPF)

ABSTRACT

Corpuz-Raros, Leonila Alzate, and Edwin F. Cook. A Revision of North American *Capitophorus* Van der Goot and *Pleotrichophorus* Börner (Homoptera: Aphididae), *Smithsonian Contributions to Zoology*, number 156, 143 pages, 494 figures, 1974.—The North American species of *Capitophorus* and *Pleotrichophorus* are reviewed. In all, 8 species and 2 subspecies of *Capitophorus*, and 46 species and 5 subspecies of *Pleotrichophorus* are considered. Of these, 10 species and 3 subspecies are described as new.

The comparative external morphology is discussed, and keys to the identification of apterous and alate viviparae of *Capitophorus* and of apterous viviparae of *Pleotrichophorus* are given. Descriptions and illustrations are provided also for all morphs, and the species distribution and host records are compiled.

A neotype for *C. xanthii* Oestlund and lectotypes for 14 *Pleotrichophorus* species described by Knowlton and Smith are designated.

OFFICIAL PUBLICATION DATE is handstamped in a limited number of initial copies and is recorded in the Institution's annual report, *Smithsonian Year*. SI PRESS NUMBER 4859. SERIES COVER DESIGN: The coral *Montastrea cavernosa* (Linnaeus).

Library of Congress Cataloging in Publication Data

Corpuz-Raros, Leonila Alzate.

A revision of North American *Capitophorus* Van der Goot and *Pleotrichophorus* Börner (Smithsonian contributions to zoology, no. 156)

Bibliography: p.

I. *Pleotrichophorus*. 2. *Capitophorus*. 3. Homoptera—North America. I. Cook, Edwin F., joint author. II. Title. III. Series: Smithsonian Institution. Smithsonian contributions to zoology, no. 156.

QL1.S54 no. 156 [QL527.A64] 591.08s [595.7:52] 73-8790

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402 - Price \$2.25 (paper cover)

Contents

	<i>Page</i>
Introduction	1
Morphology and Explanations of Terms	3
Head	3
Thorax	5
Abdomen	5
Abbreviations Used in the Text and Illustrations	7
Key to the Genera of Aphididae Discussed Herein	8
Genus <i>Capitophorus</i> Van der Goot	8
Key to the Nearctic Species of <i>Capitophorus</i>	10
<i>Capitophorus elaeagni</i> (del Guercio)	11
<i>Capitophorus essigi</i> Hille Ris Lambers	14
<i>Capitophorus hippophaes</i> (Walker)	16
Key to the Nearctic Subspecies of <i>Capitophorus hippophaes</i>	16
<i>Capitophorus hippophaes hippophaes</i> (Walker)	19
<i>Capitophorus hippophaes javanicus</i> Hille Ris Lambers	20
<i>Capitophorus horni</i> Börner	20
<i>Capitophorus jopepperi</i> , new species	22
<i>Capitophorus pakansus</i> Hottes and Frison	23
<i>Capitophorus shepherdiae</i> Gillette and Bragg	26
<i>Capitophorus xanthii</i> (Oestlund)	28
Genus <i>Pleotrichophorus</i> Börner	30
Key to the Nearctic Species of <i>Pleotrichophorus</i>	32
<i>Pleotrichophorus acanthovillus</i> (Knowlton and Smith)	38
<i>Pleotrichophorus ambrosiae</i> Hille Ris Lambers	38
<i>Pleotrichophorus amsinckii</i> Richards	41
<i>Pleotrichophorus antennarius</i> , new species	42
<i>Pleotrichophorus brevinectarius</i> (Gillette and Palmer)	43
<i>Pleotrichophorus chrysanthemi</i> (Theobald)	44
<i>Pleotrichophorus decampus</i> (Knowlton and Smith)	46
<i>Pleotrichophorus diutius</i> , new species	48
<i>Pleotrichophorus elongatus</i> (Knowlton), new combination	50
<i>Pleotrichophorus filifoliae</i> (Palmer)	52
<i>Pleotrichophorus glandulosus</i> (Kaltenbach)	53
<i>Pleotrichophorus gnaphalodes</i> (Palmer)	55
<i>Pleotrichophorus gregarius</i> (Knowlton)	56
<i>Pleotrichophorus heterohirsutus</i> (Gillette and Palmer)	58
<i>Pleotrichophorus hottesi</i> Hille Ris Lambers	60
<i>Pleotrichophorus infrequens</i> (Knowlton and Smith)	61
<i>Pleotrichophorus intermedius</i> , new species	61
<i>Pleotrichophorus knowltoni</i> , new species	62
<i>Pleotrichophorus lagacei</i> Hille Ris Lambers	63
<i>Pleotrichophorus longinectarius</i> (Gillette and Palmer)	63

	<i>Page</i>
<i>Pleotrichophorus longipes</i> (Gillette and Palmer)	64
<i>Pleotrichophorus longirostris</i> Hille Ris Lambers	65
<i>Pleotrichophorus magnautensus</i> (Knowlton and Smith)	66
<i>Pleotrichophorus neosporadicus</i> , new species	67
<i>Pleotrichophorus obscuratus</i> Hille Ris Lambers	68
<i>Pleotrichophorus oestlundii</i> (Knowlton)	68
<i>Pleotrichophorus ohioensis</i> (Smith), new combination	70
<i>Pleotrichophorus packi</i> (Knowlton)	71
Key to the Apterous Vivipara of Subspecies of	
<i>Pleotrichophorus packi</i>	73
<i>Pleotrichophorus packi brevis</i> , new subspecies	73
<i>Pleotrichophorus palmerae</i> (Knowlton)	74
<i>Pleotrichophorus parilis</i> , new species	75
<i>Pleotrichophorus patonkusellus</i> , new species	77
<i>Pleotrichophorus patonkus</i> (Hottes and Frison)	78
<i>Pleotrichophorus pseudoglandulosus</i> (Palmer)	79
<i>Pleotrichophorus pseudopatonkus</i> , new species	82
<i>Pleotrichophorus pullus</i> (Gillette and Palmer)	83
<i>Pleotrichophorus pycnorhynchus</i> (Knowlton and Smith)	85
<i>Pleotrichophorus quadritrichus</i> (Knowlton and Smith)	86
Key to the Subspecies of <i>Pleotrichophorus quadritrichus</i>	86
<i>Pleotrichophorus quadritrichus quadritrichus</i>	
(Knowlton and Smith)	87
<i>Pleotrichophorus quadritrichus pallidus</i> , new subspecies	88
<i>Pleotrichophorus quadritrichus vulgaris</i> , new subspecies	90
<i>Pleotrichophorus rusticatus</i> (Knowlton and Smith)	90
<i>Pleotrichophorus spatulavillus</i> (Knowlton and Smith)	91
<i>Pleotrichophorus sporadicus</i> (Knowlton)	92
<i>Pleotrichophorus stroudii</i> (Knowlton), new combination	94
<i>Pleotrichophorus triangulatus</i> , new species	95
<i>Pleotrichophorus utensis</i> (Pack and Knowlton)	95
<i>Pleotrichophorus wasatchii</i> (Knowlton)	97
<i>Pleotrichophorus xerozoous</i> (Knowlton and Smith),	
new combination	98
<i>Pleotrichophorus zoomontanus</i> (Knowlton and Smith),	
new combination	100
Literature Cited	101
Appendix 1: List of Hosts	107
Appendix 2: Higher Classification of Host Genera	107
Appendix 3: List of Aphid Names	108
Figures	110

A Revision of North American *Capitophorus* Van der Goot and *Pleotrichophorus* Börner (Homoptera: Aphididae)

Leonila Alzate Corpuz-Raros
and *Edwin F. Cook*

Introduction

Aphids in which the apterae have capitate hairs and well-developed laterofrontal tubercles were placed in the genus *Capitophorus* Van der Goot in 1913. Currently, these aphids are placed in nine genera: *Capitophorus* Van der Goot, *Chaetosiphon* Mordvilko, *Corylobium* Mordvilko, *Cryptaphis* Hille Ris Lambers, *Cryptomyzus* Oestlund, *Idiopterus* Davis, *Nasonovia* Mordvilko, *Pleotrichophorus* Börner, and *Rhopalomyzus* Mordvilko.

The host relationships of the above genera are markedly distinct from one another. Members of six genera are without migrant forms, that is, the life cycles are completed on one host (holocyclic): *Chaetosiphon* on *Fragaria*, *Geum*, *Potentilla* and *Rosa* (Rosaceae); *Corylobium* on *Corylus* (Betulaceae); *Cryptaphis* on Gramineae; *Idiopterus* on ferns, perhaps also on a variety of Angiosperms (Iglisch, 1967); *Rhopalomyzus* on *Poa* (Gramineae) and *Lonicera* (Caprifoliaceae); and *Pleotrichophorus* on a wide variety of Compositae including the tubuliferous tribes Anthemideae, Astereae, Helenieae, Heliantheae, Inuleae, and the liguliflorous tribe Cichocoreae. *Pleotrichophorus* is also found on *Amsinckia* (Boraginaceae), and is here recorded for the first time on *Eriogonum* (Poly-

gonaceae). Members of the remaining three genera have migrant forms: *Cryptomyzus* migrates from *Ribes* (Saxifragaceae) to Labiatae, or is holocyclic on the latter; *Nasonovia* migrates also from *Ribes* to liguliflorous Compositae and Scrophulariaceae, or is holocyclic on the composite genus *Hieracium*; and *Capitophorus* migrates from Elaeagnaceae to several tribes of Compositae, or to *Polygonum* (Polygonaceae).

All the above aphid genera are holarctic in distribution except the cosmopolitan *Idiopterus* which is believed to be originally neotropical (Hille Ris Lambers, 1949) and *Corylobium* which is so far known only from Eurasia. A few species have become more or less cosmopolitan, e.g., *Capitophorus elaeagni* (del Guercio) and *C. hippophaes* (Walker), through the introduction of their host plants from the temperate Old World.

This paper is a comprehensive treatment of North American *Capitophorus* and *Pleotrichophorus*. Until recently, knowledge on the systematics of this group in this region has been provided by Palmer's (1952) treatment of *Capitophorus*, sensu lato. Here, Palmer reviewed the 37 species described from Colorado by herself, by Gillette and Bragg (1928, 1933), and species described from Utah and the surrounding states of Idaho, Wyoming, and Montana by Knowlton (1927-1936) and Knowlton and Smith (1936 a, b, c). Two additional species descriptions, one from New Mexico (Knowlton, 1948) and one from Ohio

Leonila Alzate Corpuz-Raros, Department of Entomology, University of Philippines, College, Laguna, Philippines. *Edwin F. Cook*, Department of Entomology, Fisheries, and Wildlife, University of Minnesota, St. Paul, Minnesota 55101.

(Smith, 1940), are available in separate papers. In the midwestern states, papers of Hottes and Frison (1931) and Oestlund (1886, 1887, 1922) contain the only references to the group. In addition, but of limited value, there are available local lists of species from the eastern states by Patch (1923), Leonard (1928, 1936, 1956, 1959, 1963, 1964, 1967, 1968), Leonard and Tissot (1965), and Pepper (1965); from Quebec by Quednau (1966) and from Manitoba by Robinson and Bradley (1965, 1968).

Except for such local lists, further consideration of North American *Capitophorus* and *Pleotrichophorus* subsequent to Palmer (1952) consists of Hille Ris Lambers' (1953, 1966, 1969) description of 6 new species mostly from California, and Richards' (1968) description of one species from Canada. Hille Ris Lambers (1969) also provided a key to and synonymic notes on American *Pleotrichophorus*, which, however, omitted some well-established species.

Synonymic indications are compiled as comprehensively as possible from North American literature, and in most cases these references were consulted. References to publications not available during the study were copied and modified from Hille Ris Lambers (1953) and other reviews; these are indicated by asterisks in the bibliography.

Much of this study is based on a reexamination of the material used by Hottes and Frison, Davis, Knowlton and Smith, Oestlund, Palmer and colleagues, Patch and Richards in North America and by Eastop and Hille Ris Lambers in Europe. Many of the specimens were in the collection of E. O. Essig. Other newer material was obtained from various American aphidologists and from university and other insect collections.

Type-specimens, including holotypes in most cases, were examined and used for illustrations. A neotype for one Oestlund species and lectotypes for most of Knowlton and Smith's species are designated. In the latter case, the type slides were marked "type, cotype or paratype" and usually contained more than a single specimen. To make examinations possible many old collections, including some type-specimens, had to be cleared and remounted.

The repository for a number of types has come to light subsequent to the completion of this work and they have not, therefore, been examined by the

senior author. The junior author feels that it would be presumptuous of him to make any revision based only on his examination of types. The examination of these by the senior author would too long delay the publication of the work and the interpretations will therefore stand without such further examination.

The names and classification of host plants were referred from Fernald's (1950) *Gray's Manual of Botany* and Ferris' (1960) volume in Abram's *An Illustrated Flora of the Pacific States*. Dr. Gerald B. Ownbey, Curator of the Herbarium, Botany Department, University of Minnesota was also consulted.

ACKNOWLEDGMENTS.—We wish to thank Dr. George F. Knowlton, Extension Service, Utah State University, for kindly making available his old collections and publications of *Capitophorus*, and for providing additional newer collections since this work was initiated in 1966; and Miss Louise M. Russell, Entomology Research Division, United States Department of Agriculture, for technical assistance, review of the manuscript, and helpful suggestions.

We are also grateful to Dr. D. Hille Ris Lambers, Bennekom, Netherlands, for his advice and opinions on several problems, and for loaning numerous types and collections from the United States, Canada, and other countries.

Valuable types were made accessible through the kind help of Drs. Clyde F. Smith, North Carolina State University; Louise M. Russell, Entomology Research Division, Agricultural Research Service, U. S. Department of Agriculture; and Karl V. Krombein, Smithsonian Institution, National Museum of Natural History; Robert L. Langston, University of California, Berkeley; Lewis J. Stannard, Illinois Natural History Survey; T. O. Thatcher, Colorado State University; W. R. Richards, Research Branch, Canada Department of Agriculture, Ontario; and V. F. Eastop, British Museum (Natural History).

We are thankful for the loan of a wide variety of collections of *Capitophorus* and allied genera of aphids from the following aphidologists and entomologists: Drs. E. Balsbaugh, Jr., South Dakota State University; T. L. Bissell, Cooperative Extension Service, University of Maryland; H. D. Blocker, Kansas State University; H. B. Boudreaux,

Louisiana State University; G. W. Byers, University of Kansas; H. A. Denmark, Division of Plant Industry, Florida Department of Agriculture; R. C. Dickson, University of California, Riverside; R. L. Fischer, Michigan State University; P. H. Freytag, Ohio State University; C. Johansen, Washington State University; M. E. MacGillivray, Research Branch, Canada Department of Agriculture, Fredericton, New Brunswick; J. T. Medler, University of Wisconsin; J. O. Pepper, Pennsylvania State University; A. G. Robinson, University of Manitoba; J. G. Rozen, Jr., The American Museum of Natural History; G. W. Simpson, University of Maine; and A. N. Tissot, University of Florida.

This is Paper Number 7692 of the Scientific Journal Series, Minnesota Agricultural Experiment Station, St. Paul, Minnesota.

The following abbreviations are used for collectors, private owners of collections, and museums cited in the text: AGR = A. G. Robinson, University of Manitoba; BM = British Museum (Natural History); CFS = C. F. Smith, North Carolina State University; CNC = Canadian National Collection, Ottawa; CPG = C. P. Gillette; CSU = Colorado State University; DHRL = D. Hille Ris Lambers, Bennekom, Netherlands; MEMacG = M. E. MacGillivray, Canada Department of Agriculture, New Brunswick; EOE = E. O. Essig, University of California (Berkeley); GFK = G. F. Knowlton, Utah State University; GWS = G. W. Simpson, University of Maine; INHS = Illinois Natural History Survey; JOP = J. O. Pepper, Pennsylvania State University; KSU = Kansas State University; KU = University of Kansas; LACR = L. A. Corpuz-Raros, University of the Philippines; LCB = L. C. Bragg, Colorado State University; MAP = M. A. Palmer, Colorado State University; MDL = Mortimer D. Leonard; ORSU = Oregon State University; OSU = Ohio State University; OWO = O. W. Oestlund, University of Minnesota; PU = Purdue University; RCD = R. C. Dickson, University of California (Riverside); UC = University of California at Berkeley and Riverside; U.Me. = University of Maine; U.Minn. = University of Minnesota; USNM = United States National Museum Collections (National Museum of Natural History, Smithsonian Institution); U.Wisc. = University of Wisconsin; VFE = V. F. Eastop, British Museum; WRR = W. R. Richards, Canada Department of Agriculture, Ontario.

Morphology and Explanations of Terms

HEAD

CHAETOTAXY OF HEAD SCLERITES (Figures 1, 3, 4).—Like all other aphids, the head is dorsoventrally flattened and the head capsule is made up largely of the frontal area. The clypeus, along with other sclerites, is displaced ventrally. The mouthparts (rostrum) arise posteroventrally and extend into the thoracic sternum between the leg bases. The antennae are borne on anterolateral projections (called antennal or laterofrontal tubercles) that distinctly exceed the median frontal projection (vertex or mesofrontal tubercle) in most species. The compound eyes arise posteriorly on each side of the head and bear 3-faceted tri-ommatidia or ocular tubercles. In all alate forms and apterous males, one lateral ocellus occurs mesad of each compound eye and the median ocellus is borne anteriorly on the mesofrontal tubercle.

The chaetotaxy of the head is considered at length in all species as it provides readily distinguishable characters that are relatively stable, at least on a group basis. Setae provide additional characters by which immature stages and mutilated specimens can be identified. Appendages, particularly the antennae, are indispensable in conventional aphid taxonomy but these are not fully developed until maturity, and are rather fragile structures that can be easily lost in preserved specimens.

The following pairs of setae are morphologically distinguishable in *Capitophorus* and *Pleotrichophorus*:

Mesofrontals (mf; equivalent to verticals of authors): One pair is present in *Capitophorus*, with rare exceptions. Although it is also the mode in *Pleotrichophorus*, an additional unpaired seta is not uncommon (e.g., *P. gnaphalodes*, *P. patonkus*), 2 pairs may be regularly present (*P. oestlundi*) or else clusters of 4 or more occur in species with well-developed mesofrontal tubercles (e.g., *P. heterohirsutus* and *P. rusticatus*).

Laterofrontals (lf): On the inner margin of each laterofrontal tubercle are borne one to several setae called laterofrontals. One, among the lf's on each side, is always more distinctly ventral than the others. This pair of setae, called ventral laterofrontals (vlf), can be further recognized by its

tendency to arise near the rim of the antennal socket. One pair of lf is always present in *Capitophorus* while from 1 to 7 (most commonly 2 or 3 pairs) occur in *Pleotrichophorus*. A pair of vlf is recognizable in both genera but sometimes may be difficult to distinguish in *P. magnautensis*.

Dorsofrontals (df): The numbers and shapes of the setae on the dorsum of the head vary considerably and these offer some characters for species recognition. In *Capitophorus*, 4 pairs of df's are present in all morphs, with the occasional absence or presence of one or a few setae in some individuals within the same clone. The most anterior pair, df-1, is always associated with, and may be hard to recognize from, the mf. However, the mf setae are always borne on the mesofrontal tubercle and the df-1's flank them, usually at the level of the grooves separating the anterior head projections. A second pair of df (df-2) follows df-1 and occurs anterior to the foremargin of the compound eyes in apterae. Posteriorly, are 2 other pairs of df's: the mesal are referred to here as inner postero-frontals (ipf) and the outer referred to as outer postero-frontals (opf). These are named postero-dorsal (p-d) and laterodorsal (l-d) setae, respectively, by Smith and Dillery (1968) in the genus *Drepanaphis*. The fronto-orbitals (f-o) of the same authors are probably homologues of df-1 and df-2 referred to here. Richards' (1965) anterodiscals (a-d) and posterodiscals (p-d) in Callaphidini also seem to refer to homologous structures.

The df's are almost always more than 4 pairs in *Pleotrichophorus* and do not, as a rule, form any recognizable pattern. Clonal variation is common, although mean df counts are useful in the recognition of some species. For instance, *P. acanthovillus*, *P. sporadicus*, and *P. utensis* have 4 pairs; *P. longipes*, 5 pairs; *P. antennarius*, *P. chrysanthemi*, *P. glandulosus*, *P. magnautensis*, and *P. pycnorhynchus*, 6 or 7 pairs; *P. gregarius*, *P. packi*, *P. pseudoglandulosus* and *P. xerozoous*, 8 or 9 pairs; most species, between 10 to 20 pairs; *P. brevinectarius* and *P. oestlundii*, about 25 pairs; and *P. longinectarius*, up to 35 pairs.

Ventrofrontals (vf): The venter of the head capsule, surrounding the postclypeus and mandibular plates, bears a variable number of setae; these are called ventrofrontals. Two pairs are always present in *Capitophorus* species with cylindrical cornicles while 3 pairs are present among

clavate-cornicled species. *Pleotrichophorus* species, on the other hand, have 3 to 12 pairs, with the usual count of 4 or 5 pairs.

Clypeals: The clypeus bears 2 pairs of setae on the postclypeal area (postclypeals or pc) and 4 to 6 on the anteclypeus (anteclypeals or ac) that are usually arranged 1-2-1 (lateral-median-lateral) or 2-2-2. The pc and ac are relatively stable and variation is of little or no taxonomic significance.

Mandibulars (md): The sclerites on either side of the clypeus and which are sometimes incompletely separated from the latter, are the mandibular plates (Snodgrass, 1935:239) or mandibular laminae (Vickerey, 1908). The mandibular plates usually bear 3 setae on each side and show little variation. These are included here only for descriptive purposes.

POSTEMBRYONIC DEVELOPMENT OF HEAD CHAETOTAXY (Figures 7-14).—In *Capitophorus hippophaes*, the mf, df, and clypeal setae are already present in newly born larvae while the lf, vlf, vf, and md are added in the second instar.

ANTENNAE.—The antennae of all morphs except fundatrices of most *Capitophorus* species are 6-segmented. (The fundatrix of *C. elaeagni* has 6-segmented antennae.) Some species (e.g., *C. essigi*) may have stronger tendencies than others to have fusion between the third and fourth segments in summer apterous forms. Antennal segment I (a.s.I) is produced at varying degrees mesodistally and is usually imbricate or sometimes also spiculate on this projection. Dorsally, there may be 2 or more setae, the basal of which is small and pointed; a few more setae occur on the mesodistal projection of the anterior margin and on the ventral surface of the segment.

Antennal segment II (a.s.II) has a rather constant chaetotaxy in both genera. In *Capitophorus*, the formula in summer forms is almost always $1 - \frac{1}{1} - 1$ (lateral— $\frac{\text{dorsal}}{\text{ventral}}$ —lateral); in *Pleotrichophorus*, it is also usually $1 - \frac{1}{1} - 1$. The dorsal seta is usually missing in fundatrices and it may also be absent in oviparous females.

Measurements are given for the length of flagellar segments as well as the ratios of antennal segments IV and V to the segment III (a.s.III: IV:V) and the unguis to the base of segment VI

(VIu/VIb). Counts of secondary sensoria are sometimes useful for species differentiation and are given wherever they occur: viz, a.s.III of *Pleotrichophorus* apterae and female alatae, and a.s.IV, V of *Pleotrichophorus* males and all *Capitophorus* alates.

ROSTRUM (Figures 5, 122–164).—The 4-segmented rostrum is attached to the head capsule ventrolaterally to the maxillary plates. The small, triangular labrum is hinged to the clypeus and projects flap-like over the rostral base.

The last rostral segment (traditionally, rostrum IV+V) is especially important taxonomically. The sides always taper from a broader base to a narrower tip and the distal portion beyond the last pair of setae may be extended at varying degrees. At one extreme, this is very short so that the tip appears "obtuse" (e.g. *C. hippophaes*, Figure 5, and *P. pycnorhysus*, Figure 125); at the other extreme it is extended into a long cylindrical or needle-like point simulating a segment 5 (e.g., *P. pullus*, Figure 154, and *P. gnaphalodes*, Figure 155). In a majority of species this is continued as an acute prolongation of varying lengths and degrees of acuteness. The sides past the last pair of setae may also be slightly "convex" or almost parallel-sided before the more or less obtuse apex (e.g., *P. parilis*, Figure 146, and *P. diutius*, Figure 147) or "concave" when this distal portion is produced into a needle-like point (Figures 149–160). To summarize the shape of rostrum IV+V, the term "rostrate" has been used for *Capitophorus* species where the portion distal to the last pair of setae is not much extended and apex appears rather blunt. Although the term "stiletto-shaped" has been applied for *Pleotrichophorus* species with acutely pointed or needle-tipped last rostral segment, no general descriptive term has been found suitable for the great diversity exhibited among the many nearctic species.

A basal pair of tiny setae occurs just below the thickened anteroventral margin of rostrum IV+V (Figure 5). In *Pleotrichophorus* a ring of 4 setae follows, a pair of which is lateral (anterolateral or al setae) and the other dorsal (anterodorsal or ad setae) in position. The ad setae are absent in *Capitophorus*. Then there is a mediolateral (ml) pair which may be closely associated with the next pairs of posterior setae. The latter also consist of lateral (posterolateral or pl setae) and dorsal

(posterodorsal or pd setae) components. In addition, a few pairs of small rod-like sensilla are provided at the extreme tip of the segment.

In most nearctic species of *Pleotrichophorus* the ad and al setae are the longest (2 to 3 times the ml, pd, and pl setae) and the thickest of the rostral setae; however, in *P. lagacei* the pl is longest. In *Capitophorus* and a few *Pleotrichophorus* species (*P. acanthovillus*, *P. elongatus*, *P. magnautensis*, *P. pycnorhysus*, *P. stroudi*, and *P. utensis*), the lateral and dorsal setae are all subequally long or none of them distinctly longer than the others.

On dorsoventral mounts from which illustrations were made, only al, ml, and pl setae are ordinarily seen.

Measurements of rostrum IV+V and the proportion to the second segment of hind tarsi are given for all species of *Pleotrichophorus* (Table 1).

THORAX

Thoracic structures and appendages are not especially considered except in apterae of *Capitophorus* species. They are not especially useful taxonomically. However, measurements of the hind tibiae and second tarsal segment of hind legs (hind ta-2) are given.

ABDOMEN

CHAETOTAXY OF THORAX AND ABDOMEN (Figures 1, 2, 6).—The chaetotaxy of the thoracic and abdominal segments is of great significance in several aphid groups. This has been evaluated in European and partly in American *Capitophorus*, sensu lato (Hille Ris Lambers, 1953; Richards, 1963; Schaefers, 1960).

The terminology that has been used in the literature is adopted here. The terms are used mainly for *Capitophorus* where recognizable patterns are exhibited but these are also applicable to *Pleotrichophorus* in some instances. To shorten verbal descriptions, chaetotactic formulas are given with reference to only one side of individual or groups of segments.

The median longitudinal pair of setal rows is called spinals (s, equivalent to the "dorsals" of Schaefers, 1960) and those on each side of the body are the marginals (m). One or more longitudinal rows of setae are intercalated between the spinals

and marginals. The inner row which tends to be closer to the spinals is called pleurals (p); the outer row, which is more or less associated with the marginals, is called submarginals (sm). All but the submarginal rows may be duplicated. Fusion of spinals with pleurals, and submarginals with marginals may occur in varying degrees obliterating the longitudinal alignment of setae (e.g., species on *Inula*, Figures 103, 106, and on *Tussilago*, Figure 104). Thus multiples of 4 to 8 spinopleurals (sp) and 2 to 5 submarginal-marginals (sm-m) are present in *C. pakansus* where fusion has reached its greatest development.

The thoracic and anterior abdominal chaetotaxy is already complete at the time of birth in *C. hippophaes*. Addition of setae occurs only on the seventh and eighth segments during development (FIGURES 7-14).

GENERAL FEATURES AND SCLERITES (Figures 1, 2, 6).—In apterae, the abdomen is immovably joined to the thorax. The tergum is flattened or slightly convex, membranous with very little sclerotization. However, there often are present longitudinal pleural and submarginal rows (see below for explanation of chaetotactic terminology) or granular, pigmented patches in apterous morphs. Segmentation is obsolete and marginal tubercles are absent. The transverse segmental arrangement of the setae and intersegmental patches, along with stigmata, serve as stable landmarks for naming segments in *Capitophorus*. Only the stigmatal openings can be used for most *Pleotrichophorus* species where the setal body cover is usually much denser.

Abdominal sclerotization is best developed in alate forms of *Capitophorus* (Figures 2, 6). Abdominal sclerotization is much reduced in *Pleotrichophorus*. The dorsum of each segment in the spinopleural areas is sclerotized in varying degrees. These sclerotized areas remain separate, forming transverse bars in males while those of segments 3 to 5 are fused into a central abdominal sclerite in females. In addition, the areas mesad of the spiracles are thickened and form marginal segmental rows (marginal sclerites) that are not as well developed as the spinopleural sclerites. In *Pleotrichophorus*, spinal and pleural intersegmental and marginal segmental sclerotizations are present in many alates in various degrees of development but never fused. These are usually absent among

apterae and best developed among males, whether apterous or alate.

The texture of the dorsal integument ranges from smooth to finely corrugated, imbricate, reticulate, or even rugulose. The texture generally depends upon the amount of stretching from the contained embryos. Posteriorly, the segments are armed with minute spicules that usually thin out anterad, past the cornicular (sixth) segment. The spiculate texture is also developed laterally but the spicules become very minute and grade into the fine striae of the ventral and intersegmental membranes. In alatae, the integument is also spiculate-striate and these spicules similarly fade out anteriorly except on marginal sclerites.

The setae are borne on variously developed tubercles; these are especially conspicuous in the anterior head and posterior abdominal setae. In a few species (*P. pycnorhysus*, *P. gregarius*, and *P. xerozoous*) the integument bears dorsal projections or papillae in the spinal and pleural areas and the setae are borne on them.

CAUDA.—The cauda offers some diversity in shape, size, and chaetotaxy that is useful in aphid taxonomy. Morphological variation occurs also among the different morphs within species. In *Pleotrichophorus*, apterous and alate viviparous females usually possess similar cauda but those of the sexuales are often shorter and stouter. *Capitophorus*, on the other hand, show dimorphism between the alatae and apterae: in the former, the cauda is always shorter, more tapered and often bears fewer setae than the latter.

An anterior and a posterior lateral pair and 1 or 2 posterodorsal setae are commonly present in both genera. Some species, however, bear considerably more lateral pairs (e.g., 3 to 5 in *P. gregarius* and 6 to 8 pairs in *P. sporadicus*) and dorsal setae (e.g., apterae of *C. elaeagni* and *C. hippophaes* and all morphs of *P. oestlundii*). The caudal setae are usually simple and pointed but those on the dorsum may be expanded like the dorsal body setae (e.g., *P. magnautensis*, *P. oestlundii*, and *P. utensis*).

The caudal integument is membranous and rather heavily armed with spicules over the entire surface.

CORNICLES.—A pair of cornicles is borne on the anterolateral margins of the sixth abdominal segment. The sixth abdominal spiracles are located close to their bases, and the associated sclerites

(postcornicular sclerites) are usually obscured by bases of cornicles. In *Capitophorus* the cornicles are always long (i.e., longer than cauda) and may be clavate or cylindrical. Cornicle length and proportion to the cauda is more variable in *Pleotrichophorus* where they are cylindrical in all but one species (*P. lagacei*).

The integument making up the cornicles ranges from smooth to merely wrinkled or imbricate-spiculate in both genera although that of *Pleotrichophorus* tends to be more heavily armed. Pigmentation of cornicle tips among apterae occurs in many clavate-corniced *Capitophorus* species and in *C. elaeagni*. In *Pleotrichophorus* as much as the entire cornicle may be darkly pigmented (e.g., *P. longipes*, *P. packi packi*, *P. quadririchus*).

FEMALE GENITO-ANAL COMPLEX (Figures 16-18).—Ventrally, the female abdomen terminates in the anal plate which is always undivided in both genera. Posteriorly, the plate may be rounded or angular. Setae are borne along the ventroposterior margin and on the dorsal component of the anal plate.

Closely associated with the anteroventral margin of the anal plate are 3 setose rudimentary projections called the gonopophyses. These projections, the anal plate and the cauda, are not distinguishable as separate structures in juveniles. These are represented only by a triangular terminal segment.

In the newly born larvae of *C. hippophaes* (Figure 11), a single lateral pair of setae is present on the anterolateral corners of the terminal abdominal segment. An unpaired posterodorsal and another lateral pair are added in the second instar (Figure 12), while the third lateral pair appears in the third instar (Figure 13).

The venter of the eighth abdominal segment forms the subgenital plate. Illustrations are made of the ventral terminalia of each species treated here. Postembryonically, again in *C. hippophaes*, the number of subgenital setae progresses from 2, 5, 5 or 6, and 6 pairs in first, second, third, and fourth instars, respectively. The adult averages 6 subgenital setae. In general viviparous females, whether alate or apterous, show similar subgenital chaetotaxy. Those of oviparous females are always more hairy and setae are not arranged in a definite pattern.

MALE GENITO-ANAL COMPLEX (Figures 6, 15).—In males, the abdomen terminates in a sclerotized, angular capsule made of the anal plate, genitalia, and subgenital plate. The external genital apparatus consists of a pair of oblong, hairy lobes or parameres and a median aedeagus. The male genitalia have generally been regarded as being without significance in aphid taxonomy (Ossiannilsson, Russell, and Weber, 1956). Only minor differences were observed among species treated here but illustrations are made of them wherever available.

ABBREVIATIONS USED IN THE TEXT AND ILLUSTRATIONS

- abd.s. = abdominal segment
- ac = anteclypeal setae
- ad = anterodorsal setae of last rostral segment
- al = anterolateral setae of last rostral segment
- al.v.f. = alate viviparous female
- al.m. = alate male
- altd.ny. = alatoid nymph
- apt.m. = apterous male
- apt.ny. = apterous nymph
- apt.v.f. = apterous viviparous female
- a.s.I to a.s.VI = antennal segments I to VI
- BL = body length, taken from mesofrontal tubercle to posterior margin of anal plate
- co/ca = proportion of cornicle to caudal length, the length of cauda taken from basal hinges to apex
- df = dorsofrontal head setae
- df-1, df-2 = first or most anterior pair, second pair of dorsofrontal setae
- ipf = inner pair of posterior dorsofrontal setae, used mainly in *Capitophorus* species
- lf = laterofrontal setae or setae arising anterodorsally from laterofrontal tubercles
- m = mean, for some characters with 95 percent confidence limits about the mean given ($m \pm 95\%$ C.I.); also marginal setae
- md = mandibular setae
- mf = mesofrontal head setae or setae borne on mesofrontal tubercle
- ml = mediolateral setae of last rostral segment
- ny. = nymph, not specified as to whether it is apterous or alatoid
- opf = outer pair of posterior dorsofrontal setae, in *Capitophorus*
- ovip.f. = oviparous female
- p = pleural
- pc = postclypeal setae
- pd = posterodorsal setae of last rostral segment
- pl = posterolateral setae of last rostral segment
- rostrum IV+V/hind ta-2 = proportion of length of last rostral segment to second hind tarsal joint
- s = spinal setae
- sm = submarginal setae

sm-m = submarginal-marginal setae
 sp = spinopleural setae
 vf = ventrofrontal head setae
 vlf = ventral laterofrontal setae, or the seta borne on ventral surface of each laterofrontal tubercle
 VIb = base of sixth antennal segment, the length taken from base of segment to apex of enlarged portion and including the primary sensoria

VIu = unguis of sixth antennal segment, the length taken from the base of narrowed portion, beyond and excluding the primary sensoria, to the apex of antenna
 VIu/VIb = proportion of length of unguis to the length of base of sixth antennal segment
 We = width of head across the compound eyes

Key to the Genera of Aphididae Discussed Herein

- Last rostral segment with 1 pair of anterodorsal setae; apterae with 1 or 2 sensoria on antennal segment 3; female alatae without central sclerite on abdomen *Plectricophorus*
 Last rostral segment without anterodorsal setae; apterae with no secondary sensoria on antennal segment 3; female alatae with a central sclerite on abdomen *Capitophorus*

Genus *Capitophorus* Van der Goot

Capitophorus Van der Goot, 1913:84,145,147 [type-species: *Aphis carduiana* Walker (1850), by original designation].
Capitophorus Van der Goot, sensu lato.—Mordvilko, 1914:71.—Van der Goot, 1915:114–115.—Baker, 1920:55.—Oestlund, 1922:139.—Gaumont, 1924:346.—Hall, 1926:35–37.—Theobald, 1926:225–229.—Leonard, 1928:189; 1956:105.—Nevsky, 1928:193–196.—Börner, 1930:138.—Börner, 1931:129 [type-species erroneously designated as *Aphis hippophaes* Walker].—Hottes and Frison, 1931:280–281.—Takahashi, 1931:77; 1961:1–3.—Gillette and Palmer, 1934:144–145.—Cottier, 1935:353–358.—Knowlton and Smith, 1937:150–152.—Miller, 1938:60.—Wahlgren, 1938:179.—Blanchard, 1939:944–945.—Sampson, 1946:393–394.—Zimmerman, 1948:104–105.—Palmer, 1952:248–250.—Knowlton, 1954:8–9.—Essig, 1958:251–252.—Smith, Martorell, and Escobar, 1963:44.—Robinson and Bradley, 1965:41.
Capitophorus Van der Goot, sensu stricto.—Börner and Schilder, 1932:615.—Hille Ris Lambers, 1933:173; 1953:132–140.—Eastop, 1951:108; 1953:154; 1958:28–29; 1966:431–432.—Stroyan, 1953:258; 1955:292–293; 1964a:79.—Wood-Baker, 1953:268.—Bodenheimer and Swirski, 1957:209–210.—Börner and Heinze, 1957:207.—Heinze, 1961:48–54.—Heie, 1962:221–223.—Shaposhnikov, 1964:788.—Shaw, 1964:61, 69, 82.—Szelegiewicz, 1964:248.—Tuatay and Remaudière, 1964:266.—Huculak, 1965:230; 1966:125.—Paik, 1965:54.—Pepper, 1965:191–192.—Heie and Heikinheimo, 1966:123.—Quednau, 1966:426.—Achremowicz, 1967:286–287.—Robinson and Bradley, 1968:61.
 Subgenus *Capitophorinus* Börner, 1931:129 [type-species: *Capitophorus similis* Börner].

HISTORY.—The oldest known species in the genus, which partly included *Aphis hippophaes* Walker, is *Aphis galeopsidis* Kaltenbach, 1843 (= *Cryptomyzus galeopsidis*). Walker (1849a) also applied the name *Aphis galeopsidis* in Kaltenbach's sense, but in 1852, he described *Aphis hippophaes*, which name was also used by Koch in 1854 for the same species under a new genus *Rhopalosiphum*.

Another species, *Aphis carduina* Walker, 1850, was described earlier and was designated as the type-species of *Capitophorus* when Van der Goot erected the genus in 1913.

Meanwhile, Passerini erected the genera *Myzus* and *Phorodon* in 1860, including *Aphis ribis* Linnaeus in the former, and *Aphis galeopsidis* Kaltenbach in the latter. Consequently, between the period 1860–1913 and a little later, the species included in *Capitophorus*, sensu lato, were recorded either under *Myzus*, *Phorodon*, or *Rhopalosiphum*. In addition, a North American species was described under *Siphocoryne* Passerini by Oestlund in 1886. *Siphocoryne* is now a generally accepted synonym of *Rhopalosiphum*. *Capitophorus* shares some characters with *Rhopalosiphum*, *Myzus*, and *Phorodon*.

When Van der Goot erected the genus in 1913, he included in it *Aphis tetrarhoda* Walker, 1849, *Aphis galeopsidis* Kaltenbach, 1843, *Phorodon inulae* Passerini, 1860, *Capitophorus similis* Van der Goot, 1915 (a nomen nudum in 1913), and *Myzus elaeagni* del Guercio, 1894, in addition to the type-species, *Aphis carduina* Walker, 1850. As all these species have capitate hairs, the genus was easily diagnosed by this character. This concept prevailed for a long time in both Europe and America.

Börner (1930) adopted *Capitophorus* in Van der Goot's sense but he added a new subgenus, *Plectrichophorus*, with *Aphis glandulosa* Kaltenbach as type; this was elevated to generic rank later by Hille Ris Lambers (1933, 1947a). At the same time Börner erected a new genus, *Pentatrachopus* (type: *Aphis tetrarhoda* Walker), which was subsequently placed as a subgenus of *Chaetosiphon*.

Mordvilko by Hille Ris Lambers (1953) and later authors.

In North America, the generic classification of Baker (1920) was used for a long time, and *Capitophorus* was defined in much the same way as the Europeans used it. It similarly included species that are now placed under *Chaetosiphon* (subgenus *Pentatrichopus*), *Cryptomyzus*, and even *Rhopalomyzus*. Oestlund (1922) deviated slightly from this concept by removing *Aphis ribis* Linnaeus and designating it as type for a new genus *Cryptomyzus*. He retained *carduinus* Walker, *xanthii* Oestlund and *rosarum* Walker (= *tetrarhodus* Walker, in part); Oestlund's concept thus consisted of *Capitophorus* sensu stricto, and what is now in *Chaetosiphon* subgenus *Pentatrichopus*. *Cryptomyzus* Oestlund was accepted by Börner (1930) and Hille Ris Lambers (1947a, 1953), to whom should be credited the current concepts of these generic complexes.

DESCRIPTION.—Members of the genus *Capitophorus* share the following characters: Apterous females rather small, averaging between 1.40 and 2.00 mm in length. Body spindle-shaped or oval, pale yellow, green or white, and usually with brighter green lines along dorsum. Head with relatively well-developed but diverging laterofrontal tubercles, and mesofrontal tubercle much smaller; number of head setae as follows: mf 1p, lf 1p, vlf 1p, df 4p, vf 2-4p, pc 2p, md 1-5p, and ac 4-6; dorsal setae apically knobbed to fan-shaped, and ventral setae similarly shaped or pointed. Antennae shorter than body, 6-segmented except in fundatrices of most species where segments 3 and 4 are fused; a.s.I projected mesodistally, usually bearing 3 or 4 setae on these projections, a few others on ventral surface, and a small pointed one on basal portion of dorsum; a.s.II short and subglobular,

1
with a markedly constant setal formula of 1 — — 1
1

in summer forms (dorsal seta is usually absent in fundatrices); secondary sensoria absent from all segments.

Prothorax with 8 setae arranged in 2 transverse rows of 4 setae; meso- and metathorax with setal patterns resembling the first 5 abdominal segments. Body chaetotaxy variable but always with a distinct pattern in contrast to the more hairy *Pleotrichophorus*. Cauda tapering at various degrees,

usually with 2 or 3 lateral pairs and a more variable number of posterodorsal hairs. Cornicles always longer than cauda; cylindrical or clavate distally; smooth to imbricate and slightly paler basally than distally or else extreme tip dark. Legs shorter than in alates; hind tibiae swollen and bearing numerous pseudosensoria on basal portion in ovipara; first tarsal joints of fore to hind legs bearing 3, 3, 3 hairs. Rostrum IV+V rostrate or with a slightly produced point; without an anterodorsal pair of setae; and subequal to or longer than the second segment of hind tarsi.

Alate females with dark brown sclerotic head, mesothorax, spinopleural and marginal abdominal sclerites; flagellum of antennae, tips of tibiae and rostrum and entire tarsi also dark brown. Antennae bearing secondary sensoria on segments III to V. Head and abdominal chaetotaxy usually like apterae but setae much less expanded or merely rod-shaped. Abdomen with transverse spinopleural thickenings on discal segments, those of segments 3 to 5 coalesced into a central sclerite; segmental marginal sclerites also present. Cauda tapering, with 2 or 3 lateral pairs of setae and usually 1 posterodorsal seta. Cornicles, legs, and rostrum IV+V as in apterae except for relative sizes.

Males alate, similar to alate females in most respects except for having separate spinopleural sclerites on abdominal segments 3 to 5, greater number of sensoria on a.s.III to V, and shorter cauda which is often obscured by the sclerotic genito-anal capsule.

BIOLOGY.—The biology of many members of this genus is typical of migratory aphids. Fertilized eggs are deposited around leaf buds of the woody primary host plant (Elaeagnaceae) during late autumn. These hatch into parthenogenetic females (fundatrices) in the spring and one or 2 generations (fundatrigeniae) may follow on the overwintering host. The first generation consists of apterous females but later alates are produced exclusively. These then fly to the secondary host plant (various Compositae and *Polygonum* spp.) where several parthenogenetic generations are passed. The viviparous females produced on the summer host are called exules or alienicolae. Apterous and alate females are produced among the exules, the latter generally in smaller numbers, and depending on local food supply. In the fall, alate production is resumed, some of these females flying back to the

primary host and there depositing the larvae of apterous oviparous females. Meanwhile the remaining alatae (remaining sexuparae) on the summer host produce alate males. The males then fly to the winter host where the ovipara simultaneously attain maturity. After fertilization the eggs are deposited on the older branches of the winter host and undergo diapause.

Two major lines of deviation are exhibited by some species of *Capitophorus*. In Europe, *C. carduinus* and *C. horni* live holocyclically on the summer host, *Cirsium* spp. (Hille Ris Lambers, 1953). On the other hand, the nearctic species *Capitophorus shepherdiae* seems capable of continued reproduction on the winter host (*Shepherdia argentea*) in Colorado (Gillette and Bragg, 1916). This spe-

cies is probably facultatively holocyclic on its winter host; a likely secondary host plant, *Ambrosia*, is proposed in this work. *Capitophorus archangel-skii* Nevsky from Central Asia allegedly does not migrate (this has not been confirmed) from its *Elaeagnus* host, while there are indications of migration in the closely related *C. pakansus* in Europe and North America. Presence of oviparous females of *C. elaeagni* on the summer host (*Cirsium*) has been recorded from Colorado, although these are normally produced on *Elaeagnus* in other states. Among the species that have *Polygonum* as summer hosts, the presence of fundatrix-like features among summer apterae of *Capitophorus essigi* on *Polygonum alpinum* suggests holocycly on the secondary host.

Key to the Nearctic Species of *Capitophorus*

APTEROUS VIVIPAROUS FEMALES

1. Cornicles clavate 2
 Cornicles cylindrical 6
2. Submarginal rows of setae absent, or with only 3 pairs of longitudinal rows of setae on disk of body (mesothoracic to abdominal segment 5); integument smooth or merely corrugated between setal bases 3
 Submarginal rows of setae present at least on abdominal segments 2 to 4; integument conspicuously reticulate, often obscuring setal bases 4
3. All dorsal setae but mf, df-1, lf and spinals (and pleurals) of abdominal segments 7 and 8 inconspicuous (i.e., usually less than 1/2 size of named setae); spinals and marginals single or only partly duplicated in summer forms; summer host, *Polygonum* spp.
 *C. hippophaes* (Walker)
 Dorsal body setae subequally long; spinals and marginals (except marginals of abdominal segment 5 consistently duplicated); summer forms on *Ambrosia artemisiifolia*
 *C. joeppeperi*, new species
4. Dorsal setae on disk of body inconspicuous, with globular apices; summer host, *Polygonum alpinum* *C. essigi* Hille Ris Lambers
 Dorsal setae prominent and widely expanded, funnel- to fan-shaped 5
5. Pleural rows of setae single; unguis at least 3 times ($m = 3.62 \pm .15$, $n = 27$) base of sixth antennal segment; summer host, *Xanthium* spp. *C. xanthii* (Oestlund)
 Pleural rows of setae at least partly or completely duplicated; unguis averaging $2\frac{1}{3}$ ($m = 2.39 = .17$, $n = 12$) times as long as base of sixth antennal segment; summer forms on *Ambrosia*, or remaining on winter host *Shepherdia argentea*
 *C. shepherdiae* Gillette and Bragg
6. Spinal, pleural and marginal rows of setae separate and aligned into distinct rows along dorsum 7
 Bases of spinals and pleurals, submarginals and marginals approximate, apparently fused, longitudinal alignment of setal rows obscured; all body setae very long
 *C. pakansus* Hottes and Frison
7. All rows of body setae single or at most marginals only partly duplicated; tips of cornicles dark brown; summer hosts, *Arctium*, *Carduus*, *Cirsium*, *Cynara* and *Sonchus* spp.
 *C. elaeagni* (del Guercio)
 Spinal and marginal rows of setae consistently duplicated; distal portion of cornicles may be dusky but extreme apices not dark brown; body setae rather long, marginal setae with anterior shorter than posterior complement; summer host, *Cirsium* spp.
 *C. horni* Börner

ALATE VIVIPAROUS FEMALES

1. Cornicles clavate 2
 Cornicles cylindrical 6
2. Submarginal setae absent 3
 Submarginal setae present 4
3. Cornicles not surpassing tip of anal plate and less than 3 times cauda in length; spinals consistently single or, at most, only partly duplicated; unguis 6 to 10 times (usually 7) as long as base of antennal segment VI; summer host, *Polygonum* spp.
 *C. hippophaes* (Walker)
 Cornicles much longer, reaching tip of cauda or 3 or more times length of cauda; spinals duplicated; unguis, at most, 6 times as long as base of antennal segment VI; summer host, *Ambrosia artemisiifolia*. *C. jopepperi*, new species
4. Unguis about 3 times ($m = 3.08 \pm .50$, $n = 8$ for summer exules and $2.72 \pm .62$, $n = 18$ for fundatrigeniae) base of antennal segment VI. Antennal segment V usually without secondary sensoria; dorsofrontal setae conspicuously globose or widely expanded at apices; summer forms on *Ambrosia* or remaining on *Shepherdia argentea*
 *C. shepherdiae* Gillette and Bragg
 Unguis averaging $3\frac{1}{2}$ to $3\frac{3}{4}$ times base of antennal segment VI; antennal segment V with at least 1 secondary sensorium; dorsofrontal setae merely blunt or slightly knobbed apically 5
5. Cauda tapering to triangular point, sometimes with small terminal knob; posterodorsal caudal seta usually absent; antennal segment III with usually less than 35 ($m = 28.26 \pm 2.14$, $n = 19$) and segment V with less than 7 ($m = 3.47 \pm .65$, $n = 19$) secondary sensoria; summer forms on *Xanthium* spp. *C. xanthii* (Oestlund)
 Cauda constricted at about its midpoint before anterior pair of lateral setae; posterodorsal caudal seta always present; antennal sensoria on III ($m = 46.35 \pm 2.45$, $n = 20$) and on V ($m = 10.24 \pm 1.19$, $n = 17$); summer host, *Polygonum alpinum*
 *C. essigi* Hille Ris Lambers
6. Spinal and marginal setae normally single; tips of cornicles dark brown; summer hosts, *Arctium*, *Carduus*, *Cirsium*, *Cynara*, and *Sonchus* *C. elaeagni* (del Guercio)
 Spinal and marginal setae double; tips of cornicles may be dusky on distal $\frac{1}{3}$ or $\frac{1}{2}$ but tips not dark brown 7
7. A submarginal row of setae present so 3 or 4 setae are found on each marginal sclerite; pleural setae at least partly duplicated; cauda short, part beyond posterolateral pair of setae not more than distance between 2 lateral pairs of setae; summer host, *Inula helenium* and *I. royaliana* *C. pakansus* Hottes and Frison
 Without submarginal row of setae or only 2 setae present on each marginal sclerite; pleural setae always single; cauda well extended past posterolateral pair of setae, and distal portion subequal to distance from basal caudal hinges to anterolateral pair of setae; summer host, *Cirsium* spp. *C. horni* Börner

Capitophorus elaeagni (del Guercio)

FIGURES 77, 78, 80, 82-84

Myzus elaeagni del Guercio, 1894:189-199 [type: Italy, on *Elaeagnus*; believed to have been destroyed].—Schouteden, 1906a:32.—Davis, 1908:251-253; 1910:495.—Wilson and Vickerey, 1918:71.

Capitophorus elaeagni (del Guercio).—Patch, 1938:183.—Eastop, 1951:108.—Cottier, 1953:227-234.—Hille Ris Lambers, 1953:144-151.—Börner and Heinze, 1957:207-208.—Bodenheimer and Swirski, 1957:276.—Eastop, 1958:28-29.—MacGillivray, 1959:639.—Heinze, 1961:51, 53.—Heie, 1962:221.—Smith, Martorell, and Escobar, 1963:44-46.—Shaposhnikov, 1964:789.—Stroyan, 1964a:79.—Szelegiewicz, 1964:249.—Tuatay and Remaudière, 1964:266.—Leonard and Tissot, 1965:257.—Paik, 1965:55.—Pepper, 1965:191.—Rob-

inson and Bradley, 1965:41.—Eastop, 1966:432-433.—Huculak, 1966:125.—Quednau, 1966:426.—Leonard, 1967:262.—Coon and Pepper, 1968a:1473; 1968b:1474.—Leonard, 1968:8.—Robinson and Bradley, 1968:61.

Capitophorus elaeagni Van der Goot, 1913:84 [nomen nudum].

Myzus eloreagni [sic] Guercio.—Kirkaldy, 1906:12 [misspelling].

Capitophorus arctifoliae Shinji, 1924:359.

Myzus braggii Gillette, 1908:17-19 [type: Fort Collins, Colorado, on *Cirsium arvense*, USNM 41946].—Gillette and Bragg, 1915:102.—Jones, 1918:1-2.—Patch, 1918:90, 91.—Swain, 1919:73.—Patch, 1923:303.

Capitophorus braggii (Gillette).—Van der Goot, 1915:119-122.—Patch, 1918:90.—Takahashi, 1923:33.—Timberlake, 1924:456.—Hall, 1926:35.—Hori, 1929:82.—Judenko, 1930:166.—Takahashi, 1931:77.—Börner and Schilder, 1932:615.

- Gillette and Palmer, 1934:146-147.—Mimeur, 1934:35-36.
 —Blanchard, 1935:366-368.—Cottier, 1935:357-358.—Tseng and Tao, 1936:150.—Knowlton and Smith, 1937:151.—Patch, 1938:182 & 244.—Blanchard, 1939:945-947.—Knechtel and Manolache, 1940:243-244.—Smith, 1940:141.—Blanchard, 1944:34.—Sampson, 1946:394.—Zimmerman, 1948:106-107.—Palmer, 1952:251-252.—Knowlton, 1954:8.—Essig, 1958:251.—Leonard, 1963:70.
- Aphis cardui* Linnaeus.—Sanborn, 1904:255 [in part].
- Phorodon carduinum* (Walker).—W. M. Davidson, 1912:409.
- Capitophorus carduinus*.—Oestlund, 1922:139 [not Walker, misidentification; Oestlund's specimens seen].—Leonard, 1963:70 [not Walker, misidentification; apterous and alate viviparae from St. Louis, Missouri, in University of Maine collection, apparently of same series as those recorded by Leonard].
- Myzus carthusianus* Haviland, 1918:49-50 [type: Godalming, Surrey, England, on thistle].
- Capitophorus carthusianus* (Haviland).—J. Davidson, 1925:18.—Theobald, 1926:256.—Patch, 1938:244.
- Capitophorus cirsii* Nevsky, 1928:195 [types: Tashkent, Fergaria, Djar-Kurgan, Fettchenko in Middle Asia, on *Cirsium arvense*, *Carduus* spp., *Arctium majus* (data given in original description)].—Nevsky, 1929:139-140.—Patch, 1938:244.
- Capitophorus cynariella* Theobald, 1923a:39-42 [type: Gizeh, Egypt, on *Cynara scolymus*].—Patch, 1938:244.
- Capitophorus flaveolus* Walker.—Glendenning, 1929:56.—Hottes and Frison, 1931:282-283.—Leonard, 1936:180.
- Capitophorus* n. sp. (Laing) [sic].—Ogilvie, 1928:22 [on *Cynara cardunculus*].

DIAGNOSIS.—Apterous vivipara can be separated from other thistle aphids as follows: (1) from the European *C. carduinus*, by its more acutely tapered cauda, presence of more caudal hairs (7-13, $m = 10.4$, $n = 40$ vs. 5-6, $m = 5.6$, $n = 3$), larger proportion of unguis to base of a.s.VI ($5\frac{1}{2}$ -9 times, $m = 7.09$, $n = 51$ vs. $4\frac{3}{4}$ -6 times, $m = 5\frac{1}{3}$, $n = 4$), and the darkened tips of cornicles; and (2) from *C. horni*, by the 1-1-1 chaetotaxy of metathoracic to sixth abdominal segments, and also the dark tips of cornicles. Among alate females, *C. elaeagni* differs from both *C. carduinus* and *C. horni* by having consistently more sensoria on a.s.III (37-60, $m = 43.5$, $n = 68$ vs. 29-35, $m = 30.9$, $n = 12$ for *C. carduinus*, and 21-33, $m = 27.0$, $n = 10$ for *C. horni*) and greater ratio of unguis to base of a.s.VI (averaging $7\frac{3}{4}$ vs. $5\frac{1}{4}$ and $5\frac{3}{4}$, respectively); further from *C. carduinus* by always bearing sensoria on a.s.V (2-14, $m = 7.4$, $n = 60$ vs. 0-4, $m = 1.0$, $n = 12$), and from *C. horni* by its anterior abdominal chaetotaxy (1-1-1 vs. 2-1-2). On the primary host, apterous and alate fundatrigeniae

can be recognized from those of said species by same characters given for viviparous exules.

DESCRIPTION.—*Fundatrix* and *Apterous Fundatrigeniae*: Much like apterous exule except for shorter unguis; unique among *Capitophorus* species in that a.s.IV and V are separate, dorsal seta of a.s.II usually present.

Measurements (in mm) of 10 specimens on *Elaeagnus* (from Gainesville, Florida, 14-II-1940; Urbana, Illinois, 9-V-1929; St. Paul, Minnesota, 2-VI-1966 and 20-IV-1968; and Sturgeon Bay, Wisconsin, 4-V-1925): BL 1:28-1.82 (1.61), We .33-.41 (.38); a.s.III .22-.38 (.312), a.s.IV .16-.33 (.233), a.s.V .17-.27 (.221), a.s.VI .08-.11 (.094) + .36-.73 (.566); cornicles .40-.73 (.591), cauda .15-.25 (.216); hind tibiae .69-1.03 (.885), hind ta-2 .07-.10 (.089), and rostrum IV+V .12-.15 (.138). Spinal setae of abd.s. I-V .0110-.0440 (.0292), pleurals I-V .0088-.0308 (.0175); mf .0264-.0550 (.0387), lf .0352-.0572 (.0457), df-1 .0374-.0550 (.0468), df-2 .0110-.0484 (.0305), ipf .0110-.0440 (.0296), and opf .0088-.0374 (.0247). Proportions of a.s.III:IV:V, 1: .64-.92 (.74): .61-.75 (.71); a.s.VIu/VIb 2.33-7.56 (5.88); co/ca 2.44-3.23 (2.74); and rostrum IV+V/hind ta-2 1.40-1.88 (1.59).

Alate Fundatrigeniae: Similar to alate exules except for slightly shorter unguis.

Measurements (in mm) of 10 specimens on *Elaeagnus* (all from St. Paul, Minnesota, 2-VI-1966): BL 1.59-1.81 (1.69), We .35-.40 (.376); a.s.III .39-.44 (.415), a.s.IV .29-.33 (.312), a.s.V .23-.28 (.248), a.s.VI .09-.12 (.099) + .52-.77 (.693); cornicles .42-.47 (.446), cauda .10-.13 (.113); hind tibiae 1.06-1.14 (1.09), hind ta-2 .09-.10 (.096), and rostrum IV+V .12-.13 (.128). Proportions of a.s.III:IV:V, 1: .69-.85 (.75): .55-.65 (.60); a.s.VIu/VIb 5.2-8.11 (6.99); and co/ca 3.38-4.6 (3.97).

Apterous Viviparous Female (exule): Head with normal complement of setae, i.e., mf lp, lf lp, vlf lp, df 4p, vf 2p, ac usually 6, and md 1-6 (usually 3 or 4) on each side; proportions of dorsal setae variable but anterior ones (mf, lf and df-1) always longest, df-2 shorter than df-1 (about $\frac{2}{3}$ among apterae on *Cirsium* and *Sonchus*, see Figures 77, 78) or subequal to it (specimens on *Cynara*, Figure 80), posterior df's $\frac{1}{3}$ to $\frac{2}{3}$ df-1 among *Cirsium* specimens, and $\frac{3}{4}$ to equal df-1 among those on *Cynara*; dorsal setae capitate, ventral setae

with all but ac, pc, and md also knobbed. Antennal segment I with 5-9 (usually 6) knobbed setae aside from small pointed one on dorsum; a.s.II with 1 knobbed setae; a.s.IV about $\frac{3}{4}$ and a.s.V about $\frac{2}{3}$ the length of a.s.III; unguis of a.s.VI $5\frac{1}{2}$ -9 times ($m = 7.09$, $n = 51$) as long as base.

Prothorax with 8 setae arranged in two transverse rows of 4; mesothorax with 1 or 2 spinal, 1 pleural, and 1 or 2 marginal setae; metathorax with same pattern as abd.s. 1-5, namely, 1-1-1; abdominal marginals sometimes partly duplicated, this being more frequent among specimens on *Cynara* (e.g., 68% of 79 specimens had at least one duplication) than those on *Cirsium*; on tapered posterior segments, setal bases close together, 2 or 3 longer ones present on either side of median line, and 2 or 3 smaller outer ones. Spinal setae variable in length: .0088-.0286 ($m = .0166$, $n = 95$) in some *Cirsium*-collected specimens from Minnesota (Figure 77), .0176-.0440 ($m = 0.294$, $n = 89$) in another clone on same host and locality (Figure 78), and .0264-.0704 mm ($m = .0513$, $n = 96$) in specimens on *Cynara* from California; first type about $\frac{1}{2}$, second equal to, and third $1\frac{1}{2}$ times basal diameter of a.s.III. Pleural setae always shorter than spinals, $\frac{1}{2}$ to $\frac{2}{3}$ their lengths, and $\frac{1}{3}$ to $\frac{1}{2}$ basal diameter of a.s.III among specimens on *Cirsium* and *Sonchus*, or up to $\frac{3}{4}$ or equal this diameter among *Cynara* specimens. Cauda tapering to acute point; with 7-13 ($m = 10.4$, $n = 40$) setae, 2-4 pairs lateral and longer than those on posterodorsal surface. Cornicles cylindrical, imbricate, tips brown, and $2\frac{1}{2}$ to $3\frac{1}{3}$ times cauda in length. Rostrum IV+V rostrate; with 1 basal, 1 dorsal, and 3 lateral pairs of setae, ml distinctly removed from pl setae and all lateral setae subequally small.

Measurements (in mm) of 10 specimens on *Cirsium* (from St. Paul, Minnesota, 4 to 8-IX-1966): BL 1.67-1.85 (1.78), We .37-.40 (.39); a.s.III .35-.45 (.403), a.s.IV .30-.40 (.362), a.s.V .26-.32 (.289), a.s.VI .09-.11 (.099) + .70-.80 (.735); cornicles .68-.83 (.745), cauda .24-.30 (.272); hind tibiae .90-1.12 (1.04), hind ta-2 .08-.09 (.089), and rostrum IV+V .125-.14 (.136). Proportions of a.s.III:IV:V, 1: .80-1.00 (.89): .66-.79 (.72); VIu/VIb 6.45-8.82 (7.57); co/ca 2.48-3.32 (2.75); and rostrum IV+V/hind ta-2 1.38-

1.75 (1.52). Length of head setae: mf .0286-.0528 (.0386), lf .0396-.0550 (.0447), df-1 .0330-.0484 (.0439), df-2 .0132-.0396 (.0314), ipf .0110-.0308 (.0200), and opf .0110-.0264 (.0184).

Alate Viviparous Female (exule): Head, thorax, antennae except extreme bases of a.s.III, and abdominal sclerites brown; legs pale like membranous portions of abdomen but darker on distal $\frac{1}{3}$ to $\frac{1}{2}$ of femora, tips of tibiae and entire tarsi; rostrum IV+V, tips of cornicles, and wing veins brown. Head and abdominal chaetotaxy similar to apterous female but setae much shorter and merely blunt or pointed. Cauda variably shaped (Figures 88-90) but always with constriction before anterolateral pair of setae; with 2 or 3 lateral pairs and 1 posterodorsal setae. Cornicles and rostrum IV+V as in aptera except for size.

Measurements (in mm) of 20 specimens on *Cirsium* (from St. Paul, Minnesota, 26-VIII to 4-IX-1966): BL 1.50-1.98 (1.79), We .34-.38 (.362); a.s.III .40-.50 (.443), a.s.IV .31-.39 (.349), a.s.V .25-.31 (.277), a.s.VI .09-.11 (.101) + .68-.83 (.768); cornicles .40-.56 (.486), cauda .11-.18 (.148); hind tibiae .97-1.23 (1.10), hind ta-2 .08-.10 (.090), and rostrum IV+V .11-.14 (.128). Sensoria on a.s.III 37-51 (44.3), on a.s.IV 17-37 (26.8), and on a.s.V 2-14 (7.3).

Gynopara: Like the summer alatae except for presence of more sensoria on a.s.III-V. Counts of sensoria for 10 specimens on *Elaeagnus* (from Minneapolis, Minnesota, 20-X-1927 and 21-X-1928): 46-66 (53.4) on a.s.III; 24-42 (35.5) on a.s.IV; and 7-15 (11.5) on a.s.V.

Oviparous Female: Similar to other apterous morphs but smaller; dorsal seta of a.s.II frequently absent; dorsal setae shorter, more slender, eighth abdominal marginals sometimes pointed; cauda shorter, stouter; subgenital plate with more numerous, all pointed setae; basal portion of hind tibiae swollen, bearing numerous pseudosensoria.

Measurements (in mm) of 8 specimens on *Elaeagnus* (from Fort Collins, Colorado, 21-X-1909; Minneapolis, Minnesota, 11-X-1928; and St. Paul, Minnesota, 1-XI-1961) and 5 specimens on *Hippophae* (from Minnesota State Farm, 3-XI-1899): BL 1.34-1.73 (1.46), We .35-.40 (.368); a.s.III .21-.33 (.268), a.s.IV .16-.25 (.212), a.s.V .18-.25 (.216), a.s.VI .08-.10 (.092) + .19-.60 (.428); cornicles .38-.52 (.451), cauda .15-.19 (.168); hind tibiae .63-.74 (.700), hind ta-2 .07-.10

(.086) and rostrum IV+V .13-.15 (.139). Length of setae: abdominal spinals I-V .0132-.0352 (.0205), pleurals I-V .0088-.0198 (.0121); mf .0198-.0528 (.0379), lf .0264-.0594 (.0429), df-1 .0286-.0550 (.0412), df-2 .0110-.0440 (.0243), ipf .0110-.0264 (.0165), and opf .0110-.0220 (.0143). Proportions of a.s.III:IV:V, 1: .67-.92 (.79): .67-.93 (.80); VIu/VIb 2.11-6.33 (4.51); co/ca 2.33-3.06 (2.73); and rostrum IV+V/hind ta-2 1.44-2.0 (1.68).

Alate Male: Similar to alate female except as follows: head setae all pointed; antennae slightly longer; sensoria more numerous; spinopleural sclerites of third to fifth abdominal segments broken into transverse bars; cornicles and cauda relatively shorter. Genitalia illustrated in Figure 94; aedeagus oblong, with slightly angular apex.

Measurements (in mm) of 14 specimens on *Cirsium* (from Fort Collins, Colorado, 6-X-1914), *Elaeagnus* (from Fort Collins, Colo., 21-X-1909), and trap pans (from Union Gap, Washington, X- and XI-1952 to 1953): BL 1.45-2.12 (1.87), We .34-.41 (.396); a.s.III .47-.59 (.519), a.s.IV .37-.49 (.427), a.s.V .32-.41 (.366), a.s.VI .10-.14 (.119) + .59-.96 (.861); cornicles .36-.46 (.409), cauda .10-.14 (.123); hind tibiae 1.07-1.32 (1.17), hind ta-2 .08-.10 (.093), and rostrum IV+V .12-.14 (.133). Proportions of a.s.III:IV:V, 1: .76-.92 (.83): .66-.76 (.70); VIu/VIb 5.86-8.0 (7.23); co/ca 2.86-3.91 (3.35); and rostrum IV+V/hind ta-2 1.30-1.75 (1.44). Number of sensoria on a.s.III 56-83 (66.3), a.s.IV 39-63 (46.6), and a.s.V 16-29 (22.8).

Hosts (references to quoted hosts in parentheses).—Winter hosts: *Elaeagnus angustifolia*, *E. commutata*, *E. longipes* (Patch, 1938), *E. multiflora* (Leonard, 1956), *E. oldhami* (Takahashi, 1931, in Formosa), *E. pungens*, *E. umbellata* (Leonard, 1964); *Hippophae rhamnoides*; and *Shepherdia argentea*.

Summer hosts: *Arctium lappa*; *Carduus crispus*, *C. leptacanthus* (Eastop, 1958, in East Africa), *C. tenuiflorus* (Cottier, 1953, in New Zealand); *Cirsium arvense*, *C. horridulum*, *C. japonicum* (Takahashi, 1931, in Formosa), *C. lanceolatum*, *C. mexicanum* (Smith, Martorell, and Escobar, 1963, in Puerto Rico), *C. nuttallii*, *C. occidentalis*, *C. smallii*, *C. vulgare*; *Cnicus* sp., *Cryptostemma calendulaceum* (Cottier, 1953, in New Zealand; and Eastop, 1966, in Australia); *Cynara carduncu-*

lus, *C. scolymus*; *Silybium marianum* (Cottier, 1953, in New Zealand); and *Sonchus arvensis*.

DISTRIBUTION.—*Capitophorus elaeagni* has been recorded from all zoogeographical regions of the world.

SPECIMENS EXAMINED.—Numerous nearctic specimens of all morphs and stages from various localities including: CANADA: Manitoba, New Brunswick, Nova Scotia and Ontario. UNITED STATES: California, Colorado, Florida, Hawaii, Idaho, Illinois, Indiana, Kansas, Louisiana, Maine, Massachusetts, Michigan, Minnesota, Missouri, Montana, New Hampshire, New Jersey, North Carolina, North Dakota, Oregon, Pennsylvania, Texas, Utah, Washington, Washington, D.C., and Wisconsin. Specimens from the following countries also seen: Argentina, Brazil, Chile, China, Egypt, Italy, Japan, Netherlands, and Turkey. Specimens of *C. carduinus* include 8 apt.v.f., 8 al.v.f., 11 ovip.f., and 4 al.m. from England, Germany, and Netherlands.

Capitophorus essigi Hille Ris Lambers

FIGURES 30-38

Capitophorus essigi Hille Ris Lambers, 1953:156-157 [type: Tamarack Lake, El Dorado Co., California, 8000 ft. alt., 7-VIII-1947, EOE, on *Polygonum alpinum*; type-slide with 4 apt.v.f., 3 al.v.f., in DHRL coll.].

Capitophorus hippophaes.—Leonard, 1968:9 [not Walker; determined as *C. gilletti* Theobald by E.O. Essig; Essig slides seen by Leonard at Cornell University undoubtedly of the same series referred to herein, from University of California, Berkeley].

DIAGNOSIS.—*Capitophorus essigi* resembles the other species (*C. hippophaes*) living on *Polygonum* in having clavate cornicles but differs in having shorter antennae, 4 pairs of rows of setae on abdominal segments 1 to 5, more expanded head setae and greater proportion of cornicles to cauda ($2\frac{1}{2}$ - $3\frac{1}{4}$ vs. $1\frac{3}{4}$ - $2\frac{3}{4}$). Alates differ further in having less pointed caudal tip. It is similar to *C. shepherdiae* and *C. xanthii* in cornicle shape and shortness of antennae but differs in size of body setae in apterae and presence of more sensoria on antennal segment V (7-16 vs. 0-6 and 1-6, respectively) of alatae.

DESCRIPTION.—*Apterous Viviparous Female*: Body spindle-shaped, pale with tips of rostrum, tibiae and entire tarsi darkened. Tergum slightly sclerotic, imbricate to reticulate, with granular light

brown patches from mesothorax to sixth abdominal segment; reticulate-spiculate on posterior segments, spicules blunt, stout. Head with moderately produced meso- and laterofrontal tubercles; mf lp, lf lp, vlf lp, df 4p, vf 2-4p (usually 3), pc 2p, ac 4 arranged 1-2-1, and md 1-1p (usually 3); dorsal setae widely globular at apices, mf, lf, and df-1 distinctly stemmed, slightly longer than rest of df's; ventral setae except ac similar in shape but less expanded distally. Antennal segment I produced on mesodistal margins, imbricate, with 5-7 knobbed setae aside from basal pointed seta on dorsum;

1

a.s.II with 1-1-1 setae, with 1 occasionally added

1

or missing; a.s.III and IV fused in some individuals or asymmetrical in same individual (46.7% of 137 antennae examined with fused III and IV); unguis averaging $3\frac{1}{4}$ times base of a.s.VI.

Thoracic and abdominal chaetotaxy rather irregular but composite pattern as follows: prothorax with usual 8 setae arranged in 2 transverse rows of 4; meso- and metathorax 2-1-2 on each side; abdominal segments 1-6, 2-1-1-2, but a few setae may be added or missing in any row on either side; abd.s.5 2-1-1, submarginal pair absent; abd.s.6 with partly duplicated spinals; abd.s.7 and 8 with median unpaired seta plus 2 closely associated and a marginal seta on each side of median one on 7, and 5-8 setae in addition to median one on 8. Body setae globular to fan-shaped, sessile; setae from prothorax to abd.s.6 minute, those on abd.s. 7 and 8 about equal to anterior head setae in size. Cauda tapering to acute point; spiculate; with 5-9 setae, 2 or 3 pairs lateral, remainder posterodorsal. Cornicles clavate, slightly dusky on distal $\frac{1}{3}$; imbricate; $2\frac{1}{2}$ to $3\frac{1}{4}$ times as long as cauda. Rostrum IV+V rostrate, with short pointed apex; chaetotaxy as in other *Capitophorus* species, i.e., ad setae absent, ml and pl setal bases rather close.

Measurements (in mm) of 15 specimens (including 2 types): BL 1.87-2.19 (.204), We .37-.42 (.396); a.s.III .24-.32 (.279), a.s.IV .20-.25 (.21) or III+IV .39-.55 (.443), a.s.V .16-.23 (.188), a.s.VI .08-.10 (.083) + .23-.31 (.272); cornicles .52-.75 (.643), cauda .20-.23 (.220); hind tibiae .72-1.0 (.92), hind ta-2 .10-.12 (.108), and rostrum IV+V .115-.13 (.121). Length of head setae: mf .0264-.0418 (.0327), lf .0154-.0330 (.0259), df-1, .0220-.0418 (.0354), df-2 .0154-.0286 (.0212), ipf

.0110-.0198 (.0127), and opf .0132-.0220 (.0168). Proportions of a.s.III:IV:V, 1: .70-.85 (.79): .55-.67 (.69); VIu/VIb 2.80-3.75 (3.27); co/ca 2.52-3.22 (2.91); rostrum IV+V/hind ta-2 1.0-1.30 (1.12).

Alate Viviparous Female: Head, thorax, spinopleural and marginal abdominal sclerites and antennae dark brown; legs brown with apices darker; anterior wing margin, wing veins, distal two rostral segments, club of cornicles, cauda, subgenital and anal plates lighter brown. Head and antennal segments I and II chaetotaxy as in apterae but setae shorter, less expanded. A.s.III and IV separate; secondary sensoria distributed as follows: 36-55 (46.35 ± 2.45 , $n = 20$) on a.s.III, 16-32 (24.75 ± 2.34 , $n = 20$) on a.s.IV, and 7-16 (10.24 ± 1.19 , $n = 17$) on a.s.V; unguis averaging $3\frac{3}{4}$ times base of a.s.VI. Abdomen with well-developed, rectangular central abdominal sclerite; spinopleural sclerites of anterior and posterior segments less defined; marginal sclerites well developed; chaetotaxy as in apterae (2-1-1-2), also with irregular submarginal rows; setae short, thick. Cauda constricted about middle, tapering gradually from there to acutely rounded apex; spiculate; with 2 or 3 lateral pairs and 1 posterodorsal setae. Cornicles clavate, imbricate especially cylindrical base; about $3\frac{1}{4}$ as long as cauda. Rostrum IV+V as in aptera.

Measurements (in mm) of 10 specimens (including 3 types): BL 1.55-2.09 (1.87), We .35-.40 (.37); a.s.III .41-.49 (.433), a.s.IV .24-.32 (.288), a.s.V .22-.27 (.248), a.s.VI .08-.11 (.097) + .35-.42 (.368); cornicles .42-.53 (.51), cauda .14-.17 (.155); hind tibiae 1.02-1.13 (1.08), hind ta-2 .10-.12 (.111) and rostrum IV+V .10-.13 (.118). Length of anterior head setae: mf .0110-.0198 (.0149), and df-1 .0132-.0242 (.0182). Proportions of a.s.III:IV:V, 1: .57-.82 (.66): .49-.67 (.58); VIu/VIb 3.18-4.38 (3.81); co/ca 3.00-3.71 (3.29); rostrum IV+V/hind ta-2 .92-1.18 (1.07).

Sexuales: Unknown.

Hosts.—Winter host: unknown. Summer host: *Polygonum alpinum*.

DISTRIBUTION.—*C. essigi* has been collected only from high elevations in California. An alate female has been recovered from trap pans in Washington.

SPECIMENS EXAMINED.—Type-slide, with 4 apt.v.f. and 3 al.v.f.; 71 apt.v.f. and 75 al.v.f., with same data as types except for elevation (7800-8300 ft.); 3 apt.v.f. and 3 al.v.f. with data as in types but

from Upper Echo Lake area; 1 al.v.f., Mary Lake Ridge, Sierra Nevada Mts., elev. 10,000 ft., 29-VII-1937, M. A. Stewart, on unknown host; and 1 al.v.f., Yakima, Washington, 25-V-1955, B. J. Landis, in trap pans. All specimens but types in EOE coll.

Capitophorus hippophaes (Walker)

FIGURES 1-4, 6, 19-29

Aphis hippophaes Walker, 1852:1036 [lectotype: Burton-on-Trent, England, 24-VI-1847, on *Hippophae*; BM 843].

Capitophorus hippophaes (Walker).—J. Davidson, 1925:39.—Theobald, 1926:235-238.—Börner, 1931:129.—Börner and Schilder, 1932:615.—Hille Ris Lambers, 1933:173.—Patch, 1938:183.—Wahlgren, 1938:179.—Kloet and Hincks, 1945:65.—Palmer, 1952:259.—Hille Ris Lambers, 1953:151-156.—Wood-Baker, 1953:268.—Knowlton, 1954:8.—Leonard, 1956:105.—Bodenheimer and Swirski, 1957:276.—Börner and Heinze, 1957:207.—Eastop, 1958:29.—Heinze, 1961:50, 53.—Hille Ris Lambers, 1961:181.—Heie, 1962:221.—Hughes, et al., 1964:179 ff.—Shaposhnikov, 1964:790.—Shaw, 1964:69.—Stroyan, 1964a:79.—Szelegiewicz, 1964:249.—Tuatay and Remaudière, 1964:266.—Pepper, 1965:192.—Robinson and Bradley, 1965:41.—Eastop, 1966:433-434.—Heie and Heikinheimo, 1966:123.—Huculak, 1966:125.—Quednau, 1966:426.—Achremowicz, 1967:286.—Cooon and Pepper, 1968a:1473; 1968b:1474.—Robinson and Bradley, 1968:61.

Capitophorus hippophaes.—Leonard, 1968:9 [not Walker, misidentification; specimens listed from California are *C. essigi* rather than *C. hippophaes*].

Rhopalosiphum hippophaes Koch, 1854:28-30 [type: Germany, on *Hippophae rhamnoides*].—Lichtenstein, 1885:29.—Schouteden, 1906b:235.—Gillette, 1915:375-379.—Gillette and Bragg, 1915:101.—Patch, 1918:90, 91.—Wilson and Vickerey, 1918:89.—Swain, 1919:81-82.—Guyton, 1924:15.—Glendenning, 1925:37.

Capitophorus hippophaes (Koch).—Van der Goot, 1915:122-125.—Takahashi, 1923:28-30.—Leonard, 1928:189.—Nevsky, 1928:195.—Takahashi, 1931:76.—Patch, 1938:111.—Takahashi, 1961:1.

Myzus hippophaes (Koch).—Patch, 1923:303.

Myzus elaeagni.—Davis, 1908:251-252 [not del Guercio, misidentification].

Aphis galeopsidis Kaltenbach, 1843:35-36 [in part].—Walker, 1849a:298-301.

Phorodon galeopsidis (Kaltenbach).—Passerini, 1863:19 [in part].—Buckton, 1876:171-173.—Lichtenstein, 1885:28.—Davis, 1911:325.—Theobald, 1911:354.—W. M. Davidson, 1914:136.—Wilson and Vickerey, 1918:81.—Olsen, 1921:15.

Cryptomyzus galeopsidis (Passerini).—Leonard, 1928:189.

Capitophorus gillettei Theobald, 1926:238-241 [types: Wye, England and America, on *Hippophae rhamnoides*, *Elaeagnus* and *Polygonum* spp.].—Hottes and Frison, 1931:284.—Hille Ris Lambers, 1933:173.—Gillette and Palmer, 1934:149.—Leonard, 1936:180.—Patch, 1938:111, 245.—Knowlton, 1941:138.

Amphorophora minima Mason, 1925:36 [type: al.v.f. from Maine; in U. Me.].

Idiopterus nephrolepidis Davis.—Patch, 1938:111 [in part; hosts of *C. hippophaes* erroneously included under *I. nephrolepidis*].

Capitophorus ribis (Linnaeus).—Theobald, 1926:229-231 [in part].

DIAGNOSIS.—Apterous viviparae of *C. hippophaes* are easily recognized by their 1-1-1 anterior abdominal chaetotaxy (2-1-1 in fundatrix and fundatrigenia), clavate cornicles and broad, angular, bluntly pointed rostrum IV+V. Alatae similarly distinguished, and in addition, with cornicles usually less than 3 times cauda in length, not surpassing posterior margin of anal plate.

Three subspecies, *C. h. javanicus* Hille Ris Lambers, *C. h. mitegoni* Eastop, and *C. h. indica* Ghosh and Raychaudhuri, have been described as distinct from the typical *C. hippophaes*. Of these subspecies, *C. h. hippophaes* and *C. h. javanicus* are the most widely distributed, and both occur in North America. *Capitophorus hippophaes mitegoni* was originally described (Eastop, 1956a) from Kenya, but Eastop (1966) recently recorded additional localities in Africa and also in Australia and India. The fourth subspecies, *C. h. indica*, was only recently described from northeastern India and has not been reported elsewhere.

Key to the Nearctic Subspecies of *Capitophorus hippophaes*

- Sixth abdominal spinals and df-2 minute (less than .010 mm or less than $\frac{1}{3}$ basal diameter of antennal segment III, subequal in length to abdominal spinals 1-5, rod-shaped; abdominal segment 7 with 1 pair of conspicuous (i.e., subequal to df-1 in length), capitate setae; mf short, $\frac{1}{3}$ to $\frac{1}{2}$ length of df-1; abdominal spinals 1-5 rod-shaped, single *C. h. javanicus* Hille Ris Lambers
- Sixth abdominal spinals and df-2 conspicuous (more than $\frac{1}{2}$ basal diameter of antennal segment III, longer than spinals 1-5, apices expanded like anterior head and posterior abdominal setae; abdominal segment 7 usually bearing conspicuous pleural setae in addition to spinals; mf usually longer than $\frac{1}{2}$ length of df-1; 1-5 abdominal spinals capitate, single or partly duplicated. *C. h. hippophaes* Walker

The two other subspecies are distinct in having longer anterior abdominal body setae. Measurements and illustrations are provided for *C. h. mitegoni* for comparison. No specimens of *C. hippophaes indica* were seen. According to Ghosh and Raychaudhuri (1968), the dorsal abdominal setae of *C. h. indica* are subequal in length and 2 to 2.3 times basal diameter of third antennal segment. In this respect it differs from *C. h. mitegoni* in which abdominal spinals gradually increase in length from less than 1 for segment 1, to 1½ times for segment 5. In specimens of *C. h. mitegoni* seen, the anterior abdominal spinals are consistently single, including segment 6; pleural setae may be present or absent on seventh and eighth segments.

DESCRIPTION.—*Fundatrix*: Body oval, with reddish spots. Head slightly darker on anterior margin; mf, lf, and df's shorter, more expanded than those of summer viviparae. Antennal segment I with 4 to 5 setae; a.s.II with 1 to 3 setae, dorsal seta absent, sometimes also laterals; a.s.III and IV fused; unguis about 2 times base of a.s.VI in length. Thoracic and abdominal chaetotaxy different from other apterous morphs in that spinals more consistently duplicated and set on moderately developed papillae; pleural rows irregularly aligned; setae relatively more widely expanded than in exules; two rows of pleural intersegmental patches present on dorsum. Cauda slightly dusky, with 10 to 11 setae. Cornicles clavate on distal ⅓, wrinkled or faintly imbricate, dusky on enlarged portion. Rostrum IV+V slightly longer and darker than in other morphs.

Measurements (in mm) of 2 specimens (from St. Paul, Minnesota, 2-VI-1966): BL 1.61-1.65 (1.63), We .31-.41 (.36); a.s.III+IV .26-.33 (.298), a.s.V .12-.15 (.135), a.s.VI .09-.10 (.098) + .19-.21 (.20); cornicles .37-.40 (.385), cauda .19; hind tibiae .69-.75 (.723), hind ta-2 .08-.09 (.088), and rostrum IV+V .12-.13 (.125). Lengths of dorsal head setae: mf .0242-.0330 (.0281), lf .0220-.0242 (.0231), df-1 .0264-.0308 (.0292), df-2 .0176-.0242 (.0220), ipf .0198-.0242 (.0215), and opf .0154. Proportion of a.s.VIu/VIb 1.90-2.22 (2.06); co/ca 1.95-2.11 (2.03); rostrum IV+V/hind ta-2 1.33-1.50 (1.43).

Apterous Viviparous Female: Body spindle-shaped, pale except tips of rostrum and legs. Tergum membranous, smooth to corrugated on disk, striate-spiculate posteriorly; with pleural inter-

segmental patches on abd.s. 4 to 6 on some specimens. Head with well-developed laterofrontal and relatively low mesofrontal tubercle; mf 1p, lf 1p, vlf 1p, df 4p, vf 2p, md 1-3p, and ac 5-6; setae bulbous except pc, md, and ac; mf setae always shorter than df-1, minute, or up to ½ length of df-1 in *C. hippophaes javanicus* and up to ¾ df-1 in *C. hippophaes hippophaes*; lf and df-1 subequal; df-2 variable but usually about as long as sixth abdominal spinals, ipf and opf are subequal to abdominal spinals 1-5. Antennal segment I produced on inner distal margin, with 2 or 3 capitate setae on projection, 2 to 4 setae on venter, usual pointed seta on basal dorsal surface. A.s.II

with 1 — 1 blunt or slightly knobbed setae.

A.s.IV about ¾ and a.s.V about ⅔ length of a.s.III; unguis 5-11 (usually 7 or 8) times as long as base of a.s.VI, differing slightly among subspecies.

Arrangement of body setae illustrated in Figure 1. Prothorax with 8 setae arranged in 2 rows of 4; meso- and metathorax with 2 rows of 6 and 4 setae. Abdominal segments 1-5 with 1-1-1 setal pairs; spinals consistently single (in *C. h. javanicus*) or partly duplicated (65% of 100 specimens of *C. h. hippophaes* showed duplication of at least 1 spinal on any one of segments 1-5); spinals 1-5 minute (.0044-.0110 mm) or less than ⅓ basal diameter of a.s.III in *C. h. javanicus*, .0066-.0242 mm long, about ½ this diameter in *C. h. hippophaes*, .0154-.0506 mm long and 1⅓ times in *C. h. mitegoni*, and 2 or more times in *C. h. indica*; pleurals usually only slightly shorter than spinals; marginals about as long as spinals. Sixth abdominal with single (*C. h. javanicus* and *C. h. mitegoni*) or partly duplicated (*C. h. hippophaes*) spinals; pleurals absent, marginals single. Spinals minute (averaging .0080 mm), merely rod-shaped in *C. h. javanicus*; minute (.0066 mm) to conspicuous (up to .0506 mm), capitate in *C. h. hippophaes*; very long (.0462-.0572 mm) in *C. h. mitegoni*. Segment 7 with spinals single or duplicated, when duplicated, anterior always shorter than posterior complement; pleurals sometimes present; marginals always present. Segment 8 with 2 or 3 pairs spinopleurals and several other outer ones, inner setae always longest, decreasing in size outward. Cauda acutely tapered, spiculate, with 7-14 pointed setae. Cornicles with distal ⅓ clavate, faintly to mod-

erately imbricate, slightly dusky on clavate portion; $1\frac{3}{4}$ to $2\frac{3}{4}$ times cauda in length. Rostrum IV+V rostrate, angular at base, tapering slightly, portion beyond pl setae rather short; with 1 basal, 1 dorsal, and 3 lateral pairs of setae, ml and pl arising quite closely from near apex of segment; about as long as hind tarsal joint 2.

Measurements are listed separately under sub-specific treatments.

Alate Viviparous Female: Head and thorax brown; abdomen pale, membranous except spinopleural and marginal sclerites and subgenital plate; antennae dark brown from near bases of a.s.III; rostrum pale except tip; legs brown from near bases of tibiae, becoming darker distally; anal plate, distal $\frac{1}{2}$ of cornicles, wing veins dusky to light brown. Head and basal antennal chaetotaxy as in aptera but setae merely blunt; a.s.IV and V subequal, about $\frac{2}{3}$ a.s.III in length; unguis averaging 8 times in *C. h. hippophaes*, $7\frac{1}{4}$ times in *C. h. javanicus* and less than 6 times in *C. h. mitegoni*; distribution of sensoria indicated separately under each subspecies.

Abdomen with rectangular central sclerite, less-defined spinopleural sclerites on segments anterior and posterior to it; marginal sclerites slightly paler than central sclerite; chaetotaxy as in aptera, with partial duplication of both spinals and marginals; setae similar in shape to those of head. Cauda variably shaped (Figure 22), usually tapering to an acute tip but distal portion may be very short with cauda terminating bluntly just beyond posterolateral setae; constricted in varying degrees before anterior pair of setae in both *C. h. hippophaes* and *C. h. javanicus* but always distinctly constricted in *C. h. mitegoni* (Eastop, 1956a); with 3 lateral pairs and 1 or 2 posterodorsal setae. Cornicles slightly shorter than in aptera, in well-spread mounts, hardly reaching caudal hinges, about 2 times as long as cauda but ratio varying slightly among subspecies; clavate and imbricate. Rostrum IV+V as in aptera.

Measurements are listed separately under subspecies.

Oviparous Female: Similar to apterous vivipara except as follows: body and appendages shorter; anterior head and posterior abdominal setae shorter, more slender; marginal rows of setae sometimes accompanied by submarginal rows but otherwise all setal rows single; subgenital plate more

densely hairy; hind tibiae thickened, bearing numerous pseudosensoria on basal portion; rostrum IV+V slightly longer, about $1\frac{1}{4}$ times length of hind ta-2.

Measurements (in mm) of 10 specimens on *Hippophae* (St. Paul, Minnesota, 3-XI-1899) and *Elaeagnus* (Minneapolis, Minnesota, 11-X-1928; Lafayette, Indiana, 23-X-1912; Fort Collins, Colorado, 21-X-1909): BL 1.30-1.75 (1.51), We .30-.39 (.349); a.s.III .15-.26 (.208), a.s.IV .11-.18 (.138), a.s.V .12-.17 (.138), a.s.VI .08-.10 (.084) + .34-.49 (.409); cornicles .30-.43 (.347), cauda .14-.19 (.163); hind tibiae .58-.70 (.631), hind ta-2 .08-.09 (.084), and rostrum IV+V .10-.11 (.108). Lengths of head setae: mf. .0110-.0330 (.0216), lf .0176-.0462 (.0306), df-1 .0176-.0440 (.0273), df-2 .0110-.0176 (.0127), ipf .0088-.0132 (.0105), and opf .0066-.0110 (.0094). Proportions of a.s.III:IV:V, 1: .52-1.00 (.67): .56-.80 (.67); VIu/VIb 4.25-5.50 (4.82); co/ca 1.82-2.43 (2.16); rostrum IV+V/hind ta-2 1.11-1.38 (1.28).

Alate Male: Similar to alate viviparous female except as follows: body slightly smaller; spinopleural sclerites on segments 3 to 5 broken into transverse bars; cornicles about as long but cauda much shorter, hence the greater co/ca ratio; sensoria more on a.s.III-V. Genitalia illustrated in Figure 15; aedeagus relatively short, rounded at apex.

Measurements (in mm) of 10 specimens on *Elaeagnus* (Lafayette, Indiana, 23-X-1912; Fort Collins, Colorado, 21-X-1909) and *Polygonum* (Oak Park, Illinois, 12-X-1909; Fort Collins, Colorado, 24-IX-1914): BL 1.34-1.79 (1.59), We .35-.40 (.371); a.s.III .36-.44 (.404), a.s.IV .24-.33 (.297), a.s.V .24-.28 (.261), a.s.VI .09-.11 (.10) + .64-.76 (.710); cornicles .30-.37 (.341), cauda .10-.13 (.116); hind tibiae .90-1.10 (1.00), hind ta-2 .08-.10 (.096), and rostrum IV+V .09-.11 (.103). Proportions of a.s.III:IV:V, 1: .65-.82 (.74): .60-.72 (.65); VIu/VIb 6.40-7.89 (7.11); co/ca 2.50-3.36 (2.96); rostrum IV+V/hind ta-2 .90-1.22 (1.07). Number of sensoria on a.s.III 26-40 (34.3), on a.s.IV 17-32 (24.4), and on a.s.V 6-15 (10.8).

Hosts.—Unless otherwise stated the following hosts are nearctic. Winter hosts: *Elaeagnus angustifolia*, *E. commutata*, *E. multiflora*; *Hippophae rhamnoides*; *Shepherdia argentea*.

Summer hosts: For *C. hippophaes*, sensu lato: *Polygonum aviculare* (England; Theobald, 1911);

P. hydropiper, *P. lapathifolium*, *P. minus*, *P. nodosum*, *P. pennsylvanicum*, *P. persicaria*, and *P. tenuicaule* (England; collection data on slide from British Museum). For *C. h. javanicus*: *P. barbatum* (Java; Hille Ris Lambers, 1953), *P. caespitosum* (Pakistan; Eastop, 1966), *P. hirsutum*, *P. hydropiper* (also in Australia; Eastop, 1966), *P. hydro-piperoides*, *P. japonica* (Korea; Paik, 1965), and *P. lapathifolium*. For *C. h. mitegoni*: *P. glabrum* (India; collection data associated with slide from BM), *P. hydropiper* (Australia; Eastop, 1966), and *P. minus* (Australia; Eastop, 1966). For *C. h. indica*: *P. chinense* (northeastern India; Ghosh and Raychaudhuri, 1968).

DISTRIBUTION.—*Capitophorus hippophaes* has been reported from all parts of the world except the neotropical region. *Capitophorus h. javanicus* was originally described from Java but is now recorded in various other parts of Asia (China, Japan, Korea, India, Pakistan, and Taiwan) and Australia. It is not known to occur in Europe.

In North America, *C. h. javanicus* appears to be common in the eastern (eastward from Ohio) and southeastern (southeastward from southern Illinois?) United States, and in the southeastern part of Canada (southern Ontario and Quebec); on the Pacific coast, present records include only California. *Capitophorus h. hippophaes*, on the other hand, seems to have a more continental (midwestern U.S., Great Plains area, south central Canada) and northwestern (Oregon, Washington) distribution. The exact ranges of these nearctic subspecies is in no way considered complete from our present records; past reports and newer collections need to be more extensively examined.

Capitophorus h. mitegoni seems widely distributed in Africa but not found exclusively in that region; it also occurs in Asia (India) and Australia. In Africa, the distribution pattern of the 2 existing subspecies, *C. h. mitegoni* and *C. h. hippophaes*, is still unknown and cannot possibly be deduced from current information. The same is true for *C. h. javanicus* and *C. h. mitegoni* in Australia, and all 4 subspecies in the Asian portion of the Eurasian continent.

SPECIMENS EXAMINED.—Numerous nearctic specimens of all morphs and stages. Apterous viviparae determined as *C. h. hippophaes* include following localities: Colorado, District of Columbia, Illinois (northern part), Manitoba, Minnesota, Oregon,

Utah, Washington, and Wisconsin; as *C. h. javanicus*, from California, Florida, Illinois (Anna), Louisiana, Mississippi, North Carolina, New Jersey, New York, Ohio, Ontario, Pennsylvania, and Quebec. Undetermined alatae and sexuales were also seen from Idaho, Indiana, Iowa, Kansas, Maine, Massachusetts, Missouri, and some of the states listed above. Collections seen outside North America for these 2 subspecies listed separately under them.

Specimens of *C. h. mitegoni* seen: AFRICA: MUGUGA, Kenya, 1 al.v.f., 3-VI-1953, VFE (Paratype, in EOE coll.); near Salisbury, Southern Rhodesia, 1 al.v.f., VI-1964, on suction trap (BM). AUSTRALIA (all from BM): Brighton Beach, Melbourne, Victoria, 1 apt.v.f., 27-IV-1959, VFE, on *Polygonum minus*; Loch Valley, Victoria, 450m elev., 1 apt.v.f., 8-IV-1959, VFE, on *P. hydropiper*; Brisbane, Queensland, 2 apt.v.f., VI-1942, Jarvis, on *P. hydropiper*. INDIA: Poona, Plant Virus Research Lab, 3 apt.v.f., on *P. glabrum*.

Capitophorus hippophaes hippophaes (Walker)

FIGURES 1-4, 20

Aphis hippophaes Walker, 1852:1036.

DESCRIPTION.—*Apterous Viviparous Female*: Measurements (in mm) of 10 specimens on *Polygonum* (St. Paul, Minnesota, 27-VIII-1966; Darwin, Minnesota, IX-1966); BL 1.70-2.02 (1.87), We .36-.41 (.39); a.s.III .35-.40 (.373), a.s.IV .23-.30 (.269), a.s.V .22-.25 (.234), a.s.VI .08-.10 (.091) + .65-.78 (.725); cornicles .47-.59 (.542), cauda .20-.26 (.238); hind tibiae .86-.98 (.923), hind ta-2 .09, and rostrum IV+V .09-11 (.10). Lengths of abd.s. 1-5 spinals .0066-.0242 (.0118), abd.s.6 spinals .0066-.0242 (.0163), abd.s.1-5 pleurals .0066-.0132 (.0101); mf .0220-.0550 (.0337), df-1 .0198-.0550 (.0426), df-2 .0110-.0220 (.0153), ipf .0088-.0132 (.0108), and opf .0088-.0132 (.0107). Proportions of a.s.III:IV:V, 1: .63-.78 (.72): .55-.70 (.63); VIu/VIb 7.29-9.13 (8.03); co/ca 1.85- 2.70 (2.28); rostrum IV+V/hind ta-2 1.00-1.22 (1.11).

Alate Viviparous Female: Measurements (in mm) of 10 specimens on *Polygonum* (Oak Park, Illinois, 27-IX-1909; St. Paul, Minnesota, 26-VIII-1966); BL 1.35-2.08 (1.72), We .31-.40 (.36); a.s.III .30-.45 (.396), a.s.IV .23-.34 (.273), a.s.V .20-.27 (.238), a.s.VI .08-.11 (.099) + .71-.86 (.784); cornicles .33-

.47 (.391), cauda .12-.18 (.165); hind tibiae .90-1.23 (1.07), hind ta-2 .09-.10 (.095), and rostrum IV+V .10-.11 (.101). Proportions of a.s.III:IV:V, 1: .63-.77 (.69); .47-.68 (.60); VIu/VIb 6.55-9.25 (8.01); co/ca 2.06-2.83 (2.39); rostrum IV+V/hind ta-2 1.00-1.11 (1.07).

Distribution of Sensoria: 25-41 (30.8) on a.s.III, 12-21 (15.6) on a.s.IV, and 0-9 (4.8) on a.s.V.

ADDITIONAL SPECIMENS EXAMINED.—EUROPE (all from BM except the last): 1 apt.v.f., Ossiach, Austria, 14-VII-1966, VFE, swept at edge of lake, and 1 apt.v.f. from same locality, on *Polygonum* sp.; GREAT BRITAIN: Inverness-shire, 3 apt.v.f., 31-VII-1957, J.P. Doncaster, on *Hippophae rhamnoides*; Kew Gardens, 3 apt.v.f., 27-IX-1960, VFE, on *Polygonum tenuicaule*, and 1 apt.v.f. from same locality, 28-VII-1963, on *Polygonum* sp.; Bucks, Waddesdon, 1 al.v.f., 7-VIII-1953, VFE, on *Polygonum*; Somerset, Winsford, 8 apt.v.f., 19-IX-1955, VFE, on *Polygonum*; and Wye, 1 apt.v.f., 2-VII-1911, F.V. Theobald, on *Polygonum*. BELGIUM: Breedene, 3 apt.v.f., 21-VIII-1939, E. Janmouille, on *H. rhamnoides* (EOE coll.). JAPAN: Tokyo, 3 apt.v.f., VI-1923, VFE, on unknown host (BM).

Capitophorus hippophaes javanicus
Hille Ris Lambers

FIGURES 26-29

Capitophorus hippophaes javanicus Hille Ris Lambers, 1953: 156 [type: apt.v.f., near Bondowoso, Java, 250 m elev., 25-VIII-1949, F. W. Rappard, on *Polygonum barbatum*; in DHRL coll].—Takahashi, 1961:1.—Paik, 1965:57.—Eastop, 1966:434.

DESCRIPTION.—*Apterous Viviparous Female*: Measurements (in mm) of type-specimen: a.s.III both .28, a.s.IV both .20, a.s.V both .19, a.s.VI .10 + .75 and .09 + .73; cornicles .43 and .45, cauda .17; hind tibiae .68 and .69, hind ta-2 both .08, rostrum IV+V .08; mf .0154 and .0176, lf .0352 and .0330, df-1 .0330 and .0352, df-2 .0066, ipf and opf .0044.

Measurements (in mm) of 7 specimens from California (Santa Ana Canyon, San Bernardino Co., California, 4-VIII-1938, EOE, on *Polygonum lapathifolium*): BL 1.45-1.63 (1.58), We .32-.36 (.35); a.s.III .31-.39 (.344), a.s.IV .22-.28 (.246), a.s.V .19-.24 (.219), a.s.VI .09-.11 (.101) + .70-.75 (.721); cornicles .42-.46 (.436), cauda .18-.22 (.198); hind tibiae .80-.87 (.83), hind ta-2 .08-.09 (.085)

and rostrum IV+V .09. Abdominal spinals 1-5 .0066-.0110 (.0082), spinal 6 .0066-.0110 (.0091), pleurals 1-5 .0044-.0088 (.0071); mf .0110-.0176 (.0137), df-1 .0198-.0330 (.0292), df-2, ipf and opf .0066-.0088. Proportions of a.s.III:IV:V, 1: .62-.77 (.72); .56-.68 (.64); VIu/VIb 6.82-8.30 (7.23); co/ca 1.95-2.39 (2.22); rostrum IV+V/hind ta-2 1.0-1.11 (1.04).

Alate Viviparous Female: Measurements (in mm) of 10 specimens from California (same data as apterae above): BL 1.48-1.64 (1.54), We .31-.34 (.33); a.s.III .28-.38 (.339), a.s.IV .17-.25 (.222), a.s.V .16-.21 (.196), a.s.VI .08-.11 (.097) + .62-.75 (.691); cornicles .22-.30 (.273), cauda .12-.16 (.14); hind tibiae .73-.96 (.873), hind ta-2 .08-.09 (.081), and rostrum IV+V .08-.09 (.081). Proportions of a.s.III:IV:V, 1: .59-.75 (.66); .53-.63 (.57); VIu/VIb 6.0-8.25 (7.15); co/ca 1.69-2.50 (1.97); rostrum IV+V/hind ta-2 1.00-1.13 (1.02). Number of sensoria on a.s.III 15-23 (18.2), on a.s.IV 6-10 (7.0), and on a.s.V 0-4 (1.7).

SPECIMENS EXAMINED.—Aside from nearctic specimens and type: AUSTRALIA (all from BM and collected by VFE, on *Polygonum hydropiper*): Loch Valley, Victoria, 2 apt.v.f., 8-IV-1959, and Bibinluke, New South Wales, 1 apt.v.f. and 6 ny., 5-V-1959. PAKISTAN: Chittagong, Bengal, East Pakistan, 9 apt.v.f. and 18 al.v.f., 1-II-1954, M. A. Hasib, on "Bishkatili" (EOE coll.).

Capitophorus horni Börner

FIGURES 81, 95-105

Capitophorus (Capitophorus) horni Börner, 1931:129 [type: Germany, on *Cirsium oleraceum*; in Börner's collection at Naumberg/Saale].

Capitophorus horni Börner.—Hille Ris Lambers, 1953:158-162.—Stroyan, 1955:292-293.—Börner and Heinze, 1957:208.—Heinze, 1961:53-54.—Heie, 1962:222.—Shaposhnikov, 1964:789.

Capitophorus horni horni Börner.—Szelegiewicz, 1964:249.—Huculak, 1965:230.

Capitophorus horni gynoxantha Hille Ris Lambers, 1953: 162 [types: Netherlands, on *Cirsium oleraceum* and *C. arvense*; in DHRL].—Eastop, 1956b:272.—Bodenheimer and Swirski, 1957:276.—Stroyan, 1964a:79.—Achremowicz, 1967:286.

Capitophorus gynoxantha Hille Ris Lambers.—Heinze, 1961: 53, 54.

DIAGNOSIS.—This species is easily recognized by the combination of cylindrical cornicles and 2-1-2 anterior abdominal chaetotaxy. Collections on

thistles may occasionally yield *C. horni* mixed with the more abundant *C. elaeagni*, but the duplicated spinal and marginal setae are very distinctive. It may also resemble *C. jopepperi*, new species, but cornicles are not clavate and setae are longer and more slender in *C. horni*.

DESCRIPTION.—*Apterous Viviparous Female* (described from types of *C. horni gynoxantha* Hille Ris Lambers): Body stoutly spindle-shaped; pale, with tips of tibiae and entire tarsi brown, flagellum of antennae and tips of cornicles dusky in some specimens. Tergum membranous, slightly wrinkled. Head with rather poorly developed frontal tubercles; mf lp, lf lp, vlf lp, df 4p, vf 2p, ac usually 1-2-1, and md 1 (sometimes 2) p; dorsal setae capitate, set on large tubercles, stalks narrowed slightly before apical knobs, subequally long but df-1 longest; ventral setae also elongate and knobbed but some pc, ac pointed. Antennal segment I strongly angular on inner apex, imbricate, bearing 2 or 3 capitate setae on projection, 2-4 more capitate hairs present on antero- and lateroventral surface, aside from usual pointed one

on dorsum. A.s.II with 1—¹—1 slightly knobbed
1
setae, 1 sometimes added. Flagellar segments imbricate, slightly dusky; a.s.IV and V subequal, about $\frac{3}{4}$ length of a.s.III; unguis averaging $5\frac{1}{3}$ times as long as base of a.s.VI.

Thoracic and abdominal chaetotaxy as illustrated for oviparous female (Figure 81): prothorax with normal complement of 8 setae; mesothoracic to abdominal segment 5 generally 2-1-2, but mesothoracic pleurals may also be doubled and marginals single as in all other *Capitophorus* species; segment 6 with spinals and pleurals close at bases, setal count 2-1-1; segments 7 and 8 also with double spinals and single pleurals, approximately 2 or more marginals present, some may be pointed. Cauda stout, triangular, spiculate; with 2 or 3 lateral pairs and 5-10 smaller posterodorsal ones. Cornicles cylindrical, strongly imbricate, dusky near apices; about $2\frac{1}{2}$ as long as cauda. Rostrum IV+V rather slender, tapering to a blunt point; chaetotaxy normal, i.e., 1 basal, 1 dorsal, and 3 lateral pairs of setae present, ml distinctly removed from pl pair; about $1\frac{1}{2}$ times length of hind tarsal segment 2.

Measurements (in mm) of 6 specimens (including 3 cotypes): BL 1.76-2.16 (1.91), We .39-.45 (.418); a.s.III .29-.35 (.323), a.s.IV .21-.28 (.242), a.s.V .21-.32 (.267), a.s.VI .09-.13 (.106) + .48-.67 (.561); cornicles .56-.64 (.598), cauda .22-.24 (.228); hind tibiae .82-1.06 (.94), hind ta-2 .08-.10 (.091), and rostrum IV+V .12-.135 (.131). Dorsal head setae .0440-.0792 mm, with following mean lengths: mf .0636, lf .0601, df-1 .0728, df-2 .0675, ipf .0625, and opf .0571. Proportions of a.s.III:IV:V, 1: .64-.84 (.75); .72-.94 (.82); VIu/VIb 4.73-5.90 (5.35); co/ca 2.54-2.78 (2.62); rostrum IV+V/hind ta-2 1.33-1.69 (1.44).

Alate Viviparous Female (also based on *C. h. gynoxantha*): Head, thorax, antennae from near bases of segment III, tips of tibiae and rostrum, and entire tarsi brown; bases of legs, anterior wing margins, wing veins, abdominal sclerites, distal portions of cornicles, anal plate and cauda dusky to light brown. Head and basal antennal chaetotaxy as in aptera but dorsal head setae relatively shorter, averaging .0162 mm long; a.s.III with 21-33 (27.0), a.s.IV 12-16 (14.1), and a.s.V 1-7 (4.2) sensoria. Abdomen with setae arranged as in aptera, generally 2-1-2, but marginals sometimes 1 or 3; central sclerite not well-defined in specimens examined. Cauda tapering, slightly constricted before anterolateral pair of setae; with 5-8 setae, 2 or 3 lateral, remainder posterodorsal. Cornicles cylindrical, imbricate-spiculate; $2\frac{1}{2}$ to $3\frac{1}{4}$ times as long as cauda. Rostrum IV+V as in aptera.

Measurements (in mm) of 5 cotypes: BL 1.58-1.87 (1.72), We .36-.40 (.374); a.s.III .34-.41 (.370), a.s.IV .24-.31 (.285), a.s.V .24-.31 (.277), a.s.VI .10-.12 (.11) + .58-.73 (.628); cornicles .40-.48 (.436), cauda .13-.17 (.15); hind tibiae 1.01-1.08 (1.05), hind ta-2 .09-.10 (.097), and rostrum IV+V .13. Proportions of a.s.III:IV:V, 1: .67-.88 (.77); .63-.88 (.75); VIu/VIb 4.92-6.64 (5.73); co/ca 2.50-3.23 (2.92); rostrum IV+V/hind ta-2 1.30-1.44 (1.35).

Oviparous Female: Similar to apterous vivipara except hind tibiae shorter, basally enlarged, and bearing numerous pseudosensoria; more hairy subgenital plate; unguis of a.s.VI relatively shorter.

Measurements (in mm) of 3 specimens (from Canada and Netherlands): BL 1.71-1.95 (1.81), We .38-.44 (.410); a.s.III .31-.36 (.335), a.s.IV .22-.25 (.242), a.s.V .27-.29 (.277), a.s.VI .10-.12 (.11) +

.51-.60 (.536); cornicles .51-.62 (.562), cauda .19-.21 (.203); hind tibiae .73-.89 (.81), hind ta-2 .08-.10 (.09), and rostrum IV+V .12-.13 (.125); dorsal head setae .0440-.0694. Proportions of a.s.III:IV:V, 1: .64-.81 (.73); .78-.90 (.83); VIu/VIb 4.25-5.20 (4.80); co/ca 2.42-2.95 (2.77); rostrum IV+V/hind ta-2 1.30-1.50 (1.39).

Alate Male: Similar to alate viviparous female, differing in having spinopleural sclerites of abdominal segments 3 to 5 separate, more pointed dorsal and ventral head setae, shorter cauda, and more numerous sensoria. Genitalia illustrated in Figure 100; aedeagus oblong, slightly narrowed but rounded at apex.

Measurements (in mm) of 4 specimens (from Canada and Netherlands): BL 1.37-1.46 (1.41), We .34-.38 (.35); a.s.III .35-.40 (3.66), a.s.IV .24-.28 (.273), a.s.V .23-.29 (.268), a.s.VI .12 + .50-.59 (.55); cornicles .31-.37 (.340), cauda .10-.13 (.117); hind tibiae .87-.94 (.906), hind ta-2 .08-.09 (.085), and rostrum IV+V .12-.125 (.121). Proportions of a.s.III:IV:V, 1: .63-.83 (.75); .58-.81 (.73); VIu/VIb 4.17-4.92 (4.59); co/ca 2.77-3.2 (2.93); rostrum IV+V/hind ta-2 1.33-1.56 (1.43). Number of sensoria on a.s.III 24-43 (28.3), a.s.IV 14-15 (14.3), and a.s.V 5-10 (8.5).

Hosts.—Holocyclic on *Cirsium arvense*, *C. lanceolatum*, *C. oleraceum*, and *Cirsium* sp.

Distribution.—Widely distributed in Europe, with records from Denmark, Germany, Great Britain, Netherlands, Poland, and the U.S.S.R. It also occurs in Israel; it has not heretofore been recorded from North America.

Specimens Examined.—CANADA: Fredericton, New Brunswick, 3 ovip.f. and 2 al.m., 9-X-1964, E.MacG., on *Cirsium* sp. (E.MacG. coll.). UNITED STATES: Presque Isle, Maine, 3 al.v.f., 17-VII and 2-VIII-1951, G.W.S., on traps (EOE coll.); Union Gap, Washington, 1 al.v.f., 13-17-VIII-1953, E.W. Davis, on trap pans, 10 ft. level (EOE coll.). EUROPE (all in DHRL coll.): Great Britain, Anglesey, Wales, 3 apt.v.f., 8-IX-1946, F.H. Jacob, on *Cirsium arvense*; Netherlands, Bergen-op-Zoom, 1 apt.v.f. and 5 al.v.f., 4-VI-1942, and 2 apt.v.f., 1 ovip.f. and 2 al.m., 1-X-1941, DHRL, on *C. arvense* (cotypes of *C. h. gynoxantha*).

Note.—The few nearctic specimens seen belong to *C. h. gynoxantha* but *C. horni* is treated here in the broader sense.

Capitophorus jopepperi, new species

FIGURES 39-46

DIAGNOSIS.—This species is easily recognized by a combination of following characters: clavate cornicles, 2-1-2 anterior abdominal chaetotaxy, and subequally long, globose body setae. It resembles *C. horni* in arrangement of body setae but the clavate cornicles and the shorter and stouter body setae are distinctive. It is distinguished from the other species with clubbed cornicles (*C. shepherdiae* and *C. xanthii*) by its smooth textured integument and by the absence of submarginals.

DESCRIPTION.—*Apterous Viviparous Female*: Body narrowly spindle-shaped; pale to dark green in life; cleared specimen pale, with tips of rostrum, tibiae, entire tarsi, and areas around primary sensoria on a.s.V and VI brown, cornicle dusky to pale brown on clavate portion. Head with moderately developed laterofrontal tubercles, mesofrontal projection rather large and conspicuous; mf 1p, lf 1p, vlf 1p, df 4p, vf 3p, pc 1 or 2p, ac 4 arranged 1-2-1, md 2p; dorsal setae on large tubercles, with distinct stems and stoutly globular apices, subequal to each other as well as to those on dorsum; ventral setae, except some of ac's also capitate but less expanded. Antennal segment I strongly produced, angular, faintly imbricate on mesodistal margin; with 6 or 7 setae, all capitate

except basal one on dorsum. A.s.II with 1 — — 1
1
capitate setae. A.s.III without sensoria; setae blunt or slightly knobbed, small, longest about 1/3 basal diameter of segment. A.S.IV slightly longer than V and about 2/3 length of III; unguis averaging 4 1/2 times base of a.s.VI.

Prothorax with 8 setae arranged in 2 transverse rows of 4; mesothoracic to abdominal segment 5 with general chaetotactic formula of 2-1-2 but marginals of abd.s. 1 and 5 single; abd.s. 6 and 7 2-1-1, but pleurals may be absent on segment 6; abd.s. 8 with 7 or 8 setae, spinals arising closely in groups of 4 or 5, outer setae much smaller than spinals. Mesothoracic to eighth abdominal spinals set on papillae, best developed on posterior segments; marginals with anterior slightly shorter than posterior complement. Cauda tapering gradually to an acute point; spiculate; with 2 lateral pairs and 1 posterodorsal setae. Cornicles slightly

curved inward and clavate on distal $\frac{1}{4}$; pale except light brown apex and cylindrical portion imbricate; about $3\frac{1}{2}$ times as long as cauda. Legs with thickened, blunt to pointed setae, setae becoming more attenuate and elongate from femoral bases to apices of tibiae; first tarsal chaetotaxy 3,3,3. Rostrum IV + V rostrate, with normal set of setae (viz., 1 basal, 1 dorsal, and 3 lateral pairs), ml arising close to, and slightly mesad of pl setae; subequal to or slightly longer than hind tarsal segment 2.

Measurements (in mm) of holotype and 4 paratypes: BL 1.30–1.50 (1.42), We .31–.36 (.344); a.s.III .27–.34 (.323), a.s.IV .18–.24 (.221), a.s.V .12–.21 (.189), a.s.VI .08–.10 (.085) + .32–.41 (.381); cornicles .59–.75 (.705), cauda .18–.22 (.206); hind tibiae .75–.91 (.849), hind ta–2 .09–.10 (.093), and rostrum IV + V .10–.115 (.109). Length of dorsal head setae: mf .0330–.0396 (.0356), lf .0264–.0352 (.0297), df–1 .0396–.0484 (.0421), df–2 .0330–.0440 (.0374), ipf .0286–.0418 (.0363), and opf .0242–.0308 (.0269). Proportions of a.s.III:IV:V, 1: .65–.71 (.69); .44–.63 (.58); VIu/VIb 3.90–5.13 (4.49); co/ca 3.18–3.57 (3.42); rostrum IV + V/hind ta–2 1.10–1.28 (1.17).

Alate Viviparous Female: Head, mesothorax, appendages, wing veins brown but antennae darker from near bases of a.s.III, legs darker on apices of tibiae, entire tarsi; abdominal sclerites not well defined in type-specimens; cornicles dark on distal $\frac{3}{4}$; cauda and anal plate dusky. Head and basal 2 antennal segments similar to those of aptera but setae relatively shorter (df–1 averaging .0198 mm) and more slender; sensoria distributed as follows: a.s.III 18–21 (20), a.s.IV 5–11 (8.5), and a.s.V 0–2 (1.0). Abdominal chaetotaxy like that of aptera, 2–1–2 on segments 2 to 4 and 2–1–1 on segments 1 and 5; setae thickened, somewhat globose, as long as those of head. Cauda with slight basal constriction, tapering from constriction to acute but rounded tip; 2 lateral pairs and 1 posterodorsal setae present. Cornicles with distal $\frac{1}{4}$ thickened, slightly imbricate except on clavate portion; about 3 times length of cauda. Legs and rostrum IV + V as in aptera.

Measurements (in mm) of 2 paratypes: BL 1.28 and 1.58, We both .33; a.s.III .34–.37 (.355), a.s.IV .22–.25 (.240), a.s.V all .21, a.s.VI .07–.09 (.083) + .18–.21 (.20); cornicles .53–.58 (.558), cauda both .19; hind tibiae .93–.98 (.955), hind ta–2 .09–.10 (.095), and rostrum IV + V both .11. Proportion of

a.s.III:IV:V, 1: .61–.74 (.678); .57–.62 (.593); VIu/VIb 4.56–6.14 (5.19); co/ca 2.79–3.08 (2.93); rostrum IV + V/hind ta–2 1.11–1.22 (1.16).

Sexuales: Unknown.

Hosts.—Winter host: not known; summer host: *Ambrosia artemisiifolia*.

DISTRIBUTION.—Known only from type-locality.

TYPES.—Holotype, apt.v.f., Franklin, North Carolina, 30–VIII–1963, JOP, on *Ambrosia artemisiifolia*, paratypes all with the same data as holotype: 2 al.v.f. on same slide as holotype, and 4 apt.v.f. and 6 apt.ny. on a second slide. Holotype slide in JOP collection, and paratype slide in the U. Minn. collection.

NOTE.—This species is named in honor of its collector, Dr. J. O. Pepper, Professor Emeritus in the Department of Entomology, Pennsylvania State University.

Capitophorus pakansus Hottes and Frison

FIGURES 103, 107–111, 114, 117–119

Capitophorus pakansus Hottes and Frison, 1931:286–287 [type: al.v.f., Urbana, Illinois, 17–X–1929, Frison and Ross, on *Inula royaleana*; Slide No. 10843 in INHS coll.].—Patch, 1938:245.

Capitophorus archangelskii Nevsky.—Börner and Heinze, 1957:208 [in part, *C. pakansus* placed as synonym of *C. archangelskii*].

Capitophorus inulae Passerini.—Van der Goot, 1915:125–127 [in part].

Phorodon inulae.—Olsen, 1921:15–16 [not Passerini, misidentification; apterous vivipara with the same data referred to by Olsen examined, J. J. Davis coll. in P.U.].

Capitophorus similis Van der Goot.—Wahlgren, 1938:179 [in part].

Capitophorus vanderhooti Hille Ris Lambers, 1947b:294–299 [type: Wageningen, Netherlands, on *Inula helenium*; in DHRL coll. Cotypes of *C. vanderhooti* compared with those of *C. pakansus*; new synonym].—Hille Ris Lambers, 1953:169–174.—Heinze, 1961:51, 54.—Shaposhnikov, 1964:790.—Stroyan 1964a:79; 1964b:48–49.—Szelegiewicz, 1966:449.—Achremowicz, 1967:287.

DIAGNOSIS.—The apterous vivipara resemble those of the European species, *C. similis* (Figure 104) and *C. inulae* (Figure 106) in form and arrangement of body setae but spinopleural groups of setae are more numerous (6 or 7 vs 4 in these European species). The hairs on antennal segment III are conspicuous and capitate in both *C. pakansus* and *C. similis* but are considerably longer in the former (.0176–.0550, $m = .0324$, $n = 68$) than in the latter

(.0088-.0308, $m = .0173$, $n = 51$); those of *C. inulae* are minute, .0044-.0066 mm long. Rostrum IV+V is quite long, .16 mm or more, in *C. pakansus* and *C. similis* (Figure 112), and about $2\frac{1}{3}$ times length of second hind tarsal joint; in *C. inulae* rostrum IV+V (Figure 113) is only .12-.13 mm long and about $2\frac{1}{3}$ times length of hind ta-2. A fourth related species from Central Asia, *C. archangelskii* Nevsky, seems similar to *C. similis* in chaetotaxy (Figure 5 in Nevsky, 1928, shows sp-p and sm-m counts of 4 and 2 for abd.s. 1, and 5 and 2 for abd.s. 2 to 4 but antennal segment III hairs are, according to Hille Ris Lambers (1953:174), as conspicuous as in *C. vanderghooti* (this name is considered here synonymous with *C. pakansus*).

Among viviparous alatae, first to fourth abdominal chaetotaxy is similarly 2-2-3 for all three species, *C. pakansus*, *C. similis* (Figures 120, 121), and *C. inulae* (Figures 115, 116); however, pleurals may or may not be duplicated on third to fourth segments in *C. inulae* (Hille Ris Lambers, 1953:164). Differences in length of rostrum IV+V and its ratio to hind tarsal segment 2 also holds for alate females. Number of sensoria on a.s.V differs among these species, either absent or as many as 4 in *C. pakansus*, 6 in *C. similis*, and 2-8 in *C. inulae*; in *C. archangelskii* the count is 15-20 (for sexuparae).

DESCRIPTION.—Apterous Viviparous Female: Body narrowly spindle-shaped; pale, with tips of rostrum, tibiae, entire tarsi brown; tergum membranous, smooth to slightly wrinkled. Head with moderately developed latero- and mesofrontal tubercles; mf 1p, lf 1p, vlf 1p, df 4p, vf 2p, pc 2p, ac 4-6, md 2-4p; dorsal setae subequally long, borne on large tubercles, with very long, evenly slender stems and globular apices (about distal $\frac{1}{6}$); ventral setae also thickened and capitate except pc, ac, and md. Antennal segment I strongly projected mesodistally, with 5-8 capitate setae aside from

1

usual pointed one on dorsum. A.s.II with 1 — — 1

1

setae, these capitate but relatively thinner than those of preceding segment. A.s.III with 3-6 conspicuous capitate setae on anterior margin, setae .0176-.0550 (.0324, $n = 68$) mm long, and borne on large tubercles. A.s.IV and V subequal in length, about $\frac{3}{4}$ length of a.s.III; unguis $2\frac{1}{2}$ to $3\frac{1}{2}$ times as long as base of a.s.VI.

Thoracic and abdominal chaetotaxy shown in

Figure 103. Prothorax with usual 8 setae arranged in 2 rows of 4. On discal segments spinal and pleural rows of either side approximate setal bases forming trapezoidal or oval platelets, these rows fairly recognizable individually, especially on thorax where more widely separated; lateral rows consisting of apparent fusion of submarginal and marginal setae; sp-p and sm-m counts for mesothorax 5-9 (6.67) and 1-5 (2.7); metathorax 4-8 (5.73) and 1-4 (2.9); first abdominal segment 5-10 (6.89) and 2-4 (2.93); and second to fourth abdominal segment 4-10 (6.5) and 2-5 (3.58). Abdominal segment 5 with spinal, pleural, and marginal rows separate, submarginal row absent, sp-p-m count: 2 to 5 (3.09)-1-1; spinal and pleural setae of segments 6 and 7 also in clumps of about 4, submarginals absent, marginals single; setae of abdominal segment 8 decreasing in size from midline to outer margin. Cauda quite small, triangular, apex acutely rounded; spiculate; with 6-10 setae, 2 or 3 pairs lateral, larger than remainder on posterodorsal surface. Cornicles cylindrical; imbricate, imbrications bearing minute teeth on ventral surface, sometimes also on dorsum; entirely pale, concolorous with tergum; $3\frac{1}{3}$ to $5\frac{1}{3}$ times as long as cauda. Rostrum IV+V slender, tapering gradually to a rather blunt tip; with 1 basal, 1 dorsal, and 3 lateral pairs of setae, ml and pl distinctly separate; about $2\frac{1}{3}$ times length of hind tarsal segment 2.

Measurements (in mm) of a paratype recovered among Hottes and Frison's original series: BL 1.23, We .30; a.s.III .22 and .23, a.s.IV .16 and .17, a.s.V .17 and .18, a.s.VI .06 + .42 and .07 + .43; cornicles .45 and .46, cauda .11; hind tibiae .62 and .65, hind ta-2 both .07, rostrum IV+V .17; mf .0462, lf .0572 and df-1 .0726.

Measurements (in mm) of 10 nearctic specimens on *Inula helenium*: BL 1.29-1.62 (1.42), We .29-.35 (.322); a.s.III .22-.30 (.250); a.s.IV .15-.24 (.199), a.s.V .15-.26 (.211), a.s.VI .07-.09 (.081) + .36-.52 (.445); cornicles .45-.62 (.506), cauda .09-.13 (.10); hind tibiae .63-.85 (.745), hind ta-2 .07-.08 (.076) and rostrum IV+V .16-.19 (.177). Length of anterior head setae: mf .0462-.0704 (.0606), lf .0528-.0814 (.0713), and df-1 .0748-1.034 (.0869). Proportions of a.s.III:IV:V, 1: .71-.91 (.79): .74-.96 (.85); VIu/VIb 4.50-6.14 (5.49); co/ca 3.38-5.50 (4.67); rostrum IV+V/hind ta-2 2.25-2.57 (2.36).

Selected measurements (in mm) and proportions for 6 cotypes of *C. vanderghooti* (on *Inula helenium*, from Europe): BL 1.34–1.75 (1.59), We .33–.39 (.367); proportions of a.s.III:IV:V, 1: .69–1.0 (.85): .66–.97 (.84); VIu/Vib 5.25–6.75 (5.85); cornicles .48–.70 (.614), co/ca 4.0–5.38 (4.45); rostrum IV+V .18–.22 (.198), and rostrum IV+V/hind ta–2 2.10–2.50 (2.26).

Alate Viviparous Female: Head, thorax, and antennae dark brown; legs and rostrum brown, with apices darker; anterior wing margin, wing veins, abdominal sclerites, distal $\frac{1}{3}$ to $\frac{1}{2}$ of cornicles light brown or dusky. Head and basal antennal chaetotaxy much like aptera but setae much shorter and thinner; df–1 .0154–.0330 mm long, or up to .0672 mm in some intermediates (e.g., Figure 110); sensoria distributed as follows: 35–50 (42.6) on a.s.III, 13–26 (20.5) on a.s.IV, and 0–4 (1.2) on a.s.V.

Abdomen with 3 pairs of longitudinal seta rows: spinals and pleurals, although approximate, recognizably separated, submarginals and marginals indistinguishably fused; spinals and pleurals of abd.s. 1 to 4 generally duplicated, single on segment 5; sm–m row with 3 or 4 setae on each of abd.s. 2 to 4, usually 1 less on first, and always single on segment 5. Spinopleural and marginal sclerites as in other *Capitophorus* species, central sclerite rectangular. Cauda short, hardly extended beyond distolateral pair of setae, apex broadly rounded; with 2 lateral, 1 posterodorsal setae. Cornicles and rostrum IV+V much like those of aptera.

Measurements (in mm) of 3 paratypes on *Inula royaleana*: BL 1.49–1.52 (1.50), We .31–.33 (.32); a.s.III .32–.38 (.335), a.s.IV .24–.26 (.245), a.s.V .22–.23 (.277), a.s.VI .07–.09 (.077) + .47–.50 (.478); cornicles .36–.39 (.377), cauda .07–.08 (.077); hind tibiae .87–.95 (.93), hind ta–2 .07–.09 (.08), and rostrum IV+V .16. Proportions of a.s.III:IV:V, 1: .63–.79 (.74): .61–.73 (.69); VIu/Vib 5.88–7.00 (6.13); co/ca 4.63–5.29 (4.93); rostrum IV+V/hind ta–2 1.78–2.29 (2.01).

Selected measurements (in mm) and proportions for 4 cotypes of *C. vanderghooti*: BL 1.42–1.72 (1.57), We .32–.38 (.343); a.s.III:IV:V, 1: .68–.74 (.70): .63–.72 (.67); VIu/Vib 6.00–6.89 (6.41); cornicles .36–.43 (.408), co/ca 4.20–4.63 (4.41); rostrum IV+V .16–.18 (.173), rostrum IV+V/hind ta–2 1.89–2.00 (1.94).

Oviparous Female: Unknown.

Alate Male: Similar to alate viviparous female except for fragmenting of central abdominal sclerite into transverse bars, presence of more sensoria on a.s.III–V, and relatively shorter cornicles and cauda. Genitalia illustrated in Figure 118; aedeagus rather small, oblong and rounded apically.

Measurements (in mm) of 6 paratypes on *Inula royaleana*: BL 1.18–1.59 (1.41), We .29–.32 (.31); a.s.III .34–.39 (.373), a.s.IV .22–.26 (.239), a.s.V .21–.27 (.234), a.s.VI .07–.10 (.078) + .42–.52 (.475); cornicles .28–.31 (.296), cauda .06–.07 (.066); hind tibiae .78–.87 (.832), hind ta–2 .07–.08 (.071), and rostrum IV+V .16. Proportions of a.s.III:IV:V, 1: .56–.72 (.64): .54–.71 (.63); VIu/Vib 4.20–7.29 (6.17); co/ca 4.14–5.00 (4.54); rostrum IV+V/hind ta–2 2.00–2.29 (2.25). Number of sensoria on a.s.III 36–46 (40.7), on a.s.IV 19–25 (21.2) and on a.s.V 9–15 (13.2).

Selected data for 5 specimens on *I. royaleana* from Europe: BL 1.49–1.78 (1.68), We .34–.37 (.356); proportions of a.s.III:IV:V, 1: .67–.76 (.71): .60–.70 (.66); VIu/Vib 5.10–6.00 (5.38); cornicles .28–.32 (.304), co/ca 3.5–4.0 (3.80); rostrum IV+V .15–.16 (.158), rostrum IV+V/hind ta–2 1.88–2.14 (2.00). Number of sensoria on a.s.III 42–54 (47.4), on a.s.IV 21–35 (26.6), and on a.s.V 10–19 (13.7).

Hosts.—Winter host: *Elaeagnus* (Hille Ris Lambers, 1953; Shaposhnikov, 1964; Stroyan, 1964b). Summer hosts: *Inula helenium* and *I. royaleana*.

DISTRIBUTION.—North American records include Illinois, Ontario, Pennsylvania, and Quebec. In Europe it is known as *C. vanderghooti* from Bulgaria, Finland, Germany, Great Britain, Netherlands, Poland, Sweden, and the U.S.S.R.

SPECIMENS EXAMINED.—Specimens of *C. pakansus*: Paratype slides No. 10847, 10848, 10850, and 10862 of the INHS collection, all from Urbana, Illinois, by Frison and Ross, on *Inula royaleana*, at various dates, namely, 15–X–1929 (1 apt.v.f., 1 al.m., 19 altd.ny., and 16 apt.ny.) and 17–X–1929 (3 al.v.f., 5 al.m.); 3 apt.v.f. and several ny., Hanesdale, Pennsylvania, C. E. Olsen, on *Inula helenium* (J. J. Davis coll., PU); 5 apt.v.f. and 1 al.v.f., 10–IX–1966, Snake Island, Lake Simcoe, Ontario, J. Sijkins, on *I. helenium* (DHRL coll.); 2 apt.v.f., Old Chelsea, Quebec, 25–VIII–1961, WRR, on *I. helenium* (WRR coll.); 6 apt.v.f. Wagenningen, Netherlands, 27–VIII–1946, DHRL, on *I. helenium* (DHRL coll., cotypes of *C. vanderghooti*); and 3 al.

v.f. and 5 al.m., 10-X-1957, Wageningen, Netherlands, M.E.MacG. on *I. royaleana* (M.E.MacG. coll.).

Specimens of *C. inulae*: 3 apt.v.f. and 1 al.v.f., Reading, England, 25-X-1935, W.H.E. Hodson, on *Inula* sp. (EOE coll.).

Specimens of *C. similis*: 9 apt.v.f. and 5 al.v.f., Watermael, Belgium, 5-VIII-1939, E. Janmouille, on *Tussilago farfara* (EOE coll.); 10 apt.v.f., Boitsfort, Belgium, 13-VIII-1939, E. Janmouille, on *Petasites hybridus* (EOE coll.); and 1 apt.v.f., Usquert, Netherlands, 31-VIII-1932, DHRL, on *T. farfara* (EOE coll.).

Capitophorus shepherdiae Gillette and Bragg

FIGURES 60-76

Capitophorus shepherdiae Gillette and Bragg, 1916:445-448 [type: Fort Collins, Colorado, on *Shepherdia argentea*; USNM 41938].—Patch, 1918:91.—Gillette and Palmer, 1934: 156-157.—Knowlton, 1935c:194.—Palmer, 1952:270.

DIAGNOSIS.—*Capitophorus shepherdiae* can be distinguished from all other known species of *Capitophorus* by its discal body chaetotaxy of 2-2-1-2. It resembles *C. xanthii* most closely but is a relatively smaller species with shorter antennae and cornicles, has more strongly sculptured dorsal integument, and setae more widely expanded. Alatae differ from those of *C. xanthii* in the more rounded caudal tip, usual presence of 1 posterodorsal caudal seta, and usual absence of sensoria on antennal segment V.

DESCRIPTION.—*Apterous Viviparous Female* (fundatrigenia): Similar to apterous exule except for fusion of antennal segments III and IV, shorter unguis and cornicles and longer last rostral segment; head and body setae less regularly arranged, v.f.s 1 pair fewer, ac only 2 arranged 0-2-0; antennal segment II with $1-\overset{0}{-}-1$ setae, dorsal seta $\overset{1}{-}$ absent.

Measurements (in mm) of 10 specimens on *Shepherdia argentea*: BL 1.20-1.40 (1.31), We .31-.36 (.34); a.s.III+IV .18-.21 (.199), a.s.V .09-.11 (.103), a.s.VI .07-.09 (.075) + .07-.09 (.080); cornicles .33-.44 (.388), cauda .12-.13 (.121); hind tibiae .47-.55 (.501), hind ta-2 .07-.08 (.077), and rostrum IV+V .11-.12 (.119). Length of dorsal head setae: mf .0176-.0330 (.0269), lf .0198-.0308 (.0248),

df-1 .0286-.0374 (.0333), df-2 .0220-.0352 (.0291), ipf .0242-.0374 (.0293), and opf .0242-.0330 (.0266). Proportions of a.s.VIu/VIb .88-1.29 (1.07); co/ca 2.75-3.50 (3.15); rostrum IV+V/hind ta-2 1.38-1.71 (1.55).

Apterous Viviparous Female (exule): Body stoutly spindle-shaped; pale, with tips of legs and rostrum, areas around primary sensoria brown, distal club of cornicles dusky or very light brown. Tergum conspicuously reticulate, sculpturing sometimes obscuring setae; with pleural and submarginal rows of pale brown, granular intersegmental patches. Head with rather flat frontal margin, mesofrontal projection extending to about level of poorly developed laterofrontal tubercles; mf 1p, lf 1p, vlf 1p, df 4p with 1 or a pair occasionally added or missing, vf 3-5 (usually 4)p, pc 2p, ac 4 arranged 1-2-1, md 1-4 (usually 2 or 3) on each side; dorsal setae flaring distally into funnel- or fan-shaped structures, with rounded margins, short-stemmed or subsessile; ventral setae, except some of ac's, similarly but less expanded than those of dorsum. Antennal segment I conspicuously produced on inner distal margin, with 4-6 blunt or slightly knobbed setae in addition to pointed one

on basal dorsal surface. A.s.II with $1-\overset{1}{-}-1$ similarly blunt or knobbed setae. A.s.III and IV separate; IV and V subequal, about $\frac{3}{4}$ a.s.III in length; unguis 2 to $2\frac{3}{4}$ times ($2.39 \pm .17$, $n = 12$) as long as base of a.s.VI.

Prothorax with usual 8 setae arranged in 2 rows of 4. Discal (mesothoracic to abdominal segment 5) body chaetotaxy with general formula 2-2-1-2 but bases of pleural duplicates tend to spread out and may appear to form fifth longitudinal row, submarginals may be partly duplicated or 1 absent from any segment, fifth abdominal marginals always single. Abdominal segment 6 with duplicated spinals and 2 or 3 more setae on each side; abd.s. 7 and 8 also with 2-4 setae on each side of duplicated spinals, setae decreasing in size laterally. Cauda oblong, tapering only slightly, apex rounded; spiculate, with 2 lateral pairs and 1 posterodorsal setae. Cornicles clavate on distal $\frac{1}{2}$, club narrowed slightly at extreme end; faintly wrinkled on cylindrical base, smooth on clavate portion; concolorous with body but club slightly dusky; averaging 4 times caudal length. Rostrum IV+V rostrate, with rela-

tively long (about $\frac{1}{5}$ total length of segment), sharply pointed apical portion; with 1 basal, 1 dorsal and 3 lateral pairs of setae, setae rather long, subequal; ml and pl pairs approximate at bases; about $1\frac{1}{3}$ times as long as hind tarsal segment 2.

Measurements (in mm) of 10 specimens on *Ambrosia*: BL 1.25-1.50 (.140), We .34-.39 (.373); a.s.III .15-.19 (.172), a.s.IV .11-.14 (.122), a.s.V .11-.14 (.129), a.s.VI .07-.08 (.075) + .15-.20 (.175); cornicles .57-.65 (.621), cauda .15-.17 (.161); hind tibiae .66-.75 (.713), hind ta-2 (.087), and rostrum IV+V .11-.12 (.119). Length of dorsal head setae: mf .0198-.0286 (.0249), lf .0220-.0264 (.0241), df-1 .0220-.0286 (.0264), df-2 .0242-.0308 (.0259), ipf .0220-.0264 (.0239), and opf .0176-.0264 (.0231). Proportions of a.s.III:IV:V, 1: .65-.81 (.72): .65-.88 (.76); VIu/VIb 2.00-2.86 (2.39); co/ca 3.65-4.33 (3.94); rostrum IV+V/hind ta-2 1.22-1.50 (1.37).

Alate Viviparous Female (fundatrigenia): Head, mesothorax, and tarsi brown; antennae from near bases of a.s.III, tips of tibiae, rostrum, distal $\frac{1}{3}$ of cornicles darker than their bases; wing veins and cauda dusky or pale brown; central abdominal sclerite not well defined in remounted paratypes. Head and basal antennal chaetotaxy similar to apterous exules but setae merely globose at apices and shorter; a.s.III and IV separate, IV and V subequal and about $\frac{3}{4}$ length of a.s.III; unguis averaging $2\frac{3}{4}$ times as long as base of a.s.VI; sensoria on a.s.III 21-31 (24.2), on a.s.IV 5-14 (9.0) and on a.s.V 0-6 (.50).

Anterior abdominal segments with 4 pairs of setae rows, pleurals not duplicated, setal formula 2-1-1-2 for second to fourth and 2-1-1-1 for segments 1 and 5; sixth abdominal spinals also duplicate, 2 or 3 more setae present on each side; segments 7 and 8 with setal bases close together but rows distinct, a median row sometimes present on segment 8; abdominal setae shaped much like those of head. Cauda, cornicles and rostrum IV+V as in apterous exule except for relative sizes.

Measurements (in mm) of 10 paratypes on *Shepherdia argentea*: BL 1.47-1.74 (1.62), We .32-.39 (.354); a.s.III .23-.30 (.272), a.s.IV .16-.24 (.205), a.s.V .17-.24 (.216), a.s.VI .08-.11 (.097) + .23-.29 (.263); cornicles .37-.43 (.406), cauda .12-.14 (.129); hind tibiae .69-.86 (.808), hind ta-2 .08-.10 (.086), rostrum IV+V .11-.12 (.117), mf setae .0176-.0264 (.0223), lf .0132-.0220 (.0184), and df-1 .0198-.0330

(.0261). Proportions of a.s.III:IV:V, 1: .59-.92 (.75): .67-.88 (.79); VIu/VIb 2.40-3.38 (2.72); co/ca 2.93-3.50 (3.18); rostrum IV+V/hind ta-2 1.20-1.50.

Alate Viviparous Female (exule): Like alate fundatrigenia but setae more widely expanded.

Measurements (in mm) of 3 specimens on *Ambrosia psilostachya*: BL 1.49-1.53 (1.51), We .33-.35 (.34); a.s.III .24-.30 (.263), a.s.IV .14-.17 (.16), a.s.V .15-.16 (.154), a.s.VI .07-.08 (.076) + .20-.30 (.24); cornicles .40-.54 (.46), cauda .13-.14 (.133); hind tibiae .74-.90 (.82), hind ta-2 .07-.09 (.08), rostrum IV+V .10-.11 (.107); mf .0154-.0286 (.0211), lf .0132-.0198 (.0146), df-1 .0220-.0286 (.0258). Proportions of a.s.III:IV:V, 1: .56-.72 (.59): .53-.67 (.59); VIu/VIb 2.50-4.29 (3.08); co/ca 3.08-3.86 (3.47); rostrum IV+V/hind ta-2 1.11-1.22 (1.18). Number of sensoria on a.s.III 18-23 (20), on a.s.IV 6-8 (7.5), and on a.s.V none.

Oviparous Female: Not seen. See notes under *Capitophorus xanthii*.

Alate Male: Also like alate fundatrigenia, differing only as follows: dorsal head setae smaller, merely blunt, all ventral setae but vlf pointed; spinopleural sclerites of abdominal segments 3 to 5 not fused as central sclerite; more sensoria present on a.s.III-V. Genitalia as shown in Figure 72; aedeagus triangular, tip pointed.

Measurements (in mm) of 1 specimen from Colorado: BL 1.39, We .35; a.s.III .37 and .33, a.s.IV .23 and .21, a.s.V both .23, a.s.VI .08+.27 and .07+.25; cornicles both .21; cauda .11, hind tibiae .78 (one side only), hind ta-2 .08, rostrum IV+V .11; df-1 .0198. Number of sensoria 27 and 26 on a.s.III, 15 and 14 on a.s.IV and both 9 on a.s.V.

Hosts.—Winter host: *Shepherdia argentea*. Gillette and Palmer (1934) and Palmer (1952) also list *Elaeagnus angustifolia* as a winter host but an oviparous female on this host from their collection is doubtfully *C. shepherdiae*. Its more probable identity with *C. xanthii* is noted under this species.

Summer host: *Ambrosia* spp. (e.g., *A. psilostachya*) are probable summer hosts for this species.

DISTRIBUTION.—*C. shepherdiae* has been recorded only from Colorado and Utah. It is newly recorded from California.

SPECIMENS EXAMINED.—CALIFORNIA: La Brea Pits, Los Angeles, 12 apt.v.f., 12-V-1935, D.P. Leonard, on ragweed (EOE coll.); Pico, 3 apt.v.f. and 4 al.v.f., 27-V-1941, RCD, on *Ambrosia psilostachya* (RCD coll.). COLORADO: Fort Collins, on *Shepherdia*

argentea: 13 apt.v.f. and 9 al.v.f., 19-VI-1915, LCB (EOE coll.); 19 al.v.f., 19-VI-1915, LCB (*Paratypes*, K.U.), and 22 apt.v.f. and 7 al.v.f., 12-V-1915 (U.Me.); Palisade, 1 al.m., 10-12-1953, on aphid trap (CSU); and Salida, 1 apt.v.f., 9-3-1922, C.P.G., on *Hippophae* (?).

NOTES.—It is with some reluctance that the forms on *Ambrosia* are placed under *Capitophorus shepherdiae* because of the complete absence of associative host data and other biological information. However, morphological similarity especially in body chaetotaxy, length of antennae, along with proportions of segments and number of sensoria, cornicular, caudal, and rostral characters, is convincing evidence of conspecificity with *Capitophorus shepherdiae*.

Capitophorus xanthii (Oestlund)

FIGURES 47-48, 52-59

Siphocoryne xanthii Oestlund, 1886:36 [neotype: apt.v.f., Hennepin Co., Minnesota, 10-IX-1898, Coll. 158/98, Acc. 3537, OWO, on *Xanthium*; in OWO coll.].—Oestlund, 1887:71.—Williams, 1891:9.—Gillette and Baker, 1895:123.—Hunter, 1901:106.—Sanborn, 1906:274.—Wilson and Vickerey, 1918:180.

Capitophorus xanthii (Oestlund).—Oestlund, 1922:139.—Knowlton, 1927:238.—Gillette and Palmer, 1934:158-159.—Knowlton and Smith, 1937:152.—Patch, 1938:183, 246.—Palmer, 1952:273.—Knowlton, 1954:9.—Börner and Heinze, 1957:208.—Robinson and Bradley, 1965:41; 1968:61.

DIAGNOSIS.—This species can best be recognized by its anterior abdominal chaetotaxy of 2-1-1-2, short antennae, clavate cornicles, absence of posterodorsal caudal setae, and the large, widely expanded body setae. Its difference from *C. shepherdiae* have been mentioned under that species.

DESCRIPTION.—*Apterous Viviparous Female*: Color in life pale greenish, with dorsal markings of darker green (Oestlund, 1886:36). Body stoutly spindle-shaped; cleared specimen pale, with tips of rostrum, legs, cornicles, and areas around primary sensoria brown; tergum rather pronouncedly sculptured. Head with slightly developed latero-frontal projections, mesofrontal tubercle prominent; mf 1p, lf 1p, vlf 1p, df 4p, vf 3-6 (usually 3p), pc 2p, ac 4 arranged 1-2-1, and md 1 or 2 on each side; dorsal setae stoutly bulbous, subsessile, borne on large tubercles, subequal in length; vf setae also capitate but thinner and shorter, pc, ac, and md

elongate, mostly pointed. Antennal segment I conspicuously produced mesodistally, with 5-8 knobbed setae in addition to basal pointed one on dorsum.

A.s.II with 1 — 1 setae, similarly knobbed but smaller than those of preceding segment. A.s.IV and V subequal, about $\frac{2}{3}$ length of a.s.III; unguis 3 to $4\frac{1}{2}$ times ($m = 3.62 \pm .15$, $n = 27$) as long as base of a.s.VI.

Arrangement of thoracic and body setae shown in Figure 47; prothorax with usual number of 8, arranged in 2 rows of 4; meso- and metathorax 2-1-2 (sp-p-m); first and fifth abdominal segment 2-1-1-1 (sp-p-sm-m); second to fourth abd.s. 2-1-1-2; abd.s. 6 and 7 also with 3 pairs of setal rows, spinals duplicate, other rows single; eighth segment with a pair of duplicate spinals, median one occasionally present, 1-4 others decreasing in size laterally. Cauda tapering, sometimes with slight distal constriction before acute tip; spiculate; with 2 lateral pairs, usually without posterodorsal seta (absent in 92 of 100 specimens seen). Cornicles clavate on distal $\frac{1}{3}$, extreme apex narrowed slightly; faintly wrinkled on cylindrical base; concolorous with body, tip pale brown or dusky; $3\frac{1}{4}$ to $4\frac{1}{2}$ times as long as cauda. Rostrum IV+V rostrate, with relatively long (about $\frac{1}{4}$ entire length of segment) sharply pointed apex; 1 basal, 1 dorsal, and 3 lateral pairs of setae present, ml distinctly removed from pl and lateral pairs subequal in length; slightly longer than second joint of hind tarsi.

Measurements (in mm) of neotype and 14 neoparatypes: BL 1.40-1.94 (1.78), We .37-.44 (.402); a.s.III .21-.29 (.239), a.s.IV .15-.20 (.166), a.s.V .15-.20 (1.69), a.s.VI .07-.09 (.081) + .25-.35 (.291); cornicles .58-.75 (.703), cauda .15-.21 (.182); hind tibiae .80-1.00 (.895), hind ta-2 .09-.10 (.098), rostrum IV+V .10-.12 (.115). Length of dorsal head setae: mf .0198-.0396 (.0291), lf .0220-.0308 (.0257), df-1 .0264-.0374 (.0329), df-2 .0242-.0352 (.0290), ipf .0220-.0308 (.0255), and opf .0176-.0308 (.0254). Proportions of a.s.III:IV:V, 1: .55-.82 (.69): .63-.81 (.71); VIu/VIb 3.00-4.29 (3.62); co/ca 3.22-4.41 (3.89); rostrum IV+V/hind ta-2 1.10-1.22 (1.18).

Alate Viviparous Female: In life, yellowish green, with transverse dark green markings on abdomen (Oestlund, 1886:36). Cleared specimen with dark brown head, thorax, abdominal sclerites, tips of

tibiae, entire tarsi, and antennae from near bases of a.s.III; anterior wing margin, wing veins, and distal $\frac{1}{2}$ of cornicles dusky. Head and basal 2 antennal segments similar in chaetotaxy to those of aptera but setae relatively shorter, merely rod-shaped; all ventral setae but *vf* and *vlf* pointed. Sensoria distributed as follows: a.s.III 19–35 (28.26 ± 2.14 , $n = 19$); a.s.IV 9–17 (13.74 ± 1.18 , $n = 19$); a.s.V 1–6 ($3.47 \pm .65$, $n = 19$). Abdomen with well-defined, rectangular central sclerite, spinopleural sclerites on segments anterior and posterior to central sclerite and marginals less developed; setal pattern as in aptera. Cauda tapering to acute point, may be constricted distally, pinching off a small terminal knob (Figure 58); 2 lateral pairs of setae present, posterodorsal seta absent. Rostrum IV+V as in aptera, averaging $1\frac{1}{4}$ times length of hind tarsal segment 2.

Measurements (in mm) of 10 neoparatypes: BL 1.45–1.90 (.172), We .36–.41 (.390); a.s.III .23–.32 (.283), a.s.IV .15–.23 (.188), a.s.V .16–.20 (.178), a.s.VI .07–.10 (.086) + .27–.36 (.328); cornicles .41–.50 (.461), cauda .11–.16 (.136); hind tibiae .82–.99 (.93), hind ta-2 .08–.10 (.092), and rostrum IV+V .11–.12 (.113). Proportions of a.s.III:IV:V, 1: .59–.82 (.67): .57–.70 (.63); VIu/VIb 3.33–4.38 (3.87); co/ca 2.93–3.85 (3.42); rostrum IV+V/hind ta-2 1.10–1.50 (1.23).

Oviparous Female: Unknown? See notes below.

Alate Male: Similar to alate viviparous female except as follows: sensoria on a.s.III–V more numerous; cauda shorter, triangular, without a distal constriction, portion beyond last lateral pair of setae much shorter. Aedeagus oblong, with angular tip.

Measurements (in mm) of 3 specimens: BL 1.50–1.60 (1.55), We .38–.40 (.393); a.s.III .28–.32 (.303), a.s.IV .18–.20 (.195), a.s.V .18, a.s. VI .08–.09 (.085) + .20–.23 (.215); cornicles .35–.38 (.366), cauda .10–.11 (.107); hind tibiae .82–.84 (.83), hind ta-2 .09, and rostrum IV+V .11. Proportions of a.s.III:IV:V, 1: .58–.71 (.65): .56–.64 (.59); VIu/VIb 2.50–2.56 (2.53); co/ca 3.18–3.80 (3.58); rostrum IV+V/hind ta-2 1.22. Number of sensoria on a.s. III 32–36 (33.8), on a.s.IV 16–24 (18.5), and on a.s.V 4–9 (6.8).

Hosts.—Winter hosts: *Elaeagnus angustifolia*, *Hippophae rhamnoides* (Gillette and Palmer, 1934; Palmer, 1952).

Summer hosts: various species of *Xanthium*:

X. strumarium var. *canadense*, *X. echinatum*, *X. pennsylvanicum*, and *X. strumarium*.

DISTRIBUTION.—Aside from type-locality (Minnesota) records exist for the states of Colorado, Idaho, Iowa, Kansas, Nevada and Utah, and Manitoba in Canada.

TYPES.—The material on which Oestlund based his original description of *C. xanthii* in 1886 no longer exists in his collection at the University of Minnesota. Its occurrence elsewhere is doubtful and no references to this possibility have ever been published; however, there is abundant material collected and determined by him at later dates. Comparisons of these later collections with his original description are in perfect agreement, and their conformity with his concept of this species is quite obvious. A neotype and neoparatypes are, therefore, selected from among these available specimens.

NEOTYPE.—Apt.v.f., with data indicated above.

NEOPARATYPES.—33 apt.v.f., 8 al.v.f., with same data as neotype; 5 apt.v.f. and 4 al.v.f., Minneapolis, Minnesota, 15–X–1890, on *Xanthium*; 20 apt.v.f. and 1 al.v.f., Excelsior, Minnesota 17–VIII–1910, coll. 70/'10, Acc. 4259, on *X. canadense*; 11 apt.v.f., Minneapolis, Minnesota, 14–VII–1912, Coll. 38/'12, on *Xanthium*; 5 apt.v.f. and 10 al.v.f., Minneapolis, Minnesota, 10–IX–1921, Coll. 82/'12, on *Xanthium*; and 1 apt.v.f. and 2 al.v.f., Minneapolis, Minnesota, Coll. 103/'21, on *Xanthium*. All neoparatypes collected by O.W. Oestlund and in his collection at the University of Minnesota.

SPECIMENS EXAMINED.—Aside from types: CANADA: Manitoba: La Salle, 1 apt.v.f. on 29–VI–1963, and Winnipeg, 1 al.v.f. on 12–X–1963, both collected by AGR, on *X. strumarium*. KANSAS: Manhattan, 3 al.v.f., 23–IX–1950, J.B. Kring, on the wing (KSU); Riley Co., 2 apt.v.f. and 5 al.v.f., 3–X–1949, J.B. Kring, on *X. pennsylvanicum* (KSU). MINNESOTA (also OWO slides): apterous and alatoid nymphs associated with types; Crookston, 17–VII–1897, 222/'97, Acc. 3386, on *Xanthium*; Minneapolis, 6 apt.v.f. on 8–IX–1903 (51/'03), 1 apt.v.f. and several ny. on 12–IX–1918 (83/'18), and 2 apt.v.f., 3 al.v.f., 3 al.m., and 4 altd.ny. on 1–X–1921 (129/'21), all on *Xanthium*; Ramsey Co., 19 apt.v.f. and many ny., 12–X–1907, 95/'07, on *X. canadense*. UTAH (all collected by GFK); Bear River City, 7 apt.v.f., 3 al.v.f., and 3 ny., 11–IX–1926, on *X. echinatum* (EOE coll.); Howell, 1 apt.v.f., 16–

VIII-1925, on *X. canadense* (EOE coll.); Lewiston, 13 al. v.f., 15-IX-1926, on *X. echinatum* (GFK coll.); Tremonton, 5 apt.v.f. and 8 apt.ny., 28-VIII-1926, on *X. echinatum* (EOE coll.); and Washington, 4 apt.v.f. and 5 al.v.f., 9-VIII-1936, on Cocklebur (GFK coll.).

NOTES.—An oviparous female (Figure 50, Fort Collins, Colorado, 21-IX-1909, LCB, on Russian olive) was determined as *C. shepherdiae* Gillette and Bragg ("metatype") but chaetotaxy and proportion of unguis to base of a.s.VI places it closer to *C. xanthii* than this species. The presence, however, of 5 posterodorsal setae on the cauda makes its identity somewhat dubious. In Gillette and Bragg's (1916:446-447) original description of *C. shepherdiae*, the oviparous female was recorded only on *Shepherdia argentea* but Gillette and Palmer (1934:157) and Palmer (1952:270, 418) added *Elaeagnus angustifolia* as a host. The ovipara of *C. xanthii* was unknown to Oestlund, and indeed, none of his collections (1890-1921) includes this morph. The biology of this species remains to be differentiated from that of *C. shepherdiae*.

Description of this oviparous female (Figure 50): body stoutly oval, 1.77 mm long, .35 mm wide across eyes; body pale with tips of rostrum, legs and cornicles, areas around primary sensoria, cauda and anal plate brown; disk of tergum smooth. Head with poorly developed laterofrontal tubercles, anterior margin broadly convex on mesofrontal area; number of setae as in other *Capitophorus* species, but ac setae only 2, arranged 0-2-0; dorsal setae stoutly globose, subequal in length (mf .0154 and .0220, lf .0220 and .0242, df-1 .0330, df-2 .0242, ipf .0198, and opf .0198 and .0220 mm); ventral setae with vf and vlf expanded but thinner than dorsal setae, pc, ac, and md pointed. Antennal segment I with moderately produced mesodistal margins, with 5 small capitate hairs in addition to

0

basal pointed one on dorsum. A.s.II with 1 — — 1

1

setae. A.s.III .17, a.s.IV .13, a.s.V .12 and .13, a.s.VI .07 + .21 (only one side complete) mm.

Thoracic and abdominal chaetotaxy as in *Capitophorus xanthii*. Cauda .17 mm long; tapering to acute but rounded point, without constriction; spiculate; with 2 lateral pairs and 5 small posterodorsal setae. Anal plate extended to about $\frac{3}{5}$ length of cauda, angular posteriorly. Gonopophyses nor-

mal, with 4 setae on each lateral lobe and 6 on median one. Subgenital plate with numerous setae, without pattern. Cornicles strongly clavate on distal $\frac{1}{2}$, club tapering slightly on extreme apex; faintly imbricate, clavate portion smooth; .48 and .50 mm long. Hind tibiae .63 mm in length; thickened on basal $\frac{2}{3}$, bearing numerous pseudosensoria on enlarged portion. First tarsal joints bearing 3,3,3 setae; second joint of hind tarsi .09 mm long. Rostrum IV+V much like that of *C. xanthii*; .11 mm long.

Genus *Pleotrichophorus* Börner

Capitophorus, subgenus *Pleotrichophorus* Börner, 1930:138 [type-species: *Aphis glandulosa* Kalténbach (1846), by original designation].

Pleotrichophorus Börner.—Hille Ris Lambers, 1933:173; 1947a:296-297; 1953:114-119; 1966:604; 1969:165-169.—Remaudière, 1952:262.—Bodenheimer and Swirski, 1957:201.—Börner and Heinze, 1957:243.—Eastop, 1958:61; 1966:471.—Müller and Scholl, 1958:398-399.—Heie, 1962:219.—Shaposhnikov, 1964:790.—Stroyan, 1964a:79.—Tuatay and Remaudière, 1964:267.—Holman, 1965:281-282.—Paik, 1965:58.—Pepper, 1965:218.—Robinson and Bradley, 1965:41, 44; 1968:64.—Achremowicz, 1967:291.—Huculak, 1967:244.—Leclant, 1968:369.

HISTORY.—The history of *Pleotrichophorus* is relatively simple. The oldest known member, *glandulosus*, was originally described as an *Aphis* in 1846 by Kalténbach, and was later transferred to *Myzus* by Van der Goot in 1915. Other species were described earlier under *Myzus* (viz., *filaginis* Schouteden, 1906b, and *pilosus* Van der Goot, 1912) and subsequently, under *Capitophorus* after its erection in 1913 by Van der Goot. Most of the North American species were described between 1927 and 1938 under *Capitophorus*. A few species, *longipes* Gillette and Palmer, *packi* Knowlton and *sporadicus* Knowlton, were originally placed under *Macrosiphum* but were eventually transferred to *Capitophorus* (Palmer, 1952).

Pleotrichophorus was erected originally as a subgenus of *Capitophorus* by Börner (1930) who designated as its type-species, *glandulosus* Kalténbach. His basis of separation was the number of pronotal hairs, 6 (later corrected to 8 by Hille Ris Lambers, 1953:114) in *Capitophorus*, and many more in *Pleotrichophorus*. It was elevated to generic rank by Hille Ris Lambers in 1933, and in his monograph series (1947a and 1953) he pointed out

additional differences such as the absence of a central sclerite on the abdomen of female alatae, the presence of sensoria on the third antennal segment of the apterae, and the shape and chaetotaxy of the last rostral segment. He included in it, aside from *glandulosus* Kaltentbach, 3 other European species (*duponti* Hille Ris Lambers, *filaginis* Schouteden and *persimilis* Börner), 1 Asian species (*formosanus* Takahashi), and the widely distributed *chrysanthemii* Theobald. He also transferred to it some of the North American species, mostly having *Artemisia* as hosts. However, most of these species continued to be referred to as *Capitophorus* in occasional faunal listings of aphids in North America. It was not until the mid-1960s that the name *Pleotrichophorus* was adopted here, with the discovery of several new species.

DIAGNOSIS.—A large variable group, *Pleotrichophorus* species can easily be recognized from other Myzine aphids by the presence of many, usually expanded and funnel- to fan-shaped setae on the dorsal surface of head and body; the presence of usually 1 or 2 sensoria on the third antennal segment; by usually cylindrical cornicles; and by the presence of an anterodorsal pair of setae on the last rostral segment.

DESCRIPTION.—*Apterous Viviparous Female:* Small to large aphids, smallest about .90 (e.g., *P. heterohirsutus*), largest up to 3.30 (*P. packi*) and mean size between 1.00 and 2.70 mm long. Body spindle- or oval-shaped, usually green or yellowish green, appearing frosted due to numerous capitate hairs. Head with laterofrontal tubercles relatively well developed but diverging, mesofrontal tubercle projecting less conspicuously. Number of head setae quite variable especially df's which may range from 8 (4 pairs) to 81 (40 or 41 pairs) (see Table 1); mf usually 1p; lf 2-4p; vlf 1p; vf 3-5p but may be as many as 16p; pc 2p and ac 4-6; and md 3-5p. Dorsal head setae of various shapes and sizes, in most species expanded in various degrees into funnel-, cone-, or fan-shaped structures; sessile or borne on a cylindrical shaft of varying degrees of distinctness; setae may also be basally inflated and tapering apically, or else elongate and simply blunt or pointed; setae sometimes uniformly shaped but more often the anterior (mf, lf and df-1) longer, more slender and more distinctly petiolate than the posterior ones, and in extreme and rarer cases, distinct di- or polymorphism may occur. Ventral

setae with vf, vlf and pc generally widely expanded and similar to dorsal setae, ac and md often elongate, slightly knobbed or pointed. Antennae 6-segmented, smooth to densely imbricate; a.s.I produced mesodistally, with few to many and variably shaped hairs in addition to constantly present pointed one on basal dorsal surface; a.s.II with

normally $1 - \frac{1}{2} - 1$ setae, a few species with

$1 - \frac{1}{1} - 1$, early spring forms (fundatrices)

$1 - \frac{0}{2} - 1$; a.s.III bearing usually 1 or 2 sensoria

but may be up to 15 or even rarely absent; a.s.III hairs small, rod-shaped or slightly knobbed in most species but long (longer than basal diameter of segment) and pointed or blunt in a few; a.s.IV and V normally without sensoria, usually shorter than a.s.III; ratio of unguis to the base of a.s.VI variable, generally smaller in fundatrices than in summer forms.

Tergum membranous to faintly sclerotic; surface plain but sometimes produced into papillae around bases of spinal and pleural setae; smooth to finely striate or reticulate on disk, usually armed with spicules on tapered segments; sparsely to densely covered with hairs similar to those of head in size and shape. Cauda elongate or triangular, with or without basal constriction, apex pointed to broadly rounded; always densely spiculate; with 2 lateral pairs of setae commonly present but may be as many as 8 pairs, usually 1 or less frequently up to 10 setae present on posterodorsal surface, caudal setae usually pointed but a few species with posterodorsal ones flattened or expanded like body hairs. Cornicles from .70 to 1.44 mm, averaging from $\frac{1}{3}$ to $3\frac{1}{3}$ times caudal length (Table 1); cylindrical in all species but *P. lagacei*; faintly to densely imbricate, sometimes also wrinkled, and often armed with blunt or pointed teeth; entirely hairless but a few basal hairs present in *P. longipes*; pale like the body with dusky or light brown apices, entirely dark, or else distal $\frac{1}{4}$ to $\frac{3}{4}$ distinctly darker than base. Legs with 3, 3, 3 hairs on first tarsal joints.

Rostrum IV+V as short as .08 to as long as .23 mm, most species averaging between .10 and .14 mm; ratio to second hind tarsal segment ranging from about $\frac{1}{2}$ to 2 times but usually subequal

(Table 1); of various shapes (Figures 122–164); tapering in varying degrees; sides straight or slightly convex; apical portion past pl setae may be only slightly produced so segments end bluntly or produced to as much as $\frac{1}{2}$ its entire length, this distal portion commonly extended as continuous tapering structure from basal angles or as thin cylindrical, needle-like structure that may be slightly constricted from anterior portion. Rostral chaetotaxy rather constant, consisting of tiny basal pair on ventral surface, 2 dorsal and 3 lateral pairs; ml and pl setae usually arising distinctly apart and distinctly much shorter ($\frac{1}{4}$ to $\frac{1}{2}$) than al pair, but in *P. lagacei* ml and pl approximate at bases; in some species ml and pl subequal to al in length, or again, in *P. lagacei*, pf distinctly longest of lateral setae.

Alate Viviparous Female: Head and prothorax faintly to distinctly sclerotic, mesothorax always darker, sclerotic, abdomen basically membranous with dusky or pale brown pleural, marginal, and sometimes also spinal thickenings; antennae and legs light to dark brown, usually much darker than in apterae, apical segments similarly darker than basal ones; cornicles, cauda, anal, and subgenital plates colored as in apterae. Head with usually fewer, shorter, less expanded hairs. Antennae bearing more sensoria on segment III, like apterae, normally absent from segments IV and V. Abdomen often with 2 transverse, intersegmental, pleural bars on discal segments but these may be broken into 2 pairs of rounded ones in some segments; 2 smaller pleural sclerites often present also on segments 6 and 7 and 2 spinal dashes on discal segments; mar-

ginal segmental thickenings usually developed. Abdominal setae similarly sparser and more slender than in apterae. Cauda, cornicles, and rostrum IV+V generally resembling those of apterae except for relative sizes.

Sexuales: Oviparous females similar to apterous viviparae in most respects but setae often sparser, longer, and thinner; cauda generally shorter and thicker but cornicles also smaller so co/ca ratios do not vary much from viviparae; subgenital plate with more setae, all pointed; basal $\frac{1}{3}$ to $\frac{1}{2}$ of hind tibiae always swollen, bearing numerous pseudosensoria.

Males: Alate or apterous, the first apparently more common than latter. Resembles alate or apterous viviparous female, respectively, except as follows: spinal and pleural sclerites more developed and often contiguous; appendages darker; head and body setae less expanded and sparser; more sensoria on third, also present on fourth and fifth antennal segments; cornicles and cauda shorter; cauda triangular, often not much produced beyond posterior lateral pair of setae.

BIOLOGY.—Not much is known of the biologies of this group of aphids. The first two generations are said to be generally apterous, the third developing a number of alatae; alatae are generally rare in later generations (Hille Ris Lambers, 1953). Sexuales begin to appear in late September and eggs are deposited on the underside of leaves. In New Jersey, Leonard (1964:84) noted oviparous females and males of *P. glandulosus* to be numerous in November, and found a few small shining black eggs at the same time.

Key to the Nearctic Species of *Pleotrichophorus*

APTEROUS VIVIPAROUS FEMALES

1. Cornicles distinctly clavate; pl setae longest of lateral setae of last rostral segment; on *Haplopappus* *P. lagacei* Hille Ris Lambers
Cornicles cylindrical with apices sometimes thickened but not as much as $\frac{1}{3}$ its basal diameter; al setae distinctly longer than or subequal to ml and pl setae 2
2. Setae al of rostrum IV+V equal to or not noticeably longer than ml and pl setae; on *Chrysothamnus* 3
Setae al at least twice as long as ml and pl setae 8
3. Rostrum IV+V tapering only slightly, so segment appears parallel-sided and very bluntly pointed (Figures 122–125) 4
Rostrum IV+V distinctly tapered 7
4. Cornicles at least $1\frac{1}{4}$ length of cauda, concolorous with body, only extreme apices brown or dusky *P. pycnorhysus* (Knowlton and Smith)
Cornicles not more than $1\frac{1}{2}$ times as long as cauda, dark brown near bases 5

5. Dorsal head and body setae minute (i.e., less than .0110 mm); venter of antennal segment I bearing numerous minute hairs in double or triple rows along outer and distal margins *P. magnautensis* (Knowlton and Smith)
Dorsal head and body setae obvious; hairs on antennal segment I may be many and conspicuous, at most 15 in number 6
6. Dorsal setae elongate with slightly thickened apices; posterodorsal caudal setae pointed *P. acanthovillus* (Knowlton and Smith)
Dorsal setae short, widely expanded, fan-shaped; posterodorsal caudal seta (e) flattened *P. utensis* (Pack and Knowlton)
7. Cornicles and antennal segment III entirely pale; head and body setae fan-shaped, with circular margins, without stems *P. elongatus* (Knowlton), new combination
Cornicles and antennal segment III almost entirely dark; head and body setae more or less funnel-shaped, anterior ones at least with short stems *P. stroudi* (Knowlton), new combination
8. Cornicles bearing 4 to 6 knobbed setae on basal portion; on *Artemisia tridentata* *P. longipes* (Gillette and Palmer)
Cornicles bare, without setae 9
9. Cornicles very short, not more than .15 mm long, at most $\frac{2}{3}$ length of cauda 10
Cornicles either very long (at least .80 mm) and/or at least $2\frac{1}{2}$ times as long as cauda 15
Cornicles neither noticeably long (less than .80 mm) nor short (more than .15 mm) and their ratio to cauda between $\frac{2}{3}$ to $2\frac{1}{2}$ 24
10. Legs, antennae, cornicles, and cauda brown; dorsal setae long, quite uniformly petiolate, apices widely expanded; rostrum IV+V entirely brown and sclerotic, distal $\frac{1}{3}$ produced as thin, cylindrical needle; on *Artemisia californica* *P. obscuratus* Hille Ris Lambers
Legs, antennae, cornicles and cauda, except extreme apices of segments, pale, concolorous with body 11
11. Rostrum IV+V short (.08 mm), not much longer than basal width, tapering abruptly to a sharp point (Figure 126); on *Agoseris* *P. triangulatus*, new species
Rostrum IV+V short (.09-.11 mm), but longer than basal width, tapering gradually to rather blunt apex, sides slightly convex; on *Achillea* 12
Rostrum IV+V as short as .09 or as long as .14 mm but sides straight, apex sharply pointed or produced as needle; on *Artemisia* or *Achillea* 13
12. Dorsal setae dense, all widely expanded, funnel- to fan-shaped, df setae mostly 28 or more; cornicles usually more than $\frac{1}{4}$ caudal length ($m = .80 \pm .03, n = 33$) *P. patonkusellus*, new species
Dorsal setae not noticeably dense, anterior head and posterior abdominal setae more slender, longer-stemmed than posterior df's and discal body setae; number of df's usually less than 26; co/ca ratio averaging less than $\frac{1}{2}$ ($m = .43 \pm .02, n = 60$) *P. pseudopatonkus*, new species
13. Rostrum IV+V $1\frac{2}{3}$, or more, length of hind tarsal joint 2; on *Artemisia tridentata* *P. infrequens* (Knowlton and Smith)
Rostrum IV+V subequal or not more than $1\frac{1}{2}$ times length of hind tarsal joint 2 14
14. Dorsal setae dense, mostly without distinct stems, df usually more than 20 pairs; rostrum IV+V at least .12 mm long, apical third needle-like; cauda long, thick, distinctly constricted near base; co/ca ratio about $\frac{1}{3}$ ($m = .35 \pm .012, n = 40$); on *Artemisia longifolia* and *A. vulgaris* *P. brevinectarius* (Gillette and Palmer)
Dorsal setae relatively sparse, uniformly petiolate, df setae normally less than 15 pairs; rostrum IV+V .09-.10 mm long, not distinctly needle-like on apical third; cauda short, slender, not distinctly constricted; co/ca ratio about $\frac{1}{2}$ ($m = .50 \pm .05, n = 5$); on *Artemisia filifolia* *P. filifoliae* (Palmer)
15. Cornicles almost entirely dark 16
Cornicles entirely pale or, at most, only apex dusky or pale brown 18
16. Cornicles very long, .86 mm or more; dorsal setae not noticeably dense, df setae averaging 9 pairs; rostrum IV+V bluntly acute, not needle-tipped; on *Chrysothamnus* *P. packi packi* (Knowlton)
Cornicles much shorter, .50 mm at most; body rather densely hairy, df setae 15 or more pairs; rostrum IV+V with apical $\frac{1}{3}$ to $\frac{1}{2}$ produced into thin cylindrical needle 17
17. Setae mf and lf elongate, with apex blunt or pointed, df's distinctly expanded; large individuals more than 1.60 mm long, with rostrum IV+V at least .17 mm *P. pullus* (Gillette and Palmer)

- Setae mf and lf distinctly expanded like dfs, never pointed, small individuals less than 1.60 mm, rostrum IV+V, at most, .16 mm long ... *P. rusticatus* (Knowlton and Smith)
18. Rostrum IV+V very long (more than .20 mm), slender (Figure 164), $1\frac{3}{4}$ to 2 times length of hind ta-2; antennal segment I with conspicuous, large, funnel-shaped hairs on meso-distal projection and ventral surface; on *Amsinckia* and *Eriogonum*
P. amsinckii Richards
 Rostrum IV+V at most .16 mm long, not more than $1\frac{1}{2}$ times as long as hind ta-2; on *Artemisia* spp. 19
19. Body setae rather sparse, df setae normally less than 30 20
 Body setae noticeably dense, df setae more than 30 21
20. Cornicles averaging .30 mm, at most $2\frac{1}{2}$ times ($m = 2.35 \pm .04$, $n = 10$) as long as cauda; ratio of rostrum IV+V to hind ta-2 about $1\frac{1}{2}$ ($m = 1.51 \pm .09$, $n = 8$); df setae 6 to 7 pairs; on *Antennaria plantaginifolia* *P. antennarius*, new species
 Cornicles relatively longer, averaging .50 mm, and 2.6-3.4 times as long as cauda; ratio of rostrum IV+V to hind ta-2 about $1\frac{1}{4}$ ($m = 1.23 \pm .23$, $n = 40$); df setae averaging 9 pairs; on various *Artemisia* spp. (*A. douglasiana*, *A. frigida*, *A. ludoviciana*, and *A. vulgaris*) *P. pseudoglandulosus* (Palmer)
21. Ratio of rostrum IV+V to hind ta-2 not more than $\frac{9}{10}$; anterior head setae (viz., mf, df-1, lf) sessile, widely expanded, fan-shaped; antennal segments I and II bearing barely blunt-tipped or slightly knobbed hairs
P. zoomontanus (Knowlton and Smith), new combination
 Rostrum IV+V equal to or up to $1\frac{1}{2}$ times length of hind ta-2; anterior head setae normally petiolate, expanded but not fan-shaped; setae on a.s.I and II funnel- to fan-shaped 22
22. Cornicular integument conspicuously imbricate, wrinkled, imbrications very sparsely armed with blunt teeth; co/ca averaging 3 times 23
 Cornicular integument imbricate but not conspicuously wrinkled, densely armed with large pointed teeth; co/ca ratio may be up to 3 but averaging $2\frac{2}{3}$ ($m = 2.62 \pm .05$, $n = 94$). On *Artemisia tridentata* and *A. californica* ... *P. decampus* (Knowlton and Smith)
23. Cornicles at least .60 mm long; cauda stout, oblong, broadly rounded at apex; df setae at least 25 pairs; on *Artemisia longifolia* *P. longinectarius* (Gillette and Palmer)
 Cornicles averaging .45 mm long, not exceeding .60 mm, cauda triangular, rather slender, apex acutely rounded; df setae not more than 20 pairs; on *Artemisia frigida*
P. intermedius, new species
24. Cornicles entirely dark on at least distal fourth of length 25
 Cornicles entirely pale or only extreme tips dusky or pale brown 32
25. Distal $\frac{1}{2}$ to $\frac{1}{2}$ of last rostral segment produced as thin, cylindrical needle (Figures 152-154); on *Artemisia* spp. 26
 Rostrum IV+V acutely tapered but not produced distally as needle (Figures 127-128, 135-136); on *Chrysothamnus* spp. 28
26. Cauda stoutly elongate, distinctly constricted on basal third, broadly rounded at apex
P. quadririchus (Knowlton and Smith) sensu lato
 Cauda rather slender, slightly, if at all, constricted, apex acutely rounded 27
27. Setae mf and lf never pointed, usually widely expanded; df setae funnel- to fan-shaped; smaller individuals normally less than 1.60 mm long, with rostrum IV+V .16 mm or shorter *P. rusticatus* (Knowlton and Smith)
 Setae mf and lf elongate, slender, apex pointed or blunt; df setae narrowly expanded apically; individuals normally larger than 1.60 mm, rostrum IV+V at least .17 mm long *P. pullus* (Gillette and Palmer)
28. Dorsal integument produced around bases of spinal and pleural setae; df setae at least 6 pairs; cauda with normally 3 or 4 pairs of lateral setae 29
 Dorsal integument plain without spinal and pleural projections or papillae; df setae normally less than 6 pairs, cauda bearing 5 to 8 hairs on each side 30
29. Rostrum IV+V short (less than .10 mm), at most $\frac{2}{3}$ length of hind ta-2 ($m = .62 \pm .03$, $n = 7$), stout, abruptly tapered into sharp point (Figure 127); anterior head setae widely expanded, fan-shaped, without distinct stems (Figure 186, right)
P. xerozoous (Knowlton and Smith), new combination
 Rostrum IV+V .10 mm or longer, $\frac{2}{3}$ to equal length of hind ta-2 ($m = .79 \pm .02$, $n = 100$), rather slender, tapering gradually into bluntly acute point (Figure 128); anterior head setae narrowly expanded, funnel-shaped, petiolate (Figure 186, left)
P. gregarius (Knowlton)

30. Anterior head setae distinctly thinner than widely expanded, funnel-shaped posterior df's; df setae about 7 pairs *P. packi brevis*, new subspecies
Anterior head setae not noticeably thinner than posterior df's, setae more or less uniform in shape; df setae 4 or 5 pairs 31
31. Dorsal head setae slender, elongate, with pointed or blunt apices; body setae a mixture of pointed, basally inflated, bell-shaped and fan-shaped setae ... *P. sporadicus* (Knowlton)
Dorsal head setae flattened or funnel-shaped; body setae uniformly, widely expanded
..... *P. neosporadicus*, new species
32. Rostrum IV+V very long, at least .17 mm and 1½ times as long as hind ta-2; co/ca ratio about ¾; on *Eriophyllum stachaeifolium* *P. longirostris* Hille Ris Lambers
Rostrum IV+V relatively shorter, never as long as .17 mm averaging less than 1½ length of hind ta-2 33
33. All dorsal setae long, thin, with merely knobbed or flattened apices (Figures 266-268, 274-277, 286-288); cornicles rather long, averaging .45 to .55 mm, co/ca averaging 1¼ to 2 34
Dorsal setae basically funnel- to fan-shaped with only anterior head and posterior abdominal setae slender and petiolate; cornicle length and co/ca ratio variable 36
34. Setae df normally less than 10 pairs 35
Setae df denser, many more than 10 pairs (total of 26 in apterous vivipara and mean of 26.67 ± 3.16, n = 6 for ovipara); body setae rather dense ... *P. knowltoni*, new species
35. Body setae with long, slender stems, widely flattened knobs: stem of mf seta about ¾ to ⅝ of its entire length and 22-33 μ in diameter; on *Chrysanthemum*
..... *P. chrysanthemi* (Theobald)
Body setae with relatively shorter (stem of mf about ⅔ to ¾ its length) thicker (diameter of mf 44 μ) stems, the knobs thick and bulbous; on *Artemisia vulgaris* and *Ambrosia* ...
..... *P. glandulosus* (Kaltenbach)
36. Cauda bearing 4 to 10 flattened or funnel-shaped hairs on posterodorsal surface; tergum slightly sclerotic, conspicuously rugulose or armed with large spicules throughout entire surface *P. oestlundii* (Knowlton)
Cauda bearing only simple hairs; tergum not noticeably thickened, spiculate only on frontal projections, sometimes also basal antennal segments and tapered abdominal segments 37
37. Cornicles rather short, averaging .15 to .30 mm, not more than .50 mm long; co/ca ratio not more than 1½ 38
Cornicles relatively longer, averaging more than .35 mm; co/ca ratio at least 1½ 47
38. Rostrum IV+V relatively thick, sides past pl setae slightly convex (Figures 145-146), not more than .11 mm long 39
Rostrum IV+V slender, tapering gradually to acute point with margins straight, or else apical ⅓ or more produced into a needle 40
39. Cauda thick with broadly rounded apex; cornicles shorter than .20 mm, mean co/ca ratio about ⅘ (m = .80 ± .03, n = 33); dorsal setae dense, with df's averaging between 16 to 19 pairs; rostrum IV+V ¾ to equal length of hind ta-2 (m = .85 ± .03, n = 43); on *Achillea* *P. patonkusellus*, new species
Cauda slender, acutely rounded or pointed at apex; cornicles .18-.33 mm long (m = .247, n = 100), subequally as long as cauda (mean co/ca ratio = .96 ± .02, n = 100); dorsal setae not conspicuously dense, df setae averaging 10 to 12 pairs, rostrum IV+V at most ¾ length of hind ta-2 (m = .67 ± .007, n = 74); on *Artemisia dracunculoides* (= *A. aromatica*) *P. parilis*, new species
40. Rostrum IV+V with distal ⅓ to ½ distinctly produced as cylindrical needle; on *Artemisia* spp. 41
Rostrum IV+V acutely pointed, apical portion not distinctly needle-like; on various hosts other than *Artemisia* 44
41. Laterofrontal tubercles hardly produced beyond level of mesofrontal one, frontal margin appearing broadly convex in middle; dorsal setae a mixture of pointed and expanded ones, lf, mf, and sometimes some of df's and posterior abdominal setae pointed; antennal segments I and II also with long pointed setae; cauda slender with usually acute apex ...
..... *P. heterohirsutus* (Gillette and Palmer)
Laterofrontal tubercles more conspicuously produced than mesofrontal one; dorsal setae never pointed even if some are long and slender; a.s.I and II setae may be long but blunt or knobbed; cauda rather thick, distinctly constricted, broadly rounded at apex ... 42

42. Rostrum IV+V not more than .11-.20 mm long, about $\frac{3}{4}$ length of cauda ($m = .74 \pm .03$, $n = 10$) *P. spatulavillus* (Knowlton and Smith)
 Rostrum IV+V at least .12 mm; cornicles more than $\frac{3}{4}$ and usually equal to or slightly longer than cauda 43
43. Anterior head setae distinctly longer, more slender than posterior df's; head, basal 2 antennal segments, cornicles and basal leg segments dusky or faintly sclerotic; small individuals, usually less than 1.50 mm long; on *Artemisia tridentata*
P. quadririchus pallidus, new subspecies
 Anterior head setae widely expanded like posterior df's, sometimes with slender stems; head and appendages entirely pale, membranous; larger individuals, averaging 1.80 mm long (1.41 to 2.18 mm, $n = 70$); on *Artemisia douglasiana* and *A. ludoviciana*
P. gnaphalodes (Palmer)
44. Sensoria on third antennal segment usually 2, not more than 3; anterior head setae broadly funnel- or fan-shaped, sessile like posterior df's; df setae averaging 13 pairs; on *Chrysothamnus* *P. wasatchii* (Knowlton)
 Sensoria on a.s.III usually 3 or 4, up to 7; anterior head setae petiolate, more narrowly expanded than posterior df's; df setae averaging less than 12 pairs; on *Achillea*, *Ambrosia*, *Franseria*, or *Helianthus* 45
45. Cornicles relatively short, less than .25 mm, $\frac{2}{3}$ to $\frac{3}{4}$ length of cauda; on *Achillea*
P. patonkus (Hottes and Frison)
 Cornicles much longer than .25 mm, at least $1\frac{1}{4}$ times as long as cauda 46
46. All dorsal head setae including posterior df's, and most of setae on posterior abdominal segments petiolate (Figures 334); on *Helianthus* *P. ohioensis* (Smith), new combination
 Dorsal head setae with only anterior ones petiolate, and few petiolates on posterior abdominal segments; on *Ambrosia* or *Franseria* *P. ambrosiae* Hille Ris Lambers
47. Rostrum IV+V with margins past pl setae slightly convex, apex bluntly acute (Figure 147) 48
 Rostrum IV+V tapering to sharply acute or even needle-like apex, margins rather straight from base 49
48. Dorsal head setae slender with long stems and short but widely expanded knobs; rostrum IV+V .11-.13 mm long, subequal to hind ta-2; cornicles .38-.39 mm long, its imbrications armed with denticles or spicules; on *Achillea* *P. hottesi* Hille Ris Lambers
 Dorsal head setae widely expanded, funnel- to fan-shaped, without distinct stems (Figure 332); rostrum IV+V not more than .11 mm long, averaging $\frac{3}{4}$ ($m = .78 \pm .02$, $n = 25$) length of hind ta-2; cornicles relatively longer (.41-.52 mm, $m = .471$, $n = 38$), densely imbricate, wrinkled, imbrications thickened and sparsely, if at all, armed with blunt spicules; on *Artemisia dracunculus* (= *A. aromatica*) *P. diutius*, new species
49. Rostrum IV+V with apical $\frac{1}{3}$ or more produced into needle 50
 Rostrum IV+V acutely pointed but not needle-like 51
50. Co/ca ratio not much more than $1\frac{1}{2}$ ($m = 1.17 \pm .03$, $n = 125$); cauda stoutly elongate, broadly rounded at apex; df setae averaging less than 15 pairs (mean total = $27.76 \pm .87$, $n = 71$); on *Artemisia douglasiana* and *A. ludoviciana* .. *P. gnaphalodes* (Palmer)
 Co/ca ratio 2 to 3, with mean of $2.62 \pm .05$ ($n = 94$); cauda slender, usually acutely rounded at apex; df setae averaging well above 15 pairs (mean total = 38.31 ± 1.60 , $n = 53$), body setae relatively dense; on *A. californica* and *A. tridentata*
P. decampus (Knowlton and Smith)
51. All dorsal setae widely expanded, fan-shaped and sessile; df setae more than 15 pairs, with mean total of 40 ± 2.00 ($n = 35$); cornicles 2 to 3 ($m = 2.60 \pm .06$, $n = 64$) length of cauda; on *Artemisia* spp. *P. zoomontanus* (Knowlton and Smith), new combination
 At least anterior head setae petiolate; df setae less than 15; and co/ca ratio up to 2, but averaging less 52
52. Cornicles .45-.68 mm long ($m = .579$, $n = 82$) about $1\frac{3}{4}$ times ($m = 1.72 \pm .03$, $n = 78$) length of cauda; df setae about 12 pairs (mean total = $23.74 \pm .09$, $n = 43$).
 On *Chrysothamnus* *P. palmerae* (Knowlton)
 Cornicles usually less than .50 mm (.31-.50, $m = .388$, $n = 64$) about $1\frac{1}{2}$ times ($1.44 \pm .03$, $n = 58$) as long as cauda; df setae about 9 or 10 pairs; on *Ambrosia* or *Franseria*
P. ambrosiae Hille Ris Lambers

TABLE 1.—Mean (M) of number (N) of *df* setae, *co/ca* ratio and rostrum *IV + V/hind ta-2* ratio, with values for 95 percent confidence interval (*C.I.*) about each mean, in apterous viviparous females of nearctic *Pleotrichophorus* species

Species of <i>Pleotrichophorus</i>	Number of <i>df</i> setae		<i>co/ca</i> ratio		Rostrum <i>IV + V/hind ta-2</i>	
	N	95% M ± C.I.	N	95% M ± C.I.	N	95% M ± C.I.
<i>acanthovillus</i>	4	8.00 ± 3.18	8	1.26 ± 0.03	7	0.76 ± 0.14
<i>ambrosiae</i>	31	18.77 ± 1.47	58	1.44 ± 0.03	60	0.85 ± 0.02
<i>amsinckii</i>	6	24.67 ± 3.02	11	3.04 ± 0.13	14	1.85 ± 0.06
<i>antennarius</i>	6	12.83 ± 1.03	10	2.35 ± 0.04	8	1.51 ± 0.09
<i>brevinectarius</i>	21	46.71 ± 2.63	40	0.35 ± 0.01	27	1.00 ± 0.02
<i>chrysanthemi</i>	22	13.36 ± 0.64	41	2.12 ± 0.06	21	0.96 ± 0.04
<i>decampus</i>	53	38.21 ± 1.60	94	2.62 ± 0.05	68	1.11 ± 0.02
<i>diutius</i>	19	17.84 ± 0.98	34	1.78 ± 0.04	25	0.78 ± 0.02
<i>elongatus</i>	84	23.73 ± 0.06	100	1.61 ± 0.01	100	0.66 ± 0.01
<i>filifoliae</i>	7	23.43 ± 1.50	5	0.50 ± 0.05	9	0.96 ± 0.06
<i>glandulosus</i>	49	13.89 ± 0.48	90	2.01 ± 0.03	92	0.94 ± 0.01
<i>gnaphalodes</i>	71	27.76 ± 0.87	125	1.17 ± 0.03	100	1.15 ± 0.02
<i>gregarius</i>	98	16.28 ± 0.28	100	1.61 ± 0.10	100	0.79 ± 0.02
<i>heterohirsutus</i>	19	39.32 ± 3.13	36	1.19 ± 0.02	34	1.18 ± 0.03
<i>hottesi</i>	1	13	3	(1.69 - 1.75)		"subequal"
<i>infrequens</i>	1	31	2	0.44	2	(1.63 - 1.86)
<i>intermedius</i>	7	33.14 ± 1.80	13	3.09 ± 0.13	6	1.13 ± 0.05
<i>knowltoni</i>	1	26	2	1.74	1	0.87
<i>lagacei</i>	1	20	6	1.61 ± 0.06	-	"5/4"
<i>longinectarius</i>	9	70.89 ± 8.68	17	3.25 ± 0.22	15	1.03 ± 0.05
<i>longipes</i>	6	10.00 ± 2.57	6	3.36 ± 0.32	4	0.80 ± 0.04
<i>longirostris</i>	1	47	5	0.61 ± 0.04	-	"1 1/2"
<i>magnautensus</i>	8	12.25 ± 1.47	18	0.91 ± 0.03	10	0.68 ± 0.52
<i>neosporadicus</i>	2	10	4	(1.59 - 1.73)	2	(0.86 ± 0.92)
<i>obscuratus</i>	7	25.71 ± 2.54	12	0.56 ± 0.05	11	1.12 ± 0.06
<i>oestlundii</i>	100	51.50 ± 1.31	100	1.37 ± 0.03	100	0.86 ± 0.02
<i>ohioensis</i>	1	22	2	(1.45 - 1.48)	2	(0.86 - 0.92)
<i>packi</i>	90	18.16 ± 0.56	100	2.27 ± 0.04	100	0.65 ± 0.01
<i>packi brevis</i>	5	13.20 ± 2.39	10	1.74 ± 0.07	8	0.78 ± 0.06
<i>palmerae</i>	43	23.74 ± 0.09	78	1.72 ± 0.03	55	0.86 ± 0.02
<i>parilis</i>	56	22.21 ± 0.87	100	0.96 ± 0.02	74	0.67 ± 0.01
<i>patonkus</i>	6	21.00 ± 2.19	12	0.67 ± 0.01	10	0.99 ± 0.06
<i>patonkusellus</i>	18	34.89 ± 2.45	33	0.80 ± 0.03	43	0.85 ± 0.03
<i>pseudoglandulosus</i>	27	18.78 ± 0.56	44	2.98 ± 0.07	40	1.23 ± 0.23
<i>pseudopatonkus</i>	28	18.61 ± 1.12	60	0.43 ± 0.02	54	0.79 ± 0.02
<i>pullus</i>	6	37.50 ± 4.19	12	2.11 ± 0.32	9	1.19 ± 0.82
<i>pycnorhysus</i>	40	13.25 ± 0.59	72	2.25 ± 0.06	54	0.78 ± 0.02
<i>quadritrichus</i>	16	27.75 ± 2.29	34	0.89 ± 0.03	30	1.11 ± 0.08
<i>quadritrichus pallidus</i>	13	28.92 ± 1.98	20	1.05 ± 0.03	20	1.09 ± 0.01
<i>quadritrichus vulgaris</i>	30	35.00 ± 0.93	52	1.41 ± 0.02	33	1.08 ± 0.03
<i>rusticatus</i>	23	37.26 ± 2.23	39	1.95 ± 0.29	28	1.19 ± 0.27
<i>spatulavillus</i>	5	37.80 ± 5.91	10	0.74 ± 0.03	9	0.85 ± 0.03
<i>sporadicus</i>	39	8.69 ± 0.32	70	1.79 ± 0.04	54	0.73 ± 0.03
<i>stroudi</i>	3	17 - 22	6	1.81 ± 0.19	4	0.78 ± 0.12
<i>triangulatus</i>	1	36	2	(0.36 - 0.44)	-	-
<i>utensis</i>	19	8.05 ± 0.002	35	1.37 ± 0.05	10	0.67 ± 0.02
<i>wasatchii</i>	6	26.83 ± 0.29	14	1.30 ± 0.04	10	0.83 ± 0.05
<i>xerozoous</i>	10	15.10 ± 1.59	18	1.42 ± 0.08	7	0.62 ± 0.03
<i>zoomontanus</i>	35	40.97 ± 2.00	64	2.60 ± 0.06	40	0.72 ± 0.02

Pleotrichophorus acanthovillus
(Knowlton and Smith)

FIGURES 122, 168-170

Capitophorus acanthovillus Knowlton and Smith, 1936a:108
[lectotype: apt.v.f., Curlew Valley, Utah, 9-VI-1930, GFK,
on *Chrysothamnus*; in EOE coll.].—Palmer, 1952:250-251.

Pleotrichophorus acanthovillus (Knowlton and Smith).—Hille
Ris Lambers, 1969:167.

DIAGNOSIS.—This species resembles *P. utensis* most closely but differs in having pointed instead of expanded posterodorsal caudal seta, fewer and larger setae on the venter of the first, and relatively longer ones on antennal segment III. It is similar to *P. magnautensis* and *P. pycnorhysus* in its short, stout, blunt rostrum IV+V, but can be distinguished from the former by the distinctly larger head and body setae and from the latter by the fewer df setae (8.00 ± 3.18 , $n = 4$ vs. $13.25 \pm .59$, $n = 40$), the much smaller co/ca ratio ($1.26 \pm .03$, $n = 8$ vs. $2.25 \pm .06$, $n = 72$), the entirely dark cornicles (vs. only apices dark in *P. pycnorhysus*), and the absence of spinal and pleural papillae on dorsum.

DESCRIPTION.—*Apterous Viviparous Female:* Color in life, green (Knowlton and Smith, 1936a: 108); cleared specimens with body pale and distal $\frac{1}{2}$ to $\frac{3}{5}$ of a.s.III and IV, remainder of antennae, tips of rostrum and tibiae, entire tarsi and almost entire cornicles dark brown. Body 1.55-2.08 (1.89, $n = 4$) mm long, .47-.50 (.493) mm wide across eyes. Head with slightly developed laterofrontal and mesofrontal tubercles; number of head setae: mf 1p, lf 2-3 on each tubercle, vlf 1p, df 8 (8.00 ± 3.18 , $n = 4$), vf 6, pc 2p, ac 4 and md 3p; all dorsal head setae slightly knobbed and subequally long, mf .0198-.0330 (.0229, $n = 5$) and df-1 .0220-.0308 (.0278, $n = 8$) mm long; ventral setae of similar shape except ac blunt or pointed. Antennal segment I slightly produced mesodistally, faintly imbricate, with 6-11 setae similar in shape to df's, in addition to basal pointed seta on dorsum.

A.s.II normally with $1 - \frac{1}{2} - 1$ blunt or knobbed setae. A.s.III faintly imbricate, with blunt or knobbed setae, longest up to $\frac{2}{3}$ basal diameter; with 1-5 (2.86, $n = 7$) secondary sensoria. A.s.IV about $\frac{3}{4}$ and a.s.V about $\frac{2}{3}$ as long as a.s.III; unguis averaging $4\frac{1}{4}$ times (3.93-4.50, $n = 4$) as long as base of a.s.VI.

Dorsal body integument smooth, becoming faintly

striate caudad of abd.s. 6; body setae relatively sparse, not regularly aligned longitudinally, but spinal rows of 2 or 3 setae fairly recognizable, not borne on papillae, although posterior segments may be slightly produced around spinal pairs of setae. Cauda elongate, with slight constriction on basal third, apex acute but rounded; spiculate; with 2 pairs lateral and 1 posterodorsal setae, with all setae pointed. Cornicles .31-.42 (.350, $n = 8$) mm long and 1.19-1.31 times ($1.26 \pm .03$, $n = 8$) as long as cauda; cylindrical, of almost uniform diameter throughout length; entirely dark, very faintly imbricate-spiculate. Legs with 3, 3, 3 setae on first tarsal joints. Rostrum IV+V tapering gradually to blunt tip; .08-.10 (.093, $n = 4$) mm long about $\frac{3}{4}$ (.76 \pm .14, $n = 7$) length of hind ta-2; with 1 basal, 2 dorsal and 3 lateral pairs of setae, al, ml, and pl setae subequal in size.

Measurements (in mm) of lectotype: BL 1.96, We .50; a.s.III both .56, a.s.IV .42 and .41, a.s.V both .36, a.s.VI .14 + .55 (one side only); cornicles .40 and .42, cauda .32; hind tibiae 1.15 and 1.14, hind ta-2 .12, and rostrum IV+V .10.

Alate Viviparous Female: Not seen. Original description includes following measurements: BL 1.41; a.s.III .60, a.s.IV .44, a.s.V .34-.39, a.s.VI .094-.11 + .47-.55; cornicles .28-.31, cauda .20-.30 and hind tibiae 1.09 mm. Number of sensoria on a.s.III 5-9.

Sexuales: Not known.

HOSTS.—*Chrysothamnus viscidiflorus*, *Chrysothamnus* sp., and *Gutierrezia* sp.

DISTRIBUTION.—Records include a few localities in northern Utah: Cedar Springs and Curlew Valley in Boxelder Co., Ouray Valley in Uintah Co., and Holmes Creek in Rich Co.

TYPES (designated from slides marked "paratype").—Lectotype: data given above. Paralectotypes: 2 apt.v.f. and 2 apt.ny. with the same data as lectotype (EOE coll.); and 1 apt.v.f., 1 apt.ny. and 1 altd.ny., Curlew Valley, Utah, 9-VI-1930, GFK on *Chrysothamnus viscidiflorus* (CFS coll.).

SPECIMENS EXAMINED.—Aside from types, 1 apt. v.f., Ouray Valley, Utah, 14-IX-1956, GFK, on *Chrysothamnus* (EOE coll.).

Pleotrichophorus ambrosiae Hille Ris Lambers

FIGURES 141, 292-306, 314-323, 333

Pleotrichophorus ambrosiae Hille Ris Lambers, 1969:169-172

[type: apt.v.f., State College, Pennsylvania, 4-VIII-1966, JOP, on *Ambrosia artemisiifolia*; in DHRL coll.].
Pleotrichophorus wasatchii Knowlton [misidentification].—
 Pepper, 1965:213.

DIAGNOSIS.—*P. ambrosiae* can be recognized by having the anterior head setae (mf, lf, df-1) at least distinctly petiolate and the posterior df and discal body setae less distinctly petiolate; by the presence usually of 3 or 4 (range = 1-6, m = 3.3, n = 64) sensoria on antennal segment III, and by the rather bluntly acute tip of rostrum IV+V. The stoutly elongate cauda, co/ca ratio of about $1\frac{1}{2}$ ($1.44 \pm .03$, n = 58) and the presence usually of 9 pairs (mean total df = 18.77 ± 1.47 , n = 31) of df setae are also distinctive. Its differences from the closely related *P. diutius*, *P. ohioensis*, and *P. wasatchii* are discussed separately under those species; notes on host relationships of all these species is also considered under "NOTES" in the treatment of *P. wasatchii*.

DESCRIPTION.—*Apterous Viviparous Female* (based on same series as type material from Pennsylvania, on *Ambrosia artemisiifolia*): Color in life, green; cleared specimen pale, with tips of rostrum and tibiae, entire tarsi, apices of a.s.III and IV and remaining antenna dark. Body 1.25-2.01 (m = 1.73, n = 25) mm long, .42-.49 (m = .439, n = 31) mm wide across the eyes. Laterofrontal tubercles moderately produced, mesofrontal tubercle rather low; mf 1p with 1 commonly added, lf 2-3 (usually 2) on each side, vlf 1p, df 12-27 (18.77 ± 1.47 , n = 31), vf 6-8, pc 2p, ac usually 4, md 2-4 (usually 3) on each plate; dorsal setae basically funnel- or cone-shaped, anterior ones longer, thinner, more distinctly petiolate (stem about $\frac{1}{2}$ entire setal length) than posterior ones; ventral setae similar except much less expanded ac and md; mf .0242-.0418 (.0353, n = 72) and df-1 .0286-.0506 (.0393, n = 58) mm long. Antennal segment I slightly produced mesodistally, imbricate, with 5-9 small, blunt, or knobbed setae in addition to basal pointed one on dorsum. A.s.II imbricate, with normally

1
 1-1-1 setae, of same shape as preceding and
 2
 succeeding segments. A.s.III quite densely imbricate, with small setae, longest less than $\frac{1}{2}$ basal diameter of segment; with 1-6 (3.3, n = 64) sensoria. A.s.IV about $\frac{9}{10}$, and a.s.V about $\frac{3}{4}$ length of a.s.III; unguis of a.s.VI $5\frac{1}{2}$ to 7 times (6.01, n = 54) as long as base.

Tergum smooth on disk, becoming imbricate-spiculate caudally; with moderately dense cover of funnel- to cone-shaped setae, those on posterior 2 segments longer, more distinctly stemmed than those on disk. Cauda .23-.31 (.269, n = 29) mm, elongate, rather thick, slightly constricted on basal third, apex broadly rounded; spiculate; with 2 pairs lateral and 1 posterodorsal setae. Cornicles .31-.50 (.388, n = 64) mm long, $1\frac{1}{4}$ to $1\frac{3}{4}$ times ($1.44 \pm .03$, n = 58) as long as cauda; cylindrical, with bases slightly thickened; conspicuously imbricate, wrinkled, armed with large blunt teeth. Legs with 3, 3, 3 setae on first tarsal joints; hind tibiae 1.03-1.33 (1.17, n = 60), hind tibiae 1.03-1.33 (1.17, n = 60), hind ta-2 .11-.14 (.130, n = 60) mm long. Rostrum IV+V tapering gradually to rather bluntly acute point, margins straight; .10-.12 (1.09, n = 32) mm long, $\frac{3}{4}$ to equal (.85 \pm .02, n = 60) hind ta-2 in length; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, ml and pl $\frac{1}{3}$ to $\frac{1}{2}$ size of al setae.

Measurements (in mm) of 2 specimens on *Ambrosia* sp. from unknown locality (Figures 314-316): BL 2.13 and 2.20, We .48 and .50; a.s.III .56-.57 (.565), a.s.IV .30-.41 (.355), a.s.V .38-.41 (.395), a.s.VI .13-.14 (.135) + .84; cornicles .37-.40 (.38), cauda .30 and .32; hind tibiae 1.23-1.26 (1.25), hind ta-2 .13-.15 (.14), rostrum IV+V both .12, mf .0242-.0352 (.0314), and df-1 .0352-.0396 (.0381). Proportions of a.s.III:IV:V, 1: .53-.73 (.63): .68-72 (.70); VIu/VIIb 6.46; co/ca 1.19-1.25 (1.23) and rostrum IV+V/hind ta-2 .80-92 (.86). Number of sensoria on a.s.III 3-7 (5); number of df setae 19.

Measurements (in mm) of 3 specimens on *Franseria discolor*: BL 2.03-2.20 (2.17), We .45-.53 (.487); a.s.III .45-.49 (.470), a.s.IV .40-.41 (.408), a.s. .31-.40 (.362), a.s.VI .12-.14 (.132) + .75-.80 (.778); cauda .27-.31 (.297); hind tibiae 1.08-1.16 (1.13), hind ta-2 .13-.14 (.138); rostrum IV+V .11-.125 (.118); mf .0330-.0352 (.0336), and df-1 .0308-.0352 (.0330). Proportions of a.s.III:IV:V, 1: .82-.91 (.87): .67-.83 (.77); VIu/VIIb 5.57-6.50 (6.01); co/ca 1.09-1.32 (1.20); rostrum IV+V/hind ta-2 .85-.89 (.87). Number of sensoria on a.s.III 2-4 (2.7); number of df setae 23-27 (24.7).

Alate Viviparous Female (based on specimens on *Ambrosia artemisiifolia* from Pennsylvania): Cleared specimen with head pale, brown ring around ocelli; antennae dusky to brown from distal third of a.s.III; prothorax pale like head,

mesothorax brown; wing veins brown; tibiae brown with slightly darker bases and apices, entire tarsi dark brown, remainder of legs dusky; abdomen membranous with light brown pleural and marginal sclerites; anal plate, cauda and distal $\frac{1}{3}$ of cornicles faintly dusky. Similar to apterous viviparous female except as follows: df setae fewer (8-13, $m = 11.3$, $n = 14$), mf setae slightly shorter; more sensoria on a.s.III (10-17, $m = 12.0$, $n = 24$); abdomen with discal segments, or at least abd.s. 3 to 5 bearing 2 pairs of pleural and 1 pair of marginal sclerites, 1 pair of pleural sclerites also on segment 6; abdominal setae relatively more sparse and longer; cornicular denticles pointed not blunt.

Measurements (in mm) of 14 specimens: BL 1.56-1.87 (1.76), We .36-.43 (.399); a.s.III .52-.64 (.581), a.s.IV .48-.62 (.537), a.s.V .39-.48 (.447), a.s.VI .13-.18 (.153) \pm .86-1.08 (.955); cornicles .29-.42 (.345), cauda .24-.28 (.263), hind tibiae 1.20-1.44 (1.31), hind ta-2 .13-.15 (.139), rostrum IV+V .10-.11 (.108); mf .0176-.0374 (.0293), and df-1 .0264-.0396 (.0341). Proportions of a.s.III:IV:V, 1: .85-1.20 (.96): .69-.95 (.82); VIu/VIb 4.69-6.50 (5.56); co/ca 1.08-1.35 (1.22) and rostrum IV+V/hind ta-2 .86-1.08 (.93). Number of sensoria on a.s.III 2-7 (3.9); number of df setae 13-21 (17.3).

Oviparous Female (based on specimens on *Ambrosia* sp. and *Franseria discolor* from Colorado): Differs from apterous vivipara (on *A. artemisiifolia*) as follows: head with fewer df setae, relatively thinner, shorter anterodorsal setae (mf, lf, and df-1); body setae longer, less expanded; cornicles and cauda shorter, co/ca ratio averaging less than $1\frac{1}{4}$; cauda not constricted, more acutely tapered; subgenital plate with more numerous setae; hind tibiae with basal $\frac{1}{3}$ to $\frac{1}{2}$ enlarged, bearing numerous pseudosensoria.

Measurements (in mm) of 11 specimens on *Ambrosia* sp.: BL 1.61-2.11 (1.86), We .44-.51 (.465); a.s.III .43-.52 (.471), a.s.IV .34-.43 (.391), a.s.V .28-.37 (.336), a.s.VI .11-.16 (.129) + .68-.82 (.734); cornicles .20-.33 (.268), cauda .20-.25 (.225); hind tibiae .94-1.17 (1.05), hind ta-2 .12-.14 (.129); rostrum IV+V .10-.13 (.115), mf .0220-.0396 (.0314), and df-1 .0330-.0440 (.0399). Proportions of a.s.III:IV:V, 1: .74-.97 (.83): .61-.92 (.72); VIu/VIb 4.18-6.17 (5.59); co/ca 1.04-1.32 (1.19); and rostrum IV+V/hind ta-2 .92-1.00 (.96). Number of sensoria on a.s.III 1-10 (3.9); number of df setae 12-18 (14).

Measurements (in mm) of 12 specimens on *Franseria discolor*: BL 1.87-2.30 (2.09), We .45-.52 (.494); a.s.III .30-.49 (.422), a.s.IV .36-.44 (.399), a.s.V .30-.38 (.343), a.s.VI .11-.15 (.130) + .61-.83 (.733); cornicles .24-.42 (.295), cauda .21-.31 (.245); hind tibiae 1.00-1.13 (1.08), hind ta-2 .12-.14 (.134), rostrum IV+V .12-.13 (.124); mf .0176-.0374 (.0296), and df-1 .0330-.0440 (.0364). Proportions of a.s.III:IV:V, 1: .85-1.20 (.96): .69-.95 (.82); VIu/VIb 4.69-6.50 (5.56); co/ca 1.08-1.35 (1.22) and rostrum IV+V/hind ta-2 .86-1.08 (.93). Number of sensoria on a.s.III 2-7 (3.9); number of df setae 13-21 (17.3).

Male (based on specimens on *Franseria discolor*): Alate. Head and thorax dark brown, sclerotic; entire antennae, legs except extreme bases of femora, cornicles, genito-anal capsule and cauda brown; abdomen membranous with lighter brown spinal, pleural and marginal sclerites; wing veins light brown. Similar to alate female (on *A. artemisiifolia*) except as follows: df setae fewer (10-12, $m = 11$, $n = 8$), less expanded; more sensoria on a.s.III (29-45, $m = 37.5$, $n = 12$), also present on a.s.IV (23-37, $m = 28.2$, $n = 12$) and a.s.V (13-18, $m = 15.9$, $n = 12$); abdomen with well-developed transverse pleural bars, ovate marginal sclerites on all but segment 8, a pair of small spinal dashes on segments 1 to 6, a larger spinopleural thickening on segment 7; abdominal setae thinner, smaller; cauda shorter, not constricted and tapering to an acute point; cornicles slightly shorter, co/ca ratio relatively smaller. Genitalia consisting of 2 oblong, setaceous parameres and cylindrical, round-tipped aedeagus.

Measurements (in mm) of 8 specimens: BL 1.49-1.72 (1.59), We .40-.45 (.423); a.s.III .43-.53 (.479), a.s.IV .39-.50 (.441), a.s.V .35-.41 (.381), a.s.VI .13-.16 (.145) + .65-.90 (.792); cornicles .13-.15 (.143), cauda .14-.17 (.16); hind tibiae 1.05-1.19 (1.11), hind ta-2 .12-.15 (.138), rostrum IV+V .11-.125 (.119); mf .0176-.0286 (.0246), and df-1 .0220-.0330 (.0267). Proportions of a.s.III:IV:V, 1: .81-1.00 (.92): .76-.83 (.79); VIu/VIb 4.54-6.54 (5.41), co/ca .76-1.07 (.89); rostrum IV+V/hind ta-2 .80-.92 (.87).

HOSTS.—*Ambrosia artemisiifolia*, *A. artemisiifolia* var. *paniculata*, *A. psilostachya*, *Ambrosia* sp., and *Franseria discolor*.

DISTRIBUTION.—Widely distributed in the United States, with records from Pennsylvania, Florida,

Arkansas, Oklahoma, Nebraska, Colorado, and California. Type-locality also includes Cuba. It is here reported from northwestern Mexico, near California border.

TYPES.—Holotype and some paratypes in DHRL collection; paratypes also in collections of JOP, the USNM, and Dr. J. Holman, Prague, Czechoslovakia.

SPECIMENS EXAMINED.—On *Ambrosia artemisiifolia* (all from Pennsylvania and collected by JOP, in JOP and USNM coll.): Philipsburg, 6 apt.v.f. and 4 al.v.f., 11–VIII–1952; State College at Black Moshannon Dam, 7 apt.v.f. and 4 ny., 1–IX–1961; State College at Scotia, 5 apt.v.f., 2 al.v.f. and 2 ny., 12–VIII–1962; and State College at Waddle, 14 apt.v.f., 6 al.v.f. and 11 ny., 17–VIII–1962.

On *Ambrosia psilostachya*: CALIFORNIA: Vail Ranch, Temecula, Riverside, 3 al.v.f., 3–III–1961 by R. van den Bosch; and 4 mi N Sta. Ysabel, 1 apt.v.f., 27–V–1958, by RCD (all in RCD coll.).

On *Ambrosia* sp.: COLORADO: Ft. Collins, 4 ovip.f., 5–XI–1915 (PU). MEXICO: Sinaloa, Los Mochis, 2 apt.v.f., 10–VI–1959 by W.W. Gibson (RCD coll.). UNKNOWN LOCALITY: 2 apt.v.f. and 7 ovip.f., 10–XI–1920 (USNM).

On *Franseria discolor*: COLORADO: Ft. Collins, 4 apt.v.f., 12 ovip.f. and 8 al.m., 8–X–1922, # 3329, MAP (USNM and CSU).

In *Traps* (all from Project NC-67, Medler and Ghosh at University of Wisconsin and slides in U. Minn. coll.): NEBRASKA: Lincoln, 1 al.v.f., 5–VI–1966, in suction trap. OKLAHOMA: Stillwater, 1 al.v.f., 4–V–1964 in yellow pan trap, and 1 al.v.f., 8–XI–1965 in suction trap.

On *Unknown and Doubtful Hosts*: ARKANSAS: Howard Co., 1 apt.v.f., 24–IX–1934, W.F. Turner, on peach orchard soil (USNM). CALIFORNIA: W. Arcadia, Los Angeles Co., 1 al.v.f., 26–IX to X–1947, RCD, resting on orange (RCD coll.). FLORIDA: Hialeah, 1 apt.v.f., 26–VIII–1962, C.E. Stegmaier, on *Panicum repens* (Fla. Dept. of Agric.). MICHIGAN: Saginaw Co., 1 al.v.f., 1–IX–1956, R.R. Dreisbach, on unknown host (EOE coll.).

Pleotrichophorus amsinckii Richards

FIGURES 164, 491–494

Pleotrichophorus amsinckii Richards, 1968:195–197 [type: apt.v.f., Oliver, British Columbia, 18–VII–1965, W.R. Richards on *Amsinckia intermedia*; No. 9613 in CNC].—Hille Ris Lambers, 1969:168.

DIAGNOSIS.—*P. amsinckii* is peculiar among *Pleotrichophorus* species because of its long (.21–.23 mm), slender, slightly tapered last rostral segment which is $1\frac{3}{4}$ to twice as long as hind ta-2. The long funnel-shaped setae on the mesodistal projection of antennal segment I are also distinctive.

DESCRIPTION.—*Apterous Viviparous Female* (fundatrix): Color in life not known; cleared specimens pale except tips of rostrum, antennae from apices of a.s.V and entire tarsi. Body 1.75–1.83 (1.79, n = 3) mm long, .39–.43 (.41, n = 4) mm wide across eyes. Head with moderately developed frontal tubercles; mf 1–2p, lf 2–3 on each side, vlf 1p, df 21–28 (24.0, n = 5), vf 5–6 (usually 6), pc 2p, ac 4–5, and md 3–5 on each side; dorsal setae funnel-shaped, with distinct stalks; ventral setae similar but less expanded especially md and ac; mf .0352–.0550 (.0428, n = 15) and df-1 .0396–.0550 (.0453, n = 10) mm long. Antennal segment I conspicuously produced on mesodistal margin, faintly imbricate, with 5–7 funnel-shaped or slightly knobbed setae in addition to basal pointed seta on dorsum; some setae on mesodistal projection up to

$\frac{1}{2}$ length of mf or df-1 setae. A.s.II with 1 — — 1
2
similarly shaped but shorter setae. A.s.III with small knobbed setae, longest less than $\frac{1}{2}$ basal diameter of segment with 1 sensorium or occasionally none. A.s.IV slightly shorter than a.s.V, former about $\frac{2}{3}$, latter $\frac{3}{4}$ length of a.s.III; a.s.VI with unguis $3\frac{1}{2}$ to $4\frac{2}{3}$ (3.87, n = 9) times as long as base.

Dorsal integument smooth on disk, becoming finely spiculate caudally; setae moderately dense, shaped similar to head setae. Cauda tapering to acute but rounded tip, without basal constriction; spiculate; with 2 pairs lateral and 2 posterodorsal setae. Cornicles .46–.55 (.496, n = 11) mm long, 2.82–3.44 (3.04, n = 9) times as long as cauda; cylindrical, with bases and apices slightly incrassate; imbricate and faintly spiculate. Legs with 3, 3, 3 hairs on first tarsal joints. Rostrum IV+V slender, tapering gradually to acute tip; .21–.23 (.216, n = 8) mm long, $1\frac{3}{4}$ to 2 (1.87, n = 12) times as long as hind ta-2; with 1 basal, 2 dorsal and 3 lateral pairs of setae, ml and pl setae rather weak, short, about $\frac{1}{6}$ al in length.

Apterous Viviparous Female (summer form): Similar to fundatrix except for presence of dorsal

seta on a.s.II, relatively more setae on a.s.I (10–11 except basal pointed one on dorsum), larger ratio of unguis to base of a.s.VI (7.58) and presence of 1 posterodorsal caudal seta.

Measurements (in mm) of 1 paratype on *Amsinckia*: BL 1.56, We .39; a.s.III .50 and .53, a.s.IV .38 and .39, a.s.V .44 and .45, a.s.VI .12 + .91 (one side only); cornicles .46 and .45, cauda .15; hind tibiae 1.01 and 1.02, hind ta-2 .12, rostrum IV+V .21; mf .0352 and .0396, and df-1 .0374.

Alate Females: Unknown.

Sexuales: Unknown.

Hosts.—*Amsinckia* (Boraginaceae) and *Eriogonum* (Polygonaceae).

DISTRIBUTION.—Northwestern North America, in British Columbia (Canada) and Washington (U.S.).

SPECIMENS EXAMINED.—CANADA: 1 paratype apt. v.f. with data as in holotype (WRR coll.); U.S.: Union Gap, Washington, 7 apt.v.f., and 3 ny., 7-IV-1947, GFK, on *Eriogonum* (GFK coll.).

Plectrichophorus antennarius, new species

FIGURES 157, 448–453

DIAGNOSIS.—This species resembles *P. pseudoglandulosus*, *P. intermedius*, and *P. decampus* in the needle-tipped rostrum IV+V and a co/ca ratio of greater than 2; but the hind ta-2 is shorter so the rostrum IV+V/hind ta-2 ratio is much greater ($1.51 \pm .09$, $n = 8$ vs. $1.23 \pm .30$, $n = 40$ for the first, $1.13 \pm .05$, $n = 6$ for the second and $1.11 \pm .02$, $n = 68$ for the third species). The fewer df setae (12.83 ± 1.03 , $n = 6$, vs. $18.78 \pm .56$, $n = 27$; 33.14 ± 1.80 , $n = 7$; and 38.21 ± 1.60 , $n = 53$, respectively) and the larger VIu/VIb ratio ($7\frac{1}{4}$ to $9\frac{1}{4}$ vs. not more than $7\frac{3}{4}$ in those species, averaging $5\frac{2}{3}$ for *P. pseudoglandulosus*, $4\frac{3}{4}$ for *P. intermedius* and 6 for *P. decampus*) are additional differences.

DESCRIPTION.—*Apterous Viviparous Female*: Color in life not known; cleared specimens pale except apices of rostrum, bases and apices of tibiae, entire tarsi, joints between a.s.III and IV, IV, and V, remainder of antennae from apices of a.s.V. Body 1.14–1.33 (1.26 , $n = 5$) mm long and .34–.38 ($.350$, $n = 6$) mm wide across eyes. Head with moderately developed laterofrontal tubercles, mesofrontal rather low and small; mf 1p, lf 2–3 on each

side, vlf 1p, vf 6–7, df 12–14 (12.83 ± 1.03 , $n = 6$) vf 6–7, pc 2p, ac 4–5, md 2–3 on each lobe; dorsal setae widely funnel-shaped, anterior with more distinct stems than posterior; ventral setae similarly shaped but more narrowly expanded, most of md and ac merely blunt at apices; mf .0242–.0364 ($.0295$, $n = 6$) and df-1 .0264–.0374 ($.0306$, $n = 12$) mm long. Antennal segment I well produced on mesodistal margin, conspicuously imbricate, with 7–12 (usually 8) blunt or knobbed setae in addition to basal pointed one on dorsum. A.s.II with

1
1 — — 1 knobbed setae, one occasionally missing.

2
A.s.III densely imbricate, with small knobbed setae, longest less than half basal diameter of segment, with 1 sensorium (in all 12 segments seen). A.s.IV slightly shorter than a.s.V, about $\frac{9}{10}$ and $\frac{9}{10}$ a.s.III, respectively; a.s.VI with unguis $7\frac{1}{4}$ to $9\frac{1}{4}$ (7.83, $n = 7$) times as long as its base.

Dorsal body integument smooth, membranous on disk, becoming imbricate-spiculate caudally from about abd.s. 5; rather sparsely covered with widely funnel- or cone-shaped setae. Cauda triangular, without basal constriction, with acutely rounded apex; spiculate; with 2 lateral pairs and 1 posterodorsal setae. Cornicles .27–.36 ($.302$, $n = 12$) mm long and $2\frac{1}{4}$ to $2\frac{1}{2}$ ($2.35 \pm .04$, $n = 10$) times as long as cauda; cylindrical, with smallest diameter on apical third before slightly thickened apex; imbricate-spiculate, spicules rather small but distinct. Legs with 3, 3, 3 setae on first tarsal joints. Last rostral segment slender, distal $\frac{1}{3}$ produced into rather stout needle; .12–.13 ($.129$, $n = 6$) mm long, 1.33–1.63 ($1.51 \pm .09$, $n = 8$) times as long as hind ta-2; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, al about 3–4 times as long as ml or pl setae.

Measurements (in mm) of holotype: BL 1.38, We .38; a.s.III .49 and .50, a.s.IV .44 and .42, a.s.V both .45, a.s.VI .13 + 1.12 (one side only); cornicles .35 and .36, cauda .15; hind tibiae .95 and .94, hind ta-2 .09, and rostrum IV+V .13 mm long.

Alate Viviparous Female: Unknown.

Oviparous Female: Much like apterous vivipara, differing only as follows: body setae more elongate, less expanded; intersegmental pleural patches present on disk of body (mesothorax to abd.s. 6); ratio of unguis to base of a.s.VI relatively smaller; last rostral segment slightly longer; more setae present

on subgenital plate; hind tibiae basally enlarged, sparsely armed with large, round pseudosensoria.

Measurements (in mm) of 5 paratypes: BL 1.30–1.61 (.147), We .38–.40 (.39); a.s.III .47–.54 (.513), a.s.IV .39–.45 (.428), a.s.V .43–.52 (.473), a.s.VI .12–.15 (.135) + .89–1.07 (.98); cornicles .34–.39 (.356), cauda .15–.17 (.162); hind tibiae .96–1.05 (1.02), hind ta-2 .08–.10 (.093), rostrum IV+V .135–.150 (.141), mf .0242–.0286 (.0260), and df-1 .0286–.0352 (.0328). Proportions of a.s.III:IV:V, 1: .75–.98 (.84); .87–1.04 (.93); VIu/VIb 6.36–7.64 (7.0), co/ca 2.06–2.31 (2.18), and rostrum IV+V/hind ta-2 1.40–1.75 (1.54). Number of sensoria on a.s.III 1, and number of df 13–17 (15.4).

Apterous Male: Head brown, sclerotic; body pale, membranous, with indistinct, brown spinal dashes, larger transversely oblong pleural and small rounded marginal sclerites on disk (mesothorax to abd.s. 6); antennae, apex of rostrum, cornicles and genito-anal capsule brown; legs dusky, with darker brown tibial bases and apices and entire tarsi. Morphologically similar to apterous vivipara, differing in having more elongate, sparser body setae, shorter cauda and hence relatively greater co/ca ratio; more sensoria on a.s.III (18–19, m = 18.67, n = 3), sensoria also on a.s.IV (17–21, m = 18.33, n = 3) and a.s.V (14–16, m = 15.0, n = 3). Genitalia consisting of rather small, setaceous parameres and short truncate aedeagus.

Measurements (in mm) of 2 paratypes: BL .92 and 1.26, We .37 and .38; a.s.III .48–.54 (.52), a.s.IV .40–.43 (.41), a.s.V .40–.42 (.41), a.s.VI .11 + 1.07 (only 1 segment complete); cornicles .28–.31 (.30), cauda .09 and .13; hind tibiae 1.00–1.03 (1.02), hind ta-2 .09–.10 (.095), rostrum IV+V .12 and .13; mf .0242–.0352 (.0297), and df-1 .0286. Proportions of a.s.III:IV:V, 1: .74–.83 (.79); .76–.83 (.79); VIu/VIb 9.72; co/ca 2.39–3.11 (2.63); rostrum IV+V/hind ta-2 1.30–1.44 (1.38). Number of df setae, both 13.

Hosts.—*Antennaria plantaginifolia* and *Antennaria* sp.

DISTRIBUTION.—Records include only the type-locality (District of Columbia).

TYPES.—Holotype, apt.v.f., D.C., 14-X-1894, coll. No. 6420, on *Antennaria plantaginifolia*. Paratypes: 2 apt.v.f., 1 ovip.f., 1 apt.m. and 17 ny., with the same data as holotype; 3 apt.v.f., 4 ovip.f., 1 apt.m., and 10 ny. bearing only data, No. 6420,

2/25 and on *Antennaria*. Holotype and all paratypes in USNM.

Pleotrichophorus brevinectarius (Gillette and Palmer)

FIGURES 149, 371–378

Capitophorus brevinectarius Gillette and Palmer, 1933:350 [type: al.v.f., Chimney Rock, Colorado, 26-VI-1932, MAP, on *Artemisia longifolia*; USNM 49294]; 1934:147–148.—Patch, 1938:244.—Knowlton, 1948:122.—Palmer, 1952:252–253.

Pleotrichophorus brevinectarius (Gillette and Palmer).—Hille Ris Lambers, 1953:115; 1966:606; 1969:166.

DIAGNOSIS.—This species is easily recognized by the very short cornicles (.07–.13 mm) that are only $\frac{1}{3}$ (m = .35 ± .01, n = 40) the cauda in length; stoutly elongate and constricted cauda; rather long (.12–.14 mm), needle-tipped rostrum IV+V; and dense dorsofrontal (m = 46.71 ± 2.63, n = 21) and body setae.

DESCRIPTION.—*Apterous Viviparous Female*: Color in life medium green, without markings (Gillette and Palmer, 1933); cleared specimen with pale body, antennae dusky, with tips of a.s.III and IV and entire V and VI darker, tips of rostrum and tibiae and entire tarsi darker than their pale to dusky bases. Body length 1.30–1.93 (1.68, n = 17), width across eyes .38–.45 (.417, n = 21) mm. Head with mesofrontal produced to about level of moderately developed laterofrontal tubercles; mf 1p with 1 or 2 sometimes added, lf 2–3 (usually 3) on each side, vlf 1p, df 37–59 (46.71 ± 2.63, n = 21), vf 6–10 (usually 8), pc 2p, ac 4–5, and md 2–4 (usually 3) on each lobe; dorsal setae widely funnel- or cone-shaped, anterior longer, more distinctly stemmed than posterior ones; ventral setae with vf, vlf and pc much like dorsal setae but less expanded, md and ac pointed to blunt or slightly expanded apically; mf .0286–.0506 (.0345, n = 50), and df-1 .0374–.0550 (.0467, n = 35) mm long. Antennal segment I well produced mesodistally, imbricate, with 5–8 flattened to funnel-shaped setae in addition to basal pointed one on dorsum. A.s.II with usually $1 - \frac{1}{2} - 1$ setae, but 1 occasionally added or missing. A.s.III faintly imbricate; with rod-shaped to knobbed setae, longest less than $\frac{1}{2}$ basal diameter of segment; with 1–3 (1.8, n = 41)

sensoria. A.s.IV and V subequally long, about $\frac{3}{4}$ a.s.III in length; a.s.VI with unguis averaging $6\frac{1}{2}$ times (range of 5.67–7.55, $n = 15$) length of base.

Dorsal body integument smooth on disk, becoming imbricate-spiculate caudally from about abd.s. 5; rather thickly covered with funnel- or cone-shaped setae. Cauda .24–.32 (.273, $n = 16$) mm long; stoutly elongate, constricted on basal $\frac{1}{3}$, apex acutely rounded; spiculate; with 2 lateral pairs (1 seta sometimes added on either side) and 1–4 (2.11, $n = 19$) posterodorsal setae. Cornicles .07–.13 (.093, $n = 40$) mm long, .28–.41 times ($.35 \pm .01$, $n = 40$) as long as cauda; cylindrical, sparsely imbricate-spiculate, apices dusky. Legs with 3, 3, 3 hairs on 1st tarsal joints. Rostrum IV+V .12–.14 (.132, $n = 21$) mm long, subequally as long as hind ta-2 (range of .90–1.18, $m = 1.00 \pm .02$, $n = 27$); distal $\frac{1}{2}$ past pl setae produced into cylindrical needle; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, al 2 or more times length of ml and pl setae.

Measurements (in mm) of a paratype female (labeled "morphotype" and mounted on same slide as holotype): BL 1.93, We .44; a.s.III .58 and .59, a.s.IV .40 and .47, a.s.V .47 and .49, a.s.VI both .14 + .88; cornicles .12 and .13, cauda .32; hind tibiae (one side) 1.24, hind ta-2 .14, and rostrum IV+V .14.

Alate Viviparous Female: Head light brown with areas around ocelli darker; antennae from near bases of a.s.III dark brown; mesothorax, wing veins and legs brown with tibial apices and entire tarsi darker than leg bases; abdomen pale, membranous, with dusky to pale brown sclerites, anal plate, cornicles and cauda. Head morphologically much like aptera but with slightly fewer df setae (27–35, $m = 31$, $n = 6$); mf and df-1 .0308–.0418 mm long, averaging .0352 and .0385 mm, respectively. Antennae with 9–15 (12.4, $n = 14$) sensoria on a.s.III. Abdominal sclerotizations consisting of 2 transverse pleural intersegmental bars on segments 2 to 4, these broken into 2 pairs of ovate ones on fifth, and 1 pair of small oval ones on segments 6 and 7; 1 median trapezoidal patch on all segments, becoming more conspicuous posteriorly; more weakly developed segmental marginal sclerites from segments 1 to 7. Cornicles, cauda, and rostrum IV+V as in viviparous aptera.

Measurements (in mm) of holotype and 7 paratypes: BL 1.54–1.78 (1.68), We .38–.41 (.395); a.s.

III .56–.63 (.586), a.s.IV .47–.54 (.502), a.s.V .45–.49 (.466), a.s.VI .13–.14 (.135) + .83–.89 (.865); cornicles .10–.11 (.105), cauda .26–.29 (.280); hind tibiae 1.17–1.28 (1.23), hind ta-2 .13–.14 (.139), and rostrum IV+V .13. Proportions of a.s.III:IV:V, 1: .80–.96 (.86); .75–.86 (.80); VIu/VIb 6.0–6.77 (6.39); co/ca .34–.41 (.37); rostrum IV+V/hind ta-2 .93–1.0 (.94).

Sexuales: Unknown.

Hosts.—*Artemisia longifolia*, *A. vulgaris*, and *Artemisia* sp.

DISTRIBUTION.—Records include northern Colorado near Utah and Wyoming borders: White Sulphur Springs, Montana; and Shoshone, Wyoming.

SPECIMENS EXAMINED.—Holotype and 2 al.v.f. and 1 apt.v.f. paratypes on same slide (USNM); another paratype slide with 5 al.v.f. and same data as holotype (EOE coll.); 7 apt.v.f., "metatypes", Laramie River, Colorado, 9–VIII–1933, MAP, on *A. longifolia* (EOE coll.); 1 apt.v.f., White Sulphur Springs, Montana, 11–VI–1936, CFS, on sage (GFK coll.); and 18 apt. v.f. and 1 ny., 13–IX–1941, GFK, on *A. vulgaris* (GFK coll.).

Plectrichophorus chrysanthemii (Theobald)

FIGURES 137, 266–272

Capitophorus chrysanthemii Theobald, 1920:69 [type: Bloemfontein, Orange Free State, South Africa, 18–V–1914, on *Chrysanthemum*; in BM].—1928:49; 1929:331–332.—Hall, 1926:35–36.—Kloet and Hincks, 1945:65.—Zimmerman, 1948:107.

Plectrichophorus chrysanthemii (Theobald).—Remaudière, 1952:262.—Hille Ris Lambers, 1953:119–121.—Bodenheimer and Swirski, 1957:201.—Börner and Heinze, 1957:249.—Müller and Scholl, 1958:398–399.—Hughes, et al., 1964:187.—Stroyan, 1964a:79.—Eastop, 1966:472.

Capitophorus formosanus Takahashi, 1929:248 [type: Taihoku, Formosa, on *Chrysanthemum sinensis*]; 1931:76.—Patch, 1938:245.—Takahashi, 1961:1 [synonymizes it with *Plectrichophorus glandulosus* but based on type-host, *C. formosanus* is more probably a synonym of *P. chrysanthemii* rather than *P. glandulosus*].

Plectrichophorus glandulosus (Kaltenbach).—Leclant, 1968:365 [in part].

Plectrichophorus glandulosus chrysanthemii (Theobald).—Eastop, 1958:61.

DIAGNOSIS.—*P. chrysanthemii* closely resembles *P. glandulosus* and is rather difficult to separate from it. Hille Ris Lambers (1953) expressed his doubt as to the validity of this species and thought it

probably a synonym of *P. glandulosus*. However, he pointed out the more slender stalks of setae as a distinctive feature. This was later confirmed by Müller and Scholl (1958) but they think this difference is too inconspicuous to recognize in the absence of food plant data.

The thinner-stemmed setae of *P. chrysanthemii* is a constant difference also exhibited by nearctic specimens examined. The proportions of the apical knob to the stem is shorter (at least for mf, lf and df-1 setae), namely $\frac{1}{5}$ to $\frac{1}{4}$ in *P. chrysanthemii* vs. $\frac{1}{4}$ to $\frac{1}{3}$ in *P. glandulosus*. In addition, among mounted specimens, the apical knobs tend to be thicker and more bulbous in *P. glandulosus* while these tend to be flattened and infundibulate in *P. chrysanthemii* (Figures 267, 274).

DESCRIPTION.—Apterous Viviparous Female: Color in life, pale green (CFS collection data) to yellow (Eastop, 1958); cleared specimens pale, with dusky antennal segment VI, dark brown rostral tip and entire tarsi. Body 1.82–2.37 (2.09, n = 21) mm long and .47–.54 (.484, n = 22) mm wide across eyes. Head with moderately developed frontal tubercles; mf 1p, lf 2 on each side, vlf 1p, df 10–16 ($13.36 \pm .64$, n = 22), vf usually 6, pc 2p, ac 4, md usually 3 on each side; dorsal setae elongate, with basal $\frac{3}{4}$ to $\frac{4}{5}$ slender (22–33 μ in diameter), cylindrical, distal $\frac{1}{5}$ to $\frac{1}{4}$ flaring into short funnel; ventral setae also flattened at apices but md and ac sometimes pointed; mf .0396–.0616 (.0486, n = 37) and df-1 .0440–.0616 (.0531, n = 42) mm long. Antennal segment I produced on inner distal margins, faintly imbricate, with 5–10 (usually 8) blunt or knobbed setae aside from usual pointed

seta on dorsum. A.s.II with $1 - \frac{1}{2} - 1$ similarly knobbed setae. A.s.III imbricate, with short, blunt or knobbed setae, longest less than $\frac{1}{2}$ basal diameter of segment, 1–6 (3.00, n = 34) sensoria present. A.s.IV about $\frac{3}{4}$ and a.s.V $\frac{2}{3}$ length of a.s.III; a.s.VI with unguis averaging 6 times (range of 5.35–7.43, n = 13) length of base.

Tergum smooth, membranous, becoming finely striate-spiculate posteriorly; setae relatively sparse, of similar shape to those on head, those of abd.s. 7 and 8 similar long, thin as mf and df-1 setae, discal setae relatively shorter, thicker (stems up to 44 μ thick). Cauda stoutly elongate, sometimes slightly constricted, apex broadly rounded, spiculate, with

2 lateral pairs and 1 posterodorsal setae. Cornicles .49–.60 (.543, n = 43) mm long, $1\frac{1}{4}$ to $2\frac{1}{4}$ times ($2.12 \pm .06$, n = 41) as long as cauda; cylindrical, with widest diameter at bases; imbricate, spiculate. Legs with 3, 3, 3 hairs on 1st tarsal joints. Rostrum IV+V slender, tapering to acute point; .11–.14 (.128, n = 21) mm long, $\frac{3}{4}$ to equal (.96 \pm .04, n = 21) hind ta-2; with 1 basal, 2 dorsal and 3 lateral pairs of setae, al 2–3 times as long as ml and pl setae.

Measurements (in mm) of 13 nearctic specimens: BL 1.82–2.37 (2.15), We .45–.54 (.495); a.s.III .65–.76 (.673), a.s.IV .50–.61 (.536), a.s.V .43–.54 (.49), a.s.VI .14–.18 (.162) + .91–1.04 (.931); cornicles .49–.58 (.541), cauda .24–.30 (.272); hind tibiae 1.25–1.56 (1.42), hind ta-2 .12–.14 (.132) and rostrum IV+V .11–.14 (.129). Proportions of a.s.III: IV:V, 1: .70–.85 (.77): .60–.79 (.69); VIu/Vlb 5.35–7.43 (6.08); co/ca 1.79–2.15 (1.98) and rostrum IV+V/hind ta-2 .79–1.00 (.97).

Alate Viviparous Female: Head and thorax brown, sclerotic with areas around ocelli slightly darker; abdomen pale, membranous, with light brown sclerites; antennae, wing veins, legs brown but apices of tibiae and tarsi darker; tip of rostrum also dark brown. Much like apterous vivipara but differs as follows: slightly fewer df setae present (11–13, m = 12.1, n = 7); head setae shorter, mf .0264–.0440 (.0322, n = 14) and df-1 .0352–.0506 (.435, n = 14) mm long; more sensoria on a.s.III (12–17, m = 14.46, n = 13); abdomen with 2 large pleural bars on segment 2 to 4, 2 pairs on fifth and a pair each on segments 1, 6, and 7, also with less distinct spinal dashes and ovate marginal thickenings on discal segments; cauda thinner, more acutely pointed; cornicles slightly shorter (.37–.52, m = .447, n = 14), co/ca ratio smaller ($1\frac{1}{2}$ to 2, m = 1.75, n = 14).

Measurements (in mm) of 4 nearctic specimens: BL 2.05–2.15 (2.11), We .40–.48 (.428); a.s.III .57–.68 (.628), a.s.IV .45–.61 (.533), a.s.V .43–.53 (.482), a.s.VI .14–.19 (.163) + .91–1.10 (.997); cornicles .37–.45 (.411), cauda .24–.26 (.253); hind tibiae 1.36–1.57 (1.43), hind ta-2 .13–.14 (.136) and rostrum IV+V .12–.13 (.123) mm long. Proportions of a.s.III:IV:V, 1: .71–.91 (.84): .68–.83 (.76); VIu/Vlb 5.79–6.93 (6.15); co/ca 1.54–1.73 (1.65); rostrum IV+V/hind ta-2 .86–.92 (.88).

Sexuales: Unknown.

HOSTS.—*Chrysanthemum* species including *C. indicum* and *C. sinensis*.

DISTRIBUTION.—Recorded from Europe (Great Britain, France, and Germany), Africa (Morocco, Egypt, Rhodesia, South Africa), Hawaii, Asia (China, Formosa), and Australia (South Australia, Tasmania, Victoria). Its occurrence in North America (California, Washington, North Carolina) is reported here for the first time.

SPECIMENS EXAMINED.—North America (United States): California at Stanford Univ. Nursery, 3 apt.v.f. and 2 al.v.f., 25–XI–1910 on cultivated *Chrysanthemum* (USNM); Washington at Seattle, 9 apt.v.f. and 1 al.v.f., 22–XI–1927, W.R. Shinn, on *Chrysanthemum* (USNM) and North Carolina at Raleigh, 1 apt.v.f. and 1 al.v.f., 7–XII–1963, CFS on *Chrysanthemum* (CFS coll.). Africa: Egypt at Gezurah, 9 apt.v.f. and 1 al.v.f., 2–XI–1924, J.W. Hall, on *Chrysanthemum* (DHRL coll.). Australia: Melbourne, 2 al.v.f., 2–IV–1959, VFE, on yellow trays (DHRL coll.).

***Pleotrichophorus decampus* (Knowlton and Smith)**

FIGURES 158, 476–490

Capitophorus decampus Knowlton and Smith, 1936b:230–231 [lectotype: apt.v.f., Brigham, Utah, 28–IV–1927, GFK, on *Artemisia tridentata*; in USNM].—Knowlton, 1948:122.—Palmer, 1952:254 [in part].

Pleotrichophorus decampus (Knowlton and Smith).—Hille Ris Lambers, 1969:169, 173 [in part; *P. pseudoglandulosus* is placed in this paper as a junior synonym of *P. decampus*].

Capitophorus frigidae.—Knowlton 1954:8 [not Palmer, in part; nomen nudum].

Capitophorus glandulosus.—Knowlton and Smith, 1936b:231 [not Kaltenbach, misidentification, in part; collections recorded on *A. tridentata* from several localities seen and determined as *P. decampus*].

Capitophorus glandulosus.—Knowlton, 1946:6 [not Kaltenbach, misidentification]; 1948:122.

Capitophorus pseudoglandulosus Palmer, 1952:266 [in part].

DIAGNOSIS.—*Pleotrichophorus decampus* can be distinguished from the closely related *P. pseudoglandulosus* by its shorter rostrum IV+V (.105–.130 mm, $m = .116$, $n = 56$ vs. .13–.16 mm, $m = .143$, $n = 27$); smaller co/ca ratio (2.25–3.20, $m = 2.62 \pm .05$, $n = 94$ vs. 2.61–3.44, $m = 2.98 \pm .07$, $n = 44$); cornicular integument less conspicuously wrinkled and armed with large sharp spicules; cauda usually more acutely pointed; shorter, more

expanded and denser head setae (df's number 25–55, $m = 38.21 \pm 1.60$, $n = 53$ vs. 16–21, $m = 18.78 \pm .56$, $n = 27$) and much more dense, widely funnel-shaped and sessile body setae. Alate viviparae can be differentiated in the same manner, and in addition, sensoria on a.s.III average fewer (5–14, $m = 8.22$, $n = 36$ vs. 10–19, $m = 14.6$, $n = 10$). Oviparous females are harder to separate since setae are dense in both species; however, mean length of last rostral segment is shorter in *P. decampus* (.12–.13 mm, $m = .123$, $n = 7$) than in *P. pseudoglandulosus* (.125–.145 mm, $m = .133$, $n = 4$). Among males, the presence of wings in the first and their absence in the latter species (Palmer, 1952) is an added difference.

It resembles *P. intermedius* in the length of its rostrum IV+V and the number of df setae (33.14 ± 1.80 , $n = 7$ for *P. intermedius*) but can be separated from it by the shorter, more widely expanded head and body setae, by the cornicular armature (conspicuously imbricate, wrinkled, and sparsely armed with blunt spicules in *P. intermedius*) and by the relatively shorter co/ca ratio (2.69–3.33, $m = 3.09 \pm .13$, $n = 13$ in *P. intermedius*).

DESCRIPTION.—*Apterous Viviparous Female* (spring form based on lectotype and 3 paralectotypes): Color in life, light green (data associated with type-slide); cleared specimen pale, with apices of tibiae and rostrum, entire tarsi and antennae from about tips of segment IV dark. Body length 1.35–1.52 (1.44, $n = 4$), width across eyes .38–.41 (.395, $n = 4$). Head with moderately developed latero- and mesofrontal tubercles; mf 1p, lf 2–4 on each side, vlf 1p, df 29–34 (30.3, $n = 4$), vf 7–9, pc 2p, ac 4, and md 2–3 on each plate; dorsal setae (Figure 476) basically funnel-shaped, all widely expanded but with anterior ones longer, more distinctly stemmed than posterior; ventral setae (Figure 477) of similar shape except pointed or blunt ac; mf .0308–.0330 (.0319, $n = 6$) and df–1 .0264–.0374 (.0325), $n = 8$) mm long. Antennal segment I moderately produced mesodistally, rather densely imbricate-spiculate, with 5–7 blunt to cone- or fan-shaped setae aside from basal pointed one on dorsum. A.S.II imbricate-spiculate usually 1 — — 1
2
setae, setae of similar shape to those of preceding segment. A.s.III densely imbricate, spiculate on basal portion, setae knobbed, small, longest less

than $\frac{1}{2}$ diameter of segment, 1 sensorium present. A.s.IV and V subequal, $\frac{1}{2}$ to $\frac{3}{4}$ length of a.s.III; a.s.VI with unguis $3\frac{2}{3}$ to $4\frac{1}{3}$ times (3.89, n = 8) as long as base.

Body integument membranous, with few scattered spicules on disk, more distinctly imbricate-spiculate from about abd.s. 5; with rather dense cover of conical to fan-shaped, sessile setae (Figure 479). Subgenital plate with few small setae (Figure 478). Cauda .13-.16 (.147, n = 3) mm long, triangular, not distinctly constricted, apex acutely rounded; spiculate; with 2 lateral and 1 posterodorsal setae. Cornicles .32-.40 (.348, n = 6), 2 to 3 times (2.41, n = 6) as long as cauda; cylindrical, with bases slightly incrassate; faintly dusky at apices; densely imbricate-spiculate, slightly wrinkled, with spicules rather large and sharp. Legs with 3, 3, 3 hairs on first tarsal joints; hind tibiae .70-.75 (.733, n = 6), hind ta-2 .09-.10 (.098, n = 6) mm long. Rostrum IV+V .12-.13 (.125, n = 3) mm long, 1.20-1.44 (1.29, n = 4) times length of hind ta-2; slender, apical $\frac{1}{2}$ produced into rather thick cylindrical needle; with 1 basal, 2 dorsal and 3 lateral pairs of setae, ml and pl about $\frac{1}{3}$ the size of al setae.

Apterous Viviparous Female (summer form): Similar to spring form, with following exceptions: head and body setae more conspicuously dense (Figures 480-483), df 25-55 (38.21 ± 1.60 , n = 53); first antennal segment with more setae (7-14, usually 8 or 9, capitate ones); dorsal seta of a.s.II always present; unguis of a.s.VI longer, $5\frac{1}{4}$ to $7\frac{3}{4}$ (6.0, n = 66) as long as base; cornicles slightly longer (.32-.56 mm, m = .494) but co/ca ratio about same ($2.62 \pm .05$, n = 94); rostrum IV+V .105-.130 (.116, n = 56) mm long and 1 to $1\frac{1}{2}$ times ($1.11 \pm .02$, n = 68) as long as hind ta-2.

Measurements (in mm) of 26 specimens on *Artemisia tridentata* from Woodfords, California: BL 1.16-1.55 (1.36), We .29-.41 (.369); a.s.III .40-.53 (.458), a.s.IV .34-.53 (.419), a.s.V .34-.46 (.399), a.s.VI .12-.15 (.138) + .72-.93 (.809); cornicles .32-.52 (.414), cauda .14-.18 (.154); hind tibiae .72-1.01 (.841), hind ta-2 .08-.11 (.099), rostrum IV+V .10-.12 (.111); mf .0264-.0440 (.0357) and df-1 .0330-.0440 (.0369). Proportions of a.s.III:IV:V, 1: .79-1.04 (.92): .77-98 (.87); VIu/VIb 5.33-6.50 (5.86); co/ca 2.28-3.20 (2.66); rostrum IV+V/hind ta-2 1.00-1.38 (1.12).

Measurements (in mm) of 10 specimens on *A. galifornica* from Berkeley and Salinas, California:

BL 1.68-1.95 (1.78), We .39-.45 (.410); a.s.III .43-.53 (.474), a.s.IV .35-.44 (.405), a.s.V .39-.49 (.439), a.s.VI .11-.14 (.131) + .68-.82 (.752); cornicles .42-.48 (.438), cauda .14-.20 (.180); hind tibiae .86-.99 (.91), hind ta-2 .11-.14 (.114) and rostrum IV+V .12-.13 (.122) mm. Proportions of a.s.III:IV:V, 1: .81-.89 (.86): .87-1.00 (.93); VIu/VIb 5.29-6.64 (5.83); co/ca 2.21-3.07 (2.45); rostrum IV+V/hind ta-2 1.00-1.18 (1.07).

Alate Viviparous Female: Head, thorax, antennae, and legs brown; abdomen pale, membranous, with light brown spinal, pleural and marginal sclerites; wing veins, apex of rostrum, anal and subgenital plates brown, apices of cornicles dusky. Morphologically like apterous vivipara, differing only as follows: df setae fewer (16-29 [Figure 489], m = 22.68, n = 19); ratio of unguis to base of a.s.VI averaging greater (m = 6.48 times, n = 30 and range = 5.86-7.67); more sensoria present on a.s.III (5-14, m = 8.22, n = 36); abdomen with 2 pleural intersegmental sclerites on segments 1 to 7, a pair of smaller oval spinal sclerites on some segments, and 2 marginal segmental sclerites on all but segment 8 (Figure 490); cornicles relatively shorter (.31-.50 mm, m = .414, n = 34) and co/ca ratio slightly smaller (2.07-2.78 times, m = 2.38, n = 26).

Measurements (in mm) of 10 specimens on *A. tridentata*: BL 1.48-1.77 (1.66), We .34-.40 (.370); a.s.III .46-.60 (.545), a.s.IV .42-.54 (.484), a.s.V .37-.54 (.459), a.s.VI .12-.15 (.139) + .82-.98 (.914); cornicles .31-.50 (.412), cauda .14-.21 (.167); hind tibiae .95-1.18 (1.07), hind ta-2 .11-.12 (.113), rostrum IV + V .11-.14 (.126); mf .0242-.0396 (.0328), and df-1 .0286-.0418 (.0353). Proportions of a.s.III:IV:V, 1: .84-.95 (.89): .78-.96 (.85); VIu/VIb 5.86-7.67 (6.56); co/ca 2.07-2.78 (2.49); rostrum IV + V/hind ta-2 .92-1.27 (1.10).

Oviparous Female: Also similar to apterous vivipara, differing as follows: cornicles and cauda relatively shorter (Figure 484), co/ca ratio smaller; cauda stouter; abdominal setae longer, thinner; subgenital plate with more setae, all pointed (Figure 485); basal $\frac{1}{3}$ to $\frac{1}{2}$ of hind tibiae enlarged and bearing several to many pseudosensoria.

Measurements (in mm) of 7 specimens on *A. tridentata*: BL 1.41-1.90 (1.68), We .37-.45 (4.04); a.s.III .43-.53 (.484), a.s.IV .33-.46 (.371), a.s.V .35-.45 (.380), a.s.VI .11-.14 (.130) + .64-.76 (.707); cornicles .34-.43 (.383), cauda .18 (all); hind tibiae

.73-.96 (.835), hind ta-2 .10-.11 (.106), rostrum IV+V .12-.13 (.123); mf .0330-.0440 (.0374) and df-1 .0352-.0440 (.0382) mm. Proportions of a.s.III: IV:V, 1: .73-1.07 (.77): .69-1.05 (.79); Vlu/V1b 4.86-6.45 (5.50); co/ca 1.94-2.56 (2.28); rostrum IV+V/hind ta-2 1.09-1.20 (1.15).

Alate Male: Differs from alate viviparous female in presence of fewer df setae (13 and 19 in 2 specimens) (Figure 486); presence of more sensoria on a.s.III (32-40, m = 35, n = 4) and their presence also on a.s.IV (25-28, m = 25.75, n = 4) and a.s.V (17-20, m = 19, n = 3); cornicles and cauda shorter; cauda broadly rounded at apex, hardly produced beyond posterior pair of setae; abdominal setae sparser, longer, consisting of mixture of funnel-shaped and pointed to blunt setae (Figure 487). Genitalia consisting of 2 oblong, setaceous parameres and slightly tapered but apically rounded aedeagus (Figure 488).

Measurements (in mm) of 2 specimens on *A. tridentata*: BL 1.62, We .36 and .37; a.s.III .49-.52 (.508), a.s.IV .45-.49 (.478), a.s.V .44-.46 (.45), a.s.VI .15-.16 (.158) + .88-.95 (.923); cornicles .23-.30 (.263), cauda .09 and .13; hind tibiae .98-1.09 (1.05), hind ta-2 .12, rostrum IV+V .12; mf .0242-.0330 (.0264), and df-1 .0242-.0330 (.0286). Proportions of a.s.III:IV:V, 1: .90-.96 (.94): .88-.90 (.89); VIu/V1b 5.87-6.33 (6.05); co/ca 2.27-2.56 (2.43); rostrum IV+V/hind ta-2 1.00.

Hosts.—*Artemisia californica*, *A. tridentata*, and *Artemisia* sp.

DISTRIBUTION.—Widely distributed in the Southwestern United States, with records from various localities in California, Colorado, Idaho, Montana, Oregon, Utah, and Wyoming.

Types (designated from "type" slide).—Lectotype, apt.v.f., specimen at 5:00 o'clock on type slide. Paralectotypes: 3 apt.v.f. and 1 apt.ny., with same data and mounted on same slide as lectotype (USNM).

SPECIMENS EXAMINED.—Other than types: CALIFORNIA: Berkeley, at Strawberry Canyon, 2 apt.v.f., 15-I-1964, DHRL, on *Artemisia californica* (DHRL coll.); north of Big Sur, 10 apt.v.f., 26-III-1965, RCD, on *Artemisia* (RCD coll.); Eagleville at Emerson Canyon, 1 apt.v.f. and al.v.f., 2-VI-1966, CFS, on *A. tridentata* (EOE coll.); Inyo Co., at Beaver Pond, Baker Creek, 4 apt.v.f. and 3 al.v.f., 20-VIII-1965, RCD, on *A. tridentata* (RCD coll.); Mineral King, 52 apt.v.f., 10-VIII-1939,

G.E. Bohart, stored in nests in elder pith of *Pemphredon* (EOE coll.); Monterey Co. at S.W. Salinas, 9 apt.v.f., 28-III-1964, RCD, on *A. californica* (RCD coll.); San Bernardino Co. at Big Bear Lake, 1 apt.v.f. and 3 al.v.f., 20-X-1940, RCD, on *A. tridentata*; San Bernardino Co. at SE Big Bear Lake, 8-X-1965, RCD on *Chrysothamnus nauseosus* (?) (RCD coll.); San Bernardino Co. at Fawnskin, 1 ny. and 1 al.v.f. on 8-X-1965 and 4 apt.v.f. and 1 al.v.f. on 9-XI-1958, RCD, on *A. tridentata* (RCD coll.); San Jacinto Mts., 4 apt.v.f., 5-XI-1939, RCD, on *A. tridentata* (RCD coll.); and Woodfords, 7000 ft elev., 27 apt.v.f. and several ny., 17-VIII-1931, on *A. tridentata* (EOE coll.). COLORADO: Estes Park, 2 apt.v.f., 7-VIII-1919, CPG, on *A. tridentata* (DHRL coll.). IDAHO: Ashton, 1 apt.v.f., 2-VIII-1936, GFK, on sage (GFK coll.); Fish Haven, 1 apt.v.f. and 6 ny., 16-VIII-1927, GFK, on *A. tridentata* (GFK coll.) and Mink Creek, 2 apt.v.f., 1 al.v.f., 27-VI-1936, CFS, on *A. tridentata* (OSU). MONTANA: Gallatin, 1 apt.v.f., 15-VII-1936, GFK, on *A. tridentata* (GFK coll.). OREGON: Sisters, 3 apt.v.f., 24-VIII-1944, GFK on *A. tridentata* (USNM). UTAH: Bear River City, 7 apt.v.f., 10-VIII-1927, GFK, on *A. tridentata* (GFK coll.); Bountiful, 4 apt.v.f., 2 al.m., and 15 ny., 28-X-1968, GFK, on *A. tridentata* (LACR coll.); Brigham, 1 apt.v.f. and 1 ny., 17-VI-1927, on *A. tridentata* (GFK coll.); Eden, 1 apt.v.f., 28-VI-1955, GFK, on unknown host (EOE coll.); Farmington, 1 apt.v.f. and 1 ovip.f., 21-X-1968, GFK, on *A. tridentata* (LACR coll.); Garden City, 1 apt.v.f., 15-VIII-1959, JOP, on *Artemisia* (JOP coll.); Logan Canyon, 1 apt.v.f. and 1 al.v.f., 28-IX-1967, GFK and M.W. Knowlton, on *A. tridentata* (AGR and GFK coll.); Logan Canyon, 1 ovip.f., 28-X-1967, GFK, on *A. tridentata* (LACR coll.); Ogden Canyon, 6 apt.v.f. and 1 ny., 18-VIII-1927, GFK, on *A. tridentata* (INHS); Utah Co. at Soldier Summit, 1 al.v.f., 18-VII-1965, M.H. Ewalt, on *Artemisia* sp. (RCD coll.). WYOMING: Grand Canyon, Snake River, 1 apt.v.f., 11-IX-1941, GFK on *Artemisia* (GFK coll.).

Pleotrichophorus diutius, new species

FIGURES 147, 324-332

Capitophorus wasatchii Knowlton.—Gillette and Palmer, 1934:157-158 [in part].—Palmer, 1952:272-273.

DIAGNOSIS.—*P. diutius* can be differentiated from

the other *wasatchii*-like species (viz., *P. ambrosiae*, *P. ohioensis*, and *P. wasatchii*) by having the greatest ratio of cornicles to cauda ($m = 1.78 \pm .04$, $n = 34$ vs. $1.44 \pm .03$, $n = 58$; $1.45-1.48$; and $1.30 \pm .04$, $n = 14$ for said species, respectively); by its short, cone- to fan-shaped, mostly sessile head and body setae (Figures 332-334); the presence of few sensoria on a.s.III of both apterae (1 or 2, also in *P. wasatchii* vs. 1-7, usually 3 or 4 in *P. ambrosiae*, and 3-5 in *P. ohioensis*) and alatae (4-8 vs. 10-17 in *P. ambrosiae*; other species not known); the blunter and slightly convex-sided rostrum IV+V; and the conspicuously imbricate, wrinkled and sparsely toothed cornicular integument. It resembles *P. palmerae* somewhat in the shape of the dorsal setae and in having co/ca ratio of about $1\frac{3}{4}$ but differs most conspicuously in the shape of the last rostral segment (acutely pointed and straight-sided in *P. palmerae*), by having the cauda shorter and thicker, and the relatively shorter (.41-.52 mm., $m = .471$, $n = 38$ vs. .45-.68 mm., $m = .479$, $n = 82$) cornicles; the presence of fewer sensoria (2-9, $m = 4.3$, $n = 82$ in *P. palmerae*); head (df mean = $17.84 \pm .98$, $n = 19$ vs. $23.74 \pm .09$, $n = 43$) and body setae relatively more sparse.

DESCRIPTION.—Apterous Viviparous Female: Color in life, green (Oestlund's collection notes); cleared specimen pale with apices of rostrum and tibiae, entire tarsi, and antennae from apex of segment IV dark. Body length 1.65-2.12 (1.86, $n = 19$), width across eyes .43-.52 (488, $n = 22$) mm. Head with rather well-developed laterofrontal tubercles, mesofrontal tubercle rather low; mf 1p, lf 2-4 (usually 3) on each side, vlf 1p, df 15-21 ($17.84 \pm .98$, $n = 19$), vf 6-9 (usually 6), pc 2p with 1 sometimes added, ac usually 4, md 2-4 (usually 3) on each side; dorsal setae cone-shaped, flaring widely, without distinct stems; ventral setae similarly shaped but generally less expanded, ac often merely blunt; mf .0242-.0374 (.0296, $n = 40$), df-1 .0286-.0374 (.0325, $n = 40$) mm long. Antennal segment I distinctly produced on mesodistal margins, imbricate, with 6-12 (usually 7 or 8) blunt or knobbed setae aside from the basal pointed seta on dorsum.

A.s.II imbricate, with 1 — 1 blunt or knobbed setae. A.s.III densely imbricate; with small blunt or knobbed hairs, the longest less than $\frac{1}{3}$ basal diameter of segment; with 1-2 sensoria (usually 1,

only 1 of 29 or 3.4% of segments seen with 2 sensoria). A.s.IV about $\frac{9}{10}$ and a.s.V $\frac{3}{4}$ length of a.s.III; a.s.VI with unguis averaging $5\frac{1}{2}$ times (range = 4.86-5.69, $n = 16$) length of its base.

Body integument faintly reticulate on disk, becoming more conspicuously so, and also spiculate, posteriorly; setae moderately dense, of same shape as those of head. Cauda .24-.28 (.264, $n = 19$) mm long; stoutly elongate, with slight constriction on basal third, apex broadly rounded; spiculate; with 2 lateral pairs, 1 posterodorsal setae. Cornicles .41-.52 (.471, $n = 38$) mm long, $1\frac{1}{2}$ to 2 times ($1.78 \pm .04$, $n = 34$) as long as cauda; cylindrical with widest diameter about bases; densely imbricate, wrinkled, imbrications rather heavy, sparsely armed with small but pointed teeth. Legs with 3, 3, 3 hairs on first tarsal joints; hind tibiae .98-1.16 (1.10, $n = 31$), hind ta-2 .12-.14 (.131, $n = 27$) mm long. Rostrum IV+V .10-.11 (.101, $n = 19$) mm long, averaging $\frac{3}{4}$ (.78 \pm .02, $n = 25$, range = .71-.85) length of second tarsal joint; rather slender at base, narrowing slightly, margins straight from base but becoming slightly convex past pl setae and apex rather blunt; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, al about 3 times ml and pl setae in size.

Measurements (in mm) of holotype: BL 1.98, We .50; a.s.III and VI (only one side complete) .60, .48, .48 and .15+.80; cornicles .48 and .49, cauda .28; hind tibiae 1.10 and 1.12, hind ta-2 both .14, and rostrum IV+V .10 mm.

Alate Viviparous Female: Head and thorax pale brown with slightly darker ring around ocelli and mesothoracic lobes; legs dusky on bases and apices of tibiae, entire tarsi darker brown; antennae and cornicles slightly dusky, wing veins, apex of rostrum brown. Similar to apterous female, with following differences: fewer df setae (12-17, $m = 14.1$, $n = 10$); more sensoria on a.s.III (4-8, $m = 5.8$, $n = 10$); disk of abdomen with 2 rows of transverse pleural bars which may be broken into 2 pairs of ovate ones in some segments, more irregularly developed spinal dashes, and marginal thickenings; cornicles slightly shorter, co/ca ratio relatively smaller.

Measurements (in mm) of 10 paratypes: BL 1.73-2.00 (1.85), We .41-.46 (.446); a.s.III .54-.61 (.578), a.s.IV .46-.53 (.578), a.s.V .44-.51 (.480), a.s.VI .14-.16 (.150) + .77-.87 (.819); cornicles .37-.41 (.392), cauda .24-.28 (.259); hind tibiae

1.13–1.26 (1.19), hind ta-2 .12–.14 (.13) and rostrum IV+V .10 mm. Proportions of a.s.III:IV:V, 1: .80–.91 (.87); .79–.88 (.83); VIu/VIb 5.13–6.07 (5.47); co/ca 1.39–1.63 (1.52); rostrum IV+V/hind ta-2 .71–.83 (.77).

HOSTS.—*Artemisia dracunculoides* (= *Artemisia aromatica*), and *Artemisia* sp.

DISTRIBUTION.—Type-records include Minnesota and Colorado.

TYPES.—Holotype, apt.v.f., Minneapolis, Minnesota, 19–VII–1929, coll. # 62/29 OWO, on *Artemisia dracunculoides* (OWO coll.). Paratypes: 4 apt.v.f., 3 al.v.f. and 2 altd.ny., with same data as holotype; following paratypes also with same data as holotype, except as indicated, and all (but 2 apt.v.f. and 1 al.v.f., in LACR coll.) in OWO coll.: 2 apt.v.f. and 4 apt.ny., 1–VI–1925, riverbank at U. Minn. Campus, # 37/25; 5 apt.v.f. and 2 apt.ny., 26–VI–1929, # 30/29; 1 apt.v.f. and 3 apt.ny., 2–VII–1929, # 38/29; and 1 apt.v.f. and 7 al.v.f., 18–VII–1929, # 60/29. Other paratypes: 2 apt.v.f. and 1 apt.ny., Fort Collins, Colorado, 21–VI–1914, LCB, on *Artemisia aromatica* (DHRL coll.); and 6 apt.v.f. and 3 apt.ny., Fort Collins, Colorado, # 721, unknown date, on *Artemisia* (USNM).

Pleotrichophorus elongatus (Knowlton),
new combination

FIGURES 129, 252–264

Capitophorus elongatus Knowlton, 1929:11 [lectotype: apt.v.f., Mt. Carmel, Utah, 26–VI–1927, GFK, on *Chrysothamnus nauseosus*, in GFK coll.].—Gillette and Palmer, 1934: 148–149.—Knowlton, 1935a:283; 1935b:137.—Knowlton and Smith, 1936a:109–110; 1937:151.—Knowlton, 1948:122.—Palmer, 1952:254–255.

Capitophorus chlorophainus Knowlton and Smith, 1936a:109 [type: apt.v.f., Logan Canyon, Cache Co., Utah, 16–VIII–1927, GFK, on *Chrysothamnus viscidiflorus*; type-series in USNM and some types apparently examined by Hille Ris Lambers (1969), synonymy fide Hille Ris Lambers].

Pleotrichophorus chlorophainus (Knowlton and Smith).—Hille Ris Lambers, 1969:172.

?*Capitophorus feragaeus* Knowlton and Smith, 1936a:100 [type: apt.v.f., McCoy, Colorado, 24–VIII–1935, GFK, on *C. nauseosus*; repository USNM]; 1937:150–152.—Palmer, 1952:255.

Capitophorus palmerae Knowlton.—Palmer, 1952:265 [in part].

DIAGNOSIS.—This species very closely resembles *P. palmerae*. Hille Ris Lambers (1969:179) in fact,

believes it to be synonymous with it. Examination of paratypes of *P. palmerae* and a larger series of specimens collected and determined later by G.F. Knowlton (unpublished records), however, show consistent morphological differences that are easy to recognize. These differences are: more expanded, circular, fan-like and sessile posterior df and body setae in *P. elongatus* (vs. mostly funnel-shaped, and short-stemmed in *P. palmerae*; Figures 264, 265); relatively shorter mf and df-1 setae (.0154–.0330, m = .0218, n = 124 and .0198–.0330, m = .0265, n = 131 in *P. elongatus* vs. .0242–.0418, m = .0330, n = 84, and .0242–.0440, m = .0349, n = 84 in *P. palmerae*); more robust, slightly convex-sided, more bluntly pointed, shorter rostrum IV+V in *P. elongatus* (.08–.11 mm, m = .094, n = 70) than in *P. palmerae* (.095–.12 mm, m = .108, n = 41); a smaller rostrum IV+V/hind ta-2 ratio (.53–.83, m = .66 ± .01, n = 100 vs. .73–1.00, m = .86 ± .02, n = 55 in *P. palmerae*); in having al setae of rostrum IV+V not distinctly longer than ml and pl setae (al is 2–3 times length of ml and pl setae in *P. palmerae*); and the usual presence of fewer sensoria on a.s.III (0–3, m = 1.29, n = 128 vs. 2–10, m = 4.27, n = 82 in *P. palmerae*).

These morphological differences are supported by the distribution patterns of the two species. *P. palmerae* appears to have a more westerly (California, Nevada, and Oregon) occurrence than *P. elongatus* (Utah and Colorado).

DESCRIPTION.—*Fundatrix*: Very similar to summer apterous vivipara but with shorter unguis and cornicles, fewer df setae (14–18 in 4 specimens), no vlf seta on laterofrontal area of head nor dorsal seta on antennal segment II.

Measurements (in mm) of 5 paralectotypes (from Scipio, Utah, 4–V–1927): BL 1.91–2.21 (2.03), We .43–.48 (.463); a.s.III .54–.62 (.586), a.s.IV .32–.45 (.416), a.s.V .43–.49 (.459), a.s.VI .14–.18 (.156) + .60–.67 (.64); cornicles .45–.51 (.494), cauda .31–.33 (.318); hind tibiae .98–1.16 (1.04), hind ta-2 .11–.12 (.119), rostrum IV+V .08–.10 (.09); mf .0176–.0242 (.0211) and df-1 .0242–.0308 (.0277). Proportions of a.s.III:IV:V, 1: .52–.77 (.71): .74–.81 (.78); VIu/VIb 3.72–4.79 (4.12); co/ca 1.45–1.63 (1.55), rostrum IV+V/hind ta-2 .67–.83 (.76).

Apterous Viviparous Female (summer form): Color in life shining apple green (Knowlton, 1929: 11); cleared specimens pale with tips of rostrum and tibiae, antennae from near apices of a.s.III,

and entire tarsi darker. Body slenderly spindle-shaped, 1.75–2.70 (2.39, $n = 70$) mm long, .46–.56 (.511, $n = 67$) mm wide across eyes. Head with moderately produced laterofrontal, rather low mesofrontal tubercle; faintly imbricate on laterofrontal and ventral areas; mf usually 1p, lf 2–4 (usually 3) on each tubercle, vlf 1p, df 16–30 ($23.73 \pm .06$, $n = 84$), vf 4–15 (9.4, $n = 69$), pc 2 or sometimes 3p, ac usually 4, and md 2–4 (usually 3) on each side; dorsal setae, especially posterior df's, widely expanded, fan-shaped, with circular margins, without distinct stems; vf expanded but more narrowly than df's, pc and ac even more so, ac elongate with pointed to knobbed apices; mf setae .0154–.0330 (.0218, $n = 124$), df-1 .0198–.0330 (.0265, $n = 131$) mm long. Antennal segment I conspicuously produced on mesodistal margin, rather densely imbricate-spiculate, and with 7–17 (usually 12 or 13 small, blunt setae in addition to basal pointed

one on dorsum. A.s.II with generally 1— $\frac{1}{2}$ —1 blunt setae but 1–3 sometimes added. A.s.III imbricate, with small blunt setae, mostly less than $\frac{1}{3}$ basal diameter of segment, with 0–3 (1.29, $n = 128$) sensoria. A.s.IV subequal to (1.02 times, $n = 106$) and a.s.V only slightly shorter (.89, $n = 89$) than a.s.III; a.s.VI with unguis averaging 6 times (5.16–7.19, $n = 49$) length of base.

Dorsal body integument finely imbricate to reticulate, imbrications smooth on disk but becoming spiculate caudad of abd.s. 6; body setae moderately dense, widely expanded, fan-shaped, with circular margins, without distinct stems as in head setae. Cauda slender, elongate, with slight basal constriction, tapering gradually to acute but rounded tip; spiculate; with 2 lateral pairs and 1 posterodorsal setae. Cornicles .46–.72 (.608, $n = 136$) mm long, 1.37–1.91 ($1.61 \pm .01$, $n = 100$) times as long as cauda; cylindrical, with distal 0.1 slightly incrassate; densely imbricate-spiculate. Anal plate with rounded or angular posterior margin, may be concave in some specimens. Legs with 3, 3, 3 setae on first tarsal joints. Rostrum IV+V .07–.11 (.094, $n = 70$) mm long, about $\frac{2}{3}$ (.53–.83, $m = .66 \pm .01$, $n = 100$) length of hind ta-2; tapering gradually to rather blunt point, margins past pl setae slightly convex; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, the latter subequal in length.

Measurements (in mm) of lectotype and 16 para-

lectotypes: BL 2.20–2.70 (2.42), We .46–.54 (.51); a.s.III .58–.81 (.744), a.s.IV .55–.87 (.775), a.s.V .53–.76 (.679), a.s.VI .15–.23 (.175) + .97–1.10 (1.06); cornicles .48–.69 (.623), cauda .35–.41 (.377); hind tibiae 1.17–1.50 (1.37), hind ta-2 .12–.16 (.141), and rostrum IV+V .09–.10 (.096). Proportions of a.s.III:IV:V, 1: .95–1.11 (1.04): .64–.97 (.89); VIu/VIb 5.53–6.76 (6.15); co/ca 1.37–1.78 (1.64); rostrum IV+V/hind ta-2 .60–.83 (.68).

Alate Viviparous Female: Color in life, light to apple green (Knowlton, 1929:11). Cleared specimens with pale brown head; mesothorax, basal 2 antennal segments and wing veins, areas around ocelli, tips of rostrum and tibiae, entire tarsi, and antennae from near bases of a.s.III darker brown. Morphologically similar to apterous vivipara except as follows: with fewer df setae (13–17 in paralectotypes), more sensoria on a.s.III (8 in 1 specimen seen or 10–16 according to Knowlton, 1929), shorter cornicles, cauda, and sparser abdominal setae.

Measurements (in mm) of 1 paralectotype: BL 1.50 +, We .41; a.s.III .72 and .74, a.s.IV .73 and .78, a.s.V .70 and .66; cornicles .40 and .43; cauda .31; hind tibiae 1.31 and 1.33, hind ta-2 .14 and .15, rostrum IV+V .09, mf both .0198, and df-1 both .0242.

Sexuales: Unknown.

HOSTS.—*Chrysothamnus nauseosus*, *C. parryi*, and *C. viscidiflorus*.

DISTRIBUTION.—Throughout Utah and northern part of Colorado.

TYPES (designated from cotypes available).—Lectotype, apt.v.f. at 5:00 o'clock on type-slide. Paralectotypes (all collected by GFK): 4 apt.v.f. mounted on same slide and 1 al.v.f., 2 apt.ny. and 2 altd.ny. with same data as lectotype (GFK coll.); 5 apt.v.f. (fundatrices), Scipio, Utah, 4-V-1927, on *C. nauseosus* (GFK coll.); 9 apt.v.f., Sawtooth, Utah, 28-VI-1927, on *C. nauseosus* (EOE coll.); 6 apt.v.f. and 1 al.v.f., Sry, Utah, 27-VI-1927, on *C. nauseosus* (EOE coll.); and 3 apt.v.f., Richfield, Utah, 27-VI-1927, on *Chrysothamnus* sp. (CFS coll.).

SPECIMENS EXAMINED.—Aside from types, numerous apterous viviparous females from following localities: COLORADO: Craig, Maybelle. UTAH: Allen Canyon, Black Ridge in Beaver Co., Chicken Creek Reservoir, Current Creek, Delta, Deseret, Dog Valley, Duchesne, Filmore, Fish Lake Canyon, Fre-

mont, Fruitland, Hatton, Heber, Hinckley, Glendale, Koosharem, Lynndyl, Manderfield, Marysvale, Mt. Carmel, Nephi, Oak City, Oasis, Orderville, Panguitch, Pine Valley, Roosevelt, Sawtooth, Scipio, Sigurd, Sutherland, and Wolf Creek Canyon at 7600 ft elevation.

NOTES ON SYNONYMY.—Specimens seen on *Chrysothamnus viscidiflorus* from Sawtooth, Utah (Figures 129 right, 262, 263) agree with the original description of *Capitophorus chlorophainus* Knowlton and Smith. Although they exhibit slight differences in linear measurements (viz., slightly longer mean length of .105 mm, $n = 11$ for rostrum IV+V, and .0251 mm, $n = 18$ for mf, and .0295, $n = 20$ for df-1 setae), they exhibit more morphological resemblance to *P. elongatus* than to *P. palmerae*. Hille Ris Lambers' synonymy of *P. chlorophainus* with *P. elongatus* is accepted on this basis. However, *P. palmerae* is preserved as a good species with morphological and distributional differences from *P. elongatus* enumerated earlier.

Gillette and Palmer (1934) and Palmer (1952) apparently confused *P. palmerae* and *P. elongatus* also because of specimens on *Chrysothamnus viscidiflorus*. Palmer (1952) thus incorrectly placed *P. chlorophainus* as synonym of *P. palmerae* and included *C. viscidiflorus* as host and several Utah and Colorado localities within the distribution range of *P. palmerae*.

Another closely related species, *Pleotrichophorus feragaeus* (Knowlton and Smith), is doubtfully placed here as synonym of *P. elongatus*. Types (McCoy, Colorado on *Chrysothamnus nauseosus*) could not be discovered at the time this research was underway. They have recently been deposited in the USNM but they have not been seen by the authors.

Knowlton and Smith (1936a) and Palmer (1952) distinguish *P. feragaeus* by the relative lengths of a.s.III and IV (the former not equal to latter), the long base of a.s.VI (more than .15 mm), short vertical hairs (not longer than .015 mm), lengths of cornicles (.48-.50 mm), and cauda (not shorter than .35 mm). All these measurements, except the length of the vertical hairs, fall well within the ranges for *P. elongatus*. Furthermore, figures provided in these papers show sessile, fan-shaped head setae, distinctly tapered and rather bluntly pointed rostrum IV+V, and conspicuously imbricate an-

tennae and cornicles, which all fit descriptions of *P. elongatus*.

Knowlton and Smith (1936a) consider *P. feragaeus* to be closely related to *P. pycnorhysus* and Palmer (1952:268) doubtfully separates them. The rostral and setal shapes, however, as well as antennal measurements, are distinctly closer to *P. elongatus* than to *P. pycnorhysus*.

Pleotrichophorus filifoliae (Palmer)

FIGURES 148, 381-383

Capitophorus filifoliae Palmer, 1938:355 [type: apt.v.f., Denver, Colorado, 27-VIII-1919, LCB, on *Artemisia filifolia*; USNM 52349]; 1952:255-256.

Pleotrichophorus filifoliae (Palmer).—Hille Ris Lambers, 1966:606; 1969:166.

DIAGNOSIS.—A rather small species (1-1.23 mm long), *P. filifoliae* can be recognized by its short cornicles (.08-.12, $m = .091$, $n = 11$) that are about half (.50 \pm .05) the length of the cauda, the short (.09-.10, $m = .097$, $n = 6$), slender acutely pointed but not needle-like last rostral segment, and the rather long (mf and df-1 setae .0352-.0462 mm), distinctly stemmed and funnel-shaped head and body setae. It resembles *P. obscuratus* in the shape of setae but can be readily separated from it by the pale legs and cornicles and by the shape of the last rostral segment (distinctly needle-tipped in *P. obscuratus*).

DESCRIPTION.—*Apterous Viviparous Female*: Color in life medium green, appearing frosted due to funnel-shaped setae (Palmer, 1938); cleared specimens pale with the tips of a.s.V, remainder of antennae, tips of tibiae, entire tarsi and most of rostrum IV+V darker. Body 1.08-1.23 (1.14, $n = 5$) mm long, .30-.38 (.335, $n = 8$) mm wide across eyes. Head with moderately produced latero- and mesofrontal tubercles; mf 2p, lf 2-3 on each side, vlf 1p, df 21-27 (23.43 \pm 1.50, $n = 7$), vf 5-7, pc 2p, ac 4, and md 2-4 (usually 3) on each side; dorsal setae funnel-shaped, with distinct stems, about $\frac{2}{3}$ entire length for anterior or $\frac{1}{3}$ to $\frac{1}{2}$ for posterior setae; ventral setae with vf and vlf similarly but more narrowly funnel-shaped, remainder pointed or blunt at apices; mf and df-1 setae .0352-.0462 mm long, with means of .0389 ($n = 14$) and .0413 ($n = 13$), respectively. Antennal segment I slightly produced on inner distal margin, faintly imbricate, with 5-9 blunt or slightly

knobbed setae aside from usual pointed seta on dorsum. A.s.II usually with $1 - \frac{1}{2} - 1$ blunt or knobbed setae. A.s.III faintly imbricate, setae blunt or knobbed, rather small, longest less than $\frac{1}{2}$ basal diameter of segment, with 1 sensorium in all 14 segments counted. A.s.IV and V subequally long $\frac{3}{4}$ to equal a.s.III in length; a.s.VI with unguis $4\frac{1}{3}$ to $5\frac{1}{3}$ times (4.68, n = 7) as long as base (about 3 times in one spring-collected female seen).

Dorsal body integument smooth on disk, becoming spiculate caudally; setae moderately dense and of similar shape to those on head. Cauda .17-.18 (.178, n = 5) mm long; elongate, with slight basal constriction, acutely rounded apex; slightly dusky; spiculate; with 2 lateral pairs and 1 posterodorsal setae. Cornicles .08-.12 (.091, n = 11) mm long. .44-.53 (.50 \pm .05, n = 5) times as long as cauda; cylindrical; apices slightly dusky; imbricate-spiculate, spicules rather small but sharp. Legs with 3, 3, 3 hairs on first tarsal joints; hind tibiae .60-.70 (.674, n = 10) and hind ta-2, .09-.11 (.10, n = 10) mm long. Rostrum IV+V .09-.10 (.097, n = 6) mm long, .91-1.11 times (.96 \pm .06, n = 9) length of hind ta-2; slender at base, tapering gradually to acute point, distal $\frac{1}{4}$ to $\frac{1}{3}$ past pl setae sometimes appearing as stout "needle"; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, al about 2 times size of ml and pl setae.

Measurements (in mm) of holotype: BL 1.21, We .35; a.s.III-V all .30, .25, and .25 on both sides, a.s.VI .12 + .59 and .11 + .58; cornicles both .09, cauda .18; hind tibiae (one side) .74, hind ta-2 missing, and rostrum IV+V .10.

Alate viviparous female: Not seen. Palmer (1938) gives the following measurements for one specimen: BL 1.4; a.s.III .37, a.s.IV .27, a.s.V .28, a.s.VI .12 + .50; hind tibiae .72, hind ta-2 .10 mm. Number of sensoria on a.s.III 10.

Sexuales: Not known.

Host.—*Artemisia filifolia*.

DISTRIBUTION.—Apparently rare, and so far known only around type-locality (Denver, Colorado).

SPECIMENS EXAMINED.—Holotype: 1 paratype slide containing 8 apt.v.f. and with same data as holotype (CSU); and 1 "metatype" apt.v.f., Roggen, Colorado, 13-V-1939, MAP, on *Artemisia filifolia*.

Pleotrichophorus glandulosus (Kaltenbach)

FIGURES 138, 273-285

Aphis glandulosa Kaltenbach, 1846:170-171 [type: Germany, on *Artemisia vulgaris*; believed nonexistent].—Wilson and Vickerey, 1918:83.

Myzus glandulosus (Kaltenbach).—Van der Goot, 1915:106-107.

Pleotrichophorus glandulosus (Kaltenbach).—Börner, 1930:138.—Hille Ris Lambers, 1933:173.—Kloet and Hincks, 1945:65.—Eastop, 1951:109.—Hille Ris Lambers, 1953:126-130.—Börner and Heinze, 1957:249.—Heie, 1962:220-221.—Szelegiewicz, 1963:131.—Leonard, 1964:84.—Shaposhnikov, 1964:790.—Stroyan, 1964a:79.—Tuatay and Remaudière, 1964:267.—Paik, 1965:58.—Pepper, 1965:213.—Achremowicz, 1967:291.—Huculak, 1967:244.—Leclant, 1968:369.—Hille Ris Lambers, 1969:168.

Capitophorus glandulosus (Kaltenbach) [misidentification].—Gillette and Palmer, 1934:149-150.—Knowlton and Smith, 1936b:231; 1937:151.—Knowlton, 1946:6.

Capitophorus glandulosus (Kaltenbach).—Wahlgren, 1938:179.—Patch, 1938:245.

Pleotrichophorus glandulosus chrysanthemi (Theobald).—Eastop, 1958:61.

Capitophorus formosanus Takahashi.—Takahashi, 1961:1 [in part].

Myzus pilosus Van der Goot, 1912:68 [type: Wageningen, Netherlands, on *Artemisia vulgaris*].

Capitophorus pilosus (Van der Goot).—Theobald, 1923b:27.—J. Davidson, 1925:62.—Theobald, 1926:246-248; 1927:33.—Mimeur, 1934:36-37.—Patch, 1938:245.

DIAGNOSIS.—This species is distinct from *P. chrysanthemi* in its thicker, longer stemmed, and bulbous rather than flattened and infundibulate head and body setae. The differences are discussed more fully under *P. chrysanthemi*.

DESCRIPTION.—*Apterous Viviparous Female*: Cleared specimens pale, with slightly darkened apices of rostrum and legs. Body length 1.39-2.20 (1.83), width across eyes .40-.48 (.448, n = 49). Head with moderately well-developed frontal tubercles; mf 1p, lf 2 (sometimes 3) on each tubercle, vlf 1p, df 10-17 (13.89 \pm .48, n = 49), vf 6, pc 2p, ac 4-6 (usually 4), and md usually 3 on each side; dorsal setae elongate, of uniform diameter (about 44 μ) on basal $\frac{2}{3}$, enlarging distally to bulbous knob, about 3 times width of stem at widest. Ventral setae similarly elongate and bulbous but ac and md may be merely blunt or pointed; mf .0330-.0550 (.0445, n = 76), and df-1 .0374-.0572 (.0495, n = 77) mm long. Antennal segment I distinctly produced mesodistally, imbricate, with 7-11 (usually 8) blunt to slightly knobbed hairs in addition to basal pointed one on dorsum. A.s.II with

basically 1 — $\frac{1}{2}$ — 1 blunt or knobbed setae but one may be added. A.s.III imbricate, with small blunt or knobbed setae, longest less than $\frac{1}{2}$ basal diameter of segment, bearing 1–5 (1.92, n = 98) sensoria. A.s.IV averaging $\frac{3}{4}$, and a.s.V $\frac{2}{3}$ length of a.s.III; a.s.VI with unguis $4\frac{1}{2}$ – $7\frac{1}{2}$ (5.92, n = 76) times as long as base.

Tergum membranous, smooth, becoming finely spiculate posterior to abd.s. 6; setae similar in size and shape to those of head, rather sparse but not regularly aligned. Cauda stoutly elongate, not constricted, rounded at apex; spiculate; with 2 lateral pairs of and usually 1 (1 or 2 occasionally added) posterodorsal setae. Cornicles .35–.58 (.458, n = 94) mm long and $1\frac{1}{2}$ to $2\frac{1}{3}$ times ($2.01 \pm .03$, n = 90) as long as cauda; cylindrical, with slightly incrassate bases, conspicuously imbricate-spiculate. Legs with 3, 3, 3 hairs on first tarsal joints. Rostrum IV+V .105–.12 (.108, n = 52) mm long, about as long (m = $.94 \pm .01$, n = 92) as hind ta-2; slender, tapering, distal $\frac{1}{3}$ past pl setae produced into stout "needle"; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, al about 3 times ml and pl setae in length.

Measurements (in mm) of 18 nearctic specimens on *Artemisia vulgaris*: BL 1.45–2.18 (1.85), We .40–.49 (.449), a.s.III .52–.70 (.601), a.s.IV .36–.56 (.454), a.s.V .33–.48 (.397), a.s.VI .12–.18 (.143) + .64–1.07 (.846); cornicles .35–.58 (.461), cauda .20–.28 (.229); hind tibiae 1.05–1.47 (1.20), hind ta-2 .10–.14 (.121) and rostrum IV+V .10–.12 (.112). Proportions of a.s.III:IV:V, 1: .58–.89 (.78): .53–.80 (.69); VIu/VIb 4.57–7.64 (5.92); co/ca 1.67–2.23 (1.99); rostrum IV+V/hind ta-2 .85–1.10 (.93).

Alate Viviparous Female: Head, mesothorax, abdominal sclerites, legs from apical half of femora, antennae, and wing veins pale brown; areas around ocelli, tips of rostrum and tibiae, entire tarsi darker brown; remainder of body pale, membranous. Morphologically like aptera with following exceptions: df setae 11–16 (13.1, n = 12); head and body setae relatively shorter (mf .0154–.0374, m = .0288, n = 17, and df-1 .0242–.0440 mm, m = .0377, n = 20), apices more infundibulate than bulbous; sensoria more on a.s.III (13–22, m = 17.1, n = 20) sometimes also present on a.s.IV (0–4, m = 1.5, n = 20); VIu/VIb ratio slightly larger, averaging $6\frac{1}{3}$ (5.88–6.79, n = 13); abdomen with

pleural sclerites on segments 1 to 6, these broken into pairs of ovate sclerites on each side or contiguous, appearing transversely elongate, small marginal thickenings also present on discal segments; cornicles slightly shorter (.28–.44 mm, m = .374, n = 20); co/ca ratio smaller ($1\frac{1}{2}$ to 2, m = 1.81, n = 20); cauda slightly constricted, more slender, acutely pointed.

Measurements (in mm) of 5 specimens from Pennsylvania: BL 1.40–1.79 (1.57), We .34–.43 (.382); a.s.III .47–.59 (.533), a.s.IV .40–.53 (.452), a.s.V .38–.47 (.414), a.s.VI .12–.15 (.136) + .78–.95 (.91); cornicles .28–.39 (.356), cauda .16–.23 (.196); hind tibiae 1.15–1.38 (1.22), hind ta-2 .10–.13 (.114), and rostrum IV+V .11–.12 (.112). Proportions of a.s.III:IV:V, 1: .79–.95 (.85): .73–.81 (.78); VIu/VIb 6.00–6.79 (6.49); co/ca 1.69–2.00 (1.80); rostrum IV+V/hind ta-2 .92–1.10 (.99).

Oviparous Female: Similar to viviparous aptera except as follows: head and body setae thinner, with smaller knobs, some of those on abdomen pointed or blunt, slightly longer, the mf .0324–.0594 (.0491, n = 10) and df-1 .0484–.0616 (.0561, n = 10) mm long; abdomen with pleural intersegmental patches; cauda stouter, saclike; subgenital plate bearing more setae; basal half of hind tibiae enlarged, armed with numerous pseudosensoria.

Measurements (in mm) of 2 specimens from New Jersey: BL 2.23 and 2.25, We .51 and .53; a.s.III .59–.66 (.625), a.s.IV .45–.49 (.473), a.s.V .42–.43 (.423), a.s.VI .14–.15 (.145) + .86–.90 (.88); cornicles .44–.47 (.453), cauda both .23, hind tibiae 1.19–1.30 (1.24), hind ta-2 .12–.14 (.13), and rostrum IV+V both .12. Proportions of a.s.III:IV:V, 1: .74–.77 (.76): .64–.71 (.68); VIu/VIb 6.14–6.43 (6.29); co/ca 1.91–2.04 (1.97); rostrum IV+V/hind ta-2 .86–1.00 (.93). Number of df setae 12 and 14; and of sensoria on a.s.III 1–2 (1.25).

Apterous Male: Body slenderly elongate, 1.40–1.63 (1.52, n = 3) mm long, .40–.43 (.416, n = 3) mm wide across eyes. Head, prothorax, mesothoracic to abdominal sclerite 6, spiracular plates, genito-anal capsule, antennae and tips of rostrum and legs dark brown; remainder of body pale, legs and cornicles slightly dusky. Head similar to that of apterous viviparous female, but with fewer df setae (10–14, m = 11.7, n = 3); mf .0264–.0528 (.0358, n = 4) and df-1 .0440–.0550 (.0502, n = 6) mm long. Sensoria on a.s.III 27–40 (34.33, n =

6), on a.s.IV 17–23 (19.67, $n = 6$) and on a.s.V 12–14 (12.83, $n = 6$); unguis $4\frac{2}{3}$ to 6 times (5.58, $n = 6$) as long as base of a.s.VI. Tergum smooth on disk, becoming finely striate-spiculate posteriorly; contiguous spinopleural sclerites present on mesothorax to abd.s. 6; spinal thickenings slightly smaller and paler than pleural complements; ovate marginal sclerites on discal segments also present, spiracular plates of all segments dark brown. Cauda stout and saclike as in oviparous female. Cornicles .32–.37 (.343) mm long and 1.88–2.64 (2.44, $n = 6$) times as long as cauda. Aedeagus with broadly angular apex; parameres oblong, hairy as in other species.

Measurements (in mm) of 1 specimen from New Jersey: BL 1.63, We .43; a.s.III .57 and .59, a.s.IV .47 and .46, a.s.V .44 and .47, a.s.VI .15 + .90 and .15 + .93; cornicles .34 and .37, cauda .14; hind tibiae 1.24 and 1.28, hind ta–2 .13 and .14, rostrum IV+V .115.

HOSTS.—*Ambrosia* sp., *Artemisia lactucifolia*, and *A. vulgaris* in North America. *Artemisia maritima* (England), and *A. pinceps* var. *orientalis* and *Humulus japonicus* (Korea) are recorded hosts elsewhere.

SPECIMENS EXAMINED.—NORTH AMERICA. CANADA: Fredericton, New Brunswick (all M.E.MacG. coll.): 1 apt.v.f., 11–VIII–1952, J.B. Adams on *Ambrosia*; 2 apt.v.f., 4–VIII–1950, P. Spicer on *Ambrosia*; 6 apt.v.f., 10–IX–1964; E.MacG., on *Artemisia lactucifolia*; 5 apt.v.f., 3–IX–1957, M.E.MacG., on *A. vulgaris*; and 4 apt.v.f., 2–IX–1958, Anderson on *A. vulgaris*; Salmon River Rd., New Brunswick, 16 apt.v.f., 14–VIII–1964, M.E.MacG. on *Artemisia* sp. (M.E.MacG. coll.); Laurentide Park, 29–VIII–1956, DHRL on *A. vulgaris* (DHRL coll.). UNITED STATES (all JOP coll.): New Jersey at Haddon Field, 2 ovip.f. and 1 apt.m., 26–XI–1960, MDL on *A. vulgaris*; Pennsylvania at Strassburg, 5 apt.v.f. and 5 al.v.f., 5–VI–1962, JOP on *A. vulgaris*; and at Norristown, 3–VI–1967, 1 al.v.f., JOP, in flight. EUROPE. NETHERLANDS (all collected by DHRL): Bennekom, 8 apt.v.f. and 5 al.v.f., ?–VIII–1947, on *A. vulgaris*; and Bergem/zoom, 1 apt.v.f., 3 ovip.f., and 2 apt.m., 1–X–1941, on *A. vulgaris*.

Pleotrichophorus gnaphalodes (Palmer)

FIGURES 155, 430–435

Capitophorus gnaphalodes Palmer, 1938:356 [type: apt.v.f.,

Estes Park, Colorado, 2400 m elev., 23–VIII–1921, MAP, on *Artemisia gnaphalodes*¹; USNM 52350].

Pleotrichophorus gnaphalodes (Palmer).—Hille Ris Lambers, 1966:605; 1969:169.

Pleotrichophorus gnaphalodes (Palmer) [misidentifications].—Robinson and Bradley, 1965:44; 1968:64 [specimens loaned from AGR and collected on *Artemisia ludoviciana* from Manitoba seen and determined to be *P. pseudo-glandulosus* (Palmer)].

Capitophorus glandulosus (Kaltenbach).—Knowlton and Smith, 1936b:231 [misidentification, in part; collection recorded from Pingree Park, Colorado, on *A. ludoviciana* seen and determined to be *P. gnaphalodes*].

DIAGNOSIS.—This species can be recognized by a combination of subequally long cornicles and cauda (co/ca mean ratio of $1.17 \pm .03$, $n = 125$), stoutly elongate and constricted cauda and long (.13–.16 mm, $m = .143$, $n = 74$) needle-tipped last rostral segment. It resembles *P. parilis* in general body features but the shape and length of rostrum IV+V is distinctive (.09–.11 mm, $m = .099$, $n = 50$ in *P. parilis*).

DESCRIPTION.—*Apterous Viviparous Female*: Color in life pale green (Palmer, 1938); cleared specimen pale with tips of rostrum and tibiae, entire tarsi, antennae from apices of a.s.V darker, sometimes also dusky from apices of a.s.III (e.g., specimens on *A. douglasiana* from California). Body length 1.41–2.18 (1.83, $n = 70$), width across eyes .40–.49 (.447, $n = 72$)mm. Head with rather well-developed laterofrontal tubercles, mesofrontal tubercle also prominent; mf 1 or 2p, lf 2–3 on each side, vlf 1p, df 19–36 ($27.76 \pm .87$, $n = 71$), vf 6–14 (usually 8), pc 2p, ac 4 and md 2–3 (usually 3) on each plate; dorsal setae funnel-shaped, mostly distinctly petiolate, distal half widely expanded; ventral setae also with expanded apices except ac and some md which may be merely blunt; mf .0154–.0528 (.0365, $n = 197$) and df–1 .0330–.0506 (.0408, $n = 134$) mm long. Antennal segment I conspicuously produced on mesodistal margin; faintly imbricate, with 4–9 (usually 7 or 8) small, blunt or knobbed setae in addition to usual pointed

$$\frac{1}{2}$$

one on dorsum. A.s.II with $1 - \frac{1}{2} - 1$ knobbed setae.

¹ Data copied from holotype slide. The original description is at variance, indicating that this species was "described and drawn from holotype and 49 paratypes taken on *Artemisia gnaphalodes* at Pingree Park, Larimer Co., Colorado, August 21 (immature individuals were reared and mounted August 26)."

A.s.III faintly imbricate, with small knobbed setae, longest less than $\frac{1}{2}$ basal diameter of segment, bearing 1-4 (2.58, n = 111) sensoria, a.s.IV slightly longer than a.s.V, IV about $\frac{9}{10}$, V $\frac{3}{4}$ length of a.s.III; a.s.VI with unguis $5\frac{1}{2}$ to 7 times (6.27, n = 33) base (slightly shorter in collections made 1-25 March from Berkeley, California, with range of 4.77-7.15 times, m = 5.88, n = 57).

Dorsal body integument smooth to faintly striate on disk, becoming more distinctly imbricate-spiculate caudally from about abd.s. 5; with moderately dense cover of funnel- to cone-shaped setae, without distinct stems. Cauda .20-.29 (.251, n = 73) mm long; stoutly elongate, constricted on basal $\frac{1}{4}$ or $\frac{1}{5}$, apex broadly rounded; spiculate; with 2 pairs lateral and 1 posterodorsal setae. Cornicles .20-.43 (.288, n = 144) mm long and .83-1.56 times ($1.17 \pm .03$, n = 125) as long as cauda; cylindrical, almost uniform in diameter throughout length, apices sometimes dusky; imbricate-spiculate, with spicules rather small, blunt. Legs with 3, 3, 3 hairs on first tarsal joints. Rostrum IV+V slender, apical $\frac{1}{3}$ cylindrical, sometimes appearing constricted off as a distinct segment; .13-.16 (.143, n = 74) mm long and 1.00-1.45 ($1.15 \pm .02$, n = 100) times as long as hind ta-2; with 1 basal, 2 dorsal and 3 lateral pairs of setae, ml and pl about $\frac{1}{3}$ al setae in size.

Measurements (in mm) of holotype: BL 1.66, We .43; a.s.III .58 and .56, a.s.IV .47 and .46, a.s.V both .39, a.s.VI .15 + .98 and .15 + .97; cornicles both .32, cauda .23; hind tibiae 1.16 and 1.14, hind ta-2 both .12 and rostrum IV+V .14.

Alate Viviparous Female: Head and thorax brown, sclerotic; antennae dark brown; legs dusky to brown with slightly paler femoral bases, darker tibial apices and entire tarsi; abdomen pale, membranous, with dusky or light brown sclerites; cornicles, anal plate and cauda also dusky; anterior wing margins dusky, wing veins slightly darker brown; apical 2 rostral segments brown, sclerotic. Morphologically much like viviparous aptera, differing in presence of fewer df setae (10-19, m = 14.96, n = 28); presence of more sensoria on a.s.III (6-19, m = 13.9, n = 46); presence on abdomen of 2 indistinct spinal dashes, 2 pairs of pleural and 1 pair of marginal sclerites; abdominal setae sparser, relatively longer; cornicles (.15-.23, m = .198, n = 55), cauda (.20-.25, m =

.216, n = 28) relatively shorter, co/ca ratio slightly smaller (.75-1.32, m = .91, n = 55).

Measurements (in mm) of 10 specimens on *Artemisia douglasiana*: BL 1.65-1.90 (1.78), We .39-.43 (.415); a.s.III .50-.62 (.588), a.s.IV .46-.58 (.508), a.s.V .40-.50 (.449), a.s.VI .13-.16 (.149) + .85-.99 (.926); cornicles .15-.23 (.202); cauda .20-.23 (.217); hind tibiae 1.12-1.27 (1.21), hind ta-2 .12-.14 (.131), rostrum IV+V .12-.14 (.134); mf .0220-.0374 (.0307) and df-1 .0330-.0418 (.0373). Proportions of a.s.III:IV:V, 1: .81-.94 (.86): .69-.81 (.76); VII/VIB 5.31-6.53 (6.09); co/ca .71-1.32 (.93); rostrum IV+V/hind ta-2 .92-1.17 (1.04).

Sexuales: Unknown.

Hosts.—*Artemisia douglasiana* (= *Artemisia vulgaris* var. *heterophylla*) and *Artemisia ludoviciana* (= *A. gnaphalodes*).

DISTRIBUTION.—Rather widely distributed, with records in the states of California, Colorado, Kansas, and Oklahoma.

SPECIMENS EXAMINED.—Holotype; paratypes from Colorado State University collections: 3 apt.v.f., 1-VII-1898, La Porte, Colorado, CPG, on *Artemisia ludoviciana*, and 11 apt.v.f., 21-III-1935, Pingree Park, Colorado, GFK on *A. gnaphalodes*. Other specimens from CALIFORNIA (all on *A. vulgaris* var. *heterophylla* and in EOE coll.): Berkeley, collected by EOE on 12-III-1935 (12 apt.v.f. and 9 al.v.f.) and 25-III-1935 (19 apt.v.f. and 20 al.v.f.), and by J.H. Mitchell on 1-III-1938 (11 apt.v.f. and 1 al.v.f.); Lattonda Grade, 2 apt.v.f., 30-XI-1933 by P.J.B. COLORADO: Pingree Park, 20 apt.v.f., 21-VIII-1935, GFK on *A. ludoviciana* (GFK coll.). KANSAS: Manhattan, 1 al.v.f., 22-IV-1965, Project NC-67, at U. Wisc., by suction trap (U. Minn. coll.). OKLAHOMA: Cherokee, 1 al.v.f., 20-IV-1964, Project NC-67, U. Wisc., by suction trap (U. Minn. coll.).

Plectrichophorus gregarius (Knowlton)

FIGURES 128, 184, 185, 186 (left), 191-196

Capitophorus gregarius Knowlton, 1929:13 [lectotype: apt. v.f., Logan Canyon, Utah, 6-X-1927, GFK, on *Chrysothamnus nauseosus*; in EOE coll.].—Knowlton and Smith, 1936a:110; 1937:151.—Knowlton, 1948:122.—Palmer, 1952:258.

Plectrichophorus gregarius (Knowlton).—Hille Ris Lambers, 1969:167.

DIAGNOSIS.—This species very closely resembles

P. xerozoous from which it differs by its more slender, longer, gradually tapered, larger rostrum IV+V/hind ta-2 ratio (Figure 128 vs 127). Furthermore, the head and body setae are generally longer, more narrowly expanded (Figures 185-187, 190), at least the anterior head setae are petiolate, and there are more sensoria on a.s.III. (See diagnosis and notes under *P. xerozoous* for further details of differences).

DESCRIPTION.—*Apterous Viviparous Female:* Color in life dark brown to chocolate brown in spring forms and brown to greenish brown in summer and fall forms (Knowlton, 1929); cleared specimen pale, with last 2 rostral segments, tips of a.s.III and IV, areas around secondary sensoria, most of a.s.V and entire a.s.VI, bases and apices of tibiae, entire tarsi and distal $\frac{1}{2}$ to $\frac{2}{3}$ of cornicles brown. Body length 1.85-2.69 (2.33, n = 88), width across eyes .48-.58 (.534, n = 98) mm. Laterofrontal tubercles moderately produced, mesofrontal tubercle rather small; mf 1p, lf 2-4 on each side, vlf 1p, df 13-21 (16.28 \pm .28, n = 98), vf 7-15 (10.48, n = 94), pc usually 2p, ac 4-7, md 2-6 on each plate; dorsal setae basically funnel-shaped, anterior ones usually slightly expanded, posterior ones shorter, less distinctly stemmed; ventral setae except vlf and some of vf's elongate, with blunt or pointed apices; mf .0176-.0462 (.0362, n = 194) and df-1 .0220-.0484 (.0372, n = 195) mm long. Antennal segment I produced on mesodistal margin, faintly imbricate with 10-22 (usually 12 or 13) blunt or knobbed setae aside from basal pointed one on dorsum.

1

A.s.II normally with 1 --- 1 blunt or knobbed

2

setae. A.s.III with short setae, longest about $\frac{1}{2}$ basal diameter of segment and all setae of same shape as those of preceding segment; bearing 2-9 (4.72, n = 185) sensoria. A.s.IV and V about as long as a.s.III; unguis averaging 4 to 7 times (5.60, n = 100) base of a.s.VI.

Dorsal body integument smooth on disk, becoming faintly striate-spiculate caudally; with 2 median rows of papillae bearing 2-5 spinal setae each, papillae increasingly developed posteriorly, similar pleural projections also present but less conspicuous than spinal; dorsal setae of same shape as those on head but generally more expanded. Cauda stoutly elongate, not constricted, with rounded apex; spiculate; with 3-5 (3.91, n = 196) setae on

each side and 0-6 (3.00, n = 98) on posterodorsal surface. Cornicles .42-.77 (.574, n = 194) mm long, $1\frac{1}{4}$ to 2 times (1.61 \pm .10, n = 100) as long as cauda; cylindrical, with bases and apices slightly thickened; rather conspicuously imbricate-spiculate. Legs with 3, 3, 3 hairs on first tarsal joints. Rostrum IV+V slender at base and tapering to acute point; .10-.12 (.109, n = 195) mm long, .67-1.00 (.79 \pm .02, n = 100) times length of hind ta-2; with 1 basal, 2 dorsal and 3 lateral pairs of setae, al about twice as long as ml and pl setae.

Measurements (in mm) of lectotype and 21 paralectotypes: BL 1.85-2.50 (2.17), We .49-.58 (.53); a.s.III .50-.70 (.612), a.s.IV .35-.74 (.601), a.s.V .45-.73 (.589), a.s.VI .12-.19 (.153) + .72-.92 (.818); cornicles .41-.72 (.585), cauda .25-.40 (.344); hind tibiae 1.22-1.60 (1.43), hind ta-2 .12-.16 (.139) and rostrum IV+V .10-.12 (.111). Proportions of a.s.III: IV:V, 1: .64-1.14 (.97): .82-1.07 (.93); VIu/VIb 4.63-7.00 (5.63); co/ca 1.29-2.06 (1.69); rostrum IV+V/hind ta-2 .67-1.00 (.81).

Alate Viviparous Female: Not seen. Palmer (1952:258) gives the following measurements: BL 1.60, We .50; a.s.III .65, a.s.IV .73, a.s.V .66, a.s.VI .16 + .83; cornicles .55 and hind tibiae 1.55 mm. Number of sensoria on a.s.III 12-15.

Oviparous Female: Resembles apterous vivipara except as follows: dorsal setae less expanded; spinal pleural papillae less conspicuous; cauda shorter, stouter, saclike, darker; subgenital plate bearing more setae; hind tibiae with basal half thickened, bearing numerous pseudosensoria.

Measurements (in mm) of 5 paralectotypes: BL 1.95-2.25 (2.12), We .50-.55 (.52); a.s.III .52-.62 (.587), a.s.IV .48-.59 (.526), a.s.V .49-.55 (.531), a.s.VI .13-.16 (.143) + .76-.90 (.820); cornicles .39-.48 (.427), cauda .23-.25 (.246); hind tibiae 1.20-1.37 (1.30), hind ta-2 .12-.14 (.135), rostrum IV+V .11-.12 (.113); mf .0286-.0440 (.0360) and df-1 .0308-.0484 (.0403). Proportions of a.s.III: IV:V, 1: .81-.98 (.89): .87-.96 (.91); a.s.VIu/VIb 5.43-6.00 (5.76); co/ca 1.50-1.92 (1.73); rostrum IV+V/hind ta-2 .79-.92 (.84). Number of sensoria on a.s.III 3-8 (4.67); df setae 14-19 (16.2); lateral caudal setae 3-6 (4.5) and posterodorsal caudal setae 2-6 (4.0).

Alate Male: Dark brown except membranous portions of abdomen and wings pale. Differs morphologically from apterous viviparous female in having fewer df setae (8-13, m = 10.58, n = 12),

these merely blunt or pointed; setae shorter, mf .0176–.0286 (.0222, $n = 18$), df-1 .0220–.0330 (.0276, $n = 21$) mm long; antennal setae also blunt or pointed; more sensoria on a.s.III (34–53, $m = 42.73$, $n = 22$), also present on a.s.IV (18–32, $m = 24.57$, $n = 21$) and on a.s.V (15–27, $m = 21.71$, $n = 21$); abdominal segments 1 to 6 with 2 large, transverse pleural sclerites (may be broken on some segments), 2 dashlike spinal and 2 ovate marginal sclerites, and spinopleural areas of abd.s. 7 and 8 also sclerotized; cauda shorter, more slender, darker; cornicles (.18–.39 mm, $m = .258$, $n = 24$), cauda (.14–.19 mm, $m = .167$, $n = 12$) both shorter so co/ca ratio about same (1.20–2.14, $m = 1.58$, $n = 24$). Genito-anal capsule dark brown, aedeagus cylindrical, with rounded apex, parameres rather small, setaceous lobes.

Measurements (in mm) of 3 paralectotypes: BL 1.70–1.98 (1.84), We .39–.45 (.427); a.s.III .61–.71 (.655), a.s.IV .55–.64 (.587), a.s.V .52–.61 (.560), a.s.VI .13–.15 (.14) + .80–.89 (.845); cornicles .18–.25 (.232), cauda .14–.17 (.153); hind tibiae 1.22–1.50 (1.33), hind ta-2 .12–.14 (.132) and rostrum IV+V .10–.12 (.107). Proportions of a.s.III:IV:V, 1: .85–.98 (.89): .80–.95 (.86); VIu/VIb 5.64–5.71 (5.67); co/ca 1.20–1.79 (1.52); rostrum IV+V/hind ta-2 .77–.86 (.81).

HOSTS.—*Chrysothamnus nauseosus* and *C. viscidiflorus* (Palmer, 1952).

DISTRIBUTION.—Widely distributed in Utah and also recorded from California, Idaho, Nevada, and Oregon.

TYPES (designated from available cotypes).—Lectotype, apt.v.f. with data given above. Paralectotypes: 5 apt.v.f., 5 ovip.f., 3 al.m., 8 apt.ny., and 1 altd.ny., with same data as lectotype (12 slides in EOE coll. and 6 slides in GFK coll.); 6 apt.v.f., Brigham Canyon, 10–VIII–1927, GFK, on *Chrysothamnus nauseosus* (EOE coll.); 5 apt.v.f. and 3 apt.ny., Wellsville Canyon, Utah, 2–IX–1927, GFK on *C. nauseosus* (EOE coll.); and 5 apt.v.f. and 3 apt.ny., Immigration Canyon, Idaho, 10–IX–1927, GFK, on *C. nauseosus* (EOE coll.).

SPECIMENS EXAMINED.—Aside from types, numerous specimens of all morphs, except alate viviparae, from following localities: CALIFORNIA: Big Bear City, Big Bear Lake, Fish Springs (Inyo Co.), Lebec (Kern Co.) Mojave Desert, and 3 mi E Onion Valley (Inyo Co.). IDAHO: Franklin. NEVADA: Reno. OREGON: Warm Springs. UTAH: Blacksmith Fork

Canyon, Box Elder Canyon, Cottonwood Canyon, Dry Lake, Farmington, Hyde Park, Hyrum Dam State Park, Logan Canyon, Logan Dry Canyon, Logan Green Canyon, Mantua, Monticello, North Neola, Ogden Canyon, Paradise, Pine Valley, Salt Lake City, Smithfield Canyon, Spring Hollow, Uinta, Weber Canyon, and Wellsville Canyon.

Pleotrichophorus heterohirsutus (Gillette and Palmer)

FIGURES 151, 388–409

Capitophorus heterohirsutus Gillette and Palmer, 1933:351 [type: apt.v.f., Sheep Creek, Northern Larimer Co., Colorado, 17–IX–1932; USNM 49297]; 1934:151.—Knowlton and Smith, 1936b:231.—Patch, 1938:245.—Palmer, 1952:259.

Pleotrichophorus heterohirsutus (Gillette and Palmer).—Hille Ris Lambers, 1953:115; 1966:606; 1969:165, 167.

Capitophorus bitrichus Knowlton and Smith, 1936b:230 [originally described from apt.v.f., Bear Canyon, Bradshaw Ranch in Sardine Canyon, Lewiston and Logan, Utah, 4 to 14–VIII–1925, GFK, on *Artemisia*; type in USNM; "paratypes" from Logan, CFS coll., seen].—Knowlton, 1941:138.—Palmer, 1952:251.

Pleotrichophorus bitrichus (Knowlton and Smith).—Hille Ris Lambers, 1966:606; 1969:165, 172 [as a synonym of *P. heterohirsutus* (Gillette and Palmer)].

DIAGNOSIS.—*P. heterohirsutus* is a small, pale green aphid that can be easily recognized by its short cornicles, needle-tipped last rostral segment, broadly convex frontal margin or poorly developed laterofrontal tubercles, and the mixture of pointed and conical- to fan-shaped setae on the dorsum of the head (especially the anterior setae) and the body (especially the posterior abdominal segments). The larger members (B.L. up to 1.80 mm) may be confused with smaller, pale-legged specimens of *P. quadritrichus pallidus*; but can be separated from them by the frontal and setal characters, by its pale, triangular and usually pointed cauda (vs. oblong, distinctly constricted and broadly rounded cauda), and its much shorter, conical or fan-shaped anterior head setae (vs. elongate, cylindrical anterior head setae with blunt or flattened apices).

DESCRIPTION.—*Apterous Viviparous Female*: Color in life pale green, appearing frosted (Gillette and Palmer, 1933). Cleared specimen with pale body; antennae commonly dark from apices of a.s.V but in some individuals, dark from apices of a.s.IV (e.g., from Allen and Green Canyon, Utah)

or even distal half of a.s.IV or apices of a.s.III (e.g., from Uinta Mts., Utah); legs pale, with dusky tibial apices or sometimes bases of tibiae also brown (e.g., Green Canyon and Uinta Mts., Utah), entire tarsi dark brown; rostrum with most of last segment dark brown, sclerotic; apices of cornicles light brown or dusky, or entirely dusky (e.g., specimens from Uinta Mts.). Body 1.06–1.82 (1.36, n = 17) mm long, .29–.43 (.368, n = 19) mm wide across eyes. Head with broadly convex frontal margin, laterofrontal tubercles barely (Figures 388, 392) or slightly (Figures 396, 398) produced; mf setae usually 2p (1 or 2 sometimes added, ventrally displaced, in which case rather difficult to distinguish from vf's), lf 1–3 (usually 2) on each side, vlf 1p, df 26–49 (39.32 ± 3.13, n = 19), vf 6–15 (usually 12), pc 2p, ac 3–7 (usually 4), md 2–4 (usually 3) on each plate. Dorsal head setae a mixture of elongate, pointed (commonly lf, sometimes mf, and less commonly some of df's), elongate and blunt or flattened (mf, df-1, some of anterior df's) and shorter, funnel- to fan-shaped ones (posterior df's); ventral setae most commonly elongate, pointed but some vf's may be funnel- or fan-shaped. Antennal segment I only slightly produced mesally, almost smooth, with 3–6 long pointed setae in addition to usual small pointed one or dorsum. A.s.II with

$$1 - \frac{1}{1} - 1 \text{ or } 1 - \frac{1}{2} - 1 \text{ long, pointed setae.}$$

A.s.III faintly imbricate, with long pointed to blunt setae, longest subequally as long as basal diameter of segment, with 0–3 (1.03, n = 37) sensoria. A.s.IV and V subequal and $\frac{2}{3}$ to $\frac{3}{4}$ length of a.s.III; unguis of a.s.VI $2\frac{1}{2}$ to $4\frac{1}{3}$ times (3.44, n = 32) as long as its base.

Tergum smooth, membranous, becoming finely spiculate caudally; with rather dense cover of funnel- to fan-shaped, and sometimes also a few pointed setae. Cauda .11–.25 (.156, n = 18) mm long; basically triangular, with acute, pointed or rounded apex, in most specimens not distinctly constricted; with 2 lateral pairs and 1 posterodorsal setae. Cornicles .12–.29 (1.86, n = 38) mm long, .92–.1.45 (1.19 ± .02, n = 36) times length of cauda; cylindrical; imbricate-spiculate. Legs with 3, 3, 3 hairs on 1st tarsal joints; hind tibiae .48–.91 (.636, n = 34), hind ta-2 .10–.14 (.119, n = 34) mm long. Rostrum IV+V .13–.16 (.139, n = 19) and 1.00–1.40 times (1.18 ± .03, n = 34) as long as hind ta-2;

slender, distal half, beyond pl setae, produced into thin cylindrical needle; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, al about twice ml and pl setae in length.

Measurements (in mm) of 12 specimens from Wyoming: BL 1.06–1.37 (1.21), We .29–.40 (.349); a.s.III .21–.31 (.251), a.s.IV .14–.23 (.181), a.s.V .15–.22 (.190), a.s. VI .09–.11 (.103) + .25–.41 (.333); cornicles .12–.20 (.158), cauda .12–.16 (.134); hind tibiae .48–.68 (.573), hind ta-2 .10–.12 (.113), and rostrum IV+V .13–.14 (.136). Proportions of a.s.III:IV:V, 1: .64–.81 (.72): .65–.86 (.76); VIu/VIb 2.50–4.33 (3.42); co/ca .92–1.45 (1.17); rostrum IV+V/hind ta-2 1.13–1.40 (1.21).

Measurements (in mm) of 4 "paratypes" of *P. bitrichus*: BL .98–1.28 (1.14), We .30–.37 (.340); a.s.III .19–.25 (.215), a.s.IV .12–.19 (.154), a.s.V .15–.18 (.166), a.s.VI .07–.11 (.101) + .26–.33 (.291); cornicles .11–.15 (.128), cauda .13–.16 (.143); hind tibiae .45–.59 (.516), hind ta-2 .10–.11 (.108), and rostrum IV+V .12–.13 (.126). Proportions of a.s.III:IV:V, 1: .59–.81 (.69): .72–.84 (.76), and VIu/VIb 2.6–3.86 (2.93). Ratio of cornicles to cauda (including 10 other apt.v.f. from Hyrum, Utah) .85–1.18 (1.01 ± .03, n = 28); rostrum IV+V/hind ta-2 1.09–1.33 (1.16 ± .02, n = 27); number of df setae 19–35 (25.11 ± 3.83, n = 9); number of sensoria on a.s.III 0–1 (.62, n = 26).

Alate Viviparous Female: Head, thorax, legs, except extreme bases of mid- and hind femora, and most of fore femora, antennae, wing veins and apical 2 rostral segments brown; abdomen and cauda pale, anal plate dusky, cornicles and disc of subgenital plate brown. Morphologically like apterous vivipara, differing only as follows: df setae fewer (11); a.s.III with more sensoria (8); abdominal setae relatively sparser. Abdominal sclerotizations not distinct in cleared specimen seen.

Measurements (in mm) of 1 specimen from Green Canyon, Utah: BL 1.78, We .40; a.s.III .45 (other segments missing on both sides); cornicles both .23, cauda .19; hind tibiae (one side only) 1.00, hind ta-2 .14, and rostrum IV+V .15.

Oviparous Female: Very much like apterous vivipara, including caudal shape (often stouter and shorter in other *Pleotrichophorus* species), differs from it in thickened tibial bases, bearing pseudo-sensoria on enlarged portion, and presence of more setae on subgenital plate.

Measurements (in mm) of 8 paratypes: BL 1.27–

1.43 (1.35), We .35-.37 (.36); a.s.III .24-.32 (.279), a.s.IV .16-.20 (.180), a.s.V .17-.21 (.194), a.s.VI .09-.11 (.098) + .29-.36 (.323); cornicles .16-.19 (.17), cauda .13-.16 (.149); hind tibiae .57-.66 (.608), hind ta-2 .11-.12 (.114), and rostrum IV+V .12-.14 (.131). Proportions of a.s.III:IV:V, 1: .57-.71 (.65): .61-.75 (.71); VIu/VIb 2.91-3.67 (3.29); co/ca 1.00-1.21 (1.15); rostrum IV+V/hind ta-2 1.08-1.23 (1.15). Number of df setae 29-35 (32); number of sensoria 0-1 (.7).

Apterous Male: Head dusky, faintly sclerotic; antennae brown except extreme bases of a.s.III; sternal and pleural apophyses, legs except bases of femora and mid portions of tibiae, last 2 rostral segments, cornicles and genito-anal capsule brown; body pale, membranous with 2 dusky brown pleural sclerites on metathorax to abd.s. 7, a second outer pair of smaller pleural thickenings on abd.s. 3 to 5, less distinct and irregular spinal dashes and marginal thickenings around spiracles. Morphologically similar to apterous viviparous female except as follows: df setae fewer (15-20, m = 17, n = 4); more sensoria on a.s.III (22-30, m = 26.63, n = 8), also present on a.s.IV 8-16, m = 11.63, n = 8) and a.s.V (4-8, m = 5.5, n = 8); presence of sclerites on dorsum; body setae sparser, posterior segment bearing mostly elongate, pointed setae; cornicles shorter, co/ca ratio slightly smaller; cauda triangular, acutely pointed, not much extended beyond pl setae. Aedeagus short, thick, with truncate or slightly pointed apex; parameres small, setaceous.

Measurements (in mm) of 4 paratypes: BL 1.13-1.19 (1.16), We .30-.36 (.34); a.s.III .28-.31 (.296), a.s.IV .19-.21 (.199), a.s.V .18-.23 (.197), a.s.VI .09-.11 (.099) + .29-.32 (.306); cornicles .07-.09 (.083), cauda .09-.10 (.095); hind tibiae .56-.59 (.573), hind ta-2 .11-.13 (.12), and rostrum IV+V .13. Proportions of a.s.III:IV:V, 1: .63-.72 (.67): .58-.77 (.66); VIu/VIb 2.90-3.56 (3.21); co/ca .78-.90 (.87); rostrum IV+V/hind ta-2 1.00-1.18 (1.08).

HOSTS.—*Artemisia tridentata*, *Artemisia* sp.

DISTRIBUTION.—Colorado (northeastern), Utah (most records in northeastern and eastern portions), and Wyoming (southwestern).

SPECIMENS EXAMINED.—COLORADO: Eaton Res., No. Larimer Co., 10 ovip.f., 4 apt.m. and 6 ny., 17-IX-1932, MAP, on *Artemisia tridentata* (para-

types, C.S.U.). UTAH: Allen Canyon, 6 apt.v.f., 5-VII-1934, GFK, on *A. tridentata* (GFK coll.); Green Canyon, 1 apt.v.f., 1 al.v.f., and 2 ny., 5-VI-1953, GFK, on *A. tridentata* (GFK coll.); Uinta Mts., 2 apt.v.f., 4-VIII-1932, GFK, on *Artemisia* (CFS coll.). WYOMING: Douglas, 13 apt.v.f., 12-VIII-1929, on *Artemisia* (CSU).

Specimens of *Capitophorus bitrichus* examined: 4 apt.v.f., Logan, Utah, 12-VIII-1925, GFK, on sage brush (CFS coll.); and 9 apt.v.f. and 12 apt. ny., Hyrum, Utah, 23-VIII-1938, Knowlton and Hardy, on *A. tridentata* (CFS coll.).

Plectrichophorus hottesi Hille Ris Lambers

Plectrichophorus hottesi Hille Ris Lambers, 1969:173-175 [type: apt.v.f., National Monument, Grand Junction, Colorado, 13-IX-1965, F.C. Hottes and DHRL, on *Achillea*].

DIAGNOSIS.—From Hille Ris Lambers' descriptions and figures, *P. hottesi* is distinctive among species living on *Achillea* in having the longest cornicles (.38-.39 mm) and largest co/ca ratio (1.69-1.73). The long (up to .050 mm), petiolate head setae are also distinctive.

DESCRIPTION.—The following measurements are taken from the original description:

Apterous Viviparous Female (based on 3 type-specimens): BL 1.90-2.25; antennae 2.57-2.78, a.s. III .53-.58, a.s.IV .48-.55, a.s.V .46-.50, and a.s.VI .15-.16 + .79-.85; cornicles .38-.39, cauda .22-.23 and rostrum IV+V .11-.13 mm long. Proportions of a.s. VIu/VIb 5-5½; co/ca 1.69-1.73 (1.70, n = 3); rostrum IV+V subequal to hind ta-2. Number of df setae 13; sensoria on a.s.III, 2-3.

Alate Viviparous Female: Unknown.

Oviparous Female: Not known.

Alate Male (based on 1 specimen): B.L. 1.44, antennae 2.53 with a.s.III .60, a.s.IV .44, a.s.V .42 and a.s.VI .16 + .73; cornicles .30, and cauda .11 mm. Number of sensoria on a.s.III 28 and 31, a.s.IV 20 and 16, and a.s.V 12 and 14.

HOSTS.—*Achillea*, probably *A. lanulosa*.

DISTRIBUTION.—No records other than type-locality (Grand Junction, Colorado).

TYPES.—Holotype apt.v.f. and paratypes (apt.v.f. and al.m.) are presumably in DHRL's collection, but this is not explicitly stated in the original description.

***Pleotrichophorus infrequens*
(Knowlton and Smith)**

FIGURES 379-380

- Capitophorus infrequens* Knowlton and Smith, 1936b:231 [type: apt.v.f., Big Cottonwood Canyon, Utah, 22-VIII-1935, CFS, on *Artemisia tridentata*; in USNM].
Capitophorus infrequens [sic] Knowlton and Smith.—Palmer, 1952:260-261 [misspelling].
Pleotrichophorus infrequens [sic] (Knowlton and Smith).—Hille Ris Lambers, 1966:606 [misspelling].
Pleotrichophorus infrequens (Knowlton and Smith).—Hille Ris Lambers, 1969:166, 175.

DIAGNOSIS.—This species can be recognized by its very short cornicles (.06-.08 mm, Knowlton and Smith, 1936b:231) that are about half the length of the cauda, the short second hind tarsal joint (.07-.08 mm), the needle-tipped last rostral segment and the rather short unguis that is only about $3\frac{1}{3}$ times as long as the base of a.s.VI.

DESCRIPTION.—*Apterous Viviparous Female:* Color pale with apices of rostrum and legs dark, antennae dusky beyond middle of a.s.IV. Laterofrontal and mesofrontal tubercles of head moderately developed; mf 1p, lf 2 on each tubercle, vlf 1p, df 3l, vf 6, pc 2p and md 3 on each side; dorsal setae funnel-shaped, distinctly petiolate, stems about $\frac{2}{3}$ entire length for mf and df-1 setae; ventral setae with vf and pc funnel-shaped, md pointed; mf .0396 and df-1 .0330-.0418 mm long. Antennal segment III with small, blunt setae, less than $\frac{1}{2}$ basal diameter of segment, 1 sensorium. A.s.IV and V subequal, $\frac{3}{4}$ length of a.s.III; unguis $3\frac{1}{3}$ times as long as base of a.s.VI.

Body with moderately dense cover of funnel- to cone-shaped setae, posterior ones distinctly petiolate, those on disk less distinctly stemmed. Cauda rather slenderly elongate, slightly constricted, with broadly rounded apex; apiculate; with 2 lateral pairs and 3 posterodorsal setae (Knowlton and Smith, 1936b, figure only 1 posterodorsal caudal seta). Cornicles .06-.08 (original description) about $\frac{1}{2}$ length of cauda; cylindrical; weakly imbricate-spiculate. Legs with 3 hairs on first tarsal joints of pro- and mesothoracic legs, number on hind legs not clear in type. Rostrum IV+V .09-.10 mm long with needle-like tip (Knowlton and Smith, 1936b); with 1 basal, 2 dorsal and 3 lateral pairs of setae, ml and pl about $\frac{1}{2}$ size of al setae.

Measurements (in mm) of type-specimen: B.L. 1.30, We .32; a.s.III both .25, a.s.IV .17 and .18,

a.s.V both .18, a.s.VI .09 + .31 and .08 + .27; cornicles both .07, cauda .16, hind tibiae .54 and .53, and hind ta-2 .07 and .08. Rostrum IV+V not clear.

Alate Viviparous Female: Not known.

Sexuales: Not known.

HOST.—*Artemisia tridentata*.

DISTRIBUTION.—Apparently rare, and recorded only from type-locality (Big Cottonwood Canyon, Utah).

SPECIMEN EXAMINED.—Only the type apterous viviparous female.

***Pleotrichophorus intermedius*, new species**

FIGURES 160, 462-465

DIAGNOSIS.—This species resembles both *P. pseudoglandulosus* and *P. decampus* and exhibits a number of characters common to each of these species. Like the former, the head and body setae are long and funnel-shaped, the co/ca ratio is about 3, and the cornicles are conspicuously imbricate and wrinkled but sparsely toothed. Like the latter, the dorsofrontal (31-37) and body setae are rather dense, and rostrum IV+V is relatively short (.11-.12 mm).

DESCRIPTION.—*Apterous Viviparous Female:* Color in life unknown. Rather small individuals, 1.23-1.38 (1.33, n = 7) mm long, .38-.40 (.393, n = 7) mm wide across eyes. Head with rather well-produced laterofrontal tubercles, mesofrontal low but distinct; mf 1p, lf 2-3 (usually 3) on each side, vlf 1p, df 31-37 (33.14 ± 1.80 , n = 7), pc 2p, ac 4-6 and md 3-4 (usually 3) on each plate; dorsal setae uniformly funnel-shaped, petiolate; ventral setae with vf and pc similarly but less narrowly expanded, md and ac blunt or slightly flattened; mf .0330-.0484 (.0398, n = 12) and df-1 .0374-.0462 (.0424, n = 14). Antennal segment I moderately produced mesodistally, imbricate-spiculate, with 7-10 slightly knobbed to funnel-shaped setae in addition to basal pointed one on dorsum.

A.s.II with usually $1 - \frac{1}{2} - 1$ knobbed setae, with 1 sometimes added or missing. A.s.III conspicuously imbricate, also spiculate at extreme base, setae small, knobbed or pointed, longest up to $\frac{1}{2}$ basal diameter of segment; bearing 1-3 (2.2, n = 11) sensoria. A.s.IV and V subequal, averaging $\frac{9}{10}$

length of a.s.III; unguis of a.s.VI 4 to $5\frac{1}{2}$ times (4.79, $n = 2$) as long as base.

Dorsal body integument smooth on sides of disk, armed with large blunt spicules along midline, coarsely imbricate-spiculate caudally from about abd.s. 5; rather densely covered with funnel-shaped, mostly distinctly stemmed setae. Cauda .13-.16 (.148, $n = 7$) mm long; triangular, not constricted, apex acutely rounded. Cornicles .43-.50 (.458, $n = 13$) mm long, 2.69-3.33 ($3.09 \pm .13$, $n = 13$) times as long as cauda; cylindrical with slightly incrassate bases and apices; coarsely imbricate, faintly wrinkled, sparsely armed with large, blunt spicules. Legs with 3, 3, 3 hairs on first tarsal joints; hind tibiae .79-.91 (.86, $n = 7$) and hind ta-2 .10-.11 (.103, $n = 6$) mm long. Rostrum IV+V .11-.12 (.117, $n = 7$) mm long, 1.09-1.20 ($1.13 \pm .05$, $n = 6$) times length of hind tarsal joint, slender, apical $\frac{2}{3}$ produced into stoutly cylindrical needle, with 1 basal, 2 dorsal, and 3 lateral pairs of setae, ml and pl about $\frac{1}{3}$ al setae in length.

Alate Viviparous Female: Unknown.

Sexuales: Unknown.

Host—*Artemisia frigida*.

Types.—Holotype, apt.v.f., Minneapolis, Minnesota, 10-VII-1925, Coll. # 52/25, OWO, on *Artemisia frigida*, in U.Minn. coll. Paratypes, 6 apt.v.f. and 1 apt.ny. with same data as holotype (U. Minn. and 1 slide in LACR coll.).

Plectrichophorus knowltoni, new species

FIGURES 139, 286-291

DIAGNOSIS.—This species resembles *P. chrysanthemii* and *P. glandulosus* in its moderately long cornicles (averaging between .45 and .55 mm); acutely pointed last rostral segment; and long, thin stemmed, apically flattened head and body hairs. It differs from both species in a much denser cover of setae (mean df setae of oviparous females number 26.67 ± 3.16 , $n = 6$ vs. $13.36 \pm .64$, $n = 22$ in *P. chrysanthemii* and $13.89 \pm .48$, $n = 49$ in *P. glandulosus* apterous vivipara) and from *P. glandulosus* in its thinner-stemmed setae.

DESCRIPTION.—*Apterous Viviparous Female* (based on holotype only): Color in life unknown; cleared, stained specimen with body pale, tips of rostrum and tibiae, and entire tarsi dark brown, antennae dusky from basal $\frac{1}{4}$ of third segment

(other segments missing), cornicles dusky from about distal $\frac{1}{3}$. Body length 2.47, width across eyes .32 mm. Head with moderately developed meso- and laterofrontal tubercles; mf 1p plus 1 unpaired one, lf 2 and 3 on each side, vlf 1p, df 26, vf 7, pc 2p, ac 4, and md 3 and 4 on each lobe; distally flattened or expanded dorsal setae with long (about $\frac{5}{6}$ of length for mf and df-1) slender (about 33μ wide) stems; vf and vlf much like df setae but pc, ac, and md blunt or pointed at apices; mf .0506-.0638 and df-1 .0484 mm long. Antennal segment I produced on inner distal margin, imbricate with 7-8 blunt or spine-like setae in addition to basal pointed one on dorsum. A.s.II imbricate, with

1
1 — — 1 blunt or pointed setae. A.s.III imbricate,
2
with mostly pointed setae, longest slightly more than $\frac{1}{2}$ basal diameter of segment, with 2 sensoria on both sides; remainder of flagellum broken.

Dorsal integument smooth on disk, becoming imbricate-spiculate caudad from abd.s. 6; with 2 rows of small pleural intersegmental patches; setae of similar shape to those on head, with posterior slightly longer than discal ones. Subgenital plate with mostly marginal setae (Figure 289). Cauda .27 mm long; stoutly elongate, with rounded tip; spiculate; with 2 lateral pairs and 2 posterodorsal setae. Cornicles .47 mm long, $1\frac{3}{4}$ times as long as cauda; cylindrical, with slightly incrassate bases; imbricate, wrinkled and armed with small pointed teeth. Legs with 3, 3, 3 hairs on first tarsal joints; hind tibiae 1.39 and hind ta-2 .15 mm long. Rostrum IV+V .13 mm long; tapering to acute point, with straight margins; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, ml and pl $\frac{1}{3}$ to $\frac{1}{4}$ al in length.

Oviparous Female: Very much like apterous vivipara, differing only as follows: body setae thinner, less expanded, some of posterior setae pointed (Figure 291); subgenital plate (Figure 290) more thickly armed with pointed setae; hind tibiae thickened, bearing pseudosensoria on basal third.

Measurements (in mm) of 6 paratypes: B.L. 2.13-2.47 (.24), We .49-.56 (.530); a.s.III .57-.70 (.623), a.s.IV .42-.63 (.538), a.s.V .48-.57 (.532), a.s.VI .15-.17 (.16) + .86-.98 (.94); cornicles .43-.51 (.466), cauda .22-.27 (.238); hind tibiae 1.30-1.59 (1.37), hind ta-2 .13-.16 (.146), rostrum IV+V .13-.14 (.133); mf .0440-.0638 (.0527), and df-1

.0462-.0660 (.0564). Proportions of a.s.III:IV:V, 1: .71-.98 (.88); .77-.92 (.86); VIu/VIb 5.38-6.13 (5.84); co/ca 1.78-2.05 ($1.96 \pm .06$); rostrum IV+V/hind ta-2 .87-1.00 (.91). Number of sensoria on a.s.III 1-4 (2.3); df setae 23-32 (26.67 ± 3.16), and posterodorsal setae 2-5 (3.7).

HOST.—Unknown.

DISTRIBUTION.—No records other than type-locality (Umiat, Alaska).

TYPES.—Holotype, apt.v.f., Umiat, Alaska, 24-VII-1955, R.F. Smith, on unknown host; specimen at 5:00 o'clock on type-slide. Paratypes: 6 ovip.f., with same data as holotype and 3 of which are mounted on same slide as holotype. Holotype and all paratypes in EOE coll.

ETYMOLOGY.—This species is named in honor of Dr. George F. Knowlton, Professor emeritus, Utah State University.

Pleotrichophorus lagacei Hille Ris Lambers

Pleotrichophorus lagacei Hille Ris Lambers, 1969:175-178 [type: apt.v.f., Ski Lodge on Mt. Shasta, 2600 m elev., Siskiyou Co., California, 24-VIII-1966, C. Lagace, on *Haplopappus bloomeri*; in DHRL coll.].

DIAGNOSIS.—This species is peculiar among *Pleotrichophorus* species with its distinctly clavate cornicles and among nearctic species of this genus, by having the pl setae the longest of the rostral (IV+V) setae.

DESCRIPTION.—Hille Ris Lambers' original description includes the following data:

Apterous Viviparous Female: BL 1.80-2.50; antennae 2.41-2.94, with a.s.III .40-.61, a.s.IV .36-.52, a.s.V .38-.44, and a.s.VI .13-.16 + .75-1.06; cornicles .41-.56, cauda .27-.36, and rostrum IV+V .10-.105 mm. Proportions of VIu/VIb 6-7½; co/ca 1.52-1.67 ($1.61 \pm .058$, n = 6, calculated from his tabulated measurements); rostrum IV+V about 5/7 length of hind ta-2. Number of df setae 16, number of sensoria 1-2. Head and body rather short (e.g., .017-.019 mm), "mostly wider than long, virtually without shaft, with striate, slightly serrated, flat-tish, very widely fan-shaped knobs". Chaetotaxy of rostrum IV+V normal for *Pleotrichophorus*, that is, the anterodorsal pair of setae present.

Alate Viviparous Female: Measurements of 1 type-specimen: BL 2.01; antennae 2.65 with a.s.III .51, a.s.IV .43, a.s.V .38 and a.s.VI .14 + 1.01;

cornicles .44 and cauda .26 mm. Sensoria on a.s.III 11-13, and on a.s.IV 0-1.

Sexuales: Unknown.

HOST.—*Haplopappus bloomeri*.

DISTRIBUTION.—Known only from type-locality in Northern California (Mt. Shasta).

TYPES.—Holotype apt.v.f. and some paratypes in DHRL collection, and other paratypes in UC collection at Berkeley (Entomology Department).

SPECIMENS EXAMINED.—None.

Pleotrichophorus longinectarius (Gillette and Palmer)

FIGURES 162, 454-457

Capitophorus longinectarius Gillette and Palmer, 1933:352 [type: apt.v.f., Chimney Rock, Colorado, MAP, 26-VI-1932, beaten off *Artemisia longifolia*; USNM 49298]; 1934: 151-152.—Knowlton, 1954:8.

Pleotrichophorus longinectarius (Gillette and Palmer).—Hille Ris Lambers, 1953:115; 1969:168.

DIAGNOSIS.—*P. longinectarius* is recognizable by its long cornicles, 2½ to 4 times ($3.25 \pm .22$, n = 17) the cauda in length; the dense, wrinkled and unarmed cornicular imbrications; the stout, non-constricted cauda; the dense head (mean df = 70.89 ± 8.68 , n = 9) and body setae; the rather widely expanded setae on the basal 2 segments of the antennae; and the long (.135-.15 mm, m = .143, n = 11) and stoutly needle-tipped last rostral segment.

DESCRIPTION.—*Apterous Viviparous Female*: Color in life pea green (Gillette and Palmer, 1933: 352); cleared specimen with body pale, tips of rostrum, a.s.III, IV and V, areas around primary sensoria of a.s.VI, unguis, and tips of tibiae dusky, tarsi dark brown. Body length 2.05-2.40 (2.22, n = 10), width across eyes .47-.58 (.532, n = 10) mm. Head with large, conspicuously protruding compound eyes; laterofrontal tubercles well developed, mesofrontal tubercle rather small; mf usually 2p, lf 3-5 (usually 4) on each side, vlf 2p, df 54-81 (70.89 ± 8.68 , n = 9), vf 14-28 (21.2, n = 9), pc 2p, ac 4-6, and md 2-4 (usually 3) on each plate; dorsal setae funnel-shaped with anterior slightly longer, more distinctly stemmed than posterior ones; ventral setae similar but more elongate and slender; mf .0286-.0440 (.0383, n = 17), df-1 .0352-.0462 (.0411, n = 16) mm long. Antennal segment

I produced mesodistally, densely imbricate-spiculate, with 7–18 knobbed to funnel-shaped setae aside from usual pointed one on dorsum. A.s.II

with usually $1 - \frac{1}{2} - 1$ setae of same shape as most

on a.s.I. A.s.III densely imbricate, with small rod-like to knobbed setae, longest less than $\frac{1}{2}$ basal diameter of segment; with 1–2 (1.18, n = 22) sensoria. A.s.III about as long as a.s.V, about $\frac{9}{10}$ a.s. IV; a.s.VI with unguis averaging $5\frac{1}{3}$ times (range = 3.86–6.89, n = 17) length of base.

Dorsal body integument smooth on disk becoming imbricate-spiculate caudally; densely covered with funnel- or cone-shaped setae. Cauda .25–.30 (.266, n = 9) mm long; stoutly elongate, without basal constriction, apex broadly rounded; spiculate; with 2 pairs lateral and 1 posterodorsal setae. Cornicles .66–1.02 (.869, n = 21) mm long, $2\frac{1}{2}$ to 4 times ($3.25 \pm .22$, n = 17) as long as cauda; cylindrical, with slightly thicker bases; densely imbricate, wrinkled, without spicules. Legs with 3, 3, 3 hairs on first tarsal joints; hind tibiae 1.05–1.72 (1.46, n = 18), hind ta-2 .12–.15 (.139, n = 15) mm long. Rostrum IV+V with distal $\frac{1}{3}$ produced into thick, slightly convex-sided, not cylindrical "needle"; .135–.15 (.143, n = 11) mm long, .93–1.15 ($1.03 \pm .05$, n = 15) times length of hind ta-2; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, ml and pl $\frac{1}{3}$ to $\frac{1}{2}$ al in length.

Measurements (in mm) of holotype: BL 2.40, We .58; a.s.III both .82, a.s.IV .92 and .91, a.s.V .73 and .79, a.s.VI .24 + 1.34 and .23 + 1.38; cornicles 1.0 and 1.02, cauda .30; hind tibiae 1.71 and 1.70, hind ta-2 both .15, and rostrum IV+V .14 mm.

Alate Viviparous Female: Unknown.

Sexuales: Unknown.

Hosts.—*Artemisia longifolia*, *Artemisia* sp.

DISTRIBUTION.—Aside from type-locality, *P. longinectarius* is recorded from Yellowstone National Park in Wyoming (Knowlton, 1954), and Mt. Timpanogos in Utah (Palmer, 1952:261). Its occurrence in Canada (Alberta and Manitoba) is reported here for the first time.

SPECIMENS EXAMINED.—Holotype (USNM) and 12 paratype apt.v.f., with same data as holotype (CSU); 1 apt.v.f., Lethbridge, Alberta, Canada, 28–VII–1946, GFK, on *Artemisia* sp. (GFK coll.); and

1 apt.v.f., Glenlea, Manitoba, 17–VI–1965, on suction trap (AGR coll.).

Pleotrichophorus longipes (Gillette and Palmer)

FIGURES 163, 208–211

Macrosiphum longipes Gillette and Palmer, 1928:1–2 [types: 23 apt.v.f., 2 al.v.f., Log Cabin, Colorado, 30 July 1926, on *Artemisia tridentata*; Rustic (Larimer Co.) Colorado, 7:3026; AC 2075; USNM 41969]; 1934:186.—Knowlton and Allen, 1938:81.

Capitophorus longipes (Gillette and Palmer).—Palmer, 1952: 261–262.

Pleotrichophorus longipes (Gillette and Palmer).—Hille Ris Lambers, 1969:168.

DIAGNOSIS.—This species is unique among *Pleotrichophorus* species in the presence of 4–6 hairs on the basal half of the cornicles. It resembles *P. sporadicus* in dorsal head chaetotaxy but the posterior df's are of same shape and size as the anterior ones. It differs, further, from this species in having the cornicles entirely dark instead of only the distal half, and in the presence of 2 lateral pairs (vs. 5–8 pairs) of caudal setae.

DESCRIPTION.—*Apterous Viviparous Female*: Color in life bluish apple green and slightly pruinose (Palmer, 1952:261); cleared specimen pale green, with dark brown antennae, cornicles, sides of femora, entire tibiae and tarsi, and last 2 rostral segments. Body rather long and narrowly spindle-shaped, 2.45–2.97 (2.66, n = 6) mm long, .65–.67 (.658, n = 6) mm wide across eyes. Head with large, conspicuously protruding compound eyes and indistinct ocular tubercles; laterofrontal tubercles well developed, mesofrontal area hardly produced; mf 1p, lf 1–2 (usually 1) on each tubercle, vlf 1p, df 10 (10.00 ± 2.57 , n = 6), vf 6–8 (usually 6), pc 1–3 (usually 2) p, ac 4–5, md 3–4 on each side; dorsal and ventral setae long, thin, widest near bases, tapering gradually, extreme apices slightly knobbed; mf .0660–.0858 (.0781, n = 6), df-1 .0660–.0880 (.0760, n = 11) mm long. Antennal segment I slightly produced mesodistally, faintly imbricate, with 3–12 elongate, knobbed setae in addition to

basal pointed one on dorsum. A.s.II with $1 - \frac{1}{2} - 1$ knobbed setae. A.s.III slightly imbricate; with rather long knobbed setae, longest equal to or slightly longer than basal diameter of segment;

bearing 1-2 (1.55, $n = 11$ sensoria). Other flagellar segments incomplete in specimens seen but Gillette and Palmer (1928:1) give following measurements: a.s.III .99-1.16, a.s.IV 1.03-1.23, a.s.V .90-1.05, and a.s.VI .20 + 1.12-1.45 mm.

Dorsal body integument rather smooth, becoming very faintly striate on last abdominal segment; dorsal body setae sparse, consisting of irregularly arranged spinal, pleural, and marginal rows of 1-3 setae per row on each segment, setae of similar shape to those on head. Cauda .32-.38 (.355, $n = 6$) mm long; stoutly elongate, not noticeably constricted basally, with broadly rounded apex; spiculate; with 2 lateral pairs and 1 (sometimes 2 or 3) posterodorsal setae. Cornicles 1.06-1.44 (1.21, $n = 6$) mm long, 3 to $3\frac{3}{4}$ times ($3.36 \pm .32$, $n = 6$) as long as cauda; cylindrical, with faintly incrassate bases and apices; imbricate, dark brown from near bases, becoming slightly paler on apical $\frac{1}{5}$ to $\frac{1}{4}$; bearing 4-6 slightly knobbed setae on outer basal margin. Legs with 3, 3, 3 hairs on first tarsal joints. Last rostral segment .14-.15 (.145, $n = 6$) mm long, about $\frac{8}{10}$ (range = .78-.83) length of 2nd hind tarsal segment; apical $\frac{1}{2}$, beyond pl setae, produced into sharply pointed "needle"; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, ml and pl about $\frac{1}{2}$ length of al setae.

Alate Viviparous Female: Not seen. Gillette and Palmer (1928:2) give the following measurements: BL 2.40; a.s.III 1.05-1.10, a.s.IV 1.0-1.24, a.s.V .90-1.02, a.s.VI .20 + 1.45; cornicles 1.0, cauda .26; and hind tibiae 2.60 mm. Number of sensoria on a.s.III 1-12.

Oviparous Female: Not seen. According to Palmer (1952:262), measurements are much like those of apterous vivipara but cauda relatively stouter, the width being "greater than $\frac{1}{2}$ its length", and bearing 3 pairs lateral and 4 scattered dorsal setae.

Male: Not seen. Palmer (1952:262) gives the following descriptions and measurements: apterous; BL 2.0, antennae 4.5, cornicles .60-.70, and cauda .13-.15 mm; sensoria small and numerous on a.s.III and IV and absent on a.s.V.

Hosts.—*Artemisia tridentata*, *Artemisia* sp.

DISTRIBUTION.—Recorded from northern portions of Colorado and Utah.

SPECIMENS EXAMINED (all in EOE coll.).—4 apt.

v.f. and 5 apt.ny., Allen Creek, Utah, 11-VII-1956, GFK, on *Artemisia* sp; and 2 apt.v.f., Willard Peak, Utah, 6-VII-1956, GFK, on unknown host.

Pleotrichophorus longirostris Hille Ris Lambers

Pleotrichophorus longirostris Hille Ris Lambers, 1969:178-179 [type: apt.v.f., 3 mi E of Lucia, Monterey Co., California, 6-IV-1966, R. van den Bosch, on *Eriophyllum staechadifolium*; in DHRL coll.].

DIAGNOSIS.—From Hille Ris Lambers' (1969) descriptions and figures, *P. longirostris* appears most closely related to *P. brevinectarius* in having dense head ($df = 47$) and body setae (20 setae per square .10 mm), stoutly elongate cauda which bears usually more than 1 (2-4; and 1-4, $m = 2.11$, $n = 11$ for *P. brevinectarius*) posterodorsal hairs, rather short cornicles, and needle-tipped rostrum IV+V. The last rostral segment, however, is much longer (.17-.19 vs. .12-.14 mm) and its ratio to the second hind tarsal joint is much greater ("just over $1\frac{1}{2}$ times" [Hille Ris Lambers, 1969:178] vs. $1.00 \pm .02$, $n = 27$); co/ca ratio relatively larger ($.61 \pm .04$, $n = 5$ vs. $.35 \pm .01$, $n = 40$); and appendages, including antennae, legs and cornicles pale brownish instead of pale with only extreme apices darkened as in *P. brevinectarius*.

DESCRIPTION.—*Apterous Viviparous Female*: Data taken from original description: BL 1.65-1.90; antennae 2.20-2.30, with a.s.III .43-.49, a.s.IV .37-.40, a.s.V .35-.37, and a.s.VI .14-.17 + .68-.79; cornicles .16-.19, cauda .26-.31 and rostrum IV+V .17-.19 mm. Proportions of VIu/VIb 4-5; co/ca .60-.63 ($.61 \pm .04$, $n = 5$; calculated from tabulated measurements); rostrum IV+V/hind ta-2 "just over $1\frac{1}{2}$ times" [Hille Ris Lambers, 1969:178]. Number of df setae 47; posterodorsal caudal setae 2-4; sensoria on a.s.III 1-2, rarely 3.

Alate Viviparous Female: Unknown.

Sexuales: Unknown.

Host.—*Eriophyllum staechadifolium*.

DISTRIBUTION.—So far known only from type-locality in Monterey Co., California.

TYPES.—Holotype apt.v.f. and some paratypes in DHRL collection; other paratypes in Department of Biological Control, University of California at Berkeley.

SPECIMENS EXAMINED.—None.

Pleotrichophorus magnautensis
(Knowlton and Smith)

FIGURES 124, 171-174

Capitophorus magnautensis Knowlton and Smith, 1936a:110 [type: Fort Duchesne, Utah, 14-VII-1927, GFK, on *Chrysothamnus viscidiflorus*; types in USNM]; 1937:51.

Capitophorus magnautensis [sic] Knowlton and Smith.—Knowlton, 1948:123.—Palmer, 1952:262-263.—Knowlton, 1954:8.

Pleotrichophorus magnautensis (Knowlton and Smith).—Hille Ris Lambers, 1969:167, 179.

DIAGNOSIS.—This species is distinctive with its large size (more than 2.0 mm), entirely dark, short cornicles that are slightly shorter than the cauda (co/ca ratio $m = .91 \pm .03$, $n = 18$), short stout and blunt-tipped rostrum IV+V that is about $\frac{2}{3}$ (.68 \pm .52, $n = 10$) hind ta-2 in length, the minute head and body setae, and numerous minute setae on the venter of the head and first antennal segment. It resembles *P. utensis* in the shape of rostrum IV+V and in having flattened posterodorsal caudal setae but these caudal setae are more numerous (1-4, $m = 2.77$, $n = 9$ vs. 0-2, $m = 1.17$, $n = 15$) and all dorsal setae much smaller.

DESCRIPTION.—*Apterous Viviparous Female:* Color in life, green; cleared specimens pale with tips of rostrum, tibiae, a.s.III, IV, and V, entire a.s.VI and tarsi, and cornicles from near bases dark brown. Body 2.54-2.65 (2.60, $n = 5$) mm long, .50-.58 (.551, $n = 7$) mm across eyes. Head with well-developed laterofrontal tubercles, mesofrontal tubercle hardly produced, frontal margin appearing smoothly concave; mf usually 1p, lf 2-6 (usually 4) on each side, vlf 1p (may be situated closer than usual to vf setae and in such cases not morphologically recognizable from them and from other laterofrontal setae), df 10-14 (12.25 \pm 1.47, $n = 8$), vf 6-12 on each side but usually 9 pairs present, pc 2p, ac 3-5, and md 3-4p; dorsal setae minute, subequally long (df-1 averaging .0080 mm), rod-shaped or merely incrassate at apices; ventral setae similar in size and shape but ac slightly longer than others. Antennal segment I moderately produced on inner distal margin, imbricate, with usual pointed basal seta on dorsum, 15-27 blunt or apically thickened setae arranged in 2 to 3 rows along outer and distal ventral margins of segment.

A.s.II imbricate, usually with 1 - $\frac{2}{2}$ - 1 setae with

one sometimes added or missing. A.s.III with minute setae and 1-6 (2.9, $n = 11$) sensoria. A.s.IV slightly longer than A.s.V, about $\frac{9}{10}$ and $\frac{3}{4}$ length of a.s.III, respectively; unguis of a.s.VI $5\frac{3}{4}$ - $6\frac{3}{4}$ (6.25, $n = 6$) times length of base.

Body integument striate to reticulate on dorsum, striae more pronounced and spiculate posteriorly; lateral integument around stigmal openings produced into tuberculate processes, these tubercles increased in size from abd.s. 1 to 7; rather sparsely covered with minute, inconspicuous, slightly knobbed setae. Cauda elongate, tapering only slightly, with rounded tip; spiculate; slightly dusky; with 2 pairs pointed lateral and 1-4 (2.77, $n = 9$) apically flattened, small posterodorsal setae. Cornicles .28-.41 (.353, $n = 16$) mm long, .78-1.03 times (.91 \pm .03, $n = 18$) as long as cauda; cylindrical with slightly thickened apices; faintly imbricate-spiculate. Legs with 3, 3, 3 hairs on first tarsal joints; hind tibiae 1.45-1.75 (1.62, $n = 9$) and hind ta-2 .11-.16 (.147, $n = 9$) mm long. Rostrum IV+V stout, very slightly tapered apex blunt, .09-.11 (.099, $n = 8$) mm long and .56-.91 (.68 \pm .52, $n = 10$) times as long as hind ta-2, with 1 basal, 2 dorsal, and 3 lateral pairs of setae, al, ml and pl setae subequal in length.

Alate Viviparous Female: Unknown.

Sexuales: Unknown.

HOSTS.—*Chrysothamnus viscidiflorus* and *Chrysothamnus* sp.

DISTRIBUTION.—Recorded from several localities in Utah, generally in northeastern and central portions of the state; records also include Onetree, Wyoming, near the northeastern corner of Utah and Dinosaur, Colorado also near the Utah border.

TYPES.—Since these types were not seen, a type-specimen has not been fixed from among the original series collected from Duchesne, Utah. Two paratype slides, from Randlett and Tropic, Utah, were examined from EOE collection at Berkeley, California.

In a subsequent publication by Knowlton and Smith (1937), they refer to additional paratype records (Tropic, Orangeville, and Huntington, Utah) that were inadvertently omitted from the original description (Knowlton and Smith, 1936a); Randlett, Utah, is implied as having been originally included but actually is not listed in the original description.

These paratype designations (viz., Tropic,

Orangeville, Huntington, and Randlett, Utah) probably constitute a valid paratype designation. The original type-series, however, is likely to include more than a single species as experience with similar older collections of other *Pleotrichophorus* species has shown. The status of these type-specimens can not be properly determined until the Duchesne, Utah, series is reconsidered.

SPECIMENS EXAMINED.—COLORADO: Dinosaur, 14-VIII-1966, GFK, on unknown host (LACR coll.). UTAH (all labeled "paratypes" and EOE coll.): Tropic, 3 apt.v.f. and 1 apt.ny., 19-IX-1935, GFK, on *Chrysothamnus* sp.; and Randlett, 5 apt.v.f. and 1 apt.ny., 14-VII-1927, GFK, on *C. viscidiflorus*.

Pleotrichophorus neosporadicus, new species

FIGURES 136, 204-207

DIAGNOSIS.—This species resembles *P. sporadicus* very closely and may prove to be a spring variant of that species. It can be separated, however, by its merely dark-tipped a.s.IV and V, by its more widely and uniformly expanded posterior df and body setae, and by its more slenderly elongate cauda. It is similar to *P. packi packi* in the expanded posterior df and body setae but can be easily recognized by the pale a.s.III and a.s.IV; by having only the distal $\frac{1}{3}$, instead of the entire, cornicle dark; by the shorter cornicles (.67-.90 vs. .86-1.39 mm), smaller co/ca ratio ($m = 1.67, n = 4$ vs. $2.27 \pm .04, n = 100$), the presence of fewer df setae (10, $n = 2$ vs. $18.16 \pm .56, n = 90$), the presence of more lateral caudal hairs (6-8 on each side vs. 2-5, $m = 3.3, n = 182$). It shares with *P. packi brevis* the presence of many lateral caudal hairs and short, only distally dark cornicles; but the shape of the dorsal body setae and the relatively longer a.s.III setae (longest ones equal the diameter of segment vs. up to $\frac{1}{2}$ only in *P. packi brevis*) are distinctive.

DESCRIPTION.—*Apterous Viviparous Female:* Color in life green (collection data); cleared specimens with body pale, and tips of rostrum, a.s.III and IV, remainder of antennae, entire tarsi and distal $\frac{1}{4}$ to $\frac{1}{2}$ of cornicles brown. Head with slightly developed frontal tubercles; mf 1p (with additional one in paratype), lf 2 or 3 on each

tubercle, vlf 1p, df 10 (in both types), vf 7-9, pc 2p, ac 4-5, and md 2 or 3 on each side; dorsal setae with lf blunt or slightly knobbed, mf and anterior 2 pairs of df flattened and posterior df's rather widely spatulate; ventral setae mostly blunt or knobbed but some of md and ac pointed. Antennal segment I slightly produced on inner distal margin, with 8-9 elongate blunt-tipped setae in addition to small pointed one on base of dorsum.

A.s.II with $1 - \frac{1}{2} - 1$ blunt or slightly knobbed setae. A.s.III sparsely imbricate; with long blunt or knobbed setae, longest equal to basal diameter of segment; with 3-4 sensoria. A.s.IV and V subequal and about $\frac{3}{4}$ a.s.III in length; a.s.VI with unguis about $4\frac{1}{2}$ times as long as base.

Disk of body smooth dorsally, becoming finely striate-spiculate caudad of cornicular segment; setae rather large and thick, all expanded but in varying degrees from merely spatulate to fan-shaped. Cauda slenderly elongate, tapering gradually to acute but rounded apex; spiculate; with 6-8 setae on each side, 2-3 on posterodorsal surface. Cornicles .67-.90 (.683, $n = 4$) mm long, 1.59-1.73 (1.67, $n = 4$) times as long as cauda; slenderly cylindrical, with slightly incrassate bases and apices; conspicuously imbricate-spiculate on distal half, these imbrications fading out anteriorly. Legs with 3, 3, 3 hairs on first tarsal joints. Rostrum IV+V tapering to acute point, portion beyond pl setae with straight margins; .11-.12 mm long and .86-.92 times as long as hind ta-2; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, ml and pl about $\frac{2}{3}$ al in size.

Measurements (in mm) of holotype: B.L. 2.58, We .55; a.s.III both .73, a.s.IV .50 and .53, a.s.V .52 and .53, a.s.VI .14 + .67 (only one side complete); cornicles .67 and .69, cauda .40, rostrum IV+V .11; mf .0484, .0550, and .0616, and df-1 .0616 and .0572. Paratype with hind tibiae 1.50 and 1.52, hind ta-2 .13 and .14 and rostrum IV+V .12 mm long.

Alate Viviparous Female: Unknown.

Sexuales: Unknown.

TYPES.—Holotype, apt.v.f., Promontory, Utah, 17-V-1966, GFK, on *Chrysothamnus nauseosus*; in U.Minn. coll. Paratype, 1 apt.v.f., with the same data as holotype; in LACR coll.

***Pleotrichophorus obscuratus* Hille Ris Lambers**

FIGURES 150, 384-387

Pleotrichophorus obscuratus Hille Ris Lambers, 1966:605-607 [type: apt.v.f., Berkeley, Alameda Co., California, 2-II-1964, DHRL, on *Artemisia californica*; in DHRL coll.]; 1969:166.

DIAGNOSIS.—This species is distinctive among short cornicled species (viz., *P. brevinectarius*, *P. infrequens*, *P. filifoliae*, *P. pseudopatonkus*, *P. triangulatus*) with its entirely brown appendages, anal plate, and cauda. The short (.09-.12 mm), needle-tipped last rostral segment is also diagnostic.

DESCRIPTION.—*Apterous Viviparous Female*: Color in life pruinose, grayish green (original description). Cleared specimen with light brown head, rest of body pale; antennae brown with basal 2 flagellar segments paler; entire legs, rostrum from third segment, entire cornicles, cauda, subgenital and anal plates brown. Body 1.30-1.80 (1.59, n = 6) mm long, .37-.40 (.390, n = 7) mm wide across eyes. Head with slightly developed frontal tubercles; mf 1p, lf 2p, vlf 1p, df 20-28 (25.71 ± 2.54 , n = 7), vf 6-8 (usually 6), pc 2p, ac 4, md 2-4 (usually 3) on each side; dorsal setae funnel-shaped, with rather long stems (about $\frac{3}{4}$ entire length for anterior ones); ventral setae with vf flattened to slightly expanded on apices, pc, ac, and md much smaller and pointed; mf .0418-.0550 (.0489, n = 14), df-1 .0440-.0550 (.0490, n = 14) mm long. Antennal segment I slightly produced on inner distal margin, faintly imbricate, with 4-5 pointed or blunt-tipped setae aside from basal pointed one on dorsum. A.s.II with 1 - $\frac{1}{2}$ - 1 blunt

setae. A.s.III with blunt to pointed setae, longest about $\frac{1}{2}$ basal diameter of segment; bearing 1 sensorium. A.s.IV and V subequal, about $\frac{3}{4}$ length of a.s.III; a.s.VI with unguis $3\frac{1}{4}$ to $4\frac{1}{4}$ times (3.58, n = 13) as long as base.

Body with dorsum pale, membranous; with 2 pairs of rows of light brown pleural intersegmental patches on abdomen and brown sclerotic spiracular plates; setae moderately dense and similarly shaped to those on dorsum of head. Cauda gradually tapering to acute but rounded tip; spiculate; with 2 pairs lateral and 1 posterodorsal setae. Cornicles .09-.13 (.108, n = 12) mm long, .41-.67 times (.56 \pm .05, n = 12) as long as cauda; cylindrical, almost

uniformly thick; imbricate-spiculate, with spicules rather large, sharp. Legs bearing 3, 3, 3 setae on 1st tarsal joints. Last rostral segment .09-.12 (.11, n = 7) mm long, .82-1.22 ($1.12 \pm .06$, n = 11) times as long as hind ta-2; tapering just past pl setae, from there drawn into thin cylindrical needle, about $\frac{1}{3}$ total length of segment; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, ml and pl about $\frac{1}{2}$ al in length.

Measurements (in mm) of 2 paratypes: BL 1.30 and 1.45, We .37 and .39; a.s.III .28-.31 (.293), a.s.IV .21-.28 (.24), a.s.V .20-.21 (.205), a.s.VI .09-.10 (.095) + .37-.38 (.373); cornicles .10-.12 (.108), cauda .17 and 18; hind tibiae .67-.73 (.69), hind ta-2 .09-.10 (.093), and rostrum IV+V both .11.

Alate Viviparous Female: Unknown.

Sexuales: Unknown.

HOST.—*Artemisia californica*.

DISTRIBUTION.—California.

SPECIMENS EXAMINED.—Two paratypes, with same data as holotype; 5 apt.v.f., Riverside, California at U.C., 20-I-1965, RCD, on *Artemisia californica* (RCD coll.).

***Pleotrichophorus oestlundii* (Knowlton)**

FIGURES 132, 223-232

Capitophorus oestlundii Knowlton, 1927:235-237 [lectotype: apt.v.f., Brigham, Utah, 25-IX-1926, GFK, on *Chrysothamnus nauseosus*; in GFK coll.]; 1929:11.—Knowlton and Smith, 1936a:110-111; 1937:151.—Gillette and Palmer, 1934:153.—Knowlton, 1935b:137; 1941:138; 1946:6; 1948:123; 1954:8-9.—Palmer, 1952:263-264.

Pleotrichophorus oestlundii (Knowlton).—Hille Ris Lambers, 1953:115; 1969:167.

DIAGNOSIS.—A rather distinctive species with numerous (4-10) flattened or funnel-shaped setae on dorsum of cauda of apterous vivipara. The thick cover of fan-shaped setae on the head (mean df is 51.50 ± 1.31 , n = 100) and body, strongly spiculate dorsal integument and moderately long cornicles (.17-.46 mm) which average $1\frac{1}{3}$ times ($1.37 \pm .03$, n = 100) as long as cauda are additional diagnostic characters.

DESCRIPTION.—*Apterous Viviparous Female*: Color in life bluish green to apple green, with white pruinosity covering body in summer aptera, acquiring slight reddish cast in fall, later turning reddish to reddish brown (Knowlton, 1927).

Cleared specimen pale with antennal joints between a.s.III and IV, tips of a.s.V, entire a.s.VI, entire tarsi and tips of rostrum dark. Body 1.54–2.27 (1.89, n = 88) mm long, .41–.55 (.478, n = 95) mm wide across eyes. Head with moderately developed laterofrontal tubercles, mesofrontal rather well produced, frontal integument spiculate dorsally and ventrally; mf usually 2p, lf 4–10 (usually 6) on each side, vlf 1p, df 40–73 (51.50 ± 1.31 , n = 100), vf 14–31 (23.10, n = 92), pc usually 2p, ac 4–7, and md 3–6 (usually 3 or 4) on each lobe; dorsal setae widely expanded funnel- to fan-shaped, sessile; ventral setae except ac and some of md similar to but more narrowly expanded than df's; mf .0176–.0374 (.0294, n = 354), df-1 .0132–.0396 (.0305, n = 184) mm long. Antennal segment I conspicuously produced on inner distal margin, imbricate-spiculate, with 8–19 (usually 11 or 12) small rod-shaped or knobbed setae in addition to basal pointed one on dorsum. A.s.II imbricate,

usually with 1 – $\frac{1}{2}$ – 1 rod-shaped or knobbed setae.

A.s.III imbricate, with small setae, longest less than $\frac{1}{3}$ basal diameter of segment; bearing 1–4 (1.6, n = 173) sensoria. A.s.IV and V subequal, slightly more than $\frac{3}{4}$ a.s.III in length; a.s.VI with unguis $\frac{3}{4}$ to $7\frac{1}{2}$ times (6.01, n = 105) as long as base.

Tergum slightly sclerotic; densely imbricate-spiculate between setal bases; densely covered with uniformly fan-shaped setae. Cauda with acute but rounded apex, with slight basal constriction; spiculate; with usually 3 pairs of pointed lateral setae and 4–10 (6.27, n = 90) flattened or funnel-shaped ones on dorsum. Cornicles moderately long (.17–.46, m = .354, n = 185), extending to about level of caudal bases, 1.00 to 1.75 times ($1.37 \pm .03$, n = 100) as long as cauda; cylindrical, with slight basal and apical thickening on mesal margin, imbricate-spiculate. Legs with 3, 3, 3 hairs on first tarsal joints. Rostrum IV+V rather slender, tapering to acute point, with posterior margins slightly convex; .09–.12 (.101, n = 94) mm long, .75–1.00 ($.86 \pm .02$, n = 100) as long as second hind tarsal segment; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, ml and pl setae about $\frac{3}{4}$ as long as al.

Measurements (in mm) of lectotype and 4 paratopotypes (from Brigham and Trenton, Utah): BL 1.70–1.90 (1.80), We .43–.50 (.462); a.s.III .45–.52 (.472), a.s.IV .35–.43 (.390), a.s.V .33–.42 (.372),

a.s.VI .10–.13 (.114) + .58–.70 (.646); cornicles .26–.34 (.302), cauda .24–.27 (.256); hind tibiae .84–.91 (.872), hind ta-2 .11–.13 (.118), rostrum IV+V .09–.10 (.096); mf .0220–.0330 (.0286), and df-1 .0286–.0374 (.0312). Proportions of a.s.III:IV:V, 1: .76–.89 (.83): .73–.84 (.79); VIu/VIb 5.00–5.91 (5.52); co/ca 1.08–1.28 (1.19); rostrum IV+V/hind ta-2 .75–.91 (.82).

Alate Viviparous Female: Color in life bluish green (Knowlton, 1927); cleared specimen with body pale, mesothorax, areas around ocelli, abdominal, pleural and marginal sclerites, apices of cornicles and cauda brown, antennal joints between a.s.III and IV, IV and V, apices of a.s.V, entire a.s.VI, tips of rostrum and entire tibiae darker brown. Head chaetotaxy much like apterous female but df setae relatively fewer (30–38, m = 33.8, n = 12), all setae less expanded, funnel- rather than fan-shaped. Sensoria on a.s.III 8–14, with mean of 10.1 for 16 segments. Abdomen also like that of aptera but with 3 pairs of rows of sclerites: mesal spinal ones small and oval, pleurals larger, transverse and marginals oval, larger than spinals; dorsal setae widely expanded, funnel-shaped; dorsal caudal setae 3–8 (5.7, n = 12), more elongate, pointed, merely blunt or slightly flattened at apices.

Measurements (in mm) of 10 specimens (from Cove and Cove Fort, Utah, 20–VIII–1955): B.L. 1.85–2.03 (1.94), We .40–.46 (.430); a.s.III .54–.63 (.605), a.s.IV .45–.54 (.478), a.s.V .44–.53 (.478), a.s.VI .12–.15 (.132) + .74–.87 (.817); cornicles .30–.39 (.343), cauda .26–.27 (.264); hind tibiae 1.06–1.25 (1.16), hind ta-2 .11–.13 (.122), rostrum IV+V .10–.11 (.105); mf and df-1 .0154–.0352 with mean of .0234 and .0249, respectively. Proportions of a.s.III:IV:V, 1: .78–.91 (.83): .73–.81 (.79); VIu/VIb 5.40–7.00 (6.22); co/ca 1.15–1.46 (1.29); rostrum IV+V/hind ta-2 .77–.92 (.85).

Oviparous Female: Color in life red to brownish red (Knowlton, 1927). Morphologically similar to viviparous female except as follows: head with relatively fewer df setae (32–45, m = 37.7, n = 15), sparser dorsal body hairs; a.s. VIu/VIb ratio smaller (4.77–6.41, m = 5.39, n = 29); cornicles slightly shorter (.19–.27, m = .223, n = 32), their ratio to cauda relatively smaller (m = 1.14, n = 32); dorsal caudal hairs longer with pointed, blunt or knobbed tips; subgenital plate bearing more and pointed

setae; hind tibiae enlarged and armed with numerous pseudosensoria on basal $\frac{1}{3}$.

Measurements (in mm) of 5 paralectotypes (from Brigham, Utah): B.L. 1.61–1.75 (1.69), We .43–.48 (.460); a.s.III .47–.50 (.489), a.s.IV .37–.41 (.391), a.s.V .36–.41 (.384), a.s.VI .11–.13 (.120) + .60–.71 (.643); cornicles .21–.25 (.223), cauda .18–.20 (.192), hind tibiae .86–.90 (.878), hind ta-2 .12–.13 (.123), and rostrum IV+V .10. Proportions of a.s.III: IV:V, 1: .78–.83 (.90): .75–.82 (.77); VIu/VIb 4.77–6.41 (5.54); co/ca 1.05–1.32 (1.18); rostrum IV+V/hind ta-2 .77–.83 (.81).

Alate Male: Similar to alate viviparous female except as follows: df setae fewer (11–20, $m = 17.10$, $n = 7$), relatively shorter; sensoria more on a.s.III (19–33, $m = 27.9$, $n = 10$), present also on a.s.IV (13–30, $m = 22.1$, $n = 9$) and a.s.V (13–22, $m = 18.4$, $n = 7$); cornicles much shorter (.11–.16, $m = .134$, $n = 7$) subequally as long as cauda (.86–1.23, $m = 1.01$, $n = 7$); cauda shorter, acutely triangular, not constricted, dorsal setae all pointed. Aedeagus angular but with smooth apex.

Measurements (in mm) of 4 paralectotype (from Trenton and Brigham City, Utah): BL 1.39–1.53 (1.44), We .38–.43 (.395); a.s.III .50–.54 (.523), a.s.IV .40–.45 (.424), a.s.V .36–.41 (.388), a.s.VI .11–.12 (.113) + .60–.70 (.643); cornicles .11–.13 (.12), cauda .12–.14 (.135); hind tibiae .87–.97 (.93), hind ta-2 .12–.13 (.123), rostrum IV+V .10, mf .0154–.0242 (.0196), and df-1 .0132–.0220 (.0207). Proportions of a.s.III:IV:V, 1: .75–.85 (.80): .69–.77 (.73); VIu/VIb 5.00–6.36 (5.73); co/ca .79–1.23 (.86); rostrum IV+V/hind ta-2 .77–.83 (.81).

Hosts.—*Chrysothamnus greeni*, *C. nauseosus* var. *graveolens* and var. *nauseosus*, *C. parryi*, *C. platensis*, *C. viscidiflorus*, and *Chrysothamnus* sp. It has been collected from *Artemisia* like *A. tridentata*.

DISTRIBUTION.—Widely distributed in the western United States, records include Arizona, California, Colorado, Idaho, Montana, Nevada, Oregon, Utah, and Washington.

TYPES (designated from "cotypes" available).—Lectotype: apt.v.f. with data given above; specimen at 11:00 o'clock on slide containing 3 paralectotypes in GFK collection. Paralectotypes (all collected by GFK, on *Chrysothamnus nauseosus* at different dates and localities): 3 apt.v.f. on same slide as lectotype and 7 apt.v.f. and 17 apt. ny. also with same data as lectotype but mounted on 6 other slides (GFK coll.); 3 ovip.f., 1 al.m. and

1 apt.ny., Brigham City, Utah, 9-X-1926 (OWO coll.); 3 apt.v.f. and 4 apt.ny., Lehi, Utah, 23-VI-1926 (OWO coll.); 3 apt.v.f., 8 apt.ny., and 2 altd. ny., Trenton, Utah, 29-IX-1926 (GFK coll.); 3 ovip.f., 2 al.m., 3 apt.ny., and 1 altd.ny., Trenton, Utah, 15-X-1926 (OWO coll.); 3 apt.v.f. and 5 apt.ny., Preston, Idaho, 24-VI-1925 (OWO coll.) and 1 apt.v.f., 8 ovip.f., 2 al.m. and 9 apt. ny., Logan, Utah, 18-X-1926 (EOE coll.).

SPECIMENS EXAMINED.—Aside from types, numerous specimens of all morphs from the following localities: ARIZONA: Fredonia. CALIFORNIA: Big Bear City and Big Bear Lake in San Bernardino Co., Bridgeport in Mono Co. and San Bernardino Mts. at Cienega Seca. COLORADO: Cache la Poudre, Cache la Poudre Canyon, Elk Springs and Wolcott. IDAHO: Big River Narrows, Franklin, Montepelien, and Riverdale. MONTANA: Crown Springs. NEVADA: Winnemucca. OREGON: Klamath Falls. UTAH: Amalga, Arches National Monument, Beaver, Beaver Canyon, Bridges National Monument, Brigham, Brigham Canyon, Brigham City, Cedar Valley, Clear Creek, Cove, Cove Fort, Delta, Dewey, Draper, Emery, Fort Duchesne, Glendale, Gusher, Hanna, Heber, Hobbie Creek, Honeyville, Huntsville, Kanab, Kanab Creek, Logan Canyon, Logan Green Canyon, Losee, Maeser, Magma, Mantua, Provo Canyon, Salina Canyon, Scipio, Sigurd, Smithfield, Soldier Springs, Torrey, Trenton, Vernal, Vernal Creek, Weber Canyon, Wildcat Canyon, and Woodruff. WYOMING: Jackson and Jackson Hole.

Pleotrichophorus ohioensis (Smith), new combination

FIGURES 142, 307–313, 334

Capitophorus ohioensis Smith, 1940:141 [type: apt.v.f., Columbus, Ohio, 15-X-1938, CFS, on *Helianthus*; in USNM].

DIAGNOSIS.—*P. ohioensis* resembles *P. ambrosiae* and *P. wasatchii* in having moderately long cornicles (between .30–.50 mm long), a co/ca ratio of between $1\frac{1}{4}$ to $1\frac{1}{2}$, stoutly elongate, basally constricted and apically rounded cauda and a moderately dense body cover of setae. It differs from both species in having all anterodorsal head setae and dorsal setae of at least the 2 caudal abdominal segments distinctly stemmed, longer and more slenderly funnel-shaped (Figures 333–334, 348–350); and further from *P. wasatchii*, by

the presence of more sensoria on a.s.III (3-5 in apterous vivipara, up to 8 with mean of 4.74 in ovipara vs. 1-3 with mean of 2.31 in apterous vivipara of *P. wasatchii*) and by having rostrum IV+V more bluntly pointed.

DESCRIPTION.—*Apterous Viviparous Female* (based on 1 paratype): Color in life greenish, appearing overcast with grayish white due to fan-shaped or capitate hairs (Smith, 1940); cleared specimen with body pale, antennae dusky to brown from tips of third segment, tips of cornicles dusky, tips of rostrum and tibiae and entire tarsi dark brown. Body length 2.20, width across eyes .50 mm. Head with rather poorly developed laterofrontal tubercles, mesofrontal also small but distinct; mf 1p, lf 3p, vlf 1p, df 22, vf 9, pc 3, ac 5, md 2 and 3 on each side; dorsal head setae all distinctly petiolate, slenderly funnel-shaped, anterior relatively longer than posterior ones; ventral setae with vf, vlf and pc similarly shaped but md and ac merely blunt or very slightly expanded at apices; mf .0440-.0462, df-1 .0484 mm long. Antennal segment I moderately produced mesodistally, imbricate-spiculate, with 6-7 blunt or slightly knobbed setae aside from usual pointed one on dorsum.

A.s.II with $1 - \frac{1}{2}$ - 1 similarly shaped setae. A.s.III

imbricate, also with small blunt or knobbed setae, the longest less than $\frac{1}{2}$ basal diameter of segment; with 3-5 sensoria. A.s.IV subequal to, and a.s.V about $\frac{3}{4}$, a.s.III in length; a.s.VI with unguis about 6 times as long as its base.

Tergum smooth on disk, becoming imbricate-spiculate posteriorly; setae moderately dense, funnel-shaped, more distinctly longer-stemmed on posterior 2 segments than on disk, on which some setae may be subsessile. Cauda .33 mm long; stoutly elongate, with distinct constriction on basal $\frac{1}{3}$, apex broadly rounded; spiculate; with 2 pairs lateral and 1 posterodorsal setae. Cornicles .48-.49 mm long, about $1\frac{1}{2}$ times length of cauda; cylindrical with slightly thickened bases; conspicuously imbricate, slightly wrinkled, bearing pointed dentitions. Legs with 3, 3, 3 setae on 1st tarsal segments; hind tibiae 1.33, hind ta-2 .13-.14 mm long. Rostrum IV+V .12 mm long, about $\frac{9}{10}$ hind ta-2 in length; tapering gradually to rather bluntly acute tip; with 1 basal, 2 dorsal and 3 lateral pairs of setae, al about 3 times ml and pl in length.

Alate Viviparous Female: Unknown.

Oviparous Female: Much like viviparous aptera except as follows: df setae fewer (10-17, m = 13.75 \pm 1.25, n = 12); head and body setae sparser, longer, more slender; cornicles shorter, co/ca ratio smaller; cauda more acute but rounded at apex, not distinctly constricted basally; subgenital plate with more and all pointed hairs; basal half of hind tibiae expanded, bearing numerous pseudo-sensoria.

Measurements (in mm) of 16 paratypes: B.L. 1.77-2.28 (1.95), We .41-.49 (.448); a.s.III .42-.55 (.478), a.s.IV .36-.48 (.426), a.s.V .30-.41 (.352), a.s.VI .12-.15 (.133) + .71-.82 (.757); cornicles .22-.37 (.278), cauda .20-.24 (.227); hind tibiae .96-1.20 (1.09), hind ta-2 .12-.15 (.128), rostrum IV+V .11-.12 (.118); mf .0242-.0440 (.0363) and df-1 .0352-.0462 (.0429) long. Proportions of a.s. III:IV:V, 1: .77-1.00 (.89): .59-.85 (.74); VIu/VIb 5.29-6.31 (5.65); co/ca 1.03-1.54 (1.21 \pm .05, n = 25); rostrum IV+V/hind ta-2 .85-.92 (.89 \pm .03, n = 19). Number of sensoria on a.s.III 3-8 (4.74, n = 31).

Male: Not seen. According to Smith (1940), alate; he gives the following measurements in original description: B.L. 1.41-1.57; a.s.III .51-.53, a.s.IV .50-.52, a.s.V .39-.43, a.s.VI .12-.14 + .78-.81; cornicles .15, cauda .12-.18; hind tibiae 1.18-1.22, hind ta-2 .15, rostrum IV+V .09-.11; and hairs on vertex (mf setae) .03. Number of sensoria 27-43 on a.s.III, 23-30 on a.s.IV, and 18-21 on a.s.V.

HOST.—*Helianthus*.

DISTRIBUTION.—No records other than type-locality (Ohio).

TYPES.—Holotype and some paratypes are deposited at the USNM; paratypes consisting of apterous viviparous and oviparous females and alate males in C.F. Smith's collection.

SPECIMENS EXAMINED.—Paratypes: 1 apt.v.f., 21 ovip.f. and 1 apt.ny., all from CFS coll.

Pleotrichophorus packi (Knowlton)

FIGURES 133, 212-216, 220-222, 234-236

Macrosiphum packi Knowlton, 1928:169 [types: Elsimore, Fruita, Lehi, and St. John, Utah, on *Chrysothamnus nauseosus*; deposited in USNM]; 1935b:136.—Knowlton and Smith, 1936c:213.—Knowlton, 1946:6.

Capitophorus packi (Knowlton).—Palmer, 1952:264-265.—Knowlton, 1954:9.

Pleotrichophorus packi (Knowlton).—Hille Ris Lambers, 1953:115; 1969:167.

DIAGNOSIS.—This species can be easily recognized by its dark antennal flagellum and cornicles; its mixture of slender, knobbed anterior (viz, mf, lf and first 2 pairs of df) and more widely expanded or funnel-shaped posterior (posterior df's) head setae; the more or less uniform, widely expanded, funnel-shaped setal cover on the dorsum of body; long (.86-1.39 mm., $m = 1.11$, $n = 157$), slender cornicles that are about $2\frac{1}{4}$ times ($2.27 \pm .04$, $n = 100$) as long as cauda; and the presence of usually 3 (2-5, $m = 3.32$, $n = 182$) setae on each side of the cauda.

DESCRIPTION.—*Fundatrix*: Very much like summer vivipara differing only as follows: a.s.II with 0
1 — 1 setae; appendages relatively shorter; a.s.
2

IV and V subequally long, $\frac{2}{3}$ - $\frac{3}{4}$ a.s.III in length; unguis much shorter, averaging $3\frac{1}{3}$ times (2.82-4.08, $n = 19$) as long as base of a.s.VI.

Measurements (in mm) of 5 specimens (Benjamin, Utah, 28-IV-1935, on *Chrysothamnus*): B.L. 1.94-2.40 (2.17), We .51-.56 (.532); a.s.III .61-.70 (.644), a.s.IV .45-.50 (.466), a.s.V .43-.50 (.457), a.s.VI .15-.17 (.160) + .48-.58 (.523); cornicles .68-.77 (.73), cauda .33-.36 (.344); hind tibiae 1.13-1.20 (1.17), hind ta-2 .13-.15 (.140), and rostrum IV+V .09-.11 (.101). Proportion of a.s.III: IV:V, 1: .69-.74 (.72): .67-.74 (.71); VIu/VIb 2.82-3.67 (3.28); co/ca 1.92-2.24 (2.13); rostrum IV+V/hind ta-2 .64-.85 (.72).

Apterous Viviparous Female (summer form): Color in life rather shiny bluish green to apple green (Knowlton, 1928); cleared specimen pale with tips of rostrum, tibiae, entire tarsi, antennae from near bases of a.s.III, and cornicles from near bases dark brown. Body rather slenderly spindle-shaped, averaging 2.72 (1.87-3.30, $n = 86$) mm long, .58 (.51-.64, $n = 91$) mm wide across eyes. Head with slightly produced mesofrontal and more developed laterofrontal tubercles; mf 1p, lf 2-4 on each side, vlf 1p, df 14-26 ($18.16 \pm .56$, $n = 90$), vf 5-11 (usually 8), pc 2p, ac usually 4, and md 3-5 on each plate; dorsal setae of 2 basic shapes: mf, lf, and 2 anterior pairs of df elongate, with apices blunt to slightly knobbed or enlarged

but extreme tips pointed, posterior df's flattened apically or funnel-shaped; ventral setae all elongate, mostly blunt-tipped but vf's may be slightly knobbed and some of ac and md may be pointed; mf .0352-.0572 (.0457, $n = 88$) and df-1 .0396-.0726 (.0504, $n = 101$) mm long. Antennal segment I moderately produced mesodistally, almost smooth, with 5-17 (usually 9 or 10), long, blunt to knobbed setae aside from usual pointed one on dorsum.

A.s.II faintly imbricate and with 1 — 1 blunt
2

or knobbed setae. A.s.III with rather long, knobbed setae, longest about $\frac{2}{3}$ basal diameter of segment; with 1-15 (6.02, $n = 152$) small sensoria. A.s.IV equal to or slightly longer than a.s.III, and a.s.IV about $\frac{9}{10}$ a.s.III; unguis $4\frac{1}{4}$ to 7 times (5.68, $n = 46$) as long as base of a.s.VI.

Tergum smooth on disk, becoming faintly striate-spiculate caudally; body setae moderately dense, funnel- to fan-shaped. Cauda slenderly elongate, very slightly constricted basally, apex acute but rounded; spiculate; with 2-5 (3.3, $n = 182$) setae on each side, 0-3 (usually 1) setae on posterodorsal surface. Cornicles .86-1.39 (1.11, $n = 157$) mm long, 2-3 times ($2.27 \pm .04$, $n = 100$) as long as cauda; slenderly cylindrical, widest at base, narrowing to about $\frac{1}{2}$ basal diameter before becoming slightly thickened on apical $\frac{1}{10}$; conspicuously imbricate-spiculate, dark for most of its length. Legs with 3, 3, 3 setae on first tarsal joints. Rostrum IV+V .09-.12 (.104, $n = 94$) mm long, $\frac{1}{2}$ to $\frac{3}{4}$ ($.65 \pm .01$, $n = 100$) as long as hind ta-2; tapering to acute tip but with posterior margin slightly convex; with 1 basal, 2 dorsal and 3 lateral pairs of setae, ml and pl about $\frac{2}{3}$ as long as al setae.

Measurements (in mm) of 15 specimens (8 from Bridges National Mon., Utah, 12-VIII-1967 on *Chrysothamnus nauseosus*; and 7 from Delta, Utah, 10-VI-1968 on *Chrysothamnus* sp.): B.L. 2.50-3.15 (2.78), We .52-.62 (.57); a.s.III .74-.91 (.806), a.s.IV .72-1.09 (.850), a.s.V .60-.82 (.717), a.s.VI .13-.20 (.161) + .72-1.06 (.881); cornicles .98-1.36 (1.14), cauda .45-.53 (.483); hind tibiae 1.37-1.90 (1.66), hind ta-2 .15-.18 (.163), and rostrum IV+V .09-.115 (.103). Proportions of a.s.III:IV:V, 1: .89-1.37 (1.06): .80-1.03 (.89); VIu/VIb 4.23-7.07 (5.49); co/ca 2.04-3.02 (.235); rostrum IV+V/hind ta-2 .56-.73 (.64).

Alate Viviparous Female: Cleared specimen with

pale faintly sclerotic head; ring around ocelli, basal 2 antennal segments, mesothorax, abdominal sclerites, wing veins, mesodistal surfaces of femora and almost entire tibiae medium brown; tips of rostrum and tibiae, entire cornicles, antennae from near bases of a.s.III and entire tarsi dark brown. Morphologically much like aptera, differing as follows: df setae fewer (12 and 16 in 2 specimens); more sensoria on a.s.III (9-15 according to Palmer, 1952); abdomen with 2 pleural sclerites from segments 1 to 7 (these may be broken into 2 pairs on discal segments), spinopleural thickenings on caudal 2 segments; abdominal setae less expanded and sparser.

Measurements (in mm) of 1 specimen (St. John, Utah, 19-VI-1956, GFK, on *C. nauseosus*): BL 2.17, We .50; a.s.III .82 and .84, a.s.IV .86 and .88, a.s.V .70 (one side only) and a.s.VI .16 + .95 (one side), cornicles .83 and .88, cauda .43, hind tibiae 1.71 and 1.73, hind ta-2 .16 and .17, rostrum IV+V .10, mf both .0286 and df-1 .0440 and .0462 mm. Number of sensoria on a.s.III 11 and 14; lateral caudal hairs 3 and 4.

Oviparous Female: Similar to viviparous aptera except as follows: posterior df and dorsal abdominal setae longer, less expanded; cauda shorter, stouter, darker; subgenital plate with more numerous, all pointed setae; basal half of tibiae swollen, bearing numerous pseudosensoria.

Measurements (in mm) of 1 specimen (Panguitch, Utah, 5-X-1956, on *Chrysothamnus* sp.): B.L. 2.30, We .58; a.s.III .83 and .84, a.s.IV .72

and .73, a.s.V .64 and .68, a.s.VI .16 + .75 (one side only); cornicles .89 and .91, cauda .34; hind tibiae 1.39 and 1.43, hind ta-2 both .16, rostrum IV+V .10; mf .0374, and df-1 .0440. Number of sensoria on a.s.III both 4; number of lateral caudal hairs 5 and 4 and of posterodorsal hairs 3; number of df setae 12.

Male: Not known.

Hosts.—*Chrysothamnus nauseosus*, *C. nauseosus* var. *graveolens*, and *C. parryi*.

DISTRIBUTION.—Widely distributed in Utah; also recorded from Arizona, Idaho, Nevada and Wyoming near their borders with Utah, and from northern Colorado.

TYPES.—No type-specimens seen and no lectotypes designated from original type series. Cotypes, fundatrices and apt.v.f.'s from Elsimore, Fruita, Salina, and St. John, Utah, at the USNM, CSU and GFK collections.

SPECIMENS EXAMINED.—Numerous apterous viviparous females from the following localities: ARIZONA: Fredonia. IDAHO: Emmett. NEVADA: Contact. UTAH: American Fork, Beaver, Beaver Canyon, Benjamin, Current Creek, Delta, Deseret, Draper, Emery, Fruitland, Glendale, Goshen, Green River, Hinckley, Indian Canyon, Kanab Creek, Kingston, Leamington, Losee, Mt. Carmel, Oasis, Panguitch, Pine Valley, Promontory, Provo Canyon, Santa Clara, Soldier Springs, St. John, Sutherland, Vernal Creek, Vernon, Wolf Creek Canyon and Woodruff. WYOMING: Fort Bridger.

Key to the Apterous Vivipara of Subspecies of *Pleotrichophorus packi*

- Cornicles less than 1.0 mm long (.64-.75, $m = .684$, $n = 10$), $1\frac{1}{4}$ times ($1.74 \pm .07$, $n = 10$) as long as cauda, almost uniformly cylindrical and only distal half dark; cauda with 5 (4 to 6) setae on each side *P. p. brevis*, new subspecies
 Cornicles averaging more than 1.0 mm long (.86-1.36, $m = 1.11$, $n = 157$), $2\frac{1}{4}$ times ($2.27 \pm .04$, $n = 100$) as long as cauda, widest at base and narrowing distally to about half basal width before slightly thickened apical tenth; cauda with 2-5 (3.32, $n = 182$) setae on each side *P. p. packi* (Knowlton)

Pleotrichophorus packi brevis, new subspecies

FIGURES 134, 217-219, 237-239

A collection of 5 apterous viviparous and 2 oviparous females (from Brigham Canyon, Utah, 3-X-1928, GFK, on *Chrysothamnus nauseosus*) exhibit several differences from *P. packi*, sensu stricto. A

separate subspecific treatment is proposed for these.

DESCRIPTION.—*Apterous Viviparous Female*: Measurements (in mm) of holotype and 4 paratypes: B.L. 2.36-2.60 (.245), We .54-.56 (.548); a.s.III .71-.81 (.742), a.s.IV .69-.79 (.736), a.s.V .60-.71 (.649), a.s.VI .14-.16 (.149) + .84-.88 (.86); cornicles .64-.75 (.684), cauda .36-.41 (.394); hind

tibiae 1.56–1.68 (1.64), hind ta-2 .13–.15 (.145), rostrum IV+V .11–.12 (.112); mf .0374–.0572 (.0444), and df-1 .0374–.0484 (.0442). Proportions of a.s.III:IV:V, 1: .91–1.06 (.99); .85–.88 (.87); a.s. VIu/VIb 5.87–6.00 (5.94); co/ca 1.60–1.88 (1.74); rostrum IV+V/hind ta-2 .73–.92 (.78 ± .06, n = 8). Number of sensoria on a.s.III 2–5 (3.5); number of df setae 11–16 (13.20 ± 2.39); number of lateral caudal setae 4–6 (5.1); posterodorsal caudal setae 2–4 (3.2).

Alate Viviparous Female: Unknown.

Oviparous Female: The oviparous female of *P. p. brevis* can be separated from that of *P. p. packi* in the same way as the viviparous aptera. The cornicles, however, are dark for a relatively longer portion, the distal $\frac{2}{3}$, but not to the same extent as in *P. packi packi*. It differs from the apterous viviparous female in its shorter cauda, more elongate, less expanded dorsal head and body setae, the presence of more hairs on the subgenital plate, and by having the basal third of the tibiae thickened and bearing numerous pseudosensoria.

Measurements (in mm) of 1 paratype: B.L. 2.08, We .53; a.s.III .75 and .77, a.s.IV .77 and .78, a.s.V .69 and .70, a.s.VI .16 + .90 and .16 + .92; cornicles both .61, cauda .32, hind tibiae 1.58 and 1.60, hind ta-2 both .14, rostrum IV+V .12; mf .0242–.0374 (n = 3) and df-1 both .0440. Number of sensoria on a.s.III 5 and 7; number of df setae 11; number of lateral caudal hairs 4 and 6, and of posterodorsal hairs 5.

Male: Unknown.

Host.—*Chrysothamnus nauseosus*.

DISTRIBUTION.—Known only from type-locality, in Brigham Canyon, Utah.

TYPES.—Holotype, apt.v.f. with data indicated above. Paratypes: 4 apt.v.f., 2 ovip.f., and 4 apt.ny. with same data as holotype. Holotype and all but 2 apt.v.f. paratypes in GFK coll., the latter in U. Minn. coll.

Plectrichophorus palmerae (Knowlton)

FIGURES 130, 240–247, 265

Capitophorus palmerae Knowlton, 1935a:282 [lectotype: apt. v.f., Tahoe National Forest, California, 17-VI-1934, GFK, on *Chrysothamnus nauseosus*; in EOE coll.].—Knowlton and Smith, 1936a:111.—Palmer, 1952:265.

Plectrichophorus palmerae (Knowlton).—Hille Ris Lambers,

1969:179 [as synonym of *Capitophorus elongatus* Knowlton].

DIAGNOSIS.—*P. palmerae* can be recognized from *P. elongatus* by its funnel-shaped, short-stalked and longer head setae (Figure 265 vs. 264); the longer, acutely pointed and straight-margined rostrum IV+V; the relatively greater rostrum IV+V/hind ta-2 ratio; al distinctly longer, 2–3 times length of ml and pl rostral setae; and more sensoria present on a.s.III. (See diagnosis and synonymic notes under *P. elongatus* for a more detailed discussion.)

DESCRIPTION.—*Apterous Viviparous Female:* Color in life green (Knowlton, 1935a); cleared specimen pale with tips of rostrum and tibiae, entire tarsi, antennae from near bases of a.s.III brown. Body length 1.71–2.51 (2.16, n = 39), width across eyes .41–.51 (.474, n = 43) mm. Head with moderately developed frontal tubercles; mf 1p, lf 2–5 (usually 3) on each side, vlf 1p, df 19–30 (23.74 ± .09, n = 43), vf 6–12 (usually 8), pc 2p, ac usually 4, md 2–4 (usually 3) on each side; dorsal setae basically funnel-shaped, at least anterior ones distinctly stalked, all rather widely expanded but not widely circular and fan-shaped; ventral setae similarly funnel-shaped except some elongate and blunt or knobbed ac and md; mf .0242–.0418 (.0330, n = 84), df-1 .0242–.0440 (.0349, n = 84) mm long. Antennal segment I distinctly produced mesodistally, imbricate-spiculate, with 6–14 (usually 9 or 10) small, blunt or knobbed setae in addition to basal pointed one on dorsum. A.s.II imbricate, normally with

1
1 — 1 similarly shaped hairs. A.s.III imbricate;
2

with short knobbed setae, longest not more than $\frac{1}{2}$ basal diameter of segment; with 2–10 (4.27, n = 82) sensoria. A.s.IV about as long as, and a.s.V slightly shorter than, a.s.III; unguis averaging 6 times (5–7, n = 39) as long as base of a.s.VI.

Dorsal body integument finely striate on disk becoming striate-spiculate past abd.s. 6; setae rather dense, funnel-shaped like head setae. Cauda slenderly elongate, with slight basal constriction and rounded apex; spiculate; with 2 lateral pairs and 1 posterodorsal setae. Cornicles .45–.68 (.579, n = 82) mm long, $1\frac{1}{2}$ to 2 times (1.72 ± .03, n = 78) length of cauda; cylindrical with very faintly incrassate apices; quite densely imbricate-spiculate.

Legs with 3, 3, 3 setae on first tarsal joints. Rostrum IV+V rather slender at base, tapering to acute point; .095-.12 (.108, n = 41) mm long, .73-1.00 (.86 ± .02, n = 55) times as long as hind ta-2; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, al 2-3 times as long as ml and pl setae.

Measurements (in mm) of lectotype and 6 paralectotypes: B.L. 2.17-2.90 (2.39), We .45-.48 (.463); a.s.III .54-.76 (.678), a.s.IV .56-.72 (.644), a.s.V .53-.67 (.603), a.s.VI .15-.18 (.166) + .91-1.04 (.987), cornicles .48-.65 (.555), cauda .30-.35 (.325); hind tibiae 1.19-1.47 (1.31), hind ta-2 .11-.13 (.124) and rostrum IV+V .11-.12 (.112). Proportions of a.s.III:IV:V, 1: .84-1.00 (.96): .79-.97 (.89); VIu/VIb 5.68-6.50 (6.04), co/ca 1.48-2.00 (1.78); rostrum IV+V/hind ta-2 .85-1.00 (.92).

Alate Viviparous Female: Cleared specimen with pale brown head, mesothorax, wing veins, abdominal sclerites, apices of cornicles and legs; antennae dark brown on basal 2 segments, flagellum even darker; tips of rostrum and tibiae dark brown; remainder of body and appendages pale. Morphologically similar to apterous female, differing only as follows: df setae 22, more sensoria (15) on a.s.III; pleural and marginal setae present on segments 1 to 7 abdomen; abdominal setae relatively sparser.

Measurements (in mm) of 1 specimen from Klamath Falls, Oregon: B.L. 2.25, We .38; a.s.III .63 and .64, a.s.IV .66 and .67, a.s.V .65 and .67, a.s.VI .20 + 1.04 and .20 + 1.20; cornicles both .48, cauda .30, hind tibiae 1.44 and 1.48, hind ta-2 both .13, and rostrum IV+V .10 mm.

Sexuales: Unknown.

Hosts.—*Chrysothamnus nauseosus* and *C. nauseosus* var. *hololeucus*.

DISTRIBUTION.—Aside from type-locality, several other northern California localities in Modoc and Mono Co., western Nevada (Reno), and Oregon (Klamath Falls and Redmond) are newly recorded.

TYPES (designated from available "paratypes").—Lectotype, apt.v.f., data given above, specimen inward at about 2:00 o'clock on type-slide. Paralectotypes: 4 apt.v.f. and 8 apt.ny. mounted on same slide and bearing the same data as lectotype (EOE coll.) and 2 apt.ny. and 8 apt.ny. also with same data as lectotype (GFK coll.).

SPECIMENS EXAMINED.—Aside from types: CALIFORNIA: Boca, 4 apt.v.f., 23-VII-1944, GFK, on *Chrysothamnus* sp. (GFK coll.); Mono, 1 apt.v.f., 23-VII-1944, GFK, on *C. nauseosus* (GFK coll.);

Pit River, Modoc Co., 22 apt.v.f., 15-VI-1947, EOE, on *C. nauseosus* (EOE coll.). NEVADA: 13 mi NW of Reno, 2 apt.v.f., 23-VII-1944, GFK, on *C. nauseosus* (GFK coll.). OREGON: Klamath Falls, 1 al.v.f., 12-VI-1947, D.D. Jensen, on *Chrysothamnus* (EOE coll.) and Redmond, 7 apt.v.f., 23-VI-1954, GFK, on *Chrysothamnus* (EOE coll.).

Pleotrichophorus parilis, new species

FIGURES 146, 335-347

DIAGNOSIS.—This species resembles *P. patonkussellus* in having a short (.09-.11 mm), stout and convex-sided last rostral segment but differs in its longer hind ta-2 (.13-.16 mm, m = .148, n = 75 vs. .10-.14 mm, m = .118, n = 44) and hence relatively smaller rostrum IV+V/hind ta-2 ratio (.60-.79, m = .67 ± .01, n = 74 vs. .71-1.00, m = .85 ± .03, n = 43). It differs further in the presence of fewer df setae (22.21 ± .87, n = 56 vs. 34.89 ± 2.45, n = 18), in having cornicles usually longer than .20 mm (.18-.33, m = .247, n = 100 vs. .12-.19, m = .153, n = 37), a relatively larger co/ca ratio (.96 ± .02, n = 100 vs. .80 ± .03, n = 33) a larger ratio of unguis to base of a.s.VI (4.67-6.83, m = 5.61, n = 44 vs. 3.75-5.38, m = 4.33, n = 36) and relatively larger body size (1.41-2.00 mm long, m = 1.72, n = 24 vs. 1.16-1.62, m = 1.38, n = 31).

It may be confused with *P. spatulavillus* by the shortness of the cornicles, the dense body cover of funnel-shaped setae and the elongate and constricted cauda; but the needle-tipped and slender last rostral segment of *P. spatulavillus* is very distinctive.

DESCRIPTION.—*Apterous Viviparous Female:* Color in life not known; cleared specimen pale with tips of rostrum and tibiae, entire tarsi, and antennae from distal third of a.s.IV brown. Body 1.41-2.00 (1.72, n = 24) mm long, .40-.47 (.423, n = 25) mm wide across eyes. Head with moderately developed latero- and mesofrontal tubercles; mf 1p with 1 occasionally added, lf 2-3 on each side, vlf 1p, df 14-29 (22.21 ± .87, n = 56), vf 6-7, pc 2p, ac 4, and md 2-4 on each plate (Figure 335); dorsal setae basically funnel-shaped; anterior ones longer and more distinctly petiolate (about 1/2 total size) than posterior ones; vf setae similar but less expanded and pc, md, and ac elongate with blunt to slightly widened apices (Figures 336); mf .0242-

.0440 (.0323, n = 53) and df-1 .0286-.0440 (.0379) mm long. Antennal segment I distinctly produced on inner distal margin, imbricate, with 6-10 (usually 7 or 8) rod-shaped setae in addition to usual

1
2
pointed one on dorsum. A.s.II with 1-1-1

similarly shaped setae. A.s.III imbricate; setae also rod-shaped, rather small, longest less than $\frac{1}{2}$ basal diameter of segment; bearing 1-3 (1.3, n = 90) sensoria. A.s.IV about $\frac{1}{10}$ and a.s.V about $\frac{3}{4}$ as long as a.s.III; unguis of a.s.VI 4.67-6.83 times (5.61, n = 44) as long as base.

Tergum smooth on disk, becoming imbricate-spiculate caudally; body setae basically funnel or cone-shaped, without distinct stems, those of abd.s. 7 and 8 longer than those on discal segments (Figure 337). Cauda .22-.29 (.256, n = 51) mm long; slenderly elongate, tapering to rather acute tip, constricted on basal third; spiculate; with 2 lateral pairs and 1 posterodorsal setae. Subgenital plate with marginal seta only (Figure 338). Cornicles .18-.33 (.247, n = 100) mm long, about as long as cauda (.80-1.15, m = .96 \pm .02, n = 100); cylindrical, with bases slightly thickened; imbricate-spiculate, wrinkled, with spicules rather large and separate. Legs with 3,3,3 hairs on 1st tarsal joints; hind tibiae .93-1.15 (1.06, n = 43) and hind ta-2 .13-.16 (.148, n = 75) mm long. Rostrum IV+V .09-.11 (.099, n = 50) mm long, about $\frac{2}{3}$ (.67 \pm .01, n = 74, range = .60-.79) length of hind ta-2; rather stout at base, narrowing to rather blunt tip, margins past pl setae slightly convex; with 1 basal, 2 dorsal and 3 lateral pairs of setae, ml and pl about $\frac{1}{3}$ al setae in size.

Measurements (in mm) of holotype: B.L. 1.67, We .43; a.s.III .49 (one side only), a.s.VI .41, a.s.V .33, a.s.VI .12 + .68, cornicles .20 and .21, cauda .24, hind tibiae .98 and .99, hind ta-2 .14 and .15, and rostrum IV+V .095.

Alate Viviparous Female: Head and thorax pale brown with slightly darker mesothorax and areas around ocelli; antennae and legs dusky with darker brown tibial apices and entire tarsi; wing veins, apices of rostrum and cornicles also brown. Morphologically similar to viviparous aptera, with following exceptions: df setae fewer (11-15, m = 13.1, n = 15); setae relatively shorter (Figure 342), mf .0198-.0330 (.0243, n = 33) and df-1 .0242-.0396 (.0292, n = 29) mm long; abdominal setae sparser

(Figure 343); more sensoria on a.s.III (7-12, m = 9.8, n = 23); abdomen with weakly developed, dusky or light brown pleural (2 pairs of rows) and marginal sclerites; cornicles slightly shorter and co/ca smaller.

Measurements (in mm) of 15 paratypes: B.L. 1.40-1.75 (1.56), We .35-.43 (.393); a.s.III .46-.60 (.525), a.s.IV .40-.51 (.442), a.s.V .31-.44 (.386), a.s.VI .13-.16 (.148) + .71-.88 (.824); cornicles .14-.22 (.179), cauda .20-.23 (.220), hind tibiae .98-1.21 (1.12), hind ta-2 .14-.16 (.152), and rostrum IV+V .095-.100 (.098). Proportions of a.s.III:IV:V, 1: .76-.93 (.84); .64-.78 (.72); VIu/VIb 5.00-5.73 (5.45); co/ca .67-.96 (.82); rostrum IV+V/hind ta-2 .59-.71 (.65).

Oviparous Female: Resembles apterous vivipara except for the following: df setae fewer (15-26, m = 17.9, n = 8) (Figure 339), slightly thinner; body setae also funnel- or cone-shaped but longer, more narrowly expanded; cauda thicker, shorter, widely rounded at apex, not basally constricted; cornicles relatively shorter but co/ca ratio about same (Figure 341); subgenital plate (Figure 340) with more, all pointed setae; basal half of hind tibiae enlarged, bearing numerous pseudosensoria.

Measurements (in mm) of 8 paratypes: B.L. 1.71-2.15 (1.82), We .42-.47 (.453); a.s.III .41-.54 (.446), a.s.IV .36-.42 (.384), a.s.V .31-.35 (.332), a.s.VI .15 + .70 (only one segment complete); cornicles .15-.24 (.192), cauda .19-.22 (.213); hind tibiae .91-1.08 (.972), hind ta-2 .13-.15 (.139), rostrum IV+V .10-.11 (.102); mf .0264-.0374 (.0319), and df-1 .0330-.0484 (.0416). Proportions of a.s.III:IV:V, 1: .79-1.02 (.86); .67-.85 (.74); VIu/VIb 4.67; co/ca .71-1.21 (.91); rostrum IV+V/hind ta-2 .67-.77 (.74).

Alate Male: Morphologically similar to alate viviparae, differing only as follows: dorsal head and vf setae blunt or slightly knobbed at apices (Figure 344), pc, ac, and md mostly pointed (Figure 345); more sensoria on a.s.III (26-38, m = 32.3, n = 13), also present on a.s.IV (19-31, m = 24.2, n = 13) and a.s.V (17-21, m = 18.6, n = 12); abdomen with more developed spinal, pleural and marginal sclerites (Figure 346), setae longer, blunt to narrowly expanded; cauda triangular, not constricted, apex acute; cornicles shorter, co/ca ratio slightly smaller. Aedeagus broadly angular with rounded corners; parameres oblong and setaceous (Figure 347).

Measurements (in mm) of 8 paratypes: B.L. 1.52–1.67 (1.56), We .38–.42 (.401); a.s.III .47–.60 (.529), a.s.IV .42–.52 (.479), a.s.V .37–.45 (.420), a.s.VI .13–.18 (.153) + .80–.95 (.861); cornicles .10–.12 (.110), cauda .14, hind tibiae 1.00–1.21 (1.08), hind ta-2 .14–.17 (.150), rostrum IV+V .095–.105 (.100); mf .0132–.0264 (.0220), and df-1 .0154–.0286 (.0220). Proportions of a.s.III:IV:V, 1: .72–1.00 (.91): .69–.88 (.79); VIu/VIb 5.19–6.33 (5.81); co/ca .71–.86 (.76); rostrum IV+V/hind ta-2 .59–.71 (.67).

HOST.—*Artemisia dracunculoides* (= *A. aromatica*).

DISTRIBUTION.—Type-record only from Minnesota.

TYPES.—Holotype: apt.v.f., Minneapolis, Minnesota, 10-IX-1921, # 74/'21, OWO, on *Artemisia dracunculoides*; in OWO coll. Paratypes (all collected from same locality, and same host, by OWO): 11 apt.v.f., 6 al.v.f. and 10 apt.ny., of the same series as holotype; 5 apt. v.f. and 2 apt.ny., 3-IX-1921, # 59/'21; 7 apt.v.f., 18-IX-1921, # 69/'21; 7 apt.v.f., 15-IX-1921, # 94/'21; 3 apt. v.f., 1 al.v.f., 6 apt.ny. and 1 altd.ny., # 106/'21; 1 apt.v.f., 1 ovip.f., 2 al.m., 17 altd.ny. and 7 apt.ny., 23-IX-1921, # 111/'21; 1 apt.v.f., 7 ovip.f., 6 al.m., 2 apt.ny. and 8 altd.ny., 12-X-1921, # 140/'21; 1 apt.v.f., 17-VII-1924, # 41/'24; 3 apt.v.f. and 2 apt.ny., 1-VIII-1925, # 37/'25; 8 apt.v.f., 7 al.v.f., 3 apt.ny., 1-VIII-1925, # 69/'25; 3 apt.v.f., 1 al.v.f. and 2 altd.ny., 3-VIII-1925, # 84/'25; and 3 apt.v.f. and 4 al.v.f., 5-IX-1927, # 64/'27. All paratypes but 7 (in LACR coll.) in OWO coll.

Pleotrichophorus patonkusellus, new species

FIGURES 145, 367–370

DIAGNOSIS.—This species can be readily distinguished from other species living on *Achillea* (viz., *P. hottesi*, *P. patonkus*, and *P. pseudopatonkus*) by the most numerous dorsofrontal setae (34.89 ± 2.45 , $n = 18$ vs. 25 or fewer on said species). Its small body size (1.16–1.62, $m = 1.38$ mm long, $n = 31$), the presence of few sensoria on a.s.III (1–2, $m = 1.15$, $n = 48$), a mean co/ca ratio of about $\frac{9}{10}$ ($.80 \pm .03$, $n = 33$) and the short (.09–.11 mm, $m = .100$, $n = 24$), stout, slightly convex-sided rostrum IV+V are also distinctive. It resembles *P. parilis* in the shape and size of rostrum IV+V but differs

in having shorter hind ta-2 and thus a relatively larger rostrum IV+V/hind ta-2 ratio, in having denser head setae, a smaller ratio of unguis to the base of a.s.VI, shorter cornicles and smaller body size. Other details of differences from *P. parilis* are given under that species.

DESCRIPTION.—*Apterous Viviparous Female*: Color in life unknown; cleared specimen pale with darker apices of rostrum and tibiae, entire tarsi, tips of a.s.IV and V, and remainder of antennae (flagellum dusky from tips of a.s.III in some specimens). Body 1.16–1.62 (1.38, $n = 31$) mm long, .34–.44 (.377, $n = 30$) mm wide across eyes. Head with rather well-developed frontal tubercles; mf 1–2p (usually 2), lf 3–4 on each tubercle, vlf 1p, df 28–45 (34.89 ± 2.45 , $n = 18$), vf 6–8, pc 2p, ac 4–6, and md 2–4 (usually 3) on each side; dorsal setae widely funnel- to cone- or fan-shaped, mostly without stems except anterior ones in some specimens; ventral setae with vf and ac similarly expanded, funnel-shaped, rest blunt or slightly expanded; mf .0154–.0374 (.0310, $n = 53$) and mf .0264–.0440 (.0333, $n = 38$) mm long. Antennal segment I moderately produced mesodistally, rather densely imbricate, with 5–9 blunt or knobbed hairs aside from basal pointed one on dorsum. A.s.II

with usually $1 - \frac{1}{2} - 1$ knobbed setae. A.s.III imbricate with short knobbed setae, longest about $\frac{1}{3}$ basal diameter of segment, bearing 1–2 (1.15, $n = 48$) sensoria. A.s.IV slightly longer than a.s.VI, latter about $\frac{3}{4}$ length of a.s.III; unguis of a.s.VI averaging $4\frac{1}{3}$ times (range of $3\frac{3}{4}$ – $5\frac{2}{3}$, $n = 36$) length of base.

Tergum smooth on disk, becoming imbricate-spiculate caudally from about abd.s. 5; setae rather dense, short, widely expanded funnel- to fan-shaped. Cauda .15–.23 (.194, $n = 20$) mm long; elongate, constricted on basal $\frac{1}{3}$, broadly rounded at apex; spiculate; with 2 lateral pairs and 1 posterodorsal setae. Cornicles .12–.19 (.153, $n = 37$) mm long, $\frac{2}{3}$ to subequal ($.80 \pm .03$, $n = 33$) length of cauda; cylindrical, of uniform diameter or slightly thickened near bases; conspicuously imbricate-spiculate, wrinkled, spicules rather low and blunt but distinct. Legs with 3, 3, 3 hairs on first tarsal joints; hind tibiae .73–1.05 (.84, $n = 44$) and hind ta-2 .10–.14 (.118, $n = 44$) mm long. Rostrum IV+V .09–.11 (.10, $n = 24$) mm long, .71–1.00

times (.85 ± .03, n = 43) as long as second hind tarsal joint; rather stoutly triangular, sides past pl setae slightly convex; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, al 2-3 times ml and pl setae in length.

Measurements (in mm) of holotype: B.L. 1.29, We .38; a.s.III .40 and .38, a.s.IV .31 and .32, a.s.V both .27, a.s.VI .12 + .53 and .13 + .55; cornicles both .16, cauda .17; hind tibiae .83 and .85, hind ta-2 .12 and .11, and rostrum IV+V .10.

Alate Viviparous Female: Unknown.

Sexuales: Unknown.

Hosts.—*Achillea millefolium* and *Achillea* sp.; also collected on undetermined *Artemisia* and an unknown host.

Distribution.—Aside from type-localities, Eden in northern, and Allen Canyon in southeastern Utah.

Types.—Holotype, apt.v.f., 3-VII-1967, Logan, Utah, GFK, on yarrow (Berlese-extracted); in U. Minn. coll. Paratypes: 14 apt.v.f. and 6 apt.ny., with same data as holotype (4 slides each in U. Minn. and GFK coll.; remaining slides in LACR coll.); and 9 apt.v.f., Logan Canyon, Utah, 15-VIII-1959, JOP, on *Achillea millefolium* (JOP coll.).

Other specimens examined.—2 apt.v.f., Eden, Utah, 28-VI-1955, GFK, by sweeping *Artemisia* (EOE coll.); and 9 apt.v.f., Allen Canyon, Utah, 26-VII-1956, GFK, on unknown host (EOE coll.).

Pleotrichophorus patonkus (Hottes and Frison)

FIGURES 143, 351-358

Capitophorus patonkus Hottes and Frison, 1931:287-289 [type: al.v.f., Metropolis, Illinois, 17-IV-1930, Frison and Ross, on *Achillea millefolium*; slide no. 10786 in INHS coll.].

Pleotrichophorus patonkus (Hottes and Frison).—Hille Ris Lambers, 1953:115; 1966:605 [in part]; 1969:165 [in part].

Diagnosis.—This species can be distinguished from *P. pseudopatonkus* by its longer (at least .12 mm vs. .09-.11), slender and acutely pointed rostrum IV+V, longer cornicles (.14-.21, m = .173, n = 12 vs. .09-.14, m = .099, n = 60), relatively larger co/ca ratio (.62-.75, m = .67 ± .01, n = 12 vs. .31-.67, m = .43 ± .02, n = 60) and the usual presence of sensoria on a.s.IV of viviparous alatae (0-5, m = 2.38, n = 11, and in 84.6% of segments).

See further notes below and diagnosis under *P. pseudopatonkus*.

Description.—*Apterous Viviparous Female*: Cleared specimen with pale body; antennae dusky or pale brown on apices of a.s.III and IV and entire length of remaining segments; legs pale with tips of tibiae and entire tarsi darker. Body 1.67-1.86 (1.81, n = 6), .40-.47 (.447, n = 6) mm wide across the eyes. Head with moderately developed latero-frontal and mesofrontal tubercles; mf 1p with 1 sometimes added or missing, lf 2-3 on each side, vlf 1p, df 19-24 (21.00 ± 2.19, n = 6), vf 7-8, pc 2p, ac 4-5, md 2-3 on each side; dorsal setae basically funnel-shaped, anterior much longer, more distinctly stemmed, more narrowly expanded than posterior ones; ventral setae with vf and pc also funnel-shaped, remaining setae blunt or slightly widened apically; mf .0264-.0484 (.0358, n = 14) and df-1 .0396-.0484 (.0442, n = 10) mm long. Antennal segment I moderately produced on meso-distal margin, imbricate, with 4-8 knobbed setae in addition to basal pointed one on dorsum. A.s.II

with 1—¹—1 knobbed setae. A.s.III imbricate; ² with small knobbed setae, longest about 1/3 basal diameter of segment; with 2-6 (4.43, n = 7) sensoria. A.s.IV about 9/10 and a.s.V about 3/4 as long as a.s.III; unguis of a.s.VI 5 1/2 to 5 2/3 times (5.59, n = 4) as long as its base.

Tergum smooth on disk, becoming finely imbricate-spiculate from about abdominal segment 5; setae moderately dense, funnel- to cone-shaped, those on posterior 2 segments longer than those on disk. Cauda .22-.26 (.257, n = 6) mm long; stoutly elongate, constricted on basal 1/3 and broadly rounded at apex; spiculate; with 2 lateral pairs and 1 posterodorsal setae. Cornicles .14-.21 (.173, n = 12) mm long, .62-.73 times (.67 ± .01, n = 12) as long as cauda; cylindrical, with slightly thickened bases; imbricate-spiculate, wrinkled, spicules minute, blunt. Legs with 3, 3, 3 hairs on first tarsal joints; hind tibiae .79-1.11 (1.02) and hind ta-2 .11-.14 (.123) mm long. Rostrum IV+V .12-.13 (.122, n = 6) mm long, subequal to second hind tarsal joint (range of .86-1.09 times, m = .99 ± .06, n = 10); rather slender, tapering to acute point, portion beyond pl setae about 2/5 its entire length; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, al about 3 times ml and pl setae in length.

Alate Viviparous Female: Head and prothorax slightly sclerotic with darker brown ring around ocelli; mesothorax brown; abdomen membranous with light brown pleural and marginal sclerites; antennae with basal 2 segments dusky, flagellum from near bases of a.s.III brown; wing veins brown; apices of rostrum and tibiae, entire tarsi dark brown; cornicles slightly dusky. Morphologically much like apterous female, differing only as follows: df setae fewer (11–17, $m = 13.82$, $n = 11$); sensoria on a.s.III more numerous (11–21, $m = 16.0$, $n = 13$), usually also present on a.s.IV (0–5, $m = 2.38$, $n = 13$); abdomen with 2 transverse pleural bars on segments 1 to 4, 2 pairs on 5 and a pair of smaller, oval pleural sclerites on 6, all but segment 8 also with marginal thickenings; abdominal setae relatively sparser, longer, less expanded; cornicles armed with larger, more sharply pointed spicules.

Measurements (in mm) of 11 paratypes: B.L. 1.50–1.70 (1.64), We .38–.43 (.404); a.s.III .53–.59 (.570), a.s.IV .47–.53 (.499), a.s.V .41–.48 (.461), a.s.VI .13–.15 (.140) + .72–.90 (.802); cornicles .12–.18 (.151), cauda .23–.28 (.250); hind tibiae .98–1.23 (1.16), hind ta–2 .12–.14 (.129), rostrum IV+V .12–.13 (.124); mf .0220–.0374 (.0318) and df–1 .0330–.0462 (.0409). Proportions of a.s.III:IV:V, 1: .71–.96 (.87); .69–.88 (.81); VIu/VIb 5.14–6.29 (5.69); co/ca .48–.70 (.60); rostrum IV+V/hind ta–2 .86–1.08 (.97).

Sexuales: Not seen. Description of oviparous female in Hottes and Frison (1931:288–289) probably refers to *P. pseudopatonkus*. The description of the male apparently refers to a mixture of *P. patonkus* and *P. pseudopatonkus* as the authors describe the beak as “varying in length, in some specimens reaching to the coxae of metathoracic legs and in others reaching only to mesothoracic legs.”

HOST.—*Achillea millefolium*.

DISTRIBUTION.—Extreme southern tip of Illinois, near border with Missouri, Tennessee and Kentucky.

Whether Hille Ris Lambers' (1966:605) record from California refers to *P. patonkus* or *P. pseudopatonkus* cannot be ascertained. Similarly, Hottes' (1950) record of a “pale chocolate-brown” variety, *P. patonkus* var. *coloradensis* was not seen and its identity with 1 of the 4 species living on *Achillea* (*P. hottesi*, *P. patonkusellus* and the other 2 species

discussed above) is not resolved here. The type of *P. patonkus coloradensis* Hottes is now known to be in the USNM.

SPECIMENS EXAMINED.—Paratypes: 8 apt.v.f., 13 al.v.f. and 1 altd.ny., Metropolis, Illinois, 17–IV–1930, Frison and Ross, on *Achillea millefolium* (INHS, KU, EOE, and M.E.MacG. coll.).

Pletrichophorus pseudoglandulosus (Palmer)

FIGURES 159, 458–461, 469–471

Capitophorus pseudoglandulosus Palmer, 1952:265–266 [type: al.v.f., Fort Collins, Colorado, 25–V–1915, MAP, on *Artemisia frigida*; USNM 59326].—Knowlton, 1954:9.

Pletrichophorus pseudoglandulosus (Palmer).—Hille Ris Lambers, 1953:115.—Müller and Scholl, 1958:398–399.—Robinson and Bradley, 1965:41; 1968:64.—Hille Ris Lambers, 1969:169, 173 [as a synonym of *P. decampus* (Knowlton and Smith)].

Pletrichophorus pseudoglandulosus (Palmer) [misidentification].—Hille Ris Lambers, 1966:605 [specimen determined as *P. pseudoglandulosus* by DHRL, from Berkeley, California, on *A. californica* seen and determined as *P. decampus*].

Capitophorus decampus Knowlton and Smith.—Palmer, 1952:254 [in part; collection records on *A. vulgaris* more probably *P. pseudoglandulosus* rather than *P. decampus*].

Capitophorus frigidiae Knowlton.—Knowlton, 1954:8 [not Palmer, nomen nudum, in part; collection recorded from Paradise, Utah, on *A. vulgaris* seen and found to be *P. pseudoglandulosus*].

Capitophorus glandulosus (Kaltenbach) [misidentifications].—Gillette and Palmer, 1934:149–150.—Knowlton and Smith, 1936b:231.—Patch, 1938:245.—Knowlton, 1946:6; 1948:122.

Pletrichophorus gnaphalodes (Palmer) [misidentifications].—Robinson and Bradley, 1965:44; 1968:64 [specimens on *A. ludoviciana* from Manitoba, loaned from AGR, examined and determined as *P. pseudoglandulosus* instead of *P. gnaphalodes*].

DIAGNOSIS.—This species closely resembles *P. decampus* from which it differs most conspicuously in the more slender and sparser head and body setae, the longer last rostral segment and the conspicuously wrinkled and sparsely spiculate cornicular integument. Differences in linear measurements and ratios are indicated under *P. decampus* with further comments on these below.

It is also somewhat similar to *P. glandulosus* in the rather sparse head setae ($18.78 \pm .56$, $n = 27$ vs. $13.89 \pm .48$, $n = 49$ for *P. glandulosus*), the long anterior head setae, the stoutly elongate and non-constricted cauda, and rather long, pale cornicles. On the other hand, *P. pseudoglandulosus* differs

from *P. glandulosus* in having much shorter, funnel-shaped posterior df and body hairs, longer (.13–.16 mm, $m = .143$, $n = 23$ vs. .105–.12 mm, $m = .108$, $n = 52$) and distinctly needle-tipped rostrum IV+V, and relatively larger co/ca ratio ($2.98 \pm .07$, $n = 44$ vs. $2.01 \pm .03$, $n = 90$).

DESCRIPTION.—Apterous Viviparous Female: Color in life bluish green (Palmer, 1952:265); cleared specimen pale with apices of rostrum and tibiae, entire tarsi and antennae from about distal $\frac{1}{3}$ of a.s.IV or from apices of a.s.V brown. Body length 1.47–2.00 (1.68, $n = 24$), width across eyes .38–.56 (.446, $n = 27$). Head with moderately produced laterofrontal tubercles and mesofrontal projection rather small; mf 1p with 1 often added, lf 2–3 (usually 2) on each side, vlf 1p, df 16–29 ($18.78 \pm .56$, $n = 27$), mf 6–10 (usually 7 or 8), pc 2p, ac 4–5, and md 2–3 (usually 3) on each plate; dorsal setae basically funnel-shaped including posterior df's, anterior with slightly longer stems (about $\frac{1}{2}$ of size) than posterior ones; ventral setae similarly expanded but ac merely blunt or pointed; mf .0264–.0506 (.0357, $n = 55$) and df-1 .0330–.0484 (.0402, $n = 50$) mm long. Antennal segment I conspicuously produced mesodistally, densely imbricate, sparsely spiculate, with 6–16 (usually 8 or 9) blunt to funnel-shaped setae in addition to pointed basal one on dorsum. A.s.II

1
densely imbricate, with 1—1 blunt, knobbed
2

or apically flattened setae. A.s.III densely imbricate; with small blunt or knobbed setae, longest about $\frac{1}{3}$ basal diameter of segment; bearing 0–5 (1.38, $n = 47$) sensoria. A.s.IV about $\frac{9}{10}$ and a.s.V $\frac{3}{4}$ length of a.s.III; a.s.VI with unguis averaging $5\frac{2}{3}$ times (5 to $7\frac{1}{3}$, $n = 38$) length of base.

Dorsal body integument smooth on disk, becoming imbricate-spiculate from about abd.s. 4 or 5; with rather sparse cover of funnel- to cone-shaped setae, setae on posterior segments slightly longer, more distinctly petiolate than those on disk. Cauda .15–.21 mm long (.177, $n = 23$), slightly tapered, broadly rounded at apex, not constricted; spiculate; with 2 pairs lateral and 1 posterodorsal setae. Cornicles .36–.63 (.519, $n = 56$) mm long and 2.61–3.44 times ($2.98 \pm .07$, $n = 44$) as long as cauda; cylindrical, bases slightly incrassate; conspicuously imbricate, wrinkled, sparsely armed with blunt spicules; apex faintly dusky. Legs with 3,3,3 hairs

on 1st tarsal joints. Rostrum IV+V .13–.16 (.143, $n = 27$) mm long and 1 to $1\frac{1}{2}$ times ($1.23 \pm .23$, $n = 40$) as long as hind ta-2; slender at base, apical $\frac{1}{3}$ produced into a rather stout cylindrical needle; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, al 3–4 times as long as ml and pl setae.

Measurements (in mm) of 1 specimen from Colorado on *Artemisia* sp.: B.L. 1.68, We .50; a.s.III .57 and .58, a.s.IV .47 and .48, a.s.V .40 and .39, a.s.VI .13 + .94 (one side only); cornicles .51 and .48, cauda .17; hind tibiae .98 and .99, hind ta-2 both .12, and rostrum IV+V .15 long.

Measurements (in mm) of 1 specimen from California on *A. douglasiana*: B.L. 2.20, We .45; a.s.III .76 and .78, a.s.IV .58 and .57, a.s.V .56 and .58, a.s.VI .17 + .99 and .16 ± 1.01 ; cornicles .59 and .60, cauda .22; hind tibiae (one side) 1.29, hind ta-2 .13 and rostrum IV+V .15.

Measurements (in mm) of 2 specimens on *A. ludoviciana* from Manitoba: B.L. 1.75 and 1.89, We .53 and .56; a.s.III .68–.71 (.695), a.s.IV .60–.62 (.615), a.s.V .49–.54 (.515), a.s.VI .15–.17 (.156) + .95–1.00 (.973); cornicles .58–.63 (.605), cauda .20 and .21; hind tibiae 1.20, hind ta-2 .12–.13 (.125), and rostrum IV+V both .14.

Measurements (in mm) of 5 specimens on *A. vulgaris* from Utah: B.L. 1.47–1.63 (1.56), We .40–.45 (.422); a.s.III .47–.57 (.533), a.s.IV .43–.50 (.467), a.s.V .38–.45 (.422), a.s.VI .13–.15 (.140) + .65–.87 (.76); cornicles .44–.52 (.465), cauda .16–.18 (.17), hind tibiae .90–1.05 (.97), hind ta-2 .10–.11 (.108) and rostrum IV+V .14–.16 (.146). Proportions of a.s.III:IV:V, 1: .85–.92 (.88): .78–.81 (.79); VIu/VIb 5.00–5.80 (5.40); co/ca 2.67–3.06 (2.86); rostrum IV+V/hind ta-2 1.27–1.45 (1.34).

Measurements (in mm) of 1 specimen on *A. frigida* from Manitoba (probably a fundatrix as the absence of dorsal 2nd antennal seta and relatively small VIu/VIb ratio indicate): B.L. 1.45, We .38; a.s.III .47 and .45, a.s.IV .22 and .24, a.s.V both .32, a.s.VI .11 + .55 and .11 + .52; cornicles .45 and .40, cauda .18, hind tibiae .79 and .78, hind ta-2 .10, and rostrum IV+V .125 mm. Number of df setae 29.

Alate Viviparous Female: Head (Figures 466, 467) and prothorax faintly sclerotic, with dark brown areas around ocelli; mesothorax brown; abdomen pale, membranous, with brown, transverse pleural intersegmental sclerites on segments 1 to 7, smaller ovate spinal sclerites and marginal thick-

enings on discal segments (Figure 468); antennae dusky from near bases of a.s.III but darker from apices of a.s.V; tips of rostrum and tibiae and entire tarsi dark brown. Morphologically much like apterous vivipara, differing only as follows: df setae fewer (15–18, $m = 16.4$, $n = 5$); sensoria more numerous on a.s.III (10–19, $m = 14.6$, $n = 10$); VIu/VIIb ratio relatively greater (5.36–7.06, $m = 6.01$, $n = 8$); co/ca ratio slightly smaller (2.31–2.78, $m = 2.53$, $n = 6$); and presence of sclerotizations on abdomen.

Measurements (in mm) of holotype on *A. frigida* from Colorado: B.L. 1.24, We .34; a.s.III both .50, a.s.IV both .42, a.s.V .40 and .41, a.s.VI .13 + .79 and .13 + .77; cornicles both .37, cauda .16; hind tibiae both 1.03, hind ta-2 both .10, rostrum IV+V .13; mf .0308 and .0352, and df-1 .0374 and .0396.

Measurements (in mm) of 3 specimens on *A. douglasiana* from California: B.L. 2.10–2.12 (2.11), We .44–.49 (.46); a.s.III .66–.79 (.717), a.s.IV .55–.77 (.632), a.s.V .46–.70 (.578), a.s.VI .17–.19 (.18) + 1.01–1.27 (1.11); cornicles .48–.57 (.517), cauda .18–.23 (.20); hind tibiae 1.31–1.35 (1.33), hind ta-2 .13–.14 (.135), rostrum IV+V .15–.155 (.152); mf .0374–.0440 (.0402) and df-1 .0352–.0440 (.0403). Proportions of a.s.III:IV:V, 1: .81–.97 (.88): .68–.89 (.84); VIu/VIIb 5.03–7.06 (6.16); co/ca 2.39–2.78 (2.59); rostrum IV+V/hind ta-2 1.07–1.15 (1.11).

Oviparous Female: Similar to apterous vivipara except as follows: df setae more numerous (23–37, $m = 29.75$, $n = 4$); body setae relatively denser; cornicles slightly shorter (.40–.51 mm, $m = .435$, $n = 8$) and co/ca ratio smaller (2.10–2.55, $m = 2.36$, $n = 6$); cauda stouter, sac-like; abdomen with 2 pairs of ovate pleural and 2 small, dashlike spinal patches; subgenital setae more numerous, all pointed; basal $\frac{1}{2}$ of hind tibiae enlarged, bearing numerous pseudosensoria.

Measurements (in mm) of 3 specimens on *A. frigida* from Colorado: BL 1.68–1.86 (1.77), We .39–.42 (.407); a.s.III .46–.47 (.468), a.s.IV .37–.39 (.383), a.s.V .38–.39 (.383), a.s.VI .12–.13 (.128) + .71–.72 (.713); cornicles .40–.42 (.412), cauda .17–.19 (.18); hind tibiae .84–.88 (.858), hind ta-2 .11, rostrum IV+V .125–.13 (.128); mf .0264–.0440 (.0379) and df-1 .0396–.0484 (.0433).

Male: Not seen. According to Palmer (1952: 266), apterous; B.L. 1.22, antennae 2.44, cornicles .35, and hind tibiae .95 mm long.

HOSTS.—*Artemisia douglasiana* (= *A. vulgaris* var. *heterophylla*), *A. frigida*, *A. ludoviciana*, *A. vulgaris*, and *Artemisia* sp.

DISTRIBUTION.—Collections examined include localities from Colorado, Utah, New Mexico, and California in the southwestern and western United States and in Manitoba in south central Canada.

SPECIMENS EXAMINED.—Aside from holotype alate viviparous female: CALIFORNIA: Lattonda Grade, 1 al.v.f., 30–II–1933, on *A. vulgaris* var. *heterophylla* (EOE coll.); Riverside, at UC Central Exp. Sta., 1 apt.v.f. and 1 al.v.f., 24–III–1960, C.F. Lagace, on *Artemisia douglasiana* (RCD coll). CANADA (all collected and owned by AGR): Camp Shilo, Manitoba, 1 apt.v.f. (spring form), 9–VI–1965, on *A. frigida*; Sandilands, Manitoba, 2 apt.v.f. collected 30–VII–1963, and 1 ovip.f. collected 28–IX–1963, on *A. ludoviciana*; Easton, Saskatchewan, 15–VIII–1965 on *Lactuca scariola* (?stray). COLORADO (all in CSU): Boulder, 1 apt.v.f., 25–X–1913, LCB, on *Artemisia*, and La Porte, 3 ovip.f., 5–XI–1918, LCB, on *A. frigida*. NEW MEXICO (all collected and owned by RCD): Chavez Co. line, 15 apt.v.f., 5–VII–1965 on undetermined composite; and 10 mi W of Elk, 5–VII–1965 on *Quercus undulata* (?). UTAH: Paradise, 5 apt.v.f. and 2 ny., 5–VIII–1937, GFK, on *A. vulgaris* (GFK coll.); and Tooele, 3 apt.v.f., 23–VIII–1937, GFK and E. Hansen, on *A. vulgaris* (USNM).

NOTES.—*P. pseudoglandulosus* has been badly confused with *P. decampus* in the past due to the failure of authors to see differences between collections on *Artemisia* species, particularly *A. tridentata* from *A. vulgaris* and *A. frigida*. Also, the antennal characters (short unguis and relative lengths of a.s.III, IV, and V) used to distinguish *P. decampus* are those of fundatrices rather than summer apterae. Similar differences from summer forms are exhibited by a spring-collected apterous female (probably a fundatrix or at least an early spring generation) of *P. pseudoglandulosus* from Manitoba (see measurements under description).

The morphological differences mentioned for apterous vivipara of these 2 species were observed rather constantly associated with their respective host data. Based on partial reexamination of published collection records and of newer, unpublished ones, *P. decampus* appears to be a more southwestern species living on *Artemisia* species native to this region (*viz.*, *A. tridentata* and *A. cali-*

formica). On the other hand, *P. pseudoglandulosus* appears to have a wider range, occurring as far southwest as California (on *A. douglasiana*, a western species) and as far northeast as Manitoba on more widely distributed host species like *A. frigida* and *A. ludoviciana*. Among sexuales, the presence of wings in *P. decampus* males and their absence in *P. pseudoglandulosus* suggests differences in their life habits.

***Pleotrichophorus pseudopatonkus*, new species**

FIGURES 144, 359-366

Capitophorus patonkus Hottes and Frison, 1931:287-289 [in part].

Pleotrichophorus patonkus (Hottes and Frison).—Hille Ris Lambers, 1966:605 [in part]; 1969:165 [in part].

DIAGNOSIS.—The size of the last rostral segment has been casually observed as variable in *P. patonkus*, *sensu lato*, by the authors of this species (Hottes and Frison, 1931:288). Hille Ris Lambers (1966:605) similarly noted slight differences in the shape of this segment but in his most recent key (1969:165) his description as "on basal half not with strongly concave, and on distal half with more or less convex sides, with never more than distal $\frac{1}{3}$ part hairless" apparently refers to *P. pseudopatonkus* (see discussion below).

Examination of cleared paratypes revealed 2 rostral types, namely: (1) a stout and slightly convex-sided last rostral segment that is less than .12 mm long—among collections from Urbana and Starved Rock, Illinois (Figure 144); and (2) a slender, straight-sided and sharply pointed one that is at least .12 mm long—from Metropolis, Illinois (Figure 143). Rostral type (1) is associated with the presence of short cornicles that are at most $\frac{1}{2}$ the length of the cauda, and type (2), with longer cornicles (.14-.21) that are $\frac{2}{3}$ to $\frac{3}{4}$ times the caudal length. The presence of sensoria on a.s.IV of alate females from Metropolis (in 84.6% of 13 segments seen) is an added difference.

Whether these differences are seasonal (Metropolis collections were made 30 April while those from Urbana were made 6 to 16 October and from Starved Rock, 13 May), geographic (Metropolis is the most southerly located of these localities), or specific can be resolved only by more careful biological studies. In view of the importance placed

here on rostral and cornicular characters in delineating *Pleotrichophorus* species, a separate specific status for these two forms is preferred and proposed. The name *P. patonkus* is retained for the form from Metropolis (locality associated with holotype), and *P. pseudopatonkus* is given for the form from Urbana and Starved Rock.

The occurrence of 2 color forms, pink and green, was reported by Hille Ris Lambers (1966) but it is not known with which of the above rostral types these colors are associated. Hottes and Frison's (1931) types seem to be of a basically green color.

DESCRIPTION.—*Apterous Viviparous Female:* Color in life whitish green (J.O. Pepper's collection notes) to green (C.F. Smith's collection notes); cleared specimens pale with apices of rostrum and tibiae, entire tarsi, apices of a.s.III and IV and remainder of antennae brown. Body length 1.27-1.88 (1.58, n = 28), width across eyes .39-.45 (.421) mm. Head with moderately developed laterofrontal tubercles, mesofrontal projection rather broad and low; mf usually 1p but 1 or 2 may be added, lf 1-3 (usually 2) on each side, vlf 1p, df 14-25 (18.61 \pm 1.12, n = 28), vf 5-10 (usually 6), pc 2p, ac 4-6, md 2-4 (usually 3) on each side; dorsal setae funnel-shaped with anterior ones long, distinctly petiolate and stems about $\frac{1}{2}$ to $\frac{2}{3}$ of entire length, posterior ones shorter, without distinct stems, more widely expanded; ventral setae with vf slightly flattened to funnel-shaped, remainder blunt, expanded or pointed; mf .0286-.0462 (.0396, n = 58) and df-1 .0396-.0506 (.0426, n = 56) mm long. Antennal segment I produced mesodistally, imbricate, with 4-10 (usually 6 or 7) blunt or knobbed setae aside from usual pointed one on dorsum.

A.s.II imbricate, with normally $1 - \frac{1}{2} - 1$ knobbed or pointed setae. A.s.III imbricate; with knobbed or pointed setae, longest about $\frac{1}{3}$ to $\frac{1}{2}$ diameter of segment; with 1-8 (2.79, n = 57) sensoria. A.s.IV about $\frac{3}{4}$, and a.s.V about $\frac{2}{3}$, length of a.s.III; a.s.VI with unguis $4\frac{1}{4}$ to $7\frac{1}{4}$ (5.16, n = 44) times as long as base.

Tergum smooth on disk, becoming finely imbricate-spiculate from about abdominal segment 5; with moderately dense cover of funnel to cone-shaped setae, those on apical segments longer, less expanded than setae on discal segments. Cauda .19-.27 (.232, n = 31) mm long; stoutly elongate,

constricted on basal $\frac{1}{3}$, broadly rounded at apex; spiculate; with 2 pairs lateral and 1 posterodorsal setae. Cornicles .08-.18 (.099, n = 60) mm long, .31-.67 times (.43 \pm .02, n = 60) as long as cauda; cylindrical, widest at bases, narrowing to about $\frac{2}{3}$ basal diameter; sparsely imbricate-spiculate, slightly wrinkled, spicules rather strong, blunt. Legs with 3, 3, 3 hairs on first tarsal joints; hind tibiae .86-1.22 (1.04, n = 57) and hind ta-2 .11-.13 (.124, n = 57) mm long. Rostrum IV+V .09-.11 (.099, n = 30) mm long, .71-.92 (.79 \pm .02, n = 54) times as long as second hind tarsal joint; rather thick at base, basal width $\frac{1}{2}$ or more length of segment, tapered to acute tip, margins past pl setae slightly convex; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, ml and pl $\frac{1}{3}$ to $\frac{1}{2}$ al setae in length.

Measurements (in mm) of holotype and 6 paratypes from Illinois: B.L. 1.45-1.88 (1.66), We .40-.43 (.415); a.s.III .45-.61 (.515), a.s.IV .33-.42 (.372), a.s.V .29-.40 (.338), a.s.VI .10-.13 (.116) + .44-.69 (.599); cornicles .08-.12 (.096), cauda .20-.24 (.217); hind tibiae .86-1.09 (.941), hind ta-2 .11-.13 (.122), and rostrum IV+V .09-.11 (.097). Proportions of a.s.III:IV:V, 1: .66-.79 (.72): .60-.73 (.66); VIu/VIb 4.40-6.55 (5.25); co/ca .38-.55 (.45); rostrum IV+V/hind ta-2 .75-.85 (.79).

Alate Viviparous Female: Color in life green (CFS coll. data); cleared specimen with slightly sclerotic head and prothorax and darker brown ring around ocelli; brown mesothorax, pale, membranous abdomen with dusky or light brown pleural patches; legs from apices of tibiae and antennae from near bases of a.s.III dark brown. Morphologically similar to apterae, with following differences: df setae fewer (10-13, m = 11.64, n = 11); head setae shorter, mf .0220-.0330 (.0265, n = 17), and df-1 .0264-.0440 (.0366, n = 22) long; a.s.III with more sensoria (11-20, m = 14.26, n = 19); dorsal abdominal setae relatively sparser.

Measurements (in mm) of 9 paratypes from Pennsylvania and North Carolina: B.L. 1.43-1.60 (1.53), We .36-.42 (.389); a.s. III .56-.64 (.599), a.s.IV .43-.52 (.461), a.s.V .38-.47 (.420), a.s.VI .12-.16 (.144) + .65-.87 (.740); cornicles .07-.09 (.079), cauda .21-.23 (.221); hind ta-2 .11-.14 (.129), and rostrum IV+V .09-.10 (.099). Proportions of a.s.III:IV:V, 1: .72-.91 (.77): .65-.80 (.71); VIu/VIb 4.50-5.75 (5.12); co/ca .30-.43 (.36); rostrum IV+V/hind ta-2 .69-.91 (.77).

Sexuales: Not seen. Probably included in orig-

inal description of *P. patonkus* (Hottes and Frison, 1931:288, 289).

HOSTS.—*Achillea millefolium*, *Achillea* sp.

DISTRIBUTION.—North central (Wisconsin, Illinois), and eastern (Maine, North Carolina, Pennsylvania) United States and northeastern Canada (New Brunswick).

TYPES.—Holotype: apt.v.f., Urbana, Illinois, 7-X-1929, Frison and Ross, on *Achillea millefolium*; in INHS coll. Paratypes: ILLINOIS (data like holotype except as indicated, and all in INHS): 1 apt.v.f., with the same data as holotype; 1 apt.v.f., 6-X-1929 by Frison; 1 apt.v.f. and 4 apt.ny., 16-X-1929; 1 apt.v.f., 3-IX-1929, Frison and Hottes, *Achillea*. NORTH CAROLINA: Highlands, 3 apt.v.f., 1 al.v.f. and 1 altd.ny., 13-V-1930, Starved Rock, on *Achillea*. NORTH CAROLINA: Highlands, 3 apt.v.f., 1 al.v.f. and 1 apt.ny., 4-IX-1963, JOP, on *Achillea millefolium* (JOP coll.); and Wilmington, 3 apt.v.f., 11-V-1960, on yarrow (CFS coll.). PENNSYLVANIA (all collected and owned by JOP): Philipsburg at Black Moshannon Dam, 3 apt.v.f. and 4 al.v.f., on *A. millefolium*; and Red Rock at Ricketts Glen, 8 apt.v.f. and 4 al.v.f., 30-VIII-1950, on *A. millefolium*.

OTHER SPECIMENS EXAMINED.—3 apt.v.f. and 5 ny., South Chicago, Illinois, 7-VII-1936, on *A. millefolium* (EOE coll.); 4 apt.v.f., 1 al.v.f., Presque Isle, Maine, 30-VIII-1956, on traps (EOE coll.); and 1 al.v.f., Fredericton, New Brunswick, Canada, 28-VIII-1956, from traps on *Achillea* (M.E. MacG. coll.), large individual, with rostrum IV+V .12 mm long but distally convex-sided.

Pleotrichophorus pullus (Gillette and Palmer)

FIGURES 154, 436-439

Capitophorus pullus Gillette and Palmer, 1933:353-354 [type: al.v.f., Chimney Rock, Colorado, 26-VI-1932, MAP, on *Artemisia longifolia*; USNM 49293]; 1934:155.—Patch, 1938:245.—Palmer, 1952:266-267.—Knowlton, 1954:9.

Pleotrichophorus pullus (Gillette and Palmer).—Hille Ris Lambers, 1953:115; 1969:168.

DIAGNOSIS.—This species is distinctive from all others with its combination of long (at least .17 mm), needle-tipped rostrum IV+V; brown appendages; triangular cauda; and long, pointed or, at most, blunt mf and lf setae.

DESCRIPTION.—*Apterous Viviparous Female:* Rather large individuals, 1.68-2.00 (1.87, n = 6)

mm long, .45-.47 (.462, $n = 6$) mm wide across eyes; body stoutly spindle-shaped. Cleared specimens with light brown body, slightly darker head, basal 2 antennal segments, intersegmental pleural thickenings, cauda and anal plate; legs dark brown except most of anterior areas of fore femora, extreme bases of mid and hind femora, and most of middle portions of all tibiae are concolorous with body; antennal flagellum with apices of a.s.III and IV and entire a.s.V and VI dark brown; cornicles and distal 2 rostral segments also dark brown. Laterofrontal tubercles rather poorly developed, mesofrontal area broad, conspicuous; mf setae 2p, lf 2-3 on each side, vlf 1p, df 33-43 (37.50 ± 4.19 , $n = 6$), vf 8-11, pc 2p, ac 4, md 3 or 4 on each side; mf and lf setae elongate, slender, usually pointed apically but sometimes blunt, mf .0242-.0506 (.0399, $n = 17$) mm long; df setae with anterior pairs and some of posterior ones long (e.g. df-1 .0330-.0418 mm, $m = .0383$, $n = 12$), slender, distal $\frac{1}{4}$ flaring to about twice basal diameter; remainder of df's shorter, funnel- to cone-shaped; ventral setae all long, pointed. Antennal segment I slightly produced mesally, almost smooth, with 4-6 long, pointed setae in addition to usual pointed smaller one on dorsum. A.s.II with basically

1

1 - - 1 long, pointed setae but 1 sometimes

1

added or missing. A.s.III faintly imbricate, with rather long, pointed to slightly knobbed setae, longest $\frac{3}{4}$ to equal basal diameter of segment; with 1-2 (1.4, $n = 10$) sensoria. A.s.IV and V subequal and about $\frac{2}{3}$ length of a.s.III; unguis $2\frac{1}{2}$ to $4\frac{2}{3}$ times ($m = 3.88$, $n = 9$) base of a.s.VI.

Dorsal body integument smooth on disk, becoming finely imbricate-spiculate from abdominal segment 6; 2 pairs of pleural sclerites present on discal segments or at least abd.s. 3 to 5, 2 pleural bars also on 6 and 7, 2 thin spinal dashes on some discal segments, median areas of posterior 3 segments indistinctly thickened. Dorsal body cover of setae quite dense, setae funnel- to fan-shaped, those of tapered segments slightly longer than those on disk. Cauda .19-.22 (.202, $n = 6$) mm long; triangular, not distinctly constricted basally, apex acute but rounded; spiculate; usually with 2 lateral pairs and 1 posterodorsal setae. Cornicles .29-.50 (.443, $n = 12$) mm long, $1\frac{1}{2}$ to $2\frac{1}{2}$ times ($m =$

$2.11 \pm .32$, $n = 12$) length of cauda; cylindrical, widest at base, of uniform diameter for remainder of length; imbricate, wrinkled, very sparsely armed with spicules. Legs with 3, 3, 3 hairs on first tarsal joints; hind tibiae .83-1.07 (.98, $n = 10$), hind ta-2 .13-.15 (.144, $n = 9$) mm long. Rostrum IV+V .17-.18 (.173, $n = 6$) mm long, slightly longer to $1\frac{1}{3}$ times ($1.19 \pm .82$, $n = 9$) as long as hind ta-2; slender, with thin, cylindrical, needle-like distal $\frac{1}{2}$; setae of normal set of 1 basal, 2 dorsal, and 3 lateral pairs, ml and pl about $\frac{1}{3}$ to $\frac{1}{2}$ size of al setae.

Alate Viviparous Female: Head and thorax brown; appendages much like those of aptera but relatively darker or blackish brown. Morphologically also like aptera, differing only as follows: df setae fewer (12-13, $m = 12.67$, $n = 3$), mf setae blunt at apices, lf a mixture of blunt and pointed setae; a.s.III bearing 6-8 ($m = 7$, $n = 4$) sensoria; unguis of a.s.VI slightly longer, cornicles and cauda slightly shorter; abdominal pleural sclerotizations more pronounced, marginal sclerites also present; abdominal setae sparser.

Measurements (in mm) of 2 paratypes: B.L. 1.72 and 1.87, We .38 and .39; a.s.III .47-.49 (.48), a.s.IV .32-.35 (.335), a.s.V .28-.31 (.295), a.s.VI .13-.15 (.135) + .53-.56 (.545); cornicles .37-.38 (.372), cauda both .18; hind tibiae 1.11-1.13 (1.12), hind ta-2 .15-.16 (.158), rostrum IV+V both .18; mf .0264-.0440 (.0356) and df-1 .0330-.0418 (.0369). Proportions of a.s.III:IV:V, 1: .67-.73 (.69): .59-.65 (.62); VIu/VIb 3.73-4.23 (4.05); co/ca 2.06-2.11 (2.08); rostrum IV+V/hind ta-2 1.13-1.20 (1.15).

Sexuales: Unknown.

Hosts.—*Artemisia cana* and *A. longifolia*.

DISTRIBUTION.—Aside from type-locality in northern Colorado, records include sporadic collections from northern Utah (Logan), southwestern Montana (Forsyth), and western North Dakota (Theodore Roosevelt National Memorial Park).

SPECIMENS EXAMINED.—Two paratype slides containing 5 apt.v.f., 2 al.v.f. and 16 ny., with same data as holotype (CSU); 1 apt.v.f., 1 al.v.f., and 1 ny., Roosevelt National Memorial Park, 11-VI-1954, G. and L. Wheeler, on *Artemisia cana* (USNM).

Pleotrichophorus pycnorhysus
(Knowlton and Smith)

FIGURES 125, 175-179

Capitophorus pycnorhysus Knowlton and Smith, 1936a:111 [lectotype: apt.v.f., Curlew, Utah, 9-VI-1930, GFK, on *Chrysothamnus*; in EOE coll.]; 1937:152.—Palmer, 1952: 267-268.

Capitophorus pycnorhysus [sic] Knowlton and Smith.—Knowlton, 1941:138 [misspelling].

Pleotrichophorus pycnorhysus (Knowlton and Smith).—Hille Ris Lambers, 1969:167.

DIAGNOSIS.—*P. pycnorhysus* can be distinguished from other species with short, stout and blunt rostrum IV + V (viz., *P. acanthovillus*, *P. magnautensus* and *P. utensis*) by the presence of the longest cornicles (averaging more than .55 mm vs. less than .40 mm in these species), greatest co/ca ratio ($2.25 \pm .06$, $n = 72$ vs. less than $1\frac{1}{2}$ in these species) and by having only the cornicle apex dark (entirely dark in those species). It resembles *P. gregarius* and *P. xerzooous* in possessing spino-pleural abdominal papillae; but can be similarly differentiated from them by its pale cornicles (also dark on distal $\frac{1}{2}$ to $\frac{2}{3}$ in these species).

DESCRIPTION.—*Apterous Viviparous Female*: Color in life pale to apple green, somewhat shiny (original description); cleared specimen pale with tips of rostrum and tibiae, apical $\frac{1}{10}$ to $\frac{1}{6}$ of cornicles, entire tarsi and antennae from about distal $\frac{2}{3}$ of a.s.III brown. Body 1.65-2.25 (1.86, $n = 35$) mm long, .37-.49 (.436, $n = 39$) mm wide across eyes. Laterofrontal and mesofrontal tubercles of head moderately developed; mf 1p, lf 1-3 (usually 2 on each side), vlf 1p, df 11-18 ($13.25 \pm .59$, $n = 40$), vf 5-8 (usually 6), pc 2p, ac 4, md 3-5 (usually 3) p; dorsal setae funnel-shaped, without-distinct stems; vf and pc similar but less expanded, ac, md elongate with pointed or blunt tips; mf .0220-.0418 (.0307, $n = 75$) and df-1 .0176-.0418 (.0318, $n = 74$) mm long. Antennal segment I moderately produced mesodistally, faintly imbricate, with 7-14 blunt or knobbed setae in addition to basal pointed one on dorsum. A.s.II with usually 1
1-1-1 similarly shaped setae. A.s.III faintly 2
imbricate, with small rod-shaped setae, not more than $\frac{1}{3}$ basal diameter of segment; 1-4 (2.27, $n = 60$) sensoria. A.s.IV about $\frac{3}{4}$ and a.s.V about $\frac{2}{3}$

the length of a.s.III; unguis of a.s.VI $5\frac{2}{3}$ to 8 times (6.71, $n = 36$) as long as its base.

Dorsum of body smooth on disk, becoming faintly striate posteriorly; 2 pairs of rows of papillae present around bases of spinal and pleural setae, papillae becoming increasingly developed caudally; setae funnel- or cone-shaped, rather sparse, with 2 or 3 setae borne on spino-pleural papillae. Cauda .18-.30 (.257, $n = 37$) mm long; elongate with very slight basal constriction, acutely rounded apex; spiculate; with 2 lateral pairs and 1 posterodorsal setae. Cornicles .43-.68 (.567, $n = 80$) mm long, 1.80-3.13 times ($2.25 \pm .06$, $n = 80$) length of cauda; cylindrical, with thinnest diameter about middle; moderately imbricate-spiculate. Legs with 3, 3, 3 hairs on first tarsal joints; hind tibiae 1.03-1.53 (1.25, $n = 57$) and hind ta-2 .10-.12 (.116, $n = 53$) mm long. Rostrum IV+V .08-.10 (.092, $n = 41$) mm long, .67-.91 times ($.78 \pm .02$, $n = 54$) as long as hind ta-2; stout at base, narrowing only slightly to blunt apex; with 1 basal, 2 dorsal and 3 lateral pairs of setae, al, ml, and pl setae subequal in length.

Measurements (in mm) of lectotype: B.L. 2.05, We .44; a.s.III .56 and .59, a.s.IV .50 and .49, a.s.V .43 and .40, a.s.VI both incomplete; cornicles both .59, cauda .28; hind tibia (one side only) 1.29, hind ta-2 .11, and rostrum IV+V .09 mm.

Alate Viviparous Female: Not seen. Data from Knowlton and Smith's (1936a:111) original description include: B.L. 1.25; a.s.III .65-.72, a.s.IV .52-.55, a.s.V .42-.50, a.s.VI .12-.14 + .96; cornicles .45-.58, cauda .25, hind tibiae 1.25-1.27, hind ta-2 .11-.13, rostrum IV+V .08-.09 and hairs on vertex (probably mf setae) .034 mm. Number of sensoria on a.s.III 5-10.

Sexuales; Unknown.

HOSTS.—*Artemisia tridentata*, *Chrysothamnus viscidiflorus*, *Chrysothamnus* sp. and *Gutierrezia* sp.

DISTRIBUTION.—Widely distributed in northern Utah (north of Great Salt Lake), but also recorded as far south as Beaver; also known from southern Idaho and Logan, Montana.

TYPES (designated from "paratype" slides).—Lectotype, apt.v.f. with data given above. Paratypes: 3 apt.v.f., 1 altd.ny., and 3 apt.ny. with same data as lectotype, in EOE coll.; and 3 apt.v.f. and 2 apt.ny., Dayton, Idaho, 21-VI-1935, GFK, on *Chrysothamnus* (GFK coll.).

SPECIMEN EXAMINED.—In addition to types, all collected by GFK and CFS: IDAHO: Riverdale, 11 apt.v.f. on 27-VI-1936 and 2 apt.v.f. on 24-VII-1936, on *Chrysothamnus viscidiflorus* (CFS coll.). UTAH: Eureka, 7 apt.v.f., 21-VII-1955, on *Gutierrezia* (EOE coll.); Hoytsville, 2 apt.v.f., 16-VIII-1956 on *Artemisia tridentata* (EOE coll.); Ouray Valley, 10 apt.v.f., 14-IX-1956 on *Chrysothamnus* sp. (EOE coll.); Vernal, 1 apt.v.f., 15-IX-1959 on *C. viscidiflorus* (JOP coll.); and Wild Cat Canyon, Beaver Co., 4 apt.v.f., 18-VIII-1956 on *C. viscidiflorus*.

NOTES.—An apterous viviparous female (Figure 125, right and Figure 179) from Nioche, Utah (28-VIII-1927, GFK, on *C. viscidiflorus*) differs from typical *P. pycnorhysus* by its longer base of a.s.VI (.17 mm), by the small flattened posterodorsal caudal seta and by having less developed spinopleural papillae.

***Pleotrichophorus quadritrichus*
(Knowlton and Smith)**

FIGURES 152, 410-429

Capitophorus quadritrichus Knowlton and Smith, 1936b:233. [lectotype: apt.v.f., Boy's Camp, Logan Canyon, Utah, 21-VIII-1934, CFS, on sage; in CFS coll.]; 1937:152.—Knowlton, 1941:138; 1948:123.—Palmer, 1952:268.

Pleotrichophorus quadritrichus (Knowlton and Smith).—Hille Ris Lambers, 1969:168.

DIAGNOSIS.—*P. quadritrichus* is a rather variable species (see descriptions and notes on variation below) in which the smaller individuals resemble *P. heterohirsutus* while the larger ones tend to be more like *P. pullus*. As a group, individual variants

can be distinguished from these 2 species by possessing stoutly elongate, basally constricted, apically rounded cauda; the anterior head setae (mf, lf, df-1), although variably expanded at apices are never pointed; and the frontal head margin does not appear broadly convex because of much greater degree of development of laterofrontal than mesofrontal tubercles.

SUBSPECIFIC VARIATION.—Within *P. quadritrichus*, 3 geographic variants can be recognized among populations from Wyoming, Utah, and California, and from the Utah-Arizona border. Variation occurs most conspicuously with regards to cornicle length and co/ca ratio, the color of legs and the number of sensoria on the third antennal segment. Body length, length of rostrum IV+V, and the proportions of the unguis to the base of a.s.VI also vary but overlap between populations is more frequent.

Specimens from Logan, Utah, and southern California differ significantly in cornicle length and co/ca ratio but these are bridged indistinguishably by specimens from central parts of Utah (e.g., Butlerville and Price). Body size and length of rostrum IV+V also differ but these characters, too, intergrade through the central Utah collections. The occurrence of 3 races in Utah is possible, namely, the *P. quadritrichus*, sensu stricto, type from northern Utah, the California-like form from central Utah, and the *P. pallidus* type in the south. However, this requires analysis from more than sporadic and accidental collections such as were available in this study. Until such an investigation is conducted, it seems more convenient to consider the northern and central Utah forms under a similar nomenclatorial treatment.

Key to the Subspecies of *Pleotrichophorus quadritrichus*

1. Coxae, trochanter and femora of all legs, cornicles and cauda pale or dusky; cornicles averaging .22 mm long ($m = .219 \pm .01$, $n = 26$) and about as long as cauda (co/ca, $m = 1.05 \pm .028$, $n = 20$). On *Artemisia tridentata* *P. q. pallidus*, new subspecies
Basal segments of all legs, cornicles and cauda distinctly colored brown; length of cornicles and co/ca ratio variable 2
2. Cornicles .33-.49 mm long ($m = .407 \pm .01$, $n = 54$) and distinctly longer than cauda (co/ca, $m = 1.41 \pm .02$, $n = 52$); sensoria usually 2 or more (range of 1-4, $m = 2.34$, $n = 50$) and unguis $3\frac{3}{4}$ to $5\frac{1}{4}$ times ($m = 4.68$, $n = 29$) the base of a.s.VI; on *Artemisia vulgaris* *P. q. vulgaris*, new subspecies
Cornicles .19-.41 mm long and not more than $1\frac{1}{4}$ times as long as cauda; sensoria usually 1 (in 82.5% of 54 segments); and unguis averaging 3.87 times (range of $3\frac{1}{3}$ to $4\frac{1}{2}$, $n = 31$) as long as base of a.s.VI. On *Artemisia tridentata* and *A. californica* *P. q. quadritrichus* (Knowlton and Smith)

Pleotrichophorus quadritrichus quadritrichus
(Knowlton and Smith)

FIGURES 152, 410-429

DESCRIPTION.—*Apterous Viviparous Female* (based on lectotype and 17 specimens from Logan, Utah): Color in life bluish green, appearing grayish over body (Knowlton and Smith, 1936b:233). Cleared specimen with pale brown or dusky, slightly sclerotic frontal areas of head and pale, membranous body; basal 2 antennal segments brown, flagellum dark brown from apices of a.s.IV; legs predominantly brown but extreme bases of femora and most of tibiae pale like body; ventral head sclerites, apical 2 rostral segments brown, sclerotic; cornicles, cauda, anal and subgenital plates also brown. Body 1.15-1.67 (1.40, n = 18) mm long, .36-.41 (.381, n = 16) mm wide across eyes. Laterofrontal tubercles of head distinct, moderately produced, mesofrontal rather small and low; mf 1p, lf 1-2 (usually 2) on each tubercle, vlf 1p, df 22-37 (27.75 ± 2.29 , n = 16), vf 5-7 (usually 6), pc 2p, ac 4 to 6, md 2-4 (usually 3) on each side; dorsal setae with anterior ones elongate, merely blunt to slightly flattened apically, posterior ones shorter, widely expanded, funnel-shaped; ventral setae with vf blunt or flattened, remaining setae pointed; mf .0396-.0572 (.0485, n = 28) and df-1 .0440-.0638 (.0509, n = 30) mm long. Antennal segment I slightly produced on mesodistal margin, faintly imbricate and sclerotic, with 4-7 long, blunt setae in addition to usual small pointed one on dorsum. A.s.II faintly imbricate, with normally $1 - \frac{1}{2} - 1$ elongate, blunt setae but 1 sometimes added or missing. A.s.III moderately imbricate, setae knobbed or blunt, rather long; with 1-2 (1.06, n = 35) sensoria. A.s.IV and V subequal, about $\frac{3}{4}$ length of a.s.III; a.s.VI with unguis $3\frac{1}{3}$ to $4\frac{1}{2}$ times (3.87, n = 31) as long as its base.

Dorsal body integument smooth on disk, becoming imbricate-spiculate on distal 2 or 3 abd.s.; with moderately dense cover of funnel- or cone-shaped setae. Cauda .21-.28 (.252, n = 17) mm long; elongate, with distinct constriction on basal $\frac{1}{4}$, acute but rounded apex; spiculate; with 2 pairs of lateral and 1-2 (usually 1) posterodorsal setae. Cornicles .17-.30 ($.228 \pm .012$, n = 36) mm long. .77-1.07

times ($.89 \pm .03$, n = 34) as long as cauda; cylindrical, with bases and apices slightly incrassate; brown, faintly imbricate, sparsely armed with small, blunt spicules. Legs with 3, 3, 3 hairs on first tarsal joints; hind tibiae .80-1.02 (.93, n = 30), hind ta-2 .10-.13 (.116, n = 29) mm long. Rostrum IV+V .12-.15 ($.132 \pm .004$, n = 18) mm long, 1.08-1.30 times ($1.11 \pm .08$, n = 30) length of second hind tarsal segment; slender at base, apical $\frac{1}{2}$ or $\frac{1}{3}$ produced into thin, cylindrical needle; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, and ml and pl $\frac{1}{3}$ to $\frac{1}{2}$ size of al setae.

Measurements (in mm) of lectotype: BL 1.15, We .37; a.s.III .36, a.s.IV .28, a.s.V .26, a.s.VI both incomplete; cornicles .17 and .18, cauda .22, hind tibiae .88 (one side), hind ta-2 .11 (one side), and rostrum IV+V .12.

Measurements (in mm) of 4 specimens from central Utah (Butlerville, Price and Spring City): BL 1.56-1.97 (1.73), We .40-.42 (.413); a.s.III .37-.51 (.454), a.s.IV .33-.43 (.386), a.s.V .34-.38 (.360), a.s.VI .13-.14 (.136) + .51-.58 (.555); cornicles .27-.42 (.340), cauda .25-.32 (.293); hind tibiae 1.15-1.26 (1.21), hind ta-2 .12-.14 (.130), rostrum IV+V .15; mf .0308-.0594 (.0509), and df-1 .0396-.0704 (.0579). Proportions of a.s.III:IV:V, 1: .82-.92 (.85); .73-.95 (.80); VIu/VIb 3.92-4.38 (4.11); co/ca 1.03-1.35 (1.15); rostrum IV+V/hind ta-2 1.07-1.25 (1.16).

Measurements (in mm) of 10 specimens from California: BL 1.63-2.24 (1.86), We .38-.50 (.407); a.s.III .42-.54 (.488), a.s.IV .34-.42 (.384), a.s.V .30-.41 (.370), a.s.VI .11-.15 (.130) + .48-.58 (.536); cornicles .24-.36 (.316), cauda .24-.34 (.291); hind tibiae .98-1.27 (1.17), hind ta-2 .12-.14 (.124), rostrum IV+V .13-.15 (.145); mf .0308-.0594 (.0443) and df-1 .0418-.0550 (.0504). Proportions of a.s.III:IV:V, 1: .71-.89 (.79); .64-.84 (.75); VIu/VIb 3.43-4.83 (4.12); co/ca .97-1.24 (1.09); rostrum IV+V/hind ta-2 1.07-1.25 (1.12). Number of df setae 30-37 (33.33 ± 1.63 , n = 9); and number of sensoria on a.s.III 0-2 (1.26).

Alate Viviparous Female (based on specimens from California): Head, thorax, entire antennae, legs, cornicles, anal and subgenital plates, cauda dark brown, sclerotic; abdomen pale, membranous, with light brown spinal, pleural and marginal sclerites. Morphologically much like viviparous aptera, differing only as follows: df setae fewer (16-25, m = 19.63, n = 8); more sensoria on a.s.III

(2-7, $m = 4.87$, $n = 15$); abdomen with 2 small spinal, 2 pairs of pleural and 2 marginal sclerites; dorsal abdominal setae small, sparser, less expanded, more elongate.

Measurements (in mm) of 9 specimens: BL 1.75-1.85 (.181), We .35-.39 (.374); a.s.III .47-.58 (.521), a.s.IV .39-.46 (.429), a.s.V .35-.44 (.379), a.s.VI .12-.17 (.137) + .52-.75 (.600); cornicles .18-.31 (.249), cauda .24-.27 (.258); hind tibiae 1.10-1.32 (1.25), hind ta-2 .12-.14 (.130), rostrum IV+V .12-.14 (.136), mf .0330-.0484 (.0412) and df-1 .0396-.0506 (.0474) mm. Proportions of a.s.III: IV:V, 1: .69-.98 (.81); .71-.94 (.77); VIu/VIb 3.41-5.77 (4.49); co/ca .77-1.25 (.97); rostrum IV +V/hind ta-2 1.00-1.08 (1.05).

Oviparous Female (based on a single specimen from California): Also similar to apterous vivipara, with following differences: body setae relatively longer, sparser; disk of body with 2 pairs of pleural sclerites on abd.s. 3 to 5; cornicles and cauda relatively shorter; cauda stoutly triangular, not constricted, bearing 3 posterodorsal setae; subgenital setae more numerous, all pointed; basal $\frac{1}{4}$ of hind tibiae enlarged, with numerous pseudosensoria.

Measurements (in mm) of 1 specimen: BL 1.33, We .36; a.s.III .35 and .36, a.s.IV .24 and .25, a.s.V .20 and .26, a.s.VI .11 + .39 (one side only); cornicles both .15, cauda .16; hind tibiae .86 (one side), hind ta-2 .10; rostrum IV+V .13; and df-1 .0484 and .0462 mm. Number of df setae 20; and number of sensoria, 1 on both segments.

Alate Male (based on 5 specimens from California): Resembles alate viviparous female in most respects except as follows: df setae fewer (14-18, $m = 15.6$, $n = 5$), head and body setae relatively shorter, mf .0132-.0330 and df-1 .0220-.0286 mm long; sensoria more on a.s.III (22-32, $m = 26.5$, $n = 10$), also present on a.s.IV (16-23, $m = 20.2$, $n = 9$), a.s.V (11-18, $m = 14.1$, $n = 7$); abdominal pleural sclerotizations more developed; cauda bluntly triangular, not constricted, shorter, co/ca ratio relatively larger (1.6-2.3 times). Genitalia consisting of rather small, lobe-like, setaceous parameres and cylindrical, apically rounded aedeagus.

Measurements (in mm) of 5 specimens: BL 1.37-1.50 (1.42), We .30-.34 (.324); a.s.III .44-.48 (.459), a.s.IV .33-.44 (.400), a.s.V .33-.43 (.387), a.s.VI .12-.14 (.129) + .69-.86 (.773); cornicles .16-.25 (.217), cauda .10-.12 (.11); hind tibiae .78-.91 (.833), hind ta-2 .10, and rostrum IV+V .105-.110.

Proportions of a.s.III:IV:V, 1: .75-.93 (.88): .75-.89 (.84); VIu/VIb 5.36-7.25 (6.13); co/ca 1.60-2.08 (1.99) and rostrum IV+V/hind ta-2 1.05-1.10 (1.08).

HOSTS.—*Artemisia californica*, *A. tridentata*, and *Artemisia* sp.

DISTRIBUTION.—Northern Utah, southern Idaho near Utah and Wyoming borders and southern California.

TYPES (designated from "paratype" and "cotype" slides seen).—Lectotype: apt.v.f., Boy's Camp, Logan Canyon, Utah, 21-VIII-1934, CFS, on sage; in CFS coll. Paralectotypes: 2 apt.ny., Cedar Creek, Utah, 9-VI-1930, GFK, on *Artemisia tridentata* (EOE coll.).

SPECIMENS EXAMINED.—Aside from types: CALIFORNIA (all collected by RCD): Big Bear Lake, 3 apt.v.f. and 6 al.v.f. on 9-VII-1939 and 1 ovip.f., and 6 al.m. on 15-X-1939, on *A. tridentata* (RCD coll.); Mojave Desert near Cajon Pass, 2 apt.v.f. and 5 al.v.f., 30-IV-1939, on *Artemisia* sp. (RCD and EOE coll.); and San Dimas Canyon, 3 apt.v.f., 13-IV-1945, on *A. californica*. IDAHO: Victor, 2 apt.ny., 13-VI-1936, CFS, on *Artemisia* sp. UTAH: Butlerville, 15-VI-1937, 3 apt.v.f. and 1 ny., on *A. tridentata* (EOE coll.); Logan Green Canyon, 17 apt.v.f., 23-IX-1966 on *A. tridentata* (U.Minn., LACR and AGR coll.); Monte Cristo, 3 apt.v.f., 25-VIII-1938 on sage brush (USNM) and 3 apt.v.f. and 1 al.v.f., 22-VI-1956, on *Artemisia* (EOE coll.); 13 mi NW Price, 1 apt.v.f., 8-VII-1965, RCD on *Quercus gambelli* (casual?) (RCD coll.); Sardine Canyon, 1 apt.v.f. and 1 al.v.f., 15-VII-1937, on *A. tridentata* (OSU); and Spring City, 1 apt.v.f., 11-VIII-1936, CFS, on *Artemisia* sp. (EOE coll.).

Pleotrichophorus quadritrichus pallidus,
new subspecies

DESCRIPTION.—*Apterous Viviparous Female*: Color in life unknown. Cleared specimen with head slightly dusky, body pale and membranous; antennal segments I and II pale or dusky, concolorous with head, flagellum dark brown from apices of segment V; ventral head sclerites and last 2 rostral segments dusky but with extreme apex darker; coxae to femora of all legs dusky or very pale brown, bases and apices of tibiae, entire tarsi brown, remainder of tibiae pale like body; cor-

nicles, cauda, anal and subgenital plates dusky or pale brown. Body 1.22–1.46 (1.36, $n = 12$) mm long, .32–.37 (.348, $n = 13$) mm wide across eyes. Laterofrontal tubercles relatively less developed than in typical subspecies, mesofrontal tubercle broad, low; mf 1p, lf 1–2 (usually 2) on each side, vlf 1p, df 24–36 (28.92 ± 1.98 , $n = 13$), vf 5 to 7, pc 2p, ac 4–5, md 2–4 (usually 3 on each side); anterior dorsal setae elongate, slightly expanded, posterior shorter, more widely flaring, funnel-shaped; ventral setae with vf and pc blunt or slightly expanded, others pointed; mf .0330–.0572 (.0457, $n = 22$) and df-1 .0396 ($n = 23$) mm long. Antennal segment I slightly produced mesodistally, faintly imbricate, with 3–6 long, blunt to slightly knobbed setae aside from small pointed one on dorsum. A.s.II almost smooth, usually with

1
1 — 1 long knobbed setae. A.s.III faintly imbricate,

setae all with knobbed or bulbous apices, longest subequal to basal diameter of segment; with only 1 sensorium. A.s.IV and V subequally long averaging $\frac{3}{4}$ length of a.s.III; a.s.VI with unguis $3\frac{1}{2}$ to $4\frac{1}{2}$ times (3.89, $n = 25$) length of its base.

Dorsal body integument smooth on disk, becoming spiculate caudally from about the abd.s. 5; moderately densely covered with funnel- or cone-shaped setae. Cauda .18–.25 (.212, $n = 13$) mm long; elongate, constricted on basal $\frac{1}{4}$, acutely rounded at apex; spiculate; and bearing 2 pairs lateral and 1 posterodorsal setae. Cornicles .17–.26 (.219 $\pm .01$, $n = 26$) mm long, about as long as cauda (co/ca, .94–1.19, $m = 1.05$, $\pm .028$, $n = 20$); cylindrical, with widest diameter at bases; distinctly imbricate-spiculate, spicules rather large, blunt. Legs with 3,3,3 hairs on 1st tarsal joints, hind tibiae .69–.90 (.80, $n = 21$), and hind ta-2 .11–.12 (.116) mm long. Rostrum IV+V .12–.13 (.122 $\pm .003$, $n = 14$) mm long, slightly longer than hind ta-2 (1.08–1.14 times, $m = 1.09 \pm .01$, $n = 20$); slender at base, distal $\frac{1}{2}$ produced into cylindrical needle; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, al about twice as long as ml and pl setae.

Measurements (in mm) of holotype: BL 1.34, We .37; a.s.III .36 and .37, a.s.IV .26 and .25, a.s.V both .24, a.s.VI .11 + .40 and .11 + .39; cornicles both .24, cauda .22; hind tibiae both .75, hind ta-2 both .11, and rostrum IV+V .12 mm.

Alate Viviparous Female: Unknown.

Oviparous Female: Very much like viviparous aptera and differing only as follows: body setae relatively sparser, longer, more narrowly expanded; dorsal seta on a.s.II often absent (e.g., in 63.7% of 11 segments); cauda stouter, not distinctly constricted, broadly rounded at apex, bearing more posterodorsal hairs (1–5, $m = 3.75$, $n = 8$); subgenital plate with more setae; basal $\frac{1}{3}$ of hind tibiae enlarged, with numerous pseudosensoria.

Measurements (in mm) of 8 paratypes: BL 1.26–1.52 (1.42), We .34–.38 (.358), a.s.III .33–.45 (.411), a.s.IV .30–.36 (.325), a.s.V .28–.31 (.300), a.s.VI .10–.12 (.113) + .40–.53 (.474); cornicles .20–.25 (.213), cauda .19–.20 (.191); hind tibiae .81–1.06 (.98), hind ta-2 .11–.13 (.121), rostrum IV+V .12–.14 (.130), mf .0440–.0550 (.0499), and df-1 .0506–.0550 (.0541). Proportions of a.s.III:IV:V, 1: .68–.88 (.79): .64–.77 (.73); VIu/VIB 3.33–4.64 (4.21); co/ca 1.05–1.25 (1.12) and rostrum IV+V/hind ta-2 1.00–1.18 (1.06).

Alate Male: Associated with viviparous and oviparous females from Kanab Creek Canyon, Utah, are strikingly different from males of the typical subspecies from California in the long, pointed to blunt dorsal head and body setae; the conspicuous abdominal sclerotizations, spinal contiguous with pleural sclerites on segments 1 to 5 to 8; smaller ovate sclerites on segments 2 to 3 where sclerites are separate; more sensoria on all antennal segments bearing them.

Head, thorax, entire antennae, entire legs except extreme bases of tibiae, abdominal sclerites, cornicles, genital capsule, and apical 2 rostral segments dark brown; wing veins lighter brown; remaining areas of abdomen pale, membranous. Morphologically different from viviparous aptera in having head and body setae all pointed or merely blunt; presence of abdominal sclerotizations; presence of fewer df setae (10–12, $m = 11$, $n = 3$) and sparser body setae; presence of more sensoria on a.s.III (43–49, $m = 46.0$, $n = 4$) and their presence also on a.s.IV (30–31, $m = 30.3$, $n = 4$); in having shorter cornicles and cauda and slightly shorter rostrum IV+V/hind ta-2 ratio. Genitalia consisting of 2 oblong, setaceous parameres, aedeagus cylindrical, apically rounded.

Measurements (in mm) of 3 paratypes: BL 1.52–1.60 (1.56), We .34–.37 (.353); a.s.III .48–.53 (.505), a.s.IV .42–.44 (.430), a.s.V .34–.41 (.378), a.s.VI .13–.15 (.143) + .57–.61 (.587); cornicles .14–.16

(.143), cauda .12-.13 (.125); hind tibiae .97-1.09 (1.05), rostrum IV+V .12-.13 (.127); mf .0286-.0396 (.0334), and df-1 .0352-.0484 (.0396). Proportions of a.s.III:IV:V, 1: .83-.88 (.86): .69-.79 (.75); VIu/VIb 3.87-4.38 (4.11); co/ca 1.08-1.33 (1.19); and rostrum IV+V/hind ta-2 .92-.93 (.926).

HOST.—*Artemisia tridentata*.

DISTRIBUTION.—Utah-Arizona border.

TYPES (all in EOE coll.): Holotype, apt.v.f., Fredonia, Arizona, 13-X-1955, GFK, on *Artemisia tridentata*; specimen at 1:00 o'clock of slide with 2 apt.v.f., 1 ovip.f. and 5 ny. Paratypes: specimens on same slide as holotype; 5 apt.v.f. and 5 ny. with same data as holotype but on a different slide; 6 apt.v.f., 4 ovip.f., 3 alm., and 2 ny., Kanab Creek Canyon, Utah, 15-X-1955, GFK, on *A. tridentata* (mounted on 3 slides); 3 apt.v.f., 3 ovip.f., and 6 ny., Mt. Carmel Jct., Utah, 13-X-1955, on *A. tridentata* (2 slides).

Pleotrichophorus quadritrichus vulgaris,
new subspecies

DESCRIPTION.—*Apterous Viviparous Female*: Very much like apterous vivipara of typical subspecies (including color of body and appendages), differing only as follows: cornicles longer, averaging $1\frac{1}{2}$ times as long as cauda; more sensoria on a.s.III and ratio of unguis to base of a.s.VI greater; rostrum IV+V relatively longer.

Measurements (in mm) of holotype and 29 paratypes: BL 1.40-1.95 (1.58), We .36-.46 (.416); a.s. III .45-.58 (.515), a.s.IV .38-.50 (.431), a.s.V .32-.44 (.372), a.s.VI .11-.13 (.121) + .45-.62 (.567); cornicles .33-.49 (.407 \pm .01, n = 54), cauda .26-.33 (.293); hind tibiae 1.00-1.27 (1.10), hind ta-2 .13-.15 (.139), rostrum IV+V .14-.16 (.149 \pm .003, n = 29); mf .0242-.0462 (.0398, n = 50) and df-1 .0352-.0462 (.0422, n = 57). Proportions of a.s.III:IV:V, 1: .74-.92 (.83): .65-.88 (.72); VIu/VIb 3.75-5.27 (4.68); co/ca 1.17-1.57 (1.41 \pm .02, n = 52); rostrum IV+V/hind ta-2 .92-1.23 (1.08 \pm .03, n = 68). Number of sensoria on a.s.III 1-4 (2.34, n = 50); number of df setae 30-40 (35.00 \pm .93, n = 30).

Alate Viviparous Female: Unknown.

Sexuales: Unknown.

HOSTS.—*Artemisia vulgaris*, *Artemisia* sp.

DISTRIBUTION.—South central Wyoming.

TYPES.—Holotype, apt.v.f., Boysen, Wyoming,

13-IX-1941, GFK, on *Artemisia vulgaris*; in GFK coll. Paratypes (data like holotype except localities in Wyoming, and all but last on *A. vulgaris*): 5 apt.v.f. and 10 ny. of the same series as holotype; 15 apt.v.f. and 3 ny. from Bonneville; 11 apt.v.f. and 4 ny. from Wind River Canyon; 5 apt.v.f. from N. Riverton; and 21 apt.v.f. and 1 ny. from Wind River Canyon, on *Artemisia* sp. Paratypes in GFK, LACR, and U.Minn. collections.

Pleotrichophorus rusticatus (Knowlton and Smith)

FIGURES 153, 440-443

Capitophorus rusticatus Knowlton and Smith, 1937:150 [lectotype: apt.v.f., Yellowstone National Park, Wyoming, 17-VII-1936, GFK, on *Artemisia tridentata*; in GFK coll.]—Palmer, 1952:269-270.—Knowlton, 1954:9.

Pleotrichophorus rusticatus (Knowlton and Smith).—Hille Ris Lambers, 1969:180 [as a synonym of *P. pullus* (Gillette and Palmer)].

DIAGNOSIS.—*P. rusticatus* resembles *P. pullus* very closely in its long, needle-tipped rostrum IV+V, brown appendages, dense body cover of funnel-to fan-shaped setae and by its slender, triangular and acute-tipped cauda. It differs from it in having mf and lf setae never pointed; df setae, including the anterior pairs widely expanded and funnel-shaped; and by its smaller body size (1.13-1.60 mm, m = 1.36, n = 19 vs. 1.68-2.00 mm, m = 1.87, n = 6) and correspondingly shorter appendages and rostrum IV+V. Although it has recently been sunk as a synonym of *P. pullus* by Hille Ris Lambers (1969), *P. rusticatus* is retained as a good species on the basis of these setal characters which were found to be rather constant and easily recognizable. The occurrence of these species on host species peculiar to each, in addition to a common host, *Artemisia cana*, is suggestive of some biological distinctions that should be investigated.

DESCRIPTIONS.—*Apterous Viviparous Female*: Cleared specimen with very pale brown, membranous body; legs except for coxae and trochanters, anterior portions of fore femora and most tibiae dark brown; antennae dusky on margins of basal segment, darker brown from apices of segment 3 onward, remainder pale; distal 2 rostral segments, cornicles brown; anal and subgenital plates dusky. Body length 1.13-1.60 (1.36, n = 19), width across eyes .33-.42 (.369, n = 24) mm. Head with poorly developed laterofrontal tubercles; mesofrontal tu-

bercle produced to about same level; mf setae 2p with 1 sometimes added or missing, lf 2-3 on each side, vlf 1p, df 29-48 (32.26 ± 2.23 , $n = 23$), vf 6-10 (usually 6), pc 2p, ac 4-7, md 3-5 (usually 4) on each side; mf setae more or less triangular, without distinct stems, flaring gradually to 2 or 3 times basal diameter, lf similarly expanded but sometimes merely blunt, df setae funnel- to fan-shaped without distinct stems; ventral setae with pointed or blunt vf's and vlf's, remainder all pointed; mf setae .0154-.0462 (.0334, $n = 95$) and df-1 .0286-.0396 (.0327, $n = 43$) mm. Antennal segment I only slightly produced on inner distal margin, faintly imbricate, with 4-7 (usually 5) long pointed setae aside from smaller pointed one on

dorsum of segment. A.s.II with 1 - $\frac{1}{1}$ - 1 setae.

A.s.III faintly imbricate, with mostly pointed, rather long setae, longest subequal to basal diameter of segment; with 1-2 (1.2, $n = 44$) sensoria. A.s.IV and V subequal, about $\frac{3}{4}$ as long as a.s.III; a.s.VI with unguis averaging $4\frac{1}{2}$ times (3.44-5.25, $n = 35$) as long as its base.

Tergum smooth on disk, becoming finely imbricate-spiculate caudally; densely covered with short funnel- to fan-shaped setae. Cauda .11-.17 (.139, $n = 20$) mm long; tapering to acute tip, without noticeable basal constriction; spiculate; with 2 lateral pairs and 0-2 (usually 1) posterodorsal setae. Cornicles .20-.42 (.269, $n = 47$) mm long, $1\frac{1}{2}$ to $2\frac{1}{2}$ times length of cauda; cylindrical, widest at bases, slightly incrassate at apices; entirely dark, imbricate, armed with small blunt teeth. Legs with 3, 3, 3 hairs on first tarsal joints; hind tibiae .65-.83 (.698, $n = 35$) and hind ta-2 .11-.14 (.125, $n = 31$) mm long. Rostrum IV+V .14-.16 (.149, $n = 24$) mm long, 1 to $1\frac{1}{3}$ times ($1.19 \pm .27$, $n = 28$) as long as second hind tarsal joint; distal half produced into thin, cylindrical needle; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, ml and pl $\frac{1}{2}$ to $\frac{1}{2}$ length of al setae.

Measurements (in mm) of lectotype: BL 1.39, We 1.38; a.s.III both .32, a.s.IV .25 and .26, a.s.V .24 and .23, a.s.VI .13 + .46 (only 1 side complete); cornicles .35 and .34, cauda .16; hind tibiae .83 and .81, hind ta-2 .13 and .12, and rostrum IV+V .15 mm.

Alate Viviparous Female: Unknown.

Sexuales: Unknown.

Hosts.—*Artemisia cana*, *A. tridentata*, and *Artemisia* sp.

DISTRIBUTION.—Yellowstone National Park, Wyoming, and surrounding areas in Idaho and Montana.

TYPES (designated from slides marked "paratypes").—Lectotype, apt.v.f., specimen on left side of type-slide. Paralectotypes: 1 apt.v.f. with same data and mounted on same slide as lectotype (GFK coll.); 4 apt.v.f. with same data as lectotype (CFS coll.); 2 apt.v.f., Gallatin Valley, Montana, 16-VIII-1931, GFK, on *Artemisia* (EOE coll.); and 4 apt.v.f., Rexburg, Idaho, 14-VII-1936, GFK, on sage (OSU).

SPECIMENS EXAMINED.—Aside from types, 17 apt.v.f. and several nymphs, Wheatland, Wyoming, 9-IX-1948, GFK, on *Artemisia cana* (GFK coll.).

Pleotrichophorus spatulavillus (Knowlton and Smith)

FIGURES 156, 444-447

Capitophorus spatulavillus Knowlton and Smith, 1936b: 233-234 [lectotype: apt.v.f., Ash Creek, Washington Co., Utah, 25-IV-1935, CFS and GFK, on *Artemisia* sp., in USNM].—Palmer, 1952:271.

Pleotrichophorus spatulavillus (Knowlton and Smith).—Hille Ris Lambers, 1969:166.

DIAGNOSIS.—This species resembles *P. gnaphalodes* in having rather short cornicles and needle-tipped rostrum IV+V but differs in having a slightly smaller co/ca ratio ($.74 \pm .03$, $n = 10$ vs. $1.17 \pm .03$, $n = 125$) and shorter rostrum IV+V (.10 mm, $n = 5$ in summer apterae and .11-.12 mm, $m = .118$, $n = 4$ in fundatrices vs. .13-.16 mm, $m = .143$, $n = 74$). It is also similar to *P. patonkus* in the size of the cornicles (.14-.20 mm, $m = .165$, $n = 10$ and .14-.21 mm, $m = .173$, $n = 12$ for *P. spatulavillus* and *P. patonkus*, respectively) but has a slightly larger co/ca ratio ($.67 \pm .01$, $n = 12$ in *P. patonkus*) and fewer sensoria on a.s.III (1-2, $m = 1.40$, $n = 10$ vs. 2-6, $m = 4.4$, $n = 7$). It superficially resembles *P. parilis* and *P. patonkusellus* in the shape of the cauda, length of cornicles and moderately dense cover of funnel- to cone-shaped setae; but the needle-tipped last rostral segment (stout and slightly convex-sided in *P. parilis* and *P. patonkusellus*) is distinctive.

DESCRIPTION.—*Apterous Viviparous Female* (spring form, based on types): Color in life pale

green, appearing white due to numerous fan-shaped setae (original description); cleared specimen pale except tips of rostrum and tibiae, entire tarsi, and antennae from apices of a.s.V (a.s.IV-V may be dusky in some individuals). Body length 1.38-1.65 (1.55, n = 4), width across eyes .36-.42 (.369, n = 4). Head with rather well-developed latero- and mesofrontal tubercles; mf 1p with an unpaired one; lf 2 or 3 on each side, df 22-34 (29.5, n = 4), vf 6-8, pc 2p, ac 2 or 3, md 2-3 on each side; dorsal setae funnel-shaped, anterior ones with distinct stems, about $\frac{2}{3}$ entire length; posterior ones sessile or petiolate; ventral setae with vf blunt to slightly expanded, remainder pointed; mf .0330-.0462 (.0409, n = 10) and df-1 .0396-.0528 (.0475, n = 7) mm long. Antennal segment I moderately produced mesodistally, faintly imbricate, with 5-7 blunt setae in addition to basal pointed one on

dorsum; a.s.II with basically 1 — 1 blunt setae,

but dorsal seta may be present. A.s.III imbricate; with small, rod-shaped setae, longest less than $\frac{1}{2}$ basal diameter of segment; with 1 sensorium. A.s.IV $\frac{3}{4}$ to subequal and a.s.V $\frac{2}{3}$ to $\frac{3}{4}$ a.s.III in length; length of unguis $3\frac{1}{2}$ to 4 times (3.76, n = 4) base of a.s.VI.

Dorsal body integument smooth on disk, becoming spiculate posteriorly; with moderately dense cover of funnel- or cone-shaped setae, without distinct stems. Cauda elongate, constricted on basal $\frac{1}{4}$ to $\frac{1}{3}$, apex acutely or broadly rounded; .19-.24 (.22, n = 4) mm long; spiculate; with 2 pairs lateral and 1 posterodorsal setae. Cornicles .15-.25 (.185, n = 8) mm long, $\frac{3}{4}$ to equal (.82, n = 8) cauda in length. Legs with 3, 3, 3 hairs on first tarsal joints; hind tibiae .79-.91 (.88, n = 5) and hind ta-2 .11-.12 (.114, n = 5) mm long. Rostrum IV+V .11-.12 (.118) mm long, subequal in length to second hind tarsal joint; rather slender at base, apical $\frac{1}{3}$ produced into stoutly cylindrical needle; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, ml and pl $\frac{1}{3}$ to $\frac{1}{2}$ al setae in size.

Apterous Viviparous Female: Very much like spring form except for presence of more df setae (31-44, m = 37.80 ± 5.91 , n = 5), shorter rostrum IV+V, and longer unguis.

Measurements (in mm) of 5 specimens: BL 1.30-1.58 (1.45), We .35-.38 (.364); a.s.III .38-.47 (.428), a.s.IV .27-.34 (.307), a.s.V .25-.34 (.309),

a.s.VI .10-.12 (.11) + .73-.78 (.76); cornicles .14-.20 (.165), cauda .19-.24 (.222); hind tibiae .83-1.0 (.92), hind ta-2 .11-.12 (.116), rostrum .10; mf .0242-.0506 (.0402) and df-1 .0352-.0440 (.0396). Proportions of a.s.III:IV:V, 1: .66-.74 (.72): .64-.89 (.73); VIu/VIb 6.08-7.4 (6.68); co/ca .68-.78 (.74 \pm .03, n = 10); and rostrum IV+V/hind ta-2 .83-.91 (.85 \pm .03, n = 9). Number of sensoria on a.s.III 1-2 (1.4).

HOSTS.—*Artemisia tridentata* (Knowlton and Smith, 1936b) and *Artemisia* sp.

DISTRIBUTION.—Collection records include widely separated localities in southeastern corner of Utah (Ash Creek, Washington Co.), Utah-Idaho border (Garden City, Utah, and Mink Creek, Idaho) and Dry Lake, Utah.

TYPES (designated from "type"-slide).—Lectotype, apt.v.f. on center of type-slide; paralectotypes, 3 apt.v.f. and 1 apt.ny. bearing same data and mounted on same slide as lectotype.

SPECIMENS EXAMINED.—Aside from types, 6 apt. v.f., Garden City, Utah. 15-VIII-1959, JOP, on *Artemisia* (JOP coll.).

Plectrichophorus sporadicus (Knowlton)

FIGURES 135, 197-203

Macrosiphum sporadicum Knowlton, 1935b:135-136 [types: 1 al.v.f., 3 apt.v.f., 1 apt.ny., on *Chrysothamnus nauseosus*, Brigham Canyon, Utah, 21 July 1928, GFK coll.].—Knowlton and Smith, 1936c:213; 1937:272.

Capitophorus sporadicus (Knowlton).—Palmer, 1952:271-272.
Plectrichophorus sporadicus (Knowlton).—Hille Ris Lambers, 1969:166.

DIAGNOSIS.—*P. sporadicus* is distinguished by a combination of large body size (2.11-3.27, m = 2.63, n = 34), the presence of few ($8.69 \pm .32$, n = 39), pointed to blunt-tipped df setae; a mixture of pointed to rod-, bell-, and funnel-shaped and basally inflated dorsal body setae; entirely dark antennal flagellum, with only apical half of cornicles dark; and the presence of numerous (5-8, m = 6.2 pairs, n = 33) lateral caudal setae.

DESCRIPTION.—*Apterous Viviparous Female:* In life, apple-green, with hoary, grayish pruinose covering (Knowlton, 1935:135); cleared specimens with pale body; apices of rostrum and tibiae, antennae from near bases of a.s.III, apical $\frac{1}{2}$ to $\frac{2}{3}$ of cornicles, entire tarsi dark brown; basal two antennal segments, ventral head sclerites, rostral segment 3 and apices of femora lighter brown or

dusky. Body large, 2.11–3.27 (2.63, $n = 33$) mm or up to 4.1 mm (Knowlton, 1935b:135) long; width across the eyes .52–.63 (.569, $n = 38$) mm. Head with well-developed laterofrontal and rather low mesofrontal tubercles; mf 1p but one may be added, lf 2–3 on each side, vlf 1p, df 6–11 ($8.69 \pm .32$, $n = 39$), vf 7–13 (usually 9 or 10), pc usually 2p, ac 4 to 6, md 2–5 (usually 3) on each side; all head setae elongate, with pointed or blunt tips, bases sometimes inflated, dorsal ones subequally long, with mf .0440–.0770 (.0572, $n = 89$), df–1 .0440–.0704 (.0560, $n = 68$) mm in length. Antennal segment I slightly produced mesodistally, almost smooth; with 9–14 long pointed or blunt-tipped setae in addition to small, basal pointed one on

dorsum. A.s.II with usually $1 - \frac{2}{2} - 1$ pointed or

blunt setae. A.s.III setae also like preceding segments, largest ones about as long as basal diameter of segment; with 3–8 (4.42, $n = 67$) sensoria. A.s.IV averaging 1.2 and a.s.V .8 times as long as a.s.III; unguis averaging $6\frac{3}{4}$ times (range of 5.67–7.54, $n = 7$) length of base of a.s.VI.

Dorsal body integument smooth with very faint striae and spicules on caudal abdominal segments; dusky pleural intersegmental patches present on disk of body (faded in cleared paratype drawn, Figure 199); covered with moderately sparse setae consisting of mixture of various shapes: elongate setae with pointed or blunt tips; elongate ones inflated on basal $\frac{1}{3}$ or $\frac{1}{2}$ and tapering to blunt or slightly knobbed tips; triangular or funnel-shaped setae; and almost bell-shaped setae. Cauda stoutly elongate, very slightly narrowed, with rounded apex; spiculate; with 5–8 (6.18, $n = 72$) lateral pairs and 1–5 (2.58, $n = 36$) posterodorsal setae. Cornicles .61–1.07 (.789, $n = 70$) as long as cauda; cylindrical, widest near base, thinnest about middle, slightly incrassate on distal $\frac{1}{5}$; imbricate on darkened distal portion with imbrications mostly smooth or sometimes armed with small teeth. Legs with 3, 3, 3 setae on first tarsal joints. Rostrum IV+V tapering to acute tip; .11–.12 (.113, $n = 39$) mm long, about $\frac{3}{4}$ (.73 \pm .04, $n = 54$) second hind tarsal segment in length; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, al about twice as long as ml and pl setae.

Measurements (in mm) of 15 paratypes: BL 2.25–3.10 (2.73), We .56–.63 (.59); a.s.III .83–.93

(.892), a.s.IV .86–1.0 (.948), a.s.V .65–.81 (.729), a.s.VI all incomplete; cornicles .81–1.0 (.910), cauda .42–.50 (.469); hind tibiae 1.90–2.23 (2.08), hind ta–2 .14–.17 (.156), and rostrum IV+V .11–.12 (.113). Proportions of a.s.III:IV:V, 1: .98–1.16 (1.07): .74–.92 (.83); co/ca 1.58–2.11 (1.90), rostrum IV+V/hind ta–2 .50–.80 (.73).

Alate Viviparous Female: Head and prothorax pale brown, faintly sclerotic; mesothorax darker brown; abdomen pale, membranous, with 2 large transverse intersegmental pleural bars on segments 1–6 (broken into two oval ones on each side of abd.s. 7), 2 small indistinct oval or dashlike spinal sclerites and marginal thickenings on abd.s. 1 to 7; antennae with basal 2 segments brown, flagellum blackish (Knowlton, 1935b:135); legs brown from about distal $\frac{1}{3}$ of femora but apices of tibiae and entire tarsi much darker; wings with anterior margins dusky, veins light brown; rostrum with apices dark brown, cornicles brown from near bases. Morphologically much like apterous vivipara, differing in shorter head setae (mf .0396–.0440 and df–1 .0462–.0484 mm long), presence of more sensoria on a.s.III (9–17 according to original description) and relatively shorter cornicles (.67–.69 mm).

Measurements (in mm) given in original description by Knowlton (1935b:135): BL 2.0–2.03, a.s.III .81–.88, a.s.IV .82–1.0, a.s.V .74–.80, a.s.VI .13–.50, and cornicles .63–.71.

Oviparous Females: Similar to apterous vivipara, except as follows: body setae more dominantly of the elongate, pointed or blunt-tipped type; cauda and cornicles relatively shorter; subgenital plate more densely hairy; and basal $\frac{1}{2}$ of hind tibiae swollen, bearing numerous pseudosensoria.

Measurements (in mm) of 3 specimens: BL 2.53–2.58 (2.55), We .52–.58 (.557); a.s.III .80–.86 (.82), a.s.IV .75–.83 (.80), a.s.V .63–.77 (.694), a.s.VI .14–.15 (.142) + .93–1.09 (.992); cornicles .65–.69 (.665), cauda .35–.37 (.357); hind tibiae 1.67–1.84 (1.76), hind ta–2 .14–.15 (.148), rostrum IV+V .11, and df–1 .0506–.0660 (.0554). Proportions of a.s. III:IV:V, 1: .94–1.0 (.97): .79–.90 (.84); VIu/VIb 6.64–7.36 (6.97); co/ca 1.78–1.97 (1.87); rostrum IV+V/hind ta–2 .73–.79 (.74). Number of sensoria on a.s.III 2–7 (4.0); df setae 8–9 (8.33); lateral caudal setae 6–9 (7.67), posterodorsal caudal setae 2–4 (3.3).

HOSTS.—*Chrysothamnus nauseosus*, *Chrysothamnus* sp.

DISTRIBUTION.—The type-locality, Brigham Canyon below Mantua in Boxelder Co., Utah, was indicated by Knowlton (1935b:135–136) in his original description of *P. sporadicus*. A type-specimen has yet to be fixed from this collection which includes a series. Several paratype slides (containing many specimens each) were found in both G.F. Knowlton's and E.O. Essig's collections. One slide contains specimens from Brigham Canyon, but the label does not match the published data.

SPECIMENS EXAMINED.—“Paratypes” (all collected by G.F. Knowlton, on *Chrysothamnus nauseosus*): 2 apt.v.f., Brigham, Utah, 11–X–1927 (GFK coll.); 4 apt.v.f. and 1 apt.ny., Brigham Canyon, Utah, 13–IX–1927 (EOE coll.); 4 apt.v.f. and 1 apt.ny., Cedar Valley, Utah, 13–VI–1935 (EOE coll.); 8 apt.v.f. and 2 apt.ny., Harper, Utah, 7–IX–1928 (GFK coll.), and 3 apt.v.f. and 3 apt.ny., Preston, Idaho, 10–IX–1927 (GFK coll.).

OTHER SPECIMENS SEEN.—CALIFORNIA: Tehachapi Pass, Kern Co., 16 apt.v.f., 19–VI–1947, J.W. MacSwain, on unknown host (EOE coll.). UTAH (all collected by GFK): Cedar Valley, 4 apt.v.f., 13–VI–1935, on *C. nauseosus* (EOE coll.); N. Cove Fort, 2 apt.v.f. and 1 al.v.f. (GFK coll.), and 3 apt.v.f. (EOE coll.), 8–VIII–1956, on *C. nauseosus*; Farmington, 1 apt.v.f. and 3 ovip.f., 12–X–1966, on *C. nauseosus* (LACR coll.); Kanosh, 2 apt.v.f., 3–X–1956, on *Chrysothamnus* sp. (EOE coll.); Pine Valley, 1 apt.v.f., 20–VIII–1968 on *C. nauseosus* (LACR coll.); and Topaz Mt., 1 apt.v.f., 15–VII–1968, on *C. nauseosus* (LACR coll.).

***Pleotrichophorus stroudi* (Knowlton),
new combination**

FIGURES 131, 248–251

Capitophorus stroudi Knowlton, 1948:121–122 [lectotype: apt.v.f., White Sands National Monument, Otero Co., New Mexico, 20–VI–1948, C.F. Stroud, from Sweepings of “brush”; in GFK coll.].

DIAGNOSIS.—This species resembles *P. packi brevis* and *P. palmerae* in having *co/ca* ratio of about $1\frac{3}{4}$ and an acutely pointed last rostral segment averaging about .11 mm in length. It can be distinguished from the first species by having uniformly funnel-shaped or widely expanded dorso-

frontal setae, by the presence of more *df* setae (19.67 ± 5.36 , $n = 3$ vs. 13.20 ± 2.39 , $n = 5$), fewer lateral caudal setae (3–5, $m = 3.5$, $n = 6$ vs. 4–6, $m = 5.1$, $n = 10$), denser body setae, and by having the cornicles almost entirely dark instead of only the distal $\frac{1}{2}$. It differs from the latter in its dark cornicles (only extreme apices dusky or pale brown in *P. palmerae*), greater member of lateral caudal hairs (only 2 pairs in *P. palmerae*), the relatively fewer *df* ($23.74 \pm .09$, $n = 43$ in *P. palmerae*), and sparser body setae.

DESCRIPTION.—*Apterous Viviparous Female* (based on lectotype and 2 paralectotypes): Cleared specimens pale but antennae from near bases of a.s.III, tip of rostrum, entire tarsi and cornicles from basal $\frac{1}{5}$ dark brown. Body 2.0–2.28 (2.18, $n = 3$) mm long, width across eyes .46–.48 (.47). Head with moderately developed mesofrontal and laterofrontal tubercles; *mf* 1p, *lf* 2–3 on each side, *vlf* 1p, *df* 17–22 (19.67 ± 5.36 , $n = 3$), *vf* 7–10 (usually 8–9), *pc* 2p, *ac* 4, *md* 3–5 on each lobe; dorsal setae basically funnel-shaped but with anterior slightly less expanded than posterior ones; ventral setae elongate, with knobbed or blunt apices; *mf* .0264–.0330 (.0303, $n = 4$), and *df*–1 .0286–.0396 (.0319, $n = 6$) mm long. Antennal segment I with slight mesodistal projection, faintly imbricate, with 10–12 blunt to knobbed setae in addition to pointed one on dorsum of segment.

$\frac{1}{2}$
A.s.II with 1 — 1 blunt to knobbed setae, long-
 $\frac{2}{2}$
est about $\frac{2}{3}$ basal diameter of segment; with 3–6 (4.6, $n = 5$) sensoria. A.s.IV and V subequally as long as a.s.III; a.s.VI with unguis $\frac{6}{4}$ to 7 (6.52, $n = 4$) times as long as its base.

Dorsal body integument very finely striate, smooth on disk but becoming finely spiculate caudally; dorsal setae moderately dense, funnel-shaped. Cauda elongate, with slight basal constriction, apex acute; .35–.37 (.36, $n = 3$) mm long; spiculate; with 3–5 (3.5, $n = 6$) setae on each side, 4 setae on posterodorsal surface. Cornicles .56–.74 (.650, $n = 6$) mm long, 1.60–2.06 ($1.81 \pm .19$, $n = 6$) times as long as cauda; cylindrical, with slight basal and apical thickenings; imbricate, imbrications smooth apically, finely spiculate proximally. Legs with 3, 3, 3 setae on first tarsal joints; hind tibiae .93–1.18 (1.11, $n = 4$) and hind ta–2 .12–.14 (.133, $n = 4$) mm long. Rostrum IV+V rather

slender at base, tapering to acute point; .10-.11 (.105, $n = 3$) mm long, .71-.88 ($.78 \pm .12$, $n = 4$) times length of second hind tarsal joint; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, al only slightly or not distinctly longer than ml and pl setae.

Alate Viviparous Female: Not seen. Knowlton (1948:122) gives the following measurements in his original description: BL 2.13, We .52, cornicles .50, cauda .35, and rostrum IV+V .106 mm. Number of sensoria 21 or more, and lateral caudal hairs 3 or 4.

Sexuales: Unknown.

Host.—“Brush”; according to Knowlton (1948:121) this plant is doubtless, *Chrysothamnus nauseosus* var. *latis quameus*.

DISTRIBUTION.—White Sands National Monument, Otero Co., New Mexico.

Types (designated from a “paratype” slide).—Lectotype, specimen at 6:00 o'clock on type-slide; and paralectotypes, 2 apt.v.f. and 1 altd. ny. with the same data and mounted on same slide as lectotype.

Pleotrichophorus triangulatus, new species

FIGURES 126, 180-183

DIAGNOSIS.—This species is distinctive with its short (.08 mm), basally broad, acutely pointed rostrum IV+V and short (.09-.11 mm) cornicles that are about $\frac{1}{3}$ the cauda in length. It resembles *P. patonkusellus* in the number of df setae (36, $m = 34.89 \pm 2.45$, $n = 18$ in said species) and the dense widely expanded funnel- to fan-shaped body setae; but differs in the shape and size of rostrum IV+V (.09-.11 mm, $m = .100$, $n = 33$ and slightly convex-sided in *P. patonkusellus*), and in having a relatively smaller co/ca ratio (.36-.44, $n = 2$ vs. $.80 \pm .03$, $n = 33$ in *P. patonkusellus*).

DESCRIPTION.—*Apterous Viviparous Female* (based on a single female, the holotype): Color in life green (collection data); cleared and stained specimen with pale body, apex of rostrum, antennae from tips of a.s.V and entire tarsi brown. Body length 1.70, width across eyes .43 mm. Head with rather poorly developed mesofrontal and laterofrontal tubercles; mf 3, lf 2 on each side, vlf 1p, df 36, vf 6, pc 2p, md obscured by legs, ac 4; dorsal setae widely expanded, funnel- to fan-shaped,

anterior ones slightly longer, more distinctly petiolate than posterior ones; ventral setae with vf and vlf shaped like df's, remainder attenuate; mf .0286-.0352 and df-1 both .0330 mm long. Antennal segment I weakly produced mesodistally, faintly imbricate, bearing 7 blunt or slightly knobbed setae in addition to usual pointed one on dorsum. A.S.II

with 1 $\frac{1}{2}$ - 1 setae. A.s.III .40 mm long; with 2

short, blunt or knobbed setae, longest about $\frac{1}{3}$ basal diameter of segment; with 1 small sensorium. A.s.IV and V subequal (.31 and .30 mm, respectively), about $\frac{3}{4}$ length of a.s.III; a.s.VI with unguis (.50 mm) slightly less than 4 times base (.13 mm) in length.

Dorsal body integument finely striate, minutely spiculate; but spicules becoming more conspicuous caudally; setae rather dense, funnel- to fan-shaped, without distinct stems (Figure 183). Cauda .35 mm long, stoutly elongate, without noticeable basal constriction, broadly rounded at apex; spiculate; with 2 lateral pairs and 2 posterodorsal setae. Cornicles .09 and .11 mm long, about $\frac{1}{3}$ as long as cauda; cylindrical, almost uniform in diameter; imbricate-spiculate, spicules rather small, sharply pointed, contiguous. Legs with 3, 3, 3 hairs on first tarsal joints (counts from nymphal paratypes); hind tibiae and hind tarsi missing. Rostrum IV+V .08 mm long, about .07 mm wide at base, tapering to acute tip, with sides straight, thus appearing triangular.

Alate Viviparous Female: Unknown.

Sexuales: Unknown.

Host.—*Agoseris* sp.

DISTRIBUTION.—California, Eldorado Co.

Types.—Holotype: apt.v.f., Kit Carson Camp, Eldorado Co., California, 18-VIII-1931, on *Agoseris* sp. Paratypes: 3 apt.ny. with same data and mounted on same slide as holotype. Types in EOE collection.

Pleotrichophorus utensis (Pack and Knowlton)

FIGURES 123, 165-167

Capitophorus utensis Pack and Knowlton, 1929:201 [type: apt.v.f., Loa, Utah, 26-VI-1926, GFK, on *Gutierrezia longifolia*; in USNM].

Capitophorus utensis Pack and Knowlton.—Knowlton and Smith, 1936a:112.

Capitophorus utahensis [sic] Pack and Knowlton.—Knowlton and Smith, 1937:152 [misspelling].

Capitophorus utensis Pack and Knowlton.—Palmer, 1952:272 [emendation].

Pleotrichophorus utensis (Knowlton and Pack) [sic].—Hille Ris Lambers, 1969:167–179 [Knowlton consistently mistaken as senior author].

Capitophorus magnautensis Knowlton and Smith.—Knowlton, 1954:8 [in part; specimens recorded from Sisters, Oregon seen and determined as *P. utensis* rather than *P. magnautensis*].

DIAGNOSIS.—This species is distinctive in the combination of the following characters: a short, stout, blunt-tipped rostrum IV+V that is about $\frac{2}{3}$ ($m = .67 \pm .02$, $n = 23$) the length of hind ta-2; a rather small co/ca ratio ($1.37 \pm .05$, $n = 35$); entirely dark cornicles; the presence of few df setae ($8.05 \pm .002$, $n = 19$), and relatively sparse body setae; and the presence of 1 or 2 flattened posterodorsal caudal setae. It may be mistaken for *P. pycnorhysus* especially where spinopleural abdominal papillae are poorly developed but the shape of its posterodorsal caudal setae and the shorter and entirely dark (only apices dusky in *P. pycnorhysus*) cornicles are distinctive. Its differences from *P. acanthovillus* are described under that species.

DESCRIPTION.—*Apterous Viviparous Female:* Color in life green (Pack and Knowlton, 1929: 201); cleared specimens pale with tips of rostrum and tibiae, entire tarsi and cornicles and antennae from near bases of a.s.III brown. Body 1.55–2.18 (1.80, $n = 17$) mm long, .45–.53 (.490, $n = 19$) mm wide across the eyes. Head with poorly developed frontal tubercles; mf 1p, lf 1–3 (usually 2) on each side, vlf 1p, df 7–9 ($8.05 \pm .002$, $n = 19$), vf 6–11 (usually 8), pc 2p, ac 4 or 5, md 3–4 (usually 3) on each side; dorsal setae rather small, slightly expanded apically, ventral setae more elongate, knobbed or pointed; mf .0088–.0220 (.0140, $n = 19$), and df-1 .0110–.0242 (.0191, $n = 37$) mm long. Antennal segment I produced mesodistally, smooth, and with 6–14 (usually 11) blunt or knobbed setae in addition to basal pointed one on dorsum. A.s.II

with usually 1 — 1 blunt or knobbed setae. A.s.

III with short knobbed setae, longest about $\frac{1}{2}$ basal diameter of segment; with 1–9 (3.33, $n = 33$) sensoria. A.s.IV and a.s.V subequal, $\frac{2}{3}$ to $\frac{3}{4}$ length of a.s.III; a.s.VI with unguis averaging $4\frac{1}{4}$ times (range of $3\frac{1}{2}$ to 5, $n = 26$) as long as base.

Dorsal body integument rather smooth on disk, becoming striate-spiculate caudally; usually uniformly flattened but spino-pleural thickenings on papillae may be sometimes present on posterior segments; setae small, funnel- to fan-shaped, sparse, with 2 or 3 setae in spinal and pleural areas, more variable numbers on sides. Cauda elongate, with slight basal constriction, rounded apex; spiculate; with 2 lateral pairs of pointed setae, 0–2 (1.17, $n = 18$) expanded posterodorsal setae. Cornicles .31–.47 (.389, $n = 37$) mm long, 1.13–1.63 ($1.37 \pm .05$, $n = 35$) times as long as cauda; cylindrical, widest at apex; faintly imbricate-spiculate, dark brown from near bases. Legs with 3, 3, 3 setae on first tarsal joints. Rostrum IV+V short, robust, blunt at apex; .09–.10 (.092, $n = 20$) mm long, averaging $\frac{2}{3}$ ($.67 \pm .02$, $n = 23$, range of .60–.75) times as long as second hind tarsal joint; with 1 basal, 2 dorsal, and 3 lateral pairs of subequally long setae.

Measurements (in mm) of 10 specimens on *Gutierrezia*: BL 1.55–1.95 (1.71), We .45–.53 (.486); a.s.III .48–.64 (.552), a.s.IV .36–.50 (.433), a.s.V .34–.43 (.390), a.s.VI .11–.15 (.134) + .47–.62 (.559); cornicles .31–.40 (.368), cauda .24–.30 (.271); hind tibiae .91–1.11 (1.00), hind ta-2 .12–.15 (.134), and rostrum IV+V .09–.095 (.091). Proportions of a.s.III:IV:V, 1: .72–.88 (.79): .67–.75 (.71); VIu/VIb 3.64–5.09 (4.20); co/ca 1.13–1.63 (1.34), rostrum IV+V/hind ta-2 .60–.75 (.68).

Alate Viviparous Female: Not known.

Sexuales: Not known.

HOSTS.—*Chrysothamnus viscidiflorus* (subsp. *stenophyllus*, according to Palmer, 1952:272), *Gutierrezia longifolia*, *G. sarothrae*, and *Gutierrezia* sp.

DISTRIBUTION.—*P. utensis* has been collected from many localities in southern Utah and sporadic records exist from northern Utah, also Idaho and Oregon.

TYPES.—The original type-series from Loa, Utah, was unavailable at the time this research was completed. A lectotype has not been selected.

SPECIMENS EXAMINED.—All collected by GFK from: OREGON: Sisters, 4 apt.v.f., 24–VIII–1944, on *Chrysothamnus viscidiflorus* (GFK coll.). UTAH: Bicknell, 4 apt.v.f., 21–VI–1955, on *Gutierrezia* (EOE coll.); Grouse Creek, 3 apt.v.f., 13–VIII–1932, on *C. viscidiflorus* (USNM); Nioche, 4 apt.v.f., 24–VIII–1944, on *C. viscidiflorus* (GFK coll.); 10 mi W of Snowville, 6 apt.v.f., 7–VI–1930, on

Gutierrezia (USNM); and Wild Cat Canyon, Beaver Co., 2 apt.v.f., 8-VIII-1936, on *C. viscidiflorus* (EOE coll.).

***Pleotrichophorus wasatchii* (Knowlton)**

FIGURES 140, 348-350

Capitophorus wasatchii Knowlton, 1927:238 [lectotype: apt. v.f., Honeyville, Utah, 10-IX-1925, GFK, on *Chrysothamnus*; in USNM]; 1948:123; 1954:9.—Gillette and Palmer, 1934:157-158 [in part].—Knowlton and Smith, 1936a:112 [in part].—Palmer, 1952:273 [in part].

?*Capitophorus wasatchii* Knowlton.—Kring 1955:65.—Leonard, 1959:12 [identity doubtful].

Pleotrichophorus wasatchii (Knowlton).—Hille Ris Lambers, 1953:115; 1969:169, 172, 180.

DIAGNOSIS.—*P. wasatchii* can be distinguished from the closely related *P. ambrosiae* and *P. ohioensis* by a combination of sharply acute rostrum IV+V; short, widely expanded and sessile head and body setae; and the presence of 1-3 sensoria on antennal segment 3. It resembles *P. diutius* in the shape of the setae and the presence of few sensoria but it differs in the shape of the last rostral segment (rather bluntly pointed and slightly convex-sided in that species), the presence of relatively fewer df setae ($26.83 \pm .29$, $n = 6$ vs. $17.84 \pm .98$, $n = 19$) and in having a smaller co/ca ratio ($1.30 \pm .04$, $n = 14$ vs. $1.78 \pm .04$, $n = 34$).

DESCRIPTION.—*Apterous Viviparous Female*: Color in life greenish with a pruinose covering (Knowlton, 1927:238); cleared specimen pale with apices of a.s.IV and V, entire a.s.VI, apices of rostrum, tibiae and entire tarsi brown. Body length 1.65-2.10 (1.89, $n = 7$), width across the eyes .42-.46 (.444, $n = 7$) mm. Laterofrontal and mesofrontal tubercles of head moderately developed; mf 1 or 2p, lf 2 or 3 on each side, df 23-30 ($26.83 \pm .29$, $n = 6$), vf 8-10, vlf 1p, pc 2p, md 3p, ac 4 to 6; dorsal setae cone- or fan-shaped, flaring widely from base, without distinct stems; ventral setae with vf and pc also expanded but less so, ac and pc blunt or slightly knobbed at apices; mf .0264-.0330 (.0289, $n = 17$), df-1 .0330-.0396 (.0358, $n = 14$) mm long. Antennal segment I moderately produced on inner distal margin, faintly imbricate, bearing 6-9 knobbed setae aside from usual pointed

one on dorsum. A.s.II with $1 - \frac{1}{2} - 1$ knobbed

setae. A.s.III with 1-3 (2.31, $n = 13$) sensoria. A.s.IV and V slightly shorter or equal to a.s.III in length; a.s.VI with unguis averaging $5\frac{1}{2}$ times (range = 4.47-6.38, $n = 10$) as long as its base.

Dorsal body setae of similar shape and size to those of head. Cauda .26-.31 (.289, $n = 7$) mm long; elongate, slightly constricted on basal $\frac{1}{3}$, apex broadly rounded; spiculate; with 2 lateral pairs, 1 posterodorsal setae. Cornicles .34-.40 (.374, $n = 14$) mm long, about $1\frac{1}{4}$ times (range = 1.17-1.38, $m = 1.30 \pm .04$, $n = 14$) length of cauda; cylindrical with bases slightly incassate; imbricate, wrinkled, with small, blunt spicules; extreme apices dusky. Legs with 3, 3, 3 hairs on first tarsal joints; hind tibiae 1.17-1.28 (1.22, $n = 12$), hind ta-2 .13-.15 (.144, $n = 12$) mm long. Rostrum IV+V .115-.13 (.121, $n = 7$) mm long, $\frac{3}{4}$ to equal ($m = .83 \pm .05$, $n = 10$) hind ta-2 in length; tapering gradually to sharply pointed distal $\frac{1}{3}$; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, al about 3 times as long as ml and pl setae.

Measurements (in mm) of lectotype: BL 2.0, We .46; a.s.III both .49, a.s.IV .46 and .49, a.s.V .42 and .40, a.s.VI .14 + .82 and .15 + .78; cornicles .37 and .40, cauda .29, hind tibiae 1.23 and 1.26, hind ta-2 both .15, and rostrum IV+V .12.

Alate Viviparous Female: Unknown.

Sexuales: Unknown.

HOST.—*Chrysothamnus nauseosus* var. *graveoleus* and *Chrysothamnus* sp.

DISTRIBUTION.—Aside from type-locality, Knowlton (1927:238) lists Amalga and Madsen, Utah, in the original description. Other records on *Chrysothamnus* include Moses Lake, Washington, and possibly also from Colorado (Knowlton and Smith, 1936a:112; Gillette and Palmer, 1934:158).

TYPES (designated from fairly cleared, not remounted specimens).—Lectotype: apt.v.f. with data indicated above; inner specimen at about 8:00 o'clock of type-slide. Paralectotypes: 6 apt.v.f., 6 apt.ny., and 2 altd.ny. with same data and mounted on same slide as lectotype.

SPECIMENS EXAMINED.—Only the types.

NOTES.—*P. wasatchii* has been consistently recorded by Knowlton (1927:238, 1948:123, 1954:9) on *Chrysothamnus*. However, Gillette and Palmer (1934:158) and Palmer (1952:273) failed to distinguish *Chrysothamnus*-collected specimens from those of related species on *Artemisia dracunculus*

(*A. aromatica*), *Ambrosia* (e.g., *A. artemisiifolia*) and other hosts (see below). Knowlton and Smith (1936a) detected differences between their Utah material on *Chrysothamnus* and those of Gillette and Palmer from Colorado (probably on a mixture of host genera) with regards to pigmentation of antenna; however they failed to see the more constant differences in the shapes of dorsal setae and the last rostral segment. Consequently, *P. wasatchii*, up to recently, was made a "catch-all" for all *Pleotrichophorus* species with "acute" rostrum IV+V and intermediate-sized (.30-.50 mm) cornicles. Hille Ris Lambers (1969:172) recognized these setal and rostral differences and in addition, differences in the numbers of sensoria on a.s.III among forms on *Ambrosia*, *Artemisia dracuncululus*, and *Chrysothamnus*. Accordingly, he erected a new species for the first (*P. ambrosiae*), retained *P. wasatchii* for the third, and indicated that he suspected the second to be an undescribed species (*P. diutius*, new species). This was found an easily recognizable division and the relationship is adopted here.

Specimens on *Ambrosia* from Colorado are much like the *A. artemisiifolia* material from Pennsylvania except that the anterior head setae (mf, lf, and anterior df's) tend to be more narrowly expanded and the cornicles are slightly shorter. The same is true of specimens on *Franseria discolor* from the same area (Colorado); Palmer thought these specimens to be a new species, and so indicated on her slide labels. Both these *Ambrosia* and *Franseria* collections are determined here as *P. ambrosiae*.

A fourth form on *Helianthus* (*P. ohioensis*) is likely to be confused also with the above-named species, especially *P. ambrosiae*, but is considered to be distinct for the reasons mentioned in the discussion of *P. ohioensis*.

Specimens recorded by Gillette and Palmer's (1934) and Palmer's (1952) records on *Gaertneria tomentosa* are probably similar to those on *Franseria* (*Gaertneria* is considered a synonym of *Franseria* in Fernald, 1950, *Gray's Manual of Botany*). However, their specimen recorded on *Liatris* (family Compositae, subfamily Tubuliflorae, tribe Eupatoriaceae) or *Lacinaria* (a synonym of *Liatris*, according to Fernald, 1950) and on *Mentzelia* (family Loasaceae) should be reexamined for more accurate identification.

***Pleotrichophorus xerozoous* (Knowlton and Smith),
new combination**

FIGURES 127, 187-189, 190 (right)

Capitophorus xerozoous Knowlton and Smith, 1936a:112-113 [lectotype: apt.v.f., Milford, Utah, 22-IX-1928, on *Chrysothamnus parryi*, in USNM].

Pleotrichophorus xerozoous (Knowlton and Smith).—Hille Ris Lambers, 1969:167 [as a synonym of *P. gregarius* (Knowlton)].

?*Capitophorus gregarius* Knowlton.—Palmer, 1952:274 [in part].

DIAGNOSIS.—*P. xerozoous* very closely resembles *P. gregarius* in the presence of spinopleural papillae on the tergum, the number of df setae (15.10 ± 1.59 , $n = 10$ and $16.28 \pm .28$, $n = 98$, respectively), the rather stoutly cylindrical, slightly thickened and distally dark cornicles, and similar co/ca ratios ($1.42 \pm .08$, $n = 18$ and $1.61 \pm .10$, $n = 100$). It differs most conspicuously from this species, however, in its stouter, abruptly tapered and shorter (.09 mm, $n = 7$ vs. .10-.12 mm, $m = .109$, $n = 95$) rostrum IV+V and by having a smaller ratio of this last rostral segment to the second joint of the hind tarsi ($.62 \pm .03$, $n = 7$ vs. $.79 \pm .02$, $n = 100$). The shorter, more widely expanded and more uniformly sessile head and body setae (Figures 185-187, 190), shorter mf (.0198-.0308, $m = .0269$, $n = 21$ vs. .0176-.0462, $m = .0362$, $n = 194$) and df-1 setae (.0242-.0330, $m = .0286$, $n = 20$ vs. .0220-.0484, $m = .0372$, $n = 195$) and the presence of relatively fewer sensoria on a.s.III (1-3, $m = 1.78$, $n = 18$ vs. 2-9, $m = 4.72$, $n = 185$) are added differences (see notes below).

DESCRIPTION.—*Apterous Viviparous Female* (spring form): Resembles summer vivipara in all respects but has much shorter unguis of a.s.VI. Measurements (in mm) of 2 paralectotypes: BL both 1.90, We .47 and .46; a.s.III .49-.53 (.50), a.s.IV .28-.29 (.283), a.s.V .33-.35 (.34), a.s.VI .13-.15 (.143) + .40-.41 (.403); cornicles .37-.38 (.373), cauda .27 and .26; hind tibiae .87-.90 (.88), hind ta-2 .12-.13 (.123), rostrum IV+V .09; mf .0242-.0264 (.0252) and df-1 .0264-.0286 (.0275). Number of sensoria on a.s.III all 1; df setae 12 and 13; lateral caudal setae all 4, posterodorsal caudal setae both 2.

Apterous Viviparous Female: (summer form): Color in life green (original description); cleared specimen pale with tips of a.s.III, IV, V, rostrum,

tibiae, entire a.s.VI, tarsi and distal $\frac{1}{4}$ to $\frac{1}{2}$ of cornicles brown. Body 1.92–2.45 (2.14, n = 8) mm long, .42–.53 (.499, n = 10) mm wide across eyes. Mesofrontal and laterofrontal tubercles of head moderately developed; mf 1p, lf 2–3 on each side, vlf 1p, df 12–18 (15.10 ± 1.59 , n = 10), vf 6–8, pc 2p, ac 3–6, md 2–5 (usually 3) on each side; dorsal setae widely funnel- to fan-shaped, without stems; vf, most pc funnel-shaped but less expanded than dorsal setae, md, elongate, with blunt or slightly knobbed apices; mf .0198–.0308 (.0269, n = 21), df-1 .0242–.0330 (.0286, n = 20) mm. Antennal segment I distinctly produced mesodistally, faintly imbricate, with 8–13 rod-shaped or knobbed setae aside from basal pointed one on dorsum.

A.s.II usually with $1 - \frac{1}{2} - 1$ setae, of same shape

as those of preceding and succeeding segments. A.s.III imbricate, with very short hairs, longest less than $\frac{1}{3}$ basal diameter of segment; with 1–3 (1.78, n = 18) sensoria. A.s.IV and V averaging $\frac{3}{4}$ length of a.s.III; a.s.VI with unguis $4\frac{2}{3}$ to 6 times (5.19, n = 7) as long as its base.

Tergum smooth on disk, becoming striate-spiculate caudally; median papillae present, increasingly more developed posteriorly, bearing 3 or 4 spinal hairs; similar pleural papillae also developed on posterior segments at bases of usually duplicate pleurals; body setae widely funnel- to fan-shaped, sessile. Cauda elongate, not distinctly constricted, apex acutely to broadly rounded; spiculate; with 3–5 (3.25, n = 20) hairs on each side, 0–3 (1.9, n = 10) on posterodorsal surface. Cornicles .36–.46 (.427, n = 18) mm long, $1\frac{1}{4}$ to $1\frac{3}{4}$ times ($1.42 \pm .08$, n = 18) length of cauda; rather stoutly cylindrical, thinnest at middle, distal $\frac{1}{6}$ slightly thickened; conspicuously imbricate, also armed with small blunt spicules. Legs with 3, 3, 3 setae on first tarsal segments. Rostrum IV+V broadly angular at base, tapering abruptly to sharp, short point; .09 mm long, .60–.69 ($.62 \pm .03$, n = 7) times length of second hind tarsal joint; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, al only slightly longer than ml and pl setae.

Measurements (in mm) of lectotype and 5 paralectotypes: BL 1.92–2.45 (2.16), We .42–.53 (.487); a.s.III .48–.60 (.532), a.s.IV .34–.48 (.428), a.s.V .36–.47 (.404), a.s.VI .11–.14 (.127) + .61–.78 (.694); cornicles .36–.46 (.417), cauda .24–.30 (.275), hind

tibiae .88–1.09 (1.02), hind ta-2 .13–.14 (.139), and rostrum IV+V .09. Proportions of a.s.III:IV:V, 1: .57–.88 (.79); .67–.87 (.76); VIu/VIb 4.77–6.0 (5.18); co/ca 1.28–1.79 (1.48) and rostrum IV+V .64–.69 (.65).

Alate Viviparous Female: Unknown.

Sexuales: Unknown.

HOSTS.—*Chrysothamnus nauseosus*, *C. parryi*, and *Chrysothamnus* sp.

DISTRIBUTION.—Rather rare, recorded here from Dog Valley, Utah, in addition to the type-locality (Milford, Utah).

TYPES (designated from type and paratype slides).—Lectotype: apt.v.f., specimen at about 7:00 o'clock on type-slide. Paralectotype: 4 apt.v.f. and 1 apt.ny. bearing the same data and mounted on same slide as lectotype (USNM); 2 apt.v.f., also with same data as lectotype (CFS coll.); and 2 apt.v.f. (probably fundatrices), 6–V–1927, Milford, Utah, GFK on *Chrysothamnus nauseosus* (CFS coll.).

SPECIMENS EXAMINED.—Aside from types; 4 apt. v.f. and 1 apt.ny., Dog Valley, Utah, 7–IX–1954, on *C. nauseosus* and *Chrysothamnus* sp. (EOE coll.).

NOTES.—The type-series apparently consists of a mixture of this species and *P. gregarius*. Short-cornicled "paratypes" from Tremonton, Utah, in the Colorado State University collection, were examined and found to be more closely similar to *P. gregarius* than the Milford, Utah, collection (*P. xerozoous*) as to shape of rostrum IV+V. Knowlton and Smith (1936a:113) also comment that the *C. nauseosus* collection from Stone, Idaho, differ slightly from the Milford series (on *C. parryi*) but do not indicate specifically in what respect.

P. xerozoous has recently been sunk as a synonym of *P. gregarius* by Hille Ris Lambers (1969:167). The shape of the rostrum, however, is distinctive and easily recognized, and on this basis, *P. xerozoous* is retained as a good species.

Palmer (1952:274) apparently also confused *P. xerozoous* with *P. gregarius* and she undoubtedly saw the Tremonton, Utah "paratypes." The Stone, Idaho, paratypes, Knowlton's (1948) record from Filmore, Utah, on *Chrysothamnus greeni*, and the additional locality (Logan Canyon and Uinta, Utah) and host (*C. wyomingensis*) records by Palmer (1952:274) should be reexamined for possible misidentification.

***Pleotrichophorus zoomontanus* (Knowlton and Smith), new combination**

FIGURES 161, 472-475

Capitophorus zoomontanus Knowlton and Smith, 1936b:230 [lectotype: apt.v.f., Daniels Canyon, Utah, 16-VIII-1935, GFK, on *Artemisia*; in USNM]; 1937:152.—Knowlton, 1941: 138.—Palmer, 1952:274-275.

DIAGNOSIS.—This species most closely resembles *P. longinectarius* in its long cornicles and antennae and the conspicuously protruding compound eyes; but it can be distinguished from that species by the following characters: head ($df\ m = 40.97 \pm 2.0$, $n = 35$ vs. $m = 70.89 \pm 8.68$, $n = 9$ in *P. longinectarius*), and body setae relatively sparser, shorter and fan-shaped rather than funnel-shaped; *co/ca* ratio is relatively smaller ($m = 2.60 \pm .06$, $n = 64$ vs. $m = 3.25 \pm .22$, $n = 17$ in *P. longinectarius*); the rostrum IV+V relatively shorter (.09-.12 vs. .135-.15 mm) and only about $\frac{3}{4}$ (.72 \pm .02, $n = 40$) the length of the second hind tarsal joint (vs. 1.03 \pm .05, $n = 15$ for *P. longinectarius*). The smaller members of *P. zoomontanus* may also be mistaken for *P. decampus* but the last rostral segment is acutely pointed and without a distinct cylindrical apex or needle as in the latter species. It resembles *P. diutius* somewhat in the shorter, conical- to fan-shaped head and body setae and the short last rostral segment; but the posterior margins of rostrum IV+V taper straight to an acute point rather than being slightly convex; the cornicles are relatively longer (.43-.90 vs. .41-.52 mm in *P. diutius*) and the *co/ca* ratio is larger (1.78 \pm .04, $n = 34$ in *P. diutius*).

DESCRIPTION.—*Apterous Viviparous Female*: color in life grayish green (Knowlton and Smith, 1936b); cleared specimens pale except tips of rostrum and tibiae, entire tarsi and antennae from apices of segment 5 dark brown. Body 1.71-2.40 (1.75, $n = 29$) mm long, .49-.60 (.545, $n = 36$) mm wide across eyes. Head with large, conspicuously protruding compound eyes; laterofrontal tubercles rather well developed but mesofrontal one small, low; *mf* 1p, *lf* 2-4 (usually 3) on each tubercle, *vlf* 1p, *df* 31-55 (40.97 \pm 2.0, $n = 35$), *vf* 6-12 (usually 7 or 8), *pc* 2p, *ac* 4-6, *md* 2-4 (usually 3) on each lobe; dorsal setae widely funnel- to fan-shaped, mostly without distinct stems; ventral setae similar but longer, more narrowly expanded; *mf* .0198-.0352 (.0269, $n = 57$) and *df*-1 .0220-

.0396 (.0315, $n = 69$) mm long. Antennal segment I conspicuously produced mesodistally, imbricate-spiculate with 6-13 (usually 8 or 9) rod-shaped to knobbed setae in addition to basal pointed one on

dorsum. A.s.II with basically 1 — 1 rod-shaped

or knobbed setae. A.s.III densely imbricate; with small rod-shaped, knobbed and pointed setae, longest about $\frac{1}{3}$ basal diameter of segment; with 1-3 (1.29, $n = 66$) sensoria. A.s.IV slightly longer than, and a.s.V subequally as long as a.s.III; a.s.VI with unguis averaging 5 times (range of 3.35-5.62, $n = 12$) length of its base.

Dorsal body integument smooth to finely reticulate on disk, imbricate-spiculate caudally; dorsal setae widely expanded, funnel- to fan-shaped, moderately dense. Cauda tapering to acutely or broadly rounded apex, without noticeable basal constriction; spiculate; with 2 pairs lateral and 1 postero-dorsal setae. Cornicles .43-.90 (.685, $n = 66$) mm long, 2.05-3.12 (2.60 \pm .06, $n = 64$) times as long as cauda; slenderly cylindrical, of almost uniform diameter throughout length; densely imbricate-spiculate, wrinkled, with spicules small, blunt. Legs with 3, 3, 3 setae on first tarsal joints. Rostrum IV+V .09-.12 (.104, $n = 38$) mm long, .56-.80 (.72 \pm .02, $n = 40$) times length of 2nd hind tarsal segment; slender at base, tapering to acute point, margins straight; with 1 basal, 2 dorsal, and 3 lateral pairs of setae, *ml* and *pl* about $\frac{1}{2}$ length of al setae.

Measurements (in mm) of 11 specimens on *Artemisia tripartita*: BL 2.09-2.42 (2.29), We .52-.60 (.569); a.s.III .72-.92 (.804), a.s.IV .86-1.08 (.974), a.s.V .72-.89 (.804), a.s.VI .24-.31 (.261) + 1.21-1.36 (1.29); cornicles .68-.90 (.792), cauda .25-.32 (.287); hind tibiae 1.64-2.16 (1.86), hind *ta*-2 .13-.16 (.157); rostrum IV+V .09-.11 (.106). Proportions of a.s.III:IV:V, 1: 1.10-1.32 (1.22): .92-1.14 (1.01); VIu/VIb 4.39-5.04 (4.65); *co/ca* 2.59-3.12 (2.79) and rostrum IV+V/hind *ta*-2 .56-.80 (.69).

Alate Viviparous Female: Unknown.

Sexuales: Unknown.

HOSTS.—*Artemisia filifolia* (Knowlton and Smith, 1937), *A. tridentata*, *A. tripartita* (*A. tridentata* var. *trifida*), *A. vulgaris* (Knowlton, 1941), and *Artemisia* sp.

DISTRIBUTION.—Collection records include Yel-

lowstone Park area, Wyoming; Wyoming-Idaho-Utah borders and elsewhere in Utah (Daniels Canyon, Levan, Wolf Creek Canyon).

TYPES (designated from type-slide, with numerous mutilated specimens).—Lectotype: second specimen at about 11:00 o'clock on type-slide and paralectotypes: 18 apt.v.f. mostly with incomplete appendages, bearing same data and mounted on same slide as lectotype.

SPECIMENS EXAMINED.—Aside from types: **IDAHO:** Beaver Creek, 5 apt.v.f., 29–VIII–1937, CFS, on *A. trifida* (OSU); Geneva, 3 apt.v.f., 19–VII–1936, GFK, on *Artemisia* (INHS); Montpelier, 2 apt.v.f., 19–VII–1936, GFK, on *Artemisia* (GFK coll.). **UTAH:** Daniels Canyon, 1 apt.v.f., 4–VI–1940, GFK,

on *A. tridentata* (GFK coll.); Garden City, 1 apt.v.f., 15–VIII–1959, JOP, on *Artemisia* (JOP coll.); Logan Canyon, 2 apt.v.f. and 4 ny., 30–VIII–1937, GFK, on *A. tridentata* var. *trifida* (USNM); Logan Canyon at Amazon Mine, 4 apt.v.f., 25–VIII–1937, CFS, on *A. trifida* (OSU); Wolf Creek Canyon, 1 apt.v.f., 24–VII–1945, GFK, on *Artemisia* (GFK coll.). **WYOMING:** Moran, 2 apt.v.f. and 1 ny., 19–VII–1936, GFK, on *A. tridentata* (GFK coll.); Pilot Knob, 6 apt.v.f., 13–IX–1941, GFK, on *Artemisia* (GFK coll.); Smoot, 3 apt.v.f., 19–VII–1936, GFK, on *Artemisia* (EOE coll.); Togwotee Pass, 3 apt.v.f., 13–IX–1941, on *Artemisia* (GFK coll.); and Yellowstone Park, 6 apt.v.f. and 4 ny., 18–VII–1936, on *Artemisia* (GFK coll.).

Literature Cited

- Achremowicz, J.
1967. Die Blattläuse (Homoptera, Aphidoidea) der Grosspolnisch-Kujawischen Niederung. *Fragmenta Faunistica* (Warsaw), 13:262–297.
- Baker, A. C.
1920. Generic Classification of the Hemipterous Family Aphididae. *United States Department of Agriculture Bulletin*, 826:1–109.
- Blanchard, E. E.
1935. Aphid Miscellanea, Part II. *Physis*, 11:366–383.
1939. Estudio Sistemático de los Afidoideos Argentinos. *Physis*, 17:857–1003.
1944. Descriptiones y Anotaciones de Afidoideos Argentinos. *Acta Zoologica Lilloana*, 2:15–62.
- Bodenheimer, F. S., and E. Swirski
1957. *The Aphidoidea of the Middle East*. 378 pages. Jerusalem: Weizmann Science Press of Israel.
- Börner, C.
1930. Beiträge zu Einem Neuen System der Blattläuse. *Archiv für Klassifikatorische und Phylogenetische Entomologie* (Vienna), 1:115–194.
1931. Mittelungen über Blattläuse. *Anzeiger für schadlingskunde* (Berlin), 7:8–11, 28–30, 42–43, 128–130.
- Börner, C., and H. Blunck
1916. Beiträge zur Kenntnis der Wanderaden Blattläuse Deutschlands. *Mitteilungen für Kaiserliche Biologische Anstalten*, 16:25–42.
- Börner, C., and K. Heinze
1957. Aphidina-Aphidoidea. Volume 5 (4):1–402 in P. So-rauer, *Handbuch der Pflanzenkrankheiten*. 5th edition. Berlin and Hamburg: Paul Parey.
- Börner, C., and F. A. Schilder
1932. Aphidoidea, Blattläuse. Volume 5 (2):551–715 in *Handbuch der Pflanzenkrankheiten*. 4th edition. Berlin and Hamburg: Paul Parey.
- Buckton, G. B.
1876. *Monograph of the British Aphides*. Volume 1. London: The Royal Society.
- Coon, B. F., and J. O. Pepper
1968a. Alate Aphid Species Captured in Yellow Pans. *Journal of Economic Entomology*, 61:1472–1473.
1968b. Alate Aphids Captured in Air Traps Arranged at Different Height. *Journal of Economic Entomology*, 61:1473–1474.
- Cottier, W.
1935. Aphidides Affecting Cultivated Plants, Part III. *New Zealand Journal of Agriculture*, 50:353–358.
1953. Aphids of New Zealand. *New Zealand Dept. of Scientific and Industrial Research Bulletin*, 106:xi + 382 pp.
- Davidson, J.
1925. *A List of British Aphidea*. ix + 176 pages. London: Longmans, Green & Co.
- Davidson, W. M.
1912. Aphid Notes from California. *Journal of Economic Entomology*, 5:404–413.
1914. Plant Louse Notes from California. *Journal of Economic Entomology*, 7:127–136.
- Davis, J. J.
1908. Studies on Aphididae, I. *Annals of the Entomological Society of America*, 1:251–264.
1910. A List of the Aphididae of Illinois with Notes on Some of the Species. *Journal of Economic Entomology*, 3:407–422, 482–499.
1911. A List of the Aphids of Illinois with Notes on Some of the species. *Journal of Economic Entomology*, 4:325–331.
- del Guercio, G.
1894. Frammenti di osservazioni sulla storia natural di un *Myzus trovato sul' Elaegnus* e sulla distinzione delle forme di *Myzus Ribis* L. descritte fin qui. *Naturalista Siciliano*, 13:189–199.
- Eastop, V. F.
1951. A List of Aphids Collected in Berkshire. *Entomologist*, 84:107–112.

1953. A List of Aphids Collected in Guernsey, Herm and Sark. *Entomologists Monthly Magazine*, 89:154-155.
- 1956a. New East African Aphids (Hem.: Aphididae). *Entomologist*, 89:9-12.
- 1956b. Thirteen Aphids New to Britain and Records of Some Other Rare Species. *Entomologists Monthly Magazine*, 92:271-275.
1958. *A Study of the Aphididae (Homoptera) of East Africa*, vi + 126 pages. London: Her Majesty's Stationery Office.
1966. A Taxonomic Study of Australian Aphidoidea (Homoptera). *Australian Journal of Zoology*, 14: 399-592.
- Essig, E. O.
1958. *Insects and Mites of Western North America*. Revised edition, xiii + 1050 pages. New York: Macmillan.
- Fernald, M. L.
1950. *Grey's Manual of Botany*. 8th edition. New York: American Book Company.
- Ferris, Roxana S.
1960. Bignoniaceae to Compositae. Volume 4 in Leroy Abrams, *An Illustrated Flora of the Pacific States*. Stanford: Stanford University Press.
- Gaumont, L.
1924. Contribution a l'étude des Aphididae de France, Première partie: Generalities-historique-classification les genres. *Annales des Epiphytes*, 9:310-346, plates 1-31.
- Ghosh, A. K., and D. N. Raychaudhuri
1968. New Aphids from Northeast India (Homoptera). *Annals of the Entomological Society of America*, 61:752-754.
- Gillette, C. P.
1908. New Species of Colorado Aphididae, with Notes upon Their Life Habits. *Canadian Entomologist*, 40:17-20, 61-68.
1915. Confusion of *Rhopalosiphum hippophaes* Koch and *Myzus braggi* Gillette. *Journal of Economic Entomology*, 8:375-379.
- Gillette, C. P., and C. F. Baker
1895. A Preliminary List of the Hemiptera of Colorado. *Colorado State Agricultural College Experiment Station Bulletin*, technical series 1, 31:1-137.
- Gillette, C. P., and L. C. Bragg
1915. Notes of Some Colorado Aphids Having Alternate Food Habits. *Journal of Economic Entomology*, 8: 97-103.
1916. Two New Aphids, *Capitophorus shepherdiae* and *Siphocoryne aquatica*. *Entomological News*, 27:445-448.
- Gillette, C. P., and M. A. Palmer
1928. Notes on Colorado Aphididae. *Annals of the Entomological Society of America*, 21:1-20.
1933. New Species of Aphids from Colorado. *Annals of the Entomological Society of America*, 26:348-365.
1934. The Aphididae of Colorado, III. *Annals of the Entomological Society of America*, 27:133-255.
- Glendenning, R.
1925. Additions to the List of Aphididae of British Columbia. *Proceedings of the Entomological Society of British Columbia*, 1925:36-38.
1929. Further additions to the list of aphids of British Columbia. *Proceedings of the Entomological Society of British Columbia*, 1929:54-57.
- Guyton, T. L.
1924. A Taxonomic Ecologic and Economic Study of Ohio Aphididae. *Ohio Journal of Science*, 24:1-30.
- Hall, W. J.
1926. Notes on the Aphididae of Egypt. *Ministry of Agriculture of Egypt, Technical and Scientific Service Bulletin*, 68:1-62.
- Haviland, M. D.
1918. A New Species of *Myzus* from Thistle. *Entomologist*, 51:49-50.
- Heie, O.
1962. A List of Danish Aphids, 3. *Entomologiske Meddelelser*, 31:205-224.
- Heie, O., and O. Heikinheimo
1966. Aphids Collected in Finland during the 12th NJF Congress in 1963. *Annales Entomologici Fennici*, 32:113-127.
- Heinze, K.
1961. Systematik der Mitteleuropaischen Myzinae, III: Teil Myzini, Cryptomyzini und Nasonoviini. *Beitrage zur Entomologie*, 11:24-96.
- Hille Ris Lambers, D.
1933. Notes on Theobald's "The Plant Lice or Aphididae of Great Britain." *Stylops*, 2:169-176.
1947a. Contributions to a Monograph of the Aphididae of Europe, III. *Temminckia*, 7:179-320.
1947b. On Some Mainly Western Aphids. *Zoologische Meddelelser*, 28:291-333.
1949. Contributions to a Monograph of the Aphididae of Europe, IV. *Temminckia*, 8:182-323.
1953. Contributions to a Monograph of the Aphididae of Europe, V. *Temminckia*, 9:1-176.
1961. Notes on Three North American Aphididae. *Florida Entomologist*, 44:181-183.
1966. Notes on California Aphids, with Descriptions of New Genera and New Species (Homoptera: Aphididae). *Hilgardia*, 37:569-623.
1969. A Key to, Notes on, and Descriptions of American *Pleotrichophorus* Börner (Homoptera: Aphididae). *Entomologische Berichten*, 29:165-180.
- Holman, J.
1965. Description of *Pleotrichophorus achilleae* sp. n. with Notes on Related Species (Homoptera, Aphididae). *Acta Entomologica Bohemoslovaca*, 62:277-282.
- Hori, M.
*1929. Studies of the Noteworthy Species of Plant Lice in Hokkaido. *Hokkaido Agricultural Experiment Station Report*, 23:1-163.
- Hottes, F. C.
1950. New Species of Aphididae. *Proceedings of the Biological Society of Washington*, 63:97-100.
- Hottes, F. C., and T. H. Frison
1931. The Plant Lice or Aphididae of Illinois. *Bulletin of the Illinois Natural History Survey*, 19:121-447.

- Huculak, S.
 1965. Die Blattläuse (Homoptera, Aphidoidea) der Masurischen Seenplatte. *Fragmenta Faunistica* (Warsaw), 12:207-236.
 1966. Aphids (Homoptera) of the Mazury Lake District, II. *Fragmenta Faunistica* (Warsaw), 13:115-130.
 1967. Materialien zur Blattlausfauna (Homoptera, Aphidoidea) der Umgebung von Rzeszow und Przemysl. *Fragmenta Faunistica* (Warsaw), 13:231-248.
- Hughes, R. D., et al.
 1964. A Survey of Aphids Flying Over Eastern Australia in 1961. *Australian Journal of Zoology*, 12:174-200.
- Hunter, W. D.
 1901. The Aphididae of North America. *Iowa Agricultural Experiment Station Bulletin*, 60:63-138.
- Iglisch, I.
 1967. Biological and Morphological Investigations of *Brachycaudus spiraeae* (Oestl.) C.B., An Aphid Injurious to *Spiraea* (Homoptera, Aphididae); A Contribution on the Determination, Special Morphology and Chaetotaxy of Aphids. *Zeitschrift für Angewandte Entomologie*, 60:417-459.
- Jones, T. H.
 1918. Miscellaneous Truck-crop Insects in Louisiana, I: Insects Injurious to the Globe Artichoke in Louisiana. *United States Department of Agriculture Bulletin*, 703:1-5.
- Judenko, E.
 *1930. Materialy do fauny mszyc (Aphididae) okolicy Pulaw z uwzględnieniem biologi. *Polskie Pismo entomologiczne, Lemberg*, 9:129-186.
- Kaltenbach, J. H.
 *1843. *Monographie der Familien der Pflanzenläuse*. Aachen.
 1846. Fünf neue Species aus der Familie der Pflanzenläuse. *Stettiner Entomologische Zeitung*, 7:169-172.
- Kirkaldy, G. W.
 1906. Catalogue of the Genera of Aphididae with a List of Species Described as New from 1885 to 1905. *Canadian Entomologist*, 38:9-18.
- Kloet, G. S., and W. D. Hincks
 1945. *A Check List of British Insects*. lix + 483 p. Stockport: Kloet & Hinks.
- Knechtel, W. K., and C. Manolache
 *1940. Neue Blattläuse für Rumänien, II: *Academia Romana, Bukharest Section Scientifique, Bulletin*, 23: 236-247.
- Knowlton, G. F.
 1927. A Few *Capitophorus* Species of Utah with Descriptions of Two New Species. *Canadian Entomologist*, 59:235-238.
 1928. Three New Aphids from Utah. *Pan-Pacific Entomologist*, 4:169-172.
 1929. Notes on a Few Species of Myzini from Utah with Descriptions of Two New Species. *Canadian Entomologist*, 61:9-15.
 1935a. Four Western Aphids. *Annals of the Entomological Society of America*, 28:281-284.
 1935b. Notes on Western Aphids. *Pan-Pacific Entomologist*, 11:135-142.
 1935c. Aphid Notes. *Canadian Entomologist*, 67:190-195.
 1941. Western Aphid Notes (Homoptera: Aphididae). *Entomological News*, 52:136-138.
 1946. Aphids from Mt. Timpanogos, Utah. *Great Basin Naturalist*, 7:1-6.
 1948. A New *Capitophorus* Aphid. *Journal Kansas Entomological Society*, 21:121-123.
 1954. *Capitophorus* and *Amphorophora* Aphid Notes. *Bulletin Brooklyn Entomological Society*, 49:8-11.
- Knowlton, G. F., and C. F. Allen
 1938. *Macrosiphum* Aphids Infesting *Artemisia*. *Canadian Entomologist*, 70:73-83.
- Knowlton, G. F., and C. F. Smith
 1936a. *Capitophorus* Aphids Infecting *Chrysothamnus*. *Canadian Entomologist*, 68:107-113.
 1936b. *Capitophorus* Aphids Infesting *Artemisia*. *Canadian Entomologist*, 68:229-234.
 1936c. Notes on Intermountain Aphids. *Entomological News*, 47:210-213.
 1937. Some Aphids of the Genus *Capitophorus*. *Canadian Entomologist*, 69:150-152.
- Koch, C. L.
 1854. *Die Pflanzenläuse Aphiden*. 134 pages. Nurenburg.
- Kring, J. B.
 1955. Some Aphids and Host Plant Records from Missouri. *Journal Kansas Entomological Society*, 28:64-66.
- Leclant, F.
 1968. Un *Pleotrichophorus* nouveau vivant sur *Erigeron* (Homoptera, Aphididae). *Annales Societe Entomologique de France*, 4:365-370.
- Leonard, M. D.
 1928. A List of the Insects of New York with a List of the Spiders and Certain Other Allied Groups. *Cornell University Agricultural Experiment Station Memoir*, 101:1-1121. [Aphididae, pages 184-192.]
 1936. Additions to the New York State List of Aphids with Notes on Other New York Species. *Journal of the New York Entomological Society*, 44:177-185.
 1956. A Preliminary List of the Aphids of New Jersey. *Journal of the New York Entomological Society*, 64:99-123.
 1959. A Preliminary List of the Aphids of Missouri. *Journal Kansas Entomological Society*, 32:9-18.
 1963. Additional Records of Missouri Aphids. *Journal Kansas Entomological Society*, 36:65-84.
 1964. Additional Records of New Jersey Aphids. *Journal of the New York Entomological Society*, 72:79-101.
 1967. A List of the Aphids of Cyprus. *Proceedings Entomological Society of Washington*, 69:259-266.
 1968. California Aphids in the Cornell University Collection (Homoptera: Aphididae). *Cornell University Agricultural Experiment Station Memoir*, 407:1-32.
- Leonard, M. D., and A. N. Tissot
 1965. A Preliminary List of Texas Aphids. *Florida Entomologist*, 48:255-268.
- Lichtenstein, J.
 1885. *Les Pucerons. Monographie des aphidiens (Aphi-*

- didae*, Passerini, *Phytophires Burmeister*). Premiere Partie-Genera. 188 pages. Paris: Bailliere et Fils.
- Macchiati, L.
1883. Fauna e flora degli afidi di Calabria. *Bulletino della Societa Entomologica Italiana*, 15:221-240; 254-284.
- MacGillivray, M. E.
1959. Some Aphids from Bermuda (Homoptera). *Canadian Entomologist*, 91:638-641.
- Mason, P. W.
1925. A Revision of the Insects of the Aphid Genus *Amphorophora*. *Proceedings of United States National Museum*, 67:1-92.
- Miller, F. W.
1938. Generic Check List of Aphids and Phylloxerids. *American Midland Naturalist*, 19:658-672.
- Mimeur, J. M.
1934. Aphididae du Maroc (Trioseme note). *Bulletin de la Societe des Sciences Naturelles du Maroc, Rabat*, 40:1-71.
- Mordvilko, A.
1914. Faune de la Russie (Insecta, Hemiptera). Volume 1:1-236 of *Aphidoidea*. Petrograd.
- Müller, F. P. and S. E. Scholl
1958. Some Notes on the Aphid Fauna of South Africa. *Journal of the Entomological Society of South Africa*, 21:382-414.
- Nevsky, V. P.
1928. The Plant Lice of Middle Asia, I: Subtribe Macrosiphina. *Entomologische Mitteilungen*, 17:182-199.
1929. Aphids of Central Asia. *Bulletin of Plant Protection Station Uzbekistan*, 16.
- Oestlund, O. W.
1886. List of the Aphididae of Minnesota. *Minnesota Geological and Natural History Survey Report*, 14: 17-56.
1887. Synopsis of the Aphididae of Minnesota. *Minnesota Geological and Natural History Survey Report*, 4: 1-100.
1922. A Synoptical Key to the Aphididae of Minnesota. *19th Report of the State Entomologist of Minnesota*.
- Ogilvie, L.
1928. *The Insects of Bermuda*. Department of Agriculture, Bermuda.
- Olsen, C. E.
1921. Two Season's Collecting of Aphidae, Principally on Long Island, New York, with Notes on Some of the Species. *Bulletin of the Brooklyn Entomological Society*, 16:14-19.
- Ossiannilsson, F., L. M. Russell and H. Weber
1956. Homoptera. Pages 148-158 in S. L. Tuxen, editor, *Taxonomist's Glossary of Genitalia in Insects*. Copenhagen: E. Munksgaard.
- Pack, H. J., and G. F. Knowlton
1929. A Few Match Brush Aphids from Utah. *Canadian Entomologist*, 61:199-204.
- Paik, W. H.
1965. *Aphids of Korea*. 160 pages. Seoul: Printings Office, Seoul National University.
- Palmer, M. A.
1938. Additional Aphids from Colorado. *Annals of the Entomological Society of America*, 31:352-358.
1952. *Aphids of the Rocky Mountain Region*. Volume 5, 452 pages. College Park, Maryland: Entomological Society of America for Thomas Say Foundation.
- Passerini, G.
*1860. *Gli afido con un prospetto dei generi ed alcune species nuove Italiana*. Parma.
*1863. Aphididae Italiae hucusque observatos. *Archivio per la Zoologia, l'Anatomia e la Fisiologia*, 2:129-212.
- Patch, E. M.
1918. Food Plant Catalogue of the Aphidae of the World, Part V. *Maine Agricultural Experiment Station Bulletin*, 270:47-100.
1919. Food Plant Catalogue of the Aphidae of the World. *Maine Agricultural Experiment Station Bulletin*, 282:219-248.
1923. Family Aphididae. Pages 250-335 in W. E. Britton, editor, *Guide to the Insects of Connecticut, Part IV: The Hemiptera or Sucking Insects of Connecticut*. *Connecticut State Geological and Natural History Survey Bulletin*, 34.
1938. Food Plant Catalogue of the Aphids of the World Including the Phylloxeridae. *Maine Agricultural Experiment Station Bulletin*, 393:1-431.
- Pepper, J. O.
1965. A List of the Pennsylvania Aphididae and Their Host Plants (Homoptera). *Transactions of the American Entomological Society*, 91:181-231.
- Quednau, F. W.
1966. A List of Aphids from Quebec with Descriptions of Two New Species (Homoptera: Aphidoidea). *Canadian Entomologist*, 98:415-430.
- Remaudière, G.
1952. Contribution à l'étude des Aphidoidea de la faune française. Description de quelques Aphididae nouveaux et addition à la liste des Myzinae et Dactynotinae. *Revue de Pathologie Vegetale (Paris)*, 31: 232-263.
- Richards, W. R.
1963. The Myzaphidines of Canada (Homoptera: Aphididae). *Canadian Entomologist*, 95:680-704.
1965. The Callaphidini of Canada (Homoptera: Aphididae). *Memoirs of the Entomological Society of Canada*, 44:1-149.
1968. A New Species of *Pleotrichophorus* from British Columbia (Homoptera: Aphididae). *Canadian Entomologist*, 100:195-197.
- Robinson, A. G.
1967. A New Genus, *Misturaphis* and a New Species of *Cryptaphis* from Manitoba (Homoptera: Aphididae), with a Note on *Pseudasiphonaphis anogis*. *Canadian Entomologist*, 99:565-569.
- Robinson, A. G., and G. A. Bradley
1965. A Preliminary List of the Aphids in Manitoba. *Proceedings of the Entomological Society of Manitoba*, 21:39-45.
1968. A Revised List of Aphids of Manitoba. *Manitoba Entomologist*, 2:60-65.

- Sampson, W.
1946. A Generic Classification of California Aphids by Means of First Instar Nymphs. *University of California Publications in Entomology*, 7:365-402.
- Sanborn, C. E.
1904. Kansas Aphididae, with Catalogue of North American Aphididae, and with Host-plant and Plant Host List. *Kansas University Science Bulletin*, 3:1-82.
1906. Kansas Aphididae, with Catalogue of North American Aphididae, and with Host-plant and Plant Host List. *Kansas University Science Bulletin*, 3:225-274.
- Schaeffers, G. A.
1960. A Systematic Study on the Strawberry Aphid Complex (*Pentatrichopus* spp.). *Annals of the Entomological Society of America*, 53:783-793.
- Schouteden, H.
1906a. A Supplementary List to Kirkaldy's Catalogue of the Aphidae Described as New from 1885. *Annales de la Société Entomologique Belgique*, 50:30-36.
1906b. Catalogue des Aphides de Belgique. *Memoires de la Société Entomologique de Belgique*, 12:189-246.
- Shaposhnikov, G. C.
1964. Suborder Aphidinea—Plant Lice. Volume 1:617-799 in G. Y. Bey-Bienko, *Keys to the Insects of the European Part of the USSR*. [Trans. edition, 1967.] Israel Programme for Scientific Translations. Jerusalem.
- Shaw, M. W.
1964. A Basic List of Scottish Aphididae. *Transactions of the Society of British Entomologists*, 16:49-92.
- Shinji, G. O.
1924. New Aphids from Morioka. *Zoological Magazine* (Tokyo), 36:343-372.
- Smith, C. F.
1940. Notes on Some Ohio Aphids. *Ohio Journal of Science*, 40:139-142.
- Smith, C. F., and G. F. Knowlton
1937. *Macrosiphum* Aphids Infesting *Chrysothamnus* and *Gutierrezia*. *Canadian Entomologist*, 69:269-272.
- Smith, C. F., and D. G. Dillery
1968. The Genus *Drepanaphis* Del Guercio (Homoptera: Aphididae). *Annals of the Entomological Society of America*, 61:185-204.
- Smith, C. F., L. F. Martorell, and M. E. Perez Escolar
1963. Aphididae of Puerto Rico. *Technical Papers of the University of Puerto Rico Agricultural Experiment Station* (Rio Pedras), 37:5-121.
- Snodgrass, R. E.
1935. *Principles of Insect Morphology*. ix + 667 pages. New York: McGraw-Hill Book Co., Inc.
- Stroyan, H. L. G.
1953. Records of Cambridgeshire Aphididae. *The Entomologist*, 85:234-236, 249-259.
1955. Recent Additions to the British Aphid Fauna. *Transactions of the Royal Entomological Society of London*, 106:283-340.
1964a. Lachnidae, Chaitophoridae, Callaphididae, Aphididae, Thelaxidae, Pemphigidae. Volume II:67-86 in Kloet and Hincks, A Check List of British Insects. *Handbook for the Identification of British Insects*. London: Royal Entomological Society.
1964b. Notes on Hitherto Unrecorded or Overlooked British Aphid Species. *Transactions of the Royal Entomological Society of London*, 116:29-72.
- Swain, A. F.
1919. A Synopsis of the Aphididae of California. *California University Publications in Entomology*, 3:1-221.
- Szelegiewicz, H.
1963. Blattläuse (Homoptera, Aphididae) aus der Mongolei. *Annales musei Zoologici Polonici* (Warsaw), 21:110-142.
1964. Die Blattläusen (Homoptera, Aphididae) des Nidaltales. *Fragmenta Faunistica* (Warsaw), 11:233-254.
1966. Ergänzungen zur Blattläusfauna (Homoptera, Aphididae) Polens. *Fragmenta Faunistica*, 12:430-455.
- Takahashi, R.
*1921. Aphididae of Formosa, Part I. *Agricultural Experiment Station of Formosa, Special Report*, 20:1-97.
*1923. Aphididae of Formosa, Part II. *Department of Agriculture Government Research Institute, Formosa, Report*, 4:1-173.
1929. Aphididae of Formosa. *Transactions of the Natural History Society of Formosa*, 19:248.
1931. Aphididae of Formosa, Part VI. *Government Research Institute, Formosa, Report*. 53:1-127.
1961. Some Species of *Capitophorus* of Japan (Homoptera: Aphididae). *Transactions of Shikoku Entomological Society*, 7:1-4.
- Theobald, F. V.
1911. A Second List of the Aphididae Found in Kent. *The Entomologist*, 44:351-356, 397-399.
1914. Additions to List of Kent Aphididae. *The Entomologist*, 47:100-104.
1915. Notes on New and Little Known British Aphids. *The Entomologist*, 48:258-263.
1920. African Aphididae, Part IV. *Bulletin of Entomological Research*, 11:65-72.
1923a. New Aphididae Found in Egypt. *Bulletin de la Société Royale de Entomologie de Egypte*, 5:39-42.
1923b. New Species of British Aphids. *Entomologists Monthly Magazine*, 59:23-28.
1926. *The Plant Lice or Aphididae of Great Britain*. Volume I, 372 pages. London: Headley Brothers.
1927. Notes on British Aphids with Descriptions of Two New Species. *Entomologists Monthly Magazine*, 63:30-34.
1928. Two Chrysanthemum Aphids New to Great Britain. *The Entomologist*, 61:49-51.
1929. *The Plant Lice or Aphididae of Great Britain*. Volume 3:1-364. London: Headley Brothers.
- Thomas, I., and F. H. Jacob
*1940. A List of Aphididae Collected Mainly in North Wales During 1938 and 1939. *North Western Naturalist*, 1940:139-153.
- Timberlake, P. H.
1924. Notes on Hawaiian Aphidae with a List of Food Plants (Homoptera). *Proceedings of the Hawaiian Entomological Society*, 5:450-460.

- Tseng, S., and C. Tao
 •1936. A List of the Aphididae of China with Descriptions of Four New Species. *Entomology and Phytopathology* (Hangchow), 4:120-171.
- Tuatay, N. and G. Remaudière
 1964. First Contribution to a Catalogue of the Aphididae (Homoptera) of Turkey. *Revue de Pathologie Végétale et d'Entomologie Agricole de Turkey*, 43:243-278.
- Van der Goot, P.
 1912. Über Einige Noch Nicht Oder nur Unvollständig Beschriebene Blattlaus-arten. *Tijdschrift Voor Entomologie*, 55:58-96.
 1913. Zur Systematik der Aphiden. *Tijdschrift Voor Entomologie*, 56:69-155.
 1915. *Beitrage zur Kenntnis der Hollandischen Blattläuse*. 600 pages. Haarlem: H. D. T. Jeenk Willink and Zoon.
- Vickerey, R. A.
 1908. A Comparative Study of the External Anatomy of Plant Lice. *12th Report State Entomologist of Minnesota for 1907-1908*, 178-191.
- Wahlgren, E.
 1938. Svenska bladloss (Aphidina). *Entomologisk Tidsskrift*, 59:166-187.
- Walker, F.
 1849a. Description of Aphides. *Annals and Magazine of Natural History* (London), series 2, 3:298-301.
 1849b. Description of Aphides. *Annals and Magazine of Natural History* (London), series 2, 4:41-48.
 1850. Description of Aphides. *Annals and Magazine of Natural History* (London), series 2, 6:41-48.
 1852. *List of the Specimens of Homopterous Insects in the Collection of the British Museum*, Part IV. Printed by Order of the Trustees.
- Williams, T. A.
 1891. Host-Plant List of North American Aphididae. *University of Nebraska Department of Entomology Special Bulletin*, 1:1-28.
- Wilson, H. F., and R. A. Vickerey
 1918. A Species List of the Aphididae of the World and Their Recorded Food Plants. *Transactions of the Wisconsin Academy of Science, Arts and Letters*, 19:1-355.
- Wood-Baker, C. S.
 1953. Records of Forty-six European Aphids (Hemiptera). *Entomologists Monthly Magazine*, 89:265-270.
- Zimmerman, E. C.
 1948. *Insects of Hawaii*, Volume 5: *Homoptera, Sternorrhyncha*. 464 pages. Honolulu: University of Hawaii Press.

Appendix 1

LIST OF HOSTS

- Achillea millefolium*: *P. patonkus*, *P. patonkusellus*, *P. pseudopatonkus*
Achillea sp.: *P. hottesi*, *P. patonkusellus*, *P. pseudopatonkus*
Agoseris sp.: *P. triangulatus*
Ambrosia artemisiifolia: *C. jopepperi*, *P. ambrosiae*
A. artemisiifolia var. *paniculata*: *P. ambrosiae*
A. psilostachya: *C. shepherdiae*, *P. ambrosiae*, *P. glandulosus*
Amsinckia sp.: *P. amsinckii*
Antennaria plantaginifolia: *P. antennarius*
Antennaria sp.: *P. antennarius*
Arctium lappa: *C. elaeagni*
Artemisia californica: *P. decampus*, *P. obscuratus*, *P. quadririchus quadririchus*
A. cana: *P. pullus*, *P. rusticatus*
A. douglasiana: *P. gnaphalodes*, *P. pseudoglandulosus*
Artemisia dracunculoides: *P. diutius*, *P. parilis*
A. filifolia: *P. filifoliae*, *P. zoomontanus*
A. frigida: *P. intermedius*, *P. pseudoglandulosus*
A. lactucifolia: *P. glandulosus*
A. longifolia: *P. brevinectarius*, *P. longinectarius*, *P. pullus*
A. ludoviciana: *P. gnaphalodes*, *P. pseudoglandulosus*
A. tridentata: *P. decampus*, *P. heterohirsutus*, *P. infrequens*, *P. longipes*, *P. oestlundii*, *P. pycnorhysus*, *P. quadririchus pallidus*, *P. quadririchus quadririchus*, *P. rusticatus*, *P. spatulavillus*, *P. zoomontanus*
A. tripartita (= *A. tridentata* var. *trifida*): *P. zoomontanus*
A. vulgaris: *P. brevinectarius*, *P. glandulosus*, *P. pseudoglandulosus*, *P. quadririchus vulgaris*, *P. zoomontanus*
Artemisia sp.: *P. brevinectarius*, *P. decampus*, *P. diutius*, *P. heterohirsutus*, *P. longinectarius*, *P. longipes*, *P. patonkusellus*, *P. pseudoglandulosus*, *P. quadririchus* (all 3 subspecies), *P. rusticatus*, *P. spatulavillus*, *P. zoomontanus*
Carduus sp.: *C. elaeagni*
Chrysanthemum sp.: *P. chrysanthemi*
Chrysothamnus greenii: *P. oestlundii*
C. nauseosus: *P. elongatus*, *P. gregarius*, *P. neosporadicus*, *P. oestlundii*, *P. packi packi*, *P. packi brevis*, *P. palmerae*, *P. sporadicus*, *P. xerozoosus*
C. nauseosus graveoleus: *P. oestlundii*, *P. packi*, *P. wasatchii*
C. nauseosus var. *hololeucus*: *P. palmerae*
C. parryi: *P. elongatus*, *P. oestlundii*, *P. packi*, *P. xerozoosus*
C. plattensis: *P. oestlundii*
C. viscidiflorus: *P. acanthovillus*, *P. elongatus*, *P. gregarius*, *P. magnautensus*, *P. oestlundii*, *P. pycnorhysus*, *P. utensis*
Chrysothamnus sp.: *P. acanthovillus*, *P. magnautensus*, *P. oestlundii*, *P. palmerae*, *P. pycnorhysus*, *P. sporadicus*, *P. stroudii*, *P. wasatchii*, *P. xerozoosus*
Cirsium spp. (*arvensis*, *horridulum*, *lanceolatum*, *nuttallii*, *occidentalis*, *smallii*, *vulgare*): *C. elaeagni*
Cirsium sp.: *C. elaeagni*, *C. hornii*
Cnicus sp.: *C. elaeagni*
Cynara spp. (*cardunculus*, *scolymus*): *C. elaeagni*
Eleagnus angustifolia: *C. elaeagni*, *C. hippophaes*, *C. xanthii*
E. commutata: *C. elaeagni*, *C. hippophaes*
Elaeagnus spp. (*longipes*, *multiflora*, *pungens*, *umbellata*): *C. elaeagni*
Eriogonum sp.: *P. amsinckii*
Eriophyllum staechadifolium: *P. longirostris*
Franseria discolor: *P. ambrosiae*
Gutierrezia sp.: *P. acanthovillus*, *P. utensis*
Haplopappus bloomeri: *P. lagacei*
Helianthus sp.: *P. ohioensis*
Hippophae rhamnoides: *C. elaeagni*, *C. hippophaes*, *C. xanthii*
Inula spp. (*helenium*, *royaleana*): *C. pakansus*
Polygonum alpinum: *C. essigi*
Polygonum spp. (*hirsutum*, *hydropiper*, *hydropiperoides*, *lapathifolium*, *pennsylvanicum*, *persicaria*): *C. hippophaes*
Shepherdia argentea: *C. elaeagni*, *C. hippophaes*, *C. shepherdiae*
Sonchus arvensis: *C. elaeagni*
Sonchus sp.: *C. elaeagni*
Xanthium spp. (*echinatum*, *pennsylvanicum*, *strumarium*, *strumarium* var. *canadense*): *C. xanthii*

Appendix 2

HIGHER CLASSIFICATION OF HOST GENERA

Family Polygonaceae

Eriogonum, *Polygonum*

Family Elaeagnaceae

Elaeagnus, *Hippophae*, *Shepherdia*

Family Boraginaceae

Amsinckia

Family Compositae

Subfamily Tubuliflorae

Tribe Astereae
Chrysothamnus, Gutierrezia, Haplopappus

Tribe Inuleae
Antennaria, Inula

Tribe Helenieae
Eriophyllum

Tribe Heliantheae
Ambrosia, Franseria, Helianthus, Xanthium

Tribe Anthemidcae
Achillea, Artemisia, Chrysanthemum

Tribe Senecioneae
Petasites, Tussilago

Tribe Cynareae
Arctium, Carduus, Cirsium, Cnicus, Cynara

Subfamily Liguliflora

Tribe Cichoreae
Agoseris, Lactuca, Sonchus

Appendix 3

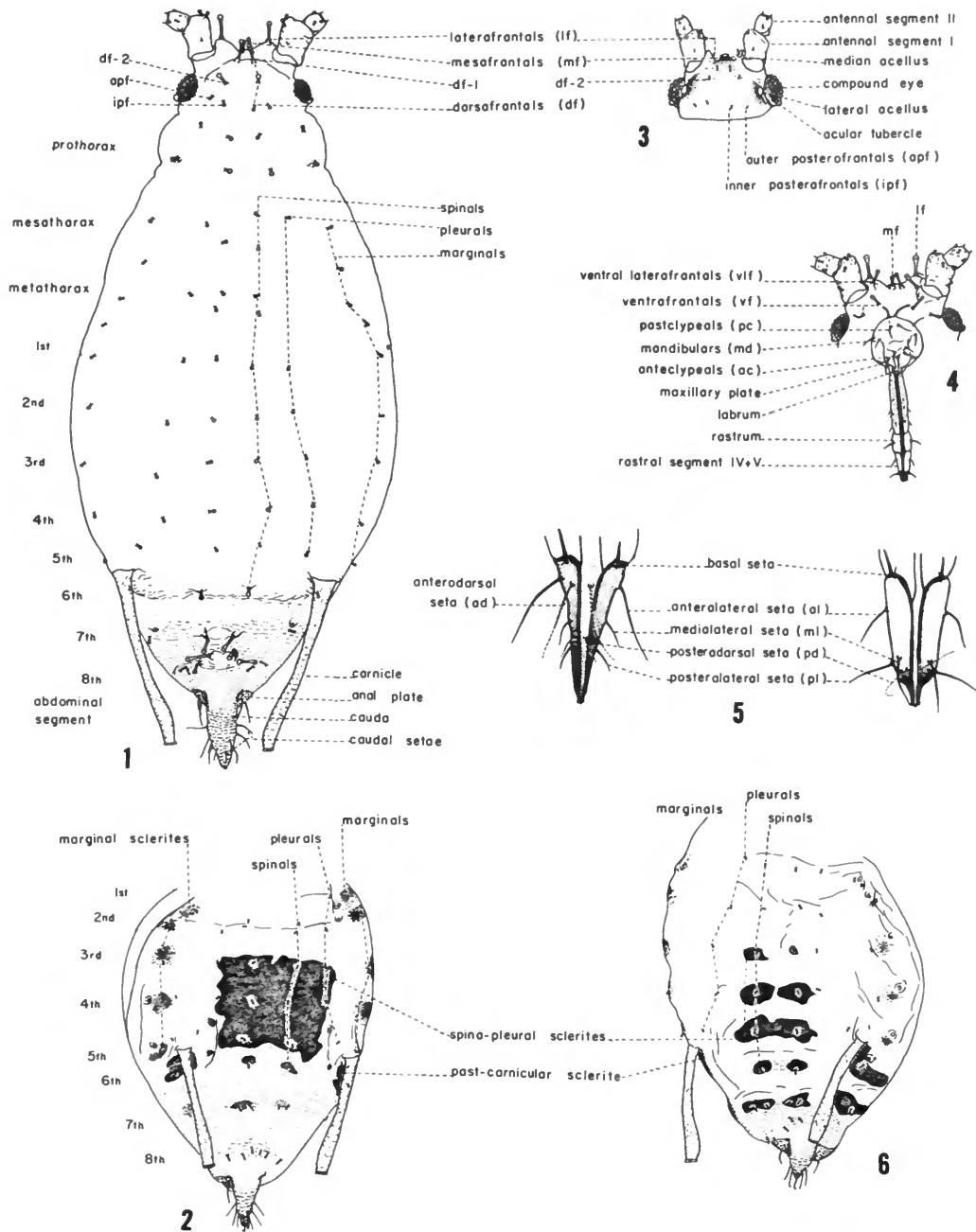
LIST OF APHID NAMES

(P. = *Pleotrichophorus*, C. = *Capitophorus*)

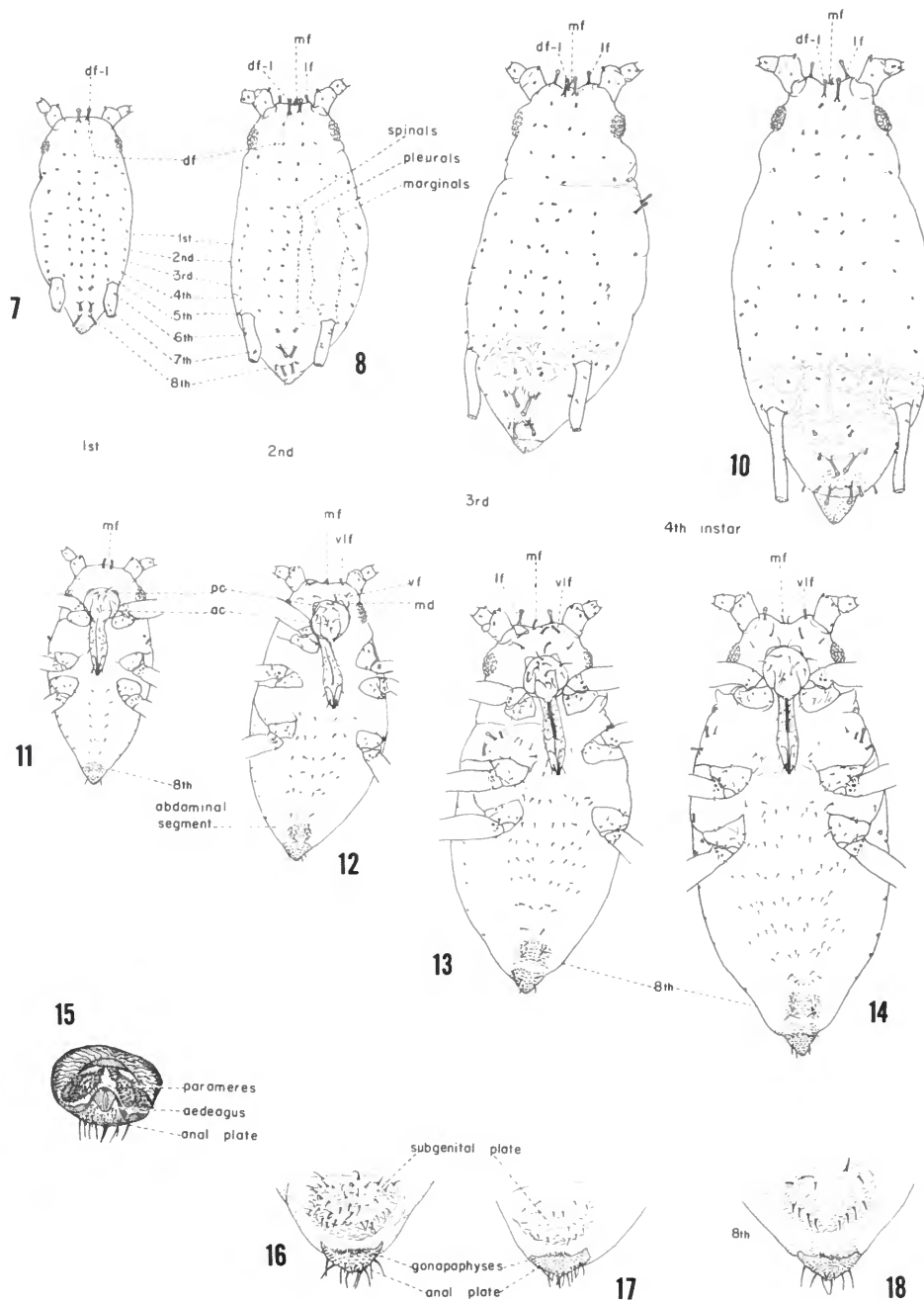
- acanthovillus* (Knowlton and Smith), P.
ambrosiae Hille Ris Lambers, P.
amsinckii Richards, P.
antennarius, new species, P.
Aphis L.
arctifoliae Shinji [= *elaeagni*]
arkangelskii Nevsky [= *pakansus*]
bitrichus (Knowlton and Smith) [= *heterohirsutus*]
braggi Gillette [= *elaeagni*]
brevinectarius (Gillette and Palmer), P.
brevis, new subspecies, P. *packi*
Capitophorinus Börner
carduinus (Walker), C.
cardui [= *elaeagni* (in part)]
carthusianus Haviland [= *elaeagni*]
Chaetosiphon Mordvilko
chlorophainus (Knowlton and Smith) [= *elongatus*]
chrysanthemi (Theobald), P.
cirsii Nevsky [= *elaeagni*]
coloradensis Hottes [possible subspecies of *P. patonkus*]
Corylobium Mordvilko
Cryptaphis Hille Ris Lambers
Cryptomyzus Oestlund
cynariella Theobald [= *elaeagni*]
decampus (Knowlton and Smith), P.
diutius, new species, P.
Drepanaphis
duponti Hille Ris Lambers, P.
elaeagni (del Guercio), C.
elongatus (Knowlton), P.
eloreagni del Guercio [= *elaeagni*]
essigi Hille Ris Lambers, C.
feragacus (Knowlton and Smith) [= *elongatus*]
filaginus Schouteden, P.
filiifoliae (Palmer), P.
flaveolus Walker [= *elaeagni*]
formosanus Takahashi [= *chrysanthemi*]
frigidae Knowlton [= *decampus* (in part), = *pseudoglandulosus* (in part)]
galeopsidis Kaltenbach, *Cryptomyzus* [= *hippophaes* (in part)]
gillettei Theobald [= *hippophaes*]
glandulosus (Kaltenbach), P.
gnaphalodes (Palmer), P.
gregarius (Knowlton), P.
gynoxantha Hille Ris Lambers [= *horni*]
heterohirsutus (Gillette and Palmer), P.
hippophaes (Walker), C.
horni Börner, C.
hottesi Hille Ris Lambers, P.
Idiopterus Davis
indica Ghosh and Raychaudhuri, C. *hippophaes*
infrequens [= *infrequenus*]
infrequenus (Knowlton and Smith), P.
intermedius, new species, P.
inulae Passerini [= *pakansus*]
javanicus Hille Ris Lambers, C. *hippophaes*
jopepperi, new species, C.
knowltoni, new species, P.
lagacei Hille Ris Lambers, P.
longinectarius (Gillette and Palmer), P.
longipes (Gillette and Palmer), P.
longirostris Hille Ris Lambers, P.
Macrosiphum
magnautens (Knowlton and Smith), P.
minima Mason [= *hippophaes*]
mitregoni Eastop, C. *hippophaes*
Myzus Passerini
Nasonovia Mordvilko
neosporadicus, new species, P.
nephrolepidis Davis [= *hippophaes*]
obscuratus Hille Ris Lambers, P.
oestlundi (Knowlton), P.
ohioensis (Smith), P.
packi packi (Knowlton), P.
pakansus Hottes and Frison, C.
pallidus, new subspecies, P. *quadritrichus*
palmerae (Knowlton), P.
parilis, new species, P.

patonkus (Hottes and Frison), *P.*
patonkusellus, new species, *P.*
Pentatrichopus Börner
persimilis Börner
Phorodon Passerini
pilosus Van der Goot [= *glandulosus*]
Pleotrichophorus Börner
pseudoglandulosus (Palmer), *P.*
pseudopatonkus, new species, *P.*
pullus (Gillette and Palmer), *P.*
pycnorhysus (Knowlton and Smith), *P.*
quadritrichus (Knowlton and Smith), *P. quadritrichus*
Rhopalomyzus Mordvilko
Rhopalosiphum Koch
ribis L. [= *hippophaes* (in part)]
rosarum Walker [= *tetrarhodus* Walker (in part)]
rusticatus (Knowlton and Smith), *P.*

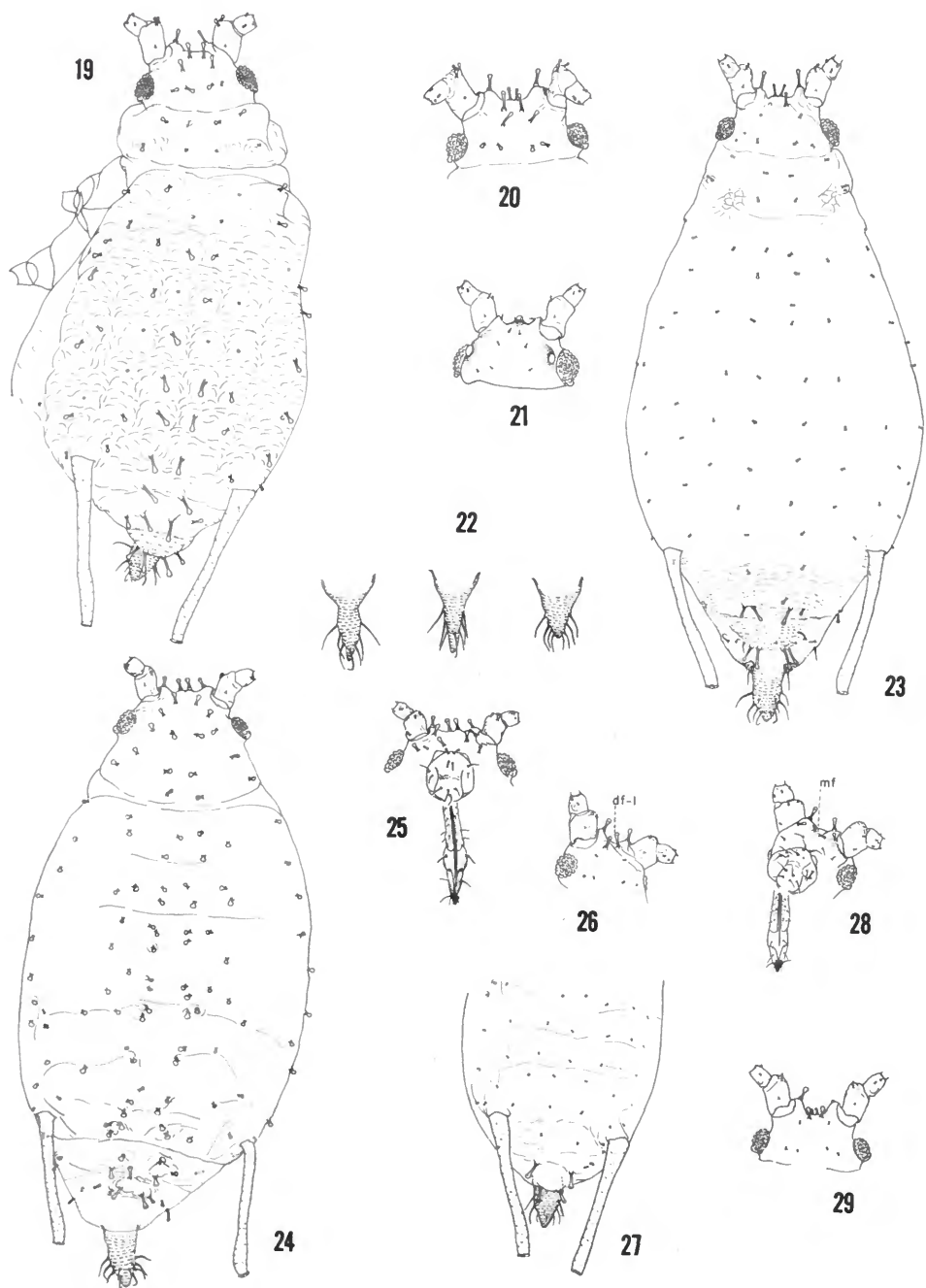
shepherdiae Gillette and Bragg, *C.*
spatulavillus (Knowlton and Smith), *P.*
similis Van der Goot [= *pakansus* (in part)]
similis Börner, *C.*
Siphocoryne Passerini
sporadicus (Knowlton), *P.*
stroudi (Knowlton), *P.*
tetrarhoda (Walker), *Chaetosiphon*
triangulatus, new species, *P.*
utensis Knowlton, *P.*
vandergooti Hille Ris Lambers [= *pakansus*]
vulgaris, new subspecies, *P. quadritrichus*
wasatchii Knowlton, *P.*
xanthii Oestlund, *C.*
xerozoous Knowlton, *P.*
zoomontanus Knowlton and Smith, *P.*



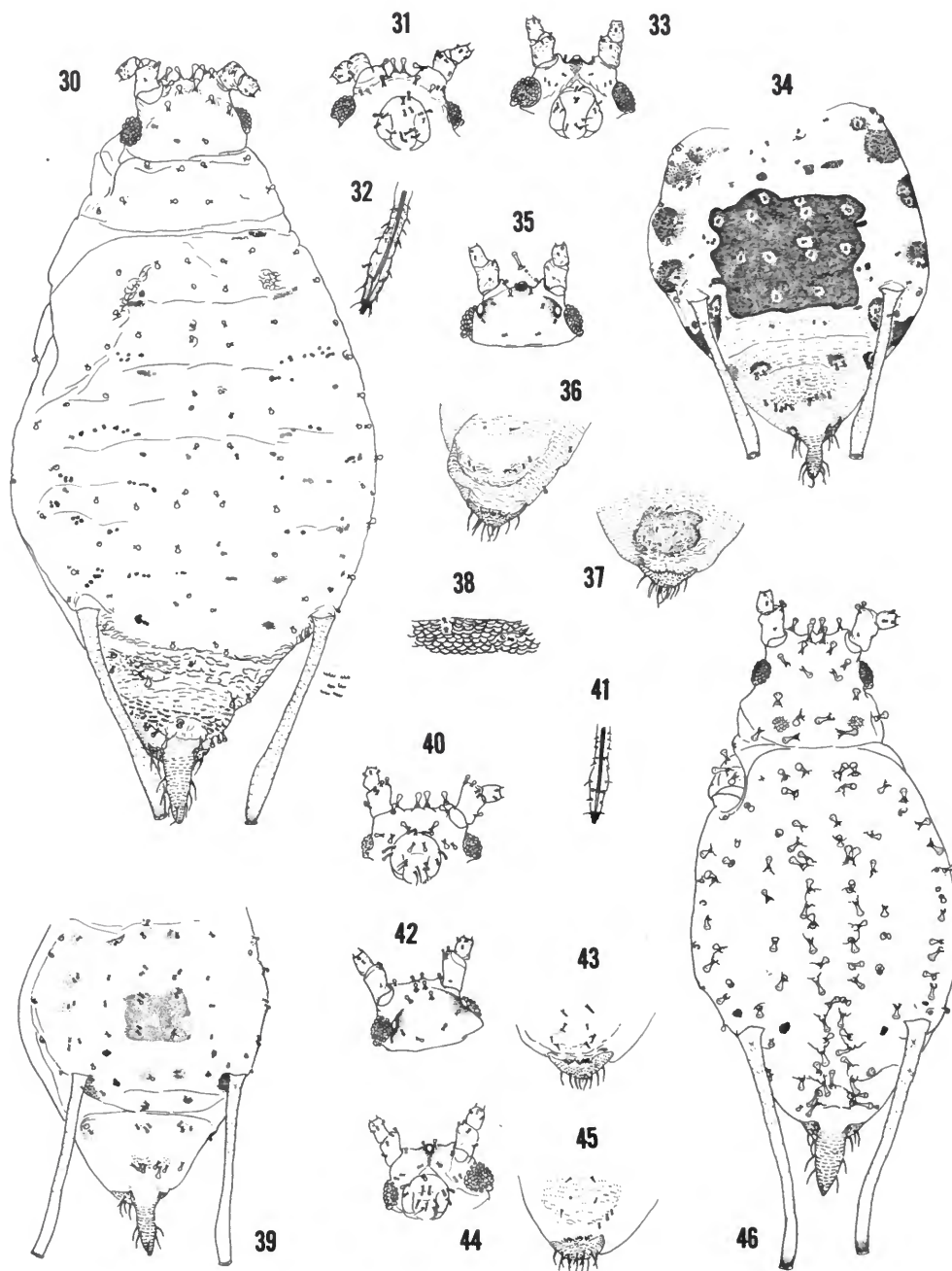
FIGURES 1-6.—Chaetotaxy of *Capitophorus hippophaes hippophaes*: 1, dorsum of apt.v.f.; 2, dorsum of abdomen of al.v.f.; 3, dorsal view of head of al.v.f.; 4, ventral aspect of head of apt.v.f.; 5, rostrum IV+V of *Pleotrichophorus glandulosus* and *Capitophorus hippophaes*; 6, dorsal abdominal view of al.m. [See pp. 7-8 for explanation of abbreviations.]



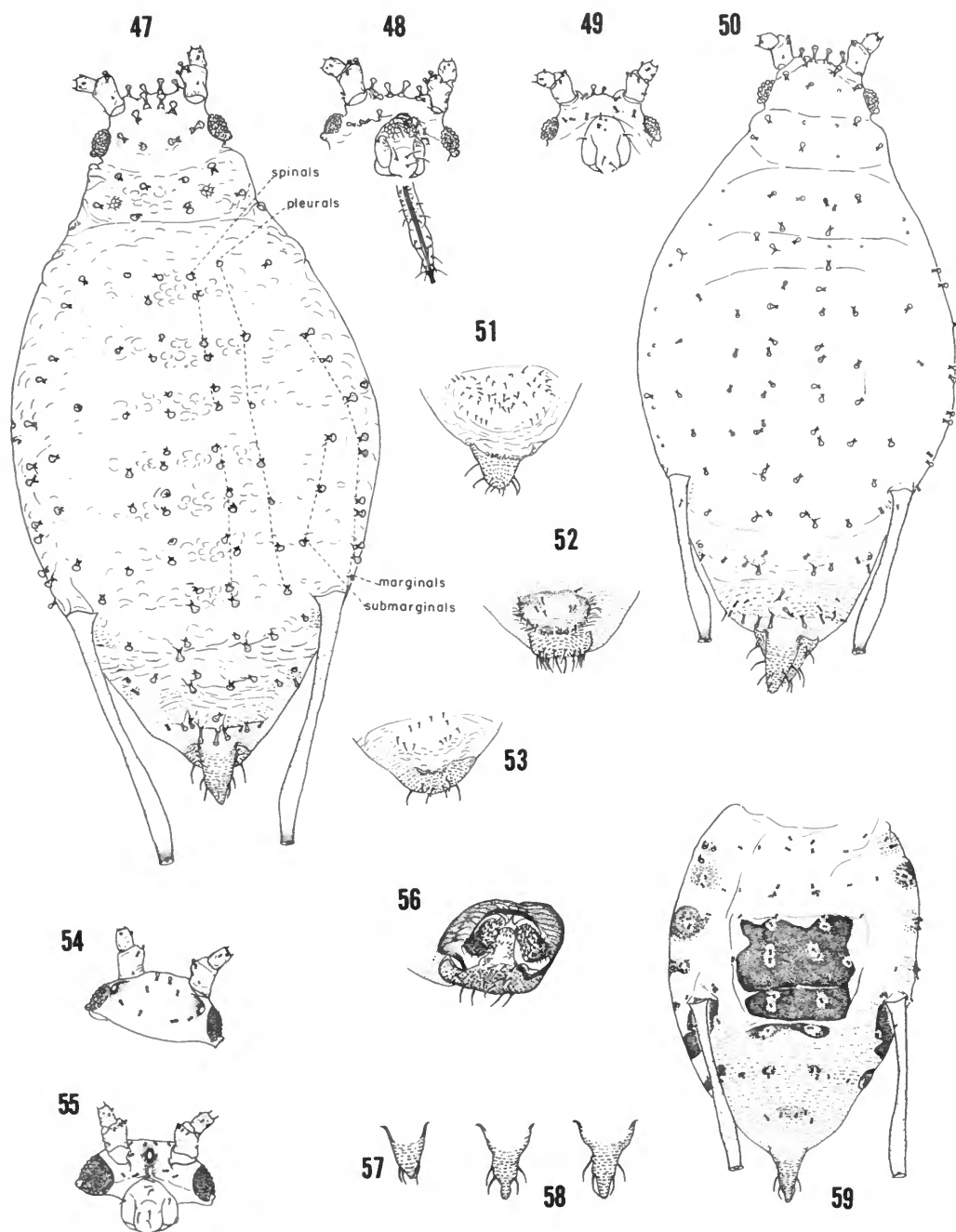
FIGURES 7-18.—*Capitophorus hippophaes*: 7-10, dorsum and 11-14, venter of first to fourth instar nymphs showing postembryonic development of dorsal and ventro-terminal chaetotaxy; 15, ventral view of male genital capsule. Ventral view of female abdominal terminalia showing subgenital and anal plates of: 16, ovip.f.; 17, al.v.f.; and 18, apt.v.f. [See pp. 7-8 for explanation of abbreviations.]



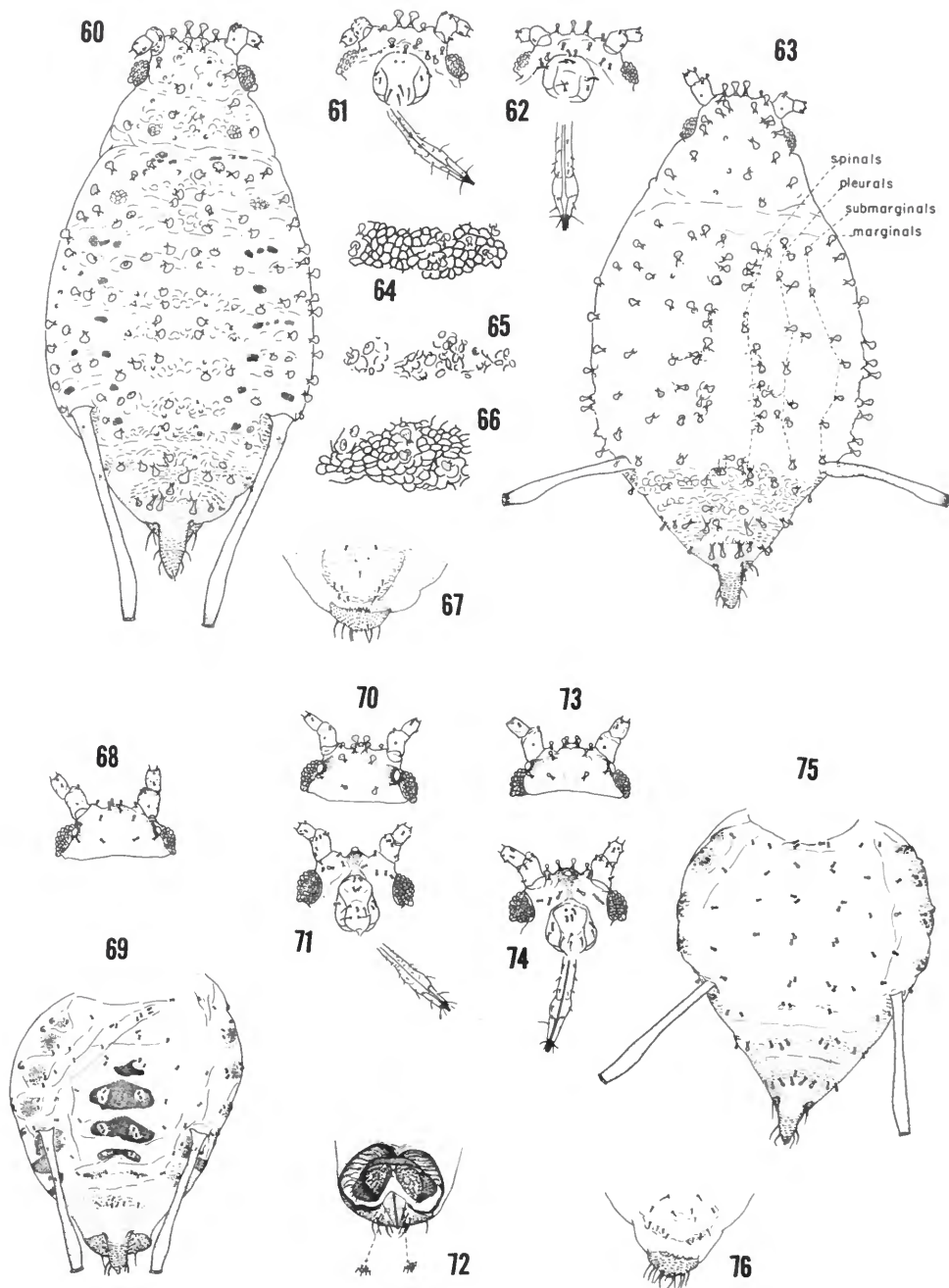
FIGURES 19-29.—Subspecies and morphs of *Capitophorus hippophaes*: 19, *C. h. mitegoni*, apt. v.f. from Poona, India, on *Polygonum glabrum*. *C. h. hippophaes*: 20, apt.v.f. from Klamath Falls, Oregon; 21, dorsum of male head; 22, variations in caudal shape among female alatae; 23, ovip.f.; 24, 25, fundatrix. *C. h. javanicus*: 26-28, type, apt.v.f.; 29, apt.v.f. from California, on *Polygonum lapathifolium*.



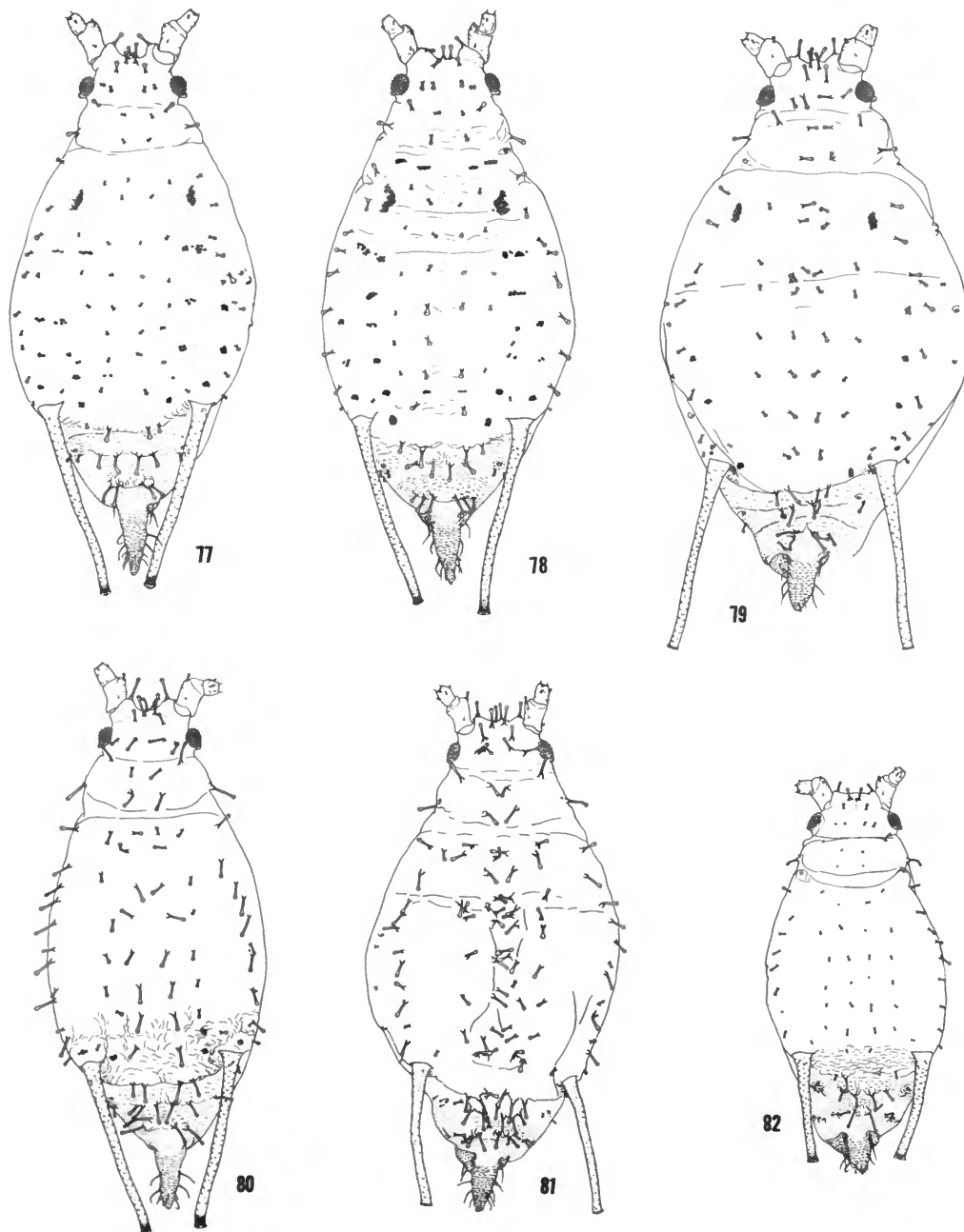
FIGURES 30-46.—Species of *Capitophorus*. *C. essigi*: 30-32, 36, apt.v.f., paratype; 33-35, al.v.f., paratype; 38, dorsal reticulations of apt.v.f. *C. jopepperi*: 39, 42-44, al.v.f., paratype; 40, 41, 45, 46, apt.v.f., holotype.



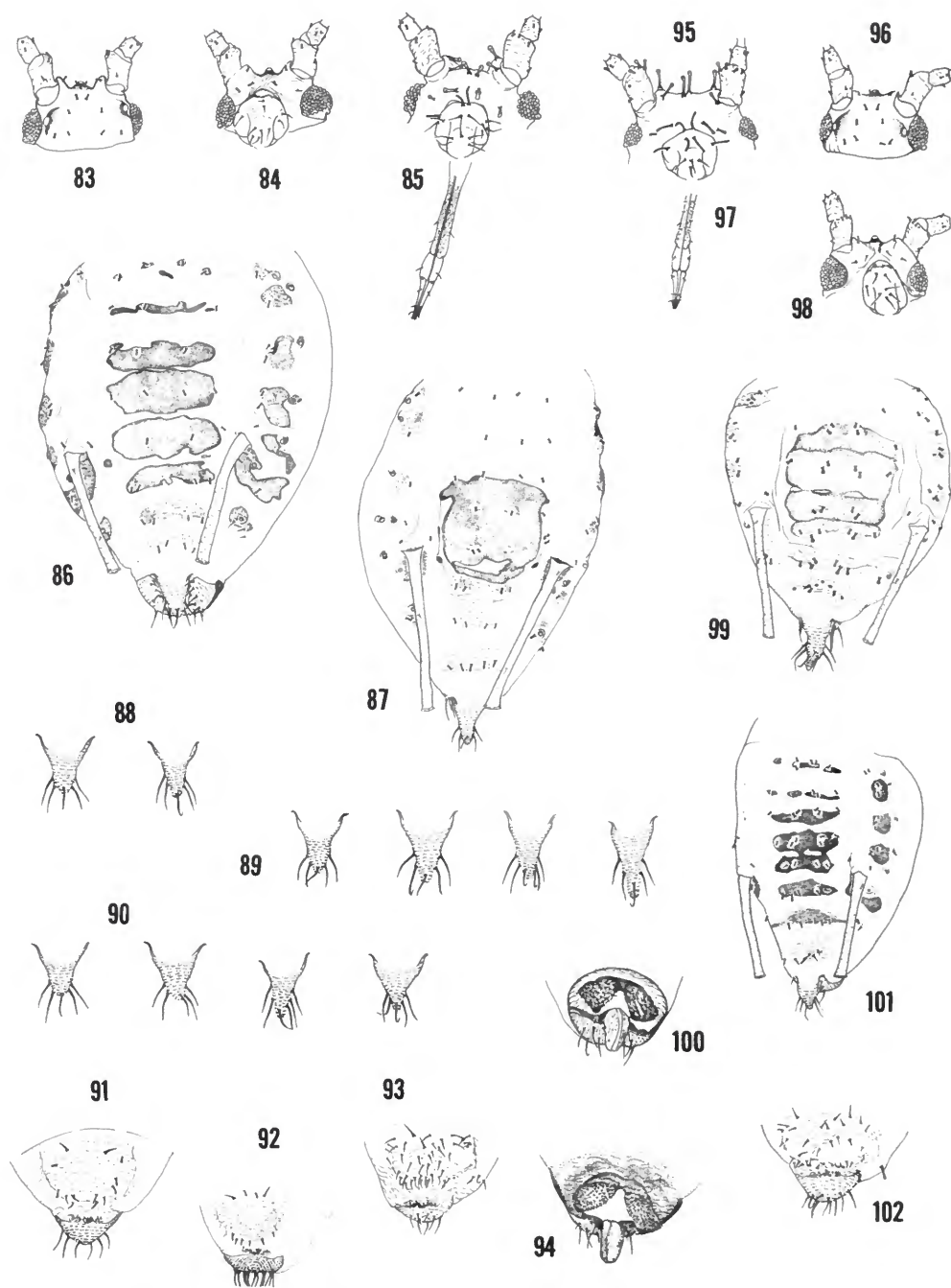
FIGURES 47-59.—*Capitophorus xanthii*: 47, 48, 53, apt.v.f., neotype; 49-51, ovip.f. from Fort Collins, Colorado, on Russian olive (determined as *C. shepherdiae* Gillette and Bragg, "meta-type"); 52, 54, 55, 59, al.v.f., neoparatypes; 56, male genital capsule; 57, caudal shape of male alata; 58, caudal shape of female alatae.



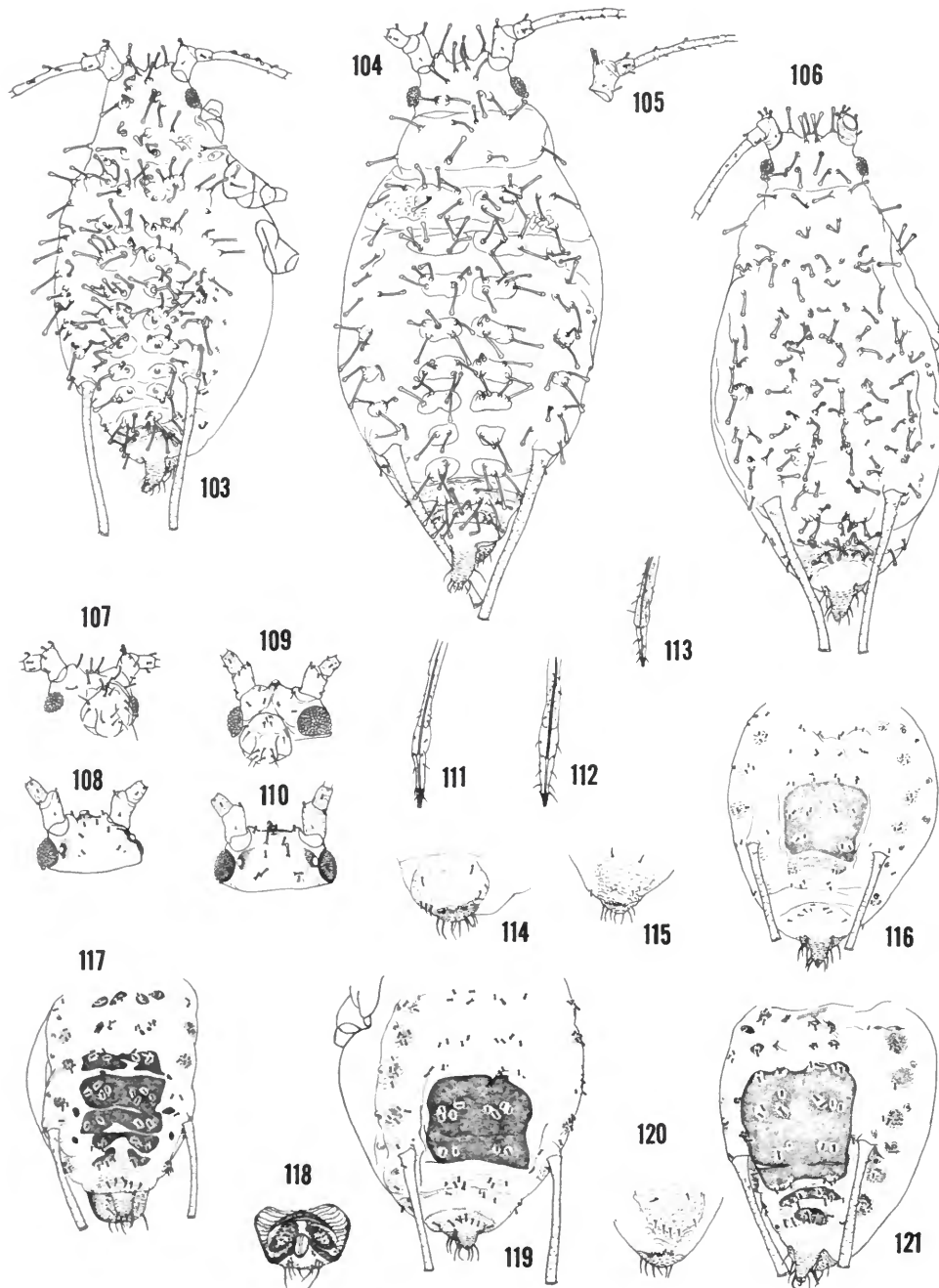
FIGURES 60-76.—*Capitophorus shepherdiae*: 60, 61, 67, apt.v.f., summer exule, on *Ambrosia* sp. from California; 62, 63, apt.v.f., fundatrigenia, on *Shepherdia argentea* from Colorado; 64-66, dorsal abdominal reticulations of apt.v.f. on *Shepherdia* (Figure 64), *Ambrosia* sp. (Figure 65), and *A. psilostachya* (Figure 66); 68, 69, 72, al.m., from aphid trap (Colorado); 70, 71, al.v.f., summer exule, on *A. psilostachya* from California; 73-76, al.v.f., fundatrigenia, paratype, on *S. argentea* from Colorado.



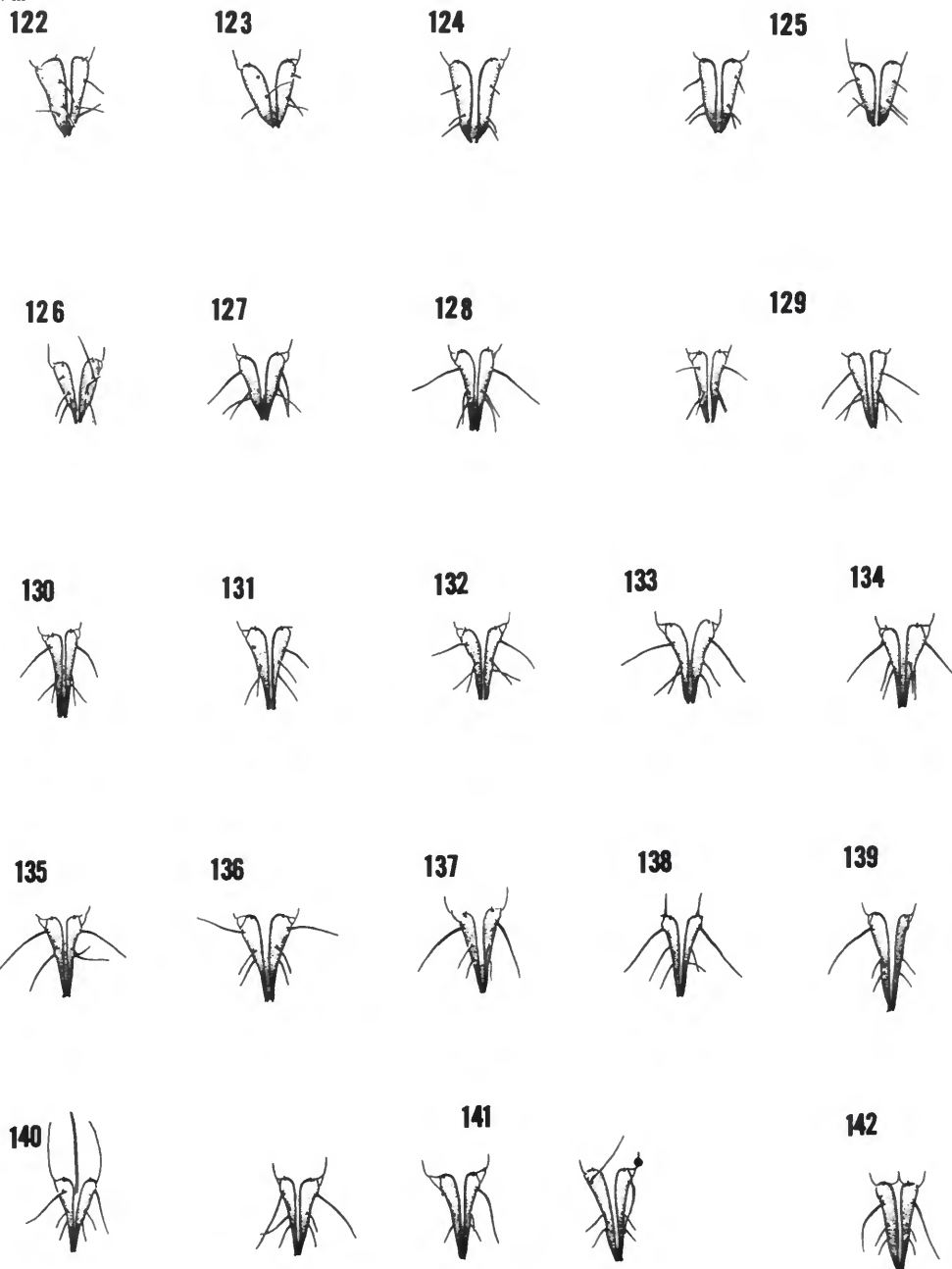
FIGURES 77-82.—Species of *Capitophorus*: 77-78, *C. elaeagni*, apt.v.f., on *Cirsium* sp. from Minnesota; 79, *C. carduinus*, apt.v.f., on *Cirsium lanceolatum* from Usquert, Netherlands; 80, *C. elaeagni*, apt.v.f., on *Cynara cardunculus* from California; 81, *C. horni*, ovip.f., on *Cirsium* sp. from New Brunswick, Canada; 82, *C. elaeagni*, ovip.f., on *Elaeagnus* from Minnesota.



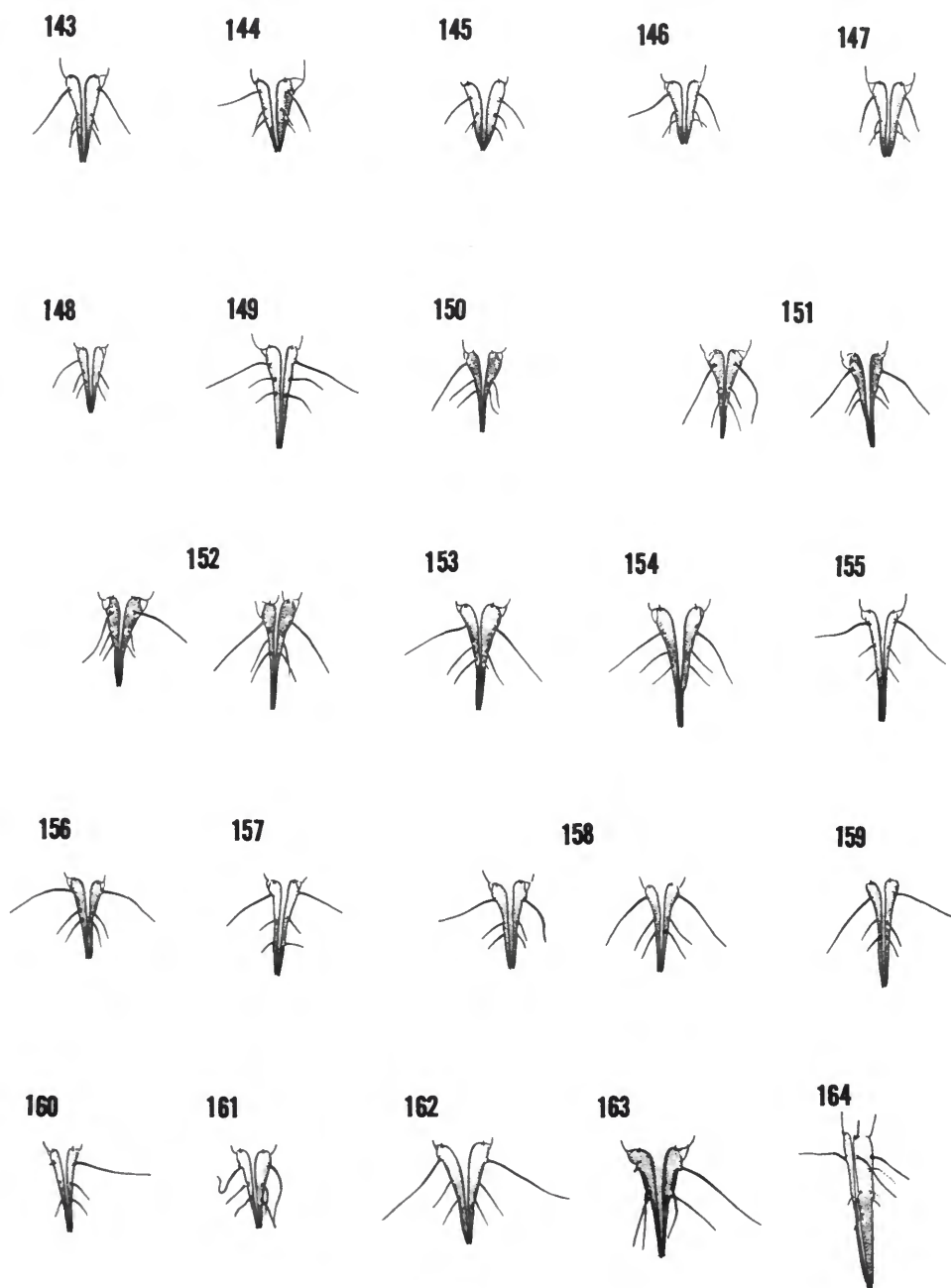
FIGURES 83-102.—Species of *Capitophorus*. *C. elaeagni*: 83, 84, 86, al.m.; 85, apt.v.f.; 87, al.v.f. Variations in caudal shape among alate viviparae: 88, on *Elaeagnus*; 89, on *Cirsium*; 90, on *Cynara*. Ventral terminalia: 91, apt.v.f.; 92, al.v.f.; 93, ovip.f.; 94, al.m. *C. horni*: 95, 97, 102, ovip.f. and, 96, 98, 100, 101, al.m., on *Cirsium* from Canada. *C. horni gynoxantha*: 99, dorsum of abdomen, al.v.f., on *Cirsium arvense* from Bergen-op-Zoom, Netherlands, cotype.



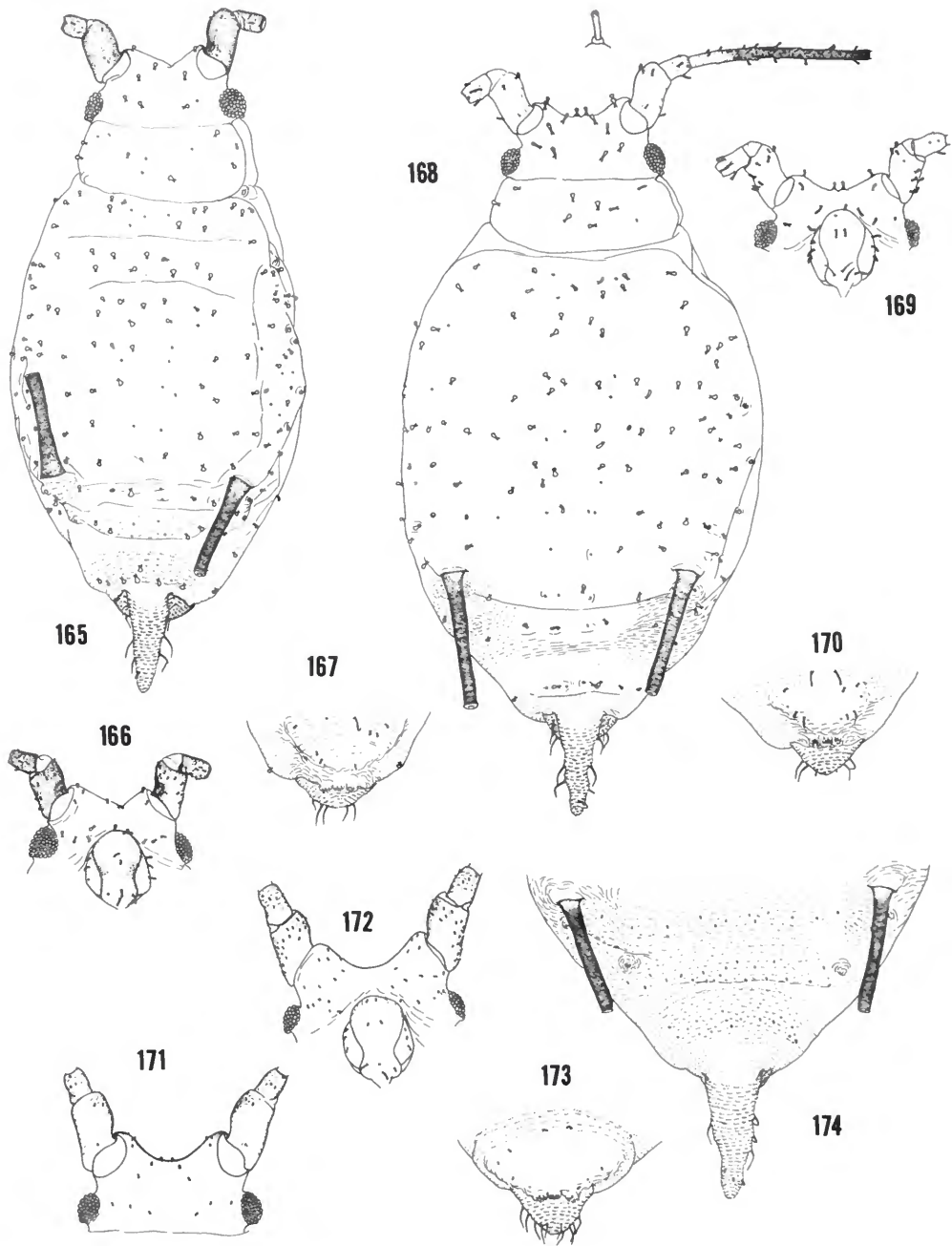
FIGURES 103-121.—Species of *Capitophorus*. *C. pakansus*: 103, 107, 111, apt.v.f., paratype; 108, 109, 114, 119, al.v.f., paratype; 110, al.v.f., cotype of *C. vanderhooti* Hille Ris Lambers, Wageningen, Netherlands, on *Inula helenium*; 117, 118, al.m., paratype. *C. similis* from Belgium: 104, apt.v.f., on *Tussilago*; 105, apt.v.f., on *Petasites*; 120-121, al.v.f., on *Tussilago*. *C. inulae*, on *Inula* sp., from Reading, England: 106, 113, apt.v.f.; 115, 116, al.v.f.



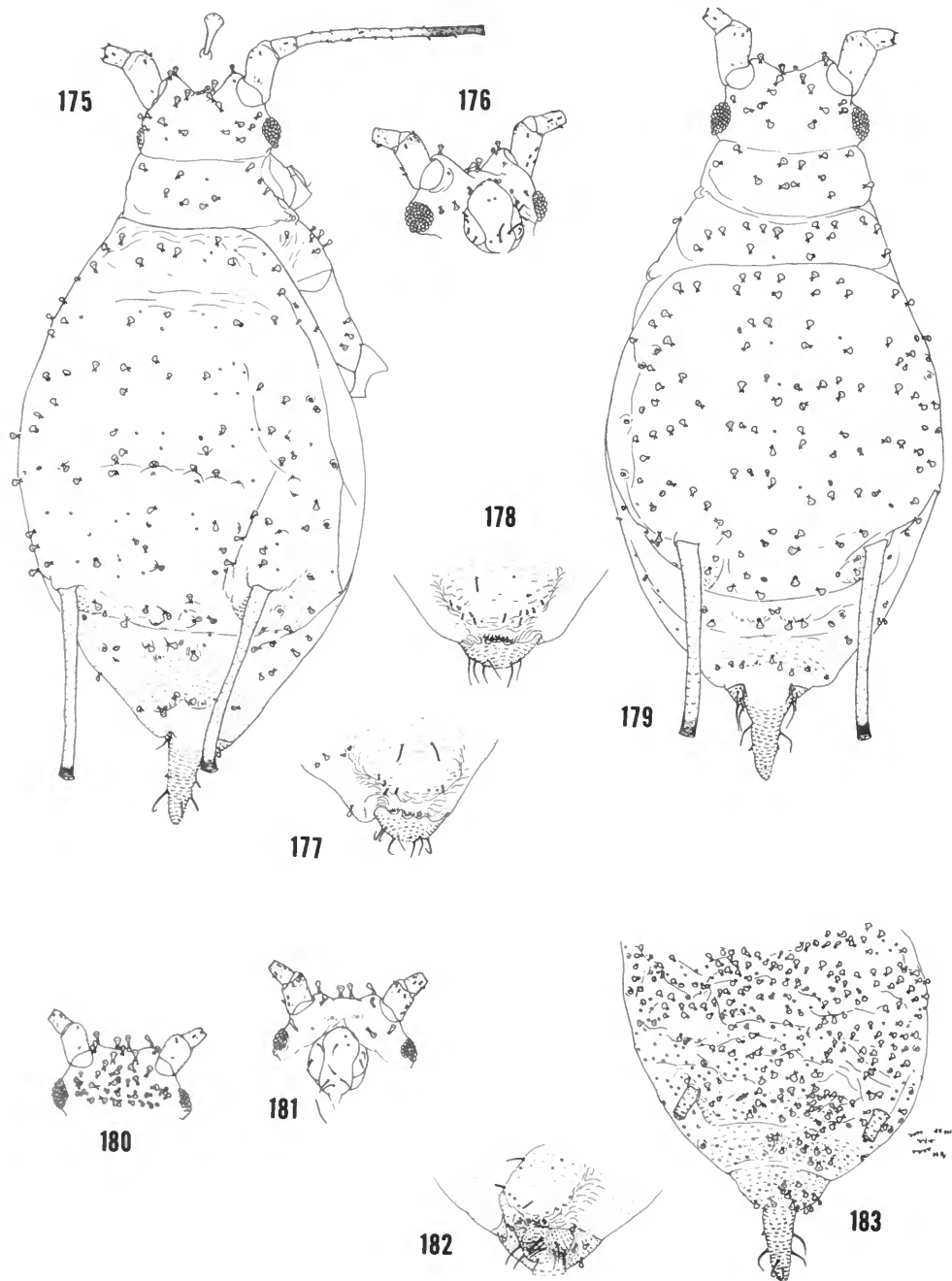
FIGURES 122-142.—Rostrum IV+V of apterous viviparous females (unless otherwise stated as another morph) of *Pleotrichophorus* species: 122, *P. acanthovillus*; 123, *P. utensis*; 124, *P. magnautensus*; 125, *P. pycnorhysus* (left, "*Capitophorus feragaeus*," right, lectotype of *P. pycnorhysus*); 126, *P. triangulatus*; 127, *P. xerozoous*; 128, *P. gregarius*; 129, *P. elongatus* (left, paralectotype on *Chrysothamnus nauseosus*, right, specimen on *C. viscidiflorus*); 130, *P. palmerae*; 131, *P. stroudi*; 132, *P. oestlundii*; 133, *P. packi packi*; 134, *P. packi brevis*; 135, *P. sporadicus*; 136, *P. neosporadicus*; 137, *P. chrysanthemi*; 138, *P. glandulosus*; 139, *P. knowltoni*; 140, *P. wasatchii*; 141, *P. ambrosiae* (left, on *Ambrosia artemisiifolia*; middle, on *Ambrosia* sp.; right, on *Franseria discolor*); 142, *P. ohioensis*, ovip.f.



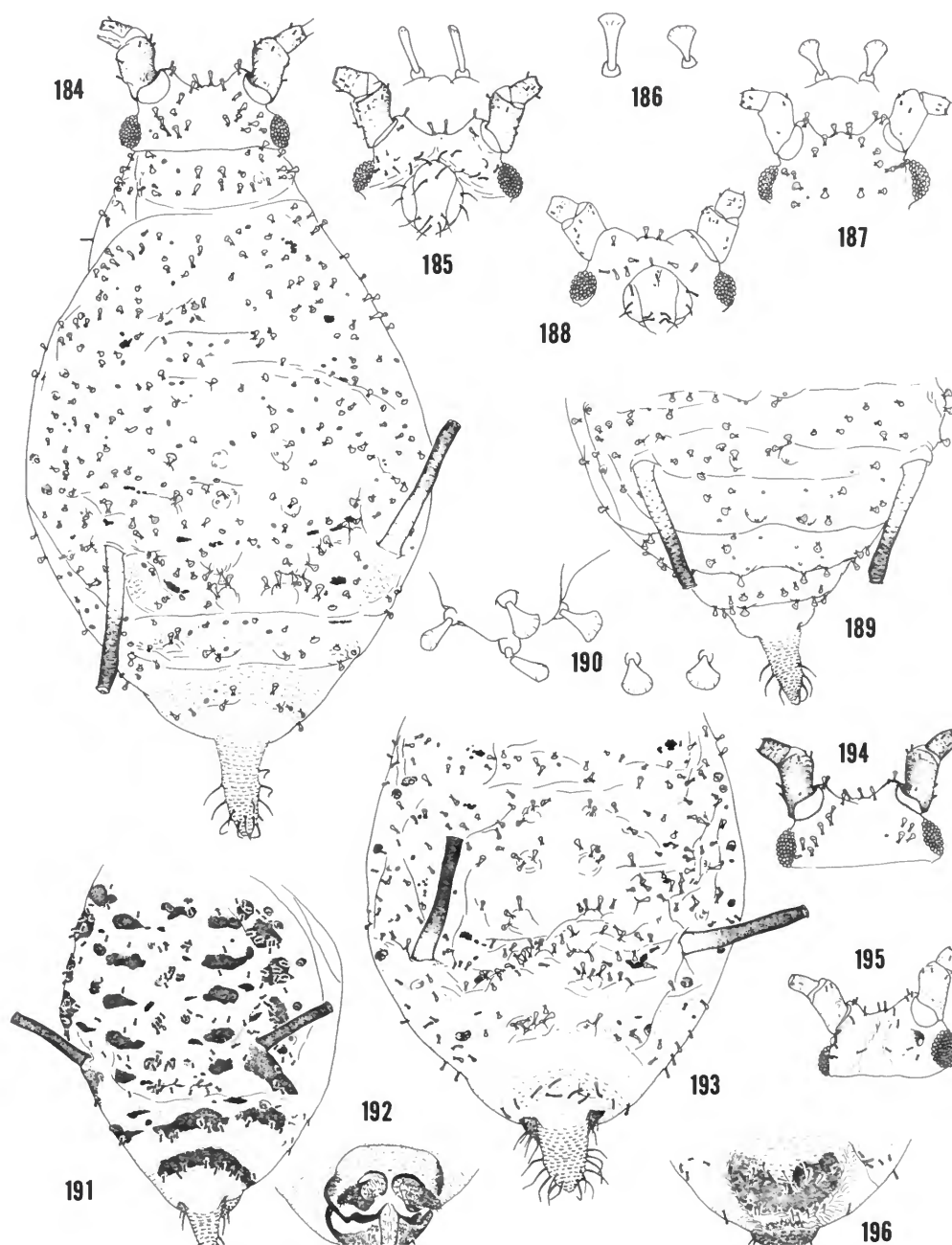
FIGURES 143-164.—Rostrum IV+V of apterous viviparous females (unless otherwise stated as another morph) of *Pleotrichophorus* species: 143, *P. patonkus*; 144, *P. pseudopatonkus*; 145, *P. patonkusellus*; 146, *P. parilis*; 147, *P. diutius*; 148, *P. filifoliae*; 149, *P. brevinectarius*, al.v.f., paratype; 150, *P. obscuratus*; 151, *P. heterohirsutus* (left, apt.v.f., "paratype" of *C. bitrichus*; right, ovip.f., paratype of *P. heterohirsutus*); 152, *P. quadririchus quadririchus* (left, lectotype from Logan, Utah; right, from California); 153, *P. rusticatus*; 154, *P. pullus*; 155, *P. gnaphalodes*; 156, *P. spatulavillus*; 157, *P. antennarius*; 158, *P. decampus* (left, fundatrix, lectotype; right, summer vivipara); 159, *P. pseudoglandulosus*; 160, *P. intermedius*; 161, *P. zoomontanus*; 162, *P. longinectarius*; 163, *P. longipes*; 164, *P. amsinckii*.



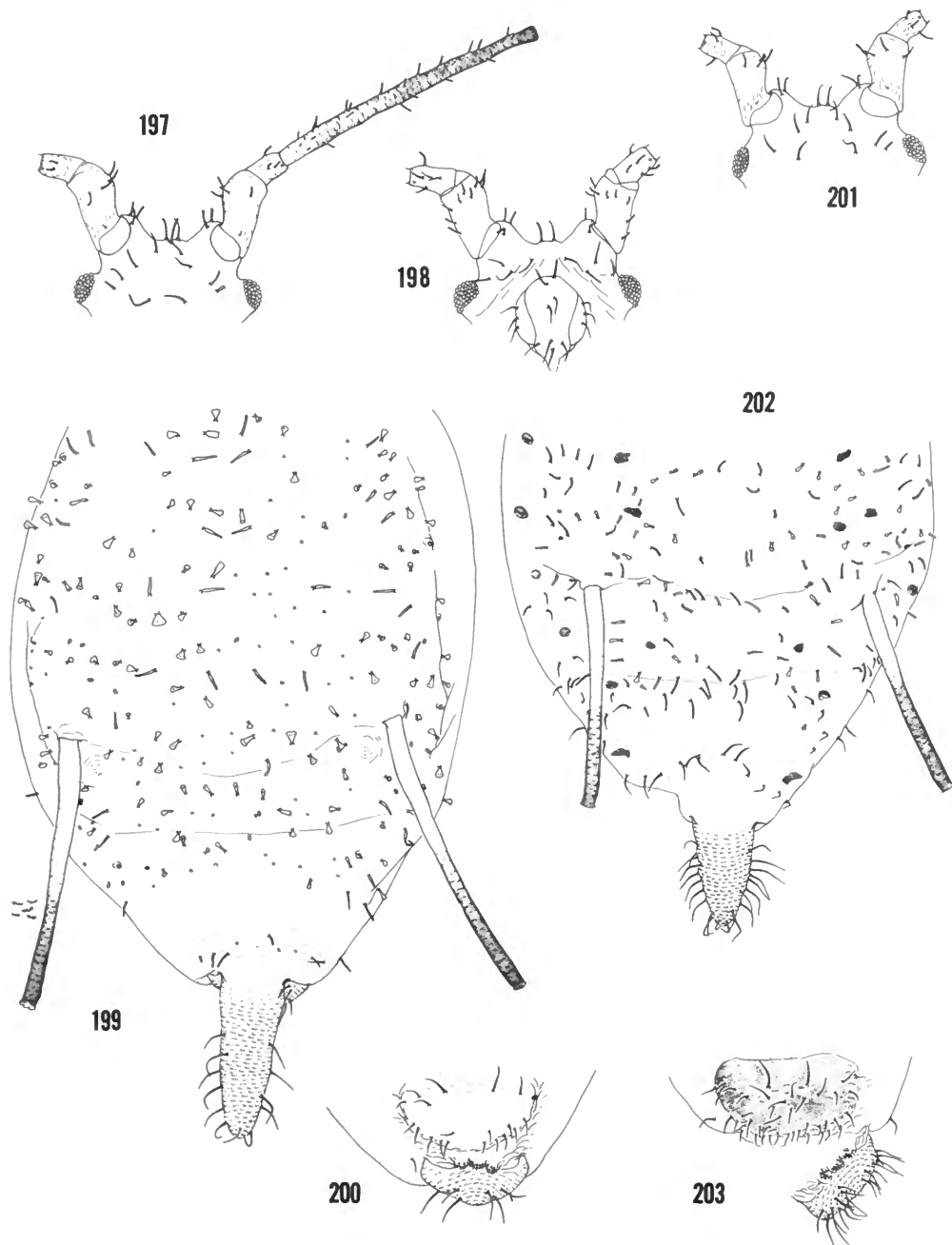
FIGURES 165-174.—Apterous viviparous females of *Pleotrichophorus* species: 165-167, *P. utensis*, from Snowville, Utah, on *Gutierrezia* (dorsum of body, venter of head and ventral abdominal terminalia); 168-170, *P. acanthovillus*, lectotype; 171-174, *P. magnautensus*, "paratype."



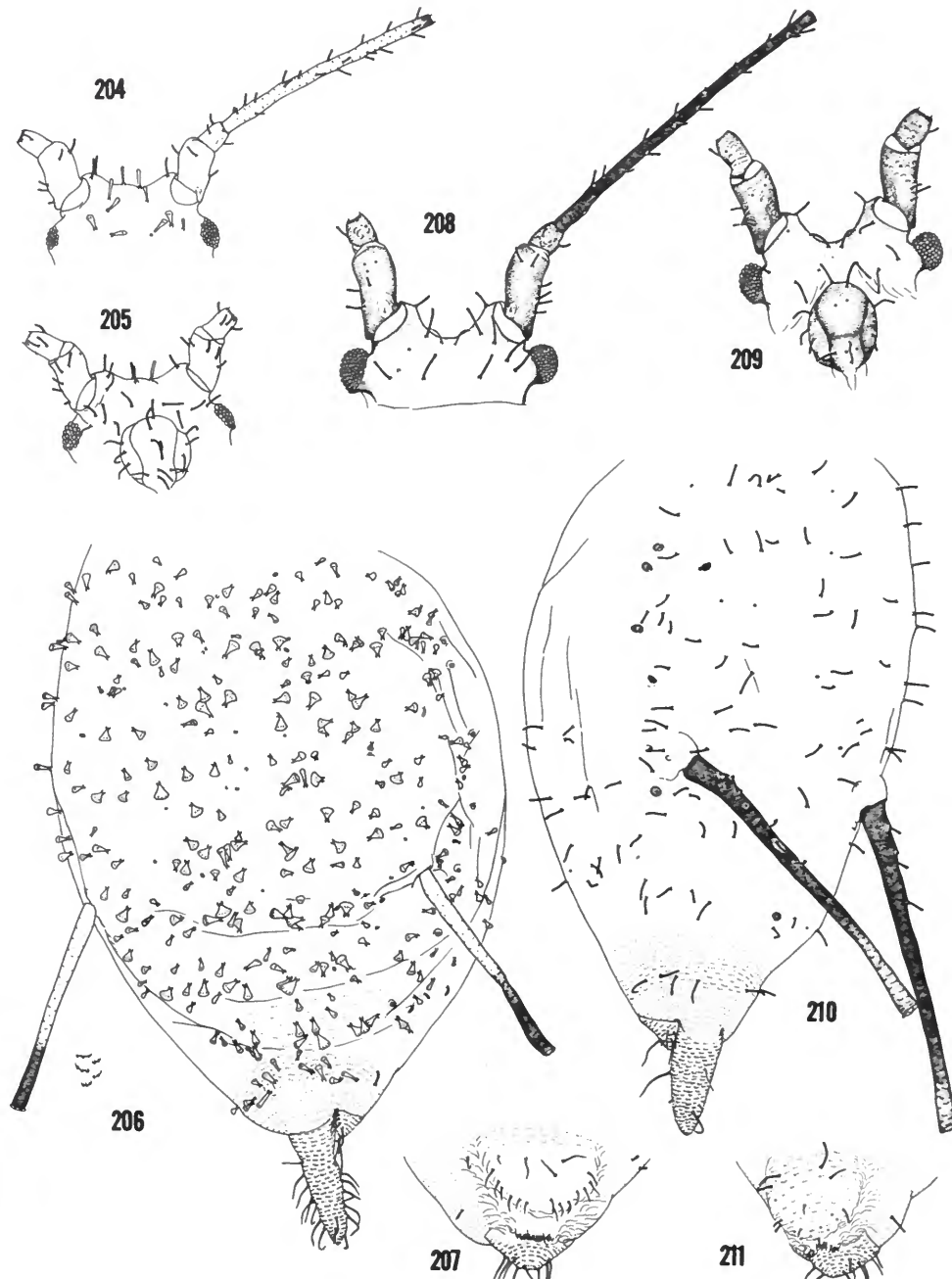
FIGURES 175-183.—Apterous viviparous females of *Pleotrichophorus* species: 175-177, *P. pycnorhysus*, lectotype; 178, 179, *P. pycnorhysus* (determined as "*Capitophorus feragaeus*," Nioche, Utah, on *Chrysothamnus viscidiflorus*); 180-183, *P. triangulatus*, holotype.



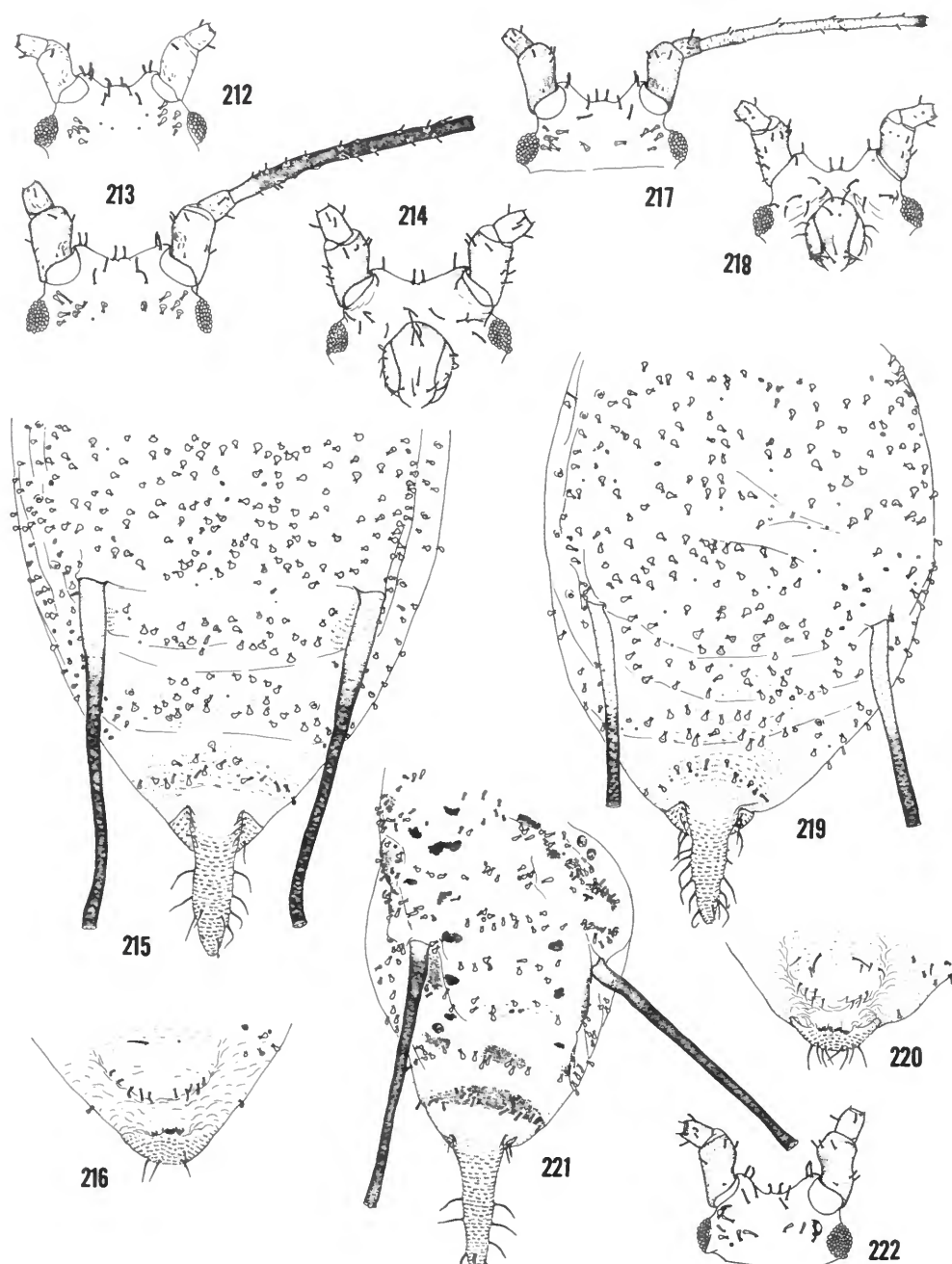
FIGURES 184-196.—Species of *Pleotrichophorus*: 184, 185, *P. gregarius*, apt.v.f., paralectotype (mf setae enlarged above Figure 185); 186, df-1 setae of *P. gregarius* (left) and *P. xerozoous* (right); 187-189, *P. xerozoous*, apt.v.f., lectotype; 190, dorsal abdominal setae of apt.v.f. of *P. gregarius* (left) and *P. xerozoous* (right); 191-192, 195, *P. gregarius*, al.m., paralectotype; 193-194, 196, *P. gregarius*, ovip.f., paralectotype.



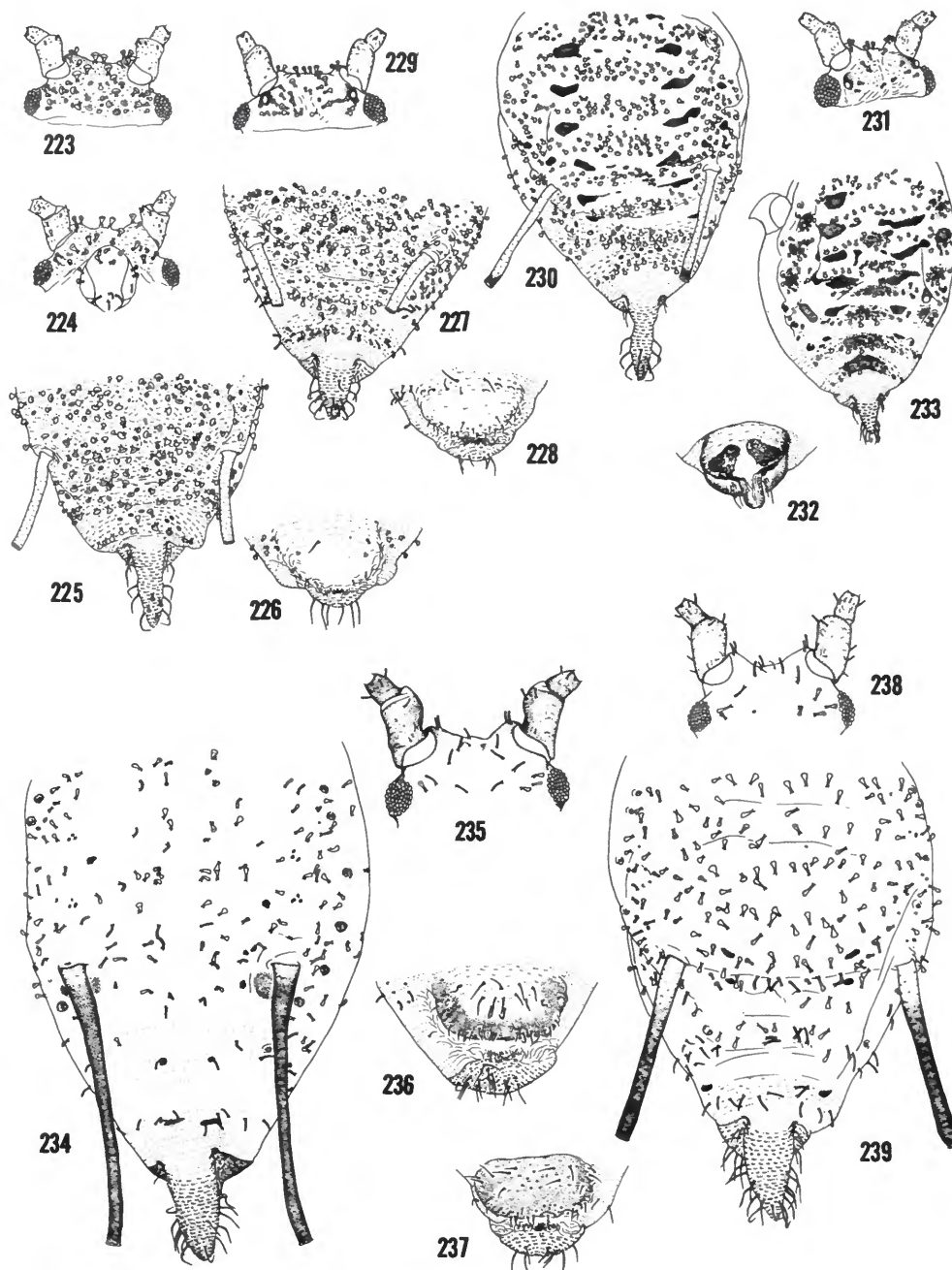
FIGURES 197-203.—*Pleotrichophorus sporadicus*: 197-200, apt.v.f., "paratype" from Harper, Utah; 201-203, ovip.f., from Farmington, Utah.



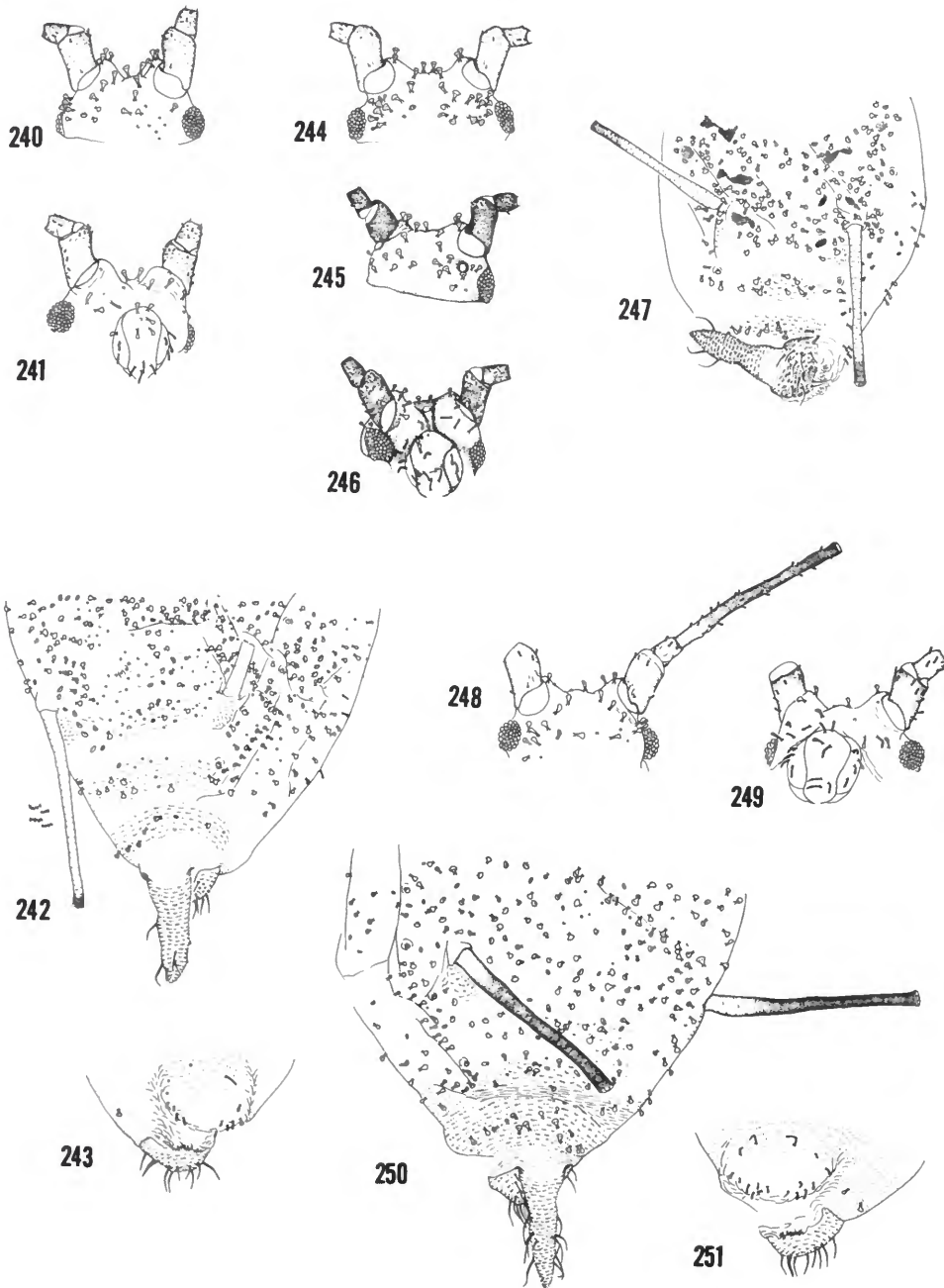
FIGURES 204-211.—Apterous viviparous females of *Pleotrichophorus* species: 204-207, *P. neosporadicus*, holotype; 208-211, *P. longipes*, from Allen Creek, Utah, on *Artemisia*.



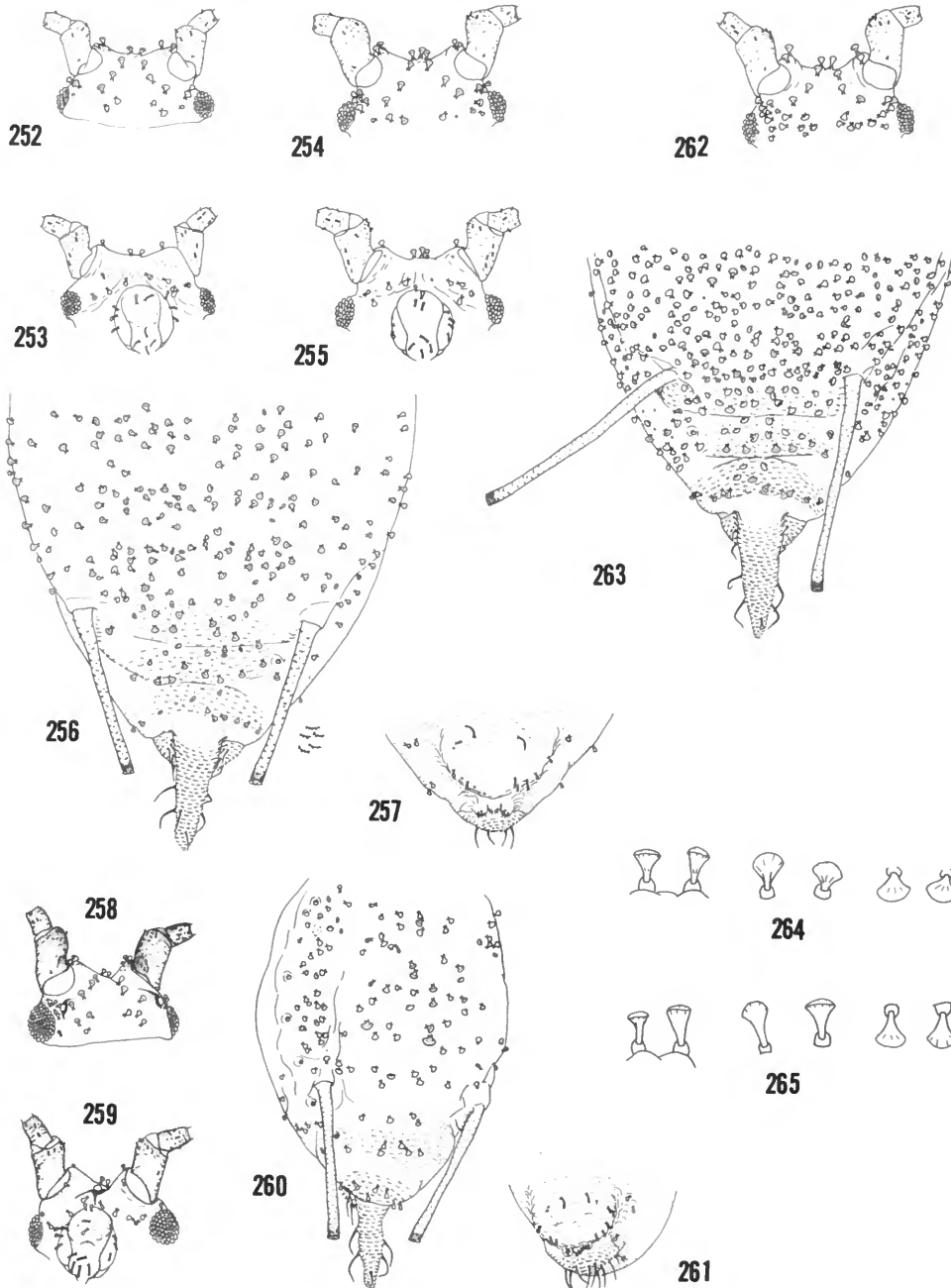
FIGURES 212-222.—Apterous viviparous females of *Pleotrichophorus packi* morphs and sub-species. *P. p. packi*: 212, fundatrix from Benjamin, Utah; 213-216, from Delta, Utah; 221-222, from St. John, Utah. *P. p. brevis*: 217-220, holotype.



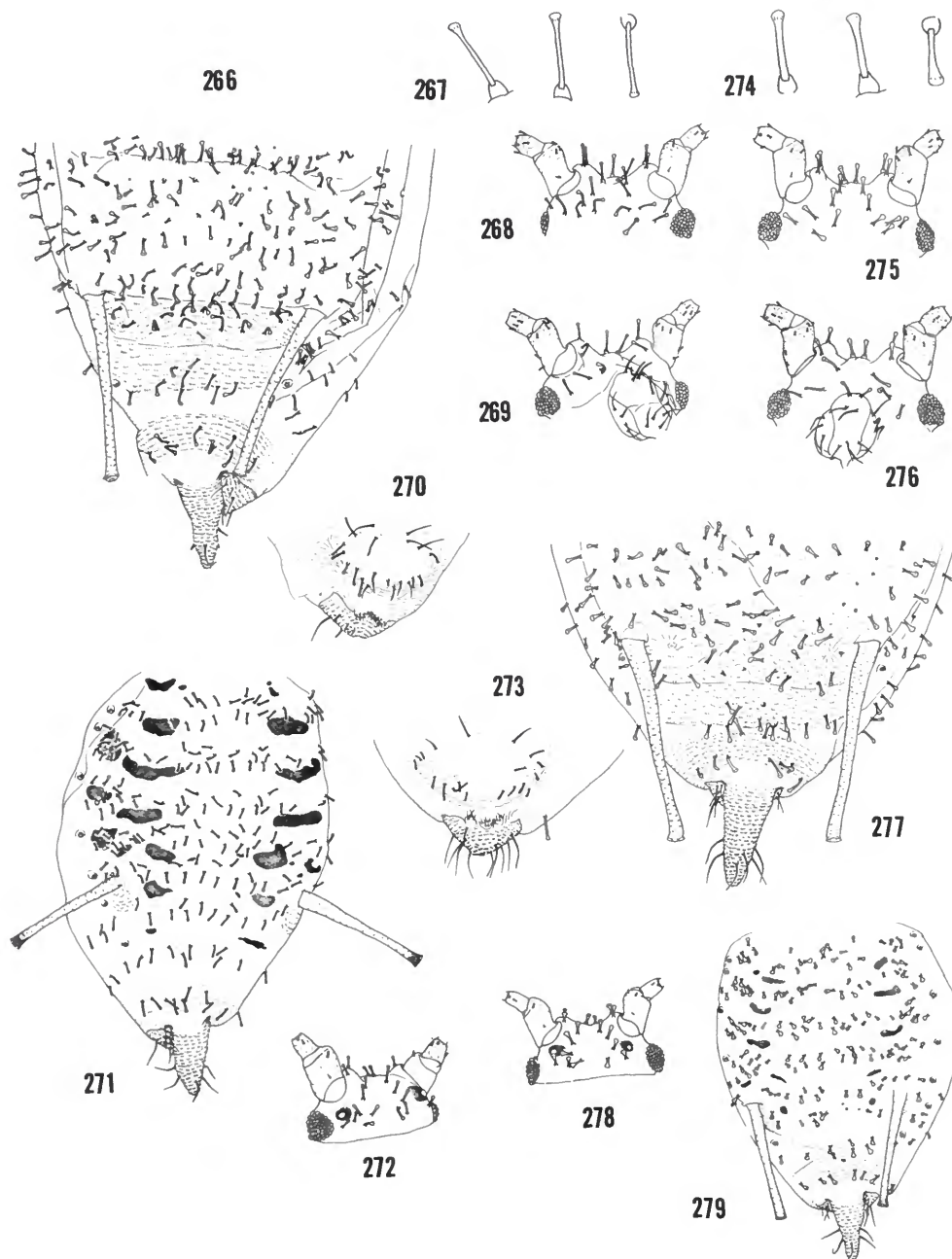
FIGURES 223-239.—Species of *Pleotrichophorus*. *P. oestlundii*: 223-226, apt.v.f., paralectotype; 227, 228, ovip.f., paralectotype; 229-230, al.v.f.; 231-233, al.m., paralectotype. *P. packi packi*: 234-236, ovip.f., from Panguitch, Utah. *P. packi brevis*: 237-239, ovip.f., paratype.



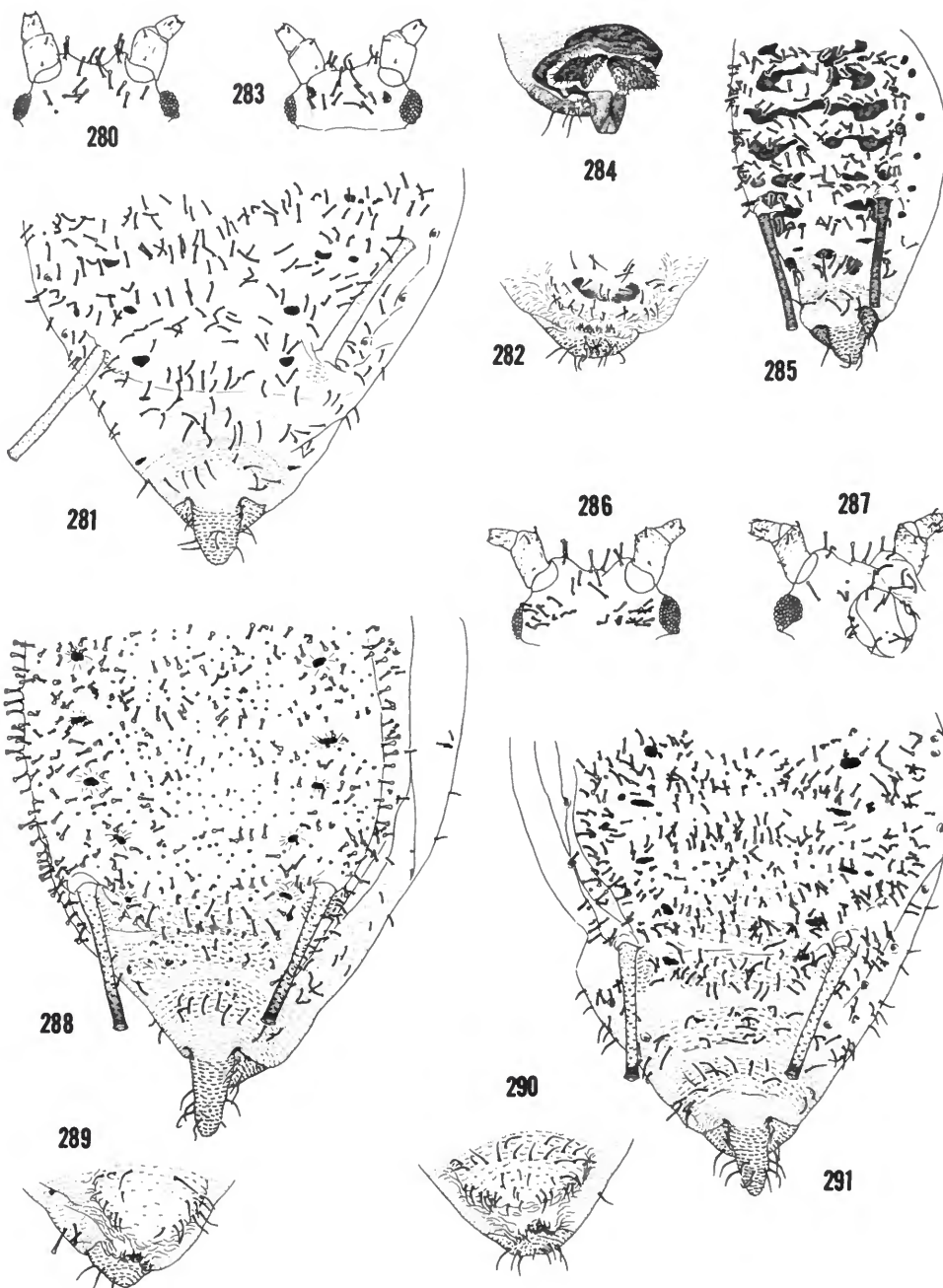
FIGURES 240-251.—Species of *Pleotrichophorus*. *P. palmerae* from Redmond, Oregon: 240-243, apt.v.f., paralectotype; 244, apt.v.f.; 245-247, al.v.f. *P. stroudi*: 248-251, apt.v.f., lectotype.



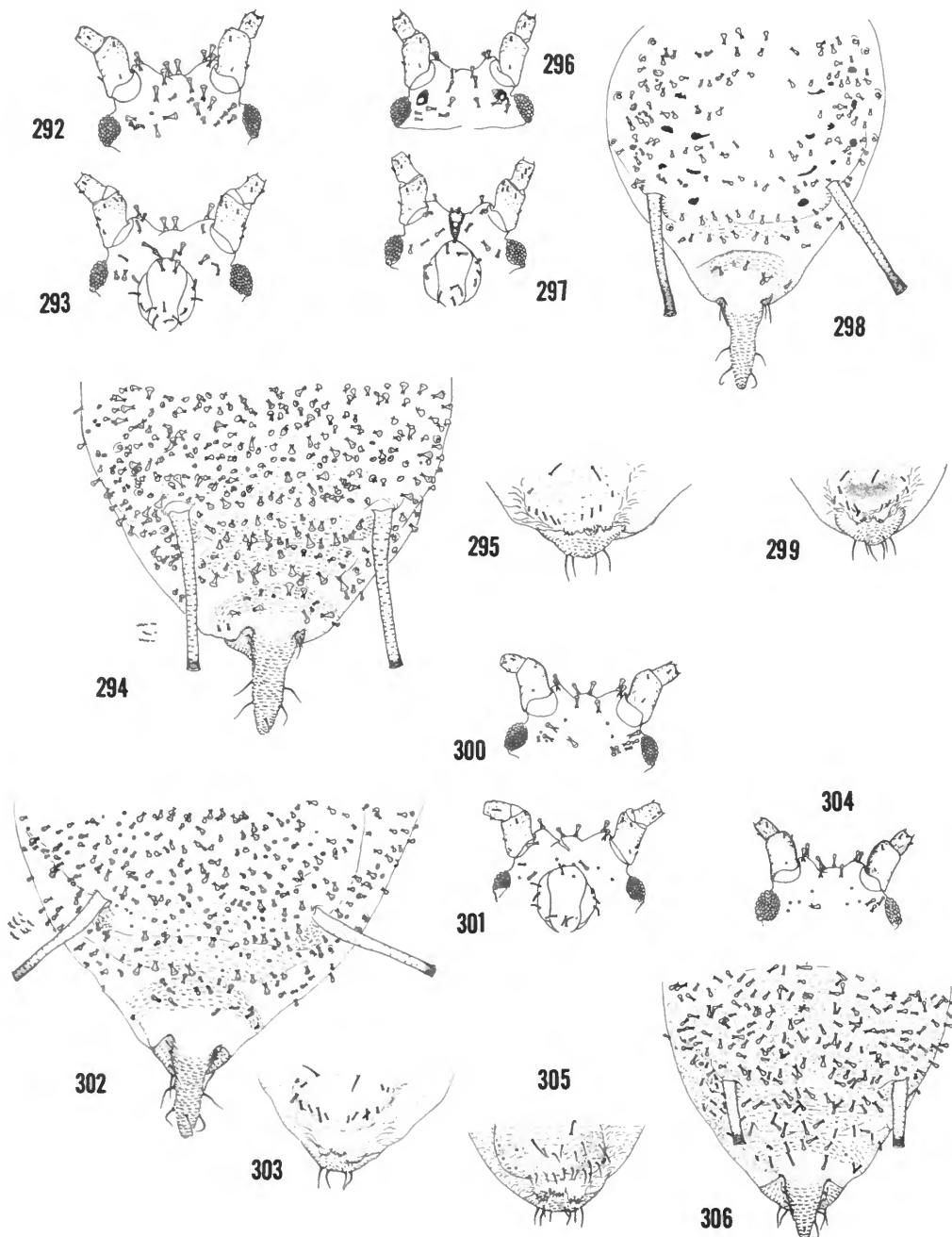
FIGURES 252-265.—Specimens of *P. elongatus*: 252, 253, 256, 257, apt.v.f., spring form, paralectotype; 254, 255, apt.v.f., summer form, lectotype; 258-261, al.v.f., paralectotype; 262, 263, apt.v.f., on *C. viscidiflorus*, from Sawtooth, Utah. Mf, df-1, posterior df, and 2 abdominal setae of: 264, *P. elongatus*; 265, *P. palmerae*, from Redmond, Oregon.



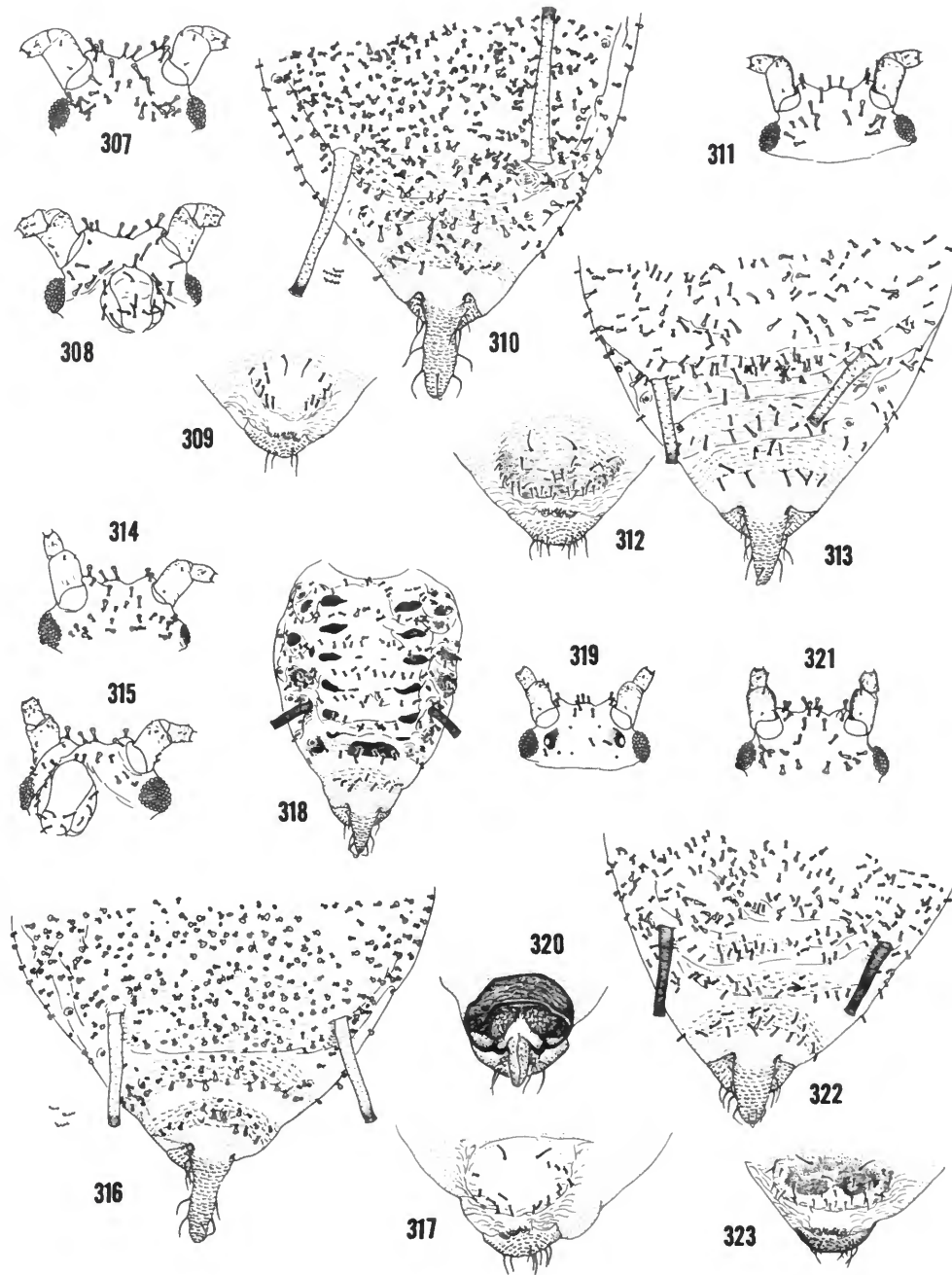
FIGURES 266-279.—Specimens of *Pleotrichophorus* species. *P. chrysanthemi*: 266-270, apt.v.f., from Stanford University Nursery (with mf, df-1, and abdominal setae enlarged in Figure 267); 271, 272, al.v.f., from Raleigh, North Carolina. *P. glandulosus*: 273-277, apt.v.f., from New Brunswick, Canada (with mf, df-1, and abdominal setae enlarged in Figure 274); 278, 279, al.v.f., from Strassburg, Pennsylvania.



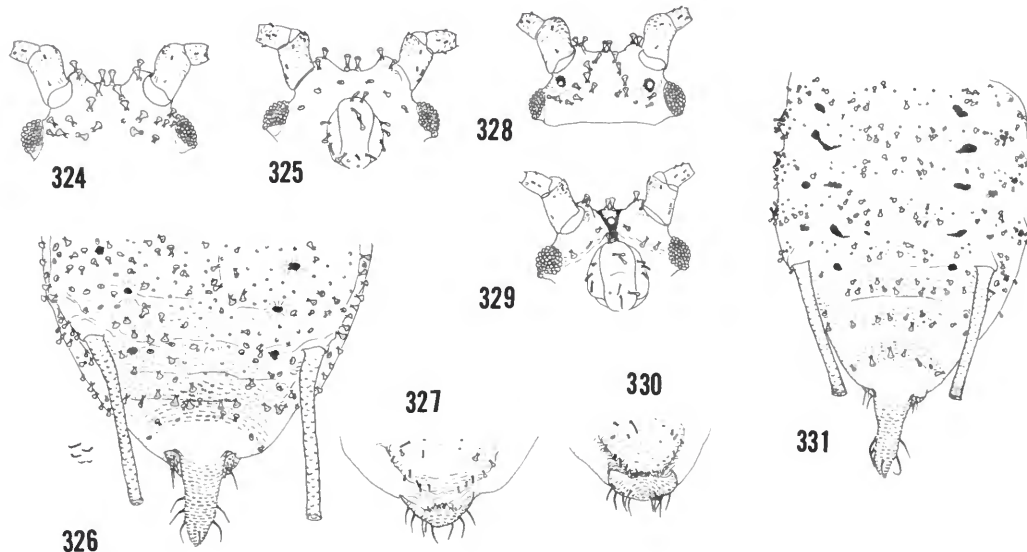
FIGURES 280-291.—Species of *Pleotrichophorus*. *P. glandulosus* from Haddon Field, New Jersey: 280-283, ovip.f.; 284, 285, apt.m. *P. knowltoni*: 286-289, apt.v.f., holotype; 290, 291, ovip.f., paratype.



FIGURES 292-306.—Females of *Pleotrichophorus ambrosiae*: 292-295, apt.v.f., on *Ambrosia artemisiifolia*, from State College, Pennsylvania (with cornicular imbrications on left of Figure 294); 296-299, al.v.f., on *A. artemisiifolia*, from State College, Pennsylvania; 300-303, apt.v.f., on *Ambrosia* sp., unknown locality; 304-306, ovip.f., on *Ambrosia* sp., unknown locality.

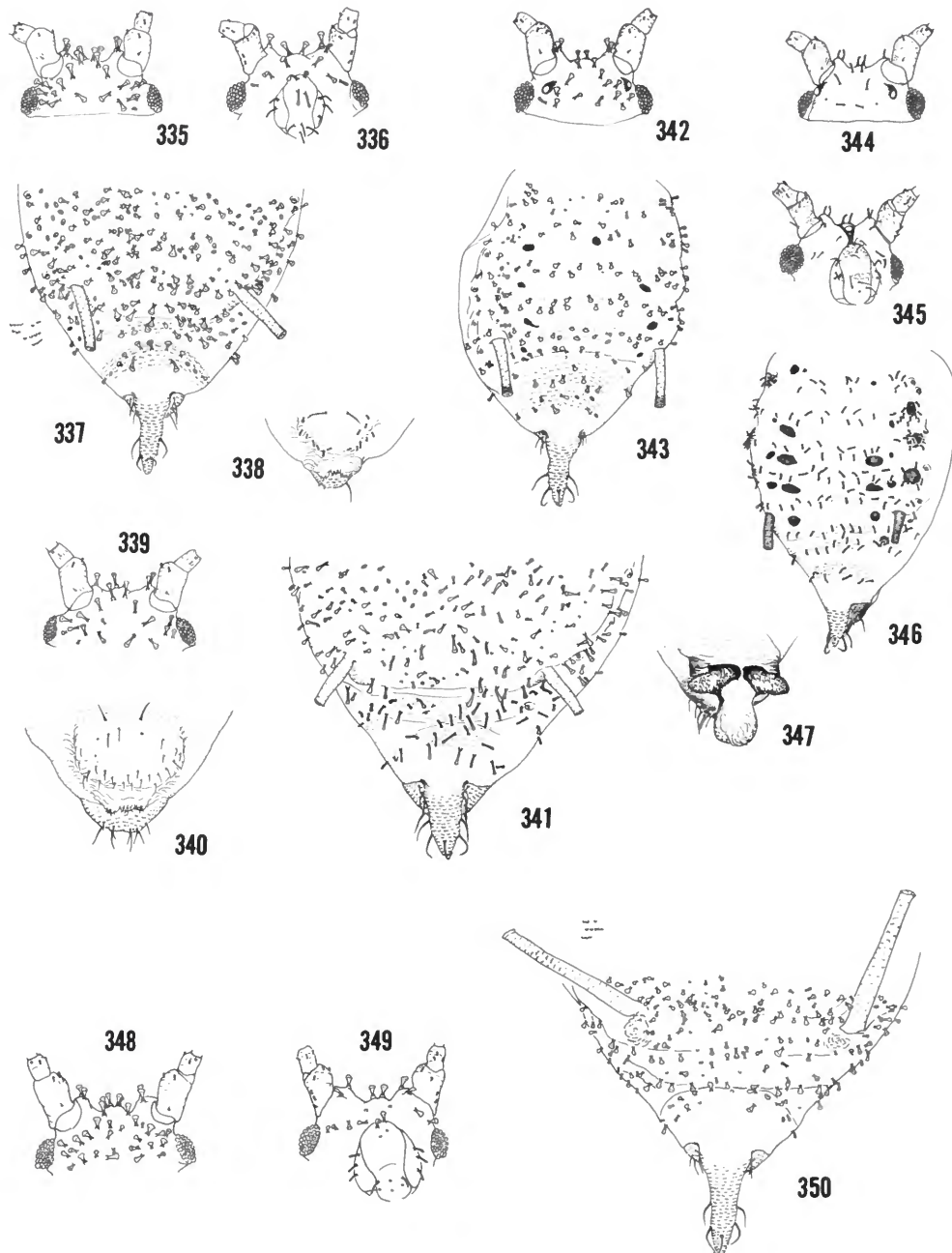


FIGURES 307-323.—Species of *Pleotrichophorus*. *P. ohioensis*, on *Helianthus*, from Columbus, Ohio: 307-310, apt.v.f., paratype; 311-313, ovip.f., paratype. *P. ambrosiae*, on *Franseria discolor*, from Fort Collins, Colorado: 314-317, apt.v.f., 318-320, al.m.; 321-323, ovip.f.

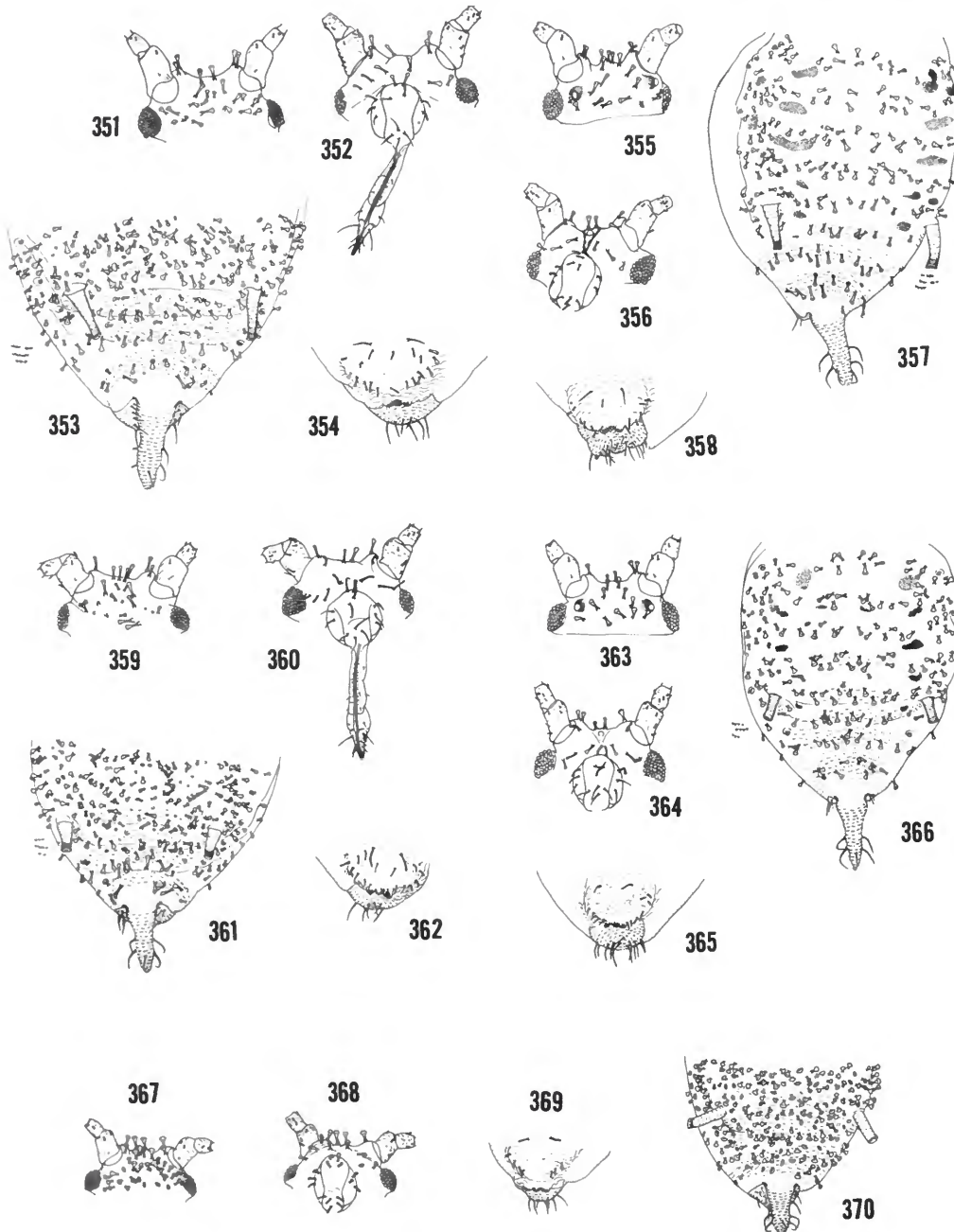


	mesofrontals (mf)	dorsofrontals (df) df-1	dorsol abdominals
332 <i>P. diutius</i>			
333 <i>P. ambrosiae</i>			
334 <i>P. ohioensis</i>			

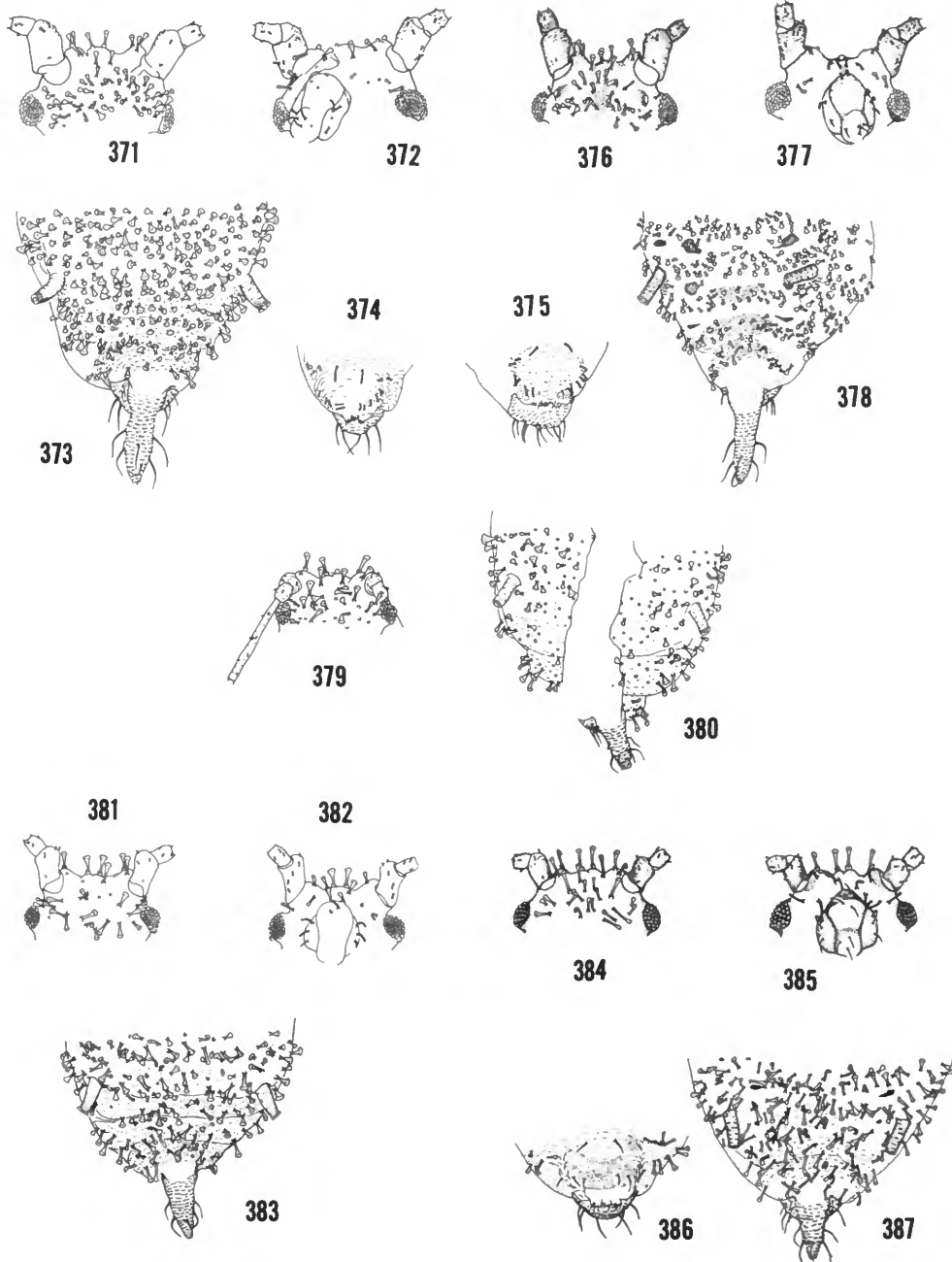
FIGURES 324-334.—Species of *Pleotrichophorus*. *P. diutius*: 324-327, apt.v.f., paratype; 328-331, al.v.f., paratype. Samples of dorsal head (mf, df-1, posterior df's) and dorsal abdominal setae of apterous viviparae, showing differences in shape: 332, *P. diutius*; 333, *P. ambrosiae*; 334, *P. ohioensis*; each on *Ambrosia artemisiifolia* (first row), on *Ambrosia* sp. (second row), and on *Franseria discolor* (third row).



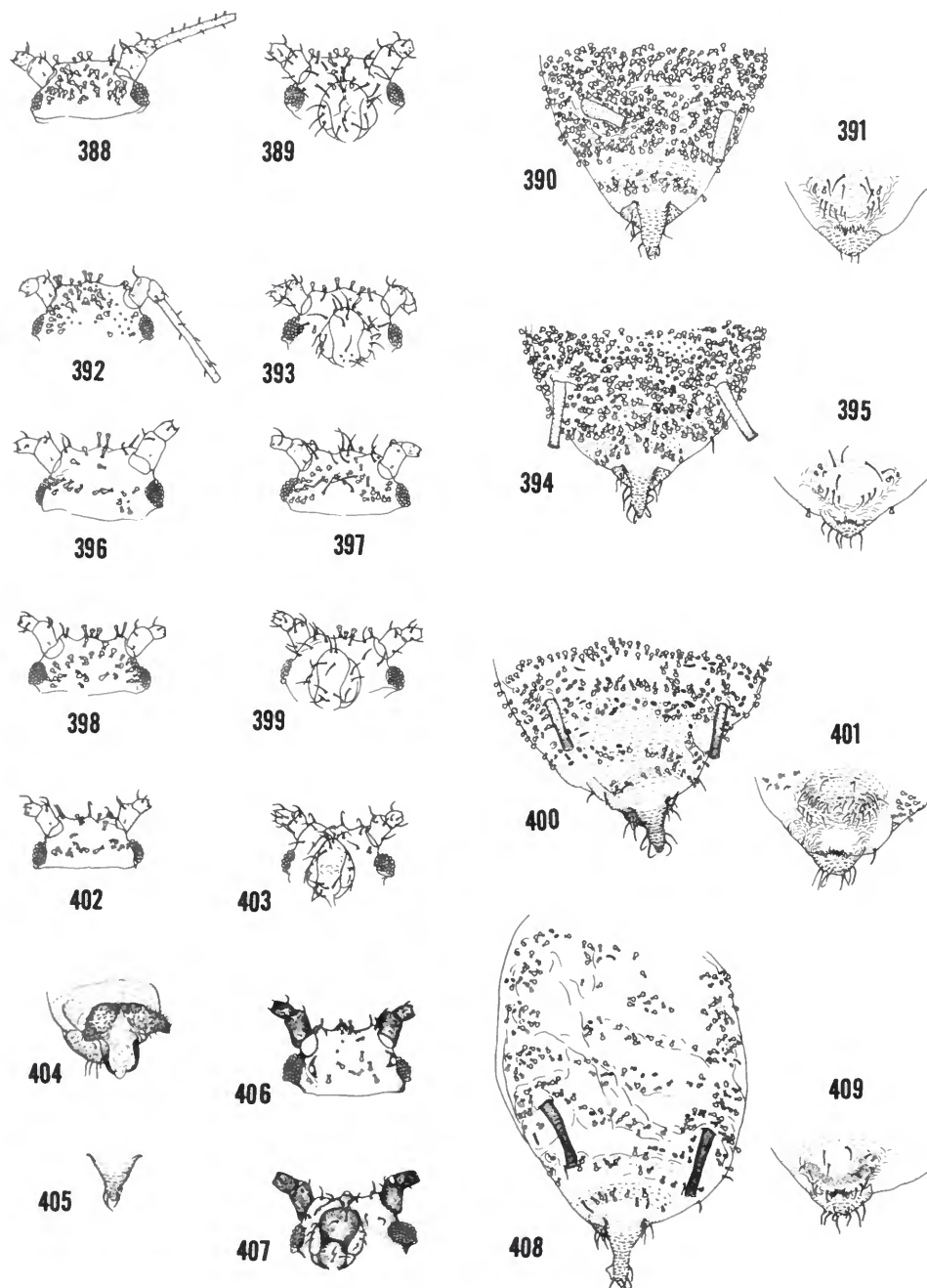
FIGURES 335-350.—Species of *Pleotrichophorus*. *P. parilis*: 335-338, apt.v.f., holotype; 339-341, ovip.f., paratype; 342, 343, al.v.f., paratype; 344-347, al.m., paratype. *P. wasatchii*: 348-350, apt.v.f., lectotype.



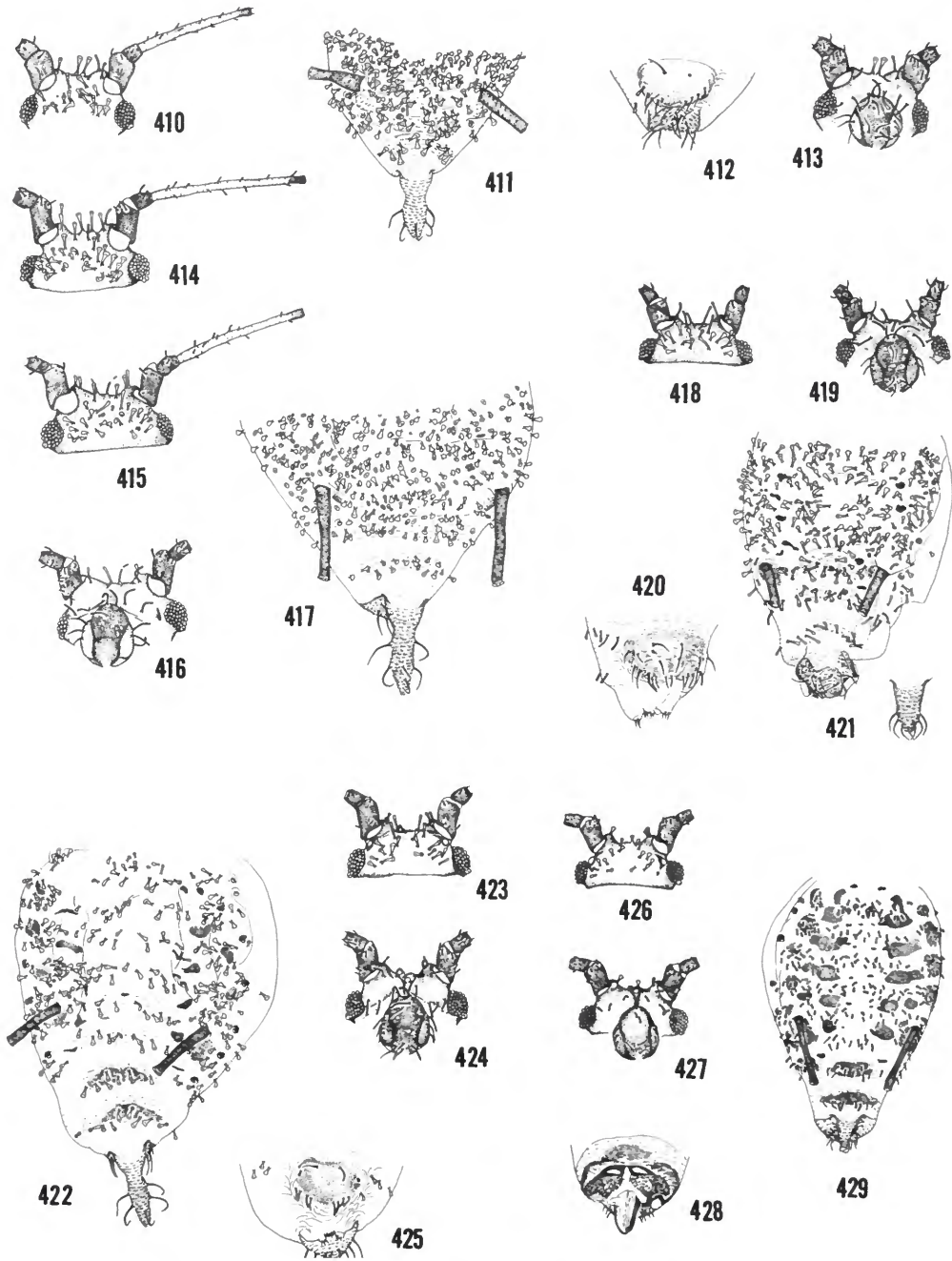
FIGURES 351-370.—Species of *Pleotrichophorus*. *P. patonkus*: 351-354, apt.v.f., paratype; 355-358, al.v.f., paratype. *P. pseudopatonkus*: 359-362, apt.v.f., holotype; 363-366, al.v.f., paratype. *P. patonkosellus*: 367-370, apt.v.f., holotype.



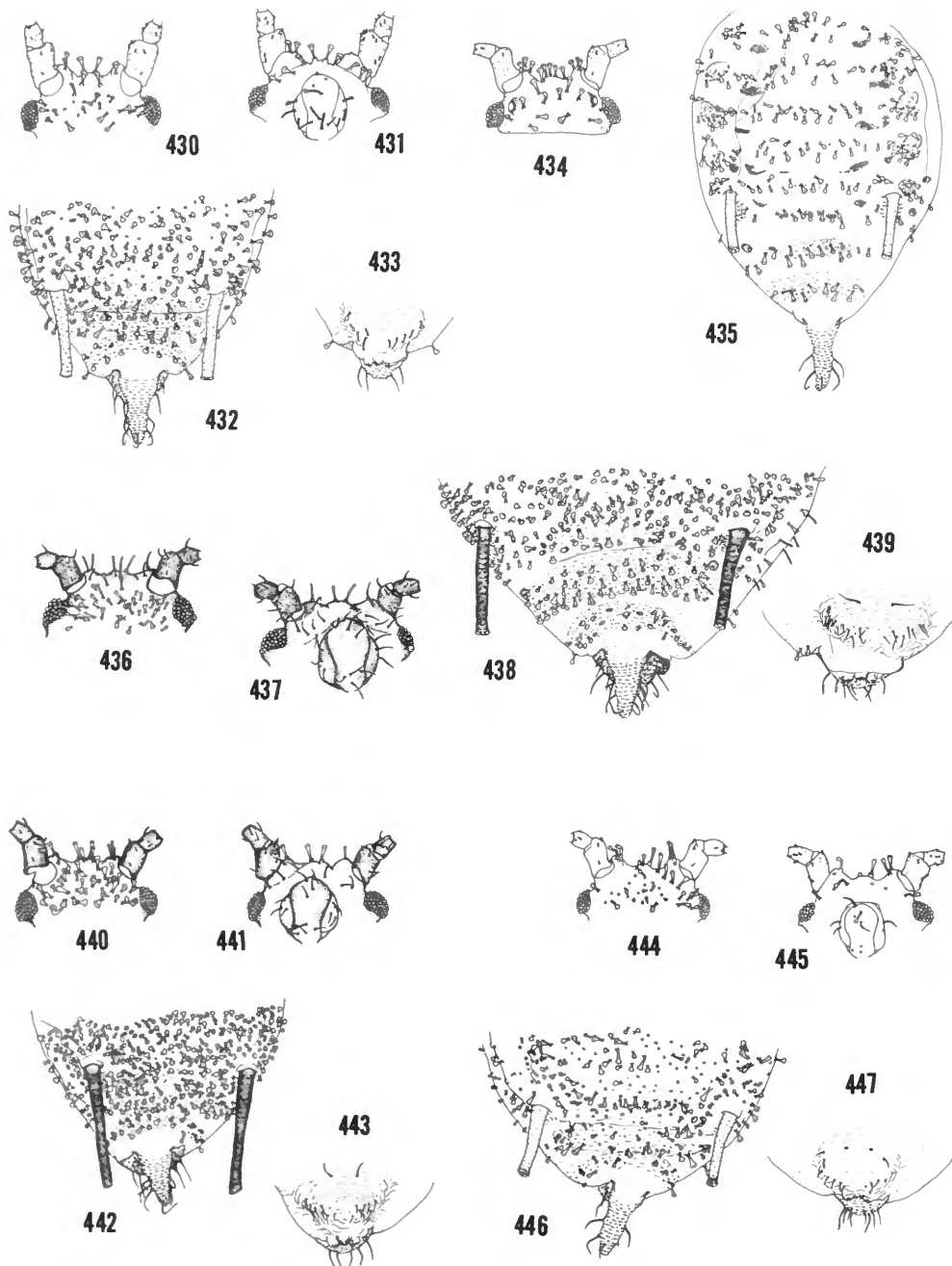
FIGURES 371-387.—Species of *Pleotrichophorus*. *P. brevinectarius*: 371-374, apt.v.f., on *Artemisia longifolia*, from Laramie River, Colorado, metatype; 376-378, al.v.f., holotype. Apterous viviparous females: 379-380, *P. infrequens*, type; 381-383, *P. filifoliae*, holotype; 384-387, *P. obscuratus*, type.



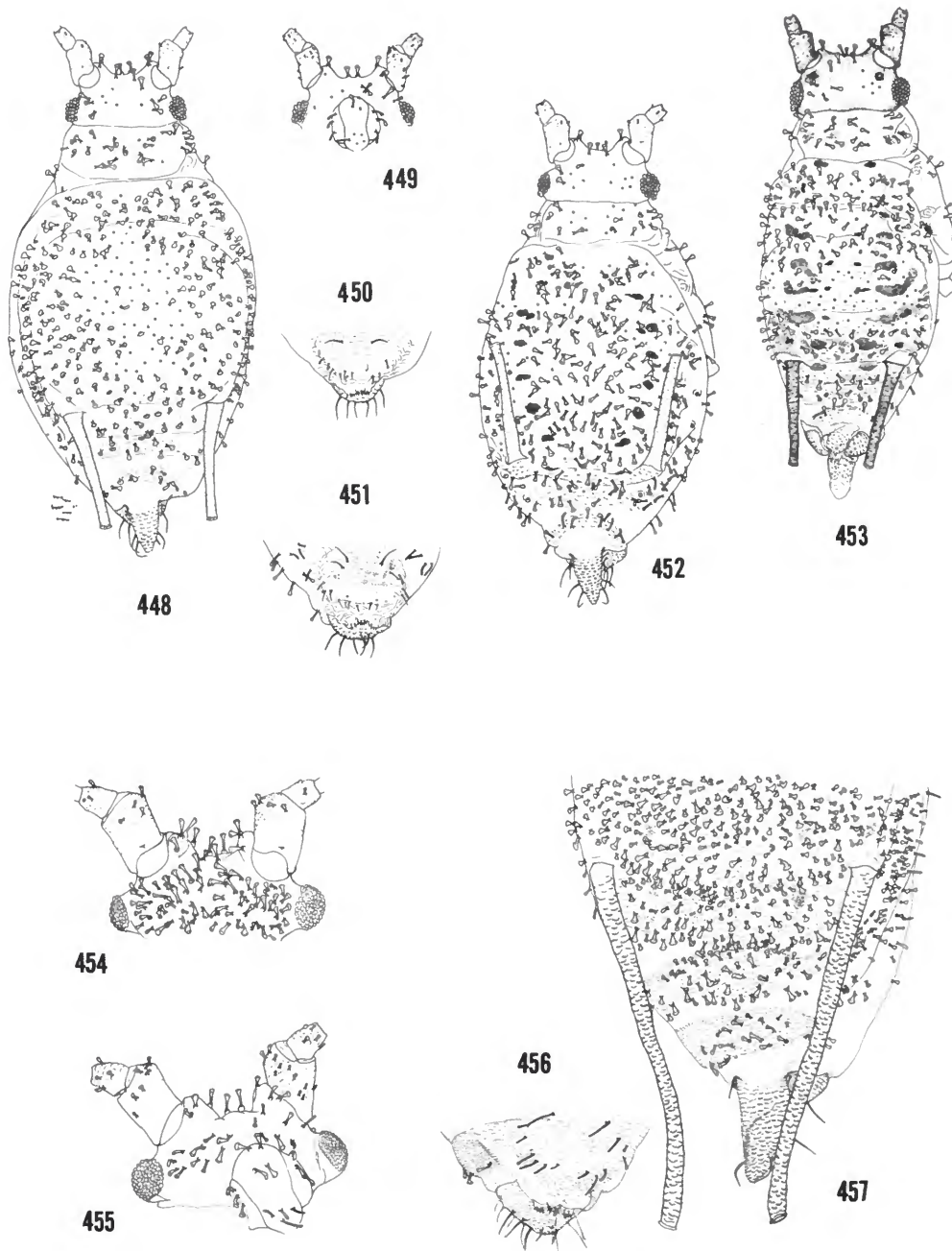
FIGURES 388-409.—*Pleotrichophorus heterohirsutus*. Apterous viviparous females: 388-391, lectotype of *Capitophorus bitrichus*; 392-395, from Douglas, Wyoming; 396, from Green Canyon, Utah; 397, from Allen Canyon, Utah. 398-401, ovip.f., paratype; 402-405, apt.m., paratype; 406-409, al.v.f., from Green Canyon, Utah.



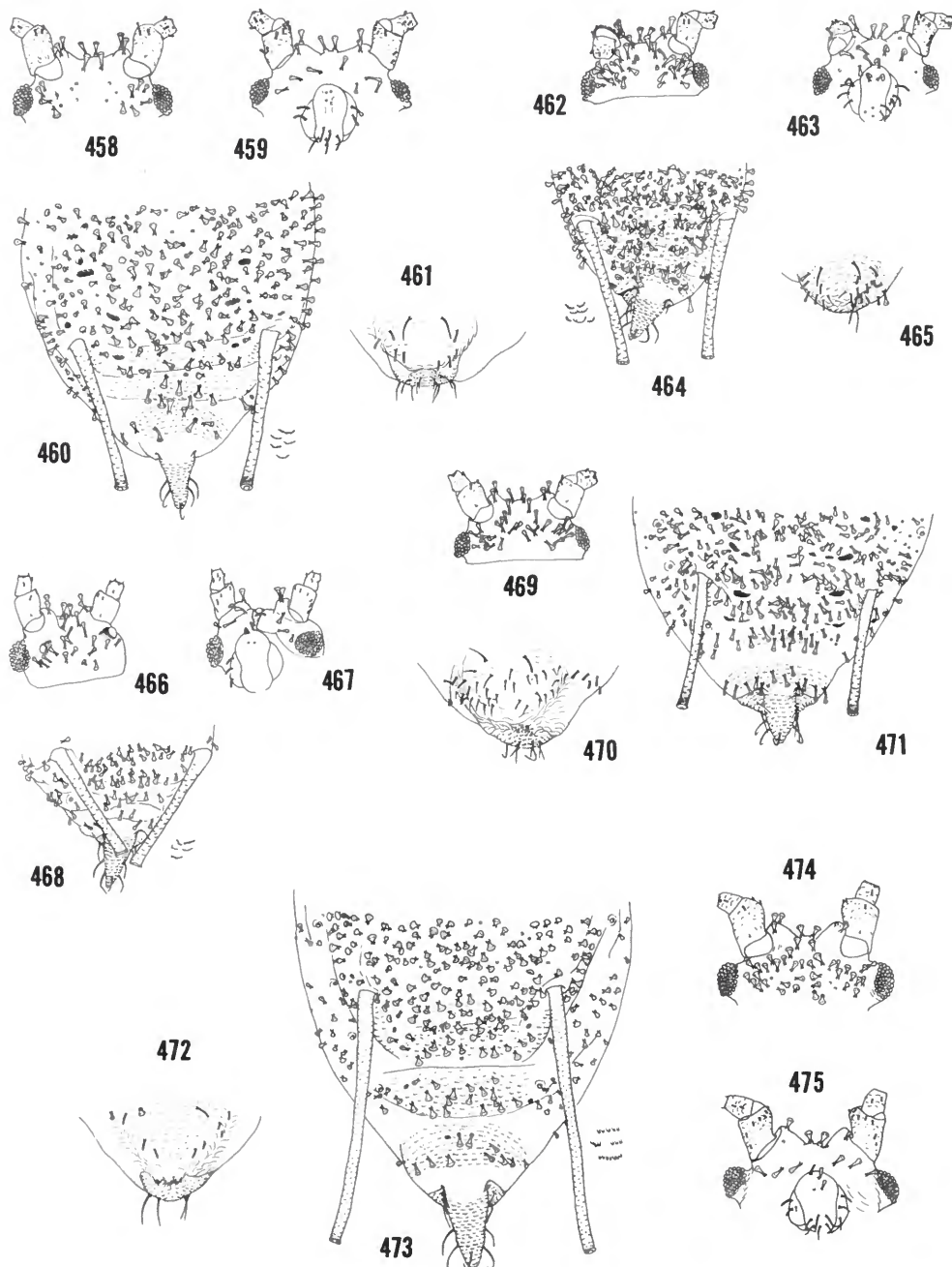
FIGURES 410-429.—*Pleotrichophorus quadritrichus quadritrichus*. Apterous viviparous females: 410-413, lectotype; 414, from Big Bear Lake, California; 415-417, from Monte Cristo, Utah. Specimens on *Artemisia tridentata* from Big Bear Lake, California: 418-421, ovip.f.; 422-425, al.v.f.; 426-429, al.m.



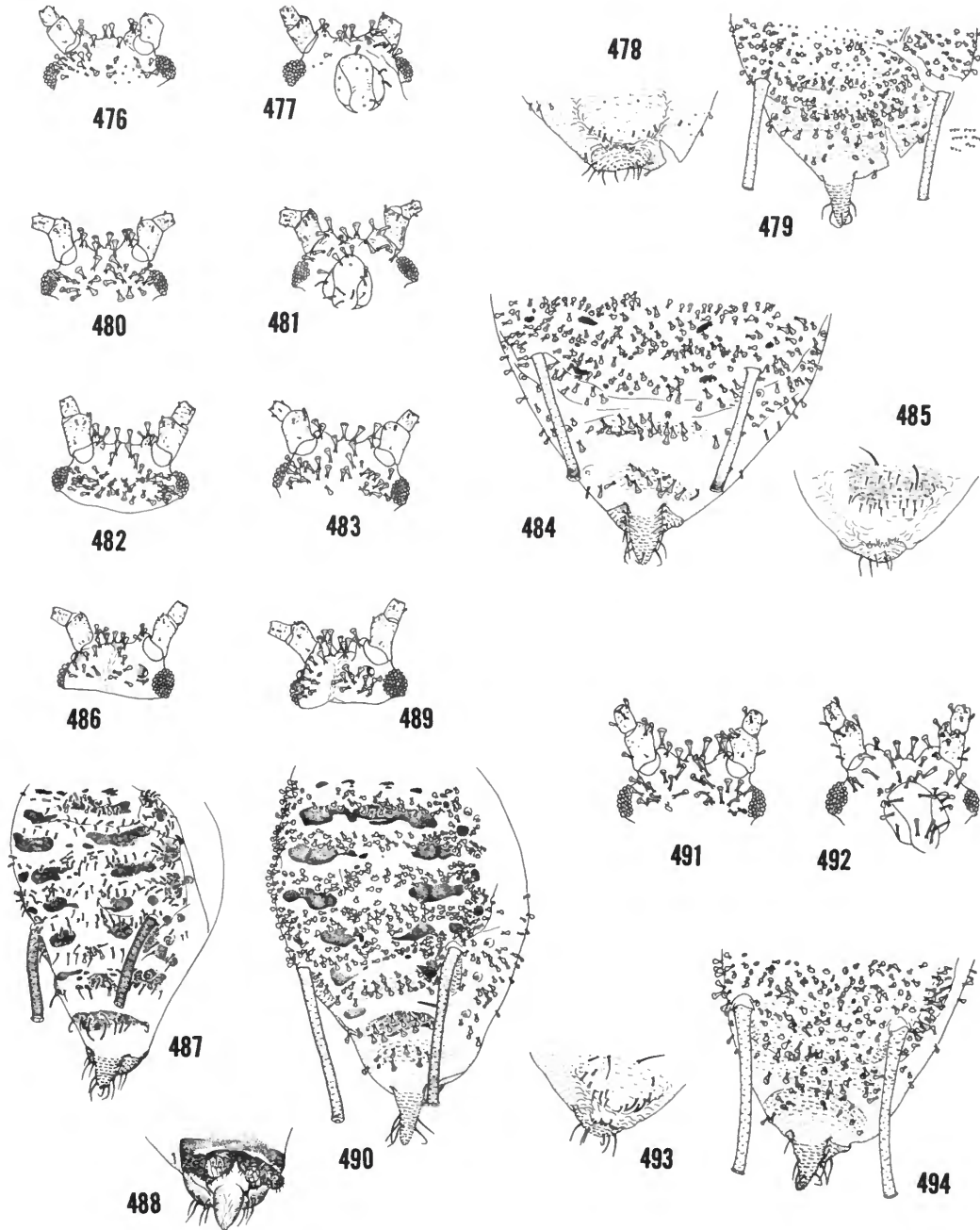
FIGURES 430-447.—Species of *Pleotrichophorus*: 430-433, *P. gnaphalodes*, apt.v.f., paratype; 434, 435, *P. gnaphalodes*, al.v.f., from Berkeley, California, on *Artemisia vulgaris*; 436-439, *P. pullus*, apt.v.f., paratype; 440-443, *P. rusticatus*, apt.v.f., paratype; 444-447, *P. spatulavillus*, apt.v.f., lectotype and paralectotype.



FIGURES 448-457.—Species of *Pleotrichophorus*. *P. antennarius*: 448-450, apt.v.f., holotype; 451-452, ovip.f., paratype; 453, apt.m., paratype. *P. longinectarius*, 454, 457, apt.v.f., holotype.



FIGURES 458-475.—Species of *Pletrichophorus*: 458-471, *P. pseudoglandulosus*, apt.v.f., on *Artemisia* sp., from Boulder, Colorado; 462-465, *P. intermedius*, apt.v.f., holotype; 466-468, *P. pseudoglandulosus*, al.v.f., holotype; 469-471, *P. pseudoglandulosus*, ovip.f., on *A. frigida*, from La Porte, Colorado; 472-475, *P. zoomontanus*, apt.v.f., on *A. tripartita* (= *A. tridentata* var. *trifida*, from Logan Canyon, Utah).



FIGURES 476-494.—Species of *Pleotrichophorus*. *P. decampus*: 476-477, apt.v.f., spring form, paralectotype; 478, 479, lectotype; 480, 481, apt.v.f., summer forms, on *Artemisia tridentata*, from California; 482-483, on *A. californica*, from California; 484, 485, ovip.f., on *A. tridentata* from Logan Canyon, Utah; 486-488, al.m., on *A. tridentata*, from Bountiful, Utah; 489, 490, al.v.f., on *Artemisia* sp., from Utah Co., Utah. *P. amsinckii*: 491-494, apt.v.f., paratype.

Publication in *Smithsonian Contributions to Zoology*

Manuscripts for serial publications are accepted by the Smithsonian Institution Press, subject to substantive review, only through departments of the various Smithsonian museums. Non-Smithsonian authors should address inquiries to the appropriate department. If submission is invited, the following format requirements of the Press will govern the preparation of copy.

Copy must be typewritten, double-spaced, on one side of standard white bond paper, with 1½" top and left margins, submitted in ribbon copy with a carbon or duplicate, and accompanied by the original artwork. Duplicate copies of all material, including illustrations, should be retained by the author. There may be several paragraphs to a page, but each page should begin with a new paragraph. Number consecutively all pages, including title page, abstract, text, literature cited, legends, and tables. The minimum length is 30 pages, including typescript and illustrations.

The *title* should be complete and clear for easy indexing by abstracting services. Taxonomic titles will carry a final line indicating the higher categories to which the taxon is referable: "(Hymenoptera: Sphecidae)." Include an *abstract* as an introductory part of the text. Identify the *author* on the first page of text with an unnumbered footnote that includes his professional mailing address. A *table of contents* is optional. An *index*, if required, may be supplied by the author when he returns page proof.

Two *headings* are used: (1) text heads (boldface in print) for major sections and chapters and (2) paragraph sideheads (caps and small caps in print) for subdivisions. Further headings may be worked out with the editor.

In *taxonomic keys*, number only the first item of each couplet; if there is only one couplet, omit the number. For easy reference, number also the taxa and their corresponding headings throughout the text; do not incorporate page references in the key.

In *synonymy*, use the short form (taxon, author, date:page) with a full reference at the end of the paper under "Literature Cited." Begin each taxon at the left margin with subsequent lines indented about three spaces. Within an entry, use a period-dash (.—) to separate each reference. Enclose with square brackets any annotation in, or at the end of, the entry. For *references within the text*, use the author-date system: "(Jones, 1910)" and "Jones (1910)." If the reference is expanded, abbreviate the data: "Jones (1910:122, pl. 20: fig. 1)."

Simple *tabulations* in the text (e.g., columns of data) may carry headings or not, but they should not contain rules. Formal *tables* must be submitted as pages separate from the text, and each table, no matter how large, should be pasted up as a single sheet of copy.

Use the *metric system* instead of, or in addition to, the English system.

Illustrations (line drawings, maps, photographs, shaded drawings) can be intermixed throughout the printed text. They will be termed *Figures* and should be numbered consecutively; however, if a group of figures is treated as a single figure, the components should be indicated by lowercase italic letters on the illustration, in the legend, and in text references: "Figure 9*b*." If illustrations (usually tone photographs) are printed separately from the text as full pages on a different stock of paper, they will be termed *Plates*, and individual components should be lettered (Plate 9*b*) but may be numbered (Plate 9: figure 2). Never combine the numbering system of text illustrations with that of plate illustrations. Submit all legends on pages separate from the text and not attached to the artwork. An instruction booklet for the preparation of illustrations is available from the Press on request.

In the *bibliography* (usually called "Literature Cited"), spell out book, journal, and article titles, using initial caps with all words except minor terms such as "and, of, the." For capitalization of titles in foreign languages, follow the national practice of each language. Underscore (for italics) book and journal titles. Use the colon-parentheses system for volume, number, and page citations: "10(2):5-9." Spell out such words as "figures," "plates," "pages."

For *free copies* of his own paper, a Smithsonian author should indicate his requirements on "Form 36" (submitted to the Press with the manuscript). A non-Smithsonian author will receive 50 free copies; order forms for quantities above this amount with instructions for payment will be supplied when page proof is forwarded.

