

## AN ABSTRACT OF THE THESIS OF

Jessica Y. Adkins for the degree of Master of Science in Entomology presented on August 27, 2003.

Title: Revision of *Wyeomyia* (*Hystatomyia*) Dyar & Knab (Diptera: Culicidae: Sabethini).

Abstract approved:

Redacted for privacy

✓ Darlene D. Judd

Members of the tribe Sabethini (Diptera: Culicidae) oviposit and develop in phytotelmata (plant-held waters) and are primarily distributed in a pantropical pattern. Recent cladistic studies have demonstrated that while the tribe is monophyletic, three of its 13 genera are not. The genus *Wyeomyia* is particularly problematic and debate among culicidologists continues with regard to the monophyly of its subgenera. For example, the subgenus *Hystatomyia* was recently resurrected to include seven species within *Wyeomyia* that were without subgeneric placement. This was based on unique larval, pupal, and adult characters. However, 12 more undescribed species were separated out and identified as *Hystatomyia* species by John Belkin during the "Mosquitoes of Middle America" project. The objective of this study was to provide a modern species-level revision of *Hystatomyia* that includes diagnosis and description of all species and an

examination of phylogenetic relationships within *Hystatomyia* using morphological characters from larval, pupal, and adult stages.

©Copyright by Jessica Y. Adkins  
August 27, 2003  
All Rights Reserved

Revision of *Wyeomyia* (*Hystatomyia*) Dyar & Knab (Diptera: Culicidae: Sabethini)

by  
Jessica Y. Adkins

A THESIS

submitted to

Oregon State University

in partial fulfillment of  
the requirements for the  
degree of

Master of Science

Presented August 27, 2003  
Commencement June 2004

Master of Science thesis of Jessica Y. Adkins presented on August 27, 2003.

APPROVED:

Redacted for privacy

---

Major Professor, representing Entomology

Redacted for privacy

---

Chair of the Department of Entomology

Redacted for privacy

---

Dean of the Graduate School

I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

Redacted for privacy

---

Jessica Y. Adkins, Author

---

## ACKNOWLEDGEMENTS

I would like to thank my advisor, Darlene Judd, for all of her time and support, intellectually and otherwise, and for always encouraging me to excel. I would also like to thank my other committee members, Andy Brower, for sharing his wealth of systematic knowledge, and Phil Rossignol, for joining the committee at such a late date.

I also owe a huge thank you to all of my lab mates who have been amazingly supportive, thoughtful, helpful, intellectual, and most importantly, for making me laugh. This goes, too, for my friends outside of the lab, thank you for keeping me sane.

I would like to express how important my family has been in getting me to this point. Especially my mom and dad, whose endless love, support, and patient ears and words have meant so much to me.

Finally, I would like to acknowledge a NSF Career Grant to Judd (DEB 0093392) and the Harold and Leona Rice Endowment for Systematic Entomology for supporting my thesis research and the institutions that loaned material, the National Museum of Natural History, Washington, D.C. and the National Museum of Natural History, Leiden, The Netherlands.

## TABLE OF CONTENTS

|                                                                                                   | <u>Page</u> |
|---------------------------------------------------------------------------------------------------|-------------|
| Introduction.....                                                                                 | 1           |
| Materials and Methods.....                                                                        | 8           |
| Phylogenetic Analysis.....                                                                        | 37          |
| Taxonomic Revision.....                                                                           | 52          |
| Conclusion.....                                                                                   | 142         |
| Bibliography.....                                                                                 | 147         |
| Appendices.....                                                                                   | 152         |
| Appendix A: Distribution and list of species assigned<br>to the subgenus <i>Hystatomyia</i> ..... | 153         |
| Appendix B: Data matrix for phylogenetic analyses in Chapter 3.....                               | 154         |
| Appendix C: List of character codings and character<br>state changes for Figures 19-22.....       | 155         |

## LIST OF FIGURES

| <u>Figure</u>                                                                                          | <u>Page</u> |
|--------------------------------------------------------------------------------------------------------|-------------|
| 1. Cladogram showing phylogenetic relationships within the tribe Sabethini (Judd 1996).....            | 3           |
| 2. Map showing geographic distribution of <i>Hystatomyia</i> species in Central and South America..... | 7           |
| 3. Structures and chaetotaxy of the pupal cephalothorax.....                                           | 14          |
| 4. Genital lobes and paddles of <i>Hystatomyia</i> male pupae.....                                     | 15          |
| 5. Epandrium (tergum of segment IX) of adult male <i>Hystatomyia</i> .....                             | 17          |
| 6. Epandrium (tergum of segment IX) of adult male <i>Hystatomyia</i> .....                             | 18          |
| 7. Gonocoxites of male <i>Hystatomyia</i> .....                                                        | 19          |
| 8. Gonocoxites of male <i>Hystatomyia</i> .....                                                        | 20          |
| 9. Gonocoxites of male <i>Hystatomyia</i> .....                                                        | 21          |
| 10. Gonocoxites of male <i>Hystatomyia</i> .....                                                       | 22          |
| 11. Gonostyli of male <i>Hystatomyia</i> .....                                                         | 24          |
| 12. Gonostyli of male <i>Hystatomyia</i> .....                                                         | 25          |
| 13. Gonostyli of male <i>Hystatomyia</i> .....                                                         | 26          |
| 14. Gonostyli of male <i>Hystatomyia</i> .....                                                         | 27          |
| 15. Structures of the aedeagus in <i>Hystatomyia</i> .....                                             | 30          |
| 16. Sternum of segment VIII in male <i>Hystatomyia</i> .....                                           | 32          |
| 17. Strict consensus tree from 2,481 cladograms of 125 steps with CI = 0.86 and RI = 0.83.....         | 38          |



# LIST OF FIGURES (Continued)

| <u>Figure</u>                                                                                             | <u>Page</u> |
|-----------------------------------------------------------------------------------------------------------|-------------|
| 18. Strict consensus tree from 37 cladograms of<br>125 steps with CI = 0.86 and RI = 0.82.....            | 40          |
| 19. Successive approximations weighted tree.....                                                          | 41          |
| 20a. Successive approximations weighted tree.....                                                         | 43          |
| 20b. Key to Figure 20a.....                                                                               | 44          |
| 21. Successive approximations weighted tree.....                                                          | 45          |
| 22. Successive approximations weighted tree.....                                                          | 46          |
| 23. Composite illustration of pupal metathoracic<br>and abdominal chaetotaxy for <i>Hystatomyia</i> ..... | 63          |
| 24. Composite illustration of larval thoracic and<br>abdominal chaetotaxy for <i>Hystatomyia</i> .....    | 64          |
| 25. Chaetotaxy of the larval cranium for <i>Hystatomyia</i> .....                                         | 65          |
| 26. Structures associated with the larval mouthparts<br>for <i>Hystatomyia</i> .....                      | 65          |
| 27. Terminal abdominal segments for <i>Hystatomyia</i> larvae.....                                        | 66          |

## LIST OF APPENDIX TABLES

| <u>Table</u>                                                                               | <u>Page</u> |
|--------------------------------------------------------------------------------------------|-------------|
| A-1. Distribution and list of species<br>assigned to the subgenus <i>Hystatomyia</i> ..... | 153         |
| B-1. Data matrix for phylogenetic analyses in Chapter 3.....                               | 154         |

## INTRODUCTION

Approximately 3200 species (Harbach & Sandlant 1997) in the three subfamilies Anophelinae, Culicinae, and Toxorhynchitinae are currently recognized in the family Culicidae (Diptera) (Harbach & Kitching 1998). This classification places Sabethini as one of 10 tribes in Culicinae. Historically, the taxonomic rank of the tribe Sabethini within the family Culicidae has been dynamic in nature. Dyar (1906a, b; Dyar & Knab 1906) originally placed the sabethines at the subfamily rank and included eight genera: *Dendromyia* Theobald, *Joblotia* Blanchard, *Lestiocampa* Dyar & Knab, *Limatus* Theobald, *Phoniomyia* Theobald, *Sabethes* Robineau-Desvoidy, *Sabethoides* Theobald, and *Wyeomyia* Theobald. A reorganization of the Culicidae by Williston (1906) resulted in the reduction of sabethines to the rank of tribe within the subfamily Culicinae (Dyar & Knab 1907, Dyar 1919, 1928, Howard et al. 1915). Dyar (1928) reaffirmed Edwards' position that, at that time, no known character existed that could separate the tribe Sabethini from other culicid tribes. Edwards (1932) consequently reduced the sabethines to the rank of subtribe. Sabethines were once again elevated to tribal rank when Lane & Cerqueira (1942) revised the sabethines of the Western Hemisphere. Subsequent classifications have maintained the rank of Sabethini as a tribe (Lane 1953, Thurman 1959, Belkin 1962, Knight & Stone 1977, Judd 1996). According to the

Systematic Catalog of Culicidae (Gaffigan 2001) there are 364 valid sabethine species in 28 subgenera and 13 genera.

Mosquitoes in the tribe Sabethini are distributed in a pantropical pattern and reach their greatest diversity in the New and Old World tropics. Members of this tribe are primarily restricted to ovipositing and developing in phytotelmata (plant-held waters). Although they are among the most structurally and biologically diverse of mosquitoes, sabethines have been overlooked by systematists until recently because they are of minor importance in vector pathogen transmission.

Cladistic studies by Judd (1995, 1996, 1998) demonstrated that while the tribe is monophyletic, three of its 13 genera are not. The genus *Wyeomyia* Theobald is particularly problematic (A, Fig. 1). For example, the genus *Limatus* Theobald is currently embedded within an assemblage of nine of 11 *Wyeomyia* subgenera, some of which are paraphyletic or polyphyletic (Judd 1996). While recent studies have concentrated on a number of these little-known species groups (Motta & de Oliveira 1995, Judd 1998, de Oliveira et al. 1999), the monophyly of subgenera within *Wyeomyia* continues to be questioned (Harbach & Kitching 1998).

Dyar (1919) originally proposed the subgenus *Hystatomyia* to identify a species-group within the growing number of newly described species from the Neotropics in the genus *Dendromyia*. Edwards opposed this division and, based

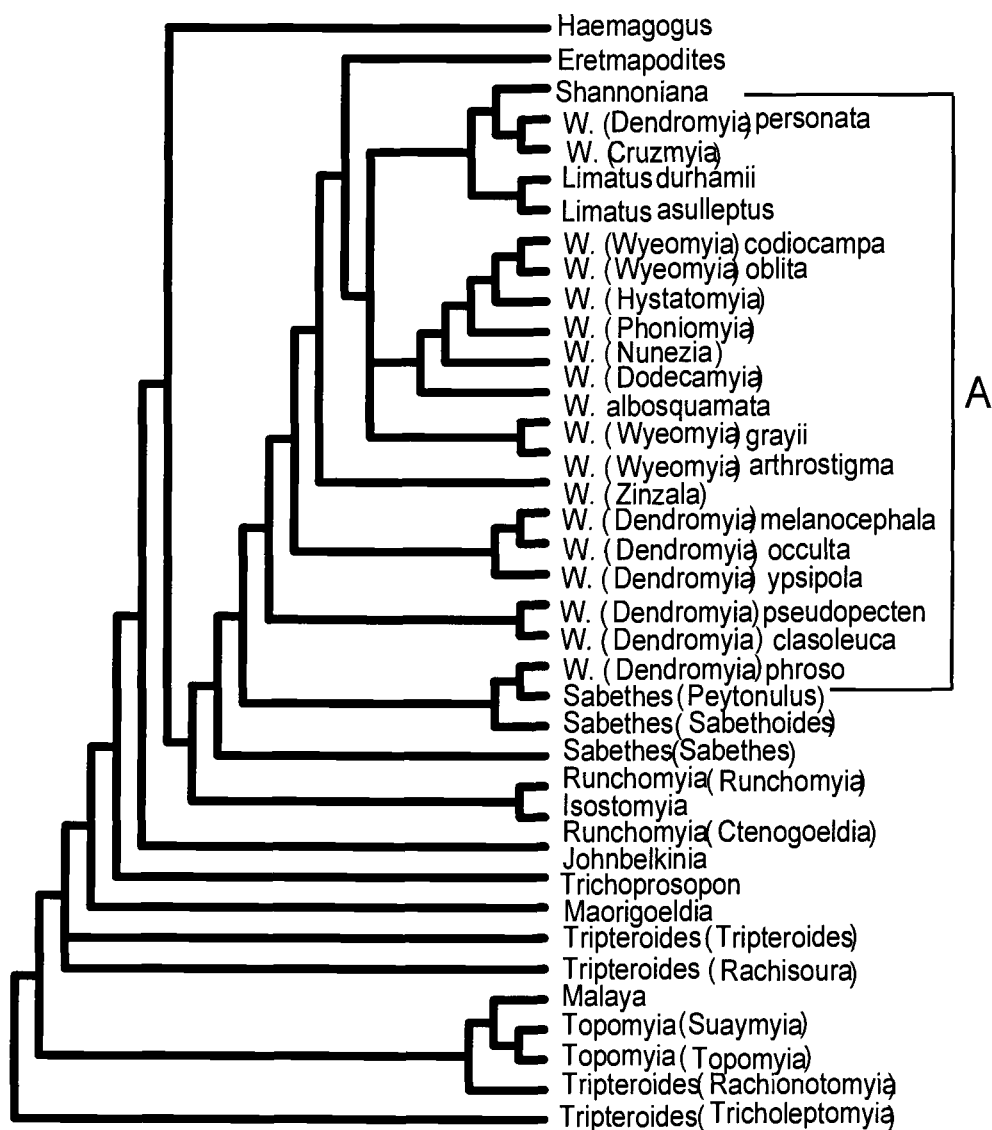


Figure 1. Cladogram showing phylogenetic relationships within the tribe Sabethini (Judd 1996). "A" demarcates the problematic *Wyeomyia* clade.

primarily on adult characters, sunk *Dendromyia* and two other genera to the level of subgenus within *Wyeomyia* during his revision of the Culicidae (1932).

Consequently, *Hystatomyia* was listed as a synonym of *Dendromyia* in Edwards' and the mosquito classifications that followed (Knight and Stone 1977).

Albuquerque Motta and Lourenço de Oliveira (1995) restricted *Dendromyia* to five species, leaving the remaining species without subgeneric placement. Larval, pupal, and adult characters used to differentiate *Dendromyia* from other *Wyeomyia* subgenera included a prominent tooth on the larval maxilla and scale patterns in the adult (Albuquerque Motta & Lourenço de Oliveira 1995). Based on unique, phylogenetically informative features and cladistic analyses of characters from larval, pupal, and adult life stages, Judd (1995, 1996, 1998) resurrected *Hystatomyia* for seven of these species within *Wyeomyia* that were without subgeneric placement. Within *Hystatomyia*, she defined two species groups using characters from adult male genitalia and redescribed a single species from each group. The first group includes four species: *W. circumcincta* Dyar & Knab, *W. coenonous* Howard, Dyar & Knab, *W. intonca* Dyar & Knab, and *W. esmeraldasi* (Levi-Castillo). The second group includes three species: *W. autocratica* Dyar & Knab, *W. lamellata* (Bonne-Wepster & Bonne), and *W. lopezii* Cova Garcia. In addition to the described species, Belkin separated out 12 putative new species

(deemed species A, B, C, D, E, F, G, H, J, K, L, and M by Belkin) during the “Mosquitoes of Middle America” project (1965). Eleven of the 12 putative species were examined by Judd. Two of the putative new species were determined to fall within an acceptable range of variation for the diagnosis of *W. circumcincta*, while the others were found sufficiently distinct to necessitate further study (Judd, pers. comm.).

The undescribed material from Belkin appear to fall within the *W. circumcincta* species group of Judd (1998) and are from Nicaragua, Costa Rica, Panama, and Colombia. Species currently placed in *Hystatomyia* are restricted to the tropics of Central and South America (Fig. 2). All have narrow geographic ranges with the exception of *W. circumcincta* Dyar & Knab, which is widespread. A revision that includes the new putative species should provide a better understanding of the complex biogeographic patterns observed in *Hystatomyia* between Central and northern South America.

Additionally, the sister group relationship of *Hystatomyia* has proven problematic. A cup-like structure on the larval maxilla unique to both *Hystatomyia* and *Phoniomyia* unites these groups as sister taxa. However, the subgenus *Phoniomyia* (Judd 1998) is not demonstrably monophyletic as currently recognized. When characters from the larval, pupal and adult life stages were analyzed simultaneously, *Phoniomyia* was consistently placed within *Wyeomyia* as

the sister group to *Hystatomyia* (Judd 1996, 1998). Judd (1998) reduced *Phoniomyia* to a subgenus of *Wyeomyia* and separated *Hystatomyia* and *Phoniomyia* based on the location of the male gonostylus, differences in structure of the pupal trumpet, and the presence or absence of a peg-like sensillum on the apex of the larval maxillary palpus. However, specimens recently collected in Costa Rica (Chavarri, pers. comm.) and identified as *Phoniomyia* possess morphological structures that conflict with previous descriptions of the subgenus and overlap with characteristics of *Hystatomyia*. If the identification proves accurate then only part of *Phoniomyia* may be the sister group to *Hystatomyia* and relationships between the two subgenera need to be reexamined.





Figure 2. Map showing geographic distribution of *Hystatomyia* species in Central and South America. Letters refer to presence of a species in the country, not to the specific site: A. *W. circumcincta*; B. *W. coenonius*; C. *W. "species C"*; D. *W. intonca*; F. *W. "species E/F"*; G. *W. "species G"*; H. *W. "species H"*; I. *W. "species K"*; J. *W. "species L"*; K. *W. "species M"*; L. *W. lamellata*; M. *W. autocratica*; N. *W. lopezii*; O. *W. esmeraldasi*.

## MATERIALS AND METHODS

### PHYLOGENETIC ANALYSIS

#### The Taxa

The ingroup included *Wyeomyia* (*Hystatomyia*) *circumcincta*, *W. intonca*, *W. coenonus*, *W. esmeraldasi*, *W. autocratica*, *W. lamellata*, and *W. lopezii*, the species currently placed in the subgenus *Hystatomyia*, as well as seven previously undescribed *Hystatomyia* species. Specimens of *W. esmeraldasi* and *W. lopezii* were unavailable, however the original species descriptions were examined (Levi-Castillo 1955 and Cova Garcia et al. 1979, respectively) and interpreted conservatively in order to include some morphological characters from these species in the analysis.

Outgroup selection was performed using an exemplar approach. This procedure was chosen over the groundplan approach as real taxa are used, rather than the composite taxa created, in large part intuitively, by the researcher using the groundplan approach (Yeates 1995). The exemplar approach also has the advantage of facilitating future analyses as its methods are explicit, a characteristic the groundplan approach lacks. The outgroup for the analysis included: *W. (Wyeomyia) grayii* Theobald, the type species for the genus; *W. (Phoniomyia) splendida* Bonne-Wepster & Bonne, *W. (Phoniomyia) trinidadensis* Theobald, and

*W. (Phoniomyia) quasilongirostris* Theobald, representing each of three species groups in *W. (Phoniomyia)*, the putative sister group of *W. (Hystatomyia)*; and *Sabethes (Sabethes) cyaneus* Fabricius, from the sister group to the genus *Wyeomyia* (Judd 1996).

### Character Selection

Morphological characters from the larval, pupal, and adult life stages were examined. A total of 42 characters from all three life stages are included in the analysis. Twenty-one of these are original (i.e. described for the first time here) morphological characters (two pupal characters and 19 adult male characters). All 13 larval characters, three pupal characters, and three adult male characters were interpreted from Judd (1995 and 1996) and are denoted by an asterisk (\*).

Morphological terminology follows Manual of Nearctic Diptera (McAlpine et al. 1981) except when referring to the pupal stage and structures not covered in the Manual. Terminology for these terms follows Harbach and Knight (1980). In instances of disagreement in terminology between the two sources, the Manual of Nearctic Diptera term will be followed by the Harbach and Knight (1980) term in parentheses at first usage. The order of character states listed in the following descriptions does not imply relative ancestral or derived status or transformation series (see Phylogenetic Analysis).

### Larval Characters

\*1. Anterior edge of the prementoligular teeth. The prementoligular teeth extend beyond seta 1-Lh (state 0) in *Hystatomyia* species and are either level with the base of seta 1-Lh (state 1) or are posterior to the base of seta 1-Lh (state 2) in the outgroups (see Judd 1995, pp. 141-143).

\*2. Pattern of denticles on the prementoligular teeth. The pattern of denticles on the prementoligular teeth is variable in the area adjacent to and posterior to setae 4- and 5-Lh. The denticles in this region are confined to the lateral margin in *Hystatomyia* (state 0) and extend posteriorly to the ventral premental spicules in the outgroups (state 1) (see Judd 1995, pp. 141-142, 184).

\*3. Condition of the lateral premental teeth of the labiohypopharynx. The lateral premental teeth are broad at the base and taper to a sharp spine-like process in *Hystatomyia* (state 0). All outgroups have these teeth with setiform apices (state 1) (see Judd 1995, pp. 141-143, 184).

\*4. Attachment of the maxillary palpus. The maxillary palpus is fused to the maxilla in *Sabethes cyaneus* (state 0). A suture is present that separates the maxillary palpus from the maxilla in *Hystatomyia* and the other outgroups (state 1) (see Judd 1995, pp. 146-148).

\*5. Attachment of the palpifer (cardo). The palpifer is separate from both the maxilla and palpus in *Hystatomyia* and *Phoniomyia* (state 2) and is either fused

to the maxilla (state 0) or to both the maxilla and palpus (state 1) in the other outgroups (see Judd 1995, pp. 146-148).

\*6. Placement of maxillary seta 3-Mx. Seta 3-Mx is placed in a lateral notch on the margin of the maxilla in *Hystatomyia* and *Phoniomyia* (state 1). This notch is absent (state 0) in the other outgroups (see Judd 1995, pp. 149, 185).

\*7. Condition of laciniastrum 1 of the maxilla. The laciniastrum 1 is characterized as spiniform (state 0) in members of *Hystatomyia* and some outgroups and as denticular (state 1) in other outgroups (see Judd 1995, pp. 146, 148-151).

\*8. Mandibular spicules. Mandibular spicules are present primarily on the outer dorsal surface of the mandible in some outgroups (state 1) and are absent in *Hystatomyia* and other outgroups (state 0) (see Judd 1995, pp. 154, 155).

\*9. Condition of seta 11-M, T. *Hystatomyia* species and some outgroups have seta 11-M, T grouped with setae 9-, 10-, and 12-, M, T on a sclerotized protuberance on the lateral ventral surface of the meso- and metathoracic segments (state 0). Seta 11-M, T is fused and spiniform in *Sabethes cyaneus* (state 1) (see Judd 1995, p. 157).

\*10. Condition of the dorsolateral surface of seta 2-S. The dorsolateral surface of seta 2-S of the siphon is unmodified (state 0) in *Hystatomyia* and some

outgroups. Transverse striations are present on seta 2-S (state 1) in *Sabethes cyaneus* (see Judd 1995, p. 161).

\*11. Presence/absence of spicules on the siphon. Spicules are absent from the siphon in *Hystatomyia* and some outgroups (state 0) and are present in the outgroup *Sabethes cyaneus* (state 1) (see Judd 1995, p. 160).

\*12. Condition of pecten. In *Hystatomyia*, the pecten is spiculate and in a single row (state 1) ventrolateral in position extending distally from the base of the siphon. Outgroup conditions for the pecten include spiculate and in a paired row (state 0), absence of the pecten (state 2), and modification of the spicules into filamentous, setae-like projections (state 3) (see Judd 1995, p. 160).

#### Pupal Characters

\*13. Condition of cephalothoracic seta 5-CT. Seta 5-CT is stout or enlarged in all *Hystatomyia* species and in some outgroup species (state 0; Fig. 3) and has multiple branches in the remaining outgroup species (state 1) (see Judd 1995, pp. 165, 166).

\*14. Apical condition of cephalothoracic seta 1-CT. The apex of seta 1-CT is unmodified in all *Hystatomyia* species (state 0; Fig. 3), whereas the apex of this seta is strongly hooked in the outgroups (state 1) (see Judd 1995, p. 167).

\*15. Trumpet shape. The trumpet can be divided into two parts, the proximal tracheoid section, which is visible internally on slide-mounted specimens, and the distal reticulate section. *Hystatomyia* species are unique in that the reticulate portion of the trumpet is at least three times the length of the tracheoid portion and the trumpet is widest apically (state 0, Fig. 3). There are two conditions for trumpet shape in the outgroups; the reticulate section is approximately twice the length of the tracheoid section and the apex is equal in width to the reticulate section (state 1) or the reticulate section is approximately equal in length to the tracheoid section and is a constant width throughout (state 2) (see Judd 1995, pp. 165-167, 169-170).

16. Size of male genital lobes. *Hystatomyia* is unique in that the genital lobes are much larger than the paddles (state 1; Fig. 4), whereas all outgroups have the genital lobes reduced (state 0, see Judd 1995, 170-171).

17. Condition of the posterior margin of the male genital lobe. The posterior margins of the genital lobes in *Hystatomyia* are either emarginate (state 0; Fig. 4A-H) or continuous (state 1; Fig. 4I-K). An inapplicable state (state 2) is assigned to the outgroups.

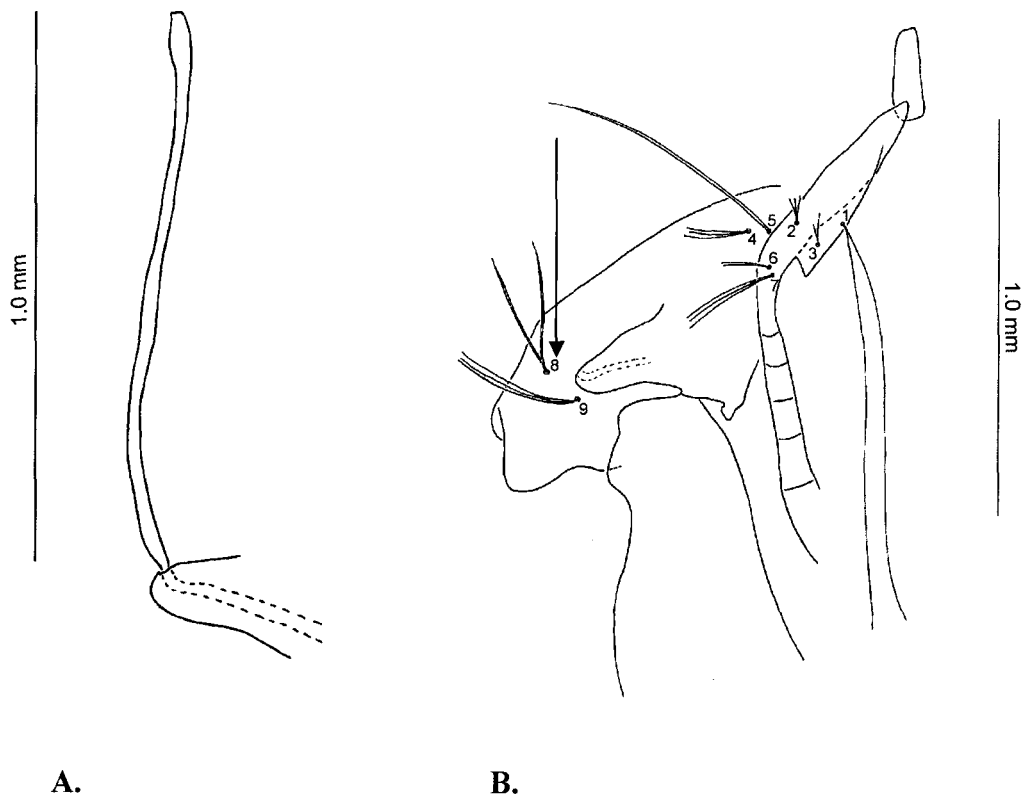


Figure 3. Structures and chaetotaxy of the pupal cephalothorax. A. Detached pupal trumpet. B. Portion of pupal cephalothorax showing chaetotaxy pattern. Arabic numerals identify homologous setae. Arrow identifies point of attachment of trumpet on cephalothorax. A. and B. represent all observed *Hystatomyia* species.



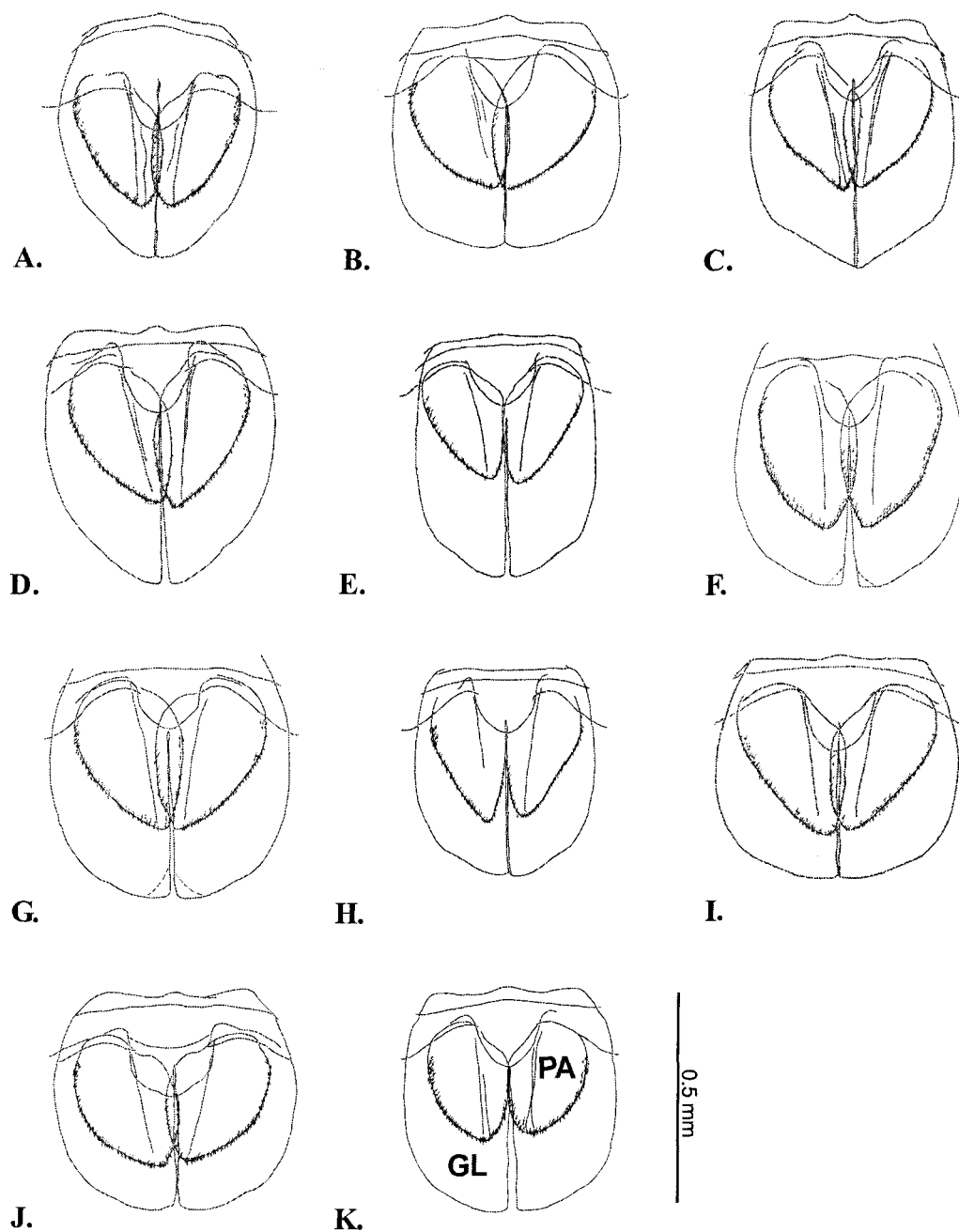


Figure 4. Genital lobes and paddles of *Hystatomyia* male pupae. A. and B. Two forms from *W. circumcincta*; C. *W.* "species C"; D. *W. intonca*; E. *W.* "species E/F"; F. *W.* "species G"; G. *W.* "species H"; H. *W. coenonius*; I. *W.* "species K"; J. *W.* "species L"; K. *W.* "species M". PA, paddle; GL, genital lobe. Measurement bar applies to A-K.

### Adult Male Characters

18. Epandrium setae. A paired group of setae are usually closely associated on the epandrium (tergum IX) (state 0; Figs. 5 and 6A,B,D). In “species L” these setae are far removed from each other on specialized lobes (state 1; Fig. 6C.).

19. Mesal lobe of gonocoxite. Members of the *W. circumcincta* species group in *Hystatomyia* have a gonocoxite with a well developed mesal lobe (state 0; Fig. 7-9). This development is absent in the *W. autocratica* species group and outgroups (state 1; Fig. 10).

20. Number of major groups of setae on the mesal lobe of the gonocoxite. *Hystatomyia* species with a well developed gonocoxal mesal lobe also have a distinct number of major groups of setae on this lobe. Major groups of setae are identified as those that are located and directed together in a defined area and are of the same type, usually stout and elongate. The possible conditions are; 1 group (state 0; Fig. 9C), 2 groups (state 1; Figs. 7, 8A, and 9B), or 3 groups (state 2; Figs. 8B-D and 9A). An inapplicable state (state 3) is assigned for those species without a well developed mesal lobe.

21. Location of the gonostylus on the gonocoxite. The gonostylus is attached to the gonocoxite in one of four locations; mesal on the mesal lobe (state 0, Fig. 9B), lateral on the mesal lobe (state 1; Figs. 7, 8, and 9A & C), subapical on the arm (state 2; Fig. 10), or apical on the arm (state 3; see Judd 1995, p. 181).

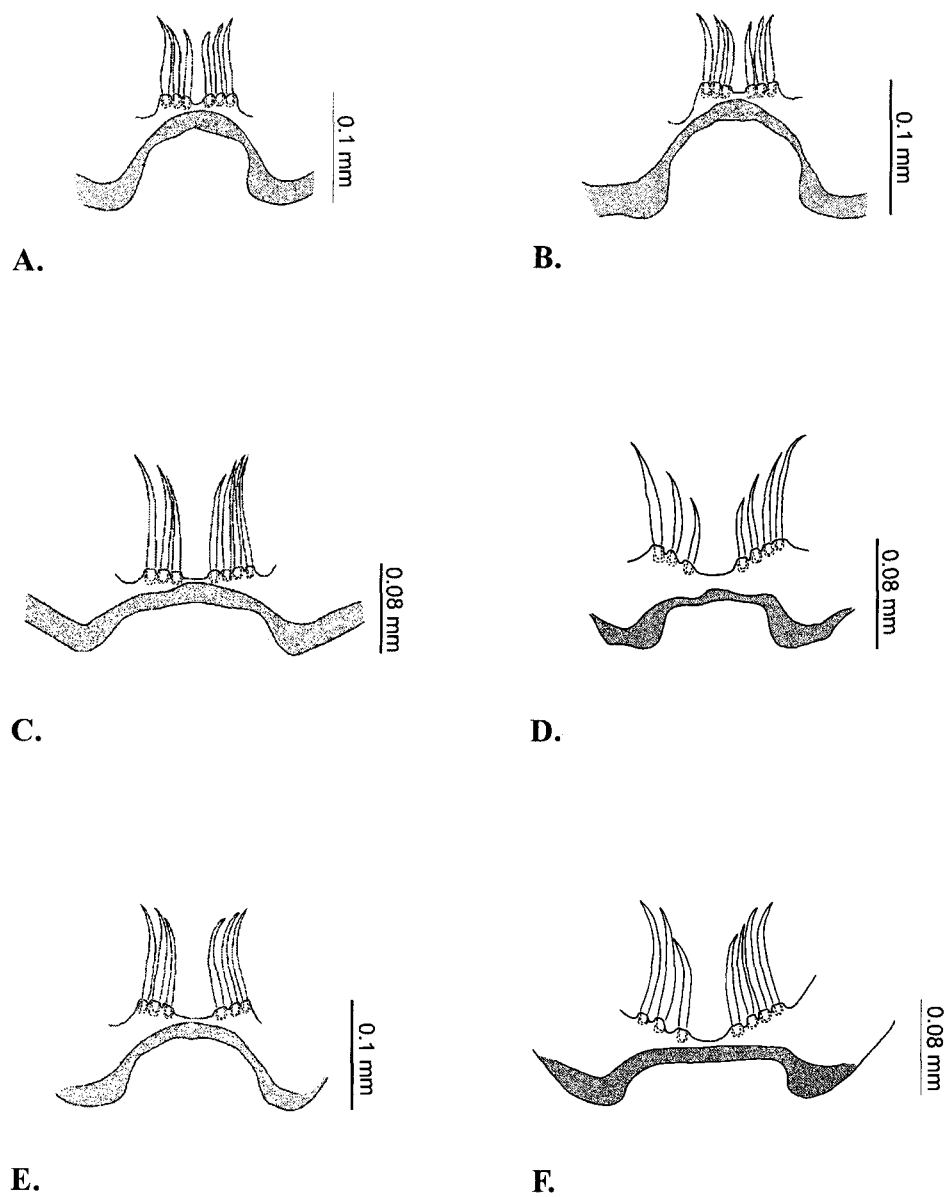


Figure 5. Epandrium (tergum of segment IX) of adult male *Hystatomyia*. A. *W. circumcincta*; B. *W.* "species C"; C. *W. intonca*; D. *W.* "species E/F"; E. *W.* "species G"; F. *W.* "species H".

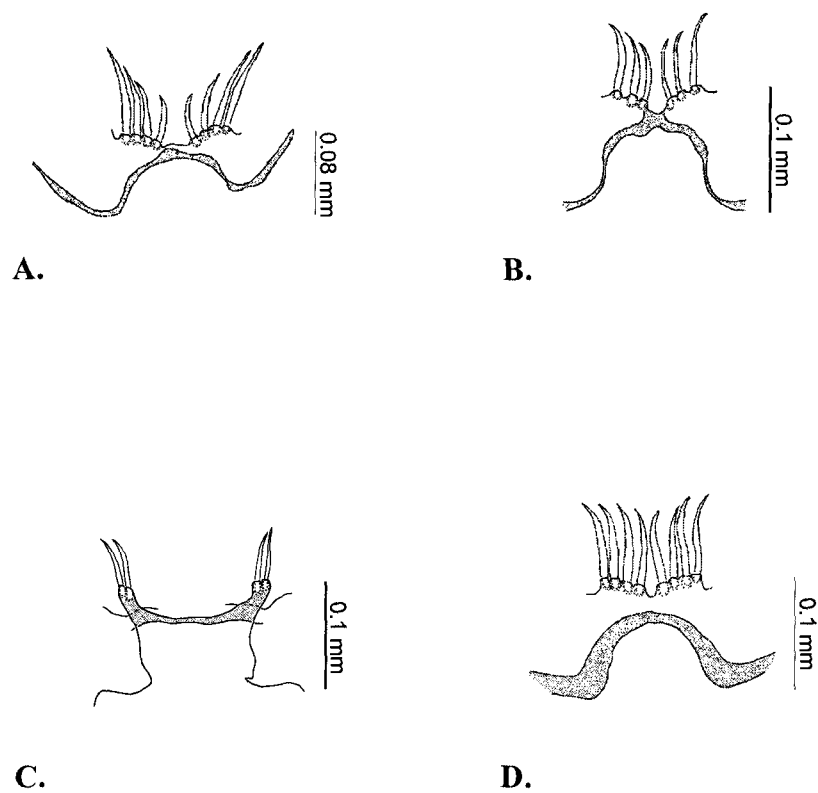


Figure 6. Epandrium (tergum of segment IX) of adult male *Hystatomyia*. A. *W. coenonius*; B. *W. "species K"*; C. *W. "species L"*; D. *W. "species M"*.

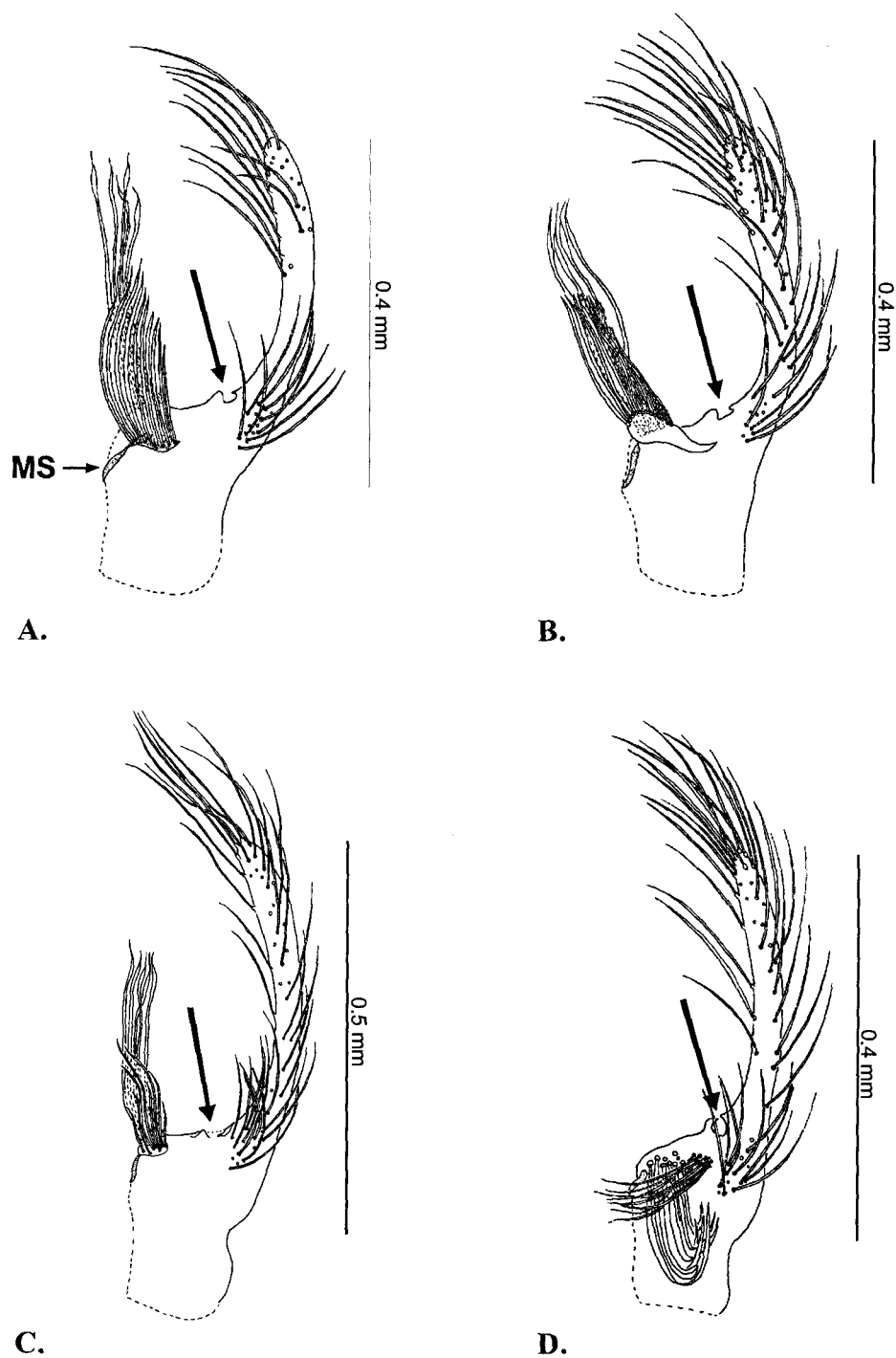


Figure 7. Gonocoxites of male *Hystatomyia*. Gonostylus removed for clarity. Arrow points to gonostylus point of attachment. A. and B. Two forms of *W. circumcincta*; C. *W.* "species C"; D. *W. coenonius*; MS, mesal sclerite (basal mesal lobe).

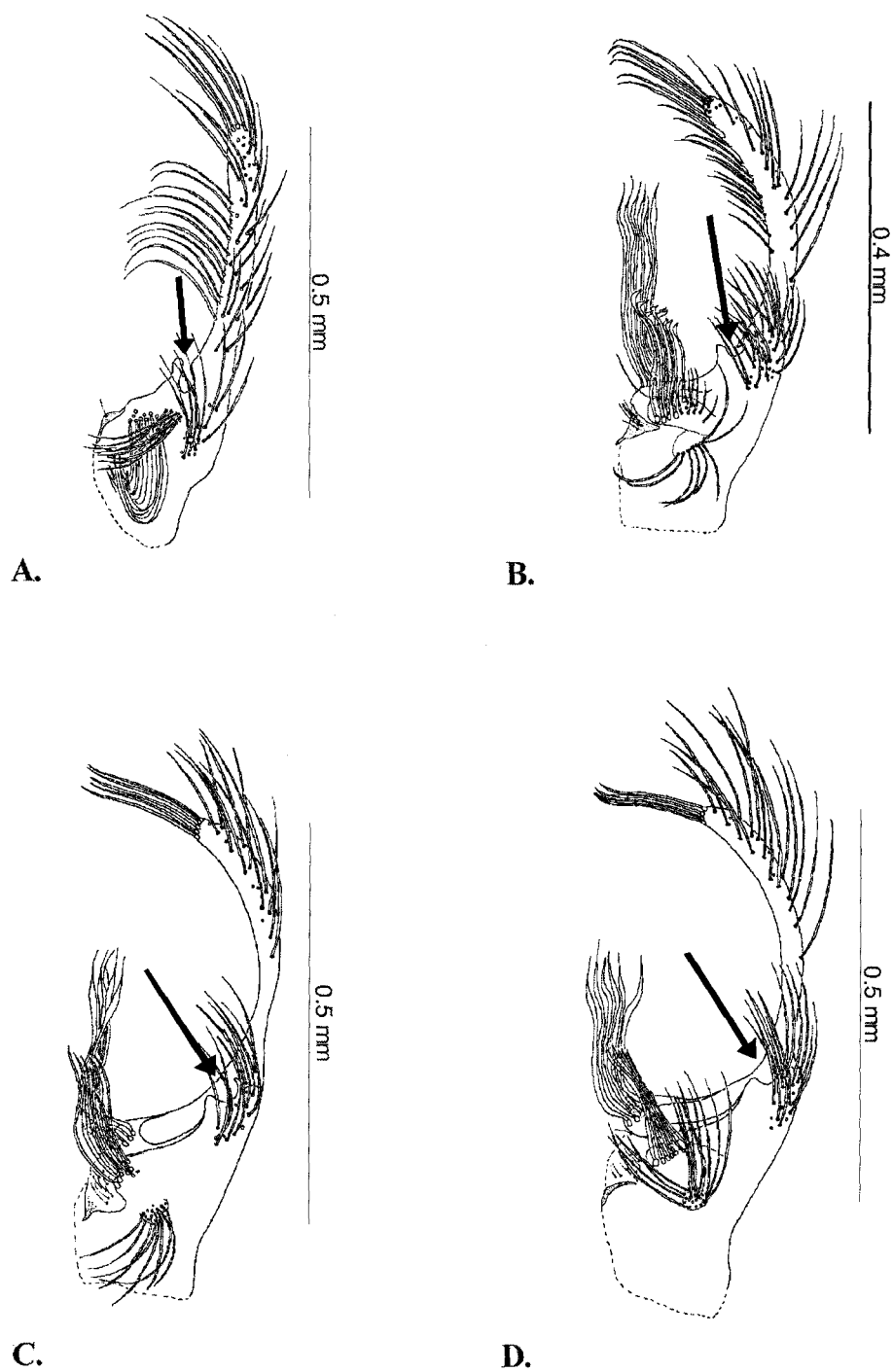


Figure 8. Gonocoxites of male *Hystatomyia*. Gonostylus removed for clarity. Arrow points to gonostylus point of attachment. A. *W.* "species E/F"; B. *W. intonca*; C. *W.* "species G"; D. *W.* "species H".

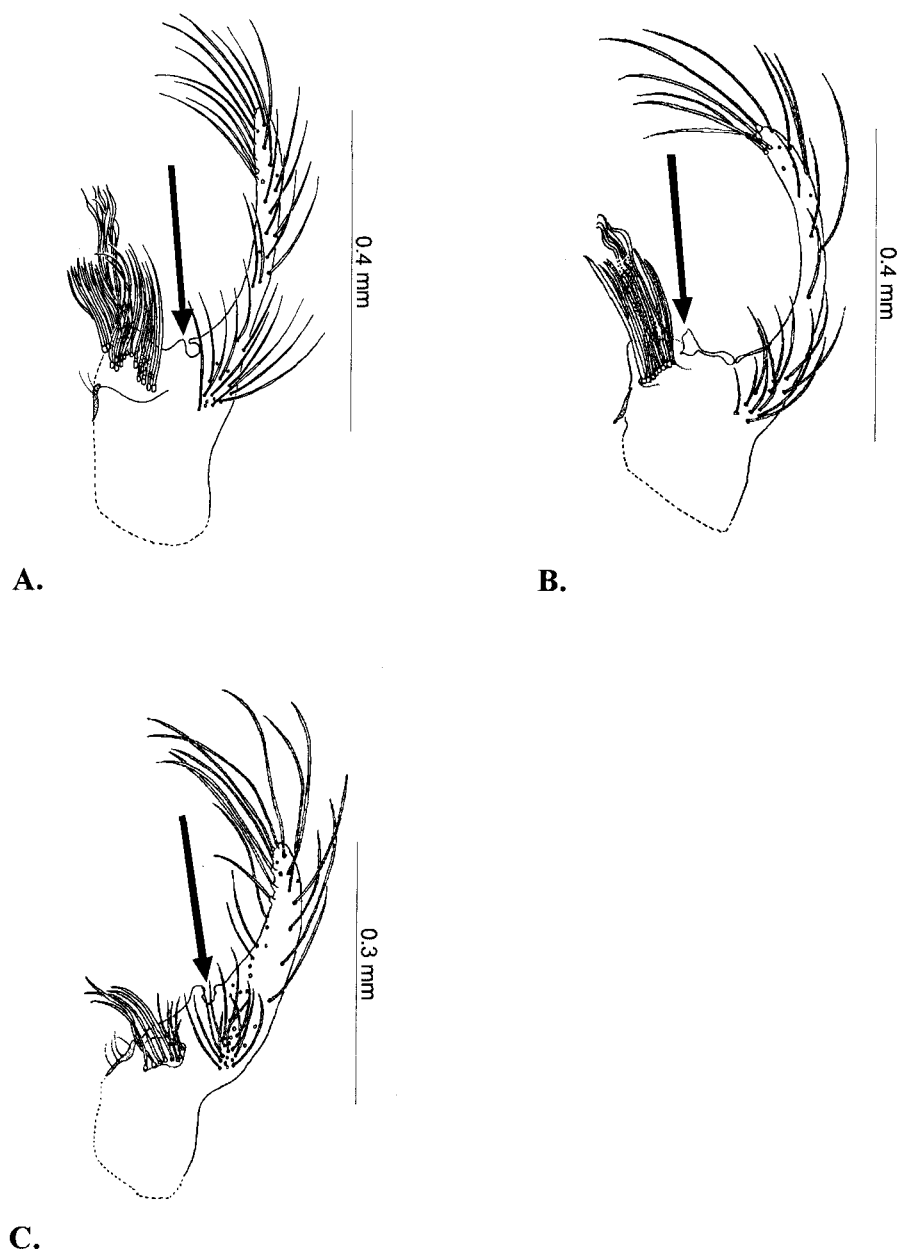


Figure 9. Gonocoxites of male *Hystatomyia*. Gonostylus removed for clarity. Arrow points to gonostylus point of attachment. A. *W.* "species M"; B. *W.* "species L"; C. *W.* "species K".

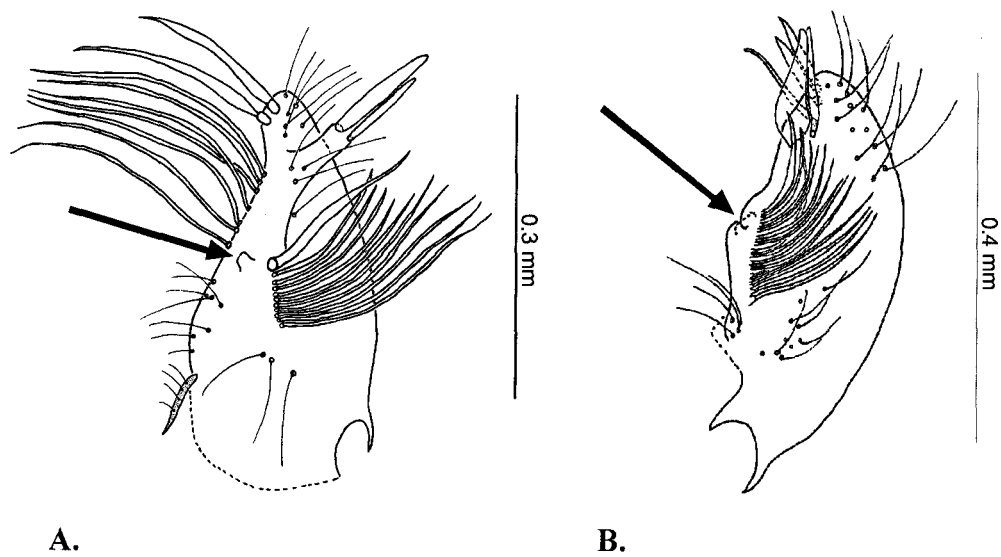


Figure 10. Gonocoxites of male *Hystatomyia*. Gonostylus removed for clarity. Arrow points to gonostylus point of attachment. A. *W. autocratica*; B. *W. lamellata*.



22. Placement of gonostylus. The gonostylus is located on the inner surface of the gonocoxite in all *Hystatomyia* species (state 0). *Phoniomyia quasilongirostris* has the gonostylus on the outer surface of the gonocoxite (state 1). An inapplicable state is assigned for those outgroups with an apical gonostylus (state 2).

23. Point of attachment of the gonostylus. There are 5 conditions for the shape of the gonocoxite at the point where the gonostylus attaches. Modifications of the gonocoxite at the point of attachment include the ball and socket (state 0, Figs. 11, 12A, and 13C), divot (state 1, Fig. 12C & D), cup-like (state 2, Figs. 13A & B and 14), and stalk (state 3, Fig. 12B) conditions. There is no modification of the gonocoxite with direct attachment (state 4).

24. Condition of the gonostylus. All *Hystatomyia* species have a simple gonostylus (state 0; Figs. 11-14). The gonostylus of some members of the outgroup has a complex apex with multiple lobes or branches (state 1; see Judd 1995, p. 181).

25. Presence of setae on the gonostylus. Within *Hystatomyia* setae are absent on the gonostyli of the *W. circumcincta* species group and *Phoniomyia quasilongirostris* (state 0; Figs. 11-13) and are present on the gonostyli of the *W. autocratica* species group and the other outgroups (state 1; Fig. 14).

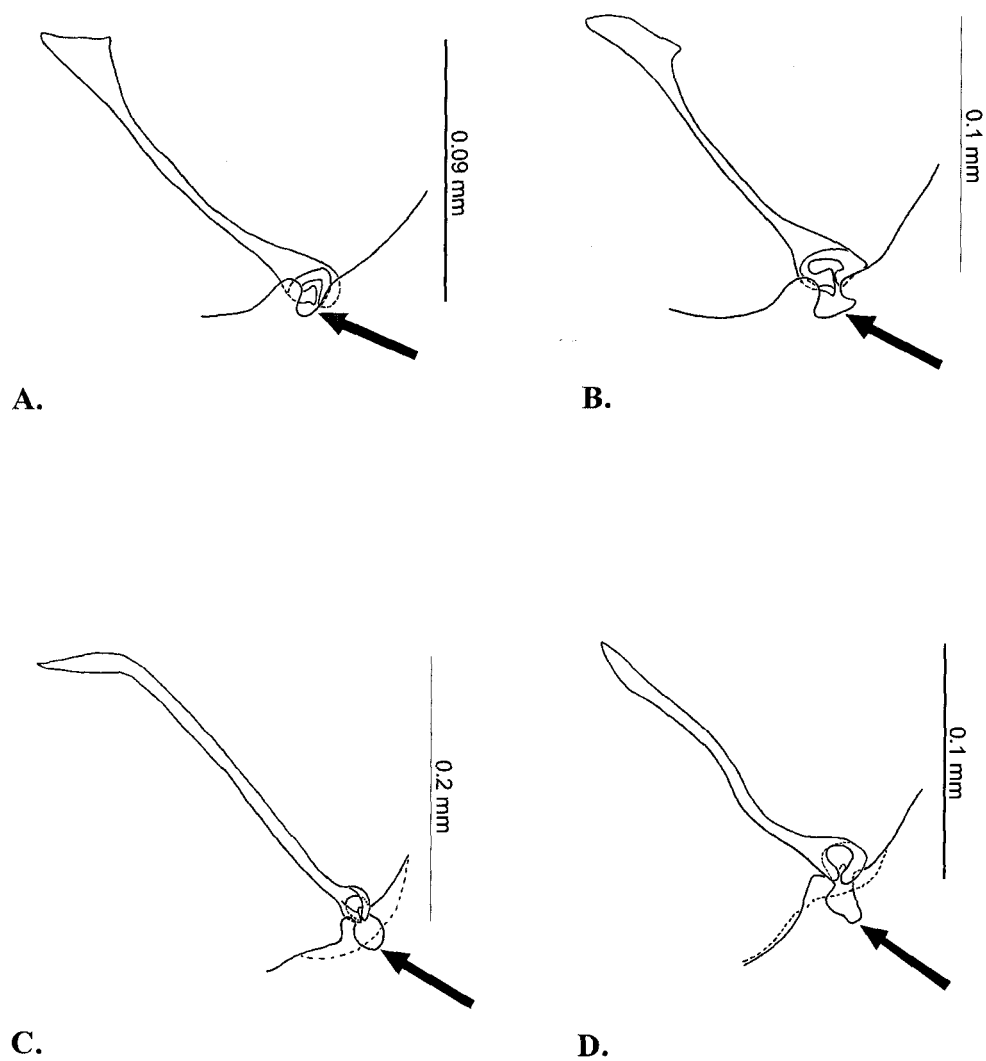


Figure 11. Gonostyli of male *Hystatomyia*. Arrow points to point of attachment to gonocoxite. A. and B. Two forms of *W. circumcincta*; C. *W. coenonius*; D. *W.* "species K".

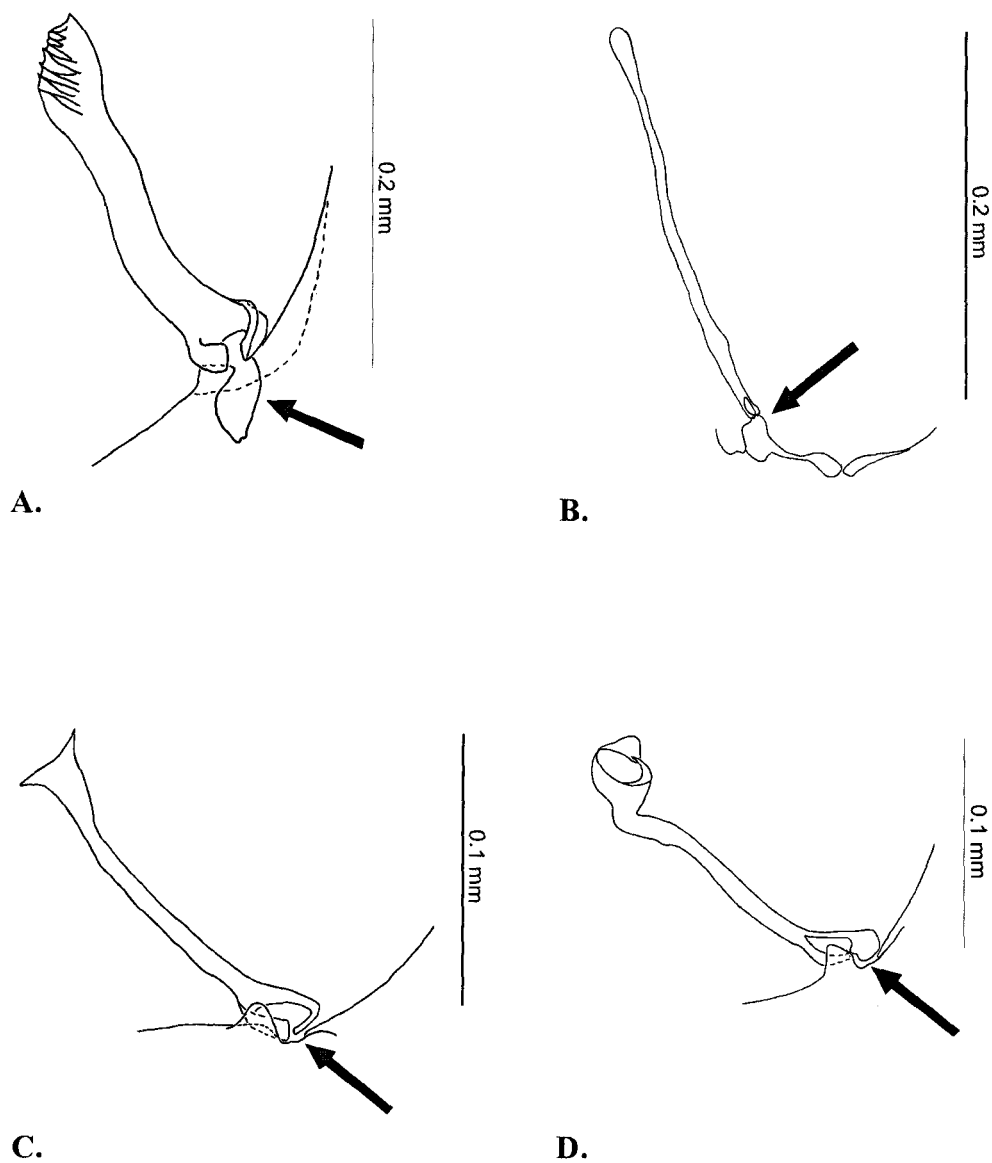


Figure 12. Gonostyli of male *Hystatomyia*. Arrow points to point of attachment to gonocoxite. A. *W.* "species E/F"; B. *W.* "species L"; C. *W.* "species C"; and D. *W.* *intonca*.

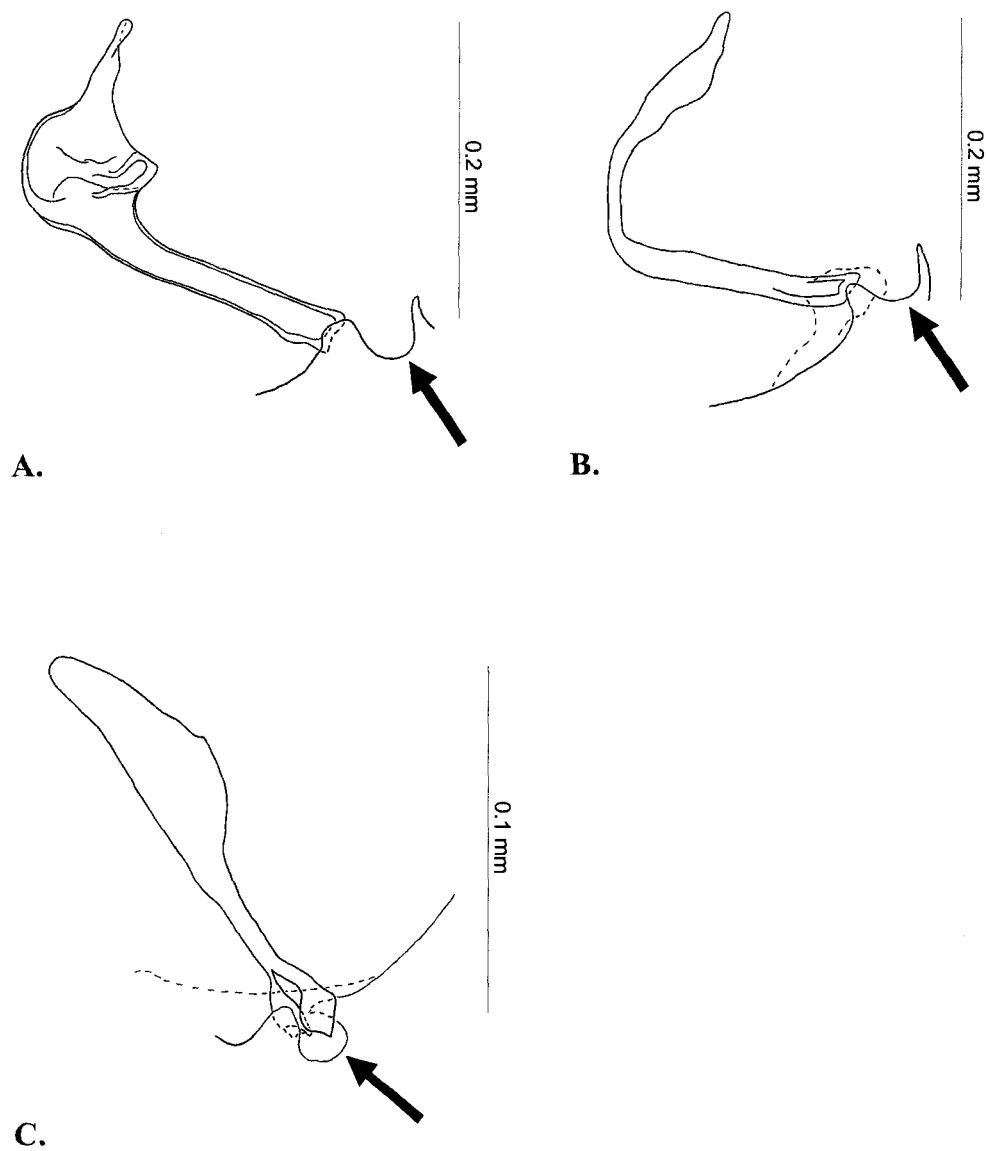


Figure 13. Gonostyli of male *Hystatomyia*. Arrow points to point of attachment to gonocoxite. A. *W.* "species H"; B. *W.* "species G"; C. *W.* "species M".

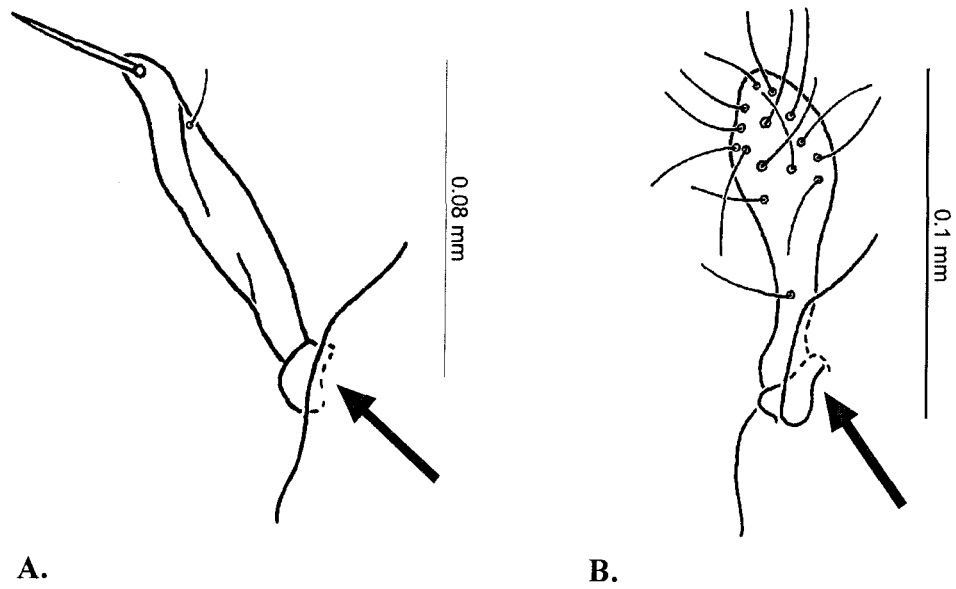


Figure 14. Gonostyli of male *Hystatomyia*. Arrow points to point of attachment to gonocoxite. A. *W. autocratica*; B. *W. lamellata*.

26. Apex of gonostylus. Species within *Hystatomyia* all have simple gonostyli that differ markedly from each other, primarily in the shape of the apex. The conditions for the apex are as follows; median corner longer than lateral corner (state 0; Fig. 11A & B), median corner equal to lateral corner or T-shaped (state 1; Fig. 12C), flattened and rounded (state 2; Fig. 12B), asymmetrically tapered (state 3; Fig. 11C & D), weakly hooked with mesal ridges (state 4; Fig. 12A), cup-like and simple (state 5; Fig. 12D), cup-like and complex (state 6; Fig. 13A), truncate on lateral margin with rounded tip (state 7; Fig. 13B), asymmetrically spatulate with rounded tip (state 8; Fig. 13C), slightly tapered with a spine-like apical seta (state 9; Fig. 14A), bulbous (state A; Fig. 14B), weakly hooked with a short, spine-like apical seta (state B), and bluntly rounded (state C; see Judd 1995, p.176). State D is assigned for outgroups with complex gonostyli.

27. Condition of the base of the gonostylus. The base of the gonostylus is either completely fused forming a solid structure (state 0; Fig. 13A & B) or open and not fused posteriorly (state 1; Figs. 11, 12, and 13C).

28. Shape of the median section of the gonostylus. In the species with simple gonostyli, the median section is straight (state 0; Figs. 11A-C, 12B-D, 13A-C, and 14), S-curved (state 1; Figs. 11D and 12A), or recurved (state 2; Fig. 13B). *Sabethes cyaneus*, *W. grayii*, and *P. trinidadensis* are each assigned a unique state (state 3, state 4, and state 5, respectively).

29. Width of the median section of the gonostylus. The width of the median section of the simple gonostylus is measured as less than half the width of the apical section (state 0; Figs. 11A & B, 12C & D, 13A & C, and 14B) or greater than half the width of the apical section (state 1; Figs. 11C & D, 12A & B, 13B, and 14A). *Sabethes cyaneus*, *W. grayii*, and *P. trinidadensis* are each assigned a unique state (state 2, state 3, and state 4, respectively).

30. Length of the gonostylus. Length is measured from base to apex. The length of the simple gonostyli ranges from 41.3-357.5  $\mu\text{m}$ . Distinct gaps were identified among this range and are identified as follows; 41.3 (state 0), 86.0-92.5 (state 1), 120.0-165.0 (state 2), 187.5-277.5 (state 3), 307.5-357.5 (state 4). *Sabethes cyaneus*, *W. grayii*, and *P. trinidadensis* are each assigned a unique state (state 5, state 6, and state 7, respectively).

31. Arms of the tergal bridge of the aedeagus. The arms of the tergal bridge are usually unadorned in *Hystatomyia* (state 0; Fig. 15A). In *W.* "species C" the median section of both arms has a small, lateral lobe present (state 1; Fig. 15B).

\*32. Condition of the lateral tergal arms of the aedeagus. All *Hystatomyia* species have the lateral tergal arms of the aedeagus apically fused (state 1; Fig. 15A & B). These structures are separate in members of the outgroup (state 0; see Judd 1995, p. 176).

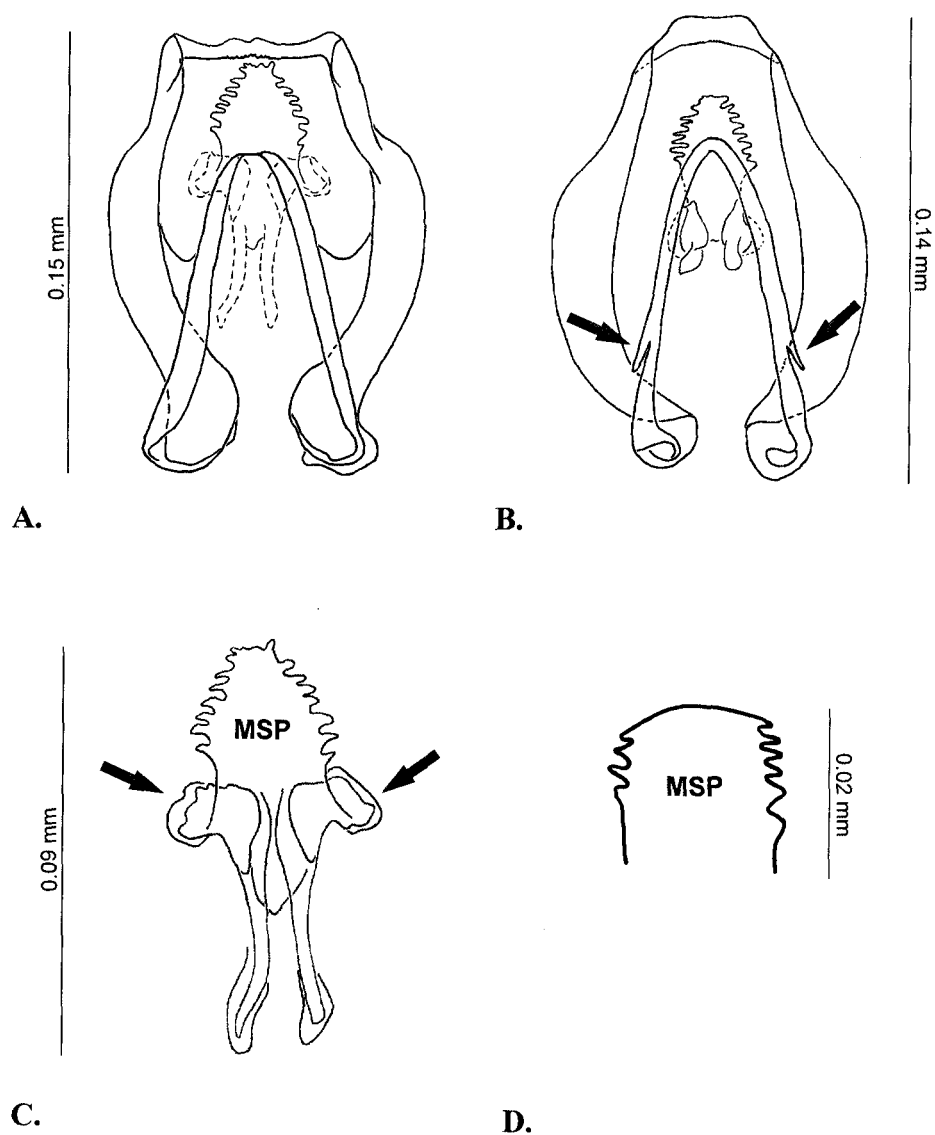


Figure 15. Structures of the aedeagus in *Hystatomyia*. A. Typical *Hystatomyia* aedeagus with unadorned tergal bridge and fused lateral tergal arms; B. *W.* "species C". Arrows point to lateral lobes on tergal bridge; C. Typical *Hystatomyia* median sternal plate. Arrows point to knob-like structures; D. Median sternal plate of *W.* "species K" with a flat, untapered apex; MSP, median sternal plate.



\*33. Shape of the aedeagal median sternal plate. In most *Hystatomyia* species the aedeagal median sternal plate is tapered with the apex and lateral margins notched (state 2; Fig. 15C). However, in *W.* "species K" this structure has a flat apex equal in width to the median section with the lateral margins notched (state 3, Fig. 15D). In the outgroups this structure is either apically rounded and cap-like (state 0) or elongate and sword shaped apically (state 1) (see Judd 1995, pp. 172-176).

\*34. Basal mesal lobe (mesal sclerite) of the genitalia. The basal mesal lobe is present in *Hystatomyia* species as an elongate sclerite fused proximally on the gonocoxite (state 1, Fig. 7A). This structure is either absent (state 0) or occurs on the arm of the gonocoxite (state 2; see Judd 1995, p. 180) in the outgroups.

35. Setae on sternum of segment VIII. Segment VIII usually has only normal type setae occurring midway to the posterior margin (state 0; Fig. 16A). *Wyeomyia* "Species L" has six additional stout, elongate setae at both posterior corners of the segment (state 1, Fig. 16B).

36. Scale pattern on midleg tibia. Male *Hystatomyia* have either cream scales only (state 0) or cream and bronze scales (state 1) on the inner surface of the midleg tibia.

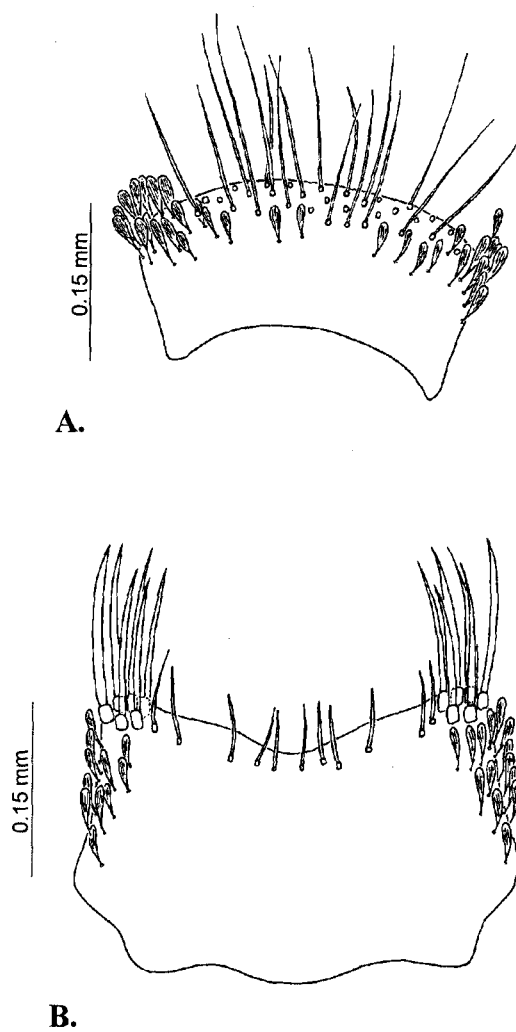


Figure 16. Sternum of segment VIII in male *Hystatomyia*. A. Typical segment VIII sternum for *Hystatomyia*. B. Segment VIII sternum of *W. "species L"* with stout setae.

37. Scale pattern on midleg tarsomere 1. Within *Hystatomyia*, most species have the outer surface of midleg tarsomere 1 covered with bronze scales only. The scale pattern on the inner surface is variable in these species and can have cream scales only (state 0), bronze scales only (state 1), or both cream and bronze scales (state 2). *Wyeomyia* "Species K" has cream and bronze scales on both the inner and outer surfaces of midleg tarsomere 1 (state 3).

38. Scale pattern on midleg tarsomere 2. Both the inner and outer surfaces of midleg tarsomere 2 have a variable scale pattern in *Hystatomyia*. Four scale patterns were observed; inner surface with cream scales only and outer surface with bronze scales only (state 0), inner and outer surfaces with bronze scales only (state 1), inner and outer surfaces with cream and bronze scales (state 2), and inner surface with cream scales only and outer surface with cream and bronze scales (state 3).

39. Scale pattern on midleg tarsomere 3. Midleg tarsomere 3 has both inner and outer surfaces with variable scale patterns. Four scale patterns were observed; inner and outer surfaces with cream scales only (state 0), inner and outer surfaces with bronze scales only (state 1), inner and outer surfaces with cream and bronze scales (state 2), and inner surface with cream scales only and outer surface with cream and bronze scales (state 3).

40. Scale pattern on midleg tarsomere 4. Midleg tarsomere 4 has both inner and outer surfaces with variable scale patterns. Four scale patterns were observed; inner and outer surfaces with cream scales only (state 0), inner and outer surfaces with bronze scales only (state 1), inner and outer surfaces with cream and bronze scales (state 2), and inner surface with cream scales only and outer surface with cream and bronze scales (state 3).

41. Scale pattern on midleg tarsomere 5. Again, the scale patterns on both inner and outer surfaces of midleg tarsomere 5 are variable. Five scale patterns were observed; inner and outer surfaces with cream scales only (state 0), inner and outer surfaces with bronze scales only (state 1), inner surface with cream and bronze scales and outer surface with bronze scales only (state 2), inner and outer surfaces with cream and bronze scales (state 3), and inner surface with bronze scales only and outer surface with cream and bronze scales (state 4).

42. Scale pattern on underside of the proboscis. *Hystatomyia* species have a variable pattern of cream and bronze colored scales on the underside of the proboscis. Three conditions exist for this character within the ingroup. A subapical patch of cream colored scales with remaining scales bronze (state 0), a solid line of cream colored scales from base to apex with no bronze scales (state 1), and basal and subapical patches of cream colored scales with variable cream and bronze scales in between and bronze scales at apex (state 2).

## Cladistic Analysis

Characters were coded as binary or multistate and were unordered and of equal weights initially. Character 30 was coded using gaps in the continuous range of lengths. Gaps were identified as a difference of at least 20  $\mu\text{m}$  between one range of lengths (i.e. one character state) and another. Characters were treated as polymorphic if more than one character state existed for a taxon. Inapplicable character states were assigned for taxa in cases where the data for a given character could never be known (Schuh 2000). The computer program PAUP\* (Swofford 2000) was used to perform the cladistic analysis. A heuristic search with TBR branch swapping and a random addition sequence with 1000 replicates was performed. The successive approximations method (Farris 1969) was used to weight the characters a posteriori and the data were reanalyzed. Characters were reweighted in successive approximations using the rescaled consistency index (Farris 1989) with a base weight of 1000. A strict consensus tree was computed for analyses that resulted in multiple most parsimonious cladograms.

## TAXONOMIC REVISION

I examined specimens from 12 previously undescribed, putative new *Hystatomyia* species. All specimens came from Belkin's "Mosquitoes of Middle America" project (1965) and were on loan to Judd from the United States National

Museum (USNM) collection. Additionally, I examined holotypes from five of the seven previously described *W. (Hystatomyia)* species, *W. circumcincta*, *W. autocratica*, *W. intonca*, *W. coenonus*, and *W. lamellata*. *W. circumcincta*, *W. autocratica*, *W. intonca*, and *W. coenonus* were examined at the depository, USNM. *Wyeomyia (Hystatomyia) lamellata* was examined at Oregon State University on loan from the National Museum of Natural History, Leiden, The Netherlands (RMNH). The holotype for *W. lopezii* was unavailable and the holotype for *W. esmeraldasi* is apparently lost. Belkin material consisted of sorted pinned adult males, unsorted pinned adult females and previously slide mounted and sorted larval and pupal exuviae and male genitalia. No whole larvae or pupae were available for the putative new species. I clipped and glycerin-mounted two additional male genitalia, one from *W. coenonus* and one from *W. "species H"*. Material was examined using a Leica DMLB compound microscope with fiber optic lighting and a Leica MZ APO dissecting microscope with base and fiber optic lighting. Measurements were made using a digital positioner (model 9598, Boeckeler Instruments, Tucson, AZ) on the dissecting microscope and an ocular micrometer on the compound microscope. Illustrations were made using a camera lucida attached to each microscope. Photographic images were taken using the AutoMontage system, again attached to each microscope.

## PHYLOGENETIC ANALYSIS

The cladistic analysis including all previous and new *Hystatomyia* species resulted in 2,481 cladograms of 125 steps with a consistency index of 0.86 and a retention index of 0.83. A strict consensus tree (Fig. 17) was constructed from these 2,481 equal-weight cladograms. These results show that *Hystatomyia* is a monophyletic subgenus (Node A, Fig. 17). Twelve unambiguous characters (2, 3, 12-16, 21, 22, and 32-34) support this clade. The *W. circumcincta* species group forms a monophyletic clade within *Hystatomyia* (Node B, Fig. 17) and is supported by five unambiguous characters (19-21, 23, and 25). All new species are included in this clade. One clade is resolved within the *W. circumcincta* group (Node C, Fig. 17) and is also supported by five unambiguous characters (20, 23, 39-41). Relationships among the three species included from the *W. autocratica* species group are unresolved (D, Fig. 17). One member of this species group, *W. lopezii*, contributed 14 missing data points to the analysis. This missing information resulted in the ambiguous results shown in the strict consensus tree for the *W. autocratica* group. Additionally, 19 missing data points were contributed to the analysis by *W. esmeraldasi*. The substantial amount of missing data for *W. lopezii* and *W. esmeraldasi* can be attributed to the absence of specimens for these species. All of their character states were interpreted from the original species descriptions, a method of character acquisition that severely limits the ability to assign character

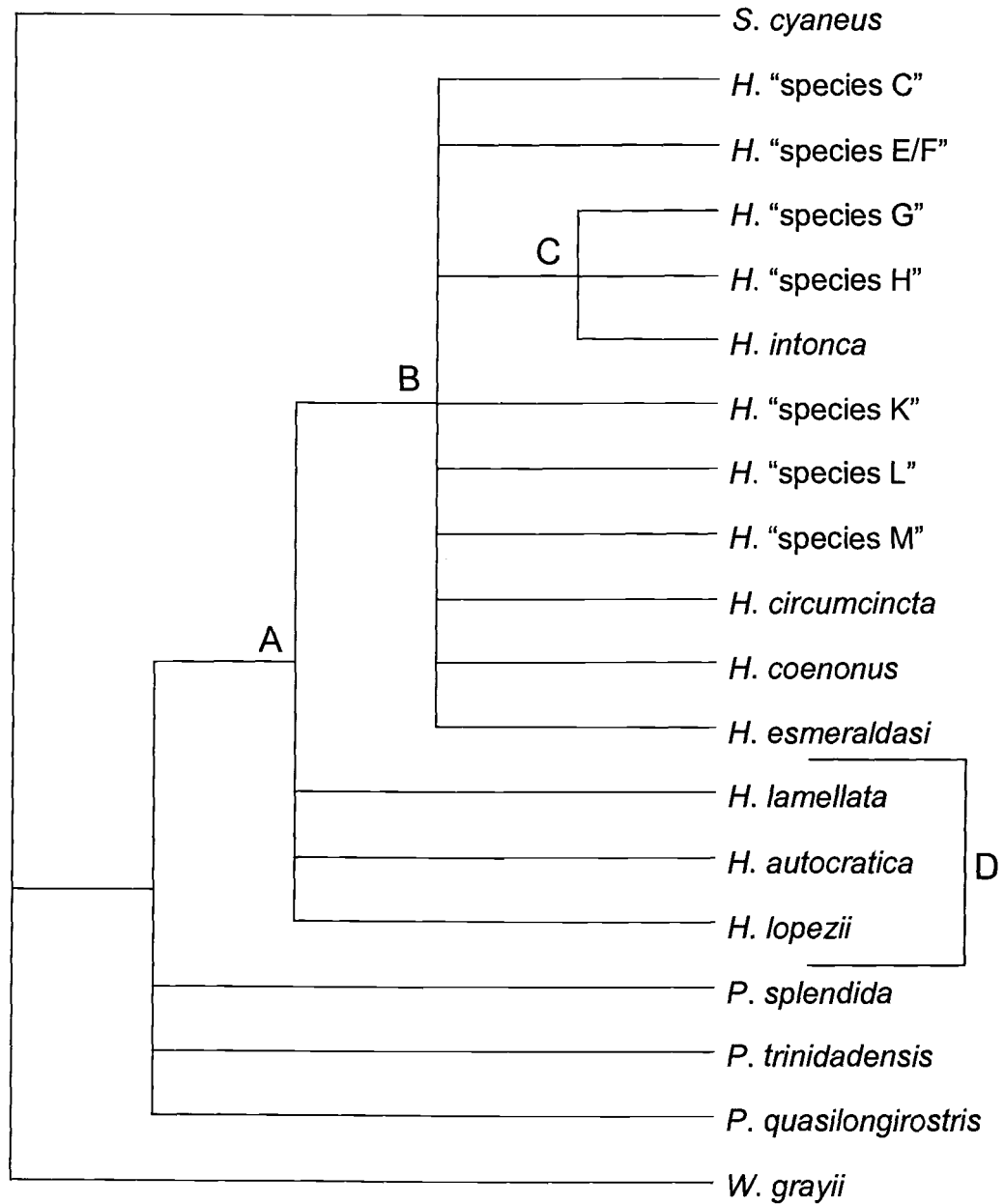


Figure 17. Strict consensus tree from 2,481 cladograms of 125 steps with CI = 0.86 and RI = 0.83. Letters referred to in text.



states and assess character homology. Considering the absence of specimens and the great number of missing data points for *W. lopezii* and *W. esmeraldasi*, it seemed advisable to exclude these species from remaining analyses.

A second cladistic analysis excluding *W. esmeraldasi* and *W. lopezii* from the ingroup resulted in 37 cladograms of 125 steps with a consistency index of 0.86 and a retention index of 0.82. Excluding these taxa from the ingroup removed 33 missing data points from the character matrix, resulting in significantly fewer most parsimonious cladograms and greater resolution of the ingroup. A strict consensus tree (Fig. 18) was generated from these 37 equal-weighted cladograms. This tree has the same topology as that in Figure 17 except the *W. autocratica* species group (Node C, Fig. 18) is monophyletic, supported by one unambiguous character (30). The *Hystatomyia* subgenus (Node A, Fig. 18) is supported by 11 unambiguous characters (2, 3, 12-16, 22, and 32-34) and the *W. circumcincta* species group (Node B, Fig. 18) is supported by four unambiguous characters (19, 20, 23, and 25) in this analysis.

The 37 cladograms from the previous analysis were weighted using successive approximations (SAW). The character weights stabilized after three iterations and resulted in one most parsimonious cladogram (Fig. 19) of 125 steps with a consistency index of 0.86 and a retention index of 0.82 when weights were restored to 1. All but four characters (13, 25, 27, and 29) were stable after the

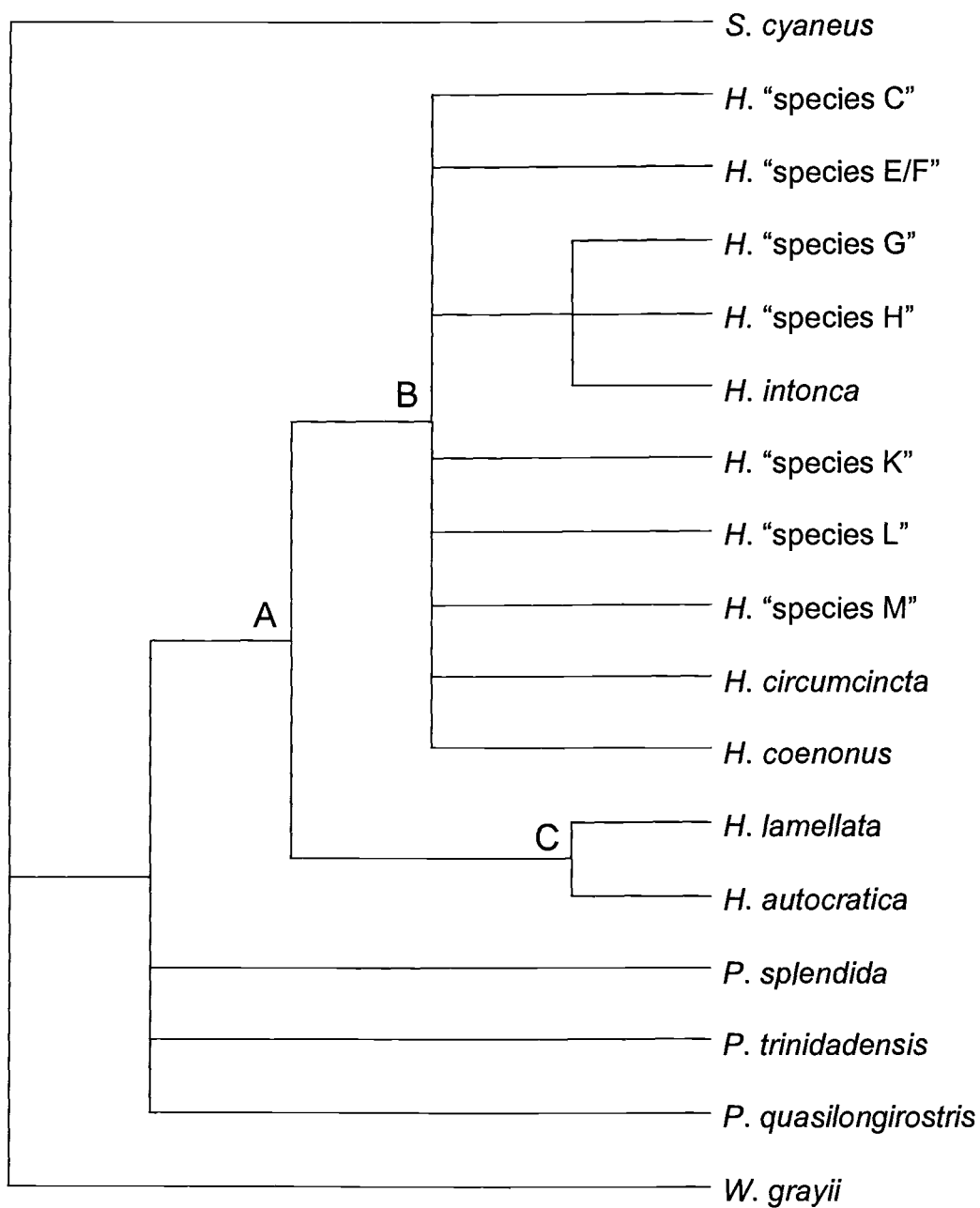


Figure 18. Strict consensus tree from 37 cladograms of 125 steps with CI = 0.86 and RI = 0.82. Letters referred to in text.

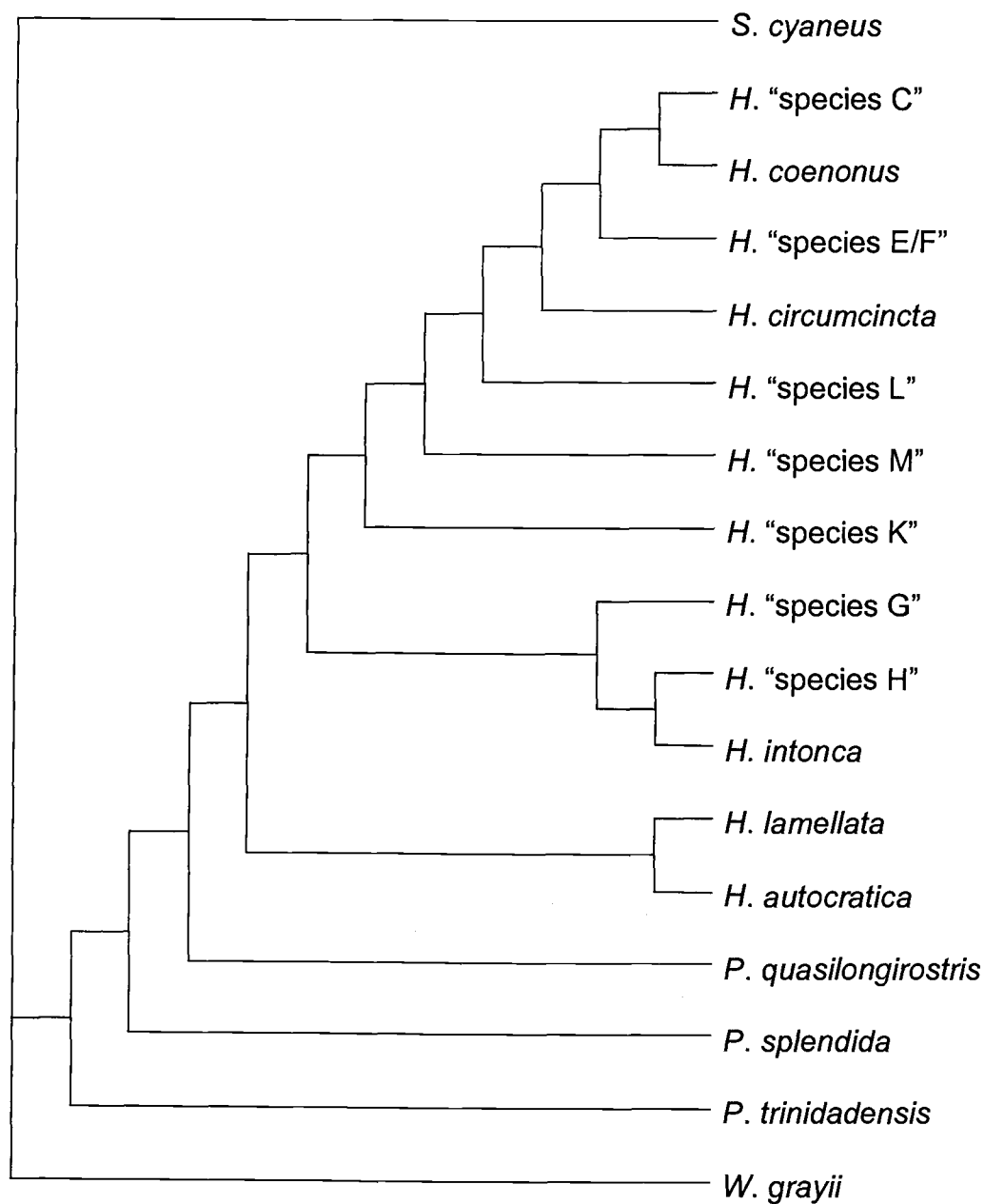


Figure 19. Successive approximations weighted tree. Tree is identical to cladogram #37 of the 37 equal-weight cladograms from analysis 2. 125 steps, CI = 0.86, and RI = 0.82.

second iteration. Each of the three iterations resulted in one fully resolved cladogram all with the same topology and the same tree length as stated for the equal-weights tree. The SAW cladogram (Fig. 19) has the same topology as cladogram #37 of the 37 equal-weighted cladograms. All unambiguous character changes including autapomorphies are mapped on Figure 20a. Given the greater capacity with which to discuss phylogenetic relationships and character evolution allowed by choosing a fully resolved cladogram (Fig. 20a), the remaining discussion will focus with this hypothesis of relationships.

Seven ambiguous characters could be optimized differently using accelerated character transformation (ACCTRAN) and delayed character transformation (DELTRAN) optimizations and are mapped on Figures 21 and 22, respectively. All unambiguous characters were optimized the same under both ACCTRAN and DELTRAN optimization (Fig. 20a).

The subgenus *Hystatomyia* is strongly supported as a monophyletic clade. Eleven unambiguous character changes support the ingroup (Node A, Figure 20a); three from the larval stage (2, 3, and 12), five from the pupal stage (13-17), and three from the adult stage (32-34). One of these character changes is a reversal; pupal seta 5-CT on the cephalothorax (character 13) has multiple branches (state 1) in *Phoniomyia*, the sister group to *Hystatomyia*, but is single and stout or enlarged

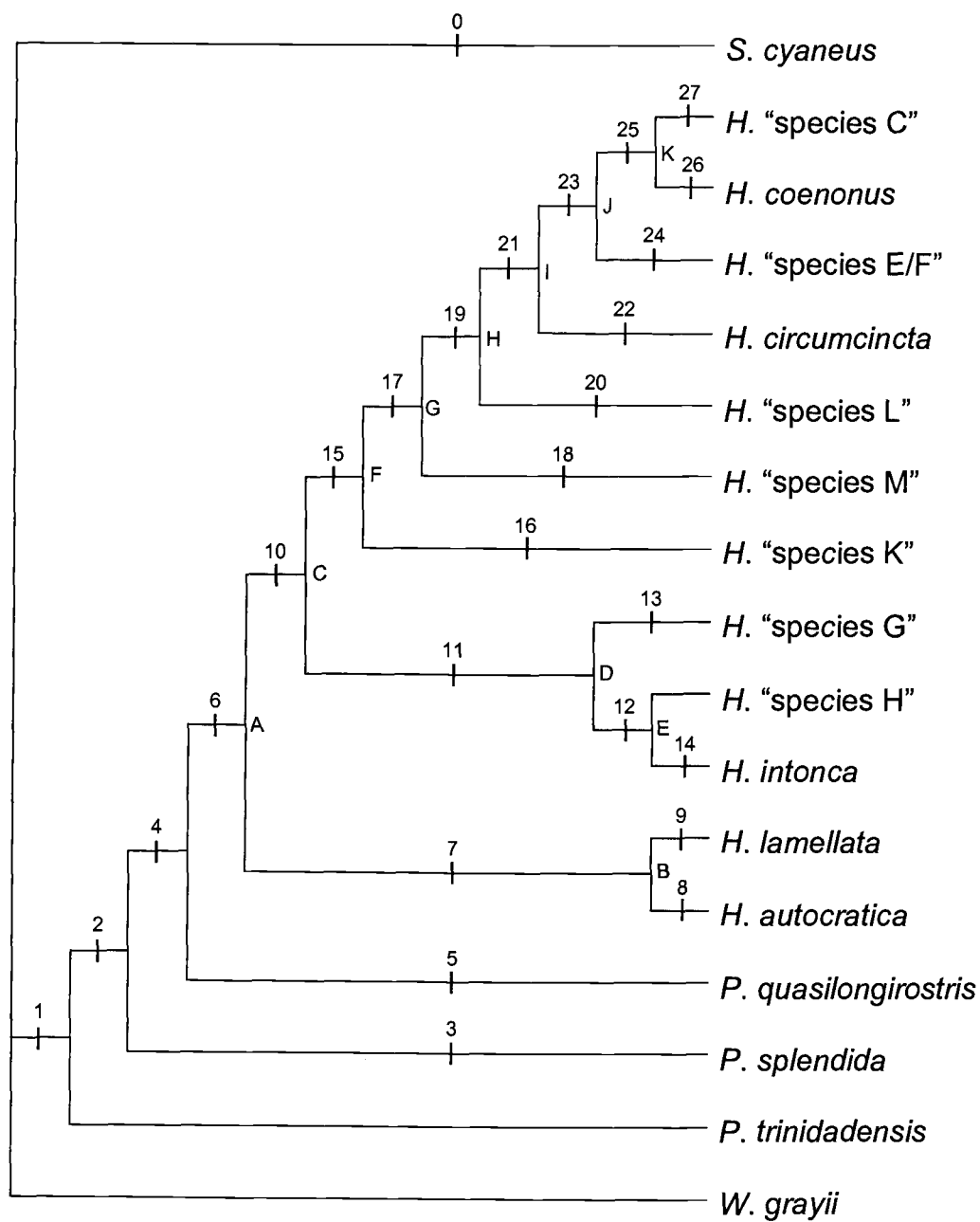


Figure 20a. Successive approximations weighted tree. Letters identify nodes. Numbers identify unambiguous character state changes listed in Figure 20b.

|                  |                                                                                                          |                   |                                                |                   |                                                          |
|------------------|----------------------------------------------------------------------------------------------------------|-------------------|------------------------------------------------|-------------------|----------------------------------------------------------|
| <b><u>0.</u></b> | 3:1→0<br>7:0→1<br>9:0→1<br>10:0→1<br>11:0→1<br>32:0→1                                                    | <b><u>8.</u></b>  | 37:2→0<br>41:1→4                               | <b><u>19.</u></b> | 20:2→1                                                   |
| <b><u>1.</u></b> | 6:0→1<br>8:1→0<br>13:0→1<br>15:2→1<br>33:0→1<br>34:2→0                                                   | <b><u>9.</u></b>  | 29:1→0<br>39:3→1<br>40:3→1                     | <b><u>20.</u></b> | 18:0→1<br>21:1→0<br>23:0→3<br>26:3→2<br>35:0→1           |
| <b><u>2.</u></b> | 24:1→0                                                                                                   | <b><u>10.</u></b> | 19:1→0<br>20:3→2<br>21:2→1                     | <b><u>21.</u></b> | 17:1→0                                                   |
| <b><u>3.</u></b> | 27:1→0                                                                                                   | <b><u>11.</u></b> | 17:1→0<br>41:1→2                               | <b><u>22.</u></b> | 26:3→0<br>29:1→0                                         |
| <b><u>4.</u></b> | 21:3→2                                                                                                   | <b><u>12.</u></b> | 29:1→0                                         | <b><u>23.</u></b> | 37:2→0<br>38:2→0                                         |
| <b><u>5.</u></b> | 30:3→0                                                                                                   | <b><u>13.</u></b> | 28:0→2<br>30:3→4                               | <b><u>24.</u></b> | 26:3→4<br>28:0→1<br>42:2→0                               |
| <b><u>6.</u></b> | 2:1→0<br>3:1→0<br>12:0→1<br>13:1→0<br>14:1→0<br>15:1→0<br>16:0→1<br>17:2→1<br>32:0→1<br>33:1→2<br>34:0→1 | <b><u>14.</u></b> | 23:2→1<br>41:2→3                               | <b><u>25.</u></b> | 41:0→3                                                   |
| <b><u>7.</u></b> | 30:3→1                                                                                                   | <b><u>15.</u></b> | 23:2→0                                         | <b><u>26.</u></b> | 39:0→2<br>40:0→2                                         |
|                  |                                                                                                          | <b><u>16.</u></b> | 20:2→0<br>28:0→1<br>33:2→3<br>36:0→1<br>37:2→3 | <b><u>27.</u></b> | 23:0→1<br>26:3→1<br>29:1→0<br>30:3→2<br>31:0→1<br>42:2→1 |
|                  |                                                                                                          | <b><u>17.</u></b> | 41:1→0                                         |                   |                                                          |
|                  |                                                                                                          | <b><u>18.</u></b> | 26:3→8<br>29:1→0<br>37:2→1                     |                   |                                                          |

Figure 20b. Key to Figure 20a. List of unambiguous character state changes. Bold, underlined number corresponds to number on branch in Figure 20a followed by the character number, a colon, and then the character state change.

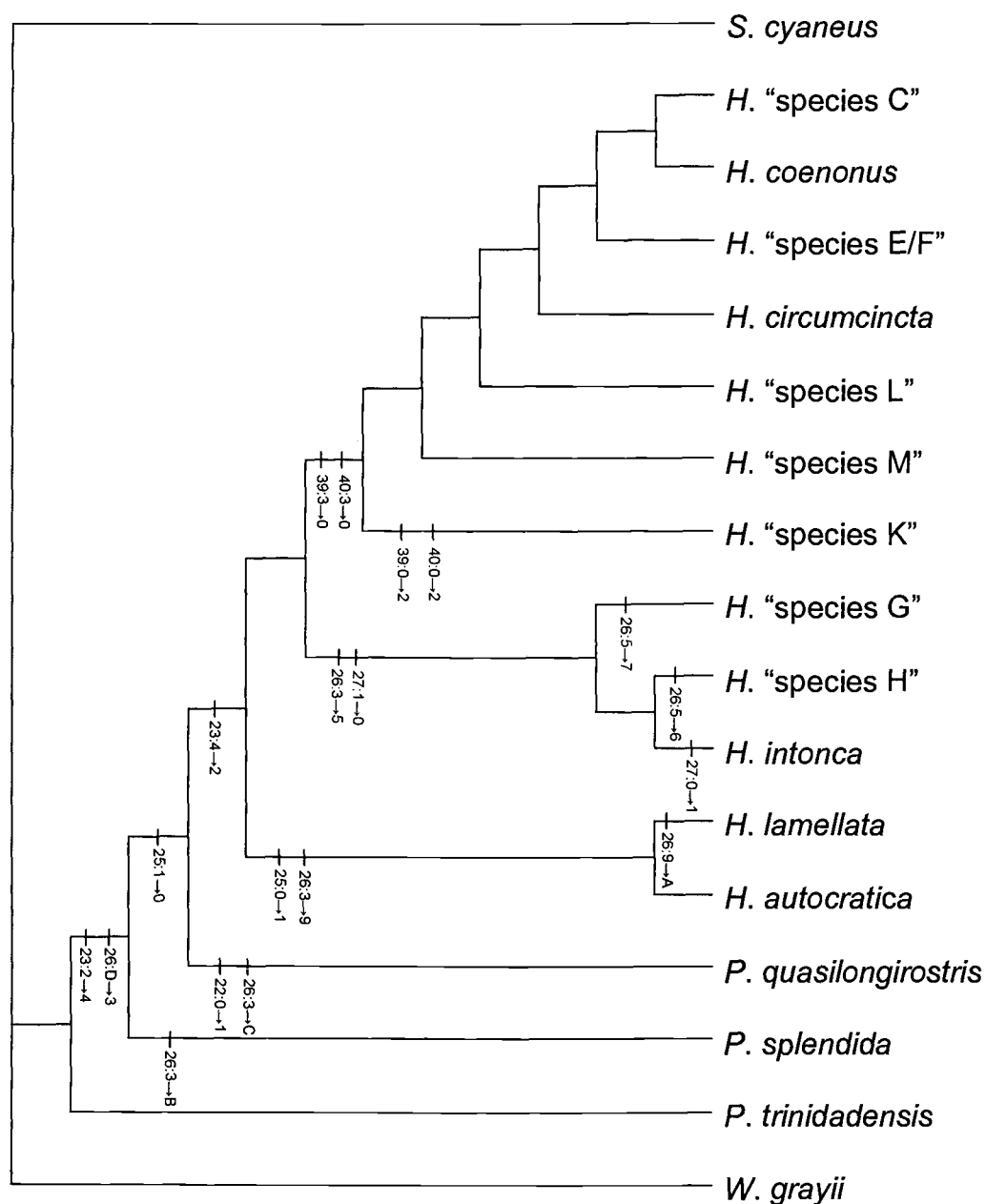


Figure 21. Successive approximations weighted tree. Ambiguous characters that can be optimized differently under ACCTRAN and DELTRAN mapped here under ACCTRAN optimization.

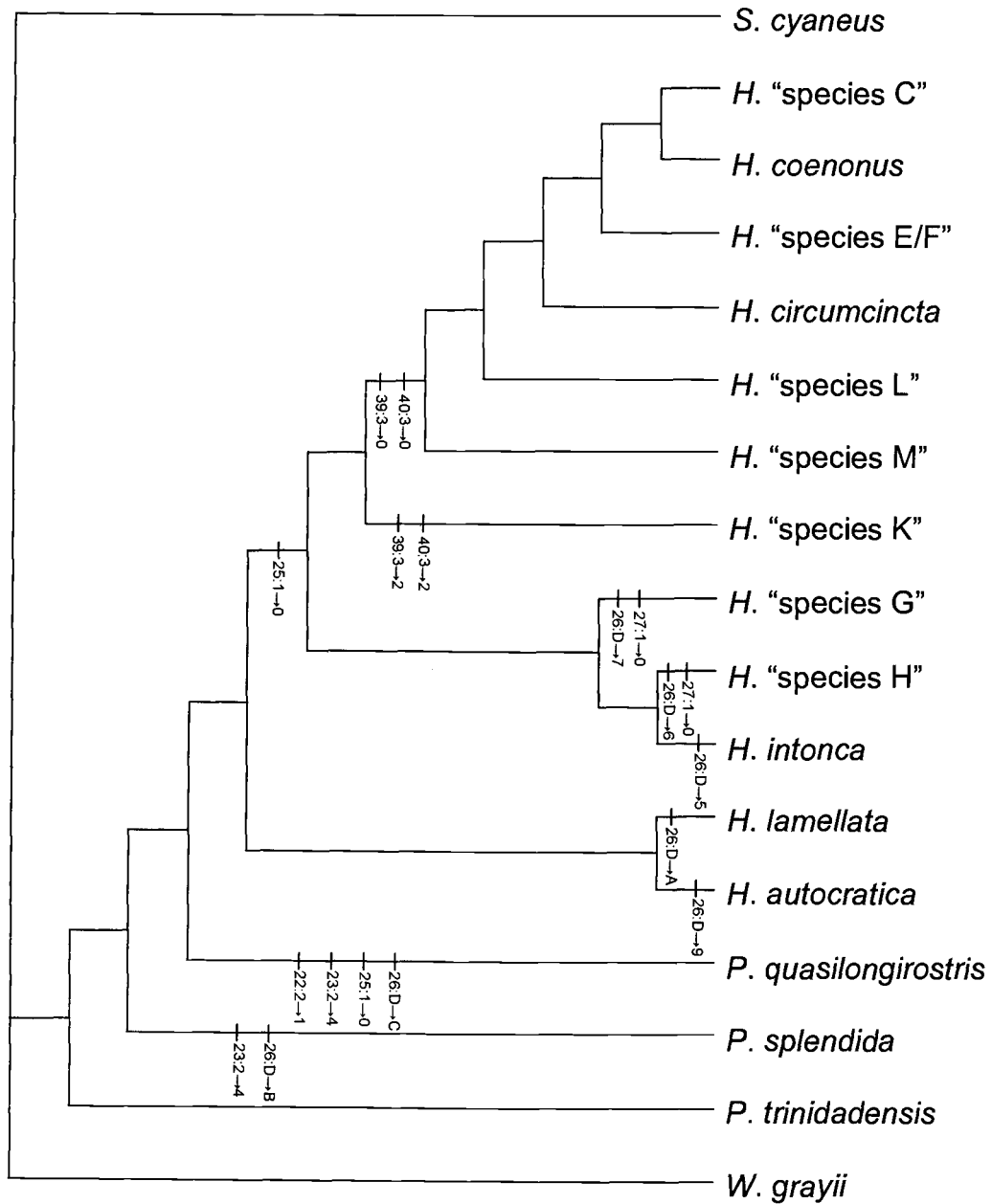


Figure 22. Successive approximations weighted tree. Ambiguous characters that can be optimized differently under ACCTRAN and DELTRAN mapped here under DELTRAN optimization.



(state 0) in *Hystatomyia* and the more distant outgroups. Eight of the remaining characters have perfect consistency within the analysis (2, 3, 12, 14-16, 33, and 34). The results show that both *Hystatomyia* species groups are monophyletic. The *W. circumcincta* group (Node C, Fig. 20a) is supported by three synapomorphies; the well developed mesal lobe of the gonocoxite (character 19, state 0), the number of major groups of setae on the mesal lobe of the gonocoxite (character 20, state 2) and the location of the gonostylus on the gonocoxite (character 21, state 0). One synapomorphy, the length of the gonostylus, (character 30, state 1) unites the *W. autocratica* group (Node B, Fig. 20a).

Two major clades are resolved within the *W. circumcincta* group, both supported by at least one synapomorphy. The clade including *W. intonca*, *W.* “species G”, and *W.* “species H” is supported by two homoplastic characters (Node D, Fig. 20a). The condition for the posterior margin of the pupal genital lobes changes from continuous (character 17, state 1) to emarginate (state 0) at node D. This character state change arises a second time at node I (Fig. 20a). The second character state change supporting node D (character 41, state 2) occurs only once, however the character state 3 arises twice, once at node K and again at the *W. intonca* terminal. The second major clade within the *W. circumcincta* group includes *W.* “species C”, *W. coenonius*, *W.* “species E/F”, *W. circumcincta*, *W.* “species L”, *W.* “species M”, and *W.* “species K” (Node F, Fig. 20a). This clade is

supported by a transition to the “ball and socket” condition of the point of attachment of the gonostylus to the gonocoxite (character 23, state 0), a change which arises only once in this cladogram (Node F). However, the “divot” condition (state 1) for this character arises twice, once at the *W.* “species C” terminal and once at the *W. intonca* terminal.

Of the six remaining clades, node H (Fig. 20a) is supported by one synapomorphy; the number of major groups of setae on the mesal lobe of the gonocoxite (character 20, state 1). Nodes G and K (Fig. 20a) are both supported by character 41 (states 0 and 3, respectively), discussed above. Node I (Fig. 20a) is supported by character 17 (state 0), a character state that appears again at node D and is previously discussed. Node J (Fig. 20a) is supported by two characters pertaining to the scale pattern of the adult male midleg. The character state change occurring in character 37 at node J (state 0) occurs again at the *W. autocratica* terminal. Character 38 is homoplastic because *W.* “species E/F” is polymorphic for this character, possessing both state 0 and state 3. The change to state 0 at node J forces state 3 to arise twice, once in the *W.* “species C” terminal and once in the *W.* “species E/F” terminal. Node E is supported by a character describing the width of the median section of the gonostylus (character 29, state 0). The change to character state 0 arises four other times in the cladogram at the *W.* “species C”, *W. circumcincta*, *W.* “species M”, and *W. lamellata* terminals (Fig. 20a).

The number of major groups of setae on the mesal lobe of the gonocoxite (character 20, Fig. 20a) emerged as an important phylogenetically informative character within *Hystatomyia* (Fig. 20a). It appears that within the clade the plesiomorphic condition is for three major groups of setae (state 2, node C). There is a character state change to two major groups of setae (state 1) at node H. The condition of one major group of setae (state 0) is an autapomorphy for *W.* "species K". The development of the mesal lobe of the gonocoxite and position of the mesal sclerite on the gonocoxite are also of interest. The condition of a well developed mesal lobe (character 19, state 0) is a synapomorphy for the *W. circumcincta* species group. Absence of a well developed mesal lobe is apparently the plesiomorphic condition, as this is the case in the *W. autocratica* species group and in all outgroups (state 1). The proximal position of the mesal sclerite on the gonocoxite is a synapomorphy for the subgenus *Hystatomyia* (character 34, state 1). The mesal sclerite is located on the mesal lobe of the gonocoxite in the *W. circumcincta* species group and basally on the arm of the gonocoxite in the *W. autocratica* species group. The sclerite appears to be absent in the sister group to *Hystatomyia*, *Phoniomyia* (state 0), but is present and distal on the arm of the gonocoxite in the more distant outgroups, the genera *Wyeomyia* and *Sabethes* (state 2).

Several more characters are informative at the species level. The apex of the gonostylus (character 26, Figs. 11-14) is highly variable between *Hystatomyia* species and is an autapomorphy for all species except *W. coenonous* and *W. "species K"*, which both possess an asymmetrically tapered apex (state 3). The scale pattern on the underside of the adult male proboscis (character 42) is autapomorphic for *W. "species C"* (state 1) and *W. "species E/F"* (state 0). Additionally, *W. "species C"* has small, lateral lobes on the median section of the arms of the tergal bridge (character 31, state 1), whereas these arms are unadorned in all other *Hystatomyia*. Four more characters are autapomorphies for *W. "species L"*. The setae of the adult male epandrium (character 18) are far removed from each other on specialized lobes (state 1, Fig. 6C) rather than close together on normal type lobes (state 0, Figs. 5 and 6A, B, & D) as in all other *Hystatomyia* species. The adult male also has a modification of the setae on the sternum of segment VIII (character 35, state 1, Fig. 16B) in *W. "species L"*, a condition not observed in any other *Hystatomyia*. The conditions of the location of the gonostylus on the gonocoxite (character 21, state 0, Fig. 9B) and the point of attachment of the gonostylus to the gonocoxite (character 23, state 3, Fig. 12B) are the final autapomorphies for *W. "species L"*. *Wyeomyia "species G"* has a much longer gonostylus than all other *Hystatomyia* species (character 30, state 4, Fig. 13B), an autapomorphy for this species. Characters of the adult male aedeagus and midleg are autapomorphic in *W. "species*

K". *Wyeomyia* "species K" has an aedeagal median sternal plate with a flattened apex (character 33, state 3, Fig. 15D), whereas this structure has a tapered apex (state 2, Fig. 15C) in all other *Hystatomyia* species. The midleg tibia and tarsomere 1 of *W.* "species K" have different scale patterns from those observed in other members of *Hystatomyia* (character 36, state 1 and character 37, state 3, respectively).

The new phylogeny presented here strongly supports the hypothesis that the subgenus *Hystatomyia* is a monophyletic group. It also corroborates previous findings by Judd (1998) that there are two species groups within *Hystatomyia*. All clades within the *W. circumcincta* species group and the *W. autocratica* species group are supported by at least one unambiguous character optimized the same under both ACCTRAN and DELTRAN optimization. These characters give support to the hypothesis of relationships within *Hystatomyia* presented here.

## TAXONOMIC REVISION

DIAGNOSIS OF THE SUBGENUS *HYSTATOMYIA*

*Hystatomyia* can be distinguished from other *Wyeomyia* subgenera by characters of the male genitalia and pupal trumpet and genital lobes. *Hystatomyia* males have a subapical gonostylus located on the inner margin of the gonocoxite on the arm or mesal lobe (Figs. 7-10). The subapical placement of the gonostylus is not observed in any other sabethine with the exception of one species group in *Phoniomyia*. However, this species group differs from members of *Hystatomyia* in that the placement of the gonostylus is barely removed from the apex and on the outer surface of the gonocoxite and the basal mesal lobe of the gonocoxite is absent. The pupal trumpets of all *Hystatomyia* species have an elongate reticulate section and are widest apically (Fig. 3). This elongation is not observed in other sabethines. The pupal genital lobes are enlarged relative to the paddles in *Hystatomyia* (Fig. 4). The genital lobes of other sabethines are reduced relative to the paddles. The placement of maxillary seta 3-Mx distinguishes *Hystatomyia* and *Phoniomyia* larvae from other sabethines. Seta 3-Mx is placed in a notch on the lateral margin of the maxilla in these subgenera, whereas the notch is absent in other sabethines. *Hystatomyia* larvae can be differentiated from *Phoniomyia* larvae by the presence of a minute, peglike sensillum on the apex of the maxillary palpus

(Judd 1996). There are no known characters that will distinguish adult female *Hystatomyia* from other *Wyeomyia* species.

Fourteen species are included here in the subgenus *Hystatomyia*, seven previously described species and seven new species: *W. circumcincta* Dyar & Knab (type species), *W. coenonus* Howard, Dyar & Knab, *W. esmeraldasi* (Levi-Castillo), *W. intonca* Dyar & Knab, *W. autocratica* Dyar & Knab, *W. lamellata* (Bonne-Wepster & Bonne), *W. lopezii* Cova Garcia, Sutil Oramas & Pulido, *W.* "species C" n. sp., *W.* "species E/F" n. sp., *W.* "species G" n. sp., *W.* "species H" n. sp., *W.* "species K" n. sp., *W.* "species L" n. sp., and *W.* "species M" n. sp. Five of the seven previously described species are redescribed here.

## GEOGRAPHICAL DISTRIBUTION

*Hystatomyia* species are distributed throughout Central and northern South America (Fig. 2). Most species have a restricted distribution with the exception of *W. circumcincta*, which is relatively widespread and has been observed in a patchy distribution from Belize south to Bolivia and east to Brazil. *Wyeomyia coenonus*, *W. intonca*, *W.* "species C", *W.* "species G", and *W.* "species H" are known only from Central America. *Wyeomyia autocratica*, *W. lamellata*, *W. lopezii*, *W. esmeraldasi*, *W.* "species K", *W.* "species L", and *W.* "species M" are known only

from northern South America. *Wyeomyia* "species E/F" has been collected near the Colombian border in Panama and in Colombia.

## SPECIES DESCRIPTIONS

### *Wyeomyia (Hystatomyia) circumcincta* Dyar & Knab

*Wyeomyia circumcincta* Dyar & Knab, 1907: 210-211. TYPE: Lectotype male adult (Stone and Knight 1957). Locality: Panama, Canal Zone, Tabernilla. Collector: A. Busck. Depository: National Museum of Natural History (USNM), specimen #10857. Important References: Belkin et al. 1965b, Bonne and Bonne-Wepster 1925, Dyar 1919, Dyar 1923, Dyar 1925, Dyar 1928, Dyar and Shannon 1924, Howard et al. 1912, Heinemann and Belkin 1977a, Heinemann and Belkin 1978a, Heinemann and Belkin 1978b, Judd 1998, Lane 1945, Lane 1953, Lane and Cerqueira 1942.

Synonyms: *Wyeomyia macrotus* Dyar & Knab (1907: 212); Dyar 1928.

*Wyeomyia andropus* Dyar & Knab (1908: 68); Dyar 1928.

FEMALE: Small-sized species of mosquito, dorsum densely covered with scales predominantly bronze and metallic blue-green with magenta highlights. Outer surface of legs covered with bronze scales. *Head*: Covered with decumbent scales only, broader than those of scutum; scales of occipital region and posterior to orbital setae concolorous with scutum, ventral portion of genae with variable patch



of distinct gray-white scales, loose band extending dorsally, but decreasing in width and increasing with degree of brown to upper third of eye. Dorsal orbital setae strong and brown, lateral orbital setae weaker, brown. Interocular space, pedicel, and clypeus without scales. Proboscis 1.56 mm, stout, apical 1/4 distinctly enlarged. Labial scales concolorous with scutum, underside apparently with a line of lighter bronze scales extending from base to apex. Antenna only slightly shorter than proboscis. Palpus apparently consisting of a single segment; slightly longer than the clypeus and covered with bronze scales. *Thorax*: Pronotal lobes widely separate; setae brown; scales mostly bronze with violet highlights with a small indistinct patch of gray-white scales on posterior lateral margin. Scutum with an anterior patch of white scales of variable size that extend ventrolaterally. Color of dorsal scales described above, scales broader at posterior margin. Scutellum trilobed, appearance enhanced by broad, decumbent scales occurring on the apex of the posterior margin of each lobe along with 3-4 stout, brown setae. Mediotergite nude, except for 8-10 pale golden setae. Pleuron covered with gray-white scales, except for the anterior portion of the katepisternum, paratergite, meron, and metapleuron, which are nude. Pleuron chaetotaxy reduced and as follows: pronotal lobe with 10-12 brown setae; 1 pale golden prespiracular seta; postspiracular seta absent; 3-4 pale golden proepimeral setae; 3-4 pale golden prealar setae; lower katepisternum with 4-5 pale golden setae; upper katepisternum

setae absent; 7-9 pale golden anepimeral setae. *Legs*: Fore-, mid-, and hind coxae and trochanters covered with scales concolorous with pleuron. Foretibiae, tibiae, and tarsomeres with outer surface covered with bronze scales with blue, green, and violet reflections except where noted in diagnoses and below. Foreleg inner surface with a cream colored line of scales on femur, tibia and tarsomeres covered with bronze scales. Midleg inner surface with a line of cream colored scales on femur and tibia, tarsomere 1 with intermittent cream colored scales, tarsomeres 2-5 covered with bronze scales. Hind leg inner surface with a cream colored line of scales on femur, tibia and tarsomeres 1-2 with intermittent cream colored scales, tarsomeres 3-5 covered with bronze scales. *Wing*: Length: 2.56 mm. Scales elongate, decumbent and restricted to veins, predominantly bronze, scales of anterior margin with metallic blue reflections. Posterior margin with a double row of fringelike fusiform scales, one row 1.5 times as long as and one row equal in length to those restricted to veins. *Abdomen*: Dorsum covered with bronze scales with blue-green reflections extending into plural regions of sternum, sternum with gray-white scales of variable width.

MALE: Same as female except for the following. *Head*: Dorsal orbital setae strong and golden or brown. Proboscis 1.15-1.51 mm. Labial scales concolorous with scutum, underside with basal patch of cream colored scales, concolorous subapical patch and scales between patches variable and may be

intermittent, sparse, or absent. If subapical patch or scales present also may have intermittent cream colored scales distributed from subapical patch to apex, apex with darker brown scales. *Thorax*: Some specimens appear to have a second small indistinct patch of gray-white scales on anterior mesal margin of pronotal lobes. Mediotergite with 9-14 pale golden setae. Pronotal lobe with 7-10 brown setae. *Legs*: Foreleg inner surface variable, usually with a cream colored line of scales extending entire length of leg. Some specimens with cream colored scales restricted to the inner surface of the femur with the tibia and tarsomeres covered with bronze scales. Midleg inner surface variable, usually with a line of cream colored scales extending from base of femur to midpoint of tarsomere 1, midpoint of tarsomere 1 through basal  $1/3-1/2$  of tarsomere 2 with bronze scales only, remainder of tarsomere 2 and tarsomeres 3-5 covered with cream colored scales. Some specimens with a line of cream colored scales extending length of femur and tibia, tarsomeres covered with bronze scales except outer surface of tarsomere 5 with lighter bronze and cream colored scales. Hind leg inner surface with a solid line of cream colored scales on femur and tibia, tarsomere 1 with line of intermittent cream colored scales that may extend into tarsomere 2, otherwise tarsomeres 2-5 covered with bronze scales. Claws of fore- and hind leg simple, midleg modified, different in size and shape. *Wing*: Length: 1.86-2.60 mm.

MALE GENITALIA (Figs. 5A, 7A&B, 11A&B, 15A&C, 16A): *Segment VIII*: Segment covered with small, fine setae. Sternum with a pair of small setae on anterior portion, larger setae occurring midway and extending along posterior margin. Scales broad, flat and primarily restricted to lateral margins. Tergum also with a pair of small setae on anterior portion, long setae confined to posterior margin. Densely covered with broad, decumbent scales. *Segment IX*: Sternum with anterior margin weakly emarginate, posterior margin roughly triangular and incompletely separated by weak line of flexion at midline, consisting of a thin strip of sclerite partially fused to gonocoxal lobes separated by a weak line of flexion. Tergum dark, deeply emarginate or upside down U-shape on anterior margin, posterior margin fused to gonocoxites with 2-3 elongate, stout, outwardly curved setae on each lobe. *Gonocoxite*: Arms appearing fused at base with segment IX. Basal portion broad with well developed mesal lobes. Mesal lobe pigmented, with two weakly separated roughly circular patches of setae, dorsal group with 15-30 stout, elongate setae with most dorsal setae raised on a small to pronounced sclerotized ridge, ventral group with 3-5 stouter, longer setae, all setae tapering to sharp point. Arms narrow, elongate and curved inward slightly. Each arm densely covered with scales and well-developed setae. Inner surface of arm with setae restricted to apical 1/2. *Gonostylus*: Length 0.15-0.17 mm. Located on inner margin of gonocoxite at the point where the lobe constricts to form the arm. Base

and apex of gonostylus wider than median section, apex truncate and at a slight angle with lateral corner lower than mesal corner. *Mesal Plate*: Thin, darkened strip of sclerite, V-shaped on mesal margin separating lobes internally. Sclerite bearing short micropile and 1-2 setae on each lobe. *Aedeagus*: Dorsal paramere (tergal bridge) forming an upside down V fused at base with lateral tergal arm. Lateral tergal arms elongate and broad through anterior  $1/2$ - $2/3$ , dorsal portion compressed linearly with posterior margin emarginate and apices fused and emarginate. Median sternal plate spatulate with lateral and apical margins emarginate not extending beyond apex of lateral tergal arms. Paired, conical, darkly sclerotized structures with truncate, concave apices near base of median sternal plate. *Proctiger*: With 1 prominent apical tooth and 1-3 accessory teeth or teeth-like structures. Dorsal surface with 3-4 small setae.

PUPA (Figs. 3, 4A&B, 23): Chaetotaxy as figured. *Cephalothorax*: Pigmentation uniform, light golden tan. Seta 1 bifid with apices unmodified. Seta 8 with 2 branches. Ecdysial sutures weak to absent. *Trumpet*: Pigmented, brown at base and apex, may be lighter brown at apex; length from 0.77-1.30 mm. Width significantly narrowed and uniform, 0.017-0.036 mm. Apex slightly swollen, 0.023-0.058 mm. *Metanotum and Abdomen*: Cuticle weakened and hyaline on the dorsum of segment I surrounding seta 1, extending anteriorly to base of setae 2 and 3. Seta 10-I apparently absent, seta 11-I present, all other ventral setae absent.

Some specimens with singular circular pit located immediately lateral of the ventral midline. Segments II-VIII concolorous with cephalothorax. Minute, uniformly spaced spicules on dorsum of segments II-VIII. Intersegmental sclerites darkly pigmented posterior to segment II, III, and sometimes IV and V. Seta 11-II present, all other ventral setae absent. Seta 3-I-III and seta 5-IV-VI single and elongate, extending the length of 2.5-3.5 abdominal segments. Seta 14-VIII present. *Paddle*: Oblong, widest at basal 1/3, narrowing at apex. Short, 2/3-3/4 the length of seta 9-VIII. Surface glabrous, lateral margins spiculate. Midrib prominent, extending length of paddle. *Male Genital Lobe*: Elongate, approximately 1.5-1.6 times length of paddle, broad with slightly curved outer margin, usually tapers in apical 1/4-1/3 to a slightly rounded posterior margin. Some specimens with a broad, untapered posterior margin.

LARVA (Figs. 24-27): Chaetotaxy as figured. *Cranium*: Anterior margin produced, slightly wider than long. Margin straight between seta pair 1-C. Cranial setae 4-15 branched. Occipital foramen with dorsolateral slit extending anteriorly 0.14-0.17 mm. *Antenna*: 0.26-0.31 mm in length. Antennal seta 1 variable, located on the dorsal surface of the apical third. *Hypostoma*: Median tooth prominent with 9-11 teeth produced laterally receding toward base, terminal teeth may be reduced. *Mandible*: Ventral teeth only, five; VT0 prominent with VT1-4 reduced in size. *Maxillae*: Seta 3-Mx located on the outer margin of the maxilla in

a sclerotized pocket or notch. Some specimens appear to have the single, prominent, elongate apical tooth of the laciniastrum absent, although this could be an artifact of the mounting process. Palpus, palpiger, and maxillary body separate. Palpus with 3 peglike setae; apex divided, inner margin with single seta, outer margin with 2. Palpiger hyaline, seta 6-Mx single. *Thorax*: Surface glabrous. *Abdomen*: Surface glabrous. *Segment VIII*: Comb teeth numerous extending ventrolaterally in an elongate patch. Individual teeth broad throughout with spiculate apical margin. *Siphon*: Length 0.95-1.16 mm. Pecten elongate, spinelike, and in a single row of 5-8, although some may have been removed during mounting process. *Anal Segment*: Saddle incomplete, covered with rows of intermittently spaced spicules. Paired, fanlike, 6-8 branched accessory setae located on ventral surface, sclerite absent between setae.

**BIONOMICS**: Epiphytic and terrestrial bromeliads. Habitat highly variable ranging from rain forest to mangrove and transitional zone palm forests to manmade plantations and partially cleared premontane wet forests with partial to full sun or deep shade. Water volume equally variable with ranges of no free water to upwards of 500 ml in tank.

**DISTRIBUTION**: Known from Belize, Bolivia, Brazil, Panama, Costa Rica and Colombia.

SYSTEMATICS: One of two species groups within *Hystatomyia* is composed of *W. circumcincta*, *W. coenonius*, *W. esmeraldasi*, *W. intonca*, *W.* "species C", *W.* "species E/F", *W.* "species L", *W.* "species M", *W.* "species K", *W.* "species G", and *W.* "species H". The holotype for *W. esmeraldasi* is apparently lost and inclusion in this species group is based on illustrations interpreted from the original species description (Levi-Castillo 1955).

Material Examined: 1 pinned female, 50 pinned males, 50 male genitalia slide-mounted, 15 reared male larval and pupal exuviae, 39 male pupal skins without associated larvae, and no whole larvae or pupae. COLOMBIA: Valle, Buenaventura. COSTA RICA: Heredia, Puerto Viejo. PANAMA: Colon, Portobelo; Darien, 4 km NE of Morti; Darien, Jaque; Panama, 4 km NE Pequeni.



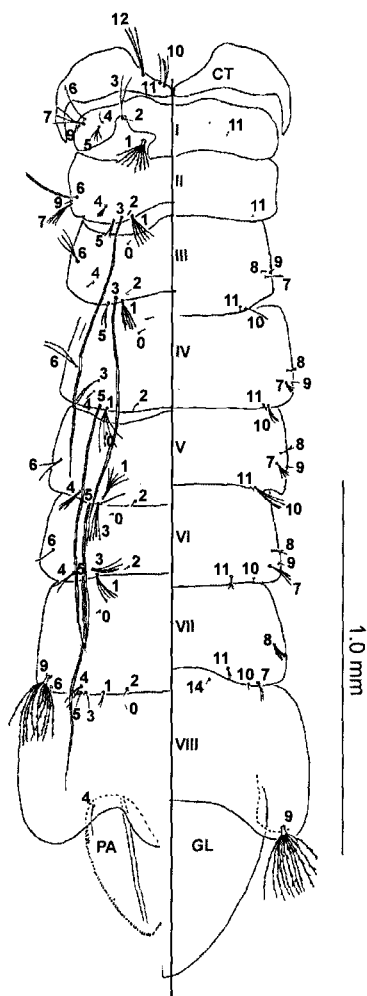


Figure 23. Composite illustration of pupal metathoracic and abdominal chaetotaxy for *Hystatomyia*. No differences were observed in pupal chaetotaxy between *Hystatomyia* species. Roman numerals refer to abdominal segments; Arabic numbers refer to setae; CT, cephalothoracic third segment; PA, paddle; GL, genital lobe. Dorsal perspective left of the longitudinal line, ventral perspective right of the longitudinal line.

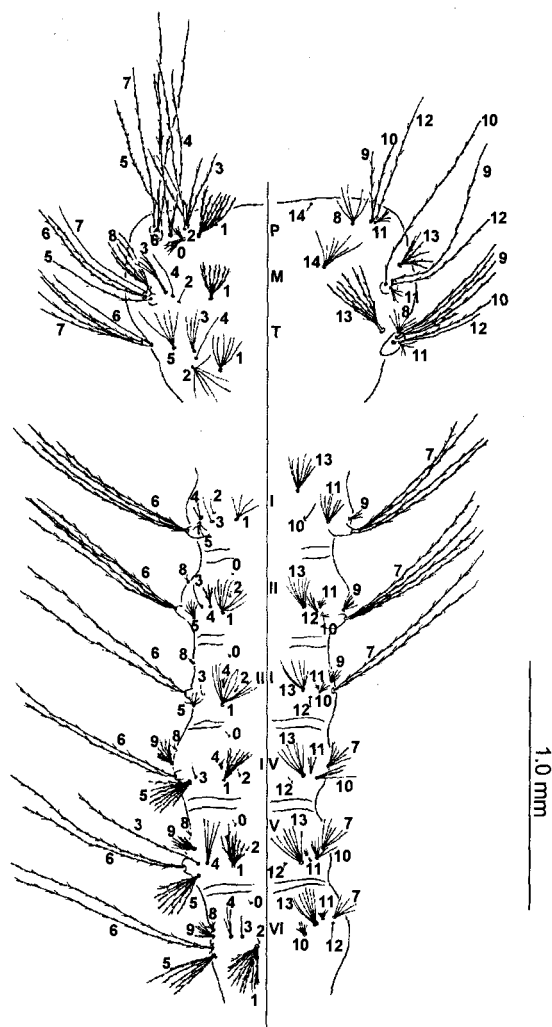


Figure 24. Composite illustration of larval thoracic and abdominal chaetotaxy for *Hystatomyia*. No differences were observed in larval chaetotaxy between *Hystatomyia* species. Illustration drawn from exuviae. Roman numerals refer to abdominal segments; Arabic numbers refer to setae; P, prothoracic segment; M, mesothoracic segment; T, metathoracic segment. Dorsal perspective left of longitudinal line, ventral perspective right of longitudinal line.

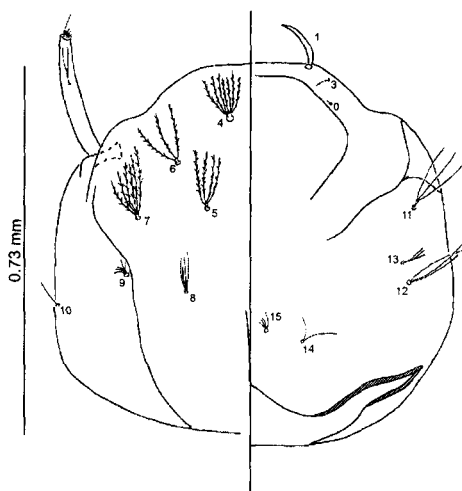


Figure 25. Chaetotaxy of the larval cranium for *Hystatomyia*. No differences were observed in larval chaetotaxy between *Hystatomyia* species. Dorsal perspective left of longitudinal line, ventral perspective right of longitudinal line.

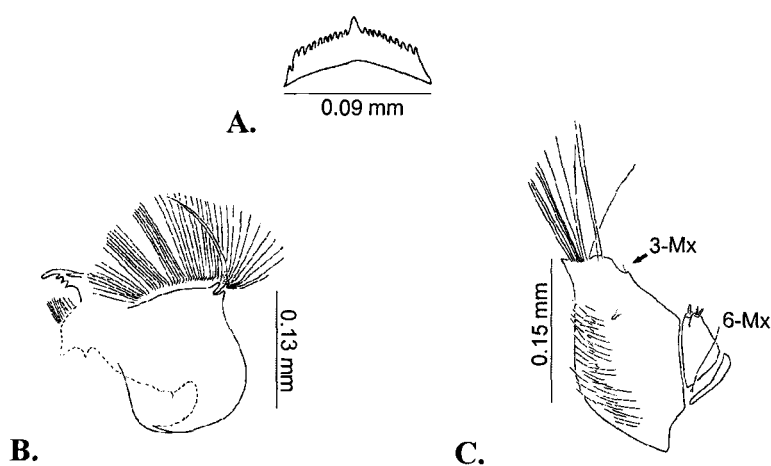


Figure 26. Structures associated with the larval mouthparts for *Hystatomyia*. A. Hypostoma; B. Mandible; C. Maxilla; 3-Mx, seta 3 of maxilla; 6-Mx, seta 6 of palpifer.

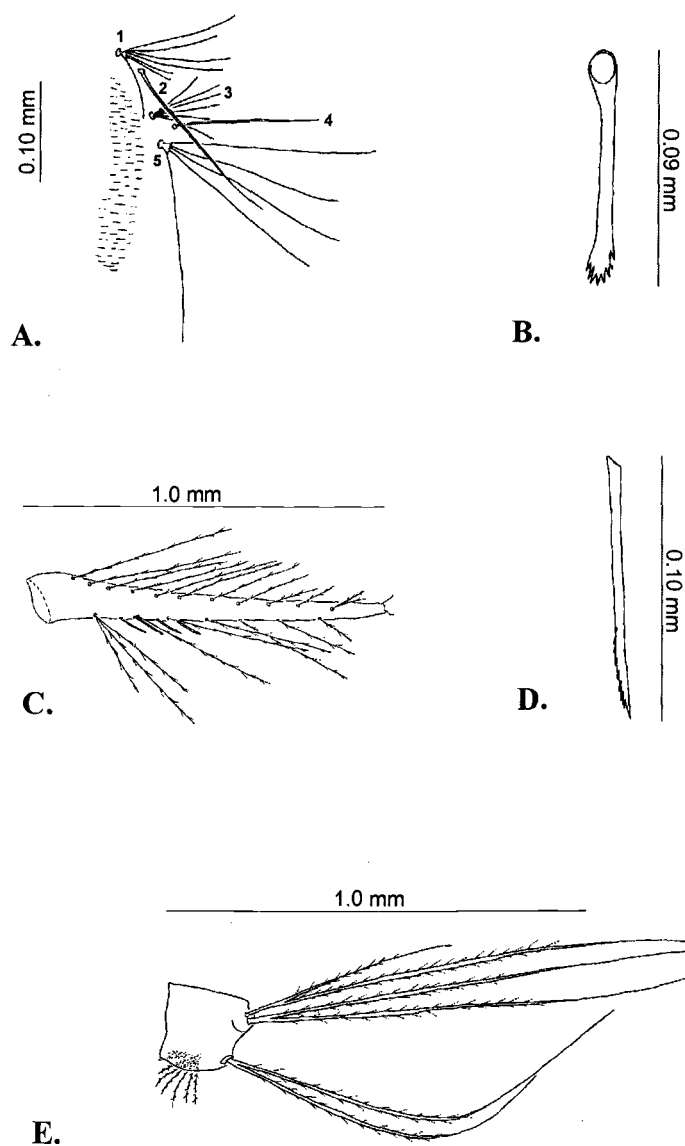


Figure 27. Terminal abdominal segments for *Hystatomyia* larvae. A. Comb; B. Comb scale enlarged; C. Siphon; D. Pecten spine enlarged; E. Saddle; Arabic numbers refer to setae.

***Wyeomyia (Hystatomyia) coenonus* Howard, Dyar & Knab**

*Wyeomyia coenonus* Howard, Dyar & Knab, 1915: 153-154. TYPE:

Lectotype male (Stone and Knight 1957). Locality: Panama, Canal Zone, Tabernilla, 14 April 1909. Collector: A. H. Jennings. Depository: National Museum of Natural History (USNM), specimen #12705. Important References: Bonne and Bonne-Wepster 1925, Dyar 1919, Dyar 1928, Dyar and Shannon 1924, Heinemann and Belkin 1977a, Heinemann and Belkin 1978a, Judd 1998, Lane 1953.

FEMALE: Small-sized species of mosquito, dorsum covered with scales predominantly bronze and metallic blue-green. Outer surface of legs covered with bronze scales. *Head*: Covered with decumbent scales only, broader than those of scutum; scales of occipital region and posterior to orbital setae concolorous with scutum, ventral portion of genae with variable patch of distinct gray-white scales, loose band extending dorsally, but decreasing in width and increasing with degree of brown to upper third of eye. Dorsal orbital setae strong and brown, lateral orbital setae weaker, brown. Interocular space, pedicel, and clypeus without scales. Proboscis 1.79 mm, stout, apical 1/4 distinctly enlarged. Labium completely covered with scales concolorous with scutum. Antenna only slightly shorter than proboscis. Palpus apparently consisting of a single segment, slightly longer than the clypeus and covered with bronze scales. *Thorax*: Pronotal lobes widely

separate; setae brown; scales mostly bronze with violet highlights with small indistinct patch of gray-white scales on posterior lateral margin. Scutum with an anterior patch of white scales of variable size that extend ventrolaterally. Color of dorsal scales described above, scales broader at posterior margin. Scutellum trilobed, appearance enhanced by broad, decumbent scales occurring on the apex of the posterior margin of each lobe along with 3-4 stout, brown setae. Mediotergite nude, except for 7-11 golden or brown setae. Pleuron covered with gray-white scales, except for the anterior portion of the katepisternum, paratergite, meron, and metapleuron, which are nude. Pleuron chaetotaxy reduced and as follows: pronotal lobe with 11-13 brown setae; prespiracular seta not visible; postspiracular seta absent; 3-4 pale golden proepimeral setae; prealar setae not visible; lower katepisternum with 4 pale golden setae; upper katepisternum setae absent; 11-12 pale golden anepimeral setae. *Legs*: Fore-, mid-, and hind coxae and trochanters covered with scales concolorous with pleuron. Formora, tibiae, and tarsomeres with outer surface covered with bronze scales with blue, green, and violet reflections. Foreleg inner surface with a cream colored line of scales on femur, tibia and tarsomeres 1-5 covered with bronze scales. Mid- and hind leg inner surface with a cream colored line of scales on femur and tibia, tarsomeres 1-5 covered with bronze scales. *Wing*: Length: 2.83-3.23 mm. Scales elongate, decumbent and restricted to veins, predominantly bronze, scales of anterior margin

with metallic blue reflections. Posterior margin with a double row of fringelike fusiform scales, one row 1.5 times as long as and one row equal in length to those restricted to veins. *Abdomen*: Dorsum covered with bronze scales with blue-green and magenta reflections extending into plural regions of sternum, sternum with a line of cream colored scales of variable width.

MALE: Same as female except for the following. *Head*: Proboscis 1.27-1.58 mm. Labial scales concolorous with scutum, underside with thin line of scales beginning at base of proboscis, variable in color from cream colored to light brown, extending to subapical patch of cream colored scales at point of enlargement, patch may be indistinct or sparse. Apex with darker brown scales. *Thorax*: Pleuron chaetotaxy as follows: pronotal lobe with 6-10 brown setae; 1 golden or brown prespiracular seta; postspiracular seta absent; 3-4 pale golden propepimeral setae; 2-3 pale golden or brown prealar setae; lower katepisternum with 3-5 pale golden setae; upper katepisternum setae absent; 7-10 pale golden anepimeral setae. *Legs*: Foreleg inner surface with a cream colored line of scales on femur and tibia, tarsomeres 1-5 covered with bronze scales, although tarsomere 1 may have intermittent cream colored scales on inner surface. Midleg inner surface with a cream colored line of scales covering entire length of leg, cream colored scales may extend laterally into dorsal bronze scales in apical tarsomeres. Hind leg with a cream colored line of scales on inner surface of femur and tibia, tarsomeres 1-5

covered with bronze scales, although tarsomeres 1 and 2 may have intermittent gray-white or cream scales on inner surface. Claws of fore- and hind leg simple, midleg modified, different in size and shape. *Wing*: Length: 2.22-2.60 mm.

MALE GENITALIA (Figs. 6A, 7D, 11C, 15A&C, 16A): *Segment VIII*: Segment covered with small, fine setae. Sternum with a pair of small setae on anterior portion, larger setae occurring midway and extending to posterior margin. Scales broad, flat and restricted to lateral margins. Tergum also with a pair of small setae on anterior portion, long setae confined to posterior margin. Densely covered with broad, decumbent scales. *Segment IX*: Sternum with anterior margin weakly emarginate, posterior margin triangular, consisting of a thin strip of sclerite partially fused to gonocoxal lobes separated by a weak line of flexion. Tergum dark, deeply emarginate on anterior margin, posterior margin fused to gonocoxites with 3-4 elongate, stout, outwardly curved setae on each lobe. *Gonocoxite*: Arms appearing fused at base with segment IX. Basal portion broad with well developed mesal lobes. Mesal lobe pigmented, with two weakly separated patches of setae, outer group transversely oval with approximately 8-11 setae, inner group roughly circular with approximately 20-30 stout, elongate, flat setae, all setae tapering to sharp point. Arms narrow, elongate and relatively straight, may curve in slightly at apex. Each arm densely covered with scales and well-developed setae. Inner surface of arm with sparse setae continuing from mesal lobe to apex of each arm,



apical setae dense, unidirectional, and elongate. *Gonostylus*: Length 0.27-0.28 mm. Located on inner margin of gonocoxite at the point where the lobe constricts to form the arm. Weakly sclerotized and narrow with width consistent throughout, straight except apex bent inward and tapering to a sharp point. *Mesal Plate*: Thin, darkened strip of sclerite, V-shaped on mesal margin separating lobes internally. Sclerite bearing short micropile and may bear variable number of longer setae on each lobe. *Aedeagus*: Dorsal paramere forming an upside down V fused at base with lateral tergal arm. Lateral tergal arms elongate and broad through anterior 7/8, dorsal portion compressed linearly with posterior margin emarginate and apices fused and deeply emarginate. Median sternal plate spatulate with lateral and apical margins emarginate not extending beyond apex of lateral tergal arms. Paired, conical, darkly sclerotized structures with truncate, concave apices near base of median sternal plate. *Proctiger*: Ventral surface cup-like, formed by three prominent tooth-like structures, median tooth with complex apex. Dorsal surface with 5-9 small setae.

PUPA (Figs. 3, 4H, 23): Chaetotaxy as figured. *Cephalothorax*: Pigmentation uniform, light golden tan. Seta 1 bifid with apices unmodified. Seta 8 with 2 or 3 branches. Ecdysial sutures weak to absent. *Trumpet*: Pigmented, amount of brown variable, primarily at base and apex; length from 0.91-1.06 mm. Width significantly narrowed and uniform, 0.018-0.024 mm. Apex slightly

swollen, 0.036-0.047 mm. *Metanotum and Abdomen*: Cuticle weakened and hyaline on the dorsum of segment I surrounding seta 1, extending anteriorly to base of setae 2 and 3, may surround seta 2. Seta 10-I apparently absent, seta 11-I present, all other ventral setae absent. With singular circular pit located immediately lateral of the ventral midline. Segments II-VIII concolorous with cephalothorax. Minute, uniformly spaced spicules on dorsum of segments II-VIII. Intersegmental sclerites darkly pigmented posterior to segment II, III, and sometimes IV. Seta 11-II present, all other ventral setae absent. Seta 3-II-III and seta 5-IV-VI single and elongate, extending the length of 2.5-3.5 abdominal segments. Seta 14-VIII present. *Paddle*: Oblong, widest at basal 2/5, tapering to apex. Short, approximately 3/4 the length of seta 9-VIII. Surface glabrous, lateral margins spiculate. Midrib prominent, extending length of paddle. *Male Genital Lobe*: Elongate, approximately 1.6 times length of paddle, broad with curved outer margin, apical 1/5 narrowed, posterior margin rounded.

LARVA (Figs. 24-27): *Cranium*: Anterior margin produced, slightly wider than long. Margin straight between setal pair 1-C. Cranial setae 4-15 branched. Occipital foramen with dorsolateral slit extending anteriorly 0.17-0.19 mm. *Antenna*: 0.27-0.31 mm in length. Antennal seta 1 with 2 branches, located on the dorsal surface of the apical third. *Hypostoma*: Median tooth prominent with 8-10 teeth produced laterally receding toward base, penultimate tooth may be enlarged.

*Mandible:* Ventral teeth only, five; VT0 prominent with VT1-4 reduced in size.

*Maxillae:* Seta 3-Mx located on the outer margin of the maxilla in a sclerotized pocket or notch. Laciniarastrium with a single, prominent, elongate apical tooth.

Palpus, palpiger, and maxillary body separate. Palpus with 3 peglike setae; apex divided, inner margin with single seta, outer margin with 2. Palpiger hyaline, seta

6-Mx single. *Thorax:* Surface glabrous. *Abdomen:* Surface glabrous. *Segment*

*VIII:* Comb teeth numerous extending ventrolaterally in an elongate patch.

Individual teeth broad throughout with spiculate apical margin. *Siphon:* Length

0.85-0.97 mm. Pecten elongate, spinelike, and in a single row, number variable, 5-

8, although some may have been removed during mounting process. *Anal*

*Segment:* Saddle incomplete, covered with rows of intermittently spaced spicules.

Paired, fanlike, 7-9 branched accessory setae located on ventral surface, sclerite absent between setae.

BIONOMICS: Epiphytic bromeliads from 0.5 to 13 m above ground.

Habitat variable from forest to partially cleared premontane wet forest to old palm plantation. Usually in partial shade.

DISTRIBUTION: Known from Panama and Costa Rica.

SYSTEMATICS: See *W. circumcincta*.

Material Examined: 2 pinned females, 9 pinned males, 4 male genitalia slide-mounted, 5 reared male larval and pupal exuviae, 3 male pupal skins without

associated larvae, and no whole larvae or pupae. COSTA RICA: Heredia, Puerto Viejo. PANAMA: Panama, Tocumen, Cerro Azul; Canal Zone, Tabernilla.

***Wyeomyia (Hystatomyia) intonca* Dyar & Knab**

*Wyeomyia intonca* Dyar & Knab, 1909: 173. TYPE: Adult male. Locality: Panama, Canal Zone, Empire, 2 March 1909. Collector: A. H. Jennings. Depository: National Museum of Natural History (USNM), specimen #12744. Important References: Bonne and Bonne-Wepster 1925, Dyar 1919, Heinemann and Belkin 1978a, Judd 1998, Lane 1945.

FEMALE: Small-sized species of mosquito, dorsum densely covered with scales predominantly bronze and metallic blue-green with magenta highlights. Outer surface of legs covered with bronze scales. *Head*: Covered with decumbent scales only, broader than those of scutum; scales of occipital region and posterior to orbital setae concolorous with scutum, ventral portion of genae with variable patch of distinct gray-white scales, loose band extending dorsally, but decreasing in width and increasing with degree of brown to upper third of eye. Dorsal orbital setae strong and golden, lateral orbital setae weaker, brown. Interocular space, pedicel, and clypeus without scales. Proboscis 1.52-1.72 mm, stout, apical 1/4 distinctly enlarged. Labium completely covered with bronze scales except underside with gray-white scales at point of enlargement. Antenna only slightly shorter than

proboscis. Palpus apparently consisting of a single segment; slightly longer than the clypeus and covered with bronze scales. *Thorax*: Pronotal lobes widely separate; setae bronze-brown; scales mostly bronze with violet highlights with a small indistinct patch gray-white scales on posterior lateral margin. Scutum with an anterior patch of white scales of variable size that extend ventrolaterally. Color of dorsal scales described above, scales broader at posterior margin. Scutellum trilobed, appearance enhanced by broad, decumbent scales occurring on the apex of the posterior margin of each lobe along with 3-4 stout, brown setae. Mediotergite nude, except for 7 pale golden setae. Pleuron covered with gray-white scales, except for the anterior portion of the katepisternum, paratergite, meron, and metapleuron, which are nude. Pleuron chaetotaxy reduced and as follows: pronotal lobe with 10-11 brown or golden setae; prespiracular seta not visible; postspiracular seta absent; 4 pale golden proepimeral setae; prealar setae not visible; lower katepisternum with 4 pale golden setae; upper katepisternum setae absent; 10-11 pale golden anepimeral setae. *Legs*: Fore-, mid-, and hind coxae and trochanters covered with scales concolorous with pleuron. Femora, tibiae, and tarsomeres with outer surface covered with bronze scales with blue, green, and violet reflections. Fore-, mid-, and hind leg inner surface with a cream colored line of scales on femur and tibia, tarsomere 1 with intermittent cream colored scales, tarsomeres 2-5 covered with bronze scales. *Wing*: Length: 2.8-2.9 mm. Scales

elongate, decumbent and restricted to veins, predominantly bronze, scales of anterior margin with metallic blue reflections. Posterior margin with a double row of fringelike fusiform scales, one row 1.5 times as long as and one row equal in length to those restricted to veins. *Abdomen*: Dorsum covered with bronze scales with blue-green reflections extending into plural regions of sternum, sternum with gray-white scales of variable width.

MALE: Same as female except as follows. Outer surface of legs covered with bronze scales; except tarsomeres 2-4 of midleg with bronze and cream colored scales. *Head*: Dorsal orbital setae strong and golden brown. Proboscis 1.28-1.52 mm. Labial scales concolorous with scutum, underside with line of cream colored scales extending from base of proboscis to subapical patch of concolorous scales at point of enlargement, apex with darker brown scales. Line connecting patches variable and may be incomplete, sparse or interspersed with light bronze scales. *Thorax*: Mediotergite with 8-11 pale golden or brown setae. Pleuron chaetotaxy as follows: pronotal lobe with 7-11 bronze-brown setae; 1 pale golden or bronze-brown prespiracular seta; postspiracular seta absent; 3-4 pale golden proepimeral setae; 3-4 pale golden or dark brown prealar setae; lower katepisternum with 4-6 pale golden setae; upper katepisternum setae absent; 7-10 pale golden anepimeral setae. *Legs*: Femora, tibiae, and tarsomeres with outer surface covered with bronze scales with blue, green, and violet reflections except where noted in

diagnoses and below. Foreleg inner surface with cream colored line of scales on femur and tibia extending intermittently into tarsomere 1 and sometimes tarsomere 2. Remainder of tarsomeres 1 and 2 and tarsomeres 3-5 covered with bronze scales. Midleg with inner cream colored line of scales extending from base of femur through basal 1/2-3/4 of tarsomere 1. This point of tarsomere 1 through basal 1/2-3/4 of tarsomere 2 covered with bronze scales. Inner surface at this point of tarsomere 2 through tarsomere 4 covered with cream colored scales extending variably into, but not covering, outer surface. Tarsomere 5 covered with light bronze, bronze, and/or cream colored scales. Hind leg inner surface with a cream colored line of scales extending from base of femur into tarsomere 1, line sparse in tarsomere 1 and may extend into tarsomere 2. Claws of fore- and hind leg simple, midleg modified, different in size and shape. *Wing*: Length: 2.23-2.74 mm.

MALE GENITALIA (Figs. 5C, 8B, 12D, 15A&C, 16A): *Segment VIII*: Segment covered with small, fine setae. Sternum with a pair of small setae on anterior portion, larger setae occurring midway and extending along posterior margin. Scales broad, flat and primarily restricted to lateral margins. Tergum also with a pair of small setae on anterior portion, long setae confined to posterior margin. Densely covered with broad, decumbent scales. *Segment IX*: Sternum with anterior margin weakly emarginate, posterior margin roughly triangular and incompletely separated by a weak line of flexion at midline, consisting of a thin

strip of sclerite partially fused to gonocoxal lobes separated by a weak line of flexion. Tergum dark, deeply emarginate on anterior margin, posterior margin fused to gonocoxites with 3-4 elongate, stout, outwardly curved setae on each lobe.

*Gonocoxite*: Arms appearing fused at base with segment IX. Basal portion broad with well developed mesal lobes. Mesal lobe pigmented, with three patches of setae; anterior group as a transverse line with 9-14 elongate setae tapering to a point, median group roughly circular with 17-22 primarily elongate, stout setae tapering to an abrupt point, posterior group roughly circular with 7-10 stouter, longer setae with a complex apex, twisted and tapering to a point. Arms narrow, elongate and curved inward. Each arm densely covered with scales and well-developed setae. Inner surface of arm with setae restricted to apical 2/3, apical setae dense, unidirectional, and elongate. *Gonostylus*: Length 0.21-0.24 mm.

Located on inner margin of gonocoxite at the point where the lobe constricts to form the arm. Elongate, width consistent through basal 2/3 where gonostylus bends posteriorly and widens to form a cup-like apex. *Mesal Plate*: Thin, darkened strip of sclerite, V-shaped on mesal margin separating lobes internally.

Sclerite bearing short micropile and longer setae. *Aedeagus*: Dorsal paramere forming an upside down V fused at base with lateral tergal arms. Lateral tergal arms elongate and broad through anterior 3/4, dorsal portion compressed linearly with posterior margin emarginate and apices fused and emarginate. Median sternal



plate spatulate with lateral and apical margins emarginate not extending beyond apex of lateral tergal arms. Paired, conical, darkly sclerotized structures with truncate, concave apices near base of median sternal plate. *Proctiger*: Apparently with 1 prominent, apical tooth and 1-2 accessory teeth, or teeth-like structures. Dorsal surface with 3-6 small setae.

PUPA (Figs. 3, 4D, 23): Chaetotaxy as figured. *Cephalothorax*:

Pigmentation uniform, light to medium golden tan. Seta 1 bifid with apices unmodified. Seta 8 with 2 or 3 branches. Ecdysial sutures weak to absent.

*Trumpet*: Pigmented, brown at apex and base, usually lighter brown at base; length from 0.96-1.46 mm. Width significantly narrowed and uniform, 0.017-0.031 mm.

Apex slightly swollen, 0.041-0.052 mm. *Metanotum and Abdomen*: Cuticle weakened and hyaline on the dorsum of segment I surrounding seta 1, extending anteriorly to base of setae 2 and 3. Seta 10-I apparently absent, seta 11-I present, all other ventral setae absent. Some specimens with singular circular pit located immediately lateral of the ventral midline. Segments II-VIII concolorous with cephalothorax. Minute, uniformly spaced spicules on dorsum of segments II-VIII. Intersegmental sclerites darkly pigmented posterior to segments II, III, IV, and sometimes V. Seta 11-II present, all other ventral setae absent. Seta 3-II-III and seta 5-IV-VI single and elongate, extending the length of 2.5-3.5 abdominal segments. Seta 14-VIII present. *Paddle*: Oblong, widest at basal 1/3, narrowing at

apex. Short, approximately  $\frac{3}{4}$  the length of seta 9-VIII. Surface glabrous, lateral margins spiculate. Midrib prominent, extending length of paddle. *Male Genital Lobe*: Elongate, approximately 1.6 times length of paddle, broad with curved outer margin, tapers in apical  $\frac{1}{3}$  with most distal point at mesal margin.

LARVA (Figs. 24-27): Chaetotaxy as figured. *Cranium*: Anterior margin produced, slightly wider than long. Margin straight between setal pair 1-C. Cranial setae 4-15 branched. Occipital foramen with dorsolateral slit extending anteriorly 0.14-0.15 mm. *Antenna*: 0.23-0.28 mm in length. Antennal seta 1 single or with 2-3 branches, located on the dorsal surface of the apical third. *Hypostoma*: Median tooth prominent with 9-11 teeth produced laterally receding toward base, terminal teeth may be reduced. *Mandible*: Ventral teeth only, five; VT0 prominent with VT1-4 reduced in size. *Maxillae*: Seta 3-Mx located on the outer margin of the maxilla in a sclerotized pocket or notch. Laciniarastrium with a single, prominent, elongate apical tooth. Palpus, palpiger, and maxillary body separate. Palpus with 3 peglike setae; apex divided, inner margin with single seta, outer margin with 2. Palpiger hyaline, seta 6-Mx single. *Thorax*: Surface glabrous. *Abdomen*: Surface glabrous. *Segment VIII*: Comb teeth numerous extending ventrolaterally in an elongate patch. Individual teeth broad throughout with spiculate apical margin. *Siphon*: Length 0.98-1.22 mm. Pecten elongate, spinelike and in a single row, number variable, 5-8, although some may have been

removed during mounting process. *Anal Segment*: Saddle incomplete, covered with rows of intermittently spaced spicules. Paired, fanlike, 6-9 branched accessory setae located on ventral surface, sclerite absent between setae.

BIONOMICS: Epiphytic and terrestrial bromeliads in forests with partial to deep shade.

DISTRIBUTION: Known only from Panama.

SYSTEMATICS: See *W. circumcincta*.

Material Examined: 2 pinned females, 10 pinned males, 9 male genitalia slide-mounted, 4 reared male larval and pupal exuviae, 2 male pupal skins without associated larvae, and no whole larvae or pupae. PANAMA: Panama, Tocumen, Cerro Azul; Canal Zone, Frijoles, Barro Colorado Island; Canal Zone, Empire; Darien, 4 km NE of Morti; Darien, Pucro.

***Wyeomyia (Hystatomyia) autocratica* Dyar & Knab**

*Wyeomyia autocratica* Dyar & Knab, 1906: 230. TYPE: Holotype larva (slide-mounted, apparently lost). Pupal exuviae and pinned male with abdomen dissected and slide-mounted from same locality (see Stone and Knight, 1957).

Locality: Trinidad. Collector: F. W. Urich. Depository: National Museum of Natural History (USNM), specimen #9986. Important References: Belkin et al.

1965b, Bonne and Bonne-Wepster 1925, Dyar 1928, Dyar and Shannon 1924, Howard et al. 1915, Judd 1998, Lane 1945, Lane 1953, Lane and Cerqueira 1942.

FEMALE: Small-sized species of mosquito, dorsum densely covered with scales predominantly bronze and metallic blue-green with magenta highlights. Outer surface of legs covered with bronze scales. *Head*: Covered with decumbent scales only, broader than those of scutum; scales of occipital region and posterior to orbital setae concolorous with scutum, ventral portion of genae with variable patch of distinct gray-white scales, loose band extending dorsally, but decreasing in width and increasing with degree of brown to upper third of eye. Dorsal orbital setae strong and brown, lateral orbital setae weaker, brown. Interocular space, pedicel, and clypeus without scales. Proboscis stout, apical 1/4 distinctly enlarged. Labium completely covered with bronze scales. Antenna only slightly shorter than proboscis. Palpus apparently consisting of a single segment; slightly longer than the clypeus and covered with bronze scales. *Thorax*: Pronotal lobes widely separate; setae brown; scales mostly bronze with violet highlights with a small indistinct patch gray-white scales on posterior lateral margin. Scutum with an anterior patch of white scales of variable size that extend ventrolaterally. Color of dorsal scales described above, scales broader at posterior margin. Scutellum trilobed, appearance enhanced by broad, decumbent scales occurring on the apex of the posterior margin of each lobe along with 3-4 stout, brown setae. Mediotergite

nude, except for 9-10 pale golden setae. Pleuron covered with gray-white scales, except for the anterior portion of the katepisternum, meron, and metapleuron, which are nude. Paratergite not visible. Pleuron chaetotaxy reduced and as follows: pronotal lobe with 10-11 brown setae; 2 pale golden prespiracular setae; postspiracular seta absent; 5 pale golden proepimeral setae; 2-3 pale golden prealar setae; lower katepisternum with 4-5 pale golden setae; upper katepisternum setae absent; 10-11 pale golden anepimeral setae. *Legs:* Anterior region of forecoxae and entire outer surface of mid- and hind coxae covered with scales concolorous with pleuron. Foretrochanter apparently nude, mid- and hind trochanters with scales concolorous with pleuron on inner surface. Formora, tibiae, and tarsomeres with outer surface covered with bronze scales with blue, green, and violet reflections except where noted in diagnoses and below. Foreleg and midleg inner surface apparently with cream colored line of scales on femur and tibia, although line may be intermittent on tibia, tarsomeres 1-5 covered with bronze scales. Hindleg inner surface appears to have a cream colored line of scales on femur, tibia, and tarsomere 1, tarsomeres 2-5 covered with bronze scales. *Wing:* Scales elongate, decumbent and restricted to veins, predominantly bronze, scales of anterior margin with metallic blue reflections. Posterior margin with a double row of fringelike fusiform scales, one row 1.5 times as long as and one row equal in length to those restricted to veins. *Abdomen:* Dorsum covered with bronze scales

with blue-green reflections extending into plural regions of sternum, sternum with gray-white scales of variable width.

MALE: Same as female except for the following. *Head*: Dorsal orbital setae strong and golden. Proboscis 1.68 mm, labial scales concolorous with scutum, underside with a basal patch of cream colored scales, continues as line of cream to lighter bronze scales to point of enlargement, apex with bronze and darker brown scales. *Legs*: Foreleg inner surface with thin, cream colored line of scales on femur, tibia and tarsomere 1 covered with bronze scales, inner surface of tarsomere 2 with cream colored and lighter bronze scales, tarsomeres 3-5 with cream colored scales extending into lateral surface. Midleg inner surface with cream colored line of scales extending entire length of leg, cream colored scales extending into lateral surface on tarsomeres 3-5. Hind femur, tibia, and tarsomere 1 covered with bronze scales. Hind leg damaged, tarsomeres 2-5 missing. Claws of fore- and hind leg simple, midleg modified, different in size and shape. *Wing*: Length: 2.56 mm.

MALE GENITALIA (Figs. 10A, 14A, 15A&C, 16A): *Segment VIII*: Segment covered with small, fine setae. Sternum with a pair of small setae on anterior portion, larger setae occurring midway and extending along posterior margin. Scales broad, flat and primarily restricted to lateral margins. Tergum also with a pair of small setae on anterior portion, long setae confined to posterior

margin. Densely covered with broad, decumbent scales. *Segment IX*: Sternum with anterior margin weakly emarginate, posterior margin U-shaped, consisting of a thin strip of sclerite fused to tergum, separated from gonocoxite by a weak line of flexion. Tergum dark, deeply emarginate on anterior margin, posterior margin fused to gonocoxites with 3-4 elongate, stout, outwardly curved setae on each lobe. *Gonocoxite*: Anterior margins apparently free. Arms appearing fused at base with tergite IX. Basal portion broad with well developed mesal lobes. Mesal lobe pigmented, with a longitudinal row of 10-12 stout, broad setae on mesal margin. Subapical stalk located on inner margin posterior of longitudinal row of setae, apex of stalk with a pair of stout, broad, squat setae. Arm of gonocoxite with posterior margin narrowed with 4-5 stout, dorsoventrally flat, broad setae distributed over dorsal and ventral surfaces. Each arm densely covered with scales and well developed setae. *Gonostylus*: Length 0.090 mm. Located midway along inner margin of gonocoxal arm. Appearance finger-like, width relatively consistent to apex which is slightly narrower. Gonostylus with a spine-like seta at apex and a second subapical normal type seta on outer margin. *Mesal Plate*: Thin, darkened strip of sclerite, broadly V-shaped on mesal margin connecting lobes internally. Sclerite bearing short micropile and longer setae. *Aedeagus*: Dorsal paramere forming an upside down V fused at base with lateral tergal arms. Lateral tergal arms elongate and broad through anterior 2/3, dorsal portion compressed linearly

with posterior margin emarginate and apices fused and emarginate. Median sternal plate spatulate with lateral and apical margins emarginate not extending beyond apex of lateral tergal arms. Paired, conical, darkly sclerotized structures with truncate, concave apices near base of median sternal plate. *Proctiger*: With 1 prominent apical tooth and approximately 1 accessory tooth or tooth-like structures. Dorsal surface with 5-6 small setae.

PUPA (Figs. 3, 23): Chaetotaxy as figured. *Cephalothorax*: Pigmentation uniform, light golden tan. Seta 1 bifid, apices may be weakly hooked or unmodified. Seta 8 bifid. Ecdysial sutures weak to absent. *Trumpet*: Pigmented, darker brown at apex and base; length 1.06 mm. Width significantly narrowed and uniform, 0.021 mm. Apex slightly swollen, 0.033 mm. *Metanotum and Abdomen*: Cuticle weakened and hyaline on the dorsum of segment I surrounding seta 1, extending anteriorly to base of setae 2 and 3. Setae 11-I present, all other ventral setae apparently absent. May have singular circular pit located immediately lateral of the ventral midline. Segments II-VIII concolorous with cephalothorax. Minute, uniformly spaced spicules on dorsum of segments II-VIII. Intersegmental sclerites darkly pigmented posterior to segment II and sometimes III and IV. Seta 11-II present, all other ventral setae absent. Seta 3-II-III and seta 5-IV-VI single and elongate, extending the length of 2-3 abdominal segments. Seta 14-VIII present. *Paddle*: Uniformly oblong or egg-shaped, slightly narrower at apex. Short, 0.7



times length of seta 9-VIII. Surface glabrous, lateral margins spiculate. Midrib prominent, extending length of paddle. *Male Genital Lobe*: Elongate, approximately 1.4 times length of paddle, broad with curved outer margin and rounded posterior margin.

LARVA (Figs. 24-27): Chaetotaxy as figured. *Cranium*: Oval with anterior margin produced, slightly wider than long. Margin straight between setal pair 1-C. Cranial setae 4-14 branched. Occipital foramen with dorsolateral slit extending anteriorly 0.17 mm. *Antenna*: 0.26 mm in length. Antennal seta 1 bifid located on the dorsal surface of the apical third. *Hypostoma*: Median tooth prominent with 10 teeth decreasing in height towards the lateral margin, terminal tooth reduced. *Mandible*: Ventral teeth only, five; VT0 prominent with VT1-4 reduced in size. *Maxillae*: Seta 3-Mx located on the outer margin of the maxilla in a sclerotized pocket or notch. Laciniarastrium with a small apical tooth. Palpus, palpiger, and maxillary body separate. Palpus with 3 peglike setae; apex divided, inner margin with single seta, outer margin with 2. Palpiger hyaline, seta 6-Mx single. *Thorax*: Surface glabrous. *Abdomen*: Surface glabrous. *Segment VIII*: Comb teeth numerous extending ventrolaterally in an elongate patch. Individual teeth broad throughout with spiculate apical margin. *Siphon*: Length 0.92 mm. Pecten elongate, spinelike, and in a single row of 3, although some may have been removed during the mounting process. *Anal Segment*: Saddle incomplete, covered

with rows of intermittently spaced spicules. Paired, fanlike, 6-7 branched accessory setae located on ventral surface, sclerite absent between setae.

BIONOMICS: Fluid filled bromeliads.

DISTRIBUTION: Known from Brazil, Trinidad, and Venezuela.

SYSTEMATICS: One of two species groups within *Hystatomyia* is composed of *W. autocratica*, *W. lamellata*, and *W. lopezii*. The holotype for *W. lopezii* was unavailable and inclusion in this species group is based on illustrations interpreted from the original species description (Cova Garcia et al. 1979).

Material Examined: 1 pinned female, 1 pinned male, 2 male genitalia slide-mounted, 1 reared male larval and pupal exuvia, 1 male pupal exuvia without associated larva, and no whole larvae or pupae.

***Wyeomyia (Hystatomyia) lamellata* Bonne-Wepster & Bonne**

*Wyeomyia lamellata* Bonne-Wepster & Bonne, 1919: 168. TYPE: Adult male. Locality: Lawa River, Suriname. Collector: J. Bonne-Wepster. Depository: National Museum of Natural History (USNM), specimen #22701. Important References: Dyar 1928, Bruijning 1959, Judd 1998, Lane 1953.

FEMALE: Unknown.

MALE: Small-sized species of mosquito, dorsum densely covered with scales predominantly bronze and metallic blue-green with magenta highlights.

Outer surface of legs covered with bronze scales. *Head*: Covered with decumbent scales only, broader than those of scutum; scales of occipital region and posterior to orbital setae concolorous with scutum, ventral portion of genae with variable patch of distinct gray-white scales, loose band extending dorsally, but decreasing in width and increasing with degree of brown to upper third of eye. Dorsal orbital setae missing, lateral orbital setae weak, brown. Interocular space, pedicel, and clypeus without scales. Proboscis 1.46 mm, stout, apical 1/4 distinctly enlarged. Labial scales concolorous with scutum, underside with line of cream colored scales from base almost to apex, line becomes weaker at point of enlargement. Antenna only slightly shorter than proboscis. Palpus apparently consisting of a single segment; slightly longer than the clypeus and covered with bronze scales. *Thorax*: Pronotal lobes widely separate; setae brown; scales mostly bronze with violet highlights with a small indistinct patch of gray-white scales on posterior lateral margin. Scutum with an anterior patch of white scales of variable size that extend ventrolaterally. Color of dorsal scales described above, scales broader at posterior margin. Scutellum trilobed, appearance enhanced by broad, decumbent scales occurring on the apex of the posterior margin of each lobe along with 4 stout, bronze-brown setae. Mediotergite nude, except for 9-10 pale golden setae. Pleuron covered with gray-white scales, except for the anterior portion of the katepisternum, paratergite, meron, and metapleuron, which are nude. Pleuron

chaetotaxy reduced and as follows: pronotal lobe with 8-9 brown setae; 1 pale golden prespiracular seta; postspiracular seta absent; 3-4 pale golden proepimeral setae; 2-3 pale golden prealar setae; lower katapisternum with 3-5 pale golden setae; upper katapisternum setae absent; 6-7 pale golden anepimeral setae. *Legs:* Fore-, mid-, and hind coxae and trochanters covered with scales concolorous with pleuron. Formora, tibiae, and tarsomeres with outer surface covered with bronze scales with blue, green, and violet reflections. Foreleg inner surface with a cream colored line of scales on femur, tibia and tarsomeres covered with bronze scales. Midleg inner surface with a line of cream colored scales on femur and tibia, tarsomere 1 with intermittent cream colored scales, tarsomeres 2-5 covered with bronze scales. Hind leg inner surface with a cream colored line of scales on femur, tibia, and tarsomere 1, tarsomere 2 with intermittent cream colored scales in basal  $\frac{1}{3}$ , remainder of tarsomere 2 and tarsomeres 3-5 covered with bronze scales. Claws of fore- and hind leg simple, midleg modified, different in size and shape. *Wing:* Length: 2.38-2.47 mm. Scales elongate, decumbent and restricted to veins, predominantly bronze, scales of anterior margin with metallic blue reflections. Posterior margin with a double row of fringelike fusiform scales, one row 1.5 times as long as and one row equal in length to those restricted to veins. *Abdomen:* Dorsum covered with bronze scales with blue-green reflections extending into plural regions of sternum, sternum with gray-white scales of variable width.

MALE GENITALIA (Figs. 10B, 14B, 15A&C, 16A): *Segment VIII*:

Segment covered with small, fine setae. Sternum covered with long setae, also with a pair of small setae on anterior portion. Scales broad, flat and primarily restricted to anterior and lateral margins. Tergum also with a pair of small setae on anterior portion, long setae confined to posterior margin. Densely covered with broad, decumbent scales. *Segment IX*: Sternum with anterior margin weakly emarginate, posterior margin triangular, consisting of a thin strip of sclerite partially fused to tergum, separated from gonocoxite by a weak line of flexion. Tergum dark, deeply emarginate on anterior margin, posterior margin fused to gonocoxites with 4-5 elongate, stout, outwardly curved setae on each lobe.

*Gonocoxite*: Anterior margins apparently free. Arms appearing fused at base with tergite IX. Basal portion broad with well developed mesal lobes. Mesal lobe pigmented, with a longitudinal row of 20-25 stout, elongate setae on mesal margin. Arm of gonocoxite with posterior margin narrowed with 9-10 stout, dorsoventrally flat, broad setae distributed over dorsal and ventral surfaces. Each arm densely covered with scales and well developed setae. *Gonostylus*: Length 0.095 mm. Located midway along inner margin of gonocoxal arm. Appearance club-like, base and median section of gonostylus narrower than apex, apex covered with long setae. *Mesal Plate*: Darkened strip of sclerite, broadly V-shaped on mesal margin separating lobes internally. Sclerite bearing numerous setae on each lobe.

*Aedeagus*: Dorsal paramere forming an upside down V fused at base with lateral tergal arm. Lateral tergal arms elongate and broad through anterior 2/3, dorsal portion compressed linearly with posterior margin emarginate and apices fused and emarginate. Median sternal plate spatulate with lateral and apical margins emarginate not extending beyond apex of lateral tergal arms. Paired, conical, darkly sclerotized structures with truncate, concave apices near base of median sternal plate. *Proctiger*: With 1 prominent apical tooth and 1 accessory tooth or tooth-like structure. Dorsal surface with 6-7 small setae.

PUPA: Unavailable.

LARVA: Unknown.

BIONOMICS: Bromeliaceae near river bank.

DISTRIBUTION: Known only from Suriname.

SYSTEMATICS: See *W. autocratica*.

Material Examined: No pinned females, 2 pinned males, 1 male genitalia slide-mounted, no pupal or larval exuviae, and no whole larvae or pupae.

***Wyeomyia (Hystatomyia) esmeraldasi* Levi-Castillo**

*Wyeomyia esmeraldasi* Levi-Castillo, 1955: 389-391. TYPE: Male (apparently lost). Locality: Changuaral Island, Ancón de Sardinas Bay, Esmeraldas Province, Ecuador. Collector: Not stated. Depository: Centro

Ecuatoriano de Investigaciones Entomológicas, Guayaquil, Ecuador. References:  
Judd 1998.

FEMALE: Unknown.

MALE: Unavailable. The type specimen was deposited at the Centro Ecuatoriano de Investigaciones Entomológicas in Guayaquil, Ecuador, but is apparently lost.

PUPA: Unknown.

LARVA: Unknown.

BIONOMICS: The type specimen was collected feeding on papaya in a rain forest.

DISTRIBUTION: Known only from Ecuador.

SYSTEMATICS: See *W. circumcincta*.

Material Examined: No specimens available.

***Wyeomyia (Hystatomyia) lopezii* Cova Garcia, Sutil Oramas & Pulido**

*Wyeomyia lopezii* Cova Garcia, Sutil Oramas & Pulido, 1979: 21-22.

TYPE: Male. Locality: La Soledad, Municipio Altamira, Estado Barinas, Venezuela. Collector: Not stated. Depository: Laboratorio de Morfología de Insectos de la División de Endemias Rurales, Maracay, Venezuela. References:  
Judd 1998.

FEMALE: Unknown.

MALE: Unavailable. The type specimen is deposited at the Laboratorio de Morfología de Insectos de la División de Endemias Rurales in Maracay, Venezuela, however the museum is closed and the specimen was unavailable for loan.

PUPA: Unavailable.

LARVA: Unavailable.

BIONOMICS: The type specimen was collected from a bromeliad.

DISTRIBUTION: Known only from Venezuela.

SYSTEMATICS: See *W. autocratica*.

Material Examined: No specimens available.

***Wyeomyia (Hystatomyia) "species C" Adkins & Judd, sp. n.***

*Wyeomyia* "species C" Adkins & Judd, 2003. TYPE: Male. References: Heinemann and Belkin 1977a & b.

FEMALE: Unknown.

MALE: Small-sized species of mosquito, dorsum densely covered with scales predominantly bronze and metallic blue-green with magenta highlights. Outer surface of legs covered with bronze scales; except tarsomeres 2 and 5 of midleg with cream and bronze colored scales, tarsomeres 3 and 4 of midleg with



cream colored scales only. Some specimens with lighter bronze scales at base of tarsomeres 3 and/or 4. *Head*: Covered with decumbent scales only, broader than those of scutum; scales of occipital region and posterior to orbital setae concolorous with scutum, ventral portion of genae with variable patch of distinct gray-white scales, loose band extending dorsally, but decreasing in width and increasing with degree of brown to upper third of eye. Dorsal orbital setae strong and golden, lateral orbital setae weaker, brown. Interocular space, pedicel, and clypeus without scales. Proboscis 1.36-1.52 mm, stout, apical 1/4 distinctly enlarged. Labial scales concolorous with scutum, underside with solid line of cream colored scales extending from base to apex. Antenna only slightly shorter than proboscis. Palpus apparently consisting of a single segment; slightly longer than the clypeus and covered with bronze scales. *Thorax*: Pronotal lobes widely separate; setae bronze-brown; scales mostly bronze with violet highlights with small indistinct patch gray-white scales on posterior lateral margin. Scutum with an anterior patch of white scales of variable size that extend ventrolaterally. Color of dorsal scales described above, scales broader at posterior margin. Scutellum trilobed, appearance enhanced by broad, decumbent scales occurring on the apex of the posterior margin of each lobe along with 3-4 stout, brown setae. Mediotergite nude, except for 7-11 pale golden setae. Pleuron covered with gray-white scales, except for the anterior portion of the katepisternum, paratergite, meron, and

metapleuron, which are nude. Pleuron chaetotaxy reduced and as follows:

pronotal lobe with 7-10 bronze-brown setae; 1 golden or bronze-brown prespiracular seta; postspiracular seta absent; 3-4 pale golden proepimeral setae; 3 pale golden prealar setae; lower katepisternum with 5 pale golden setae; upper katepisternum setae absent; 7-11 pale golden anepimeral setae. *Legs*: Fore-, mid-, and hind coxae and trochanters covered with scales concolorous with pleuron. Formora, tibiae, and tarsomeres with outer surface covered with bronze scales with blue, green, and violet reflections except where noted in diagnoses and below. Foreleg femur inner surface with cream colored patch of scales covering basal  $1/3-1/2$ , second cream colored patch of scales at apex of femur with bronze scales covering area in between. Inner cream colored line extends from apex of femur through basal  $1/4-1/2$  of tarsomere 2, line may grow sparse in tarsomere 1. Remainder of tarsomere 2 and tarsomeres 3-5 covered with bronze scales. Midleg inner surface with cream colored line of scales extending from base of femur to apex of tarsomere 4. Apical  $1/4-1/2$  of tarsomere 2 through tarsomere 4 outer surface also covered with cream colored scales, tarsomere 5 covered with cream and light bronze colored scales. Some specimens with light bronze scales at base of tarsomere 3 and/or 4. Hind leg inner surface with cream colored line of scales on femur and tibia extending sparsely into tarsomere 1, tarsomeres 2-5 covered with bronze scales. Claws of fore- and hind leg simple, midleg modified, different

in size and shape. *Wing*: Length: 2.44-2.61 mm. Scales elongate, decumbent and restricted to veins, predominantly bronze, scales of anterior margin with metallic blue-green and magenta reflections. Posterior margin with a double row of fringelike fusiform scales, one row 1.5 times as long as and one row equal in length to those restricted to veins. *Abdomen*: Dorsum covered with bronze scales with blue-green reflections extending into plural regions of sternum, sternum with gray-white scales of variable width.

MALE GENITALIA (Figs. 5B, 7C, 12C, 15B&C, 16A): *Segment VIII*:

Segment covered with small, fine setae. Sternum with a pair of small setae on anterior portion, larger setae occurring midway and extending along posterior margin. Scales broad, flat and primarily restricted to lateral margins. Tergum also with a pair of small setae on anterior portion, long setae confined to posterior margin. Densely covered with broad, decumbent scales. *Segment IX*: Sternum with anterior margin weakly emarginate, posterior margin roughly triangular and incompletely separated by weak line of flexion at midline, consisting of a thin strip of sclerite partially fused to gonocoxal lobes separated by a weak line of flexion. Tergum dark, deeply emarginate or upside down U-shape on anterior margin, posterior margin fused to gonocoxites with 3 elongate, stout, outwardly curved setae on each lobe. *Gonocoxite*: Arms appearing fused at base with segment IX. Basal portion broad with well developed mesal lobes. Mesal lobe pigmented, with

two weakly separated roughly circular patches of setae, dorsal group with 8-11 mostly stout setae, ventral group with 4-6 stout, elongate setae, all setae tapering to sharp point. Arms narrow, elongate and curved inward slightly. Each arm densely covered with scales and well-developed setae. Inner surface of arm with setae restricted to apical  $3/4$ , apical setae dense, unidirectional, and elongate.

*Gonostylus*: Length 0.13-0.15 mm. Located on inner margin of gonocoxite near the point where the lobe constricts to form the arm. Base and apex of gonostylus wider than median section, apex truncate, resembling an upside down triangle.

*Mesal Plate*: Thin, darkened strip of sclerite, V-shaped on mesal margin separating lobes internally. Sclerite bearing short micropile and 1-2 setae on each lobe.

*Aedeagus*: Dorsal paramere forming an upside down V fused at base with lateral tergal arm. Each arm of dorsal paramere with a short, laterally directed lobe  $1/3$  up from base. Lateral tergal arms elongate and broad through anterior  $3/5$ , dorsal portion compressed linearly with posterior margin emarginate and apices fused and emarginate. Median sternal plate spatulate with lateral and apical margins emarginate not extending beyond apex of lateral tergal arms. Paired, conical, darkly sclerotized structures with truncate, concave apices near base of median sternal plate. *Proctiger*: With 1 prominent apical tooth and 1-2 accessory teeth or teeth-like structures. Dorsal surface with 3-7 small setae.

PUPA (Figs. 3, 4C, 23): Chaetotaxy as figured. *Cephalothorax*:

Pigmentation uniform, light golden tan. Seta 1 bifid with apices unmodified. Seta 8 with 2 or 3 branches. Ecdysial sutures weak to absent. *Trumpet*: Pigmented, usually brown at base and lighter brown at apex, may have variable distribution of brown from base to apex; length from 0.92-1.13 mm. Width significantly narrowed and uniform, 0.017-0.034 mm. Apex slightly swollen, 0.025-0.042 mm.

*Metanotum and Abdomen*: Cuticle weakened and hyaline on the dorsum of segment I surrounding seta 1, extending anteriorly to base of setae 2 and 3. Seta 10-I apparently absent, seta 11-I present, all other ventral setae absent. Some specimens with singular circular pit located immediately lateral of the ventral midline. Segments II-VIII concolorous with cephalothorax. Minute, uniformly spaced spicules on dorsum of segments II-VIII. Intersegmental sclerites darkly pigmented posterior to segment II, III, IV and sometimes V and VI. Seta 11-II present, all other ventral setae absent. Seta 3-I-II and seta 5-IV-VI single and elongate, extending the length of 2.5-4 abdominal segments. Seta 14-VIII present. *Paddle*: Oblong, widest at basal 1/3, narrowing at apex. Short, 2/3-3/4 the length of seta 9-VIII. Surface glabrous, lateral margins spiculate. Midrib prominent, extending length of paddle. *Male Genital Lobe*: Elongate, approximately 1.7 times length of paddle, broad with curved outer margin, tapers sharply in apical 1/4 with most distal point at mesal margin.

LARVA (Figs. 24-27): Chaetotaxy as figured. *Cranium*: Anterior margin produced, slightly wider than long. Margin straight between setal pair 1-C. Cranial setae 4-15 branched. Occipital foramen with dorsolateral slit extending anteriorly 0.14-0.19 mm. *Antenna*: 0.23-0.26 mm in length. Antennal seta 1 single or with 2-3 branches, located on the dorsal surface of the apical third. *Hypostoma*: Median tooth prominent with 9-11 teeth produced laterally receding toward base. *Mandible*: Ventral teeth only, five; VT0 prominent with VT1-4 reduced in size. *Maxillae*: Seta 3-Mx located on the outer margin of the maxilla in a sclerotized pocket or notch. Laciniarastrium with a single, reduced, apical tooth. Palpus, palpiger, and maxillary body separate. Palpus with 3 peglike setae; apex divided, inner margin with single seta, outer margin with 2. Palpiger hyaline, seta 6-Mx single. *Thorax*: Surface glabrous. *Abdomen*: Surface glabrous. *Segment VIII*: Comb teeth numerous extending ventrolaterally in an elongate patch. Individual teeth broad throughout with spiculate apical margin. *Siphon*: Length 0.95-0.99 mm. Pecten elongate, spinelike, and in a single row, number variable, 4-7, although some may have been removed during the mounting process. *Anal Segment*: Saddle incomplete, covered with rows of intermittently spaced spicules. Paired, fanlike, 6-8 branched accessory setae located on ventral surface, sclerite absent between setae.

BIONOMICS: Epiphytic and terrestrial bromeliads. Habitat consists of second growth and old palm and cacao plantations. In partial to full sun.

DISTRIBUTION: Known from Costa Rica and Nicaragua.

SYSTEMATICS: See *W. circumcincta*.

Material Examined: No pinned females, 5 pinned males, 5 male genitalia slide-mounted, 4 reared male larval and pupal exuviae, 2 male pupal skins with no associated larvae, and no whole larvae or pupae. COSTA RICA: Heredia, Puerto Viejo. NICARAGUA: Zelaya, Bluefields.

***Wyeomyia (Hystatomyia)* “species E/F” Adkins & Judd, sp. n.**

*Wyeomyia* “species E/F” Adkins & Judd, 2003. TYPE: Male. References: Heinemann and Belkin, 1978a & b.

FEMALE: Unknown.

MALE: Small-sized species of mosquito, dorsum densely covered with scales predominantly bronze and metallic blue-green with magenta highlights. Outer surface of legs covered with bronze scales except midleg tarsomere 2 with cream and bronze scales and tarsomeres 3-5 of midleg with cream colored scales only. One specimen with bronze scales only on outer surface of midleg tarsomere 2, tarsomere 3 with cream and bronze scales. *Head*: Covered with decumbent

scales only, broader than those of scutum; scales of occipital region and posterior to orbital setae concolorous with scutum, ventral portion of genae with variable patch of distinct gray-white scales, loose band extending dorsally, but decreasing in width and increasing with degree of brown to upper third of eye. Dorsal orbital setae strong and brown, lateral orbital setae weaker, brown. Interocular space, pedicel, and clypeus without scales. Proboscis 1.18-1.57 mm, stout, apical 1/4 distinctly enlarged. Labial scales concolorous with scutum, underside with subapical patch of cream colored scales at point of enlargement, patch may extend toward base as line of lighter bronze scales, apex with darker brown scales. Antenna only slightly shorter than proboscis. Palpus apparently consisting of a single segment; slightly longer than the clypeus and covered with bronze scales. *Thorax*: Pronotal lobes widely separate; setae brown; scales mostly bronze with a small indistinct patch of gray-white scales on posterior lateral margin. Scutum with an anterior patch of white scales of variable size that extend ventrolaterally. Color of dorsal scales described above, scales broader at posterior margin. Scutellum trilobed, appearance enhanced by broad, decumbent scales occurring on the apex of the posterior margin of each lobe along with 3-4 stout, brown setae. Mediotergite nude, except for 8-10 brown or pale golden setae. Pleuron covered with gray-white scales, except for the anterior portion of the katepisternum, paratergite, meron, and metapleuron, which are nude. Pleuron chaetotaxy reduced and as follows:



pronotal lobe with 8 brown setae; 1 brown prespiracular seta; postspiracular seta absent; 2-4 pale golden proepimeral setae; 3 pale golden or brown prealar setae; lower katepisternum with 3-4 pale golden setae; upper katepisternum setae absent; 7-10 pale golden anepimeral setae. *Legs:* Fore-, mid-, and hind coxae and trochanters covered with scales concolorous with pleuron. Femora, tibiae, and tarsomeres with outer surface covered with bronze scales with blue, green, and violet reflections except where noted in diagnoses and below. Foreleg inner surface with a cream-colored line of scales on femur and tibia. Inner surface of tarsomere 1 may have intermittent cream colored scales, otherwise tarsomeres 1-5 covered with bronze scales. Midleg inner surface with cream colored line of scales extending entire length of leg, tarsomeres 2-4 with cream colored scales only except at base of tarsomere 2, which has a small patch of bronze scales on anterior facing surface. One specimen with bronze scales only on outer surface of tarsomere 2 through basal 1/2 of tarsomere 3, remainder of tarsomere 3 through tarsomere 5 covered with cream colored scales only. Hind leg inner surface with a line of cream-colored scales on femur. Tibia and tarsomere 1 may have intermittent cream colored scales on inner surface, otherwise tibia and tarsomeres 1-5 covered with bronze scales. Claws of fore- and hind leg simple, midleg modified, different in size and shape. *Wing:* Length: 2.26-2.68 mm. Scales elongate, decumbent and restricted to veins, predominantly bronze, scales of

anterior margin with metallic blue reflections. Posterior margin with a double row of fringelike fusiform scales, one row 1.5 times as long as and one row equal in length to those restricted to veins. *Abdomen*: Dorsum covered with bronze scales with blue-green reflections extending into plural regions of sternum, sternum with gray-white scales of variable width.

MALE GENITALIA (Figs. 5D, 8A, 12A, 15A&C, 16A): *Segment VIII*:

Segment covered with small, fine setae. Sternum with a pair of small setae on anterior portion, larger setae occurring midway and extending along posterior margin. Scales broad, flat and restricted to lateral margins. Tergum also with a pair of small setae on anterior portion, long setae confined to posterior margin.

Densely covered with broad, decumbent scales. *Segment IX*: Sternum with anterior margin weakly emarginate, posterior margin triangular, consisting of a thin strip of sclerite partially fused to gonocoxal lobes separated by a weak line of flexion. Tergum dark, deeply emarginate on anterior margin, posterior margin fused to gonocoxites with 3-4 elongate, stout, outwardly curved setae on each lobe.

*Gonocoxite*: Arms appearing fused at base with segment IX. Basal portion broad with well developed mesal lobes. Mesal lobe pigmented, with two weakly separated transversely oval patches of setae, outer group with 10-15, inner group with 20-30 stout, elongate, flat setae, all setae tapering to a sharp point. Arms narrow, elongate and relatively straight. Each arm densely covered with scales and

well-developed setae. Inner surface of arm with setae continuing from mesal lobe to apex of each arm, apical setae dense, unidirectional, and elongate. *Gonostylus*: Length 0.20-0.24 mm. Located on inner margin of gonocoxite at the point where the lobe constricts to form the arm. Short, stout, and broad with width consistent throughout, apex weakly hooked with a series of ridges on mesal margin. One specimen with ridges absent, however this could be an artifact of the mounting process. *Mesal Plate*: Thin, darkened strip of sclerite, V-shaped on mesal margin separating lobes internally. Sclerite bearing short micropile and may bear a single seta or setae on each lobe. *Aedeagus*: Dorsal paramere forming an upside down V fused at base with lateral tergal arm. Lateral tergal arms elongate and broad through anterior 7/8, dorsal portion compressed linearly, posterior margin apparently smooth and apices fused and deeply emarginate. Median sternal plate spatulate with lateral and apical margins emarginate not extending beyond apex of lateral tergal arms. Paired, conical, darkly sclerotized structures with truncate, concave apices near base of median sternal plate. *Proctiger*: Ventral surface cup-like, formed by three prominent tooth-like structures, median tooth with complex apex. Dorsal surface with 3-7 small setae.

PUPA (Figs. 3, 4E, 23): Chaetotaxy as figured. *Cephalothorax*:

Pigmentation uniform, light golden tan. Seta 1 bifid with apices unmodified. Seta 8 with 2 or 3 branches. Ecdysial sutures weak to absent. *Trumpet*: Pigmented,

brown at apex and base; length from 0.84-1.02 mm. Width significantly narrowed and uniform, 0.022-0.026 mm. Apex slightly swollen, 0.034-0.050 mm.

*Metanotum and Abdomen:* Cuticle weakened and hyaline on the dorsum of segment I surrounding seta 1, extending anteriorly to base of setae 2 and 3. Seta 10-I apparently absent, seta 11-I present, all other ventral setae absent. Some specimens with singular circular pit located immediately lateral of the ventral midline. Segments II-VIII concolorous with cephalothorax. Minute, uniformly spaced spicules on dorsum of segments II-VIII. Intersegmental sclerites darkly pigmented posterior to segment II, III, and sometimes IV and V. Seta 11-II present, all other ventral setae absent. Seta 3-II-III and seta 5-IV-VI single and elongate, extending the length of 2.5-3.5 abdominal segments. Seta 14-VIII present. *Paddle:* Oblong, widest at basal 1/3, tapering to apex. Short, 2/3 the length of seta 9-VIII. Surface glabrous, lateral margins spiculate. Midrib prominent, extending length of paddle. *Male Genital Lobe:* Elongate, approximately 1.75-2 times length of paddle, broad with straight outer margin with most distal point at mesal margin.

LARVA (Figs. 24-27): Chaetotaxy as figured. *Cranium:* Anterior margin produced, slightly wider than long. Margin straight between setal pair 1-C. Cranial setae 4-15 branched. Occipital foramen with dorsolateral slit extending anteriorly 0.13-0.17 mm. *Antenna:* 0.25-0.29 mm in length. Antennal seta 1

single or with 2-3 branches, located on the dorsal surface of the apical third.

*Hypostoma*: Median tooth prominent with 8-10 teeth produced laterally receding toward base, penultimate tooth enlarged. *Mandible*: Ventral teeth only, five; VT0 prominent with VT1-4 reduced in size. *Maxillae*: Seta 3-Mx located on the outer margin of the maxilla in a sclerotized pocket or notch. *Lacinia* with a single, prominent, elongate apical tooth. Palpus, palpiger, and maxillary body separate. Palpus with 3 elongate setae; apex divided, inner margin with single seta, outer margin with 2. Palpiger hyaline, seta 6-Mx single. *Thorax*: Surface glabrous. *Abdomen*: Surface glabrous. *Segment VIII*: Comb teeth numerous extending ventrolaterally in an elongate patch. Individual teeth broad throughout with spiculate apical margin. *Siphon*: Length 0.81-0.94 mm. Pecten elongate, spinelike, and in a single row, number variable, 5-8, although some may have been removed during the mounting process. *Anal Segment*: Saddle incomplete, covered with rows of intermittently spaced spicules. Paired, fanlike, 7-9 branched accessory setae located on ventral surface, sclerite absent between setae.

**BIONOMICS**: Epiphytic and terrestrial bromeliads including pineapple. Habitat highly variable ranging from rain forest to transitional zone mangrove and palm forests to manmade plantations with partial to full sun or deep shade. Water volume equally variable with ranges of no free water to upwards of 500 ml in tank.

**DISTRIBUTION**: Colombia and Panama.

SYSTEMATICS: See *W. circumcincta*.

Material Examined: No pinned females, 12 pinned males, 10 male genitalia slide-mounted, 6 reared male larval and pupal exuviae, 2 male pupal skins without associated larvae, and no whole larvae or pupae. COLOMBIA: Valle, Buenaventura. PANAMA: Darien, Pucro, Rio Tacarcuna Valley.

***Wyeomyia (Hystatomyia) "species G" Adkins & Judd, sp. n.***

*Wyeomyia* "species G" Adkins & Judd, 2003. TYPE: Male. References: Heinemann and Belkin 1977a, 1978a.

FEMALE: Unknown.

MALE: Small-sized species of mosquito, dorsum densely covered with scales predominately bronze and metallic blue-green with magenta highlights. Outer surface of legs covered with bronze scales; except tarsomeres 2-4 of midleg with bronze and cream colored scales. *Head*: Covered with decumbent scales only, broader than those of scutum; scales of occipital region and posterior to orbital setae concolorous with scutum, ventral portion of genae with variable patch of distinct gray-white scales, loose band extending dorsally, but decreasing in width and increasing with degree of brown to upper third of eye. Dorsal orbital setae strong and golden to golden brown, lateral orbital setae weaker, brown. Interocular space, pedicel, and clypeus without scales. Proboscis 1.43-1.76 mm, stout, apical

1/4 distinctly enlarged. Labial scales concolorous with scutum, underside with thin line of cream colored scales from base of proboscis to subapical patch of concolorous scales at point of enlargement, patch may extend almost to apex, apex with darker brown scales. Antenna only slightly shorter than proboscis. Palpus apparently consisting of a single segment; slightly longer than the clypeus and covered with bronze scales. *Thorax*: Pronotal lobes widely separate; setae bronze-brown; scales mostly bronze with violet highlights with small indistinct patch of gray-white scales on posterior lateral margin. Scutum with an anterior patch of white scales of variable size that extend ventrolaterally. Color of dorsal scales described above, scales broader at posterior margin. Scutellum trilobed, appearance enhanced by broad, decumbent scales occurring on the apex of the posterior margin of each lobe along with 3-4 stout, bronze-brown setae. Mediotergite nude, except for 10-12 golden setae. Pleuron covered with gray-white scales, except for the anterior portion of the katepisternum, paratergite, meron, and metapleuron, which are nude. Pleuron chaetotaxy reduced and as follows: pronotal lobe with 10-11 bronze-brown setae; 1 golden prespiracular seta; postspiracular seta absent; 2-4 pale golden proepimeral setae; 3-4 pale golden prealar setae; lower katepisternum with 3-4 pale golden setae; upper katepisternum setae absent; 8-13 pale golden anepimeral setae. *Legs*: Fore-, mid-, and hind coxae and trochanters covered with scales concolorous with pleuron. Formora, tibiae, and

tarsomeres with outer surface covered with bronze scales with blue, green, and violet reflections except where noted in diagnoses and below. Foreleg inner surface with a cream colored line of scales starting at base of femur, extending at least to apex of tarsomere 1 and may extend into tarsomeres 2 and 3 as intermittent scales. Midleg with inner cream colored line of scales extending from base of femur to midpoint of tarsomere 1. Midpoint of tarsomere 1 through basal 1/2-3/4 of tarsomere 2 covered with bronze scales. Inner surface at midpoint of tarsomere 2 through tarsomere 4 covered with cream colored scales extending variably into, but not covering, outer surface. Tarsomere 5 inner surface with cream and bronze scales, outer surface with bronze and light bronze scales. Hind leg inner surface with a cream colored line of scales extending from base of femur into tarsomere 1, line intermittent in tarsomere 1 and may extend into tarsomere 2. Tarsomeres 2-5 covered with bronze scales. Claws of fore- and hind leg simple, midleg modified, different in size and shape. *Wing*: Length: 2.59-2.75 mm. Scales elongate, decumbent and restricted to veins, predominantly bronze, scales of anterior margin with metallic blue reflections. Posterior margin with a double row of fringelike fusiform scales, one row 1.5 times as long as and one row equal in length to those restricted to veins. *Abdomen*: Dorsum covered with bronze scales with blue-green reflections extending into plural regions of sternum, sternum with gray-white scales of variable width.



MALE GENITALIA (Figs. 5E, 8C, 13B, 15A&C, 16A): *Segment VIII*:

Segment covered with small, fine setae. Sternum with a pair of small setae on anterior portion, larger setae occurring midway and extending along posterior margin. Scales broad, flat and primarily restricted to lateral margins. Tergum also with a pair of small setae on anterior portion, long setae confined to posterior margin. Densely covered with broad, decumbent scales. *Segment IX*: Sternum with anterior margin weakly emarginate, posterior margin roughly triangular and incompletely separated by weak line of flexion at midline, consisting of a thin strip of sclerite partially fused to gonocoxal lobes separated by a weak line of flexion. Tergum dark, deeply emarginate on anterior margin, posterior margin fused to gonocoxites with 2-3 elongate, stout, outwardly curved setae on each lobe.

*Gonocoxite*: Arms appearing fused at base with segment IX. Basal portion broad with well developed mesal lobes. Mesal lobe pigmented, with three roughly circular patches of setae; anterior group with 20-30 elongate setae tapering to a long, fine apex, median group with 7-12 elongate, stouter setae tapering to a point, posterior group with 6-8 most stout and elongate setae with a complex apex, twisted and tapering to a point. Arms narrow, elongate and curved inward. Each arm densely covered with scales and well-developed setae. Inner surface of arm with setae absent, apical setae stout and elongate, forming a stiff brush.

*Gonostylus*: Length 0.31-0.36 mm. Located on inner margin of gonocoxite at the

point where the lobe constricts to form the arm. Elongate and relatively stout, width consistent to midpoint where gonostylus narrows and curves outward, forming a “J” shape. Widens again in apical 1/4 with apex truncate on the lateral facing side. *Mesal Plate*: Thin, darkened strip of sclerite, V-shaped on mesal margin separating lobes internally. Sclerite bearing short micropile and longer setae on each lobe. *Aedeagus*: Dorsal paramere forming an upside down V fused at base with lateral tergal arm. Lateral tergal arms elongate and broad through anterior 2/3, dorsal portion compressed linearly with posterior margin emarginate and apices fused and emarginate. Median sternal plate spatulate with lateral and apical margins emarginate not extending beyond apex of lateral tergal arms. Paired, conical, darkly sclerotized structures with truncate, concave apices near base of median sternal plate. *Proctiger*: With 1 prominent apical tooth and 1-2 accessory teeth or teeth-like structures. Dorsal surface with 5-7 small setae.

PUPA (Figs. 3, 4F, 23): Chaetotaxy as figured. *Cephalothorax*: Pigmentation uniform, light golden tan. Seta 1 bifid with apices unmodified. Seta 8 with 2 branches. Ecdysial sutures weak to absent. *Trumpet*: Pigmented, brown at base, may also be lighter brown at apex; length from 1.04-1.32 mm. Width significantly narrowed and uniform, 0.017-0.023 mm. Apex slightly swollen, 0.035-0.057 mm. *Metanotum and Abdomen*: Cuticle weakened and hyaline on the dorsum of segment I surrounding seta 1, usually extending anteriorly to base of

setae 2 and 3, may stop posterior to setae. Seta 10-I apparently absent, seta 11-I present, all other ventral setae absent. Some specimens with singular circular pit located immediately lateral of the ventral midline. Segments II-VIII concolorous with cephalothorax. Minute, uniformly spaced spicules on dorsum of segments II-VIII, although may be difficult to see on anterior segments. Intersegmental sclerites darkly pigmented posterior to segment II, III, and sometimes IV and V. Seta 11-II present, all other ventral setae absent. Seta 3-II-III single and seta 5-IV-VI single or bifid and elongate, extending the length of 2.5-3.5 abdominal segments. Seta 14-VIII present. *Paddle*: Oblong, widest at basal 1/3, narrowing at apex. Short, 3/4-4/5 the length of seta 9-VIII. Surface glabrous, lateral margins spiculate. Midrib prominent, extending length of paddle. *Male Genital Lobe*: Elongate, approximately 1.5 times length of paddle, broad with curved outer margin, apical 1/6 narrowed, posterior margin rounded.

LARVA (Figs. 24-27): Chaetotaxy as figured. *Cranium*: Anterior margin produced, slightly wider than long. Margin straight between setal pair 1-C. Cranial setae 4-15 branched. Occipital foramen with dorsolateral slit extending anteriorly 0.16-0.19 mm. *Antenna*: 0.25-0.31 mm in length. Antennal seta 1 variable, located on the dorsal surface of the apical third. *Hypostoma*: Median tooth prominent with 10-11 teeth produced laterally receding toward base, terminal teeth variably reduced. *Mandible*: Ventral teeth only, five; VT0 prominent with

VT1-4 reduced in size. *Maxillae*: Seta 3-Mx located on the outer margin of the maxilla in a sclerotized pocket or notch. Laciniarastrium with a single, apparently reduced apical tooth. Palpus, palpiger, and maxillary body separate. Palpus with 3 peglike setae; apex divided, inner margin with single seta, outer margin with 2. Palpiger hyaline, seta 6-Mx single. *Thorax*: Surface glabrous. *Abdomen*: Surface glabrous. *Segment VIII*: Comb teeth numerous extending ventrolaterally in an elongate patch. Individual teeth broad throughout with spiculate apical margin. *Siphon*: Length 1.11-1.22 mm. Pecten elongate, spinelike, and in a single row, number variable, 4-7, although some may have been removed during mounting process. *Anal Segment*: Saddle incomplete, covered with rows of intermittently spaced spicules. Paired, fanlike, 7-10 branched accessory setae located on ventral surface, sclerite absent between setae.

BIONOMICS: Epiphytic and saxicolous bromeliads. Habitat ranging from partial forest to tropical moist forest to cacao plantation with partial shade.

DISTRIBUTION: Known from Costa Rica and Panama.

SYSTEMATICS: See *W. circumcincta*.

Material Examined: No pinned females, 7 pinned males, 7 male genitalia slide-mounted, 6 reared male larval and pupal exuviae, 1 male pupal skin with no associated larva, and no whole larvae or pupae. COSTA RICA: Cartago,

Turrialba; Limon, 4 km E of Zent. PANAMA: Bocas del Toro, 3 km S of Punta de Pena, El Guabo.

***Wyeomyia (Hystatomyia) "species H" Adkins & Judd, sp. n.***

*Wyeomyia* "species H" Adkins & Judd, 2003. TYPE: Male. References: Heinemann and Belkin 1977a & b.

FEMALE: Unknown.

MALE: Small-sized species of mosquito, dorsum densely covered with scales predominately bronze and metallic blue-green with magenta highlights. Outer surface of legs covered with bronze scales; except tarsomeres 1-4 of midleg with bronze and cream colored scales. *Head*: Covered with decumbent scales only, broader than those of scutum; scales of occipital region and posterior to orbital setae concolorous with scutum, ventral portion of genae with variable patch of distinct gray-white scales, loose band extending dorsally, but decreasing in width and increasing with degree of brown to upper third of eye. Dorsal orbital setae strong and golden to golden brown, lateral orbital setae weaker, brown. Interocular space, pedicel, and clypeus without scales. Proboscis 1.24-1.51 mm, stout, apical 1/4 distinctly enlarged. Labial scales concolorous with scutum, underside with thin line of cream colored scales from base of proboscis to subapical patch of concolorous scales at point of enlargement, patch may extend almost to apex, apex

with darker brown scales. Antenna only slightly shorter than proboscis. Palpus apparently consisting of a single segment; slightly longer than the clypeus and covered with bronze scales. *Thorax*: Pronotal lobes widely separate; setae bronze-brown; scales mostly bronze with violet highlights with small indistinct patch of gray-white scales on posterior lateral margin. Scutum with an anterior patch of white scales of variable size that extend ventrolaterally. Color of dorsal scales described above, scales broader at posterior margin. Scutellum trilobed, appearance enhanced by broad, decumbent scales occurring on the apex of the posterior margin of each lobe along with 3-4 stout, bronze-brown setae.

Mediotergite nude, except for 7-13 golden or brown setae. Pleuron covered with gray-white scales, except for the anterior portion of the katepisternum, paratergite, meron, and metapleuron, which are nude. Pleuron chaetotaxy reduced and as follows: pronotal lobe with 8-10 bronze-brown setae; 1-2 golden or bronze-brown prespiracular setae; postspiracular seta absent; 2-4 pale golden proepimeral setae; 3-4 pale golden or bronze-brown prealar setae; lower katepisternum with 4-7 pale golden setae; upper katepisternum setae absent; 7-12 pale golden anepimeral setae.

*Legs*: Fore-, mid-, and hind coxae and trochanters covered with scales concolorous with pleuron. Femora, tibiae, and tarsomeres with outer surface covered with bronze scales with blue, green, and violet reflections except where noted in diagnoses and below. Foreleg inner surface with a cream colored line of scales

starting at base of femur, extending at least to apex of tarsomere 1 and may extend up to midpoint of tarsomere 2 as intermittent scales. Midleg with inner cream colored line of scales extending from base of femur to approximate midpoint of tarsomere 1. Midpoint of tarsomere 1 with bronze scales extending to approximate midpoint of tarsomere 2. Inner surface at midpoint of tarsomere 2 through tarsomere 4 covered with cream colored scales extending variably into, but not covering, outer surface. Tarsomere 5 inner surface with cream and bronze scales, outer surface with bronze and light bronze scales. Hind leg inner surface with a cream colored line of scales extending from base of femur into tarsomere 1, line intermittent in tarsomere 1. Tarsomeres 2-5 covered with bronze scales. Claws of fore- and hind leg simple, midleg modified, different in size and shape. *Wing*: Length: 2.25-2.71 mm. Scales elongate, decumbent and restricted to veins, predominantly bronze, scales of anterior margin with metallic blue reflections. Posterior margin with a double row of fringelike fusiform scales, one row 1.5 times as long as and one row equal in length to those restricted to veins. *Abdomen*: Dorsum covered with bronze scales with blue-green reflections extending into plural regions of sternum, sternum with gray-white scales of variable width.

MALE GENITALIA (Figs. 5F, 8D, 13A, 15A&C, 16A): *Segment VIII*:

Segment covered with small, fine setae. Sternum with a pair of small setae on anterior portion, larger setae occurring midway and extending along posterior

margin. Scales broad, flat and primarily restricted to lateral margins. Tergum also with a pair of small setae on anterior portion, long setae confined to posterior margin. Densely covered with broad, decumbent scales. *Segment IX*: Sternum with anterior margin weakly emarginate, posterior margin roughly triangular and incompletely separated by weak line of flexion at midline, consisting of a thin strip of sclerite partially fused to gonocoxal lobes separated by a weak line of flexion. Tergum dark, deeply emarginate on anterior margin, posterior margin fused to gonocoxites with 2-4 elongate, stout, outwardly curved setae on each lobe.

*Gonocoxite*: Arms appearing fused at base with segment IX. Basal portion broad with well developed mesal lobes. Mesal lobe pigmented, with three roughly circular patches of setae; anterior group with 20-25 elongate setae tapering to a long, fine apex, median group with 10-15 elongate, stouter setae tapering to a point, posterior group with 4-7 most stout and elongate setae with a complex apex, twisted and tapering to a point. Arms narrow, elongate and curved inward. Each arm densely covered with scales and well-developed setae. Inner surface of arm with setae absent, apical setae stout and elongate, forming a stiff brush.

*Gonostylus*: Length 0.24-0.31 mm. Located on inner margin of gonocoxite at the point where the lobe constricts to form the arm. Elongate, width consistent to midpoint where gonostylus widens to form a cup, width narrowed in apical 1/5 with a rounded apex directed outward. *Mesal Plate*: Thin, darkened strip of



sclerite, V-shaped on mesal margin separating lobes internally. Sclerite bearing short micropile. *Aedeagus*: Dorsal paramere forming an upside down V fused at base with lateral tergal arm. Lateral tergal arms elongate and broad through approximately anterior 3/4, dorsal portion compressed linearly with posterior margin emarginate and apices fused and emarginate. Median sternal plate spatulate with lateral and apical margins emarginate not extending beyond apex of lateral tergal arms. Paired, conical, darkly sclerotized structures with truncate, concave apices near base of median sternal plate. *Proctiger*: With 1 prominent apical tooth and 1-2 accessory teeth or teeth-like structures. Dorsal surface with 5-7 small setae.

PUPA (Figs. 3, 4G, 23): Chaetotaxy as figured. *Cephalothorax*:

Pigmentation uniform, light golden tan. Seta 1 bifid with apices unmodified. Seta 8 with 2 branches. Ecdysial sutures weak to absent. *Trumpet*: Pigmented, brown at base, may also be brown at or near apex; length from 0.94-1.32 mm. Width significantly narrowed and uniform, 0.018-0.025 mm. Apex slightly swollen, 0.035-0.051 mm. *Metanotum and Abdomen*: Cuticle weakened and hyaline on the dorsum of segment I surrounding seta 1, extending anteriorly to base of setae 2 and 3. Seta 10-I apparently absent, seta 11-I present, all other ventral setae absent. Some specimens with singular circular pit located immediately lateral of the ventral midline. Segments II-VIII concolorous with cephalothorax. Minute, uniformly

spaced spicules on dorsum of segments II-VIII, although may be difficult to see on anterior segments. Intersegmental sclerites darkly pigmented posterior to segment II, III, and sometimes IV and V. Seta 11-II present, all other ventral setae absent. Seta 3-II-III and seta 5-IV-VI single and elongate, extending the length of 2.5-4 abdominal segments. Seta 14-VIII present. *Paddle*: Oblong, widest at basal 1/3, narrowing at apex. Short, approximately 3/4 the length of seta 9-VIII. Surface glabrous, lateral margins spiculate. Midrib prominent, extending length of paddle. *Male Genital Lobe*: Elongate, approximately 1.5 times length of paddle, broad with curved outer margin, apical 1/6 narrowed, posterior margin rounded.

LARVA (Figs. 24-27): Chaetotaxy as figured. *Cranium*: Anterior margin produced, slightly wider than long. Margin straight between setal pair 1-C. Cranial setae 4-15 branched. Seta 14-C with 2 or 3 branches. Occipital foramen with dorsolateral slit extending anteriorly 0.16-0.18 mm. *Antenna*: 0.25-0.29 mm in length. Antennal seta 1 single or with 2 branches, located on the dorsal surface of the apical third. *Hypostoma*: Median tooth prominent with 9-11 teeth produced laterally receding toward base, terminal teeth may be reduced. *Mandible*: Ventral teeth only, five; VT0 prominent with VT1-4 reduced in size. *Maxillae*: Seta 3-Mx located on the outer margin of the maxilla in a sclerotized pocket or notch. Laciniarastrium with a single, prominent, elongate apical tooth. Palpus, palpiger, and maxillary body separate. Palpus with 3 peglike setae; apex divided, inner

margin with single seta, outer margin with 2. Palpiger hyaline, seta 6-Mx single.

*Thorax*: Surface glabrous. *Abdomen*: Surface glabrous. *Segment VIII*: Comb teeth numerous extending ventrolaterally in an elongate patch. Individual teeth broad throughout with spiculate apical margin. *Siphon*: Length 0.96-1.13 mm. Pecten elongate, spinelike, and in a single row, number variable, 1-6, although some may have been removed during mounting process. *Anal Segment*: Saddle incomplete, covered with rows of intermittently spaced spicules. Paired, fanlike, 6-10 branched accessory setae located on ventral surface, sclerite absent between setae.

BIONOMICS: Epiphytic and terrestrial bromeliads. Habitat variable ranging from tropical and premontane wet forests to old palm and cacao plantations. Found in partial to deep shade.

DISTRIBUTION: Known from Costa Rica and Nicaragua.

SYSTEMATICS: See *W. circumcincta*.

Material Examined: No pinned females, 11 pinned males, 7 male genitalia slide-mounted, 8 reared male larval and pupal exuviae, 3 male pupal skins with no associated larvae, and no whole larvae or pupae. COSTA RICA: Limon, approximately 10 km S of Guapiles; Heredia, Puerto Viejo. NICARAGUA: Zelaya, Bluefields.

***Wyeomyia (Hystatomyia) "species K" Adkins & Judd, sp. n.***

*Wyeomyia* "species K" Adkins & Judd, 2003. TYPE: Male. References:

Heinemann and Belkin 1978b.

FEMALE: Unknown.

MALE: Small-sized species of mosquito, dorsum covered with scales predominately bronze and metallic blue-green with magenta highlights. Outer surface of legs covered with bronze scales; except tarsomeres 1-4 of midleg with bronze and cream colored scales. *Head*: Covered with decumbent scales only, broader than those of scutum; scales of occipital region and posterior to orbital setae concolorous with scutum, ventral portion of genae with variable patch of distinct gray-white scales, loose band extending dorsally, but decreasing in width and increasing with degree of brown to upper third of eye. Dorsal orbital setae strong and brown, lateral orbital setae weaker and brown. Interocular space, pedicel, and clypeus without scales. Proboscis 1.32-1.38 mm, stout, apical 1/4 distinctly enlarged. Labial scales concolorous with scutum, underside with thin line of cream colored scales beginning at base of proboscis extending to subapical patch of cream colored scales at point of enlargement, line may become sparse near subapical patch. Apex with darker brown scales. Antenna only slightly shorter than proboscis. Palpus apparently consisting of a single segment, slightly longer than the clypeus and covered with bronze scales. *Thorax*: Pronotal lobes widely

separate; setae brown; scales mostly bronze with violet highlights, small indistinct patch of gray-white scales on posterior lateral margin. Scutum with an anterior patch of gray-white scales of variable size that extend ventrolaterally. Color of dorsal scales described above, scales broader at posterior margin. Scutellum trilobed, appearance enhanced by broad, decumbent scales occurring on the apex of the posterior margin of each lobe along with 4-5 stout, brown setae. Mediotergite nude, except for 9-10 golden or brown setae. Pleuron covered with gray-white scales, except for the anterior portion of the katepisternum, paratergite, meron, and metapleuron, which are nude. Pleuron chaetotaxy reduced and as follows: pronotal lobe with 7-8 brown setae; 1 brown prespiracular seta; postspiracular seta absent; 3 pale golden proepimeral setae; 3-4 golden or brown prealar setae; lower katepisternum with 4-5 pale golden setae; upper katepisternum setae absent; 7-9 pale golden anepimeral setae. *Legs*: Fore-, mid-, and hind coxae and trochanters covered with scales concolorous with pleuron. Formora, tibiae, and tarsomeres with outer surface covered with bronze scales with blue, green, and violet reflections except where noted in diagnoses and below. Foreleg femur inner surface with cream colored patch of scales covering basal  $1/3$ - $1/2$ , second cream colored patch of scales at apex with bronze scales covering area in between. Tibia inner surface with cream colored line of scales extending from base to apex, line tapers in apical  $1/4$ , tarsomere 1 may have intermittent cream colored scales on

inner surface primarily at basal portion. Tarsomeres 2-5 covered with bronze scales. Midleg with inner cream colored line extending from base of femur through approximately basal  $\frac{2}{3}$  of tibia. Tarsomere 1 with cream colored patch of scales covering basal  $\frac{1}{3}$  of inner surface, extending laterally into outer surface.

Tarsomeres 2-4 with cream colored patch of scales covering basal  $\frac{1}{2}$ - $\frac{2}{3}$  of inner surface of segments, extending laterally to cover majority of outer surface of segments. Tarsomere 5 and regions of other segments not with cream colored scales covered with bronze scales. Hind leg with cream colored line of scales on inner surface extending from base of femur to apex of tarsomere 4, line sparse on tibia and tarsomere 1. Tarsomere 5 covered with lighter bronze scales. Claws of fore- and hind leg simple, midleg modified, different in size and shape. *Wing*:

Length: 2.37-2.41 mm. Scales elongate, decumbent and restricted to veins, predominantly bronze, scales of anterior margin with metallic blue reflections.

Posterior margin with a double row of fringelike fusiform scales, one row 1.5 times as long as and one row equal in length to those restricted to veins. *Abdomen*:

Dorsum covered with bronze scales with blue-green and magenta reflections extending into plural regions of sternum, sternum with a line of cream-colored scales of variable width.

#### MALE GENITALIA (Figs. 6B, 9C, 11D, 15D, 16A): *Segment VIII*:

Segment covered with small, fine setae. Sternum with a pair of small setae on

anterior portion, larger setae occurring midway and extending along posterior margin. Scales broad, flat and primarily restricted to lateral margins. Tergum also with a pair of small setae on anterior portion, long setae confined to posterior region. Densely covered with broad, decumbent scales. *Segment IX*: Sternum with anterior margin weakly emarginate, posterior margin roughly triangular and incompletely separated by weak line of flexion at midline, consisting of a thin strip of sclerite partially fused to gonocoxal lobes separated by a weak line of flexion. Tergum dark, deeply emarginate on anterior margin, posterior margin fused to gonocoxites with 3-4 elongate, stout, outwardly curved setae on each lobe.

*Gonocoxite*: Arms appearing fused at base with segment IX. Basal portion broad with well developed mesal lobes. Mesal lobe pigmented, with one patch of 15-18 variable setae all tapering to a sharp point and forming an incomplete, open circle. Arms relatively stout and short, and curved inward slightly. Each arm densely covered with scales and well-developed setae. Inner surface of arm with setae of variable type continuing from mesal lobe to apex of each arm. *Gonostylus*: Length 0.19-0.21 mm. Located on inner margin of gonocoxite at the point where the lobe constricts to form the arm. Weakly sclerotized and narrow with width consistent throughout, curving inward near midpoint, apex blade-like and tapering to a point. *Mesal Plate*: Thin, darkened strip of sclerite, V-shaped on mesal margin separating lobes internally. Sclerite bearing short micropile and variable number of longer

setae on each lobe. *Aedeagus*: Dorsal paramere forming an upside down V fused at base with lateral tergal arm. Lateral tergal arms elongate and broad through anterior 1/2, dorsal portion compressed linearly with margin smooth and apices fused and concave. Median sternal plate spatulate with lateral margins emarginate and apex truncate, not extending beyond apex of lateral tergal arms. Paired, conical, darkly sclerotized structures with truncate, concave apices near base of median sternal plate. *Proctiger*: Apex with 3 prominent tooth-like structures, median tooth with complex apex. Dorsal surface with 3-5 small setae.

PUPA (Figs. 3, 4I, 23): Chaetotaxy as figured. *Cephalothorax*: Pigmentation uniform, light golden tan. Seta 1 bifid with apices unmodified. Seta 8 with 2 or 3 branches. Ecdysial sutures weak to absent. *Trumpet*: Pigmented, brown at apex and base, may be lighter brown at apex; length from 0.76-0.96 mm. Width significantly narrowed and uniform, 0.020-0.027 mm. Apex slightly swollen, 0.041-0.046 mm. *Metanotum and Abdomen*: Cuticle weakened and hyaline on the dorsum of segment I surrounding seta 1, extending anteriorly to surround setae 2 and 3. Seta 10-I apparently absent, seta 11-I present, all other ventral setae absent. Some specimens with singular circular pit located immediately lateral of the ventral midline. Segments II-VIII concolorous with cephalothorax. Minute, uniformly spaced spicules on dorsum of segments II-VIII. Intersegmental sclerites darkly pigmented posterior to segment II, III, IV and



sometimes V. Seta 11-II present, all other ventral setae absent. Seta 3-II-III and seta 5-IV-VI single and elongate, extending the length of 2.5-3 abdominal segments. Seta 14-VIII present. *Paddle*: Uniformly oblong, widest at basal 1/2, narrowing at apex. Short, approximately 3/4 the length of seta 9-VIII. Surface glabrous, lateral margins spiculate. Midrib prominent, extending length of paddle. *Male Genital Lobe*: Elongate, approximately 1.4 times length of paddle, broad with rounded lateral and posterior margins, forming a wide horseshoe shape.

LARVA (Figs. 24-27): Chaetotaxy as figured. *Cranium*: Anterior margin produced, slightly wider than long. Margin straight between setal pair 1-C. Cranial setae 4-15 branched. Occipital foramen with dorsolateral slit extending anteriorly 0.17-0.19 mm. *Antenna*: 0.25-0.29 mm in length. Antennal seta 1 single or with 2 branches, located on the dorsal surface of the apical third. *Hypostoma*: Median tooth prominent with 8-10 teeth produced laterally receding toward base. *Mandible*: Ventral teeth only, five; VT0 prominent with VT1-4 reduced in size. *Maxillae*: Seta 3-Mx located on the outer margin of the maxilla in a sclerotized pocket or notch. Laciniarastrium with a single, prominent, elongate apical tooth. Palpus, palpiger, and maxillary body separate. Palpus with 3 peglike setae; apex divided, inner margin with single seta, outer margin with 2. Palpiger hyaline, seta 6-Mx single. *Thorax*: Surface glabrous. *Abdomen*: Surface glabrous. *Segment VIII*: Comb teeth numerous extending ventrolaterally in an elongate

patch. Individual teeth broad throughout with spiculate apical margin. *Siphon*: Length 0.95-1.03 mm. Pecten elongate, spinelike, and in a single row, number variable, 4-5, although some may have been removed during mounting process. *Anal Segment*: Saddle incomplete, covered with rows of intermittently spaced spicules. Paired, fanlike, 6-10 branched accessory setae located on ventral surface, sclerite absent between setae.

BIONOMICS: Epiphytic and terrestrial bromeliads in tropical rain forests with partial shade. Water volume variable ranging from no free water to 20 ml in tank.

DISTRIBUTION: Known only from Colombia.

SYSTEMATICS: See *W. circumcincta*.

Material Examined: No pinned females, 3 pinned males, 3 male genitalia slide-mounted, 3 reared male larval and pupal exuviae, and no whole larvae or pupae. COLOMBIA: Valle, Buenaventura.

***Wyeomyia (Hystatomyia) "species L" Adkins & Judd, sp. n.***

*Wyeomyia* "species L" Adkins & Judd, 2003. TYPE: Male. Locality: Valle, Buenaventura, Colombia. Collector: P. A. Orjuela. References: Heinemann and Belkin 1978b.

FEMALE: Unknown.

MALE: Small-sized species of mosquito, dorsum densely covered with scales predominantly bronze and metallic blue-green with magenta highlights. Outer surface of legs covered with bronze scales; except tarsomere 2 of midleg, with cream and bronze colored scales and tarsomeres 3-5 of midleg with cream colored scales. *Head*: Covered with decumbent scales only, broader than those of scutum; scales of occipital region and posterior to orbital setae concolorous with scutum, ventral portion of genae with variable patch of distinct gray-white scales, loose band extending dorsally, but decreasing in width and increasing with degree of brown to upper third of eye. Dorsal orbital setae strong and brown, lateral orbital setae weaker, brown. Interocular space, pedicel, and clypeus without scales. Proboscis 1.31 mm, stout, apical 1/4 distinctly enlarged. Labial scales concolorous with scutum, underside with thin line of cream colored scales beginning at base of proboscis, extending to subapical patch of concolorous scales at point of enlargement, apex with darker brown scales. Antenna only slightly shorter than proboscis. Palpus apparently consisting of a single segment; slightly longer than the clypeus and covered with bronze scales. *Thorax*: Pronotal lobes widely separate; setae brown; scales mostly bronze with violet highlights with a small indistinct patch of gray-white scales on posterior lateral margin. Scutum with an anterior patch of white scales of variable size that extend ventrolaterally. Color of dorsal scales described above, scales broader at posterior margin. Scutellum

trilobed, appearance enhanced by broad, decumbent scales occurring on the apex of the posterior margin of each lobe along with 4 stout, brown setae. Mediotergite nude, except for 10-11 brown setae. Pleuron covered with gray-white scales, except for the anterior portion of the katepisternum, paratergite, meron, and metapleuron, which are nude. Pleuron chaetotaxy reduced and as follows: pronotal lobe with 8-9 brown setae; 1 brown prespiracular seta; postspiracular seta absent; 3 pale golden proepimeral setae; 3 pale golden and brown prealar setae; lower katepisternum with 4 pale golden and brown setae; upper katepisternum setae absent; 7 pale golden anepimeral setae. *Legs*: Fore-, mid-, and hind coxae and trochanters covered with scales concolorous with pleuron. Formora, tibiae, and tarsomeres with outer surface covered with bronze scales with blue, green, and violet reflections except where noted in diagnoses and below. Foreleg inner surface with a cream colored line of scales on femur and tibia, extending as an intermittent line to cover approximately 3/4 of tarsomere 1. Remainder of tarsomere 1 and tarsomeres 2-5 covered with bronze scales. Midleg inner surface with cream colored scales on femur and tibia, tarsomere 1 bronze except with several cream colored scales near base, tarsomere 2 with basal patch of bronze scales extending as a line to cover 3/4 of outer surface, remainder of tarsomere 2 and tarsomeres 3-5 covered with cream colored scales. Hind leg femur and tarsomere 1 with inner line of cream colored scales, tibia inner surface with

intermittent cream colored scales, tarsomeres 2-5 covered with bronze scales.

Claws of fore- and hind leg simple, midleg modified, different in size and shape.

*Wing:* Length: 2.36 mm. Scales elongate, decumbent and restricted to veins, predominantly bronze, scales of anterior margin with metallic blue reflections.

Posterior margin with a double row of fringelike fusiform scales, one row 1.5 times as long as and one row equal in length to those restricted to veins. *Abdomen:*

Dorsum covered with bronze scales with blue-green reflections extending into plural regions of sternum, sternum with gray-white scales of variable width.

MALE GENITALIA (Figs. 6C, 9B, 12B, 15A&C, 16B): *Segment VIII:*

Segment covered with small, fine setae. Sternum with a pair of small setae on anterior portion and a group of seven stout, elongate setae at both posterior corners with shorter, less stout setae along posterior margin in between. Scales broad, flat and restricted to lateral margins. Tergum also with a pair of small setae on anterior portion, long setae confined to posterior margin. Densely covered with broad, decumbent scales. *Segment IX:* Sternum with anterior margin weakly emarginate, posterior margin roughly triangular and incompletely separated by a weak line of flexion at midline, consisting of a thin strip of sclerite partially fused to gonocoxal lobes separated by a weak line of flexion. Tergum dark, deeply emarginate on anterior margin, posterior margin fused to gonocoxites with 2 elongate, stout setae on each widely separated lobe. *Gonocoxite:* Arms appearing fused at base with

segment IX. Basal portion broad with well developed mesal lobes. Mesal lobe pigmented, with two weakly separated patches of setae, dorsal group with approximately 15 stout, elongate, flat setae with a blade-like tip, ventral group with 5-7 equally stout, slightly longer, flat setae, with a weakly hooked tip. Arms narrow, relatively short, and curved inward. Each arm densely covered with scales and well-developed setae. Inner surface of arm with setae sparse or absent.

*Gonostylus*: Length 0.26 mm. Located on inner margin of gonocoxite mesad of the point where the lobe constricts to form the arm. Weakly sclerotized and narrow with width consistent throughout, relatively straight, apex slightly wider and rounded. *Mesal Plate*: Thin, darkened strip of sclerite, V-shaped on mesal margin separating lobes internally. Sclerite bearing short micropile and variable number of longer setae on each lobe. *Aedeagus*: Dorsal paramere forming an upside down V fused at base with lateral tergal arm. Lateral tergal arms elongate and broad through anterior  $7/8$ , dorsal portion compressed linearly apparently with posterior margin smooth and apices fused and emarginate. Median sternal plate spatulate with lateral and apical margins emarginate not extending beyond apex of lateral tergal arms. Paired, conical, darkly sclerotized structures with truncate, concave apices near base of median sternal plate. *Proctiger*: Apex with three prominent tooth-like structures, median tooth with complex apex. Dorsal surface with approximately 10 small setae.

PUPA (Figs. 3, 4J, 23): Chaetotaxy as figured. *Cephalothorax*:

Pigmentation uniform, light golden tan. Seta 1 bifid with apices unmodified. Seta 8 with 2 branches. Ecdysial sutures weak. *Trumpet*: Pigmented, brown at base; length 0.77 mm. Width significantly narrowed and uniform, 0.031 mm. Apex slightly swollen, 0.049 mm. *Metanotum and Abdomen*: Cuticle weakened and hyaline on the dorsum of segment I surrounding seta 1, extending anteriorly to base of setae 2 and 3. Ventral setae and singular circular pit of segment I not visible. Segments II-VIII concolorous with cephalothorax. Minute, uniformly spaced spicules on dorsum of segments II-VIII. Intersegmental sclerites darkly pigmented posterior to segment II, III, IV, and V. Seta 11-II present, all other ventral setae absent. Seta 3-II-III and seta 5-IV-VI single and elongate, extending the length of 2.5-3 abdominal segments. Seta 14-VIII present. *Paddle*: Uniformly oblong, widest at basal 1/2, narrowing at apex. Short, 3/4 the length of seta 9-VIII. Surface glabrous, lateral margins spiculate. Midrib prominent, extending length of paddle. *Male Genital Lobe*: Elongate, approximately 1.5 times length of paddle, broad with rounded lateral and posterior margins, forming a broad horseshoe shape.

LARVA (Figs. 24-27): Chaetotaxy as figured. *Cranium*: Anterior margin produced, slightly wider than long. Margin straight between setal pair 1-C. Cranial setae 4-15 branched. Occipital foramen with dorsolateral slit extending anteriorly 0.19 mm. *Antenna*: 0.26 mm in length. Antennal seta 1 single or with 2

branches, located on the dorsal surface of the apical third. *Hypostoma*: Median tooth prominent with 9-10 teeth produced laterally receding toward base.

*Mandible*: Ventral teeth only, five; VT0 prominent with VT1-4 reduced in size.

*Maxillae*: Seta 3-Mx located on the outer margin of the maxilla in a sclerotized pocket or notch. Laciniarastrium with a single, prominent, elongate apical tooth.

Palpus, palpiger, and maxillary body separate. Palpus with 3 peglike setae; apex divided, inner margin with single seta, outer margin with 2. Palpiger hyaline, seta

6-Mx single. *Thorax*: Surface glabrous. *Abdomen*: Surface glabrous. *Segment*

*VIII*: Comb teeth numerous extending ventrolaterally in an elongate patch.

Individual teeth broad throughout with spiculate apical margin. *Siphon*: Length 1.0 mm. Pecten elongate, spinelike, and in a single row of 6, although some may

have been removed during the mounting process. *Anal Segment*: Saddle

incomplete, covered with rows of intermittently spaced spicules. Paired, fanlike, 7-

8 branched accessory setae located on ventral surface, sclerite absent between setae.

BIONOMICS: Terrestrial bromeliad (pineapple) in plantation in full sun.

DISTRIBUTION: Known only from Colombia.

SYSTEMATICS: See *W. circumcincta*.



Material Examined: No pinned females, 1 pinned male, 1 male genitalia slide-mounted, 1 reared male larval and pupal exuviae, and no whole larvae or pupae. COLOMBIA: Valle, Buenaventura.

***Wyeomyia (Hystatomyia) "species M" Adkins & Judd, sp. n.***

*Wyeomyia* "species M" Adkins & Judd, 2003. TYPE: Male. Locality: Valle, Buenaventura, Colombia. Collector: P. A. Orjuela. References: Heinemann and Belkin 1978b.

FEMALE: Unknown.

MALE: Small-sized species of mosquito, dorsum densely covered with scales predominantly bronze and metallic blue-green with magenta highlights. Outer surface of legs covered with bronze scales; except tarsomeres 2-5 of midleg with cream and bronze colored scales. *Head*: Covered with decumbent scales only, broader than those of scutum; scales of occipital region and posterior to orbital setae concolorous with scutum, ventral portion of genae with variable patch of distinct gray-white scales, loose band extending dorsally, but decreasing in width and increasing with degree of brown to upper third of eye. Dorsal orbital setae strong and golden or brown, lateral orbital setae weaker, brown. Interocular space, pedicel, and clypeus without scales. Proboscis 1.32-1.41 mm, stout, apical 1/4 distinctly enlarged. Labial scales concolorous with scutum, underside with thin

line of cream colored scales beginning at base of proboscis, extending to prominent, subapical patch of concolorous scales at point of enlargement, cream colored line may be interrupted by patch of brown scales near midpoint of proboscis. Apex with darker brown scales. Antenna only slightly shorter than proboscis. Palpus apparently consisting of a single segment; slightly longer than the clypeus and covered with bronze scales. *Thorax*: Pronotal lobes widely separate; setae brown; scales mostly bronze with violet highlights with small indistinct patch of gray-white scales on posterior lateral margin. Scutum with an anterior patch of white scales of variable size that extend ventrolaterally. Color of dorsal scales described above, scales broader at posterior margin. Scutellum trilobed, appearance enhanced by broad, decumbent scales occurring on the apex of the posterior margin of each lobe along with 3-4 stout, brown setae. Mediotergite nude, except for 10-11 golden setae. Pleuron covered with gray-white scales, except for the anterior portion of the katepisternum, paratergite, meron, and metapleuron, which are nude. Pleuron chaetotaxy reduced and as follows: pronotal lobe with 8-10 brown setae; 1 golden or bronze-brown prespiracular seta; postspiracular seta absent; 3 pale golden proepimeral setae; 3 golden or bronze-brown prealar setae; lower katepisternum with 4-5 pale golden setae; upper katepisternum setae absent; 6-10 pale golden anepimeral setae. *Legs*: Fore-, mid-, and hind coxae and trochanters covered with scales concolorous with pleuron.

Formora, tibiae, and tarsomeres with outer surface covered with bronze scales with blue, green, and violet reflections except where noted in diagnoses and below.

Foreleg inner surface with a cream colored line of scales on femur. Tibia and tarsomeres covered with bronze scales. Midleg inner surface with cream colored scales on femur and tibia, tarsomere 1 through basal 1/3 of tarsomere 2 covered with bronze scales, remainder of tarsomere 2 and tarsomeres 3-5 with cream and lighter bronze colored scales. Hind leg femur and tibia with inner line of cream colored scales, line may be intermittent on tibia and extend to base of tarsomere 1, otherwise tarsomeres 1-5 covered with bronze scales. Claws of fore- and hind leg simple, midleg modified, different in size and shape. *Wing*: Length: 2.09-2.27 mm. Scales elongate, decumbent and restricted to veins, predominantly bronze, scales of anterior margin with metallic blue reflections. Posterior margin with a double row of fringelike fusiform scales, one row 1.5 times as long as and one row equal in length to those restricted to veins. *Abdomen*: Dorsum covered with bronze scales with blue-green reflections extending into plural regions of sternum, sternum with gray-white scales of variable width.

MALE GENITALIA (Figs. 6D, 9A, 13C, 15A&C, 16A): *Segment VIII*: Segment covered with small, fine setae. Sternum with a pair of small setae on anterior portion, larger setae occurring midway and extending along posterior margin. Scales broad, flat and primarily restricted to lateral margins. Tergum also

with a pair of small setae on anterior portion, long setae confined to posterior margin. Densely covered with broad, decumbent scales. *Segment IX*: Sternum with anterior margin weakly emarginate, posterior margin roughly triangular and incompletely separated by weak line of flexion at midline, consisting of a thin strip of sclerite partially fused to gonocoxal lobes separated by a weak line of flexion. Tergum dark, deeply emarginate on anterior margin, posterior margin fused to gonocoxites with 3-4 elongate, stout, outwardly curved setae on each lobe. *Gonocoxite*: Arms appearing fused at base with segment IX. Basal portion broad with well developed mesal lobes. Mesal lobe pigmented, with three weakly separated patches of setae; dorsal group with 16-23 stout, elongate setae tapering long and thin toward apex, median group with 10-12 setae same as those of dorsal group, but directed inward, ventral group with 4-6 stout, longer, flat setae, with a complex apex, twisted and tapering long and thin. Arms narrow, elongate and curved inward slightly. Each arm densely covered with scales and well-developed setae. Inner surface of arm with setae restricted to apical 1/4. *Gonostylus*: Length 0.18-0.19 mm. Located on inner margin of gonocoxite near the point where the lobe constricts to form the arm. Basal 1/3 uniformly narrow, apical 2/3 broadly spatulate, narrowing again in the apical 1/3 to a rounded apex with lateral margin truncate. *Mesal Plate*: Thin, darkened strip of sclerite, V-shaped on mesal margin separating lobes internally. Sclerite bearing short micropile and longer setae on

each lobe. *Aedeagus*: Dorsal paramere forming an upside down V fused at base with lateral tergal arm. Lateral tergal arms elongate and broad through anterior 2/3, dorsal portion compressed linearly with posterior margin emarginate and apices fused and emarginate. Median sternal plate spatulate with lateral and apical margins emarginate not extending beyond apex of lateral tergal arms. Paired, conical, darkly sclerotized structures with truncate, concave apices near base of median sternal plate. *Proctiger*: With three prominent tooth-like structures, median tooth with complex apex. Dorsal surface apparently with 3-4 small setae.

PUPA (Figs. 3. 4K, 23): Chaetotaxy as figured. *Cephalothorax*:

Pigmentation uniform, light golden tan. Seta 1 bifid with apices unmodified. Seta 8 with 2 or 3 branches. Ecdysial sutures weak to absent. *Trumpet*: Pigmented, brown at base and may be lighter brown at apex; length from 0.91-1.25 mm. Width significantly narrowed and uniform, 0.020-0.024 mm. Apex slightly swollen, 0.038-0.041 mm. *Metanotum and Abdomen*: Cuticle weakened and hyaline on the dorsum of segment I surrounding seta 1, either extending anteriorly to reach base of setae 2 and 3 or surrounding seta 2 and reaching base of seta 3. Seta 10-I apparently absent, seta 11-I apparently present, all other ventral setae absent. Some specimens with singular circular pit located immediately lateral of the ventral midline. Segments II-VIII concolorous with cephalothorax. Minute, uniformly spaced spicules on dorsum of segments II-VIII. Intersegmental sclerites darkly

pigmented posterior to segments II, III, and sometimes IV and V. Seta 11-II present, all other ventral setae absent. Seta 3-II-III and seta 5-IV-VI single and elongate, extending the length of 2.5-3 abdominal segments. Seta 14-VIII present. *Paddle*: Oblong, widest at basal  $1/2$ , narrowing at apex. Short,  $2/3$ - $3/5$  the length of seta 9-VIII. Surface glabrous, lateral margins spiculate. Midrib prominent, extending length of paddle. *Male Genital Lobe*: Elongate, approximately 1.75 times length of paddle, broad with slightly curved outer margin, posterior margin slightly narrowed and rounded.

LARVA (Fig. 24-27): Chaetotaxy as figured. *Cranium*: Anterior margin produced, slightly wider than long. Margin straight between setal pair 1-C. Cranial setae 4-15 branched. Occipital foramen with dorsolateral slit extending anteriorly 0.14-0.15 mm. *Antenna*: 0.23-0.27 mm in length. Antennal seta 1 with 2-3 branches, located on the dorsal surface of the apical half to third. *Hypostoma*: Median tooth prominent with 9-11 teeth produced laterally receding toward base, penultimate tooth may be enlarged. *Mandible*: Ventral teeth only, five; VT0 prominent with VT1-4 reduced in size. *Maxillae*: Seta 3-Mx located on the outer margin of the maxilla in a sclerotized pocket or notch. Laciniarastrium with a single, prominent, elongate apical tooth. Palpus, palpiger, and maxillary body separate. Palpus with 3 peglike setae; apex divided, inner margin with single seta, outer margin with 2. Palpiger hyaline, seta 6-Mx single. *Thorax*: Surface

glabrous. *Abdomen*: Surface glabrous. *Segment VIII*: Comb teeth numerous extending ventrolaterally in an elongate patch. Individual teeth broad throughout with spiculate apical margin. *Siphon*: Length 0.93-1.01 mm. Pecten elongate, spinelike, and in a single row, number variable, 2-4, although some may have been removed during mounting process. *Anal Segment*: Saddle incomplete, covered with rows of intermittently spaced spicules. Paired, fanlike, 8-10 branched accessory setae located on ventral surface, sclerite absent between setae.

BIONOMICS: Epiphytic bromeliads in tropical rainforest in partial shade.

May have no free water.

DISTRIBUTION: Known only from Colombia.

SYSTEMATICS: See *W. circumcincta*.

Material Examined: No pinned females, 3 pinned males, 3 male genitalia slide-mounted, 3 reared male larval and pupal exuviae, and no whole larvae or pupae. COLOMBIA: Valle, Buenaventura.

## CONCLUSION

Of the 12 putative new *Hystatomyia* species four were identified as previously described species. *Wyeomyia* "species A" and *W.* "species B" were identified as *W. circumcincta*, *W.* "species J" was identified as *W. coenonius*, and *W.* "species D" was identified as *W. intonca*. Of the eight remaining putative species seven new species have been described. Structures of the male genitalia, primarily characteristics of the gonostylus and the number and type of major groups of setae on the mesal lobe of the gonocoxite, were the most useful in diagnosing species.

*Wyeomyia circumcincta* is the most geographically widespread and also the most morphologically variable. This species exhibits variation in the scale pattern of the adult male midleg. Additionally, there appear to be two forms of the gonocoxal chaetotaxy within the species. Both forms have the same number and type of major groups of setae on the gonocoxite, however three specimens were observed to have the most dorsal group of setae raised up on a prominent sclerotized ridge (Fig. 7B). This ridge is much less prominent in all other specimens (Fig. 7A). The three specimens with the prominent sclerotized ridge also appeared to have a gonostylus slightly different from the remaining species (Fig. 11B), however this is thought to be an artifact of the slide mounting process. None of these morphological variations appear to follow a geographical gradient.



Ultimately it was decided that these variations were not distinct enough to warrant designating new species.

*Wyeomyia* “species G” and *W.* “species H” are morphologically similar to each other and to *W. intonca*. These species share similarities in adult male midleg and proboscis scale patterns and in gonocoxite chaetotaxy. However, characteristics of the gonostylus are markedly distinct between all three species (Figs. 12D, 13A&B). Additionally, the known distributions of *W.* “species G”, *W.* “species H”, and *W. intonca* within Nicaragua, Costa Rica, and Panama do not overlap and there is little morphological variation within these species. It was concluded that these differences in morphology and distribution warranted the designation of two new, allopatric species.

The designation of *W.* “species E/F” from *W.* “species E” and *W.* “species F” proved somewhat problematic. Only one pinned adult male specimen with slide-mounted genitalia was known for *W.* “species E”. *Wyeomyia* “species E” and *W.* “species F” vary slightly in characteristics of the gonostylus, which are relatively invariant within all other species. The gonostylus of *W.* “species E” is not as stout as that of *W.* “species F” and the apex does not have the series of ridges observed in all specimens of *W.* “species F” (Fig. 12A). However, we concluded the differences were an artifact of the slide-mounting process (the gonostylus of *W.* “species E” could have been stretched out and smashed down,

causing it to appear longer and thinner and lose the series of ridges at the apex). Considering the absence of morphological differences besides the characteristics of the gonostylus and the presence of only one specimen of *W.* "species E" to examine, a conservative approach was taken and it was concluded that *W.* "species E" and *W.* "species F" are the same species.

The designation of all remaining putative species as new species was clear. While there was also only one specimen of *W.* "species L", this specimen had five autapomorphic characters, discussed previously in the Phylogenetic Analysis chapter, that warranted a new species designation without question. All other new species had at least three specimens available for examination.

Results from the phylogenetic analysis support the establishment of the seven new species within *Hystatomyia*. Of the seven new species, six have at least one unambiguous character change occurring on the terminal branch (Fig. 20a). *Wyeomyia* "species H" is the only species without an unambiguous character on the terminal. However, like all other new species, *W.* "species H" has at least one autapomorphy that can be used to diagnose it as a species. In addition to autapomorphies, all terminals possess a unique combination of characters that support the designation of the new species.

Problems encountered in this study include the lack of whole larvae and pupae for the new species. There were no observed differences between the larvae

of *Hystatomyia* species and the only differences observed between the pupae were in the shape of the male genital lobes. The chaetotaxy of the cranium, thorax, abdomen, and terminal segments was explored in the larvae and the chaetotaxy of the cephalothorax and abdomen were explored in the pupae. However, examining only slide-mounted exuviae inhibits the ability to explore these character systems and others, such as structures of the larval mouthparts and terminal segments, because; 1) the exuviae are fragile and frequently become tangled or torn in the mounting process and 2) the head capsules of the larvae can not be dissected. This, combined with the limits involved in seeking out species level morphological differences, accounts for the absence of any new larval characters and few pupal characters in the phylogenetic analysis. Additionally, only pinned adult males were sorted and given putative species designations by Belkin. Pinned adult females were left unsorted and without these species designations. This, combined with the absence of any reared broods, made it impossible to positively associate females with the appropriate new species. Thus, no new characters were discovered that can distinguish adult female *Hystatomyia* from other *Wyeomyia* species and no female morphological characters were included in the phylogenetic analysis. These problems can only be rectified by the collection of new material and the rearing of broods in order to positively associate whole larvae and females with the appropriate new species.

No new information is provided on the adult male ‘knob-like’ structures associated with the aedeagus and observed in all *Hystatomyia* species. These structures were first mentioned by Judd (1998) and are also included in the species descriptions here (Fig. 15C). It appears that these structures are specifically associated with the base of the median sternal plate and may even be part of the median sternal plate, however the relationship remains unclear.

In conclusion, this is the most comprehensive study of the subgenus *Hystatomyia* to date. While our knowledge of the group is limited by the lack of female specimens and new material, these results provide significant advances in our knowledge of the subgenus as a whole and our understanding of phylogenetic relationships within the group.

## BIBLIOGRAPHY

- Albuquerque Motta, M.A. and R. Lourenço-de-Oliveira. 1995. *Wyeomyia luteoventralis* Theobald, the type species of the subgenus *Dendromyia* Theobald (Diptera: Culicidae). *Memoirs of the Instituto Oswaldo Cruz* 90:375-385.
- Belkin, J.N. 1962. *The Mosquitoes of the South Pacific* (Diptera, Culicidae). Vol. 1. University of California Press, Los Angeles, 608 pp.
- Belkin, J.N., R.X. Schick, P. Galindo, and T.H.G. Aitken. 1965a. Mosquito studies (Diptera, Culicidae). I. A project for a systematic study of the mosquitoes of Middle America. *Contrib. Am. Entomol. Inst.* 1:1964-1967.
- Belkin, J.N., R.X. Schick, and S.J. Heinemann. 1965b. Mosquito studies (Diptera, Culicidae). V. Mosquitoes originally described from Middle America. *Contrib. Am. Entomol. Inst.* 1:1-95.
- Bonne, C. and J. Bonne-Wepster. 1925. Mosquitoes of Surinam. A study on Neotropical mosquitoes. *Meded. Kol. Inst. Amsterdam (Trop. Hyg.)* 21:54-77.
- Bonne-Wepster, J. and C. Bonne. 1919. *Hystatomyia lamellata*. *Insect. Inscit. Menst.* 7:168.
- Bruijning, C.F.A. 1959. Notes on *Wyeomyia* mosquitoes of Suriname. *in: Studies on the fauna of Suriname and other Guyanas*. The Hague/Martinus Nijhoff 3:124-125.
- Cova Garcia, P., E. Sutil Oramas, and J. Pulido F. 1979. *Wyeomyia lopezii* n. sp. (Diptera, Culicidae). *Bol. Inf. Dir. Malariol. y San. Amb.* 14(1-2):21-22.
- Dyar, H.G. 1906a (1905). On the classification of the Culicidae. *Proc. Ent. Soc. Wash.* 7:188-191.
- Dyar H.G. 1906b. The classification of mosquitoes. *Science* 23:233-244.
- Dyar, H.G. 1919. A revision of the American Sabethini of the *Sabethes* group by the male genitalia. *Insect. Inscit. Menst.* 7:114-142.

- Dyar, H.G. 1923. The mosquitoes of Panama (Diptera, Culicidae). *Insect. Inscit. Menst.* 11:167-186.
- Dyar, H.G. 1925. The mosquitoes of Panama (Diptera, Culicidae). *Insect. Inscit. Menst.* 13:101-195.
- Dyar, H.G. 1928. The mosquitoes of the Americas. Publication 387. Carnegie Institution of Washington, Washington, D.C.
- Dyar, H.G. and F. Knab. 1906. Class I, Hexapoda. Order IV, Diptera. The larvae of Culicidae classified as independent organisms. *J. N. Y. Entomol. Soc.* 14:230.
- Dyar, H.G. and F. Knab. 1907. Description of new mosquitoes from the Panama Canal Zone. *J. N. Y. Entomol. Soc.* 15:210-212.
- Dyar, H.G. and F. Knab. 1908. Descriptions of some new mosquitoes from tropical America. *Proc. U.S. Natl. Mus.* 35:68.
- Dyar, H.G. and F. Knab. 1909. Description of three new American mosquitoes. *Proc. Ent. Soc. Wash.* 11:173.
- Dyar, H.G. and R.C. Shannon. 1924. Entomology. The subfamilies, tribes, and genera of American Culicidae. *J. Wash. Acad. Sci.* 14:472-486.
- Edwards, F.W. 1932. Diptera. fam. Culicidae. *in* *Genera insectorum* (ed. P. Wytsman). Desmet-Verteneuil, Brussels, Belgium. Fascicle 194, 258 pp.
- Farris, J.S. 1969. A successive approximations approach to character weighting. *Syst. Zool.* 18:374-385.
- Farris, J.S. 1989. The retention index and the rescaled consistency index. *Cladistics.* 5:417-419.
- Gaffigan, T, ed. 2001. Systematic Catalog of Culicidae. Online database, <http://www.mosquitocatalog.org/>. Walter Reed Biosystematics Unit, Smithsonian Institution, Washington D.C.
- Harbach, R.E. and K.L. Knight. 1980. Taxonomists' glossary of mosquito anatomy. Plexus Publishing, Inc. Marlton, N.J. 413 pp.

- Harbach, R.E. and G.R. Sandlant. 1997. CABIKEY Mosquito Genera of the World. Windows CD-ROM. CAB International, Wallingford, England.
- Harbach, R.E. and I.J. Kitching. 1998. Phylogeny and classification of the Culicidae (Diptera). Syst. Entomol. 23:327-370.
- Heinemann, S.J. and J.N. Belkin. 1977a. Collection records of the project "Mosquitoes of Middle America" 7. Costa Rica. Mosq. Syst. 9:237-287.
- Heinemann, S.J. and J.N. Belkin. 1977b. Collection records of the project "Mosquitoes of Middle America" 8. Central America: Belize, Guatemala, El Salvador, Honduras, Nicaragua. Mosq. Syst. 9:403-454.
- Heinemann, S.J. and J.N. Belkin. 1978a. Collection records of the project "Mosquitoes of Middle America" 10. Panama, including Canal Zone. Mosq. Syst. 10:119-196.
- Heinemann, S.J. and J.N. Belkin. 1978b. Collection records of the project "Mosquitoes of Middle America" 12. Colombia. Mosq. Syst. 10:493-539.
- Howard, L.O. H.G. Dyar, and F. Knab. 1912. The Mosquitoes of North and Central America and the West Indies. Plates. No. 159. Carnegie Institution of Washington, Washington, DC.
- Howard, L.O., H.G. Dyar, and F. Knab. 1915. The Mosquitoes of North and Central America and the West Indies. Systematic description. Part I. Carnegie Institution of Washington, Washington, D.C. 3:116-118, 150-154.
- Judd, D.D. 1995. Evolution and classification of the Sabethini (Diptera: Culicidae). Ph.D. dissertation, Texas A & M University, College Station, TX.
- Judd, D.D. 1996. Review of the systematics and phylogenetic relationships of the Sabethini (Diptera: Culicidae). Syst. Entomol. 21:129-150.
- Judd, D.D. 1998. Review of a bromeliad-ovipositing lineage in *Wyeomyia* and the resurrection of *Hystatomyia* (Diptera: Culicidae). Ann. Entomol. Soc. Am. 91:572-589.
- Knight, K.L. and A. Stone. 1977. A catalog of the mosquitoes of the world (Diptera: Culicidae). 2<sup>nd</sup> ed. Thomas Say Found IV:301-338.

- Lane, J. 1945. Os sabetineos da América (addenda e corrigenda). Rev. Entomol. 16: 132-157.
- Lane, J. 1953. Neotropical Culicidae, Vol. II. University of São Paulo, Brasil, São Paulo, pp. 553-1112.
- Lane, J. and N.L. Cerqueira. 1942. Os sabetineos da América (Diptera, Culicidae). Arquivos de Zoologia 3:473-849.
- Levi-Castillo, R. 1955. *Phoniomyia esmeraldasi*, a new mosquito from Equador. Revista Ecuatorana de Entomologia y Parasitologia 2:389-391.
- Lourenço-de-Oliveira, R., R.E. Harbach, M.G. Castro, M.A. Motta, and E. L. Peyton. 1999. *Wyeomyia (Prosopolepis) confusa* (Lutz): subgeneric validation, species description, and recognition of *Wyeomyia flui* (Bonne-Wepster and Bonne) as the senior synonym of *Wyeomyia kerri* Del Ponte and Cerqueira. J. Am. Mosq. Control Assoc. 15:200-212.
- McAlpine, J.F., B.V. Peterson, G.E. Shewell, H.J. Teskey, J.R. Vockeroth, and D.M. Wood, eds. 1981. Manual of Nearctic Diptera, Vol.1. Agriculture Canada Monograph No. 27. Canadian Government Publishing Centre. Hull, Quebec, Canada. 674 pp.
- Schuh, R.T. 2000. Biological systematics: principles and applications. Cornell University Press, Ithaca N.Y. 236 pp.
- Stone A. and K.L. Knight. 1957. Entomology- type specimens of mosquitoes in the United States National Museum, V: the Sabethini (Diptera, Culicidae). J. Wash. Acad. Sci. 47:120-124.
- Swofford, D.L. 2000. PAUP\*. Phylogenetic Analysis Using Parsimony (\*and Other Methods). Version 4.0b8. Sinauer Associates, Sunderland, Massachusetts.
- Thurman, E.H.B. 1959. A contribution to a revision of the Culicidae of Northern Thailand. University of Maryland Agricultural Experiment Station, Bulletin A-100, 182 pp.
- Ward, R.A. 1992. Third supplement to "A Catalog of the Mosquitoes of the World" (Diptera: Culicidae). Mosq. Syst. 24:177-230.



Williston, S.W. 1906. The classification of the Culicidae. *Can. Entomol.* 38:384-388.

Yeates, D.K. 1995. Groundplans and exemplars: paths to the tree of life. *Cladistics* 11:343-357.

## APPENDICES

## APPENDIX A

Table A-1. Distribution and list of species assigned to the subgenus *Hystatomyia*.

| Species                       | Status               | Known Distribution      |
|-------------------------------|----------------------|-------------------------|
| <i>Wyeomyia circumcincta</i>  | Previously described | Central & South America |
| <i>Wyeomyia coenonous</i>     | Previously described | Central America         |
| <i>Wyeomyia intonca</i>       | Previously described | Central America         |
| <i>Wyeomyia esmeraldasi</i>   | Previously described | South America           |
| <i>Wyeomyia</i> "species C"   | New                  | Central America         |
| <i>Wyeomyia</i> "species E/F" | New                  | Central & South America |
| <i>Wyeomyia</i> "species G"   | New                  | Central America         |
| <i>Wyeomyia</i> "species H"   | New                  | Central America         |
| <i>Wyeomyia</i> "species K"   | New                  | South America           |
| <i>Wyeomyia</i> "species L"   | New                  | South America           |
| <i>Wyeomyia</i> "species M"   | New                  | South America           |
| <i>Wyeomyia autocratica</i>   | Previously described | South America           |
| <i>Wyeomyia lamellata</i>     | Previously described | South America           |
| <i>Wyeomyia lopezii</i>       | Previously described | South America           |

Table B-1. Data matrix for phylogenetic analyses in Chapter 3.

|                                                       | Characters |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|-------------------------------------------------------|------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Taxa                                                  | 1          | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 |   |   |   |   |   |
| <i>Wyeomyia (Hystatomyia)</i> "species C"             | 0          | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 2 | 1 | 1 | 2 | 1 | 0 | 0 | 0 | 3 | 0 | 0 | 3 | 1 |   |
| <i>Wyeomyia (Hystatomyia)</i> "species E/F"           | 0          | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 4 | 1 | 1 | 1 | 3 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |   |
| <i>Wyeomyia (Hystatomyia)</i> "species G"             | 0          | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 1 | 0 | 2 | 0 | 0 | 7 | 0 | 2 | 1 | 4 | 0 | 1 | 2 | 1 | 0 | 0 | 2 | 2 | 3 | 3 | 2 | 2 |
| <i>Wyeomyia (Hystatomyia)</i> "species H"             | 0          | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 1 | 0 | 2 | 0 | 0 | 6 | 0 | 0 | 0 | 3 | 0 | 1 | 2 | 1 | 0 | 0 | 2 | 2 | 3 | 3 | 2 | 2 |
| <i>Wyeomyia (Hystatomyia)</i> "species K"             | 0          | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 3 | 1 | 1 | 1 | 3 | 0 | 1 | 3 | 1 | 0 | 1 | 3 | 2 | 2 | 2 | 1 | 2 |
| <i>Wyeomyia (Hystatomyia)</i> "species L"             | 0          | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 3 | 0 | 0 | 2 | 1 | 0 | 1 | 3 | 0 | 1 | 2 | 1 | 1 | 0 | 2 | 2 | 0 | 0 | 0 | 2 |   |   |   |   |
| <i>Wyeomyia (Hystatomyia)</i> "species M"             | 0          | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 8 | 1 | 0 | 0 | 3 | 0 | 1 | 2 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 2 |   |   |   |   |
| <i>Wyeomyia (Hystatomyia)</i> <i>circumcincta</i>     | 0          | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 1 | 2 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 2 |   |
|                                                       |            |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   | 3 |   |   |   |   |   |   |   |   |   | 2 | 2 | 1 | 1 | 1 |
|                                                       |            |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|                                                       |            |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| <i>Wyeomyia (Hystatomyia)</i> <i>intonca</i>          | 0          | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 1 | 0 | 1 | 0 | 0 | 5 | 1 | 0 | 0 | 3 | 0 | 1 | 2 | 1 | 0 | 0 | 2 | 2 | 3 | 3 | 3 | 2 |   |   |   |   |
| <i>Wyeomyia (Hystatomyia)</i> <i>coenonus</i>         | 0          | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 1 | 3 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 2 | 2 | 3 | 2 |   |   |   |   |
| <i>Wyeomyia (Hystatomyia)</i> <i>esmeraldasii</i>     | 0          | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | ? | ? | ? | ? | 0 | 1 | 1 | 0 | ? | 0 | 0 | ? | ? | ? | ? | 1 | ? | ? | 1 | ? | ? | ? | ? | ? | ? | ? | ? | ? | ? | ? |   |
| <i>Wyeomyia (Hystatomyia)</i> <i>autocratica</i>      | 0          | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 3 | 2 | 0 | 2 | 0 | 1 | 9 | ? | 0 | 1 | 1 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 3 | 3 | 4 | 2 |   |   |   |   |
| <i>Wyeomyia (Hystatomyia)</i> <i>lamellata</i>        | 0          | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | ? | ? | ? | 0 | 1 | 3 | 2 | 0 | 2 | 0 | 1 | A | 1 | 0 | 0 | 1 | 0 | 1 | 2 | 1 | 0 | 0 | 2 | 1 | 1 | 1 | 1 | 2 |   |   |   |
| <i>Wyeomyia (Hystatomyia)</i> <i>lopezii</i>          | 0          | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | ? | ? | ? | 1 | 3 | 2 | 0 | ? | 0 | 1 | ? | ? | ? | ? | 1 | ? | 0 | 1 | 2 | 1 | ? | ? | ? | ? | ? | ? | ? | ? |   |   |
| <i>Wyeomyia (Phoniomyia)</i> <i>splendida</i>         | 0          | 1 | 1 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 2 | 0 | 1 | 3 | 3 | 2 | 4 | 0 | 1 | B | 0 | 0 | 1 | 3 | 0 | 0 | 1 | 0 | 0 | ? | ? | ? | ? | ? | ? | ? | ? |   |   |   |
| <i>Wyeomyia (Phoniomyia)</i> <i>trinidadensis</i>     | 0          | 1 | 1 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 2 | 0 | 1 | 3 | 3 | 2 | 2 | 1 | 1 | D | ? | 5 | 4 | 7 | 0 | 0 | 1 | 0 | 0 | ? | ? | ? | ? | ? | ? | ? | ? |   |   |   |
| <i>Wyeomyia (Phoniomyia)</i> <i>quasilongirostris</i> | 0          | 1 | 1 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 2 | 0 | 1 | 3 | 2 | 1 | 4 | 0 | 0 | C | ? | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | ? | ? | ? | ? | ? | ? | ? | ? |   |   |   |
| <i>Wyeomyia (Wyeomyia)</i> <i>grayii</i>              | 1          | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 1 | 2 | 0 | 2 | 0 | 1 | 3 | 3 | 2 | 2 | 1 | 1 | D | 1 | 4 | 3 | 6 | 0 | 0 | 0 | 2 | 0 | ? | ? | ? | ? | ? | ? | ? | ? |   |   |   |
| <i>Sabethes (Sabethes)</i> <i>cyaneus</i>             | 2          | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 3 | 0 | 1 | 2 | 0 | 2 | 0 | 1 | 3 | 3 | 2 | 2 | 1 | 1 | D | ? | 3 | 2 | 5 | 0 | 1 | 0 | 2 | 0 | ? | ? | ? | ? | ? | ? | ? | ? |   |   |

## APPENDIX C

List of character codings and character state changes for Figures 19-22.

The character codings follow that of the "Character Selection" section of Chapter 2. The type of character optimization is identified in brackets, ACCTRAN is identified by [A] and DELTRAN is identified by [D]. Character state changes occurring between two nodes that are optimized the same under both ACCTRAN and DELTRAN are identified by [A/D]. The character state changes occurring between two nodes are listed in parentheses. The nodes for the character state changes are listed in Figure C-1 and are identified as two numbers or a number and the name of a terminal taxon immediately preceding the character state change in parentheses.

### Larval Characters

\*1. Anterior edge of the prementoligular teeth extend beyond seta 1-Lh (0), level with the base of seta 1-Lh (1), posterior to the base of seta 1-Lh (2).

Character Reconstruction: [A/D] 1-*Sabethes cyaneus* (0-2), 1-*Wyeomyia grayii* (0-1)

\*2. Denticles on the prementoligular teeth confined to the lateral margin (0), extend posteriorly to the ventral premental spicules (1).

Character Reconstruction: [A/D] 4-5 (1-0).

\*3. Lateral premental teeth of labiohypopharynx broad at base and taper to a sharp spine-like process (0), with setiform apices (1).

Character Reconstruction: [A/D] 4-5 (1-0).

\*4. Maxillary palpus fused to maxilla (0), separated by a suture (1).

Character Reconstruction: [A/D] 1-*Sabethes cyaneus* (1-0).

\*5. Palpifer fused to maxilla (0), fused to maxilla and palpus (1), separate from maxilla and palpus (2).

Character Reconstruction: [A/D] 1-*Sabethes cyaneus* (0-1), 1-2 (0-2).

\*6. Seta 3-Mx in lateral notch (1), notch absent (0).

Character Reconstruction: [A/D] 1-2 (0-1).

\*7. Laciniarastrum 1 spiniform (0), denticular (1).

Character Reconstruction: [A/D] 1-*Sabethes cyaneus* (0-1).

\*8. Mandibular spicules present on outer dorsal surface of mandible (1), absent (0).

Character Reconstruction: [A/D] 1-2 (1-0).

\*9. Seta 11-M, T grouped with setae 9-, 10-, and 12-, M, T on a sclerotized protuberance (0), fused and spiniform (1).

Character Reconstruction: [A/D] 1-*Sabethes cyaneus* (0-1).

\*10. Dorsolateral surface of seta 2-S unmodified (0), transverse striations present (1).

Character Reconstruction: [A/D] 1-*Sabethes cyaneus* (0-1).

- \*11. Spicules absent from siphon (0), present (1).

Character Reconstruction: [A/D] 1-*Sabethes cyaneus* (0-1).

- \*12. Pecten spiculate in a paired row (0), spiculate in a single row (1), absent (2), spicules modified into filamentous, setae-like projections (3).

Character Reconstruction: [A/D] 1-*Sabethes cyaneus* (0-3), 4-5 (0-1), 1-*Wyeomyia grayii* (0-2).

#### Pupal Characters

- \*13. Seta 5-CT stout or enlarged (0), with multiple branches (1).

Character Reconstruction: [A/D] 1-2 (0-1), 4-5 (1-0).

- \*14. Apex of seta 1-CT unmodified (0), strongly hooked (1).

Character Reconstruction: [A/D] 4-5 (1-0).

- \*15. Reticulate portion of trumpet at least three times the length of tracheoid portion and widest apically (0), reticulate section approximately twice the length of tracheoid section and apex equal in width (1), reticulate section approximately equal in length to tracheoid section and constant in width (2).

Character Reconstruction: [A/D] 1-2 (2-1), 4-5 (1-0).

- 16. Genital lobes reduced (0), larger than paddles (1).

Character Reconstruction: [A/D] 4-5 (0-1).

17. Posterior margin of genital lobes emarginate (0), continuous (1), inapplicable character (2).

Character Reconstruction: [A/D] 4-5 (2-1), 12-13 (1-0), 7-8 (1-0).

#### Adult Male Characters

18. Epandrium setae closely associated (0), far removed from each other on specialized lobes (1).

Character Reconstruction: [A/D] 12-*Wyeomyia* "species L" (0-1).

19. Well developed mesal lobe of gonocoxite present (0), absent (1).

Character Reconstruction: [A/D] 5-7 (1-0).

20. Number of major groups of setae on mesal lobe of gonocoxite, 1 group (0), 2 groups (1), 3 groups (2), inapplicable character (3).

Character Reconstruction: [A/D] 5-7 (3-2), 11-12 (2-1), 10-*Wyeomyia* "species K" (2-0).

21. Gonostylus mesal on mesal lobe (0), lateral on mesal lobe (1), subapical on arm (2), apical on arm of gonocoxite (3).

Character Reconstruction: [A/D] 3-4 (3-2), 5-7 (2-1), 12-*Wyeomyia* "species L" (1-0).

22. Gonostylus on inner surface of gonocoxite (0), on outer surface (1), inapplicable character (2).



Character Reconstruction: [A] 3-4 (2-0), 4-*Phoniomyia quasilongirostris* (0-1); [D] 4-5 (2-0), 4-*Phoniomyia quasilongirostris* (2-1).

23. Point of attachment of gonostylus to gonocoxite, ball and socket (0), divot (1), cup-like (2), stalk (3), direct attachment (4).

Character Reconstruction: [A] 2-3 (2-4), 4-5 (4-2), 7-10 (2-0), 15-*Wyeomyia* "species C" (0-1), 12-*Wyeomyia* "species L" (0-3), 9-*Wyeomyia intonca* (2-1); [D] 7-10 (2-0), 15-*Wyeomyia* "species C" (0-1), 12-*Wyeomyia* "species L" (0-3), 9-*Wyeomyia intonca* (2-1), 4-*Phoniomyia quasilongirostris* (2-4), 3-*Phoniomyia splendida* (2-4).

24. Gonostylus simple (0), complex (1).

Character Reconstruction: [A/D] 2-3 (1-0).

25. Setae on gonostylus absent (0) present (1).

Character Reconstruction: [A] 3-4 (1-0), 5-6 (0-1); [D] 5-7 (1-0), 4-*Phoniomyia quasilongirostris* (1-0).

26. Apex with median corner longer than lateral corner (0), median corner equal to lateral corner or T-shaped (1), flattened and rounded (2), asymmetrically tapered (3), weakly hooked with mesal ridges (4), cup-like and simple (5), cup-like and complex (6), truncate on lateral margin with rounded tip (7), asymmetrically spatulate with rounded tip (8), slightly tapered with a spine-like apical seta (9),

bulbous (A), weakly hooked with a short, spine-like apical seta (B), bluntly rounded (C), inapplicable character (D).

Character Reconstruction: [A] 2-3 (D-3), 15-*Wyeomyia* "species C" (3-1), 14-*Wyeomyia* "species E/F" (3-4), 13-*Wyeomyia circumcincta* (3-0), 12-*Wyeomyia* "species L" (3-2), 11-*Wyeomyia* "species M" (3-8), 7-8 (3-5), 8-*Wyeomyia* "species G" (5-7), 9-*Wyeomyia* "species H" (5-6), 5-6 (3-9), 6-*Wyeomyia lamellata* (9-A), 4-*Phoniomyia quasilongirostris* (3-C), 3-*Phoniomyia splendida* (3-B); [D] 7-10 (D-3), 15-*Wyeomyia* "species C" (3-1), 14-*Wyeomyia* "species E/F" (3-4), 13-*Wyeomyia circumcincta* (3-0), 12-*Wyeomyia* "species L" (3-2), 11-*Wyeomyia* "species M" (3-8), 8-*Wyeomyia* "species G" (D-7), 9-*Wyeomyia* "species H" (D-6), 9-*Wyeomyia intonca* (D-5), 6-*Wyeomyia lamellata* (D-A), 6-*Wyeomyia autocratica* (D-9), 4-*Phoniomyia quasilongirostris* (D-C), 3-*Phoniomyia splendida* (D-B).

27. Base of gonostylus fused (0), open (1).

Character Reconstruction: [A] 7-8 (1-0), 9-*Wyeomyia intonca* (0-1), 3-*Phoniomyia splendida* (1-0); [D] 8-*Wyeomyia* "species G" (1-0), 9-*Wyeomyia* "species H" (1-0), 3-*Phoniomyia splendida* (1-0).

28. Gonostylus median section straight (0), S-curved (1), recurved (2), *Sabethes cyaneus* (3), *Wyeomyia grayii* (4), and *Phoniomyia trinidadensis* (5).

Character Reconstruction: [A/D] 1-*Sabethes cyaneus* (0-3), 14-*Wyeomyia* “species E/F” (0-1), 10-*Wyeomyia* “species K” (0-1), 8-*Wyeomyia* “species G” (0-2), 2-*Phoniomyia trinidadensis* (0-5), 1-*Wyeomyia grayii* (0-4).

29. Median section of gonostylus less than half the width of apical section (0), greater than half the width of apical section (1), *Sabethes cyaneus* (2), *Wyeomyia grayii* (3), *Phoniomyia trinidadensis* (4).

Character Reconstruction: [A/D] 1-*Sabethes cyaneus* (1-2), 15-*Wyeomyia* “species C” (1-0), 13-*Wyeomyia circumcincta* (1-0), 11-*Wyeomyia* “species M” (1-0), 8-9 (1-0), 6-*Wyeomyia lamellata* (1-0), 2-*Phoniomyia trinidadensis* (1-4), 1-*Wyeomyia grayii* (1-3).

30. Length of gonostylus in  $\mu\text{m}$  41.3 (0), 86.0-92.5 (1), 120.0-165.0 (2), 187.5-277.5 (3), 307.5-357.5 (4), *Sabethes cyaneus* (5), *Wyeomyia grayii* (6), and *Phoniomyia trinidadensis* (7).

Character Reconstruction: [A/D] 1-*Sabethes cyaneus* (3-5), 15-*Wyeomyia* “species C” (3-2), 8-*Wyeomyia* “species G” (3-4), 5-6 (3-1), 4-*Phoniomyia quasilongirostris* (3-0), 2-*Phoniomyia trinidadensis* (3-7), 1-*Wyeomyia grayii* (3-6).

31. Arms of tergal bridge unadorned (0), lateral lobes present (1).

Character Reconstruction: [A/D] 15-*Wyeomyia* “species C” (0-1).

\*32. Lateral tergal arms of aedeagus apically fused (1), separate (0).

Character Reconstruction: [A/D] 1-*Sabethes cyaneus* (0-1), 4-5 (0-1).

\*33. Aedeagal median sternal plate with apex rounded and cap-like (0), elongate and sword shaped apically (1), tapered with apex and lateral margins notched (2), apex flat, equal in width to median section with lateral margins notched (3).

Character Reconstruction: [A/D] 1-2 (0-1), 4-5 (1-2), 10-*Wyeomyia* “species K” (2-3).

\*34. Basal mesal lobe absent (0), present as elongate sclerite fused proximally on gonocoxite (1), on arm of gonocoxite (2).

Character Reconstruction: [A/D] 1-2 (2-0), 4-5 (0-1).

35. Segment VIII with normal type setae (0), six stout, elongate setae at both posterior corners of segment (1).

Character Reconstruction: [A/D] 12-*Wyeomyia* “species L” (0-1).

36. Midleg tibia with cream scales only (0), cream and bronze scales (1).

Character Reconstruction: [A/D] 10-*Wyeomyia* “species K” (0-1).

37. Inner surface of midleg tarsomere 1 with cream scales only (0), bronze scales only (1), both cream and bronze scales (2), cream and bronze scales on both inner and outer surfaces (3).

Character Reconstruction: [A/D] 13-14 (2-0), 11-*Wyeomyia* “species M” (2-1), 10-*Wyeomyia* “species K” (2-3), 6-*Wyeomyia autocratica* (2-0).

38. Midleg tarsomere 2 inner surface with cream scales only and outer surface with bronze scales only (0), inner and outer surfaces with bronze scales only (1), inner and outer surfaces with cream and bronze scales (2), inner surface with cream scales only and outer surface with cream and bronze scales (3).

Character Reconstruction: [A/D] 5-7 (0-2), 13-14 (2-0), 15-*Wyeomyia* "species C" (0-3), 6-*Wyeomyia lamellata* (0-1).

39. Midleg tarsomere 3 inner and outer surfaces with cream scales only (0), inner and outer surfaces with bronze scales only (1), inner and outer surfaces with cream and bronze scales (2), inner surface with cream scales only and outer surface with cream and bronze scales (3).

Character Reconstruction: [A] 7-10 (3-0), 15-*Wyeomyia coenonius* (0-2), 10-*Wyeomyia* "species K" (0-2), 6-*Wyeomyia lamellata* (3-1); [D] 10-11 (3-0), 15-*Wyeomyia coenonius* (0-2), 10-*Wyeomyia* "species K" (3-2), 6-*Wyeomyia lamellata* (3-1).

40. Midleg tarsomere 4 inner and outer surfaces with cream scales only (0), inner and outer surfaces with bronze scales only (1), inner and outer surfaces with cream and bronze scales (2), inner surface with cream scales only and outer surface with cream and bronze scales (3).

Character Reconstruction: [A] 7-10 (3-0), 15-*Wyeomyia coenonius* (0-2), 10-*Wyeomyia* "species K" (0-2), 6-*Wyeomyia lamellata* (3-1); [D] 10-11 (3-0), 15-

*Wyeomyia coenonius* (0-2), 10-*Wyeomyia* “species K” (3-2), 6-*Wyeomyia lamellata* (3-1).

41. Midleg tarsomere 5 inner and outer surfaces with cream scales only (0), inner and outer surfaces with bronze scales only (1), inner surface with cream and bronze scales and outer surface with bronze scales only (2), inner and outer surfaces with cream and bronze scales (3), inner surface with bronze scales only and outer surface with cream and bronze scales (4).

Character Reconstruction: [A/D] 10-11 (1-0), 14-15 (0-3), 7-8 (1-2), 9-*Wyeomyia intonca* (2-3), 6-*Wyeomyia autocratica* (1-4).

42. Underside of proboscis with a subapical patch of cream colored scales with remaining scales bronze (0), solid line of cream colored scales from base to apex with no bronze scales (1), basal and subapical patches of cream colored scales with variable cream and bronze scales in between and bronze scales at apex (2).

Character Reconstruction: [A/D] 15-*Wyeomyia* “species C” (2-1), 14-*Wyeomyia* “species E/F” (2-0).

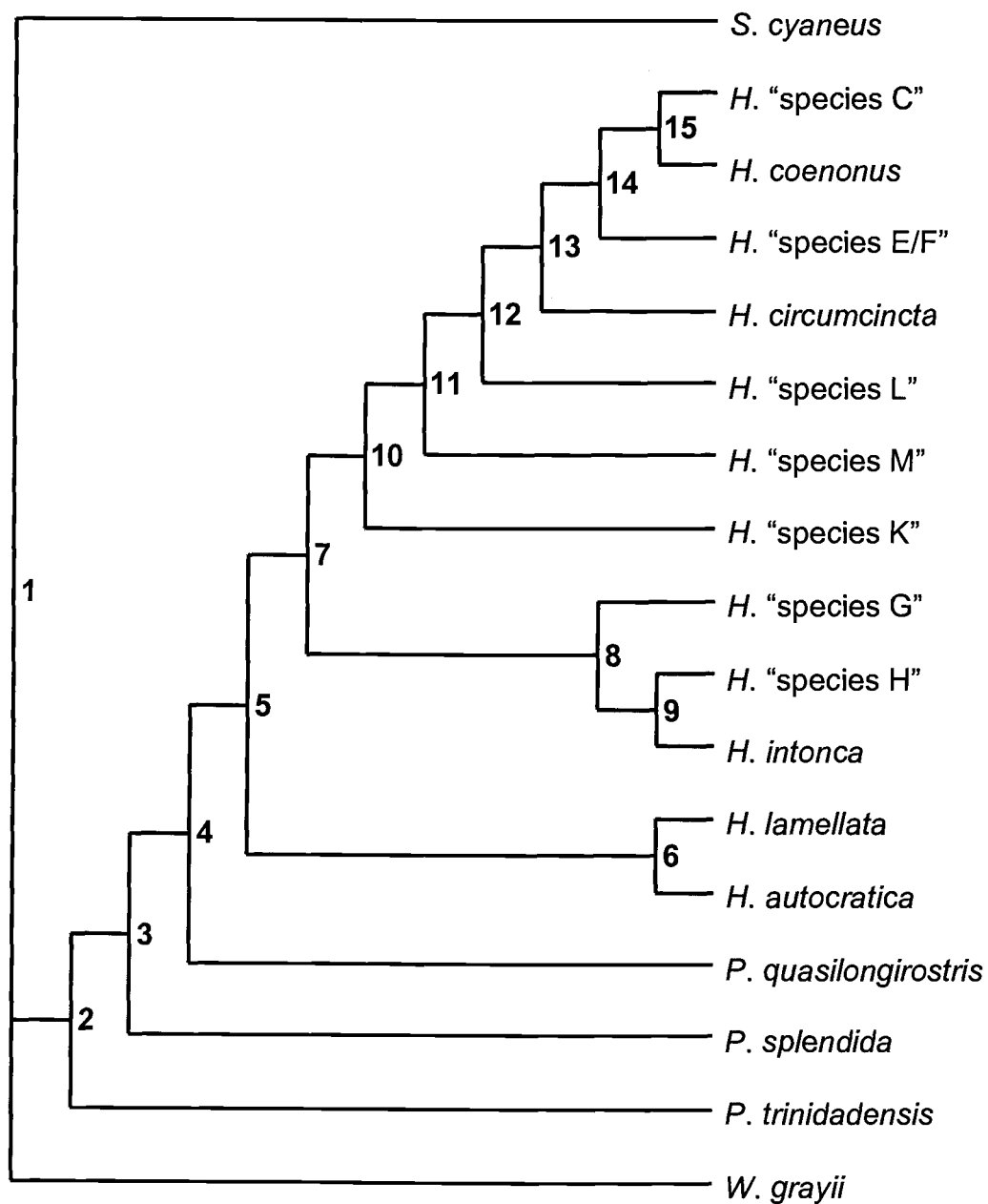


Figure C-1. Successive approximations weighted tree from Chapter 3 with nodes numbered for Appendix C.