

A Revision and Cladistic Analysis  
of the Spider Family Pimoidae  
(Araneoidea: Araneae)

GUSTAVO HORMIGA

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*Gustavo Hormiga*



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## ABSTRACT

Hormiga, Gustavo. A Revision and Cladistic Analysis of the Spider Family Pimoidae (Araneioidea: Araneae). *Smithsonian Contributions to Zoology*, 549, 104 pages, 442 figures, 1 table, 1994.—The spider family Pimoidae is revised at the species level. Twenty-one species, including 11 new species, are recognized in the Pimoidae. All species, including those under the junior synonym *Louisfagea* (Fage), are grouped in the genus *Pimoida* Chamberlin and Ivie. Pimoids are distributed in western North America, southern Europe, and Asia. A numerical cladistic analysis of the interrelationships of the Pimoidae was performed, focusing mainly on classical characters (such as genitalic and somatic morphology) and spinneret spigot morphology. Nine linyphiid species and the genera *Tetragnatha* and *Zygiella* were used as outgroups for assessing character polarities. Cladograms hypothesizing the interrelationships of pimoids and the sample of linyphiid taxa are provided. The monophyly of pimoids is confirmed. The Linyphiidae are hypothesized as the sister group of Pimoidae.

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# Contents

	<i>Page</i>
Introduction . . . . .	1
Acknowledgments . . . . .	2
Materials and Methods . . . . .	2
List of Abbreviations Used in the Text and Figures . . . . .	4
Taxonomic History . . . . .	4
Comparative Morphology of the Pimoids and Characters for the Phylogeny of Pimoidae . . . . .	5
Male Genitalia . . . . .	5
Female Genitalia . . . . .	8
Somatic Morphology . . . . .	9
Spinneret Spigot Morphology . . . . .	11
Behavior . . . . .	11
Familial Placement, Cladistic Analysis, and Phylogenetic Relationships of the Pimoids . . . . .	11
Taxonomic Considerations . . . . .	17
Biogeography . . . . .	18
Taxonomic Revision . . . . .	19
PIMOIDAE Wunderlich . . . . .	19
<i>Pimoida</i> Chamberlin and Ivie . . . . .	19
Key to the Species of <i>Pimoida</i> . . . . .	25
Males . . . . .	25
Females . . . . .	26
<i>Pimoida rupicola</i> (Simon) . . . . .	27
<i>Pimoida breuili</i> (Fage) . . . . .	32
<i>Pimoida cthulhu</i> , new species . . . . .	39
<i>Pimoida vera</i> Gertsch . . . . .	45
<i>Pimoida hespera</i> (Gertsch and Ivie) . . . . .	46
<i>Pimoida mono</i> , new species . . . . .	50
<i>Pimoida haden</i> Chamberlin and Ivie . . . . .	52
<i>Pimoida jellisoni</i> (Gertsch and Ivie) . . . . .	57
<i>Pimoida gandhii</i> , new species . . . . .	60
<i>Pimoida crispa</i> (Fage) . . . . .	63
<i>Pimoida indiscreta</i> , new species . . . . .	66
<i>Pimoida sinuosa</i> , new species . . . . .	67
<i>Pimoida nematoide</i> , new species . . . . .	71
<i>Pimoida anatolica</i> , new species . . . . .	73
<i>Pimoida altiocolata</i> (Keyserling) . . . . .	75
<i>Pimoida petita</i> , new species . . . . .	82
<i>Pimoida breviata</i> Chamberlin and Ivie . . . . .	83
<i>Pimoida curvata</i> Chamberlin and Ivie . . . . .	87
<i>Pimoida laurae</i> , new species . . . . .	92
<i>Pimoida edenticulata</i> , new species . . . . .	94
<i>Pimoida mephitis</i> , new species . . . . .	98
Literature Cited . . . . .	103



# A Revision and Cladistic Analysis of the Spider Family Pimoidae (Araneoidea: Araneae)

*Gustavo Hormiga*

## Introduction

The spiders of the family Pimoidae have long been a controversial taxonomic problem, as evidenced by the different familial placements they have had over the years. Pimoids are a relictual group, with a small number of taxa (formerly less than a dozen of species were known) distributed in the west coast of North America, Europe (the Alps and the Apennines, and northern Spain), and the Himalayas.

A mixture of derived and primitive characters made them bounce from one taxon into another, depending on how systematists weighed different characters. Although some of the first described pimoid species were initially considered as linyphiids, they certainly did not perfectly fit into the Linyphiidae family diagnosis. Not until the 1970s was their palpal morphology studied in detail with the intention of establishing homologies across the several possible families where they might have been placed. Thaler (1976) found it impossible to place them in linyphiids because of their palpal anatomy. He considered them, at least provisionally, tetragrathids. Wunderlich (1986) reexamined the problem and concluded that they were in fact the most basal group within the linyphiids.

Understanding pimoids is crucial for the study of the linyphiid phylogeny. Resolving the phylogenetic position of linyphiids within the Araneoidea will be critical for the understanding of the evolution and relationships of the major groups within this large and diverse superfamily.

The corroboration of the sister group relationship of pimoids and linyphiids proposed by Wunderlich is the first necessary step in the study of linyphiid higher level systematics. Because the most commonly used method for assessing character polarities is outgroup comparison, we need a hypothesis of the

cladistic relationships of the pimoids to study the interrelationships of linyphiids. In this paper I have revised the pimoids, redescribed the known species, and described ten new species from North America and Asia. I have assembled a dataset based on comparative morphology to study pimoid phylogenetic relationships using numerical cladistic methods.

One of the methodological problems one first encounters is the "design" of the dataset. Of course one tries to maximize the number of characters in order to increase the support of the phylogeny, however a different approach has to be taken when selecting the taxa. To study the pimoid relationships I included all the species I was able to gather. But how does one select a "representative" sample of linyphiids, the second largest spider family in terms of described generic diversity? The goal of this study is not to present a detailed phylogenetic hypothesis of linyphiid interrelationships, but to understand the cladistic structure of pimoids and how it might affect the phylogeny of linyphiids. Linyphiid diversity has motivated taxonomists for decades, and many new species and genera are still being documented. Unfortunately this enthusiasm is not evident at the suprageneric level. The higher level systematics of linyphiids are very poorly understood. Adequate systematic studies exploring the phylogenetic structure of the family and their relationships to other araneoids are lacking, although a few monophyletic groups can be characterized from the published work of some arachnologists. This is probably due, at least in part, to the fact that linyphiids are a taxonomically "difficult" group for several reasons. First, linyphiids (especially erigonines) are small in size, and therefore it can be cumbersome to work with them. Second, the characters used for their classification are mainly genitalic, and difficult to study accurately. Also, their small size seems to invite superficial description of their genitalic morphology. Third, homoplasies seem to be rampant, different characters systems are incongruent and seem to suggest different hypotheses of relationship.

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I have followed Wunderlich's (1986) scheme for the subfamily structure of linyphiids to select the sample of linyphiid taxa for the dataset. Two genera have been chosen for each subfamily, except for the monogeneric Stemonyphantinae. Thus, in addition to the pimoids the dataset contains the following outgroups: nine linyphiids (*Linyphia triangularis* (Clerck) and *Microlinyphia dana* (Chamberlin and Ivie) (Linyphiinae, Linyphiini); *Bolyphantes luteolus* (Blackwall) and *Lepthyphantes tenuis* (Blackwall) (Linyphiinae, Micronetini); *Erigone psychrophila* Thorell and *Walckenaeria directa* (O. P.-Cambridge) (Erigoninae); *Haplisis diloris* (Urquhart) and *Novafroneta vulgaris* Blest (Mynogleninae); and *Stemonyphantes blauveltae* Gertsch (Stemonyphantinae)) plus two genera outside the pimoid-linyphiid assemblage that represent the families that have been hypothesized as sister to linyphiids: *Zygiella x-notata* (Clerck) (Araneidae) and *Tetragnatha versicolor* Walckenaer (Tetragnathidae). With this dataset I also intend to test Wunderlich's hypothesis of subfamilial relationships. In the present paper I present and discuss the revision and cladistic structure of pimoids. The problems of its implications for the phylogeny of linyphiids are discussed in detail elsewhere (Horniga, 1993).

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SM	Senckenberg Museum, Frankfurt, Germany, Dr. M. Grasshoff
UB	Universitat de Barcelona, Departament de Biologia Animal, Barcelona, Spain, Dr. C. Ribera
USNM	former United States National Museum, collections in National Museum of Natural History, Smithsonian Institution, Washington, D.C. Dr. J.A. Coddington and Mr. S. Larcher
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#### Materials and Methods

Specimens were examined and illustrated using a Wild M-5 stereoscopic microscope, with a Wild 1.25 × camera lucida. Further details were studied using a Leitz Ortholux II compound microscope and an Olympus BH-2 compound microscope, and illustrated using an Olympus 1.25 × drawing tube. SEM services were provided by the Cambridge Stere-



oscan-100 of the Smithsonian Institution (NMNH) Scanning Electron Microscope Facility.

All measurements are in millimeters. Somatic morphology measurements were taken using a grid reticle in the dissecting microscope. Eye diameter and interocular distances are taken from the span of the lens. When the lens outline was not circular the diameter was measured at the widest point. The cephalothorax length and height were measured in lateral view and its width was taken at the widest point. Similarly, the length and height of the abdomen was measured in lateral view, and the width as the widest point as seen from a dorsal view. The measurements of the abdomen are only approximations, because the abdomen size changes more easily in preserved specimens than other more sclerotized parts do (e.g., the chelicerae). The total length was measured in lateral view and is also an approximation, because it involves the size of the abdomen and its relative position. Furthermore, it is often the case that we do not know the actual resting position of the abdomen (i.e., more or less vertical or horizontal in reference with the cephalothorax) in the living animal. Leg article lengths were measured in lateral view without detaching the legs from the animal and positioning the article being measured perpendicularly. The only way to obtain accurate and consistent measurements of leg article lengths is to excise every leg and mount it on a slide. I did not follow such method because it involves the partial destruction of specimens (many species were represented by one or a few specimens) and is very time consuming. For this reason my measurements of leg segments are also approximations. The position of the metatarsal trichobothrium is expressed as in Millidge (1980:105). Female genitalia were excised using microscissors or sharpened needles. With fine needles most of the tissue was cleaned away and the genitalia were then placed in household bleach (suggested by C. Griswold, although I did not need to use a prior trypsin digestion) and watched under the dissecting microscope until most of the non-chitinous tissues were dissolved (usually one to three minutes or less). The specimen was then transferred to distilled water and then to 70% ethanol for examination under the dissecting microscope. For examination with the compound microscope the specimen was transferred to an 85% solution of lactic acid and temporarily mounted as described in Coddington (1983).

Male palps from preserved specimens were expanded by placing them in a concentrated (around 35%) KOH solution for about five minutes, transferring them to distilled water several times and then returning them to alcohol when expansion was obtained. The left palp was illustrated; if otherwise, this is stated. Male palps examined with the SEM were first excised and transferred to a vial with 70% ethanol and then cleaned ultrasonically for one to three minutes. The specimen was then transferred to absolute ethanol and left overnight. After critical point drying, the specimens were glued to rounded rivets using an acetone solution of polyvinyl resin and then coated for examination at the SEM.

For the dissections of tracheal system the specimens were transferred from alcohol into distilled water, where the dorsum of the abdomen (above the pedicel and the spinnerets) was excised with microscissors. Overall the method I followed has been modified from Ray Forster (pers. comm.); but see also Levi (1967), Blest (1976), and Millidge (1984) for methods of study of the tracheal system. First the abdomen was separated from the cephalothorax. For small specimens a small window was cut in the cuticle of the dorsal part of the abdomen. The specimen was then transferred to an excavated slide containing a solution of potassium hydroxide (around 35%), which was placed on a hot plate (up to 230°C–280°C) for several minutes, until most of the soft parts were dissolved. Afterwards the specimen was transferred again into distilled water and the dorsum of the abdomen was excised. The remaining soft tissues were cleaned away with a fine needle under the dissecting microscope. The specimen was then stained in an aqueous solution of chlorazol black (2–3 minutes) and transferred into distilled water where the excess of colorant was washed away. The specimen was then mounted on a slide with a drop of 85% solution of lactic acid, positioned with the help of needles under a dissecting microscope and covered with a cover slip. These preparations were examined with an Olympus BH-2 compound microscope and illustrated using an Olympus 1.25× drawing tube.

Spinneret spigot morphology was examined for every known species of Pimoidae in which females were available. Methods of study and homology assessments follow those of Coddington (1989). When material was available the specimens were examined with the SEM and photographed, otherwise they were examined using a Leitz Ortholux II compound microscope with epi-illumination at 110×.

Autoscopy in pimoids was studied using live specimens and museum material. However, for the linyphiids and the outgroups I relied on the museum material determinations and on data from the literature. In live material I grasped one or more legs at the tarsus end with forceps and pulled until the leg broke. Frequently the spider pulled the grasped leg until it broke and ran away afterwards. The museum specimens frequently have broken legs; in most of the cases the legs of linyphiids and pimoids were broken at the patella-tibia junction. It is not uncommon to find adult specimens in the collections that lost part of one or more legs before being collected, as can be inferred from the "healed" dark tegument that covers the distal end of the segment. In such cases the fracture point is almost invariably at the patella-tibia junction in the pimoids and the linyphiids. But even if the preserved specimen has no broken legs one can detect the predetermined fracture point by gently pulling with a forceps from the distal end of the leg, as suggested by Roth and Roth (1984).

The numerical cladistic analysis was accomplished using the microcomputer package for phylogenetic analysis, Hennig86 version 1.5 (Farris, 1988). See the cladistic analysis section for details of the analysis.

## LIST OF ABBREVIATIONS USED IN THE TEXT AND FIGURES

A	alveolus
AC	aciniform gland spigot(s)
AG	aggregate gland spigot(s)
ALS	anterior lateral spinneret
BH	basal haematodocha
C	conductor
CD	copulatory duct
CDP	cymbial denticulate process
CL	column (stalk)
CO	copulatory opening
CY	cylindrical gland spigot(s)
DP	dorsal plate of the epigynum
E	embolus
ED	ejaculatory duct
EF	epigynal fold
EP	epigynal plug
F	fundus
FD	fertilization duct
FL	flagelliform gland spigot(s)
m	membrane (or membranous)
MA	median apophysis
MAP	major ampullate gland spigot(s)
mAP	minor ampullate gland spigot(s)
pt	prolateral trichobothria (palpal tibia)
P	paracymbium
PCS	pimoid cymbial sclerite
Pe	petiole
PEP	pimoid embolic-tegular process
PI	piriform gland spigot(s)
PLS	posterior lateral spinneret
PMS	posterior median spinneret
rt	retrolateral trichobothria (palpal tibia)
S	spermatheca
ST	subtegulum
t	trichobothrium(a)
T	tegulum
TS	tegular suture
VP	ventral plate of the epigynum

## Taxonomic History

The first known pimoid was *Labulla rupicola*, described by Simon in 1884, from southern Europe. Keyserling described in 1886 the first North American species of *Pimoid* (*alticulata*) and also placed it within the linyphiid genus *Labulla* Simon. In 1931 Fage described *Metella breuili* from females and juveniles collected in several caves in northern Spain. Fage placed the new genus *Metella* within the Tetragnathidae (Argiopidae: Tetragnathinae sensu Simon, 1894, 1929). He noted the somatic similarity between that new species and *Meta menardi* and *M. bourneti* (Tetragnathidae: Metinae), although several characters clearly separated it from *Meta*: the clypeus height, the extremely long setae covering all the leg articles but the tarsi, and the complexity of the epigynum, which, according to Fage, is similar to that of the North African species of *Parameta* Simon (Tetragnathidae). Fage was aware of the importance of the study of the palpal characters of the male (unknown at that time) to determine its taxonomic position.

The male of *M. breuili* was also described and illustrated by Fage (1935). He noticed (page 00) the close relationship between *M. breuili* and *Labulla rupicola*, and regarded them as members of the same genus, based mainly on male palpal characters: "La ressemblance chez ces deux espèces d'un organe aussi complexe fixe d'une manière certaine leurs affinités." However, Fage also noted differences from the other species of *Labulla* (viz., *Labulla thoracica* Wider and *L. flahaulti* Simon). For that reason he considered it justified to maintain provisionally the genus *Metella* as a subgenus of *Labulla*, including in it *breuili* and *rupicola*, until these and other poorly delimited genera were revised. In 1943 Chamberlin and Ivie erected the genus *Pimoid* to include four pimoid North American species that previously had been placed within *Labulla*, plus three newly discovered North American species. The diagnosis of the genus (Chamberlin and Ivie, 1943:9) was based mainly on the somatic morphology, although they incorrectly described the chelicerae as lacking any stridulatory striae, a character that has special phylogenetic significance. The only mention of the copulatory organs refers to the paracymbium as fused to the cymbium. *Metella crista*, from India, was also described by Fage (1946), who placed it in the vicinity of *M. breuili* and *M. rupicola*, resurrecting *Metella* as a genus of its own, separated from *Labulla*. He also redefined the genus *Metella* based mainly on the morphology of the copulatory organs and the characteristic leg hairiness, and stated that the North American species *Pimoid alticulata* (Keys.), and probably *P. hespera* (Gertsch and Ivie) and *P. jellisoni* (Gertsch and Ivie), also belonged to *Metella*. In 1951 Gertsch added another new species, making a total of eight North American species.

Roewer (1942:920) maintained the name *Metella* in his catalog, perhaps because he thought that in the future it would be considered a subgenus of *Labulla*. Bonnet (1957:2820) noted that the name *Metella* was preoccupied, aside from being at that time a synonym of *Labulla* (Bonnet's catalog covered only the literature through 1939 and it was not until 1946 that Fage justified the maintenance of *Metella* as a separate genus from *Labulla*).

Brignoli created in 1971 the replacement name *Louisfagea* for the species under the genus *Metella*. He also reviewed the possible relationships of this genus, but without providing any new information on the problem. Brignoli (1975:13) did not find a close affinity between *Pimoid* and *Louisfagea*, although he recognized that they were somewhat related. Thaler (1976) studied the palpal morphology and the affinities of *Louisfagea rupicola*. He concluded that the genus should be placed, at least provisionally, within Tetragnathidae and that its placement in Linyphiidae was not possible. Thaler also corroborated the close relationship between *Louisfagea* and *Pimoid*, based on palpal homologies, and pointed out the "striking similarity" of *Louisfagea*'s palp to that of *Cyatholipus* (Cyatholipidae).

Wunderlich (1979) synonymized *Louisfagea* and *Pimoid* under the fossil genus *Acrometa* Petrunkevitch and erected the

monotypic tribe Acrometini. Such synonymy was not accepted by Brignoli (1979:36), who based his criticism mainly in the palpal differences between *Pimoida* and *Louisfagea*, and *Acrometa*, and in their geographic distribution (see discussion under "Taxonomic Considerations").

In 1986 Wunderlich erected the linyphiid subfamily Pimoinae to include the genera *Louisfagea* and *Pimoida*, and proposed a cladogram for the tribes and subfamilies of Linyphiidae. In his cladogram (p. 106) the Pimoinae stands as the sister group of the rest of the Linyphiidae, but the synapomorphies supporting the groupings of his hypothesis are not explicitly stated, and at least some of them are non-synapomorphic diagnostic features.

Crawford (1988:23) realized the difficulties in having *Pimoida* and *Louisfagea* within Metinae (a tetragnathid subfamily), as well as in any other known family, and concluded that "further study of this group should prove illuminating to phylogenetic studies, and it is probable that separate family status will prove justified." Millidge (in litt.) completely rejects the placement of *Pimoida* in Linyphiidae, and maybe even in Araneoidea! He thinks that it may require a new family. More recently, Hormiga (1993) synonymized *Louisfagea* with *Pimoida* and raised pimoids to family rank.

#### Comparative Morphology of the Pimoids and Characters for the Phylogeny of Pimoidae

The following discussion describes the main features of pimoid morphology and how they are allocated into the characters and character states used in the cladistic analysis. The explicit character and character state definitions are also given. Because there is a subset of linyphiid taxa in the data set, there are characters that are relevant only for the linyphiid phylogeny. The linyphiid characters are included in the dataset to resolve the linyphiid topology, because the character state optimizations at the outgroup node are needed to determine character polarities by outgroup comparison. These linyphiid characters and phylogeny are discussed elsewhere (Hormiga, 1993).

When necessary for clarity, an exemplar taxon exhibiting the character state being described is given in parentheses, and if possible reference to an illustration is made. The "exemplar character state" is meant to be taken as a reference for future homology assessments, analogous to type species for allocating specimens to a given taxon.

#### MALE GENITALIA

The male palp morphology provides the largest suite of characters for the study of pimoid relationships (37 out of a total of 62 characters). Although male genitalia are commonly used in spider phylogenetic systematics, it can be extremely difficult to establish homologies of the palpal sclerites across a wide range of taxa (for a recent detailed and illuminating discussion on the subject see Coddington, 1990a). Albeit many

pimoids had been initially described as linyphiids, their palpal morphology had not been studied in detail. When the palp was first studied and the homologies of its sclerites evaluated (Thaler, 1976; Wunderlich, 1979) a linyphiid placement of pimoids seemed impossible, at least on the basis of palpal morphology. Given the evidence of the linyphiid-pimoid sister relationship provided by non-genitalic characters (stridulatory organ, patellar autospasy, spinneret spigot morphology, sheet-web) some of the homologies of the palp sclerites have to be reinterpreted.

*Character 1:* Morphology of the cymbium. 0: without dorsoectal denticulate process; 1: with a dorsoectal cymbial denticulate process (CDP; *breuili*, Figure 44); 2: with a dorsoectal process without denticles (*edenticulata*, Figure 410).

*Character 2:* Denticles of cymbial denticulate process. 0: numerous (more than 20; *rupicola*, Figure 16); 1: fewer (less than 20; *breviata*, Figure 365).

*Character 3:* Apex of dorsoectal denticulate process. 0: not pointed, normal sclerotization; 1: with the distal end pointed and heavily sclerotized (*laurae*, Figure 391).

The presence of a dorsoectal denticulate process on the cymbium (character 1) is a synapomorphy of pimoids, and one of their most conspicuous diagnostic characters. The presence of a second process of this type is autapomorphic for *breuili* (Figure 44). The shape and relative position of this process (characters 2 and 3) vary across taxa, as well as the number and arrangement of denticles or cusps. The denticles are secondarily absent in *edenticulata* (Figures 410, 426). A relatively large process with numerous denticles (e.g., in *rupicola*, Figures 15–17) seems to be the plesiomorphic state because it is present in the two most basal taxa (this character reverses in *crispa*). The reduction of the size of the process and the number of denticles appears to be a later development (e.g., in *hespera*, Figure 128). A modification of the distal end of the cymbial process (pointed and heavily sclerotized, character 3; Figure 391) provides a synapomorphy for *laurae* plus *edenticulata*. The denticles or cusps seem to be modified spines (macrosetae) and although they might vary in shape from one species to another, they all seem to share two common features: they are fairly thick (compared to other spines in the cymbium) and pointed at the distal end, and they have longitudinal striae (Figures 68–70, 111, 324). *Pimoida cthulhu* presents an autapomorphic secondary cymbial process that more or less shares its base with the denticulate process, but is relatively ventral to it. This secondary process has a very conspicuous group of thick and long spines in its distal half; its proximal half is densely covered with setae (Figures 85, 87, 89, 91, 107). On the cymbium of *curvata* a large and complex, heavily sclerotized projection is found, in a relatively dorsal position to the denticulated process. The anterior distal end of this process is twisted and covered on its posterior side with several rows of small spines, denticle-like, but different from those of the typical denticulate process (Figures 368–370, 387, 389). These secondary cymbial projections in *cthulhu* and

*curvata* are probably not homologous, because they do not meet the criteria of position and special similarity.

Pimoids share the presence of a sclerite on the ventral side of the cymbium, anteroectal to the distal margin of the alveolus (Figures 46, 54, 303). The sclerite can be seen best when the cymbium is dissected apart from the basal haematodocha; then it appears as a dark sclerotized plate that lies between the distal end of the alveolus and the membranous attachment of the PCS on the ventral side of the cymbium. The distal margin of this sclerite can be seen in an unexpanded palp from a ventral and/or anterior view (Figures 43, 44, 156). It is particularly large in *curvata* (Figure 368). I have not been able to find a homologous structure in the palp of other araneoids and it seems to be synapomorphic for pimoids.

**Character 4:** Pimoinea cymbial sclerite (PCS). 0: absent; 1: present.

**Character 5:** PCS connection to the cymbium. 0: sclerotized and rigid (*rupicola*, Figure 17); 1: membranous and flexible (*hespera*, Figure 130).

**Character 6:** PCS membranous ridge. 0: absent; 1: large (*breuili*, *rupicola*, Figures 44, 16); 2: small (*ctulhu*, Figure 87).

**Character 7:** PCS conformation. 0: U-shaped in ectal view (*breuili*, Figure 44); 1: more or less elongated anteroposteriorly and parallel to the cymbial margin in dorsal view (*altioculata*, Figure 304); 2: T-shaped in ventral view (*hespera*, Figures 126, 130); 3: reversed-J shaped in ventral view (*sinuosa*, Figure 256).

**Character 8:** Relative length of the branches of the T conformation PCS, as seen in ventral view. 0: unequal (*hespera*, Figures 126, 130); 1: equal length (*haden*, Figure 156).

**Character 9:** PCS distal branch. 0: short; 1: long and distally projected (*edenticulata*, Figure 411).

The presence of the PCS (character 4) is synapomorphic and diagnostic for the pimoids, as all of the known species have it and its presence is restricted to this clade. So far I have not been able to identify a structure homologous to the PCS outside the pimoids. The characters that are present only in the ingroup (therefore there is not a character state for them in the outgroup), e.g., the PCS cannot be polarized by outgroup comparison by themselves. They are polarized based on those characters that are represented in both the outgroup and the ingroup and optimized in such a way that they add no extra length to the cladogram. In other words, the rooting of such transformation series is based on the character that present states in both the ingroup and the outgroup and therefore can be polarized by outgroup comparison. By examining the resulting optimizations on the cladogram we can infer primitive and derived states for the mentioned characters. In a ventral view of the palp the PCS is positioned on the ectal margin of the cymbium, between the paracymbium and the cymbial denticulated process. As I already mentioned, in *Pimoid breuili*, *P. rupicola*, and *P. ctulhu* (Figures 43–45 and 54, 15–17, and

88–91, respectively) the base of the PCS is non-membranous and continuous with the paracymbium (character 5), whereas in the rest of pimoids the PCS is attached to the ventral side of the cymbium by means of a membrane (e.g., *jellisoni*, in Figure 190). According to the hypothesis of relationships suggested by the preferred cladogram (Figure 442) a sclerotized and rigid connection of the PCS (character 5) is the plesiomorphic condition. The membranous connection of the PCS is inferred to be synapomorphic for all pimoids except the three most basal taxa. *Pimoid breuili*, *P. rupicola*, and *P. ctulhu* share the presence of a sclerotized membranous ridge of the PCS (character 6), somewhat smaller in the latter species (Figures 15–17, 43–45, and 87, 88, respectively). The overall conformation of the PCS varies (character 7) across taxa: *Pimoid breuili*, *P. rupicola*, and *P. ctulhu* have the PCS (as seen from an ectal view of the palp) more or less U-shaped (Figure 44). In the Asian taxa the PCS is seen in the ventral view as a reversed J (Figures 218, 233, 256); in the *hespera* clade it is seen as an inverted T (Figures 130, 190), the branches being of equal length in *haden* (character 8). Finally, *curvata*, *laurae*, and *edenticulata* are characterized by the presence of a long and projected distal branch in the PCS (character 9; Figures 368, 392, 411). On the basis of the preferred phylogeny (Figure 442) the non-membranous connection of the PCS, the U-shaped conformation, and the presence of a sclerotized ridge are plesiomorphic states for the pimoids, and are present exclusively in the three most basal taxa.

**Character 10:** Paracymbium attachment. 0: integral (i.e., continuous with the cymbial margin, as in *hespera*, Figure 130); 1: intersegmental (*Leptyphantus*).

**Character 11:** Paracymbium morphology. 0: straight (*Tetragnatha*); 1: U-J shaped (*Linyphia*); 2: fused to PCS and linguiform (*breuili*); 3: triangular (*hespera*); 4: short and procurved (*crispa*); 5: large and distally pointed (*Zygiella x-notata*); 6: *Stemonyphantus* type; 7: small bump (*nematoide*).

**Character 12:** Paracymbium apophyses. 0: absent; 1: present.

The pimoid paracymbium appears as a lateral projection of the base of the ectal margin of the cymbium (character 11). Millidge (1988) has named this type integral paracymbium. Although its morphology might vary, it is never attached to the cymbium by means of a membrane (intersegmental, if Millidge's terminology is preferred) as it is the case in most linyphiids. The integral paracymbium appears to be the plesiomorphic condition for araneoids. Intersegmental paracymbia are found only in the Linyphiidae and in some tetragnathids (e.g., *Pachygnatha* and *Tetragnatha* (Levi, 1981:274, 286)), but these conditions probably arose independently. *Pimoid breuili*, *P. rupicola*, and *P. ctulhu* have a linguiform paracymbium, relatively long and continuous with the base of the PCS (Figures 45, 17, and 89–91). In other words, in the mentioned taxa the ectal margin of the cymbium gives rise at its base to the paracymbium, and more distally to the PCS. If the cladogram presented in Figure 442 is accepted,

the linguiform paracymbium connected to the PCS would represent the primitive state for pimoids and its occurrence is restricted to the three most basal taxa. The known males of the rest of the North American pimoids have a more or less triangular paracymbium (Figures 130, 158). In the Asian taxa (except *nematoide*) the paracymbium is shorter and more or less procurved at its distal end (Figures 221, 234). In *nematoide* (although being relatively short and modified) there is a long and narrow sclerotized area of the cymbium between the ectal cymbial margin and the anterior paracymbial margin (Figures 285, 286). Linyphiids (except *Stemonyphantes*) have been coded as having the same overall paracymbium morphology, with a proximal and a distal paracymbial branch of varying length and more or less U-J shaped (character 11, state 1). In *Stemonyphantes* the paracymbium is a more or less flat plate, roughly U-shaped and attached by a membrane both to the cymbium and the tibia-cymbium intersegmental membrane; this is considered by Millidge (1988) as an intermediate form between the integral and intersegmental types. Overall paracymbial morphology variation is very difficult to interpret and to code, resulting in the character with the largest number of states in the matrix.

**Character 13:** Tegular suture: 0: conspicuous (*breuili*, Figure 43); 1: subtle or absent (*altioculata*, Figure 301).

In pimoids the tegulum is seen in a ventral view of the palp as a more or less smooth and rounded surface that bears a series of apophyses and processes. On the tegulum there is a suture, which I call the tegular suture (character 13), that runs from the anteroectal towards the posteromesal margin (or anterior towards posterior in *rupicola*, Figure 15) and divides the tegulum into an anterior and a posterior region. However, in the most distal clades the suture disappears or is very lightly marked (e.g., in *laurae*, Figure 392). The primitive condition is inferred to be the presence of a well-defined suture and an anterior and posterior tegular regions. The reduction and loss of this suture would then be the apomorphic condition. The posterior tegular region has in many instances a more or less pronounced bump, particularly conspicuous and pointed in *gandhii* (Figure 218). The ejaculatory duct, coming from the tegular bridge, runs close to the tegular margin, making a loop in the posterior tegular region just before entering into the PEP-embolus base (Figures 9, 10, 373). Pimoids lack the linyphiid suprategulum (character 15).

The subtegulum is connected to the cymbial alveolus by means of a basal hematodocha. A more or less lightly sclerotized structure, the petiole, anchors the subtegulum to the ventral side of the cymbium. The petiole is fused to the internal side of the subtegulum (i.e., facing the alveolus), but can be only seen in the expanded palp (Figures 9, 10, 311). The subtegulum is a ring-shaped sclerite, connected to the tegulum by means of a membrane and by a sclerotized bridge (Figures 9, 10) that I call tegular bridge (although it is in fact a tegulum-subtegulum connection). The ejaculatory duct runs from the subtegulum into the tegulum through the tegular

bridge. The fundus is located in the subtegulum, at the base of the tegular bridge (Figures 9, 10; note that these two figures are schematic, and in fact the tegular bridge has been illustrated slightly larger for clarity purposes).

**Character 14:** Mynoglenine tegular apophysis. 0: absent; 1: present (*Haplisis*).

**Character 15:** Suprategulum. 0: absent; 1: articulated (with a hinge; *Stemonyphantes*); 2: continuous with the tegulum (i.e., not articulated; *Lepthyphantes*). The suprategulum is absent in pimoids.

**Character 16:** Median apophysis. 0: present (*breuili*, Figure 66); 1: absent.

**Character 17:** Conductor. 0: present (*breuili*, Figure 66); 1: absent.

On the anterior tegular division two structures are found in almost all the pimoids, closely associated one to each other and located near the tegular suture: a membrane (character 17) and a small hook-shaped apophysis (character 16). On the tegular membrane rests the distal end of the embolus, and it seems logical to hypothesize that the embolic membrane serves the function of protecting the delicate distal end of the embolus, where the ejaculatory orifice is (Figures 66, 67). I have regarded this tegular membrane as homologous to the araneoid conductor. The tegular membrane varies in size and morphology (character 18), and it is frequently covered with small cuticular denticle-like projections (Figures 67, 106, 216, 217). This membrane is present in all the pimoids that I have examined, although there are some, presumably independent, cases of reduction (e.g., in *petita* and *sinuosa*; Figures 340 and 256, respectively). I have homologized the tegular hook (character 16) with the araneoid median apophysis. The pimoid median apophysis has been independently lost in the *breviata* clade and in *ctulhu*, otherwise it is present in the rest of the pimoid species I have examined, with a more or less similar morphology but varying in size. Both the median apophysis and the conductor are positioned very close to each other (Figures 214, 215; the homology of the conductor and the median apophysis are discussed in detail in the "Cladistics" section).

**Character 18:** Conductor morphology. 0: small and undivided (*altioculta*, Figure 321); 1: large and bilobate (*curvata*, Figure 388).

**Character 19:** Distal end of conductor. 0: unmodified; 1: with a hook-like projection (*jellisoni*, Figure 214).

**Character 20:** Embolus length. 0: long and filiform (*altioculata*, Figure 310); 1: short (*Lepthyphantes*). In the pimoids the embolus is always filiform and more or less long. The presence of a distal twist in the embolus (character 21) is synapomorphic for *sinuosa* and *nematoide* (Figures 256 and 287, respectively). A long and filiform embolus also occurs in *ctulhu* (Figure 85) but presumably it appeared independently.

**Character 21:** Distal end of embolus. 0: straight (*breviata*, Figure 345); 1: with distal twist (*sinuosa*, Figure 256).

**Character 22:** Embolic membrane (defined as an outgrow

of the column). 0: absent; 1: present (*Linyphia*).

**Character 23:** Pimoid embolic process (PEP). 0: absent; 1: present (Figures 9, 10). The most conspicuous structure on the pimoid tegulum is the pimoid embolic process, which is diagnostic and synapomorphic for the pimoids. The PEP is a long tegular projection that parallels the tegular margin (as well as the embolus in many cases), ending on the posterior tegular margin, more or less in the proximity of the conductor, median apophysis, and PCS connection to the cymbium (e.g., in *hespera*, Figure 130). Although the PEP morphology and relative position vary across taxa (characters 24–26), it is always connected to the posterior tegular division. In those species without a tegular suture (or with an inconspicuous tegular suture) the PEP occurs either on the posterior tegular region (e.g., *edenticulata*, Figure 410) or on the ectal region (e.g., *nematoide*, Figure 287). The plesiomorphic condition is inferred to be a bifurcated and more or less filiform PEP (*rupicola* and *breuili*, Figure 10), and wide and lamelliform non-bifurcated PEPs probably represent the derived state (e.g., *curvata*, Figure 371). The PEP in *breuili* is particularly complex, bearing several apophyses on the bifurcation (Figure 47). I have not found a homologous structure to the PEP in other araneoids.

**Character 24:** PEP conformation. 0: undivided (*crispa*, Figure 233); 1: with secondary branch (*breuili*, Figure 10).

**Character 25:** PEP apex. 0: non-rolled (*crispa*, Figure 233); 1: rolled or twisted (*jellisoni*, Figure 192).

**Character 26:** PEP base. 0: narrow (*breuili*, Figure 48); 1: wide and lamelliform (*curvata*, Figure 371).

**Character 27:** Length of the embolus, in relation to the PEP (the length is measured from the embolus-PEP connection towards the distal end). 0: embolus shorter than the PEP (*breuili*, Figure 43); 1: embolus and PEP of roughly the same length (*breviata*, Figure 346); 2: embolus longer than the PEP (*sinuosa*, Figure 256).

The pimoid embolus is closely associated with the PEP, sharing a common base through which the ejaculatory duct runs (e.g., *curvata*, Figures 373, 374), although its length relative to the PEP varies (character 27). The plesiomorphic state for the embolus length is to be shorter than the PEP, as is the case in *breuili* (Figures 10, 43). *Pimoa breviata* is autapomorphic in having the embolus and the PEP of roughly the same length (Figure 346).

**Character 28:** Radix. 0: absent; 1: present.

Pimoids lack the radix that can be found in linyphiids and araneids, and therefore the characters that describe the radix and the radical apophyses (characters 31, 32) have to be scored as “non applicable” for pimoids.

**Character 29:** Column (distal haematodocha in Araneidae). 0: absent; 1: present.

**Character 30:** Fickert’s gland. 0: absent; 1: present.

This structure can be seen as a more or less globular enlargement of the sperm duct in the radix of some linyphiids.

**Character 31:** Terminal apophysis. 0: absent; 1: present.

The terminal apophysis is a radical structure located near the base of the embolus of some linyphiids.

**Character 32:** Lamella characteristic. 0: absent; 1: present (*Lepthyphantes*).

The lamella characteristic is a sclerite of the linyphiid embolic division, located in the posterior part of the radix, adjacent and posterior to the terminal apophysis.

**Character 33:** Tibial apophysis in male pedipalp. 0: absent; 1: dorsal and rounded (*ctulhu*, Figure 87); 2: dorsal and conical (*jellisoni*, Figure 193); 3: retrolateral (*Walckenaeria*); 4: ventral and hooked (*Stemonyphantes*). The distal end of the male palpal tibia of pimoids has a dorsal apophysis or protuberance that varies in size and shape. The presence of this dorsal apophysis (character 33) is a synapomorphy of pimoids. The preferred cladogram (Figure 442) suggests that this apophysis is neither homologous to the retrolateral tibial apophysis of erigonines, nor to the ventral tibial apophysis of *Stemonyphantes*: when optimized on the cladogram it requires three independent origins (in erigonines, in *Stemonyphantes*, and in pimoids). The plesiomorphic state in pimoids is a more or less rounded apophysis (e.g., *ctulhu*, Figure 87). The conical and pointed apophysis of *haden* and *jellisoni* (Figure 193) are regarded as apomorphic. An elongated tibia (longer than twice its width) is synapomorphic for the *hespera* clade (Figure 131); a similarly elongate palpal tibia is predicted for *mono* in which the male remains unknown. The presence of a row of dorsal spines in the distal end of the tibia (character 34; Figure 347) is a synapomorphy of the *breviata* clade.

**Character 34:** Male pedipalp tibial spines. 0: not clustered; 1: in a distal row (*breviata*, Figure 347).

**Character 35:** Number of trichobothria in prolateral tibial margin of male pedipalp. 0: one; 1: three or more; 2: two.

**Character 36:** Number of trichobothria in retrolateral tibial margin of male pedipalp. 0: two; 1: four; 2: three; 3: five or more. The number of prolateral and retrolateral trichobothria in the male pedipalpal tibia (characters 35 and 36 respectively) characterizes the *hespera* clade within the pimoids, by having a larger number of trichobothria than in most of the rest of pimoids. These characters are meaningful only in the context of pimoids, and when scored for a larger suite of taxa (i.e., at a higher level) they seem to be uninformative.

**Character 37:** Male palp trochanter. 0: smooth; 1: with apophysis (*alticulata*, Figure 307).

## FEMALE GENITALIA

Female genitalic characters provide diagnostic features for the species identifications, as well as information for the study of the phylogenetic relationships. I shall describe first the general morphology of the female pimoid genitalia and then the modifications of it. The groundplan for the female pimoid genitalia consists of an evagination of the abdominal wall made of a dorsal (posterior) and a ventral (anterior) plate. The ventral

and dorsal plates of the epigynum contact each other by a fold or suture that I have called the epigynal fold (character 39), as well as by the distal end (which is something like a hinge between the dorsal and ventral plates). The copulatory openings are located at the distal end of the epigynal fold. The copulatory duct is partially located at the epigynal fold (at least the initial part, which is in fact the more or less tubular space that the dorsal and ventral plates leave in between them). The copulatory duct opens into a more or less spherical spermatheca. The spermathecae are connected to the uterus externus by short fertilization ducts, which are associated with the proximal end of the dorsal plate. In several species (e.g., *indiscreta*) the spermathecae present an accessory chamber, which runs in a dorsoventral direction and originates from both the base of the spermatheca, sensu stricto, and the base of the fertilization duct. The fertilization ducts do not offer any significant morphological variation across the pimoids.

**Character 38:** Epigynum form. 0: protruding less than its width (*rupicola*, Figure 29); 1: protruding more than its width (*curvata*, Figure 377).

**Character 39:** Epigynal fold. 0: dorsal (*altiocolata*, Figure 313); 1: lateral (*crispa*, Figure 240). Most of the pimoids have dorsal epigynal folds (e.g., *altiocolata* in Figure 313) but the *gandhii* group have them in lateral position (e.g., *indiscreta* in Figure 250). The dorsal epigynal folds are considered to be the plesiomorphic condition.

**Character 40:** Epigynal ventral plate. 0: unmodified; 1: "humped" (in lateral view) and lip-like (in posteroventral view; *hespera*, Figure 138); 2: pointed (in lateral view, *mephitis*, Figure 431).

**Character 41:** Epigynal plate margins. 0: thin; 1: swollen and lip-like in lateral view ("labiate"; *gandhi*, Figure 225).

**Character 42:** Position of the dorsal plate. 0: external; 1: internal (i.e., covered by the ventral plate, as in *vera*, Figures 118–120). *Pimoida vera* and *P. cthulhu* share a special conformation of the epigynum: it is very long and cylindrical, the ventral plate leaving an elongated opening on the dorsal side of the epigynum; at the base of this opening can be seen the base of the dorsal plate (Figures 95 and 119) that otherwise is covered by the ventral plate.

**Character 43:** Dorsal plate. 0: without projections; 1: with short projections (*curvata*, Figure 382); 2: with long projections (*laurae*, Figure 396).

**Character 44:** Opening of the epigynal ventral plate. 0: unmodified; 1: shaped as keyhole (*jellisoni*, Figure 196).

**Character 45:** Copulatory ducts. 0: discrete (i.e., non fused); 1: fused (*indiscreta*, Figure 251). The fusion of the proximal (basal) part of the copulatory ducts has occurred in *gandhii* and *indiscreta* (Figures 228 and 251, respectively). Discrete copulatory ducts is inferred to be the primitive condition.

**Character 46:** Copulatory duct length. 0: longer than the spermatheca width (*ctulhu*, Figure 94); 1: shorter than the spermatheca width (*hespera*, Figure 141).

**Character 47:** Copulatory duct double twist. 0: absent; 1: present (*sinuosa*, Figure 272). The plesiomorphic state is to have a single twist in the copulatory duct (e.g., *rupicola*, Figure 32). The twist has been lost in the *breviata* clade (Figure 378). There are more than one twist in the copulatory ducts of *anatolica* and *sinuosa* (Figures 297, 272).

**Character 48:** Atrium (as defined in Blauvelt, 1936). 0: absent; 1: present (*Linyphia*).

#### SOMATIC MORPHOLOGY

**Character 49:** Mynoglenine cephalic sulci. 0: absent; 1: present.

**Character 50:** Tracheal system. 0: haplotracheate (*altiocolata*); 1: desmitracheate (*Erigone*). Both terms are used sensu Millidge (1984). Within the pimoids, tracheal system dissections were done for *altiocolata*, *breviata*, *ctulhu*, *jellisoni*, and *breviata*. In all cases they were found to have an haplotracheate system, the atrium opening by means of a single spiracle. The tracheal system was inferred not to vary across species in the pimoids, and was scored with the same state for all the species (although only five were actually dissected and studied). Detailed descriptions of the tracheal anatomy of linyphiids are provided in Hormiga (in press).

**Character 51:** Dorsal pattern of abdomen. 0: otherwise; 1: two light chevrons on a dark gray background (*sinuosa*, Figure 269). The pattern of abdominal pigmentation varies across species, although all the pimoids have a common general pattern. This general dorsal abdominal pattern consists of a more or less dark background color (black–dark gray or dark brown) with lighter (very light brown or whitish color) marks (Figures 134, 230). There is a substantial degree of intraspecific variation in the pattern, as well as in the overall degree of pigmentation of the individual specimen (e.g., *Pimoida altiocolata* in Figures 305, 306, 318, 319). Different individuals of the same species might have different abdominal patterns, and/or different overall degree of pigmentation (light vs. dark individuals). This variation might not be strictly geographical, because individuals from the same locality and date of collection can vary in their pattern. I have illustrated and described (at least partially) the variation of the abdominal pattern, but in most of the cases this pattern cannot be used alone by itself for species identifications. *Pimoida cthulhu* (Figure 99) presents an abdominal pattern consisting of only four relatively small light marks; such reduction is autapomorphic for this species. In *indiscreta* and *anatolica* the abdominal pattern has two conspicuous light chevrons (character 51; Figures 254 and 295, respectively).

**Character 52:** Prolateral surface of male chelicera. 0: smooth; 1: with stridulatory striae (*altiocolata*, Figure 326). Pimoids share with most of the linyphiids the presence of stridulatory striae on the ectal side of the chelicera (Figures 326, 75). Presumably vibrations are produced by friction of the enlarged setal bases (found on the base of the prolateral side of

the pedipalpal femur, Figure 366) against the cheliceral striae. The presence of this type of stridulatory organ provides support for the monophyly of pimoids plus linyphiids, as Wunderlich (1986) suggested.

**Character 53:** Number of retrolateral teeth in female chelicera. 0: four or more; 1: two; 2: three.

The number cheliceral teeth has been a classical character in species descriptions, although its value for phylogenetic inference may vary from case to case. Three prolateral teeth is invariant across the pimoids, but the number of retrolateral teeth does vary across species. The number of retrolateral teeth in the female chelicera was studied for most of the pimoids and the linyphiids. It has been studied in the females because in six pimoid species only the females are known, while two species are known only from the males (a total of eight out the 21 known species of pimoids are known for only one of the sexes). Female pimoids have either two (e.g., *rupicola*) or three retrolateral cheliceral teeth (e.g., *hespera*); the sample of linyphiids represented in my dataset have four or more retrolateral teeth. Intraspecific variation exists in this trait (for example in *breuili* it varies from two to three). In the outgroups of my study (*Tetraagnatha* and *Zygiella*) the number was three, but other taxa in the same families (and probably even in the same genera) might have a different number of retrolateral cheliceral teeth. So the polarity decision for this character is linked to the specific choice of the exemplars for the outgroups (see discussion in the "Cladistics" section).

**Character 54:** Female pedipalp tarsus. 0: with claw; 1: without claw.

**Character 55:** Leg autospasy at the patella-tibia junction. 0: absent; 1: present.

Pimoids share with linyphiids the autospasy of legs at the patella-tibia junction. This is unique among araneoids (Roth and Roth, 1984:142) and therefore is a synapomorphy for the linyphiid-pimoid clade, as Wunderlich (1986) suggested. Autospasy and its distribution across major spider groups was reviewed by Roth and Roth (1984). However, detailed information about the anatomical and physiological bases of autospasy is lacking and we are limited to report it as a mere absence/presence, without a real understanding of it. Although it might be easy to propose hypotheses about its possible adaptive value (e.g., to facilitate escaping from predators), it is not clear why some spiders do not exhibit any autospasy at all (e.g., most haplogynes, Roth and Roth, 1984:140).

**Character 56:** Male Femur I midthird. 0: few spines (less than 10), not clustered; 1: with group (10 or more) of stout spines (*altioculata*, Figure 309). Spination patterns exhibit a great degree of intraspecific variation and even "intraindividual" variation (differences between the number of spines in the right and left sides of the body). For example, the holotype of *breviata* has on its left femur I four dorsal and four prolateral spines, while the right one has two dorsal and two prolateral. The total range for 12 specimens of *breviata* in which I recorded the spination of the femur I was dorsal two to five, and

prolateral two to five spines for the whole sample. Similar ranges of variation were found in other species. The phenotypic expression of both the spination and the setal patterns could have a large environmental component. Because of its variability, spination patterns are not reported in the descriptions unless they offer diagnostic features, as for example in the case of the basal femoral cluster of *sinuosa* (Figure 265). It is interesting to note that pimoids have two spines on the dorsum of the fourth tibia, as many as the "linyphiine" linyphiids do. This provides explicit outgroup evidence for considering plesiomorphic the presence of two dorsal spines on tibia IV, a classical character used to define (or at least diagnose) the linyphiines. For example, van Helsdingen (1986:122) when analyzing the affinities of mynogenines pointed out that "Linyphiinae as a rule bear two dorsal spines on tibia IV." Because two dorsal spines on tibia IV is the plesiomorphic condition, its presence in other linyphiid taxa does not provide evidence for monophyly. A single dorsal spine on tibia IV or absence of dorsal tibial spines (as in many erigonines) is therefore apomorphic within linyphiids.

Many pimoids (but not all) have extremely long setae covering the legs, particularly the tibia, metatarsus, and tarsus, e.g., in *Pimoid breuili* and *P. ctulhu* (Figures 76, 98). However, this trait varies intraspecifically. For example, some specimens of *rupicola* are densely covered with long setae, while others lack them almost completely. Although in some cases the absence of the characteristic long setae might be a preservation artifact, in others it is clearly not.

**Character 57:** Metatarsus IV trichobothrium. 0: present; 1: absent.

The presence/absence of the trichobothrium of the metatarsus IV and the position of trichobothrium of the metatarsus I are classical characters in linyphiid systematics. In most pimoids the trichobothrium is located in the distal third of the metatarsus. However, its position varies in what seem to be the most basal pimoid taxa. The European taxa (*breuili* and *rupicola*) have it in the medial third, and *ctulhu* is autapomorphic in having a large number of metatarsal trichobothria in a row (in the metatarsus I it varies from 7 to 11 in the male, and from 8 to 10 in the female). Most of the linyphiids in the data set have it in the proximal third but *Novafrotoneta*, and the erigonines *Erigone* and *Walckenaeria* have it in medial position. *Haplinis* has a row of 4 or 5 metatarsus I trichobothria. The relative position of the trichobothrium is described as a ratio (e.g., in Millidge, 1980:105) and has a continuous range of values. Therefore the use of relative positions of trichobothria presents many of the coding problems of continuous characters, although this is only a methodological drawback. I do not think that the study of the relative position of trichobothria across wide ranges of taxa provides clear evidence of recency of common ancestry. It is often the case that this character varies widely within some genera, as pointed out by Holm (1984) for *Walckenaeria*. Although I have documented the position of the trichobothrium



of the metatarsus I in the pimoids, I have not used it in the cladistic analysis for the above mentioned reason. The trichobothrium of the metatarsus IV is present in all pimoids.

#### SPINNERET SPIGOT MORPHOLOGY

Pimoids exhibit a pattern of spigot morphology consistent with the araneoid groundplan (see Coddington, 1989), although it has some unique features. Linyphiids and pimoids share the position of the mesal cylindrical spigot on the PLS. This spigot is located on the periphery of the PLS (Figure 146), however this is not exclusive of linyphiids and pimoids. A similar location was already known for some tetragnathids (Coddington, pers. comm.; Platnick et al., 1991). Examination of *Zygiella x-notata* (the affinities of *Zygiella* are problematic: currently it is placed in Tetragnathidae, formerly it was placed in Araneidae; recent unpublished analyses of Araneoidea relationships by J. Coddington and N. Scharff suggest that *Zygiella* is either sister to Araneidae, i.e., it is the most basal taxon within araneids, or sister to Araneinae, i.e., basal within the araneine clade; Scharff, pers. comm.) shows that the mesal cylindrical spigot on peripheral position might be more widespread than initially thought, because it occurs in some taxa of at least three araneoid clades: the araneids, tetragnathids, and the linyphiid-pimoid clade. Pimoids and linyphiids lack the PMS anterior aciniform brush found in many primitive orbicularians, but the brush is also absent in many other taxa (e.g., tetragnathids and theridiids).

*Character 58:* PLS mesal cylindrical spigot base. 0: same size as ectal; 1: enlarged (larger than the other cylindrical spigot base) (*hespera*, Figure 146). A relative enlargement of the base of the peripheral cylindrical spigot of the PLS is found in pimoids and linyphiids, the base is larger than the base of the other cylindrical on the PLS (Figures 116, 146). This synapomorphy provides additional support for the sister group relationship of pimoids and linyphiids. The difference in size between the two PMS cylindrical spigots seems to be more conspicuous in the linyphiids that I examined than in the pimoids.

*Character 59:* Aciniform spigots on female PMS. 0: more than one; 1: one; 2: absent.

*Character 60:* Aciniform spigots on female PLS. 0: more than one; 1: one; 2: absent.

Pimoids are unique in having a drastic reduction of the PMS and PLS aciniform fields: they either have one or none aciniform spigots for each spinneret. This synapomorphy provides further support for the monophyly of pimoids. Although the loss of all the aciniform spigots is a very rare event, it has also occurred in the linyphiid genus *Stemonyphantes* (this loss has presumably occurred independently). The number of aciniform spigots on both the PLS and the PMS (characters 59 and 60, respectively) has been scored for the females of all the pimoids. Three meristic patterns were found for the distribution of aciniform spigots in pimoids: one

aciniform on the PLS and one on the PMS (e.g., *ctulhu*), one aciniform on the PLS and none on the PMS (e.g., *sinuosa*), and no aciniforms on either spinneret (e.g., *hespera*). However, at least one of these two characters exhibits intraspecific variation: individuals of *breuili* might present one aciniform spigot on the PMS or none (Figures 82 and 80, respectively). The individuals that lack the mentioned spigot have instead a nubbin in its place, presumably the vestigial remnant of the lost aciniform spigot. I have not investigated in detail the intraspecific variation of this character across taxa, and although I have scanned more than one individual in several species, only in the case of *breuili* did I find variation. Peters and Kovoor (1991, their table 1) have reported a small range in the variation of the number of aciniform spigots on the PMS and PLS of *Linyphia triangularis*. Linyphiids have elongated aciniform fields on the female PLS.

#### BEHAVIOR

*Character 61:* Male position during construction of spermweb. 0: above spermweb; 1: below spermweb (from van Helsdingen, 1983).

*Character 62:* Male position during ejaculation. 0: above spermweb; 1: below spermweb (from van Helsdingen, 1983).

#### Familial Placement, Cladistic Analysis, and Phylogenetic Relationships of the Pimoids

The familial placement of the pimoids has remained controversial during many decades, as is evident from their taxonomic history. The initial placement in the linyphiids was never explicitly justified, not even at the generic level. The linyphiid genus *Labulla*, where several pimoids were initially placed, is clearly a "tailor's drawer" where different scraps are put together, regardless of their origin. Although I have examined only some of the species placed in *Labulla*, I have not found any with the exception of *L. flahaulti* Simon, and perhaps *L. impudica* Denis, that is clearly congeneric with the type species (*Labulla thoracica* Wider). "*Labulla*" *contortipes* Karsch is not a linyphiid, the Hawaiian "*L.*" *graphica* Simon and "*L.*" *torosa* Simon probably require a new genus, and "*L.*" *grisea* Schenkel, described from China, has been recently transferred to the genus *Stemonyphantes* (Tanasevitch, 1989). Evidently the criterion followed by many arachnologists for such placements has been quite broad and vague: similar overall somatic morphology and color pattern, and a "complex" palp morphology. One wonders how many more similar cases are to be found in linyphiid taxonomy.

The particular combination of derived and primitive character states present in the pimoids has caused its chaotic shifting from one group to another, depending on the characters that were taken into consideration. Their overall somatic and palp morphology vaguely suggested a tetragnathid placement (e.g., Fage, 1931; Thaler, 1976), close to the metines, particularly because the palp morphology seemed to be very different from

that of the linyphiids (paracymbium continuous with the cymbium (integral), absence of the typical linyphiid embolic division). However, none of those placements was clearly and explicitly documented with shared apomorphies. Crawford (1988:23) noted that the conformation of the male palp of *Pimoida* is "nearly identical to that of *Chrysometa* [Tetragnathidae], including the distinctive cymbial apophysis." A detailed examination of the palpi in both genera shows that they are not so identical. The paracymbium of *Chrysometa* is "a separate sclerite broadly attached to the cymbium" (Levi, 1986:102), and therefore quite different from that of *Pimoida*. The cymbial apophysis is also different in both genera; the PCS is an independent sclerite in most of the pimoid species, and not an apophysis. If the suggested homology is between the cymbial process and the pimoid CDP, the differences are also notable. *Chrysometa*'s palp conformation falls well into the metine general conformation (e.g., *Meta* and *Metellina*, see also Coddington, 1990a:16), including the presence of a conductor and the "terminal apophysis" (the Metine Embolic Apophysis or MEA of Coddington, 1990a). There is some similarity between the PEP and the MEA of *Chrysometa*, but the conductor is quite different, being a free sclerite in *Chrysometa*. The tegular morphology is also different, being more or less globular in the pimoids contrary to the tegulum of *Chrysometa*. The similarities in the palp morphology between *Chrysometa* and *Pimoida* vanish when examined in detail.

The computer program Hennig86 (Farris, 1988) was used to analyze the data set presented in Table 1. The multistate characters (15 out of a total of 62 characters) were treated as unordered. Five out of the 21 pimoid taxa were represented only by females, and therefore a large number of cells in the data matrix (those pertinent only to male characters) have a "?" entry. Because of the way the operational algorithms in the program treat missing entries, the presence of a large number of those entries in the matrix can result in an enormous set of equally parsimonious alternative solutions, some of them not supported by the actual available data in the matrix (Platnick, Griswold, and Coddington, 1991). Because of this effect I performed my initial analyses excluding the "female taxa" from the dataset, in an attempt to minimize the number of missing entries. Later on I studied the effect of the inclusion of the mentioned taxa in the matrix. Four out of five of the species with unknown males have putative synapomorphies that unambiguously group them in distal positions of the cladogram. The inclusion of these mentioned four species in the dataset does not have an effect on the number of equally parsimonious cladograms produced. However the inclusion of *Pimoida mephitis* produces a dramatic increase in the number of alternative equally parsimonious solutions (using the heuristic search option "m\*;bb\*;" produces 177 cladograms, of 119 steps and 0.71 and 0.87 consistency and retention indices, respectively), because of the multiple possible placements of this taxon. For that reason *mephitis* was excluded from the dataset for subsequent analyses, and its relationships are

considered incertae sedis.

The implicit enumeration option (using the command "ie;") produced 15 equally parsimonious cladograms, with a length of 118 and consistency and retention indices of 0.71 and 0.87, respectively. The same results are obtained by using the heuristic search option implemented by the commands "m\*;bb\*;" For this dataset the latter option is over five hundred times faster than the implicit enumeration option. The strict consensus tree for the 15 initial cladograms (Figure 440) shows where the conflicts are in the cladogram. There is a basal trichotomy that involves *Stemonyphantes*, the rest of linyphiids, and the pimoids. Except the mentioned trichotomy, the rest of the linyphiid cladogram is fully resolved. The pimoid clade has a basal heptachotomy and a distal trichotomy for *anatolica*, *sinuosa*, and *nematoide*. Based on the consensus cladogram the pimoids can be initially divided into five components (the *ctulhu*, *hespera*, *breviata*, *altioculata*, and *gandhii* clades) plus two species (*rupicola* and *breviuli*). The different arrangements of these seven pimoid components found in the 15 most parsimonious cladograms can be summarized into three topologies (Figure 441). The different alternative topologies for the pimoid section of the cladogram are three rooting variations of the same network (Figure 441C). In other words, the 15 cladograms produced by implicit enumeration suggest the same cladistic network for the Pimoidae, and differ only in the position of the root (1, 2, and 3 in Figure 441C).

Two alternative topologies exist for the resolution of linyphiids (Figure 441A,B), differing in the placement of *Stemonyphantes*, which can either be sister to the rest of linyphiids or sister to the pimoids. The three pimoid summary topologies differ quite drastically in the relationships they suggest. All of them have *Louisfagea* as polyphyletic. The *gandhii* clade is suggested as a distal branch by two topologies (Figure 441C, topologies 2 and 3) and as the most basal one by a third topology (Figure 441C, topology 1). Although the consensus tree might be useful to show the conflicts between the different alternative hypotheses, it can be a poor hypothesis of relationships, both from the parsimony and the information content points of view. In this particular case in which there is a single network for the pimoids, the strict consensus tree produces a basal heptachotomy, failing thus to inform us of what is only a problem of alternative rootings. The strict consensus tree is 135 steps long, requiring then 17 extra instances of homoplasy.

Successive character weighting (Farris, 1969; Carpenter, 1988) was used as implemented by Hennig86 to select a tree from the initial suite of 15 cladograms. This procedure is based on the concept of cladistic reliability, that is, the degree of fit between the characters and the phylogeny (Farris, 1969). Successive character weighting ascribes new weights to the characters based on their consistency with the original set of cladograms obtained. The weighting scheme implemented by Hennig86 uses the product of the consistency index by the

retention index (see Farris, 1989; and Guyer and Savage, 1992 for a discussion on the properties of this kind of weighting). A single iteration of successive character weighting produced three equally parsimonious cladograms that differed in the resolution of the three taxon statement *anatolica*, *sinuosa*, and *nematoide*. These three cladograms were represented in the original suite of 15 cladograms (topology 3, Figure 441c for pimoids plus topology 432a for pimoids and outgroups), therefore their length (for the unweighted data) is of 118 steps. This result remains stable in a second iteration. The strict consensus tree for the three cladograms produced by successive weighting (Figure 440) is also 118 steps long. I have preferred this consensus tree as a hypothesis for pimoid relationships because it summarizes the three alternative cladograms for the weighted data without adding extra length. Furthermore the resolution of the distal trichotomy of the consensus cladogram has no major relevance for the study of character evolution. My discussion of the pimoid groupings and of character evolution refers to the mentioned preferred cladogram (Figure 442), unless otherwise stated.

The monophyly of pimoids plus linyphiids is supported by the following synapomorphies: autospasy at the patella-tibia junction, presence of stridulatory striae on the ectal side of (at least) the male chelicerae, and an enlarged and rounded base of the mesal cylindrical gland spigot in the PLS. The two first synapomorphies were already suggested by Wunderlich (1986). Additional support is provided by the absence of paracymbial apophyses, although this character reverses in the leptyphantines. The stridulatory striae are secondarily absent in *Linyphia* and *Erigone*, among several other genera. Wunderlich (1986) also suggested that additional support for the monophyly of pimoids and linyphiids was given by the presence in both clades of sheet webs. The way pimoids move upsidedown on the undersurface of the web is also congruent with linyphiids. I have studied the webs of several North American species (*alticulata*, *breviata*, *edenticulata*, *laurae*, and *ctulhu*); Coddington (pers. comm.) has documented the same kind of web for *sinuosa*. Although the webs of *rupicola* and *breulli* have not been documented it seems reasonable to assume that they do not differ significantly from the ones we know. To my knowledge, apart from linyphiids, only cyatholipids (and some syntaxids; C. Griswold, pers. comm.) make similar webs among araneoids. Based on the most recent estimates of Araneoida phylogeny (Coddington, 1990a, 1990b) it seems quite reasonable to infer that sheet webs are apomorphic in araneoids. Whether the sheet web has evolved once or more is a question that cannot be resolved without resolving the problematic placement of cyatholipids.

The monophyly of the pimoids is unambiguously supported by the following putative synapomorphies: the presence of a cymbial denticulate process, the pimoid cymbial sclerite, the pimoid tegular-embolic process, and the presence of a dorsal rounded tibial apophysis in the male palp. The two first listed synapomorphies were already suggested by Wunderlich

(1986). Griswold (1990:14) has suggested that the absence of palpal tibial processes is probably plesiomorphic for Orbiculariae, although there is some homoplasy in this character because it occurs in some anapids and many linyphiids. The denticles of the cymbial process are secondarily lost in *edenticulata*. Additional support for pimoid monophyly is provided by the reduction of the number of aciniform spigots in the PMS and PLS. The loss of all the aciniform spigots is an extremely rare event in araneoids, and to my knowledge it has not been documented before. But in spite of its rarity it has also occurred, presumably in parallel, in the linyphiid genus *Stemonyphantes*. Several equally parsimonious optimizations exist for the number of aciniforms on the PMS (character 59) on the preferred cladogram, but none of them can explain the data without re-appearance of the aciniform spigots after being lost. Furthermore, none of the 15 most parsimonious cladograms can explain the data without having the aciniforms gained, at one point or another, after being lost in the nearest ancestor. One of the possible optimizations in the preferred cladogram is to assign the total loss of PMS aciniforms to the common ancestor of pimoids and linyphiids, but that requires subsequently the gain of the aciniform fields in the rest of linyphiids after the *Stemonyphantes* node as well as in some pimoids. Because that seems to be a rare event, I have dismissed such optimization and preferred to map the changes where they first occur. For that reason I have preferred to interpret homoplasy regarding the loss of the PMS aciniforms in the sense of two independent events, occurring in parallel in *Stemonyphantes* and in the pimoids. In the case of the PLS aciniform spigots the data unambiguously support the loss in parallel in the higher pimoids and in *Stemonyphantes*.

Six of the 15 most parsimonious cladograms suggest *Stemonyphantes* as sister to the pimoids. I reanalyzed the data after inactivating the characters that refer to the number of aciniform spigots (characters 59 and 60). The "m\*; bb\*;" option of Hennig86 produced 102 parsimonious cladograms 109 steps long, with consistency and retention indices of 0.73 and 0.87, respectively. The strict consensus tree of the 102 cladograms supported the relationships (Pimoids (*Stemonyphantes*, Linyphiids)). So consideration of *Stemonyphantes* as sister of the pimoids seems to be based on the loss of the aciniform spigots, although that clearly contradicts the evidence provided by the palp morphology.

I have studied the spinneret spigot morphology and distribution for all the species of Pimoidae for which I had female specimens. When enough specimens were available they were photographed with the SEM. To my knowledge this is the first time that this morphological character has been exhaustively documented at the species level for a relatively large number of species within a monophyletic group. The character exhibits little variation within the generic level, but provides some grouping information. Deactivating the characters that account for the number of aciniform spigots provokes a substantial loss of resolution (i.e., many more equally

TABLE 1.—Character data for Figures 440–442. [Rows represent characters and columns taxa. The first state is “state 0,” the second is “state 1,” etc. Question marks represent missing data, and dashes “non applicable” states. The last two columns give the consistency index (CI) and the weight (WE) assigned to the character in the successive character weighting analysis (see text). Taxon (in the same order as in the matrix) abbreviations: Te = *Tetragnatha versicolor*, Zy = *Zygiella x-notata*, Li = *Linyphia triangularis*, Mi = *Microlinyphia dana*, Bo = *Bolyphantes luteolus*, Le = *Lepthyphantes tenuis*, Er = *Erigone psychrophila*, Wa = *Walckenaeria directa*, Ha = *Haplinis diloris*, No = *Novafroneta vulgaris*, St = *Stemonyphantes blauveltae*. The remaining taxa are species of *Pimoa*: ru = *rupicola*, br = *breuilii*, ct = *ctulhu*, ve = *vera*, mo = *mono*, he = *hespera*, ha = *haden*, je = *jellisoni*, ne = *nematoide*, si = *sinuosa*, an = *anatolica*, in = *indiscreta*, cr = *crispa*, ga = *gandhii*, pe = *petita*, al = *alticulata*, bv = *breviata*, cu = *curvata*, ed = *edenticulata*, la = *laurae* (me = *mephiitis* was excluded from the numerical analysis, see text).]

	TZLMBLEWHNSrbcvmhjhnsaicgpabcelm	C	W
	eyiioeraaoturteoeaeiinraelvudae	I	E
<b>MALE GENITALIA</b>			
01. Cymbium morphology: without DDP; DDP; DDP with denticles lost	0000000000111??11111??11111121?	1.00	10
02. DDP denticles: numerous (>20); few (<20)	-----001??11111??011111111?	0.50	02
03. DDP distal end: unmodified; pointed and heavily sclerotized	-----000??00000??00000011?	1.00	10
04. PCS: absent; present	0000000000111??11111??11111111?	1.00	10
05. PCS-cymbium connection: sclerotized and rigid; membranous and flexible	-----000??11111??111111111?	1.00	10
06. PCS membranous ridge: absent; large; small	-----112??00000??00000000?	1.00	10
07. PCS conformation: U; elongated anteroposteriorly; T; reversed J	-----000??22233??331111111?	1.00	10
08. Branch length in PCS T conformation: unequal; equal	-----??011--??-----?	1.00	10
09. PCS distal branch: short; long	-----000??00000??00000111?	1.00	10
10. Paracymbium attachment: continuous with cymbial margin; intersegmental	10111111111000??0000??0000000?	0.50	04
11. Paracymbium morphology: straight; U-J; linguiform fused to PCS; triangul.; short-procurved; large-pointed apex; <u>s</u> type; bump	051111111116222??33374??44333333?	1.00	10
12. Paracymbium apophyses: absent; present	11001100000000??0000??00000000?	0.50	03
13. Tegular suture: conspicuous; subtle or absent	-----000??00010??001111111?	0.50	04
14. Mynoglenine tegular apophysis: absent; present	00000000110000??00000??00000000?	1.00	10
15. Suprategulum: absent; articulated; continuous with tegulum	00111111002000??0000??00000000?	1.00	10
16. Median apophysis: present; absent	10111111111001??00000??00001111?	0.25	02
17. Conductor: present; absent	00111111111000??00000??00000000?	1.00	10
18. Conductor form: small and undivided; large and bilobate	00-----000??00000??00001111?	1.00	10
19. Distal end of conductor: unmodified; with hook-like projection	00-----000??11100??00000000?	1.00	10
20. Embolus length: long and filiform; short	00001110000000??0000??00000000?	0.50	02
21. Distal end of embolus: straight; twisted	00000000000000??00011??00000000?	1.00	10
22. Embolic membrane: absent; present	-0101111110---??---??-----?	0.50	02
23. Pimoid embolic process (PEP): absent; present	00000000000111??11111??11111111?	1.00	10
24. PEP conformation: undivided; divided	-----110??00000??00000000?	1.00	10
25. PEP apex: non rolled; rolled	-----000??01100??00000000?	1.00	10
26. PEP base: narrow; wide and lamelliform	-----000??01100??001111111?	0.50	04
27. Embolus/PEP length: E<PEP; E=PEP; E>PEP	-----002??00022??00001000?	0.66	03
28. Radix: absent; present	01111111111000??0000??00000000?	0.50	04
29. Column: absent; present	01111111111000??0000??00000000?	0.50	04

	TZLMBLEWHNSrbcvmhhjsaicgpabcelm C W	eyioeraaoturteoeaeiinraelvudae I E
30. Fickert's gland: absent; present	00001100000000??0000??000000000?	1.00 10
31. Terminal apophysis: absent; present	-0111110000-???-???-??-????-??	0.50 03
32. Lamella characteristica: absent; present	-0111100000-???-???-??-????-??	1.00 10
33. Male pedipalpal tibial apophysis: absent; dorsal, rounded; dorsal, conical; retrolateral; ventral	00000033004111??12211??111111111?	1.00 10
34. Male pedipalpal tibial spines: not clustered; distal row	00000000000000??00000??00001111?	1.00 10
35. Proateral trichobothria in male pedipalpal tibia: one; three or more; two	22000000200211??11122??2222222?	0.50 04
36. Retrolateral trichobothria in male pedipalpal tibia: two; four; three; five or more	1020000020021??33322??22?22222?	0.50 03
37. Male palp trochanter: smooth; with apophysis FEMALE GENITALIA	00000000000000??00000??00110000?	1.00 10
38. Epigynum form: protruding less than its width; protruding more	-000000000000111111?11111?111111	1.00 10
39. Epigynal fold: dorsal; lateral	-----00000000?11111?000000	1.00 10
40. Epigynal ventral plate: unmodified; "humped" with lip-like apical margin; pointed	-000000000000001100?00000?000002	1.00 10
41. Epigynal plate margins: thin; swollen and lip-like	-0000000000000000000?01001?000000	0.50 00
42. Dorsal plate relative position: external; internal (covered by ventral plate)	-000000000000110000?00000?000000	1.00 10
43. Dorsal plate: without projections; with short projections; with long proj.	-00000000000000000000?00000?011220	1.00 10
44. Opening of ventral plate: unmodified; keyhole shape	-00000000000000000011?00000?000000	1.00 10
45. Copulatory ducts: separated; fused	00000000000000000000?00101?000000	0.50 00
46. Copulatory duct length: longer than spermatheca width; shorter	-000000000000001100?00000?000000	1.00 10
47. Copulatory duct double twist: absent; present	00000000000000000000?11000?000000	1.00 10
48. Atrium: absent; present SOMATIC MORPHOLOGY	-011000010000000000?00000?000000	0.50 02
49. Mynoglenine cephalic sulci: absent; present	000000?0110000000000000000000000	1.00 10
50. Tracheal system: haplotracheate; desmitracheate	00000011000000000000000000000000	1.00 10
51. Dorsal pattern of abdomen: otherwise; reduced to two light chevrons	00000000000000?0000?111?10000000	1.00 10
52. Ectal surface male chelicerae: smooth; with stridulatory striae	000111011111111??11111?111111111?	0.33 01
53. Retrolateral teeth female chelicera: four or more; two; three	2200000200?1?121111?22222??11111	0.40 04
54. Female pedipalpal tarsus: with claw; without claw	0000011100000000000?00000?000000	0.50 02
55. Patella-tibia autospasy: absent; present	00111111111111111111111111111111	1.00 10
56. Male femur I mid third: few spines, not clustered; cluster (10 or more) of spines	00000000000000??00010??00110000?	0.50 02
57. Trichobothrium metatarsus IV: present; absent SPINNERET SPIGOT MORPHOLOGY	10111100000000?0000?00000?000000	0.50 03
58. PLS mesal cylindrical gland spigot base: same size; enlarged	001111111111111111111?11111?111111	1.00 10
59. Aciniform gland spigots in female PMS: more than one; one; absent	000000000022?11?222?22112?222222	0.50 06
60. Aciniform gland spigots in female PLS: more than one; one; absent BEHAVIOR	000000000021112222?11112?222222	0.50 06
61. Male position during construction of sperm web: above sperm web; below	??00?01?1???????????????????????	1.00 10
62. Male position during ejaculation: above sperm web; below	??00?01?1???????????????????????	1.00 10

parsimonious trees). In the PMS the aciniform spigots were presumably lost in the most recent common ancestor of pimoids (although as I previously noted, other equally parsimonious optimizations exist) and subsequently regained in two independent instances: in the *ctulhu* clade and in the ancestor of the clade composed by *sinuosa*, *nematoide*, and *anatolica*. The loss of the PLS aciniform spigots unambiguously supports the monophyly of the component that includes the *hespera*, *gandhii*, *altioculata*, and *breviata* clades. The reappearance of this spigot supports the monophyly of the *gandhii* clade with the exclusion of *gandhii*. In contrast with the PMS, the optimization of the number of aciniforms on the PLS offers no ambiguity and the character requires a single homoplasious event.

Because no species was found with aciniforms on the PMS but not on the PLS, it is inferred that in the evolutionary history of the pimoids the aciniform spigots are first lost from the PMS, and when they are absent from the PMS they disappear from the PLS.

In summarizing our present knowledge of silk biology Coddington (1989) states that the aciniform gland silk is used for prey wrapping, retreats, and eggsacs. He also mentions that "aciniform spigots probably are mostly responsible for the threads used in prey-wrapping." Peters and Kovoov (1991:15) point out that "Araneidae use this (aciniform gland) silk, together with piriform fibres, for swathing prey (Peters, 1982). This swathing is very weak in *Linyphia triangularis*, corresponding to the poor development of aciniform glands." If the aciniform spigots were the only ones responsible for the prey-wrapping we should not expect to find such behavior in the pimoids. That is not the case, at least if we assume the homology of this behavior across taxa. However, it has to be noted that prey-wrapping and wrap-attack are different behaviors. Coddington refers to the wrap attack when he discusses the use of the aciniform gland silk. Some prey-wrapping is probably primitive for all spiders, but that is different from the wrap-attack and bite complex present in Araneidae and Deinopoidea. I have observed prey-wrapping behavior in all the pimoids I have been able to observe in the field, that is *altioculata*, *breviata*, *edenticulata*, *laurae*, and *ctulhu*. All but the last mentioned species lack the aciniform spigots in both pairs of posterior spinnerets. *ctulhu* has one in the PMS and one in the PLS. If prey-wrapping is a plesiomorphic feature of araneoids as Coddington (1989) suggests, and this behavior is homologous across araneoids, silk glands different from the aciniforms have to be involved in the production of silk used for prey wrapping. An alternative hypothesis is the non-homology of prey-wrapping in different araneoids, that is, the convergence on this behavior but with different silk glands involved in it in different taxa.

*Pimoida rupicola* and *P. breuili* are the two most basal taxa in the pimoids; they present many of the characters states that are inferred to be primitive for Pimoidae. The monophyly of all the pimoids with the exclusion of *rupicola* and *breuili* is

unambiguously supported by three synapomorphies: a cymbial denticulate process with less than 20 denticles, the non-bifurcated PEP, and the presence of an epigynum protruding less than its width.

The male palpal and the epigynal morphology provide the majority of the characters for the resolution of the species phylogeny. Some characters are informative for only a small subset of taxa, while other characters might vary across a large number of taxa. An example of the latter is the paracymbium morphology (character 11), which varies widely. That results in a character coded as a large number of states, whose transformation series is difficult to hypothesize a priori. The character transformation series can be studied a posteriori from the inferred phylogeny. The pimoid paracymbium is continuous with the ectal margin of the cymbium ("integral paracymbium," sensu Millidge, 1988), and this is the plesiomorphic state for araneoids. The intersegmental paracymbium of linyphiids is therefore an apomorphic feature, as already has been suggested by many authors. By looking at the basal pimoids we can infer the plesiomorphic paracymbium morphology for the pimoids. *Pimoida rupicola*, *P. breuili*, and *P. ctulhu* have a linguiform paracymbium, continuous with the PCS and this is inferred to be the primitive pimoid condition. This mentioned paracymbium is then transformed into a triangular paracymbium, with a wider base and independent from the PCS. The PCS connection to the cymbium becomes membranous and lightly sclerotized. In the *gandhii* clade the paracymbium is procurved and reduced in size.

I have interpreted the pimoid tegular membrane and the tegular hook, as a conductor and a median apophysis respectively. The presence of a median apophysis and a conductor on the tegulum is regarded as plesiomorphic for araneoids, the superfamily to which pimoids belong (Coddington, 1990a). However, for interpreting the median apophysis in pimoids it is crucial to know the outgroup condition for pimoids plus linyphiids, a problem still awaiting resolution. Two of the possible candidates are tetragnathids (lack the median apophysis) and araneids (usually have a median apophysis), but they do not unambiguously resolve the problem.

The conductor and median apophysis may be ontogenetically linked (Coddington, 1990a), and sometimes it might be difficult to say which one is which. Usually a functional criterion is then used, and the conductor is taken as the one that protects the distal end of the embolus (the intromittent section of the palp). However, the median apophysis has been lost in parallel in several clades; those absences are then considered as derived. In linyphiids for example, both the conductor and the median apophysis are absent.

On the pimoid tegulum two structures can be found: a membrane on which the tip of the embolus rests (Figures 10, 66), and a tegular hook-shaped projection (Figures 10, 66, and 214). Although these two tegular processes are positioned where the conductor and the median apophysis are in many araneoids, they are not particularly similar to the araneoid

conductor and the median apophysis. The tegular hook particularly fails to meet the criterion of special similarity because it lacks a membranous connection to the tegulum. For that reason, their nature has remained somewhat uncertain. In spite of their tegular position they have not been previously homologized to the conductor and median apophysis.

Two possible interpretations exist: the pimoid tegular hook can either be a novel sclerite or a sclerite homologous to the araneoid median apophysis. Both hypotheses might be equally parsimonious in terms of counting steps on a cladogram: loss of the median apophysis in the ancestor of pimoids and linyphiids, and gain of a new apophysis in pimoids (two steps) or modification of the median apophysis from its outgroup condition in pimoids and loss of the median apophysis in linyphiids (two steps). However, the non-homology hypothesis requires the loss of the median apophysis and the appearance de novo of another tegular sclerite in more or less the same position. Without any evidence for a novel sclerite I have preferred the alternative hypothesis because it seems more likely to postulate a transformation of the araneoid median apophysis than the gain of a new apophysis. However, the median apophysis has a very low consistency index (0.25) in my cladogram. Within the pimoids the median apophysis has been lost in parallel in the *breviata* clade and in *P. cthulhu*. Coddington (1990a) reported a 0.12 consistency index for the median apophysis in his study of Araneoidea palp morphology (the consistency index for his data set as a whole was 0.72).

Similarly, I have homologized the tegular membrane with the conductor. This homology is also supported by the presumed function of the pimoid conductor, i.e., the protection of the delicate apex of the embolus. Thaler (1976) considers the PEP as a conductor, implicitly suggesting homology to the araneoid conductor. I disagree with such homology because it seems to be based on functional criteria alone. In pimoids the embolus and the PEP share a common base through which the ejaculatory duct passes (e.g., *curvata* in Figure 373). In several species the PEP is wide and lamelliform, and seems to perform the function of protecting the embolus, except its distal portion, which is protected by the tegular membrane. In araneoids the ejaculatory duct does not go through the conductor, although the latter does protect the embolus (particularly its distal portion). Although the principle of minimizing the number of ad hoc hypotheses needed to establish a homology can be used in conjunction with the classical criteria, it might not be decisive. Resolving homologies might require weighting evolutionary steps when assessing alternative hypotheses. Then simplest explanations should be preferred to more complex ones, when there is a lack of strong evidence for the latter.

The primitive pimoid conductor is a relatively small membrane. An elongated and pointed projection of the conductor is synapomorphic for the *hespera* clade. A relatively large and bilobate conductor is synapomorphic for the *breviata* clade.

The PCS morphology is quite variable. The presumed

primitive PCS conformation with a sclerotized connection to the paracymbium is exclusively found in the taxa of the three most basal branches of the preferred cladogram. The rest of pimoids share the apomorphic PCS membranous attachment.

In summary, the pimoids are a well-defined monophyletic group supported by several synapomorphies. Their long history as an enigmatic group of difficult taxonomic placement is partly a reflection of systematic methods in which explicit statement of the hypothesis of relationships was not always pursued. Even worse, the distinction between primitive and derived character states was not reflected in the taxonomic groups proposed, resulting in a poor fit between phylogeny and taxonomy. The sister group relationship of pimoids and linyphiids is confirmed with the addition of a new synapomorphy provided from the spinneret spigot morphology. The study of web architecture and its behavioral characters is likely to provide further support for the Pimoidae-Linyphiidae monophyly.

### Taxonomic Considerations

The phylogenetic hypothesis that I propose (Figure 442) renders the genus *Louisfagea* polyphyletic. It is obvious that *crispa* has to be transferred into another genus, but then *Louisfagea* (*breuili* and *rupicola*) becomes a paraphyletic genus. Forcing the monophyly of *rupicola* and *breuili* requires an additional step, that is, 119 steps for the cladogram in Figure 442. A monotypic genus could be created for the type species (*breuili*), but then a new monotypic genus would have to be erected for *rupicola*. Monotypic supraspecific taxa for a single species are paraphyletic and therefore their creation should be avoided, except in the cases in which a species would be otherwise assigned to no genus (Platnick, 1976, 1977; Farris, 1976; see later). Obviously *rupicola* and *breuili* were united within the same genus on the basis of plesiomorphic characters. The simplest solution, although not the only valid one, is to group all the pimoids under a single genus and to establish *Louisfagea* as a junior synonym of *Pimoo*. This latter alternative is the one that I have preferred (Hormiga, 1993). *Pimoo* (Chamberlin and Ivie, 1943) is the oldest available name. *Louisfagea* was made available by Brignoli (1971) as a replacement name for *Metella* Fage, 1931, because the latter was pre-occupied.

I shall provide here some comments regarding the affinities between the fossil genus *Acrometa* and *Pimoo*. There are some conspicuous differences in the male palp morphology between *Pimoo* and *Acrometa*. The cymbial denticulate process of pimoids is absent in *Acrometa*. The latter genus has a large paracymbium with small denticles, which, judging from Petrunkevitch (1942) and Wunderlich's (1979, 1986) illustrations, are different from those found in pimoids. Wunderlich (1979, fig. 1) first homologized the cymbial fold of *Acrometa* with the paracymbium, but subsequently (Wunderlich, 1986, figs. 273-275) the basal projection of the cymbium was

homologized with the paracymbium, as Petrunkevitch (1942) had originally done. *Acrometa* lacks the median apophysis and the pimoid cymbial sclerite. *Acrometa* has a chitinous spiral distally positioned on the tegulum, which has been homologized to the conductor by Wunderlich (1986) and to the embolus by Brignoli (1979). It also has a proximal chitinous spiral on the tegulum, which has been homologized to the embolus by Wunderlich (1986) and to the conductor by Brignoli (1979). Both structures are quite different from the pimoid conductor, which is reduced to a small membrane or absent in a few species. The proximal spiral could be homologized with the pimoid embolic process, but the position on the tegulum of the distal spiral suggests homology to the conductor, which renders the proximal spiral as the embolus.

*Acrometa* lacks the four synapomorphies provided by the male palpal morphology that support the monophyly of *Pimoida* (the female characters cannot be assessed due to the absence of female specimens of *Acrometa*). I do not know of any synapomorphy(ies) suggesting a sister group relationship between *Acrometa* and *Pimoida*. Therefore, it seems that the synonymy proposed by Wunderlich is unjustified. Brignoli (1979:36) rejected Wunderlich's mentioned synonymy, but also pointed out the "non corrispondenza tra *Louisfagea* e *Pimoida*," his conclusion being based mostly on male genitalic differences. However, the characters he suggested for *Louisfagea* are plesiomorphies (e.g., bifurcated pimoid embolic process, numerous denticles on the cymbial process, shorter epigynum, etc.) and cannot be used to support the monophyly of *Louisfagea*. The present study provides several characters that support the monophyly of all the species described within *Louisfagea* and *Pimoida*.

A different question is whether to rank the pimoids as a linyphiid subfamily or as a family of its own. I have ranked pimoids as a family (Hormiga, 1993), but because of the existence of only one pimoid genus, the inclusion of *Pimoida* in a family for itself falls under "Gregg's Paradox" (the family does not provide any new grouping information). It could be argued that sister taxa should have the same absolute rank, but Farris (1976) has shown that it is not a requirement of a phylogenetic classification: "phylogenetic classification requires only that each monophyletic group be a taxon, each taxon be a monophyletic group, and the natural inclusion relations of monophyletic groups be retained by the taxa." But, what is to be gained from the removal of the pimoids from the Linyphiidae? Once it is clear that a sister group relationship exists between these two groups, the answer to that question is somewhat arbitrary. Linyphiids are a highly diverse group of poorly understood phylogenetic structure. The exclusion of the pimoids renders the Linyphiidae more homogeneous and therefore easier to diagnose. Some of the classical diagnostic characters of the linyphiids (e.g., the paracymbium and the embolic division, the loss of the araneoid conductor and median apophysis) would be "moved up one node" in a phylogenetic classification if we were to accommodate the

pimoids within Linyphiidae. The price to pay for having the pimoids ranked as a family is to have an empty, and therefore meaningless, category in the classification, because the genus and the family would convey the same grouping information. Another alternative, as Farris (1976) has suggested, is to assign the genus to no family, because that is not a requirement of the rules of nomenclature. This alternative has the advantage of avoiding the pitfall of Gregg's Paradox, retaining the diagnosis of Linyphiidae. The disadvantages are several. For the user of a classification it is easier to visualize the Araneioidea (or any other Superfamily) as a group of families, rather than families and genera. This point applies as well to catalogs and bibliographies. The lack of a familial assignment in the title of a publication might be misleading for the reader (e.g., it might implicitly suggest an incertae sedis relationship, because the genus is not placed in any family). These considerations have led me to the familial rank assignment for pimoids, in spite of the mentioned disadvantages.

### Biogeography

Pimoids live in the Himalayas, the Alps and the Cantabrian Mountains (northern Spain), and western North America. Their disjunct pattern suggests an ancestral, widespread, Holarctic distribution, with subsequent extinction in the intervening areas, as has already been suggested by Thaler (1976). The Himalayas and the Alps are relatively new formations, dating from the Tertiary, and have been suggested as refugia during the Pleistocene climatic changes. The opilionid genus *Sabacon* (Sabaconidae) has a distribution almost identical to that of *Pimoida* (Thaler, 1976; Martens, 1983), although *Sabacon* also lives in eastern North America. Area cladograms from different taxa are required to study the historical relationships of these areas of endemism. Although such data are not available for organisms with distributions similar to those of *Pimoida*, we can produce area cladograms for the pimoids and examine what set of historical relationships of areas they suggest. A preliminary inspection of the distribution pattern of pimoids suggests three disjunct areas: western Europe, the Himalayas, and western North America. However, examination of the preferred cladogram for the Pimoidae (Figure 442), in conjunction with the distribution of the species, shows that Asia is the only area defined by a monophyletic group (the *gandhii* clade). No monophyletic group defines neither western North America nor western Europe. The occurrence of the *hespera* clade defines the most eastern area of the distribution of pimoids in North America, but the sister group to the *hespera* clade contains both North American and Asian taxa. The exclusion of the *gandhii* clade renders all the North American taxa as monophyletic, which may suggest a dispersal event (from North America to Asia) of a common ancestor of the *gandhii* clade, which has its closest relatives in western North America (the *alticolata* and *breviata* clades). The Pacific coast area between Coos county in Oregon and Sonoma county in northern California is the richest



area in North America in *Pimoida* species, though undefined as an area by any clade. The species occurring in the mentioned area are (from north to south): *altioculata*, *vera*, *breviata*, *mephitis*, *edenticulata*, and *ctulhu*. Western Europe is not defined by any clade either, because *rupicola* and *brevili* are two successive branches at the base of the pimoid cladogram (Figure 442). The two equally parsimonious alternative topologies (rooting options 1 and 2 in Figure 441C) have Europe and Asia as areas supported by monophyletic groups, but North America remains unsupported as an area.

The Himalayas are particularly rich in species for many groups of organisms (Martens, 1981). So far six species of pimoids are known from the Himalayas, but the group is probably at least as diverse there as it is in North America. *Pimoida* has been recorded from agricultural fields in eastern North America (Kentucky; Culin and Yeargan, 1983:42) but the record cannot be verified because the specimens are lost (K. Yeargan and J. Culin, pers. comm.). Until new specimens are recorded its presence in eastern North America should be regarded as dubious.

### Taxonomic Revision

#### PIMOIDAE Wunderlich

PIMOINAE Wunderlich, 1986:119.

PIMOIDAE.—Hormiga, 1993 [type genus by monotypy *Pimoida* Chamberlin and Ivie].

DIAGNOSIS.—Pimoidae contains only the genus *Pimoida* and therefore its diagnosis is the same as the genus.

#### *Pimoida* Chamberlin and Ivie

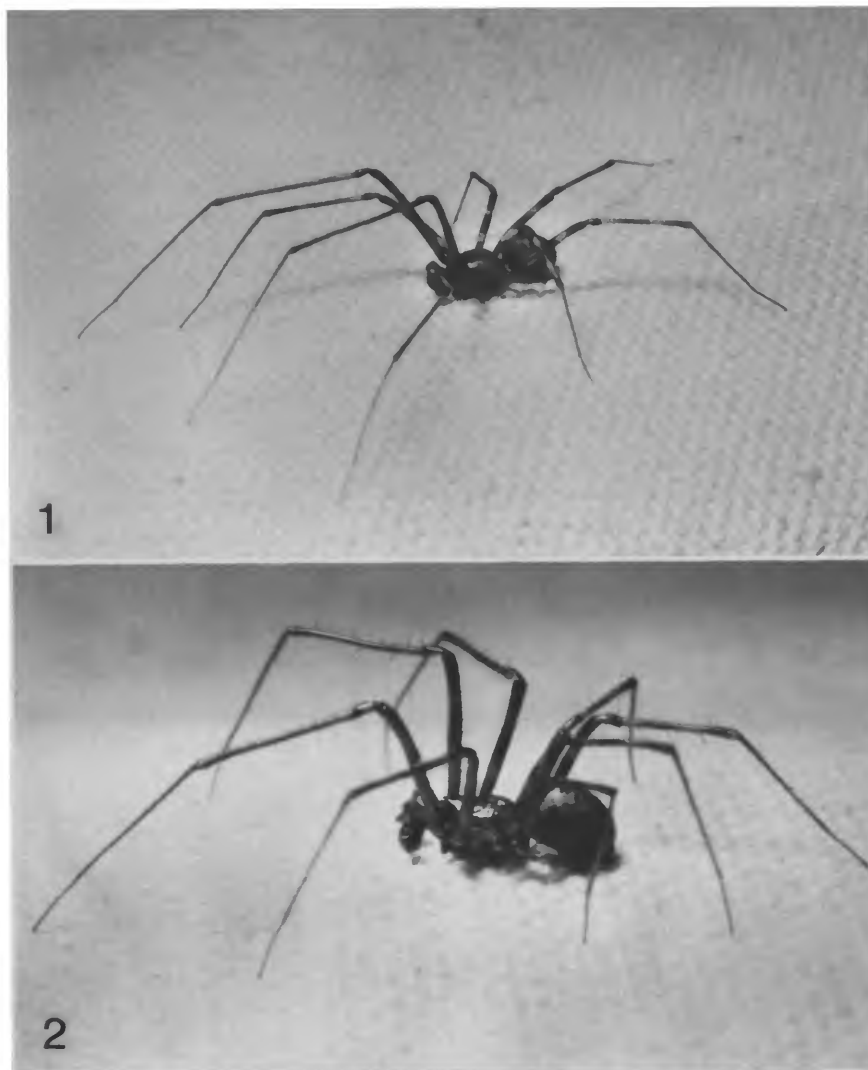
*Metella* Fage, 1931:195–197, fig. 38 [♀]; 1946:387.—Roewer, 1942:920.—Bonnet, 1957:2828. [Preoccupied by *Metella* Müller, 1839. [Type species by original designation *Metella brevili* Fage, in MNHN, Paris, examined.]

*Pimoida* Chamberlin and Ivie, 1943:9–10.—Brignoli, 1983:231.—Crawford, 1988:23.—Rohr, 1988:45.—Platnick, 1989:275.—Hormiga, 1993. [Type species by original designation *Labulla hespera* Gertsch and Ivie, in AMNH, New York, examined.]

*Louisfagea* Brignoli, 1971:161, 163; 1975:13; 1979:36; 1983:229.—Ribera, 1980:226.—Platnick, 1989:259.—Hormiga, 1993. [replacement name for *Metella*; regarded as a junior synonym of *Pimoida* by Hormiga (1993)].

DIAGNOSIS.—Male palpus with a retrolateral cymbial sclerite and a dorsoectal cymbial process with denticles or cuspules (Figure 11, 68). Males differ from linyphiid males in having the paracymbium continuous with the base of the cymbium (the paracymbium is intersegmental in most linyphiids) and lacking an embolic division. Pimoids, in general, are larger in size than linyphiids. The epigynum is protruding, with a dorsal to lateral fold or groove with the copulatory opening at the distal end (Figures 14, 414). Pimoids usually have stridulatory striae on the ectal side of the chelicera. The somatic morphology is similar to that of *Meta* (Tetragnathidae), but in *Pimoida* the clypeus is higher, autospasy occurs at the patella-tibia junction, and they build sheet-webs (metines build orb webs).

DESCRIPTION.—Small- to medium-sized spiders, total length 5 to 12 mm. Cephalothorax longer than wide, ranging in length from 2.1 to 6.1 mm. Thoracic fovea elongated, wide, and conspicuous (Figure 413). All eyes of roughly the same diameter. ALE and PLE juxtaposed. Lateral eyes with canoe tapetum (Wunderlich, 1986:119, citing Homann in litt.). Eyes usually surrounded with dark pigment. Clypeus 1.43–3.00 times AME diameter (except in *crispa*, which has eyes of reduced size and the clypeus height is 4.20). Chelicerae large, with three prolateral and one to four retrolateral teeth. Stridulatory striae usually present on the ectal side of the chelicerae (Chamberlin and Ivie, 1943:9 erroneously described *Pimoida* as lacking stridulatory striae). Labium free and wider than long. Sternum (Figure 50) longer than wide, projecting behind coxae IV and usually dark. Legs longer and slender in the male, yellowish to dark brown and frequently with dark annuli (Figures 1 and 2). Femur I length 1.39 (female *curvata*)-3.31 (male *crispa*) times the cephalothorax length. Leg formula 1243 (except in *rupicola*, *laurae*, and *edenticulata*, qq. v.). All tarsi with three claws (Figures 178, 179). Femur IV with two dorsal spines. Spination patterns variable (inter- and intraspecifically). In most species all legs (but particularly I and II) densely covered with long setae, curved at the distal end, variable intraspecifically. Leg autospasy at the patella-tibia junction. Female pedipalp with claw (Figure 177). Metatarsus I trichobothrium in medial or proximal third (except in *ctulhu*, which has several trichobothria). Abdomen longer than wide, dark gray with light marks, sometimes chevron-like (Figures 24, 99, 134, and 230). Venter usually with two light longitudinal bands. Tracheal system haplotracheate (sensu Millidge, 1984). Colulus relatively large and fleshy, with setae (Figures 112, 332). Spinnerets with reduction of the aciniform fields to one or none spigots in the PMS and/or PLS (Figures 78–81, 143–146). PLS with peripheral cylindrical gland spigot that has an enlarged base (Figures 146, 336). Male pedipalpal tibia with a rounded dorsal protuberance, with 2–4 prolateral and 2–5 retrolateral trichobothria. Cymbium with alveolus in an eccentric position, close to the prolateral margin (Figures 46, 303). Paracymbium continuous with the retrolateral cymbial margin. Cymbium wide, with a relatively large retrolateral cymbial sclerite, termed here pimoid cymbial sclerite (PCS). Dorsum of cymbium with a projection bearing dark denticles or cuspules (except in *edenticulata*). Tegulum large, more or less globular and bearing a membranous conductor and a hook-shaped apophysis (median apophysis; it is absent in several species). Embolus long and filiform, curved following the margin of the tegulum. Embolus paralleled by a long process (pimoid embolic process, PEP) with which the embolus shares a common base. Epigynum with a dorsal and ventral plate that have at their margin a groove, the epigynal fold. Epigynal fold distally bears the copulatory opening (Figures 14, 140, 141). Copulatory ducts varying in length and degree of sinuosity. Spermathecae usually spherical, with short and lightly sclerotized fertilization ducts (Figures 12–14, 378–380).

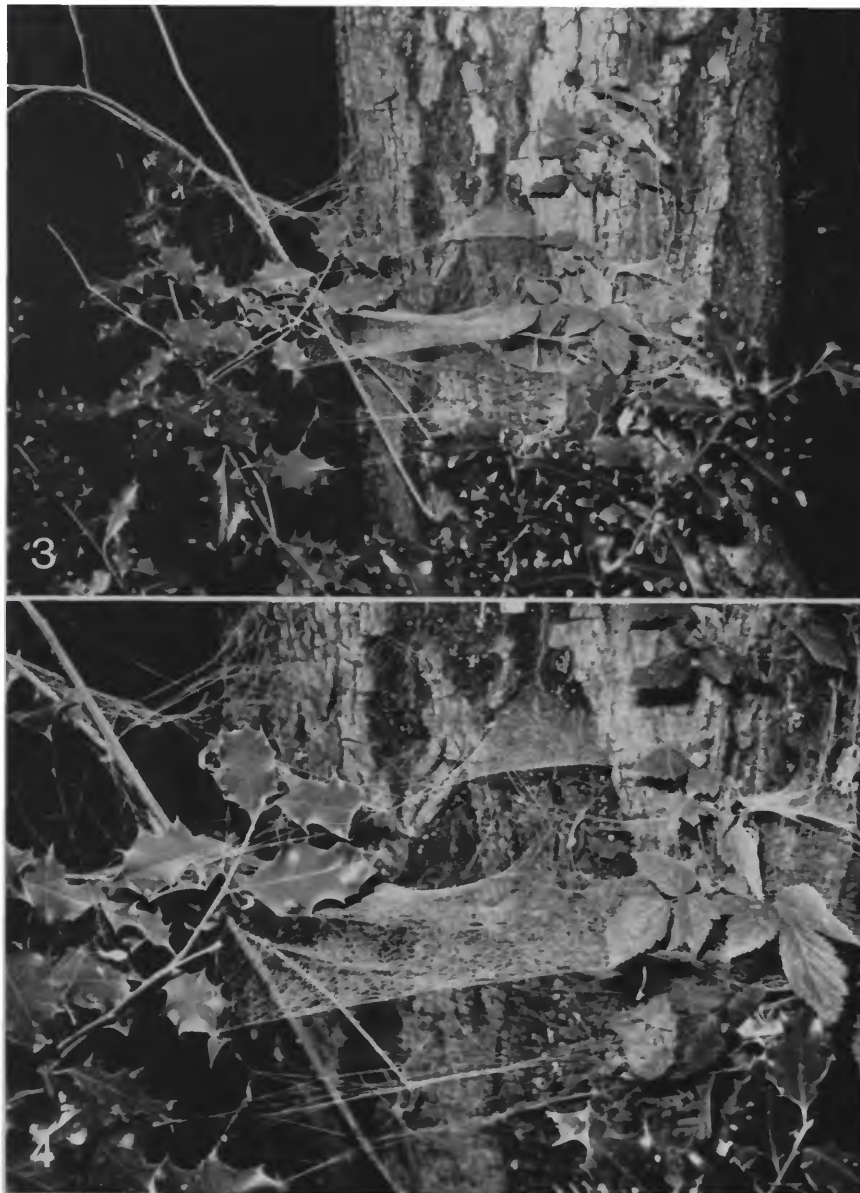


FIGURES 1, 2.—1, *Pimoa edenticulata*, new species, male from Sahasta-Trinity National Forest (California); 2, *Pimoa laurae*, new species, male from Lake Tahoe (California).

**NATURAL HISTORY.**—Pimoids are relatively common spiders in western North America, particularly in the redwood forests. Little data are available about their abundance and occurrence in Eurasia. Because several isolated specimens found in collections were collected by generalist collectors in Asia, I presume that the spiders are at least as common and speciose in that part of the world as their relatives in North America. *Pimoa breuili* is common in caves (Ribera, pers. comm.). Fage (1946:387) mentions that *P. crispa* is abundant in the caves of the Dehra Dun district of India, where it can be found on the wet walls: "sur les parois humides, à la manière des *Meta*." *Pimoa sinuosa* was fairly common in the area of

Nepal where the only available specimens were collected (Coddington, pers. comm.). Pimoids seem to be restricted to humid areas, although I have collected specimens of *Pimoa breviata* and *P. edenticulata* under fairly dry conditions. Several species have been collected in caves (*rupicola*, *breuili*, *hespera*, *mephitis*, *mono*, and *crispa*) but their presence should probably be considered opportunistic (probably because of the higher humidity), although the two last mentioned species are known only from specimens collected in caves. Only in *crispa* is there a reduction of the eye diameter; the other species do not seem to present particular adaptations to the cavernicolous life.

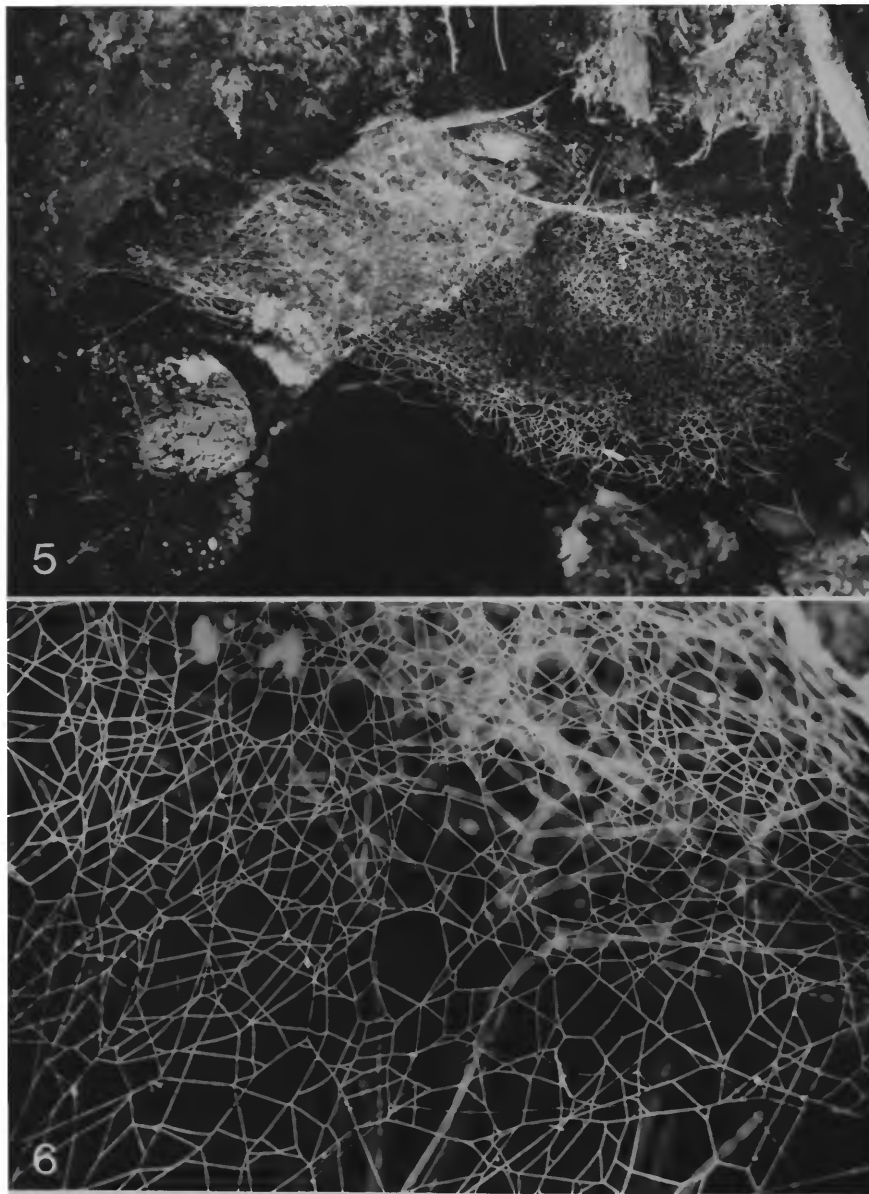
North American pimoids build relatively large sheet webs,



FIGURES 3, 4.—Web of *Pimoa breviata* Chamberlin and Ivie from California.

usually close to the ground (Figures 3–8). The web is secured to nearby structures mainly on the sides, but some “dorsal” and “ventral” threads provide additional support. Among the commonest places for webs are fallen tree trunks and hollow stumps; they are also commonly found in road cuts, especially when the cuts are concave and provide a shadowy habitat (Figures 7, 8). Their webs also can be found on rural houses and other human-built structures. The spider moves on the undersurface of the web, as linyphiids do. They are nocturnal

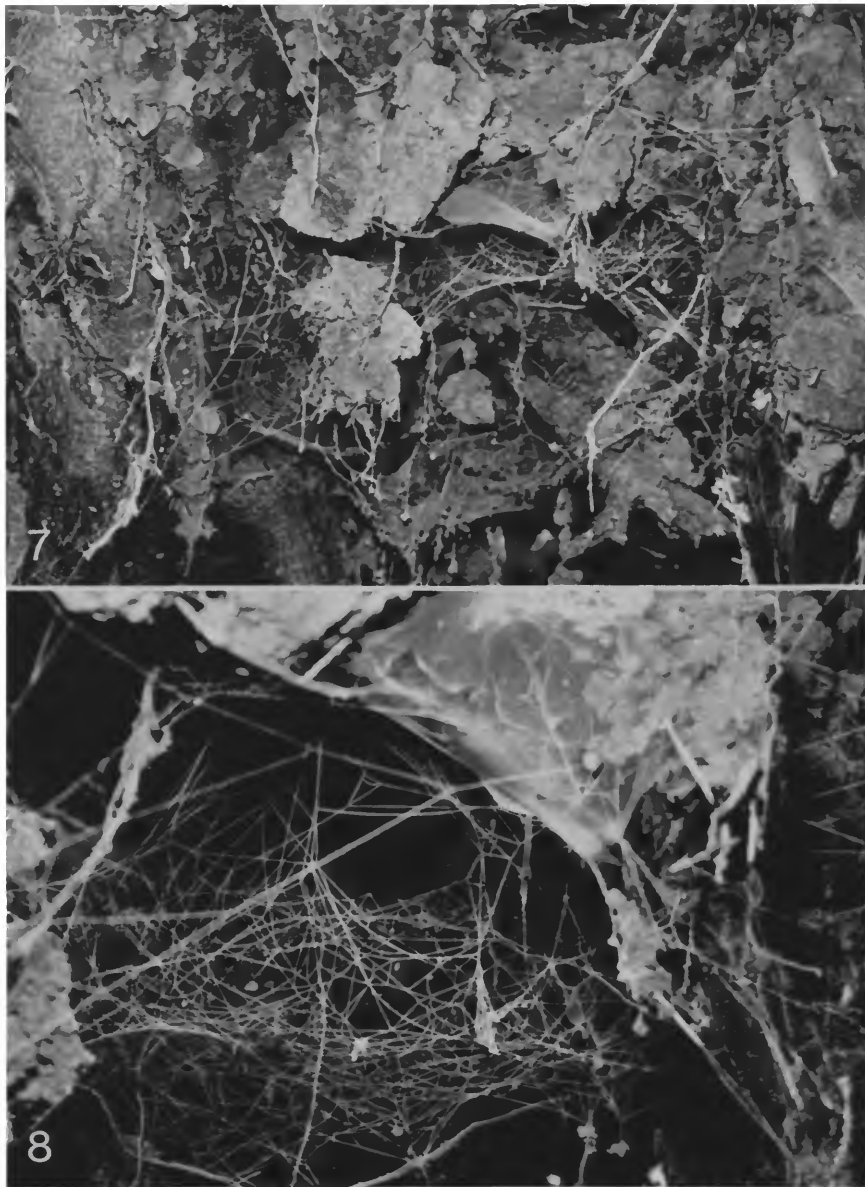
and during the day hide in retreats (such as cracks and holes, underneath bark, leaves, mosses, debris, etc.), which they leave only when a prey falls in the web. The webs vary in size. The largest web I have recorded was from an immature specimen of *breviata* in a redwood forest in Humboldt County (California), measuring around one square meter (approximately  $1.10 \times 1.00$  m). Other individuals (adults and immatures as well) of the same species in a nearby locality (in a xerophytic forest) had webs of no more than 20 cm of diameter. Perhaps the



FIGURES 5, 6.—Web of *Pimosa breviata* Chamberlin and Ivie from California (photographs by J. Coddington).

explanation for this intraspecific variation in web size could be found in the variation of environmental conditions, such as humidity. Most of the webs that I have been able to study were built relatively close to ground level; some webs of *breviata* were built at heights up to approximately 1.50 m, on tree trunks covered by ivy (Figures 3, 4). The web of the Nepalese species *Pimosa sinuosa* is very similar to that of its North American relatives, as judged by the photographs of the webs taken by J. Coddington.

I was able to examine an eggcase of *P. edenticulata*, which was suspended beneath the web and guarded by a female. It was spherical (about 12 mm in diameter) and covered with debris (mostly small fragments of bark). It contained 65 first instar spiders. The eggcase of *chulhu* is very similar, although I do not have data on the number of eggs. One eggcase of *haden* was examined; it was covered with little debris (although that seems to be a preservation artifact) and contained 105 eggs. One eggcase of *curvata* was also examined. It was spherical (9 mm in



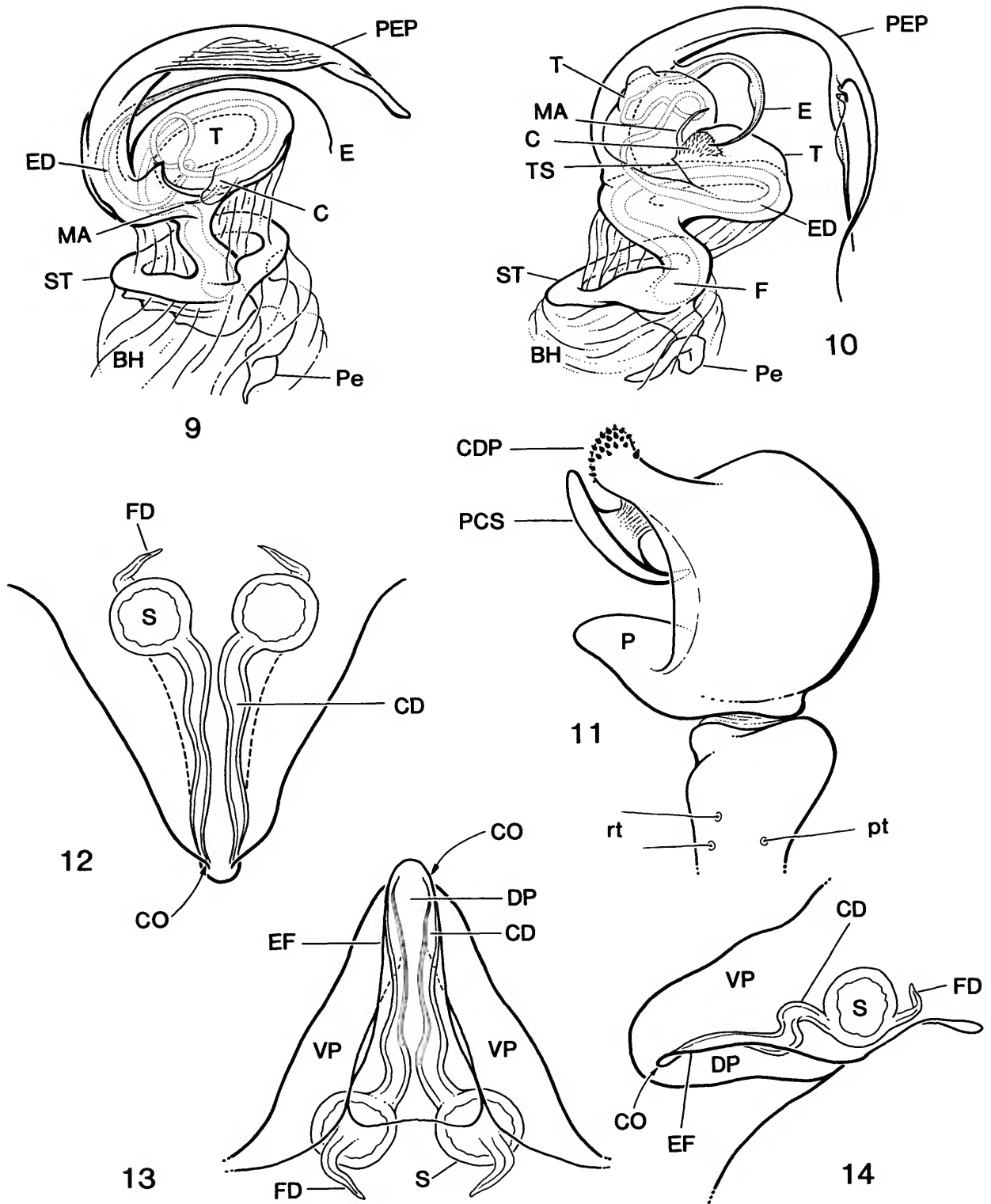
FIGURES 7, 8.—Web of *Pimoides altioculata* (Keys) from California.

diameter), covered with debris, and contained 83 eggs.

**COMPOSITION.**—Twenty-one species. Relationships of the genus are illustrated on the cladograms in Figures 440–442. Probably many more Asian species exist. The group is likely to be as speciose in Asia as it is in North America.

**DISTRIBUTION.**—Pimoids have a Holarctic distribution:

Northern Spain (Cantabrian Mountains), southeastern France and northwestern Italy (the Alps and the Apennines), northern India and Nepal (the Himalaya Mountains), and western North America from California through Alaska (roughly between the Coast Ranges and the Sierra Nevada and Bitterroot Range; Figures 117, 189, and 337).



FIGURES 9-14.—Diagrammatic male and female genital morphology of pimoids: 9, *Pimoid alticulata*, male expanded palp (removed from cymbium); 10, *Pimoid breuili*, male expanded palp (removed from cymbium); 11, generalized cymbium (dorsal); 12, generalized epigynum (cleared), ventral; 13, same, dorsal; 14, same, lateral.

Key to the Species of *Pimoa*

MALES

1. PEP bifurcated [Figure 11]; metatarsus I trichobothrium in medial third . . . . . 2  
 PEP non bifurcated [Figure 9]; metatarsus I trichobothrium in distal third or numerous (7–11) trichobothria . . . . . 3
2. Cymbium with two dorsoectal denticulate processes [Figure 44]; Northern Spain . . . . . *P. breuili*  
 Cymbium with one dorsoectal denticulate process [Figure 16]; Southeastern France, Northern Italy . . . . . *P. rupicola*
3. PCS attached to cymbium by means of a membrane; paracymbium and PCS not interconnected . . . . . 4  
 PCS continuous with the paracymbium [Figure 91]; cymbial denticulate process with denticles in a row on ectal margin [Figure 87]; a second cymbial projection with a group of long and thick spines [Figure 89]; MA absent; metatarsus I with a row of 7–11 trichobothria; Northwestern California (Sonoma and Mendocino Co.) . . . . . *P. cthulhu*, new species
4. PCS (as seen in a ventral view of the palp) with an “inverted T” conformation [Figures 130, 190]; pedipalpal tibia elongated, much longer than wide [Figure 131], and with 5 or 6 retrolateral, 3 prolateral trichobothria . . . . . 5  
 PCS conformation otherwise; pedipalpal tibia with 3 retrolateral and 2 prolateral trichobothria . . . . . 7
5. Metatarsus I sinuous, widest at one third of its length [Figure 129]; cymbial denticulated process rounded [Figure 128]; distal end of PEP not rolled [Figure 126]; Eastern California (Fresno, Tulare, and Tuolumne Co.) . . . . . *P. hespera*  
 Metatarsus I not sinuous; pedipalpal tibia with conical dorsal apophysis [Figure 193]; cymbial denticulated process pointed [Figure 190]; distal end of PEP rolled [Figure 100] . . . . . 6
6. Pedipalp femur stout, its distal end wider than the pedipalpal tibia and with a group of thick spines [Figure 102]; Washington, Idaho, Montana, and British Columbia . . . . . *P. haden*  
 Pedipalpal femur slim, narrower than the pedipalpal tibia at its widest point and without a cluster of thick spines [Figure 193]; Washington and Idaho . . . . . *P. jellisoni*
7. Paracymbium short and procurved [Figure 234], except in *nematoide* in which the paracymbium is a small bump [Figure 285]; PCS shaped as a reversed J; Asia . . . . . 8  
 Paracymbium more or less triangular, when not triangular it is longer than wide; PCS shaped otherwise; Western North America . . . . . 11
8. Embolus longer than PEP . . . . . 9  
 Embolus shorter than PEP . . . . . 10
9. Cymbial denticulate process long, thin, and pointed with a sclerotized membranous-like tegument between the posterior margin of the paracymbium and the lateral margin of the cymbium [Figure 285]; femur I without a group of thick spines in the proximal third; Nepal; female unknown . . . . . *P. nematoide*, new species  
 Cymbial denticulate process with distal end curved towards the PCS [Figure 256]; femur I with a group of thick spines in the proximal third [Figure 265]; Nepal . . . . . *P. sinuosa*, new species
10. Cymbial denticulate process large, with numerous (>20) denticles [Figure 233]; pedipalpal tibia longer than wide; India . . . . . *P. crispa*  
 Cymbial denticulate process with 3 or 4 denticles [Figure 218]; pedipalpal tibia about as long as wide; India . . . . . *P. gandhii*, new species
11. Pedipalpal trochanter with apophysis [Figures 307, 343] . . . . . 12  
 Pedipalpal trochanter without apophysis . . . . . 13

12. Cymbial denticulate process with 2 or 3 denticles [Figure 338]; Oregon; female unknown . . . . . *P. petita*, new species  
 Cymbial denticulate process with numerous denticles [Figure 301]; from Northern California through Alaska . . . . . *P. altiocularata*
13. PEP of same length as embolus; PCS smaller than paracymbium [Figure 347]; Oregon, California . . . . . *P. breviata*  
 PEP longer than embolus; PCS larger than paracymbium . . . . . 14
14. Distal end of the cymbial denticulate process rounded; cymbium with a large lateral projection, parallel to the cymbial denticulate process [Figures 368, 369]; Washington, Oregon . . . . . *P. curvata*  
 Cymbial denticulate process pointed and heavily sclerotized . . . . . 15
15. Cymbial process with denticles and with its distal end elongated [Figure 391]; middle part of PCS smooth, without hook [Figure 392]; Northeastern California . . . . . *P. laurae*, new species  
 Cymbial process without denticles, instead with a stout and thick curved hook [Figure 411]; PCS with a curved hook in middle part [Figures 410, 411]; Northern California . . . . . *P. edenticulata*, new species

## FEMALES

1. Epigynum protruding less than its width [Figures 29, 56]; metatarsus I trichobothrium in medial third; Europe . . . . . 2  
 Epigynum protruding more than its width; metatarsus I trichobothrium in distal third; North America, Asia . . . . . 3
2. Turn of the copulatory duct (in lateral view) closer to the copulatory opening than to the spermatheca [Figure 60]; Northern Spain . . . . . *P. breuili*  
 Turn of the copulatory duct (in lateral view) closer to the spermatheca than to the copulatory opening [Figure 32]; France, Italy . . . . . *P. rupicola*
3. Epigynum very long and "sausage-like," the ventral plate having an elongated opening in the dorsal side of the epigynum [Figures 95, 119]; Western California . . . . . 4  
 Epigynum otherwise . . . . . 5
4. Distal end of epigynum pointing towards abdominal wall and latero-compressed [Figures 92, 93]; Northwestern California (Sonoma and Mendocino Co.) . . . . .  
 . . . . . *P. cthulhu*, new species  
 Distal end of the epigynum rounded [Figure 120]; Western Oregon; male unknown . . . . . *P. vera*
5. Distal end of epigynal margin rounded and without projections or "horns" . . . 6  
 Distal end of epigynal margin otherwise . . . . . 9
6. Epigynal ventral plate opening key-hole shaped [Figures 162, 196]; copulatory duct length larger than spermatheca width . . . . . 7  
 Epigynal ventral plate opening shaped otherwise; distal end of epigynum pointing towards posterior end of abdomen [Figures 138, 149]; copulatory duct length smaller than spermatheca width . . . . . 8
7. Epigynum protruding more or less perpendicularly to abdominal wall [Figure 163]; Washington, Idaho, Montana, and British Columbia . . . . . *P. haden*  
 Epigynum protruding more or less parallel to abdominal wall [Figures 197, 200]; Washington and Idaho . . . . . *P. jellisoni*
8. Distance between the distal ends of copulatory ducts equal or larger than one spermatheca width [Figure 141]; Eastern California (Fresno, Tulare, and Tuolumne Co.) . . . . . *P. hespera*  
 Distance between the distal ends of copulatory ducts less than one spermatheca width [Figure 152]; Eastern California (Mono Co.); male unknown . . . . .  
 . . . . . *P. mono*, new species



- 9. Epigynal fold lateral [Figures 230, 250]; Asia . . . . . 10
- Epigynal fold dorsal [Figures 313, 378]; North America . . . . . 14
- 10. Copulatory ducts (left and right) fused near spermatheca [Figures 229, 251] . . 11
- Copulatory ducts not fused . . . . . 12
- 11. Dorsal and ventral epigynal lips of approximately same width [Figure 225]; India . . . . . *P. gandhii*, new species
- Dorsal epigynal lip thin, narrower than ventral lip [Figure 250]; India; male unknown . . . . . *P. indiscreta*, new species
- 12. Copulatory duct with double switch [Figures 272, 298] . . . . . 13
- Copulatory duct without double switch [Figure 247]; India . . . . . *P. crispa*
- 13. Two epigynal lips clearly marked [Figure 292]; in lateral view, epigynum distal end narrower than 1/2 width of base; Western China; male unknown . . . . . *P. anatolica*, new species
- No epigynal lips; in lateral view, epigynum distal end wider than 1/2 width of base [Figure 268]; Nepal . . . . . *P. sinuosa*, new species
- 14. Epigynum distal end pointed and sclerotized [Figure 431]; Northern California; male unknown . . . . . *P. mephitis*, new species
- Epigynum otherwise . . . . . 15
- 15. Epigynum distal end projecting (scape-like) and heavily sclerotized; [Figure 312]; from Northern California through Alaska . . . . . *P. altiocolata*
- Epigynum with dorsal plate projections [Figures 349, 397] . . . . . 16
- 16. Epigynum with dorsal plate projection rounded and thick [Figures 376, 378]; Washington, Oregon . . . . . *P. curvata*
- Dorsal plate projections not rounded, more or less pointed . . . . . 17
- 17. Dorsal plate projections very short and sclerotized [Figure 349]; Oregon, California . . . . . *P. breviata*
- Dorsal plate projections otherwise . . . . . 18
- 18. Dorsal plate projection curved ventrally [Figure 397]; Northeastern California . . . . . *P. laurae*, new species
- Dorsal plate projection straight [Figure 415]; Northern California . . . . . *P. edenticulata*, new species

***Pimosa rupicola* (Simon)**

FIGURES 15-42

*Labulla rupicola* Simon, 1884:264; 1929:624, figs. 938-941 [♂, ♀].—Roewer, 1942:576.—Bonnet, 1957:2335.

*Labulla (Metella) rupicola*.—Fage, 1935:177-180, fig. 2 [♂].

*Metella rupicola*.—Fage, 1946:387.

*Louisfugea rupicola*.—Brignoli, 1971:161-163, figs. 40-43 [♂, ♀]; 1975:12-13; 1979:36.—Thaler, 1976:207-209, figs. 11-18 [♂].—Wunderlich, 1986:223, fig. 250.—Maurer and Thaler, 1988:337-338, figs. 15, 16 [♀].—Platnick, 1989:259.

*Pimosa rupicola*.—Hormiga, 1993:534.

**TYPES.**—I have not been able to locate the holotype of this species.

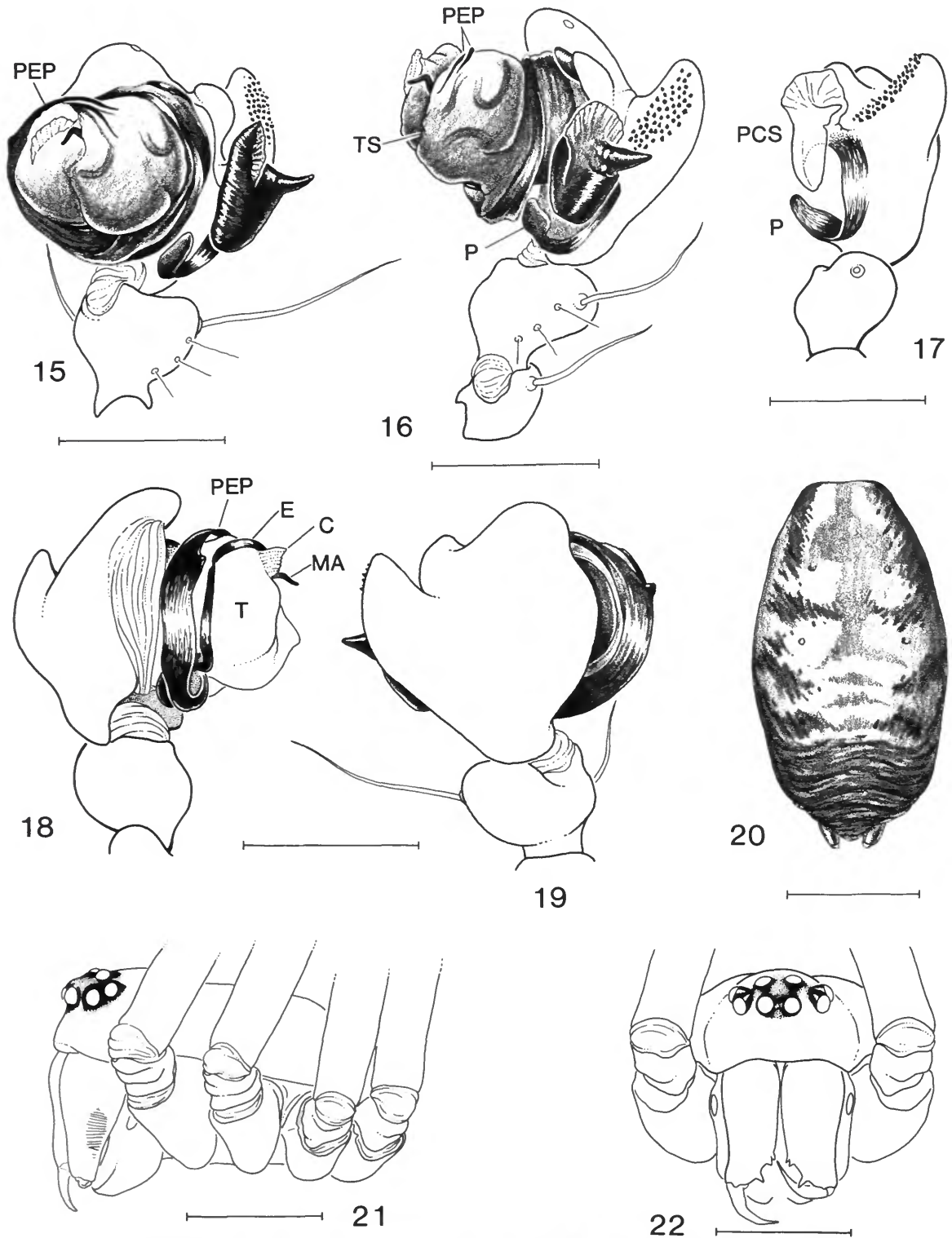
**DIAGNOSIS.**—Males can be distinguished from *brevili* by having only one cymbial denticulate process (Figure 16). Females can be distinguished from *brevili* by having (in lateral view) the turn of the copulatory duct closer to the spermatheca than to the copulatory opening (Figure 32).

**Male** (from Alpi Apuane): Total length 5.2. Cephalothorax 2.7 long, 2.1 wide, 1.6 high; light brown. Sternum 1.7 long, 1.4

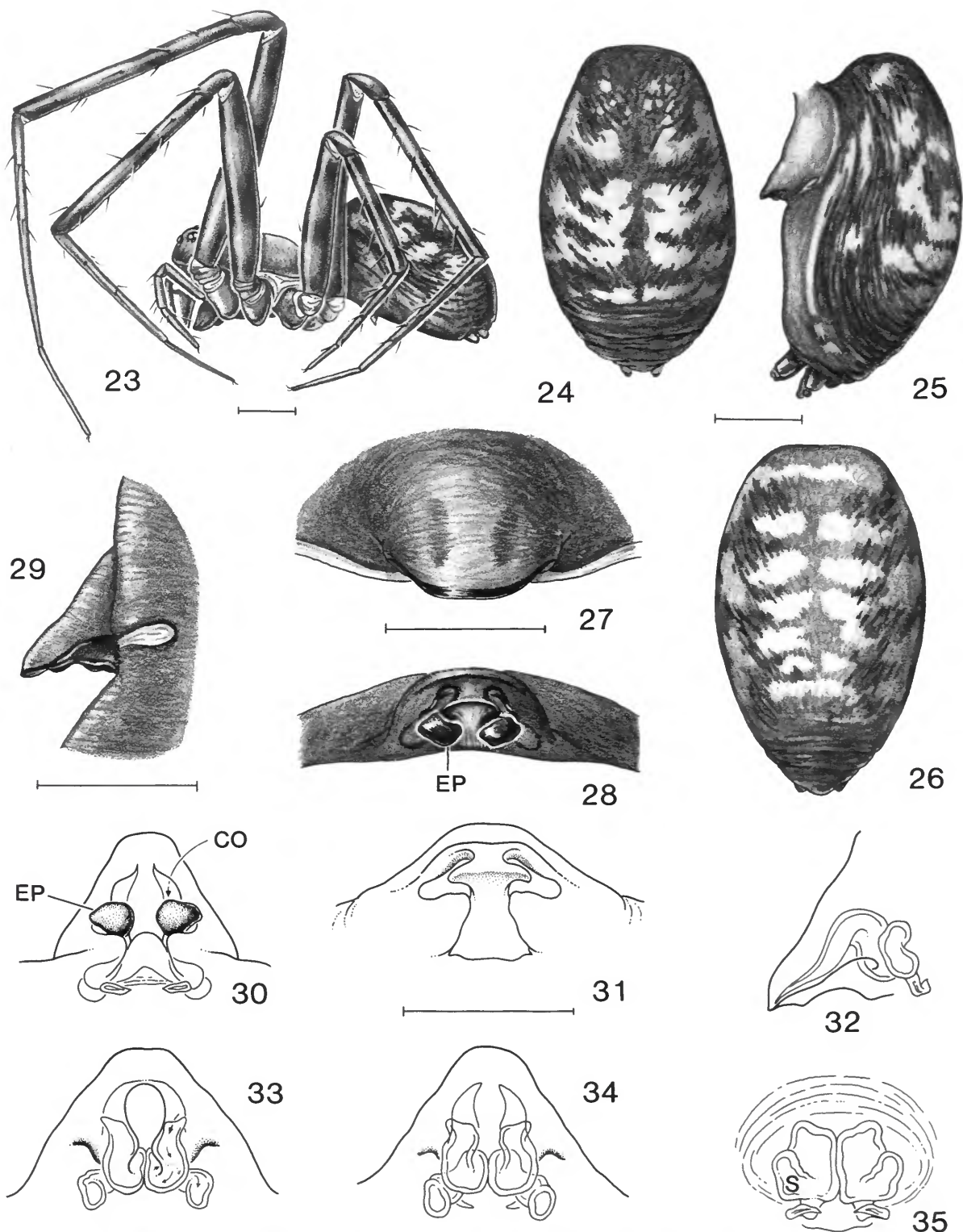
wide; dark brown. Abdomen 3.1 long, 1.7 wide; whitish with gray pattern, some guanine spots on dorsum (Figure 20). AME diameter 0.14. PME 1.00, PLE 1.00, ALE 1.00 times one AME diameter. AME separation 0.57 times their diameter, PME separation 0.71 times their diameter. PME-PLE separation 0.86 times one PME diameter, AME-ALE separation 0.57 times one ALE diameter. Clypeus height 2.14 times one AME diameter. Chelicerae with three prolateral and two retrolateral teeth. Cheliceral stridulating files present and conspicuous. Legs light brown. Leg and pedipalp lengths of male described above:

	I	II	III	IV	Pdp
Femur	6.7	5.3	4.2	5.5	1.0
Patella	1.0	0.9	0.7	0.7	0.4
Tibia	—	—	3.7	5.7	0.5
Metatarsus	—	—	4.0	5.0	—
Tarsus	—	—	1.5	2.1	0.8
Total	—	—	14.1	19.0	2.7

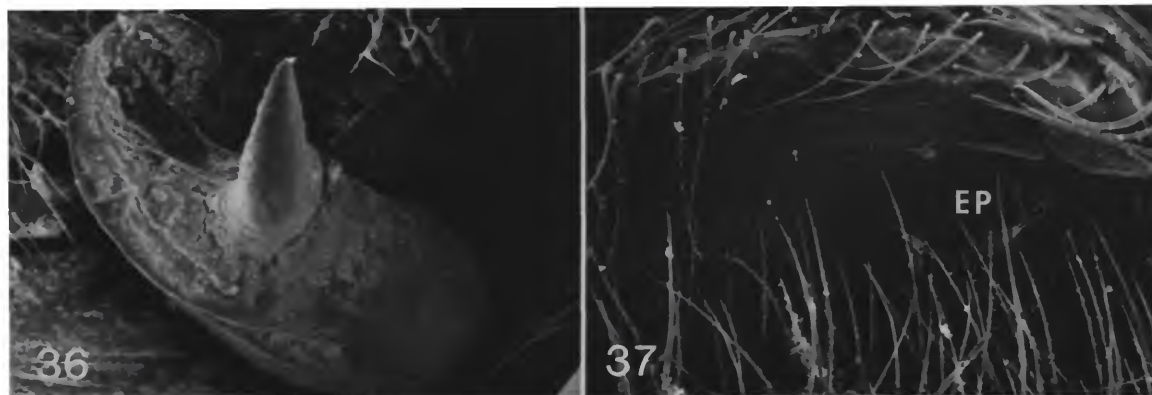
Femur I 2.48 times length of cephalothorax. Metatarsus I trichobothrium (measured in another specimen) 0.59. Pedipalp as in Figures 15-19, 36.



FIGURES 15-22.—*Pimoides rupicola* (Simon), male from France: 15, palp, ventral; 16, same, ectal; 17, same, detail cymbium, dorsoctal; 18, same, mesal; 19, same, dorsal; 20, abdomen, dorsal; 21, cephalothorax, lateral; 22, same, frontal. (Scale lines: 0.5 mm, except 20-22, 1.0 mm.)



FIGURES 23-35.—*P. imoa rupicola* (Simon), female: 23, female from Italy, habitus, lateral; 24, female from Italy, abdomen, dorsal; 25, same, lateral; 26, female from Italy, abdomen, dorsal; 27, female from France, epigynum, ventral; 28, same, posterior; 29, same, lateral; 30, same epigynum, cleared, dorsal; 31, same, posterior; 32, same, lateral; 33, 34, same, ventral; 35, same, anterior. (Scale lines: 1.0 mm, except 27-35, 0.5 mm.)



FIGURES 36, 37.—*Pimoa rupicola* (Simon): 36, male, PCS; 37, female, epigynum, ventral.

**Female** (from same locality as male): Total length 7.0. Cephalothorax 2.2 long, 2.4 wide, 2.0 high; light brown, darker at margins. Stemum 1.6 long, 1.5 wide; dark brown. Abdomen 3.9 long, 2.6 wide, 2.6 high; whitish with light gray pattern, some guanine spots on dorsum (Figures 23–26). AME diameter 0.16. PME 1.00, PLE 1.00, ALE 1.00 times one AME diameter. AME separation 0.63 times their diameter, PME separation 0.63 times their diameter. PME-PLE separation 1.00 times one PME diameter, AME-ALE separation 0.75 times one ALE diameter. Clypeus height 2.63 times one AME diameter. Chelicerae with three prolateral and two retrolateral teeth. Cheliceral stridulating files present but inconspicuous and scale-like. Legs light brown, with very light gray annuli. Leg and pedipalp lengths of female described above:

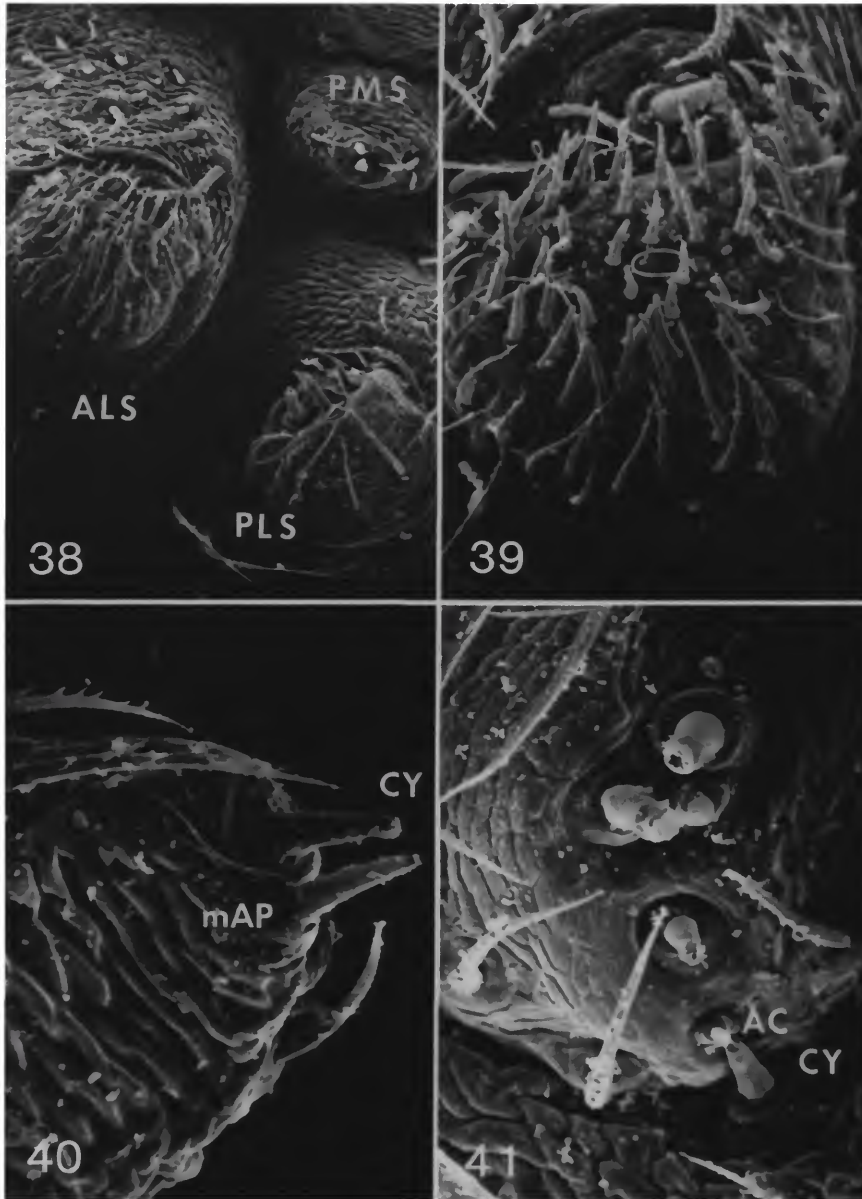
	I	II	III	IV	Pdp
Femur	5.3	4.6	3.5	4.9	1.1
Patella	1.2	1.0	0.8	1.0	0.5
Tibia	5.5	4.6	3.2	4.7	0.7
Metatarsus	5.2	4.4	3.4	4.7	—
Tarsus	2.2	2.0	1.5	2.1	1.3
Total	19.4	16.6	12.4	17.4	3.6

Legs 1423. Femur I 2.41 times length of cephalothorax. Metatarsus I trichobothrium 0.61. Epigynum as in Figures 27–35, 37.

**VARIATION.**—Male cephalothorax ranges in length from 2.1 to 2.7, female from 2.2 to 4.5. Overall degree of pigmentation and density and length of the setae covering the legs varies, some individuals lacking long setae on the legs and others being densely covered by long setae. The number of retrolateral cheliceral teeth in the females varies from one to two.

**ADDITIONAL MATERIAL EXAMINED.**—FRANCE: Alpes Maritimes (MNHN), 1♂, 3♀; Alpes Maritimes, Cagnes (Berland, MNHN), 3♀; Menton, 22 Mar 1915 (MNHN), 1♂, 8♀; ITALY: Alpi Apuane, 16 Oct 1975, 500 m, (IZUI), 1♂, 1♀; Alpi Cozie, Giaveno fomo n. Torino, Oct 1972, 50 m (JW), 1♀; Alpi Cozie, Saluzzo, Bagnolo Piemonte, 8 Oct 1972, 1050 m (IZUI), 1♀; Appennino Ligure, Ponto di Nava, Grotta dell Ono (PO99%/118Pi), 6 Aug 1971 (M. Bologna, JW), 1♀; Appennino Ligure, M. Alta Val Nervia, Margheria dei Boschi, Tana Rossa, 7 Sep 1971, 1100 m (S. Bologna, JW), 1♂; Alpi Maritime, Ligure, Ormea, Isola Perosa, 2 Oct 1972, 600 m (IZUI), 1♀; Appennino Ligure, Savona prov., C. Giovetti, Massimino, 2 Oct 1972, 900 m (IZUI), 1♀; Appennino Tosco-Emiliano, Toscana, Passo del Cerreto, 20 Oct 1975, 1120 m (IZUI), 1♀.

**DISTRIBUTION.**—Known from mountainous regions in meridional France (Alpes Maritimes and Var) and Italy (Piemonte, Toscana, and Liguria) (Figure 42).



FIGURES 38–41.—*Pimoa rupicola* (Simon), spinnerets, female: 38, spinneret group; 39, ALS; 40, PMS; 41, PLS.

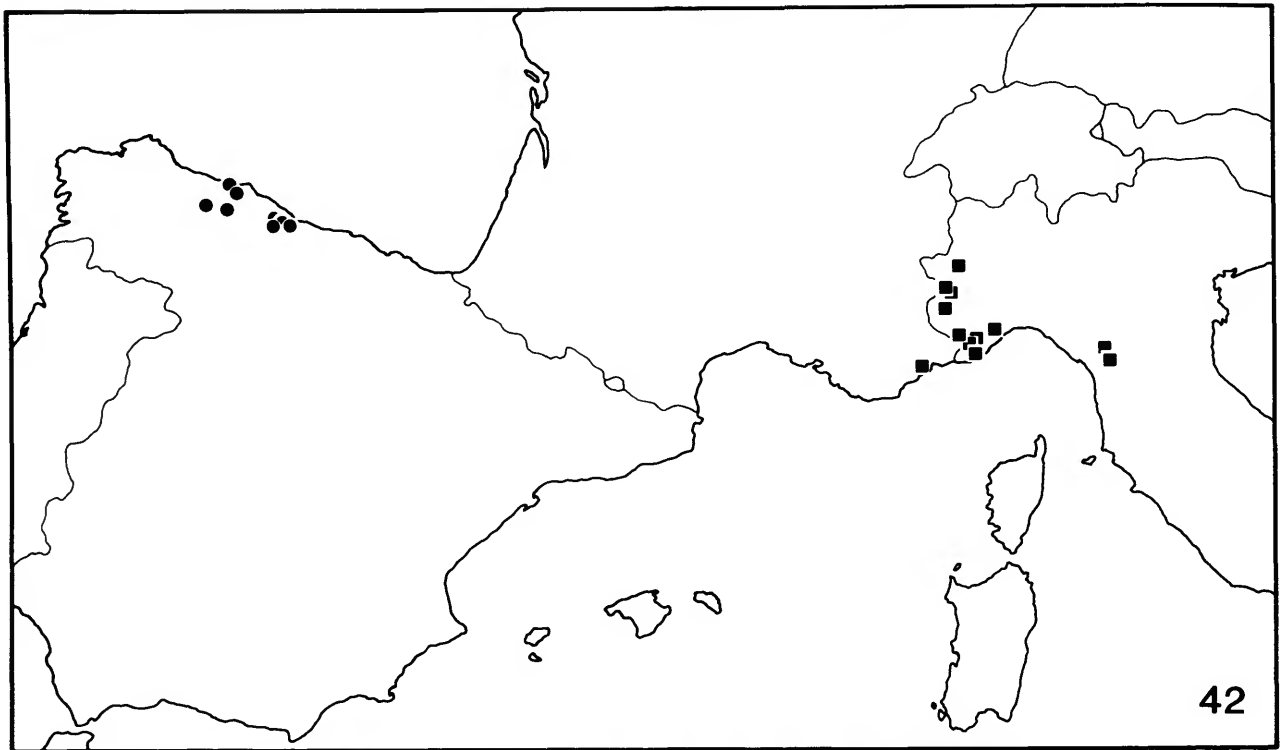


FIGURE 42.—Distributions of *Pimoa breuili* (circles) and *P. rupicola* (squares).

***Pimoa breuili* (Fage)**

FIGURES 10, 42–84

*Metella breuili* Fage, 1931:195–197, fig. 38 [♀]; 1946:387.—Roewer, 1942: 920.—Ribera, 1980:226–229.

*Labulla (Metella) breuili*.—Fage, 1935:177–180, fig. 1 [♂].—Dresco and Hubert, 1971:200–201.

*Labulla breuili*.—Bonnet, 1957:2828.

*Louisfagea breuili*.—Brignoli, 1971:161, 163; 1979:36; 1983:259.—Thaler, 1976:209.—Crawford, 1988:23.—Platnick, 1989:259.—Wunderlich, 1986:220, figs. 236–239 [♂].

*Acrometa breuili*.—Wunderlich, 1979:411–416, figs. 2–11 [♂].

*Pimoa breuili*.—Hormiga, 1993:534.

**TYPES.**—Female holotype, labels state “*Metella breuili* Fage” and “Fage. Type! biosp. n° 792. Caverna de San Román de Candamo, part. de Pravia, prov. Oviedo, Espagne.” Deposited in MNHN. Examined.

**DIAGNOSIS.**—Both sexes have legs covered with numerous long setae. Male with bifurcated PEP and two denticulated cymbial processes. Epigynum protruding less than its width; the turn of the copulatory duct (in a lateral view of the epigynum) is closer to the copulatory opening than to the spermatheca (Figure 45).

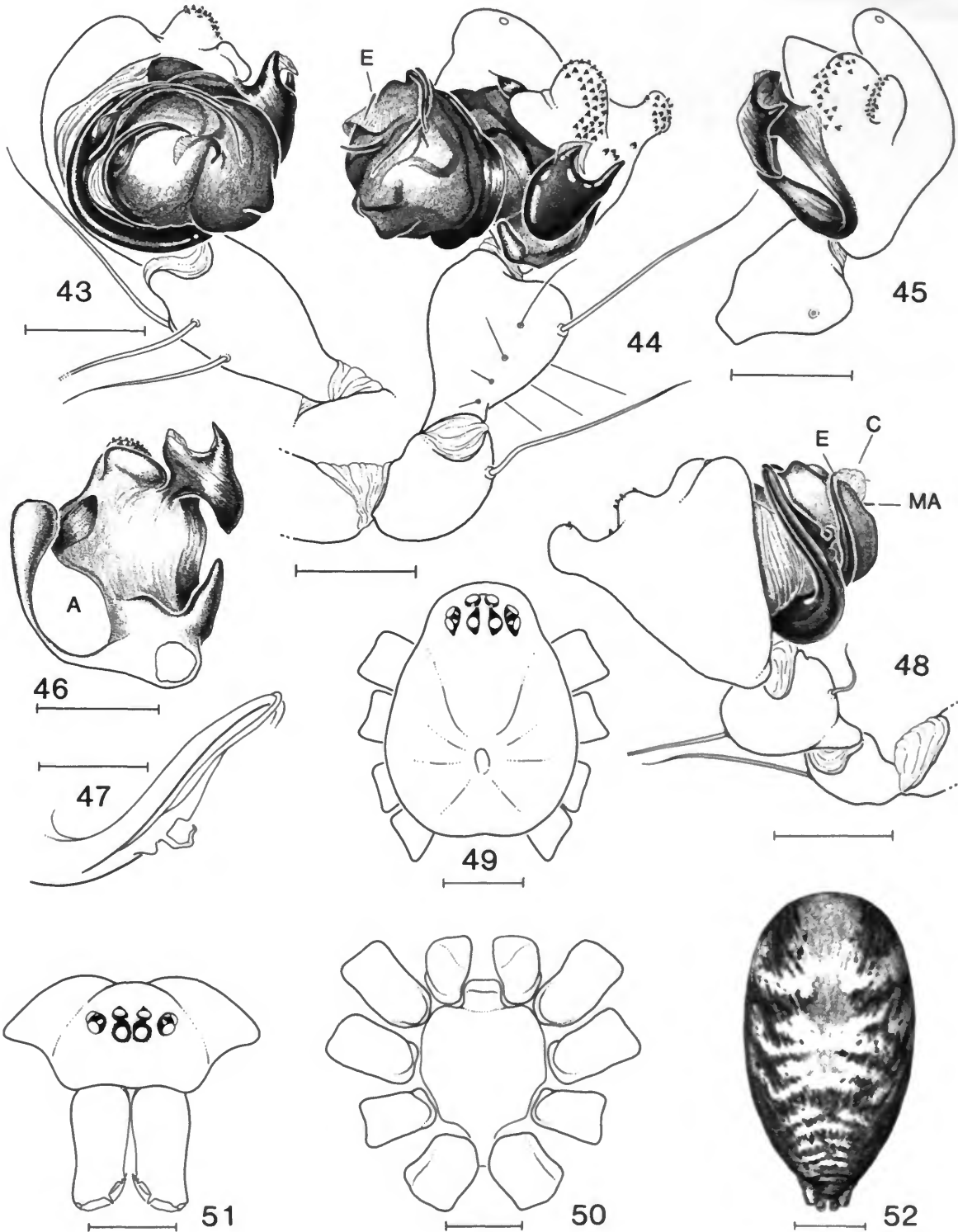
**Male** (from Teverga, Asturias, Spain): Total length 7.1. Cephalothorax 3.5 long, 2.7 wide, 2.0 high; yellowish brown.

Sternum 2.1 long, 1.7 wide; brown, darker at margins. Abdomen 4.0 long, 2.1 wide, 2.8 high; whitish with dark gray pattern. AME diameter 0.22. PME 1.00, PLE 1.00, ALE 1.00 times one AME diameter. AME separation 0.29 times their diameter. PME separation 1.00 times their diameter. PME-PLE separation 0.71 times one PME diameter, AME-ALE separation 0.71 times one ALE diameter. Clypeus height 2.00 times one AME diameter. Chelicerae with three prolateral and two (three) retrolateral teeth. Cheliceral stridulating files present (Figure 73). Legs reddish brown. Leg and pedipalp lengths of male described above:

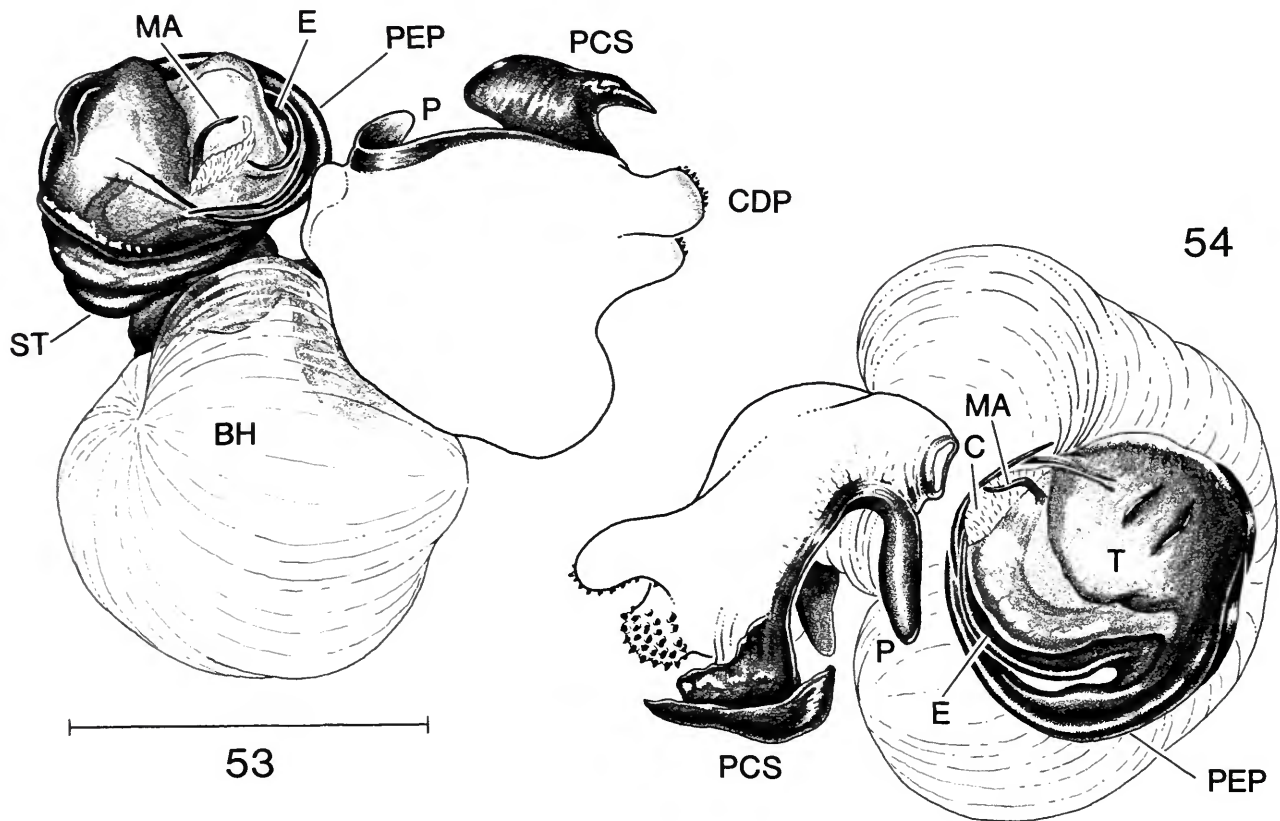
	I	II	III	IV	Pdp
Femur	11.2	10.0	6.9	8.8	1.3
Patella	1.4	1.3	1.1	1.2	0.5
Tibia	12.0	10.5	6.4	9.3	0.7
Metatarsus	13.7	12.2	7.3	9.8	—
Tarsus	3.3	2.9	2.1	2.7	1.0
Total	41.6	36.9	23.8	31.8	3.5

Legs 1243. Femur 1.3.20 times length of cephalothorax. Legs covered with long setae. Metatarsus I trichobothrium 0.58. Pedipalp as in Figures 43–48, 53, 54, 64–70.

**Female** (from same locality as male): Total length 8.5. Cephalothorax 4.5 long, 3.0 wide, 2.1 high; reddish brown.



FIGURES 43-52.—*Pimosa brevili* (Fage), male from Asturias, Spain: 43, palp, ventral; 44, same, ectal; 45, same, dorsoectal; 46, cymbium (basal haematodocha removed), ventral; 47, detail PEP branches; 48, palp, mesal; 49, cephalothorax, dorsal; 50, same, ventral; 51, same, frontal; 52, abdomen, dorsal. (Scale lines: 0.5 mm, except 47, 0.25 mm and 49-52, 1.0 mm.)



FIGURES 53, 54.—*Pimoa breuili* (Fage), male from Asturias, Spain, expanded palp: 53, dorsal; 54, anteroectal. (Scale line: 1.0 mm.)

Sternum 2.5 long, 1.8 wide; dark reddish brown. Abdomen 5.1 long, 3.4 wide, 3.6 high; whitish with dark gray pattern. AME diameter 0.22. PME 1.00, PLE 1.00, ALE 1.00 times one AME diameter. AME separation 0.29 times their diameter, PME separation 1.00 times their diameter. PME-PLE separation 1.00 times one PME diameter. AME-ALE separation 1.00 times one ALE diameter. Clypeus height 2.57 times one AME diameter. Chelicerae with three prolateral and two (three) retrolateral teeth. Cheliceral stridulating files present although quite inconspicuous. Legs reddish brown. Leg and pedipalp lengths of female described above:

	I	II	III	IV	Pdp
Femur	9.4	8.5	6.4	8.2	1.5
Patella	1.7	1.6	1.3	1.3	0.5
Tibia	9.7	8.4	5.6	8.9	1.1
Metatarsus	9.8	8.9	5.7	7.9	—
Tarsus	3.2	2.9	2.0	2.5	1.9
Total	42.8	30.3	21.0	28.8	5.0

Legs 1243. Femur I 2.09 times length of cephalothorax.

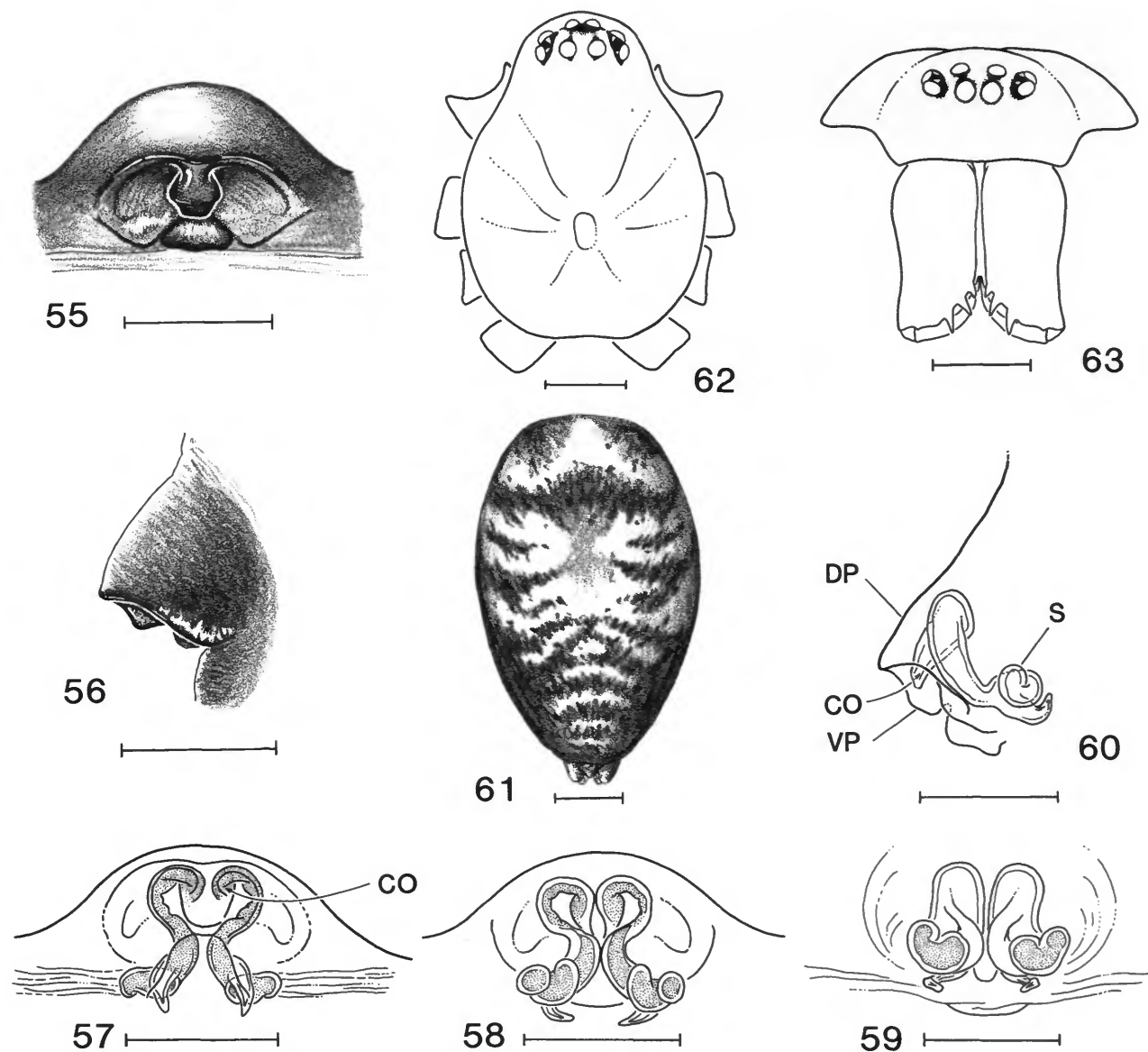
Metatarsus I trichobothrium 0.62. Legs covered with long setae. Epigynum as in Figures 55–60.

VARIATION.—Male cephalothorax ranges in length from 3.5 to 5.7, female from 2.8 to 4.9. The general coloration varies, some individuals being fairly light in color while others are heavily pigmented.

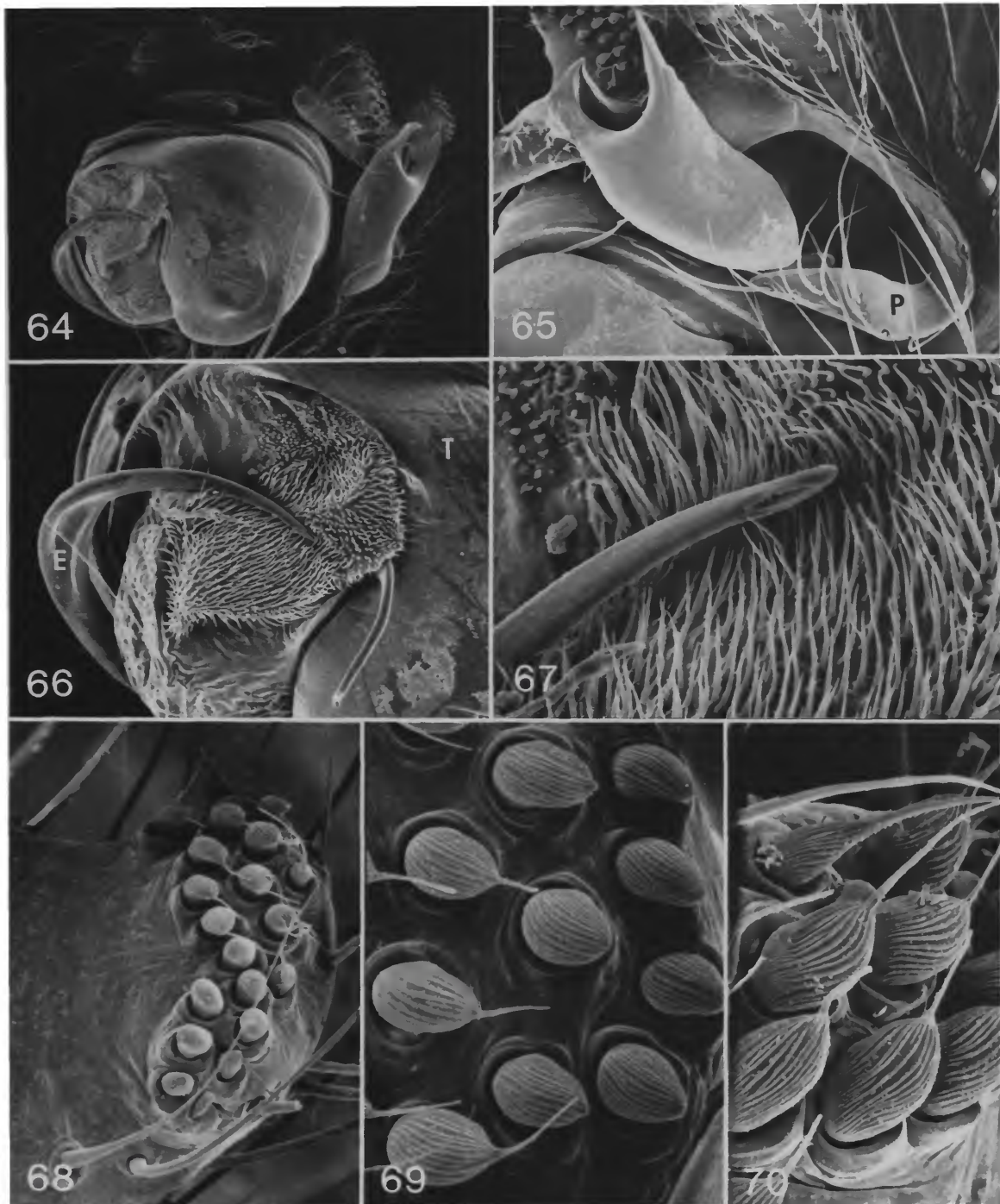
ADDITIONAL MATERIAL EXAMINED.—SPAIN: ASTURIAS: Babia de Abajo, 5 Sep 1987 (Ribera, Serra, Dominguez, UB), 1♂, 2♀; Oviedo, Cueva del Agua, Boquerón de Brañes, 3 Sep 1987 (Ribera, Serra, Dominguez, UB), 2♂, 1♀; Cueva del Escribano, La Escalda, 3 Sep 1987 (Ribera, Serra, Dominguez, UB), 2♂, 1♀; Cueva de la Huerta, Teverga (C. Bolivar, MNHN), 1♂; Cueva de la Huerta, Teverga, 1 Sep 1987 (Ribera, Serra, Dominguez, UB), 2♂, 6♀.

DISTRIBUTION.—Known only from the Cordillera Cantábrica, in northern Spain. Its distribution in the caves of northern Spain is given by Ribera (1980:228–229). Ribera's locality records (when adult specimens were collected) have been included in the distribution map (Figure 42).

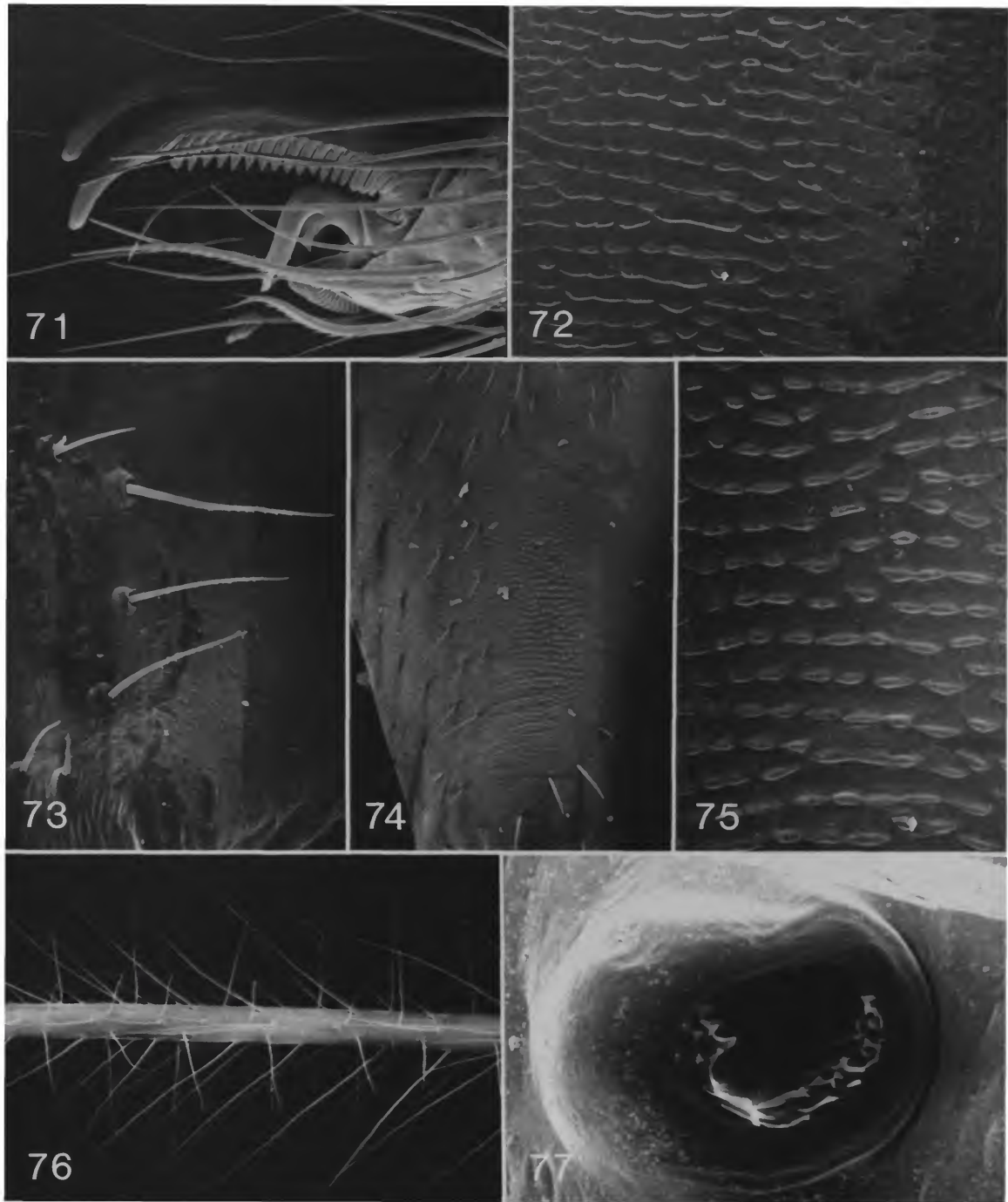




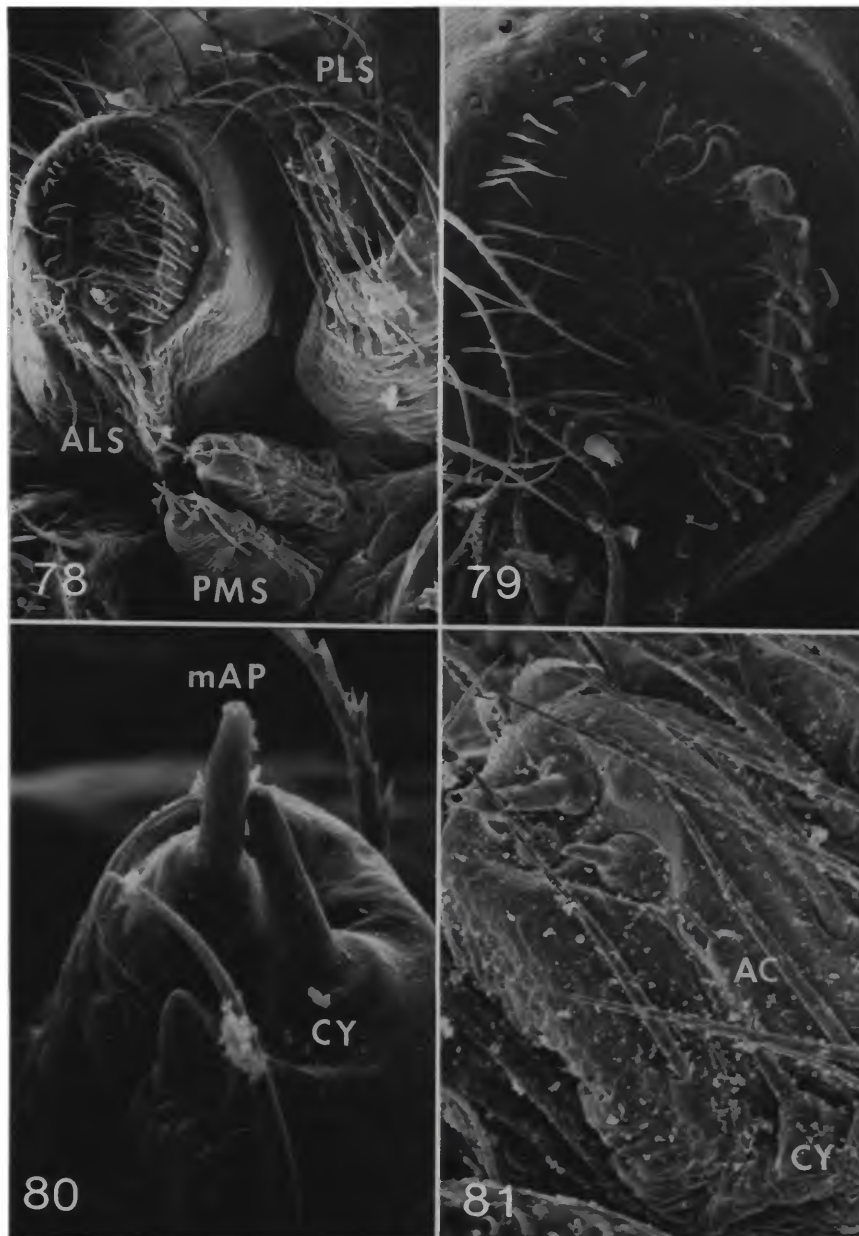
FIGURES 55-63.—*Pimoa brevili* (Fage), female from Asturias, Spain: 55, epigynum, posteroventral; 56, same, lateral; 57, epigynum, cleared, posterior; 58, same, anteroventral; 59, same, anterior; 60, same, lateral; 61, abdomen, dorsal; 62, cephalothorax, dorsal; 63, same, frontal. (Scale lines: 0.5 mm, except 61-63, 1.0 mm.)



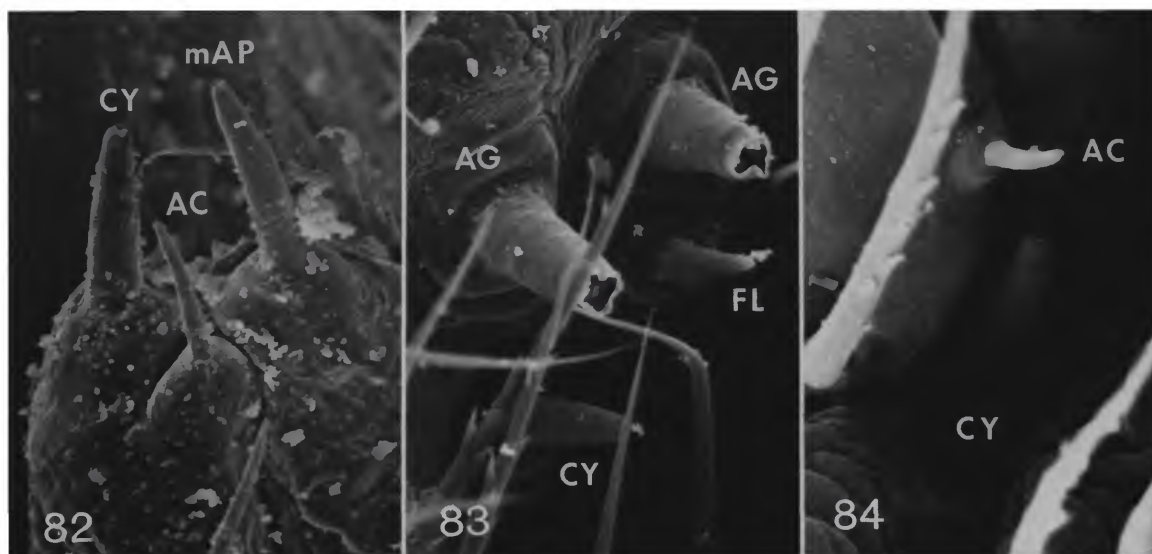
FIGURES 64-70.—*Pimoa breuili* (Fage), male from Asturias, Spain: 64, palp, ventral; 65, paracymbium and PCS, ectal; 66, embolus, conductor, and median apophysis; 67, embolus (apex) and conductor; 68, cymbial denticulated process; 69, 70, cymbial denticles, detail.



FIGURES 71-77.—*Pimoa breuili* (Fage), male from Asturias, Spain: 71, tarsal claw I; 72, stridulatory striae, detail of 74; 73, base of palpal femur, mesal with enlarged setal bases; 74, chelicera with stridulatory striae; 75, detail of striae; 76, metatarsus I; 77, tarsal organ I.



FIGURES 78-81.—*Pimoa breuili* (Fage), spinnerets, female from Asturias, Spain: 78, spinneret group; 79, ALS; 80, PMS; 81, PLS.



FIGURES 82-84.—*Pimoa breuili* (Fage), spinnerets, female from Asturias, Spain: 82, PMS; 83, 84, PLS, detail.

***Pimoa cthulhu*, new species**

FIGURES 85-117

**TYPES.**—Male holotype and female paratype from Mendocino Woodlands (S end), in hollow redwood stumps, Mendocino Co., California; 16-17 Sep 1990, D. Ubick col. Male and female paratypes from Mendocino Woodlands Camp, Mendocino Co.; 24 Feb 1979 (♂) and 2 Feb 1973 (♀), S.C. Williams col. Holotype deposited in CAS, paratypes deposited in CAS and DU.

**ETYMOLOGY.**—Named after H.P. Lovecraft's mythological deity Cthulhu, akin to the powers of Chaos.

**DIAGNOSIS.**—Males can be easily distinguished by a cluster of thick spines on a cymbial projection (Figures 85, 89, 107). The paracymbium is long and continuous with the PCS. Females have a long sausage-like epigynum that can be distinguished from its sister species *vera* because of *cthulhu*'s narrower and laterally compressed distal end (Figures 92-97).

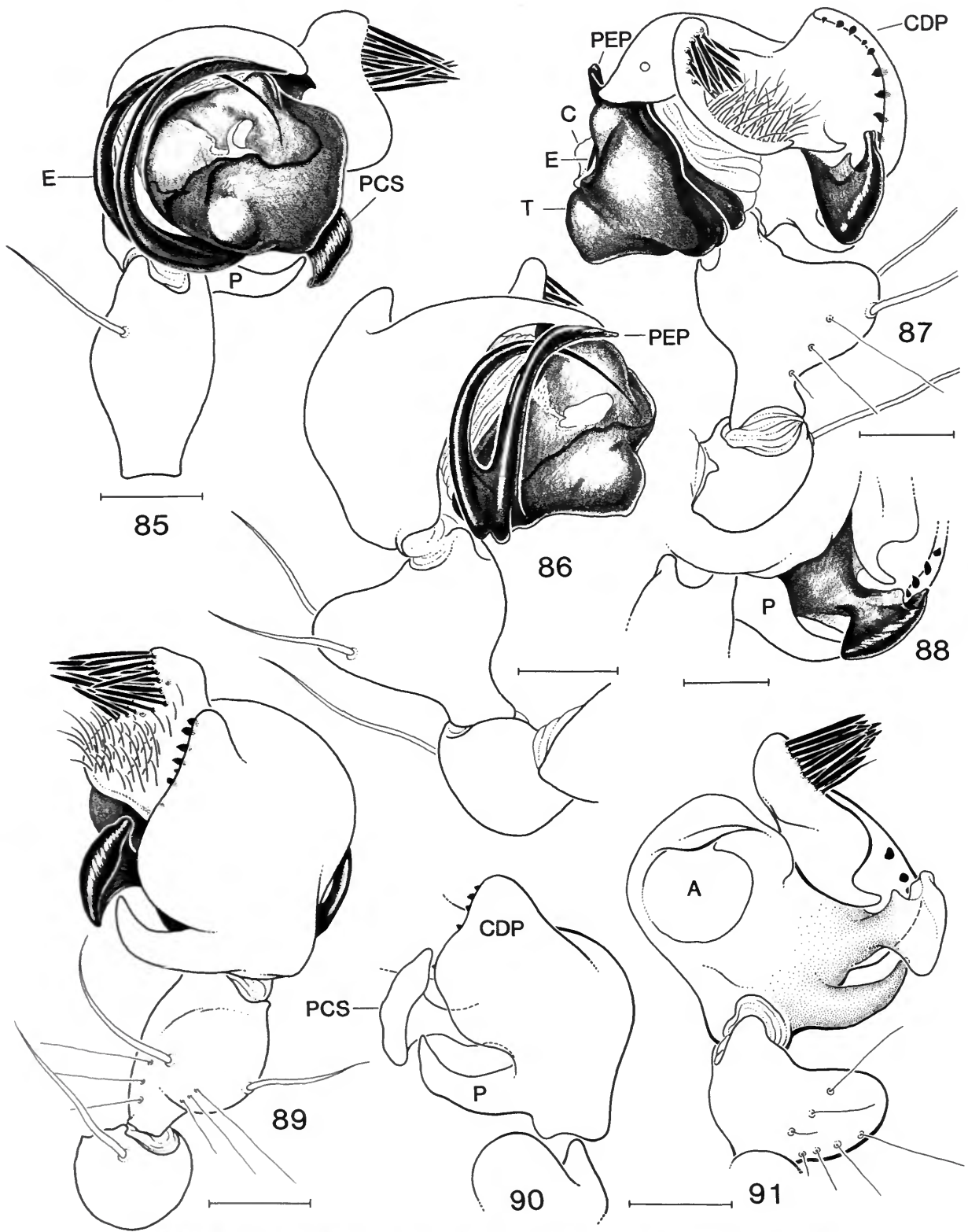
**Male (holotype):** Total length 10.5. Cephalothorax 4.8 long, 3.8 wide, 2.6 high; very light brown, slightly darker at margins. Sternum 2.8 long, 2.2 wide; brown. Abdomen 5.1 long, 3.8 wide, 5.0 high; dark gray with four dorsal whitish spots, very similar to the female. AME diameter 0.28. PME 0.79, PLE 0.79, ALE 0.79 times one AME diameter. AME separation 0.50 times their diameter, PME separation 0.91 times their diameter. PME-PLE separation 1.18 times one PME diameter, AME-ALE separation 0.73 times one ALE diameter.

Clypeus height 1.43 times one AME diameter. Chelicerae with three prolateral and two retrolateral teeth. Cheliceral stridulating files scale-like and inconspicuous. Legs brown. Leg and pedipalp lengths of male described above:

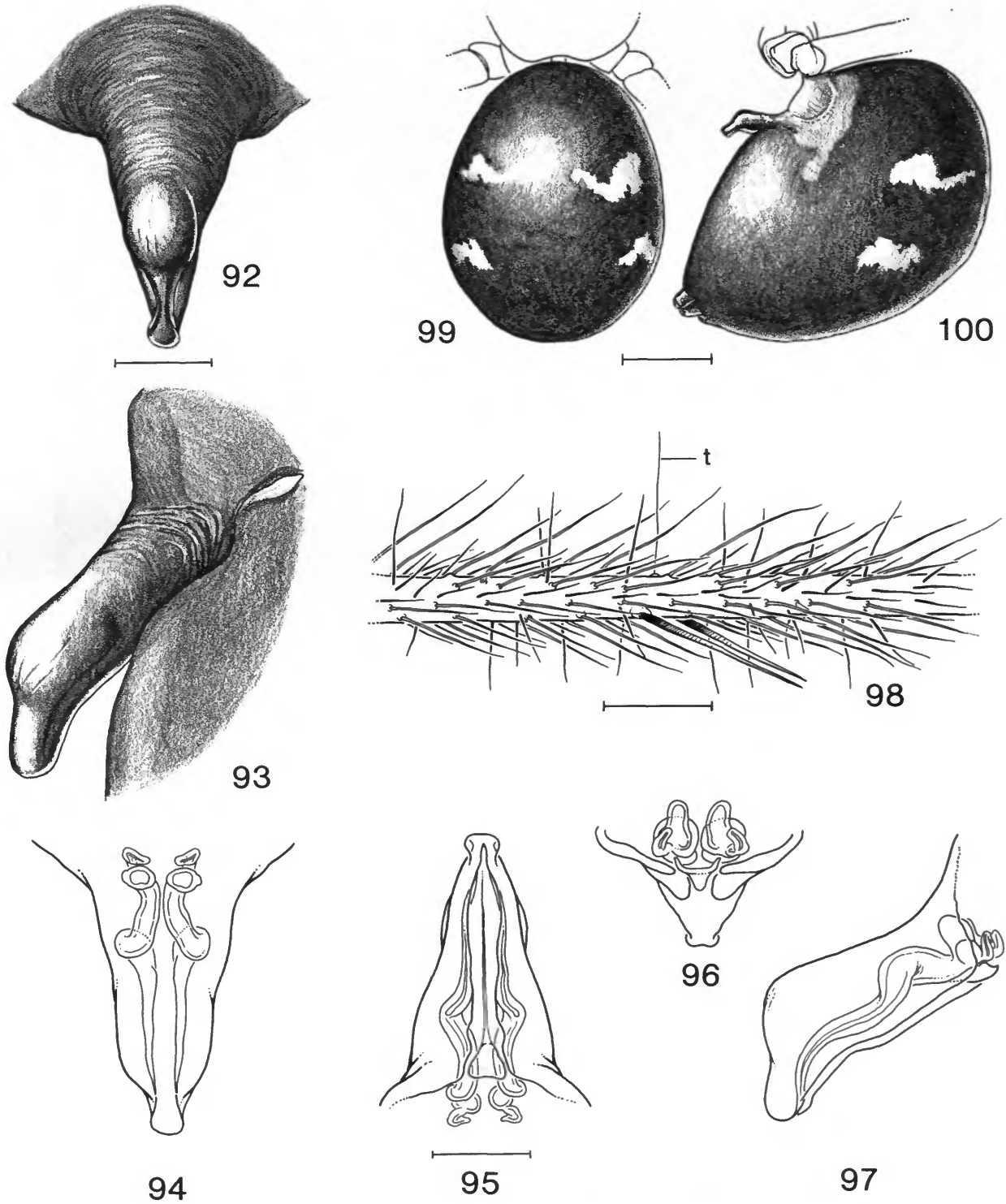
	I	II	III	IV	Pdp
Femur	12.8	11.6	8.6	10.3	2.0
Patella	1.8	1.8	1.5	1.5	0.7
Tibia	12.4	11.4	7.4	9.8	0.8
Metatarsus	14.6	13.7	8.7	11.1	—
Tarsus	4.8	4.2	3.3	3.3	1.6
Total	46.3	42.7	29.5	36.0	5.1

Legs 1243. Femur I 2.67 times length of cephalothorax. Legs covered with long setae (Figure 98). Metatarsus I with eleven trichobothria. Pedipalp as in Figures 85-91, 101-107, 110, 111.

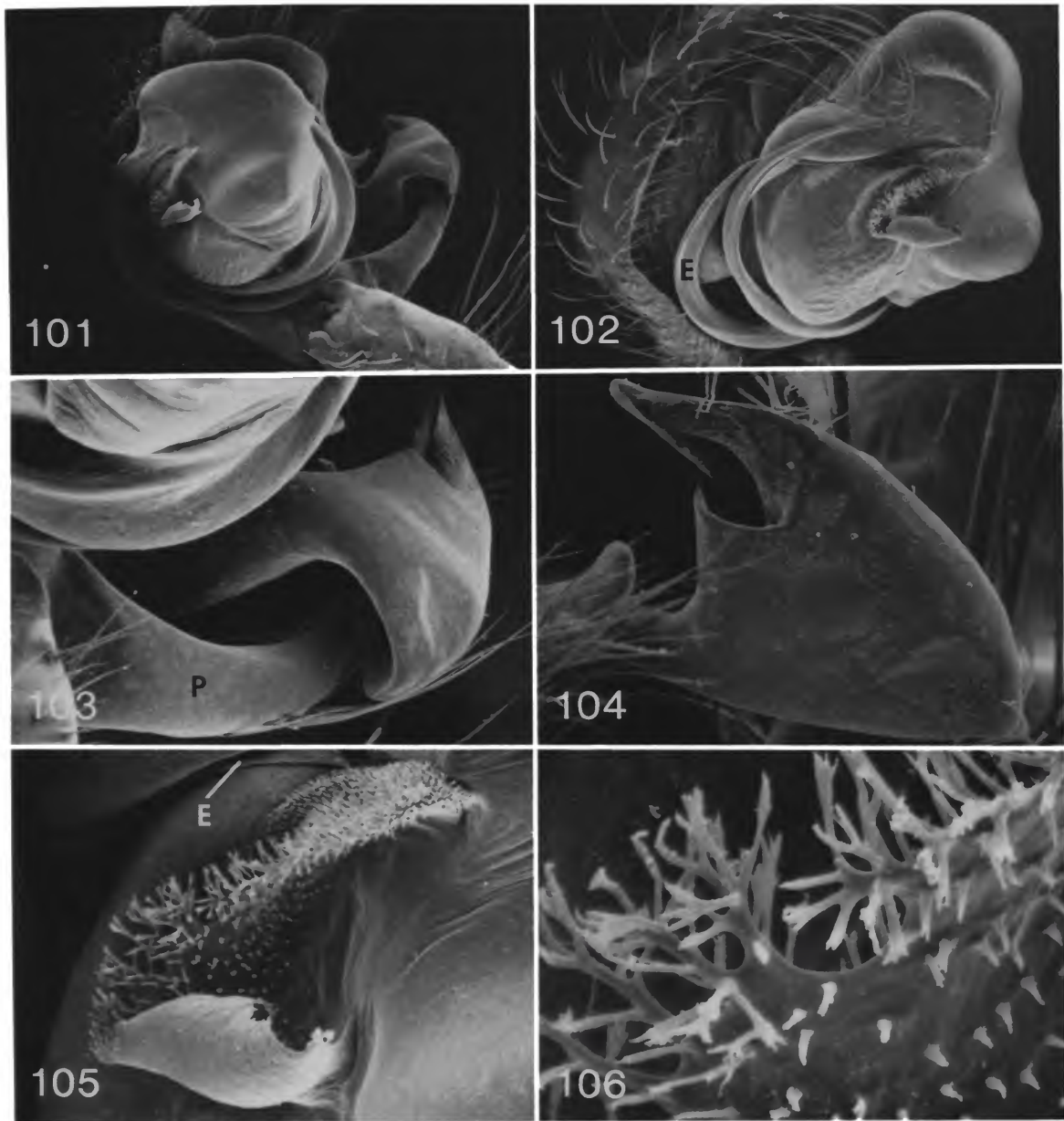
**Female (paratype):** Total length 12.3. Cephalothorax 5.6 long, 4.1 wide, 6.4 high; light brown, darker at the margins. Sternum 2.8 long, 2.3 wide; reddish brown. Abdomen 6.8 long, 5.4 wide, 7.2 high; dark gray with four dorsal whitish spots. AME diameter 0.30. PME 0.80, PLE 0.73, ALE 0.73 times one AME diameter. AME separation 0.47 times their diameter, PME separation 0.83 times their diameter. PME-PLE separation 1.36 times one PME diameter, AME-ALE separation 1.00 times one ALE diameter. Clypeus height 1.73 times one AME diameter. Chelicerae with three prolateral and two retrolateral teeth. Cheliceral stridulating files scale-like. Legs dark reddish



FIGURES 85-91.—*Pimotha ctulhu*, new species, males from California: 85, palp, ventral; 86, same, mesal; 87, same, ectal; 88, same, detail base of cymbium, ectoventral; 89, same, dorsal; 90, palp, dorsal; 91, same, ventral (basal haematodocha removed). (Scale lines: 0.5 mm.)



FIGURES 92-100.—*Pimoidia cithulu*, new species, female: 92, epigynum, ventral; 93, same, lateral; 94, epigynum, cleared, ventral; 95, same, dorsal; 96, same, anterior; 97, same, lateral; 98, paratype, detail metatarsus I; 99, paratype, abdomen, dorsal; 100, same, lateral. (Scale lines: 0.5 mm, except 99, 100, 2.0 mm.)



FIGURES 101-106.—*Pimoa cthulhu*, new species, male from California: 101, palp, ventral; 102, palp, mesal; 103, paracymbium and PCS, ventral; 104, PCS, ventral; 105, embolus and conductor; 106, conductor, detail.

brown. Leg and pedipalp lengths of female described above:

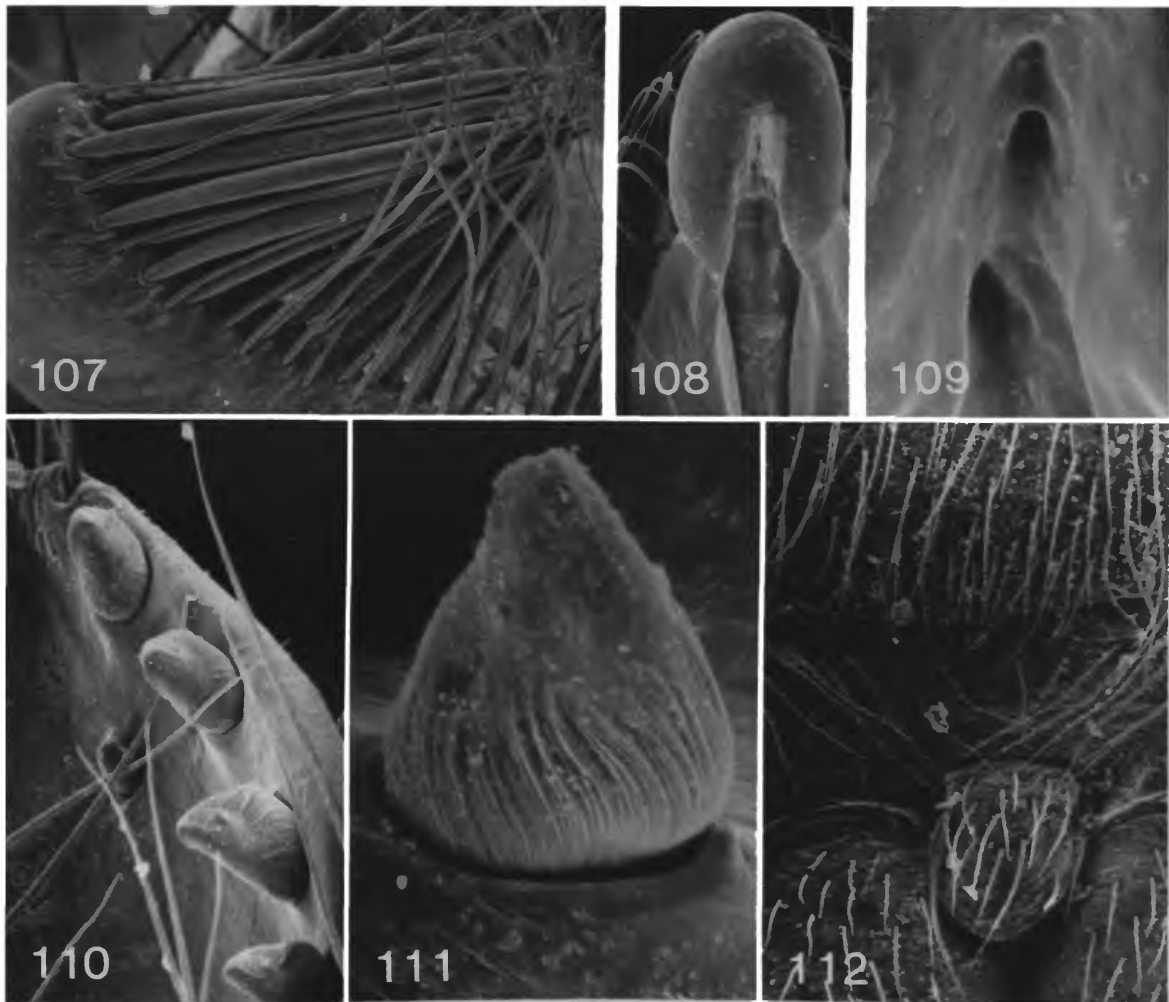
	I	II	III	IV	Pdp
Femur	11.3	10.1	7.5	9.8	2.5
Patella	2.0	1.9	1.6	1.8	1.4
Tibia	11.2	9.9	6.5	9.1	0.7
Metatarsus	12.0	10.6	7.3	9.2	—
Tarsus	4.2	3.6	2.4	3.0	2.1
Total	40.7	36.1	25.3	32.9	6.7

Legs 1243. Femur I 2.02 times length of cephalothorax. Legs

covered with long setae (Figure 98). Metatarsus I with eight trichobothria. Epigynum as in Figures 92-97, 108, 109.

VARIATION.—Male cephalothorax ranges in length from 4.4 to 5.7, female from 4.0 to 6.1. The number of metatarsal trichobothria is quite variable in this species. In the males it varies from seven to 11 for the first and from seven to nine for the fourth metatarsus. In the females it varies from eight to 10 for the first and from six to 10 for the fourth metatarsus. The number of prolateral trichobothria of the male pedipalp tibia varies from three to four.



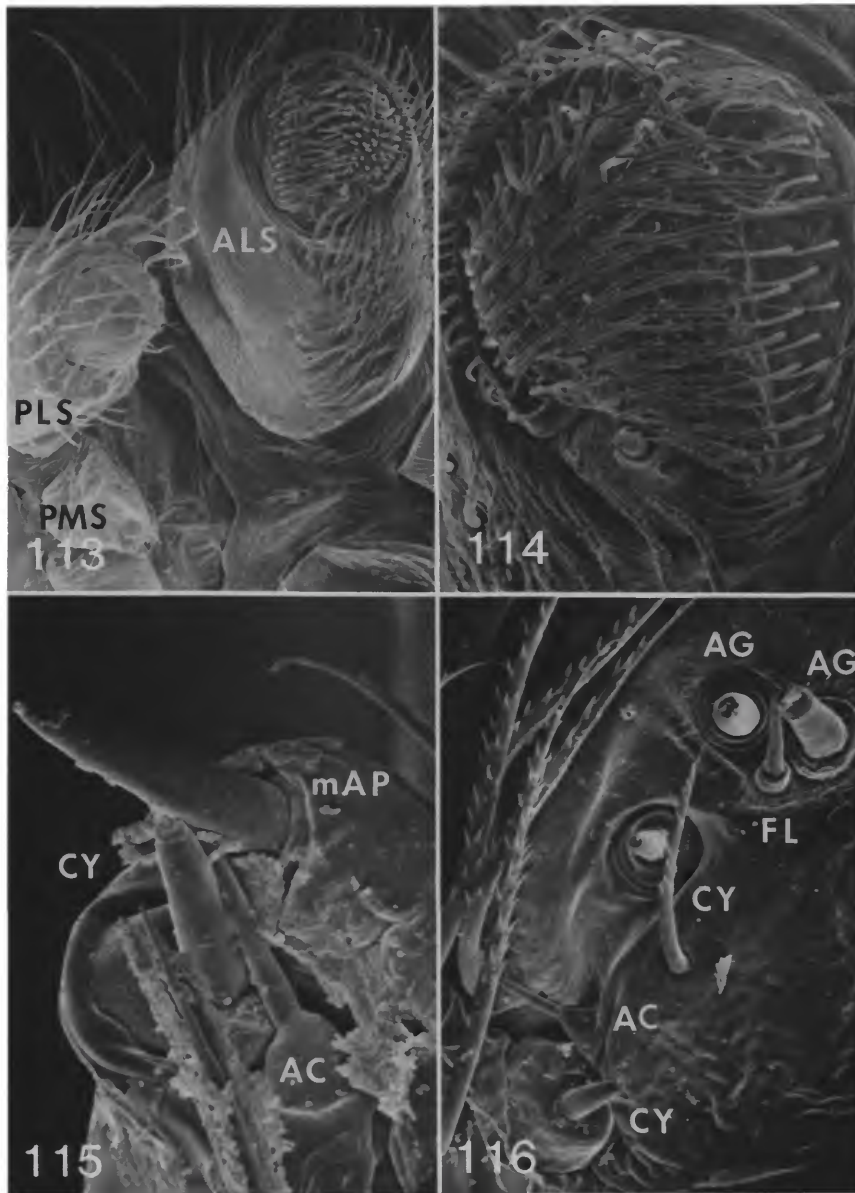


FIGURES 107-112.—*Pimoa ethulhu*, new species, from California: 107, cymbial apophysis; 108, epigynum, dorsoapical detail; 109, closeup of cuticular openings of Figure 108; 110, cymbial denticulated process, 111, cymbial denticle; 112, female, colulus and spiracle.

**ADDITIONAL MATERIAL EXAMINED.**—UNITED STATES: CALIFORNIA: Mendocino Co.: 1 mi (1.6 km) S of Caspar (39°N, 123°W), 13 Sep 1961 (W.J. Gertsch, W. Ivie, AMNH), 2♀; 9.8 mi (15.7 km) SW Highway 101, along Highway 1, 20 Sep 1990, web in hollowed out redwood stump, 1000 ft (D. Ubick, DU), 1♀; Mendocino Woodlands, 26 Mar 1977 (P.R. Craig, CAS), 1♂; 3.0 mi (4.8 km) S of Rockport, 19 Sep 1990, web in burned out cavity in redwood stump, 300 ft (D. Ubick, DU),

1♀; Tranquility, 1.5 mi (2.4 km) S of Caspar, 19 Sep 1990, webs in shed, 300 ft (D. Ubick, J. Helfer, DU), 4♂, 1♀; 1 mi (1.6 km) NE Usal Road, along Highway 101, 20 Sep 1990, in redwood duff, 200 ft (D. Ubick, DU), 1♀. Sonoma Co.: Salt Point State Park, 22 Sep 1990, webs in hollow redwood stumps under logs (D. Ubick, V. Vutrain, S. Lee, DU), 2♂, 2♀.

**DISTRIBUTION.**—Known only from Mendocino and Sonoma counties in Western California (Figure 117).



FIGURES 113-116.—*Pimosa ctulhu*, new species, spinnerets, female from California: 113, spinneret group; 114, ALS; 115, PMS; 116, PLS.

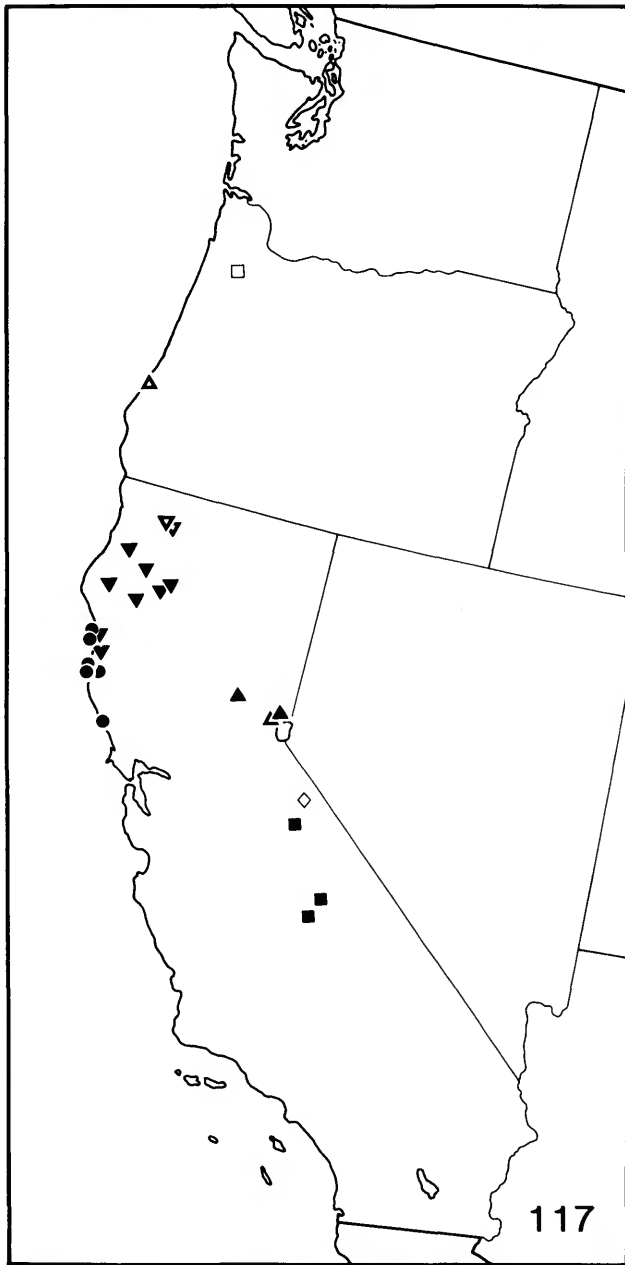


FIGURE 117.—Distributions of *Pimoa petita*, new species (open square), *P. vera* Gertsch (open upright triangle), *P. mephitis*, new species (inverted open triangles), *P. edenticulata*, new species (inverted closed triangles), *P. chulhu*, new species (circles), *P. laurae*, new species (closed upright triangles), *P. mono*, new species (diamond), and *P. hespera* (Gertsch and Ivie) (closed squares).

***Pimoa vera* Gertsch**

FIGURES 117-125

*Pimoa vera* Gertsch, 1951:4-6, fig. 6 [♀].—Brignoli, 1975:13; 1983:231.—Roth, 1988:45.

**TYPES.**—Female holotype, label states “*Pimoa vera* Gertsch Oregon: North Bend Vera Norton coll. ♀ HOLOTYPE.” Deposited in AMNH. Examined.

**DIAGNOSIS.**—It can be distinguished from its sister species *ctulhu* by the rounded distal end of the epigynum (which is laterocompressed in *ctulhu*; Figures 118-123).

**Male:** Unknown.

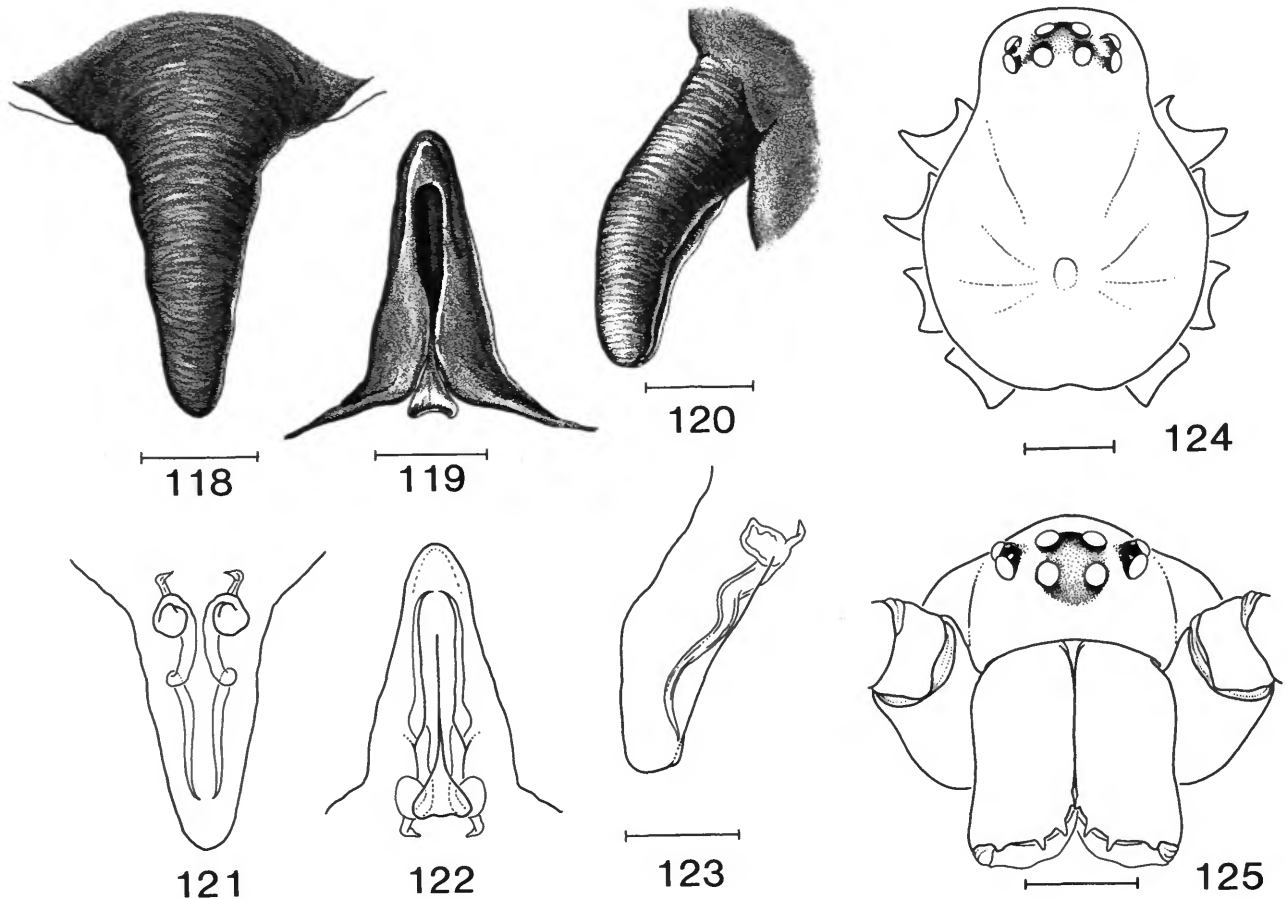
**Female (holotype):** Cephalothorax 4.2 long, 3.3 wide, 2.3 high; reddish brown. Sternum 2.5 long, 1.9 wide; yellowish brown. Abdomen yellowish brown. AME diameter 0.22. PME 1.00, PLE 1.00, ALE 1.00 times one AME diameter. AME separation 1.40 times their diameter, PME separation 1.40 times their diameter. PME-PLE separation 1.14 times one PME diameter, AME-ALE separation 1.00 times one ALE diameter. Clypeus height 2.14 times one AME diameter. Chelicerae with three prolateral and three retrolateral teeth. Cheliceral stridulating files absent. Legs yellowish brown. Leg and pedipalp lengths of female described above:

	I	II	III	IV	Pdp
Femur	9.1	8.5	6.5	—	1.5
Patella	3.3	3.3	—	—	0.5
Tibia	—	—	—	—	1.1
Metatarsus	—	—	—	—	—
Tarsus	—	—	—	—	2.0
Total	—	—	—	—	5.1

Femur I 2.17 times length of cephalothorax. Epigynum as in Figures 118-123.

**ADDITIONAL MATERIAL EXAMINED.**—None.

**DISTRIBUTION.**—Known only from the type locality, in western Oregon (Figure 117).



FIGURES 118-125.—*Pimosa vera* Gertsch, female (holotype): 118, epigynum, ventral; 119, same, dorsal; 120, same, lateral; 121, epigynum, cleared, ventral; 122, same, ventral; 123, same, lateral; 124, cephalothorax, dorsal; 125, same, frontal. (Scale lines: 0.5 mm, except 124, 125, 1.0 mm.)

### *Pimosa hespera* (Gertsch and Ivie)

FIGURES 126-146, 117

*Labulla hespera* Gertsch and Ivie, 1936:16-18, figs. 34-36 [♂].—Roewer, 1942:577.—Fage, 1946:387.—Bonnet, 1957:2335.

*Pimosa hespera*.—Chamberlin and Ivie, 1943:9-10.—Brignoli, 1971:163; 1975:13; 1979:36; 1983: 231.—Thaler, 1976:209.—Crawford, 1988:23.—Roth, 1988:45.

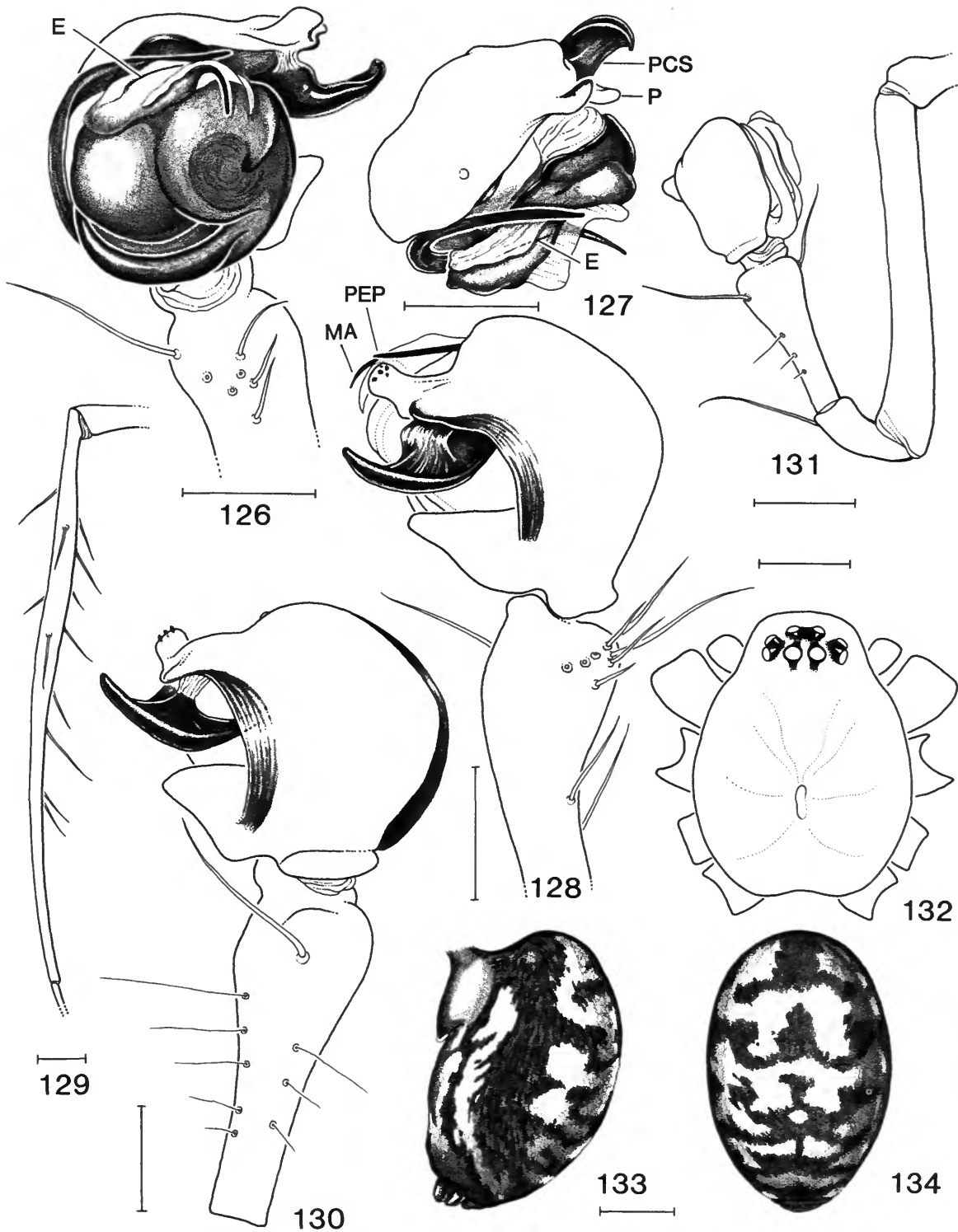
*Acrometa hespera*.—Wunderlich, 1979:411.

TYPES.—Male holotype, labels state “*Pimosa hespera* (Gertsch and Ivie)/*Labulla hespera* Gertsch and Ivie ♂ 119.37 nw. California: Yosemite Park (Aspen Valley) August 12, 1931 Wilton Ivie collector HOLOTYPE” and “*Labulla hespera* G and I. California: Yosemite Park (Aspen Valley) ♂ ♀ HOLOTYPE 8-12-31 coll: W. Ivie Det.” Deposited in AMNH. Examined.

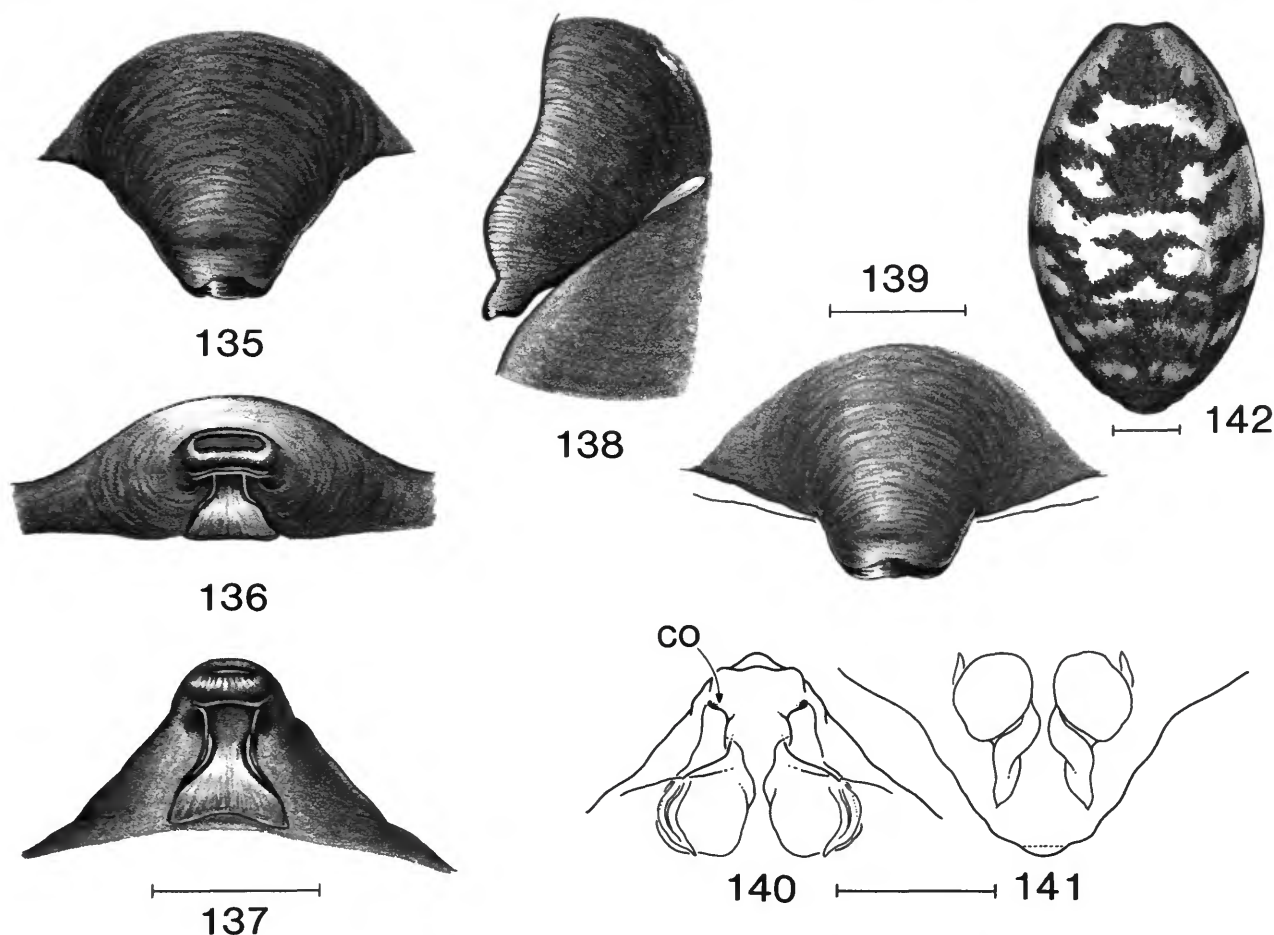
DIAGNOSIS.—Males can be easily distinguished by having the metatarsus I sinuous and widest at the distal end of the

proximal third (Figure 129). Females can be distinguished from its sister species *mono* by a less rounded end of the epigynum and a the distance between the copulatory openings (approximately equal to one spermatheca width; Figures 140, 141).

*Male* (from Kings Canyon National Park, California): Total length 9.3. Cephalothorax 4.5 long, 3.4 wide, 2.6 high; light brown, slightly darker at margins. Sternum 2.6 long, 2.1 wide; dark brown. Abdomen 4.5 long, 3.3 wide, 3.9 high; whitish with a dark gray pattern. AME diameter 0.22. PME 0.91, PLE 0.91, ALE 0.91 times one AME diameter. AME separation 0.73 times their diameter, PME separation 0.80 times their diameter. PME-PLE separation 1.01 times one PME diameter. AME-ALE separation 0.80 times one ALE diameter. Clypeus height 2.36 times one AME diameter. Chelicerae with three prolateral and two retrolateral teeth. Cheliceral stridulating files present and conspicuous. Legs brown, annuli very faintly marked. Leg and pedipalp lengths of male described above:



FIGURES 126-134.—*Pimoa hespera* (Gertsch and Ivie), males from California: 126, holotype, palp, ventral; 127, same, apical; 128, same, dorsal; 129, tibia 1, ectal; 130, palp, dorsal; 131, same, mesal; 132, cephalothorax, dorsal; 133, abdomen, lateral; 134, same, dorsal (Figures 126-128 right palp reversed). (Scale lines: 0.5 mm, except 132-134, 1.0 mm.)



FIGURES 135-142.—*Pimosa hespera* (Gertsch and Ivie), females from California: 135, epigynum, ventral; 136, same, posterior; 137, same, dorsal; 138, epigynum, lateral; 139, same, ventral; 140, epigynum, cleared, dorsal; 141, same, ventral; 142, abdomen, dorsal. (Scale lines: 0.5 mm, except 142, 1.0 mm.)

	I	II	III	IV	Pdp
Femur	10.7	9.8	7.5	9.0	3.7
Patella	1.8	1.7	1.4	1.4	1.1
Tibia	10.2	9.2	6.2	8.2	1.8
Metatarsus	12.4	11.2	7.0	9.3	—
Tarsus	4.5	3.7	2.2	2.9	1.4
Total	39.6	35.6	24.3	30.8	8.0

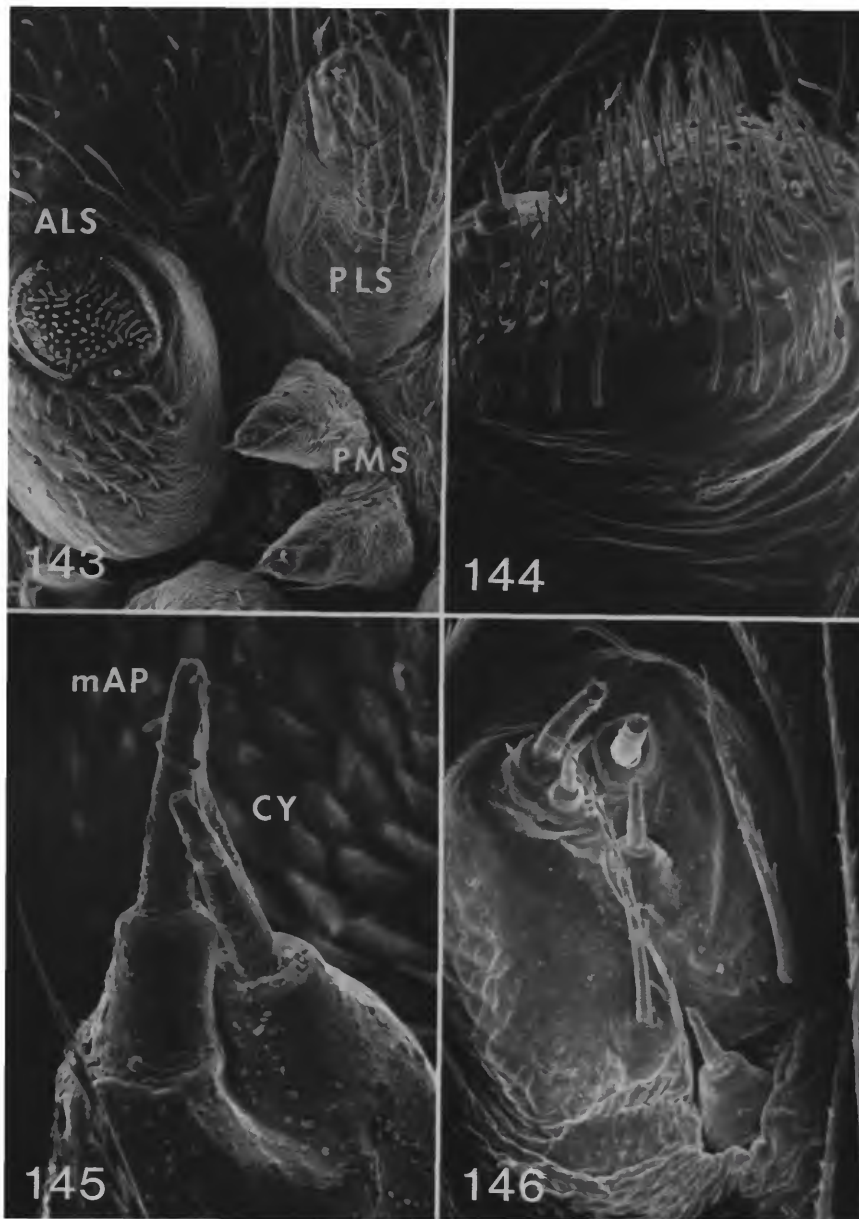
Legs 1243. Femur I 2.38 times length of cephalothorax. Metatarsus I sinuous and thickened near the proximal end (Figure 129). Legs (especially I and II) covered with long setae. Metatarsus I trichobothrium 0.85. Pedipalp as in Figures 126-128, 130, 131.

*Female* (from Deep Creek Cave, California): Total length 9.5. Cephalothorax 4.6 long, 3.4 wide, 2.15 high; yellowish brown, darker at margins and anterior to the thoracic fovea. Sternum 2.70 long, 1.95 wide; dark brown. Abdomen 6.0 long, 3.7 wide, 5.1 high; whitish with dark gray pattern. AME diameter 0.20. PME 0.90, PLE 1.00, ALE 1.00 times one AME

diameter. AME separation 0.60 times their diameter, PME separation 0.89 times their diameter. PME-PLE separation 1.33 times one PME diameter, AME-ALE separation 1.00 times one ALE diameter. Clypeus height 2.60 times one AME diameter. Chelicerae with three prolateral and two retrolateral teeth. Cheliceral stridulating files present, but less conspicuous than in the male (and scale-like). Legs brown, darker than the cephalothorax, with annuli very faintly marked. Leg and pedipalp lengths of female described above:

	I	II	III	IV	Pdp
Femur	8.7	7.8	6.1	7.7	2.0
Patella	1.6	1.5	1.3	1.4	0.7
Tibia	8.7	7.8	5.2	7.1	1.2
Metatarsus	8.8	7.9	5.6	7.3	—
Tarsus	3.5	3.1	2.1	2.5	1.9
Total	31.29	28.08	20.28	25.86	5.7

Legs 1243. Femur I 1.89 times length of cephalothorax. Legs (especially I and II) covered with long setae. Metatarsus I

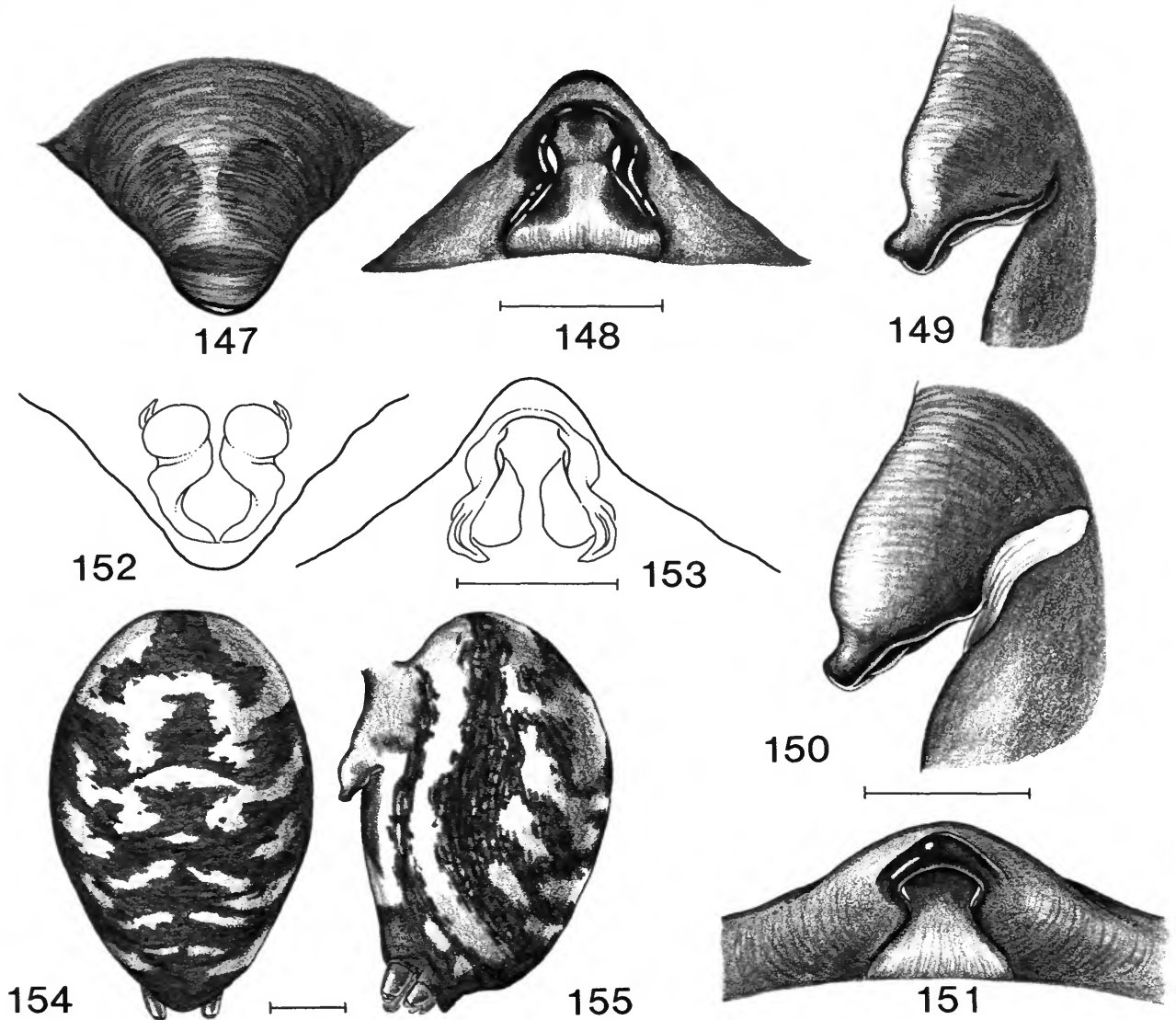


FIGURES 143-146.—*Pimoa hespera* (Gensch and Ivie), spinnerets, female from California: 143, spinneret group; 144, ALS; 145, PMS; 146, PLS.

trichobothrium 0.85. Epigynum as in Figures 135-141.

VARIATION.—Male palp morphology exhibits some variation in the shape of the paracymbium (more pointed in the holotype than in other specimens examined) and the median apophysis (slightly thicker and more compressed in the specimen from Kings Canyon N. P.). Female cephalothorax ranges in length from 4.0 to 5.2. Some female specimens are very dark, with the light dorsal abdominal marks reduced.

ADDITIONAL MATERIAL EXAMINED.—UNITED STATES: CALIFORNIA: Fresno Co.: Kings Canyon National Park, Cedar Grove, 8 Aug 1953, 5200 ft (W.J. and J.W. Gertsch, AMNH), 1♀. Tulare Co.: Ash Mtn., Sequoia Ntl. Park (36°30'N, 118°50'W), 9 Jul 1958 (W.J. Gertsch, V. Roth, AMNH), 1♀; Deep Creek Cave, 30 Sep 1980 (W. Rauscher and T.S. Briggs, DU), 1♀; Hurricane Crawl Cave, 26 Jul 1991 (T. Briggs, DU), 1♀; Kings Canyon National Park: Redwood Canyon, Lilburn



FIGURES 147-155.—*Pimoa mono*, new species, female from California: 147, epigynum, ventral; 148, same, dorsal; 149, same, lateral; 150, epigynum, lateral; 151, same, posterior; 152, epigynum, cleared, ventral; 153, same, dorsal; 154, abdomen, dorsal; 155, same, lateral. (Scale lines: 0.5 mm, except 154, 155, 1.0 mm.)

Cave, Mayr's entrance, 17 Aug 1984, 1600 m (T.S. Briggs and D. Ubick, DU), 1♂, 1♀; Kings Canyon National Park: Redwood Canyon, Mayr's Cave, Nov 1966, 1600 m (V.F. Lee, CAS), 3♀; 16 Aug 1984 (T.S. Briggs, V.F. Lee, and D. Ubick, DU), 1♀; Sequoia National Park, 1945 (F.R. Oberhansley, AMNH), 1♀; Soda Cr., W of Camp Nelson (118°45'N, 36°09'W), 11 Jul 1958 (V.D. Roth and W.J. Gertsch, AMNH), 1♀.

DISTRIBUTION.—Known from the Fresno, Tuolumne, and Tulare counties in eastern California (Figure 117).

***Pimoa mono*, new species**

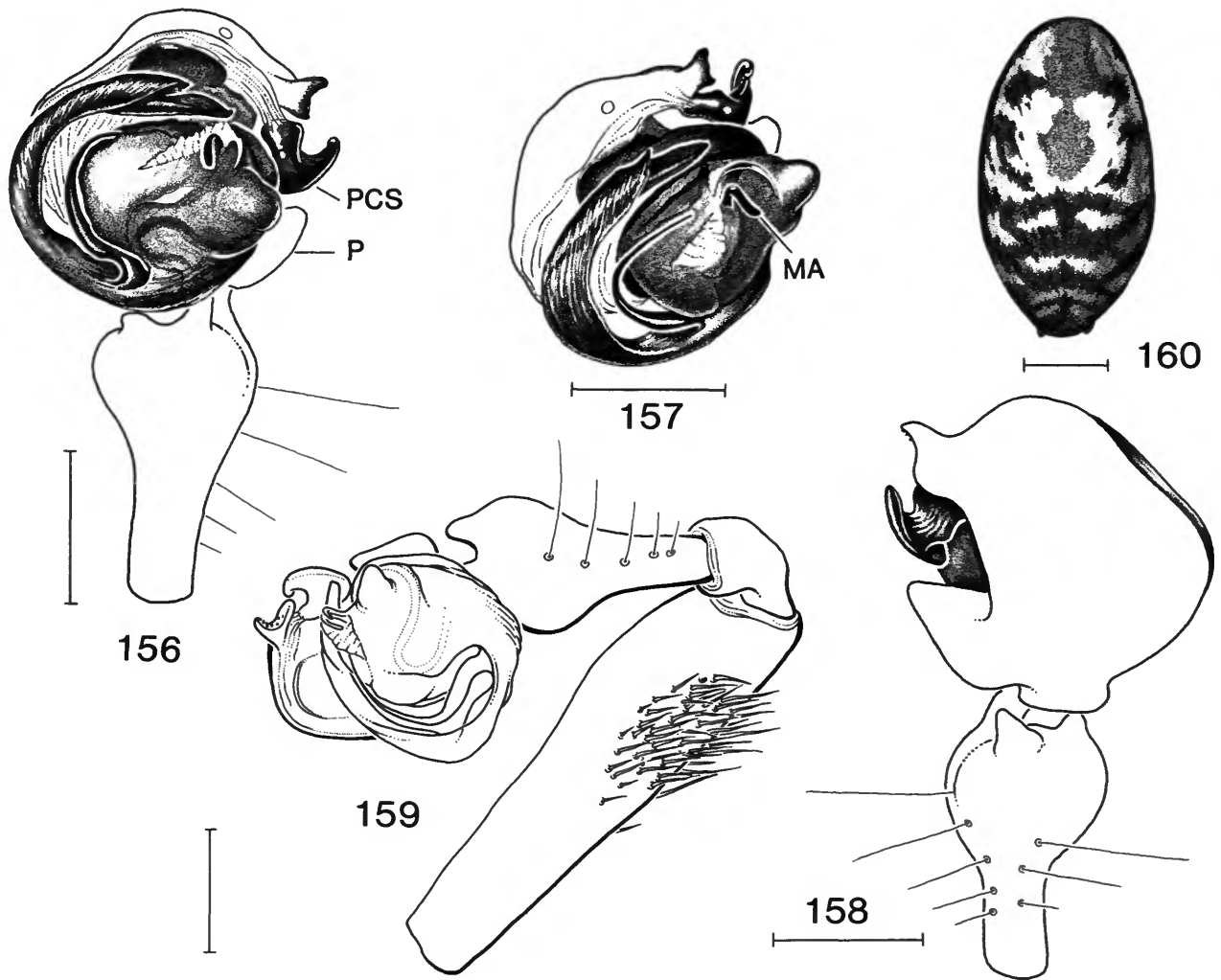
FIGURES 147-155, 117

TYPES.—Female holotype and three females paratypes from Meander Cave, Twin Lakes, near Mono Hot Springs, Mono Co., California; 3 Sep 1972, A. Jung, B. Lem, and T. Briggs col. Holotype deposited in CAS, paratypes deposited in DU.

ETYMOLOGY.—The species epithet is a noun in apposition taken from the county name of the type locality.

DIAGNOSIS.—It can be distinguished from its sister species





FIGURES 156-160.—*Pimoa haden* Chamberlin and Ivie, male from Washington: 156, palp, ventral; 157, same, apical; 158, same, dorsal; 159, holotype, palp, ventral; 160, abdomen, dorsal. (Scale lines: 0.5 mm, except 160, 1.0 mm.)

*hespera* by the rounded end of the epigynum and the small distance between the copulatory openings (Figures 152, 153).

**Male:** Unknown.

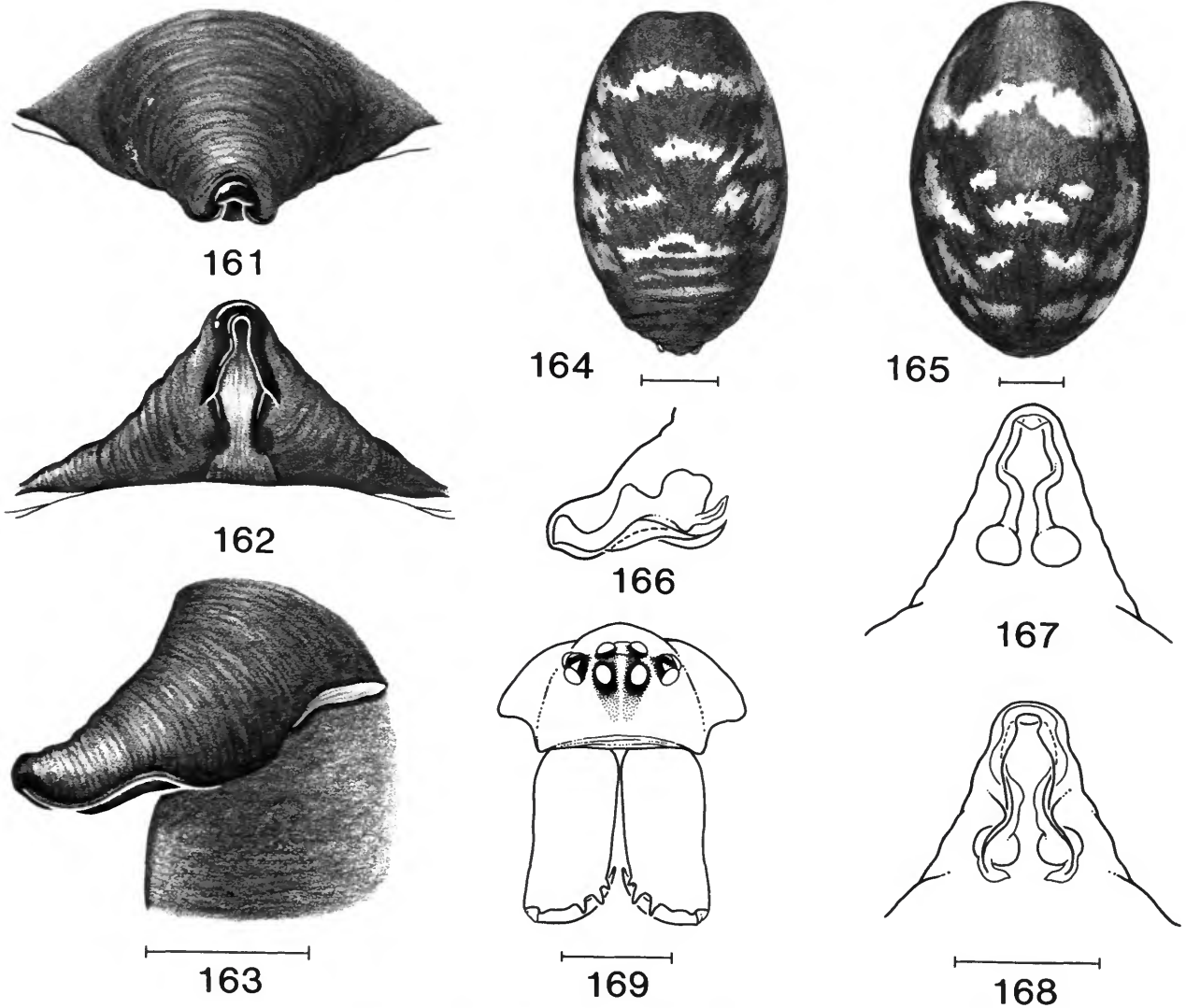
**Female (holotype):** Cephalothorax 5.0 long, 3.5 wide, 2.5 high; brown. Sternum 2.8 long, 2.1 wide; dark brown. Abdomen 6.0 long, 4.0 wide, 4.7 high; whitish with a dark gray pattern. AME diameter 0.20. PME 1.00, PLE 1.00, ALE 1.00 times one AME diameter. AME separation 0.90 times their diameter, PME separation 0.90 times their diameter. PME-PLE separation 1.20 times one PME diameter. AME-ALE separation 0.90 times one ALE diameter. Clypeus height 3.00 times one AME diameter. Chelicerae with three prolateral and two retrolateral teeth. Cheliceral stridulating files scale-like and inconspicuous. Legs dark reddish brown. Leg and pedipalp

lengths of female described above:

	I	II	III	IV	Pdp
Femur	10.9	9.8	7.4	8.8	2.1
Patella	1.9	1.9	1.5	1.6	0.6
Tibia	11.2	10.1	6.4	7.7	1.5
Metatarsus	11.4	9.9	2.1	7.8	—
Tarsus	4.2	3.6	2.3	2.8	2.1
Total	39.6	32.3	19.7	28.7	6.3

Legs 1243. Femur 1.28 times length of cephalothorax. Legs (particularly I and II) covered with long setae. Metatarsus I trichobothrium 0.88. Epigynum as in Figures 90, 147, 153.

**VARIATION.**—Female cephalothorax ranges in length from 4.2 to 5.0.



FIGURES 161-168.—*Pimosa haden* Chamberlin and Ivie, female: 161, paratype, epigynum, ventral; 162, same, dorsal; 163, same, lateral; 164, paratype, abdomen, dorsal; 165, female from Washington, abdomen, dorsal; 166, female from Washington, epigynum, cleared, lateral; 167, same, ventral; 168, same, dorsal; 169, cephalothorax, frontal. (Scale lines: 0.5 mm, except, 164, 165, 169, 1.0 mm.)

ADDITIONAL MATERIAL EXAMINED.—None.

DISTRIBUTION.—Known only from the type locality in eastern California (Figure 117).

*Pimosa haden* Chamberlin and Ivie

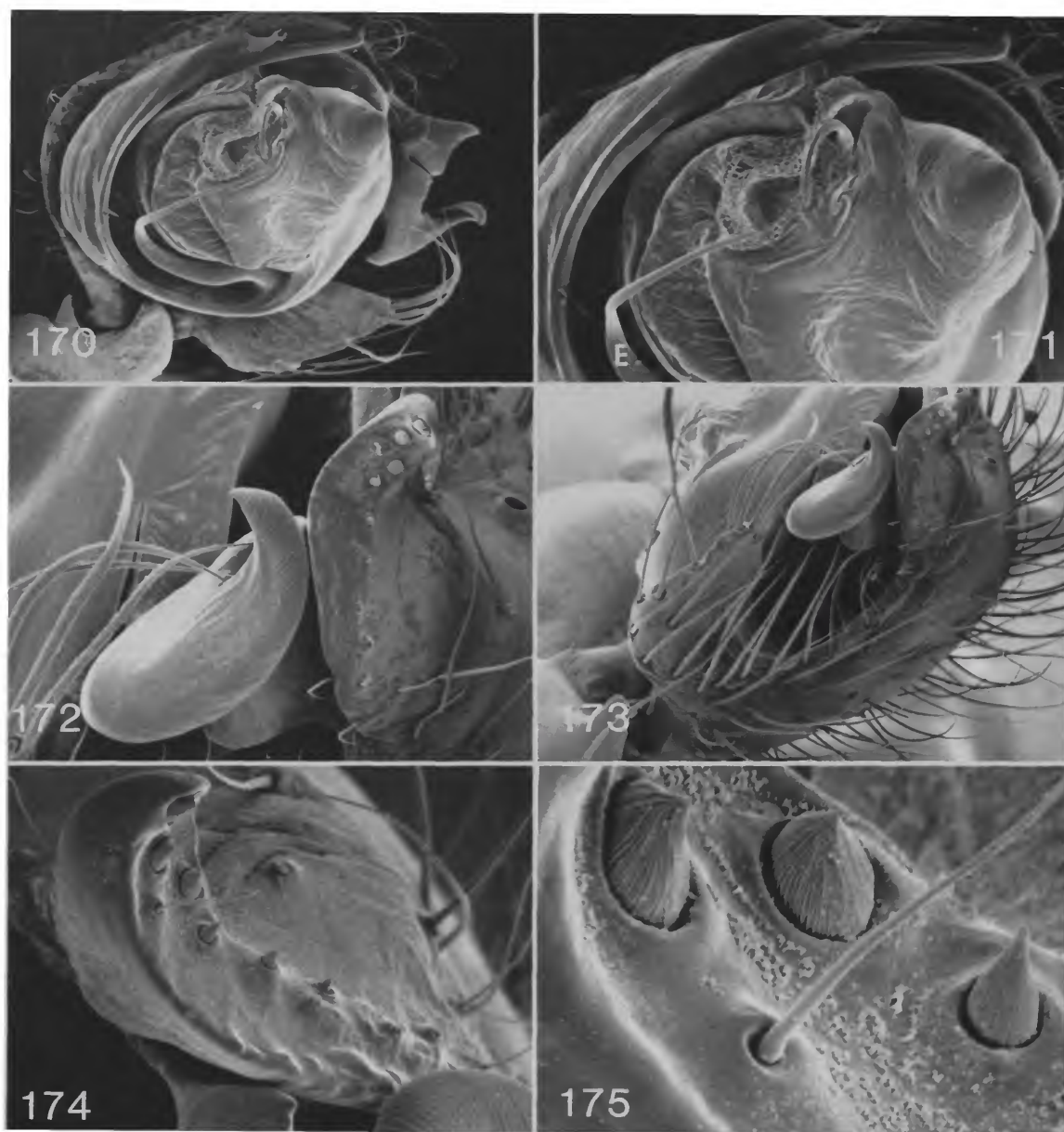
FIGURES 156-189

*Pimosa haden* Chamberlin and Ivie, 1943:10, figs. 13, 14 [♂, ♀].—Brignoli, 1975:13; 1983:231.—Crawford, 1988:23.—Roth, 1988:45.

TYPES.—Male holotype and female paratype, labels state “*Pimosa haden* Chamberlin and Ivie ♂ ♀ Idaho: Hayden Lake

♂ HOLOTYPE ♀ ALLOTYPE” and “Hayden Lake Ida. Lot. 34.70.” Deposited in AMNH. Examined.

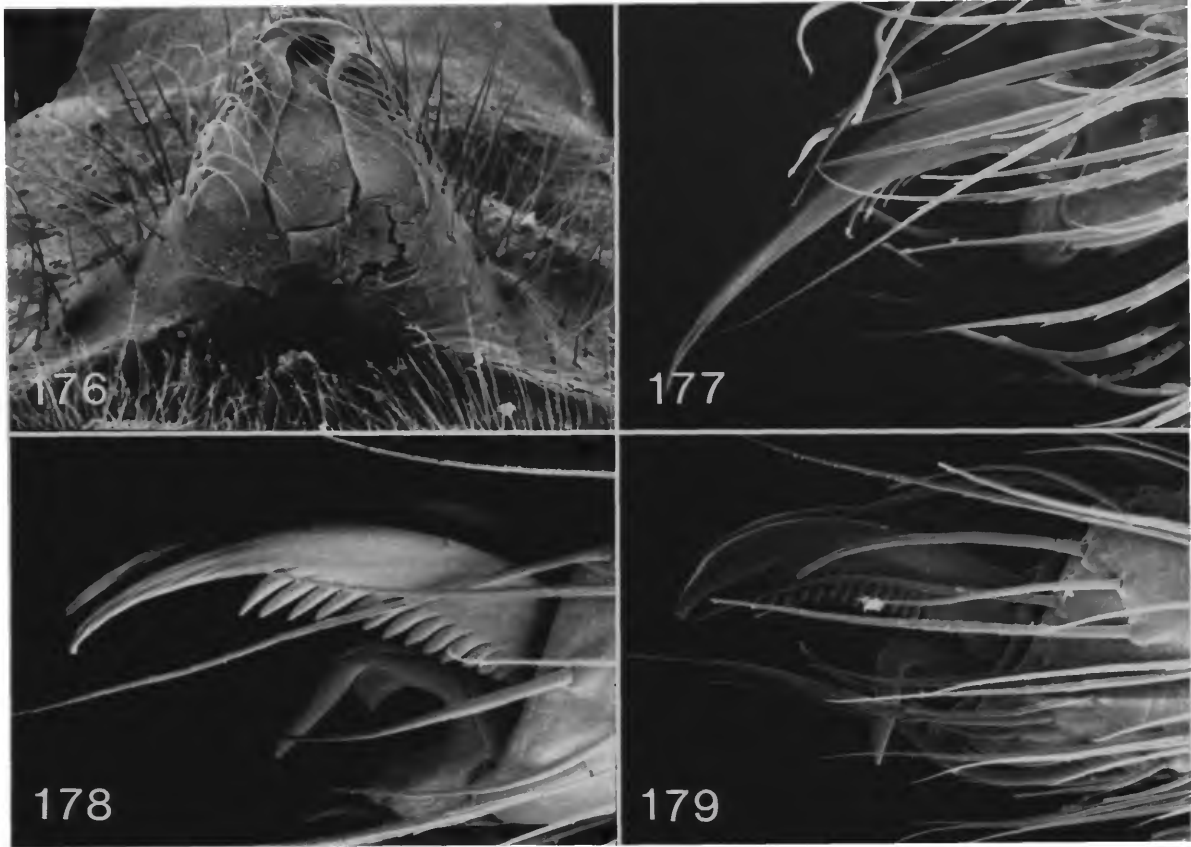
DIAGNOSIS.—Male with distal end of the PEP rolled (Figure 99) and five to six retrolateral trichobothria in the palpal tibia, which also has dorsal conical apophysis. Very similar to its sister species *jellisoni*, but can be distinguished from it because *haden* has thicker pedipalpal femur which bears a group of spines in its ectal side (Figure 159). Females of *haden* and *jellisoni* are difficult to tell apart when their respective males are not available. The epigynum of *haden* (Figures 161-163) is projected more perpendicularly to the abdominal wall than in *jellisoni*, which has it more parallel to the abdomen.



FIGURES 170–175.—*Pimoides haden* Chamberlin and Ivie, male from Washington: 170, palp, ventral; 171, palp, closeup of Figure 170; 172, PCS and cymbial denticulated process; 173, palp, ectal; 174, cymbial denticulated process; 175, cymbial denticles.

**Male** (from Cedar Lake, Washington): Total length 7.9. Cephalothorax 4.0 long, 3.0 wide, 2.1 high; red-brown, slightly darker at margins. Sternum 2.3 long, 1.8 wide; dark brown. Abdomen 3.9 long, 2.6 wide, 4.7 high whitish with a dark gray pattern (Figure 158). AME diameter 0.22; whitish with a dark gray pattern. PME 0.58, PLE 0.73, ALE 0.91 times one AME diameter. AME separation 0.45 times their diameter, PME

separation 1.00 times their diameter. PME-PLE separation 1.00 times one PME diameter, AME-ALE separation 0.44 times one ALE diameter. Clypeus height 2.27 times one AME diameter. Chelicerae with three prolateral and two retrolateral teeth. Cheliceral stridulating files present and conspicuous. Legs red brown, without annuli. Leg and pedipalp lengths of male described above:



FIGURES 176-179.—*Pimoides haden* Chamberlin and Ivie: 176, female from Washington, epigynum; 177, female from Washington, pedipalpal claw; 178, male from Washington, tarsal claw I; 179, female from Washington, tarsal claw I.

	I	II	III	IV	Pdp
Femur	9.6	8.4	6.1	7.7	2.4
Patella	1.5	1.4	1.2	1.3	0.7
Tibia	10.5	9.3	5.7	7.5	1.1
Metatarsus	10.8	9.8	6.4	3.6	—
Tarsus	3.5	3.2	1.9	2.7	1.1
Total	35.9	32.1	21.3	22.8	5.3

Legs 1243. Femur I 2.40 times length of cephalothorax. Legs covered with long setae. Metatarsus I trichobothrium 0.87. Pedipalp as in Figures 156-159, 170-175.

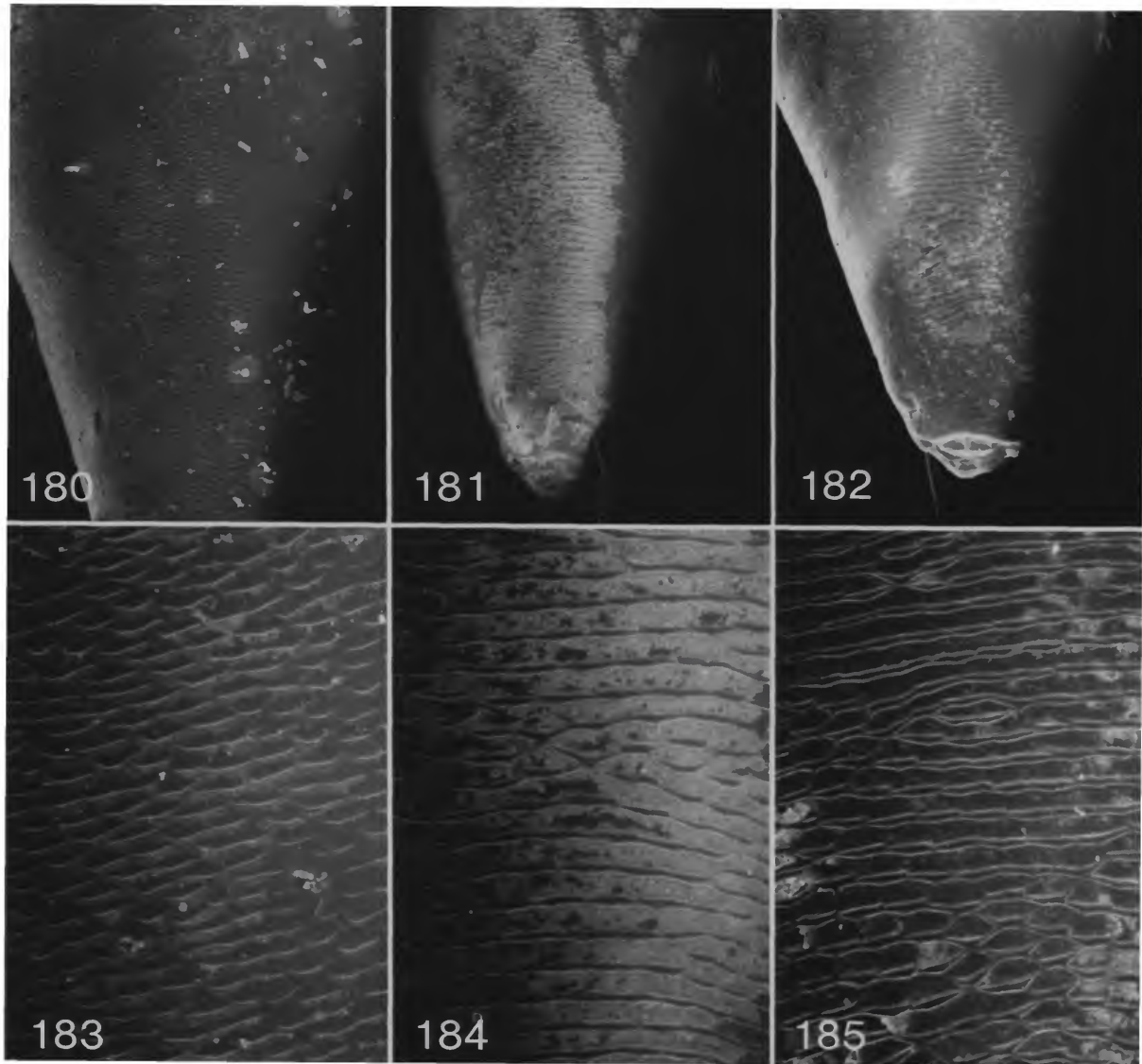
*Female* (same locality than male): Total length 7.4. Cephalothorax 3.4 long, 2.6 wide, 2.0 high; brown, slightly darker at margins. Sternum 2.1 long, 2.0 wide; dark brown. Abdomen 3.7 long, 2.9 wide, 4.2 high; whitish with a dark gray pattern (Figures 164, 165). AME diameter 0.20. PME 0.75, PLE 0.85, ALE 0.90 times one AME diameter. AME separation 0.50 times their diameter, PME separation 1.00 times their diameter. PME-PLE separation 1.00 times one PME diameter, AME-ALE separation 0.56 times one ALE diameter. Clypeus

height 1.90 times one AME diameter. Chelicerae with three prolateral and two retrolateral teeth. Cheliceral stridulating files absent. Legs brown, without annuli. Leg and pedipalp lengths of female described above:

	I	II	III	IV	Pdp
Femur	6.3	5.8	4.5	5.9	1.3
Patella	1.2	1.1	1.0	1.1	0.4
Tibia	6.6	5.9	3.7	5.5	0.9
Metatarsus	7.2	5.6	3.0	5.2	—
Tarsus	2.7	2.4	1.6	2.1	1.4
Total	24.0	20.8	13.8	19.8	4.0

Legs 1243. Femur I 1.85 times length of cephalothorax. Legs covered with long setae. Metatarsus I trichobothrium 0.89. Epigynum as in Figures 161-163, 166-168, 176.

VARIATION.—Male cephalothorax ranges in length from 3.0 to 4.0, female from 2.2 to 4.6. The number of tibial retrolateral trichobothria of the male palp varies between five and six. Variation in cheliceral striae in two different males can be seen in Figures 181, 182, 184, 185. Some females show subtle

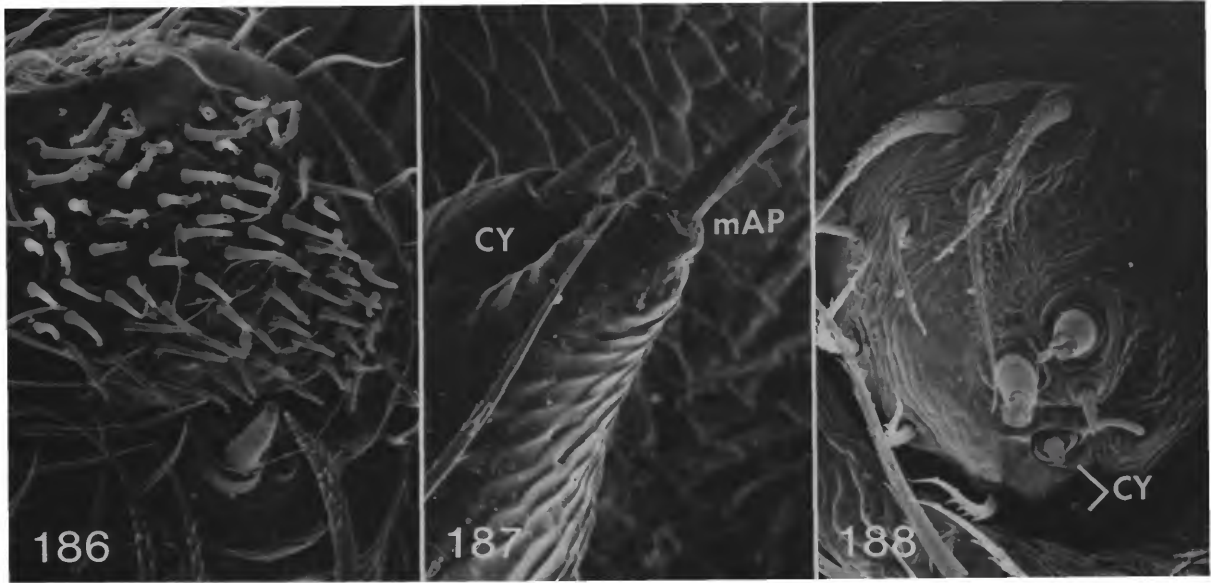


FIGURES 180-185.—*Pimoa haden* Chamberlin and Ivie, cheliceral striae: 180, female from Washington; 181, male from Washington; 182, male from Washington; 183, closeup of Figure 180; 184, closeup of Figure 181; 185, closeup of Figure 182.

cheliceral striae (Figures 180, 183).

ADDITIONAL MATERIAL EXAMINED.—CANADA: BRITISH COLUMBIA: Stagleap Park (49°05'N, 117°02'W), 24 Dec 1980, on snow, 5000 ft (I. Askevold, CNC), 1♂. UNITED STATES: IDAHO: Clearwater Co.: Pierce (46°30'N, 115°47'W), 29 Aug 1959 (W.J. Gertsch, V. Roth, AMNH), 1♂, 7♀. Kootenai Co.: Coeur d'Alene, Aug 1949 (Mulaik, AMNH), 1♂. Shoshone Co.: Wallace, 3 Sep 1949 (S. Mulaik, AMNH), 2♀. MONTANA: Sanders Co.: Thompson Falls, 26-30 Jun 1950 (B. Malkin, AMNH), 1♀. WASHINGTON: Pend Oreille Co.: Crawford State

Park (48.995°N, 117.370°W), 21 Oct 1980, web on outside of building, 2680 ft (R. Crawford, UW), 1♀; Middle Br. Leclerc Cr. (48.595-597°N, 117.266°W), 9 Jun 1986, under log bark, 2840 ft (R. Crawford, UW), 1♀. Stevens Co.: Cedar Lake (48°55'N, 117°36'W), 30 Sep 1964 (J. and W. Ivie, AMNH), 1♂, 8♀; Cedar Lake, N of Lead Point (48°56'N, 117°36'W), 27 Jul 1968 (W. Ivie, AMNH), 3♀; Cedar Lake, N of Lead Point (48°56'N, 117°36'W), Apr to Jun 1968 (H. Cusic, AMNH), 1♀; Cedar Lake, N of Lead Point (48°55'N, 117°35'W), May 1962 (W. Ivie, AMNH), 1♂, 17♀; Cedar



FIGURES 186-188.—*Pimoida haden* Chamberlin and Ivie, spinnerets, female from Washington: 186, ALS; 187, PMS; 188, PLS.

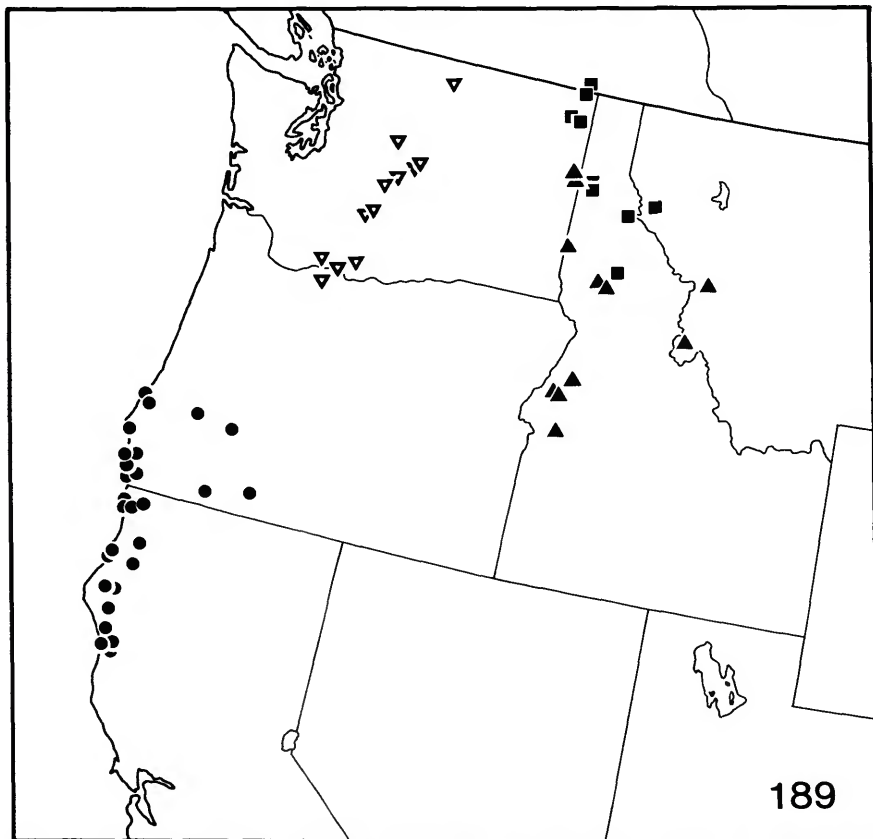
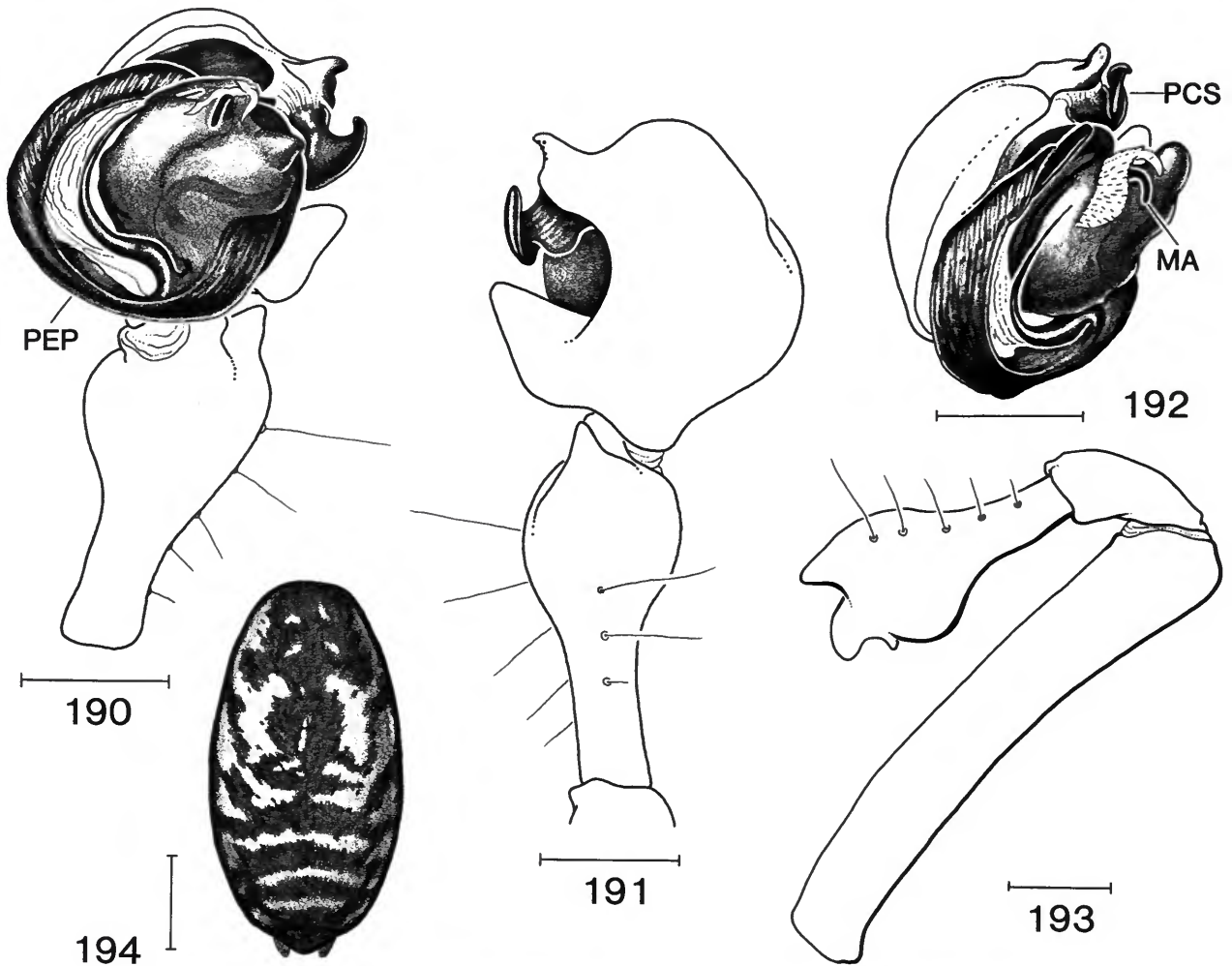


FIGURE 189.—Distributions of *Pimoida curvata* Chamberlin and Ivie (inverted open triangles), *P. jellisoni* (Gertsch and Ivie) (closed upright triangles), *P. haden* Chamberlin and Ivie (squares), and *P. breviata* Chamberlin and Ivie (circles).



FIGURES 190-194.—*Pimooa jellisoni* (Gertsch and Ivie), male from Idaho: 190, palp, ventral; 191, same, dorsal; 192, same, apical; 193, pedipalp (cymbium removed), ectal; 194, male from Washington, abdomen, dorsal. (Scale lines: 0.5 mm, except 194, 1.0 mm.)

Lake, N of Lead Point (48°55'N, 117°35'W), May 1968 (W. Ivie, AMNH), 7♀; Cedar Lake, N of Lead Point (48°55'N, 117°35'W), 1-10 Jun 1968 (W. Ivie, AMNH), 1♀; Cedar Lake (48°55'N, 117°36'W), 10 Sep 1963 (J. and W. Ivie, AMNH), 2♂, 2♀.

DISTRIBUTION.—Northern Idaho, northeastern Washington, northwestern Montana, and their bordering region of Canada (Figure 189).

*Pimooa jellisoni* (Gertsch and Ivie)

FIGURES 189-217

*Labulla jellisoni* Gertsch and Ivie, 1936:18-19, figs. 37-38 [♀].—Gertsch and Jellison, 1939:4-5.—Bonnet, 1957:2335.

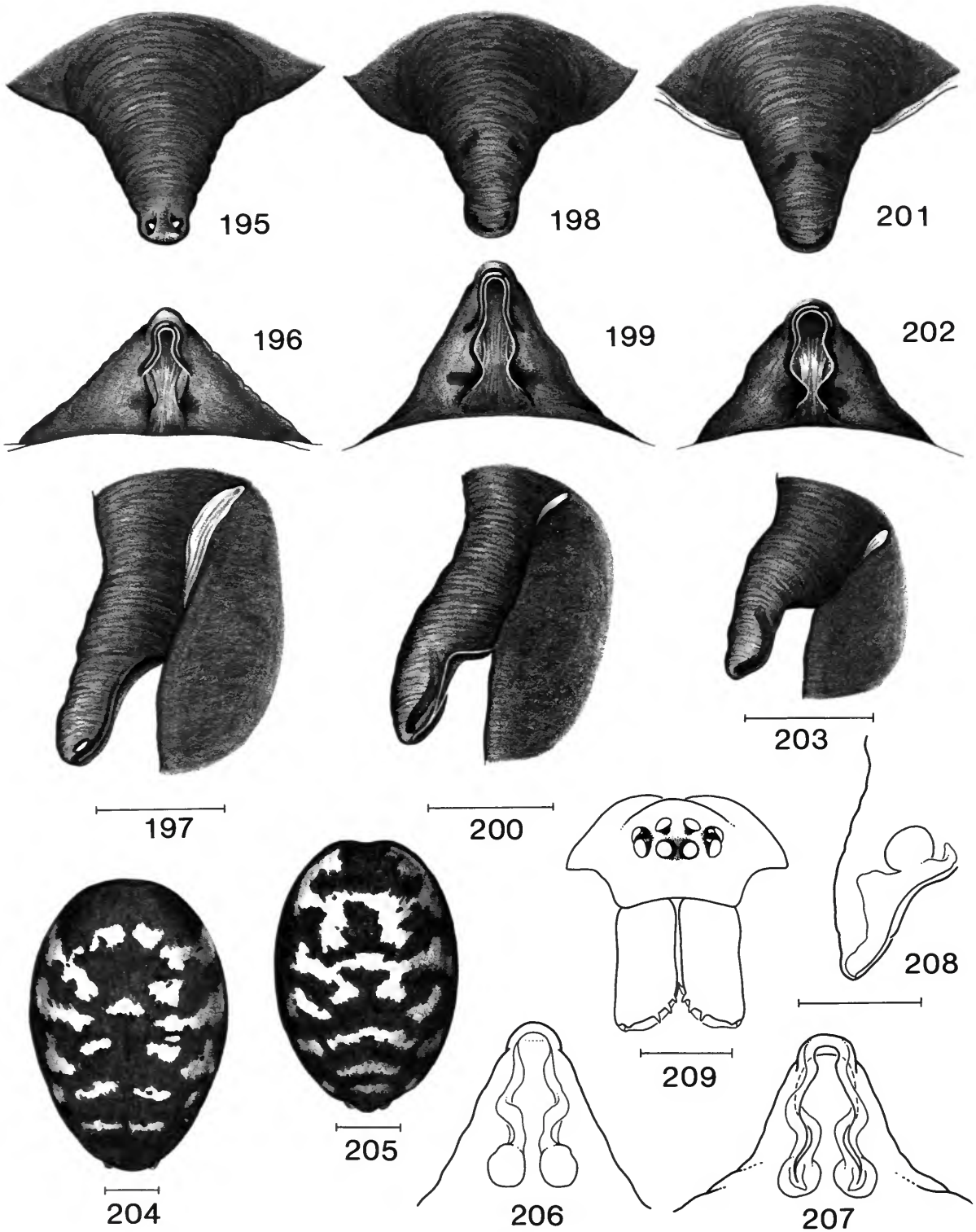
*Labulla jellisoni*.—Roewer, 1942:577 [lapsus calami].

*Labulla ellisoni*.—Fage, 1946:387 [lapsus calami].

*Pimooa jellisoni*.—Chamberlin and Ivie, 1943:10, fig. 12 [♂].—Brignoli, 1971:163; 1975:13.—Roth, 1988:45.

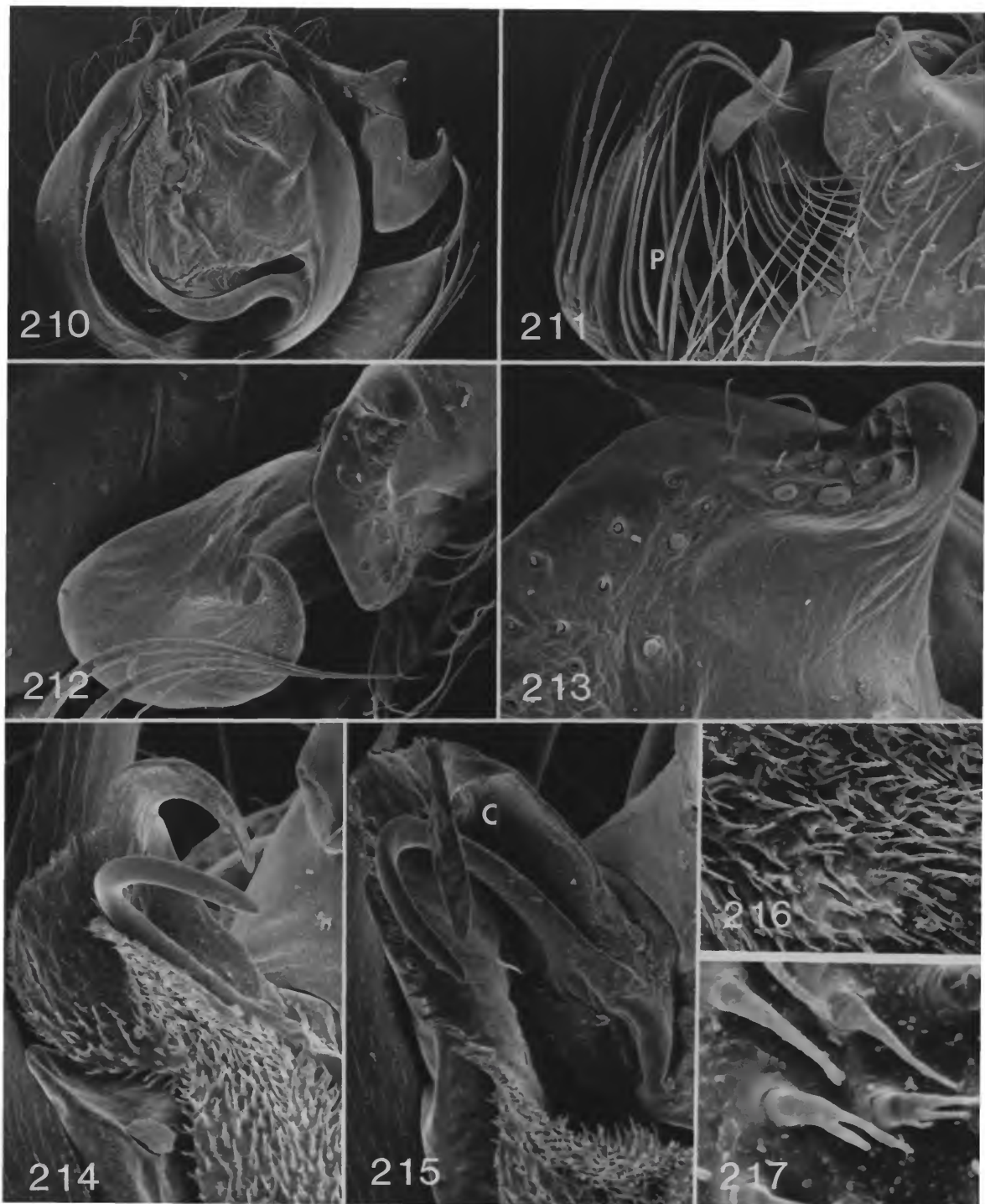
TYPES.—Female holotype, label states "Labulla jellisoni G and I. Blodgett Canyon, ♀ holotype April 21, 1933 Mont. Jellison." Female paratype "West Fork, Ravalli Co. ♀PARATYPE Mar 11, 1934 Montana W. Jellison." Deposited in AMNH. Examined.

DIAGNOSIS.—Male very similar to its sister species *haden*, but can be distinguished by a slimmer palpal femur (Figure 193), which lacks the cluster of spines characteristic of *haden*. Females are difficult to distinguish from *haden* in the absence of males. Although the epigynum seems to be quite variable (Figures 195-203) it is usually less protruding (more parallel to



FIGURES 195-209.—*Pimoa jellisoni* (Gertsch and Ivie), female: 195, holotype, ventral; 196, same, dorsal; 197, same, lateral; 198, female from Montana, ventral; 199, same, dorsal; 200, same, lateral; 201, female from Montana, ventral; 202, same, dorsal; 203, same, lateral; 204, female from Washington, abdomen, dorsal; 205, female from Idaho, abdomen, dorsal; 206, female from Washington, epigynum, cleared, ventral; 207, same, dorsal; 208, same, lateral; 209, cephalothorax, frontal. (Scale lines: 0.5 mm, except 204, 205, 209, 1.0 mm.)





FIGURES 210-217.—*Pimco jellisoni* (Gertsch and Ivie), male from Idaho: 210, palp, ventral; 211, palp, dorsoectal closeup; 212, PCS and cymbial denticulated process; 213, cymbial denticulated process; 214, conductor and median apophysis; 215, conductor and median apophysis; 216, 217, conductor, closeups.

the abdominal wall) than in *haden*.

**Male** (from Lost Lake, Idaho): Total length 8.6. Cephalothorax 4.0 long, 3.1 wide, 2.0 high; brown, slightly darker at margins. Sternum 2.4 long, 1.9 wide; brown. Abdomen 4.2 long, 3.3 wide, 5.1 high; whitish with dark gray pattern. AME diameter 0.20. PME 0.90, PLE 0.90, ALE 0.90 times one AME diameter. AME separation 0.50 times their diameter, PME separation 0.78 times their diameter. PME-PLE separation 1.11 times one PME diameter, AME-ALE separation 1.11 times one ALE diameter. Clypeus height 2.50 times one AME diameter. Chelicerae with three prolateral and two retrolateral teeth. Cheliceral stridulating files present. Legs red-brown, without annuli. Leg and pedipalp lengths of male described above:

	I	II	III	IV	Pdp
Femur	10.8	9.5	7.0	8.5	2.8
Patella	1.5	1.5	1.2	1.3	0.8
Tibia	11.3	10.0	6.1	8.2	1.2
Metatarsus	13.7	11.2	7.0	9.0	—
Tarsus	3.6	3.3	2.3	2.7	1.2
Total	40.9	35.5	32.6	29.7	6.0

Legs 1243. Femur I 2.70 times length of cephalothorax. Legs covered with long setae. Metatarsus I trichobothrium 0.93. Pedipalp as in Figures 190–193, 210–217.

**Female** (same locality as male): Total length 8.8. Cephalothorax 4.5 long, 3.4 wide, 2.3 high; brown, slightly darker at margins. Sternum 2.5 long, 1.8 wide; dark brown. Abdomen 4.5 long, 3.3 wide, 3.5 high; whitish with dark gray pattern. AME diameter 0.20. PME 0.90, PLE 0.90, ALE 0.90 times one AME diameter. AME separation 0.70 times their diameter, PME separation 1.00 times their diameter. PME-PLE separation 1.00 times one PME diameter, AME-ALE separation 0.67 times one ALE diameter. Clypeus height 2.40 times one AME diameter. Chelicerae with three prolateral and two retrolateral teeth. Cheliceral stridulating files present, but inconspicuous and ridges scale-like. Legs brown, without annuli. Leg and pedipalp lengths of female described above:

	I	II	III	IV	Pdp
Femur	8.0	7.3	5.6	7.1	1.7
Patella	1.7	1.6	1.3	1.4	0.6
Tibia	8.3	7.5	4.8	6.8	1.2
Metatarsus	7.8	7.2	5.2	6.6	—
Tarsus	3.3	2.8	2.1	2.4	1.9
Total	29.1	26.4	19.0	24.3	5.4

Legs 1243. Femur I 1.78 times length of cephalothorax. Legs covered with long setae. Metatarsus I trichobothrium 0.88. Epigynum as in Figures 195–203, 206–208.

**VARIATION**.—Male cephalothorax ranges in length from 2.9 to 4.1, female from 3.0 to 4.5. Some specimens have a particularly dark coloration. The morphology of the epigynum is quite variable (Figures 195–203).

**ADDITIONAL MATERIAL EXAMINED**.—UNITED STATES: IDAHO: Adams Co.: 7 mi (11.2 km) NE of Council (44°48'N,

116°22'W), 5 Aug 1943 (W. Ivie, AMNH), 4♂, 1♀; summit 7 mi (11.2 km) NE of Council (44°49'N, 116°24'W), 7 Oct 1944 (W. Ivie, AMNH), 2♀; Evergreen Camp, Upper Weiser river (44°52'N, 116°22'W), 2 Jul 1943 (W. Ivie, AMNH), 3♀; 6 Aug 1943 (W. Ivie, AMNH), 1♂, 1♀; Boise Co.: Lost Lake, below dam (44°N, 116°W), 20 Aug 1936 (W. Ivie, AMNH), 15♀; 7 Aug 1943 (W. Ivie, AMNH), 1♂, 2♀; Clearwater Co.: Greer (46°24'N, 116°04'W), 30 Aug 1959 (W.J. Gertsch and V. Roth, AMNH), 1♀; Idaho Co.: Clearwater Creek, nr Kooskia (46°N, 115°W), 23 Aug 1940 (W. Ivie, AMNH), 2♀; Mud Cr. Jct, 25 Nov 1978, with grylloblattids on snow (AMNH), 2♂, 2♀; Latah Co.: Moscow Mts., Moscow, Jun 1936 (C.B. Philips, AMNH), 1♀; Valley Co.: NE of McCall (44°55'N, 116°04'W), 31 May 1944 (W. Ivie, AMNH), 2♀. MONTANA: Granite Co.: Rock Creek Rec. Area, Kitchen Gulch, Lolo Natl. Forest, 23 Sep 1950, (V. Roth, AMNH), 3♀; Ravali Co.: Forest Service, Garbae Pt., East Fork, 24 Jul 1944 (Jellison, AMNH), 1♀. WASHINGTON: Spokane Co.: Newman Lake, 29 May 1937 (M.H. Hatch, CAS), 1♀; Spokane Mt., 25 mi (40 km) NE of Spokane, 28 Aug 1959 (V. Roth and W.J. Gertsch, AMNH), 8♂, 17♀; Mt. Spokane, 30 May 1937 (M.H. Hatch, CAS), 1♀.

**DISTRIBUTION**.—Idaho, northeastern Washington, and western Montana (Figure 189).

### *Pimosa gandhii*, new species

FIGURES 218–232

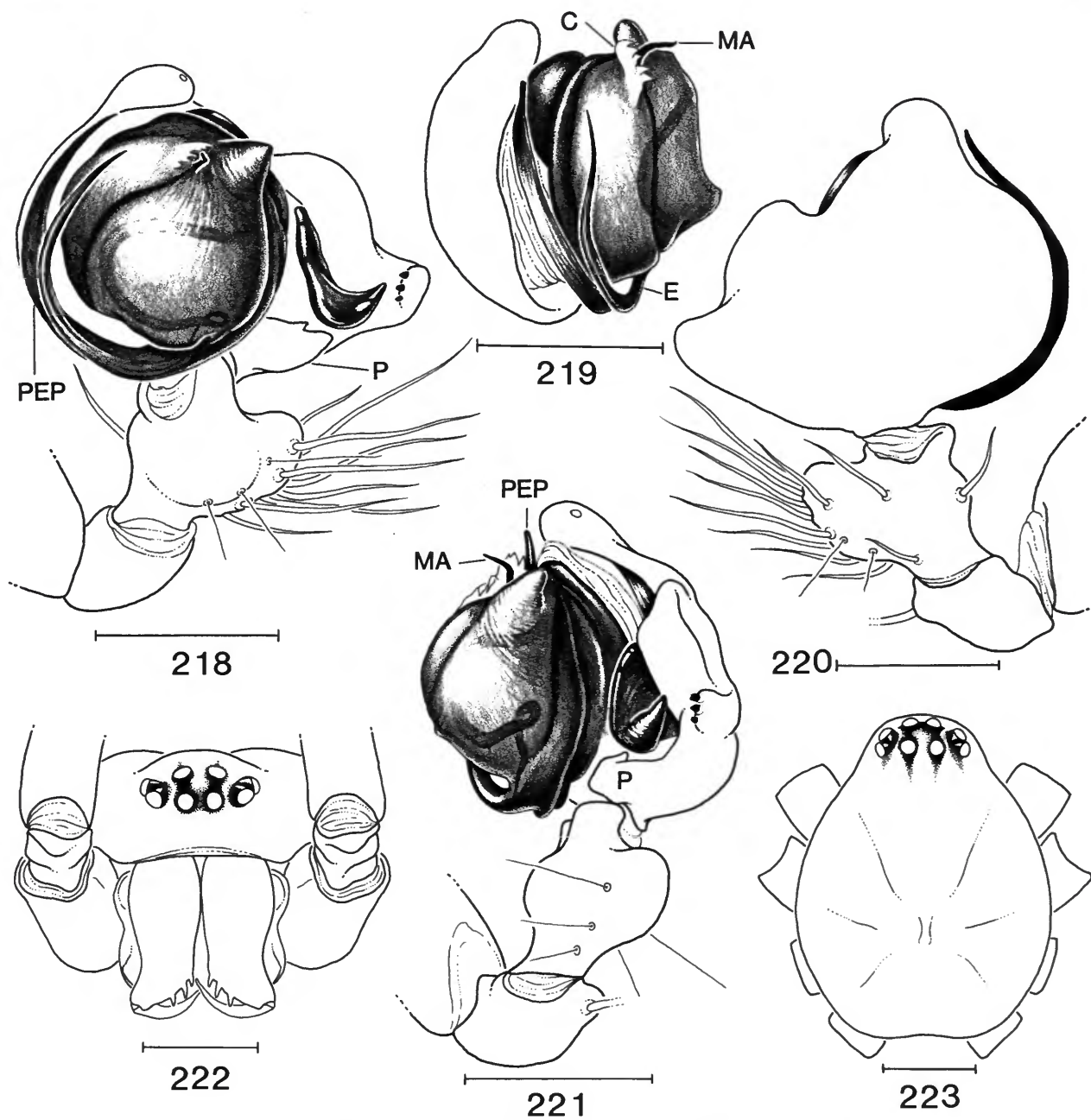
**TYPES**.—Male holotype and two females paratypes, label states "India: Kashmir, Pahalgum [sic.] Oct 24–30 1989, Riwe forests, V. and B. Roth 1♂+ 2♀." Deposited in USNM.

**NOTE**.—The correct locality spelling is Pahlgam, Kashmir South (34°00'N, 75°23'E).

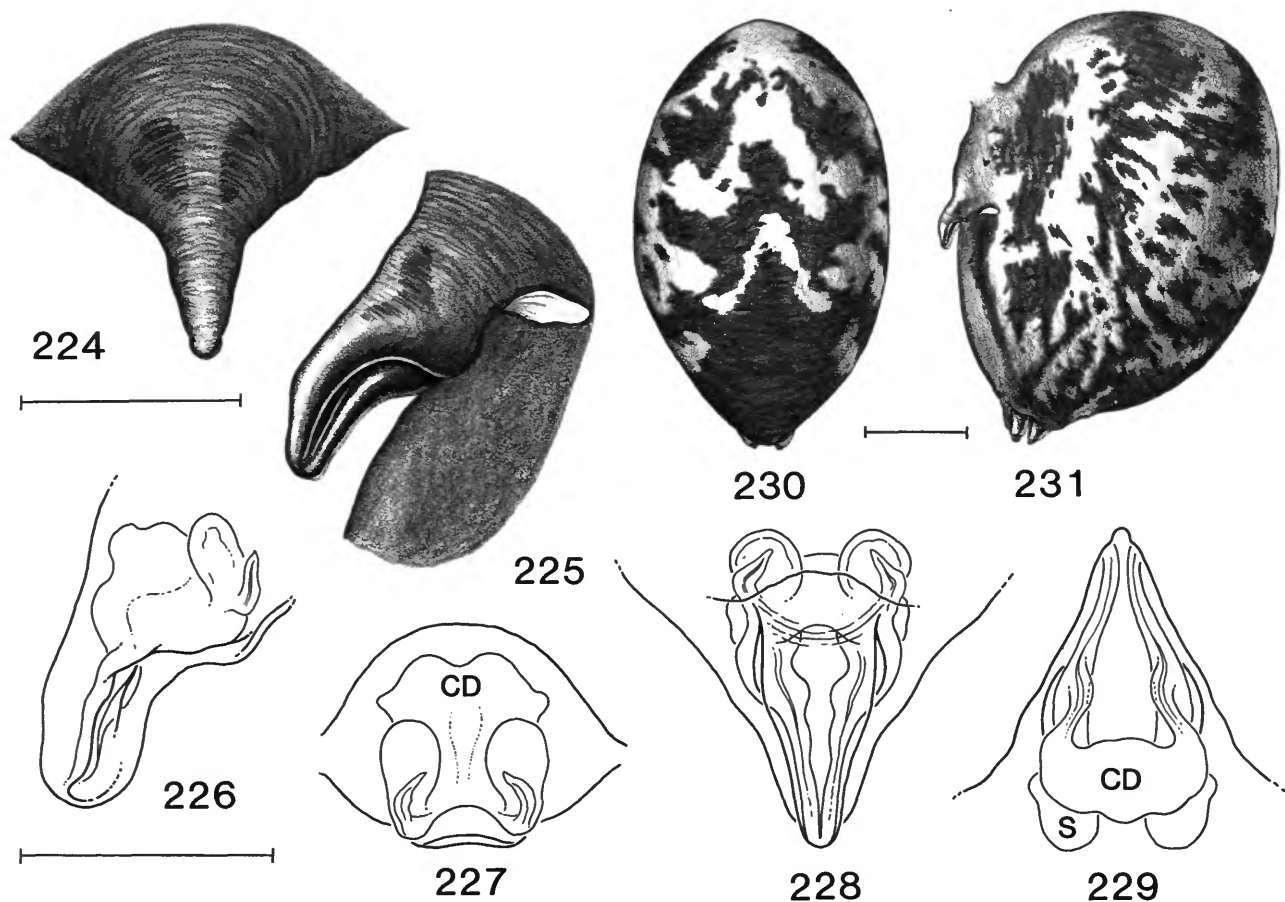
**ETYMOLOGY**.—The species epithet is a patronym in honor of Mohandas K. Gandhi.

**DIAGNOSIS**.—Males can be distinguished by having the denticulated cymbial process in a relatively basal position, with only three or four denticles (Figure 218). The distal end of the CDP is broader than in *sinuosa* and *nematoide*. Females can be distinguished having a lateral epigynal fold with "lips" of approximately the same width and fused copulatory ducts (Figures 224–229).

**Male** (holotype): Cephalothorax 3.7 long, 2.7 wide, 1.7 high; yellowish brown with dark gray margins and central longitudinal line. Sternum 1.90 long, 1.49 wide; dark gray. AME diameter 0.18. PME 1.00, PLE 1.00, ALE 1.00 times one AME diameter. AME separation 0.55 times their diameter, PME separation 0.55 times their diameter. PME-PLE separation 1.00 times one PME diameter, AME-ALE separation 1.00 times one ALE diameter. Clypeus height 2.00 times one AME diameter. Chelicerae with three prolateral and three retrolateral teeth. Cheliceral stridulating files present. Legs reddish brown with dark gray annuli. Leg and pedipalp lengths of male described above:



FIGURES 218-223.—*Pimoa gandhii*, new species, male (holotype): 218, palp, ventral; 219, same, apical; 220, same, dorsal; 221, same, ectal; 222, cephalothorax, frontal; 223, same, dorsal. (Scale lines: 0.5 mm, except, 222, 223, 1.0 mm.)



FIGURES 224-231.—*Pimoa gandhii*, new species, female (paratype): 224, epigynum, ventral; 225, same, lateral; 226, epigynum, cleared, lateral; 227, same, anterior; 228, same, dorsal; 229, same, ventral; 230, abdomen, dorsal; 231, same, lateral. (Scale lines: 0.5 mm, except 230, 231, 1.0 mm.)

	I	II	III	IV	Pdp
Femur	7.1	6.1	4.3	5.4	1.0
Patella	1.3	1.3	0.9	1.0	0.4
Tibia	7.2	6.1	3.7	—	0.5
Metatarsus	7.1	6.0	4.0	—	—
Tarsus	2.9	2.2	1.5	—	0.9
Total	25.5	21.7	14.4	—	2.8

Legs 1243. Femur I 1.92 times length of cephalothorax, with a row of thick prolateral spines. Legs covered with long setae. Metatarsus I trichobothrium 0.91. Pedipalp as in Figures 218-221.

**Female (paratype):** Cephalothorax 3.1 long, 2.1 wide, 1.8 high; yellowish brown with dark gray margins and central longitudinal line. Sternum 1.4 long, 1.2 wide; dark gray. Abdomen 4.3 long, 2.5 wide, 2.7 high; light brown with very dark gray pattern (Figures 230, 231). AME diameter 0.15. PME 1.29, PLE 1.14, ALE 1.00 times one AME diameter. AME

separation 0.86 times their diameter, PME separation 0.66 times their diameter. PME-PLE separation 1.00 times one PME diameter, AME-ALE separation 0.77 times one ALE diameter. Clypeus height 2.43 times one AME diameter. Chelicerae with three prolateral and three retrolateral teeth. Cheliceral stridulating files scale-like. Legs light brown with dark gray annuli. Leg and pedipalp lengths of female described above:

	I	II	III	IV	Pdp
Femur	4.7	4.1	3.2	3.7	1.0
Patella	1.2	1.1	0.9	0.9	0.3
Tibia	4.7	3.9	2.5	—	0.7
Metatarsus	4.1	3.5	2.6	—	—
Tarsus	2.0	1.7	1.3	—	1.3
Total	16.7	14.3	10.5	—	3.3

Legs 1243. Femur I 1.51 times length of cephalothorax. Legs covered with long setae. Metatarsus I trichobothrium 0.89. Epigynum as in Figures 224-229.

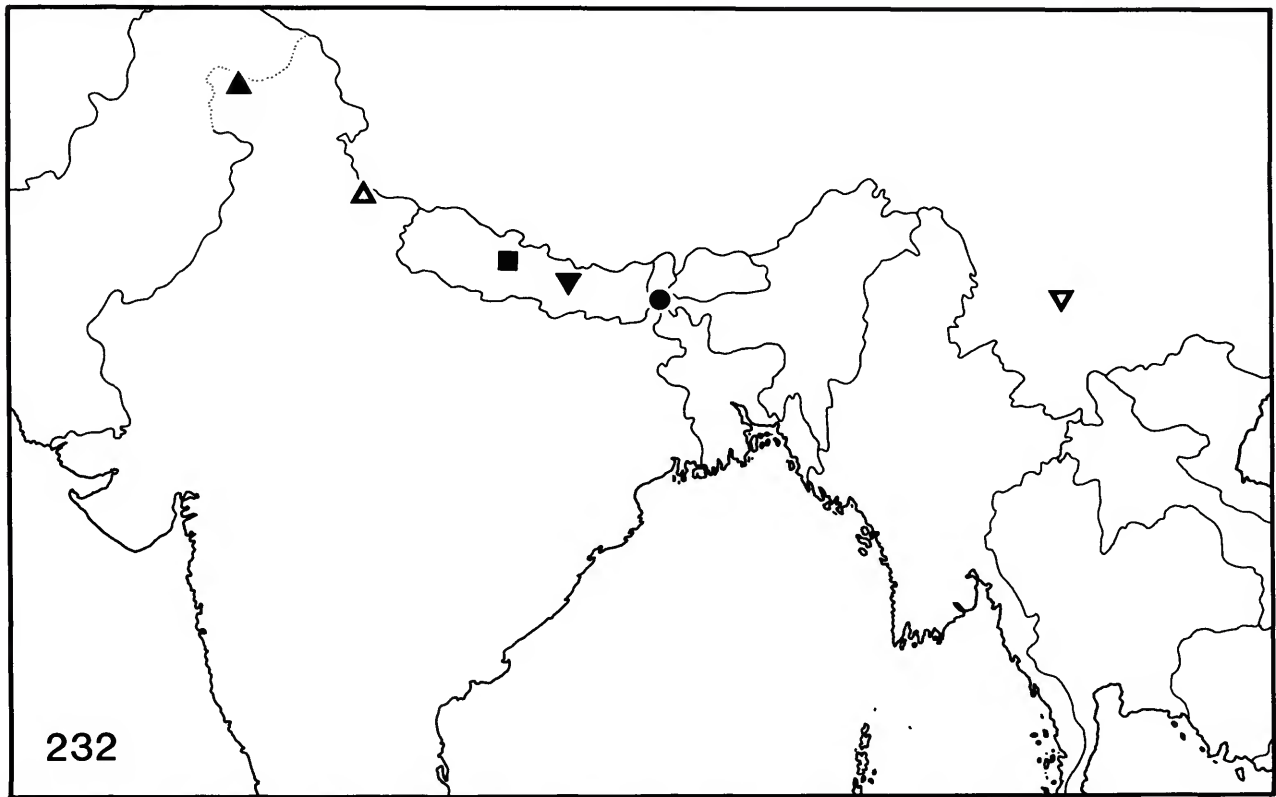


FIGURE 232.—Distributions of *Pimoa gandhii*, new species (closed upright triangle), *P. crispa* (Fage) (open upright triangle), *P. sinuosa*, new species (square), *P. nematoide*, new species (closed inverted triangle), *P. indiscreta*, new species (circle), and *P. anatolica*, new species (open inverted triangle).

**VARIATION.**—Female cephalothorax ranges in length from 2.7 to 3.1.

**ADDITIONAL MATERIAL EXAMINED.**—None.

**DISTRIBUTION.**—Known only from the type locality in the South Kashmir region of India (Figure 232).

### *Pimoa crispa* (Fage)

FIGURES 232–247

*Metella crispa* Fage, 1946:385–387, figs. 3, 4 [♂, ♀].

*Acrometa crispa*.—Wunderlich, 1979:413.

*Louisfagea crispa*.—Brignoli, 1971:163; 1983:229.—Thaler, 1976:209.—Crawford, 1988:23.

*Pimoa crispa*.—Horniga, 1993:534.

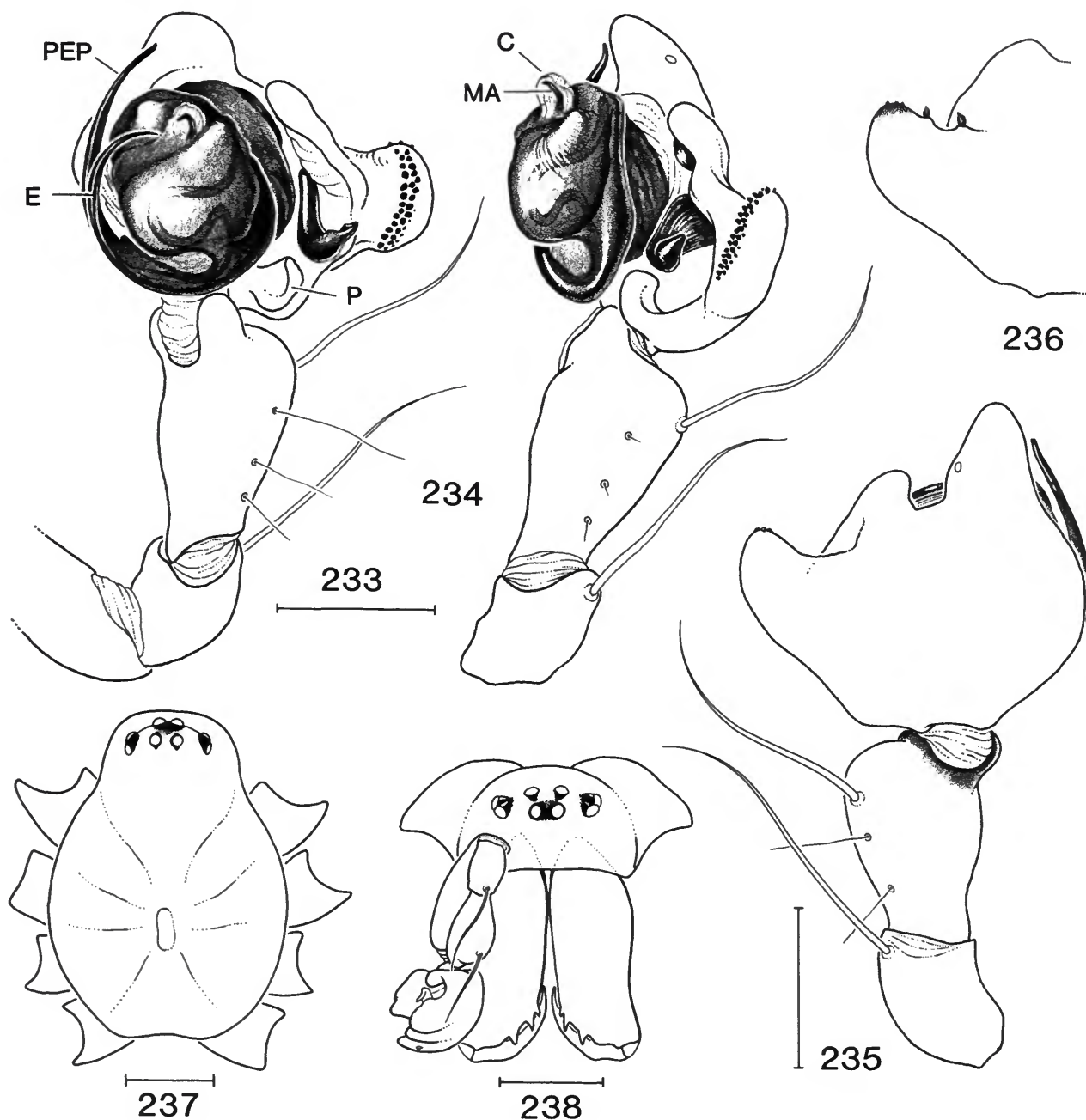
**TYPES.**—One male and one female syntypes (included in the same vial there are two adult male pedipalps and one epigynum), label states “*Metella crispa* Fage Grotte de Moila Swallet Inde Types! Chakrata Tahsil. Dehra-Dun district.” Deposited in MNHM. Examined.

**NOTE.**—A more detailed description of the type locality is given in Fage (1946:382, 387): India, Chakrata, Dehra Dun

district (30°46'N, 77°47'E), 2550 m alt. E.A. Glennie Coll.. Type locality: “Toad Hole; Moila Caves; Moila Swallet; Surflet Pot; 4♂, nombreuses ♀ et nombreux jeunes.” The rest of the syntype series is apparently lost.

**DIAGNOSIS.**—Male palp with a large and broad lateral cymbial denticulated process, with numerous denticles. The paracymbium is short and procurved. Pedipalpal tibia at least longer than twice its width (Figures 233). Epigynum with lateral fold. Copulatory ducts with a single turn and not fused (Figures 244–247).

**Male** (syntype): Cephalothorax 3.9 long, 2.8 wide, 1.9 high; very light brown. Stemum 2.3 long, 1.8 wide; very light brown. Abdomen 3.7 long; yellowish. AME diameter 0.16. PME 1.00, PLE 1.00, ALE 1.00 times one AME diameter. AME separation 0.50 times their diameter, PME separation 0.80 times their diameter. PME-PLE separation 1.80 times one PME diameter, AME-ALE separation 1.60 times one ALE diameter. Clypeus height 3.00 times one AME diameter. Chelicerae with three prolateral and three retrolateral teeth. Cheliceral stridulating files present. Legs very light brown. Leg and pedipalp lengths of male described above:

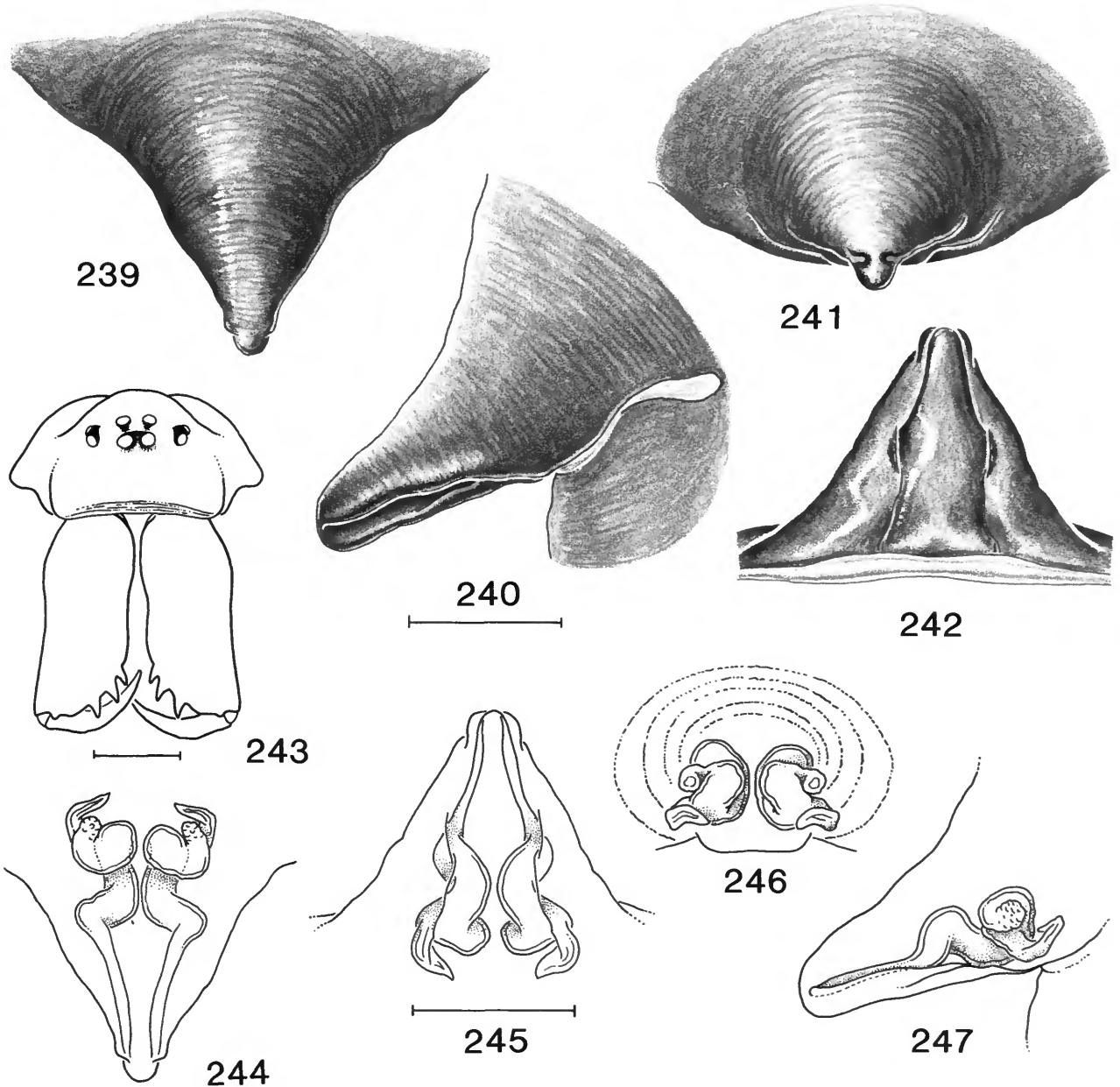


FIGURES 233–238.—*Pimoa crisa* (Fage), male (syntype): 233, palp, ventral; 234, same, ectal; 235, same, dorsal; 236, detail cymbial process, dorsal; 237, cephalothorax, dorsal; 238, same, frontal. (Scale lines: 0.5 mm, except 237, 238, 1.0 mm.)

	I	II	III	IV	Pdp
Femur	12.9	—	8.8	—	1.6
Patella	1.7	—	—	—	0.5
Tibia	—	—	—	—	0.8
Metatarsus	—	—	—	—	—
Tarsus	—	—	—	—	1.1
Total	—	—	—	—	4.0

Femur I 3.31 times length of cephalothorax. Legs covered with long setae. Pedipalp as in Figures 233–236.

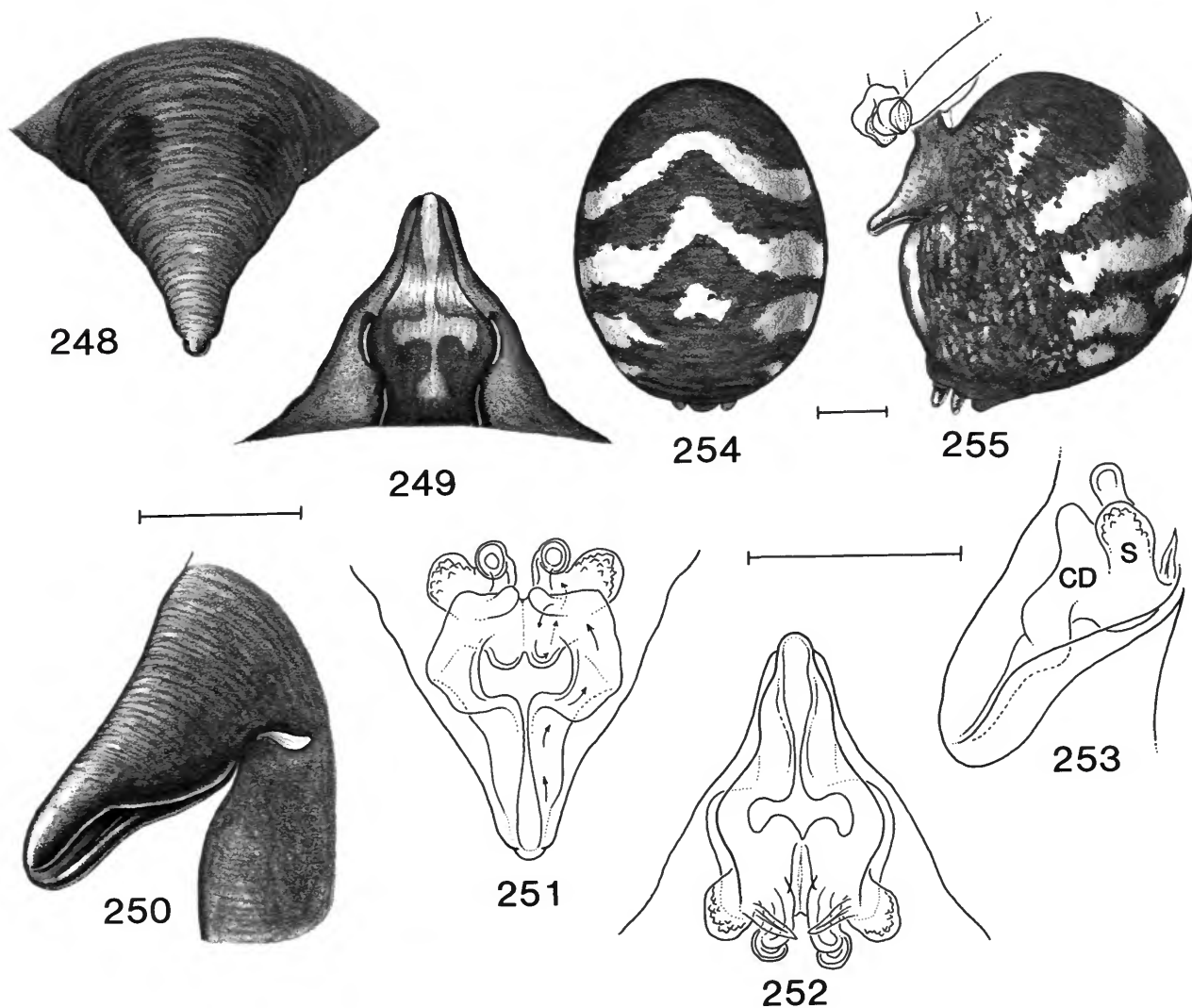
*Female* (syntype): Cephalothorax 4.9 long, 3.4 wide, 2.7 high; reddish brown. Sternum 2.7 long, 2.0 wide; reddish brown. Abdomen 7.3 long, 5.3 wide, 5.6 high; whitish. AME diameter 0.16. PME 1.00, PLE 1.00, ALE 1.00 times one AME diameter. AME separation 0.60 times their diameter, PME



FIGURES 239-247.—*Pimoa crista* (Fage), female (syntype): 239, epigynum, ventral; 240, same, lateral; 241, same, posterior; 242, same, dorsal; 243, cephalothorax, frontal; 244, epigynum, cleared, ventral; 245, same, dorsal; 246, same, anterior; 247, same, lateral. (Scale lines: 0.5 mm, except 243, 1.0 mm.)

separation 1.00 times their diameter. PME-PLE separation 1.80 times one PME diameter, AME-ALE separation 1.80 times one ALE diameter. Clypeus height 4.20 times one AME diameter. Chelicerae with three prolateral and three retrolateral teeth. Cheliceral stridulating files absent. Legs reddish brown. Leg and pedipalp lengths of female described above:

	I	II	III	IV	Pdp
Femur	10.6	10.2	10.1	9.4	2.3
Patella	1.9	1.9	1.6	1.7	0.6
Tibia	11.8	10.9	10.8	9.7	1.3
Metatarsus	12.1	11.3	—	—	—
Tarsus	—	—	—	—	2.6
Total	—	—	—	—	6.8



FIGURES 248–255.—*Pimosa indiscreta*, new species, female (holotype): 248, epigynum, ventral; 249, same, dorsal; 250, same, lateral; 251, epigynum, cleared, ventral; 252, same, dorsal; 253, same, lateral; 254, abdomen, dorsal; 255, same, lateral. (Scale lines: 0.5 mm, except 254, 255, 1.0 mm.)

Femur I 2.16 times length of cephalothorax. Legs covered with long setae. Metatarsus I trichobothrium 0.95. Epigynum as in Figures 239–242.

ADDITIONAL MATERIAL EXAMINED.—None.

DISTRIBUTION.—Known only from its type locality in northern India (Figure 232).

*Pimosa indiscreta*, new species

FIGURES 248–255, 232

TYPES.—Female holotype, labels state “India: W. Bengal, Debrepani, 10 mi (16 km) W Ghum, 2010 m, X-22-1691 [sic.]”

and “colls. E.S. Ross, D. Cavagnaro.” Deposited in CAS.

ETYMOLOGY.—The species epithet is derived from the Latin *indiscretus* (unseparated, closely connected) and refers to the fusion of the copulatory ducts.

DIAGNOSIS.—Female with fused copulatory ducts (Figure 251). *Pimosa indiscreta* can be distinguished from *gandhii* because of the narrow dorsal epigynal lateral lip of the former (Figure 250).

Male: Unknown.

Female (holotype): Total length 7.2. Cephalothorax 3.0 long, 2.4 wide, 1.7 high; brown. Sternum 1.6 long, 1.5 wide; dark brown. Abdomen 4.4 long, 3.5 wide, 4.2 high; whitish



with gray pattern (Figures 254, 255). AME diameter 0.20. PME 1.00, PLE 1.00, ALE 1.00 times one AME diameter. AME separation 0.50 times their diameter, PME separation 0.80 times their diameter. PME-PLE separation 0.80 times one PME diameter, AME-ALE separation 0.60 times one ALE diameter. Clypeus height 2.20 times one AME diameter. Chelicerae with three prolateral and three retrolateral teeth. Cheliceral stridulating files absent. Legs brown, with slightly marked gray annuli. Leg and pedipalp lengths of female described above:

	I	II	III	IV	Pdp
Femur	5.8	4.9	3.3	4.8	1.3
Patella	1.2	1.0	0.9	1.0	0.5
Tibia	6.2	4.8	2.8	—	0.8
Metatarsus	5.5	4.3	3.0	—	—
Tarsus	2.5	1.8	1.3	—	1.4
Total	21.2	16.8	11.3	—	4.0

Legs 1243. Femur I 1.93 times length of cephalothorax. Legs covered with long setae. Metatarsus I trichobothrium 0.83. Epigynum as in Figures 248–253.

ADDITIONAL MATERIAL EXAMINED.—None.

DISTRIBUTION.—Known only from its type locality in the West Bengal province of India (Figure 232).

### *Pimoa sinuosa*, new species

FIGURES 256–284, 232

TYPES.—Male holotype and six female paratypes from Nepal, Gandaki zone, Kaski Dist., Banthati, Rhododendron forest, about 2500 m, 26 Oct 1985, J. Coddington col. Deposited in USNM.

ETYMOLOGY.—The species epithet is from the Latin *sinuosus* (full of bendings, windings) and refers to shape of the copulatory duct.

DIAGNOSIS.—Males have a characteristic group of spines in the proximal third of femur I (Figure 265). Females have a lateral epigynal fold but without pronounced lips; in lateral view, the epigynum distal end is wider than half of its width at the base (Figure 268). The conformation of the copulatory duct is also diagnostic (Figures 272–274).

*Male* (Holotype): Total length 8.0. Cephalothorax 3.8 long, 3.4 wide, 1.9 high; brown with gray margins and a dark gray stripe between the ocular area and the thoracic fovea (Figure 262). Sternum 2.2 long, 1.9 wide; dark gray-brown. Abdomen 4.2 long, 2.7 wide, 2.3 high; whitish with dark gray (almost black) pattern (Figures 263, 264). AME diameter 0.19. PME 1.00, PLE 1.00, ALE 1.00 times one AME diameter. AME separation 0.50 times their diameter, PME separation 0.75 times their diameter. PME-PLE separation 1.00 times one PME diameter, AME-ALE separation 0.75 times one ALE diameter. Clypeus height 2.50 times one AME diameter. Chelicerae with three prolateral and three retrolateral teeth. Cheliceral stridulating files present. Legs brown with dark gray

annuli. Leg and pedipalp lengths of male described above:

	I	II	III	IV	Pdp
Femur	10.4	10.0	6.7	8.6	1.3
Patella	1.5	1.6	1.2	1.3	0.5
Tibia	10.7	10.0	5.8	—	0.6
Metatarsus	11.9	11.1	6.7	—	—
Tarsus	4.0	3.5	2.1	—	1.3
Total	38.5	36.2	22.5	—	3.7

Legs 1243. Femur I 2.73 times length of cephalothorax, with numerous thick and long spines in the ventral, prolateral, and retrolateral side of the proximal third. Legs covered with long setae. Metatarsus I trichobothrium 0.87. Pedipalp as in Figures 256–259.

*Female* (paratype): Total length 9.7. Cephalothorax 4.5 long, 3.4 wide, 2.3 high; light brown with dark gray margins and a dark gray stripe between the ocular area and the thoracic fovea (Figure 271). Sternum 2.48 long, 2.01 wide; dark brown. Abdomen 5.7 long, 4.6 wide, 2.3 high; whitish with dark gray (almost black) pattern (Figure 269). AME diameter 0.26. PME 1.00, PLE 1.00, ALE 1.00 times one AME diameter. AME separation 0.50 times their diameter, PME separation 0.80 times their diameter. PME-PLE separation 1.00 times one PME diameter, AME-ALE separation 0.80 times one ALE diameter. Clypeus height 2.37 times one AME diameter. Chelicerae with three prolateral and three retrolateral teeth. Cheliceral stridulating files present (Figure 278). Legs brown with dark gray annuli. Leg and pedipalp lengths of female described above:

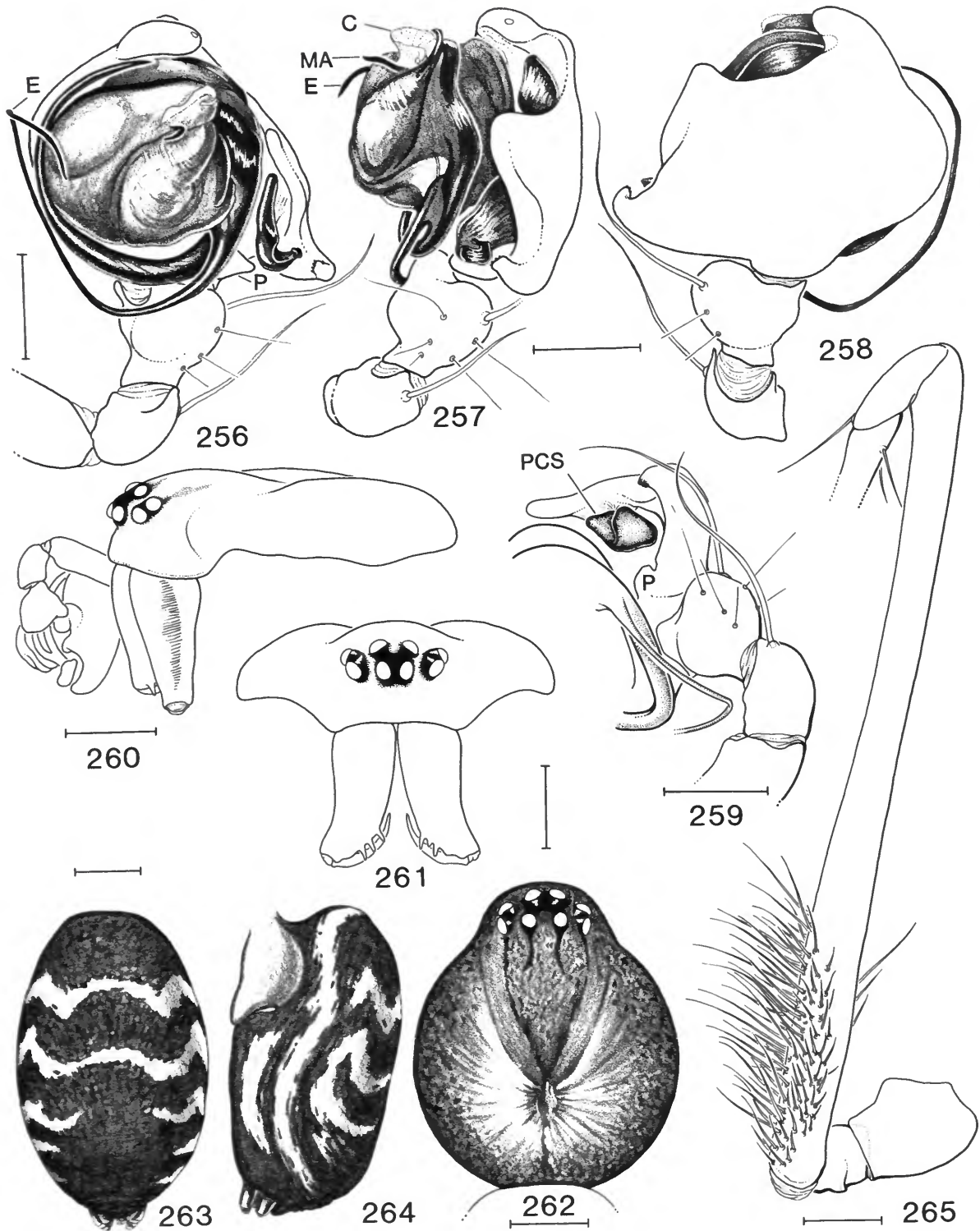
	I	II	III	IV	Pdp
Femur	9.7	8.6	6.1	7.9	1.7
Patella	1.7	1.5	1.3	1.3	0.5
Tibia	10.0	8.6	5.3	7.4	1.1
Metatarsus	9.8	8.4	5.7	7.3	—
Tarsus	3.4	2.7	1.9	2.3	2.1
Total	34.6	29.8	20.3	26.3	5.4

Legs 1243. Femur I 2.15 times length of cephalothorax, with a group (less than a dozen) of thick prolateral spines in the proximal third. Legs covered with long setae. Metatarsus I trichobothrium 0.92. Epigynum as in Figures 266–268, 272–276.

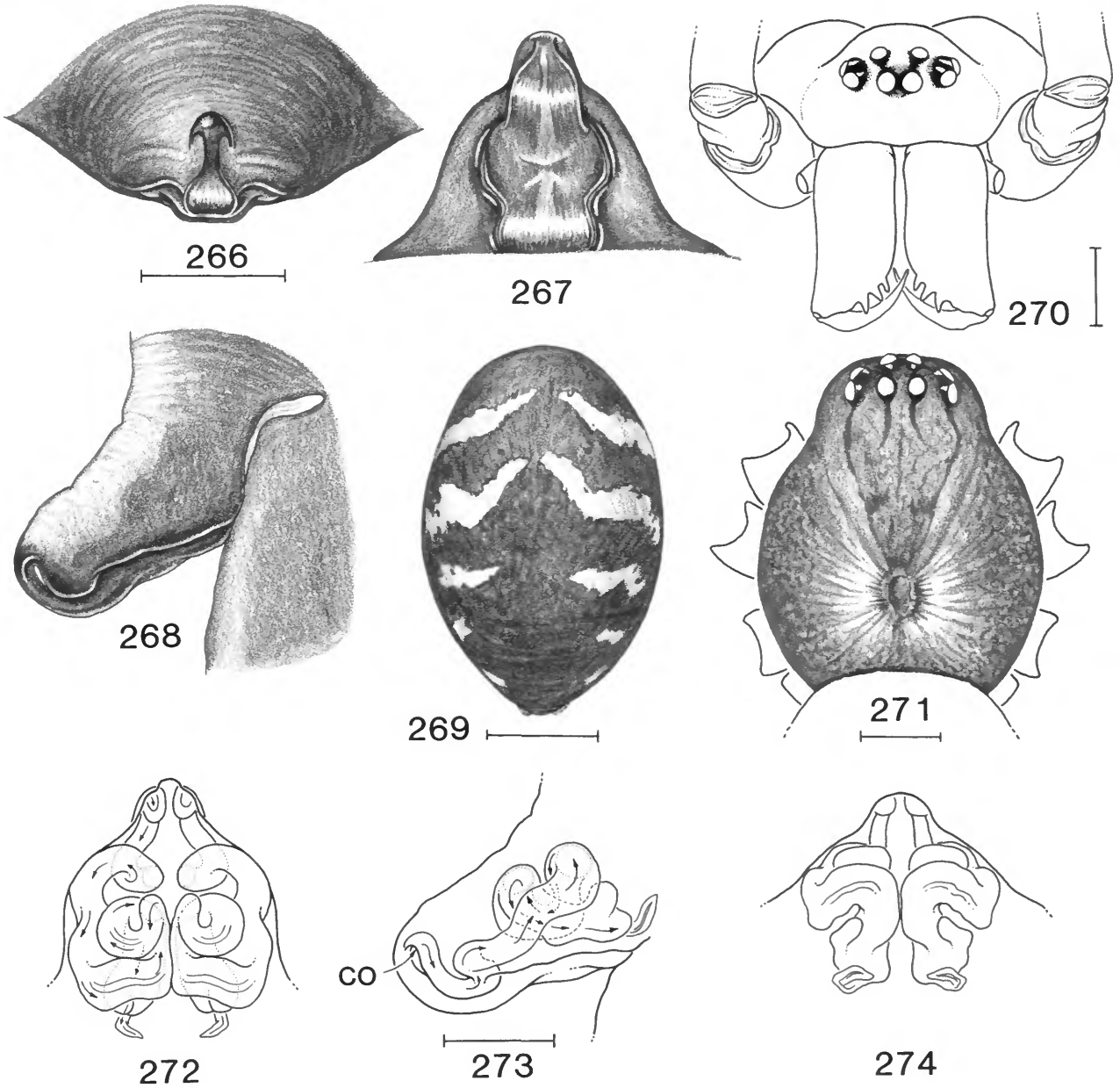
VARIATION.—Female cephalothorax ranges in length from 2.8 to 4.5.

ADDITIONAL MATERIAL EXAMINED.—NEPAL: Kaski District, Gandaki Zone: Chomrung-Khuldi Ghar trail, 22 Oct 1985, montane forest, 2300 m (J.A. Coddington, USNM), 1♀; Dobang, 23 Oct 1985, bamboo forest, about 2500 m (J.A. Coddington, USNM), 2♀; Rhododendron bamboo forest near Khuldi Ghar, 22 Oct 1985, 2400 m (J.A. Coddington, USNM), 2♀; Rhododendron bamboo forest near Khuldi Ghar, 23 Oct 1985, 2400 m (J.A. Coddington, USNM), 1♀.

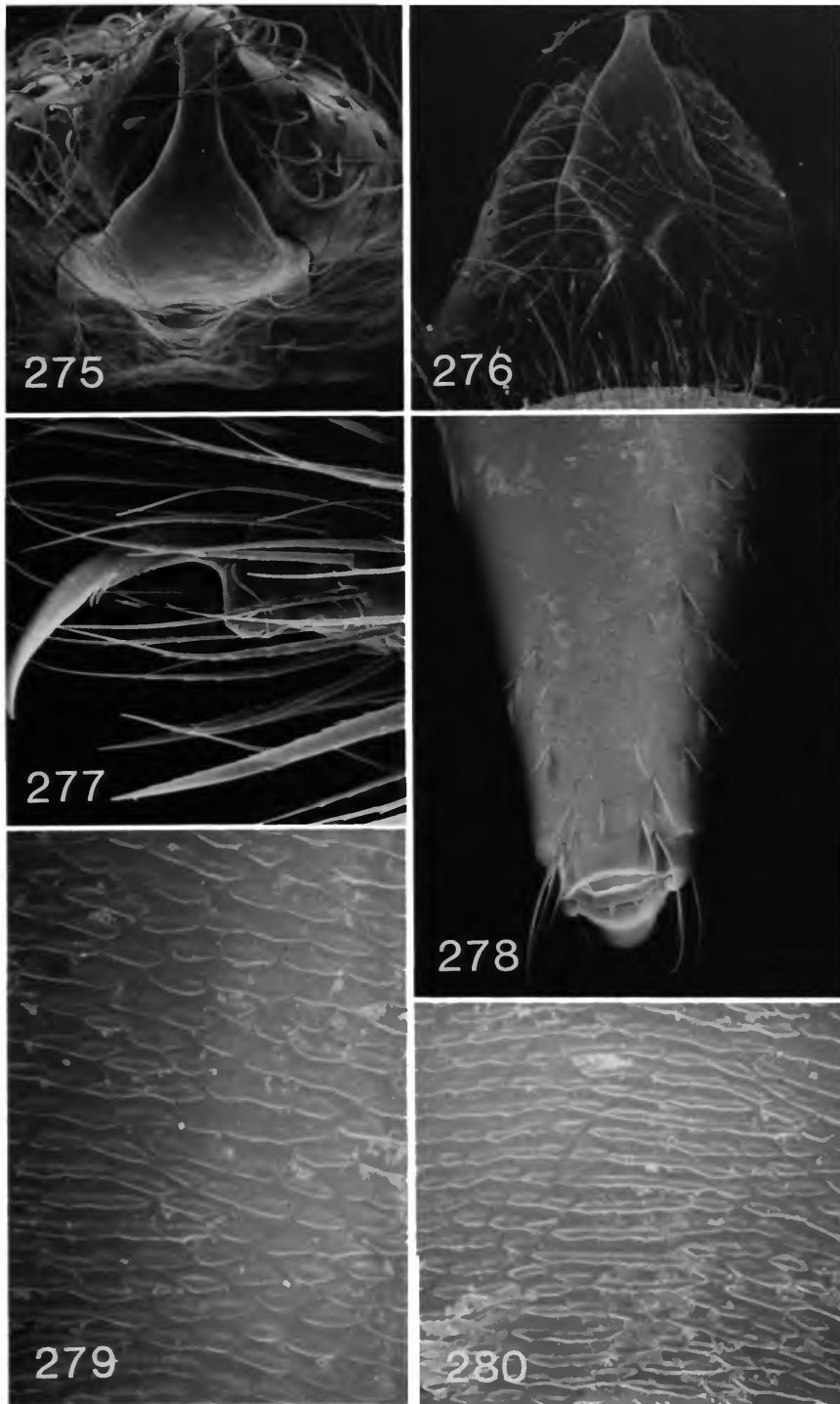
DISTRIBUTION.—Known only from the Gandaki zone in the Kaski district of Nepal (Figure 232).



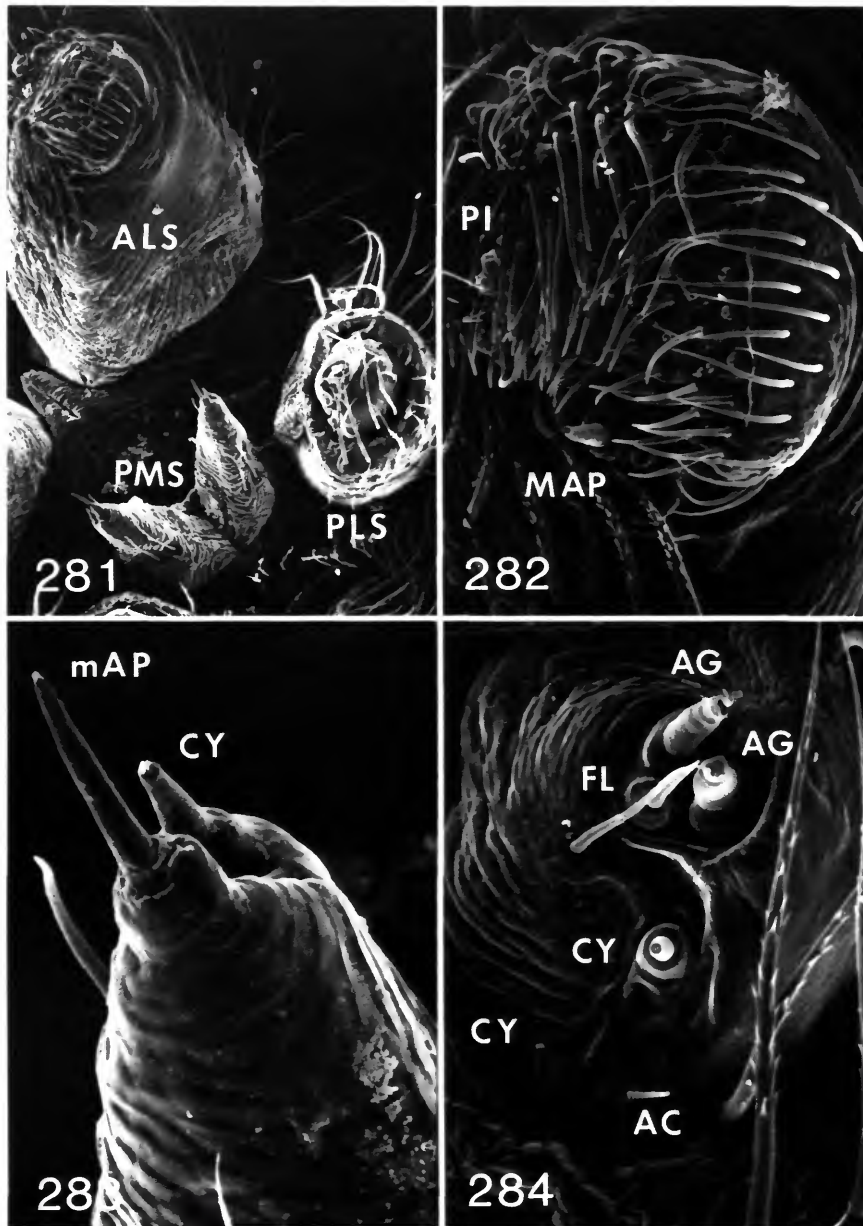
FIGURES 256-265.—*Pimoida sinuosa*, new species, male (holotype): 256, palp, ventral; 257, same, ectal; 258, same, dorsal; 259, same, detail base of cymbium, ectoventral; 260, cephalothorax, lateral; 261, same, frontal; 262, same, dorsal; 263, abdomen, dorsal; 264, same, lateral; 265, femur I, ectal. (Scale lines: 0.5 mm, except 260-265, 1.0 mm.)



FIGURES 266-274.—*Pimoa sinuosa*, new species, female (paratype): 266, epigynum, ventral; 267, same, dorsal; 268, same, lateral; 269, abdomen, dorsal; 270, cephalothorax, frontal; 271, same, dorsal; 272, epigynum, cleared, ventral; 273, same, lateral; 274, same, anterodorsal. (Scale lines: 0.5 mm, except 269-271, 1.0 mm.)



FIGURES 275–280.—*Pimoa sinuosa*, new species, female from Nepal: 275, epigynum, apical; 276, epigynum, posterodorsal; 277, pedipalpal claw; 278, chelicera, ectal; 279, 280, cheliceral striae, closeups.



FIGURES 281-284.—*Pimoida sinuosa*, new species, spinnerets, female from Nepal: 281, spinneret group; 282, ALS; 283, PMS; 284, PLS.

***Pimoida nematoide*, new species**

FIGURES 285-289, 232

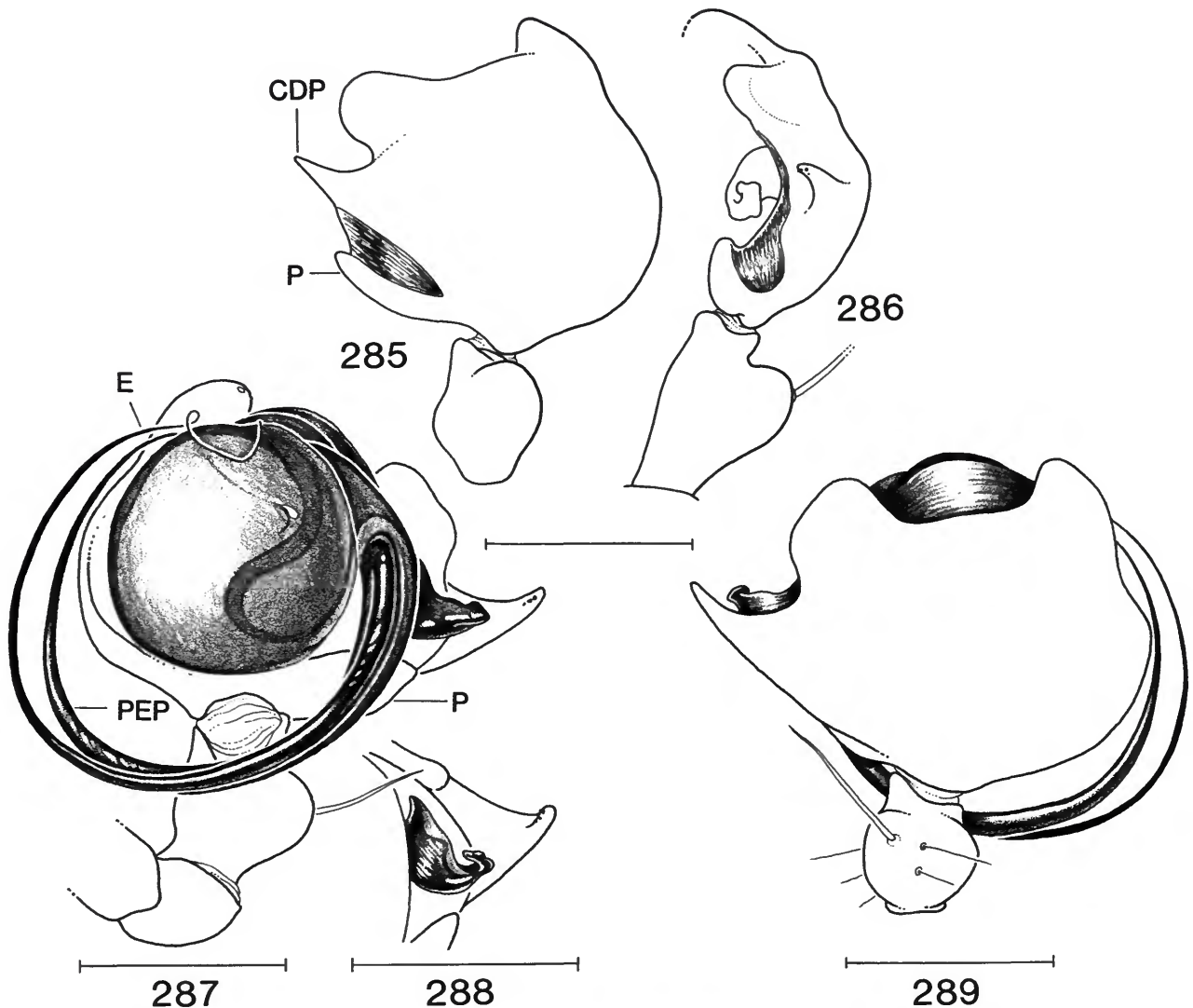
*Acrometa* sp.—Wunderlich, 1979:411, figs. 18, 19 [♂].

TYPES.—Male holotype and one male paratype from Nepal. Labels state “Linyphiidae: Pimoidae sp., 1♂ Nepal, 57;

Chordung, Martens leg.” (holotype) and “Senck. Mus 29974 Frankfurt/Main. *Acrometa* sp. 1♂ Nepal. Martens leg. Wunderlich det. 1979” (paratype). Deposited in SM.

ETYMOLOGY.—The species epithet is derived from the Greek *nematos* (thread), hence *nematoide* thread-like, and refers to the shape of the embolus of this species.

DIAGNOSIS.—The male can be distinguished from other



FIGURES 285-289.—*Pimoa nematoide*, new species, male: 285, palp, dorsal; 286, same, detail base of cymbium, ectal; 287, same, ventral; 288, same, PCS, ectoventral; 289, same, dorsal (Figures 287-289 right palp reversed). (Scale lines: 0.5 mm.)

Asian *Pimoa* by its very long and filiform embolus and PEP (similar to *sinuosa*, but longer) and by the sclerotized cymbial region between the paracymbium and the ectal margin of the cymbium (Figures 285, 286). The globular shape of the tegulum is also diagnostic.

**Male (holotype):** Total length 4.6. Cephalothorax 2.1 long, 1.7 wide, 1.2 high; yellowish brown. Sternum 1.3 long, 1.1 wide. Abdomen 2.1 long, 1.6 wide, 2.0 high; very light brown. AME diameter 0.11, PME 1.00, PLE 1.00, ALE 1.00 times one AME diameter. AME separation 0.30 times their diameter, PME separation 0.71 times their diameter. PME-PLE separation 0.86 times one PME diameter, AME-ALE separation 0.71 times one ALE diameter. Clypeus height 2.71 times one AME

diameter. Chelicerae with three (four) prolateral and three (two) retrolateral teeth. Cheliceral stridulating files present. Legs light brown without annuli. Leg and pedipalp lengths of male described above:

	I	II	III	IV	Pdp
Femur	3.2	3.0	2.4	3.0	0.7
Patella	—	0.7	0.6	0.7	0.3
Tibia	—	—	2.1	2.8	0.3
Metatarsus	—	—	2.1	2.8	—
Tarsus	—	—	0.9	1.1	0.8
Total	—	—	8.1	10.4	2.1

Femur I 1.52 times length of cephalothorax, with a group

(about a dozen) of thick and long ventral spines in the medial third. Pedipalp as in Figures 285–289.

*Female:* Unknown.

**VARIATION.**—Male cephalothorax ranges in length from 1.9 to 2.1. The number of prolateral cheliceral teeth varies from three to four and the retrolateral from two to three. The paratype has the legs covered with long setae, the absence of setae in the holotype seems to be a preservation artifact.

**DISTRIBUTION.**—Known only from the type locality in Nepal (Figure 232).

*Pimosa anatolica*, new species

FIGURES 290–300, 232

**TYPES.**—Female holotype, label states “China, Tsuyung Yunnan Nov. 10, 1944. Mont A. Cazier.” Deposited in AMNH.

**ETYMOLOGY.**—The species epithet is derived from the Greek *anatole*, east.

**DIAGNOSIS.**—Epigynal lateral lips clearly marked and wide (Figure 292). Distal end of the epigynum (in lateral view) narrower than half the width of the base. Copulatory duct with double switch (Figure 297).

*Male:* Unknown.

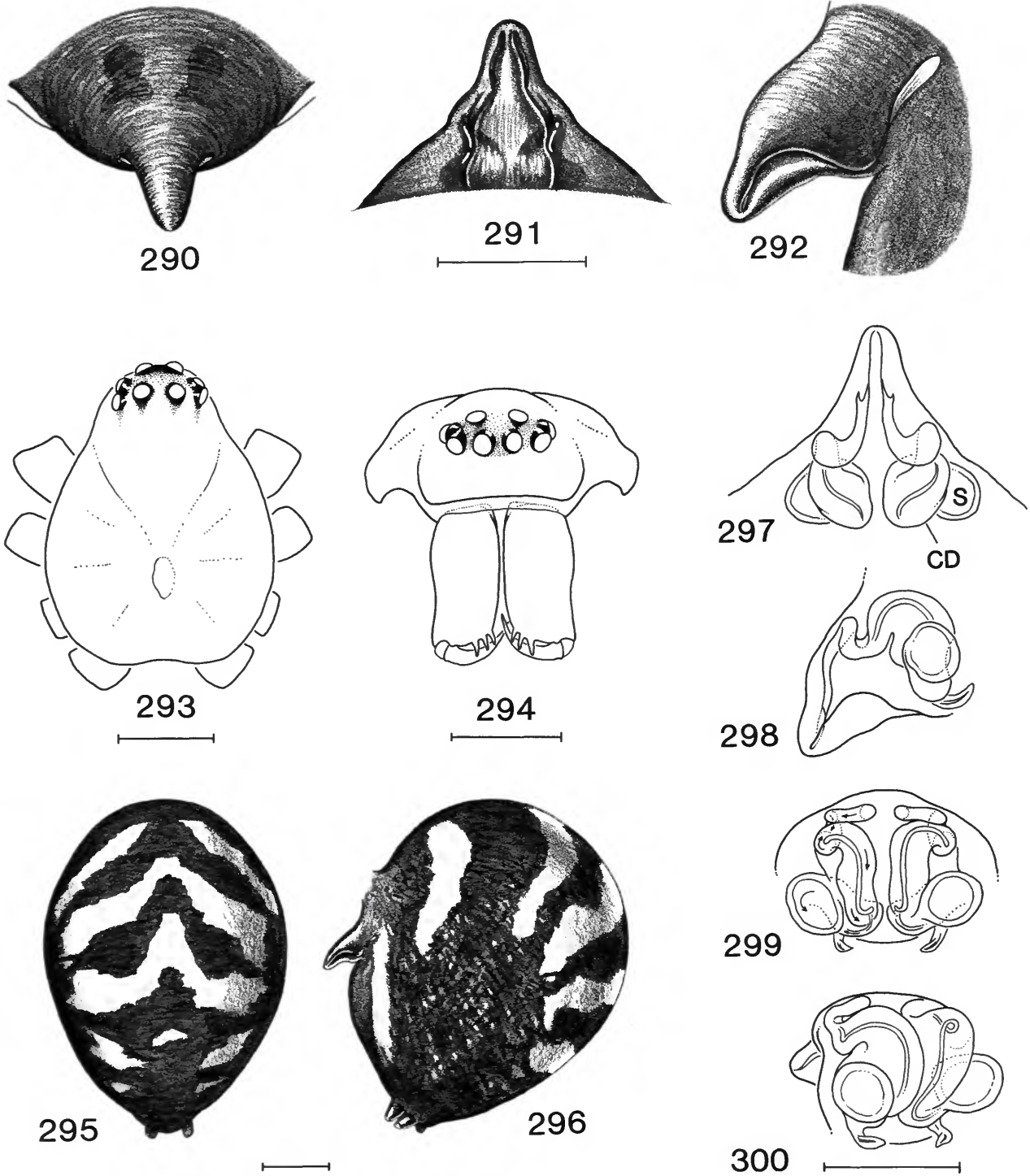
*Female* (holotype): Total length 7.5. Cephalothorax 3.1 long, 2.4 wide, 1.7 high; dark brown, darker at margins. Sternum 1.7 long, 1.5 wide; dark brown. Abdomen 4.3 long,

3.6 wide, 4.8 high; whitish with dark gray pattern (Figures 295, 296). AME diameter 0.19. PME 1.00, PLE 1.00, ALE 1.00 times one AME diameter. AME separation 0.67 times their diameter, PME separation 0.67 times their diameter. PME-PLE separation 0.83 times one PME diameter, AME-ALE separation 0.50 times one ALE diameter. Clypeus height 2.00 times one AME diameter. Chelicerae with three prolateral and three retrolateral teeth. Cheliceral stridulating files absent. Legs brown with dark gray annuli. Leg and pedipalp lengths of female described above:

	I	II	III	IV	Pdp
Femur	5.6	4.8	3.1	4.0	1.0
Patella	1.2	1.2	0.8	0.9	0.4
Tibia	5.7	5.1	2.7	4.0	0.6
Metatarsus	4.7	4.3	2.5	3.5	—
Tarsus	2.2	2.1	1.2	1.5	1.3
Total	19.4	17.5	10.3	13.9	3.3

Legs 1243. The right leg I is shorter than the left (17.3 total length; Metatarsus I trichobothrium 0.86; right femur I 1.6 times length of cephalothorax), probably due to loss and posterior regeneration. Femur I 1.8 times length of cephalothorax. Metatarsus I trichobothrium 0.89. Epigynum as in Figures 290–292, 297–300.

**DISTRIBUTION.**—Known only from the type locality in western China (Figure 232).



FIGURES 290–300.—*Pimoa anatolica*, new species, female (holotype): 290, epigynum, ventral; 291, same, dorsal; 292, same, lateral; 293, cephalothorax, dorsal; 294, same, frontal; 295, abdomen, dorsal; 296, same, lateral; 297, epigynum, cleared, ventral; 298, same, lateral; 299, same, anterior; 300, same, anterolateral. (Scale lines: 0.5 mm, except 293–296, 1.0 mm.)



*Pimosa altiocolata* (Keyserling)

FIGURES 7-9, 301-337

*Labulla altiocolata* Keyserling, 1886:94-96, fig. 186 [♂, ♀].—Gertsch and Ivie, 1936:15-16, figs. 40, 41 [♀].—Roewer, 1942:577.—Bonnet, 1957:2334.

*Labulla utahana* Gertsch and Ivie, 1936:16, fig. 39 [♀] [female holotype from Salt Lake City, Utah, AMNH; examined]. [New synonymy.]

*Pimosa utahana*.—Chamberlin and Ivie, 1943:12.

*Labulla alticola*.—Fage, 1946:387 [lapsus calami].

*Pimosa altiocolata*.—Chamberlin and Ivie, 1943:11, 12.—Brignoli, 1975:13; 1971:163; 1979:36.—Thaler, 1976:209, figs. 10-15 [♂].—Crawford, 1988:23.—Roth, 1988:44.

*Acrometa altiocolata*.—Wunderlich, 1979:411 et passim, figs. 12-17 [♂ ♀]. [Type specimens deposited in BMNH. Examined.]

**TYPES.**—Three male and four female syntypes, label states "*Labulla altiocolata*, keys. 7752-8 Washington (type)." Deposited in BMNH. Examined.

**DIAGNOSIS.**—Male with apophysis in pedipalpal trochanter (Figures 307, 308) and numerous denticles in the cymbial denticulated process. The femur I has a group of thick spines (10 or more) in the center of the ventral-prolateral side (Figure 309). Only *P. petita* has also an apophysis in the trochanter (somewhat smaller), but its cymbial process has only two or three denticles. Female with epigynum distal end projected into a small plate heavily sclerotized, which bears the copulatory openings (Figures 312, 317, 328, 330).

**Male** (from Grays River, "Swede Park," Wahkiakum Co., Washington, 25 Oct 1984, 60 ft, R. Crawford, UW): Total length 6.5. Cephalothorax 3.0 long, 2.4 wide, 1.7 high; light brown, darker at the margins. Sternum 1.7 long, 1.4 wide; brown. Abdomen 3.2 long, 2.6 wide, 3.1 high; whitish with a dark gray pattern (Figures 305, 306). AME diameter 0.20. PME 0.80, PLE 0.70, ALE 0.80 times one AME diameter. AME separation 0.20 times their diameter, PME separation 0.63 times their diameter. PME-PLE separation 0.75 times one PME diameter, AME-ALE separation 0.50 times one ALE diameter. Clypeus height 1.60 times one AME diameter. Chelicerae with three prolateral and two (three) retrolateral teeth. Cheliceral stridulating files present (Figure 326). Legs brown with dark gray annuli. Leg and pedipalp lengths of male described above:

	I	II	III	IV	Pdp
Femur	6.2	4.6	3.5	4.5	1.0
Patella	1.0	1.0	0.8	0.9	0.5
Tibia	5.2	4.7	3.0	4.8	0.4
Metatarsus	5.6	4.6	3.2	4.2	—
Tarsus	2.1	2.1	1.3	1.8	0.8
Total	20.1	17.0	11.8	15.2	2.7

Legs 1243. Femur I 2.07 times length of cephalothorax, with a group of thick spines (10 or more) in the center of the ventral-prolateral side (Figure 309). Legs covered with long setae. Metatarsus I trichobothrium 0.85. Pedipalp as in Figures

301-304, 310, 311, 320-325, with retrolateral apophysis in the trochanter (Figures 307, 308).

**Female** (same locality than male): Total length 8.8. Cephalothorax 3.9 long, 2.9 wide, 2.9 high; light brown darker at the margins. Sternum 1.7 long, 2.1 wide; dark brown. Abdomen 4.7 long, 3.1 wide, 3.3 high; light gray with a dark gray pattern (Figures 318, 319). AME diameter 0.20. PME 0.90, PLE 0.90, ALE 1.10 times one AME diameter. AME separation 0.70 times their diameter, PME separation 0.78 times their diameter. PME-PLE separation 0.89 times one PME diameter, AME-ALE separation 0.45 times one ALE diameter. Clypeus height 2.30 times one AME diameter. Chelicerae with three prolateral and three retrolateral teeth. Cheliceral stridulating files present. Legs light brown with dark brown annuli. Leg and pedipalp lengths of female described above:

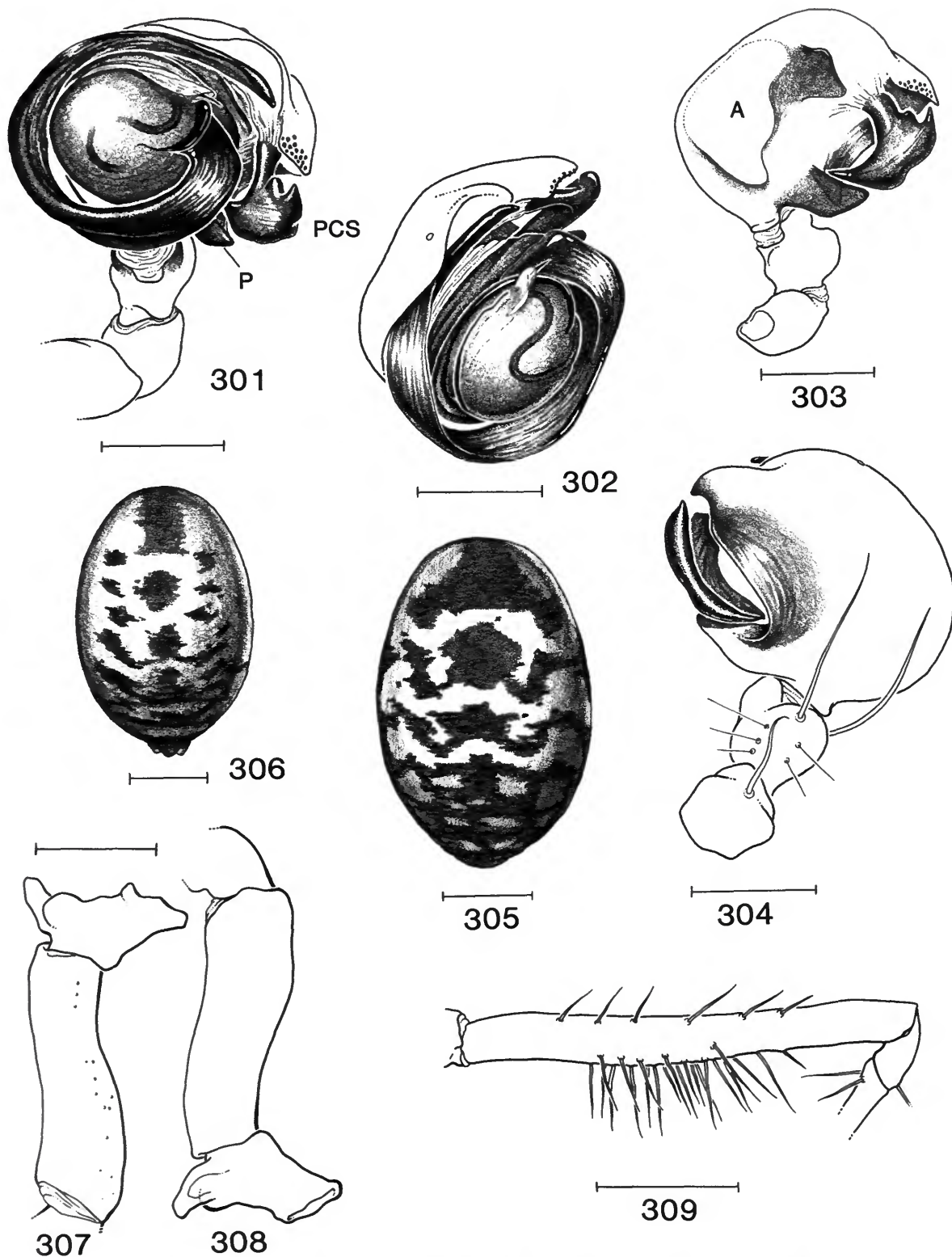
	I	II	III	IV	Pdp
Femur	6.5	5.5	4.4	5.6	1.4
Patella	1.5	1.4	1.1	1.3	0.5
Tibia	6.5	5.6	3.7	5.3	0.9
Metatarsus	6.2	5.3	3.9	5.1	—
Tarsus	2.9	2.2	1.7	2.1	1.7
Total	23.6	20.0	14.8	19.4	4.5

Legs 1243. Femur I 1.67 times length of cephalothorax, with a group of thick spines (less numerous than in the male) in the center of the ventral-prolateral side. Legs covered with long setae. Metatarsus I trichobothrium 0.85. Epigynum as in Figures 312-317, 328-331.

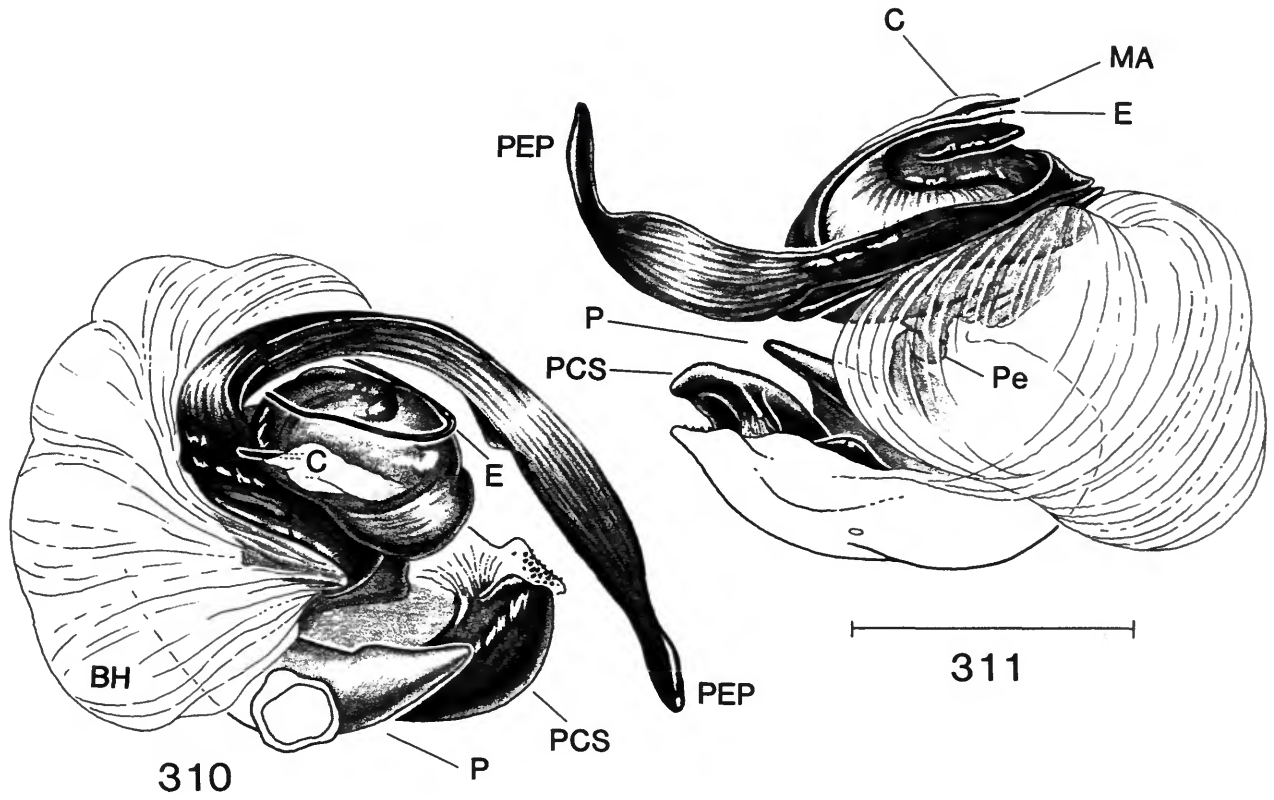
**VARIATION.**—Male cephalothorax ranges in length from 2.1 to 3.4, female from 2.1 to 4.0. The number of retrolateral cheliceral teeth varies from two to three in both sexes. Some females present heavily sclerotized setal bases on the ventral side of the abdomen. These setal bases appear as dark dots on both sides of the abdomen, posterior to the epigynum.

**ADDITIONAL MATERIAL EXAMINED** (County records only).—CANADA: BRITISH COLUMBIA. UNITED STATES: ALASKA; CALIFORNIA: Siskiyou; OREGON: Benton, Clackamas, Clatsop, Coos, Douglas, Hood River, Jackson, Jefferson, Josephine, Lane, Lincoln, Marion, Multnomah, Washington, Yamhill; WASHINGTON: Clallam, Clark, Cowlitz, Grays Harbor, Island, Jefferson, King, Kitsap, Lewis, Mason, Pacific, Pierce, San Juan, Skagit, Skamania, Snohomish, Thurston, Wahkiakum, Whatcom.

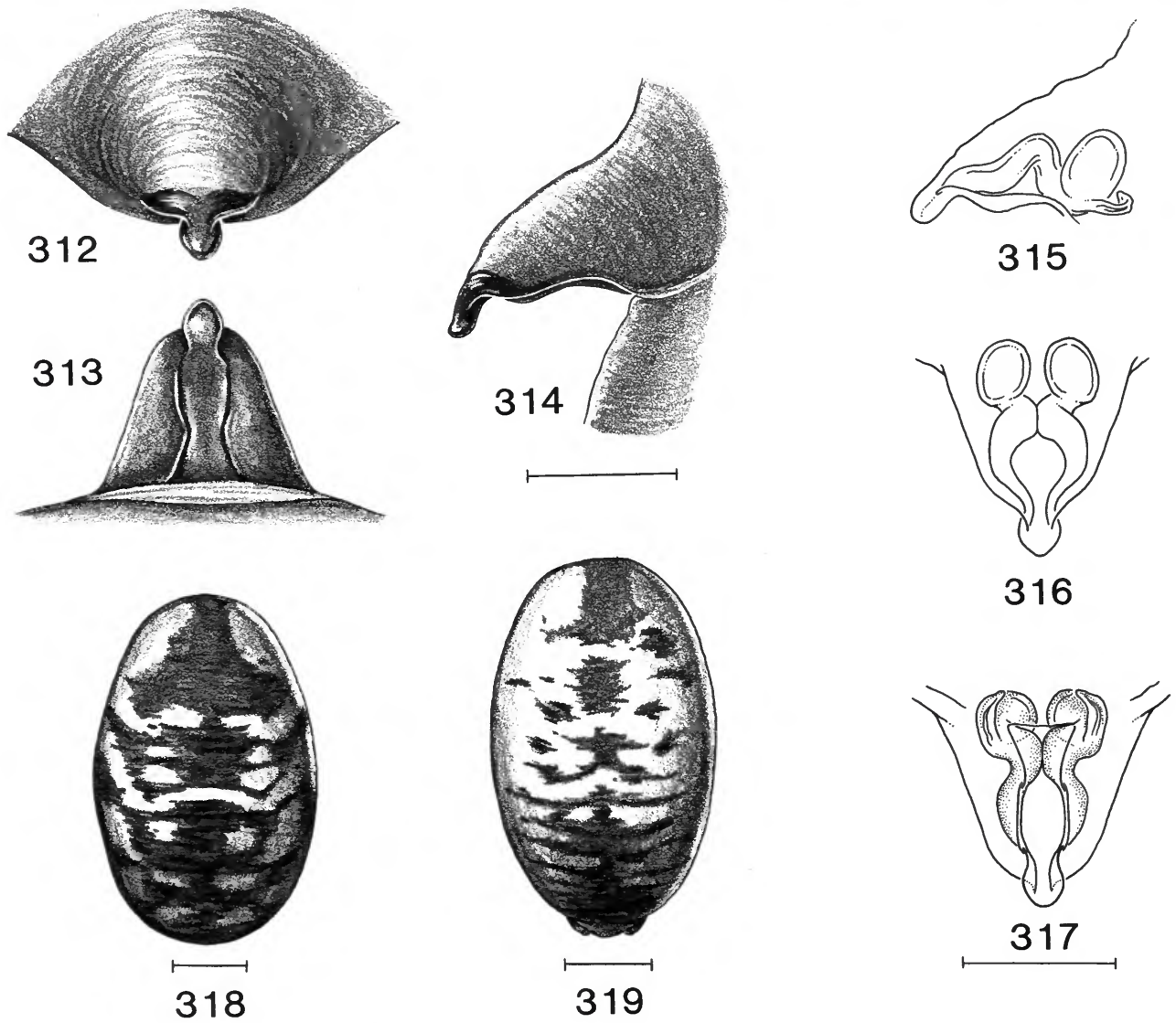
**DISTRIBUTION.**—Western North America, from northern California through Alaska (Figure 337). There is a record of a single specimen from Salt Lake City, Utah (Gertsch and Ivie, 1936) which would be the most eastern record for this species. The Utah specimen was considered to be a different species by its authors. I cannot tell it apart from *altiocolata*, and therefore is treated here as junior synonym. This isolated record is provisionally considered as dubious, until more specimens are collected from the mentioned area.



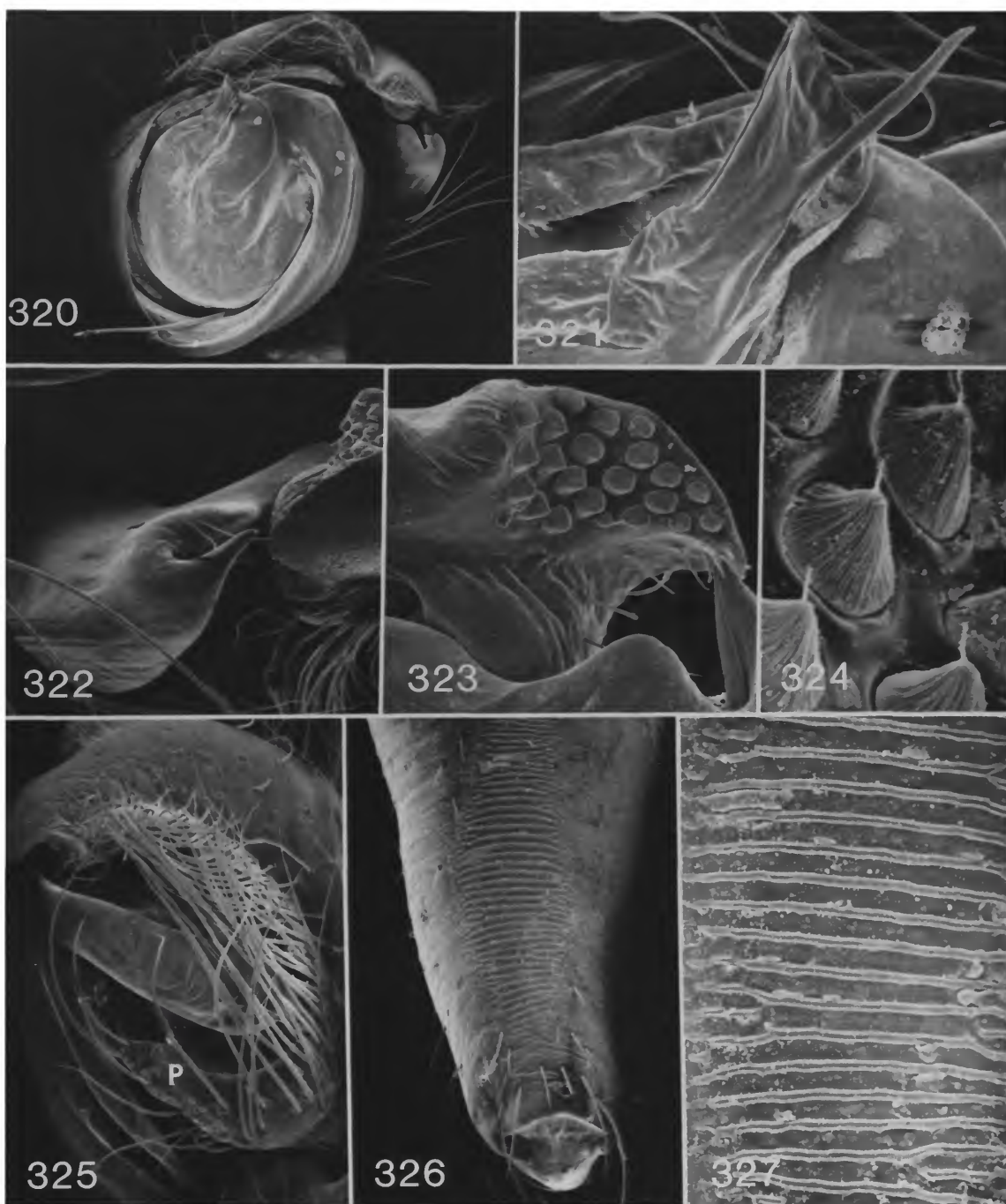
FIGURES 301-309.—*Pimoides altiocolata* (Keyserling), male: 301, male from Oregon, palp, ventral; 302, same, apical; 303, same, cymbium (basal haematodocha removed); 304, same, dorsal; 305, male from Oregon, abdomen, dorsal; 306, male from Washington, abdomen, dorsal; 307, male from Oregon, trochanteral apophysis, mesal; 308, same, ectal; 309, male from Washington, femur I, dorsomesal. (Scale lines: 0.5 mm, except 305, 306, 1.0 mm and 309, 2.0 mm.)



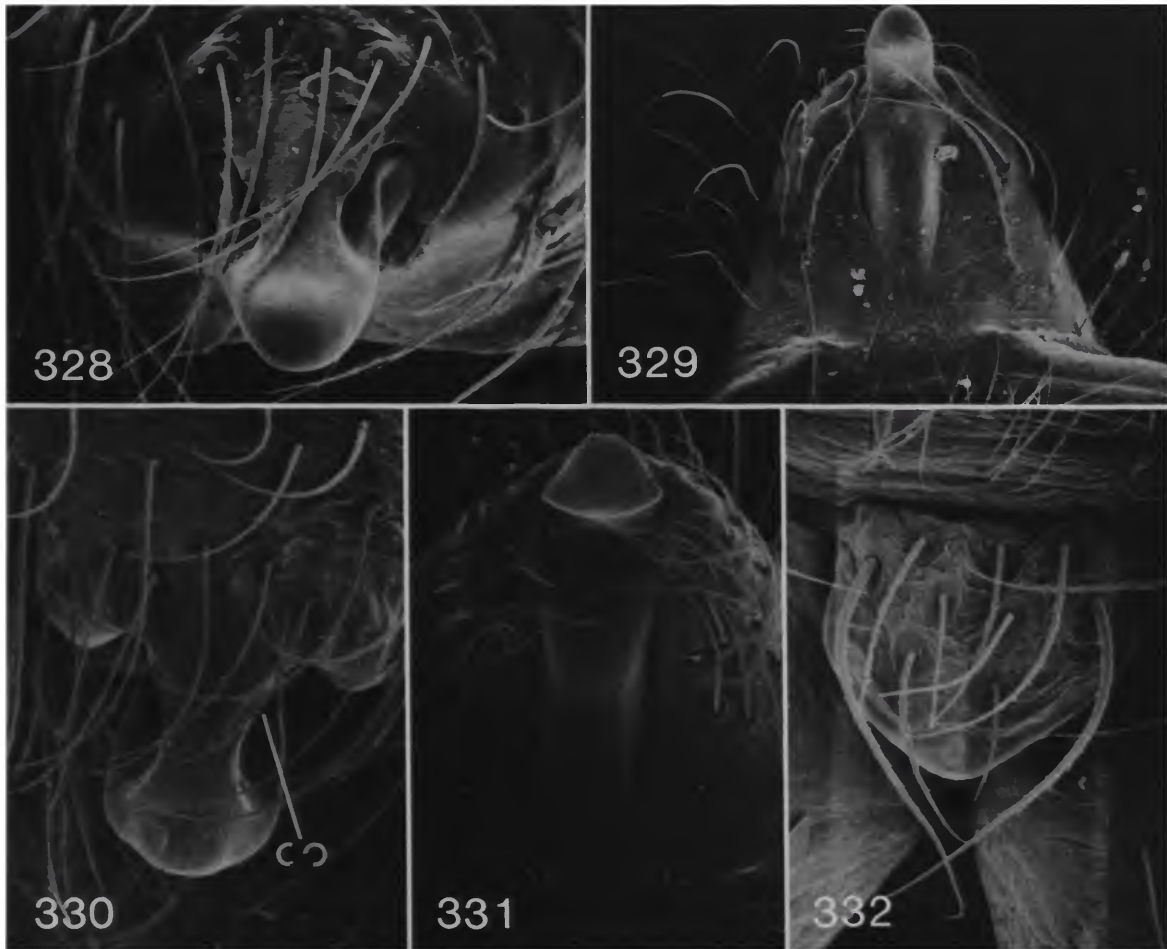
FIGURES 310, 311.—*Pimosa altioxulata* (Keyserling), male from Washington, expanded palp: 310, anteroventral; 311, apical. (Scale line: 1.0 mm.)



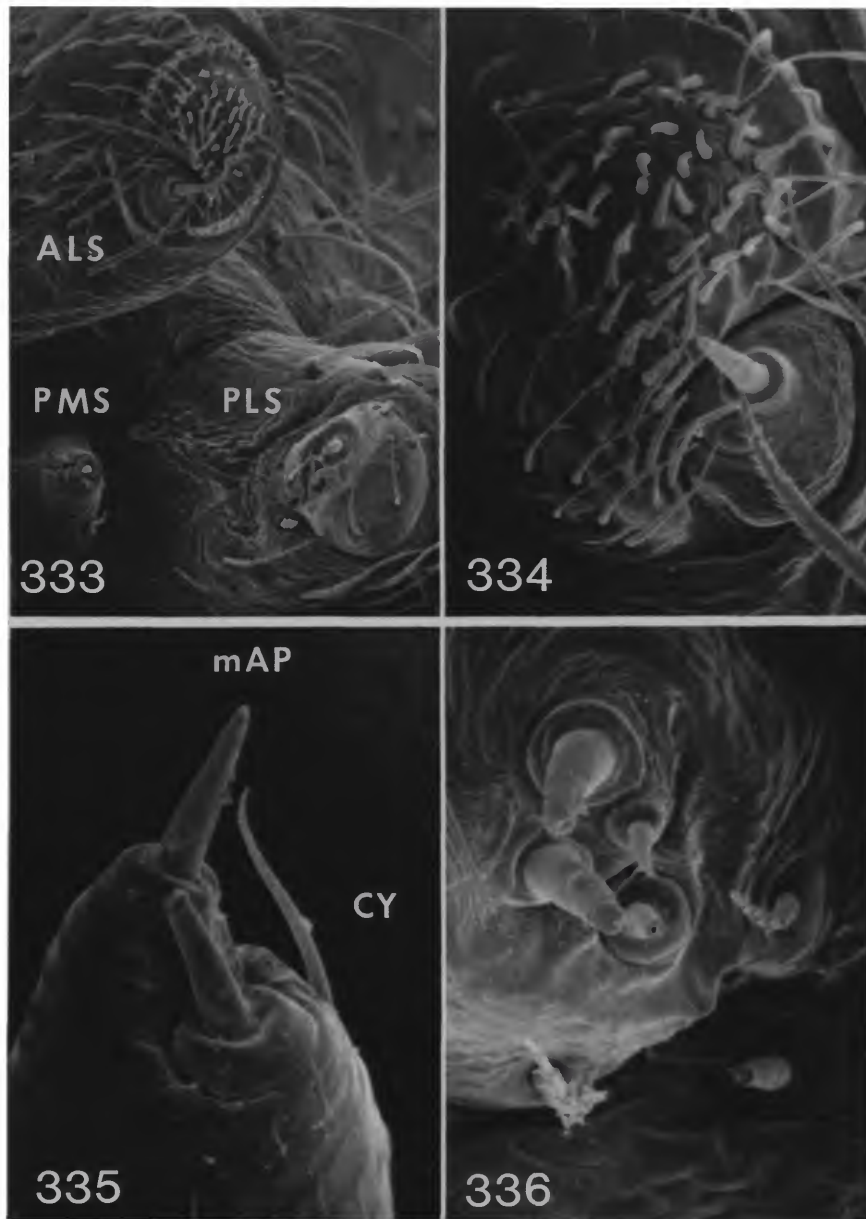
FIGURES 312-319.—*Pimoa altiocolata* (Keyserling), female: 312, female from Washington, epigynum, ventral; 313, same, dorsal; 314, same, lateral; 315, same epigynum, cleared, lateral; 316, same, ventral; 317, same, dorsal; 318, female from Alaska, abdomen, dorsal; 319, female from Washington, abdomen, dorsal. (Scale lines: 0.5 mm, except 318, 319, 1.0 mm.)



FIGURES 320-327.—*Pimoida altiocolata* (Keyserling): 320, male from Alaska, palp, ventral; 321, same male, conductor and median apophysis; 322, same male, PCS and cymbial denticulated process, apical; 323, male from Oregon, cymbial denticulated process, ventral; 324, male from Alaska, cymbial denticles; 325, same male, palp, ectal; 326, male from Oregon, chelicera, ectal; 327, cheliceral striae, closeup.



FIGURES 328-332.—*Pimoa altiocularata* (Keyserling): 328, female from Oregon, epigynum, ventral; 329, same female, epigynum, dorsal; 330, female from Oregon, epigynum, ventral; 331, same female, epigynum, posterodorsal; 332, same female, colulus.



FIGURES 333-336.—*Pimaa altiocolata* (Keyserling), spinnerets, female from Oregon: 333, spinneret group; 334, ALS; 335, PMS; 336, PLS.

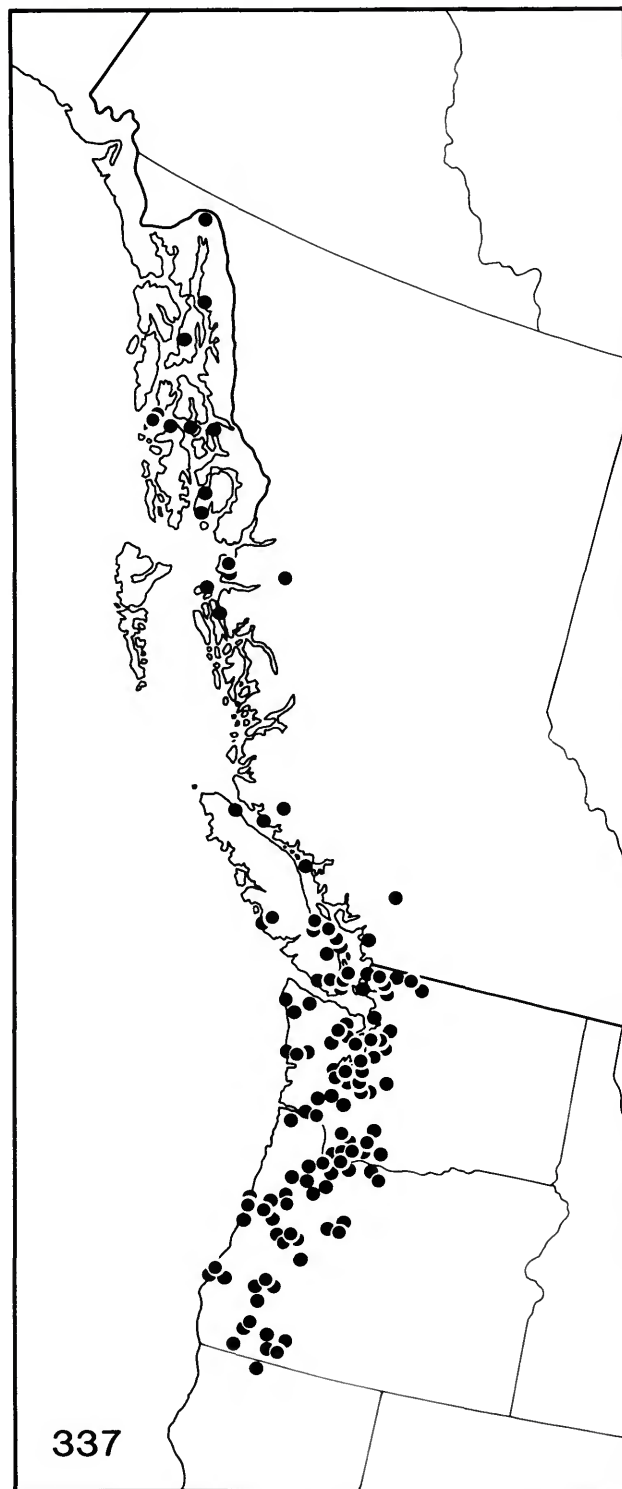


FIGURE 337.—Distribution of *Pimosa altiocolata* (Keyserling).

*Pimosa petita*, new species

FIGURES 338–344, 117

**TYPES.**—Male holotype from McMinnville, Oregon. Label states “Oregon: Peavine Ridge near McMinnville 1 Nov–Dec, 1946 K.M. Fender.” Deposited in AMNH.

**ETYMOLOGY.**—The specific epithet is from the Catalan *petit* (small) and refers to the small size of this species.

**DIAGNOSIS.**—Male with a retrolateral apophysis in the trochanter (Figure 343) and only two or three denticles in the cymbial process. Only *P. altiocolata* also has an apophysis in the trochanter, but usually it is of larger body size and has numerous denticles in the cymbial process.

**Male (Holotype):** Total length 4.83. Cephalothorax 2.33 long, 1.95 wide, 1.40 high; light brown, with a light gray longitudinal line and margins. Sternum 1.21 long, 1.21 wide; gray. Abdomen 2.33 long, 1.86 wide, 1.95 high; very light brown with a dark gray pattern. AME diameter 0.12. PME 1.17, PLE 1.17, ALE 1.00 times one AME diameter. AME separation 0.67 times their diameter, PME separation 0.71 times their diameter. PME-PLE separation 1.00 times one PME diameter, AME-ALE separation 0.50 times one ALE diameter. Clypeus height 2.50 times one AME diameter. Chelicerae with three prolateral and two retrolateral teeth. Cheliceral stridulating files present and conspicuous. Legs light brown with light gray annuli. Leg and pedipalp lengths of male described above:

	I	II	III	IV	Pdp
Femur	4.5	3.7	2.9	3.6	0.7
Patella	0.8	0.8	0.7	0.7	0.3
Tibia	4.7	3.8	2.4	3.4	0.2
Metatarsus	4.5	3.5	2.5	3.3	—
Tarsus	2.0	1.8	1.3	1.6	0.6
Total	16.5	13.6	9.8	12.6	1.8

Legs 1243. Femur I 1.96 times length of cephalothorax, with a group of thick spines (around 10) in the center of the ventral-prolateral side. Metatarsus I trichobothrium 0.85. Pedipalp with retrolateral apophysis in the trochanter, as in Figures 338–343.

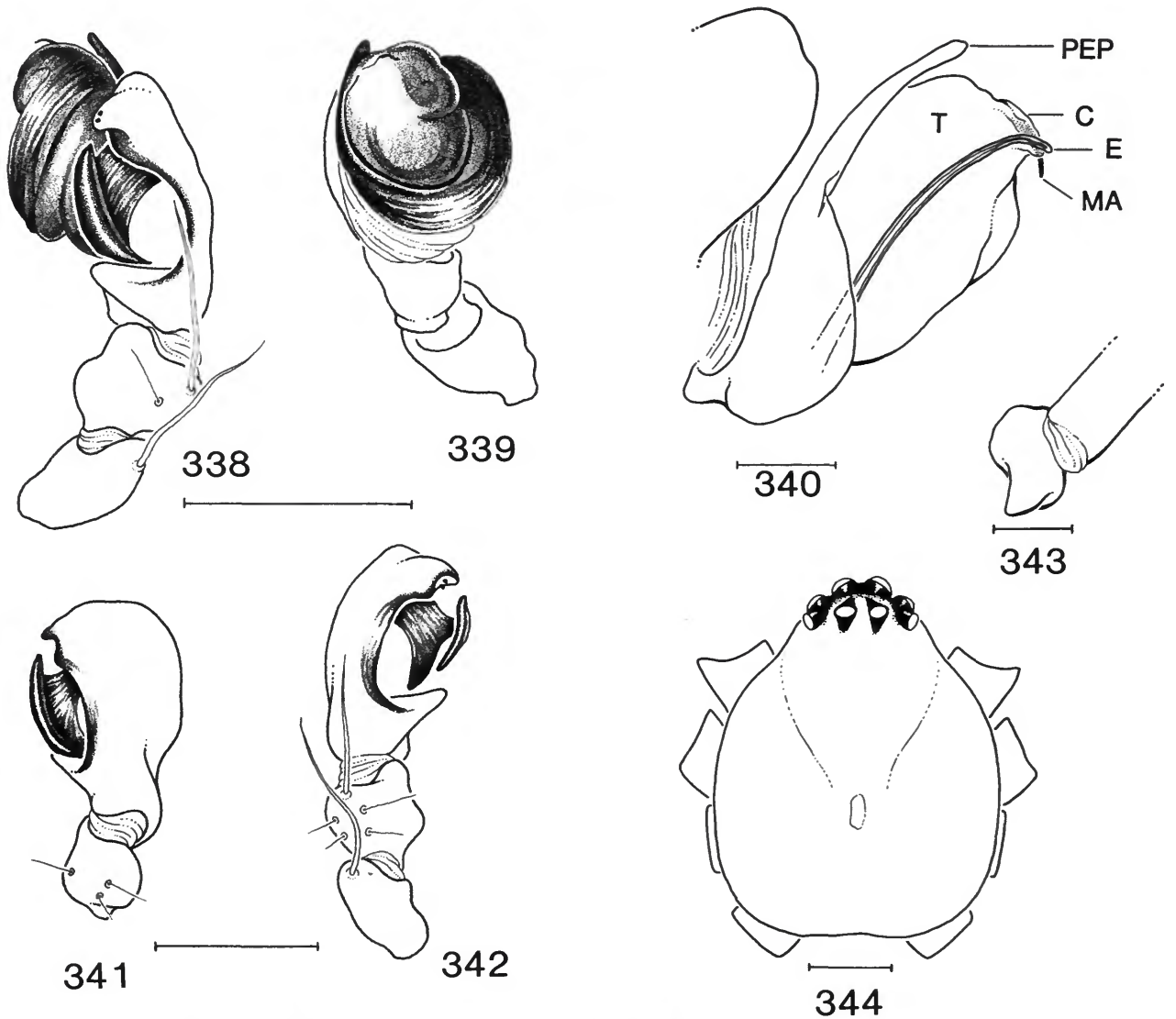
**Female:** Unknown.

**VARIATION.**—The right and left pedipalps of the only specimen available present some differences. The PCS in the right pedipalp is quite different from the left one, in that the former has a constriction (Figure 342), and the tibia has two retrolateral trichobothria (while there is only one in the left one). Obviously one of the PCS is malformed. Because the PCS of the left palp is very similar to the one in its sister species *altiocolata* I think that the right PCS is the malformed one.

**ADDITIONAL MATERIAL EXAMINED.**—None.

**DISTRIBUTION.**—Known only from the type locality in the Yamhill County in northwestern Oregon (Figure 117). It is interesting to note that its sister species, *Pimosa altiocolata*, can be also found in the type locality of *petita*. Although I did





FIGURES 338-344.—*Pimoa petita*, new species, male (holotype): 338, palp, ectal; 339, same, ectal; 340, same, mesal; 341, same, dorsal; 342, right palp, ectal; 343, trochanter I; 344, cephalothorax, dorsal. (Scale lines: 0.5 mm, except 340, 0.1 mm, and 343, 0.25.)

collect *altioculata* in Peavine Ridge, the type locality, I could not find *petita*.

***Pimoa breviata* Chamberlin and Ivie**

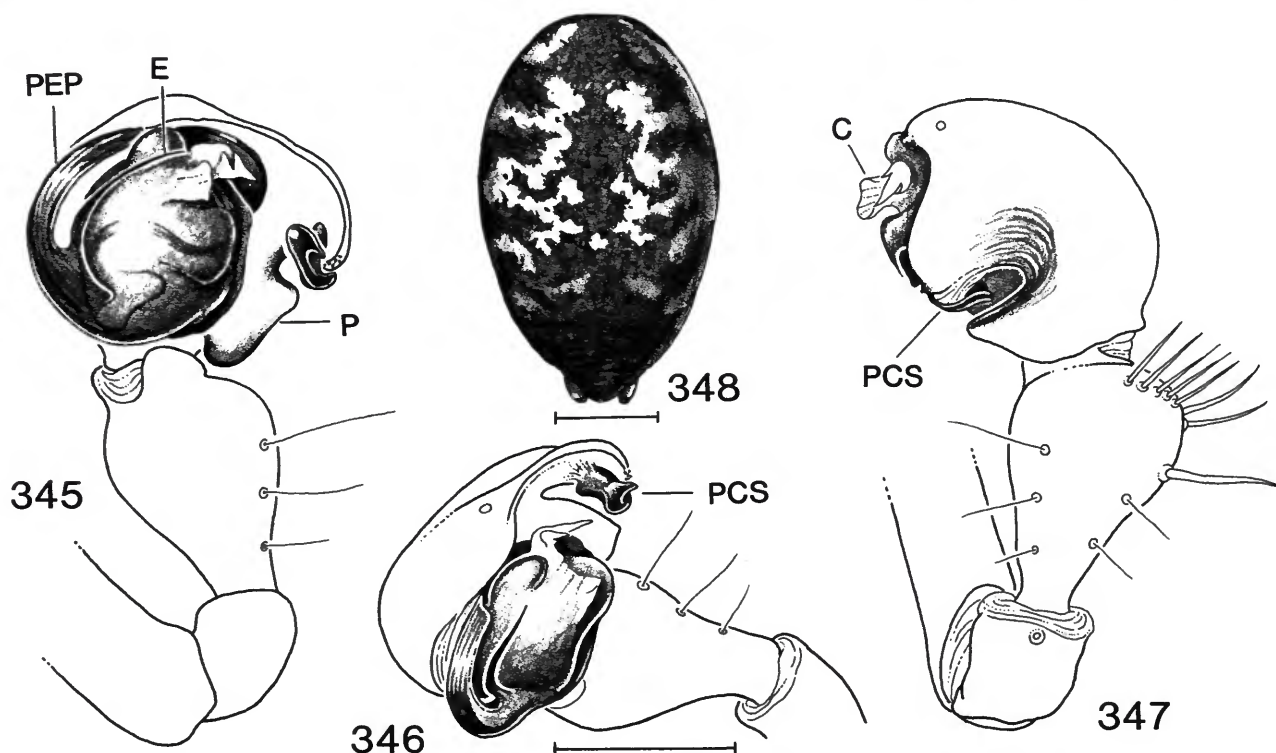
FIGURES 3-6, 345-367, 189

*Pimoa breviata* Chamberlin and Ivie, 1943:11, fig. 16 [♀].—Brignoli, 1975:13; 1983:231.—Roth, 1988:45.

TYPES.—Female holotype and two female paratypes, labels state "*Pimoa breviata* Chamberlin and Ivie ♀ 122.43 NW

Oregon: Canyon Creek So. of Roseburg September 9, 1935 Chamberlin & Ivie HOLOTYPE" and "*Pimoa breviata* Chamberlin and Ivie ♀ 123.43 NW Oregon: Comstock September 9, 1935 Chamberlin and Ivie PARATYPE" (two females). Deposited in AMNH. Examined.

DIAGNOSIS.—Male with embolus of approximately the same length as the PEP (measured from the embolus-PEP connection towards the distal end, Figure 346). Epigynum with heavily sclerotized distal margin, bearing two short dorsal plate projections, distant one from another no more than one



FIGURES 345-348.—*Pimoa breviata* Chamberlin and Ivie, male: 345, male from California, palp, ventral; 346, same, apical; 347, same, dorsoactal; 348, male from California, abdomen, dorsal. (Scale lines: 0.5 mm, except 348, 1.0 mm.)

projection length. The dorsal plate projections of *laurae* and *edenticulata* are larger.

**Male** (from Bookings, Oregon): Total length 7.0. Cephalothorax 3.4 long, 2.5 wide, 2.1 high; light brown with a gray longitudinal line and margins. Sternum 1.7 long, 1.6 wide; dark brown. Abdomen 3.6 long, 2.2 wide, 3.0 high; whitish with a dark gray pattern (Figure 348). AME diameter 0.20. PME 1.00, PLE 0.80, ALE 1.00 times one AME diameter. AME separation 0.60 times their diameter. PME separation 0.60 times their diameter. PME-PLE separation 0.80 times one PME diameter, AME-ALE separation 0.50 times one ALE diameter. Clypeus height 1.60 times one AME diameter. Chelicerae with three prolateral and two retrolateral teeth. Cheliceral stridulating files present. Legs brown with dark brown annuli. Leg and pedipalp lengths of male described above:

	I	II	III	IV	Pdp
Femur	8.5	6.5	4.5	5.7	1.6
Patella	1.3	1.1	0.9	1.0	0.5
Tibia	9.4	9.9	8.5	5.7	0.8
Metatarsus	10.0	7.4	4.7	6.3	—
Tarsus	3.2	2.5	1.8	2.1	0.8
Total	32.4	24.4	20.4	20.8	3.7

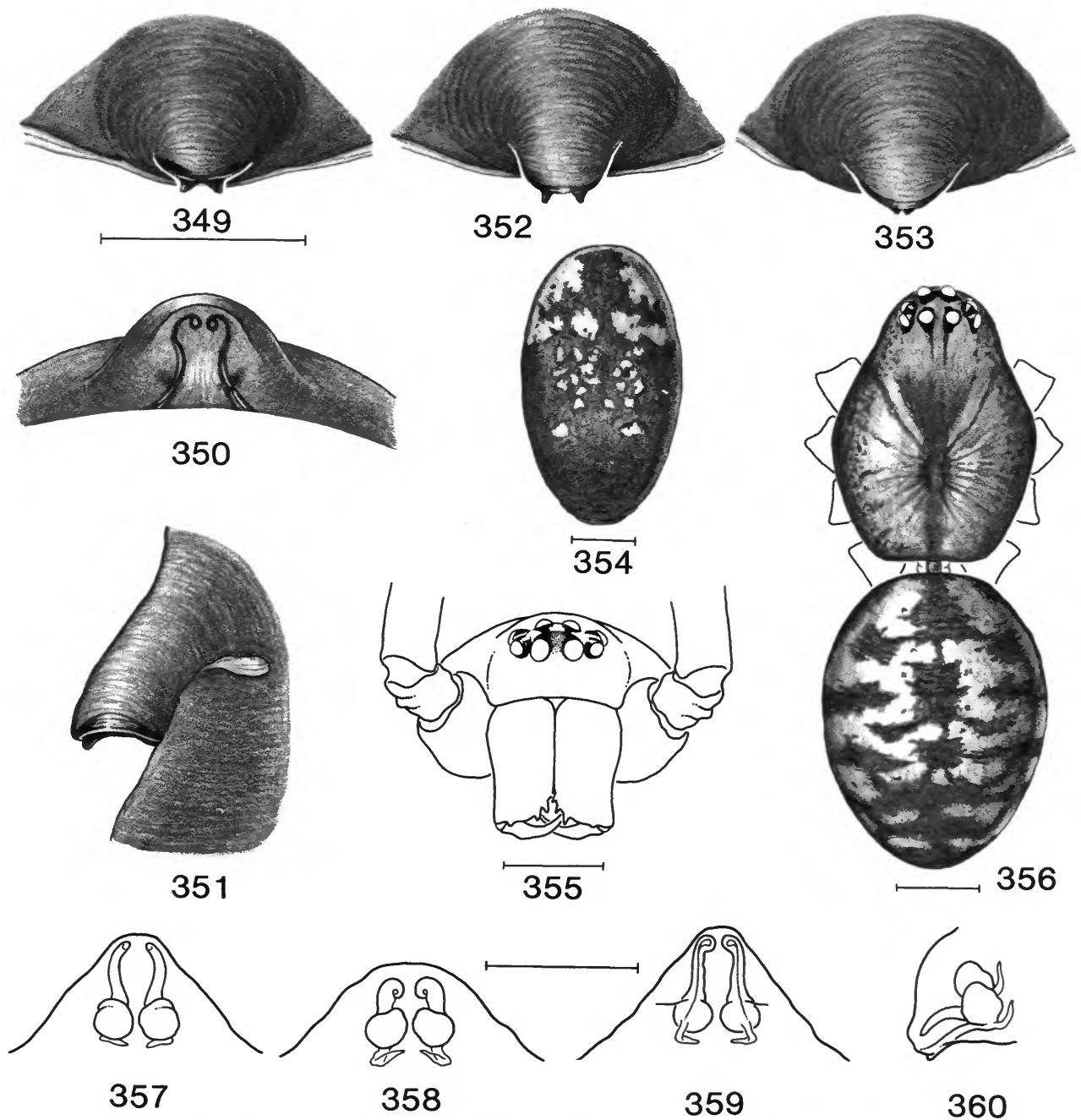
Legs 1243. Femur I 2.50 times length of cephalothorax. Legs covered with long setae (specially legs I and II). Metatarsus I

trichobothrium 0.86. Pedipalp as in Figures 345-347, 361-365.

**Female** (holotype): Total length 7.4. Cephalothorax 3.6 long, 2.8 wide, 1.9 high; light brown with a dark brown longitudinal line and margins (Figure 356). Sternum 2.0 long, 1.6 wide; dark brown. Abdomen 3.7 long, 3.1 wide, 3.5 high; light brown with a dark brown pattern (Figure 356). AME diameter 0.22. PME 0.90, PLE 0.90, ALE 0.90 times one AME diameter. AME separation 0.50 times their diameter, PME separation 0.77 times their diameter. PME-PLE separation 1.00 times one PME diameter, AME-ALE separation 0.50 times one ALE diameter. Clypeus height 2.00 times one AME diameter. Chelicerae with three prolateral and two retrolateral teeth. Cheliceral stridulating files absent. Legs light brown with dark brown annuli. Leg and pedipalp lengths of female described above:

	I	II	III	IV	Pdp
Femur	6.1	5.3	4.0	4.8	1.3
Patella	1.4	1.3	1.0	1.1	0.5
Tibia	6.5	5.3	3.4	5.1	0.8
Metatarsus	6.1	5.1	3.6	4.8	—
Tarsus	2.7	2.3	1.7	2.1	1.4
Total	22.8	19.3	13.7	17.9	3.8

Legs 1243. Femur I 1.69 times length of cephalothorax. Legs

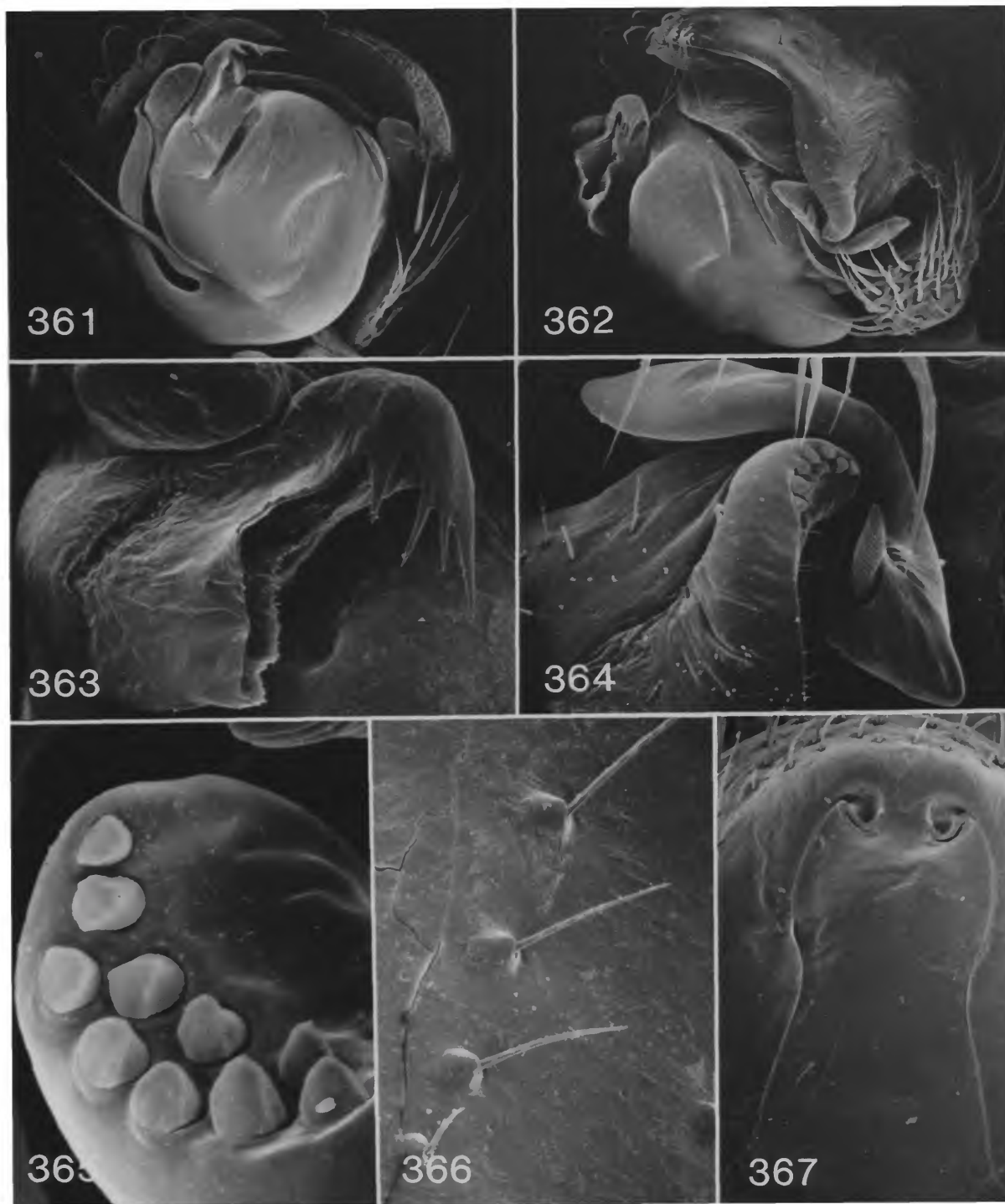


FIGURES 349-360.—*Pimoa breviata* Chamberlin and Ivie, female: 349, female from Oregon, epigynum, ventral; 350, same, dorsal; 351, same, lateral; 352, female from California, epigynum, ventral; 353, female from Oregon, epigynum, ventral; 354, female from Oregon, abdomen, dorsal; 355, holotype, cephalothorax, frontal; 356, holotype, dorsal; 357, female from California, epigynum, cleared, ventral; 358, same, anteroventral; 359, same, dorsal; 360, same, lateroventral. (Scale lines: 0.5 mm, except 354-356, 1.0 mm.)

covered with long setae. Metatarsus I trichobothrium 0.87. Epigynum as in Figures 349-353, 357-360, 367.

VARIATION.—Male cephalothorax ranges in length from 2.7

to 3.8, female from 3.3 to 5.1. Some females have very inconspicuous (scale-like) stridulatory striae. Some individuals have a very dark body coloration, with the abdominal light



FIGURES 361-367.—*Pimoa breviata* Chamberlin and Ivie, male from California, female from Oregon: 361, palp, ventral; 362, palp ectal; 363, conductor; 364, cymbial denticulated process and PCS; 365, cymbial denticulated process; 366, base of palpal femur (mesal) with enlarged setal bases; 367, epigynum, dorsal (dorsal plate projections are broken off).

pattern quite reduced (Figure 354). The dorsal plate projections vary in size and in the distance between them (approximately no longer than one projection length; Figures 349, 352, 353).

**ADDITIONAL MATERIAL EXAMINED.**—UNITED STATES: CALIFORNIA: Del Norte Co.: near Crescent City, Six River Natl. For., 4 Jul 1951 (Levi, MCZ), 1♀; Del Norte Coast, Redwood State Park, off US101 (41°38'N, 124°05'W), 17 Jul 1990, *Sequoia sempervirens* forest (G. Hormiga, USNM), 1♀; Middle Fork of Smith river (41°51'N, 123°55'W), 4 Sep 1963 (J. and W. Ivie, AMNH), 1♂; Patrick (41°50'N, 123°50'W), 16 Sep 1961 (W.J. Gertsch, W. Ivie, AMNH), 1♀; Humboldt Co.: Arcata, Azalea Park, 3 Sep 1963 (J. and W. Ivie, AMNH), 1♂, 2♀; 1.5 mi (2.4 km) E Bridgeville, off Rt. 36 (40°27'N, 123°46'W), 18 Jul 1990 (G. Hormiga, USNM), 1♀; 1–1.5 mi (1.6–2.4 km) E Bridgeville, off Rt. 36 (40°27'N, 123°46'W), 18 Jul 1990 (G. Hormiga, USNM), 1♂, 1♀; Carlotta (40°N, 124°W), 15 Sep 1965 (W.J. Gertsch, W. Ivie, AMNH), 1♂; Carlotta (40°N, 124°W), 15 Sep 1961 (W.J. Gertsch, W. Ivie, AMNH), 1♀; Grizzly Creek Redwoods State Park, Hiker's trail (40°31'N, 123°58'W), 18 Jul 1990, *Sequoia sempervirens* forest (G. Hormiga, USNM), 2♂, 4♀; 7.3 mi (11.7 km) E of Carlotta (40°32'N, 123°56'W), 1 Oct 1959 (V. Roth, AMNH), 1♀; Mckinleyville bog area, near Azalea Avenue, 5 Aug 1980 (T.W. Davies, CAS), 1♀; near Miranda, Humboldt Redwoods St. Park (40°14'N, 123°49'W), 30 Sep 1963 (W.J. Gertsch, AMNH), 1♀; 5 mi (8 km) S of Orleans (41°16'N, 123°35'W), 22 Aug 1959 (W.J. Gertsch, V. Roth, AMNH), 1♀; 5 mi (8 km) S of Scotia (40°26'N, 124°03'W), 14 Sep 1961 (W.J. Gertsch, W. Ivie, AMNH), 2♂, 5♀; 18 mi (29 km) W of Willow Creek (40°54'N, 123°55'W), 21 Aug 1959 (W.J. Gertsch, V. Roth, AMNH), 2♂, 1♀; Mendocino Co.: 8 mi (13 km) N Branscomb, NCCRP, 18–21 May 1985 (E. Schlinger, MCZ); 8 mi (13 km) N Branscomb, NCCRP, 18–21 May 1985 (E. Schlinger, USNM), 1♂ (reared to adult, 15 Jul 1985); Rt. 208, 15 mi (24 km) S of Leggett, 24 Mar 1980, *Abies* forest (J.A. Coddington, MCZ), 3♀; Rt. 208, 15 mi (24 km) S of Leggett, 24 Mar 1980, *Abies* forest (J.A. Coddington, USNM), 1♀; off Rt. 1, between Leggett and Rockport (39°46'N, 126°47'W), 19 Jul 1990 (G. Hormiga, USNM), 2♀; Piercy (39°58'N, 123°47'W), 23 Sep 1943 (W.J. Gertsch, AMNH), 2♀.

OREGON: Coos Co.: near Bridge Camp Myrtlewood, 28–31 Jul 1954 (V. Roth, AMNH), 1♀; Coos Bay, Thomas Street (42°23'N, 124°11'W), 15 Jul 1990, patch of forest in urban area (G. Hormiga, USNM), 1♀; Curry Co.: Azalea State Park, Brookings (42°04'N, 124°15'W), 16 Jul 1990 (G. Hormiga and L. Garcia de Mendoza, USNM), 1♂, 6♀; Brookings, 6 Jun 1951 (B. Malkin, AMNH), 1♂; 7 mi (11.2 km) E Brookings, Myrtle Grove, Chetco river, 29 May 1952 (V. Roth, AMNH), 1♂; 10 mi (16 km) N Brookings, 1 May 1951 (V. Roth, AMNH), 1♀; 12 mi (19.2 km) NE of Gold Beach (42°30'N, 124°15'W), 30 Sep 1959 (V. Roth, AMNH), 5♂, 24♀; Pistol river, 18 Jun 1952 (B. Malkin, AMNH), 1♀; Pistol river, 17 Sep 1950 (B. Malkin, AMNH), 1♀; Port Orford, 17 Jul 1951 (B. Malkin, AMNH), 1♀; Jackson Co.: Ashland, 30 Aug 1931 (W. Ivie, AMNH), 1♀; Klamath Co.: Klamath L., 12 Sep 1932 (T. Kincaid, UW), 1♂;

Lane Co.: Blue Pool Forest Camp, Willamette Ntl. For., 7 Sep 1949 (V. Roth, AMNH), 1♀.

**DISTRIBUTION.**—Western California and Oregon (Figure 189).

### *Pimosa curvata* Chamberlin and Ivie

FIGURES 368–389, 189

*Pimosa curvata* Chamberlin and Ivie, 1943:10–11, fig. 15 [♀].—Brignoli, 1975:13; 1983:231.—Crawford, 1988:23.—Roth, 1988:45.

**TYPES.**—Female holotype, label states "*Pimosa curvata* Chamberlin and Ivie ♀ 121.46 NW. Washington: American river July 5, 1938. Wilton Ivie collector. HOLOTYPE," deposited in AMNH. Examined.

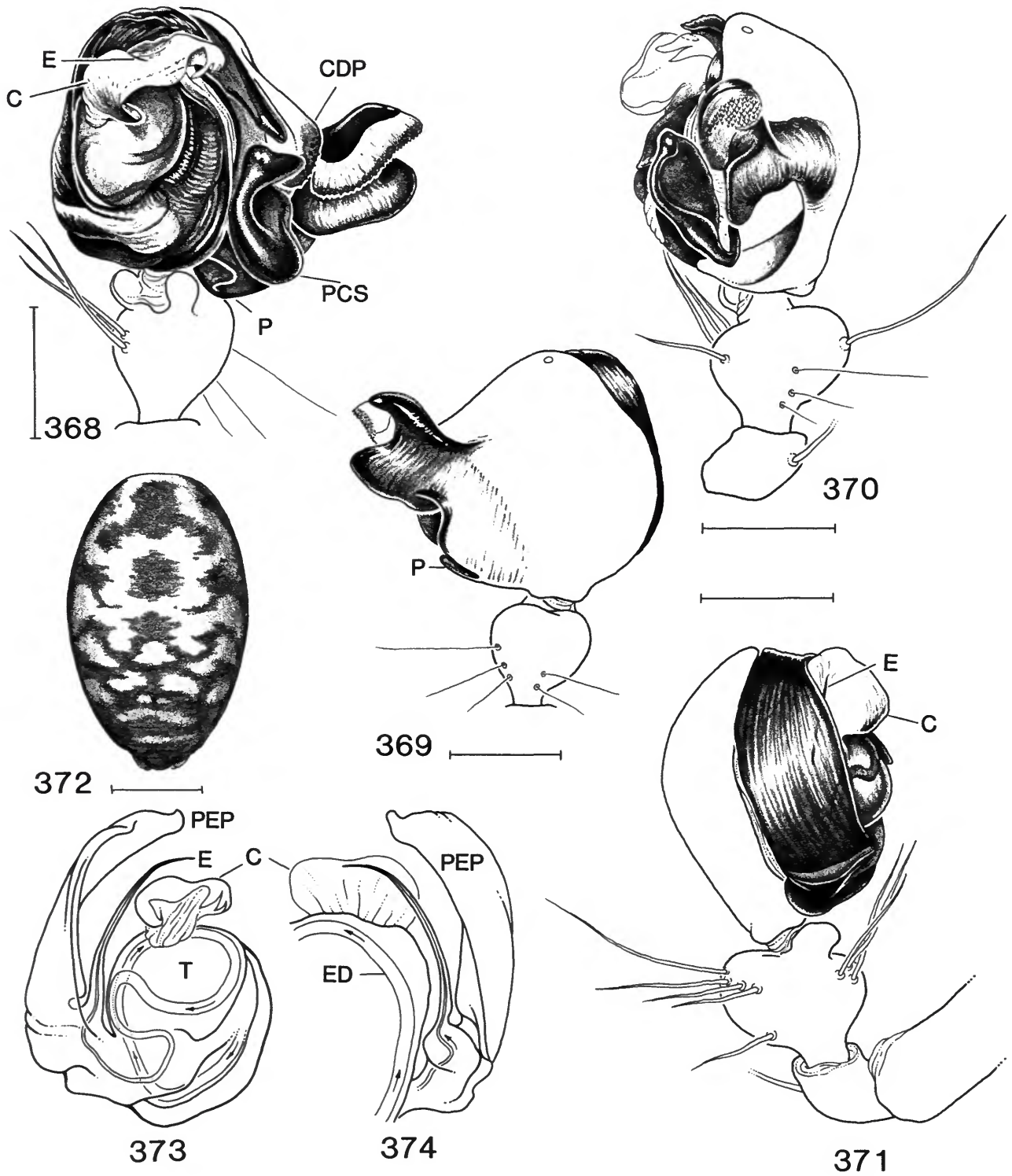
**DIAGNOSIS.**—Male cymbium with a large retrolateral projection which bears on its distal margin several rows of small teeth (Figures 368–370, 384, 385, 387). The cymbial denticulated process lays between the other retrolateral projection and the distal end of the PCS. PEP with a wide lamelliform base. Conductor very large and bilobate (Figures 368, 388). Epigynum with a thick and rounded dorsal plate projection (Figure 375).

**Male** (from Lake Wenatchee, Washington): Total length 7.2. Cephalothorax 3.4 long, 2.7 wide, 2.1 high; light brown, darker at the margins. Sternum 2.0 long, 1.6 wide; dark brown. Abdomen 3.4 long, 2.9 wide, 3.9 high; dark gray-brown pattern on a whitish background (Figure 372). AME diameter 0.16. PME 0.88, PLE 0.88, ALE 1.00 times one AME diameter. AME separation 0.63 times their diameter, PME separation 1.14 times their diameter. PME-PLE separation 1.00 times one PME diameter, AME-ALE separation 0.75 times one ALE diameter. Clypeus height 3.00 times one AME diameter. Chelicerae with three prolateral and two retrolateral teeth. Cheliceral stridulating files present and conspicuous. Legs yellowish brown with darker brown annuli. Leg and pedipalp lengths of male described above:

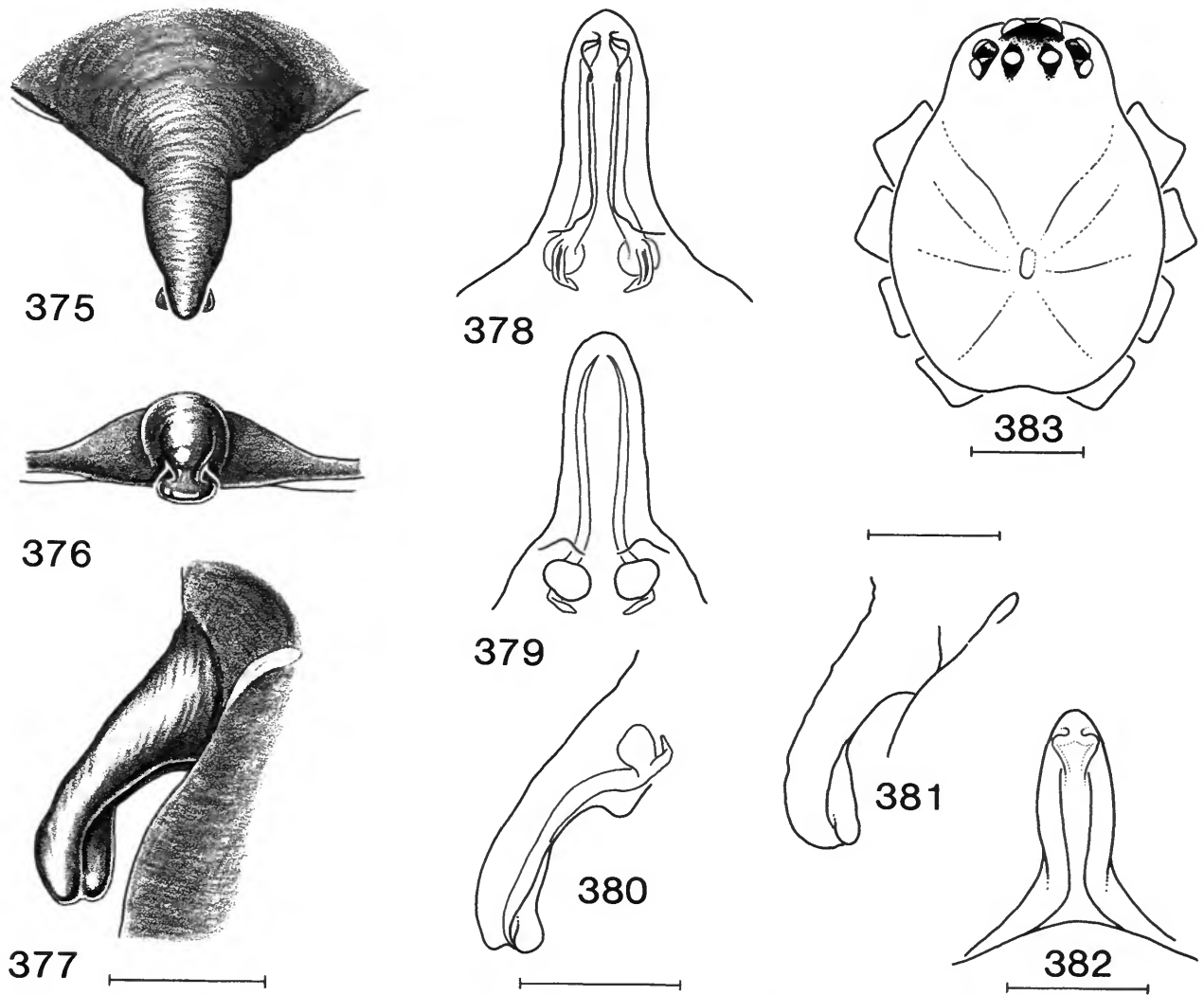
	I	II	III	IV	Pdp
Femur	5.7	4.8	3.8	4.7	1.5
Patella	1.1	1.0	0.8	1.0	0.4
Tibia	6.0	5.2	3.4	4.8	0.5
Metatarsus	5.8	4.8	2.6	4.8	—
Tarsus	2.5	2.1	1.6	1.9	1.2
Total	21.1	17.9	12.2	17.2	3.64

Legs 1243. Femur I 1.68 times length of cephalothorax. Metatarsus I trichobothrium 0.90. Pedipalp as in Figures 368–371, 373, 374, 384–389.

**Female** (Holotype): Total length 7.3. Cephalothorax 3.6 long, 2.7 wide, 1.9 high; reddish brown darker at the margins. Sternum 2.1 long, 1.6 wide; dark brown, darker at the margins. Abdomen 3.8 long, 3.2 high; dark gray pattern on a whitish background, very similar to the male. AME diameter 0.20. PME 1.00, PLE 0.90, ALE 0.90 times one AME diameter. AME separation 0.60 times their diameter, PME separation 0.77 times their diameter. PME-PLE separation 0.77 times one



FIGURES 368-374.—*Pimoa curvata* Chamberlin and Ivie, male from Washington: 368, palp, ventral; 369, same, dorsal; 370, same, ectal; 371, same, mesal; 372, abdomen, dorsal; 373, tegulum, schematic, ventral; 374, same, dorsomesal. (Scale lines: 0.5 mm, except 372, 1.0 mm.)



FIGURES 375-383.—*Pimoa curvata* Chamberlin and Ivie, female: 375, female from Washington, epigynum, ventral; 376, same, posterior; 377, same, lateral; 378, female from Washington, epigynum, cleared, dorsal; 379, same, ventral; 380, same, lateral; 381, epigynum, lateral; 382, same, dorsal; 383, holotype, cephalothorax, dorsal. (Scale lines: 0.5 mm, except 383, 1.0 mm.)

PME diameter, AME-ALE separation 0.55 times one ALE diameter. Clypeus height 2.20 times one AME diameter. Chelicerae with three prolateral and two retrolateral teeth. Cheliceral stridulating files absent. Legs brown with dark gray annuli. Leg and pedipalp lengths of female described above:

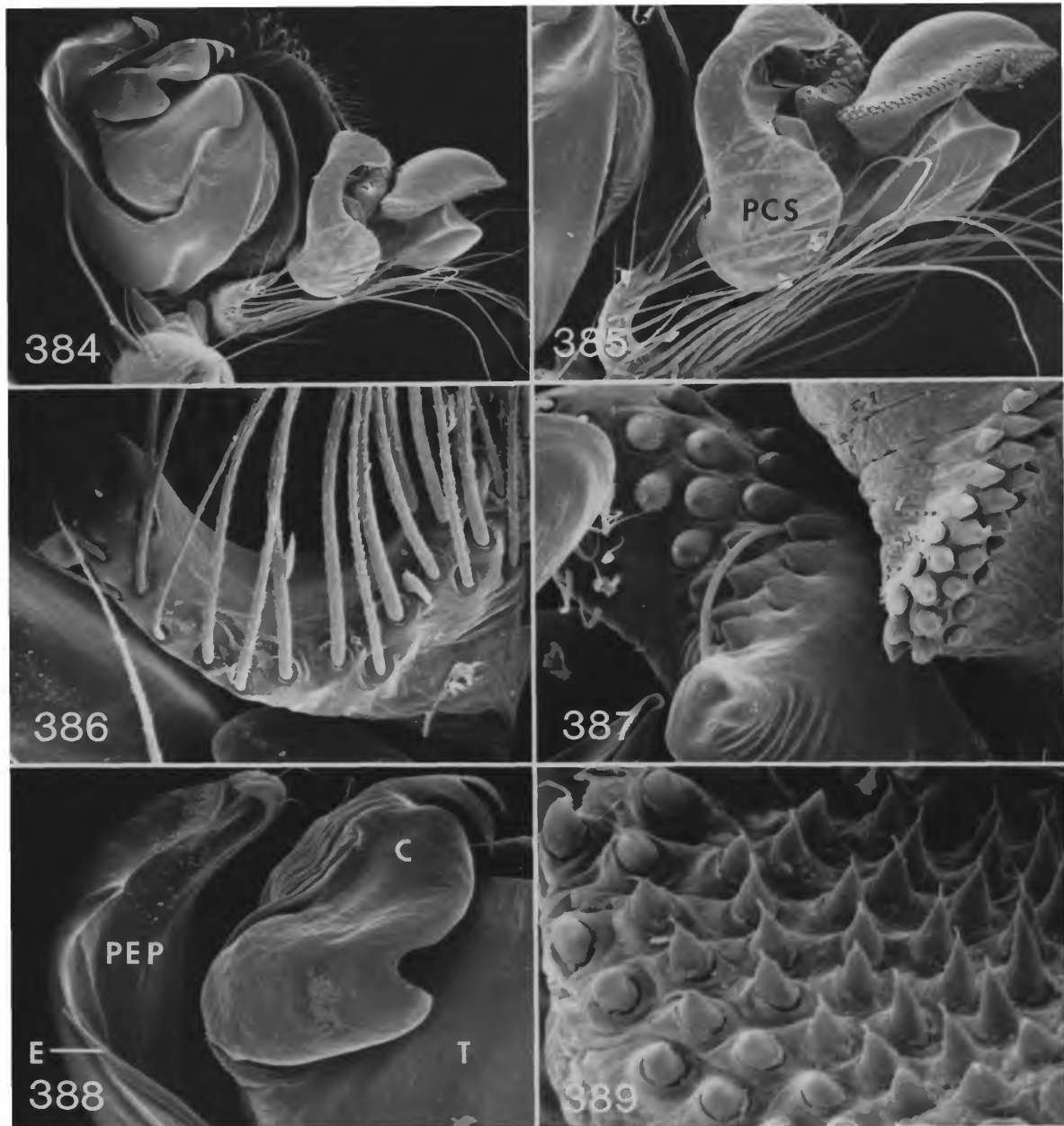
	I	II	III	IV	Pdp
Femur	5.0	4.6	3.7	4.8	1.3
Patella	1.2	1.1	1.0	1.2	0.4
Tibia	5.2	4.6	3.0	4.3	0.8
Metatarsus	4.6	4.1	3.2	4.3	—
Tarsus	2.3	1.9	1.4	1.8	1.6
Total	18.3	16.3	12.3	16.4	4.1

Legs 1243. Femur I 1.39 times length of cephalothorax.

Metatarsus I trichobothrium 0.87. Epigynum as in Figures 375-382.

VARIATION.—Male cephalothorax ranges in length from 3.2 to 3.4, female from 3.1 to 4.5. Some specimens have legs covered with long setae. Some specimens have darker abdomens, with a reduced light pattern.

ADDITIONAL MATERIAL EXAMINED.—UNITED STATES: OREGON: Hood River Co.: Parkdale, 31 Mar 1938 (Gray and Schuh, AMNH), 1♀; WASHINGTON: Chelan Co.: Bridge Cr. Camp (47.563°N, 120.782°W), 8-9 May 1987, 2280 ft, ex rotten logs and stumps (R. Crawford, UW), 1♀; Lake Wenatchee (47.80-84°N, 120.7°W), 27 Sep 1970, 1900 ft (J.R. Thompson, UW), 1♂; Orr Creek (47.306°N, 120.340°W), 4 May 1974, 3380 ft, under log bark (R. Crawford, UW), 1♀; W

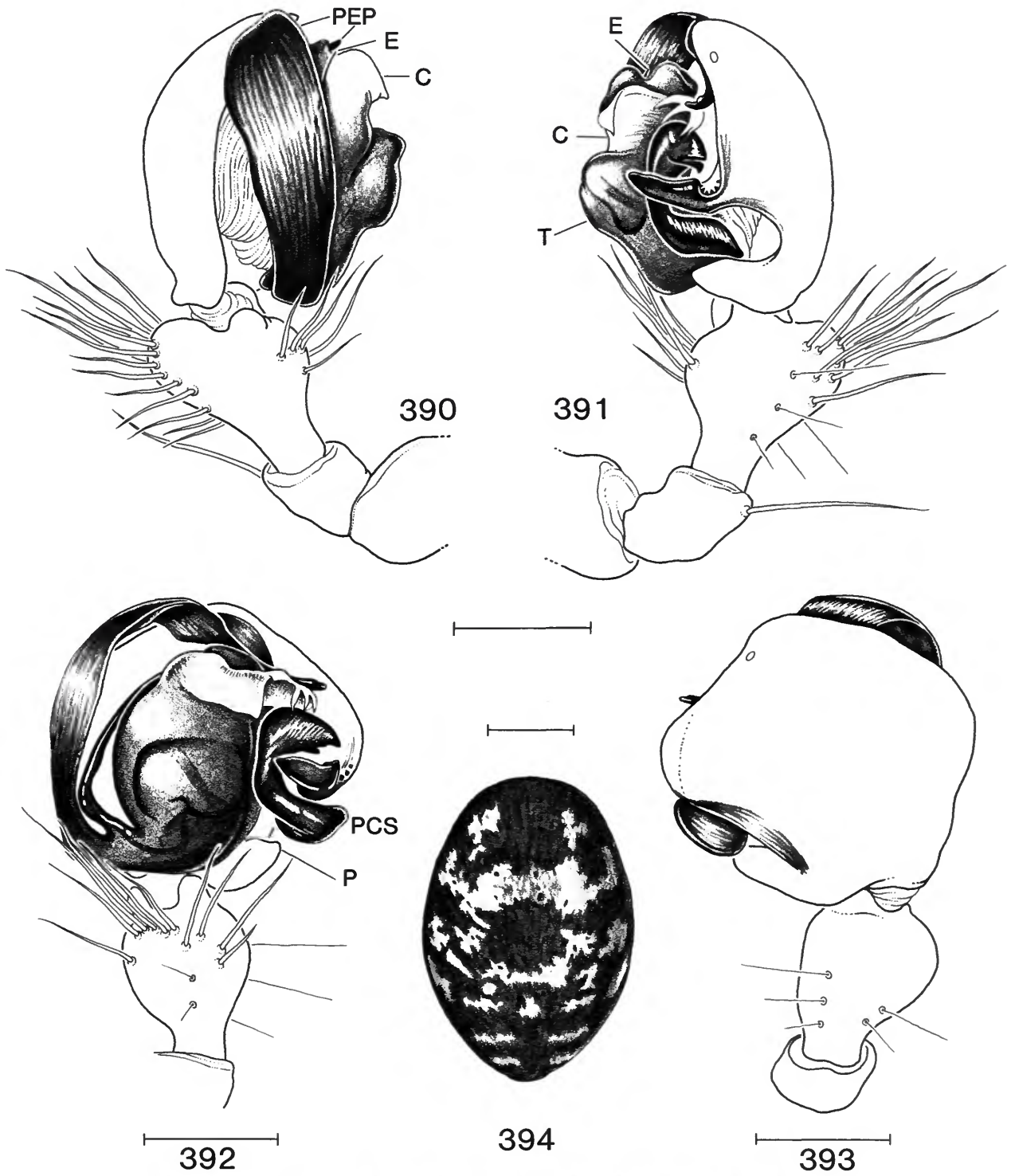


FIGURES 384–389.—*Pimoina curvata* Chamberlin and Ivie, male from Washington: 384, palp, ventral; 385, cymbial denticulated process, cymbial apophysis, and PCS; 386, paracymbium, ectal; 387, cymbial denticulated process and cymbial apophysis; 388, palp, apical closeup; 389, cymbial apophysis, closeup.

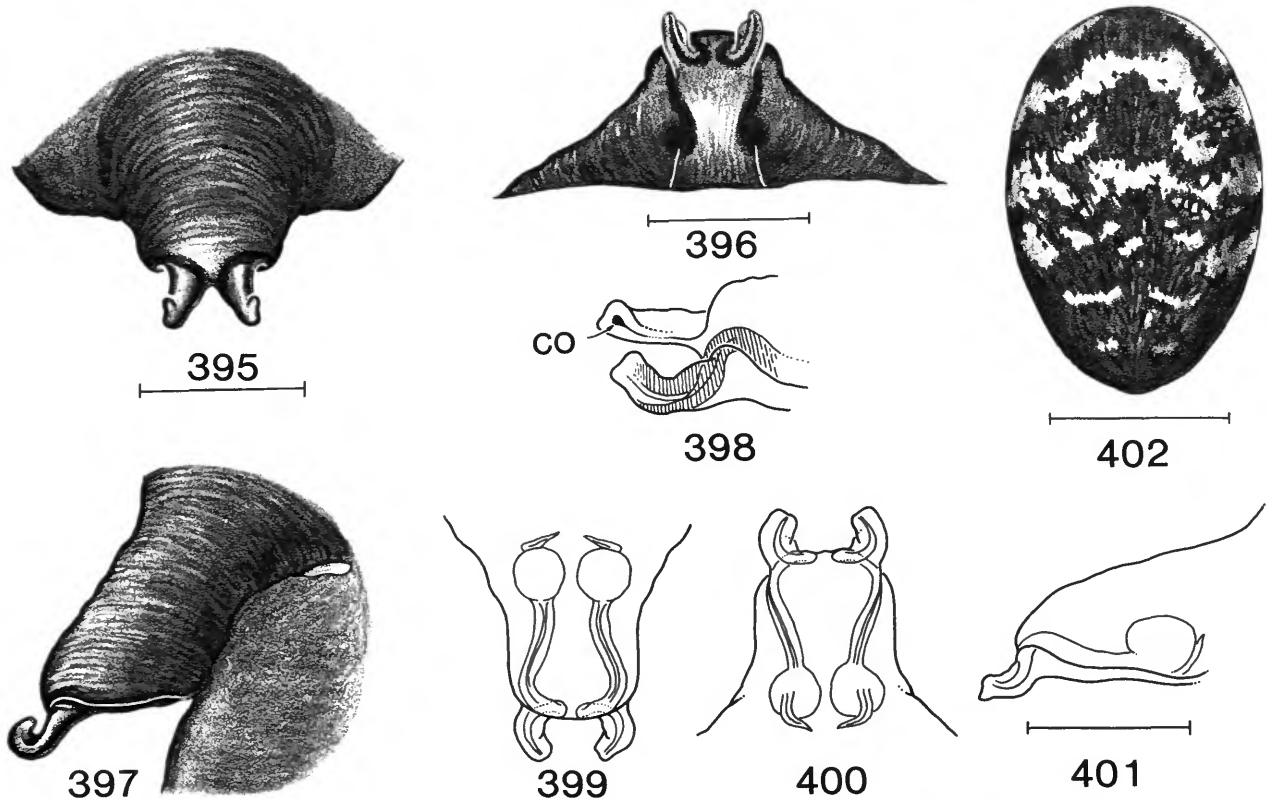
Tronsen Mdws. (47.336–341°N, 120.569°W), 7 Jul 1985, under bark by lower mdws (R. Crawford, UW), 1♂ (reared, matured Sep 1985); Kittitas Co.: (47.117°N, 120.785°W), 26 May 1986, 2160 ft, in old shack in *Populus* woods (R. Crawford, UW #7107), 1♂; Lost Lake Trailhead (47.022°N,

120.942°W), 5 Jun 1977, 4480 ft, under log bark (R. Crawford, UW), 1♂; Morrison Canyon (47.119°N, 120.811°W), 25 May 1986, 2450 ft (R. Crawford, UW), 1♀; Klickitat Co.: State Hwy 141, near Husum (45.786°N, 121.496°W), 11 Apr 1986, 550 ft, under rocks and logs (R. Crawford, UW), 1♀; Okanogan Co.:





FIGURES 390-394.—*Pimoa laurae*, new species, male from California: 390, palp, mesal; 391, same, ectal; 392, same, ventral; 393, same, dorsal; 394, holotype, abdomen, dorsal. (Scale lines: 0.5 mm, except 394, 0.25 mm.)



FIGURES 395-402.—*Pimoa laurae*, new species, female from California: 395, epigynum, ventral; 396, same, dorsal; 397, same, lateral; 398, copulatory opening, schematic, lateroventral; 399, epigynum, cleared, ventral; 400, same, dorsal; 401, same, lateral; 402, paratype, abdomen, dorsal. (Scale lines: 0.5 mm.)

Tiffany Spr. Camp (48.699°N, 119.955°W), 31 Jul 1985, 6700 ft, under rocks and wood on ground (R. Crawford, UW), 4♀; Skamania Co.: S Peterson Prairies (45.964°N, 121.654°W), 19 Jun 1975, 2900 ft, near abandoned outhouse, with eggs, one prey of *Novalena* (R. Crawford, UW), 1♀; S Peterson Prairies (45.964°N, 121.654°W), 15 Jun 1975, 2900 ft, under rocks and logs (R. Crawford, UW), 1♀; Yakima Co.: N Fork Oak Cr. (46.736°N, 120.922°W), 4 Jun 1988, 2820 ft, under log bark (R. Crawford, UW), 1♀; Rimrock Lake, SE Rainier Park, 12 Sep 1965 (W. Ivie, AMNH), 1♂, 1♀.

DISTRIBUTION.—Central Washington and northern Oregon (Figure 189).

#### *Pimoa laurae*, new species

FIGURES 2, 390-408, 117

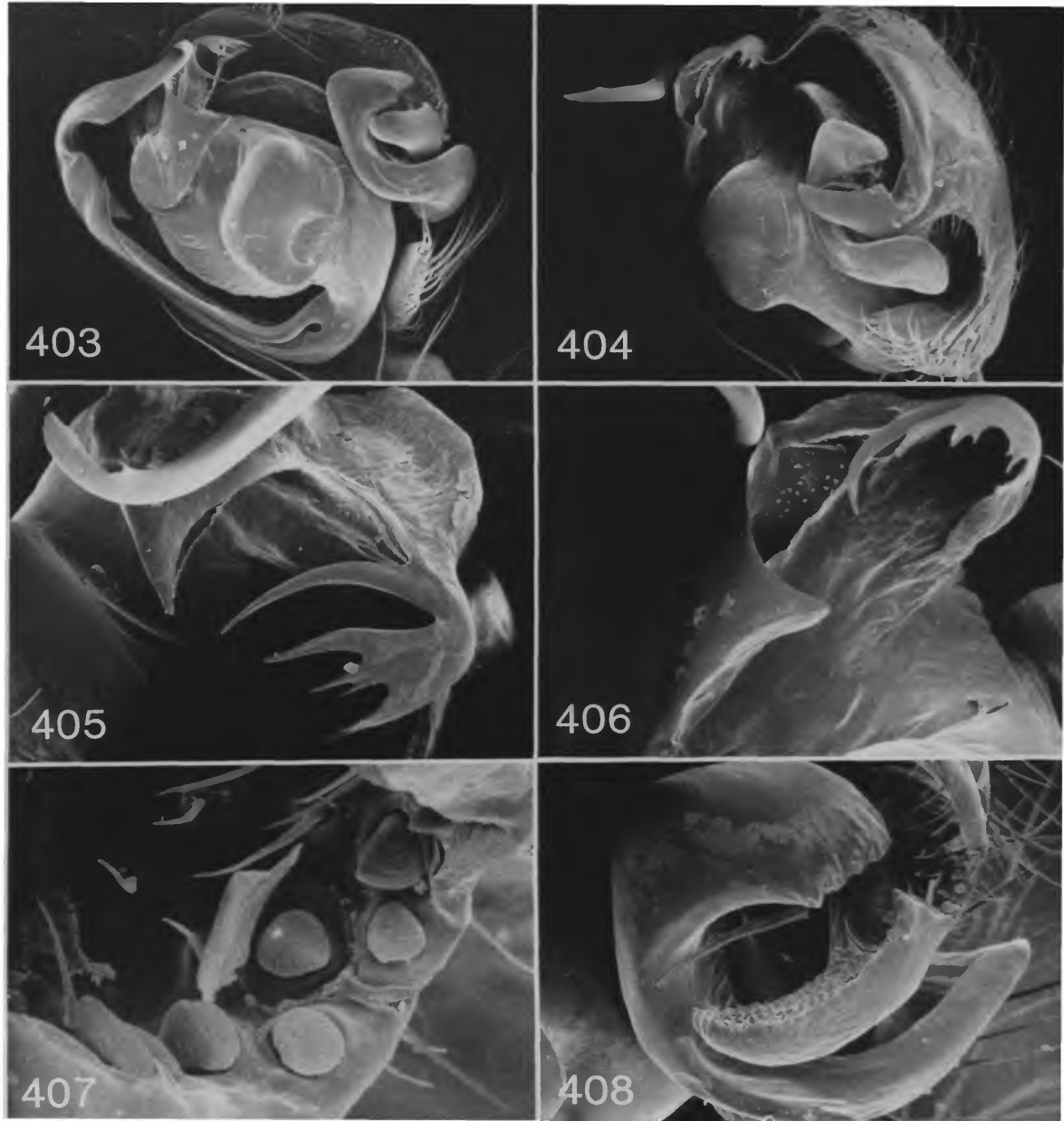
TYPES.—Male holotype, four males and two female paratypes from Bear Creek, near intersection Route 89 and Alpine Meadow Road, 4 mi (6.4 km) NW of Tahoe City, Placer Co., California (39°12'N, 120°15'W), 28.VII.1990, G. Hormiga and W.P. Maddison cols. Males collected as subadults and reared in the laboratory, molted to adults in August 1990. Deposited in

USNM.

ETYMOLOGY.—The species epithet is a patronym after my wife Laura.

DIAGNOSIS.—Males can be distinguished from its sister species *edenticulata* by the shape of the PCS and the pointed sclerotized end of the cymbial denticulate projection (Figures 391, 392). Females differ from those of *edenticulata* in having the dorsal plate projections curved ventrally (Figure 397).

*Male* (holotype): Total length 7.3. Cephalothorax 3.4 long, 2.5 wide, 1.9 high; light brown, darker at margins and with a gray longitudinal line. Sternum 1.9 long, 1.6 wide; dark brown, darker at margin. Abdomen 3.5 long, 2.5 wide, 1.9 high; whitish with dark gray pattern. AME diameter 0.50. PME 0.80, PLE 0.80, ALE 0.80 times one AME diameter. AME separation 0.50 times their diameter, PME separation 0.75 times their diameter. PME-PLE separation 0.89 times one PME diameter, AME-ALE separation 0.75 times one ALE diameter. Clypeus height 2.00 times one AME diameter. Chelicerae with three prolateral and two retrolateral teeth. Cheliceral stridulating files present. Legs brown with dark gray annuli, less pronounced in the first femur. Leg and pedipalp lengths of male described above:



FIGURES 403–408.—*Pimoides laurae*, new species, male from California: 403, palp, ventral; 404, palp, ectal; 405, conductor and PEP apex; 406, conductor; 407, cymbial denticulated process; 408, cymbial denticulated process and PCS.

	I	II	III	IV	Pdp
Femur	6.5	5.6	4.1	5.2	2.0
Patella	1.3	1.2	1.0	1.0	0.6
Tibia	6.7	5.7	4.9	3.5	0.7
Metatarsus	7.4	6.3	5.4	4.3	—
Tarsus	2.9	2.5	2.1	1.9	1.2
Total	24.8	21.3	17.5	15.9	4.5

Legs 1234. Femur I 1.91 times length of cephalothorax. Legs covered with long setae. Metatarsus I trichobothrium 0.91. Pedipalp as in Figures 390–393, 403–408.

*Female* (paratype): Total length 7.3. Cephalothorax 3.3 long, 2.5 wide, 1.8 high; brown, darker at margins and with a gray longitudinal line. Sternum 2.1 long, 3.4 wide; dark brown. Abdomen 5.0 long, 3.3 wide, 3.4 high; whitish with dark brown pattern. AME diameter 0.20. PME 0.90, PLE 0.90, ALE 0.90

times one AME diameter. AME separation 0.50 times their diameter, PME separation 0.78 times their diameter. PME-PLE separation 0.89 times one PME diameter. AME-ALE separation 0.50 times one ALE diameter. Clypeus height 1.60 times one AME diameter. Chelicerae with three prolateral and two retrolateral teeth. Cheliceral stridulating files present but inconspicuous. Legs light brown with dark brown annuli. Leg and pedipalp lengths of female described above:

	I	II	III	IV	Pdp
Femur	5.5	4.7	3.8	4.9	1.0
Patella	1.2	1.2	1.0	1.1	0.4
Tibia	5.7	4.7	3.1	4.7	0.7
Metatarsus	5.3	4.7	3.5	4.5	—
Tarsus	2.5	2.1	1.5	1.9	1.4
Total	20.2	17.4	12.9	17.1	3.5

Legs 1243. Femur I 1.67 times length of cephalothorax. Legs covered with long setae. Metatarsus I trichobothrium 0.84. Epigynum as in Figures 395–401.

VARIATION.—Male cephalothorax ranges in length from 3.4 to 4.2, female from 3.3 to 5.8.

ADDITIONAL MATERIAL EXAMINED.—UNITED STATES: CALIFORNIA: Placer Co.: 3 mi (4.8 km) N of Tahoe City (39°13'N, 120°09'W), 20 Sep 1961 (W.J. Gertsch, V.D. Roth, AMNH), 1♀. Yuba Co.: Camptonville (39°N, 121°W), 7 Sept 1959 (W.J. Gertsch, V.D. Roth, AMNH), 1♀.

DISTRIBUTION.—Known only from eastern California (Figure 117).

### *Pimosa edenticulata*, new species

FIGURES 1, 409–430, 117

TYPES.—Male holotype, two males and three females paratypes from Campground 3 mi (4.8 km) W of Willow Creek, Six Rivers National Forest, Humboldt Co., California; oak-bay-madrone forest, ex webs in evening, 27 Oct 1990, D. Ubick col. Holotype deposited in CAS, paratypes deposited in DU.

ETYMOLOGY.—The species epithet is from the Latin *edenticulatus* (without small teeth). It refers to the loss in this species of the characteristic denticles or cusps of the cymbial projection of pimoids.

DIAGNOSIS.—Males can be distinguished from its sister species *laurae* by the shape of the PCS. The absence of the characteristic pimoid denticles of the cymbial process is also diagnostic (Figures 410, 424). Females differ from those of *laurae* in having the epigynal dorsal plate projections straight instead of curved (Figures 415, 419).

*Male* (holotype): Total length 8.2. Cephalothorax 3.7 long, 2.8 wide, 2.2 high; light brown, with dark gray margin and longitudinal line. Sternum 2.2 long, 1.8 wide; dark brown with dark gray margin. Abdomen 4.0 long, 2.7 wide, 2.3 high; light brown with a dark gray pattern. AME diameter 0.24. PME 0.75, PLE 0.75, ALE 0.75 times one AME diameter. AME separation

0.50 times their diameter, PME separation 0.67 times their diameter. PME-PLE separation 1.00 times one PME diameter, AME-ALE separation 1.11 times one ALE diameter. Clypeus height 2.00 times one AME diameter. Chelicerae with three prolateral and two retrolateral teeth. Cheliceral stridulating files present and scale-like. Legs light brown with dark gray annuli. Leg and pedipalp lengths of male described above:

	I	II	III	IV	Pdp
Femur	7.7	6.1	4.1	5.8	2.1
Patella	1.4	0.8	1.0	1.1	0.7
Tibia	9.3	6.6	3.9	5.9	0.8
Metatarsus	9.4	6.7	4.6	6.0	—
Tarsus	3.5	2.7	1.9	2.2	1.3
Total	31.3	22.9	15.5	21.0	4.9

Legs 1243. Femur I 2.08 times length of cephalothorax. Legs covered with long setae. Metatarsus I trichobothrium 0.88. Pedipalp as in Figures 409–412, 421–426.

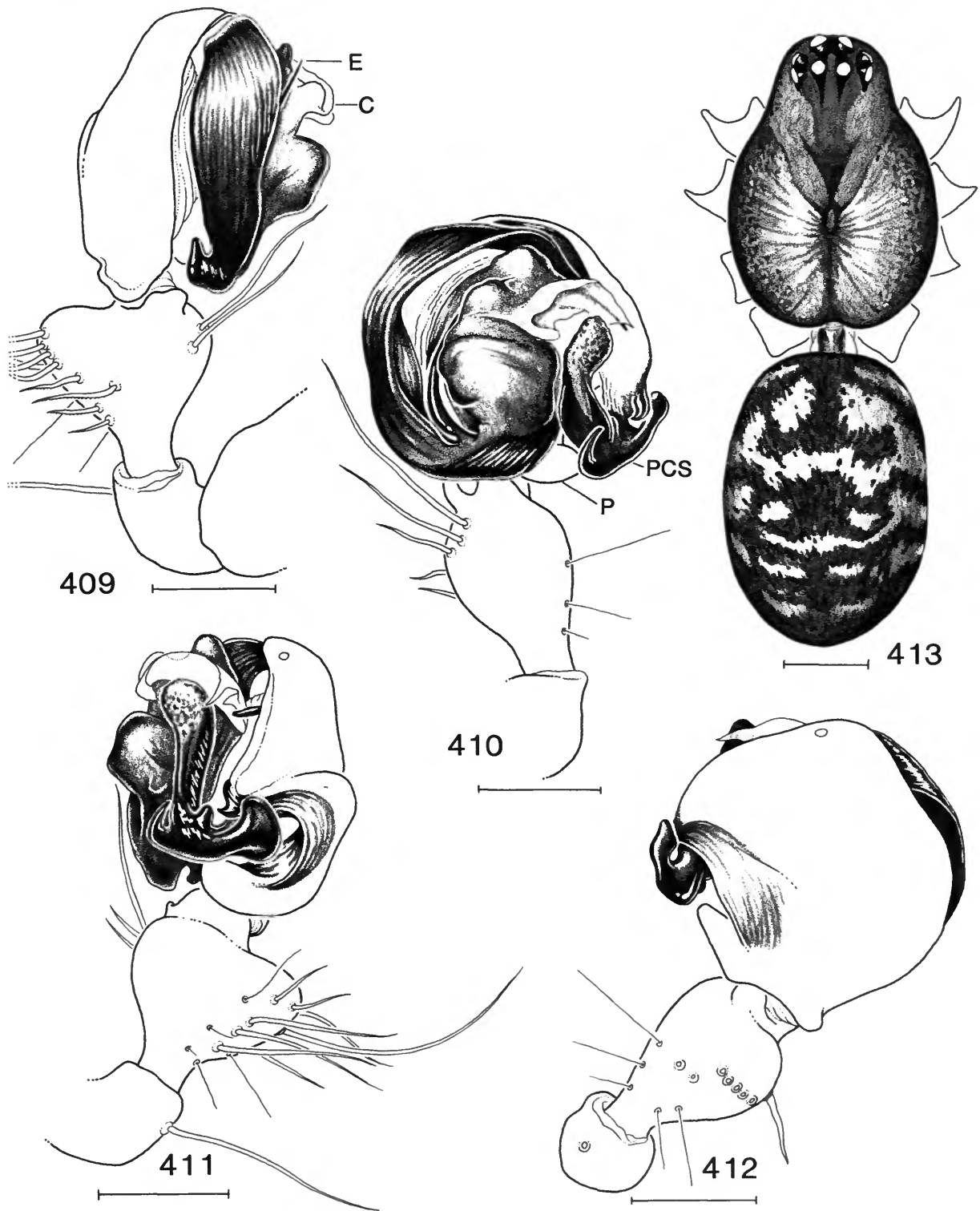
*Female* (paratype): Total length 9.0. Cephalothorax 4.2 long, 3.1 wide, 2.2 high; light brown, with very dark gray margin and longitudinal line. Sternum 2.4 long, 1.9 wide; dark brown, darker at margins. Abdomen 4.7 long, 3.5 wide, 5.6 high; light brown with dark gray pattern. AME diameter 0.24. PME 0.75, PLE 0.75, ALE 0.75 times one AME diameter. AME separation 0.58 times their diameter, PME separation 1.28 times their diameter. PME-PLE separation 1.00 times one PME diameter, AME-ALE separation 0.56 times one ALE diameter. Clypeus height 1.91 times one AME diameter. Chelicerae with three prolateral and two retrolateral teeth. Cheliceral stridulating files present and scale-like. Legs light brown with very dark brown annuli. Leg and pedipalp lengths of female described above:

	I	II	III	IV	Pdp
Femur	6.1	5.2	4.1	5.4	1.4
Patella	1.5	1.4	1.1	1.2	0.5
Tibia	6.8	5.4	3.4	5.2	1.3
Metatarsus	6.0	2.1	3.7	4.8	—
Tarsus	2.7	2.2	1.6	1.9	1.4
Total	23.1	16.3	13.9	18.5	4.6

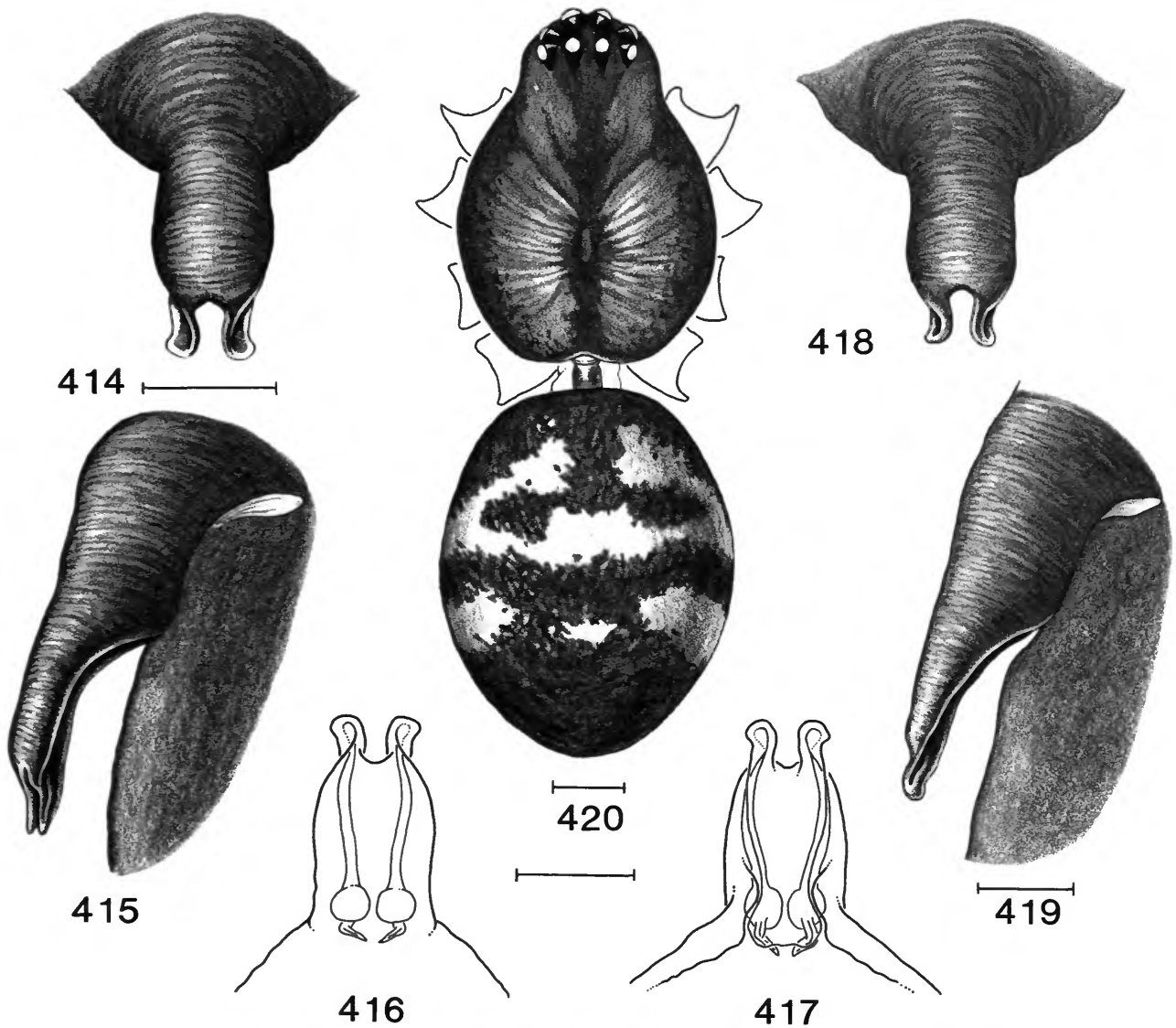
Legs 1432. Femur I 1.45 times length of cephalothorax. Legs covered with long setae. Metatarsus I trichobothrium 0.82. Epigynum as in Figures 414–419.

VARIATION.—Male cephalothorax ranges in length from 3.2 to 3.7, female from 2.8 to 4.2.

ADDITIONAL MATERIAL EXAMINED.—UNITED STATES: CALIFORNIA: Humboldt Co.: 10 mi (16 km) E of Bridgeville (40°N, 123°W), 20 Aug 1959 (W.J. Gertsch and V.D. Roth, AMNH), 1♀. Mendocino Co.: 8 mi (12.8 km) N of Branscomb, 18–21 May 1985 (E. Schlinger, USNM), 1♀; Standish-Hickley State Park, 20 Sep 1990, webs at campsite structures (D. Ubick, DU), 1♂ (matured 24 Sep 1990), 1♀. Trinity Co.: Del Loma, 25 Jun 1953 (W.J. and J.W. Gertsch, AMNH), 1♀; 5 mi (8 km) E of Forest Glen, 21 Aug 1959 (W.J. Gertsch and V.D. Roth,



FIGURES 409-413.—*Pimoa edenticulata*, new species, male from California: 409, palp, mesal; 410, same, ventral; 411, same, ectal; 412, same, dorsal; 413, holotype, dorsal. (Scale lines: 0.5 mm, except 413, 1.0 mm.)

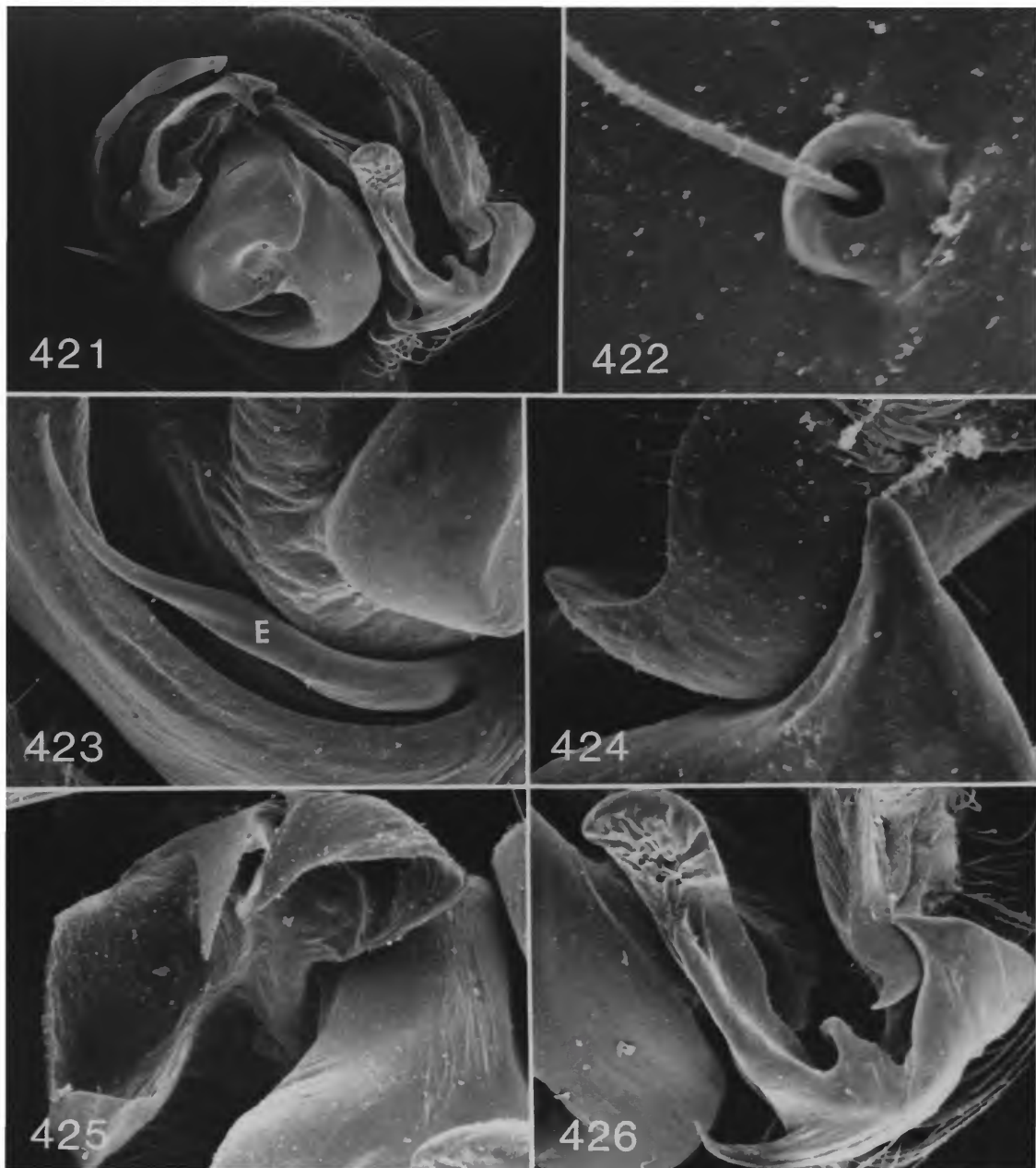


FIGURES 414–420.—*Pimou edenticulata*, new species, female from California: 414, epigynum, ventral; 415, same, lateral; 416, epigynum, cleared, ventral; 417, same, dorsal; 418, epigynum, ventral; 419, same, lateral; 420, paratype, dorsal. (Scale lines: 0.5 mm.)

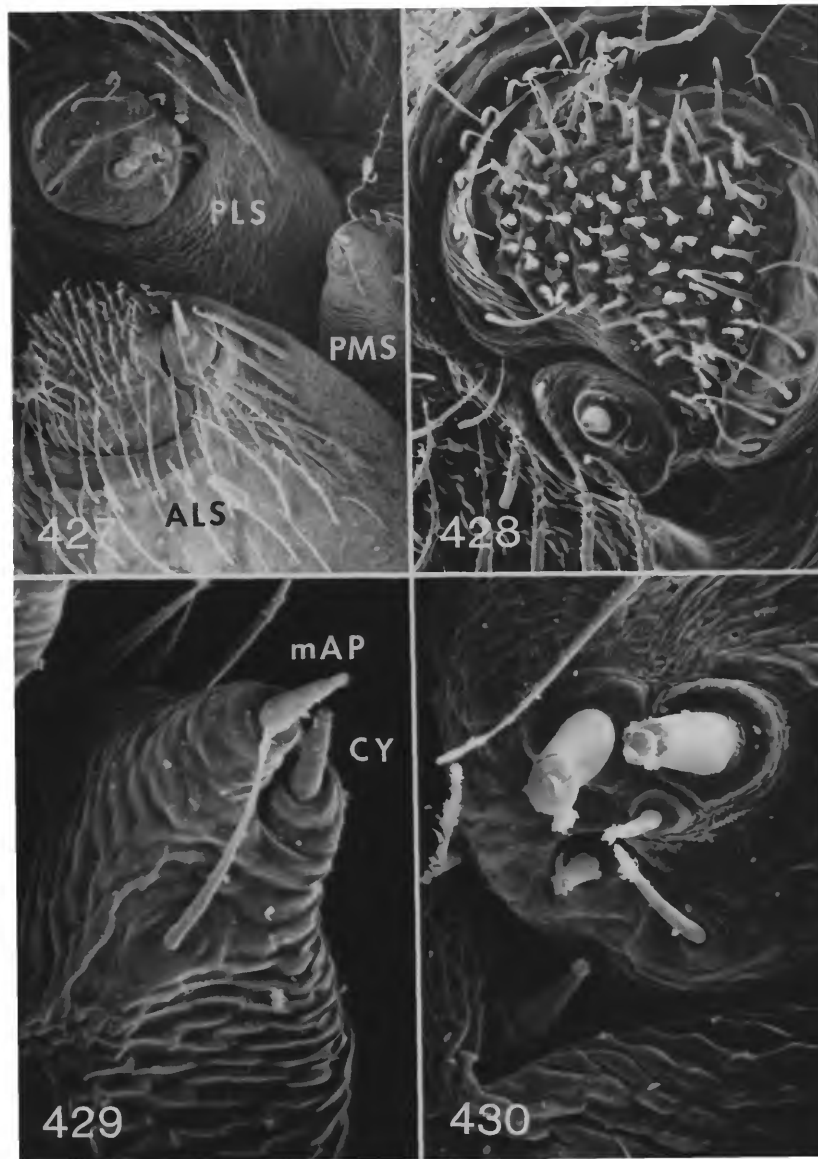
AMNH), 1♀; E of Weaverville (40°45'N, 122°50'W), 6 Apr 1960 (W.J. Gertsch and W. Ivie, AMNH), 2♀; 13 mi (23.8 km) N of Weaverville, near Tanbark picnic ground, off Route 3, Sahasta-Trinity National Forest (40°52'N, 122°53'W), 30 Jul

1990 (G. Hormiga, USNM), 3♂ (molted 27, 28, 29 Aug 1990), 3♀.

DISTRIBUTION.—Northern California (Figure 117).



FIGURES 421–426.—*Pimoa edenticulata*, new species, male from California: 421, palp, ventral; 422, pedipalpal tibia trichobothrium; 423, embolus; 424, apical end of cymbial denticulated process; 425, conductor; 426, PCS.



FIGURES 427-430.—*Pimoo edenticulata*, new species, spinnerets, female from California: 427, spinneret group; 428, ALS; 429, PMS; 430, PLS.

***Pimoo mephitis*, new species**

FIGURES 431-439, 117

**TYPES.**—Female holotype and paratype from Skunk Hollow Cave (Sec. 23, T14N R12W), 15 mi (24 km) W of Fort Jones, Siskiyou Co., California; 29 Apr 1979, D.C. Rudolph, D. Cowan, and B. van Ingen col. Deposited in AMNH.

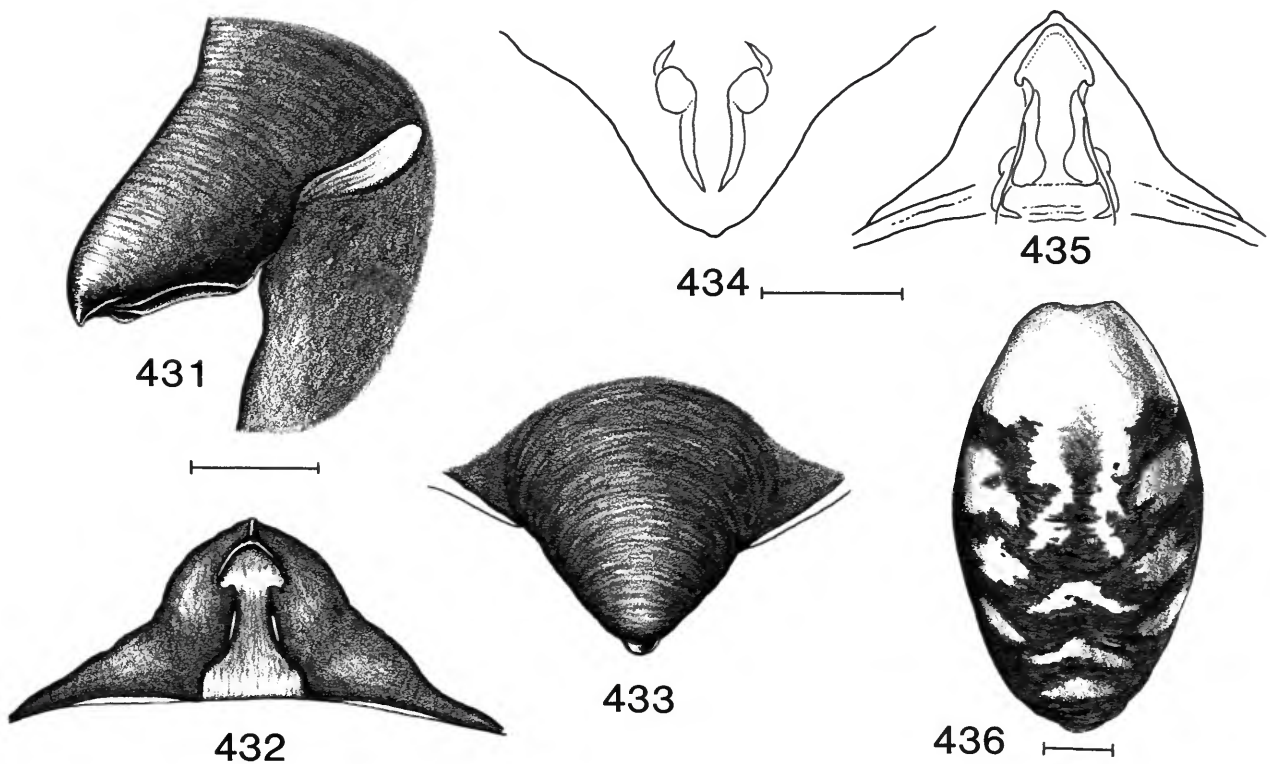
**ETYMOLOGY.**—Named after the mustelid genus *Mephitis*.

**DIAGNOSIS.**—The pointed distal end of the epigynum (Figures 431-433) is diagnostic for this species.

**Male:** Unknown.

**Female (holotype):** Total length 10.4. Cephalothorax 5.5 long, 3.6 wide, 1.9 high; brown. Sternum 2.8 long, 2.2 wide; reddish brown. Abdomen 7.0 long, 4.4 wide, 3.7 high; whitish with a dark gray pattern. AME diameter 0.22. PME 1.00, PLE 1.00, ALE 0.91 times one AME diameter. AME separation 0.45 times their diameter, PME separation 0.82 times their diameter. PME-PLE separation 1.09 times one PME diameter, AME-ALE separation 0.91 times one ALE diameter. Clypeus height 2.54 times one AME diameter. Chelicerae with three prolateral





FIGURES 431-436.—*Pimoa mephitis*, new species, female from California: 431, epigynum, lateral; 432, same, dorsal; 433, same, ventral; 434, epigynum, cleared, ventral; 435, same, dorsal; 436, abdomen, dorsal. (Scale lines: 0.5 mm, except 436, 1.0 mm.)

and two retrolateral teeth. Cheliceral stridulating files absent. Legs reddish brown. Leg and pedipalp lengths of female described above:

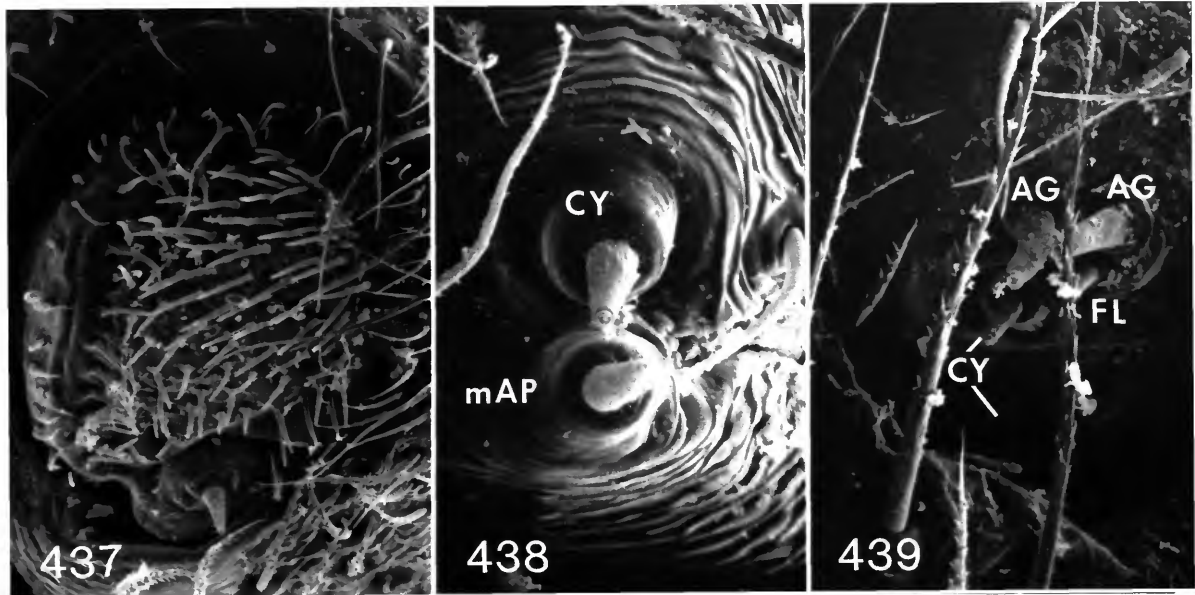
	I	II	III	IV	Pdp
Femur	10.9	9.5	7.5	9.5	2.1
Patella	1.8	1.8	1.3	1.6	0.7
Tibia	11.9	10.2	6.7	—	1.5
Metatarsus	11.9	10.2	7.4	—	—
Tarsus	3.7	3.2	2.2	—	2.4
Total	40.2	34.9	22.1	—	6.7

Legs 1243. Femur I 1.98 times length of cephalothorax. Legs covered with long setae. Metatarsus I trichobothrium 0.85. Epigynum as in Figures 431-435.

VARIATION.—Female cephalothorax ranges in length from 4.6 to 5.6.

ADDITIONAL MATERIAL EXAMINED.—UNITED STATES: CALIFORNIA: Siskiyou Co.: Marble Mountain Wilderness Area, Bigfoot Cave, breathing entrance, 6 Jul 1985 (T.S. Briggs, DU), 1♀; Mountain Wilderness Area, Trail Junction Cave, 29 Apr 1979 (D.C. Reed, C. Cowan, and B. van Ingen, AMNH), 1♀; Marble Mountain Wilderness Area, Marble Valley, Klamath National Forest, 1 Aug 1975, in cave (D. Hemphill, AMNH), 1♀; Marble Mountain Wilderness Area, Marble Valley, Klamath National Forest, 7 Nov 1979, 7000 ft (D. Hemphill, AMNH), 1♀.

DISTRIBUTION.—Known only from the Marble Mountains in northern California (Figure 117).



FIGURES 437–439.—*Pimoa mephiitis*, new species, spinnerets, female from California: 437, ALS; 438, PMS; 439, PLS.

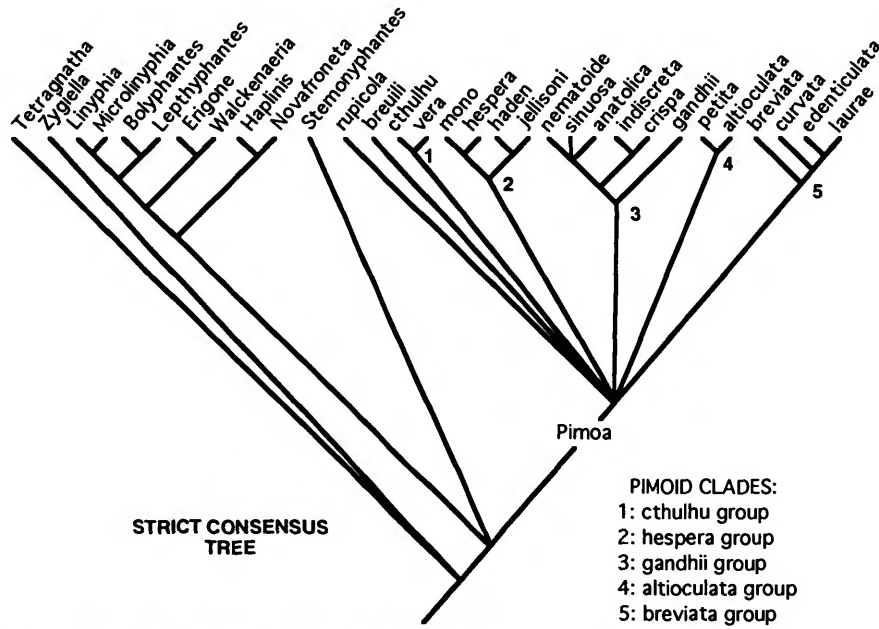


FIGURE 440.—Strict consensus cladogram for the Pimoidae and outgroups. The cladogram length is 135 steps, and the consistency and retention indices are 0.62 and 0.80, respectively. Nodes one to five refer to the pimoid clades in Figure 441 and are discussed in the text.

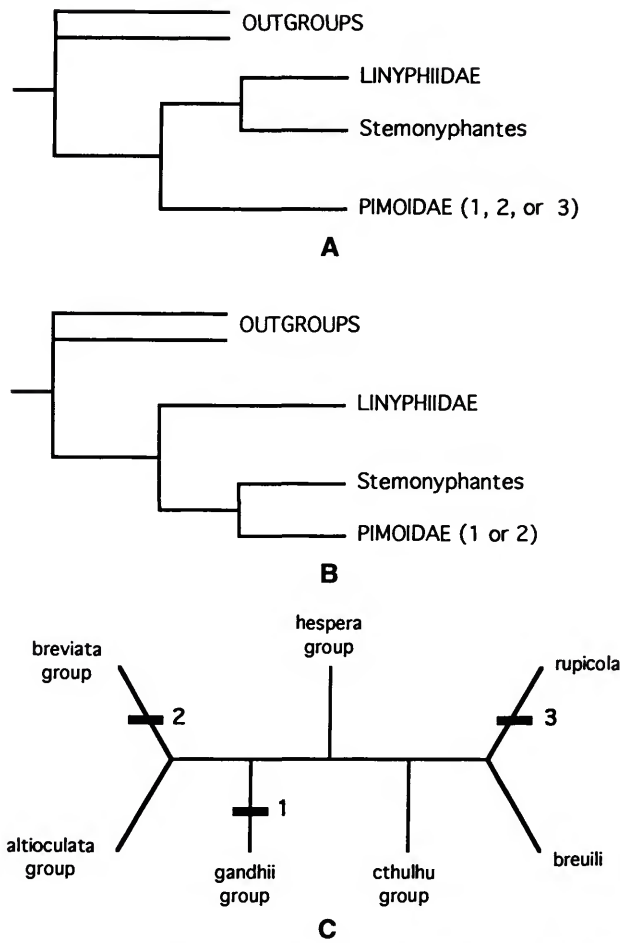


FIGURE 441 (A-C).—Summary of the alternative topologies for the pimoids and outgroups. Figures 441A and B show the alternative placements of *Stemonyphantes*; numbers 1, 2, and 3 refer to alternative resolutions for the Pimoidae. Figure 441C show the cladistic network for the pimoid taxa (pimoid groups refer to the clades defined in Figure 440). Three possible rooting options exist for the network of pimoids, represented by black bars (labeled 1, 2, and 3).

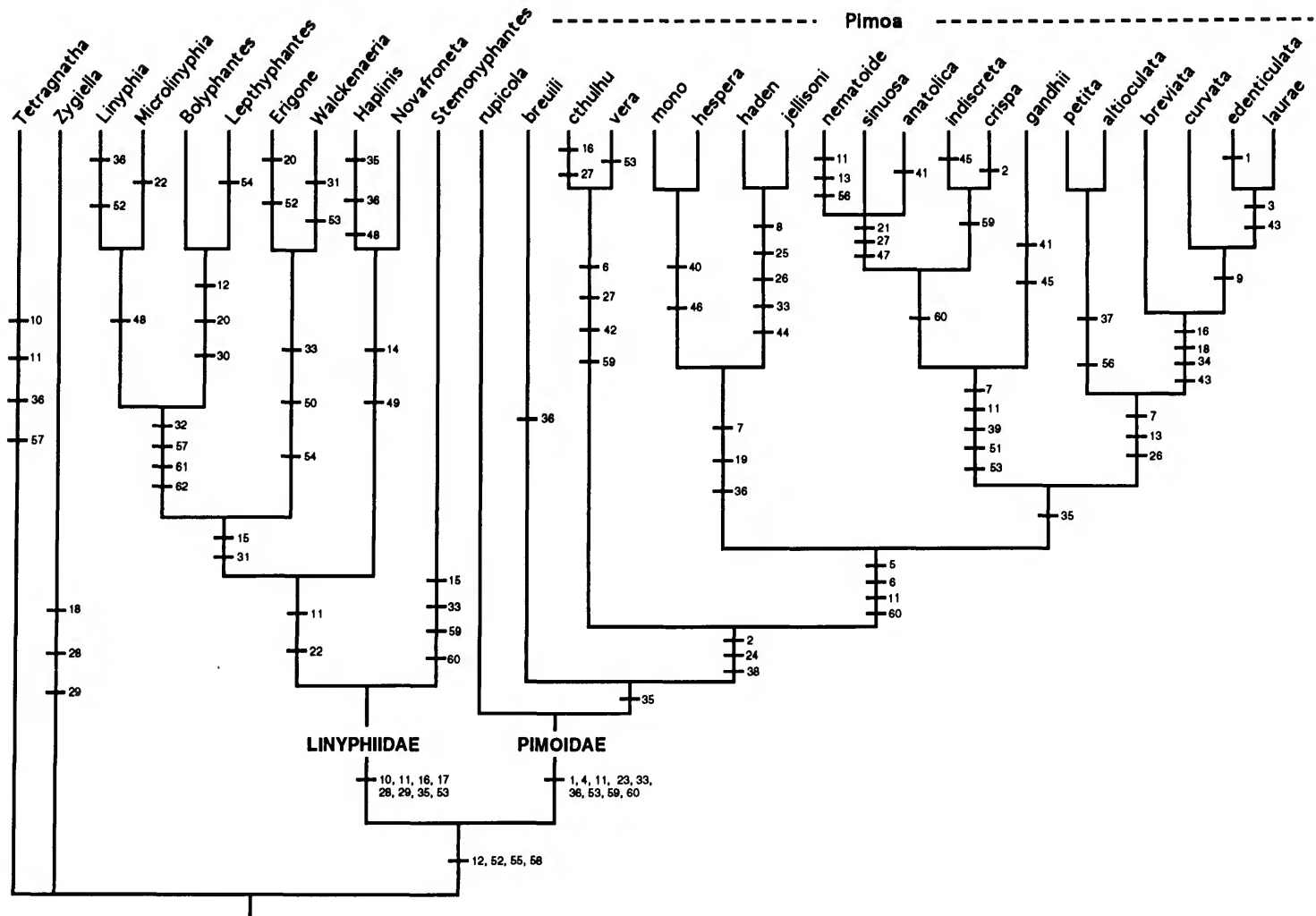


FIGURE 442.—Preferred cladogram for the Pimoidae and outgroups with character changes mapped on it (the mapping of several transformations is ambiguous, see text). The cladogram length is 118 steps, and the consistency and retention indices are 0.71 and 0.87, respectively.

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