



Myrmecophilous and Apidophilous Soft Scale Insects of the New World (Hemiptera: Sternorrhyncha: Coccidae)

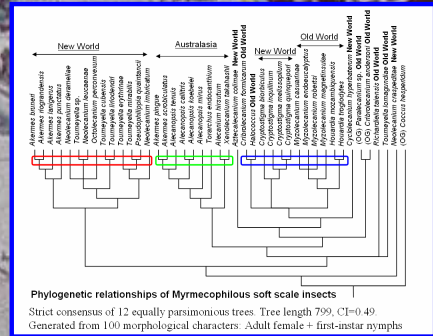


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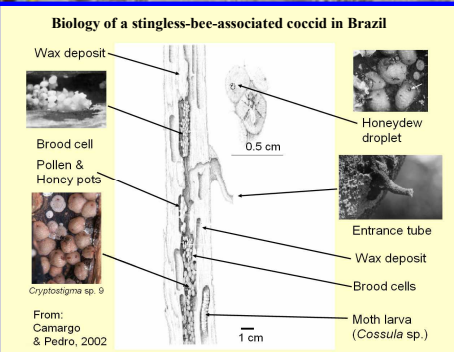
INTRODUCTION

Soft scales belonging to the Myzolecaniinae are often called myrmecophilous, however, there may be other coccids in different subfamilies not included in this study that are closely associated with Hymenoptera. The Myzolecaniinae has a worldwide distribution and contains the most derived insects in the Coccidae. Morphological features have evolved in such a way that these coccids can no longer survive without attendance by their symbiotic ants (rarely bees; the term apidophilous has been herein used to refer to the stingless-bee-associated species). However, there are some exceptions, i.e. *Toumeyella erythrinae* has been well studied but no hymenopterans have ever been observed attending them; *Cryptostigma siveirai* and *Cryptostigma* sp. 10 are hypogean in habit feeding on the roots of its host and are not associated with Hymenoptera. The original descriptions of many of the species included in the Myzolecaniinae lack information on their biology, thus their association with Hymenoptera remains unknown.

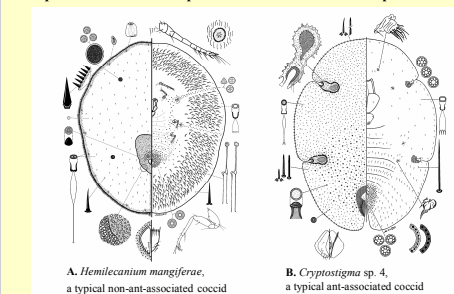
The Myzolecaniinae in the New World is represented by the following genera: *Akermes*, *Aztecacleanium*, *Cryptostigma*, *Cycloecanium*, *Megasaissetia*, *Neolecanium*, *Ocotecanium*, *Pseudophilippia* and *Toumeyella*. The Myzolecaniinae are thought to be composed of several non-related genera which share common features such as: the reduction in size of legs, antennae and anal tube; the increase in size of spiracles; lack of eyespots; and other shared characters that could be a result of parallel evolution in the adult female morphology. Several scale insects treated in the present study are known to be agricultural pests. For example, *Cryptostigma siveirai* is a serious pest of grape vines in Brazil, and *Toumeyella erythrinae* is a pest of erythrina trees in Brazil. Interestingly the two species are not closely-associated with ants. In the USA, *T. parvicornis* often causes serious damage to pine trees. The hosts of *Cryptostigma* sp. 10 is a species with a potential of becoming an agricultural pest since its hosts includes oil palms, bananas, Manila hemp, orchids and pineapples. This study presents our current understanding of New World ant- and bee-coccid relationships, their ecology and biogeography.



Phylogenetic relationships of Myrmecophilous soft scale insects
Strict consensus of 12 equally parsimonious trees. Tree length 799, CI=0.49
Generated from 100 morphological characters. Adult female + first-instar nymphs



Comparison of a non-ant-specialized coccid with an ant-specialized coccid



- Symbiotic association with tending Hymenoptera facultative or absent
 - Eyes present
 - Anal plates with few 3 or 4 setae
 - Anal tube well developed
 - Dorsal setae usually present
 - Spiracles rather small
 - Spiracular sclerotization absent
 - Antennae long, segments distinct
 - Legs normal, segments distinct
 - Usually found on leaves or externally on its host. Not found inside woody domatia nor hollow stems, twigs or branches
- Symbiotic association with tending Hymenoptera facultative or obligate
 - Eyes absent
 - Anal plates with 4 to 21 setae
 - Anal tube reduced or absent
 - Dorsal setae present or absent
 - Spiracles rather large
 - Spiracular sclerotization often present
 - Antennae short, segments indistinct
 - Legs reduced, segments indistinct
 - Rarely found on leaves. Often found with ants inside woody domatia, hollow stems, twigs or branches

ACKNOWLEDGEMENTS
Many thanks to João Camargo for allowing me to use his photos and for sending me material of *Cryptostigma* sp. 10, to David Roubik for the photo and material of *Cryptostigma* sp. 6, to Mike Williams for his assistance in collecting *Toumeyella parvicornis* and *Toumeyella* sp. 1, and for the loan of material, to Douglas Miller for the loan of material, to Penny Gullan for photos and loan of material, to Deborah Gordon and Rodolfo Dirzo for sending me material of *Aztecacleanium* and *Cryptostigma reticulolaminae*, to Jon Martin for the loan of material, and to Cory Ururah for assistance in designing the poster. Many of the undescribed species of *Cryptostigma* were collected by Jack Longino and Phil Ward, many thanks to them, and all who have helped gather material for this study. This research was supported by grant DEB-0118718 from the U.S. National Science Foundation (Partnerships for Enhancing Expertise in Taxonomy program) to P.J. Gullan

LITERATURE CITED
Camargo, J.M.F. & Pedro, S.R.M. 2002. Mutualistic association between a tiny Amazonian stingless bee and a wax-producing scale insect. *Biotropica* 34(3): 446-451.

New World Myzolecaniinae: Distribution, Hosts and Notes

| Species | Known Distribution | Hosts | Associated Hymenoptera | Remarks |
|--|--|---|--|--|
| <i>Akermes bruneri</i> Cockerell | Argentina, Paraguay, Uruguay | Citrus lale | Azteca sp. | Type species of the genus |
| <i>Akermes colombianus</i> Kondo & Williams | Colombia | <i>Leucaena glauca</i> , <i>Cordia alliodora</i> | Azteca, Crematogaster, Myrmelachista | Congeneric with <i>A. bruneri</i> |
| <i>Akermes cordiae</i> Morrison | Panama | undetermined host | <i>Cryptostigma</i> | Oobius congenic |
| <i>Akermes molisii</i> (Cockerell) | Brazil | undetermined host | None reported | Not congeneric |
| <i>Akermes punctatus</i> (Cockerell) | Grenada | <i>Citrus medica</i> v. <i>acidia</i> | None reported | Congeneric with <i>A. bruneri</i> |
| <i>Akermes rogersianus</i> Hempel | Brazil | <i>Schinus molle</i> | None reported | Congeneric with <i>A. bruneri</i> |
| <i>Akermes townsendi</i> (Cockerell) | Mexico | <i>Citrus</i> sp. | None reported | Congeneric with <i>A. bruneri</i> |
| <i>Akermes venosus</i> (Signoret) | Uruguay | undetermined host | None reported | Insectae sedis. Material missing |
| <i>A. xylocum</i> Gravenhorst | Argentina | <i>Citrus</i> sp., <i>Astragalus</i> sp. | None reported | Identical to <i>Malleococcus lanigerus</i> |
| <i>Aztecacleanium colimae</i> (Cockerell) | Mexico | undetermined host | Azteca sp. | Monotypic genus |
| <i>Cryptostigma borbiculatum</i> Morrison | Colombia, Costa Rica, Panama | Citrus, Citrus, <i>Tetrathylacium polytrichum</i> | Azteca spp., <i>Pseudomyrma sericea</i> | Congeneric with <i>C. aquilina</i> |
| <i>Cryptostigma ingulmina</i> (Newstead) | Grenada, Brazil, Grenada, Guyana, Suriname, 11 other | polytrichum | 4 ant species in 4 subfamilies | Type species of the genus |
| <i>Cryptostigma quinquepori</i> (Newstead) | Costa Rica, Panama, Mexico | Citrus, <i>Triplaris americana</i> | <i>Pseudomyrma tripalis</i> | Congeneric with <i>C. aquilina</i> |
| <i>Cryptostigma reticulolaminae</i> Kondo & Williams | Mexico | undetermined host | Azteca sp. | Congeneric with <i>C. aquilina</i> |
| <i>Cryptostigma siveirai</i> (Hempel) | Brazil | roots of <i>Vitis vulpina</i> | None reported | Past of grapes; congeneric only collected on wooden crates |
| <i>Cryptostigma</i> sp. 1 | Mexico | <i>Sapumite</i> spp. | <i>Pseudomyrma villosa</i> | Congeneric with <i>C. aquilina</i> |
| <i>Cryptostigma</i> sp. 2 | Costa Rica | <i>Cordia</i> spp., <i>Triplaris</i> sp. | 3 species of Azteca | Congeneric with <i>C. aquilina</i> |
| <i>Cryptostigma</i> sp. 3 | Costa Rica, Ecuador, Panama | "cedrus" trees | <i>Crematogaster stollii</i> | Congeneric with <i>C. aquilina</i> |
| <i>Cryptostigma</i> sp. 4 | Guatemala | <i>Eriobotrya cyclocarpa</i> | <i>Pseudomyrma</i> sp. | Congeneric with <i>C. aquilina</i> |
| <i>Cryptostigma</i> sp. 5 | Bolivia | <i>Schwarzia livida</i> , <i>Phaba</i> sp. | <i>Schwarzia livida</i> | "Associated with stingless bees" |
| <i>Cryptostigma</i> sp. 6 | Brazil | <i>Aucoumea germana</i> | <i>Pseudomyrma</i> sp. cf. <i>fortis</i> | Congeneric with <i>C. aquilina</i> |
| <i>Cryptostigma</i> sp. 7 | Venezuela | <i>Citrus</i> sp. | None reported | Congeneric with <i>C. aquilina</i> |
| <i>Cryptostigma</i> sp. 8 | Colombia | <i>Campanula angustifolia</i> | <i>Schwarzia coccophila</i> | "Associated with stingless bees" |
| <i>Cryptostigma</i> sp. 9 | Colombia, Costa Rica, Ecuador, Panama | lots of <i>Homalium</i> plants | None reported | Hippodamia? host; potential pest |
| <i>Cycloecanium hyperbaterum</i> Morrison | Panama | <i>Cordia alliodora</i> | <i>Pseudomyrma</i> , <i>Crematogaster</i> , <i>Azteca</i> , <i>Cremat.</i> | Monotypic genus |
| <i>Megasaissetia brasiliensis</i> Hempel | Brazil | undetermined host | None reported | Not congeneric with <i>M. infesta</i> |
| <i>Megasaissetia nectandrae</i> Hempel | Brazil | tree named "lauri" | None reported | Type species of the genus |
| <i>Neolecanium argemolis</i> Hempel | Brazil | <i>Nectandra</i> sp. | None reported | Insectae sedis. Material missing |
| <i>Neolecanium dermaliae</i> (Morrison) | Panama | plant named "tambop" paca" | Congeneric with <i>Toumeyella</i> | Congeneric with <i>Toumeyella</i> |
| <i>Neolecanium mammosum</i> Hempel | Brazil | undetermined host | Azteca sp. | Not congeneric with <i>N. imbricatum</i> |
| <i>Neolecanium amazonense</i> Földi | Brazil, Colombia | ex "Caretta blanca & c. paca" | None reported | Congeneric with <i>Toumeyella</i> |
| <i>Neolecanium obtusatum</i> (Cockerell) | Mexico | <i>Platanus caroliniana</i> | found in ant shelters | Not congeneric with <i>N. imbricatum</i> |
| <i>Neolecanium comparvum</i> (Thro) | USA | <i>Chrysomelids</i> , <i>Membr.</i> , <i>Chrysomel.</i> sp. | None reported | Not congeneric with <i>Toumeyella</i> |
| <i>Neolecanium craspedae</i> Morrison | Costa Rica, Trinidad & Tobago | <i>Magnolia</i> spp. | None reported | Not congeneric with <i>N. imbricatum</i> |
| <i>Neolecanium dermaliae</i> Morrison | Panama | <i>Cordia</i> , <i>Mangifera indica</i> | Azteca nigron | Not congeneric with <i>N. imbricatum</i> |
| <i>Neolecanium hemisphaerum</i> Cockerell | Mexico | undetermined host | Azteca sp. | Not congeneric with <i>Toumeyella</i> |
| <i>Neolecanium imbricatum</i> (Cockerell) | USA | <i>Agave</i> sp. | None reported | Congeneric with <i>Toumeyella</i> |
| <i>Neolecanium leucanum</i> (Cockerell) | Mexico | <i>Mimosa</i> sp. | None reported | Type species of the genus |
| <i>Neolecanium maculatum</i> (Cockerell) | Mexico | <i>Leucaena</i> sp. | None reported | Not congeneric with <i>N. imbricatum</i> |
| <i>Neolecanium plebeium</i> (Cockerell) | Mexico | <i>Leucaena</i> sp. | None reported | Congeneric with <i>Toumeyella</i> |
| <i>Neolecanium subterraneanum</i> Hempel | Brazil | <i>Ficus</i> sp. | None reported | Congeneric with <i>Toumeyella</i> |
| <i>Neolecanium tuberculatum</i> (Town & Ck) | Brazil | lots of undetermined host | None reported | Insectae sedis. Material missing |
| <i>Neolecanium unguis</i> (Cockerell) | USA | plant named "calletto" | None reported | Congeneric with <i>Toumeyella</i> |
| <i>Ocotecanium guatemalense</i> Kondo & Williams | Guatemala | See <i>Cryptostigma quinquepori</i> | See <i>Cryptostigma quinquepori</i> | Identical to <i>C. quinquepori</i> |
| <i>Ocotecanium parvicornis</i> (Cockerell) | Brazil | undetermined host | None reported | Genus close to <i>Toumeyella</i> |
| <i>Ocotecanium peruvianum</i> (Cockerell) | Brazil | <i>Nectandra</i> sp. | None reported | Genus close to <i>Toumeyella</i> |
| <i>Pseudophilippia quantianii</i> Cockerell | USA | <i>Pinus</i> sp. | None reported | Genus close to <i>Toumeyella</i> |
| <i>Toumeyella cerifera</i> Ferris | Mexico | <i>Abies occidentalis</i> | None reported | Not congeneric with <i>T. mirabilis</i> |
| <i>Toumeyella colimae</i> Kondo & Koller | Mexico | <i>Citrus</i> sp. | None reported (but see remarks) | <i>T. signatulae</i> junior synonym? |
| <i>Toumeyella erythrinae</i> Kondo & Williams | Mexico | <i>Erythrina caribaea</i> | None reported | Past of erthrina trees in Mexico city |
| <i>Toumeyella fuliginosa</i> Williams | USA | <i>Quercus alba</i> | <i>Quercus alba</i> | Identical to <i>Toumeyella cubensis</i> |
| <i>Toumeyella liriodendri</i> (Giesbr.) | Mexico, Brazil | <i>Liriodendron tulipifera</i> , <i>Magnolia</i> | ants protect them against predators | Known as a pest of its hosts |
| <i>Toumeyella mirabilis</i> (Cockerell) | Mexico, USA | <i>Prosopis juliflora</i> v. <i>glandulosa</i> | <i>Crematogaster</i> sp. (see photo) | Type species of the genus |
| <i>Toumeyella nectandrae</i> Hempel | Brazil | <i>Nectandra grandiflora</i> | None reported | Congeneric with <i>T. mirabilis</i> |

