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SYSTEMATICS OF THE NEW WORLD PTININAE:
(COLEOPTERA: ANOBIIDAE)

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By

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The Ohio State University
1997

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ABSTRACT

1. The biology of the subfamily Ptininae (Coleoptera: Anobiidae), with emphasis on the New World fauna, is reviewed and includes the following topics: adult lifestyles, biology, development and immatures, economic importance, evolution of myrmecophily, and systematics. A list of all the currently accepted generic names of the Ptininae with a sublist of the native New World genera is included. A key to all native and introduced genera encountered in the New World is also given.

2. A phylogenetic analysis of the New World Ptininae, based on the principles of cladistics is presented. One hundred and two characters (43 multistate) from 34 taxa (22 species of ptinines, eight additional anobiids, three bostrichids, and one endecatomid) were utilized. The single tree shows both the Ptininae and its sister, the remaining Anobiidae, as monophyletic. The phylogeny indicates that wing loss has occurred at least three times within the Ptininae, and myrmecophily in the New World ptinines has also probably evolved on at least three separate occasions. The evolution of feeding habits, myrmecophily, and wing loss are discussed. The classifications of the Ptininae and the remaining Anobiidae are also examined.
3. *Cubaptinus* Zayas is synonymized with *Fabrasia* Martinez and Viana. Known only from Cuba, *Cubaptinus* shares in common several characteristic morphological features of *Fabrasia* that necessitate it being placed as a junior synonym.

4. *Lachnoniptus lindae* New Genus, New Species from the Virgin Islands, is described. It appears most similar to *Trigonogenius*, and characters differentiating the two genera are given. The habitat and probable biology of this new species are discussed.

5. *Coleoaethes tetralobus* New Genus, New Species from Panama, is described. It is the third myrmecophilous genus of ptinine known from the New World. It is characterized by the presence of four lobes near the elytral apices, each with patches of brush-like setae or trichomes. The relationship of *Coleoaethes tetralobus* to other myrmecophilous ptinines and the diversity and distribution of this latter group are also discussed.

6. A revision of the genus *Niptinus* Fall is presented. *Niptinus grandimaculatus* is described as new, and *Trigonogenius niveus trinotatus* Pic is elevated to specific status. *Trigonogenius niveus* Gorham and *T. arcuatus* Gorham are transferred to *Niptinus*, raising the total number of species in this genus to six. The genus and all
previously described species are redescribed, and a key is provided. The relationship of *Niptinus* to other closely related genera and the known biology are discussed.

7. The New World genus *Prosternoptinus* is revised. Thirteen new species are described: *P. aeneus*, *P. argosomos*, *P. assumentum*, *P. bellesi*, *P. calileguanensis*, *P. castaneus*, *P. expandipronotus*, *P. glabrihumeralis*, *P. kryptoambon*, *P. obrienorum*, *P. oculigrandis*, *P. quadrimaculatus*, and *P. tricoratus*, raising the total number of known species to 24. The genus and most previously known species are redescribed, and a key to all species is provided. A discussion of the biology and relationships of the genus is also included.

8. The first larval leaf mining and live-leaf feeding by adults is reported in the Anobiidae and the more inclusive superfamily Bostrichoidea. Larvae of *Pitnus antillanus* Bellés bore in leaves of *Tournefortia gnaphalodes* (Linnaeus) (Boraginaceae) and adults feed on leaves of the larval host plant. Larvae complete their development and metamorphosis within a single leaf. It is suggested that leaf mining is a recently derived trait in *Pitnus.*
ACKNOWLEDGMENTS

I wish to thank a large number of individuals, and the order of my list is not indicative of the importance of the great number of people who helped make this dissertation possible. To those I possibly and accidentally excluded, my apologies.

I thank my advisor, Norman F. Johnson, and committee composed of Brian J. Armitage, Woodbridge A. Foster, and Charles A. Triplehorn for their guidance and support throughout my studies. All of them spent a great deal of time reviewing this thesis and other various documents. Norman was particularly supportive throughout my tenure here with equipment needs and financial assistance for professional travel. His expertise in systematics, vision for the future of our field, and high standards have hopefully been at least partially acquired by me.

Michael Ivie, my former advisor, has continued to support and encourage me and is one of the few with whom I can discuss anobiine evolution. He passed on his broad interest of Coleoptera to me, for which I am grateful.

My gratitude is owed to John Wenzel for his musings and teachings on phylogenetic theory, techniques, and help with cladistic programs and data analysis.

My appreciation is extended to Barry Valentine for his interesting discussions and wealth of knowledge on collections, museums, and other aspects of
systematics, especially regarding the Coleoptera. He also reviewed several chapters of this dissertation.

Xavier Bellés was of great help in suggestions on particular groups and in general encouragement in my studies on spider beetles. I thank him for his generosity in allowing me to work on "his" group. Additionally his reprints, and a set from Richard White, saved my search time and were of great use during these studies.

My gratitude also extends to the following curators and individuals, who gave, loaned, or made available material for these and other studies: Rolf Aalbu, Robert Anderson, Fred Andrews, Miguel Archangelsky, Cheryl Barr, Richard Baumann, Jane Beard, Nicole Berti, Yves Bousquet, Roberta Brett, Edward Brodie, Jorge Carvajal, John Chemsak, Shawn Clark, William Clark, José Clavijo, Robert L. Davidson, Greg Forbs, David Furth, Terry Galloway, François Génier, Bruce Gill, Wilfred Hanson, Lee Herman, Richard Hoebeke, Gloria House, Michael Ivie, Norman Johnson, Luis Joly, David Kavanaugh, Peter Kovarik, Will Lanier, Jean-Michel Maes, Vicky Moseley, Alfred Newton, Charles O'Brien, Mark O'Brien, Norman Penny, Philip Perkins, Darren Pollock, Edward Riley, Terence Schiefer, Catherine Seibert, Derek Sikes, Paul Skelley, Cecil Smith, Angel Solis, Michael Thomas, William Warner, and Keti Zanol. I am grateful to George Keeney who supplied colonies of two species and media for rearing.

Thanks to Derrick Sikes and Richard Miller, who made the original observations of the association of *Pitnus antillanus* with *Tournefortia gnaphalodes*, and to Mike and LaDonna Ivie, who made the study on the biology of this species possible. Michael also collected most of the specimens of *Lachnoniptus lindae*. 
I thank K. Roach, D. Hanmer, and D. Hennessey (USDA/APHIS/PPQ) for providing a permit to import spider beetles and host plant material from the Virgin Islands and Kathleen Akin (USDA/APHIS/VS) for one to import more spider beetles from Venezuela. Thanks to the following individuals for their help to my coauthors (Chapter 8) in the Virgin Islands: K. Woody for help with field work in the Virgin Islands; D. Nellis for help locating St. Thomas populations; Z.-M. Hillis of the National Park Service and E. Towle and S. R. Tate of Island Resources Foundation for logistic support during field work on St. Croix and St. Thomas. I also thank John Furlow for his assistance with identification of the host plant and for use of the herbarium library. Thanks to the staff of Lewis and Clark Caverns, Montana, for permission to collect spider beetles in the caves.

I thank the librarians at the OSU Biological-Pharmacy library: Susan Birky, Bruce Leach, and Susan Ward for their patience in helping me find the many volumes of obscure references needed to do taxonomic work.

My gratitude to Ken Chamberlain (OSU Communications and Technology) for allowing me to use his great Nikon macro camera equipment, which made it relatively easy to take photos of my tiny beetles. Miguel Archangelsky also was a great deal of help for his photographic skills on numerous occasions. Thanks also to Jodi Miller (OSU Communications and Technology) for allowing me to use her darkroom facilities and for her help with developing of film and printing of the photos of Prosternoptinus. John Mitchell was also of great help in taking the scanning electron microscope pictures and help with specimen preparation, and Eric Johanni in printing these negatives.
Thanks to Andrey Sharkov for his assistance with illustration techniques, with locating equipment, and with discussions on insects.

Steve Passoa was of great help in building my library of both beetles and books, which became excess baggage to him, but were a great wealth to me. Steve was also of great help in several ways, perhaps most notably in his knowledge of microscopes.

Thanks to all my fellow grad students, in particular Alex Aguiar (and Luciana Musetti), Miguel Archangelsky, Todd Blackledge, Marc Branham, Eric Dotseth, Flávia Ejchel, Robert Hancock, Peter Kovarik, and Chi-Feng Lee, for the contagious enthusiasm and continual discussions on insect behavior and systematics.

My appreciation to all my hockey buddies for our regular games, for making the stress of school much more tolerable, and for never too seriously injuring me in the course of play.

My sincere appreciation to my in-laws, Molly and Wilfred Gerofsky, for their support of what must seem like a strange career choice. Additionally, they have supported important field work in Florida and Tortola, British Virgin Islands.

My love and gratitude to my parents, Effie and Bruce Philips, who started me on the road to studying the more unusual and generally unloved animals in my early childhood, with trips to Lake Mazinaw, and who continue to support my interest in insects. In particular, my mother showed a great deal of patience with her young son by tolerating live animals in the house and dead creatures in the freezer. Additional thanks to my aunt and uncle, Susan and Hinson McLeod, who (like my parents) have always supported and believed in me. My siblings also encouraged
me, particularly my brother lan, who once wrote, "keep going." after I had completed my Master's Degree.

My deepest appreciation to my loving wife, Linda Gerofsky, who gives me ideas and occasionally edits my work, but more importantly understands and always tolerates me and my love of insects. She amazes me with her patience and continual support. Without her, the completion of this degree would have been much more difficult (and much less fun).
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2. Philips, T. K., R. G. Hancock, and W. A. Foster. 1996. Epigamic display and
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   Journal of Insect Behavior 9: 739-753.

   aggregations of *Anetia briarea* Godart (Nymphalidae: Danainae).

   Hispaniola (Coleoptera: Scarabaeidae: Scarabaeinae). Journal of the

   (Coleoptera: Cerambycidae, Anthicidae). Pan-Pacific Entomologist 65:162.

x

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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Abstract</th>
<th>ii</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acknowledgments</td>
<td>v</td>
</tr>
<tr>
<td>Vita</td>
<td>x</td>
</tr>
<tr>
<td>List of Tables</td>
<td>xv</td>
</tr>
<tr>
<td>List of Figures</td>
<td>xvi</td>
</tr>
</tbody>
</table>

Chapters:

1. **Introduction** ........................................ 1
   - Lifestyles ............................................. 1
   - Economic Importance .................................. 6
   - Development and Immatures .......................... 7
   - Evolution of Myrmecophily ......................... 10
   - Systematics ........................................... 11
   - Generic List of New World Ptininae ............... 15
   - Generic List of New World Fauna ................... 16
   - Key to the Genera of Ptininae Encountered in the New World . 18

2. **Phylogenetic Analysis of the New World Ptininae** .......... 24
   - Introduction .......................................... 24
   - Materials and Methods .............................. 27
     - Characters of Potential Use But Not Analyzed . 41
     - Discussion of Selected Characters and their States . 44
     - List of Taxa Used in the Analysis ............... 49
   - Results and Discussion .............................. 51
     - Anobiidae, *Sensu Lato* .......................... 52
     - Anobiidae, *Sensu Stricto* ....................... 54
     - Ptininae .............................................. 55
     - The Clades Within the Ptininae .................... 59
     - Evolutionary Traits Within the Ptininae .......... 62
       - Feeding Habits ..................................... 62
       - Evolution of Myrmecophily ....................... 65

xii
8. Leaf Mining and Grazing in Spider Beetles: 
An Unreported Mode of Larval and Adult Feeding in the Bostrichoidea  . 332

Introduction ................................. 332
Materials and Methods ....................... 334
Results ........................................ 335
Discussion ..................................... 339

List of References .......................... 345
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>States of characters used in the analysis</td>
<td>41</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Antennal morphology of representative Anobiidae</td>
<td>78</td>
</tr>
<tr>
<td>2.2</td>
<td>Menta of representative Anobiidae</td>
<td>80</td>
</tr>
<tr>
<td>2.3</td>
<td>Labia of representative Anobiidae</td>
<td>82</td>
</tr>
<tr>
<td>2.4</td>
<td>Maxillae of representative Anobiidae</td>
<td>84</td>
</tr>
<tr>
<td>2.5</td>
<td>Mandibles of representative Anobiidae</td>
<td>86</td>
</tr>
<tr>
<td>2.6</td>
<td>Pronota of representative Anobiidae</td>
<td>88</td>
</tr>
<tr>
<td>2.7</td>
<td>Scutella and scuta of representative Anobiidae</td>
<td>90</td>
</tr>
<tr>
<td>2.8</td>
<td>Scutella and scuta of representative Anobiidae</td>
<td>92</td>
</tr>
<tr>
<td>2.9</td>
<td>Mesosterna of representative Anobiidae</td>
<td>94</td>
</tr>
<tr>
<td>2.10</td>
<td>Ventrites of representative Anobiidae</td>
<td>96</td>
</tr>
<tr>
<td>2.11</td>
<td>Metacoxal plates</td>
<td>98</td>
</tr>
<tr>
<td>2.12</td>
<td>Wings of representative Ptininae</td>
<td>100</td>
</tr>
<tr>
<td>2.13</td>
<td>Wings of representative Anobiidae, <em>sensu stricto</em></td>
<td>102</td>
</tr>
<tr>
<td>2.14</td>
<td>Wings of representative outgroups</td>
<td>104</td>
</tr>
<tr>
<td>2.15</td>
<td>Cladogram of the Anobiidae and the four outgroups</td>
<td>106</td>
</tr>
<tr>
<td>2.16</td>
<td>Cladogram of the Ptininae</td>
<td>108</td>
</tr>
<tr>
<td>2.17</td>
<td>Cladogram of the more derived, flightless, ptinines</td>
<td>110</td>
</tr>
<tr>
<td>2.18</td>
<td>Cladogram of the base of the tree with myrmecophily indicated</td>
<td>112</td>
</tr>
<tr>
<td>2.19</td>
<td>Cladogram of the base of the tree with flightlessness indicated</td>
<td>114</td>
</tr>
</tbody>
</table>
2.20 Apex of the tree with the Sphaericus and Trigonogenius generic groups indicated .......................................................... 116
2.21 Apex of the tree with the three lineages of Niptus indicated ........... 118
2.22 Cladogram of the non-ptinine anobiids .................................................. 120
4.1 External morphology of Lachnoniptus lindae .............................................. 132
4.2 Head of Lachnoniptus lindae ................................................................. 134
5 External morphology of Coleoathes tetrilobus ............................................. 145
6.1 Elytral patterns of Niptinus species .......................................................... 181
6.2 Elytral patterns of Niptinus species .......................................................... 183
6.3 Elytral patterns and lateral profiles of Niptinus niveus ............................... 185
6.4 Ventrites and frontal view of head of Niptinus species ................................ 187
6.5 Male genitalia of Niptinus arcuatus and N. unilineatus ............................... 189
6.6 Male genitalia of Niptinus niveus .............................................................. 191
6.7 Male genitalia of Niptinus ovipennis ......................................................... 193
7.1 Elytral patterns of Prosternoptinus species ................................................ 298
7.2 Elytral patterns of Prosternoptinus species ................................................ 300
7.3 Male genitalia of Prosternoptinus theresae and P. tricoratus ....................... 302
7.4 Male genitalia of Prosternoptinus bellensi ................................................. 304
7.5 Male genitalia of Prosternoptinus assumentum and P. maculithorax .......... 306
7.6 Male genitalia of Prosternoptinus quadrimaculatus and P. argosomos ....... 308
7.7 Male genitalia of Prosternoptinus castaneus and P. oculigrandis ............... 310
7.8 Male genitalia of Prosternoptinus obrienorum and P. semibrunneus .......... 312
7.9 Male genitalia of Prosternoptinus nigricolor and P. submetallicus ............. 314
7.10 Male genitalia of Prosternoptinus aeneus and P. donckieri ....................... 316
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.11</td>
<td>Male genitalia of <em>Prosternoptinus bechynei</em> and <em>P. rufipennis</em></td>
<td>318</td>
</tr>
<tr>
<td>7.12</td>
<td>Male genitalia of <em>Prosternoptinus bordoni</em>, <em>P. jolyi</em>, and <em>P. bicolor</em></td>
<td>320</td>
</tr>
<tr>
<td>7.13</td>
<td>Ventrites of <em>Prosternoptinus</em> species</td>
<td>322</td>
</tr>
<tr>
<td>7.14</td>
<td>Pronota of <em>Prosternoptinus</em> species</td>
<td>324</td>
</tr>
<tr>
<td>7.15</td>
<td>Dorsal habitus views of males of <em>Prosternoptinus</em> species</td>
<td>326</td>
</tr>
<tr>
<td>7.16</td>
<td>Dorsal habitus views of <em>Prosternoptinus</em> species</td>
<td>328</td>
</tr>
<tr>
<td>7.17</td>
<td>Eyes and antennae of males of <em>Prosternoptinus</em> species</td>
<td>330</td>
</tr>
<tr>
<td>8</td>
<td>Host plant damage, an egg, and adults of <em>Pitnus antillanus</em></td>
<td>343</td>
</tr>
</tbody>
</table>
CHAPTER 1

INTRODUCTION

The Ptininae, a subfamily within the Anobiidae of long-legged, small beetles, have the habit of holding their antennae in front of their bodies and alternately waving and tapping each on the substrate as they walk. The beetles thus appear to have eight legs rather than six. This, together with their small size, globose shape, and setose appearance has resulted in their common name of "spider beetles." Approximately 600 described species are placed in 66 genera. Taxa are distributed throughout most of the world but are more numerous in drier regions of the subtropical and temperate zones.

Lifestyles

Considering the small size of the group, species occupy a wide array of habitats and have very diverse and unusual lifestyles. Similar to many anobiids, there is evidence that some larvae in the genus *Ptinus* Linnaeus are woodborers. Picard (1919) stated that the larvae of *P. lichenum* Marsham live in the dry wood and bark of fig trees. Bellés (1980) reported larvae of the same species boring galleries in trees of an undetermined species of *Juniperus*. He also lists records of other species
of *Ptinus* found in association with various species of trees. Some of these records should be viewed with caution, as many of the species collected from wood or under bark, etc. may not be true wood borers.

The best known ptinines are scavengers which feed upon accumulated organic matter of either plant or animal origin. This food resource includes a wide variety of habitats such as mammal, bird, bee and ant nests; leaf litter; caves; dung; stored food products and other places with accumulated organic debris. There is even a species which feeds on the remains of arthropods in spider webs and on spider eggs (Hickman 1974).

Bird nests are important habitats for ptinines. *Tipnus unicolor* Piller and Mitterpacher, *Ptinus sexpunctatus* Panzer, and *P. fur* Linnaeus have all been found in the nests of birds (Linsley 1944). In an ecological study of bird nests, Woodroffe (1953) found several more species of ptinines and some (*Trigonogenius globulus* Sol., *Ptinus fur*, *P. clavipes* Panzer and *P. tectus* Boieldieu) were sometimes very abundant. Adults and larvae of *Ptinus tectus* Boieldieu have been collected in White-flippered Penguin (*Eudyptula albosignata*) nests in New Zealand (Philips unpublished). Rodent nests are also extensively used as a refuge. *Ptinus agnatus* Fall has been found in nests of wood rats, (*Neotoma* Say & Ord) and *Mezium affine* Boieldieu in nests of the Norway rat (*Rattus* Fischer). *Mezium affine* Boieldieu, *P. fur*, and *P. tectus* have been recorded from bat roosts. A complete list of known animal nest utilization is given in Moore (1959).

Several species are known to be associated with bee nests. The most commonly recorded hosts are in the genus *Osmia*. The European *Ptinus sexpunctatus* Panzer was the first species taken in association with bees (Nicholas
1892). Linsley and MacSwain (1942) were the first to describe the life history of a North American ptinine, *Ptinus californicus* Pic, which lives as a depredator in the nests of wild bees. Host genera includes both *Osmia* and *Anthophora*. Eggs are laid in the pollen provision supplied by the adult bee, and the ptinine larvae then feed upon the surface of the pollen mass. The presence of several ptinine larvae usually results in the death of the bee larva in an early instar, hence the recognition of this beetle as a depredator.

Myrmecophiles include nine genera and 44 species. A possible termitophile in the genus *Fabrasia* Martinez and Viana (=*Cubaptinus* Zayas, Philips 1997) is known from Cuba. Many species have several morphological features, such as trichomes and paddle-shaped legs or antennae, which indicate a very close, possibly symphilic relationship with their hosts.

Almost nothing is known about the biology of these myrmecophiles beyond the associated ant species. The single exception is an account of the New World *Gnostus floridanus* Blatchley (Thomas et al. 1992). Ants were observed palpating and chewing on beetles. An ant would often lie partially on top of a beetle with its head on the elytra. If any other ant approached the pair, the ant in possession of the beetle made aggressive motions toward the intruder. Ants also sometimes fed beetles via trophallaxis. One last behavior noted was that periodically a beetle would raise its body off the substrate and vibrate or quiver for a few seconds. The role of this movement is unknown.

Dung is the primary source of food for many ptinines. Species of *Niptus* are recorded feeding on *Neotoma* fecal pellets (Aalbu and Andrews 1992). In Australia, pellets of the Koala (*Phascolarctos cinereus* Goldfuss) are also used by *Ptinus* sp.
(Melzer et al. 1994). In semiarid Chile, one species of ptinine feeds in goat dung (Sáiz 1991). It is likely that at least some species use the dung of domestic livestock as easily as that of native species and switch between dung types, depending on availability.

Once adult ptinines locate dung, some species use it as a mating site (Philips unpublished). Females oviposit eggs in cracks and crevices on the dung surface. After hatching, first instar larvae burrow into the dung pellet or dung mass. The dung is hollowed out by feeding larvae and the resulting chamber becomes filled with frass, with the outer casing remaining intact (Aalbu and Andrews 1992, Philips personal observations).

Xeric areas, or mesic areas with dry microhabitats, such as caves or some tree holes, seem to be critical for some dung feeding species by enabling them to complete their larval development without competition from scarabaeines. Lack of soil or dry habitats tend to exclude scarabaeines (e.g., Rougon and Rougon 1991), since most dung beetle species need soil for dung burial and moist conditions for larval survival and successful reproduction. With the reduction or absence of scarabaeines in these areas (either temporally or spatially), ptinines avoid competition for dung, which remains unburied on the surface.

Dry season activity of ptinines is associated with utilizing dry habitats, when most scarabaeines are inactive (Howden and Young 1981, Cambefort 1991, Gill 1991). For example, Ptinus costaricensis Andrews and P. latefasciatus Gorham may only be active during the dry season in Guanacaste, Costa Rica (Andrews 1967). This is the same time (and in the same study site) that Janzen (1983) found most dung beetles were absent. Both the ptinine species were found breeding in coati
(Nasua narica) scats. Dry habitat and dung utilization has also been observed in Arachnomimus cristithorax Bellés in Venezuela (Philips unpublished). Specimens were found in a region without active scarabaeines except for one area adjacent to an active cattle and goat pasture, with a species of large Dichotomius.

Andrews (1967) proposed two additional reasons for why the dry season may be most favorable for some breeding ptinines. The lack of heavy rainfall and moisture tends to preserve the integrity of the coati scat, a necessity for larval development. Animal life (and their scat) also becomes concentrated along the rivers toward the end of the dry season. This may augment ptinine breeding. But unlike other dung feeding species of Ptinidae, such as Arachnomimus Bellés, Andrews (1967) studied two species of Ptinus fully capable of flight. Therefore, the concentration of dung may not be a factor for the more vagile flighted ptinines. As previously mentioned, scarabaeine activity and not rainfall is probably the main factor in eliminating the dung resource during the wetter times of the year.

Some ptinines have been found associated with carrion (e.g. Fall 1905, Bornemissa 1956, Payne and King 1969). Some of these are probably isolated collecting events and do not represent any true pattern, and ptinines may be only using the carrion as a moist hiding place. For example, Bornemissa (1956) discovered two individuals of an unidentified ptinine beneath a carcass during the butyric fermentation stage (when the carcass is drying out). But ptinines sometimes do indeed utilize carcasses for food. Species have been found in breeding in dead animal remains in deserted nests (Howe 1959). Nests of hymenopterans are also sometimes used as a food source. Weidner (1952) discovered Niptus hololeucus Faldermann and Ptinus tectus in old wasp and hornet nests and Schaeffer (1931)
found *P. raptor* Sturm in a deserted wasp nest. The larvae and adults may feed on the dried remains of adult or larval vespids, as well as nest detritus.

There are two records of spider beetle larvae feeding on living insects. Braune (1943) observed *P. sexpunctatus* Panzer eating larvae of *P. fur* Linnaeus and Howe and Burges (1953a) observed cannibalism in *P. tectus*. These cases may be a result of captivity.

Leaf and stem miners and a lichen grazer have been noted in three genera of closely related and highly derived forms (as characterized by globular bodies and lack of wings). The recently described *Stereocaulophilus volcanius* Bellés feeds upon a lichen, *Stereocaulon vesubianum* Persoon, growing on recent lava deposits in the Canary Islands (Bellés 1994). Stem mining is recorded in a species of *Neoptinus* Gahan, a genus recorded from Christmas Island and northern Australia (Bellés and Lawrence 1990). Beetles and larvae were found feeding in the pith of dead *Scaevola sericea* M. Vahl (Goodeniaceae) stems. The most recently discovered mode of larval feeding is leaf mining. *Pitnus antillanus* Bellés was found boring in leaves of *Tourneforti gnaphalodes* (Linnaeus) in the Virgin Islands (Philips et al. unpublished).

**Economic Importance**

Spider beetles are part of the larger superfamily, the Bostrichoidea, which contains many important pests. The Bostrichidae (including the Lyctidae) and the Anobiidae are major pests of structural timber and furniture around the world. The most serious pests include *Lyctus brunneus* Stephens, *Dinoderus minutus* Fabricius (Bostrichidae) and *Anobium punctatum* Degeer (Anobiidae). Various *Dermestes*
Linnaeus species (Dermestidae), *Lasioderma serricorne* Fabricius (Anobiidae),
*Rhizopertha dominica* Fabricius (Bostrichidae), and the spider beetle genera *Gibbium*
Scopoli, *Mezium* Curtis, *Niptus* Boieldieu, and *Ptinus* Linnaeus (Ptininae) can all be
serious pests of stored products.

Although ptinines occasionally infest food, they usually do very little damage
and the food weight loss from their feeding tends to be small (Spilman 1991).
Because of the ability of these beetles to infest stored food products, many species,
such as *Gibbium aequinoctiale* Boieldieu and *G. psylloides* (Czenpinski) have
cosmopolitan distributions (Bellés and Halstead 1985). The precise origins of
practically all of these pest species before anthropic spread are uncertain, but *P. tectus*
Boieldieu may be native to Tasmania (Howe 1959, Bellés et al. 1989). Most
of the others are probably native to Europe or the circum-Mediterranean region. A
key to the economically important species was made by Hinton (1941). Twenty-four
species are keyed out, although two of the names are currently out of date (*Ptinus
hirtellus* Sturm = *P. clavipes* Panzer, *Eurostus* Mulsant & Rey = *Pseudoeurostus*
Heyden). A nearly complete list of recorded pest species is in Howe (1959).

**Development and Immatures**

Howe (1959 and citations), Howe and Bull (1956), and Howe and Burges
(1951, 1952, 1953a, 1953b, 1955) examined the life histories of ptinines of
economic importance through a series of 17 articles. These works involved studies
including (but not limited to) effects of temperature, humidity, and food type; effect
of parental age on development, oviposition rate, larval developmental rates and
intrinsic rates of increase. The major larval work is a key to larvae of most of the stored product pests (Manton 1945). Three more species were later incorporated into the Manton key by Hall and Howe (1953). New World literature includes Böving (1956) with the larval description of *Ptinus californicus* and Andrews (1967) with the larval description of *Ptinus latefasciatus* Gorham from Central America. The only published pupal description and illustration is of *Ptinus exulans* Erichson (Hickman 1974).

*Ptinines* probably have the ability to digest cellulose, but not without symbionts. In other anobiids, these microorganisms have been identified as saccharomycetes (yeasts) (Kelsey 1958). They have been found in special glands or caecal pouches (mycetomes) on the anterior and posterior ends of the mid-intestine. Yeast-containing pouches are also located adjacent to the reproductive organs in females. During oviposition, the eggs become coated with yeast cells. The first instar larvae eat part of the shell after emergence, and become inoculated (Kelsey 1958 and citations within). In *Anobium punctatum* Degeer and other species of Anobiidae, yeast cells are essential for proper development of the insect.

Heitz (1927) and Müller (1934) (both cited in Serdyukova 1993) found that microorganisms extracted from the guts of anobiid larvae could not digest cellulose, even when reared under aerobic or anaerobic conditions. Although Serdyukova (1993) hypothesized the presence in anobiid larvae of non-symbiotic cellulose enzymes, her results do not support this contention.

Cocoons are formed by several species of *ptinines*. The source of thread for the cocoon is the peritrophic membrane, which lines the midgut (Peters 1992, Tristram 1977). The use of this membrane for cocoon construction has also been
noted in at least two genera of weevils, *Cionus* Schellenberg and *Cleopus* Suffrain (Rudall and Kenchington 1971). Cocoons vary in their degree of development (Philips personal observations). Some consist of very loose strands of thread (e.g. *Pitnus antillanus* Bellés and *Arachnomimus cristithorax* Bellés) while others are very dense (e.g. *Mezium affine* Boieldieu and *Gibbium psyloides* Czempinski). Tristram (1977) discovered that shortly before a cocoon is to be spun, the peritrophic microfiber changes from a mainly orthogonal fibrillar structure to a more random arrangement. Also the peritrophic membrane stops forming as a tube but collapses and is compressed in the gut, emerging from the anus as a flat thread. Cocoon construction involves the larva taking the thread from the anus by the mouthparts and pulling it up between the legs. The palps then place the thread into position (Hickman 1974, König 1936).

One of the more unusual reproductive biologies is found in *Ptinus latro* Fabricius. This species is a parthenogenetic triploid which reproduces by gynogenesis (Moore et al. 1956). The female cannot reproduce without insemination by a male. While males of at least three species (*P. fur*, *P. pusillus* Sturm and *P. clavipes*) can be used to successfully induce *P. latro* females to lay viable eggs, *P. clavipes* is the most effective male for offspring production (Woodroffe 1958). Live sperm seems to play an essential part of the reproductive process as evidenced by experiments where sterilized males were used. Thelytokous triploid parthenogenesis in *P. latro* Fabricius is similar to that of otiorrhynchine weevils. But obligatory gynogenesis and the ability to mate with males of more than one species is unique in the Coleoptera and perhaps all of the Insecta.
Evolution of Myrmecophily

The morphologically distinct myrmecophilous ptinines reach their greatest species richness in Australia, with 35 of the 44 known species. The reasons for their abundance in Australia could be due to several factors. Lawrence and Reichardt (1969) note that ptinines are generally more successful in arid and semi-arid regions, which includes a large portion of Australia. Also, all ant-associated ptinines on this continent are wingless, which could reduce gene flow between populations. Lastly, the Australian ant fauna is composed of many ground nesting species which have large, long term colonies. In theory, this would enable populations of beetles to build up, while at the same time remaining isolated from other populations for long periods of time because of their difficulties with dispersal (due to flightlessness).

Besides the Australian species, the South African *Diplocotidus formicola* Peringuey is wingless. Both are associated with ground nesting ants in open, xeric regions (Lawrence and Reichardt 1969). In contrast, all the New World species and the southeast Asian *Myrmecoptinus butteli* Wasmann are fully winged and associated with arboreal ants in forests. *Fabrasia* is associated with *Camponotus* Mayr ants and both *Gnostus* and *Myrmecoptinus* with ants in the genus *Crematogaster* Lund. Both of these ant genera nest in the tree canopy within cavities of living or dead plants (Wilson 1971). These ants generally have relatively less permanent colonies, especially when compared to some ground-nestng species such as the Australian *Iridomyrmex conifer* Forel. Therefore, the advantage of possessing wings for more easily locating and colonizing ant nests may outweigh their disadvantages, such as reduced fecundity.
The species in Australia may be derived forms, as evidenced by a strongly reduced fourth ventrite and the prosternal process separating the procoxae and reaching the mesosternum. The New World fauna of myrmecophilous ptinines, although very specialized forms, are not highly derived as evidenced by presence of wings and several other ancestral states which place them basally in the ptinine clade (Philips unpublished).

Systematics

Spider beetles are usually categorized as a family. They were first divided into two subfamilies, the Gibbiinae and the Ptininae, in Genera des Coléoptères d’Europe (du Val 1861). The classification of LeConte & Horn (1883) placed the Bostrichinae and the Lyctinae in the Ptinidae. These two subfamilies were removed by Fall (1905), leaving the Ptininae and Anobiinae. Fall (1905) continued combining the anobiids and ptinines (as the Ptinidae) and was the first to remove *Hedobia* and *Eucrada* from the ptinines, and place them correctly in the anobiines. Pic (1912) in the Coleopterorum Catalogus raised the Ptininae to familial status. Their categorization as a subfamily (of the Anobiidae) has again been proposed (Lawrence and Britton 1991, Lawrence and Newton 1995) and is the view I currently follow. One other alternative view is the placement the ptinines as a tribe of Anobiinae in the Bostrichidae (Ivie 1985). The name Ptinidae Latreille has priority over the Anobiidae Westwood if the two groups are combined.

Most workers have considered the Ptininae (or Ptinidae) to be composed of two tribes (or subfamilies), the Gibbiini and the Ptiniini (e.g. Fall 1905, Pic 1912,
Papp 1962, and Bellés 1984a). Bellés (1982) proposed three main groups within the Ptinidae; the Gibbiinae, the Ptininae and a third subfamily composed of his *Trigonogenius* and *Sphaericus* generic groups.


Bellés (1982) recognized 9 generic groups of ptinines: the *Xylodes*-group, the *Gynopterus*-group, the *Maheoptinus*-group, the *Ptinus*-group, the *Niptus*-group, the *Casopus*-group, the *Trigonogenius*-group, the *Sphaericus*-group, and the *Gibbium*-group. The *Xylodes* and the *Maheoptinus* groups were later combined in Bellés (1985c). He concluded that all of his proposed groups had particular problem species which bridged the morphological gaps among all of the groups. He also suggests that both the *Trigonogenius*-group and the *Sphaericus*-group should be recognized as tribes, and four other generic groups (the *Xylodes*, *Gynopterus*, *Maheoptinus*, and *Ptinus* groups) as a third tribe (Bellés 1982).

The myrmecophiles have caused a great deal of taxonomic confusion. Westwood (1855) considered *Gnostus* to be related to the Xylophaga of Latreille. Subsequently it has been placed near the Paussidae, Pselaphidae, or Scydmaenidae.
(for more details, see Lawrence and Reichardt 1966). Taxa have been placed in their own families twice. Gemminger and Harold (1869) first proposed the family Gnostidae for both _Gnostus_ and _Ectrephes_ Pascoe. Wasmann (1894) proposed the family Ectrephidae for _Ectrephes_ and the two Westwood genera, _Diplocotes_ and _Polyplocotes_. Various workers noted the similarities between some of these genera and ptinines. Sharp and Muir (1912) observed the genital similarities between _Polyplocotes_ and _Ptinus_. The ectrephines (including _Polyplocotes_) were first treated as members of the Ptinidae by Wasmann (1916) and Mjöberg (1916). The similarity of wing veination in _Gnostus_ with the ptinines was also noted by Forbes (1926). A very thorough study by Lawrence and Reichardt (1969) also confirmed the inclusion of the Australian ectrephids within the ptinines.

Different genera or groups of genera of myrmecophiles have also been the basis for separate subfamilies within the Ptinidae (i.e., the Gnostinae, Polyplocotinae, Paussoptininae, Ectrephinae, and the Fabrasiinae). These rankings have been based on the level of distinctiveness and not on any careful phylogenetic (i.e., cladistic) analysis. Lawrence and Reichardt (1969) believe there are at least five independent lineages of myrmecophilous ptinines. Regardless of the exact number, the rank of these different groups will remain uncertain until a complete study is made of the generic classification in spider beetles.

Spider beetles were first revised for the U.S. and Canada by Fall (1905). Papp (1962) expanded this work by including two Central American species. The latter has several egregious errors and is at best a marginal improvement over Fall. Descriptions of North American _Ptinus_ are given in Andrews (1967), Smith (1967), and Spilman (1976). Since Fall (1905), no comprehensive work has been undertaken.
on the North American *Ptinus* species. No synthesis of the South American species has ever been done. Pic contributed 51 descriptions of Neotropical species from 1896 to 1939 and Bellés (1984b, 1986) described three new species from Venezuela.

The genera *Prosternoptinus* and *Arachnomimus* were created to encompass species from Venezuela and Brazil (Bellés 1985a, 1985b). Spilman (1968) described two species of North American *Niptus* and the species in the United States were revised by Aalbu and Andrews (1992). They described four new species from the Great Basin area, including one apparently endemic to a single cave. One species of *Pitnus* was described from the Galápagos Islands (Franz 1985) and the entire genus (with 13 New World and one Australian species) was revised by Bellés (1992). Lawrence and Reichardt (1966) revised two myrmecophilous genera, *Fabrasia* and *Gnostus*, and Zayas (1988) described *Cubaptinus* (= *Fabrasia*, new synonymy (Philips 1997)) from Cuba. *Coleoaethes*, New Genus, is described from Panamá and a second new genus, *Lachnoniptus*, is known from the Virgin Islands, West Indies (Philips, submitted).

Pic (1912) divided *Ptinus* into 11 subgenera. More recent workers have divided the genus into six subgenera (for example Bellés 1978, Bellés 1982, lablokoff-Khnzorian and Karapetian 1991), although there is not complete agreement over which subgenera should be recognized. While all recent authors now recognize *Eutaphrus* Mulsant and Rey as a distinct genus, *Gynopterus* Mulsant and Rey (the only other non-sexually dimorphic group of *Ptinus*) is also recognized by Belles (1982) as a distinct genus, while lablokoff-Khnzorian and Karapetian (1991) consider it a subgenus. Bellés also recognizes *Heteroptinus* Reitter and *Pseudobruchus* Pic as
subgenera in contrast to lablokoff-Khnzorian and Karapetian. The latter authors also created another subgenus, *Tectoptinus*, for the single species, *P. tectus*.

In the New World, only two native subgenera of *Ptinus* are known. The subgenus *Ptinus* Linnaeus is characterized by sexual dimorphism and flightless females while the subgenus *Gynopterus* has similarly shaped sexes, both of which fly.

As many species are stored product pests, they are occasionally introduced and several have become established in the New World. The following key to genera has been constructed to account for all the native and introduced genera which have been found in the New World. I have eliminated characters used specifically for either males or females, since someone unfamiliar with the group may have difficulty establishing the sex of their specimen. Many of the characters previously used are of little value in differentiating genera due to increased knowledge of taxa and new genera and species described. Others are just difficult to use, especially for the novice. Hopefully, users of this key will find that the selected characters are easy to use. One genus, *Chilenogenius* Pic, has been excluded from the key. The single type specimen was not available for study and the description is not detailed enough to diagnose the genus.

One final note: Ptinines have been named by the construction of anagrams based on the genus *Ptinus*. One must be careful not to confuse very similar generic names such as *Ptinus, Pitnus, Niptus, Niptinus*, and *Tipnus.*
Generic List of New World Ptininae (Anobiidae: Bostrichoidea)

*Arachnomimus* Bellés
*Chilenogenius* Pic
*Coleoaethes* Philips
*Fabrasia* Martinez and Viana
*Gibbium* Scopoli
*Gnostus* Westwood
*Lachnoniptus* Philips
*Mezium* Curtis
*Niptinus* Fall
*Niptus* Boieldieu
*Niptomezium* Pic
*Pitinus* Gorham
*Prosternoptinus* Bellés
*Ptinus* Linnaeus
*Sphaericus* Wollaston
*Tipnus* Thomson
*Trigonogenius* Solier

Generic List of the World Fauna of the Ptininae

(Groups from Bellés 1982 and 1985c)

**Gibbium-group:**

*Costatomezium* Pic
*Damarus* Péringuey
*Gibbium* Scopoli
*Lepimedoziun* Bellés
*Meziomorphum* Pic
*Mezium* Curtis
*Stethomezium* Hinton
*Sulcatogibbium* Bellés

**Xylodes-Maheoptinus-group:**

*Cavoptinus* Pic
*Cylindroptinus* Pic
*Diegous* Pic
*Eutaphrimorphus* Pic
*Hanumanus* Bellés
*Kedirinus* Bellés
*Luzonoptinus* Pic
Maheoptinus Pic
Silisoptinus Pic
Sundaptinus Bellés
Xyloides Waterhouse

Gynopterus-group:

Dignomus Wollaston
Eutaphrus Mulsant and Rey
Gynopterus Mulsant and Rey
Paulianoptinus Bellés
Pseudeutaphrus Pic
Singularivultus Bellés
Sulcoptinus Bellés
Trymolopphus Bellés

Ptinus-group:

Niptinus Fall
Prosternoptinus Bellés
Ptinus Linneaus

Niptus-group:

Arachnomimus Bellés
Cyphoniptus Bellés
Eurostodes Reitter
Eurostoptinus Pic
Lapidoniptus Bellés
Mezioniptus Pic
Microptinus Kiesenwetter
Niptomezium Pic
Niptus Boieldieu
Pseudeurostus Heyden
Pseudomezium Pic
Tipnus Thomson
Trigonogenioptinus Pic

Casopus-group:

Casopus Wollaston
Piotes Wollaston

Trigonogenius-group:

Chilenogenius Pic
Lachnoniptus New Genus
Key to the Genera of Ptininae Encountered in the New World

1  Ventrites about 1/3 as wide as the elytra when viewed ventrally; elytra smooth and shiny, or with dense setae at base and posteriorly with a few more scattered erect setae ......................................... 2

1' Ventrites at least 1/2 the width of the elytra when viewed ventrally; elytra usually sparsely to densely covered with both erect and appressed or recumbent setae ......................................................... 3
2(1) Head and thorax glabrous; abdomen with four ventrites; metatrochanter 2/3 the length of the femur .................. Gibbium

2' Head and thorax densely setose; abdomen with five ventrites; metatrochanter at most 1/3 the length of the femur .......... Mezium

3(1') Trichomes present and visible as small clumps of reddish brown hair on the pronotum, metafemora, or near the apex of the elytra .... 16

3' Trichomes absent ................................................................. 4

4(3') Elytral surface smooth but very slightly granular, scattered small punctures difficult to see; elytra densely covered with recumbent scattered scale-like setae which obscures the surface; ventrites slightly more than 1/2 the width of the elytra when viewed ventrally; introduced from Europe ..................................................... Sphaericus

4' Elytral surface punctate; if scales present, surface of elytra not entirely obscured and punctures easily visible and oriented in longitudinal rows; ventrites nearly equal in width to the elytra when viewed ventrally . . . ............................................................................................................................. 5

5(4') Antennae with nine antennomeres; small, length 0.9-1.4 mm; known from Florida, West Indies and circum-Caribbean, western Mexico and the adjacent United States, and the Galapagos Islands ........ Pitnus

5' Antennae with 11 antennomeres; medium to large, length 1.6 mm or larger, usually 2.5-4.5 mm ................................................. 6
6(5') Raised flat portion of frons between antennal fossae equal to about 1/2 or more of the length of the antennal scape .......................... 7

6' Raised flat portion of frons between antennal fossae equal to less than 1/4 of the length of the antennal scape ............................. 11

7(6) Pronotal width slightly greater than length, about 1/10-1/5 wider than long ................................................................. 8

7' Pronotal width slightly less than length, about 1/10-1/5 longer than wide . . ................................................................. 9

8(7) Apical antennomere slightly wider than penultimate antennomere and broadest at apical 1/3; erect setae on elytra scattered over surface and of a single length; denser thick undercoat of setae fluffy or woolly in appearance; Virgin Islands and probably Puerto Rico . . . *Lachnoniptus*

8' Apical antennomere similar in width to penultimate and broadest at about middle; erect setae on elytra in distinct longitudinal rows and of two lengths, shorter setae 1/3-1/2 the length of the longer setae; dense thick undercoat of recumbent setae forms a flat mat on the elytral surface; western North and South America .............................. *Trigonogenius*
9(7') Elytral punctures distinctly visible among erect or suberect and appressed 
setae; metafemora not parallel sided but very gradually increasing in 
width from base to near or past middle; punctures generally large,
usually at least two times the width of elytral setae at their bases . . . 

9' Elytra punctures hidden from view by a dense recumbent layer of setae (in 
addition to the erect setae); metafemora parallel sided for more than 
1/2 the total length, from near base to just past middle; if setae 
abraded, punctures very small, about the same diameter as the elytral 
setae at their bases; introduced from Europe . . *Niptus* (*N. hololeucus*)

10(9) Appressed or recumbent interpuncture elytral setae scattered and often four 
or five setae in any given area in a nearly transverse row, these setae 
oriented towards a median point in the middle of the row and forming 
a distinct longitudinal setal carinae; introduced from Europe . . . . . . .

.................................................. *Tipnus* (*T. unicolor*)

10' Appressed or recumbent interpuncture setae scattered or aligned, but never 
forming distinct longitudinal setal carinae; southwestern United States, 
Central and possibly South America . . . . . . . . . . . . . . . . . . . . .

................................. *Niptus* (excluding the *Pseudeurostus* species group)

11(6') In ventral view, hind trochanters long, exceeding margin of elytra when 
projected perpendicular to longitudinal axis of the body . . . . . . . . . . 12
11' In ventral view, hind trochanters short, not reaching the margin of elytra when projected perpendicular to longitudinal axis of the body .... 13

12(11) Elytral surface smooth or slightly granular and without punctures, although sometimes darker areas of cuticle give the appearance of puncture rows; elytra covered with fine fairly dense recumbent setae obscuring surface; Argentina and possibly Chile ............... Niptomezium

12' Elytral surface with distinct rows of punctures, surface not obscured by setae .................................................. 14

13(11') Pronotum with a vertical cleft or canal on each lateral edge at basal 1/3 when viewed from above, pronotum with distinct setal tufts; elytra black; Venezuela, Curaçao, Aruba, and Bonaire ...... Arachnomimus

13' Pronotum with smooth rounded sides and no clefts or grooves; pronotum with or without setal tufts; elytra usually brown or reddish brown; introduced and native North America species .................. Niptus (Pseudeurostus group)

14(12') Prosternum expanded anteriorly and ventrally, capable of concealing mouthparts when head is in a retracted position; Neotropics excluding the West Indies ................................. Prosternoptinus

14' Prosternum not expanded, mouthparts easily visible when head is retracted .................................................. 15
15(14') Large irregular and elongate punctures distinctly visible in anterior 1/5-1/3 of pronotum; elytra with white recumbent setae forming distinct maculations; first and second ventral sutures absent or at most faintly impressed at middle; Texas, Mexico, and Central America . . . Niptinus

15' Punctures on anterior part of pronotum round or ovoid and usually not very large or distinctly visible, often obscured by setae; elytral patterns highly variable; first and second ventral sutures usually completely and distinctly impressed at middle; distributed throughout the New World .

................................................................. Ptinus

16(3) Trichomes located on pronotum at basal 1/3 near the lateral edges, antennae with three antennomeres; Neotopics and Florida . . . Gnostus

16' Trichomes located on either the elytra or hind legs; antennae with 11 antennomeres ................................................................. 17

17(16') Trichomes located near the apex of the elytra; ultimate antennomere with a rounded apex; middle of elytra without a slight constriction; Panama .

................................................................. Coleoaethes

17' Trichomes located at the apex of the metafemora; ultimate antennomere with a truncate apex; middle of the elytra with a slight but distinct constriction; Neotropics ........................................ Fabrasia
CHAPTER 2

A PHYLOGENETIC ANALYSIS OF THE NEW WORLD PTININAE

(ANOBIIIDAE: BOSTRICHOIDEA)

INTRODUCTION

The Ptininae is a group of insects most often recognized by their small, hairy, and globular shape and are commonly known as spider beetles. Worldwide in distribution, there are 66 described genera and about 600 species. Often thought of as a distinct family (for e.g. Bellés 1994, Downie & Arnett 1996), they are considered a subfamily of the Anobiidae by Lawrence and Newton (1995) and this is the view I follow.

Spider beetles are considered a well defined, monophyletic group. Adults have been distinguished and differentiated from the morphologically similar anobiids, sensu stricto, (i.e. excluding the Ptininae) by close antennal insertions, lack of coxal plates, separate hind coxae, and ventrites one through three connate (Lawrence and Britton 1991, Lawrence 1982). There are some groups of anobiids though, that closely approach the morphology of ptinines. Because of this similarity, ptinines are thought to have evolved from an ancestral wood boring anobiid (Crowson 1967). The
divergence from a wood-boring lifestyle to a scavenging lifestyle is believed to have been the key ecological factor that resulted in the split of the two groups.

The precise relationship of the Ptininae to the remaining anobiid subfamilies is unknown. The relationships among the anobiid, sensu stricto, subfamilies is also unclear. A hypothesis of the evolution of the North American subfamilies was proposed by White (1971). As no branching diagram was given, the actual relationships of the taxa are unclear, but he did consider the Ptilininae and the Eucradinae to be monophyletic.

Ptinines contain a large diversity of morphological forms. This includes highly specialized myrmecophiles with the unusual concomitant features such as trichomes, dung feeders with very compact globular bodies, and wood-boring species similar in appearance to elongate-bodied bostrichids. This morphological diversity has created difficulties with attempts at internal classification. Bellés (1982) discussed the suprageneric relationships of ptinine taxa and defined nine (Bellés 1982) and later eight generic groups (Bellés 1985c). He noted that "problem" taxa bridged morphological gaps among or between all of his generic groups. Additionally, none of the myrmecophilous taxa were placed in a group because of their highly derived morphologies which make them difficult to place with any certainty (see also Lawrence and Reichardt (1969) for more details). A phylogeny has been hypothesized only for the eight genera in the Gibbium-group of Bellés (1982) (= Gibbiinae sensu Bellés 1985c).

This phylogenetic study has several objectives. One purpose is to test the monophyly of the ptinines. Although mostly New World genera were used, this fauna is a very good representation of the worldwide diversity within the subfamily.
To determine the sister group of the Ptininae (and under the assumption that the Anobiidae sensu stricto either is, or contains, the sister group of spider beetles), taxa representing most of the remaining subfamilies of the Anobiidae were included. As corollaries, this also tests whether the anobiids, exclusive of ptinines, is paraphyletic and will be a preliminary examination of the subfamily relationships within the Anobiidae.

Three species of *Niptus* and two of *Niptinus* were included to test the monophyly of each genus. These species represent the five main morphological types known in these genera. The two species of *Ptinus* represent only two subgenera of the eight that are currently recognized (Bellés 1982, Lablokoff-Khnzorian and Karapetian 1991), and so is only a weak test of *Ptinus* monophyly. Two undescribed species possibly representing distinct lineages were included in the analysis, to help determine if these taxa deserve generic status.

As with all phylogenetic analyses, the evolution of characters and character states can be examined and with the ptinines there are several aspects which make this subject particularly interesting. Myrmecophily has arisen in this group and may have one to several origins. One common state in ptinines is flightlessness, but it is unclear how many times this state has evolved. This analysis will elucidate the suite of morphological traits associated with the wingless ptinines. The phylogeny is also useful as a preliminary study of the patterns of behavioral or lifestyle evolution within the Ptininae. Lastly, the phylogeny will be an examination of the naturalness of the classification scheme proposed by Bellés (1982 and 1985c).
MATERIALS AND METHODS

A cladistic analysis of 34 taxa representing 22 species of Ptininae, 8 species of Anobiidae, *sensu stricto*, three species of Bostrichidae, and one species of Endecatomidae was conducted using adult characters. Larval and pupal characters were excluded due to lack of material and the associated problems with large numbers of missing data points (Platnick et al. 1991). Because of our lack of knowledge on the natural histories of most members of the Ptininae, behavioral characters were also not included. Representatives of all New World genera were studied except for *Chilenogenius aeneus* Pic, as the single type of this monotypic genus is unavailable for study. Two of the ptinines, *Microptinus minimus* Heyden, and *Trigonogenioptinus diversepubens* Pic are from the Old World. *Mezium affine* Boieldieu, *Gibbium aequinoctiale* Boieldieu, *Niptus hololeucus* Falderman, *N. hilleri* (Reitter), *Sphaericus gibboides* Boieldieu, and *Tipnus unicolor* Piller & Mitterpacher are species found in the New World, but have probably been introduced.

Three bostrichids, and one endecatomid were used as outgroups. This reduced the problem of the use of a single outgroup with its own potential apomorphies and homoplasies which may reduce global parsimony (Maddison et al. 1984). The eight anobiids represent seven of the nine subfamilies of the Anobiidae as recognized by Lawrence and Newton (1995). The Dryophilinae and the Alvarenganiellinae were not included in this analysis.

Specimens used in this study were borrowed from the following collections, with the coden in parentheses: Essig Museum Entomology Collection (EMEC); The Carnegie Museum of Natural History (CMNH); Canadian National Collection of Insects
Pinned specimens were first prepared for dissection by rehydration in hot water for several minutes and then soaked in lactic acid to macerate tissues. Material from alcohol was directly transferred to the clearing agent. Disarticulated specimens were observed on slides in glycerine. *Coleoaethes tetrabulus* Philips, *Fabrasia wheeleri* Lawrence & Reichardt, and *Niptomezium patagonicum* Pic were not dissected due to lack of material.

Approximately 30 characters were found to be either invariant or autapomorphic and hence were excluded from the analysis. Some potential characters were excluded if they were too variable within species or with continuous states among the taxa and therefore too difficult to code or completely subjective as to a specific state. Some characters which are quantitative, such as the degree of prosternal process extension, have easily differentiated and discrete conditions for which extensive measurements were not necessary. Where quantitative characters appeared useful but were not discrete, measurements were made and ranges defined.

The sexually dimorphic taxon, *Ptinus clavipes* Panzer, was coded with male characters if there was a choice in states. Hence, females were considered as a more derived state within the species.
One hundred and two characters, 43 multistate, were analyzed. All characters were examined unweighted and unordered. Some multistate characters were then ordered to determine if the tree topology would change. Transformation series were only hypothesized for multistate characters if thought plausible. Hennig 86, version 1.5 (Farris, 1988) was used to initially analyze the data with the mhennig and branch breaker options (mh*; and bb*; commands respectively). The ie* (implicit enumeration) command was not used due to the large number of included taxa. Therefore, the Nona option in Dada, which uses branch and bound search options (with random taxon order during each run) was used to make certain all the shortest trees were found (Nixon 1992). The single tree discovered was run in Hennig using the successive approximations weighting option (xs w;) (Farris 1969).

Character state distributions on the tree were examined with Clados, version 1.2 (Nixon 1992). The tree was rooted at the node between the Anobiidae sensu lato (i.e. including the Ptininae) and the one endecatomid and three bostrichid outgroups to determine the direction of character state evolution (i.e., the polarity [Nixon and Carpenter 1993]). Decay indices for each node were calculated by manually moving branches (clades or taxa) in Clados and observing the effect on tree length.

The morphological terminology of Lawrence and Britton (1991), Doyen (1966), and Sharp and Muir (1912) was used. The multistate characters (including those analyzed as ordered) and the consistency and retention indices (sensu Farris 1989) for each character are indicated. The following are descriptions of the
characters and their states used in this analysis. A list of the states for each taxon is given in the following table 1.

HEAD

1. Eye shape: Semicircular (1), or approximately round (0). c.i. 0.25, r.i. 0.78.
2. Eye setae: Present between ommatidia (1), or absent (0). c.i. 0.12, r.i. 0.50.
3. Antennae: Last antennomere ovoid and distinctly wider than the penultimate one (1), or approximately equal sized (0). c.i. 0.50, r.i. 0.50.
4. Antennal club: capitate, elongate and narrow (0), capitate, elongate and broad (1), capitate and short (2), no club (3). c.i. 0.75, r.i. 0.75.
5. Antennae shape: Clubbed (0), filiform (sometimes with a slight anterior expansion of each antennomere, eg. Fabrasia) (1), pectinate (2), serrate (3), moniliform (4). c.i. 0.57, r.i. 0.66.
6. Antennal scape: Robust and second antennomere attached at side of truncate end of scape (1), or not (0). c.i. 1.00, r.i. 1.00.
7. Antennae: Insertions approximate (between eyes) (1), or distant (near anterior margin of eye adjacent to lateral edge of head) (0). c.i. 1.00, r.i. 1.00.
8. Antennal fossae: Dorsal border distinctly, narrowly carinate (and not just a very sharp knife-like edge, or a very broadly rounded ridge) (1), or not (0). c.i. 0.20, r.i. 0.00.
9. Interantennal space: An evenly and broadly rounded ridge (3), a sharp edged ridge (2), a narrowly rounded ridge (1), or flat (0). c.i. 0.33, r.i. 0.40.
10. **Antennal base:** No ridge (1), or with a narrow ridge over the base (0). (ridge often just over the insertion point of the scape on the frons). c.i. 0.50, r.i. 0.88.

11. **Concealment of antennae and palpi:** Hidden during repose (1), or not able to be hidden (0). c.i. 0.50, r.i. 0.66.

12. **Fronto-clypeal suture:** Indistinct or none (1), or distinct (0). c.i. 0.50, r.i. 0.90.

13. **Head-body retraction:** With head markedly reflexed and extending posteriorly and the mandibles near to or reaching metasternum (1), or with head not markedly reflexed and mandible distant from metasternum (0). c.i. 1.00, r.i. 1.00.

14. **Eye and antennal sexual dimorphism:** Obvious size and shape differences (1), or no major differences (0). c.i. 0.25, r.i. 0.62.

**MOUTHPARTS**

15. **Labrum:** Anterior edge broadly rounded (3), pointed (2), truncate or nearly so (1), or distinctly emarginate (0). c.i. 0.33, r.i. 0.14.

16. **Mentum width to length ratio:** As wide as long (1:0.80-1.20) (2), width shorter than length (1:1.25-1.50) (1), or wider than long (1:0.80 or less) (0). c.i. 0.40, r.i. 0.76.

17. **Mentum:** With a broad cavity and a longitudinal carina ventrally for part of the length (3), transverse but curved groove distinct and deep throughout entire length (2), with shallow groove or cavity of various widths (1), or no groove or cavity present (0). c.i. 0.75, r.i. 0.91.
18. Mentum: Anterior edge broadly emarginate (4), broadly rounded (3), truncate but laterally notched (2), pointed to narrowly rounded (1) or truncate but without a notch (0). c.i. 0.66, r.i. 0.81.

19. Mentum: With a patch of 4-8 moderately long to long setae antero-medially (2), with 2 moderately long to long setae medial-anteriorly (1) or with scattered moderate to short setae (0). c.i. 1.00, r.i. 1.00.

20. Hypopharyngeal setae: Proximal setae closely spaced and nearly overlapping (1), or distinctly separated (0). c.i. 0.33, r.i. 0.50.

21. Maxilla: Sclerotized portion of first palpomere strongly arched (about 90°) (1), about 45 degrees to nearly straight (0). c.i. 1.00, r.i. 1.00.

22. Maxillary palps: First segment longer than second (1), or first segment shorter than second (0). c.i. 1.00, r.i. 1.00.

23. Galea length: Reduced and much shorter than lacinia (1), or galea about the same length as lacinia (0). c.i. 0.50, r.i. 0.88.

24. Galeal setae: Some spatulate with tips occasionally truncate (1), or none spatulate or truncate (0). c.i. 1.00, r.i. 1.00.

25. Galeal setae (measured from setal apices to base of distigalea): Distinctly longer than galeal length (3), approximately the same length (2), distinctly shorter (1), or very short and brush like (0). c.i. 0.75, r.i. 0.87.

26. Galeal and lacinial spines: Large and stout and easily visible (3), stout spines present but largely obscured with finer setae (2), no stout spines (1), or lacinia with rows of closely spaced, parallel, stout, spine-like setae (0). c.i. 0.50, r.i. 0.75.

32
27. Labium: Distal edge of ligula with spatulate setae (1), or not (0). c.i. 1.00, r.i. 1.00.
28. Labium ligula (paraglossae): Distal edge without distinct lobes (2), with distinct parallel sided lobes (1), with distinct triangular lobes (0). c.i. 1.00, r.i. 1.00.
29. Labium: Distinct anterior projection of glossa medially (1), or without any projection (0). c.i. 0.50, r.i. 0.00.
30. Labial setae on dorsal surface: In an isolated triangular patch medially on glossa (2), extending posteriorly in two broad rows (1), or concentrated at the apical margin of glossa only (0). c.i. 0.40, r.i. 0.76.
31. Labial setae on dorsal surface: Medially, setae near apical margin of glossa in a very dense, circular clump of erect setae (1), or not (0). c.i 0.50, r.i. 0.50.
32. Labial palp: Distal palpomere expanded apically and obliquely truncate/emarginate (2), expanded apically and transversely emarginate/truncate (1), or fusiform/tapered to a point (0). c.i. 0.66, r.i. 0.75.
33. Labial palp: First segment about as long or longer than second segment (1), or distinctly shorter than second (0). c.i. 0.33, r.i. 0.50.
34. Mandibular teeth: Single tooth at apex (2), single tooth at apex and at middle of mandible(1), or two or three teeth at and near apex of mandible (0). c.i. 0.66, r.i. 0.88.
35. Mandibular pseudomola: Absent (2), poorly developed (1), or present (0).
PROTHORAX

36. Pronotal punctation: Anterior 1/3 or 1/4 with small, sparse, widely scattered punctures associated with setae (4), two large round punctures without setae (3), with numerous small, closely spaced punctures without setae (2), numerous large, elongate punctures without setae (1), or none (0). c.i. 0.40, r.i. 0.62.

37. Pronotal setal tufts: Present (1); Absent (0). c.i. 0.16, r.i. 0.44.

38. Pronotum: Distinctly and strongly constricted near posterior border (1), or not (0). c.i. 0.33, r.i. 0.85.

39. Prothorax: No margin laterally (1), or margined along the sides (0). c.i. 0.50, r.i. 0.87.

40. Prothorax: Ventral surface modified (i.e. inflated laterally, flattened, concave or much reduced and concealed with head (1), or not (0). c.i. 0.50, r.i. 0.88.

41. Prosternal process when viewed ventrally: Apex obviously expanded (1), or not (0). c.i. 0.33, r.i. 0.85.

42. Prosternal process: Not extending ventrally (3), extending ventrally about as far as coxae (2), extending ventrally about 1/2 the length of the coxae (1) or very slightly extending ventrally (0). Ordered. c.i. 0.42, r.i. 0.63.

43. Procoxal cavities: Open (2), partially closed (1), or closed (0). c.i. 1.00, r.i. 1.00.
MESOTHORAX (excluding elytra)

44. Scutellum: Indistinct or hidden (1), or visible (0). c.i. 0.50, r.i. 0.91.

45. Scutellum: Vertical to plane of scutum (1), or horizontal (0). c.i. 0.50, r.i. 0.85.

46. Scutellum vertical to plane of scutum, apex shape: notched (2), narrowly rounded (1), broadly rounded (0). c.i. 0.66, r.i. 0.00.

47. Scutellum horizontal in the same plane as scutum, apex shape: narrowly rounded to pointed (5), notched (4), truncate and slightly broadly emarginate (3), broadly rounded (2), truncate or nearly so, narrowly rounded laterally (1) truncate and narrowing to base (0). c.i. 0.55, r.i. 0.60.

48. Scutellum: Axillary cord obsolete (2), attached obliquely to the longitudinal axis of the scutellum (1), or attached perpendicularly (0). c.i. 0.33, r.i. 0.66.

49. Scutum and scutellum: Both horizontal but distinctly separated by being on different horizontal planes (1) or not (0). c.i. 1.00, r.i. 1.00.

50. Prescutum dorsally in the medial 1/3: Anterior margin nearly straight (2), with a 140-150° notch (1), or with approximately a 90° notch (0). Ordered. c.i. 0.25, r.i. 0.62.

51. Mesosternal process width: Large, 1/2 to 2/3 width of mesocoxa (2), narrow, 1/6-1/3 width of mesocoxa (1), or very narrow and sometimes abbreviated and not contacting metasternum (0). Ordered. c.i. 0.25, r.i. 0.50.
52. Mesosternal process: Broadly emarginate and with a transverse ridge near the apex (1), or not (0). c.i. 1.00, r.i. 1.00.

53. Mesepimeron: Invisible (2), visible and very narrow (1), or visible and distinctly triangular (0). Ordered. c.i. 0.40, r.i. 0.57.

54. Mesosternal-mesepisternal suture: Not present (2); Present but faint (1); Present and distinct (0). Ordered. c.i. 0.50, r.i. 0.75.

METATHORAX (excluding wings)

55. Metasternum width: About equal to mesosternum (1), or wider than mesosternum (0). c.i. 1.00, r.i. 1.00.

56. Metasternum sculpture: Some of the surface with tubercles (2), with irregularly shaped punctures (1), or smooth and occasionally with small round or oval punctures (0). c.i. 0.50, r.i. 0.33.

57. Metasternum: Posterior margin without teeth (1), or margin with a pair of short acute tooth-like projections (0). c.i. 0.33, r.i. 0.71.

58. Metasternum: With a thickened, transverse ridge at the basal margin (1), or without a ridge (0). c.i. 0.25, r.i. 0.80.

59. Metendosternite: Without any stalk or furcal arms (1), or with both a stalk and furcal arms (0). c.i. 0.20, r.i. 0.20.

60. Metepisternum: Not visible (fused with metasternum) (2), visible and lateral or oblique contact with lateral edge of metacoxae (1), visible and contact with anterior margin of metacoxae (0). Ordered. c.i. 0.25, r.i. 0.64.
61. Metepimeron: Weakly sclerotized and very narrow (2), weakly sclerotized and with a broad flange (1), or heavily sclerotized and with a broad flange (0). Ordered. c.i. 0.66, r.i. 0.66.

VENTRITES

62. First and second sutures: Nearly obliterated at middle (1), or distinctly impressed (0). c.i. 0.25, r.i. 0.25.

63. Penultimate ventrite, compared to third last: Extremely reduced in length (1:5.1-5.8) (2), greatly reduced (1:1.5-3.7) (1), or approximately equal (1:0.9-1.4) (0). Ordered. c.i. 0.50, r.i. 0.85.

64. Anterior margin of fourth ventrite at extreme lateral edge: Straight (1); Arcuate (0). c.i. 0.50, r.i. 0.66.

65. First ventrite: Depressed or grooved for the reception of the hind legs (1) or unmodified (0). c.i. 1.00, r.i. 1.00.

66. Ventrites: Non connate (4), all 5 connate or immobilized (3), second and third connate (2), first through third connate (1), or first and second connate (0). c.i. 1.00, r.i. 1.00.

67. Anterior margin of first ventrite laterally: Straight (3), narrowly pointed (2), sharply pointed (1), or broadly pointed (0). c.i. 1.00, r.i. 1.00.

68. Ventrite intercoxal process: Narrow and parallel sided (5), parallel sided and slightly expanded anteriorly (4), triangular or nearly so (3), narrowly rounded (2), broadly rounded (1), or absent (0). c.i. 0.45, r.i. 0.60.
ELYTRA

69. Fusion: Complete to various degrees (1), or not (0). c.i. 1.00, r.i. 1.00.

70. Punctuation: With micropunctures (2), without punctures (1) or with macropunctures (0). c.i. 0.33, r.i. 0.50.

71. Punctuation: In longitudinal rows (1), or scattered (0). c.i. 0.25, r.i. 0.57.

72. Setae: completely obscuring surface (1), or less dense and surface still easily visible (0). c.i. 0.50, r.i. 0.66.

73. Setae: Scattered, short recumbent and erect setae (3) absent or nearly so (2), long, erect and recumbent setae between and along puncture rows (1), or short, recumbent setae (0). Ordered. c.i. 0.50, r.i. 0.75.

74. Integument surface: Granulate (2), smooth and shiny (1), or punctate (0). c.i. 1.00, r.i. 1.00.

75. Integument surface: Striate with continuous distinct grooves (which may have punctures) (1), or not (0). c.i. 0.25, r.i. 0.25.

76. Width: More than 2X as wide as abdominal sterna (1), or less than 2X as wide (0). c.i. 1.00, r.i. 1.00.

LEGS

77. Procoxae: Not contiguous (1), or in contact (0). c.i. 0.20, r.i. 0.42.

78. Procoxae: Strongly projecting and cone-shaped (2), projecting, but neither strongly nor cone-shaped (1), globular (0). c.i. 0.66, r.i. 0.88.

79. Metacoxae: Separated by a distance > \(1/3\) the width of the first ventrite (1), or separated by a distance < \(1/4\) the width of the first ventrite (0). c.i. 0.25, r.i. 0.78.
80. Metacoxae: Ovoid, elliptical, or roughly triangular (1), or transverse or rectangular (0). c.i. 0.25, r.i. 0.66.
81. Metacoxae: Fused to metasternum (1), or not (0). c.i. 0.50, r.i. 0.92.
82. Coxal plates: Very distinct (2), only a remnant (1), or completely absent (0). c.i. 0.50, r.i. 0.75.
83. Anterior trochantins: More or less visible (1), or hidden (0). c.i. 1.00, r.i. 1.00.
84. Profemora: Clavate distally with widest point beyond middle (1), or roughly parallel sided or gradually tapering to apex, and with widest point at or before middle (0). c.i. 1.00, r.i. 1.00.
85. Protibial length: About equal or shorter than tarsi (1), or distinctly longer than corresponding tarsi (0). c.i. 0.20, r.i. 0.20.
86. Protibia: No spurs (1) or one spur (0). c.i. 1.00, r.i. 1.00.
87. Metatibial spines at apex: None (2), one (1), or two (0). Ordered. c.i. 0.50, r.i. 0.00.
88. Protarsi ventrally (dorsal view): Fourth tarsomere lobed (1), or not (0). c.i. 0.25, r.i. 0.57.
89. Protarsi (lateral view): Second through fourth pectinate (3), third and fourth pectinate (2), fourth pectinate (1), or none pectinate (0). Ordered. c.i. 0.60, r.i. 0.66.
90. Metatarsi: First tarsomere short, about 0.5 X length of second (2), about equal to length of second (1), or elongate, about 1.5-2 X length of second (0). c.i. 0.50, r.i. 0.86.
91. Trochanters: Attached squarely (1), or obliquely (0). c.i. 1.00, r.i. 1.00.
92. Trochanter length: Relatively long (1), or short (0). c.i. 1.00, r.i. 1.00.

WINGS
93. Wing development: Apterous (2), brachypterous (1), or pterous (0). Ordered.
   c.i. 0.66, r.i. 0.92.
94. Jugal lobe: Absent (1), or present (0). c.i. 0.33, r.i. 0.66.
95. Wedge cell: Absent (1); Present (0). c.i. 0.20, r.i. 0.20.
96. Wing vein AP3+4: Absent (1), or present (0). c.i. 0.50, r.i. 0.75.
97. Cross vein between MP-MP (=CUA1): Present (1), or absent (0). c.i. 0.50, r.i. 0.00.
98. Cross vein between MP1+2 and MP3+4 ( = cr ): Present or remnant (1), or entirely absent (0). c.i. 0.33, r.i. 0.33.
99. RP2 vein: Absent (1) or present (0). c.i. 1.00, r.i. 1.00.
100. r4 vein (i.e. RP + rr connected): Absent (1), or present (0). c.i. 1.00, r.i. 1.00.

GENITALIA
101. Spiculum gastale: With 4 (1), or 2 arms (0). c.i. 0.20, r.i. 0.42.
102. Aedeagus: Stout, paramere to basal piece ratio = 1.5 : 1 or less (the "anobiid s.s." type) (1), or relatively elongate, paramere to basal piece ratio = 1.6 : 1 or greater (the "ptinine" type) (0). c.i. 0.50, r.i. 0.83.
CHARACTERS OF POTENTIAL USE BUT NOT INCLUDED IN THE ANALYSIS

LARVAL CHARACTERS:
1. food source: wood or accumulated organic material of plant, fungal, or animal origin.
2. lifestyle: myrmecophily, borer of plants, detritivore
3. spiracle: present on anterior lateral edge of prothorax or absent.
4. abdomen: dorsal surface with rows of spines or without.
5. preanal sclerite: large and U-shaped or small and shape variable.
6. leg: empodial lobe present or absent.
7. mandible: mesal tooth angle acute or obtuse
8. labrum: one pair of setae on the postmentum or none.
9. epipharynx: three or four labral setae.
10. epipharynx: presence or absence of setae laterally.

COCOON CHARACTERS:
1. structure: incorporation of food source or free from food.
2. structure: tightly or loosely woven form.
Table 1: States of characters used in the analysis.
Table 1 (Continued):

6
7
8
9
10
1234567890123456789012345678901234567890123456789012

Arachnomimus
Byrrhodes
Coleoaethes
Ernobius
Eucrada
Fabrasia
Gibbium
Gnostus
Hedobia
Lachnoniptus
Lasioderma
Mezium
Microptinus
Niptinus ovipennis
Niptinus unilineatus
Niptomezium
Niptus hololeucus
Niptus hilleri
Niptus ventriculus
Oiigomerus
Pitnus
Ptilinus
Ptinus clavipes
Ptinus tectus
Prosternoptinus
Sphaericus
Tipnus
Tricorynus
Trigonogenioptinus
Trigonogenius
Endecatomis
Euderia
Lyctus
Prostephanus

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1000001001001001120010100011000001010030110011101110
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1001011112001001111010100011111001010001112 ----------------- 10
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43


Discussion of Selected Characters and their States

Head Characters (excluding mouthparts)

Antennae are extremely variable in the Anobiidae and are useful in defining monophyletic groups. Some ptinine taxa have the last antennomere slightly but distinctly wider than the penultimate antennomere (character 3, figure 2.1 C and H). This antennal condition is not considered as clubbed (character 5). Therefore all ptinines are considered to have filiform antennae (figure 2.1 C, E, H, I, K-M). Reduction in the number of antennomeres is found in *Gnostus* (figure 2.1 I) and *Pitnus* (figure 2.1 H), but these states are autapomorphic and so were excluded from the analysis. A robust antennal scape with a truncate apex and the second antennomere attached at the side (character 6) is found in some of the more derived anobiines, *sensu stricto* (figure 2.1 G).

The antennal fossae sometimes have a dorsal border which is distinctly carinate, while other taxa have a sharp knifelike edge or a broadly rounded ridge (character 8). The interantennal space also has several different states ranging from a sharp ridge to a flat space.

Mouthparts

The mentum width to length ratio (character 16) has several different states such as approximately equal (figure 2.2 A, B, D) to width shorter than length (figure 2.2 C). The anterior edge can be truncate with a notch (figure 2.3 B), without a notch (figure 2.2 A), or rounded in various ways (figure 2.2 B-D). Additionally, the presence and number of long setae on the mentum are useful as certain ptinines
have two (figure 2.2 C) while most have a patch near the anterior margin (figure 2.2 B and D). Most anobiids, sensu stricto, have the surface covered with scattered setae of moderate to short length (figure 2.2 A). The hypopharyngeal setae (back from the distal edge) on the dorsal surface is brush-like and aligned in two longitudinal and approximately parallel rows along the sclerotized edges. These parallel rows vary in their proximity. They are either closely spaced (figure 2.3 C) or distinctly separated (figure 2.3 D). The labial setae on the dorsal surface (character 30) is in an isolated triangular patch (figure 2.3 A) in anobiids, sensu stricto, except for the Eucradianae which, like in most ptinines, has the setae concentrated (but not limited to) the apical margin of the ligula (figure 2.3 C and D). In Niptinus, this setae is concentrated in a very distinct, circular clump (character 31, figure 2.3 C).

The ligula on the labium has distinct lobes or paraglossae in the anobiids, sensu stricto (figure 2.3 A and B). In contrast, the ptinines are without any obvious lobes (figure 2.3 C and D). The anobiids with paraglossae also have one of two shapes; either triangular (figure 2.3 B) or parallel-sided (figure 2.3 A). The distal labial palpomere in anobiids can have either a truncate (figure 2.3 B) or fusiform/tappered apex (figure 2.3 A).

The first segment of the maxillary palpus is strongly arched in ptinines (figure 2.4 C-E) while in the remaining anobiines it is slightly arched or fairly straight (character 21, 2.4 A and B). This same segment is also longer than the second segment in ptinines while in the anobiids it is distinctly shorter (character 22). The galea and lacinia also have several character states of phylogenetic use (characters 23, 24, 25, and 26). The galeal length relative to the lacinia is easiest to observe on dissected parts under a compound microscope so that the focal point can eliminate...
the obscuring effect of dense setae. Galeal setae varies in length relative to the
length of the galea (character 25). They are longer in some taxa (figure 2.4 C),
about the same length in others, and occasionally are short and brush-like (figure 2.4
B).

All the non-ptinine anobiids have their mandible with only apical teeth while in
the ptinines there is a tooth both apically and near the middle of the mandible (figure
2.5 A and B).

Prothorax

The pronotum has anterior punctures which have several states (character
36). The ptinines usually have numerous punctures. In Prosternoptinus and
Niptinus, they are large (figure 2.6 B) while most genera have punctures that are
relatively small (figure 2.6 A). Anobiids, sensu stricto, have small punctures
associated with setae (figure 2.6 C). In Gnostus there are two large punctures
present anteriorly. Longitudinal grooves from these punctures lead back toward
trichomes. It is likely that the punctures are associated with glands and the grooves
enable fluid to flow back toward the posteriorly located setal tufts. In the anobiids,
sensu stricto, the ventral surface of the prothorax is modified in various ways, but
the Ptininae have no alterations (character 40).

Mesothorax

Although the scutellum and scutum are sometimes greatly reduced in some of
the flightless ptinines, there are still several character states that can be assigned to
taxa. In most (or all) of the flightless ptinines, the scutellum is vertical to the plane
of the scutum (figure 2.7 A-D). In the remaining anobiids the scutellum is horizontal relative to the scutum (figure 2.8 A-D) (character 45). In those taxa with the scutellum and scutum both horizontal, some of the anobiids (such as Tricorynus) have these two structures on distinctly separate levels (figure 2.8 A-B). In dorsal view, the anterior margin of the prescutum is usually notched (character 50). This notch can be about 90° (figure 2.8 B), about 140-150° (figure 2.7 A and C; 2.8 A) or completely absent.

The mesosternal process has various widths that can be readily divided into three states (character 51). While in most flightless ptinines it is relatively large (figure 2.9 A), in others it is reduced to various degrees (figure 2.9 B and C).

Metathorax (excluding wings)

The metasternum in ptinines and highly derived anobiids, sensu stricto, (i.e., Lasioderma, Tricorynus, and Byrrhodes) does not have any teeth posteriorly (character 57). In other anobiids, there are two small teeth at the middle of the posterior margin.

Ventrites

The fourth ventrite compared to the third is reduced to various degrees in ptinines (figure 2.10 C-F) whereas the anobiids, sensu stricto, this sclerite is not, or only slightly reduced (figure 2.10 A and B). The anterior margin of the fourth ventrite at the lateral edge curves posteriorly in all Anobiidae (figure 2.10 A, C-F) except the Gibbium generic group (represented by Gibbium and Mezium) and the Mesocoelopodinae and Dorcatominae (figure 2.10 B) (represented by Tricorynus and
*Byrrhodes*, where the anterior margin is straight. Both of these groups are highly derived members of their respective clades and have very compact, rounded abdomens. The anterior margin of the first ventrite laterally (character 67) ranges from broadly pointed through to narrowly pointed (figure 2.10 E) or sharply pointed (figure 2.10 C). One additional character of the first ventrite is the medial anterior process which extends between the metacoxae to various degrees and in several forms (character 68). In ptinines, this process is narrowly or broadly rounded in most taxa (figure 2.10 C-F) but in some taxa (*e.g.*, *Gibbium*) it is completely absent. In anobiids, *sensu stricto*, it has several states including triangular shaped (figure 2.10 A) and parallel sided and expanded anteriorly (2.10 B).

Legs

The coxal plates are very pronounced in most anobiids (figure 2.11 A) excluding the eucradines which have weak plates (figure 2.11 B) and most ptinines which have them completely absent (figure 2.11 C).

Wings

Wings in many or perhaps most of the ptinines are lost. Those taxa that have wings have veination reduced to only the subcostal-radial vein (at the anterior margin), the MP$_{1+2}$-RP (the central wishbone shaped veins), and a few veins in the anal portion of the wing (figure 2.12 A and B). The simplest wing veination in the anobiids, *sensu stricto*, is seen in the representatives of the Eucradinae (*Hedobia* (figure 2.13 A) and *Eudrada* (figure 2.13 B)). Although it approaches that found in the ptinines, the veination in the eucradines is still more complex. The most complex
veination in the taxa included in this analysis is seen in the outgroup taxa (e.g., figure 2.14 A-C).

The presence of a jugal lobe (character 94) in the ancestor of the Anobiidae, sensu lato, is ambiguous, but several more wing vein character states support this clade (see the section on the Anobiidae, sensu lato, clade for more details). The presence of a wedge cell (character 95) is support for the sister clade of the Euderine anobiids, although there is a reversal in two of the apical taxa, Lasioderma and Byrrhodes. A cross vein between MP_{1+2} and MP_{3+4} (= cr) (character 98) is hypothesized to be synapomorphic for the Eucradinae (figure 2.13 A and B) and is also found in the taxa Oligomerus (figure 2.13 C) and Ernobius.

List of Taxa Used in the Cladistic Analysis

Anobiidae:

Anobiinae: \textit{Oligomerus obtusus} LeConte

Dorcatominae: \textit{Byrrhodes tristriatus} LeConte

Eucradinae: \textit{Eucrada humeralis} Melsh

\textit{Hedobia granosa} LeConte

Ernobiinae: \textit{Ernobius nigrans} Fall

49
Mesocoelopodinae: *Tricorynus estriatus* Horn

Ptilininae: *Ptilinus ruficornis* Say

Ptininae: *Arachnomimus cristi thorax* Bellés
*Coleoaethes tetralobus* Philips
*Fabrasia wheeleri* Lawrence & Reichardt
*Gibbium aequinoctiale* Boieldieu
*Gnostus floridanus* Blatchley
*Lachnoniptus lindae* Philips
*Mezium affine* Boieldieu
*Microptinus minimus* Heyden
*Niptinus ovipennis* Fall
*Niptinus unilineatus* Pic
*Niptomezium patagonicum* Pic
*Niptus hilleri* Reitter
*Niptus hololeucus* Falderman
*Niptus ventriculus* LeConte
*Ptinus antillanus* Bellés
*Prosternoptinus castaneus* Philips
*Ptinus clavipes* Panzer
*Ptinus tectus* Boieldieu
*Sphaericus gibboides* Boieldieu
*Trigonogenioptinus diversepubens* Pic
Trigonogenius globulum Solier
Tipnus unicolor Piller & Mitterpacher

Xyletininae: Lasioderma serricorne (Fabricius)

OUTGROUPS:

Endecatomidae:

Endecatomus rugosus Randall

Bostrichidae:

Euderia squamosa Broun
Lyctus planicollis LeConte
Prostephanus punctatus (Say)

RESULTS AND DISCUSSION

A single tree was found with a length 362, a consistency index (c.i.) of 0.46 and a retention index (r.i.) of 0.74. Additional branch swapping in Nona was not necessary. Ordering some multistate characters did not alter the tree topology. The four outgroup terminals were not mixed with the ingroup, thereby supporting the hypothesis of a monophyletic Anobiidae (figure 2.15).

Successive weighting was done on the single tree. This method more heavily weighs those characters with less homoplasy. Use of successive weighting provides
a method of basing groups on more reliable characters without making a priori
decisions on weighting. This procedure is normally used to reduce the number of
equally parsimonious trees. Since only one shortest tree was found in this analysis,
its application was not necessary. Use of this technique does not presume softening
of the parsimony criterion to determine the best hypothesis of evolution. But it does
indicate two areas of the tree that are weakly supported and so may be of interest.
The resulting tree was two steps longer and the topology was altered in two ways:
*Ptinus* (represented by *P. clavipes* and *P. tectus*) is paraphyletic and the Anobiinae
(represented by *Oligomerus*) and Ernobiinae (represented by *Ernobius*) became a
monophyletic clade.

*Anobiidae, Sensu Lato*

*Anobiidae, sensu lato* (i.e. including the ptinines), are a monophyletic group
supported by nine synapomorphies, five of which are uncontroverted (1, 2, 4, 6, and
7). These states are as follows: 1) wing vein RP and rr not connected, (i.e. r4
absent) 2) wing vein RP2 absent, 3) wing vein AP 3+4 absent (present in *Eucrada*),
4) procoxal cavities open, 5) procoxae strongly projecting (reversal to moderately
projecting in *Prosternoptinus* through to remaining more apical ptinines), 6)
trochanter attached to femur squarely, 7) and mandibular pseudomola present.

Use of accelerated transformation (which maximizes reversals and minimizes
parallelisms [criterion of Farris 1970]), results in three additional characters which
can be used to support the Anobiidae *sensu lato*: 1) a ventrally unmodified
prothorax, 2) the presence of a jugal lobe, and 3) loss of a ridge over the antennal
insertions. The first two states are hypothesized to be synapomorphies but the third is not. A ventrally modified prothorax may not be homologous between the four outgroup taxa and the eucradine anobiid sister clade. White (1971) also considers the modifications of the prothorax in this clade as derived from the common ancestor of all the anobiids. This ancestral species was similar in morphology to *Ptinus* or the Eucradinae. Therefore, an unmodified prothorax is considered synapomorphic for the Anobiidae sensu lato, with subsequent modification in the more derived Anobiidae. The presence of a jugal lobe as a synapomorphy for the Anobiidae (with parallel losses in the Eucradinae and *Ptinus clavipes*) seems as likely as parallel evolution of this lobe in (or synapomorphies for) the Ptininae (with a loss in *Ptinus clavipes*), and anobiid clade composed of the Ptilininae through to the most apical Dorcatominae + Mesocoelopodinae. Regarding the third character, it may be most plausible to hypothesize the loss of the ridge has occurred as a parallelism both within the Eucradinae (*Hedobia* and *Eucrada*) and the Ptininae. If this is the case, this character is not a synapomorphy for the group. My evidence for this is that the ridge over the antennal insertions is hypothesized to be homologous between the Bostrichidae and the Anobiidae (excluding the Eucradinae) sensu stricto.

Although larval characters were not included in this analysis, Ivie (1985) mentioned two larval character states which support the monophyly of the Anobiidae: an exerted head and two-segmented antennae. The ancestral states are an inserted head and three-segmented antennae.

One last character which may be a synapomorphy for the Anobiidae, is the lack of a leptophragmata in the cryptonephridial system (Saini 1964). The leptophragmata are specialized cells which attach the Malpighian tubules to the
perinephric membrane. The absence of these cells is unique in the Anobiidae, out of a diverse assemblage of Coleoptera families studied by Saini (1964). But since only three relatively derived anobiids, *sensu stricto*, (*Stegobium paniceum, Anobium punctatum*, and *Lasioderma serricorne*), two derived ptinines (*Ptinus tectus* and *Niptus hololeucus*), and one species of bostrichid (*Rhizopertha dominica*) were included in this study, the results should perhaps be viewed with caution.

**Anobiidae, Sensu Stricto**

The Anobiidae, *sensu stricto*, (i.e. excluding the Ptininae) are monophyletic. The synapomorphies are as follows: 1) anterior trochantin more or less visible (uncontroverted) 2) eye and antennal sexual dimorphism (lost in *Lasioderma*, parallelisms in *Euderia* and *Ptinus clavipes*), 3) setae between ommatidia (also in 11 taxa of ptinines), and 4) fourth protarsus lobed (lost in *Lasioderma* and *Byrrhodes*, parallelism in *Niptinus*).

Coxal plates have been used to separate the anobiids, *sensu stricto*, from the ptinines. It is generally a good character state to separate these two groups, but the anobiids *Hedobia* and *Eucrada* (*Eucradinae*), have only a remnant plate. Additionally, at least one ptinine I have examined has coxal plates more distinct then those of the Eucradinae. Although probably not a homologous character, both *Euderia* (Bostrichidae) and *Endecatomus* (Endecatomidae) also have what appears to be a remnant plate.

The fusion of the first two ventrites has been used to define the Anobiidae, *sensu stricto*, and although ambiguous on the tree, is still a good character state
The Bostrichidae have all the ventrite sutures free and the Ptininae have the first three ventrites fused. The anobiids, sensu stricto, have one additional state of ventrite fusion. In both *Byrrhodes* and *Tricorynus* (representatives of the highly derived Dorcatominae and Mesocoelopodinae), all five ventrites are fused into a relatively immovable piece. The degree of fusion between each of the five visible ventrites appears similar, although in *Tricorynus* the fusion between the second and third appears more complete.

**Ptininae**

The Ptininae are a strongly supported monophyletic group. Five uncontroverted synapomorphies are as follows: 1) approximate antennal insertions, 2) maxillary palps with the first segment longer than the second, 3) maxillary palps with the first segment arched, 4) labium without distinct lobes (paraglossae), and 5) the anterior margin of first ventrite pointed at the lateral edge.

Two synapomorphies are uncontroverted, but have more derived states within the ptinines. The first three ventrites are connate except for two genera. *Mezium* has the second and third ventrites fused and the suture between the first and second is flexible. *Gibbium* has only four ventrites. This reduction in the number of ventrites is probably due to complete fusion of the first two ventrites with loss of the suture, as evidenced by the relative sizes of these sclerites compared to those in *Mezium*. Filiform antennae is also a synapomorphy for the ptinines with several exceptions. Myrmecophilous taxa, including two in this analysis (*Gnostus* and *Coleoaethes*), have the antennae modified in several ways, including reductions in
number of antennomeres, moniliform or paddle shaped antennae. If we assume these modifications are all more derived states within these ptinines, then filiform antennae is a synapomorphy for the group.

Additional support (nine controverted character states) for the ptinine clade are as follows (taxa outside the Ptininae sharing the same state indicated in parentheses, homoplasic taxa inside the Ptininae in square brackets): 1) posterior margin of metasternum without teeth (also in *Lyctus*, and the monophyletic clade composed of *Lasioderma*, *Byrrhodes*, and *Tricorynus*), 2) lack of a ridge over the antennal insertions (also lacking in *Hedobia* and *Eucrada*), 3) galeal setae the same or longer than the length of the galea (the same length in *Lyctus*), 4) galeal length shorter than lacinial length (and in *Hedobia*), 5) mandibles with a tooth at middle (also in *Prostephanus* [absent in the ptinine *Gnostus*]), 5) intercoxal process broadly or narrowly rounded (broadly rounded in *Lyctus* [absent in the ptinines *Gibbium*, *Sphaericus*, and *Niptus hololeucus*]), 6) mentum with a groove (present in *Lyctus* [lost in *Coleoaethes*]), 7) both erect and recumbent elytral setae (also in *Hedobia*), 8) clavate profemora [parallel sided in *Coleoaethes*], and 9) the fourth ventrite compared to third reduced in length [reversal to both equal in length in *Gibbium*, *Mezium*, and *Lachnoniptus*].

Previous authors (Lawrence and Britton 1991, Lawrence 1982) have distinguished or diagnosed adult ptinines from the other anobiids by several character states. The first three ventrites connate appears to be a reliable character. Approximate antennal insertions have long been used as a key character to separate ptinines from anobiids *sensu stricto*. Although close antennal insertions are very useful with the taxa I included in this analysis, examination of another undetermined
species of ptinine from New Zealand bridges this gap, although in most other respects it is a perfectly good spider beetle. Two other characters are the lack of coxal plates and separated hind coxae. These characters usually work but there are several taxa which bridge this gap. For example in the anobiid *Hedobia*, there is only a slight remnant coxal plate. A fringe of setae also exaggerates the appearance of this coxal plate when dry specimens are examined. The previously mentioned ptinine from New Zealand also has coxal plates developed to a much greater extent than any *Hedobia* species I have examined, which is further evidence for the unreliability of this character. An analogous situation is in the degree of metacoxal separation. Certain ptinines have metacoxae as close together as some anobiids, although this character is reliable to separate the anobiids *sensu stricto* from the more derived, flightless ptinines. One final character often used to differentiate these groups is the presence of lateral edges on the pronotum of anobiids, *sensu stricto*. There are exceptions in both groups, as the ptinine *Neoptinus* has distinct pronotal edges and some anobiids, *sensu stricto*, such as *Hedobia* and *Eucrada* do not. Additionally, *Euderia*, representing the sister lineage of the Anobiidae, *sensu lato*, has the pronotum laterally rounded. Therefore, it is more parsimonious to hypothesize that rounded edges first evolved in the common ancestor of *Euderia* and the anobiids with lateral edges appearing in the anobiid sister clade of the Eucradinae.

Ivie (1985) postulated how the loss of coxal plates may have occurred in the less derived ptinines, such as *Ptinus*. While his idea assumed that the coxal plates were lost, my phylogeny indicates the character state in the common ancestor of the Anobiidae, *sensu stricto*, the Ptininae, or the Anobiidae, *sensu lato*, is ambiguous. Coxal plates may have evolved in the common ancestor of anobiids, *sensu stricto*,
and are well developed in most Anobiidae, although in the Eucradinae they are poorly
developed. If this hypothesis is correct, then the ptinines never had coxal plates.
But I suspect ptinines ancestrally did have coxal plates since, 1) the New Zealand
ptinine has plates, and 2) a poorly developed plate is present in *Euderia* (and
*Endecatomus*). If *Euderia* is hypothesized to be the sister group of the Anobiidae,
sensu lato, and the plates of these two groups are considered homologous, then it is
equally parsimonious to hypothesize that a poorly developed plate evolved in the
common ancestor of both *Euderia* and all of the Anobiidae. While the plates became
more developed in the apical anobiids, *sensu stricto*, they were lost in an early
ancestral ptinine.

Ptinines basal in the clade (such as *Ptinus*) have metacoxae reduced in length
and with a slight concave surface compared to anobiids, *sensu stricto*. There
appears to be a remnant coxal plate at the anterior edge of the coxa in some species
and a relatively well developed plate in one species from New Zealand. Ivie (1985)
states that the plates disappeared due to the metacoxae being tipped forward, so
that the plate is directed ventrally (toward the substrate) instead of posteriorly.
Rather than the coxae tilted, they may have "moved" slightly in an anterior direction,
towards the metasternum. This coxal shift, together with the slight projection of the
posterior margin, has given the coxae a slightly more excavated appearance. The
anteriorly located ventral ridge (which forms the coxal plate) is at most only slightly
raised and is part of the posterior margin. If most of the ptinines had plates and lost
them, the simplest explanation is that the plates disappeared due to the plate
reducing in size.
In summary, regardless of some unreliable characters used to separate the ptilines from the anobiids, there are many additional character states which support the complete separation of these two lineages.

The Clades Within the Ptilinae

The ptilines can be divided into two main groups of taxa; basal paraphyletic pleiomorphic forms, and apical monophyletic more derived forms (figure 2.16). The pleiomorphic forms are usually characterized by elongate bodies and fully developed wings. The apomorphic forms are apterous and have short, globular-shaped bodies. The monophyletic apical clade (figure 2.17) is supported by six synapomorphies. These character states are as follows: 1) fused elytra (uncontroverted), 2) metacoxae fused to metasternum (also in Niptinus ovipennis), 3) first metatarsi equal to length of second (also in Gnostus and Endecatomus + Prostephanus), 4) aptery (and in Niptinus ovipennis), 5) scutellum indistinct or hidden (reversed to visible in Microptinus), and 6) eyes semicircular in shape (also in Coleoaethes and Gnostus, reversal to eyes round in Pitnus).

The loss of flying ability generally results in a short globular body with rounded humeral angles. Several of these character states are associated with wing muscle reduction or loss and are probably not independent from each other (i.e. character states 1, 2, 4, and 5). But the character states of the first and second metatarsi equal in length and semicircular eyes may be completely independent of wing loss and are further evidence for the monophyly of this group.
Aptery and fusion of the metacoxae to the metasternum are found outside the monophyletic group (of globular-shaped taxa) as a parallelism in Niptinus ovipennis. Wing loss is also associated with rounded humeral angles in Niptinus and flightless females in the genus Ptinus.

The shortening of the metasternum is quite pronounced in flightless ptinines (and noted in Smith, 1964). Another character associated with body shortening is the presence of a thickened transverse ridge at the basal margin of the metasternum. This state is found in all the flightless taxa including Ptinus tectus and Niptinus ovipennis, although it is absent in Mezium. The only species with this state and fully developed wings is the myrmecophilous Fabrasia. This character state may be associated with strengthening the body to resist ant attack in this taxon.

The metasternum lacking a distinct external medial longitudinal sulcus (= the discrimen), indicating the position of internal keel, may also be associated with loss of flight. This apodeme is part of the metendosternite where it attaches at or near the posterior margin of the metasternum. Reduction of the metendosternite is also seen in Niptus hololeucus, N. hilleri, Tipnus, Microptinus, and Niptinus ovipennis.

The hind coxae have also become further separated in the most derived ptinines. This separation has resulted in the transverse or rectangular coxae becoming triangular, elliptical or rounded and progressively more fused with the metasternum. In some cases the fusion lines have almost completely disappeared. This is also the case with other sutures on the ventral surface, which are obsolete in these derived taxa. These include the metepisternal-metasternal suture and the mesepisternal-mesosternal suture.
The metatergum has a large range of variation in flightless forms but generally undergoes a reduction in size and sclerotization. These modifications associated with flightlessness in most taxa include a hidden or vertical orientation of the scutellum, the anterior margin of the pre-scutum nearly straight, and the loss of the axillary cord.

The reduction in the length of the mesosternal process resulting in a large and subtrapezoidal shape is seen in most apterous ptinines. Two notable exceptions include Gibbium and Mezium which have a narrow and rectangular process. Smith (1964) in contrast, found no general structural alterations of the mesothorax due to retention of the elytra. He does note the mesopleura as very narrow in apterous ptinines. I found the mesepimeron totally absent and the trend towards sclerite fusion in some, but not all, of the highly derived forms such as Mezium, Gibbium, Niptus hololeucus, and N. hilleri.

Lachnoniptus New Genus (Philips, in press) is hypothesized to be sister of Trigonogenius. Support for this relationship is based on a shared reversal of closely spaced metacoxae, dense elytral setae, labial setae in two broad rows, and no setae between the ommatidia. None of these appear to be very strong character states, but taken together are evidence for the sister group relationship. In particular, the presence of ommatidial setae is a very homoplasic character and the dense elytral setae may not be homologous between these two taxa. Lachnoniptus has very wool-like setae and Trigonogenius has closely appressed setae more like that of N. hololeucus. The uniqueness of the Lachnoniptus lineage is also evidenced by the following morphological differences, with the states of Trigonogenius in parentheses: 1) the apical antennomere distinctly wider than penultimate one (equal in width), 2)
the mesosternal process is 2/3 the width of the mesocoxae (1/3 the width), 3) lack of a mesosternal-mesepisternal suture (present), 4) the metasternum not visible via fusion (visible) 5) metacoxae round (rectangular), 6) metacoxae contacting the ventrite (in contact), 7) the fourth ventrite about equal in length to third (greatly reduced), and 8) the anterior margin of first ventrite is narrowly pointed laterally (not sharply pointed).

Coleoaethes New Genus (Philips, in press) appears as a unique lineage at the base of the ptinine clade. It shares several character states with anobiids senso stricto such as parallel sided profemora, strongly projecting front coxae and an unexpanded apex on the prosternal process, scattered setae on the ventral surface and the absence of a groove on the mentum, and the presence of a fronto-clypeal suture. These states are evidence of the antiquity of this lineage within the Ptininae.

Evolutionary Traits Within the Ptininae

Feeding Habits

The lifestyle of the common ancestor of all the Anobiidae, sensu lato, can be postulated based on the biologies of extant taxa which are either sister to the Anobiidae sensu lato, or are lineages within the clade. The hypothesized sister to the Anobiidae (including the Ptininae) is the Euderiinae, a subfamily of Bostrichidae. Adults of the only known genus Euderia Broun (with two species, one undescribed) are usually collected beating Nothophagus branches. Larvae have been collected in galleries in the bark or wood of the same species (Crowson 1961). Similarly, basal
members of the anobiid subfamily Eucradinae (such as the genera *Eucrada* or *Hedobia*) or the sister lineage in Anobiidae, *sensu stricto*, are all borers in bark or wood of dead hardwoods (White 1982). In contrast to *Euderia* and the anobiids, *sensu stricto*, the two most basal taxa in the ptinine clade (included in this analysis) are myrmecophiles. These are highly derived lineages which may not represent the ancestral habits of the main evolutionary lineage of the Ptininae. The food habits of these taxa are unknown except for *Gnostus floridanus*. Adults of this species were observed being fed by *Crematogaster* ants (Thomas et al. 1992). The most plausible lifestyle for these groups is that the larvae and perhaps the adults feed on some sort of nest detritus. The other most likely possibility is that they are predacious similar to, for example, some of the staphylinoid myrmecophiles. This latter lifestyle seems unlikely, since there is no evidence that any of the Bostrichoidea are predacious.

Crowson (1967) may be correct in his presumption of the loss of the wood-boring habit as a key factor in the evolution of and divergence of the ptinines from their "anobiid"-like ancestors. The most basal ptinines in this analysis are myrmecophilous taxa which probably do not feed on wood but are more likely nest detritivores. The switch from habitats associated with dead wood to myrmecophily is a well known phenomenon (Crowson 1981, Park 1964). But in conflict with the Crowson hypothesis are the several species of ptinines that are true wood/stem-borers, and even more that have been observed associated with dead wood (Bellés 1980). For example, *Ptinus palliatus* (Howe 1959) and *P. lichenum* (Bellés 1980) are wood borers, like many of the anobiids, *sensu stricto*. As few wood-boring *Ptinus* are known, these species may be basal in the *Ptinus* clade before more derived feeding habits evolved. It is also possible that this condition in *Ptinus* is a reversal to
the pleisiotypic state. Confounding this hypothesis is our lack of knowledge on the feeding behaviors of the vast majority of ptinines. No information has yet to be reported for the closely related *Niptinus* which may help clarify this situation. Although also not documented, the even more basal *Prosternoptinus* may be a borer of either wood or possibly stems. Evidence for this is twofold. First, specimens have usually been collected by beating branches and this is a common collecting method for other wood boring anobiids. Second, *Prosternoptinus* also holds a very basal position in the phylogeny before ptinines with derived behavior of scavenging on accumulated organic matter. It is only in the speciose and widespread *Ptinus* and the more apical globular-shaped ptinines where a scavenging lifestyle is known. But in support of the Crowson scenario, gut contents of adults of both *Prosternoptinus* and *Niptinus* contain various types of fungal spores. This indicates some utilization of fungi for a food resource. But until larvae of these genera are found, we cannot be certain what they are using for a food source.

Reversals to the pleisiomorphic lifestyle of boring is known in two genera. At least one species of the very derived *Ptinus* is a leaf miner (Philips et al. unpublished). Bellés and Lawrence (1990) also recorded the closely related *Neoptinus* as a borer of stems.

Ptinines are considered more abundant in the drier regions of the world. This may be a way of avoiding competition with other species that use organic matter such as dung. This could be the reason why some ptinine species are not collected during the wet season or in areas with adequate moisture to allow activity of scarabaeine dung beetles. This has been recorded in two Costa Rican species, *Ptinus latefasciatus* and *P. costaricensis* (Andrews, 1967), and a Venezuelan species,
*Arachnomimus cristithorax* Bellés (Philips, unpublished). There is no doubt of the better ability of scarabaeines to quickly locate dung compared to most flightless ptinines. In areas with a prolonged dry season, scarabaeine emergence from estivation is generally triggered by moisture (Howden and Young 1981, Janzen 1983). Once active, these scarabs quickly locate and usually bury the dung. Ptinines need this resource to remain on the surface so that their larvae can complete their endocoprous form of development undisturbed (terminology from Halffter and Edmonds 1982). The long developmental times for many species (up to eight weeks for a complete generation under ideal conditions [Howe 1959]) is another factor. An analogous situation of competition avoidance may be found in species which utilize carrion carcasses in the later and drier stages of decomposition to avoid fly larvae found on the fresher resources (Crowson 1981).

Evolution of Myrmecophily

As only three out of nine myrmecophilous genera were included in this analysis only some very general remarks can be made. Two myrmecophilous species of ptinine, *Coleoaethes* and *Gnostus* are basal in the ptinine clade, indicating they were perhaps the first two ptinine lineages to separate from the ancestral lineage that lead to the remaining extant ptinines (figure 2.18). The only other New World ptinine myrmecophile is *Fabrasia*. This genus is more apical in the tree than the other two genera and appears as the sister to the monophyletic ptinines characterized by flightlessness and a globular body shape (figures 2.16 and 2.18). I hypothesize that none of the three myrmecophilous genera share a most recent common ancestor.
and that each evolved myrmecophily separately. It is equally parsimonious to hypothesize that myrmecophily is a synapomorphy for all the Ptininae, but was lost after the *Gnostus* lineage split off from the main ptinine lineage. But in regards to the very different morphologies of *Coleoaethes* and *Gnostus* lineages, the best current hypothesis is that the myrmecophilous habit evolved in each lineage as a parallelism. This is also the most conservative hypothesis until other excluded taxa of ptinines can be critically examined and their placement in the phylogeny postulated, as there may be one or more non-myrmecophilous taxa which evolved as separate lineages between those of *Coleoaethes* and *Gnostus* clades.

Lawrence and Reichardt (1969) hypothesized five separate lineages of myrmecophilous ptinines and with *Coleoaethes*, we must recognize a sixth. Unlike the New World lineages, the three Old World lineages are may not all be basal (i.e. members of the paraphyletic group of elongate flightless ptinines). Although none of these genera were included in the analysis, all are flightless and appear similar to more derived forms, such as *Niptus*. Therefore *Diplocotes*, *Ectrephes* or *Enasiba*, for example, may share more recent common ancestors with the flightless taxa located more apically in the tree.

### Flightlessness

*Ptinines have two common states of flightlessness. In the most derived taxa, both sexes are flightless. These species have characteristic morphologies associated with this loss, such as shortened metasterna and rounded humeral angles, as previously discussed. All species in this category are apterous or nearly so. The*
second state is where only females of the species are flightless due to microptery or brachyptery. These females also have the characteristic more rounded body appearance. In both groups, the degree of body shortening and other traits associated with reduction or loss of wings varies greatly among species. There is no evidence for wings, once lost, are ever regained in any ptinine lineage.

The phylogeny indicates that completely flightless species (i.e. both sexes wingless) have evolved at least twice, both in *Niptinus* and in the more derived apical ptinines. Most species of *Ptinus* have flightless females, while in some species both sexes are capable of flight. But in a few species, such as *P. pusillus*, both sexes are brachypterous (Smith 1964). Populations of *P. tectus* are also brachypterous (as my sample) or polymorphic for wing length. Therefore, complete flightlessness in both sexes has evolved at least three times in the ptinines (figure 2.19). This phylogeny also shows the character state of wingless females evolving only once in *Ptinus clavipes*. This is obviously not evidence that it evolved only a single time without more representative species. As *Ptinus* is such a widespread and speciose genus, it is quite possible that the condition of flightless females has evolved several times, depending upon the selective pressures in the particular habitat of each species. But as admittedly weak evidence against this hypothesis, this condition is only known within the genus *Ptinus*. There is no evidence in this analysis suggesting that loss of flight in females is the first stage in the evolution of complete flightlessness in both sexes.

The underlying cause of wing loss is most plausibly due to the effect of random mutations (Thayer 1992). Evidence for Coleoptera suggest that wing length is a simple Mendelian character and brachyptery is the dominant trait (Hammond
1985 and references within). It has also been claimed that in flightless taxa, the frequency of macropterous individuals will usually be driven towards very low levels, but will not entirely disappear (Hammond 1985). The low but continuous production of recessives will continue to occasionally result in the production of fully winged individuals. This is the case in some flightless ptinines as *Ptinus tectus*, as previously mentioned, has been found to be polymorphic for wing length, with some individuals of either sex macropterous or brachypterous (Smith 1964). *Ptinus constricticolis* Blatchley has populations with various degrees of wing development among sampled islands in the Bahamas (Philips, unpublished).

Why has evolution favored the development of flightlessness in the ptinines? Several authors have proposed reasons for the selection of wing reduction or loss in insects. These include small-area stable habitats, isolated habitats, cold areas or areas with seasonable activity, caves, and areas with suboptimal conditions for survival and reproduction. Many species associated with nests of birds and mammals, either as scavengers or parasites, are also wingless (Thayer 1992 and references within). Some of these associations obviously apply to ptinines, such as those utilizing cave and nest habitats. Many of the ptinines found in stored products have been thought to have spread to human habitations and stores from either rodent or bird nests (Hinton 1943; Howe 1959). All of these are flightless except for some species of *Ptinus*. Even in this genus, the species which have retained normal wings in both sexes have not become important storage pests. It is only in the species with one or both sexes flightless, which are scavengers. This is also true for all of the monophyletic flightless ptinines, where feeding habits are known. Although little is known about the feeding habits of *Niptinus*, examined gut contents

68
have revealed several types of spores. No differences in food type between either
the winged or wingless *Niptinus* were noted.

There is no doubt that flight is energetically very expensive both in the
calories consumed during flight and in the cost of producing wing musculature,
wings, and other structures associated with flight (Roff and Fairbairn, 1991).
Selection favoring the elimination of flight is plausible if it is not necessary for
successful reproduction. The lost of flight and the reproductive advantages it incurs
for females has been noted (Roff 1990, Roff and Fairbairn 1991). A form of this
state, where males have functional wings and lose no reproductive advantage,
mating with flightless females who gain egg laying capacity has arisen at least once
in *Ptinus*.

It is possible that other factors associated with loss of flight, besides a
reproductive advantage or a scavenging lifestyle, are the greater selective force in
the development of this trait. Many flightless ptinines inhabit dry desert areas and all
exhibit various degrees of elytral fusion. Fused elytra also occur in several other
groups of beetles found in desert environments, such as Tenebrionidae,
Curculionidae, Carabidae and the Trogidae (Scholtz 1981). Wing loss may occur
indirectly due to the strong selective pressure to reduce water loss via elytral fusion.
Spiracles opening into an enclosed subelytral cavity, instead of directly to the
outside, reduce water loss by transpiration (Cloudsley-Thompson, 1964). In
contrast, Fiori (1977) hypothesized that the main function of the cavity is to protect
the membranous portions of the cuticle from water loss and to allow expansion of
the abdomen both for feeding and ovariole and calyx development. Roff (1990)
notes that fusion equivalent to that found in Coleoptera does not occur in other
insect orders found in deserts. Because of this, he concludes that fusion is probably a secondary and not primary adaptation to prevent water loss. But it may only be that beetles are particularly well suited for this adaptation, unlike other insects without elytra.

Two more factors which may lead to the selection for wing loss and possibly applies to ptinines are habitat stability and seasonality. In a heterogeneous environment or one with temporary habitats, the ability to migrate or disperse may outweigh the selective advantages of flightlessness. Flightlessness favored by persistent habitat does appear to have broad support (Roff, 1990 and references within) but I do not know of any direct evidence for this factor leading to flightlessness in ptinines. Seasonality in dung feeding ptinines is known, but is not necessarily associated with flightless species.

Regardless of the primary selective force for wing loss, there is no doubt that moisture control is very important in these beetles, especially considering their small size of usually less than five mm. The importance of a moisture source has also been found in rearing experiments of ptinines where egg production greatly increases if water is made available (Braune, 1943; Howe, 1959). Ptinines may be able to control moisture loss by selection of microhabitat. For example, specimens of Niptus kelleri Brown were found in a dry cave in Montana at the interface of the moist and dry soil or litter (Philips personal observation).

The importance of the control of water loss is also reflected internally. Spider beetles, as well as other Coleoptera in xeric habitats, have a cryptonephridial system which assists in water retention from the rectum (Chapman, 1982). Two additional factors probably applicable to ptinines have been found in dry habitat tenebrionids.
The latter have relatively low metabolisms and related to their cryptonephridism, they are very efficient at reabsorbing water and solutes from their urine (Zachariassaen 1996).

It seems likely then, that the evolution of flightlessness in ptinines may have occurred for different reasons. The actual factors are not clear, but may be a result of several different selective forces exerting their effect in different environments. In the species where only the females are flightless, the loss or reduction of wings may be due to selection for improved fecundity. In species where both sexes are flightless, flight in dry environments is risky and potentially fatal from water loss and does not outweigh advantages from improved resource detection for both food and reproduction. With ptinines feeding on scattered food sources such as dung, it does seem as though there would be strong selection pressure to maintain flying ability to enable the beetles to locate these potential breeding sites. This may not be the case due to their ability to utilize resources that are not fresh, seasonality, and a relatively long adult lifespan (Howe, 1959).

**Classification of the Ptininae**

The sister-group relationship of the Ptininae and the Anobiidae, *sensu stricto*, supports the hierarchical level of the ptinines as a family, since this does not create a paraphyletic Anobiidae *sensu stricto*. Ivie (1985) has shown that the Bostrichidae without the Anobiidae is paraphyletic. Therefore, since sister groups should be classified at the same hierarchical level, the anobiids, *sensu stricto*, should also be classified as a subfamily, like the Ptininae. The only other more radical alternative, if
the desired classification reflects natural relationships, is to raise the rank of the all
the subfamilies within the Bostrichidae to the familial level.

Ivie suggested that spider beetles should be considered a tribe of the
Anobiinae. His evidence is based on the appearance of ptinines as "highly derived
and divergent anobiines", with most of the morphological changes involving
reduction. These modifications, such as shortened metasternum and wider
separation of the metacoxae, are found in ptinines, but only in the more highly
derived forms. Basally, the ptinine lineage shares many character states in common
with the anobiids, sensu stricto, but these are pleisiomorphic for the Anobiidae,
sensu lato. Therefore there is little evidence that spider beetles evolved from within
the Anobiidae, sensu stricto, and should be considered a tribe. The anobiids are
monophyletic without the inclusion of the Ptininae.

This phylogeny supports the implied hypothesis of White (1971), that the
ptinines are the sister group of the anobiids, sensu stricto. White stated that the
Eucradinae (= his Hedobiinae) most likely had ancestors similar to Ptinus. Crowson
(1967) noted the progression between Hedobia types of anobiids through to more
derived genera such as Trigonogenius and Gibbium. Bellés (1982) also hypothesized
the stepwise evolution of the ptinines through to the Gibbiini. This phylogeny
indicates that several more distinct lineages continued to evolve after the
synapomorphically rich "Gibbium-Niptomezium" lineage split off from its sister group
(figure 2.17). Crowson (1967) also considered it probable that Ptinines share a
common ancestor with Hedobia, and how the ptinine Xylodes, is intermediate in form
between Hedobia and Ptinus. A ptinine from New Zealand with antennal insertions
spaced intermediate in distance between Ptinus and non-ptinine anobiids and with
true coxal plates, may be even better than *Xylodes*, in "linking" these two groups together. These "intermediates" do illustrate the continuum in form from certain non-ptinine anobiids through to species of flightless ptinines. But based on the evidence of my hypothesized phylogeny, there is little support for a sister group relationship between the Eucradine anobiids and the Ptininae.

Crowson (1967, 1961) considered the Ptinidae-Anobiidae and the Bostrichidae-Lyctidae lineages to be sisters. Ivie (1985) does not consider the Anobiinae, *sensu lato*, to be the sister group of the Bostrichidae. His phylogeny supports the euderiine bostrichids as the sister group of the anobiid-ptinine lineage. Although somewhat outside the scope of this study (as only three taxa of Bostrichidae were included in the analysis), *Euderia* was also found to be the sister taxon to the Anobiidae, *sensu lato*, if the root is moved more apically within the outgroup node.

A classification of the Ptininae should reflect natural (i.e. monophyletic) groups. Lawrence and Reichardt (1969) recognized four distinct lineages within the myrmecophilus ptinines which could be given subfamilial or tribal status. These are both the New World *Gnostus* and *Fabrasia*, the South African *Diplocotidus* and the Australian ectrephines. It is apparent that a fifth group can now be added to this set, based on the *Coleoaethes tetralobus* lineage. Bellés (1982 and 1985c) proposed generic groupings which may have some predictive value of a phylogenetic or natural classification. His *Gibbium* generic group, represented by *Gibbium* and *Mezium*, are perhaps the most distinctive ptinines and are defined by numerous synapomorphies. The recognition of the Gibbiini (including *Niptomezium*) would necessitate creating another tribe based on their sister group, containing most of the highly derived
ptinines (figure 2.17). The problem is how to classify the remaining, more basal, ptinines (figure 2.16). One or several tribes composed of all the less derived groups could be created, but recognition of any of these creates a classification based on paraphyly which may not be stable as new taxa and characters are recognized.

Bellés (1982) considered his *Sphaericus* group, consisting of *Sphaericus*, *Pitnus*, and four other taxa excluded from this study (*Neoptinus*, *Nitpus*, *Stereocaulophilus*, and *Wollastonella*), as a tribe (figure 2.20). His suggestion of combining this group with his *Trigonogenius* group (consisting of *Lachnoniptus*, *Trigonogenius*, and the excluded *Chilenogenius* and *Piarius*) as a subfamily (or a tribe of the Ptininae) would create a polyphyletic arrangement (figure 2.20) if my hypothesized phylogeny is followed as a classification blueprint.

The genera *Ptinus* and *Niptinus* are sister genera (figure 2.19) and supported by up to four character states depending upon whether we use the delayed transformation option of Swofford and Maddison (1978) which maximizes parallelisms and minimizes reversals, or the accelerated transformation option of Farris (1970) which maximizes reversals and minimizes parallelisms. The monophyly of *Niptinus* is well supported by six character states. The genus *Ptinus* is also monophyletic and supported by one character state. Successive approximations weighting resulted in *Ptinus* becomes paraphyletic without including *Niptinus*. As this analysis only included two species of this genus, more taxa of *Ptinus* would be needed to thoroughly eliminate the possibility of paraphyly in this genus. As an indication of this possibility, *Ptinus* has been divided into as many as 12 subgenera (Pic 1912) and about 300 species have been recognized, although the number has
been slightly reduced via the creation of new genera (for e.g., Bellés 1985a, 1990, 1991a, and 1991b).

There is no evidence that *Niptus* is a natural taxon. The included taxa represent three distinct lineages within the genus (figure 2.21). The separation of these taxa creates the problem of a polyphyletic genus of which there are several ways to rectify. *Niptus hololeucus* Falderman is the type species for this genus and therefore has priority for the generic name. *Niptus hilleri*, *N. kelleri*, and related species have been placed by some authors in the genus *Pseudeurostus* Heyden. This genus is characterized by a carinate frons between the antennal fossae. This name should be used for this group. *Niptus ventriculus* (LeConte) is the one included New World species which represents a larger group of southwestern North American species recently reviewed by Aalbu and Andrews (1992). If my phylogenetic hypothesis is considered valid, these species and possibly the South American *N. maximus* Pic, *N. schmidti* Faim. and *N. tournoueri* Pic (I have not yet seen types of any of these species) should be placed together in a new genus. Aalbu and Andrews (1992) stated the creation of a new genus as a possible solution but rejected it with the following argument. The presence of a carinate frons in the species (formerly) placed in *Pseudeurostus* separates them from the other *Niptus*. A strongly reduced fourth ventrite is a synapomorphy for the *Pseudeurostus* species and the remaining *Niptus* except for *N. hololeucus*. Therefore the resurrection of *Pseudeurostus* would necessitate the separation of *N. hololeucus*, the type species of the genus, from the remaining species of *Niptus*. This would create the need for a new generic name for the remaining New World species of *Niptus*. Not having any strong phylogenetic evidence, their conservative approach was the best option. But my analysis is
further support for the resurrection of *Pseudeurostus* and the creation of a new genus for New World *Niptus*. One more radical alternative is to combine a large group of genera into a single genus but this would result in several separate and distinctive lineages placed together under a common name.

Bellés (1982) discussed the suprageneric classification of spider beetles and noted that all his suggested groups contain problem species. These intermediate forms make defining groups difficult and very subjective. Until a more complete analysis of ptinines can be completed, proposals for a tribal or other levels of higher classification should be delayed. Regardless, there may not be a very suitable solution to reflect the natural relationships due to the type of evolution exemplified by ptinines. The phylogeny reflects a continuum from the primitive ptinines like *Prosternoptinus* or the *Ptinus + Niptinus* clade through to more derived forms or clades, with each successively as sister to the remaining group. The best solution may be to simply recognize ptinines as a distinct subfamily composed of two informal groups of genera: a basal paraphyletic clade and an apical monophyletic clade (figure 2.16).

**Classification of the Anobiidae Sensu Stricto**

The relationships of the subfamilies of North American Anobiidae have been discussed by White (1971) and the assignment of genera into subfamilies later modified (White 1974b). With only a limited number of anobiid genera representing seven subfamilies included in this analysis (2.22 A and B), only very preliminary comments can be made regarding relationships in this group. The evolutionary
scenario described by White can only be converted into a branch diagram with a
great deal of uncertainty since he implies several ancestor-descendent relationships
among the subfamilies. If his phylogeny is correct, the Eucradinae (= his
Hedobiinae), and the Ptilininae are the only monophyletic subfamilies. The
Anobiinae, Dorcatominae, Ernobiinae (= Dryophilinae), and the Ptilininae are either
para- or polyphyletic.

White (1971) describes the successive changes in body form which lead to
the phylogenetic sequence of the subfamilies. He considered the Eucradinae to be
derived from an ancestor most similar to *Ptinus* either implying that the Ptilininae is
the sister taxon of either the Eucradinae or possibly all Anobiidae, *sensu stricto*. This
sister relationship of the ptinines to the remaining anobiids is supported by my
analysis. My phylogeny also supports an alternative interpretation of White (1971):
the sister group relationship of the Eucradinae with the remaining anobiid subfamilies
(figure 2.22 B).

Any changes in the classification of the Anobiidae will have to wait until an
investigation including more representative taxa can be included.
FIGURE 2.2

Menta of representative Anobiidae: (A) *Eucrada*, (B) *Niptus hilleri*, (C) *Gibbium*, (D) *Niptinus unilineatus*. Scale line = 100 um.
FIGURE 2.2
Labia of representative Anobiidae: (A) *Ptilinus*, (B) *Byrrhodes*, (C) *Niptinus ovipennis*, (D) *Niptus ventriculus*. Scale line = 100 um.
FIGURE 2.3

83
FIGURE 2.4

Maxillae of representative Anobiidae: (A) _Ptinus_, (B) _Lasioderma_, (C) _Niptus hololeucus_ (apical palpomeres missing), (D) _Ptinus clavipes_, (E) _Niptus ventriculus_.

Scale line = 100 um.
FIGURE 2.4
85
FIGURE 2.5

Mandibles of representative Anobiidae: (A) *Ptinus clavipes*, (B) *Oligomerus*.

Scale line = 100 um.
FIGURE 2.6

Pronota of representative Anobiidae: (A) *Niptus hilleri*, (B) *Niptinus unilineatus*, (C) *Oligomerus*. Scale line = 100 μm.
FIGURE 2.6
FIGURE 2.7

Scutella and scuta of representative Anobiidae: A-B *Niptus ventriculus*; (A) dorsal view, (B) oblique lateral view. C-D *Arachnomimus*; (C) dorsal view, (D) oblique lateral view. Scale line = 100 um.
FIGURE 2.7
FIGURE 2.8

Scutella and scuta of representative Anobiidae:  A-B *Tricorynus*;  (A) dorsal view,  (B) oblique lateral view.  C-D *Ptinus clavipes*;  (C) dorsal view,  (D) oblique lateral view.  Scale line = 100um.
Mesosterna of representative Anobiidae: (A) *Niptus hilleri*, (B) *Ptinus clavipes*, (C) *Lasioderma*. Scale line = 100um.
FIGURE 2.9
FIGURE 2.10

Ventrites of representative Anobiidae: (A) *Ptilinus*, (B) *Tricorynus*, (C) *Ptinus clavipes*, (D) *Arachnomimus*, (E) *Lachnoniptus*, (F) *Ptinus*. Scale line = 100 um, except 1 mm for (B) *Tricorynus*. 
FIGURE 2.10
FIGURE 2.11

Metacoxal plates of representative Anobiidae: (A) Lasioderma, (B) Eucrada, (C) Ptinus clavipes. Scale line = 100 um.
FIGURE 2.11

99
FIGURE 2.12

Wings of representative Ptininae: (A) Prosternoptinus, (B) Niptinus, (C) Ptinus clavipes. Scale line = 1.0 mm.
FIGURE 2.12

A

B

C
FIGURE 2.13

Wings of representative Anobiidae, *sensu stricto*: (A) *Hedobia*, (B) *Eucrada*, (C) *Oligomerus*. Scale lines = 1.0 mm.
FIGURE 2.14

Wings of representative outgroups: (A) Lyctus, (B) Euderia, (C) Endecatomis.

Scale line = 1.0 mm.
FIGURE 2.14

105
FIGURE 2.15

Euderia

Lycus

Prostephanus

Endecatomis

Anobiidae, s.s.

Ptininae
FIGURE 2.16

Part of the cladogram showing the more derived, flightless, monophyletic taxa of included Ptininae. The hollow branch lines indicate the monophyletic *Gibbium-* *Niptomezium* clade which is sister to the remaining derived Ptininae (beetle illustrations from Bellés 1985b, Bellés 1985c, Bellés 1992, Hinton 1941, and Papp 1962).
Cladogram of the base of the tree. The hollow branch lines indicate the lineages where myrmecophilous habits occur (beetle illustrations from Bellés 1985a, Hinton 1941, Lawrence and Reichardt 1966, and White 1983).
Coleoaethes

Gnostus

Prosternoptinus

Ptinus clavipes

Ptinus tectus

Niptinus unilineatus

Niptinus ovipennis

Fabrasia
Cladogram of the base of the tree. The hollow branch lines indicate the lineages where flightlessness occurs (beetle illustrations from Bellés 1985a, Hinton 1941, Lawrence and Reichardt 1966, and White 1983).
FIGURE 2.20

Apex of the tree where the Sphaericus-group and the Trigonogenius-group of Ptininae occur as indicated by the hollow branch lines (beetle illustrations from Hinton 1941 and Papp 1962).
Apex of the tree where the three lineages of *Niptus* occur as indicated by the hollow branch lines (beetle illustrations from Hinton 1941 and Papp 1962).
Cladogram of the non-ptinine anobiids: (A) Tree of the representative species of Anobiidae, (B) Same tree with the taxa converted into their representative subfamilies. *Eucrada* and *Hedobia* are placed in the Eucradinae (illustrations from White 1962 and 1983).
Cubaptinus Zayas, a new synonym of Fabrasia Martinez and Viana
(Coleoptera: Anobiidae: Ptininae)

Zayas (1988) in his work on the beetles of Cuba described Cubaptinus cubanus as a new genus and species based on two specimens. No precise locality was reported. From the description and a good illustration of the dorsal habitus, there is no doubt it is a member of the genus Fabrasia Martinez and Viana. Both genera share synapomorphies of a truncate apical antennomere, a characteristically enlarged metafemora and metatibia, a constriction at the middle of the elytra, separated elytral apices, and the anterior angles of the pronotum terminating in two sharp flanges or spines. The Cuban species has a slightly more elongate body than the other Fabrasia species, but this is characteristically a variable feature within several ptinine genera. As both names refer to the same genus, I synonymize them here (new synonymy).

Fabrasia was previously known from only three rarely collected species in the Neotropics and was revised by Lawrence and Reichardt (1966). Fabrasia wheeleri Lawrence and Reichardt, described from Colombia, has also been recorded from as far north as Oaxaca, Mexico (Lawrence and Reichardt 1969). Fabrasia borgmeieri Lawrence and Reichardt is known from Goiás, Brazil and F. alvarengai Martinez and
Viana was described from Rio Grande do Norte, Brazil. In view of this broad distribution, the presence of a fourth species in the West Indies is not surprising.

Two of the three mainland species have been found associated with ants in the genus *Camponotus* Mayr. Interestingly, *Fabrasia cubana* (new combination) was discovered in wood being attacked by termites (*Heterotermes* Froggatt sp.). I do not know if *F. cubana* has the large, shallow, glandular elytral pores present on other members of the genus. Termitophilous beetles tend to show less extreme structural modifications than comparable myrmecophilous species (Crowson 1981) and the lack of these pores may be an indication that this species truly is a termitophile.

Most of the Zayas types, including this one, are presently unavailable for study to any workers, including Cuban entomologists (for more details, see Ivie 1991). The publication of this work 23 years after the manuscript was finished has resulted in many synonymies. Because of this, all workers should be aware of this publication when working with Neotropical beetle faunas.
CHAPTER 4

A NEW GENUS AND SPECIES OF SPIDER BEETLE FROM THE VIRGIN ISLANDS:
Lachnoniptus iindae (COLEOPTERA: ANOBIIDAE: PTININAE)

INTRODUCTION

The ptinine fauna of the Virgin Islands presently includes one recorded species, Pitnus antillanus Bellés (Bellés 1992). In the more inclusive West Indies, another species of Pitnus Gorham, four species of Ptinus Linneaus, three Gibbium, and one Fabrasia Martinez and Viana (= Cubaptinus Zayas, Philips 1997) have been recorded (Bellés 1992, Bellés and Halstead 1985, Pic 1906, Boieldieu 1856, Gorham 1898, Lopesme 1947, Wolcott 1948 and Zayas 1988). Recent investigations on the beetle fauna of the Virgin Islands have resulted in the discovery of two undescribed species of ptinine. When analyzed in a phylogenetic analysis of spider beetles (Philips unpublished), the unique morphology and phylogenetic position of this species requires the creation of a new genus. I take this opportunity to make a name available for use elsewhere.
Lachnoniptus New Genus

Type Species. *Lachnoniptus lindae* new species.

**Diagnosis.** This genus is easily recognized by the transverse pronotum and the very convex globose shape of the elytra. The dense pubescence dorsally results in a very woolly, fluffy appearance. Also, the apical antennomere is slightly but distinctly wider than the penultimate one. *Trigonogenius* is the only genus which approaches this elytral and pronotal shape, but *Trigonogenius* has dense, appressed setae on the elytra, unlike the fluffy elytral setae of *Lachnoniptus*. Further, *Trigonogenius* does not have the laterally enlarged and distally rounded apical antennomere of *Lachnoniptus*. In contrast, *Trigonogenius* is characterized by the apical and penultimate antennomeres subequal in diameter and the apex acuminate. Other differences include the following: *Lachnoniptus* with a mesosternal process 2/3 the width of the mesocoxa (1/3 the width for *Trigonogenius*); the absence of the mesosternal-mesepisternal suture (present in *Trigonogenius*); metepisternum not visible through fusion (visible in *Trigonogenius*); metacoxae approximately round (rectangular in *Trigonogenius*); the metacoxae laterally contacting the first ventrite (laterally adjacent to the metepisternum in *Trigonogenius*); the fourth ventrite compared to third about equal in length (a ratio of about 1.15:1) (greatly reduced in *Trigonogenius* (a ratio of about 3:1)); and the anterior margin of the first ventrite narrowly pointed laterally (sharply pointed in *Trigonogenius*). There are two more subtle characters which differentiate these two genera. The scutellum is narrowly rounded in *Lachnoniptus* but is broadly rounded in *Trigonogenius*. In some
specimens of *Lachnoniptus* there is a faint row of transverse setal tufts on the pronotum. Pronotal tufts are completely absent in *Trigonogenius*. While Lachnoniptus is known from the West Indies, Trigonogenius is found in the western part of North and South America.

**Description.** Body robust and globular, densely covered with erect fluffy setae which obscures cuticle surface.

Head. Very robust, not visible from above, partially hidden within the pronotum up to the posterior dorsal margin of the eye, eye nearly semicircular, slightly rounded on dorsal side; longitudinal groove on the frons between antennal insertions, clypeus an equilateral triangle shape, labrum narrow, no wider than proximal edges of antennal insertions, anterior margin approximately truncate, anterio-lateral edges broadly rounded; antennae 11 segmented, second segment attached on side of scape near apex, apical antennomere distinctly widest at anterior 1/3, tapering to rounded tip; mentum slightly longer than wide, triangular, not truncate but narrowly rounded at anterior margin, with a small round depression medially at basal 1/3, a patch of 4-8 moderately long setae anterio-medially; hypopharyngeal setal rows closely spaced and nearly overlapping; maxillary and labial palps with apical segment tapered to a point; galea and lacinia with stout spines, spines obscured with fine setae.

Thorax. Pronotum globose and convex, transverse, appearing about 1.35 times wider than long, widest at middle; scutellum small, hidden, slightly tranversely ovoid, distinctly below level of elytra; procoxae cylindrical, projecting, prosternal process with apex expanded and rounded, extending ventrally about as far as coxae,
at narrowest width about 1/3 the width of coxa; mesosternum smoothly concave, slightly narrower posteriorly, process about 2/5 width of mesocoxa; mesepimeron visible but narrow, mesosternal-mesepisternal suture absent; metasternum about half the length of the mesosternum, sharply, obtusely emarginate at posterior margin; metacoxae transversely triangular, laterally in contact with first ventrite.

Elytra. Globose and convex, fused, nearly as wide as long, length about 1.10 times width; large strial punctures easily discernable and in longitudinal rows, puncture edges broadly rounded, intervals convex, surface usually hidden beneath dense pubescence.

Ventrites. All sternal sutures clearly defined, second ventrite widest at middle and at lateral edge, third ventrite distinctly narrowest at middle, third ventrite only slightly longer than fourth, about 1.1-1.2 times length of fourth.

Legs. Femora slowly increasing in size towards apex, pro and mesotibiae about 2/3 as long as metatibiae, all tarsomeres about equal in length, except first metatarsomere about 1/3 longer than second.

Etymology. Derived from the Boieldieu genus Niptus combined with the greek lachno. The name translates as "woolly-haired" Niptus.

Lachnoniptus lindae New Species

Figures 4.1 and 4.2

Diagnosis. This species is easily recognized by the variegated pattern of brown and tan pubescence on the elytra. It can also be recognized by the laterally
(but not posteriorly) carinate antennal fossae that are separated by a ridge as broad as the second antennomere. Pronotal tufts are usually absent or, at most, very loose and indistinct.

**Description.** Length: 2.25-3.04 mm (n = 23). Body very robust and globular, covered with dense fine short brown and tan pubescence, on pronotum and elytra relatively longer and more erect than the rest of the body, also much longer scattered erect or suberect setae arising above short setae which usually have the tips curved towards the posterior.

Head. Covered with appressed very dense tan colored setae, slightly darker towards vertex and on the fronto-clypeal area, longer slender suberect brown setae scattered on front of head; antennal fossae separated by a ridge as broad as second antennomere, laterally with carinate borders which become obsolete posterior to antennal insertions; relatively deep narrow longitudinal groove between fossae, deepest at a point about equal to posterior margin of fossae; eyes moderate in size, about as long as second antennomere, usually eight ommatidia at minimum width, nine-ten ommatidia at maximum.

Thorax. Pronotum covered with dense brown pubescence except pale orange or tan colored in a longitudinal median band at middle on anterior 3/5, expanding on posterior 2/5 to form a triangular patch adjacent to base about 3 times as wide as scutellum; this same color of setae laterally at posterior edge expanding slightly from a point near coxae up to dorsal-lateral border and forming an elongate triangle on each side, another less distinct lateral band near anterior margin; shallowly, moderately rugose-reticulate surface visible beneath setae; erect elongate curved
setae occasionally forming very loose, indistinct tufts on dorsal surface, two inner tufts at posterior 1/3 on either side of midline, two outer tufts at middle but laterad of inner tufts; scutellum covered with pale tan pubescence.

Elytra. Dense tan and brown pubescence in a mottled or variegated pattern, slightly darker brown color surrounding scutellum and along first elytral interval at basal 1/5; moderately large well separated somewhat square-shaped strial punctures slightly visible beneath pubescence, edges smoothly rounded, at middle punctures separated longitudinally by about 3 time their length, puncture rows separated by about 4 times puncture width; long erect setae rising above dense pubescence, about 1.5 times as long as one elytral interval at middle, decreasing in length laterally and posteriorly; dense pubescence slightly more orange colored adjacent to apical margin.

Ventral surface. With dense yellowish-tan pubescence, slightly darker patches near margins of second through fourth ventrites, also present are evenly scattered suberect dark brown setae; posterior margin of mesepisternum with distinctly orange colored pubescence; first and second sutures between ventrites becoming more obscure laterally; ventrite ratios (first - fifth): 20: 21: 15: 13: 30.

Legs. Covered with dense recumbent tan pubescence and longer darker scattered appressed setae; trochanters and apices of femora and tibia orange-tan in color, longer courser setae at tibial apex and ventral margin distinctly orange in color; margins at apical 2/5 of pro and mesotibiae and apical 1/3 of metatibiae covered with longer, coarser more erect setae.

Sexual dimorphism. None.
Type material. Holotype: VIRGIN ISLANDS: Guana Island, Quail Dove Ghut, 600 ft.,
12 July - 09 Oct. 1994, flight intercept #13, M. A. & L. L. Ivie colr [600, 18° 28.49' N, 64° 34.21'W] (NMNH); Paratypes, same data as holotype (10), same data
[400', 18° 28.64' N, 64° 34.20'W] (5), St John, Estate Carolina, NW Coral Bay, 250
ft., 09 May 1994, litter among rocks, Muchmore (1), St John, Lameshur Bay,
V.I.E.R.S., 10 Mar. 1984, leaf litter, W. B. Muchmore (1), St John, Maho Bay, 12
Mar. 1984, in hollow tree, W. B. Muchmore colr (1), Guana Island, July - October
1993, "beetle-trap", collected by C. Bartlett & J. Cryan (1), Tortola, Windy Hill, 25 -
28. XII. 1993, 350', thorn-scrub for., T. K. Philips, colr., dung pitfall (1) (Paratypes in
the collections of the author, the Virgin Islands Beetle Project Collection [Montana
State University, Bozeman, Montana], Xavier Bellés, Muséum National d'Histoire

Distribution. This species is known from three of the northern Virgin Islands (Guana
Island, St John, and Tortola). It seems likely that it will be found on other Virgin
Islands and Puerto Rico, of the Puerto Rican Bank which were connected as a single
land mass during periods of low eustatic water levels during the Pleistocene
(Heatwole and MacKenzie 1966).

Etyomology. Named after my wife Linda, whose support and encouragement has
been so important to my career.
**DISCUSSION**

*Lachnoniptus lindae* is one of the more highly derived ptinines as characterized by fused elytra, winglessness, and a very globular body form. The majority of species in this group utilize dung or other accumulated organic material of animal or plant origin as a food source. As it has been collected with a dung trap, this species may be using dung from various animals as an adult and larval food.

All sites where this species was collected are tropical dry forest, characterized by rocky, thin red soils. Evapotranspiration is considerably higher than rainfall for much of the year, especially during droughts, such as that which occurred in 1993-4. The absence of scarabaeine competition in these areas may be critical for successful reproduction of this ptinine, if it really is a dung feeder. But more observations are needed to determine the biology of this beetle.
External morphology of *Lachnoniptus lindae*: (A) dorsal habitus, (B) lateral view, (C) ventrites (most of the setae abraded), (D) elytral setae. Scale line = 1.0 mm for A and B. Scale line = 100um for C and D.
FIGURE 4.2

Head of Lachnoniptus lindae: (a) frontal view of head, (b) lateral view of eye.

Scale line = 100 um.
FIGURE 4.2

135
CHAPTER 5

A NEW GENUS AND SPECIES OF PUTATIVELY MYRMECOPHILOUS PTININE:

*Coleoaethes tetralobus* (COLEOPTERA: ANOBIIDAE: PTININAE)

Myrmecophilous ptinines are some of the most unusual and bizarre looking beetles. The 43 described species exhibit highly modified morphologies including body protuberances and invaginations, trichomes, modified legs and antennae, and mouthpart reductions. Of the eight genera of ant associated ptinines, six are limited to the Old World: the relatively speciose *Diplocotes* Westwood, *Polyplocotes* Westwood, *Ectrephes* Pascoe, and *Enasiba* Olliff in Australia and the monotypic *Mymecoptinus* Wasmann from Southeast Asia and *Diplocotidus* Peringuey from South Africa (Lawrence and Reichardt 1969). The New World genera, *Gnostus* Westwood and *Fabrasia* Martinez and Viana, have three and four species respectively (Lawrence and Reichardt 1966, Philips 1997).

Both New World genera are very distinct morphologically. *Fabrasia* is characterized by a transverse row of large pores at the middle of each elytron and trichomes at the apices of enlarged hind femora. *Gnostus* has trichomes situated near the pronotal base close to the lateral edge on posterior and anterior facing
processes and three segmented antennae. Phylogenetic analysis has revealed an apparent third New World lineage no less unique, which I take this opportunity to name.

_Coleoaethes_ New Genus

**Type species.** _Coleoaethes tetralobus_ New Species

**Diagnosis.** Superficially similar in dorsal habitus to _Ptinus_, this genus is recognizable by the presence of two expanded lobes near the apex of each elytron, with a deep transverse cleft between the anterior and posterior lobes. Additionally, the antennae are relatively moniliform, especially the sixth through tenth antennomeres and the fronto-clypeal region is protuberant.

**Description.** Form elongate, very convex; in transverse cross section at middle, slightly ovoid and slightly wider than long; integument shiny, with scattered erect, suberect, and recumbent setae not obscuring surface.

Head. Strongly declined, easily visible from above including the short neck behind eyes; vertex slightly convex; clypeus and frons fused and strongly expanded anteriorly in front of eyes, roughly triangular in shape in frontal view, slightly emarginate at labral union; labrum small, about 1/4 the minimum width between eyes in frontal view, anterior edge broadly rounded; laterally a distinct broad groove between eye and ventral edge of antennal insertion to near dorsal mandibular insertion, genae expanded laterally and maximally at posterior margin of eye, palps reduced in length, tips of apical palpomeres truncate to slightly emarginate;
mandibles strongly curved, strongly concave on posterior or proximal surface; mentum plate-like, apex truncate, separate from the remaining labium and projecting ventrally and slightly anteriorly; antennae with 11 antennomeres, distinctly moniliform.

**Pronotum.** Slightly transverse, constricted at anterior 1/4, sides rounded, setal tufts weak or absent; scutellum large, triangular and broad, rounded at apex.

**Elytra.** About 3.4 times as long as pronotum, each elytron slightly narrower than width of pronotum; elytra very slightly increasing in width to apical 2/5, then tapering to apex, apices slightly, irregularly truncate, humeral angles pronounced, elytral base sinuate; an oblique carina from lateral edge of humeral angle to suture forming a distinct lobe near elytral apex, directly posterior to this and closer to elytral apex another larger lobe, both lobes with small patches of brush-like setae near or at their apices; hind wings fully developed.

**Ventral surface.** Prosternum very short in front of procoxae, prosternal process very short, barely extending between coxae and not extending ventrally; procoxae conical, strongly projecting, contiguous; prosternal-pronotal suture indistinct; mesosternum subequal in length to prosternum, mesosternal process narrow, approximately 1/8 width of mesocoxa, extending posteriorly approximately ½ the length of mesocoxa, mesocoxae about the same size as the procoxae but not as strongly projecting; mesosternal - mesepisternal suture distinct; metasternum nearly 2 times as long as mesosternum, and 2 times as wide as long, sharply declivous at posterior margin between metacoxae; median dark line present but without an associated and distinct sulcus; metacoxae separated at middle by a distance equal to about 2/3 length of first ventrite, transverse, broadly triangular.
lateral edge contacting elytron, slightly concave distad of trochanter insertion; abdomen length about 1.15 times width, most strongly convex anteriorly, fourth and fifth ventrites flat at middle, second ventrite longer than first and third, first and third nearly equal, fourth greatly reduced, about ½ length of third.

Legs. Long, not clavate, widest point at or before middle, first tarsomere about 2 times as long as second; large spine on apex of mesotibia apex; pro and mesotarsomeres 1 through 4 and metatarsomeres 2 through 4 with dense short setae ventrally forming a pad.

Etymology. Derived from the greek words "coleo" (sheath) and "aethes" (unusual or strange) in reference to the unique modification of the elytra.

*Coleoaethes tetralobus* New Species

Figure 5

Diagnosis. This species is recognizable by the modified elytral apices with four expanded lobes near the suture. The anterior lobe on each elytron is bifurcate and consists of a small dorsal lobe with a patch of elongate setae and a larger, more sharp edged ventral lobe with a trichome consisting of a small fringe of brush-like setae. Directly opposite the anterior lobe and separated from it by a deep cleft is the posterior lobe. This lobe also has a small brush-like fringe of setae directly opposite the trichome on the anterior lobe. Also characteristic are the strongly moniliform antennae, especially on antennomeres six through ten, and the strongly inflated fronto-clypeal region.
Description. Male. Length 2.37-2.57 mm (n=2); integument light chestnut or reddish brown, shiny, covered with short, yellow mainly erect and recumbent setae which does not obscure surface of integument.

Head. Covered with scattered erect and suberect setae of various lengths, the longest equal to the width of one eye; fine granulate texture on head, more coarse on vertex, less so on labrum; genae and vertex with small, scattered setose granulations; eye margins slightly concave dorsally and ventrally, maximally 13 ommatidia dorso-ventrally and nine anterio-posteriorly; very slightly carinate above antennal insertions, carinae quickly becoming obsolete dorso-laterally; slight longitudinal depression at middle between the tumid region posterior of antennal insertions, swelling not continuing posterior of the hind margin of the eye; antennae moniliform, especially antennomeres 6 through 10, apical antennomere about 1.5 times as long as 10th, scape elongate oval; interantennal space broadly rounded, fossa posteriorly at most only very slightly carinate proximally.

Pronotum. Covered with scattered setae of moderate length, none of which are completely erect, each originating from a small tubercle, setae forming a pattern similar to concentric rings dorso-laterally which form, at most, very weak setal tufts at the lateral declivity; surface between tubercles very finely granulate; strong anterior collar laterally.

Elytra. Surface shiny, slightly irregular with broad very shallow depressions or punctures which are indicated by translucent areas irregularly shaped but usually rounded, variable in size, spacing irregular but somewhat aligned in longitudinal rows, more numerous and irregular laterally; translucent areas absent from near lateral edge which appears as a longitudinal opaque band about as wide or slightly less wide as
antennomere width, and absent from apical lobes; humeral angles well pronounced, extending anteriorly beyond posterior margin of pronotum; a large carina extending from lateral edge of humeral angle obliquely inward to about apical 1/5 of elytra, the carina becoming more pronounced posteriorly due to more rapid declivity of the surface to elytral apex, at apical 1/5 the carina curving more sharply in towards suture and forming a narrow, smoothly rounded acute lobe dorsally, appearing roughly triangular in dorsal view, directly below this a slightly larger, more truncate lobe with a sharper carinate edge extending slightly more posteriorly than the dorsal lobe; opposite this bifurcate anterior lobe is a broader larger posterior lobe originating from near elytral apex and rising almost vertically and slightly anteriorly to a point below the anterior dorsal lobe, distal edge of posterior lobe sharp and carinate, in posterior view lobe appearing trapezoidal in shape with the dorsal side rounded, more gradually so towards suture, distinctly concave near elytral apex, anterior facing surface concave, partially encompassing ventral anterior lobe; small setal tufts composed of long setae on dorsal anterior lobe, one at dorsal lobe apex and the other more anterior on margin of carina adjacent to first with setae initially rising vertically but then extending laterally and curving down ventrally; a narrow patch of short brush-like setae on anterior ventral lobe situated medially, in dorsal view, between the two long setal tufts on dorsal lobe; posterior lobe with an elongate patch of brush-like setae arising on inner edge of dorsal carina at lobe apex, about opposite these similar setae on anterior lobe, setae continuing laterad and then ventrally and dorsally along anterior edge of lobe; setal fringes of long setae, about equal in size to those on anterior lobe, located on elytral margin near suture; cleft between anterior and posterior lobes deep, narrow near suture, more open laterally; elytral setae of
two types; long erect setae roughly arranged in longitudinal rows between translucent spots on the elytra, each seta about as long as one of the antennomeres 2-10, becoming shorter close to lateral margin; also sparsely covered with recumbent or depressed setae averaging 1/3 - ½ the length of the erect setae and more randomly scattered.

Ventral surface. With scattered, fine, recumbent and appressed setae; metasternal surface slightly more granulate laterally, sternal and ventrite surface with fine scattered punctures; no obvious depressions or protuberances on any ventrites; ventrite ratio (first - fifth): 23: 25: 20: 9: 41.

Legs. With scattered erect and suberect setae of various lengths, also scattered recumbent setae; large gently curved spine on apex of mesotibia apex about the same length as first tarsomere.

Male genitalia. Parameres and median lobe very elongate and narrow, median lobe slightly expanded near apex, parameres gradually tapering to apices, each apex with a small tuft of long setae (genitalia not dissected but partially visible).

Sexual Dimorphism. Females are unknown.

Type material. Holotype ♂, PANAMA: Panama Province, Altos de Majé, X - 6/15 -1975, D. S. Chandler, beating; paratype ♂, with the same data except beating in forest. Holotype and paratype in the Ohio State University Collection.

Distribution. Known only from the type locality in Panama.
Etymology. The specific name is derived from the greek words “tetra” and “lobus,” in reference to the four elytral lobes (with trichomes) near the elytral apices.

DISCUSSION

Trichomes (i.e., distinct setiferous processes) are known in many groups of Coleoptera, but their location on elytra are reported only in some clavigerid pselaphids and the scarabaeid genus Chaetopisthes (Wilson 1971). This is the first example, in the relatively speciose myrmecophilous ptinines, of trichomes on the elytra. Other ptinines have trichomes positioned on either the pronotum or femora.

In *C. tetralobus*, the lobes bearing the trichomes are in adjacent pairs on each elytron, with the anterior and posterior lobes narrowly separated and with their apices converging. Lawrence and Reichardt (1969) surmise that this lobe position and shape may be a way to collect a drop of glandular liquid. Another feature which may improve the fluid holding capacity in *C. tetralobus* is the concave inner surface of the posterior lobe. Other glandular structures, such as elytral pores and antennal pilosity found in other myrmecines, are not present in *C. tetralobus*.

One unusual feature in *Coleoaethes* is the plate-like mentum which is attached to the labium basally and projects anteriorly and downwards. It may function to assist in protecting mouthparts or even for interspecific trophallaxis. A similar ventral projection can be seen in the ptinine *Enasiba tristis* Olliff, but the mentum in this species is not plate-like and is more robust. *Coleoaethes tetralobus* and some other myrmecophilous ptinines have an anteriorly expanded fronto-clypeus. The
function of this protruberance is unknown but this structure may protect mouthparts or assist in trophallaxis.

*Coleoaethes tetralobus* is one of the more basal taxa of ptinines. This genus shares a number of ancestral character states not found in most other ptinines (Philips, unpublished). As in the non-ptinine bostrichoids, the femora of *C. tetralobus* are relatively parallel-sided, instead of clavate. Similar to non-ptinine Anobiidae (i.e., *Anobiidae, sensu stricto*), *C. tetralobus* has contiguous and strongly projecting procoxae, a reduced prosternal process with an unexpanded apex, an anteriorly truncate and non-grooved mentum, a fronto-clypeal suture, and lacks a distinct pronotal constriction.

Nothing is known of the biology or ant associates of *Coleoaethes tetralobus*. Since other fully winged myrmecophilous ptinines are associated with arboreal ants in forests (such as *Gnostus* with *Crematogaster* and *Fabrasia* with *Camponotus*), *C. tetralobus* may also have a similar association.
External morphology of *Coleoaethes tetralobus*: (A) dorsal habitus, (B) oblique view of elytral apices showing the location of the four apical lobes with trichomes, (C) lateral view, (D) front of head showing the expanded fronto-clypeal region and the strongly projecting front coxae.
CHAPTER 6

REVISION OF THE NEW WORLD GENUS Niptinus Fall
(COLEOPTERA: ANOBIIDAE: PTININAE)

INTRODUCTION

The genus Niptinus was first created by Fall (1905) to differentiate two species known from Texas and Mexico. He described N. ovipennis and transferred Ptinus unilineatus Pic to this new genus. He also noted that Gorham (1883, 1886) described two species of Trigonogenius and suggested both should probably be placed within Niptinus.

Gorham (1883) based one of his Trigonogenius species, T. niveus, on material from Guatemala. He excluded from the type series specimens from Panamá. Pic (1900), in his study of the Ptinidae of Central America, created the varietal name trinotatus for these Panamánian specimens Gorham had excluded. Pic also mentioned the presence of a species in Chile under the name of Trigonogenius aeneus Germar which approaches Niptinus arcuatus (Gorham).

This study describes one new species and raises the Pic varietal name to specific status. I also place the two Gorham species from Trigonogenius into Niptinus resulting in six species currently within this group. The genus and all
previously described species have been redescribed and a key to species is provided. Relationships of *Niptinus* to other ptinine genera is briefly discussed.

**MATERIALS AND METHODS**

Approximately 220 adult specimens were examined during this work. The following collections and their acronyms supplied specimens used in this study: Monte L. Bean Life Science Museum, Brigham Young University, Provo, UT (BYUC); California Academy of Sciences, San Francisco, CA (CASC); Entomology Division, Canada Museum of Nature, Ottawa, ON (CMNC); Canadian National Collection of Insects, Ottawa, ON (CNCI); Essig Museum of Entomology, University of California, Berkeley, CA (EMEC); Florida State Collection of Arthropods, Gainesville, FL (FSCA); Ohio State University, Columbus, OH (OSUC); Servicio Entomológico Autónomo, Museo Entomológico, Leon, Nicaragua (SEAN); Texas A & M University, College Station, TX (TAMU); Collection of the author, Columbus, OH (TKPC); University of Georgia, Athens, GA (UGCA); United States National Museum, Washington D.C. (USNM); Utah State University, Logan, UT (USUC).

Body lengths were determined by measuring the distance from the apex of the elytra to the anterior edge of the pronotum since the head is usually hidden from above when in a normal or relaxed position. All genitalia were cleared in lactic acid on a 30 degree Celcius slide warming tray. The position of the aedeagus between the parameres is sometimes in an extended position, but all drawings have been done with the aedeagus in a retracted position. Setae are easily abraded which can make determinations difficult in this genus and other ptinines, due to high reliance on setal
patterns. In all specimens, enough setae were present which, together with other characters, allowed me to place each specimen within a species. Drawings were made using a camera lucida. Under the material examined, label data is excluded if it is identical to the preceding specimen(s) and only the difference on the label is recorded. More precise locality data not included on the label is indicated by square brackets.

*Niptinus* Fall


*Trigonogenius* (in part) Gorham, 1883: 196; Pic, 1900: 258; Pic 1912: 9; Blackwelder, 1945: 401; Papp 1962: 376.

Type species. *Niptinus ovipennis* Fall.

**Diagnosis.** The small size (1.5 - 2.8 mm), rounded eyes, deep irregular punctures in anterior 1/5 to 1/3 of pronotum, and presence of a jugal lobe in the wing will differentiate this genus from all ptinine genera in the New World except one. *Prosternoptinus* is very similar, but *Niptinus* does not have an anteriorly and ventrally expanded prosternum partially concealing the head.
Description. Length 1.5-2.8 mm, color generally brown to black with varying degrees of reddish brown or reddish black on all the appendages, including mouthparts.

Head. Not visible from above when in the normal deflexed position; surface moderately covered with short recumbent, often scale-like, usually bifurcate whitish setae and longer more scattered erect or suberect dark colored setae; eyes round or slightly ovoid, projecting laterally and sometimes with distinct groove or slight constriction at base without any ommatidia; maxillary and labial palpi with apical segment tapered to a point; antennae filiform, with 11 antennomeres.

Thorax. Pronotum with projecting granulations, each with single seta, anterior 1/5 to 1/3 with deep irregular punctures; scutellum large and obvious; prosternum normal, not enlarged or expanded anteriorly; prosternal process very narrow, slightly expanded distally, and extending past posterior margin of procoxae; mesosternal process extending posteriorly 2/3 length of mesocoxae, > 2x width of prosternal process at narrowest point; metasternum with median suture visible as a slight depression only just anterior to sternite, visible at most for 1/3 total metasternal length; legs not strongly clavate, widest at about middle.

Elytra. With longitudinally aligned rows of punctures; setation composed of two types, one type consisting of a row of erect or suberect setae between punctures, the second type consisting of a row of generally recumbent setae along each puncture row; humeral angles either broadly rounded without humeral prominences or narrowly rounded with obvious humeral prominences.

Abdomen. First two sternal sutures obsolete at middle for over 1/2 their total length, but a line is usually still visible between sternites, fourth sternite not
significantly reduced, about 2/3 the length of third sternite; surface with dense
carapace consisting of numerous fine punctures and granulate surface, apical and
lateral margins of sternites densely, finely granulate; aedeagus trilobed, paramere
arms symmetric, spiculum gastrale with two main branches, without additional short
internal arms.

**Distribution.** Neotropics from Mexico through to Panamá.

**Discussion.** An additional species that should be examined for potential
inclusion in *Niptinus* is *Chilenogenius aeneus* (Pic). Pic described it in *Trigonogenius*
in 1900 and later (1950) created for it the monotypic genus *Chilenogenius*. In the
original description, Pic stated that *C. aeneus* was similar to *T. arcuatus* Gorham,
which I have moved to *Niptinus*. Because Pic was conservative in his generic
concepts in the Ptininae, I doubt that *C. aeneus* belongs in *Niptinus*. As Pic's
description lacks critical details and I have been unable to examine the type, I am
unable to resolve the problem at this time.

**Relationships.**

Relationships of this genus are poorly known, but the following discussion
offers some information which may be of use indicating possible relationships. In the
New World, *Niptinus* is similar to *Niptus* in having a relatively short metasternum (Fall
1905), although it does not approach the degree of reduction in the latter. Two
species of *Niptinus*, *N. ovipennis* and *N. arcuatus*, share with *Niptus* very similar
globose bodies with little or no external sexual dimorphism.
Niptinus and Ptinus are very similar and may be sister genera. Females of Ptinus in several sexually dimorphic subgenera (with elongate males and rotund females), such as Pseudoptinus and Ptinus, sensu stricto, have similar metasternal lengths. Both Niptinus and Ptinus share a very similar pattern of erect and recumbent longitudinal rows of vestiture along and between the rows of punctures on the elytra, a well developed scutellum and similar shaped legs and antennae.

Both genera also share a derived character state of a horizontal scutellum, which is in the same plane of the scutum, and has a narrowly rounded to pointed apex (Philips unpublished). Although Fall (1905) noted that the medially obsolete first and second visible sternal sutures are characteristics unknown in Ptinus, this is not the case. A similar degree of fusion can be seen in at least one member of the "semiobscurus" group of Ptinus (Bellés, 1986) and Ptinus strangulatus Fall.

The Neotropical genus Prosternoptinus Bellés is also similar to Niptinus. In the New World ptinines, two characteristics are unique to these taxa. These are the modification of the anterior 1/5 to 1/3 of the pronotum with deep, irregular punctation and the presence of a jugal lobe, formed by a moderately deep but rounded notch in the anal region of the wing. Although the dense sculpture on the ventral surface of Niptinus is unique to this genus within the ptinids of America north of Mexico, as Fall postulated, similar sculpturing is present in Prosternoptinus.

Niptinus may have a close relationship with several genera in southeast Asia and Australia such as Hanumanus Bellés. Both genera share a similar size and overall morphology but relationships between the two and among several other Old World genera remain obscure without any detailed phylogenetic analysis (Bellés 1991).
Biology

Little is known about the biology of *Niptinus*. Since most Anobiidae (excluding the Ptilininae) are known to be wood borers, it is possible that this genus also has a similar lifestyle. Examined gut contents revealed several different types of spores, which may indicate a relationship with fungi. Two species, *N. ovipennis* Fall and *N. arcuatus* (Gorham), are flightless and have globular shaped bodies. They may be scavengers on accumulated organic matter of plant or animal origin, like other morphologically similar ptinines such as *Gibbium*, *Niptus*, and *Sphaericus*. Specimens have been collected by many different modes, including malaise traps, flight intercept traps, and beating vegetation. Except for perhaps *N. unilineatus* Pic, none of the species appear to be common.

Species List of *Niptinus*

- *Niptinus arcuatus* (Gorham)
- *Niptinus grandimaculosus* New Species
- *Niptinus niveus* (Gorham)
- *Niptinus ovipennis* Fall
- *Niptinus trinotatus* (Pic)
- *Niptinus unilineatus* (Pic)

Key to Species of *Niptinus*

1. Humeral angles broadly rounded with most of the rounding continuing beyond the posterior margin of scutellum (Figure 6.1 C and D), and without distinct humeral prominences rising above elytral surface  . . . . . . . . 2

153
1'. Humeral angles narrowly rounded with most of the rounding completed before the posterior margin of scutellum (Figures 6.1 A and B, 6.2, 6.3 A and B), and with distinct humeral prominences rising above elytral surface ............................................................. 3

2. Elytral base lacking fine yellow or white recumbent setae at the elytral base and no white setal collar on pronotal base, white patch at most only slightly wider than longitudinal median setal line; elytral length to width ratio about 6:5; white elytral maculation at base forming a broad shallow "U" shape across each elytron, posterior elytral maculations closely spaced, separated by a distance equal to about 1/2 width of inner maculation; Absence of fine yellow and sometimes white recumbent setae at the base of the elytra; no white setal collar at pronotal base, white setal patch at most only slightly wider than longitudinal median setal line; Panamá ......................... N. arcuatus

2'. Elytral base with fine yellow and sometimes white recumbent setae at the elytral base and a white setal collar on pronotal base; elytral length to width ratio 4:3; white elytral maculation forming a "V" shape or a deep steep sided "U" shape across each elytron, posterior maculations on each elytron separated by a distance equal to width of inner maculation; presence of fine yellow and sometimes white recumbent setae at the base of the elytra; a white setal collar present at pronotal base; Texas ................................. N. ovipennis
3. Middle of elytron with white elytral maculation consisting of one large irregularly shaped triangle from about basal 1/5 to 3/5 (Figure 6.1 A), triangle with one side nearly parallel to elytral suture and lateral side extending obliquely from apical 2/5 anteriorly to lateral margin at basal 2/5. 

4. White elytral maculations on basal 1/2 consisting of only narrow longitudinal bands about 1-1.5 intervals wide just posterior of humeral protruberance. These bands not extending past middle (Figure 6.1 B) 

5. Erect or suberect elytral setae between puncture rows very long, average length equal to width of 3.0-3.5 elytral intervals (Figures 6.2 B-D, 6.3 A and B) 

N. grandimaculosus

4'. White elytral maculations on basal 1/2 consisting of an irregularly shaped and broken transverse band usually in the shape of a "V" on each elytron (Figures 6.2, 6.3 A and B) 

5. Erect or suberect elytral setae between puncture rows very long, average length equal to width of 3.0-3.5 elytral intervals (Figures 6.2 B-D, 6.3 A and B) 

N. niveus
5'. Erect or suberect elytral setae between puncture rows of moderate length, average length equal to width of about 2.0 elytral intervals (Figure 6.2 A) ................................. N. unilineatus

*Niptinus trinotatus* (Pic), New Status

Figure 6.1 A

*Trigonogenius niveus var. trinotatus* Pic, 1900: 258; Pic 1912: 9; Blackwelder, 1945: 401; Papp 1962: 378.

*Trigonogenius niveus* Gorham, 1883: 197 (in part).

**Diagnosis.** This species is easily recognized by the presence of two small white setal maculations on each elytron. These include a short thick line posterior of the humeral angle and a single ovoid mark at about apical 1/3 near the middle of each elytron.

**Description.** Length 2.24 mm (n = 1), shiny black, tarsi and tibia slightly reddish black, mouthparts dark reddish brown; elytral vestiture moderately long, length of longest setae about equal to width of three elytral intervals.

Head. With scattered recumbent white, sometimes branched scale-like setae, scales narrow, absent from center of frons but present on anterior edge, lateral 1/3 and on genae, a few scales scattered on anterior margin of vertex, longer erect and suberect dark brown setae widely scattered over surface of frons; frons with moderately large, shallow and closely spaced punctures, about 2-2.5 times diameter.
of ommatidium, smaller and more closely spaced on vertex, about half the diameter of those on frons; eyes very projecting, extending 8 ommatidia laterally when viewed from front and slightly constricted around base, constriction or basal groove as wide as width of about 2.5 ommatidia when viewed from front; first and second antennomeres with scattered narrow, scale-like setae, more dense and larger on the following 4 antennomeres.

Pronotum. Covered with scattered, slightly projecting granulations, each with a single erect or suberect dark brown seta, dorsally, granulations separated on average by a distance slightly less than their own diameter; medially a narrow, longitudinal line of white recumbent and bifurcate setae extending from anterior margin to transverse line of punctures at base, a few scattered white setae along basal punctures, more dense along anterior margin of pronotum, especially laterally and ventrally, setae completely absent on each side of longitudinal line at middle; anterior 1/3 with scattered numerous, irregular, deep punctures which surround most of the raised granulations.

Elytra. Intervals very flat, humeral angles very pronounced dorsally; at middle punctures longitudinally elongate with their apices somewhat tapered, punctures about 2.5 times as long as wide, each separated from following puncture by a distance equal to their length, puncture rows separated by about 5 times their width; anterior margin of each puncture with depressed dark brown seta exceeding the margin of following puncture; long erect or suberect dark brown setae between puncture rows, longer interstrial setae on third, fifth, seventh, and ninth intervals, these longer setae about three times as long as width of one interval; apical margin with very fine granulations; scutellum covered with white appressed setae; white
recumbent setae forming maculations on each elytron; at basal 1/4 a subhumeral elongate patch concentrated within interval six, maculation about three times as long as wide; at apical 1/3 each elytron with oval patch centered on third interval, elytral margin with gradually tapered dense white setal line from suture to about basal 1/3, becoming gradually replaced by more widely scattered setae on basal 1/3.

Ventral Surface. Covered with moderately dense, recumbent fine white setae, also more widely scattered longer, suberect white setae; metasternum smooth at middle except laterally and also sternites with numerous shallow punctures; apices and margins of sternites, especially third and fourth sternites, with fine granulose surface.

Legs. Femora and dorsal surface of tibiae and tarsi covered with scattered white recumbent and depressed narrow setae, also longer yellowish or brownish depressed narrow setae, apices of femora with dark brown setae.

Male Genitalia. Unknown.

Sexual Dimorphism. Uncertain, but antennomeres in the male may be slightly longer than those of the female.

Material Examined. Holotype: probably male- [Panama, extreme NE Chiriqui], Volcan de Chiriqui [approx. 16 km E. Costa Rican border 8°48', 82°36'], 2-3,000 ft., Champion (BMNH); 1- probably female: Panama, Concepcion, ±10 mi.N.Concepcion, 3.VI.1977, Stop 2, H.&A. Howden (CMNC).

Distribution. Panamá.

Discussion. *Niptinus trinotatus* is a species based on a varietal name from Pic (1900). Pic based his name on material Gorham (1883) examined but did not
formally name. Gorham described *Niptinus niveus* based on specimens from Guatemala and Panamá. He considered the specimens from Panamá as possible females of his species, since they have a different elytral maculation but excluded them from the type series. I have examined one of Gorham’s Panamánian specimens from Volcan de Chiriquí and another specimen from Concepción, Panamá, and have concluded they represent a distinct species. No other specimens approach the distinctive elytral pattern and long interstrial setae of this species. The single specimen I borrowed from the British Museum of Natural History has a small round label with a red border and is labeled "Type H.T." which I assume indicates a holotype. As this specimen never had any type status, I designate it as such and have labeled the specimen with my label as the holotype of *N. niveus* (Pic).

*Niptinus grandimaculosus*, New Species

Figure 6.1 A

**Diagnosis.** The presence of two large triangular shaped patches on each elytron from about basal 1/4 to apical 2/5, each with an emargination along the anterior margin, should differentiate this species from all others.

**Description.** Length 2.06 mm (n = 1), shiny black, tibia slightly reddish black, tarsi increasingly reddish brown towards apex; elytral vestiture moderately long, length of longest setae about width of three elytral intervals.

**Head.** With scattered moderately dense recumbent narrow scale-like setae, usually basally bifurcate, becoming smaller towards vertex, middle of frons between
and slightly above eyes nearly devoid of scales, longer scattered suberect or erect brownish black setae much more widely scattered over surface of frons; frons with a few large very shallow and obscure punctures visible at middle, each puncture 2-2.5 times the diameter of ommatidium, more granular, finer texture on vertex; eyes projecting, extending about 7 ommatidia laterally when viewed from front and slightly constricted around base, basal constriction or groove almost as wide as width of two ommatidia when viewed from front; first seven antennomeres with scale-like setae similar to those on the frons, although less numerous on the seventh.

Pronotum. Covered with scattered, moderately projecting granulations, each with an erect or suberect moderately long, black seta; dorsally, granulations separated on average by slightly more than their own diameter; a narrow, longitudinal line of white recumbent, basally bifurcate narrow setae present on basal half, line about as wide as scutellum, slightly wider at base anterior to transverse basal row of punctures; another small triangular patch of setae adjacent to ventral and posterior edge, a few more setae to anterior margin and at basal margin at middle; anterior 1/3 with numerous scattered deep punctures surrounding raised granulations.

Elytra. Intervals convex, humeral angles moderately pronounced dorsally; at middle punctures longitudinally elongate, slightly narrowed at middle, punctures about two times as long as wide, each separated from following puncture by a distance slightly less than their length, puncture rows separated by about four times their width; anterior margin of each puncture with a depressed, dark brown seta which does not quite reach the anterior margin of the following puncture; long erect or suberect dark brown setae between puncture rows, longer interstrial setae on the
third, fifth, seventh, and ninth intervals, longest setae equal in length to the width of three intervals, most usually 2.5 intervals; apical margin with very fine granulations, scutellum covered with white appressed setae, similar setae on elytra forming a large maculation from basal 1/5 to apical 1/3, approximately in shape of a “W”, posteriorly on each elytron this maculation extends obliquely anteriorly and slightly irregularly to the lateral margin, maculation absent from first interval except anteriorly where it curves inwards towards the suture, also anteriorly broadly emarginate on each elytron, a few scattered setae extending posteriorly around lateral-dorsal declivity to about rounded maculation at apical 2/5, this maculation located on seventh through ninth intervals, slightly smaller maculation at the apex of each elytron near suture.

Ventral surface. Covered with moderately dense, recumbent white setae, also more widely scattered, longer, suberect yellowish setae; metasternum and sternites with numerous shallow punctures, third through fifth sternites and lateral margins of first and second with fine granulose surface.

Legs. Femora and dorsal surface of tibiae and tarsi covered with scattered white recumbent narrow scale shaped setae, also longer pale brownish yellow depressed narrow setae, a few reddish brown setae near apices of the femora.

Male Genitalia. Unknown.

Sexual Dimorphism. Unknown.

**Material Examined.** Holotype labeled Mexico, Chiapas, .5 mi. n. Ocozocoautla, July 8, 1971, Clark, Murray, Hart, Schaffner (TAMC).

**Distribution.** Known only from the type locality in Chiapas, Mexico.

**Etymology.** Named after the large white setose patch on each elytron.
Discussion. Although this species is based on only one specimen, its distinctive elytral pattern and moderately long setae are very distinct and separate it from any of the other specimens I have examined in this genus.

*Niptinus niveus* (Gorham), New Combination

Figures 6.2 B-D, 6.3, 6.4 B, C, and E, 6.6

*Trigonogenius niveus* Gorham, (in part) 1883: 197 and Tab. X fig.3; Pic 1912: 9;

Not *Trigonogenius niveus* var. *trinotatus* Pic, 1900: 258; Gorham, 1883: 197 and Tab.X fig.4 (in part); Pic 1912: 9; Blackwelder 1945: 401; Papp 1962: 378.

Diagnosis. This species can be recognized by the extremely long erect elytral setae which are equal in length to width of about 3.0-3.5 elytral intervals and the white elytral maculations consisting of a "W" shape at the basal 1/3, 4 spots at the apical 1/3, and a single spot near the apex of each elytron. This species has a similar elytral pattern to *N. unilineatus*, except the basal maculation tends to be more transverse with a very shallow instead of a deep "U" shaped maculation in *N. niveus*. The much shorter length of the erect elytral setae of *N. unilineatus* (no longer than the width of two elytral intervals) will also differentiate these two species.

Description. Length 1.84-2.60 mm (n = 18), black except for mouthparts, tarsi, and usually base of femora, tibia, and tarsi reddish brown or reddish black,
femora (excluding base) usually reddish black, especially at apex; elytral vestiture long, length of longest setae about equal to width of four elytral intervals.

Head. With scattered to moderately dense recumbent white bifurcate setae, much more widely spaced or scattered longer suberect or erect dark brown or black setae on surface of frons; surface of frons usually obscured at middle but with moderate to large shallow punctures visible, diameters variable, on average about 1.5 to 2.5 times the diameter of an ommatidium, becoming finer and more granular on vertex; eyes very projecting, extending 7-10 ommatidia laterally when viewed from the front, slightly constricted around base, constriction or basal groove as wide as the width of about 2 ommatidia when viewed from front; first 6 and occasionally 7 antennomeres with dense white recumbent, bifurcate setae, similar to setae on frons.

Pronotum. Covered with scattered, projecting granulations but relatively in large diameter, each with a single erect or suberect, moderately long black seta; dorsally each granulation separated from the adjacent one on average by a distance equal to about their own diameters; medially a narrow longitudinal line of white, recumbent, and basally bifurcate narrow setae extending from anterior margin to transverse line of punctures near basal margin or sometimes further to posterior margin; anteriorly line about as wide as scutellum; anterior dorsal 1/3 sometimes with widely scattered setae, also much finer pale setae dorsally along basal margin anterior to row of transverse punctures, laterally a few scattered setae medially, ventral margin sometimes densely setose; anterior 1/3 to 1/4 with scattered, irregular, sometimes transverse or oblique deep punctures.
Elytra. Intervals slightly convex to flat, humeral angles slightly produced
dorsally; at middle punctures longitudinally elongate, about 2 times as long as wide,
each separated from the following puncture by a distance equal to half their length,
puncture rows separated by about one to three times their width, anterior margin of
each puncture with a depressed dark brown seta which usually does not quite reach
the anterior margin of the following puncture; long erect or suberect dark brown or
black setae between puncture rows, longer interstrial setae on third, fifth, seventh,
and ninth intervals, longest setae equal in length to width of 4 intervals, more usually
3.0-3.5 intervals in length; scutellum covered with white appressed setae, similar
basally bifurcate white recumbent setae forming several maculations on each elytron;
at about basal 1/3 an irregular "V" or transverse "U" shaped mark from outer edge of
first to sixth interval, usually attached to another band extending transversely and
sometimes sparsely from middle of distal arm of "V" to near the lateral margin of the
elytron, this entire maculation usually much thicker laterally, decreasing in thickness
and density towards the suture; at posterior 1/3 each elytron with 2 maculations, the
inner maculation oval shaped and located between first and fourth puncture rows (on
the second and fourth interval), the outer smaller maculation, sometimes as much as
1/2 the diameter of the larger, more rounded and between the sixth and ninth
puncture rows (on the eighth and ninth interval), 2 somewhat transverse spots at the
apex of each elytron but not within the first interval; laterally below humeral angle
white setae sparse and scattered, continuing posteriorly as a line along the lateral
edge which increases in density and additionally in thickness slightly at the apex.

Ventral Surface. Covered with moderately dense fine recumbent white setae,
also more scattered suberect longer yellowish setae; metasternum and sternites with
numerous shallow punctures, apex and lateral margins of sternites with a granulose surface. First and second sternal sutures rarely visible as a faint line at middle; parameres parallel sided along about distal 1/3 to apex, adeagus relatively narrow and parallel sided, sometimes slightly broader at distal 1/3.

Legs. Dorsal and sometimes ventral surface of tibiae and tarsi covered with fine white recumbent narrow scale-like setae, similar to those on the antennae, also with several longer pale brownish-yellow depressed narrow setae; femoral apices with brown or dark brown setae sometime continuing onto tarsomeres.

Male Genitalia. Parameres approximately parallel sided at apical 1/3 with apex broadly to narrowly rounded, median lobe parallel sided or at most very slightly wider at apical 1/3.

Sexual Dimorphism. None or slight antennal length differences at most.

Anderson, oak/pine/Mimosa forest, 91-57 (CMNC); 1- Baja Verapaz, 16 km N.
Salama, 1550m, 23.V.1991, R Anderson, oak pastureland, 91-14 (CMNC); 1-
Nicaragua, Jinotega, L. Apanes, VII-89, F. Reinboldt (SEAN); 1- Honduras, 10 mi.N.
Tegucigalpa, 2900', VI-12-1974, C. W. & L. O'Brien & Marshall (CASC); 2- El
Salvador, Tonacatepeque, 20 June 1958, L.J. Bottimer (USNM); 2- Panama, Chepo
Maje Is, 5/1/80, 9°8'N 78°49'W, KHJ (TKPC).

Distribution. Mexico and Central America.

Discussion. This species has a relatively large distribution, ranging from the
Mexican state of Jalisco through to Panamá, although few specimens exist in
collections. The variation among many of the specimens could be regarded as
specific differences but due to a lack of material from the intervening areas I have
chosen to take a more conservative approach and regard them all as belonging to a
single polymorphic species previously described by Gorham (1883). All share in
common extremely long erect elytral setae, a similar elytral pattern and similar
genitalia. As in other ptinines with elytral patterns formed by setae, there is
variation in appearance among specimens. Additionally, no specific differences in
male genitalia were observed. Due to the variation found within this species, it
seems appropriate to describe the major differences among the various localities.

Variation Within the Species

Mexico: Jalisco. Both specimens have the elytral and pronotal-line shaped
maculations broader in width and the rounded patches larger in diameter compared
to the other specimens examined.
Quintana Roo. These specimens are exemplified by having a very convex stout body form and relatively convex intervals with erect elytral setae finer and curved near the tips.

Chiapas, El Alguacero. The white maculations on the elytra vary from all other specimens in that the "W" maculation is longer in height and the 4 spots at the apical 1/3 are large and irregular with the pair on each elytron almost blending in to each other.

Chiapas, Parque Nacional Sumidero. These specimens are more stout and convex and have finer brown erect elytra setae which are curved at the tip similar to those from Quintana Roo. Another specimen (collected from a malaise trap) has thicker and darker erect elytral setae and is slightly less convex.

Guatemala: Volcan Pacaya. This specimen is similar to those from Quintana Roo and Parque Nacional Sumidero in Chiapas but the eyes are less projecting.

Baja Verapaz and Guatemala City. Both specimens have less of an elytral "W" than other specimens as this maculation appears more like an irregular transverse line. Additionally, the elytral intervals are much less convex and appear almost flat and the scale-like white setae on the femora is present only on the dorsal surface.

El Salvador: Tonacatepeque. Both of these specimens are somewhat more convex and have thicker and darker erect elytral bristles compared to the other specimens.

Nicaragua: Jinotega. This specimen has the most distinct elytral markings and very flat intervals. The "W" is broken up into 3 maculations on each elytron similar to the specimen illustrated in the Biologia Centrali Americana. The maculation near the apex of each elytron extends anteriorly both along the suture almost up to
or at the declivity and along the lateral edge although composed of only a single row of setae along approximately 1/2 of its length.

Panamá: Maje Island. A white line along the elytral margins which increases in density and thickness towards the apex and flat elytral intervals are characteristics of these two specimens.

*Niptinus unilineatus* (Pic)

Figures 6.2 A, 6.4 D, 6.5 D-F

*Ptilinus unilineatus* Pic, 1900: 252;


**Diagnosis.** The white elytral maculations consist of an interrupted, transverse “W” at basal 1/3 and four spots nearly transversely aligned and equidistant from each other at apical 1/3 are characteristic of this species. Also, the erect setae between the puncture rows are about as long as the width of two elytral intervals. This species is similar to *N. niveus* but the much longer erect elytral setae (the length equal to three or four elytra intervals) will easily differentiate this latter species.

**Description.** Length 1.88- 2.58 mm (n = 147), shiny black, rarely dark brownish black except for the mouthparts; legs (usually only tarsi and tibiae) and occasionally antennae reddish brown to reddish black; erect elytral vestiture relatively short.
Head. With moderately dense, recumbent white, basally bifurcate scale-like setae, but largely absent from the middle of the frons, frons also with long widely scattered suberect or erect dark brown setae; between eyes surface of frons with moderate sized shallow closely spaced punctures, about 1.5-2.0 times the diameter of an ommatidia, becoming finer and more granulate towards vertex; eyes not projecting, extending 6 or 7 ommatidia laterally when viewed from the front and usually without an obvious constriction around the base; first seven and sometimes eight antennomeres with white setae dorsally, similar to that on frons, setae concentrated at apex but sometimes present throughout dorsal surface of each antennomere, although less dense relative to that at antennomere apices, occasionally some white setae decreasing in density to various degrees distally.

Pronotum. Covered with scattered, projecting small to moderate sized granulations, each with a single erect or suberect short, brown to dark brown seta; dorsally granulations separated by about or slightly more than their own diameters; medially a narrow longitudinal line of white recumbent basally bifurcate, narrow setae extending from anterior to posterior margin, sparser and narrower width and sometimes absent in places on anterior 1/3, white setae also present along basal margin, although less dense and usually finer in thickness, median longitudinal strip about as wide as scutellum; anterior 1/4 with deep transverse or obliquely transverse, irregularly shaped, often elongate punctures.

Elytra. Intervals slightly convex, humeral angles slightly produced dorsally; at middle punctures longitudinally elongate and slightly narrowed at middle, about 2 times as long as wide, each separated from the following puncture by a distance ranging from slightly less than 1/2 to slightly more than 1 times their length,
puncture rows separated by 2-3 times their width, anterior margin of each puncture
with a depressed brown seta exceeding anterior margin of following puncture;
relatively short erect or suberect brown seta between puncture rows, all setae
approximately equal in length but slightly longer towards lateral margin, longest
setae equal in length to width of 2 to almost 2.5 intervals; scutellum covered with
white recumbent setae, similar basally bifurcate white recumbent setae forming
several maculations on each elytron, at anterior 1/3 an irregular V-shaped mark from
within first interval and just below scutellum to sixth interval, another band
extending transversely from distal arm of V, to lateral margin of elytron, at posterior
1/3, elytra with 4 maculations, the inner maculations nearest suture oval shaped and
located within second and fourth intervals, the outer maculations more rounded and
between sixth (rarely) or seventh through to the ninth puncture rows, also 2 rounded
but somewhat transverse spots at apex, but outside first interval, and usually smaller
than those at posterior 1/3.

Ventral surface. Covered with moderately dense, recumbent fine white setae,
also more scattered suberect longer white or yellowish setae; metasternum and
stermites with numerous, closely spaced, shallow punctures, laterally these punctures
surrounded by a granulose surface; first and second sternal sutures usually visible at
middle as a faint line; parameres parallel sided along about distal 1/3, adeagus
usually broadest at distal 1/3.

Legs. Dorsal surface of femora, tibiae, and tarsi covered with white
recumbent narrow scale-like setae, similar to those on the antennae, also with
several longer pale brownish-yellow depressed narrow setae; dark brown setae at
apices of femora.

170
Male genitalia. Parameres parallel sided from about apical 1/3, apices rounded; median lobe slightly broader at apical 1/3.

Sexual Dimorphism. None.

Distribution. This species is presently known only from Texas, Belize, San Luis Potosi and another unknown locality in Mexico where the type was collected (in the Pic collection).

Discussion. Several specimens recently collected from Belize agree fairly well with the description of this species. Unfortunately, I have seen only one Mexican specimen (an interception record from orchids) which could be assigned to this species. Therefore, until more material becomes available, I place the Belize specimens in this species. Compared to specimens from Texas, both have similar lengths and thickness of elytral setae and a similar maculation pattern. Subtle differences in the Belize specimen include more strongly projecting eyes laterally, the anterior white elytral maculation is less "V" shaped and more transverse (especially near the suture), the basal maculation is more posterior of the humeral projection, the elytra punctures are slightly closer spaced longitudinally and since each puncture has an associated seta, the specimen has a more setose appearance. There is also a greater change in puncture diameter from the posterior to the anterior, due to the greater reduction of the posterior punctures in the Belize specimens. Additionally, these specimens have a slightly stouter shape, the pronotal tubercles are slightly larger in diameter and less pronounced, and finally the humeral angles are more pronounced anteriorly (slightly beyond the pronotal base) to a greater extent than seen in the specimens from Texas.

A single dissected male from Brazil (Rio de Jan., Conceicion de Macabu, IX.1978, M. Alvarenga [CNCI]) appears to be *N. unilineatus*, although most of the
elytral setae are abraded. I am not sure if this specimen represents a range extension, an undescribed Brazilian species, an introduction, or is the result of mislabelling.

Like *N. niveus*, the morphological differences among specimens potentially indicate the range of variation possible within species of *Niptinus*. Although these characters do vary, they do so only in a limited manner. Intermediate forms bridging the gap between this species and any of the others have not been found.

*Niptinus ovipennis* Fall

Figures 6.1 D, 6.4 A, 6.7


**Diagnosis.** This species is easily recognized by the very rounded, unpronounced elytral humeral angles and the presence of fine yellowish-brown and sometimes white setae at the posterior pronotal margin and the adjacent elytral base. The elytra are also brown or piceous unlike the black elytra of the other known species. The only species likely to be confused with this one is *N. arcuatus*. In addition to the characters given in the key, the smaller size of *N. arcuatus* and its distribution in Panama (not Texas), should help separate the two species.
Description. Length 2.20-2.84 mm (n = 39), usually shiny brown but sometimes piceous, darker on pronotum and occasionally lighter on humeral angles; legs, antennae, and mouthparts brown, often lighter coloration than the rest of the body; elytral vestiture of moderate length.

Head. Covered with dense, recumbent, white, usually basally bifurcate narrow, scale-like setae; distribution even, without the less dense area in the middle of the frons; longer, suberect or erect dark brown or brown setae widely scattered over surface of frons; between eyes surface of the frons largely hidden but with small, shallow, closely spaced punctures, usually only slightly larger than the diameter of an ommatidia, becoming finer and more granulate towards and on vertex; eyes relatively small and not projecting, extending about 6 ommatidia laterally when viewed from the front, and with no obvious constriction around base; the first 7 antennomeres with dense white setae similar to those on frons.

Pronotum. Covered with scattered, small projecting granulations, each with an erect or suberect short brown to dark brown seta; dorsally granulations closely spaced, separated on average by about 1/3 their own diameters; medially a narrow longitudinal line of white, recumbent, basally bifurcate narrow setae from the anterior to the posterior margin, slightly narrower width on anterior 1/2, line usually wider than scutellum, white setae sometimes spreading laterally slightly from the medial strip at basal margin, also present along basal margin are very fine recumbent, yellowish setae, similar to those on the elytra bases; anterior 1/4 with moderately deep irregularly shaped punctures.

Elytra. Intervals slightly convex to flat, humeral angles rounded, not produced dorsally; at middle punctures ovoid and slightly narrowed at middle, separated from
the following by a distance equal to slightly less than their length, puncture rows
separated by about 2.5-3.0 times the width of a single puncture, anterior margin of
each with a depressed nearly straight brown seta which reaches the middle and
often exceeds the posterior margin of the following; moderately long erect setae
between puncture rows, all setae approximately equal in length but slightly longer
towards lateral margin, longest setae equal in length to width of 2.5-3.0 intervals;
scutellum covered with white recumbent setae, similar basally bifurcate white
recumbent setae forming maculations on each elytron; around basal 1/3, a "V" or
deep "U" shaped mark separated from base by a distance equal to about length of
scutellum, usually starting within second interval but occasionally within first,
extending posteriorly obliquely to about basal 1/3 at middle of elytron, and then
extending anteriorly to seventh interval at basal 1/5 where the maculation extends
transversely narrowly throughout it's length to the ninth or tenth interval, at
posterior 1/3 on each elytron a longitudinally ovoid maculation on second and third
to sometimes fourth interval and a larger transversely ovoid maculation from within
sixth through ninth interval, also 2 spots at apex in second and third but not within
first interval, usually similar in size to those at apical 1/3.

Ventral surface. Covered with very dense, recumbent fine white setae, also
more scattered suberect longer yellowish setae; metasternum and sternites with
numerous fine shallow punctures, lateral margins and the entire fifth sternite with
fine granulose surface.

Legs. Tibiae and tarsi dorsally with white setae similar to that on the
antennae, femora covered with fine white setae similar to those on the ventral
surface, also with longer yellowish or pale brown depressed narrow setae, apices of femora with brown setae.

Male Genitalia. Relatively elongate; parameres parallel sided from about middle, apices rounded; median lobe gradually tappering from about middle.

Sexual Dimorphism. Male antennomeres, especially the ultimate mere, are slightly longer than those of the female. Eye size is similar in both sexes.


Distribution. This species is presently known only from Texas.

Discussion. This species is one of the most distinct morphologically with the rounded humeral angles which are not strongly projecting dorsally. The only species it could possibly be confused with is *N. arcuatus* which has a similar morphology and elytral maculations.
Niptinus arcuatus (Gorham), New Combination

Figures 6.1 C, 6.5 A-C

Trigonogenius arcuatus Gorham, 1886: 347, Tab. XIII. fig. 20; Pic 1912: 9;
Blackwelder 1945:401; Papp 1962: 377

Diagnosis. Niptinus ovipennis Fall is the only species which could be confused with N. arcuatus as both have rounded, unpronounced humeral angles unlike other species in the genus. Both species also have somewhat similar elytral maculation patterns. They can be easily separated by the absence in N. arcuatus of fine yellowish setae and sometimes white recumbent setae at the base of the elytra. Additionally this species lacks the white setal collar at the pronotal base present in N. ovipennis. The relatively widely spaced tubercles on the pronum and the broader body will also separate N. arcuatus from N. ovipennis. Besides the differences previously mentioned between P. arcuatus and P. ovipennis, another is their size. Niptinus arcuatus have a maximum length of 1.8 mm while the smallest example of N. ovipennis I have seen is 2.2 mm long.

Description. Length 1.7-1.8 mm (n=2), shiny, brown to piceous brown but sometimes piceous, pronotum similar in color to elytra; legs, antennae, and mouthparts brown, often lighter coloration than the rest of the body; elytral vestiture moderate to long in length.

Head. Covered with dense, recumbent, white, usually basally bifurcate narrow, scale-like setae; distribution uneven, with a less dense area in the middle of
the frons; longer, suberect or erect brown or light brown setae widely scattered over surface of frons, tips slightly spatulate and or bifurcate; between eyes surface of the frons largely hidden but with small, shallow, closely spaced punctures, usually only slightly larger than the diameter of an ommatidia, becoming finer and more granulate towards and on vertex; eyes very small and distinctly projecting, extending about 8 ommatidia laterally when viewed from the front, and with a very distinct constriction around base; the first 7 or so antennomeres with dense white setae similar to those on frons.

Pronotum. Covered with scattered, small projecting granulations, each with an erect or suberect short brown to dark brown seta; dorsally granulations moderately widely spaced, separated on average by about 1/2-1 times their own diameters, some smooth area visible between punctures and granulations; medially a narrow longitudinal line of white, recumbent, basally bifurcate narrow setae from the anterior to the posterior margin, of similar width throughout, line usually wider than scutellum, white setae spreading laterally from the medial strip at basal and anterior margin and continuing laterally at base, without any fine recumbent yellowish setae at base; anterior 1/3 with moderately deep irregularly shaped punctures.

Elytra. Intervals flat or nearly so, humeral angles rounded, not produced dorsally; at middle punctures ovoid and slightly narrowed at middle, separated from the following by a distance equal to slightly less than their length, puncture rows separated by about 3.0-3.5 times the width of a single puncture, anterior margin of each with a depressed distinctly curved brown seta which reaches the middle and often exceeds the posterior margin of the following; moderately long erect setae between puncture rows, all setae approximately equal in length but slightly longer
towards lateral margin, longest setae equal in length to width of 3.5-4.0 intervals; scutellum covered with white recumbent setae, similar basally bifurcate white recumbent setae forming maculations on each elytron; around basal 1/3, a broad shallow "U" shaped mark separated from base by a distance equal to about length of scutellum, starting within first interval, extending posteriorly obliquely to about basal 1/3 at middle of elytron, then extending anteriorly to sixth interval at basal 1/5 where the maculation extends transversely at first broadly but then tappers to a point at the ninth or tenth interval; at posterior 1/3 on each elytron a rounded maculation on first or second through to fourth interval and a similar sized transversely ovoid maculation from within sixth or seventh through ninth interval, also 2 spots at apex in second and third intervals but not within first interval, much smaller in size to those at apical 1/3.

Ventral surface. Covered with very dense, recumbent fine white setae, also more scattered suberect longer yellowish setae; metasternum and sternites with numerous fine shallow punctures, lateral margins and the entire fifth sternite with fine granulose surface.

Legs. Tibiae and tarsi dorsally with white setae similar to that on the antennae, femora covered with fine white setae similar to those on the ventral surface, also with longer yellowish or pale brown depressed narrow setae, apices of femora with brown setae.

Male Genitalia. Parameres approximately parallel sided at apical 1/3 with apex broadly to narrowly rounded, median lobe parallel sided or at most very slightly wider at apical 1/3.
Sexual Dimorphism. Male antennomeres are slightly longer than those of the female.

Material Examined. Lectotype: 1 male- Panama, Taboga Island [8°47' N, 79°34' W]. Paralectotype: 1 female- with the same data.

Distribution. Known only from Taboga Island in Panamá.

Discussion. This species was described from two specimens collected on Taboga Island, Panamá. This is a small island in Bahía de Panamá, approximately 20 km south of Panamá City. No other specimens are known. *Niptinus arcuatus* and *N. ovipennis* form a group distinct from the other four species of *Niptinus* by the lack of ability to fly. Morphologically this trait is most obviously characterized by the loss of wings, rounded humeral angles and shortened metasterna.

It seems unusual that no other individuals of this species are known or that any other species of this subgroup have been discovered. The relatively vast geographic distances between *N. arcuatus* and *N. ovipennis* may be real or simply due to lack of collecting, although material from Costa Rica (IN-Bio), a relatively large collection, produced no additional material of this genus. Perhaps it is more a problem of lack of recognition of members of this genus as ptinines.
FIGURE 6.1

Elytral patterns of *Niptinus* species: (a) *N. grandimaculosus*, (b) *N. trinotatus*, (c) *N. arcuatus*, (d) *N. ovipennis*. Scale bar = 0.5 mm.
FIGURE 6.2

Elytral patterns of *Niptinus* species: (a) *N. unilineatus*, (b) *N. niveus* (Mexico, Chiapas), (c) *N. niveus* (Panama, Chepo), (d) *N. niveus* (Guatemala, Baja Verapaz).

Scale bar = 0.5 mm.
FIGURE 6.2
FIGURE 6.3

Elytral patterns of *Niptinus niveus* (scale bar = 0.5 mm): (a) specimen from Mexico, Jalisco, (b) specimen from Guatemala, Volcan Pacaya. Lateral profiles of elytra of *Niptinus niveus* from Mexico and Central America: (c) Mexico, Jalisco, (d) Mexico, Quintana Roo, (e) Mexico, Chiapas, (f) Guatemala, Baja Verapaz, (g) Panama, Chepo.
FIGURE 6.3
186
FIGURE 6.4

Ventrites of *Niptinus* species (scale bar = 0.5 mm): (a) *N. ovipennis*, (b) *N. niveus*, (c) *N. niveus*. Frontal view of the head illustrating the difference in the degree of lateral eye projection of *Niptinus* species: (d) *N. unilineatus*, (e) *N. niveus*. 
FIGURE 6.4

188
Male genitalia of *Niptinus arcuatus* and *N. unilineatus*: (a)-(c) *N. arcuatus*; (a) dorsal view, (b) lateral view, (c) spiculum gastrale. (d)-(f) *N. unilineatus*; (a) dorsal view, (b) lateral view, (c) spiculum gastrale. Scale bar = 0.1 mm.
Male genitalia of *Niptinus niveus* illustrating the range of variation within the male genitalia: (a)-(b) Mexico, Quintana Roo; (a) dorsal view, (b) lateral view; (c)-(d) Mexico, Chiapas; (c) dorsal view, (d) lateral view; (e)-(f) Mexico, Jalisco; (e) dorsal view, (f) lateral view. Scale bar = 0.1 mm.
FIGURE 6.7

Male genitalia of *Niptinus ovipennis*: (a) dorsal view, (b) lateral view, (c) spiculum gastrale. Scale bar = 0.1 mm.
FIGURE 6.7

194
CHAPTER 7

REVISION OF THE NEW WORLD GENUS Prosternoptinus BELLÉS
(COLEOPTERA: ANOBIIDAE: PTININAE)

INTRODUCTION

*Prosternoptinus* is unique among the New World ptinines in having an anteriorly expanded prosternum. This feature enables an adult to completely conceal mouthparts when their head is reflexed downwards. Endemic to the Neotropics, Bellés (1985) created the genus for seven species originally described and placed in *Ptinus* by Maurice Pic (1896, 1898, 1900, 1901, 1931). The Pic species are known from Brazil and Argentina. Bellés (1985) described four more species from Venezuela. With this revision, the genus now contains 24 species and the known distribution has increased to include Central America and Mexico. Specimens are very rarely collected and hence the group is poorly known.

The original descriptions were relatively brief which makes it difficult to confirm identifications. Therefore, the genus and all previously known taxa are diagnosed. Species are redescribed except for *P. jolyi* Bellés and *P. bicolor* Bellés. All species are included in the key and the possibly biology of the genus is also discussed.
MATERIALS AND METHODS

All known museums in Latin America and the major and many minor collections in Canada and the United States were contacted for available material. Relatively few collections contained any specimens of this genus. The only major collection in Europe which has specimens of this genus is the Muséum National d'Histoire Naturelle in Paris. This repository has seven types for species described by Maurice Pic (1896, 1898, 1900, 1901, 1931). Four of the types were borrowed to determine the validity of the hypothesized species. The other three Pic species were relatively easy to assigned to specimens based on the original descriptions and the diagnoses and illustrations supplied by Bellés (1985).

Species were recognized based on morphological evidence. Many of the species are known from single specimens or very small series. Since species limits are based on currently available material, the degree of variability within many species is poorly known.

More detailed or precise locality data (such as longitude and latitude) was sometimes included in the material examined section and indicated by square brackets ([ ]).

As very dirty specimens obscures both setae and sculpturing, cleaning was done with "Pro Formula 409 " fluid (The Clorox Co., Oakland CA). Specimens were soaked in the solution for up to 30 minutes and then, if necessary, gently brushed. Ultrasonic cleaning was only rarely attempted since this treatment will remove setae from specimens.
To examine genitalia, specimens were briefly soaked in hot water and then abdomens removed. Abdomens were then cleared overnight or sometimes longer in lactic acid and genitalia extracted. Abdomens were glued to the point with the specimen. Genitalia were placed in micro vials and pinned beneath the specimen. Specimens were examined with Wild M-5 and M-20 microscopes and drawings done with the aid of camera lucidas. Total lengths were measured from the anterior portion of the head in a deflexed position to the elytral apex. Measurements were made with a micrometer and rounded to the nearest 0.1 mm. Measurements of specimens from Bellés (1985) were included to increase the sample size of each species.

As in all ptinines, setae are frequently abraded or broken and so their use in the diagnoses and keys has been kept to a minimum. Additionally, characters of setal length and color are also somewhat variable. This is especially true of the latter which can be influenced by the strength or type of light used to examine specimens. In addition to incandescent light, fluorescent light was used to illuminate specimens to assist in observing cuticular sculpture and setation.

White setae on the frons or pronotum are often difficult to see, particularly if they are dirty and matted. Moreover, it is often difficult to see the interantennal carinae, especially on dark specimens. Setae and carinae are best observed by moving the light source to obliquely light the specimen, thereby obtaining a strong reflection from the setal surface.

Setal tufts are usually not very distinct in this genus. They are always much easier to examine in lateral and frontal views. This is especially true when trying to observe the more centrally located dorsal tuft, which is practically invisible in dorsal
view. This enables one to determine if the setal tips are converging to a central point forming a distinct tuft or if the setae are not or only slightly converging.

The length of long slender erect setae on elytra was compared to elytral interval width by viewing beetles dorsally and examining setae at or near the lateral elytral margins. Lengths of the depressed elytral setae can be variable, but they usually are fairly constant. In some specimens, these setae are occasionally obliquely rather than longitudinally oriented. In these cases, the posterior extension of setal length was used without trying to mentally longitudinally align the setae. Depressed setal lengths were measured relative to whether the setal apex reached the following setal insertion point or elytral puncture. The distance between each puncture and the puncture size varies from anterior to posterior. Because of this, the appressed setal extensions were measured at the middle of the elytra on the first through third puncture rows.

Elytral punctures are large basally and (usually gradually but sometimes relatively abruptly) become much finer towards the apex. Therefore, for comparisons of puncture size, punctures were measured along the second and third puncture row at the middle of each elytron. Punctures can also look larger than they actually are due to the cuticular surface sloping down near the perimeter of the puncture. This is especially true in those species with their elytral intervals convex, which tends to exaggerate this feature. The punctures on the paler colored species often have a surrounding dark halo. This also has the effect of making the punctures much larger than they actually are. These artifacts can be avoided by observing specimens with diffused light or with the illuminating light placed at an oblique angle relative to the specimen.
The following institutions or collections, their acronyms, and curators loaned or made available material for this study: Carnegie Museum of Natural History (CMNH), Robert L. Davidson; Canadian Museum of Nature (CMNC), François Génier and Robert Anderson; Museu de Entomologia Pe. Jesus Santiago Moure (DZUP), Keti Zanol; Entomology Museum, Utah State University (EMUS), Wilfred Hanson; Field Museum of Natural History (FMNH), Al Newton; Instituto Nacional de Biodiversidad (INBC), Jorge Carvajal A.; Instituto de Zoología Agrícola (IZAV), Luis J. Joly; Museum National d’Histoire Naturelle (MHNP), Nicole Berti; National Museum of Natural History (NMNH), Edward Brodie; Texas A & M University (TAMU), Edward Riley; Collection of the author (TKPC); University of Michigan (UMMZ), Mark O’Brien.

*Prosternoptinus* Bellés

*Prosternoptinus* Bellés, 1985: 132.

Type species: *Ptinus thersae* Pic, 1898: 171.

**Diagnosis.** This genus is easily differentiated from all other New World taxa by the following set of characters: the ability to hide the ventral portion of the head within the anteriorly expanded prosternum; antennal insertions situated close together between the eyes; labial palps with slightly flattened apices which are obliquely or transversely truncate; ultimate palpomere with two slightly extended tips at the most extreme opposite sides on the distal surface. *Prosternoptinus* also has serrate pro and mesotarsi and pectinate metatarsi. The ptinine genus *Niptinus* is
similar to or slightly larger in size compared to *Prosternoptinus*. Both genera have deep irregular punctures on the anterior part of the pronotum. But *Niptinus* does not have the anteriorly expanded prosternum. This is also true for members of the genus *Ptinus*.

**Description.** Length 1.5–2.6 mm. Body elongate, covered with both erect and recumbent setae which does not obscure surface of the cuticle; color black to light brown, sometimes infused with various degrees of red.

Head. Usually slightly or easily visible from above when in a normal position, inserted within the pronotum near or up to the hind margin of the eye, eye approximately circular in shape, size ranging from small (diameter about equal to length of scape) to very large (diameter greater than length of scape and second antennomere combined), small groove around eye base about equal to diameter of one ommatidium sometimes present, scattered erect setae also present between ommatidia; interantennal space narrow with a shallow longitudinal groove, distinct carinae present on each side of groove; clypeus an equilateral triangle in shape, anterior margin slightly emarginate; labrum broadly rounded to truncate, small, no wider than distal edges of antennal insertions, sclerotized portion wider than long; antennae 11 segmented, filiform, second antennomere attached off center of scape apex towards posterior edge; apical antennomere widest at about anterior 1/3, tapering to narrowly rounded tip; maxillary palps with 4 segments, apex tapering to a point; labial palp with apical palpmere expanded apically and flattened, apex obliquely or transversely truncate and ending in two small projections at opposite
sides of distal surface; mentum with a longitudinal ridge, two small pits located near
the posterior margin, about as wide as long with the anterior edge broadly rounded.

Thorax. Pronotum slightly elongate or subequal, generally with 4 loose setal
tufts at about middle, 2 on either side of the midline and 2 anterior-laterally; divided
into 3 regions dorsally, anterior 1/4 to 2/5 with deep irregular but usually elongate
punctures in a random orientation except for those closest to anterior margin which
tend to be oriented transversely or parallel to anterior edge, most strongly
constricted at posterior 1/4 and forming a collar which expands in diameter to
posterior margin, near posterior edge a row of deep transverse punctures present,
sometimes some of them are contiguous or nearly so, becoming a continuous groove
laterally; surface with scattered tubercles, each with an erect seta, laterally tubercles
give the pronotum a very irregular, bumpy appearance when viewed dorsally; dorsal
surface posteriorly sometimes with recumbent setae of various densities and
thicknesses, sometimes almost completely obscuring cuticle surface; ventrally
prosternum expanded anteriorly and slightly ventrally which can conceal the
mouthparts when the head is in a retracted position; procoxae cylindrical, slightly
projecting; prosternal process extending ventrally the length of the procoxae, also
extending posteriorly as far as the procoxae, at middle width of process about equal
to 1/2 procoxal diameter; mesosternum convex, mesosternal process similar in width
to prosternal process and about 1/2 the width of mesocoxae, mesepimeron visible
and rectangular, mesosternal-mesepisternal suture present; metasternum convex and
about 2 times length of mesosternum, posterior margin with a small smoothly
rounded notch between metacoxae in which anterior margin of first ventrite fits into,
 anterior to this notch at the posterior margin a median longitudinal groove of various
widths extending no more than 1/2 length of the metasternum, although often continuing as a dark line indicating the location of the metendosternite; metepisternum visible and contacts anterior margin of metacoxae, metacoxae transverse, separated at middle by a distance equal to about 1/4 the width of the first ventrite; wings with a jugal lobe, no wedge cell, two anal veins present (figure xx); scutellum relatively large and visible, covered with pale pubescence.

Elytra. Elongate with longitudinal rows of easily visible punctures, punctures sometimes surrounded by a visible ovoid halo much larger than actual puncture but punctures still separate from each other, surface between punctures usually slightly convex but sometimes flat; setae of two types; longer erect interstitial setae and much shorter recumbent or depressed setae along puncture rows, sometimes recumbent setae also present in patches and forming distinct patterns.

Ventrites. First three fused and suture lines sometimes obsolete at approximately middle 1/3; fourth ventrite reduced in length, third ventrite about 1.5-3.0 times length of fourth.

Legs. Pro and mesofemora clavate, metafemora less strongly so, tarsomeres dentate or pectinate posteriorly to various degrees.

Male Genitalia. Elongate, symmetrical, parameres and median lobe about the same length, spiculum gastrale composed of 4 arms, sometimes with the inner arms fused into a larger plate.

Sexual Dimorphism. Males sometimes with proportionally longer antennomeres and larger eyes; elytra sometimes more convex longitudinally in female.
Discussion

Several potentially useful characters and their states are difficult to observe in this genus. Most specimens have their mouthparts partially or completely hidden beneath the anteriorly expanded prosternum when they dry. The head is difficult to move to view mouthparts, even if the specimen is relaxed. More critical examination of the mouthparts is not possible unless they are removed from the head. This procedure usually results in at least partial destruction of the head capsule. Therefore, details of the shape of mouthparts at the specific level is excluded from this study. There is variation in the shape of the ultimate labial palpomere. Moreover, while all species have the apical palpomere with bifurcate tips, the degree of tip separation varies. This apical palpomere also varies in the angle of truncation. Some species have the tip transversely truncate whereas other species have the tip distinctly truncate at an oblique angle. In specimens where the mentum can be observed, it has a longitudinal ridge. These previous character states may prove very useful for differentiating species and hypothesizing relationships, when more material is available to allow destructive dissections.

Although similar to *Niptinus* and some species of *Ptinus, Prosternoptinus* has a unique prosternal morphology in the New World ptinines. Bellés (1985) noted the similarity in the prosternal morphology between *Prosternoptinus* and *Maheoptinus*, an Old World genus. While *Maheoptinus* has an expanded prosternum, it is not as extensive as that of *Prosternoptinus*. At least one other undetermined ptinine from Gabon has the prosternum expanded anteriorly. This species appears to be a myrmecophile as evidenced by the presence of trichomes.
The reason for the evolution of an enlarged prosternum is not clear. This particular morphology may have been selected to help protect mouthparts from predators, particularly ants. Other known myrmecophilous species of ptinines do not have an expanded prosternum. Several genera of mymecophilies, such as Gnostus, may reduce the risk of mouthpart damage from predators by a reduction in the size of mouthparts. But this reduction may be simply due to this species acquiring regurgitated food from their ant hosts (Thomas et al. 1992). There is no evidence that Prosternoptinus lives with either ants or termites.

Prosternoptinus exemplifies the state of knowledge on arthropod biodiversity in the tropics. Although some groups, such as butterflies, are relatively well known, most are not. This is particularly true with small insects, such as Prosternoptinus, less than 5 mm in length. Additionally, Prosternoptinus is a genus infrequently collected. This is exemplified by seven of 24 species known from single types.

Undoubtedly many more species remain to be described. Adding to the problem of working with this genus is the similarity among some species and sexual dimorphism. If a determination proves difficult using external characters, specimens can usually be assigned to species accurately with the use of male genitalia. This may be particular true if one is unfamiliar with the genus and has dirty or abraded specimens. The females of some species may be difficult to assign to a species without associated males.

Many of the species are known from single specimens or very small series. By describing organisms from many individuals one is more likely to get a better hypothesis of intraspecific variability. Hence, descriptions of some species may have to be altered as more material becomes available. Unfortunately this genus, like
most species of anobiids, is rarely collected. This is possibly due to the small size and secretive habits of these beetles. Even a relatively well collected fauna in the tropics such as the Costa Rican collection from IN-Bio (INBC) had only two specimens of this genus. Because it is unlikely to become any more common in collections in the future, species limits were defined with currently available material.

Biology

Little can be said about the habits of *Prosternoptinus* as there is no published information or much label data to indicate lifestyle. Specimens have been collected by beating vegetation, sweeping, in Malaise traps, and at lights. Specimens have been found in the both the wet and dry seasons. This is in contrast to some species, such as *Ptinus costaricensis* and *P. latefasciatus*, which appear to be active only during the dry season (Andrews, 1967). Immature stages are unknown, which is not surprising considering the rarity of adults. Feeding habits are unknown for both the larvae and adults. Gut content analyses of adults show the presence of various types of spores. This may indicate at least a partial association with fungi (or perhaps lichens). Gut contents also contained plant cell wall fragments. The basal position of *Prosternoptinus* in a phylogenetic analysis near the common ancestor of both the Ptininae and the non-ptinine Anobiidae (Anobiidae, *sensu stricto* [Philips unpublished]) is evidence that members of this genus (like basal Anobiids, *sensu stricto*) may be twig or stem borers. As the most common mode of capture is beating vegetation, this may indicate some utilization of fungi associated with dead or dying branches of plants.
Species List of *Prosternoptinus*

*Prosternoptinus aeneus* New Species
*Prosternoptinus argosomos* New Species
*Prosternoptinus assumptionum* New Species
*Prosternoptinus bechynei* Bellés
*Prosternoptinus bellesi* New Species
*Prosternoptinus bicolor* Bellés
*Prosternoptinus bordoni* Bellés
*Prosternoptinus calileguanensis* New Species
*Prosternoptinus castaneus* New Species
*Prosternoptinus donckieri* (Pic)
*Prosternoptinus expandipronotus* New Species
*Prosternoptinus glabrihumeralis* New Species
*Prosternoptinus jolyi* Bellés
*Prosternoptinus kryptoambon* New Species
*Prosternoptinus maculithorax* (Pic)
*Prosternoptinus nigricolor* (Pic)
*Prosternoptinus obrienorum* New Species
*Posternoptinus oculigrandis* New Species
*Prosternoptinus quadrimaculatus* New Species
*Prosternoptinus rufipennis* (Pic)
*Prosternoptinus semibrunneus* (Pic)
*Prosternoptinus submetallicus* (Pic)

206
Prosternoptinus theresae (Pic)

Prosternoptinus tricoratus New Species

Key to the Species of Prosternoptinus

1 Elytra with white recumbent pubescence forming distinct spots or bands around basal 1/4 or apical 1/3 (figures 7.1 A, B, E, F, and 7.2), these maculations sometimes obscured by matting or partially to completely absent due to abrasion, but setal insertion points on cuticle still visible as a region of fine punctures ........................................ 2

1' Elytra without dense white recumbent pubescence forming distinct spots or bands ................................................................. 8

2 White recumbent pubescence forming spots or bands only on basal 1/4, and no spots present on apical 1/3 (figure 7.1 A and B) ........ 3

2' White recumbent pubescence forming patches or bands at both basal 1/4 and apical 1/3 (figures 7.1 E, F, and 7.2) ........................ 4

3 Recumbent white elytral setae forming longitudinally elongate bands on or near humeri (figure 7.1 B). Elytra reddish or chestnut brown. ....... .............................................................. P. kryptoambon

207
3' Recumbent white elytral setae forming slightly transverse patches on or near humeri (figure 7.1 A). Elytra black .................. P. argosomos

4 Recumbent white elytral setae forming two patches at about apical 1/3, one on each elytron (figure 7.1 E) ..................... P. quadrimaculatus

4' Recumbent white elytral setal patches forming four patches at about apical 1/3, two on each elytron (figures 7.1 F and 7.2) ................. 5

5 Recumbent white setae at basal 1/4 on each elytron forming a transverse band which is slightly curved or wavy (figure 7.2 E and F) ............. P. theresae

5' Recumbent white setae at basal 1/4 on each elytron forming a transverse band which is distinctly curved or wavy, either forming a "V" shape or in a series of distinct maculations on each elytron (figures 7.1 F and 7.2 A-D) .............................................. 6

6 Recumbent white setae at basal 1/4 on each elytron forming a continuous "V" shaped transverse band (figure 7.2 A-C) .................. P. bellesi
6' Recumbent white setae at basal 1/4 on each elytron in a series of separate
cmaculations forming a discontinuous "V" shape (figures 7.1 F and 7.2
D) ................................................................. 7

7 Patches of recumbent white setae on basal 1/4 nearest the suture on each
elytron slightly ovoid, less than 2 times as long as wide and elytra
parallel sided (figure 7.2 D), male genitalia as in figure 7.12 A and B.
Venezuela. ......................................................... P. bordoni

7' Patches of recumbent white setae on basal 1/4 nearest the suture on each
elytron elongate, about 3 times as long as wide, elytra slightly wider at
posterior 1/3 (figure 7.1 F), male genitalia as in figure 7.3 D-F.
Colombia. .......................................................... P. tricoratus

8 Cuticle of elytra distinctly bicolored with a dark brown or black triangular
shaped area on basal 1/3 or 1/2 and remaining cuticle reddish brown
(figure 7.1 C and D) ........................................ 9

8' Cuticle of elytra a single color, either a fairly uniform shade of brown, reddish
brown or black, although apical 1/4 sometimes slightly but distinctly
paler ................................................................. 10

9 Elytral cuticle dark brown around scutellum, extending laterally and reaching
humeral angles (figure 7.1 C); interstitial erect pubescence moderately
long, when viewed from above setae along lateral edge about equal in
length to width of about two elytral intervals ............... \textit{P. bicolor}

9' Elytral cuticle dark brown around scutellum, not reaching humeral angles
(figures 7.1 D); interstrial erect pubescence very long, when viewed
from above setae along lateral edge about equal in length to width of
three to four elytral intervals ............................. \textit{P. semibrunneus}

10 Tubercles on the pronotum very pronounced except sometimes less so on
dorsal surface, tubercles most obvious on lateral edges when viewed
dorsally resulting in a very rough or irregular appearance (figures 7.14
A and 7.15 B) ......................................................... 11

10' Tubercles on the pronotum present but not very pronounced (figures 7.14 B-
F). ................................................................. 13

11 Elytra black ............................................ \textit{P. nigricolor}

11' Elytra either light reddish brown or dark brown or dark reddish brown
approaching black but with the apical 1/4 distinctly paler ........ 12

12 Elytra a fairly uniform reddish brown ...................... \textit{P. rufipennis}
12' Elytra dark brown or dark reddish brown to nearly black with the apical 1/4 distinctly paler, either light reddish or yellowish brown.  ... P. bechynei

13 Basal 1/3 of the pronotum with dense to moderately dense recumbent white pubescence forming a transverse patch, sometimes interrupted at middle and continuing anteriorly to about middle of pronotum, setae either very fine in texture and somewhat difficult to see (figure 7.14 C and D) or thick in texture and very obvious (figure 7.14 E and F) ....

.................................................................14

13' Basal 1/3 of pronotum without dense recumbent white pubescence and not forming a distinct patch, at most a few scattered white setae .... 19

14 Dense recumbent white pubescence at basal 1/3 of the pronotum very fine in texture, setae bifurcate and appearing to arise from both tubercle apices and surrounding surface .................................15

14' Dense recumbent white pubescence at basal 1/3 of the pronotum very coarse and thick in texture, setae arising distinctly from tubercles only ... 18

15 Elytra reddish or chestnut brown ................................. P. assumentum

15' Elytra black or dark brown ...........................................16

211
16  Erect or suberect pronotal setae dark brown or black; elytral punctures large and interstriae narrow and slightly convex. Argentina and Brazil ... 17

16' Erect or suberect pronotal setae light brown; elytral punctures very fine and interstriae large and flat. Venezuela ................................. P. jolyi

17  Fine recumbent white setae at pronotal base usually quite distinct (figure 7.14 D); elytral setae similar in color except for those along suture usually distinctly lighter in color; antennae relatively elongate; elytra black or nearly so .................................................. P. calileguaensis

17' Fine recumbent white setae at pronotal base usually very obscure and difficult to see (figure 7.16 A); elytral setae similar in color throughout except sometimes a few setae at base slightly lighter, antennae relatively robust; elytra dark brown ........................................ P. obrienorum

18  Elytra light reddish or chestnut brown; white pronotal setae at basal 1/3 forming a transverse band which extends anteriorly to dorsal tufts (figure 7.14 F) ........................................ P. expandipronotus

18' Elytra black; white pronotal setae confined to basal 1/3 and not extending anteriorly to dorsal tufts (figure 7.14 E) ...................... P. maculithorax

19  Elytra chestnut brown or bright reddish brown in color ..................... 20

212
19' Elytra dark brown or black in color .............................................. 21

20 Head and pronotum dark in color, black or nearly so; recumbent setae on frons white and concentrated in a distinct band adjacent to inner margin of each eye .................................................... P. glabrihumeralis

20' Head and pronotum reddish brown in color; recumbent setae on frons yellow and concentrated on anterior and posterior margins of the frons and vertex region with a sparsely setose area between eyes .................. P. castaneus

21 Pronotum bicolored, cuticle very slightly to distinctly lighter at both anterior and posterior margin of pronotum at a minimum, sometimes extending up to anterior 1/3 and posterior 1/4 of the pronotum, usually very dark brown to black at middle and dark reddish brown to brown at anterior and posterior; elytral setae a single color, pale to brown; males with very large eyes (figure 7.16 B) ......................... P. oculigrandis

21' Pronotum only a single color throughout, either dark brown to black; elytral setae either one or two separate colors; males with normal sized eyes ................................................................. 22

22 Elytra with a distinct bronze metallic sheen, usually with a slight greenish or yellowish tint ................................................................. 23
22' Elytra without a metallic sheen ................................................................. 24

23 Body relatively broad (figure 7.15 A) and antennomeres elongate (figure 7.17 D); frons and vertex with erect setae dark brown and short recumbent or appressed setae widely scattered, surface covered with distinct shallow punctures; male genitalia as in figure 7.9 D-F .................................

........................................................... P. submetallicus ♀

23' Body relatively elongate (figure 7.15 D) and antennomeres relatively short (figure 7.17 C); frons and vertex with erect setae pale yellow to white and short recumbent or appressed setae dense and obscuring surface, surface granular and shallow punctures absent or indistinct; male genitalia as in figure 7.10 A-C ................................. P. aeneus

24 Elytra black; eyes relatively large in the male (figure 7.17 B) ................. 25

24' Elytra dark brown; eyes relatively small in the male ........... P. obrienorum

25 Eyes large (figure 7.17 B) ................................................................. P. donckieri ♂

25' Eyes small ............................................................... 26

26 Body elongate; appressed setae on basal half of elytra dark ... P. donckieri ♀
Prosternoptinus aeneus New Species
Figures 7.10 A-C, 7.15 D, 7.17 A and C

Diagnosis. This species is distinctive by the slight greenish-bronze reflection on the black elytra. *P. donckieri* (Pic) has a similar elongate body shape in the male but lacks the metallic sheen on the elytra. Males of these two species can also be separated by the less elongate antennomeres and the smaller eyes in *P. aeneus* (figure 7.17 A and C). Also, the parameres of *P. aeneus* are narrower basally and more rounded apically (figure 7.10 A). In lateral view (figure 7.10 B), the parameres are also curved towards their apices to a much greater extend than in *P. donckieri*. Another species, *P. submetallicus*, has a similar metallic sheen but has a relatively stout body shape (figure 7.15 A) and the genitalia are quite different (figure 7.9 D-F). While the fourth ventrite in *P. aeneus* is completely granulate, those of *P. donckieri* and *P. submetallicus* have the fourth ventrite with a smooth surface at middle. One last characteristic that appears useful is the frons with a granular surface and indistinct shallow setose punctures.

Description. Length = 2.3-2.4 mm (n=4). Head, pronotum, and elytra black or nearly so, antennae black or basally black and apically brown or reddish brown, mouthparts slightly lighter and sometimes yellowish.
Head. Frons and vertex with scattered erect pale yellow or white setae, short basally bifurcate recumbent or appressed setae similarly colored densely scattered and largely obscuring surface sculpture, surface between eyes very granular and finely irregular, large shallow punctures absent or at most very indistinct, groove between carinae very broad, width including carinae equal to 3-4 times ommatidial diameter, sometimes continuing posteriorly as a shallow depression on anterior portion of frons; antennae moderately elongate, large appressed setae reddish brown except those on scape and sometimes some on second and third antennomere yellow.

Pronotum. Covered with scattered moderately projecting tubercles, each with an erect or suberect dark brown seta, at middle tubercles usually separated by 0.5 times their own diameters or slightly more, surface between tubercles shiny; anterior 1/3 with elongate irregular punctures, surface rough and irregular, little or no smooth surface visible between punctures and tubercles; dorso-lateral tufts loose with setae slightly converging, dorsal tufts very distinct with setae strongly converging; row of transverse punctures at basal margin forming a nearly continuous groove but interrupted irregularly by shallow ridges and tubercles, anterior to groove scattered fine appressed and recumbent yellowish colored setae on basal 1/3, setae anteriorly directed.

Elytra. Smooth and shiny between punctures, intervals slightly convex, basally appearing very rough, humeral angles slightly produced; punctures longitudinally elongate, at middle about 2.0 times as long as wide, each separated from the following by a distance equal to 0.5 times their own length or slightly more, puncture rows separated by about 2.5-3.5 times their width; appressed elytral setae
dark brown, erect setae a blend of white or nearly white setae interspersed with the more numerous dark brown setae, dark setae more prevalent on dorsal surface while pale setae more numerous laterally except at apex, anterior margin of each puncture with a depressed seta which usually reaches insertion point of the following puncture, rows of long slender erect setae about 3.0 times as long as the width of one elytral interval; apical margin with a narrow band of granulations of moderate length; scutellum large and chordate shaped and covered with appressed white setae.

Ventral Surface and Legs. Mostly covered with fine granulations and shallow punctures, metasternum fairly smooth at middle with a few small scattered punctures except at anterior margin and laterally with a few moderate or small sized shallow indistinct punctures separated by 1-2 times their diameters, remaining surface densely granulate, longitudinal invagination at base moderately deep and narrow, extending nearly 1/2 metasternal length, surrounding surface concave; mes- and metepisternum densely covered with white recumbent setae; ventrites with moderately dense recumbent setae, also longer scattered depressed setae, both light brown to nearly white, first two sutures very distinct; on second ventrite surface at middle fairly smooth, moderate sized round or ovoid shallow punctures not very numerous, most separated from 1.5-2.0 times their own diameters, remaining surface with more numerous small punctures and some granulations; legs covered with light brown to nearly white suberect and appressed setae.

Male Genitalia. Elongate, parameres narrow, narrowest near apical 1/3; aedeagus parallel sided with a broadly rounded tip (figure 7.10 A-C).

Sexual Dimorphism. Unknown.
Type Material. Holotype: male- Brazil, Paraná, Jundiaí do Sul, Fazenda Monte Verde, 17.XI.1986, Lev. Ent. Profaupar, Malaise; Paratypes: 1 male- same data as holotype; 1 male- same data except 03.XI.1986 (all DZUP).

Distribution. The only known locality is Fazenda Monte Verde, Jundiaí do Sul in Paraná, Brazil.

Discussion. Females have not been associated with this species and it is unknown if they will have the distinctive green-bronze sheen which gives this species its specific name. Females of *P. submetallicus* lack the metallic coloration of males. I suspect females of *P. aeneus* may be difficult to differentiate from *P. donckieri* or possibly *P. submetallicus*. Placing specimens in hot water does not affect the reflection as has been observed in other metallic colored beetles.

*Prosternoptinus argosomos* New Species

Figures 7.1 A, 7.6 D-F, 7.14 B

**Diagnosis.** The black coloration and the elytral maculation consisting of a single patch on each elytron at the humeral angle (figure 7.1 A) will diagnose this species. Additionally, the white setal triangular patches on the frons by each eye will further help to verify the identity of this taxon.
**Description.** Length = 1.7-1.9 mm (n = 8). Color black except for legs (especially tibia and base of femora) and the ventral surface of the head reddish black, mouthparts yellowish brown to reddish black.

Head. Frons and vertex with scattered, erect and moderately long brown setae, dense patch of short white recumbent setae roughly in a triangular shape, starting at the middle of the inner margin of the eye and expanding both obliquely posteriorly towards, but not reaching, middle of the vertex and around each eye, completely surrounding dorsal eye margin; each patch separated on vertex by a distance about equal to length of antennal scape; frons with moderately large shallow setose punctures, nearly equal in diameter to 3 times the diameter of one ommatidium, surface rugose but not granulate at middle, slightly finer texture on vertex and clypeus, labro-clypeal suture very distinct; interantennal carinae distinct with a longitudinal groove continuing posteriorly but somewhat indistinctly onto frons; antennae robust and moderately long, large appressed setae brown to dark brown, similar in color on all antennomeres.

Pronotum. Covered with scattered moderately projecting tubercles, each with an erect or suberect brown or dark brown setae, at middle tubercles separated by 1.0-1.5 times their diameters, surface between tubercles shiny; anterior 1/3 with small irregularly shaped punctures, smooth surface visible between tubercles and punctures; dorso-lateral tufts distinct with setae converging, dorsal tufts similar, transverse punctures at the basal margin forming an incomplete groove, sometimes interrupted quite broadly, anterior to this white basally bifurcate setae extending anteriorly into dorsal tufts and sometimes concentrated there, other setae occasionally present lateral of tufts.

219
Elytra. Smooth and shiny between punctures, intervals slightly convex, basally appearing slightly rough, humeral angles not strongly produced; punctures longitudinally elongate, at middle about 3 to 4 times as long as wide, each separated from the following by a distance about equal to their length, puncture rows separated by about 4 times their width; elytral setae brown to dark brown in color, anterior margin of each puncture with a depressed, setae, which usually and distinctly does not reach the margin of the following puncture; rows of long slender erect interpuncture setae, the longest of which are 2 to 2.5 times as long as one elytral interval; each elytron with a patch of dense, white, recumbent setae at humeral angle, on basal 1/4 near base beginning on third interval and extending laterally onto declivity on the seventh interval; apical margin with a narrow moderately long band of granulations; scutellum large and chordate shaped with appressed white setae.

Ventral Surface and Legs. Mostly covered with very fine granulations and shallow punctures, metasternum at middle smooth except at anterior margin, laterally punctures small, becoming smaller distally and very closely spaced with many in contact; mes- and metepisternum densely covered with white recumbent setae; ventrites with moderately dense, fine, recumbent, white setae, also longer scattered depressed setae, both light brown, first two sutures obscured at middle; on second ventrite at middle, shallow punctures on ventrites moderate to small, smaller punctures 1/3 diameter of larger punctures and densely surrounding large punctures, without any smooth surface remaining, larger punctures separated from each other by a distance equal to 1 to 2 times their diameters; legs covered with white
recumbent appressed setae and mainly yellow or pale brown, suberect, setae; femora distinctly strongly clavate.

Male Genitalia. Relatively short, parameres narrow, approximately parallel sided from basal 1/3; aedeagus broad, widest at apex (figure 7.6 D-F).

Sexual Dimorphism. Both sexes are similar in external morphology.

Type material. Holotype: Panama, CZ, Paraiso, Apr. 24, 1911, E. A. Schwarz.
Paratypes: same locality except Apr. 21 (1), Apr. 22 (3), Apr. 28 (1), and May 4 (1) (all NMNH).

Distribution. Currently known only from the Canal Zone, Panama.

Etymology. This species is named from the combination of the Greek words for white (argos) and shoulder (omos) in reference to the maculations on the humeral angles of the elytra.

Discussion. No specimens of this species are known to have been collected since the type series by E. A. Schwarz in 1911.

Prosternoptinus assumentum New Species

Figures 7.5 A-C, 7.14 C

Diagnosis. The fine white recumbent setae at the base of the pronotum will differentiate this species from the only two other species which are also completely

221
chestnut brown in color and lack white elytral maculations. But in contrast to *P. assumentum* from Venezuela, both *P. glabrihumeralis* from Costa Rica and *P. castaneus* from Brazil lack the triangular white setal patches on frons by each eye, although *P. glabrihumeralis* does have short white setae concentrated around the eye margin. One other predominantly brown species, *P. bicolor*, is similar in appearance but has a dark, triangular shaped cuticular maculation on the elytral base. Since both *P. bicolor* and this new species are known from Venezuela, teneral specimens of the former may look similar to the latter. But the white setal patches on the frons of *P. assumentum* should differentiate the two species.

Description. Length = 1.8-1.9 mm (n = 2). Elytra, legs, except sometimes part of metacoxae, and mouthparts reddish brown, tarsi slightly darker than the rest of the leg; ventral surface, pronotum, and head ranging from reddish-brown to brownish-black, with head, prothorax, and sternites slightly to much darker color than the elytra.

Head. Frons and vertex with scattered, suberect, brown or light brown setae of moderate length, dense patch of short white recumbent narrow setae roughly in a triangular shape starting at the middle of inner margin of each eye and expanding both obliquely towards, but not reaching, middle of frons and around each eye to the eye's dorsal apex, each patch about equal in length to eye length and separated at middle by a distance about equal to width of a single patch; surface between eyes rough and granular with several scattered moderately large shallow setose punctures, the largest equal to 2.5 times ommatidial diameter, posterior region of frons at middle without large shallow punctures; vertex and apex of clypeus similar to
anterior portion of frons or more rough and irregular, labro-clypeal suture slightly indistinct; interantennal carinae small but distinct, continuing as a shallow groove onto frons between eyes; antennae robust and moderately long, large appressed setae brown, similar in color throughout.

Pronotum. Anterior 1/3 slightly lighter in color; covered with scattered slightly projecting tubercles, each with an erect or suberect dark brown seta, tubercles at middle separated by 0.5 to 2.0 times their diameter, distinctly sparser and smaller on anterior 1/3, surface between tubercles smooth and shining; anterior 1/3 with elongate irregular shaped punctures relatively small and with relatively few tubercles, surface distinctly smooth and shiny between punctures and tubercles; at middle four very loose tufts of setae; row of transverse punctures present at the basal margin forming an almost continuous groove anterior to this on the posterior 1/3 dorsally is a transverse patch of white recumbent setae, similar to that on the head, slightly interrupted at middle, laterally slightly more extended distally and less dense, appearing longitudinally oriented and "brushed" forward from posterior to anterior.

Elytra. Very smooth and shiny between punctures, intervals very slightly convex, basally appearing smooth, humeral angles not strongly produced; at middle punctures longitudinally elongate, about two times as long as wide, each separated from the following by a distance about equal to their length, puncture rows separated by about three times their width; elytral setae yellow or light brown, anterior margin of each puncture with a depressed seta which exceeds the margin of the following puncture, rows of long slender erect interpuncture setae, the longest which are 2.5 to 3 times as long as one elytral interval; apical margin with narrow
moderately long band of granulations; scutellum large and chordate shaped and covered with appressed white setae.

Ventral Surface and Legs. Mainly covered with very fine granulations and shallow punctures; smooth at middle of metasternum, anteriorly and laterally with large shallow punctures separated from each other by usually less than their diameters, surrounding surface densely granulate; invagination at base elongate ovoid in shape, extending anteriorly about 1/3 metasternal length, adjacent surface fairly flat; mes- and metepisternum densely covered with white recumbent setae; sternites with moderately dense, recumbent setae, also longer, scattered depressed setae, both yellowish white in color, first two sutures obscured at middle, second ventrite at middle with indistinct shallow punctures, separated from their nearest neighbor by a distance usually equal to 1.0 - 1.5 times their own diameters, remaining surface very granular; legs covered with white or yellowish white, suberect and appressed setae.

Male Genitalia. Relatively elongate, parameres narrow, parallel sided from about middle; aedeagus broad, tapering from apical 1/3 to narrow apex (figure 7.5 A-C).

Sexual Dimorphism. Unknown.

Type Material. Holotype: Sex unknown- Venezuela [Carabobo], Las Trincheras, VI.1922, Collected by L. R. Reynold, Field Mus. (F. Psota Coll.) (FMNH). Paratype: male- with same data as the holotype except collector label absent (FMNH).
Distribution. This species is only known from Las Trincheras in the state of Carabobo, Venezuela.

Etymology. Named from the latin word for patch, in reference to the triangular shaped white setal patches on the frons.

Discussion. The sex of holotype could not be determined externally and was not dissected. If it is indeed a female, the eye size and antennomere lengths are similar in proportion to those of the male paratypes.

Prosternoptinus bechynei Belles

Figures 7.11 A-C, 7.14 A, 7.16 C


Diagnosis. This species has very distinctive pronounced pronotal tubercles (figure 7.14 A). This is especially noticeable when the lateral edges are viewed dorsally. The pronotum is also slightly tumid medially. This swelling is exaggerated by a declivity which extends posteriorly from middle to the posterior 1/3. Finally the apical 1/4 of the elytra, excluding the suture, is distinctly paler in color than the remaining elytra. The apex is usually a light brown and the remaining elytra dark reddish black.
**Description.** Length = 2.2-2.4 mm (n = 8). Head, pronotum, and elytra very dark brown, dark reddish brown to nearly black, apical 1/4 of elytra light reddish or yellowish brown; ventral surface, legs, and antennae reddish brown, ventrites sometimes darker.

**Head.** Frons and vertex with scattered erect brown or dark brown setae, white setae absent, a few short slightly bifurcate pale brown setae present, especially on vertex; frons very rough with some moderate sized shallow setose punctures generally indistinct, the largest equal in diameter to about 3 times ommatidial diameter, vertex with a slightly finer texture, clypeus rough but much finer in texture compared to frons, labro-clypeal suture indistinct, clypeus slightly concave; interantennal carinae present and distinct, very slight indistinct groove extending posteriorly just on to frons, sometimes a slight longitudinal depression at middle of frons between eyes; antennae with moderately elongate antennomeres, large appressed setae brown or dark brown and similar in color on each antennomere, cuticle also similar in color.

**Pronotum.** Anterior 1/4 slightly lighter, covered with scattered strongly projecting tubercles, each with an erect or suberect brown or dark brown seta, at middle tubercles separated by slightly less than their own diameters on average, surface between tubercles shiny; anterior 1/3 with small irregularly shaped punctures, slight smooth or slightly granular surface visible between tubercles and punctures; dorso-lateral tufts indistinct, dorsal tufts with setae slightly converging; at middle pronotum slightly swollen or tumid, appearing as a smoothly rounded bump; row of transverse punctures at basal margin shallow but forming a nearly complete
groove, interrupted slightly but shallowly by frequent small ridges and occasionally small tubercles; anterior to groove white recumbent setae entirely absent.

Elytra. Smooth and shiny between punctures, intervals slightly convex, basally appearing slightly rough, humeral angles not strongly pronounced; punctures longitudinally elongate, at middle about 1.5 times as long as wide, each separated from the following by a distance equal to about 2/3 their own length, puncture rows separated by about 1.5-2.0 times their width; elytral setae dark brown to brown, anterior margin of each puncture with a depressed seta which usually reaches or nearly reaches anterior margin of the following puncture, rows of slender erect interpuncture setae, with the longest about 2-2.5 times as long as the width of one elytral interval; apical margin with narrow but distinctive band of granulations; scutellum large and chordate shaped and covered with appressed white setae.

Ventral Surface and Legs. Mostly covered with fine granulations and large shallow punctures, metasternum at middle smooth except anterior margin and laterally, with moderate to large punctures separated by their diameters or less, surface between punctures granular but not densely so, longitudinal invagination at base narrow, short, about 1/3 metasternal length, surrounding surface flat or slightly concave; mes- and metepisternum moderately densely covered with white recumbent setae; ventrites with moderately dense recumbent setae, also longer scattered depressed setae, both brown or light brown, first two sutures obscured at middle, second ventrite at middle relatively smooth without granulations, shallow punctures on ventrites small, on second ventrite separated from each other by a distance equal to 2 - 3 times their own diameters; legs with a similar reddish brown color
throughout, covered with brown or light brown suberect and appressed setae, suberect setae on tibiae relatively long and well separated.

Male Genitalia. Moderately long, parameres nearly parallel sided, slightly narrowly at middle; aedeagus slightly tapering and moderately narrowly rounded at apex (figure 7.11 A-C).

Sexual Dimorphism. Males have slightly longer antennae and the eyes are larger and more projecting laterally. When viewed from the front, the width of the frons between the eyes is about the same width as the eye in the male whereas in the female the frons is distinctly wider than the eye. The shallow punctures on the metasternum of the male are generally smaller and the surface is relatively smooth compared to those of the female.


Discussion. Bellés (1985) illustrates this species with the appressed elytral setae not reaching the following puncture. This is obviously a variable character in this species. The two specimens I examined do indeed have setae which reach the following puncture. This species has the labial palp apex with bifurcate tips narrowly separated, whereas most species have tips relatively broadly separated. The male holotype and a female paratype are being borrowed for re-examination from the Instituto de Zoología Agrícola, Universidad Central de Venezuela, Maracay.

Prosternoptinus bellesi New Species

Figures 7.2 A-C, 7.4

Diagnosis. The white setal elytral maculations consisting of four patches at the apical 1/3 will separate this species and three others from all the remaining species. On the basal elytral 1/3, both P. tricoratus and P. bordoni have their maculations consisting of a broken "V" on each elytron (figures 7.1 F and 7.2 D) whereas in P. bellesi it is a continuous band (7.2 A-C). In P. bellesi, this band is a fairly distinct "V" shape while on P. theresae it is more of a transverse line (figure 7.2 E and F). The distribution in Venezuela and Trinidad will also help differentiate this species from the Brazilian P. theresae. Moreover, the characteristically very unusually elongate male genitalia will distinguish this species from all similar species.

Description. Length = 2.2-2.7 mm (n = 4). Color black, antennae and tarsi dark reddish-black, mouthparts yellow or pale brown, legs excluding coxae reddish brown.
Head. Frons and vertex with scattered, suberect dark brown to brown setae, the longest about the length of scape, lighter colored and less erect near inner margin of the eyes; white recumbent setae scattered but distinctly more dense around dorsal and inner margin of each eye, extending medially at or near distal margin of frons anterior of level of antennal fossae; frons rough with scattered punctures, equal in diameter to 2 or 3 times an ommatidial diameter; vertex similar in texture to frons, labro-clypeal suture slightly indistinct; interantennal carinae distinct, groove between carinae not extending onto frons, antennae robust and moderately long, large appressed setae on segments 1 through 6 pale to light brown, black and brown setae increase in abundance through to segment 7 or 8, with dark setae on remaining antennomeres.

Pronotum. Covered with scattered, moderately projecting tubercles, each with an erect or suberect dark brown seta, at middle granulations separated by 0.5 to 1.5 times their diameter, surface between granulations shiny; anterior 1/3 with moderate sized irregularly shaped deep punctures, almost no smooth surface visible between tubercles and punctures; dorso-lateral tufts indistinct and setae sometimes very slightly converging, dorsal tufts fairly distinct with setal tips converging; transverse punctures at basal margin almost forming a continuous groove, interrupted occasionally by small tubercles, anterior to this groove are rather sparse fine white setae which extend onto the pronotal disc.

Elytra. Smooth and shiny between punctures, intervals slightly convex, basally appearing moderately rough, humeral angles moderately to strongly produced; punctures longitudinally elongate, at middle about 1.5 times as long as wide, each separated from the following by about 0.5-1.0 their length, puncture rows separated
by 2.0-2.5 times their width, anterior margin of each puncture with a depressed brown setae which reaches the margin of the following puncture, rows of interpuncture setae suberect, the longest of which are slightly more than two times as long as the width of one elytral interval; apical margin paler colored than rest of the elytra, without granulations; scutellum completely covered with appressed white setae; elytron maculations formed by white appressed setae and consisting of an irregular, incomplete, transverse "V" at about basal 1/4 extending from the base of humeral projection to second elytral stria and 2 spots at apical 1/3 between second and fourth intervals and the seventh and ninth intervals.

Ventral Surface and Legs. Covered with scattered shallow punctures, relatively smooth at middle of metasternum, anterior 1/2 and lateral edges with moderate to small punctures separated by usually about 0.5 times their diameters or less, surrounding surface densely granulate; mes- and metepisternum densely covered with white recumbent setae; sternites with a moderately dense fine recumbent setae, also longer scattered suberect setae both tan or pale brown, first two sutures indistinct at middle, second ventrite at middle quite smooth except for large and medium sized ovoid shallow punctures separated by about 1-2 times their diameters; legs covered with white or yellowish white suberect and appressed setae, tarsi with brown setae.

Male Genitalia. Extremely elongate, parameres narrow, parallel sided from basal 1/4; aedeagus widest near apex, tip abruptly narrowing, apex truncate (figure 7.4).

Sexual Dimorphism. Female antennomeres are slightly more robust and shorter. Eye size is similar in both sexes.

231

Distribution. This species is known from northern Venezuela and Trinidad.

Etymology. Named after my colleague Xavier Bellés, whose work on ptinines and his assistance during the beginning of my work on the Ptininae was of great assistance.

Discussion. This species is closely related to P. bordoni and P. tricoratus. It may be mistaken for either one of these two species if the white elytral setae on the basal 1/3 of the elytra is abraded or matted. With careful examination, the elytral setae or their insertion points on the surface will be visible. Perhaps the most distinctive characteristic is the exceedingly long male genitalia. No other species have genitalia which approach the elongate shape of P. bellesi.

Prosternoptinus bicolor Bellés

Figures 7.1 C, 7.12 D

angles (7.1 D) and the elytral setae are about as long as three to four elytral intervals.

Male genitalia are moderate in length and the parameres nearly tapering throughout their entire length; aedeagus parallel sided except for apical 1/6 where it abruptly tappers to a very narrowly rounded tip.


Distribution. This species is known only from the state of Aragua, in Venezuela.

Discussion. The single type is being sent for re-examination from the Instituto de Zoología Agrícola, Universidad Central de Venezuela, Maracay.

*Prosternoptinus bordoni* Bellés

Figures 7.2 D, 7.12 A and B


**Diagnosis.** This species is recognizable by the white maculation at the anterior 1/3 of each elytron in the shape of a disjunct "V" (figure 7.2 D). This is close to *P. tricoratus* in general appearance but the two species can be separated by differences given in the key. Moreover, these two species may be easily separated by the following differences in the male genitalia: the median lobe has a truncate tip
**Diagnosis.** This species is recognizable by the white maculation at the anterior 1/3 of each elytron in the shape of a disjunct "V" (figure 7.2 D). This is close to *P. tricoratus* in general appearance but the two species can be separated by differences given in the key. Moreover, these two species may be easily separated by the following differences in the male genitalia: the median lobe has a truncate tip (instead of rounded in *P. tricoratus*), is expanded around the apical 1/3 (instead of parallel sided), and is the same length as the parameres (not distinctly longer). Additionally, the parameres are slightly but distinctly enlarged apically (instead of parallel sided), the inner arms of the spiculum gastrale are elongate (instead of short and stout), and internally the arms are separated by a deep cleft (not shallowly emarginate) (figures 7.12 A, B, 7.3 D-F).

**Description.** Length = 2.0 - 2.3 mm (n=5). Body black, appendages reddish brown to dark reddish brown.

**Head.** Frons and vertex with scattered erect dark brown setae of moderate length, short white basally bifurcate recumbent setae also widely scattered on surface but not densely so, more numerous above antennal fossae and along anterior margin of eye, surface between eyes rough with numerous moderately large shallow setose punctures each about 2.5 times ommatidial width, vertex with finer texture, clypeus more rough and irregular, labro-clypeal suture distinct; interantennal carinae small but distinct; antennae robust and moderately long, large appressed setae yellow on antennomeres 1-5, dark brown on 7-11, apical 1/2 to 2/3 of ultimate antennomere and basal antennomeres excluding scape lighter in color than base.
Pronotum. Covered with scattered moderately projecting tubercles, each with an erect or suberect dark brown seta, at middle tubercles separated by about their own diameters, smaller granulations present at middle, anterior 1/3 coarse and irregular but with some smooth surface between punctures and tubercles, surface between tubercles shiny; dorso-lateral tufts loose and indistinct, dorsal tufts largely absent; row of transverse punctures at basal margin separate and not forming a continuous groove, anterior to this on basal 1/2 are scattered recumbent basally bifurcate moderately fine white setae, more dense towards posterior, somewhat randomly oriented.

Elytra. Moderately smooth and shiny between punctures, moderately convex interpuncture surface, basally appearing coarse, punctures longitudinally elongate, about 2 times as long as wide, each separated from the following by a distance equal to about 1/2 their length, puncture rows separated by about twice their width; anterior margin of each puncture with a depressed black seta which reaches the base of the following seta; rows of long slender erect black interpuncture setae 3-4 times as long as width of one elytral interval; apical margin with few or no granulations; large white elytral maculations consisting of recumbent setae in two ovoid patches at posterior 1/3 of each elytron, inner dorsal patch located mainly on 3rd and 4th interval, at anterior 1/3 beginning at first puncture row and forming a disjunct or continuous line in the shape of a "V" dorsally, continuing laterally as a generally transverse line to the 9th interval; scutellum large and chordate shaped and covered with appressed white setae.

Ventral Surface and Legs. Mainly covered with fine granulations interspersed with large very shallow ovoid punctures usually separated from each other by less
than their own diameters; metasternum smooth at middle except at anterior, longitudinal invagination at base elongate and narrow, extending to about the middle of metasternum; mes- and metepisternum densely covered with white recumbent setae; ventrites with moderately dense recumbent setae, also longer scattered depressed setae, both pale yellow or white; shallow punctures very distinct, slightly elongate and widely scattered, separated from each other by about 1-2 times their diameters; legs with coxae black, tarsomeres black or nearly so and remaining leg reddish brown, covered with white or yellowish white, suberect and appressed setae, femora strongly clavate, apices with a loose patch of erect or suberect setae.

Male Genitalia. Moderately long, parameres broadest near apex at about apical 1/5; aedeagus truncate (figure 7.12 A and B).

Sexual dimorphism. Unknown but probably at most only slight antennal and eye size differences between the sexes.

Holotype. Labeled: Venezuela, Carabobo, Cerro El Café, La Entrada, 1000 m, 6.11.1971, Bordón leg. (Carlos Bordon Collection, Maracay).

Material Examined. Paratype: 1 female- same data as holotype (IZAV).

Distribution. Venezuela: Carabobo, Cerro El Café and Chirqua; Dto. Los Caracas.

Discussion. It is possible that the female paratype collected in Los Caracas may be a female of _P. bellesi_, as these species appear similar. This is especially true if the recumbent white setae at the base of the elytra are abraded. Loan of this type
specimen is pending from the Instituto de Zoología Agrícola, Universidad Central de Venezuela, Maracay. Even more specimens are needed to know the possible variability in shape of the basal elytral maculation, regardless of whether abrasion has occurred.

Prosternoptinus calileguanensis New Species

Figures 7.14 D

Diagnosis. This species has a characteristic white maculation on the pronotum. At basal 1/3 on each side of middle is a dense patch of white setae extending both to the lateral edge and anteriorly, forming a triangular shape. This is similar to *P. expandipronotus* but the setae on this new species are much finer and do not extend onto the anterior 1/2. The black body color is like that of *P. maculithorax* but the finer setae and the interruption at middle dividing the maculation into 2 distinct patches will differentiate the two species. This new species could also possibly be mistaken with *P. obrienorum*, but the much finer and more obscure pronotal setae and the smaller more longitudinally rounded body shape of the latter species will differentiate these taxa.

Description. Length = 2.4 mm (n=1). Head, pronotum, elytra, and ventral surface black or nearly so, legs and antennae reddish brown or dark reddish brown, metacoxae very dark reddish brown, palps yellowish brown.

Head. Frons and vertex with scattered erect dark brown setae, short usually bifurcate recumbent or appressed white setae moderately dense just anterior of
antennal fossae and on posterior 1/2 of frons and vertex except at middle, relatively sparse in a broad band between eyes; surface between eyes irregular with very numerous moderate sized shallow setose punctures, usually about equal to 2 times an ommatidial diameter, some small smooth areas between punctures, clypeus with a similar texture, vertex similar but with a finer texture, granulations absent; interantennal carinae moderately distinct, groove between carinae extending posteriorly onto anterior margin of frons; labro-clypeal suture very distinct; antennae relatively elongate, large appressed setae dark brown except white on scape.

Pronotum. Covered with scattered moderately projecting tubercles, each with an erect or suberect dark brown to black setae, at middle tubercles separated by 0.5-1.0 times their own diameters, surface between granulations shiny; anterior 1/3 with elongate irregular punctures, tubercles relatively small, smooth surface easily visible between punctures and tubercles; dorso-lateral tufts loose and indistinct, dorsal tufts similar; row of transverse punctures at basal margin not forming a complete groove and sometimes slightly oblique, frequently separated by ridges and tubercles; anterior to groove a dense patch of white basally bifurcate setae, distinctly interrupted at middle and extending onto lateral declivity although more sparsely so, setae on each side extending anteriorly to near middle in a narrowing band and forming a triangular patch, setae generally oriented towards anterior, although sometimes very obliquely so.

Elytra. Smooth and shiny between punctures, intervals slightly concave, basally appearing slightly rough, humeral angles moderately strongly produced; punctures longitudinally elongate, at middle about 1.5 times as long as wide, each separated from the following by a distance usually equal to their own length or
sometimes slightly less, puncture rows separated by 3.0-4.0 times their own width; elytral setae dark brown to black, usually not reaching anterior margin of the following puncture on first and second rows, while setae on third or fourth usually reaching puncture margin, rows of long slender erect setae about 3 times as long as width of one elytral interval; apical margin with very short band of granulations; scutellum large and chordate shaped and covered with appressed white setae.

Ventral Surface and Legs. Mostly covered with fine granulations and moderately large shallow punctures, metasternum smooth at middle except anterior margin, laterally large punctures closely spaced, separated by 0.5-1.0 times their diameters, longitudinal invagination at base shallow narrow and indistinct, extending anteriorly nearly 1/2 metasternal length, surrounding surface concave; mes- and metepisternum densely covered with white recumbent setae; ventrites with moderately dense recumbent setae, also longer scattered depressed setae, both light brown, first two sutures completely absent at middle, on second ventrite at middle surface with punctures at numerous punctures of various sizes, very closely spaced and often adjacent except for a small smooth area; legs covered with tan colored suberect and appressed setae.

Male Genitalia. Unknown.

Sexual Dimorphism. Unknown.

Distribution. This species is known only from the holotype collected in Calilegua National Park, in Argentina.

Etymology. This species is named after the National Park in Argentina where the type was collected.

Discussion. This species is known only from a single female. The very distinctive nature of the pronotal maculation together with the black color make me confident as to the specific status of this specimen.

*Prosternoptinus castaneus* New Species

Figure 7.7 A-C

**Diagnosis.** The completely brown body color and the lack of white setae on the frons should diagnosis this species. Additional characters include the distinct interantennal carinae and the metepisternum with relatively sparse setation similar to that on the metasternum. Sometimes the distal area of the metasternum adjacent to the elytral epiplura does have dense setation but the proximal area does not.

**Description.** Length = 2.0-2.4 mm (n = 7). Body light reddish brown, basal 2/3 of pronotum and ventral surface sometimes distinctly darker, palps yellowish brown.

Head. Frons and vertex with scattered erect brownish or yellowish-white setae, short bifurcate recumbent or appressed setae of similar color scattered
moderately densely throughout frons and vertex but less dense in a very broadly between eyes but not including area laterally adjacent to eyes; surface between eyes very rough and granular with numerous moderate sized somewhat indistinct shallow setose punctures, the largest of which is equal in diameter to about 2 times ommatidial diameter, vertex with a much finer texture, clypeus slightly less rough than frons; interantennal carinae present and very distinct, groove between carinae not extending to frons; antennae slender and moderately elongate (female) to elongate (male), large appressed setae sparse, brown on proximal antennomeres becoming yellow or pale yellow towards apex or pale yellow throughout.

Pronotum. Covered with scattered moderately projecting tubercles, each with a light brown to pale yellow seta, at middle tubercles separated by 0.5-1.0 times their own diameters, surface between tubercles shiny, anterior 1/3 with coarse numerous irregular shallow punctures, slight amount of smooth surface visible between punctures and tubercles, tubercles slightly smaller on anterior 1/3; dorso-lateral tufts loose but distinct with setae converging, dorsal tufts very distinct with setae strongly converging; row of transverse punctures at basal margin forming a nearly continuous narrow groove with frequent but usually shallow interruptions; anterior to this no short recumbent bifurcate setae.

Elytra. Smooth and shiny between punctures, intervals slightly convex, basally appearing slightly rough, humeral angles moderately produced; punctures longitudinally elongate, at middle about 1.5 times as long as wide, each separated from the following by a distance equal to 0.5-1.0 times their own length, puncture rows separated by about 2.0-3.0 times their width; elytral setae pale to brownish yellow, anterior margin of each puncture with a depressed brown seta which reaches
the anterior margin of the following puncture, rows of long slender erect setae about 2.0-3.0 times as long as the width of one elytral interval; apical margin with a long narrow band of granulations extending to elytra become parallel or subparallel; scutellum large and chordate shaped and covered with appressed white setae.

Ventral Surface and Legs. Mostly covered with fine granulations and moderate to small granulations, metasternum smooth at middle but basally a few to several small punctures, anteriorly margin slightly coarser, laterally punctures dense, larger punctures separated by less than their own diameters; longitudinal invagination at base deep, moderately broad, extending about 1/2 metasternal length, surrounding surface flat to slightly concave; mes- and metepisternum not densely covered, usually similar to that on metasternum or slightly denser but sometimes more dense on distal 1/2 adjacent to elytra; ventrites with moderately dense recumbent and longer scattered depressed setae, both pale yellow, first two sutures broadly obscured at middle to visible, on second ventrite granulations slightly less numerous and variable sized punctures separated from their neighbor by a distance equal to 1-2 times their maximum diameters; legs with pale yellow suberect and appressed setae, suberect setae on apex of femora longer.

Male Genitalia. Moderately long, parameres parallel sided on apical 1/3; aedeagus very broad, parallel sided, apex nearly truncate (figure 7.7 A-C).

Sexual Dimorphism. The eyes in the male are slightly smaller and the antenomemeres are slightly longer compared to the female.

Type Material. Holotype: male- Brazil, Paraná, Jundiaí do Sul, Fazenda Monte Verde, 03.XI.1986, Lev. Ent. Profaupar, Malaise; Paratypes: 1 male- same data as holotype
except 27.X.1986; 1 female- same data except 20.X.1986, 1 male- same data 
except 06.X.1986 (head and pronotum only); 1 male- Brazil, Paraná, Fênix, Reserva 
Est.-ITCF, 20.X.1986, Lev. Ent. Profaupar, Malaise; 1 male- same data except 
27.X.1986; 1 female- same data except 13.X.1986; 1 male- same data except 
10.XI.1986 (disarticulated) (all DZUP).

Material Examined but not included as types: 2 females- Argentina, Jujuy Prov. 
ground forest, malaise-FIT (CMNC).

Distribution. Currently known from Paraná state in Brazil and Jujuy Province in 
Argentina.

Etymology. Named after the distinctive light reddish brown body color, this species 
is currently the only one known with this relatively light colored and bright 
appearance.

Discussion. The Argentinian specimens are very similar to the Brazilian specimens 
but due to a lack of a male to verify their status they were excluded from the type 
series. The former specimens differ from the latter in the following ways: anterior to 
the transverse pronotal groove there are some depressed setae (instead of none) 
which are angled in an anterior direction; there is slightly more smooth surface 
present between punctures and tubercles on the pronotal 1/3; the longitudinal 
invagination at the base of the metasternum is narrow (instead of moderately broad)
and extends 1/3 the total metasternal length (instead of 1/2); the second ventrite at middle is less granular and covered with numerous small or very small punctures, most of which are separated by less than their diameters or juxtaposed; the setae on throughout the body slightly paler. These differences are considered intraspecific and the these specimens from Argentina are placed in this species at this time.

_Prosternoptinus donckieri_ (Pic)

Figures 7.10 D-F, 7.15 C, 7.17 B, E

_Ptinus donckieri_ Pic 1898:171; Pic 1912:21; Blackwelder 1945:401.

_Prosternoptinus donckieri_ (Pic), Bellés 1985:140.

**Diagnosis.** Males. This is a distinctive species with close affinities to both _P. submetallicus_ and _P. aeneus_. Unlike these other two species, _P. donckieri_ males lack the distinctive metallic sheen on the elytra. Males of _P. submetallicus_ can be separated from _P. donckieri_ by a more elongate body form in the latter (figures 7.15 A and C). Males of _P. aeneus_ can be separated from _P. donckieri_ by the longer antennomeres and larger eyes in the latter (figure 7.17 A-C and E). The frons of _P. aeneus_ is densely covered with recumbent setae throughout and the surface is granular with indistinct shallow punctures. In contrast, the frons of _P. donckieri_ is sparsely covered with setae and the surface has distinct shallow punctures.

The genitalic differences between _P. donckieri_ and _P. submetallicus_ are quite distinct (figures 7.10 D-F and 7.9 D-F). This is not the case in _P. donckieri_ and _P._
aeneus (figure 7.10 A-C). The more subtle differences include parameres broader basally and more pointed apically. For more detail see the diagnosis of P. aeneus.

Diagnosis. Females. Very similar to females of P. submetallicus with a black body color and longitudinally much more convex elytra compared to other species and the respective males. These two species can be differentiated from the others and from each other as outlined under the female diagnosis given under P. submetallicus.

Description. Male length = 2.2-2.5 mm (n = 4). Female length = 2.1 (n = 2). Head, pronotum and elytra black or very dark brown, antennae and legs, excluding both the scapes and coxae reddish brown, but femora distinctly darker, palps yellowish brown, ventrites black.

   Head. Frons and vertex with scattered erect brown setae, very short bifurcate recumbent or appressed white setae scattered on surface but moderately densely on anterior part of frons and in a broad band by inner margin of each eye to vertex, sparse at middle of frons; surface between eyes slightly rough and granular, large shallow setose punctures very indistinct, vertex and clypeus slightly rougher; interantennal carinae moderately distinct, groove between carinae moderately broad, width including carinae 2.5 times ommatidial diameter, continuing posteriorly as a broader shallow depression on anterior portion of frons; antennae elongate (♂) to moderately long (∞), especially apical antennomeres in male, large appressed setae reddish brown throughout.
Pronotum. Covered with scattered moderately projecting tubercles, each with an erect or suberect dark brown seta, at middle tubercles separated by usually 0.5 times or less than their own diameters, surface between tubercles shiny; anterior 1/3 with elongate irregular punctures, surface very rough and irregular with little or no smooth surface visible between punctures and tubercles; dorso-lateral tufts loose with setae slightly converging, dorsal tufts very distinct with setae strongly converging; row of transverse punctures at basal margin large and deep at middle and nearly continuous, distinctly smaller laterally, immediately anterior to groove tubercles sparse, no white setae present on pronotum.

Elytra. Smooth and shiny between punctures, intervals slightly convex, basally appearing moderately rough or slightly irregular, humeral angles slightly produced; punctures longitudinally elongate, at middle about 2.0 times as long as wide, each separated from the following by about 0.5-1.0 times their own length, puncture rows separated by about 2.5 times their width; elytral setae very light brown with a few dark brown or brown on basal 2/3, dark brown to brown on apical 1/3, anterior margin of each puncture with a depressed seta which usually does not quite reach the insertion point of the following puncture, rows of long slender erect setae about 3 times as long as the width of one elytral interval; apical margin with a very narrow and short band of granulations; scutellum large and chordate shaped and covered with white appressed setae.

Ventral Surface and Legs. Mostly covered with fine granulations and moderately large shallow punctures, metasternum mainly smooth at middle except for anterior margin, laterally with moderately sized shallow indistinct punctures, separated by about their own diameters, surrounding surface densely granulate with
some smooth areas, longitudinal invagination at base deep and narrow, extending nearly 1/2 metasternal length, surrounding surface concave; mes- and metepisternum densely covered with white recumbent setae; ventrites with moderately dense recumbent setae, also longer scattered depressed setae, both very pale brown, first two sutures very distinct throughout, on second ventrite at middle very smooth, large shallow punctures widely separated by about 2-3 times their own diameters, smaller punctures more numerous and scattered throughout; legs covered with suberect and appressed setae, suberect setae somewhat sparse.

Male Genitalia. Moderately long, parameres narrow, parallel sided from about apical 1/3, tapering to a point; aedeagus relatively narrow and parallel sided, slightly wider at basal 1/2 (figure 7.10 D-F).

Sexual dimorphism. Females differ from the males in the following ways: the erect setae at the elytral base are slightly longer; the elytra are longitudinally more convex; the antennomeres are slightly shorter; the eyes are much smaller in diameter; the pronota are slightly more elongate.

Material Examined. Holotype: male- Brazil, Goiás, Jataí (Jatahy [sic]), Sept-Nov. 1897 (missing the head) (MHNP); 1 male- Argentina, Buenos Aires Prov., Punta Lara [just S. of La Plata], 30.XI.1962, J. Daguerre (NMNH); 1 female- Paraguay, S. Bernardino [25°16' S, 57°19' W], IX-7, K. Fiebrig collector; 1 female- similar data except IX-12 (both NMNH).

Distribution. This species is known from the Brazilian state of Goiás, Paraguay, and the Argentinian province of Buenos Aires.
Discussion. This is a species with close affinities to *P. aeneus* (Pic), exemplified by their very similar male genitalia and external body morphology. It is possible that the two species may be conspecific if, at a minimum, the eye size, antennal length and genitalic differences are part of the range of variability within this species. Based on the current evidence, this seems unlikely.

Females of this species are very close to females of *P. submetallicus*. Two subtle differences are that females of *P. donckieri* have more dense white setae on frons but fewer white setae on the pronotum, compared to *P. submetallicus*. They also have more reddish brown setae intermixed with the white setae on the basal 2/3 of the elytra. See the remarks under *P. submetallicus* for a more complete discussion. As females are presently unknown for *P. aeneus*, it is possible that they may be difficult to differentiate from either *P. donckieri* or *P. submetallicus*.

*Prosternoptinus expandipronotus* New Species

Figure 7.14 F

**Diagnosis.** The very distinctive pronotum is unique among all known species of *Prosternoptinus*. The pronotum at the anterior 1/3 is expanded anteriorly and dorsally forming a thick transverse ridge (figure 7.14 F). This expansion gradually narrows to approximately 2/5 the total width of the pronotum at the proximal edge. Additionally, the basal 1/3 of the pronotum is covered with thick white or yellowish white setae which extends onto the middle of the pronotum in two narrowing bands on either side of midline. Similar setae are also present on the anterior 1/3 but are much more widely scattered. This new species is also chestnut or reddish brown in
One species similar to this new species is *P. maculithorax* but the normal pronotal shape, the black color and the white setae only on the basal 1/3 of the pronotum differentiate this species. *Prosternoptinus calileguaensis* has a similar pronotal setal pattern but the setae are very fine. Additionally, the pronotum is normally shaped and the body color is black.

**Description.** Length = 2.2 mm (n = 1). Dorsal surface and legs light chestnut or reddish brown; coxae, trochanters, and basal portion of femora slightly darker; Basal 2/3 and anterior margin of pronotum, sternites and middle of ventrites distinctly darker.

Head. Missing.

Pronotum. Covered with scattered moderately projecting tubercles, each with an erect, suberect, or appressed white seta, the shorter less erect setae often appearing slightly flattened; at middle tubercles usually separated by 0.5 times their diameters or less, surface between tubercles shiny and carinate, anterior 1/3 with elongate, irregular punctures, surface among punctures and tubercles slightly rippled, anterior margin expanded anteriorly and curved upwards or dorsally forming a thick transverse ridge just posterior of anterior margin, ridge approximately 2/5 the total width of the pronotum, ridge and anterior margin with numerous erect dark brown setae; dorso-lateral tufts loose but distinct with setae converging, especially on the anterior half, dorsal tufts very distinct; row of transverse punctures at basal margin forming a nearly complete groove, with distinct but narrow and widely spaced interruptions; at middle posterior to groove appressed and recumbent thick or coarse white setae, anterior to groove similar recumbent slightly flattened setae forming a
broad transverse band, setae directed anteriorly or anterio-medially and continuing anteriorly in two broad bands decreasing in width but more erect on either side of midline to middle and partially forming dorsal tufts, similar setae on anterior 1/3 among elongate punctures.

Elytra. Smooth and shiny between punctures, intervals convex, basally appearing slightly rough, humeral angles slightly produced; punctures longitudinally elongate, at middle about 2.0 times as long as wide, each separated from the following by a distance equal to about 0.5 times their own length, puncture rows separated by about 1.0-1.5 times their width, punctures rather abruptly decreasing in size just posterior of middle; elytral setae brown to light reddish brown, distinctly whiter at and posterior to humeral angles, anterior margin of each puncture with a depressed oblique seta which does not reach the anterior margin of the following puncture, rows of long slender erect setae about 2.5 times as long as the width of one elytral interval; apical margin with narrow moderately long band of granulations which nearly reaches lateral and parallel edge of elytra; scutellum large and chordate shaped and covered with appressed white setae.

Ventral Surface and Legs. Mostly covered with fine granulations and moderate sized shallow punctures, metasternum at middle fairly smooth with a few small punctures excluding anterior 1/2, laterally punctures separated by their own diameters, surrounding surface granulate, longitudinal invagination at base shallow and very narrow, extending over 1/3 metasternal length, surrounding surface flat; mes- and metepisternum densely covered with white recumbent setae; ventrites with moderately dense recumbent setae, also longer scattered depressed setae, both tan or light brown in color, first two sutures distinct, not obscured at middle, on second
ventrite small shallow punctures indistinct, variable in size, densely covered with granulations; legs covered with tan or light brown suberect and appressed setae.

Male genitalia. Unknown.

Sexual Dimorphism. Unknown.


Distribution. Known only from the type locality in Paraná, Brazil.

Etymology. Named after the unusually enlarged and anteriorly extended pronotum of this species.

Discussion. Although this species is known from only a single female, it has a very unique pronotal morphology, as outlined in the diagnosis. The thick, recumbent, pronotal setation is another relatively unusual state in the genus and is presently known in only one other species, P. maculithorax.
**Prosternoptinus glabrihumeralis** New Species

**Diagnosis.** Very similar to *P. kryptoambon* but can be easily separated by the absence of white recumbent setose maculations on the humeri. For more differences see the diagnosis given for *P. kryptoambon*.

**Description.** Length = 2.5 mm (n = 1). Elytra chestnut brown, head and thorax black or nearly so, sterna, legs and antennae reddish or brownish black, ventrites chestnut brown, mouthparts yellowish or reddish brown.

Head. Frons and vertex with scattered erect brown or tan setae, short recumbent or appressed bifurcate setae fine white setae not readily apparent, concentrated at distal margin of frons and at inner margin of eyes, extending posteriorly and in a widening band to vertex, also several more setae scattered on remaining surface; surface between eyes with large smooth irregular shaped shallow setose punctures, the largest of which is equal in diameter to about 3 times the ommatidial diameter, punctures continuing onto vertex and clypeus of which the former is only slightly more granulate; interantennal carinae present but not very distinct; antennae very robust and moderately long, base slightly darker than apex, large appressed setae very dense, dark brown to black, becoming shorter in length towards apex, apical antennomere distinctly lighter than others.

Pronotum. Covered with scattered moderately projecting tubercles, each with an erect or suberect dark brown seta, at middle tubercles separated by about 0.5 times their own diameters, surface between tubercles shiny; anterior 1/3 with coarse irregular punctures, some smooth surface visible between punctures and tubercles.
dorso-lateral tufts very loose with setae slightly converging, dorsal tufts very distinct; row of transverse punctures at basal margin interrupted regularly by shallow ridges or tubercles, anterior to groove a few recumbent white setae at middle.

Elytra. Smooth and shiny between punctures, interval flat, basally appearing very smooth, humeral angles moderately produced; punctures longitudinally elongate, at middle very narrow, about 2.0-2.5 times as long as wide, each separated from the following by a distance equal to their own length or slightly less, puncture rows separated by about 5 times their width; elytral setae brown, anterior margin of each puncture with a depressed seta which usually reaches the anterior margin of the following puncture, rows of long slender erect setae about 3 times as long as width of one elytral interval; apical margin without granulations; scutellum large and chordate shaped and covered with appressed white setae.

Ventral Surface and Legs. Mostly covered with fine granulations and large shallow punctures, metasternum smooth at middle except near anterior margin and laterally where punctures are distinct and closely spaced, usually separated by 0.5 times their diameters, smooth to slightly granular between punctures; longitudinal invagination at base shallow and moderately narrow, extending nearly 1/2 metasternal length at middle, surrounding surface concave; mes- and metepisternum densely covered with white recumbent setae, ventrites with moderately dense recumbent setae, also longer scattered depressed setae, both light brown in color, first two sutures completely absent at middle, on second ventrite surface fairly smooth, ovoid or elongate punctures variable in size and moderately numerous, separated from each other by 1-2 times their own diameters, fifth ventrite medially with two slight protuberances on either side of middle, each very slightly obliquely
transverse; legs dark reddish brown, slightly darker than ventrites, covered with light brown and white suberect and appressed setae.

Male Genitalia. Unknown.

Sexual Dimorphism. Unknown.


Distribution. Known only from the single type collected in Guanacoste Province, Costa Rica.

Etymology. This species is named after the lack of white recumbent setal maculations on the humeral angles.

Discussion. This species is known from a single specimen. Surprisingly, no individuals of this species were found in possibly the largest Costa Rican collection, INBio (INBC). Regardless, the very distinctive form leaves no doubt as to its specific status.

Prosternoptinus jolyi Bellés

Figure 7.12 C

Prosternoptinus jolyi Bellés, 1985:140.

254
reddish brown elytra and a very different shaped male genitalia. *Prosternoptinus jolyi* is also similar to *P. calileguaensis* (see the discussion for more details).

The male genitalia are moderately long, parameres are approximately parallel sided from about middle, apices bulbous and curved inwards; aedeagus parallel sided except for apical 1/4 which tapers to a narrowly rounded tip.


Distribution. This species has been collected in Venezuela in the following localities: Cojedes, El Baúl; Carabobo, San Joaquín; Bolivar, Las Nieves.

Discussion. This species may be most similar to *P. calileguaensis* from Argentina, as both are black in body color and have white pronotal pubescence. But *P. jolyi* has robust antennae, fine elytral punctures and large and flat interstria, unlike *P. calileguaensis*. The precise status will have to wait until a specimen of this species can be reexamined. A type is being sent from the Instituto de Zoología Agrícola, Universidad Central de Venezuela, Maracay.

*Prosternoptinus kryptoambon* New Species

**Diagnosis.** This species is easily recognized by the longitudinally elongate white setal maculations on the humeral angles of the elytra together with the reddish
Prosternoptinus kryptoambon New Species

**Diagnosis.** This species is easily recognized by the longitudinally elongate white setal maculations on the humeral angles of the elytra together with the reddish or chestnut brown color of the elytra. It is most similar to *P. glabrihumeralis* except that this latter species lacks elytral maculations. Additionally, *P. glabrihumeralis* does not have distinct transverse setose carinae on either side of middle on the fifth ventrite as *P. kryptoambon* but instead has only slight protuberances. More subtle character differences include the frons and vertex with a similar texture (composed of large smooth punctures) in *P. glabrihumeralis* while the vertex, compared to the frons, is distinctly rough and irregular in *P. kryptoambon*. The elytra punctures at middle are relatively fine in this new species. Each puncture is separated from the following by a distance equal to about their length and the puncture rows are separated from each other by 3-4 times their width. In contrast, *P. kryptoambon* has each puncture separated from the following by a distance equal to 1/3 to 1/2 times the puncture length and the puncture rows are separated from each other by about 2 times their width.

**Description.** Elytra chestnut brown, head and thorax black or nearly so, ventral surface, including legs and antennae brownish or reddish black, mouthparts yellow or pale brown to dark reddish brown.

Head. Surface with scattered, suberect, brown setae of moderate length, a few short, basally bifurcate recumbent white setae at distal margin of the frons; surface between, but not directly adjacent to eyes with relatively large, smooth, but
shallow setose punctures, the largest equal to 3 times ommatidial diameter, clypeus and vertex rough with irregular, generally smaller punctures and granulations, labro-clypeal suture indistinct; interantennal ridge narrow but flat, without a distinct groove but a depression on anterior portion of frons at middle; antennae robust and moderately long, base and apex of each antennomere darker than middle, thickly covered with erect dark brown to black setae.

Pronotum. Covered with scattered slightly projecting granulations, each with an erect or suberect brown seta, at middle tubercles separated by about 0.5 - 1.5 times their own diameters, surface between tubercles shiny; anterior 1/3 with elongate irregular punctures, some smooth surface present between tubercles and punctures; dorso-lateral tufts very loose and indistinct, dorsal tufts similar but with some setae very slightly converging; row of transverse punctures at basal margin forming an almost continuous groove, interrupted occasionally with tubercles, anterior to groove on both basal and anterior 1/3 are only a few barely noticeable white appressed bifurcate setae.

Elytra. Smooth and shiny between punctures, intervals flat, basally appearing fairly smooth, humeral angles moderately produced; punctures longitudinally elongate, about 1.5 to 2 times as long as wide, each separated from the following by 1/2 or slightly less than their total length, puncture rows separated by 1.5 times their width, anterior margin of each puncture with a depressed brown seta which just reaches the margin of the following puncture; rows of long, slender, erect brown interpuncture setae, the longest of which are slightly more than 3 times as long as one elytral interval; apical margin without fine granulations; scutellum large and
chordate shaped and covered with appressed white pubescence, distinctly rising above the level of the elytra and with a longitudinal narrow groove at middle.

Ventral Surface and Legs. Covered with fine granulations and shallow punctures, smooth at middle of metasternum, surrounding surface flat; middle of metasternum smooth, longitudinal invagination at base shallow and narrow, extending more than 1/3 metasternal length; surrounding surface relatively flat anteriorly and laterally with moderate sized punctures, laterally each separated from each other by less than 0.5 to more than 2.0 times their diameters, moderately granulate between punctures; mes- and metepisternum densely covered with white recumbent setae; ventrites with moderately dense, recumbent setae, also longer, scattered, depressed setae, both brownish yellow, first two sutures obsolete at middle, on second ventrite at middle ovoid shallow punctures variable in size, usually separated by a distance equal to their diameters, on fifth ventrite 2 distinct transverse setose carinae on each side of middle, separated by about 1.5-2.0 times their lengths, each one nearly as long as the length of the fourth ventrite; legs covered with pale yellow, suberect and appressed setae, tarsi, especially tarsomere apices much darker than the rest of the leg; femora distinctly, strongly clavate.

Sexual Dimorphism. Unknown.

Male Genitalia. Unknown.

Distribution. *Prosternoptinus kryptoambon* is known from only the type specimen collected in the Canal Zone of Panama.

Etymology. Named after the Greek words for hidden and ridge. This is a reference to one of the more subtle characteristics of this species, which is the partially hidden carina on the fifth ventrite.

Discussion. Although known only from the single female type, males of this species should pose no problem to associate with this specimen because of the distinct color and elytral maculation of this species. It is most likely closely related to the Costa Rican species, *P. glabrihumeralis*. Both species have very similar cuticular color patterns. *P. glabrihumeralis* most obviously lacks the white setal maculation on the elytra and differs in other more subtle ways as outlined in the diagnosis.

*Prosternoptinus maculithorax* (Pic)

Figures 7.5 D-F, 7.14 E

*Ptinus maculithorax* Pic, 1896:45; Pic, 1912:28; Blackwelder 1945:402

*Prosternoptinus maculithorax* (Pic), Bellés 1985:136.

**Diagnosis.** This species is readily recognized by the dense transverse band of thick white recumbent setae restricted to the posterior 1/3 of the pronotum (figure 7.14 E) and the black or nearly black body and reddish brown appendages. The only other black or dark brown species with white setae on the pronotal base are *P.*
*calileguaensis* and *P. obrienorum*. But in these species the setae are relatively fine and basally bifurcate (figure 7.14 C and D). The setae in these two species also are not restricted to the posterior 1/3 but extend to the middle or beyond, and often in 2 distinct longitudinal bands on either side of the midline, unlike *P. maculithorax*.

**Description.** Length = 1.9-2.3 mm (n = 6). Head, pronotum, elytra, and ventral surface black; antennae reddish brown, scape darker; legs reddish brown, coxae distinctly darker and sometimes similar in color to the metasternum.

Head. Frons and vertex with scattered erect and suberect brown or light brown setae, short recumbent or appressed white setae moderately dense, not basally bifurcate, less dense at middle of frons between eyes except occasionally at middle; surface between eyes granulate with numerous shallow somewhat indistinct punctures no larger than 2 times ommatidial diameter, vertex with similar or more granular texture except lacking punctures, clypeus similar in texture to frons; interantennal carinae distinct, groove between carinae extending posteriorly and more broadly onto anterior margin of frons; antennae moderately elongate, large appressed setae a mix of brown and white, although predominantly white apically.

Pronotum. Covered with scattered moderately projecting tubercles, each with an erect or suberect brown or light brown seta, at middle tubercles separated by about 0.5 times their own diameters, surface between tubercles shiny; anterior 1/3 with elongate irregular punctures, tubercles very small or appearing absent, smooth surface present between punctures; dorso-lateral tufts distinct with setae slightly converging, dorsal tufts very distinct with setae strongly converging; row of transverse punctures at basal margin partially obscured by white setae but regularly
interrupted and not forming a complete groove; a dense transverse band of recumbent thick white setae almost as long as setae forming tufts restricted to basal 1/3, white setae also present on margin just posterior of transverse punctures, setae directed anteriorly or antero-medially.

Elytra. Smooth and shiny between punctures, intervals convex, basally appearing moderately rough, humeral angles slightly or moderately produced; punctures longitudinally elongate, at middle about 1.5-2.0 times as long as wide, each separated from the following by a distance equal to 0.5-1.0 times their own length, puncture rows separated by about 1.5-2.0 times their width; elytral setae brown or light brown, anterior margin of each puncture with a depressed seta which nearly reaches or reaches anterior margin of the following puncture, rows of long slender erect setae about 3.0 times as long as the width of one elytral interval, apical margin with a narrow fairly short band of granulations; scutellum large and chordate shaped and covered with white appressed setae.

Ventral Surface and Legs. Mostly covered with fine granulations and large shallow irregular ovoid punctures, each separated by about their own diameters, metasternum only slightly more smooth at middle and with shallow punctures, longitudinal invagination at base narrow, extending anteriorly from 1/3-2/5 metasternal length, surrounding surface concave; mes- and metepisternum densely covered with white recumbent setae; ventrites with sparse recumbent setae, also longer scattered depressed setae, both light brown or paler in color. first two sutures distinct at middle, on second ventrite at middle ovoid or round shallow punctures numerous but moderately to very obscure, usually separated by less than their
diameters; legs covered with light brown or paler colored suberect and appressed setae.

Male Genitalia. Moderate in length, parameres nearly parallel sided from basal 1/3; aedeagus broadest near apical 1/4, rapidly tapering to a somewhat narrowly rounded tip (figure 7.5 D-F).

Sexual Dimorphism. The male antennomeres are slightly more elongate and the male eyes are slightly larger in diameter than those of the female.

Holotype. Female- labeled: Brazil, Bahfa.

Material Examined. 3 males and 2 females- Brazil, Rio de Janeiro, Acc. No. 2966, October (CMNH).

Distribution. This species is only known from Bahfa and Rio de Janeiro in Brazil.

Discussion. This is one of the most distinctive species of Prosternoptinus known. The characteristic pronotal setae and the genitalia make this species difficult to confuse with any other.

Prosternoptinus nigricolor (Pic)

Figure 7.9 A-C, 7.15 B

Ptinus nigricolor Pic 1901:26; Pic 1912:28; Blackwelder 1945:402.

Prosternoptinus nigricolor (Pic) Bellés 1985:140.

262
Diagnosis. The combination of a black body color without any metallic sheen or reflection and the very pronounced pronotal tubercles will separate this species from all others known (figure 7.15 B). Most similar to three other dark colored species (*P. aeneus*, *P. donckieri*, and *P. submetallicus*), *P. nigricolor* differs in several other ways. While *P. aeneus*, *P. donckieri*, and *P. submetallicus* have some of their elytral setae pale in color, those of *P. nigricolor* are all dark brown. The anterior 1/3 of the pronotum in *P. nigricolor* is also slightly more coarse in texture than these other species. The clearly defined shallow punctures on the frons and the stout body shape of *P. nigricolor* are unlike both *P. aeneus* and *P. donckieri*, although this is similar to *P. submetallicus*. But *P. nigricolor* lacks the distinct metallic sheen of *P. submetallicus* (and *P. aeneus*). The genitalia of *P. nigricolor* are also quite unique.

Description. Length = 2.2-2.7 mm (n = 4). Body black or very dark brownish or reddish black. Antennae and legs dark reddish or chestnut brown, palps lighter.

Head. Frons and vertex with scattered erect brown or dark brown setae, short recumbent or appressed white setae relatively sparse, mainly on anterior and posterior margin of frons and vertex, a few present in a broad band between eyes; surface between eyes rough, with numerous very dense large shallow setose punctures, most equal to 2.5-3.5 times an ommatidial diameter, vertex and clypeus with similar texture; interantennal carinae moderately indistinct, antennae moderately robust, large appressed setae moderately abundant, reddish brown throughout.

Pronotum. Covered with scattered strongly projecting tubercles, each with an erect or suberect brown or dark brown seta, at middle usually separated by 0.5-1.0 times their own diameters by some nearly adjacent, surface between tubercles shiny;
anterior 1/3 with irregular shallow punctures, some smooth surface visible between punctures and tubercles; dorso-lateral and dorsal tufts loose and indistinct although dorsal tufts with setae slightly converging; transverse puncture at basal margin forming an incomplete groove, frequently interrupted with narrow ridges that are slightly more shallow than the surrounding surface, just anterior to groove before inclination a sparse cover of short recumbent or appressed yellowish colored setae anteriorly directed.

Elytra. Smooth and shiny between punctures, interval very slightly convex, basally appearing slightly rough and irregular, humeral angles moderately produced; punctures longitudinally elongate, at middle about 1.5-2.0 times as long as wide, each separated from the following by a distance equal to 0.5 or slightly more times their own length, puncture rows separated by about 2.5 times their own width; elytra setae brown or dark brown, anterior margin of each puncture with a depressed seta which does not usually reach the anterior margin of the following puncture, rows of long slender erect setae about 2.5 times as long as width of one interval; apical margin with a narrow but long band of granulations reaching or nearly reaching the parallel lateral edge of the elytron; scutellum large and chordate shaped and covered with appressed white setae.

Ventral Surface and Legs. Mostly covered with fine granulations and moderate to small shallow punctures, metasternum fairly smooth at middle except anterior margin, laterally punctures usually separated by about their own diameters or less, surface somewhat smooth but slightly rippled between punctures, longitudinal invagination at base moderately deep, narrow, extending slightly more than 1/3 metasternal length, surrounding surface slightly concave; mes- and metepisternum
densely covered with white recumbent setae, also longer scattered depressed setae, both white or off-white, first two sutures visible but slightly obscured at middle, on second ventrite at middle ovoid shallow punctures either moderate or small in size, all fairly regularly and densely spaced, separated by their own diameters or less; legs covered with suberect and appressed pale setae, suberect setae on tibiae sparse.

Male Genitalia. Moderately long, parameres nearly parallel sided from about middle, slightly bulbous at apex; aedeagus broad, distinctly narrower through basal 1/2 (figure 7.9 A-C).

Sexual Dimorphism. None.

Material Examined. Holotype: probably female- Argentina, Tucuman, 12.XII.1899 (missing the head) (MHNP); female- Argentina, Salta Province, El Rey National Park, 950 m, Pozo Verde Trail, 10-13.XII.1987, S. & J. Peck, Yungas Forest, sweeping; 1 unknown sex- same data as previous; 1 male- same data except 900m, Rio La Sala, 5.XII.1987, humid chaco forest, night beating (all CMNC).

Distribution. Known only from north-west Argentina in the provinces of Tucuman and Salta.

Discussion. This species includes a group of three species that have quite distinct, strongly projecting pronotal tubercles. This can be a subtle characteristic not always readily apparent upon first examination.
Prosternoptinus obrienorum New Species

Figure 7.8 A-C, 7.16 A

**Diagnosis.** This species has a combination of character states, each of which are not always very apparent or unique. But, together, they readily diagnose this species. This is one of the few species that is dark brown excluding the head and pronotum, which approach black. The legs and mouthparts are reddish brown. The basal 1/2 of the pronotum has several very fine recumbent whitish colored setae, most dense on either side of midline (figure 7.16 A). The interantennnal carinae are very indistinct and the antennae appear quite robust. This species has very small elytral punctures, which at the middle of each elytron are separated by 3.5-4.0 times the puncture width. The male genitalia are also very distinct.

*Prosternoptinus calileguanensis* could also possibly be mistaken with *P. obrienorum*, but the much finer and more obscure pronotal setae and the smaller more longitudinally rounded body shape of the latter species will differentiate these taxa.

**Description.** Length = 1.9-2.0 mm (n = 3). Body dark brown except for the head and pronotum which approach black. The legs, mouthparts, and antennae are reddish brown or dark reddish brown except the apical antennomere is sometimes darker.

Head. Frons and vertex with scattered erect brown to dark brown setae, short basally bifurcate recumbent or appressed white setae relatively dense and randomly scattered; surface between eyes finely rugose with numerous small shallow
setose punctures 1.5-2.0 times ommatidial width, vertex and clypeus with a texture similar to that of frons; interantennal carinae very indistinct or absent, without a groove between carinae; antennae appearing robust, large appressed setae moderately to densely numerous, brown to dark brown and similar in color throughout.

Pronotum. Covered with scattered moderately projecting tubercles, each with an erect or suberect light brown to dark brown seta, posterior setae sometimes lighter in color than anterior setae; at middle tubercles separated by about 0.5-1.0 times their own diameters, usually slightly smaller on anterior 1/3, surface between tubercles shiny; anterior 1/3 with elongate irregular punctures, smooth surface present among punctures and tubercles; dorso-lateral tufts loose with few setae converging, dorsal tufts distinct with setae converging; row of transverse punctures at basal margin not forming a complete groove, interrupted frequently by ridges and tubercles; anterior to this a transverse band of sparse fine recumbent basally bifurcate white setae with their apices directed anteriorly, extending to middle in two narrowing bands.

Elytra. Smooth and shiny between punctures, intervals flat, basally appearing fairly smooth, humeral angles strongly produced; punctures longitudinally elongate, at middle about 1.5 times as long as wide although some approximately round, punctures of inner rows smaller than punctures of outer rows, each separated from the following by a distance equal to about 1.5-2.0 times their own length, puncture rows separated by about 3.5-4.0 times their width; elytra setae dark brown to brown, sometimes paler just around humeral angles, anterior margin of each puncture with a depressed seta which nearly reaches anterior margin of the following
puncture, rows of long slender erect setae about 2.0-2.5 times as long as width of one interval; apical margin with narrow band of granulations; scutellum large and chordate shaped and covered with appressed white setae.

Ventral Surface and Legs. Mostly covered with fine granulations and moderate sized shallow punctures, metasternum fairly smooth at middle except anterior margin, laterally punctures separated by a distance equal to their own diameters; longitudinal invagination at base shallow narrow and lancelet shaped, extending anteriorly about 1/3 or slightly more of metasternal length, very slightly concave around invagination; mes- and metepisternum densely covered with white recumbent setae; ventrites with moderately dense recumbent setae, also longer scattered depressed setae, both yellowish white, first two sutures broadly obscured at middle, on second ventrite ovoid or round punctures variable in size from large to very small and very numerous, punctures moderately to very numerous and contiguous or nearly so, surface smooth between punctures; legs covered with yellowish white suberect and erect setae.

Male Genitalia. Moderately long, parameres slightly wider near apex; aedeagus distinctly tappering to a narrowly rounded tip (figure 7.8 A-C).

Sexual Dimorphism. Both sexes appear similar.

Material examined but not included as part of the type series. 1 female, Brazil, Pará, Santarem, Acc. No. 2966 [2°26' S, 54°42' W] (CMNH).

Distribution. This species is known from Argentina, Jujuy Province and the Brazilian states of Paraná and Pará.

Etymology. Named after my colleagues Charles and Lois O'Brien in recognition of their collecting efforts for Anobiidae, including part of the type series of this species.

Discussion. This species has one of the largest distributions known, ranging from northern Argentina north to the Brazilian state of Pará, in Amazônia. The Brazilian specimens have the antennomeres slightly more robust and with more long appressed setae which together make the antennae look distinctly thicker. This is particularly true with the specimen from Pará. This specimen also differs in two other slight ways. The pronotal tubercles are smaller in diameter on average and the fine recumbent basally bifurcate setae at the pronotal base continue anteriorly to distal margin and forms a second somewhat indistinct transverse band at the anterior 1/3.

Prosternoptinus oculigrandis New Species

Figures 7.7 D-F, 7.16 B

Diagnosis. The pale colored setae throughout the body and the anterior and posterior 1/6-1/3 of the pronotal cuticle slightly paler than the middle are
characteristics of both sexes. Males have very elongate antennae and large eyes. Females, without associated males, are more difficult to diagnose. The longitudinally rounded elytra, granulations instead of distinct shallow punctures on the frons and the relatively long antennomeres will help to identify this species. The large eyed males of *P. oculigrandis* are similar to males of *P. bechynei* except that the very strongly projecting pronotal tubercles and the apical 1/4-1/3 of the elytra distinctly paler in the latter will easily differentiate the two species.

**Description.** Length = 1.7-2.1 mm (n = 6). Body generally very dark brown or nearly black, sometimes with a brownish or reddish tint, anterior and posterior 1/6-1/3 of the pronotum slightly paler than middle, usually very dark reddish brown. Antennae and legs reddish brown, mouthparts reddish or yellowish brown, ventral surface dark reddish brown.

Head. Frons and vertex with scattered erect very light brown or yellowish white setae, short bifurcate recumbent or appressed white setae moderately dense, slightly less concentrated between eyes in females; surface between eyes mainly finely granulate, large shallow punctures absent posteriorly, absent or very indistinct anteriorly, diameters about equal to 1.5-2.0 times an ommatidia, similar appearing texture on vertex and clypeus, frons between eyes convex in female, flat or slightly concave in male; interantennal carinae distinct with a slight groove between which continues more broadly onto anterior portion of frons, carina < 2 ommatidia wide in male, > 2 ommatidia wide in female; antennae elongate, more so in male, large appressed setae moderately abundant, pale colored or white throughout.
Pronotum. Covered with scattered moderately projecting tubercles, each with an erect or suberect very light brown or yellowish white seta, at middle tubercles separated by about their own diameters, tubercles mainly of two sizes, some moderate in size, most small, surface between tubercles shiny; anterior 1/3 with irregular elongate deep or very deep punctures, smooth surface visible between punctures and tubercles although sometimes fine somewhat parallel (usually transversely) ripples or granular texture on surface between punctures; dorso-lateral tufts loose and setae parallel, dorsal tufts with setae strongly converging and tips crossing each other; row of transverse punctures at basal margin very narrow, usually not appearing as a groove and regularly and broadly interrupted by ridges, anterior to this on basal 1/2 a few scattered recumbent or appressed basally bifurcate fine white setae, randomly oriented but generally pointed in an anterior direction.

Elytra. Smooth and shiny between punctures, intervals slightly concave, basally fairly smooth but with a slight irregular surface, humeral angles moderately produced; punctures longitudinally elongate, about 1.5-2.0 times as long as wide, each separated from the following but a distance equal to about 1.5 times their own length, puncture rows separated by about 3.0-4.0 times their width; elytral setae very light brown to yellowish white, anterior margin of each puncture with a depressed seta which usually or nearly reaches the base of the following seta, rows of long erect setae about 2.5-3.0 times as long as width of one elytral interval; apical margin with a narrow to moderately wide, fairly long band of granulations which nearly reaches the lateral edge of elytra, also sometimes extending anteriorly along
suture; scutellum large and chordate shaped and covered with appressed white setae.

Ventral Surface and Legs. Mostly covered with fine granulations and moderately large shallow punctures, metasternum smooth at middle except anterior 1/3, laterally punctures somewhat indistinct, separated by 0.5-1.5 times their diameters or rarely less, surface including punctures sometimes densely granulate, longitudinal invagination at base shallow, moderately narrow and short, extending only 1/3 or less of metasternal length, surrounding surface flat or slightly depressed; mes- and metepisternum densely covered with white recumbent setae; ventrites with moderately dense recumbent setae, also longer scattered depressed setae, both very light brown or yellow, first two sutures obscure at middle, second suture usually more apparent as a line, second ventrite at middle with large and moderate sized ovoid shallow punctures, each separated by 0.5-2.0 times their own diameters and interspersed and sometimes partially covered by very fine punctures, some smooth areas visible; legs covered with white or nearly white suberect and appressed setae, suberect setae on tibia sparse.

Male Genitalia. Relatively short, parameres narrowest near apical 2/5; aedeagus wide, widest near apical 1/3, tapering to a narrowly rounded apex (figure 7.7 D-F).

Sexual Dimorphism. Males have very enlarged eyes and elongate antennae. While the female frons between eyes is transversely convex, the male frons flat or slightly concave. Females also have more longitudinally rounded elytra compared to the narrow or elongate elytra of the males.

Distribution. This species is known only from the type locality in Paraná, Brazil.

Etymology. Named after the extremely large eyes of the male. The size of the eyes in males of this species exceeds that of any other known species of Prosternoptinus.

Discussion. Males of this species are one of the most distinctive with their extremely large eyes. This is similar to males of P. bechynei. Besides these two species, no others in Prosternoptinus have this degree of sexual dimorphism. Although this type of dimorphism occurs in some of the non-ptinine anobiids, the only other ptinines that exhibit this extreme physical difference between the sexes are a minority of species in the genus Ptinus.

Prosternoptinus quadrimaculatus New Species

Figures 7.1 E, 7.6 A-C

Diagnosis. The presence of four white setal maculations on the elytra (figure 7.1 E) and the black body are the easiest way to distinguish this species. Further useful characters include small triangular patches of white recumbent setae by each eye, the anterior 1/3 of the pronotum with relatively large areas of smooth cuticle
between the tubercles and punctures, and the dorsal surface of the pronotum with
two somewhat sparse, white recumbent setal bands oriented longitudinally on either
side of middle.

**Description.** Length = 1.8-2.2 mm (n = 5). Body and antennae black, legs
brown to black; more specifically coxae and femora black and tibiae and tarsi
blackish brown or legs predominantly black except basal 1/2 and the apex of tibia or
etire tibia and tarsi reddish brown.

Head. Frons and vertex with scattered erect brown setae, setae short,
shorter than length of scape; short white basally bifurcate recumbent setae
concentrated in a triangular patch by each eye starting at about the middle of inner
margin of eye and extending dorsally and increasing in width to near vertex, several
more widely and irregularly scattered on frons; surface between eyes rough with
numerous shallow setose punctures 2-3 times ommatidial diameter, vertex with finer
texture, clypeus rough but additionally finely granulate, labro-clypeal suture very
indistinct; interantennal carinae indistinct and not continuous, antennae moderately
robust, large appressed setae brown or light brown at base changing to black or dark
brown by apical antennomere, cuticle similar in color throughout.

Pronotum. Covered with scattered moderately projecting tubercles separated
at middle by about 1/2 to more than their diameters, also tubercles at middle
sometimes noticeably smaller compared to most of the surrounding ones, surface
between tubercles shiny; anterior 1/3 with small punctures and relatively large areas
of smooth cuticle between punctures or tubercles; dorso-lateral setal tufts loose but
distinct with setal tips slightly converging, dorsal tufts also distinct and with setal
tips strongly converging; row of transverse punctures at basal margin continuous
although partially interrupted by granulations within groove, groove widest at middle,
anteoric to this a transverse band of white recumbent basally bifurcate fine setae,
which continues anteriorly as two longitudinal bands on either side of midline up to
anterior 1/3 of pronotum.

Elytra. Smooth and shiny between punctures, intervals flat or slightly
convex, especially near suture, basally appearing quite smooth, punctures very
elongate, about 3 times as long as wide, each separated from the following by a
distance equal to 1/3 to 2/3 their length, puncture rows separated by about 3.5 to 4
times their width; anterior margin of each puncture with a depressed brown to dark
brown setae not quite reaching anterior margin of the following puncture, rows of
interpuncture setae 2 to 2.5 times as long as width of one elytral interval;
granulations on apical margin sometimes present as narrow band or nearly absent;
elytral maculations consisting of white recumbent setae in two patches on each
elytron, on posterior 1/3 an ovoid slightly transverse patch at middle of 3rd or 4th
interval to 6th or middle of 7th, on anterior 1/4 or 1/5 another transverse patch
about 2 times as wide as long from about middle of 3rd interval extending to 7th on
the declivity posterior to humeral angle; scutellum large and chordate shaped and
covered with appressed white setae.

Ventral Surface and Legs. Mostly covered with fine granulations and large
shallow punctures on metasternum and ventrites; metasternum smooth at middle
except for anterior margin, laterally punctures moderate to small, each separated by
1.0-2.0 times their own diameters, surrounding surface densely granulate;
longitudinal invagination at base narrow, extending anteriorly about 1/2 metasternal
length; metepisternum densely covered with white recumbent setae; ventrites with moderately dense recumbent setae, also longer scattered depressed setae, both pale yellow or white, first two sutures obscured broadly at middle, second ventrite at middle somewhat smooth with granulations or ripples but usually less pronounced than those laterally, shallow punctures rounded or ovoid, separated from each other by a distance equal to about 2 times their diameters on average, large punctures sometimes surrounded by many smaller punctures or granulations 1/4 or 1/3 the size, all of which are closely spaced with many nearly in contact with each other; legs covered with white or yellowish white, suberect and appressed setae, femora strongly clavate.

Male Genitalia. Relatively short, parameres curved around apical 1/4 and widest near tip; apex of aedeagus arrow-head shaped (figure 7.6 A-C).

Sexual Dimorphism. Eye size is similar but the female antennomeres are slightly shorter than those of the male.

Distribution. Known from as far north as the state of Michoacan, Mexico south to Guanacaste Province in Costa Rica.

Etymology. Named for the four white setal maculations on the elytra.

Discussion. The specimen from Mexico differs from the others in several ways. The frons is more rugose and the ovoid shallow punctures less well defined. The ventrites have large shallow punctures as the others but they are surrounded by many smaller punctures. It also has an overall more convex body than the other specimens. This variation is similar to that seen in species of another ptinine genus, Niptinus, from Mexico and Central America and so does not appear that unusual. The aedeagus of this species has a very characteristic arrow-head shaped tip.

_Prosternoptinus rufipennis_ (Pic)

Figure 7.11 D-F

_Prosternoptinus rufipennis_ (Pic), Bellés 1985:138.

_Ptinus rufipennis_ Pic, 1931:5; Blackwelder, 1945:402.

Diagnosis. The reddish brown color of the elytra is similar to _P. castaneus_, but the pronotal tubercles are not quite as pronounced. These two species are most easily differentiated though by the eye size. When viewed from the front, the frons between the eyes in _P. rufipennis_ is equal to about 1-1.5 times the width of one eye (in frontal view), while in _P. castaneus_ the frons is equal to about 3 times the eye...
easily differentiated though by the eye size. When viewed from the front, the frons between the eyes in *P. rufipennis* is equal to about 1-1.5 times the width of one eye (in frontal view), while in *P. castaneus* the frons is equal to about 3 times the eye width. The pronotum and head is also distinctly darker than the elytra in *P. rufipennis* compared to the similar coloration throughout in *P. castaneus*. This species has pronounced pronotal tubercles laterally, similar to *P. bechynei* and *P. nigricolor*. Unlike these other two species though, they are not strongly produced dorsally. The elytra of *P. rufipennis* are a bright reddish brown, while those of *P. bechynei* are dark brown or dark reddish brown to nearly black excluding the apical 1/4 which is distinctly paler. The elytra of *P. pecki* are black.

**Description.** Length = 2.4 mm (n = 1). Elytra light chestnut or reddish brown, ventral surface, legs and antennae reddish brown, anterior 1/3 and posterior 1/4 of pronotum dorsally slightly darker, remaining surface of pronotum and head distinctly darker, dark reddish brown to nearly black.

Head. Frons and vertex with scattered erect brown or reddish brown setae, white setae absent, a few short recumbent pale brown setae present, especially on vertex; frons very rough with some moderate sized shallow setose punctures moderately distinct, the largest equal in diameter to about 3 times ommatidial diameter, vertex with a slightly finer texture, clypeus rough but much finer in texture compared to frons, labro-clypeal suture indistinct, clypeus slightly concave; interantennal carinae present and distinct, slight but distinct groove extending posteriorly on to frons and continuing to about posterior margin of eyes; antennae
with moderately elongate antennomeres, large appressed setae reddish brown and similar color on each antennomere, cuticle also similar in color throughout.

Pronotum. Anterior 1/3 and posterior 1/4 distinctly lighter than middle, covered with scattered strongly projecting tubercles laterally, dorsally appearing flattened; each with an erect or suberect reddish brown seta, at middle tubercles separated by about 1/3 than their own diameters on average, surface between tubercles shiny; anterior 1/3 with small irregularly shaped punctures, slight smooth or slightly granular surface visible between tubercles and punctures; dorso-lateral and dorsal tufts indistinct, without converging setae; row of transverse punctures at basal margin shallow but forming a nearly complete groove, interrupted slightly but shallowly by frequent small ridges and occasionally small tubercles; anterior to groove white recumbent setae entirely absent.

Elytra. Smooth and shiny between punctures, intervals flat, basally appearing fairly smooth, humeral angles moderately pronounced; punctures longitudinally elongate, at middle about 1.5 times as long as wide, each separated from the following by a distance equal to about 2/3 their own length, puncture rows separated by about 2.0-3.0 times their width; elytral setae reddish brown, anterior margin of each puncture with a depressed seta which reaches anterior margin of the following puncture, rows of slender erect interpuncture setae, with the longest about 2.0 times as long as the width of one elytral interval; apical margin with narrow but distinctive band of granulations; scutellum raised above elytral surface, large and chordate shaped and covered with appressed white setae.

Ventral Surface and Legs. Mostly covered with fine granulations and large shallow punctures, metasternum at middle smooth except anterior margin and
laterally, with moderate to large punctures separated by about their diameters, surface between punctures granular, longitudinal invagination at base narrow, short, about 1/3 metasternal length, surrounding surface flat or slightly concave; mes- and metepisternum moderately densely covered with white recumbent setae; ventrites with moderately dense recumbent setae, also longer scattered depressed setae, both reddish brown, first two sutures obscured at middle, second ventrite relatively smooth at middle without granulations, shallow punctures small, on second ventrite separated from each other by a distance equal to 2 - 3 times their own diameters, also much smaller punctures scattered throughout; legs dark reddish brown in color, covered with light brown suberect and appressed setae.

Male Genitalia. Moderately long, paramere arms diverging from basal 1/3 and gradually increasing in width to apex; median lobe broad, widest at about apical 2/5, tapering to narrowly rounded apex (figure 7.11 D-F).

Sexual Dimorphism. Unknown, but females may have relatively smaller eyes and shorter antennomeres compared to the males.

Material Examined. Holotype: Male- labeled Brazil, Mato Grosso, Corumbá (MNHN).

Distribution. This species is only known from the Brazilian state of Mato Grosso.

Discussion. Although only known from the single type, this species is very distinctive, both externally and internally in the male genitalia. It shows a close affinity with *P. bechynei*, as both have strongly pronounced pronotal tubercles and similar male genitalia, including the spiculum gastrale.
Prosternoptinus semibrunneus (Pic)

Figures 7.1 D, 7.8 D-F

Ptinus semibrunneus Pic, 1898:170; Pic, 1912:33; Blackwelder, 1945:402.

Prosternoptinus semibrunneus (Pic), Bellés 1985:136.

Diagnosis. This is one of the more distinctive species of *Prosternoptinus* and one of two with basally bicolored elytra. This species is characterized by the basal 2/5 of the elytra, excluding the humeri, with a dark brown or nearly black elongate triangle extending down the suture. The remaining elytra is reddish brown. This dark basal patch is distinct and rather abruptly grades into the lighter color present on the remaining and majority of cuticle. Similar to *P. bicolor*, it can be differentiated by the dark basal patch not including the entire base. Also the elytral setae are equal in length to the width of 3 to 3.5 elytral intervals whereas in *P. bicolor* they equal the width of about 2 intervals.

Description. Length = 1.9-2.1 mm (n = 2). Antennae, head, pronotum, and base of elytra excluding the humeri, and ventral surface very dark brown or black; legs, mouthparts and remaining surface of elytra reddish brown.

Head. Frons and vertex with scattered erect light brown setae of moderate length, slightly shorter than length of scape, short basally bifurcate recumbent or appressed and widely scattered setae off-white or light brown in color, surface between eyes very rough with numerous moderate sized shallow setose punctures, the largest of which is equal in diameter to about 2 times ommatidial diameter,
vertex with finer texture, clypeus rough and similar in texture to frons; interantennal carinae present and distinct, groove between carinae extending posteriorly onto frons and up to about the same level as dorsal margin of eye; antennae moderately robust, large appressed setae reddish brown at base, gradually changing to brown or light brown at antennal apex, cuticle similar in color throughout; labial palp apex with bifurcate tips well separated, mentum with longitudinal ridge.

Pronotum. Covered with scattered moderately projecting tubercles, each with an erect or suberect light brown seta, at middle tubercles separated by about their own diameters, surface between granulations shiny; anterior 1/3 with coarse irregular punctures, basally punctures larger and deeper than those near anterior margin, smooth surface present and most noticeable near anterior margin between punctures and tubercles; dorso-lateral tufts loose but distinct with tips converging slightly, dorsal tufts similar; row of transverse punctures at basal margin few in number and some very elongate, with distinct interruptions and so not forming a complete groove, just anterior to this at middle a few recumbent white basally bifurcate fine white setae with their apices directed anteriorly.

Elytra. Smooth and shiny between punctures, intervals flat, basally appearing fairly smooth, humeral angles strongly produced; punctures longitudinally elongate, about 2 times as long as wide, each separated from the following by a distance equal to about their own length or slightly more, puncture rows separated by about 3-4 times their width; elytral setae light brown, anterior margin of each puncture with a depressed seta which reaches or nearly reaches anterior margin of the following puncture, rows of long slender erect setae about 3 times as long as the width of one
elytral interval; apical margin with narrow band of granulations; scutellum large and chordate shaped and covered with appressed white setae.

Ventral Surface and Legs. Mostly covered with fine granulations and large shallow punctures, metasternum smooth at middle except at anterior margin, longitudinal invagination at base deep, broad and lancelet shaped, surrounding surface concave, invagination extending anteriorly nearly 1/2 metasternal length; metepisternum densely covered with white recumbent setae; ventrites with moderately dense recumbent setae, also longer scattered depressed setae, both brown or light brown, first two sutures obscured at middle, on second ventrite ovoid or round shallow punctures on ventrites variable in size and numerous, many adjacent to each other; legs with a reddish brown color throughout, except coxae slightly darker, covered with light brown suberect and appressed setae, suberect setae on tibiae relatively short, femora strongly clavate.

Male Genitalia. Moderately long, parameres nearly parallel sided from about apical 1/3; aedeagus distinctly tapering to a narrowly rounded tip (figure 7.8 D-F).

Sexual Dimorphism. Unknown.

Holotype. Male- labeled: Brazil, Goiás, Jataí (MHNH).


Distribution. This species is presently known only from the Brazilian states of Goiás and Paraná.
Discussion. This very distinctive species is known from only two males.

*Prosternoptinus submetallicus* (Pic)

Figures 7.9 D-F, 7.15 A, 7.17 D

*Ptinus submetallicus* Pic, 1900:253; Pic, 1912:35; Blackweider, 1945:402.

*Prosternoptinus submetallicus* (Pic), Bellés 1985:139.

Diagnosis. Males: Similar to *P. aeneus* as both have a bronze reflection on the elytra, these species can be separated by the broader body, basally smooth elytra, and the slightly more elongate antennomeres of *P. submetallicus* (figure 7.15 A and 7.17 D). *Prosternoptinus aeneus* has a more elongate body, distinctly rough and irregular elytral bases and more compact antennomeres (figure 7.15 D and 7.17 C). This new species is also similar to *P. donckieri* but the latter species does not have a metallic sheen on the elytra and has distinctly larger eyes (figure 7.17 B). The eyes of *P. submetallicus* are similar in size to those of *P. aeneus* (figure 7.17 A). The male genitalia of *P. submetallicus* are also very distinct compared to these other two species (figure 7.9 D-F).

Diagnosis. Females: Very similar to females of *P. donckieri*. Both species can be differentiated from other species by the anterior 3/5 of the pronotum with dark brown setae and the posterior 2/5 with white setae. Also, the apical 1/3 of the elytra (excluding the lateral margin) has reddish-brown setae. The coarse rough anterior 1/3 of the pronotum with no smooth areas and the elytral punctures rapidly
decreasing in size at middle are an additional verification. The females of *P. donckieri* and *P. submetallicus* can be differentiated by the stouter body of the latter and the appressed setae on the basal 1/2 of the elytra predominantly white or light in color. In contrast *P. donckieri* females have a relatively elongate body and the appressed setae on the elytra on the basal 1/2 mainly brown in color.

**Description.** Male. Length = 2.3 mm (*n* = 1). Head, pronotum, elytra, and ventral surface black, elytra with a distinctive bronze colored sheen or reflection. Legs, excluding coxae, and the antennae reddish brown, palps yellowish brown.

Head. Frons and vertex with scattered erect dark brown setae, short bifurcate recumbent or appressed and widely scattered yellow or white setae; surface between eyes rough and granular with numerous moderate sized shallow setose punctures, the largest of which is equal to about 2.5 times an ommatidial diameter, clypeus and vertex similar in texture to frons; interantennal carinae distinct, groove between carinae extending posteriorly onto anterior portion of frons, antennae elongate, especially apical antennomeres, large appressed setae moderately abundant, pale on scape, dark reddish brown on remaining antennomeres.

Pronotum. Covered with scattered moderately projecting tubercles, each with an erect or suberect seta, setae dark brown or black on anterior 2/3, yellow on posterior 1/3, at middle tubercles separated by about 0.5 times their own diameters or less, surface between granulations shiny; anterior 1/3 with numerous slightly elongate irregular punctures, surface rough with very little smooth area present between tubercles and punctures; dorso-lateral tufts very loose and indistinct, dorsal tufts distinct with setae converging; row of transverse punctures at basal margin.
numerous, not forming a complete groove, frequent interruptions due to shallow
ridges and tubercles; just anterior to punctures no white setae, yellow setae arising
from tubercles more appressed at base.

Elytra. Smooth and shiny between punctures, intervals very slightly convex,
basally slightly rough, humeral angles slightly to moderately produced; punctures
longitudinally elongate, at middle about 1.5 times as long as wide, each separated
from the following by a distance about equal to their own length, puncture rows
separated by about 3.0 times their width; elytral setae in two colors, lateral edges,
apices, and along suture with tan or yellowish-white setae, basal 1/2 a mix of this
light colored setae and dark brown setae, apical 1/2 with dark brown setae, anterior
margin of each puncture with a depressed seta which usually reaches anterior margin
of the following puncture, rows of long slender erect setae about 3 times as long as
the width of one elytral interval; apical margin with long narrow band of
granulations; scutellum large and chordate shaped and covered with appressed white
setae.

Ventral Surface and Legs. Mostly covered with fine granulations and
moderate sized ovoid but irregularly shaped indistinct shallow punctures, usually
separated by 1-2 times their own diameters, metasternum fairly smooth at middle
with a few shallow punctures, except anterior margin similar to lateral edge;
longitudinal invagination at base deep and narrow, extending anteriorly nearly 1/2
metasternal length, surrounding surface concave; mes- and metepisternum densely
covered with white recumbent setae; ventrites with moderately dense setae also
longer scattered depressed setae, both tan or yellowish white, first two sutures very
distinct at middle, on second ventrite at middle elongate ovoid shallow punctures

286
from 1-3 times their diameters; surface between punctures smooth; legs covered with tan or yellowish-white suberect and appressed setae.

**Description.** Female. Length = 1.9-2.3 (n = 5). Color black except for apical 1/3 of the elytra and sternites dark reddish black; antennae and legs reddish brown except coxae black or nearly so, femora also sometimes slightly dark than remaining distal portion of leg.

Head. Frons and vertex with scattered, erect brown or dark brown setae, short white recumbent or appressed often basally bifurcate white setae scattered over surface, sparsely to moderately densely, frons covered with granulations and moderately rugose, slightly more rugose on anterior portion of frons and vertex, shallow setose punctures not apparent, clypeus moderately rugose, labro-clypeal suture distinct; interantennal carinae very distinct, a deep groove between carinae, groove continuing just onto anterior portion of frons; antennae robust and moderately long, large appressed setae pale or light brown at base becoming darker by about fourth or fifth antennomere through to apex, cuticle constant color throughout, although scape sometimes darker and apical antennomere sometimes lighter.

Pronotum. Covered with scattered moderately projecting granulations, each with an erect or suberect setae, setae on anterior 3/5 dark brown, white on posterior 2/5, at middle tubercles usually separated by 0.5 times their diameters; anterior 1/3 with deep, irregular, moderate sized punctures, surface coarse without much smooth surface visible between tubercles and punctures; anterior 3/5 of pronotal setae dark brown, posterior 2/5 pale, nearly white, creating bicolored setal tufts, dorso-lateral
and dorsal tufts distinct with setal tips slightly converging although more so on dorsal tufts; row of transverse punctures at basal margin forming an incomplete groove and fairly regularly interrupted by ridges and the occasional tubercle, anterior to groove white recumbent setae entirely absent.

Elytra. Smooth and shiny between punctures, intervals slightly convex, basally very rough, humeral angles only slightly produced; punctures longitudinally elongate, at middle transversely slightly narrowed at middle, about 1.5 times or slightly less as long as wide, each separated from the following by a distance about equal to 0.5 their length, puncture rows separated by about 2.0 times their width, punctures decreasing in size from base to apex especially rapidly at middle of elytra; setae predominantly white on basal 2/3, reddish brown on apical 1/3-1/2 except white around lateral edge and along suture; anterior margin of each puncture with a depressed seta which usually exceeds anterior margin of the following puncture; rows of slender erect interpuncture setae with the longest 4.0 times or more as long as the width of one elytral interval; apical margin with distinct but narrow band of granulations; scutellum chordate shaped and covered with appressed white setae.

Ventral Surface and Legs. Mostly covered with fine granulations and shallow punctures, metasternum at middle without granulations but some scattered shallow ovoid punctures present, laterally punctures separated by about their own diameters, longitudinal invagination at base narrow and deep extending about 1/3 metasternal length, surrounding area sometimes slightly concave; mes- and metepisternum densely covered with white recumbent setae; ventrites with moderately dense recumbent setae, also longer scattered depressed setae, both white or very pale brown in color, first two sutures very distinct, except sometimes middle 1/10
obscure, shallow punctures on second ventrite at middle elongate or small and round, separated from each other by a distance 1-2 times their maximum diameters; legs covered with white or very pale brown suberect and appressed setae, setae longer at femora apex.

Male Genitalia. Relatively short, parameres joined for more than 1/2 their length, at middle rapidly tapering to a slightly curved tip; aedeagus parallel sided, very narrow throughout entire length (figure 7.9 D-F).

Sexual Dimorphism. Antennomeres are longer and the eyes slightly larger in the male. The female elytra are also more convex longitudinally. The male has very distinct shallow punctures on the frons unlike the female, but the granular surface is still distinctly visible on both sexes. The females do not have the distinct metallic sheen of the male. The erect elytral setae are slightly longer in the female. The light colored setae on the elytra are slightly more white in the female. Lastly, the setae on the apical 1/3-1/2 of the elytra in the female are reddish brown whereas in the male they are dark brown.

Material Examined: Holotype: probably female- Brazil (MNHN); male- Brazil, Paraná, Fênix, Reserva Est.-ITCF, 06.IX.1986, Lev. Ent. Profaupar, Lâmpada (DZUP); 1 female- Brazil, Mato Grosso, Chapada [15°26' S, 55°45' W], Acc.No. 1966, Nov.; 1 female- Brazil, Rio de Janeiro, Acc. No. 2066, Oct.; 1 female- as previous except Acc. No. 2966; 1 female- as previous except Nov. (all CMNH).

Distribution. This species is known from Brazil in the states of Paraná, Mato Grosso, and Rio de Janeiro.
Discussion. The single type has no precise locality data and is only labeled as from Brazil. The very distinctive male genitalia, broad or robust body, and the metallic sheen are strong evidence for its recognition as a species. It is unknown if the degree of metallic sheen is a variable characteristic in the male, but females are not metallic. It should be noted that placing the male specimen in hot water does not seem to affect the reflection as has been observed in some other metallic colored beetles.

The females of this species are very similar to two female specimens from Paraguay which I attribute to *P. donckieri*. The females of *P. donckieri* differ from females of *P. submetallicus* in subtle ways. In addition to the characters given in the diagnosis, *P. submetallicus* females have more dense white setae on frons but fewer white setae on the pronotum. They also have more reddish brown setae intermixed with the white setae on the basal 2/3 of the elytra.

*Prosternoptinus theresae* (Pic)

Figures 7.2 E-F, 7.3 A-C

*Ptinus theresae* Pic, 1898:171; Pic, 1912:36; Blackwelder, 1945:402.

*Prosternoptinus theresae* (Pic), Bellés 1985:135.

**Diagnosis.** The approximately transverse recumbent white setal band only narrowly separated along the suture at the base of the elytra will differentiate this species from all others known from Brazil (figure 7.2 E-F). A similar pattern is found
in some specimens of *P. bellesi* but the distinctive genitalia and the Venezuelan
distribution will separate *P. bellesi* from *P. theresae*.

**Description.** Length = 2.3-2.6 mm (n = 4). Body black to very dark brown,
appendages distinctly paler, legs with coxae black to reddish brown, tarsomeres
slightly darker and remaining leg reddish brown.

Head. Frons and vertex with scattered erect dark brown setae, short white
basally bifurcate recumbent setae sparse and widely scattered, slightly more dense
near junction of dorsal margin of eye and above the antennal fossae; surface
between eyes very rough with numerous large shallow setose punctures, the largest
of which is equal in diameter to about 3 times the ommatidial diameter, vertex with
finer texture, clypeus rough but additionally finely granulate, labro-clypeal suture
moderately to very distinct; interantennal carinae present but indistinct; antennae
moderately robust, large appressed setae reddish brown at base changing to black by
the 5th or 6th antennomere, cuticle of antenna also progressively darker to apex
although more gradually.

Pronotum. Covered with scattered moderately projecting tubercles, each with
an erect or suberect dark brown or black seta, at middle tubercles separated by
about 1/2 their own diameters, surface between tubercles shiny; anterior 1/3 with
coarse irregular punctures and without any smooth flat surface between punctures or
tubercles; dorso-lateral tufts loose and indistinct, dorsal tufts less distinct but with
some setal tips converging; row of transverse punctures at basal margin nearly
forming a continuous groove, anterior to this a sparse transverse narrow band of
recumbent white basally bifurcate fine setae, several more widely scattered on remaining dorsal surface.

Elytra. Smooth and shiny between punctures, intervals slightly convex, basally appearing coarse; punctures elongate, about 2 times as long as wide, each separated from the following by a distance equal to 1/2 to 1 times their length, puncture rows separated by about 2.5 times their width; anterior margin of each puncture with a depressed black or brown seta which reaches the anterior margin of the following puncture; rows of long slender erect black or brown setae 3 times as long as width of one elytral interval; apical margin with some fine granulations; scutellum large and chordate shaped and covered with appressed white setae; large white maculations consisting of recumbent setae in two ovoid patches at posterior 1/3 of each elytron, inner patch located on middle of second through to fourth, slightly posterior of inner patch the outer patch located on sixth or seventh interval to middle of eighth or ninth, maculations on anterior 1/3 consisting of a slightly irregular transverse band beginning at second interval and continuing through seventh or middle of eighth posterior of humeral protuberance, width of band equal to width of 1-2 intervals.

Ventral Surface and Legs. Mostly covered with fine granulations and large shallow punctures on metasternum and ventrites, metasternum smooth at middle except for anterior margin and laterally, punctures separated from each other by less than their diameters, longitudinal invagination at base narrow with surrounding area flat, extending anteriorly nearly 1/2 metasternal length; mes- and metepisternum densely covered with white recumbent setae; ventrites with moderately dense recumbent setae, also longer scattered depressed setae, both pale yellow or white,
first two sutures obscured at middle, on second ventrite at middle surface finely rippled, shallow elongate punctures usually separated by a distance equal to their maximum diameter; legs covered with white or yellowish white, suberect and appressed setae.

Male Genitalia. Moderately long, parameres nearly parallel sided from basal 1/4; aedeagus tapering from about apical 1/3 to narrowly rounded tip (figure xx).

Sexual dimorphism. Females are longitudinally more convex than males. The eyes and antennae appear similar in both sexes.

Holotype. Labeled: Brazil, Goiás, Jataí (MNHN).


Distribution. This species is known from the Brazilian states of Goiás, Mato Grosso, and Rondonia.

Discussion. The specimen from Chapada, Mato Grosso, Brazil differs slightly from the others in the following ways: both the body color is dark brown and the elytral setae are brown to dark brown instead of black; the elytral punctures are slightly larger and more closely spaced; the elytral apex has relatively little granulation and each elytron is slightly more pointed at the apex. These differences are probably
those of population and possibly intersexual variation rather than interspecific variability.

*Prosternoptinus tricoratus* New Species

Figures 7.1 F, 7.3 D-F

**Diagnosis.** Similar to *P. bordoni* and can be separated by the characters given in the key. They can also be differentiated by genitalic and spiculum gastrale characters given under the diagnosis of *P. bordoni*.

**Description.** Length = 2.5 (n = 1). Body black, legs reddish brown, antennae slightly darker.

Head. Frons and vertex with scattered erect brown or dark brown setae, short white basally bifurcate recumbent setae sparse and widely scattered, slightly more dense near junction of dorsal margin of eye and above the antennal fossae; surface between eyes very rough with numerous large shallow setose punctures, the largest of which is equal in diameter to about 3 times the ommatidial diameter, vertex with finer texture, clypeus rough but additionally finely granulate; interantennal carinae present but indistinct, groove continuing just onto anterior margin of frons; antennae moderately robust, large appressed setae reddish brown at base changing to black by the 5th or 6th antennomere, cuticle of antenna also progressively darker to apex although more gradually.

Pronotum. Covered with scattered moderately projecting granulations, each with an erect or suberect brown or dark brown seta, at middle granulations separated
by about 0.5-1.0 times their own diameters, surface between granulations shiny; anterior 1/3 with coarse irregular punctures and with a slight amount of smooth surface between punctures or granulations; dorso-lateral tufts loose but moderately distinct with some setal tips converging, dorsal tufts similar; row of transverse punctures at basal margin nearly forming a continuous groove but regularly interrupted, anterior to this a moderately dense transverse band of recumbent white basally bifurcate fine setae which continues in a more scattered irregular manner and sometimes in small clumps on remaining dorsal surface up to anterior margin of pronotum.

Elytra. Smooth and shiny between punctures, intervals slightly convex, basally appearing slightly coarse; punctures elongate, about 1.5 times as long as wide, each separated from the following by a distance equal to 1 times or slightly less than their length, puncture rows separated by about 3.0 times their width; anterior margin of each puncture with a depressed dark brown or brown seta which does not reach the anterior margin of the following puncture; rows of long slender erect dark brown or brown setae 3 times as long as width of one elytral interval; apical margin with a broad but short row of fine granulations; scutellum large and chordate shaped and covered with appressed white setae; large white maculations consisting of recumbent setae in two ovoid patches at posterior 1/3 of each elytron, inner dorsal patch located on 2nd through 4th interval and slightly anterior of outer lateral patch located on 7th to nearly through 9th; maculations on anterior 1/3 beginning at first puncture row near scutellum extending posteriorly and obliquely to just inside 3rd interval, also two transverse lines slightly posterior of previous
maculation, one from outer edge of 3rd to inner edge of 5th interval and another from 6th extending into the 9th interval.

Ventral Surface and Legs. Mostly covered with fine granulations and large shallow punctures; metasternum smooth at middle except for anterior margin and with a few widely scattered punctures, longitudinal invagination at base narrow but poorly defined with surrounding area broadly concave, extending anteriorly about 1/2 metasternal length; metepisternum densely covered with white recumbent setae; ventrites with moderately dense recumbent setae, also longer scattered depressed setae, both pale yellow or white; legs with coxae nearly black, remaining leg reddish brown, tarsi slightly darker, covered with white or yellowish white, suberect and appressed setae, femora strongly clavate.

Male Genitalia. Moderately long, parameres parallel sided from about basal 1/3; aedeagus parallel sided and moderately broadly rounded at the tip (figure 7.3 D-F).

Sexual Dimorphism. Unknown but probably at the most only slight eye and antennal size differences.

Type Material. Holotype: Colombia, Norte de Santander, 1000 m, 3 km. N. Chinacota [7°36' N 72°37' W], May 8, 1974, H. & A. Howden (CMNC).

Distribution. This species is known only from the type locality in Colombia.

Etymology. Because of the very similar external appearance to P. bordoni, this species was named after the latin word (tricoratus) in reference to a trickster.
Discussion. This is a species most easily recognized by genitalic characters, including the spiculum gastrale. There are many other more subtle characters that may be useful to differentiate this species from other similar species. These characters of *P. tricoratus* are as follows: scattered white recumbent pronotal setae dorsally extending up to the anterior margin instead of on only the basal half; the interantennal carinae is indistinct; the scape and the 9th through to the base of the 11th antennomeres are darker in color than the remainder; the white recumbent setae on the frons forms a transverse line above the antennal fossae which continues along the anterior and dorsal margin of the eye; the frons has small shallow punctures (approximately 2 times the ommatidial diameter); the basal metasternal longitudinal line is relatively broad and indistinct and continues for about 1/3 the total metasternal length; the tarsi are similar in color to the tibia or slightly darker. Another character which may be useful is the length of the eye setae, which in *P. tricoratus* are no longer than 2 times the diameter of an ommatidia. Those of *P. bellesi* and *P. theresae* are usually equal to 3 times an ommatidial diameter.
FIGURE 7.1

Elytral patterns of Prosternoptinus species: (A) *P. argosoma*, (B) *P. kryptoambon*, (C) *P. bicolor*, (D) *P. semibrunneus*, (E) *P. quadrimaculatus*, (F) *P. tricolor*. Scale bar = 0.5 mm.
FIGURE 7.2

Elytral patterns of *Prosternoptinus* species: (A) *P. bellesi* ♀ (Venezuela, Carabobo), (B) *P. bellesi* ♂ (Trinidad), (C) *P. bellesi* ♀ (Venezuela, El Valle), (D) *P. bordoni* (redrawn from Bellés 1985), (E) *P. theresae* (Brazil, Rhondonia), (F) *P. theresae* (Brazil, Mato Grosso). Scale bar = 0.5 mm.
FIGURE 7.2

301
FIGURE 7.3

Male genitalia of *Prosternoptinus theresae* and *P. tricoratus*: (A)-(C) *P. theresae*; (A) dorsal view, (B) lateral view, (C) spiculum gastrale. (D)-(F) *P. tricoratus*; (D) dorsal view, (E) lateral view, (F) spiculum gastrale. Scale bar = 0.1 mm.
FIGURE 7.4

Male genitalia of *Prosternoptinus bellesi*: (A) dorsal view, (B) lateral view, (C) spiculum gastrale. Scale bar = 0.1 mm.
Male genitalia of *Prosternoptinus assumentum* and *P. maculithorax*: (A)-(C) *P. assumentum*; (A) dorsal view, (B) lateral view, (C) spiculum gastrale. (D)-(F) *P. maculithorax*; (D) dorsal view, (E) lateral view, (F) spiculum gastrale. Scale bar = 0.1 mm.
Male genitalia of *Prosternoptinus quadrimaculatus* and *P. argosomos*: (A)-(C) *P. quadrimaculatus*; (A) dorsal view, (B) lateral view, (C) spiculum gastrale. (D)-(F) *P. argosomos*; (D) dorsal view, (E) lateral view, (F) spiculum gastrale. Scale bar = 0.1 mm.
FIGURE 7.7

Male genitalia of \textit{Prosternoptinus castaneus} and \textit{P. oculigrandis}: (A)-(C) \textit{P. castaneus}; (A) dorsal view, (B) lateral view, (C) spiculum gastrale. (D)-(F) \textit{P. oculigrandis}; (D) dorsal view, (E) lateral view, (F) spiculum gastrale. Scale bar = 0.1 mm.
FIGURE 7.8

Male genitalia of *Prosternoptinus obriènorum* and *P. semibrunneus*: (A)-(C) *P. obriènorum*; (A) dorsal view, (B) lateral view, (C) spiculum gastrale. (D)-(F) *P. semibrunneus*; (D) dorsal view, (E) lateral view, (F) spiculum gastrale. Scale bar = 0.1 mm.
Male genitalia of Prosternoptinus nigricolor and P. submetallicus: (A)-(C) P. nigricolor; (A) dorsal view, (B) lateral view, (C) spiculum gastrale. (D)-(F) P. submetallicus; (D) dorsal view, (E) lateral view, (F) spiculum gastrale. Scale bar = 0.1 mm.
Male genitalia of *Prosternoptinus aeneus* and *P. donckieri*: (A)-(C) *P. aeneus*; (A) dorsal view, (B) lateral view, (C) spiculum gastrale. (D)-(F) *P. donckieri*; (D) dorsal view, (E) lateral view, (F) spiculum gastrale. Scale bar = 0.1 mm.
Male genitalia of *Prosternoptinus bechynei* and *P. rufipennis*: (A)-(C) *P. bechynei*; (A) dorsal view, (B) lateral view, (C) spiculum gastrale. (D)-(F) *P. rufipennis*; (D) dorsal view, (E) lateral view, (F) spiculum gastrale. Scale bar = 0.1 mm.
Male genitalia of *Prosternoptinus bordoni*, *P. jolyi*, and *P. bicolor* (all redrawn from Bellés 1985): (A)-(B) *P. bordoni*; (A) dorsal view, (B) spiculum gastrale. (C) *P. jolyi*, dorsal view. (D) *P. bicolor*, dorsal view. Scale bar = 0.1 mm.
FIGURE 7.12
321
FIGURE 7.13

Ventrites of *Prostemoptinus* species: (A) *P. quadrimaculatus*, (B) *P. bellesi*, (C) *P. nigricolor*, (D) *P. oculigrandis*, (E) *P. castaneus*, (F) *P. maculithorax*, (G) *P. submetallicus*, (H) *P. aeneus*. Scale bar = 0.5 mm.
FIGURE 7.13
323
FIGURE 7.14

Pronota of Prosternoptinus species: (A) *P. bechynei*, (B) *P. argosomos*, (C) *P. assumentum*, (D) *P. calileguaensis*, (E) *P. maculithorax*, (F) *P. expandipronotus*. 
FIGURE 7.14

325
FIGURE 7.15

Dorsal habitus views of males of *Prosternoptinus* species: (A) *P. submetallicus*, (B) *P. nigricolor*, (C) *P. donckieri*, (D) *P. aeneus*.
FIGURE 7.15
Dorsal habitus views of *Prosternoptinus* species: (A) *P. obrienorum* (male), (B) *P. oculigrandis* (male), (C) *P. bechynei* (female).
Eyes and antennae of males of *Prosternoptinus* species: (A) lateral view of eye of *P. aeneus*, (B) lateral view of eye of *P. donckieri*, (C) apical antennomeres of *P. aeneus*, (D) apical antennomeres of *P. submetallicus*, (E) apical antennomeres of *P. donckieri*. 
FIGURE 7.17

331
CHAPTER 8

LEAF MINING AND GRAZING IN SPIDER BEETLES
(COLEOPTERA: ANOBIIDAE: PTININAE):
AN UNREPORTED MODE OF LARVAL AND ADULT FEEDING
IN THE BOSTRICHOIDEA

INTRODUCTION

Compared to the very large number of species in the Coleoptera, relatively few are known to be leaf miners. The families Buprestidae, Chrysomelidae, and the Curculionidae contain the majority of species (Hespenheide 1991) with smaller numbers in the Nitidulidae and Mordellidae (Paulian 1988). Nearly all species in the Anobiidae (including the Ptininae) feed exclusively on plant or fungal materials in their larval stages, with the majority boring in dead wood or bark (White, 1962). There is, though, a large range of feeding habits and styles in this family. For example, most species of Tricorynus (=Catorama) feed in seeds, although a few have been reared from galls (White 1965 and 1974a). Many species of dorcatomine anobiids feed on fungi (White 1974a and 1982) and members of the subfamily Ptininae mainly scavenge dry organic matter of plant or animal origin (Lawrence and Britton 1991). Specialized habits within the latter general category includes species
closely associated with human (Howe 1959, Hinton 1941) and bee (Linsley and MacSwain 1942 and references therein) stored products. Many others are ant associates (Lawrence and Reichardt 1969), and one species may be a termitophile (Zayas 1988). *Ptinus exulans* Erichson subsists mainly on the dried remains of insects and spiders and the dry eggs of spiders (Hickman 1974). No ptinines, or any other members of the Bostrichoidea, have ever been recorded to mine or feed on living leaves.

Leaf mines are channels created by insects (or possibly other organisms) within mesophyll or epidermal tissues. An insect must leave both layers of the epidermis or their outer walls intact in order to be considered a true miner (Hering 1951). This paper describes the life history of this type of miner, *Ptinus antillanus* Bellés, based on field and laboratory observations.

The biology of the 12 members of the genus *Ptinus, sensu stricto*, is poorly known (Bellés 1992). All published information is limited to data on specimen labels. A perusal of data reported by Bellés indicates that *Ptinus* is associated with succulent plants in beach or xeric habitats. Although single records exist for associations with *Cryptocarpus* sp. (Nyctaginaceae), fish poison tree (*Piscidia piscipula*: Fabaceae), sea grape (*Coccoloba uvifera*: Polygonaceae), *Djaleya* sp. [sic] and green leaf tobacco (*Nicotiana tabacum*: Solanaceae), repeated records exist for cacti (two records and species in southwestern North America) and *Tournefortia* (= *Mallontonia*) *gnaphalodes* (three records for two species in Florida and the West Indies). Several additional records mention shrubs or leaf litter on beaches (three records and species).
*Pitnus antilanus* is a rarely collected species known from Puerto Rico (including Mona Island and Cayo Solito) and the Virgin Islands (Sellés 1992). Observations to date are limited to label notes indicating specimens were extracted, via berlese funnels, from beach litter and dead leaves of *T. gnaphalodes* (Sellés 1992, Ivie unpublished).

**MATERIALS AND METHODS**

*Pitnus antilanus* specimens collected by two staff members of the Virgin Islands Beetle Fauna Project (D. S. Sikes and R. S. Miller) were noticed feeding on leaves of a living Boraginaceae on the east end of St. Croix in January, 1993. Following up on this observation of such a rare species, beetles were observed on two occasions (by M. A. Ivie) on the host plant, *Tournefortia gnaphalodes* (Linnaeus), Boraginaceae, at East Bay, (St. Croix) and Smith Bay, (St Thomas) U.S. Virgin Islands. Fifty-eight individuals were collected on 28 August, 1995 at East Bay and used to establish colonies. Other specimens from both localities were mounted as vouchers. Cultures were set up in plastic Petri dishes of two different sizes using dead leaves. A single large colony was kept in a 90 X 15 mm dish and smaller subcultures were maintained in 55 X 15 mm dishes. Leaves were scattered throughout the bottom of the large culture dish, one to two layers deep. Groups or individual leaves were used in the small Petri dishes. With isolated leaves, the development of individual larvae could be more carefully studied. Small pieces of apple were added periodically as a food and moisture source, and a 1-cm square
piece of paper towel was moistened daily with distilled water to humidify the cultures.

Host-plant branches with infested leaves also were collected for examination in the laboratory. These branches were preserved in 95% ethanol and each leaf and stem carefully examined in the laboratory at Montana State University. All information on use of living leaves were taken from these samples by L. L. Ivie.

Voucher specimens have been placed in the Virgin Islands Beetle Fauna Project Collection, The Ohio State University Insect Collection, and the collection of T. K. P.

RESULTS

Field Observations

Returning to the site of the Sikes and Miller collections on August 28, 1995, plants were examined for adult beetles by M. A. Ivie. Visual searching was not productive as the beetles are tiny (1.0-1.4 mm) and are exceeding difficult to see on the grey-green foliage covered with silvery trichomes. A sharp tap over a beating sheet, however, yielded _P. antillanus_ in numbers. Closer examination showed a progression from healthy, firm, fleshy leaves at the top of each stem, down through wilted, shriveled ones, to dried hard brown obviously dead leaves at the bottom of the whorl. Bare stem, with leaf scars, occupied the remainder of the stem. Dead leaves laid in piles under the plant. Splitting open the woody stem (the expected larval habitat) showed no evidence of larval feeding. The leaves, however, showed evidence of leaf mining. Ptinine larvae were observed in several leaves with the leaf
condition ranging from turgid to flaccid. Newly eclosed adults were found in dry leaves. A general progression of leaves with less-to-more mature larvae seemed to go from terminal to basal positions respectively, with adults in the lowest leaves. Examination of more *T. gnaphalodes* on St Thomas yielded concurring observations.

**Adult Behavior**

Adult beetles were repeatedly observed feeding on living leaves of the host plant, *T. gnaphalodes* in the Virgin Islands. Microscopic examination showed that beetles chewed leaf trichomes or hairs to gain access to the leaf surface and mesophyll tissue. Feeding damage was usually not so deep as to completely perforate leaves (Fig. 1). In culture, adults were observed to feed on dead leaves (and pieces of apple). Although the leaves are thickly covered with fine overlapping trichomes, they did not seem to impose any difficulties in feeding. Beetles consumed the trichomes as readily as epidermal or mesophyll plant tissue. The hairs did not create any difficulties for movement, as numerous individuals were observed walking quickly over leaf surfaces (Fig. 2). Adult feeding damage created discolored areas that were used as hiding places. Adults survived in colonies for as long as three months.

**Oviposition**

Adults laid eggs directly on undamaged plant leaves and generally placed eggs among leaf hairs. They also used damaged areas such as feeding sites, cracks in leaves, or other potential hiding spots (Fig. 3). Only dead leaves were available in the lab, and were readily accepted for oviposition. Eggs are ovoid and white with a
pointed tip. Egg length was $0.37 \pm 0.03$ mm and the width $0.25 \pm 0.04$ mm ($n = 10$). Eggs were laid singly, although several were found in small groups within approximately three mm of each other in particularly good hiding spots. It is not known how many females contributed eggs found in such locations. Eggs were inserted inside leaf tissues only if there was a break in the leaf surface to allow ovipositor access.

Larval Development

Complete larval development appears to take place within a single leaf. Larval mines were found in both mature leaves and smaller, immature leaves attached to within 3 cm of the apical meristems. Larval development can occur entirely within a dead leaf. Eclosion occurred as larvae chewed through their egg shells (in no cases were egg shells completely consumed) and into the leaf epidermis. Larvae then proceeded to hollow out the inner leaf tissues, leaving the outer cells of both the upper and lower epidermal tissues intact. First instar larvae initially develop their mines as a single tract (Fig. 4) but later expand the tunnel as a full depth, blotch mine as they mature (Fig. 5) (terminology from Hering 1951). This type of mine is formed by tunnel expansion in both a horizontal and vertical direction, with no particular sense of direction. Larvae were constrained somewhat by the elongate leaf shape but were not affected by leaf venation. As the leaf gradually narrows to the stem no distinct petiole exists and leaves were mined their entire lengths, but mining was never observed in the plant stem. No feces are removed or ejected and hence mines always contained a large quantity of frass. Only a single larva per leaf was observed in the field-collected leaves, but on several occasions, more than one
larva was found within a leaf in lab colonies. The effect of several larvae developing in a single leaf is unknown, and may at least be partially a result of captivity and possible overcrowding.

Compared to a typical scarabaeiform anobiid larva, *P. antillanus* larvae are very linear and almost eruciform. This modified form affects their ability to move. Although their locomotion was not quantified, larvae appeared very mobile and can move easily within a mine or over flat surfaces. No carpeting of the mine cavity with silk was observed prior to pupation.

**Pupation**

Pupation occurred within the mine and no particular pupation mine or special burrow was made. No emergence holes or slits were made before larvae pupated, but emerging adults easily chewed small round holes through the leaf tissue to escape pupation chambers (Fig. 6). Pupation occurred directly within the chamber that had been previously created by larval feeding. Thin-walled pupal cocoons were constructed with silk, but the amount of silk used appears to vary a great deal. In most cases the amount seemed to be small, as evidenced by the difficulty we had in locating old pupation sites. Chambers could be detected by the presence of the larval and pupal exuvia. In one case, a relatively large amount of silk was found and formed a thin but tightly woven cocoon. Pupal cocoons were surrounded with debris consisting almost entirely of black fecal pellets.
DISCUSSION

There are now six families with known leaf miners. How these species evolved into leaf miners is unknown, but hypotheses have been presented by several authors. Although buprestids are mainly cambium borers, it has been noted that cambium tissue is not very different from the thin layer of tissue in a leaf (Needham et al. 1928). This ancestral feeding mode may have preadapted species for leaf mining. Curculionid miners are generally thought to have been derived from stem dwelling ancestors (Needham et al. 1928). Later they evolved into petiole borers and other forms that live and feed in the large ribs of leaves and remaining leaf tissue. Chrysomelids contain many species whose larvae and adults feed on leaves. A switch from exposed feeding to feeding within the leaf may have afforded added protection from predators or parasitoids (Needham et al. 1928).

Most Anobiidae and their sister groups in the Bostrichidae are wood borers. Crowson (1967) proposed that the evolution of the ptinines from within the anobiids may have been due to the switch from wood-boring to scavenging food of both plant and animal origin. He stated that the loss of wood-boring was "a fundamental factor conditioning the divergence of the Ptinidae as a family." Evidence against this hypothesis is that some Ptinus spp. are true wood-borers (Howe 1959, Bellés 1980). Unlike Ptinus, Pitinus is a very derived member of the Ptininae with a characteristic globular body form, fused elytra, and an absence of flight wings. They belong to a lineage of highly derived ptinines (such as Sphaericus, Trigonogenius, Gibbium etc.) which feed upon accumulations of dead organic matter of plant or animal origin.
Many members of this lineage are known to feed in animal dung, such as rodent pellets (Aalbu and Andrews 1992).

Hering (1951) considered species that do not live in fresh, green leaves but mine dead tissue to be transitional between true miners and saprophytes (Hering 1951). *Pitnus antillanus* may represent both forms, as it is a species which may start mining in live tissue but can complete development in a dying or dead leaf, as shown by our lab rearing. Adults inside shed leaves are probably the source of reported beach litter records for the species (Bellés 1992).

Selection for a mining lifestyle may be due to two factors. Mines afford protection from enemies and desiccation (Hering 1951). The former may be particularly relevant for a small species like *P. antillanus*, which is less than 1.5 mm long (Bellés 1992). Additionally, this species lives in sea beach habitats with high sun and wind exposure. The succulent leaves of *T. gnaphalodes* provide moisture in a very dry habitat. Further, no parasites were observed in the field-collected leaves.

*Pitnus antillanus* has a large parental investment in each egg produced. Each egg averages 0.37 mm in length, while adults range in size only from 1.0 up to 1.4 mm (Bellés 1992). Hence, total egg production is probably quite low. Although ptinines vary a great deal in total egg production (e.g. *Ptinus sexpunctatus* Panzer averages only 21 eggs per female while *P. tectus* Boieldieu can lay nearly 1,000 [Howe 1959]), low fecundity in *Pitnus* may indicate reduced larval mortality associated with mining. The adults may also be long lived, as evidenced by their abundance when collected with a beating sheet, and the relatively large series (for anobiids) of 20 or 30 specimens used to describe several species (Bellés 1992).
The more linear body form of the larva, rather than the typical "C"-shaped scarabaeiform bostrichoid larva, probably enables *P. antillanus* to move more easily within a mine. In comparison, other ptinine larvae are capable of movement, but are relatively awkward when removed from their feeding site. This is particularly true in the large final instar. The only other bostrichoid larvae known to retain the ability to walk on a substrate are the fungivorous Endecatominae (Kompantsev 1978, Ivie 1985). Although we have no evidence for this, the mobility of the larva of *P. antillanus* may also be an adaptation for moving from leaf to leaf via the plant exterior. Leaf miners of other families are known to wander on stems to select other leaves during the course of their development (Hering 1951, Ford and Cavey 1985). One general characteristic of mining larvae is a strongly thickened fore body to facilitate penetration into plant tissue (Hering 1951). These modifications were not observed in *P. antillanus*.

Adults are present throughout the year (records in Bellés 1992 and from museum specimens), as is the perennial host plant, so breeding potentially can occur at any time of the year. The host plant for *P. antillanus*, *Tournefortia gnaphalodes*, is a widespread coastal species. It is found at least as far south as Aruba, Bonaire, and Curaçao, throughout the West Indies and Florida, and along the coast of tropical Mexico (Boldingh 1914, Britton and Millsbaugh 1920, Long and Lakela 1971). With this broad host distribution, it is likely that many more populations or species of *Pitnus* occur in coastal areas of the Caribbean, in addition to those listed by Bellés (1992).

It is possible that adult or larval feeding affects leaf tissue or causes leaf abscission, which might improve the host as a food source. We suspect that these
beetles may be introducing a fungus that affects the larval food source quality. More studies on the beetles and their hosts will need to be done before we can answer these questions.
FIGURE 8

Host plant damage, an egg, and adults of *Pitnus antillanus*: (A) adult feeding damage on the host plant, *Tournefortia gnaphalodes*, (B) adults on leaves of the host plant, (C) exposed egg which had been oviposited through a split in the leaf surface, (D) cross-section through a leaf exposing two mines in leaf mesophyll tissue, (E) exposed mine of late instar on a section of leaf, (F) emergence hole of adult.


Hammond, P. M. 1985. Dimorphism of wings, wing-folding and wing-toiletry devices in the ladybird, Rhysobius litura (F.) (Coleoptera: Coccinellidae), with a discussion of inter-population variation in this and other wing-dimorphic beetles species. Biological Journal of the Linnean Society 24: 15-33.


Hinton, H. E. 1943. Stethomezium squamosum gen. et. sp. n. infesting stored food in Britain, with notes on a South African ptinid not previously recorded in stored products (Coleoptera). Proceedings of the Royal Entomological Society London (B) 12: 50-54.


350


Nicholas (-). 1892. Ptinus sexpunctatus. L'Échange 8: 143-145.


Pic, M. 1901. Notes diverses et diagnoses (4e article). L’Échange 17: 25-27


Wasmann, E. 1916. Wissenschatliche ergebnisse einer forschungsreise nach ostindien... V. Termitophile und myrmecophile Coleopteren... Zoologischer Jahresbericht 39: 169-210, pls. 4-5.


