

# Reevaluation of the Genus *Hyalomyzus* Richards with the Description of Two New Species (Homoptera: Aphididae)

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Ann. Entomol. Soc. Am. 92(4): 488-513 (1999)

**ABSTRACT** Alatae and apterae of the genus *Hyalomyzus*, including 2 new species, *Hyalomyzus orphnophlebos* n. sp. and *Hyalomyzus pocosinus* n. sp., are described, illustrated, and keys are provided for identification. *Hyalomyzus tissoti* Nielsson & Habeck is considered a synonym of *Hyalomyzus jussiaeae* Smith. Cladistic analysis of 17 taxa using 25 morphological characters is discussed.

**KEY WORDS** Aphids, Aphididae, *Hyalomyzus*

NORTH AMERICAN APHID systematics has always been dominated by descriptive work and keys to small genera and groups of aphids on particular host plants. Exceptions to this tendency exist, but most revisionary works dealt with genera in the Myzocallidinae (Drepanosiphinae of authors), Chaitophorinae, and other small subfamilies. The subfamily Aphidinae represents over half of all aphids, yet few genera have been formally revised, despite the fact that nearly all pest aphids belong to the Aphidinae. Within the Aphidinae, a group of genera related to *Myzus* is particularly important because it contains many of the most important crop pests, including *Myzus persicae* (Sulzer) (green peach aphid), *Myzus cerasi* (F.) (black cherry aphid), *Aulacorthum solani* (Kaltenbach) (foxglove aphid), *Aulacorthum (Neomyzus) circumflexum* (Buckton) (crescentmarked lily aphid), and *Ovatus crataegarius* (Walker) (mint aphid). In a revision of the genus *Myzus* Passerini, Mason (1940) included species that are today placed in many other genera besides *Myzus* (*Aulacorthum* Mordvilko, *Eriocaphis* Börner, *Hyalomyzus* Richards, *Ovatus* van der Goot, and *Rhodobium* Hille Ris Lambers). Since Mason (1940), there have been no revisionary works on North American *Myzus* or any of the genera that have since been split from it. To realize a thorough understanding of the relationships among pestiferous *Myzus*-like genera, a meaningful, natural classification must be constructed for the tribe. To achieve this, all species within the tribe should be examined critically, and the concepts of all genera scrutinized.

*Hyalomyzus* was described for a single species, *Myzus eriobotryae* Tissot, and was distinguished from *Myzus* and other related genera by its swollen cornicles, numerous secondary sensoria distributed on antennal segments III-V in alatae, and by the lack of a pigmented central patch on the abdominal dorsum of alatae. Richards (1958) suggested that a 2nd species, *Myzus sensoriatus* Mason, might also belong in *Hyalomyzus*. Since 1958, 3 species have been transferred

to *Hyalomyzus*, and 7 new species described, resulting in a genus of 11 valid species (Remaudière and Remaudière 1997).

Three articles have been published in North America since 1958 dealing specifically with *Hyalomyzus*. Nielsson and Habeck (1971) described 1 new species and presented a key to the 4 species then known. Smith (1982) also described a new species and provided a key, but dealt with 7 species. Voegtlin (1984) described a new species with an amended key to *Hyalomyzus* and included a discussion of the biology of the genus. In addition, 3 species have been described from India, 1 of which was placed in a monotypic genus, *Neohyalomyzus* Basu et al. (1976), and subsequently moved back to *Hyalomyzus* (Bhattacharya 1994).

As the number of species referable to *Hyalomyzus* increased, the morphological and biogeographical variation among the species included in the genus also expanded. However, no study exists that examined the expanded concept of the genus. Here we critically examine *Hyalomyzus* as it is comprised today and revise the species currently placed in the genus. We include diagnoses and illustrations of the valid North American species, including 2 new species, and notes on 2 Indian species and the Indian genus *Neohyalomyzus* Basu et al. (1976). *Hyalomyzus* and its relationship to a few other *Myzus*-like genera are discussed based on the results of a cladistic analysis.

## Materials and Methods

Synoptic descriptions were taken from original descriptions, type specimens, and identified material from the Aphidoidea collection of the National Museum of Natural History (USNM), Beltsville, MD, U.S.A.; the Illinois Natural History Survey (INHS), Champaign-Urbana, IL, U.S.A.; Mississippi State University Entomological Museum (MSEM), Starkville, MS, U.S.A.; Pennsylvania State University Frost En-

tomological Museum (PSFM), State College, PA, U.S.A.; The Natural History Museum (BMNH), London, UK; Florida State Collection of Arthropods (FSCA), Gainesville, FL, U.S.A.; North Carolina State University (NCSU), Raleigh, NC, U.S.A.; and Canadian National Collection of Insects (CNCI), Ottawa, Canada. Measurements are presented in millimeters as minimum and maximum ranges of representative specimens.

There is no standard set of terms currently in use for aphid morphs and morphological structures. For terms that vary among modern aphid taxonomy literature, we have chosen to use the following, with the alternates one may see elsewhere in parentheses: Terminal process (=unguis, processus terminalis). Secondary sensoria (=secondary rhinaria). Cornicle (=siphunculus). Fundatrix/fundatrices (=stem mother). Apter/Apterae (=wingless viviparous female). Alata/Alatae (=winged viviparous female). Ovipara/Oviparae (=egg-laying female).

Detailed locality information is provided for New World species of *Hyalomyzus*. The information under *Material Examined* is organized to conserve space. Abbreviations for fundatrices, apterae, alatae, oviparae, apterous males, alate males, and immatures are listed as: fund., ap., al., ov., ap. ♂, al. ♂, and imm., respectively. If a collection was made at the same locality, but on a different date as a previously listed collection, we did not repeat the duplicate information. For example, the documentation provided for some locality data may be Florida: Otter Creek, 2-IV-36, on *Crataegus luculenta* [= *Crataegus aetivalis*], E. West & A. H. Tissot (2 al.) USNM; 4-IV-36, 29-VIII-57, 21-XI-57, on *Crataegus* sp., (15 ap. on 15 sl.) USNM. In this hypothetical example, the 2nd collection was also found at Otter Creek, although 'Otter Creek' was not repeated. When specimens are mounted on a single slide (sl.), it is not written as such but is assumed. Collectors' names precede the recorded aphid morph. When the collector's name is unknown, it is left blank. Bracketed ( [ ] ) text represents supplemental information by the current authors for clarification purposes. Collection data that are the same except for collection date are simply listed sequentially. A complete listing of host plants for New World *Hyalomyzus* is given in Table 1. Botanical names listed in the collection data were checked against the Integrated Taxonomic Information System and the PLANT National Database (see Anonymous 1998a, 1998b).

**Phylogenetic Analysis.** Cladistic analysis of the New World *Hyalomyzus* and selected outgroups was undertaken to test the hypothesized monophyly of *Hyalomyzus* and to infer something about its relationships to other similar *Myzus*-like genera. Nine species of *Hyalomyzus* were included in the analysis: *Hyalomyzus collinsoniae* (Pepper), *Hyalomyzus eriobotryae* (Tissot), *Hyalomyzus jussiaeae* Smith (= *Hyalomyzus tissoti* Nielsson & Habeck, see below), *Hyalomyzus mitchellensis* Smith, *Hyalomyzus monardae* Davis [= *Hyalomyzus scrophulariae* (Thomas)], *Hyalomyzus orphnophlebos* n. sp., *Hyalomyzus pocosinus* n. sp., *Hyalomyzus sensoriatus* (Mason), and *Hyalomyzus trian-*

*gulatus* Voegtlin. Three additional species (*Hyalomyzus fragaricola* L. K. Gosh, *Hyalomyzus himachali* Bhattacharya, and *Hyalomyzus raoi* Hille Ris Lambers) described from India are listed as congeneric (Remaudière and Remaudière 1997), but were not included in the current analysis. Only a single aptera (BMNH) of *H. fragaricola* and the original species description were available for character examination. However, because many of the characters included within our analysis apply to the alata, these characters could not be scored for *H. fragaricola*. Specimens of *H. himachali* were not available for examination and only a few characters could be scored in our analysis from the original description. Originally placed in *Hyalomyzus* with reservation by Hille Ris Lambers (1973), *H. raoi* was later designated the nominal species for *Neohyalomyzus* by Basu et al. (1976). More recently Bhattacharya (1994) synonymized *Neohyalomyzus* under *Hyalomyzus* for having scabrous frontal tubercles, median frontal prominence, rugose body in apterae, clavate cornicles with preapical circumcision both in apterae and alatae, and 3 hairs on the 1st tarsal segments. All these characters were included in the original description of *Neohyalomyzus* by Basu et al. (1976). However, Bhattacharya (1994) apparently ignored some defining characters of *Neohyalomyzus* such as the presence of a nearly smooth dorsum of the head in apterae and a pigmented abdominal dorsum in the alatae. The latter character is most important because *Hyalomyzus* as described by Richards (1958) has no pigmented sclerotic patterns on the dorsum of the abdomen in the alatae. Because of these critical differences, *H. raoi* should be returned to *Neohyalomyzus*.

Because *Hyalomyzus* and *Utamphorophora* were suspected to be subgenera of *Ovatus* (Eastop 1966) and *Hyalomyzus* was listed as a subgenus of *Ovatus* (Quednau 1966), representative species of *Ovatus*, *Ovatus crataegarius* (Walker) and *Ovatus insitus* (Walker) and *Utamphorophora*, *Utamphorophora humboldti* (Essig) and *Utamphorophora physocarpus* (Pepper) (which are often listed as synonyms) are included to test these relationships. Representatives of *Myzus*, *Myzus cerasi* (F.), *Myzus lythri* (Schrank), *Myzus persicae* (Sulzer), and *Myzus (Sciomyzus) cymbalariae* Stroyan are included in the analysis in an attempt to root the trees.

Character distributions for the 17 included taxa are summarized in Table 2 and the 25 characters used in the analysis are listed below. Characters 2, 10, and 13 (treated as unordered) have 3 states; all others are binary. The analysis was performed using PAUP 3.1.1 (Swofford 1993) and MacClade 3.0 (Maddison and Maddison 1992). The 'branch and bound' option was applied.

**Characters.** Character distributions are summarized in Table 2. Unknown or indeterminable characters were coded as missing data.

**Apterae, Head Capsule.**

1. Anterior setae on dorsum of head capsule: less than ½ the basal width of antennal segment III (0); more than ½ the basal width of antennal segment III (1).

Table 1. Host plants of New World *Hyalomyzus*

Plant names	Aphid species
Apple leaves (see <i>Malus</i> sp.)	
Apple seedling (see <i>Malus</i> sp.)	
Aster sp.	<i>Hyalomyzus mitchellensis</i> Smith
<i>Collinsonia canadensis</i> L.	<i>Hyalomyzus collinsoniae</i> (Pepper)
<i>Collinsonia serotina</i> Walt.	<i>Hyalomyzus orphnophlebos</i> n. sp.
<i>Collinsonia</i> sp.	<i>Hyalomyzus collinsoniae</i> (Pepper)
Crab-Apple (see <i>Malus</i> sp.)	
<i>Crataegus aestivalis</i> (Walt.) Torr. & Gray	<i>Hyalomyzus eriobotryae</i> (Tissot)
	<i>Hyalomyzus orphnophlebos</i> n. sp.
<i>Crataegus calpodendron</i> (Ehrh.) Medic.	<i>Hyalomyzus eriobotryae</i> (Tissot)
<i>Crataegus crus-galli</i> L.	<i>Hyalomyzus eriobotryae</i> (Tissot)
	<i>Hyalomyzus sensoriatus</i> (Mason)
<i>Crataegus monogyna</i> Jacq.	<i>Hyalomyzus eriobotryae</i> (Tissot)
<i>Crataegus phaenopyrum</i> (L.f.) Medic.	<i>Hyalomyzus eriobotryae</i> (Tissot)
<i>Crataegus punctata</i> Jacq.	<i>Hyalomyzus eriobotryae</i> (Tissot)
<i>Crataegus succulenta</i> Schrad. ex Link	<i>Hyalomyzus eriobotryae</i> (Tissot)
<i>Crataegus vicana</i>	<i>Hyalomyzus jussiaeae</i> Smith
<i>Crataegus viridis</i> L.	<i>Hyalomyzus eriobotryae</i> (Tissot)
	<i>Hyalomyzus jussiaeae</i> Smith
<i>Crataegus</i> sp.	<i>Hyalomyzus sensoriatus</i> (Mason)
	<i>Hyalomyzus collinsoniae</i> (Pepper)
	<i>Hyalomyzus eriobotryae</i> (Tissot)
	<i>Hyalomyzus jussiaeae</i> Smith
<i>Drosera capillaris</i> Poir.	<i>Hyalomyzus orphnophlebos</i> n. sp.
<i>Eriobotrya japonica</i> (Thunb.) Lindl.	<i>Hyalomyzus jussiaeae</i> Smith
	<i>Hyalomyzus eriobotryae</i> (Tissot)
	<i>Hyalomyzus jussiaeae</i> Smith
<i>Gelsemium sempervirens</i> St. -Hil.	<i>Hyalomyzus eriobotryae</i> (Tissot)
Haw (see <i>Crataegus</i> sp.)	
Hawthorn (see <i>Crataegus</i> sp.)	
<i>Hypericum densiflorum</i> Pursh	<i>Hyalomyzus triangulatus</i> Voegtlin
<i>Hypericum mitchellianum</i> Rydb.	<i>Hyalomyzus mitchellensis</i> Smith
<i>Hypericum prolificum</i> L.	<i>Hyalomyzus triangulatus</i> Voegtlin
<i>Hypericum</i> sp.	<i>Hyalomyzus mitchellensis</i> Smith
<i>Lactuca</i> sp.	<i>Hyalomyzus collinsoniae</i> (Pepper)
Lamiaceae	<i>Hyalomyzus eriobotryae</i> (Tissot)
	<i>Hyalomyzus monardae</i> (Davis)
<i>Ludwigia bonariensis</i> (M. Micheli) Hara	<i>Hyalomyzus jussiaeae</i> Smith
<i>Ludwigia decurrens</i> (Walt.) DC.	<i>Hyalomyzus jussiaeae</i> Smith
<i>Ludwigia octovalvis</i> ssp. <i>octovalvis</i> (Jacq.) Raven	<i>Hyalomyzus jussiaeae</i> Smith
<i>Ludwigia suffruticosa</i> Walt.	<i>Hyalomyzus jussiaeae</i> Smith
<i>Ludwigia</i> sp.	<i>Hyalomyzus jussiaeae</i> Smith
<i>Lycopus americanus</i> Muhl. ex W. Bart.	<i>Hyalomyzus sensoriatus</i> (Mason)
<i>Lycopus virginicus</i> L.	<i>Hyalomyzus eriobotryae</i> (Tissot)
<i>Lycopus</i> sp.	<i>Hyalomyzus eriobotryae</i> (Tissot)
<i>Malus</i> sp.	<i>Hyalomyzus collinsoniae</i> (Pepper)
	<i>Hyalomyzus eriobotryae</i> (Tissot)
May Haw (see <i>Crataegus aestivalis</i> )	
<i>Monarda fistulosa</i> L.	<i>Hyalomyzus monardae</i> (Davis)
<i>Monarda</i> sp.	<i>Hyalomyzus monardae</i> (Davis)
Moss	<i>Hyalomyzus mitchellensis</i> Smith
<i>Phottinia glabra</i> (Thunb.) Maxim.	<i>Hyalomyzus eriobotryae</i> (Tissot)
<i>Plantago major</i> L.	<i>Hyalomyzus eriobotryae</i> (Tissot)
<i>Rubus hispida</i> L.	<i>Hyalomyzus eriobotryae</i> (Tissot)
<i>Salix azurea</i> Michx. ex Lam.	<i>Hyalomyzus collinsoniae</i> (Pepper)
<i>Triadenum virginicum</i> (L.) Raf.	<i>Hyalomyzus pocosinus</i> n. sp.
<i>Vaccinium</i> sp.	<i>Hyalomyzus eriobotryae</i> (Tissot)
<i>Veronica</i> sp.	<i>Hyalomyzus eriobotryae</i> (Tissot)

This host plant information represents a consolidation of those plants listed in literature pertaining to each species of New World *Hyalomyzus* and host data collected from slides at the USNM Aphidoidea collection or borrowed from the institutions listed in the *Materials and Methods*. Although some of the host data may represent aberrant hosts (e.g. *Plantago major* for *H. eriobotryae*), they are included for reference purposes. When common names for various hosts were used, they are recorded as such on the list and we have added the scientific name in parentheses for cross-reference.

2. Spinulation/nodulation on dorsum of head capsule: present anteriorly and along margins, smooth in middle posteriorly (0); without spinules/nodules, sometimes with wrinkles (1); spinules entirely covering dorsum of head (2).

3. Venter of head capsule adjacent to eyes: spinulose (0); smooth (1).

4. Ventral tubercles at rear of head capsule: present (0); absent (1).

5. Spinule/nodule type on head: spinules small, in

Table 2. Data matrix used in the cladistic analysis

Species	11111111	1122222	2
	12345678901234567	8901234	
<i>H. collinsoniae</i>	000000000020011	1110001	0
<i>H. eriotryae</i>	000000000020011	1110001	0
<i>H. jussiaeae</i>	000000000021011	1100011	0
<i>H. mitchellensis</i>	00010110010021011	1110011	0
<i>H. monardae</i>	10†1000†000021110	0001011	0
<i>H. orphnophlebos</i>	1000000101020111	†100001	0
<i>H. pocosinus</i>	0200000000020011	1110001	0
<i>H. sensoriatius</i>	0111†10†00002†011	111†0†1	0
<i>H. triangulatus</i>	01110110010021011	1111011	0
<i>M. cerasi</i>	00001000000000000	0000000	0
<i>M. cymbalariae</i>	120100000†100011	0100100	1
<i>M. lythri</i>	0000110000001000	0000000	0
<i>M. persicae</i>	00011000021000010	0001000	1
<i>O. crataegarius</i>	0011000000020001	1111101	1
<i>O. insitus</i>	0011000001020001	1111101	1
<i>U. physocarpus</i>	01110001020011010	0101101	1
<i>U. humboldti</i>	†1110001020011010	0001101	1

† Indicates a 0/1 polymorphism.

groups, pointed (0) (e.g., Fig. 4A); spinules more nodulose, rounded or crescent-shaped (1) (Fig. 3D).

#### Antennae.

6. Ratio of terminal process to the base of antennal segment VI: >3 (0); less than 3 (1).

7. Antennal segment II venter: bumpy (0); smooth (1).

8. Antennal segment III sensoria: absent (0); present (1).

#### Mouth Parts.

9. Rostral segment III number of pairs of setae: almost always 2 (0); >2 (1).

10. Ultimate rostral segment: longer than hind tarsal segment II (0); shorter than hind tarsal segment II and without accessory setae (1); shorter than hind tarsal segment II and with accessory setae (2).

11. Ultimate rostral segment number of setae. 0-3 (usually 2) or rarely 4 accessory setae (0); usually 3 or more (rarely 2) accessory setae (1).

#### Legs.

12. First tarsal segments chaetotaxy formula: 3-3-3 (0); 3-3-2 (1)

#### Abdomen.

13. Tergum patterning or sculpturing: maze-like with no distinct polygons at least in spinal area (0); smooth (1); distinct irregular polygon-like structures over whole dorsum (2) (Fig. 3B).

14. Spinal tubercles on abdominal tergite VII: usually present (0); absent (1).

15. Abdominal tergite VIII setae: much shorter than basal width of antennal segment III (0); subequal to basal width of antennal segment III (1).

16. Cornicles swollen on apical half: no (0); yes (1).

17. Caudal apical spinulation: entire, without blank spaces dorsally (0); reduced with blank spaces dorsally (1).

#### Alatae, Antennae.

18. Antennal segment V secondary sensoria: absent (0); present (1).

19. Antennal segment IV sensoria: absent (0); present (1).

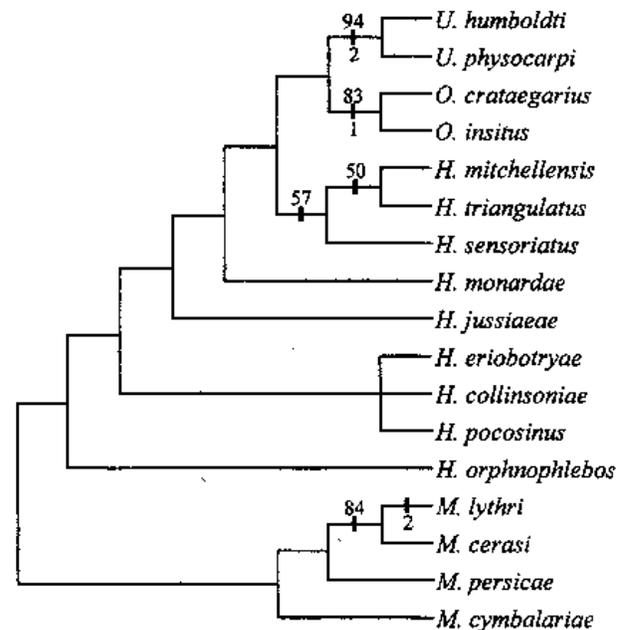


Fig. 1. One of 7 trees found using the branch-and-bound option in PAUP (statistics: length, 62; CI, 0.52 (0.47 excluding uninformative characters); RI, 0.66; RC of 0.34). Numbers above branches indicate results from bootstrap analyses, numbers below are decay indices.

20. Antennal segment III sensoria: restricted to approximately half the circumference of the segment (0); distributed around the entire circumference of the segment (1).

#### Mouthparts.

21. Lateral mandibular ornamentation: spinulose or scabrous (0); smooth (1).

#### Thorax.

22. Mesosternum ornamentation: with rows of minute spinules (0); smooth or with big bumps (1).

#### Abdomen.

23. Lateral abdominal tubercles: present in at least some specimens (0); absent (1).

24. Pigmented abdominal patch or bands: present (0); absent (1).

#### Nymphs, Legs.

25. Hind tibia apical spinulation: present (0); absent (1).

**Cladistics Results.** Application of the "branch-and-bound" option in PAUP resulted in a set of 7 trees of length 62, with consistency index (CI) of 0.52 (0.47 excluding uninformative characters), retention index (RI) of 0.66, and rescaled consistency index (RC) of 0.34. Two of these trees are shown in Figs. 1 and 2. These 2 trees illustrate the degree of uncertainty in the analysis. Fig. 1 suggests that *Hyalomyzus* is paraphyletic with the strong clade of *H. mitchellensis* and *H. triangulatus* being the most terminal of the genus, and with *Ovatus* and *Utamphorophora* grouped together. Fig. 2 is nearly the reverse situation, with the *H. mitchellensis*/*H. triangulatus* clade near the base of *Hyalomyzus*, and the group of 3 species including *H. eriotryae* most terminal. In the latter tree, *Hyalomyzus* is depicted as being monophyletic, with *Ovatus* and



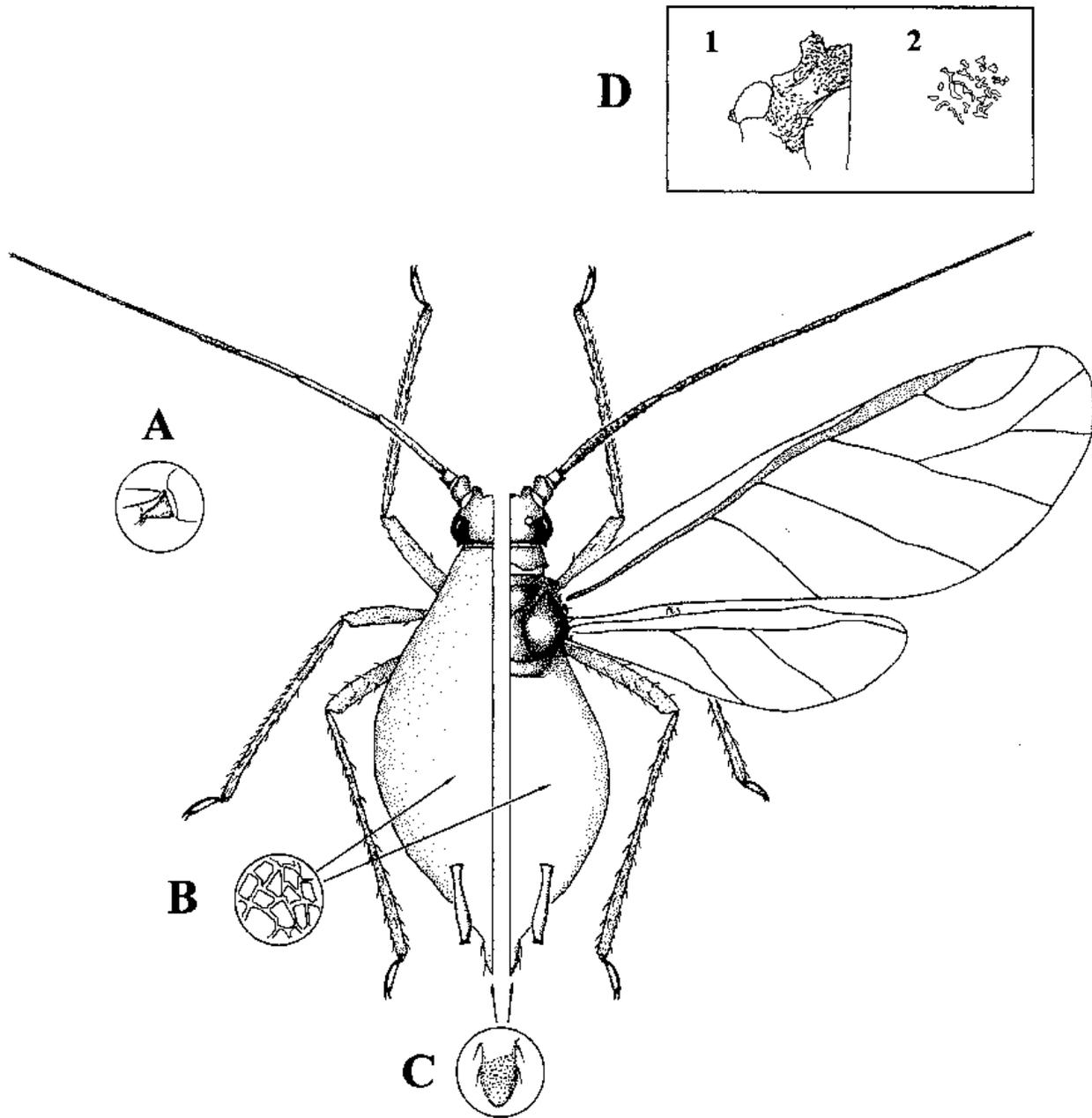


Fig. 3. Generalized *Hyalomyzus*, aptera left side, alata right side. A. 1st tarsal segment, illustrating the 3 small setae; B. Dorsal sculpturing of aptera; C. Detail of cauda showing smooth spaces dorsally; D. Contrasting characters of the head spinules (1) and dorsal sculpturing (2) found in *Myzus lythri* and other *Myzus* in the analysis.

**Key to Apterac and Alatae of New World  
*Hyalomyzus***

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|--|--|
| <p>1. Dorsum of head with spinules scattered over entire surface, more sparsely so in the alata; hind wing in alata with 1 transverse vein; 8th abdominal tergite with 2 setae. . . . .</p> <p>    . . . . . <i>Hyalomyzus pocosinus</i> n. sp.</p> <p>- Dorsum of head without spinules in middle posteriorly, sometimes entire dorsum of head smooth; hind wing of alata usually with 2 transverse veins; 8th abdominal tergite usually with 3 or more setae . . . . . 2</p> | <p>2 (1). Ultimate rostral segment shorter than hind tarsal segment II, and usually without accessory setae . . . . . 3</p> <p>- Ultimate rostral segment longer than hind tarsal segment II, and always with at least 2 accessory setae . . . . . 4</p> <p>3 (2). Head wrinkled dorsally; alata with 11-19 secondary sensoria on antennal segment III; ratio of terminal process to base <math>\approx 1:1</math>. . . . .</p> <p>    . . . . . <i>Hyalomyzus triangulatus</i> Voegtlin</p> <p>- Head with some spinules dorsally; alata with 19-38 secondary sensoria on antennal seg-</p> |
|--|--|

- ment III; ratio of terminal process to base  $\approx 1\frac{1}{2}$ -2:1 . . . . . *Hyalomyzus mitchellensis* Smith
- 4 (2). Ratio of terminal process to base <2; antennae of alata shorter than body . . . . .  
 . . . . . *Hyalomyzus sensoriatius* (Mason)
- Ratio of terminal process to base 3 or more; antennae of alata subequal or longer than body, if subequal in length, then antennal segment III with fewer than 15 sensoria . . . . . 5
- 5 (4). Base of hind tibiae with scabrous area; head of alata with a wide band of spinules ventrally between the antennal tubercles and the mouthparts (Fig. 6B) . . . . .  
 . . . . . *Hyalomyzus jussiaeae* Smith
- Base of hind tibiae without scabrous area; head of alata without a wide band of spinules ventrally between the antennal tubercles and the mouthparts (Fig. 5B) . . . . . 6
- 6 (5). Antennal segment III of alata with fewer than 15 sensoria, in a single row; ventral tubercles near posterior of head small, not very protuberant (Fig. 8A) . . . . .  
 . . . . . *Hyalomyzus monardae* (Davis)
- Antennal segment III of alata with >15 sensoria in more than a single row; ventral tubercles near posterior of head large and very protuberant . . . . . 7
- 7 (6). Ultimate rostral segment with 6 or more accessory setae; sensoria on antennal segment III of alata mostly limited to 1 side of the segment . . . . .  
 . . . . . *Hyalomyzus orphnophlebos* n. sp.
- Ultimate rostral segment with 5 or fewer accessory setae; sensoria on antennal segment III of alata mostly encircling the segment . . . . . 8
- 8 (7). Alata with 1-9 secondary sensoria on antennal segment V; sensoria on antennal segment III of alata usually appearing small and not protuberant (Fig. 4B); forewing of alata usually with veins distinctly bordered with brown . . . . .  
 . . . . . *Hyalomyzus collinsoniae* (Pepper)
- Alata with 5-19 secondary sensoria on antennal segment V, but almost always with 10 or more; sensoria on antennal segment III of alata usually appearing larger and protuberant (Fig. 5C); forewing of alata usually with veins not bordered with brown . . . . .  
 . . . . . *Hyalomyzus eriobotryae* (Tissot)

*Hyalomyzus collinsoniae* (Pepper)  
(Fig. 4)

*Micromyzus collinsoniae* Pepper, 1950: 13-14.

*Hyalomyzus collinsoniae* (Pepper), Pepper, 1965: 201.

**Type Material.** Holotype alata (4 o'clock position, designated with a map), 2 apterae paratypes (1 designated morphotype) and an alata paratype with left label "*Micromyzus collinsoniae* Pepper [positional map drawn] *Collinsonia canadensis*"; right label "State College Pennsylvania 26 August-1946 (Greenwood Furn.) wine color J. O. Pepper - coll." (USNM). In addition, we have examined other paratypes in the

PSFM. Other paratype material in the collection of A. N. Tissot (Pepper 1950) not seen.

**Field Features.** Apterae and alatae of similar "purple lake" color (Pepper 1950); also recorded as "greenish to purplish" or "wine color" (USNM and PSFM slide data).

**Recognition Characters.** Aptera: Body length 1.32-1.93; width through eyes, 0.35-0.45. Antennae longer than body; venter of segment II bumpy; III, 0.37-0.52 long; IV, 0.26-0.45 long; V, 0.22-0.37 long; base of VI, 0.10-0.14 long; terminal process, 0.39-0.65 long. Anterior setae on dorsum of head capsule long, more than half basal width of antennal segment III; dorsal spinulation of head capsule present anteriorly and along margins, smooth in middle posteriorly. Venter of head capsule adjacent to eyes spinulose; ventral tubercles present laterad to base of rostrum. Rostrum extending to hind coxae; rostral segment III with 2 pairs of setae; ultimate segment 0.10-0.13 long, usually with 2 accessory setae and longer than hind tarsal segment II. Dorsal base of hind tibiae smooth or slightly wrinkled, hind tibia 0.77-1.16 long; hind tarsus II 0.07-0.10 long. Abdomen with distinct irregular polygon-like structures over whole dorsum; spinal tubercles on abdominal tergite VII usually present; setae of abdominal tergite VIII much shorter than basal width of antennal segment III. Cornicles scabrous, 0.32-0.48 long, swollen on apical half. Cauda 0.12-0.18 long, elongate, triangular, occasionally with slight medial constriction, with 2-3 pairs of lateral setae and reduced apical spinulation with blank spaces dorsally.

Alata: Body length 1.39-2.16; width through eyes, 0.37-0.43. Antennae longer than body; III, 0.43-0.64 long, with 42-65 secondary sensoria distributed around the entire circumference of the segment; IV, 0.34-0.52 long, with 18-42 secondary sensoria; V, 0.28-0.42 long, with 1-9 secondary sensoria; base of VI, 0.11-0.16 long; terminal process, 0.55-0.72 long. Head setae slightly shorter and head much smoother in comparison to aptera. Rostral length and setae similar to aptera, ultimate segment 0.12-0.13 long; lateral mandibular ornamentation spinulose or scabrous. Mesosternum with rows of minute spinules; hind tibia 1.10-1.51 long; hind tarsus II 0.07-0.09 long. Abdominal tergum without patches or bands, surface sculpturing similar to aptera except less distinct; lateral abdominal tubercles present in at least some specimens. Cornicles slightly scabrous, 0.31-0.43 long, similar to aptera. Cauda 0.12-0.19 long, similar to aptera.

**Discussion.** This species has been found on *Crataegus* spp. (Rosaceae) and on *Collinsonia*, and *Salvia* (Lamiaceae). It has been found relatively rarely on *Crataegus*, so less is known about host alternation biology than is known for *H. eriobotryae*. The fact that it has been collected from both plants suggests a heteroecious life cycle between *Crataegus* (as primary host) and *Collinsonia* (as secondary host), but there has been no experimental proof of this.

This species is most closely related to *H. eriobotryae*, and the 2 species have been listed as synonyms in the past (Nielsen and Habeck 1971). Throughout most of the course of this study it was unclear whether the 2

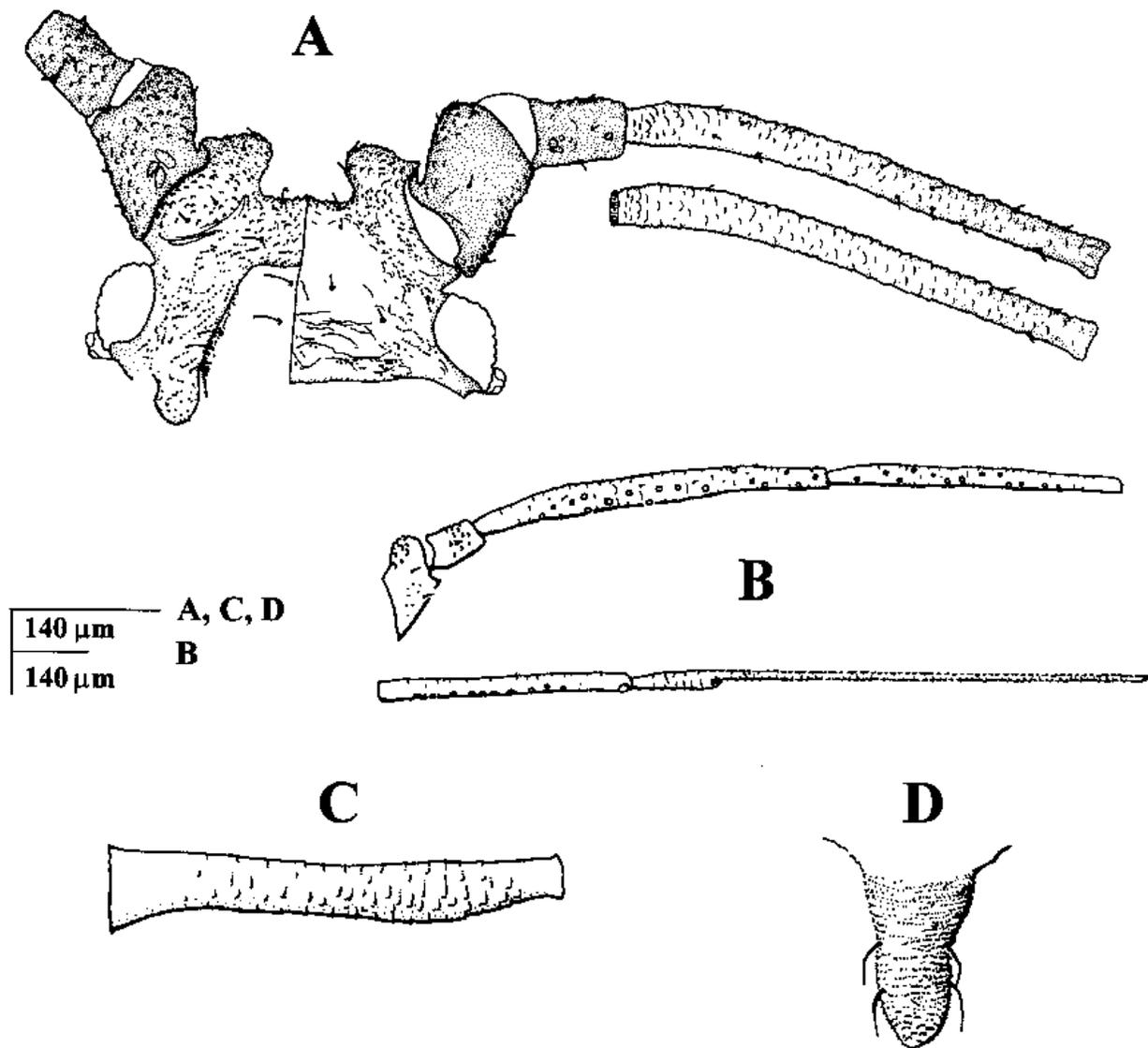


Fig. 4. *Hyalomyzus collinsoniae* (Pepper). A. Apterous dorsum of head and 1st 2 antennal segments, right side, with dorsal and ventral surface of antennal segment III; ventral surface of head and 1st 2 antennal segments, left side. B. Antenna of alata. C. Cornicle of aptera. D. Cauda of aptera.

species were distinct. Examination of a large amount of material from Pennsylvania and North Carolina has convinced us that *H. collinsoniae* should be treated as a distinct species. The morphological distinctions between the 2 species are extremely slight, but consistent. The most important way *H. collinsoniae* differs from *H. eriobotryae* is in the structure of the antennal sensoria and the general appearance of the antennae in the alatae. As shown in Fig. 4B, the antennal segment III of *H. collinsoniae* is more completely cylindrical, with the sensoria protruding only slightly or not at all. By contrast, *H. eriobotryae* has more protuberant, larger sensoria, resulting in a different appearance in the antennal segment. Antennal segment V of *H. collinsoniae* also usually has fewer sensoria than does *H. eriobotryae*. Apterous are nearly impossible to separate when occurring on *Crataegus*. We have identified a few apterae from *Crataegus* as this species based largely on the more deeply pigmented antennal seg-

ments I and II. Differences between this and other related species are the same as for *H. eriobotryae*, and are discussed under that species.

**Material Examined.** U.S.A.: New York: Schuyler Co., TX, Hollow, 2-IX-71, on *Collinsonia canadensis*, L. L. Pechuman, (4 ap. on 2 sl.) USNM.

Mississippi: Stone Co., Wiggins, Black Creek, 2-V-34, on *Salvia azurea*, J. P. Kislanko, (13 ap., 18 al., 9 imm. on 10 sl.) MSEM; Jones Co., Sandersville, 23-VIII-34, on *Salvia azurea*, J. P. Kislanko, (1 al.) MSEM; Harrison Co., Saucier, 11-X-34, on *Salvia azurea*, J. P. Kislanko, (3 ap., 1 al., 1 imm.) MSEM.

North Carolina: Franklin, 30-VIII-63, on *Collinsonia canadensis*, J. O. Pepper, (11 ap., 4 al., 17 imm. on 5 sl.) PSFM; McCready, Joshua Creek, 10-IX-63, on *Collinsonia canadensis*, J. O. Pepper, (12 ap., 3 al., 8 imm. on 10 sl.) PSFM; 2-VI-66, on *Crataegus* sp., C. F. Smith and H. L. G. Stroyan, (2 ap.) USNM; Laurel Springs, 7-IV-66, on crab apple, C. F. Smith, (4 al.) FSCA;

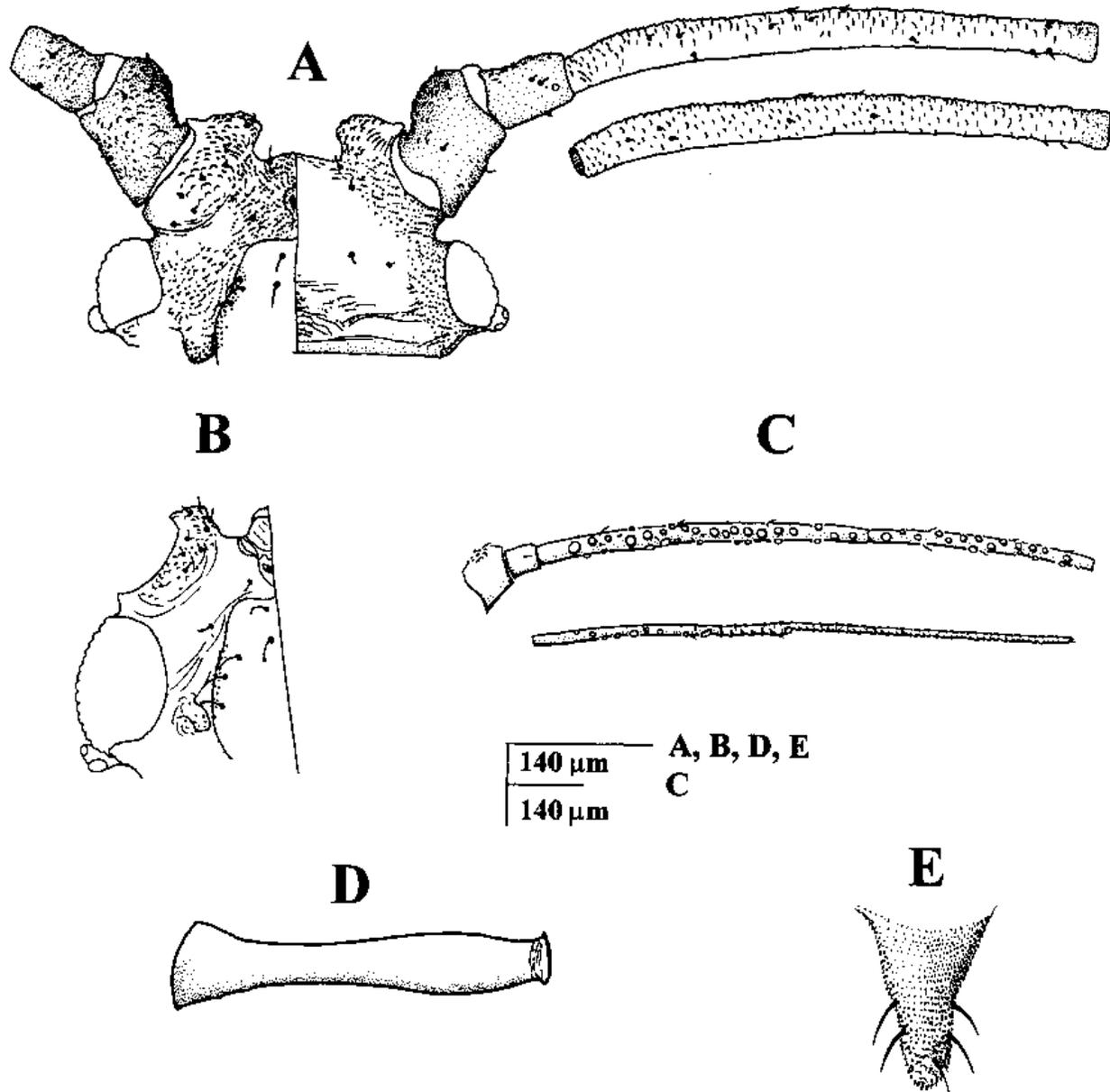


Fig. 5. *Hyalomyzus eriobotryae* (Tissot). A. Aptera dorsum of head and 1st 2 antennal segments, right side, with dorsal and ventral surface of antennal segment III; ventral surface of head and 1st 2 antennal segments, left side. B. Ventral surface of head of alata. C. Antenna of alata. D. Cornicle of aptera. E. Cauda of aptera.

McGrady, 9-IX-63, on *Collinsonia canadensis*, C. F. & C. K. Smith, (3 ap., 2 imm.).

Pennsylvania: State College, Greenwood Furn., 26-VIII-46, on *Collinsonia canadensis*, J. O. Pepper, (9 ap., 12 al., on 5 sl., includes holotype and paratypes) PSFM, USNM; 25-VIII-50, on *Collinsonia canadensis*, J. O. Pepper, (39 ap., 58 al., 1 imm. on 24 sl.) PSFM, USNM; 25-IX-55, on *Collinsonia* sp., J. O. Pepper, (26 al. on 6 sl.) PSFM; on *Lactuca* sp., J. O. Pepper, (1 al.) PSFM; Waddle, 7-IX-64, on *Collinsonia canadensis*, J. O. Pepper, (13 ap., 3 al., 6 imm. on 4 sl.) PSFM; Red Rock, Ricketts Glen, 30-VIII-50, on *Collinsonia canadensis*, J. O. Pepper, (19 ap., 23 al., 28 imm. on 10 sl.) PSFM; Bucks Co., 20-VIII-5-IX-1987, on *Collinsonia*, (2 al. on 2 sl.) PSFM.

*Hyalomyzus eriobotryae* (Tissot)  
(Fig. 5)

*Myzus eriobotryae* Tissot, 1935:49-52.

*Hyalomyzus eriobotryae* (Tissot), Richards, 1958: 169-172.

Type Material. Alata holotype with left label "A. N. Tissot *Myzus eriobotryae* n. sp. Holotype on Loquat *Eriobotrya japonica*"; right label "Gainesville Florida Agr. Exp. Sta. 12-4-28 F428-28 coll. A. N. T." (USNM). In addition, we have examined 1 other paratype (FSCA). Other paratype material (Tissot 1935) deposited in the Entomology Department, FL, Agricultural Experiment Station and the collection of A. N. Tissot was not seen.

One slide listed as a paratype (designated as "allotype" by Tissot [1935]) with left label "A. N. Tissot *Myzus eriobotryae* n. sp. Allotype ♂ on Loquat *Eriobotrya japonica*"; right label "Gainesville Florida Agr. Exp. Sta. 12-4-28 F428-28 coll. A. N. T." (USNM) is a misidentification. We determined this specimen to be *H. jussiaeae*, labeled it accordingly on the front left of the slide and corresponding slide holder, and moved the specimen to the *H. jussiaeae* section of the USNM collection. A note also reflecting this action has been placed in the front of the *H. eriobotryae* section of the USNM collection for future reference.

**Field Features.** Apteræ, greenish-purple (USNM slide data); alata, body brown with brown appendages (Tissot 1935) to nearly black or greenish-purple (USNM slide data). In life the tip of the cauda is covered in a light fluffy wax.

**Recognition Characters.** Apteræ: Body length 1.02–2.00; width through eyes, 0.27–0.46. Antennae longer than body; venter of segment II bumpy; III, 0.27–0.58 long; IV, 0.19–0.48 long; V, 0.17–0.40 long; base of VI, 0.09–0.13 long; terminal process, 0.30–0.62 long. Anterior setae on dorsum of head capsule short, less than half basal width of antennal segment III; dorsal spinulation of head capsule present anteriorly and along margins, smooth in middle posteriorly. Venter of head capsule adjacent to eyes spinulose; ventral tubercles present laterad to base of rostrum. Rostrum extending to hind coxae; rostral segment III almost always with 2 pairs of setae; ultimate segment 0.09–0.120 long, with 2–3 accessory setae and longer than hind tarsal segment II. Dorsal base of hind tibiae smooth or slightly wrinkled, hind tibia 0.46–1.20 long; hind tarsus II 0.06–0.11 long. Abdomen with distinct irregular polygon-like structures over whole dorsum; spinal tubercles on abdominal tergite VII usually present; abdominal tergite VIII with 2–4 setae, these much shorter than basal width of antennal segment III. Cornicles (Fig. 5D) scabrous, 0.22–0.47 long, swollen on apical half. Cauda (Fig. 5E) 0.09–0.20 long, elongate, triangular, occasionally with slight medial constriction, usually with 4–6 lateral setae and reduced apical spinulation with blank spaces dorsally.

**Alata:** Body length 1.16–2.04; width through eyes, 0.38–0.46. Antennae longer than body; III, 0.44–0.68 long, with 40–60 secondary sensoria distributed around the entire circumference of segment; IV, 0.37–0.53 long, with 22–40 secondary sensoria; V, 0.29–0.40 long, with 5–19 secondary sensoria; base of VI, 0.12–0.15 long; terminal process, 0.47–0.69 long. Head setae and spinulation similar to aptera. Rostral length and setae similar to aptera, ultimate segment 0.11–0.12 long with 2–4 accessory setae; lateral mandibular ornamentation spinulose or scabrous. Mesosternum with rows of minute spinules; hind tibia 0.86–1.27 long; hind tarsus II 0.07–0.10 long. Wing veins occasionally with fuscous highlighting. Abdominal tergum without patches or bands, surface sculpturing similar to aptera, abdominal tergite VIII with 2–6 setae; lateral abdominal tubercles absent. Cornicles scabrous, 0.26–0.38 long, similar to aptera. Cauda 0.06–0.18 long, similar to aptera, usually with 5–6 lateral setae.

**Discussion.** The life cycle of this species is not entirely clear despite all the collecting and study it has received. It has been found on a few different trees and shrubs in the Rosaceae, and on Lamiaceae, mostly *Lycopus*. Collections on *Crataegus* and apple have been made throughout the spring, well into summer, and throughout the fall. Collections on *Lycopus* have been made in all 4 seasons. In the Beltsville, MD, area this species was found on *Lycopus* until the plants died back in the late fall, and 1 collection was beyond that time (13 November) on *Rubus hispidus* L. (Rosaceae), a trailing vine that was growing alongside the *Lycopus*. A population was followed throughout the fall, but no migration of alatae was observed; colonies consisted almost entirely of apterae. At the same time, populations were observed colonizing *Crataegus*, where oviparae and males were collected. Specimens on the 2 plants appear to be the same species. Additionally, apterae and alatoid nymphs were found on *Lycopus* far too early in the spring for those colonies to have arisen from migrants from *Crataegus*. This sort of evidence suggests that there may be 2 species involved. However, among material we examined, there are slides that suggest that there may have been a host transfer conducted by C. F. Smith. A few slides of specimens collected on *Lycopus* are labeled as "from" other collections collected on apple seedlings. Assuming that these slides indicate a successful host plant transfer experiment, it is clear that the species on apple (and *Crataegus*) is the same as the 1 on *Lycopus*. We believe that *H. eriobotryae* exhibits a loosely heteroecious biology in which migration is not required, a concept supported by the fact that males are alate in this species. Such biology is not unknown, a prominent example being *Macrosiphum rosae* (L.), which feeds on *Rosa* sp. as primary host, and may or may not use its *Dipsacus* secondary host.

This species is most similar to *H. jussiaeae*, *H. orphnophlebos* and *H. collinsoniae*. The apterae of *H. eriobotryae* can be distinguished from the 1st of these by its smooth tibial bases, as opposed to the scabrous bases of the tibiae in *H. jussiaeae*, and by its normally shorter ultimate rostral segment. Alatae of *H. eriobotryae* differ from *H. jussiaeae* by the lack of spinules between the antennal tubercles and mouthparts ventrally (Figs. 5B and 6B), and the distribution of sensoria on the antennae. *Hyalomyzus eriobotryae* is 1 of 4 species of *Hyalomyzus* that are found on Lamiaceae, the others being *H. collinsoniae*, *H. orphnophlebos*, and *H. sensoriatus*. *Hyalomyzus eriobotryae* differs from *H. orphnophlebos* by having fewer setae on the ultimate rostral segment and rostral segment III, as well as generally shorter setae. Differences between *H. eriobotryae* and *H. collinsoniae* are slight and are discussed under the latter species. *Hyalomyzus eriobotryae* is easily separated from *H. sensoriatus* by its much longer terminal process and heavily spinulose head.

**Material Examined.** Canada: Ontario: Marmora, 15-IX-52, on "Roots of *Veronica*?" E. H. N. Smith, (1 al., 9 imm. on 6 sl.) CNCI; Ottawa, 26-IX-52, on *Crataegus calpodendron*, E. H. N. Smith, (2 al. on 2 sl.) CNCI; on *Crataegus monogyna* (3 al., 3 imm. on 4 sl.) CNCI; on

*Crataegus succulenta*, (2 al., 6 imm. on 4 sl.) CNCI; 28-IX-58, on *Crataegus*, W. R. Richards, (4 al., 5 ov., 2 imm. on 10 sl.) CNCI; 15-X-56, 16-X-56, (2 al., 5 al. ♂, 1 ov. on 8 sl.) CNCI; 10-VI-60, on *Vaccinium* sp. (2 ap., 1 al. on 3 sl.) CNCI; Crystal Bay, 16-X-56, on Apple, W. R. Richards, (2 al. on 2 sl.) CNCI; Xtal Bay, OH, 16-X-56, on *Crataegus*, W. R. Richards, (3 al. on 3 sl.) CNCI.

Prince Edward Island: Prince Co., Alberton (Elite Seed Farm), 26-VII -1-VIII-96, on pan trap, (1 al.) CNCI.

U.S.A.: District of Columbia: 5 May 1895, on *Crataegus* sp., T. Pergande, (1 al., 2 imm.) USNM; Chain Bridge, 14-V-06, on *Crataegus crus-gali*, T. Pergande, (1 al., 3 imm.) USNM; U.S. National Arboretum, 31-X-97, 6-XI-97, on *Crataegus punctata*, *Crataegus viridis*, *Crataegus phaenopyrum*, *Crataegus* leaves, A. Jensen & G. Miller, (5 al., 6 ov., 1 imm. on 11 sl.) USNM.

Florida: Gainesville, 12-IV-28, on Loquat *Eriobotrya japonica*, A. N. T., (1 al. holotype, 1 al. paratype on 2 sl.) NCSU, USNM; Gainesville, Hogtown Creek W. of Golf Course, 6-IV-36, on Yellow jessamine *Gelsemium sempervirens*, A. N. T., (2 al.) FSCA; Agr. Exp. Sta. 30 March 1942, on *Crataegus rimasiformis* [?], (2 ap., 1 al.) BMNH; on *Crataegus luculenta* [= *Crataegus aestivalis*], (1 ap., 1 al.) PSFM; Monticello, 2-IV-69, on *Photinia glabra*, W. H. Whitcomb, (5 ap. on 5 sl.) FSCA.

Maryland: Long Beach, 7-V-78, on *Crataegus* sp., M. B. Stoetzel, (1 al., 1 imm.) USNM; Prince George's Co., BARC-East, 14-V-97, 15-V-97, on Lamiaceae, A. Jensen, (13 ap., 15 al., 1 imm. on 7 sl.) USNM; 28-V-97, on *Plantago major*, A. Jensen, (1 ap.) USNM; Patuxent River Queen Anne's Bridge, 9-X-97, on *Crataegus*, A. Jensen, (3 al.) USNM; Beltsville, 15-X-97, 20-X-97, -XI-97, on *Lycopus virginicus*, A. Jensen, (37 ap., 1 al. ♂, 2 imm. on 7 sl.) USNM; 13-XI-97, on *Malus* -apple, A. Jensen, (1 ov.) USNM; on *Rubus hispidus*, A. Jensen, (3 ap., 1 imm. on 3 sl.) USNM; Sandy Spring, 3-XI-97, on *Crataegus viridis*, A. Jensen & G. Miller, (2 al., 4 ov. on 6 sl.) USNM.

Mississippi: Hattiesburg, 4-IV-31, on crab-apple, J. P. Kislanko, (2 al., 4 imm. on 2 sl.) USNM, MSEM; 26-XI-34, on May Haw, (1 ap., 3 al., 2 imm.) USNM; 29 March 1934, (2 ap., 3 al., 2 imm. on 4 sl.) USNM; 26-IV-33, on hawthorn, (6 ap., 1 al./ap. intermediate, 3 imm. on 10 sl.) USNM.

North Carolina: Raleigh, 29-IV-59, on apple (2 al.) NCSU; 3-V-59, (3 ap.) NCSU; 15-XI-59, on Labiateae, (7 ap., 3 al. ♂, 4 imm. on 3 sl.) NCSU; 12-I-60, on *Lycopus virginicus*, C. F. Smith, (13 ap., 11 imm. on 3 sl.) NCSU; 22-I-60, (3 ap., 10 al., 1 imm. on 6 sl.) NCSU, BMNH; 16-IV-67, on apple (seedling in lab), (13 ap., 10 al., 32 imm. on 5 sl.) NCSU, USNM; 20-IV-67, on apple seedling, (5 ap., 1 al., 12 imm. on 3 sl.) NCSU; 30-V-67, on *Lycopus virginicus* from 67 to 234 (apple), (9 ap.) NCSU; 27-VI-67, (19 ap. on 3 sl.) NCSU; 22-XI-63, on apple leaves, C. F. S. - Graham, (1 al.) NCSU; 27-XI-63, on apple stems, C. F. Smith, (4 ov., 4 imm. on 2 sl.) NCSU; 7-XI-66, on apple leaves, (6 al. on 2 sl.) NCSU, USNM; Umstead Park, 27-V-59, on *Crataegus*, C. F. S., (2 ap., 2 imm.) NCSU; 31-V-61, (12 ap., 4 imm. on 4 sl.)

NCSU; Raleigh, College Farm, 4-V-60, S. S. O. T., (3 ap., 1 al., 5 imm.) NCSU; Blowing Rock, 18-X-60, on Labiate, S.-S., (13 ap., 8 imm. on 5 sl.) NCSU; McGrady, Joshua Cr., 15-X-62, on *Lycopus*, C. F. & C. K. Smith, (6 ap., 1 imm. on 2 sl.) NCSU; Linville, 20-V-66, on *Crataegus* sp., H. L. G. S., (4 ap.) BMNH; 2-VII-66, C. F. Smith, (8 al. on 4 sl.) NCSU; 15-X-66, (1 ov.) NCSU; 16-X-66, (1 ov.) NCSU; Boone, Blueridge Pkwy., Post 270, 6-VII-67, C. F. Smith & M. G. Robertson, (6 ap., 1 al., 3 imm. on 2 sl.) NCSU; 15-VI-67 (1 al.) NCSU; 11-VI-68, on *Crataegus*, C. F. Smith, (9 al., 2 imm. on 4 sl.) NCSU; Cliffs of Neuse State Park, 12-V-69, on *Crataegus*, (2 ap., 1 al./ap. intermediate, 14 imm.) NCSU.

Pennsylvania: Clearfield, Parker Dam, 9-VI-62, on *Crataegus* sp., J. O. Pepper, (5 al. on 5 sl.) PSFM; on grass, J. O. Pepper, (1 al.) PSFM; Phillipsburg, Black Moshannon Park, 20-V-62, on *Crataegus* sp., J. O. Pepper, (5 ap., 2 al., 3 imm. on 2 sl.) PSFM, USNM; Shermansdale, 13-X-61, on apple, J. O. Pepper, (1 al.) PSFM; State College, golf course, 21-V-75, on *Crataegus* sp., J. O. Pepper, (5 ap., 2 imm. on 4 sl.) PSFM; 30-VI-75, on *Crataegus* sp., J. O. Pepper, (8 al., 15 imm. on 6 sl.) PSFM; Tamrack, 3-VI-75, on *Crataegus* sp., J. O. Pepper, (2 ap., 21 al., 19 imm. on 19 sl.) PSFM.

Virginia: Botetourt Co., Rieley Orchard, 30-X-96, on Delicious apple leaf, Pfeiffer & Rhoades, (1 al.) USNM.

#### *Hyalomyzus jussiaeae* Smith

(Fig. 6)

*Hyalomyzus jussiaeae* Smith, 1960: 160-161.

*Hyalomyzus tissoti* Nielsson and Habeck, 1971: 883-885 (new synonymy).

**Type Material.** Alata holotype (upper left specimen on slide) and aptera paratype (designated paracolony-type by Smith 1960) (lower right specimen on slide) with left label "Maricau Forest P.R. Km. 219 11 March 1955 Dirty greenish brown, reddish around cornicles CFS"; right label "Holotype 55-214-PR *Jussiaea angustifolia* *Hyalomyzus jussiaeae* Smith Holotype"; surface of glass microscope slide labeled "al holotype" (USNM). In addition, we have examined 36 other paratypes (FSCA, NCSU, USNM). Other paratypes (Smith 1960) in the collections of the Agricultural Experiment Station of the University of Puerto Rico, D. Hille Ris Lambers (currently in the BMNH), and A. N. Tissot were not seen.

We also examined type material of *H. tissoti* labeled: "*Hyalomyzus tissoti* n. sp. Nielsson & Habeck Holotype *Crataegus vicana*"; right label "Gainesville Florida Agr. Exp. Sta. 3-30-1942 A.N. Tissot coll. F-2302-42" (USNM); 2 slides with left labels "*Hyalomyzus tissoti* n. sp. Nielsson PARATYPE Sundew *Drosera capillaris* remounted 1970 by R.J.N." and right labels "Otter Creek Florida 4-2-1936 E. West & A.N. Tissot colls. F-1346-36" (USNM); 3 slides with left labels "*Hyalomyzus tissoti* n. sp. Nielsson PARATYPE Sundew *Drosera capillaris*" and right labels "Otter Creek Florida 4-2-1936 E. West & A.N. Tissot colls. F-1346-36" (FSCA); 2 slides with left labels "Morphotype *Hyalom*

*myzus tissoti* N + H Sundew *Drosera capillaris*" and right labels "Otter Creek Florida 4-2-1936 E. West & A.N. Tissot colls. F-1346-36" (NCSU); 2 slides with left labels "*Hyalomyzus tissoti* n. sp. Nielsson PARATYPE Sundew *Drosera capillaris*" and right labels "Otter Creek Florida 4-2-1936 E. West & A.N. Tissot coll. Remounted 1975 by ANT F-1346-36" (FSCA); 1 slide with left label "*Hyalomyzus tissoti* Nielsson PARATYPE Flower Stalks *Drosera capillaris*" and right label "Otter Creek Florida 4-2-1936 E. West & A.N. Tissot colls. F-1346-36" (FSCA); 1 slide with left label "*Hyalomyzus tissoti* Nielsson MORPHOTYPE Flower Stalks *Drosera capillaris* remounted 1970 by R.J.N." and right label "Otter Creek Florida 4-2-1936 E. West & A.N. Tissot colls. F-1346-36" (USNM). Other type material of *H. tissoti* not seen, but deposited in the collection of R. J. Nielsson (Nielsson and Habeck 1971). The FSCA, NCSU, and USNM specimens, now synonyms of *H. jussiaeae*, have been labeled accordingly on the front of each slide. The USNM specimens were moved to the *H. jussiaeae* section of the USNM collection and a note reflecting this action was placed in the *H. tissoti* section for future reference.

**Field Features.** Apteræ, brown (Nielsson and Habeck 1971) to greenish brown with reddish area around cornicles (Smith 1960); alatae, brown (Nielsson and Habeck 1971) to brownish amber (Smith 1960).

**Recognition Characters.** Apteræ: Body length 1.24–1.90; width through eyes, 0.34–0.46. Antennae longer than body; venter of segment II bumpy; III, 0.28–0.49 long; IV, 0.19–0.35 long; V, 0.17–0.31 long; base of VI, 0.10–0.13 long; terminal process, 0.42–0.58 long. Anterior setae on dorsum of head capsule short, less than half basal width of antennal segment III; dorsal spinulation of head capsule present anteriorly and along margins, smooth in middle posteriorly. Venter of head capsule adjacent to eyes spinulose; ventral tubercles present laterad to base of rostrum. Rostrum extending beyond hind coxae; rostral segment III almost always with 2 pairs of setae; ultimate segment 0.12–0.15 long, with 2 accessory setae and longer than hind tarsal segment II. Dorsal base of hind tibiae distinctly scabrous or imbricated, hind tibia 0.53–0.88 long; hind tarsus II 0.08–0.11 long. Abdomen with distinct irregular polygon-like structures over whole dorsum; spinal tubercles on abdominal tergite VII absent; abdominal tergite VIII with 2–4 setae, setae much shorter than basal width of antennal segment III. Cornicles scabrous, 0.26–0.40 long, swollen on apical half. Cauda 0.11–0.16 long, triangular, occasionally with slight medial constriction, usually with 4 lateral setae and reduced apical spinulation with blank spaces dorsally.

Alata: Body length 1.08–2.16; width through eyes, 0.37–0.45. Antennae longer than body; III, 0.33–0.52 long, with 23–45 secondary sensoria restricted to approximately half the circumference of the segment; IV, 0.23–0.41 long, with 9–22 secondary sensoria; V, 0.19–0.33 long, with 0–9 secondary sensoria; base of VI, 0.12–0.14 long; terminal process, 0.49–0.69 long. Head setae and spinulation similar to aptera. Rostral length and setae similar to aptera, ultimate segment

0.12–0.16 long with 2–3 accessory setae; mandible with spinulose or scabrous ornamentation laterally. Mesosternum with rows of minute spinules; hind tibia 0.68–1.01 long; hind tarsus II 0.08–0.10 long. Wing veins without pronounced highlighting. Abdominal tergum without patches or bands, surface sculpturing similar to aptera, abdominal tergite VIII with 2–4 setae; lateral abdominal tubercles absent. Cornicles 0.24–0.36 long, similar to aptera. Cauda 0.10–0.14 long, similar to aptera with 4–5 lateral setae.

**Discussion.** This species is found on *Crataegus* spp. (Rosaceae) and *Ludwigia* (Onagraceae) nearly throughout the year. Several specimens were also collected on Droseraceae (*Drosera capillaris*) in the spring. However, we speculate that *Drosera* represents an incidental host, since *Drosera* is a carnivorous plant and may be difficult for an aphid to colonize routinely. As with other species in this genus, a heteroecious life cycle is suggested by the presence of a woody Rosaceae host and an herb host, along with the alate condition of the males. However, heteroecy has not been proven for this species, and the aphid's occurrence in tropical countries probably indicates that host alternation is not required.

Specimens collected from Honduras and Mississippi were important in our decision in the synonymy of *H. tissoti* with *H. jussiaeae*. Nielsson and Habeck (1971) described *H. tissoti* based upon specimens collected solely from Florida. Distinguishing characters of *H. tissoti* were listed as: reduced numbers of sensoria,  $Cu_2$  in the hind wing partially or wholly absent, and the placement of 1 pair of the apical setae on the rostrum unusually basad (Nielsson and Habeck 1971). Nielsson and Habeck (1971) proposed a phylogeny that considered *H. tissoti* and *H. jussiaeae* as sister groups. However, their comparison of *H. tissoti* to *H. jussiaeae* was based only on specimens of *H. jussiaeae* collected from Puerto Rico. Our examination of *H. jussiaeae* alatae from Honduras and Mississippi collected on *Ludwigia* spp., revealed that some of these specimens not only possessed a partial  $Cu_2$  in the hind wing on 1 side, but the  $Cu_2$  was absent on the other side. Even in the type series of *H. jussiaeae* from Puerto Rico, the  $Cu_2$  of the hind wing is not a robust vein. We have also compared the placement of apical setae on the rostrum of *H. tissoti* with specimens of the *H. jussiaeae* type series and other material. We could not find consistency in the position of these setae that would warrant separation of 2 species. Furthermore, Nielsson and Habeck (1971) separated *H. jussiaeae* from *H. tissoti* by the presence of 3 dorsal setae on abdominal segment VIII in the former species versus 2 (sometimes 3 or 4) in the latter species. While some specimens from the type series do exhibit 3 dorsal setae on abdominal segment VIII, others have 4 setae. Specimens from Honduras have 2, 3 and 4 dorsal setae on abdominal segment VIII. We believe that this too does not represent a character that is dependable for species separation. Finally, Nielsson and Habeck (1971) based their species separation on differences in the number of setae on the lateral abdominal sclerites. We

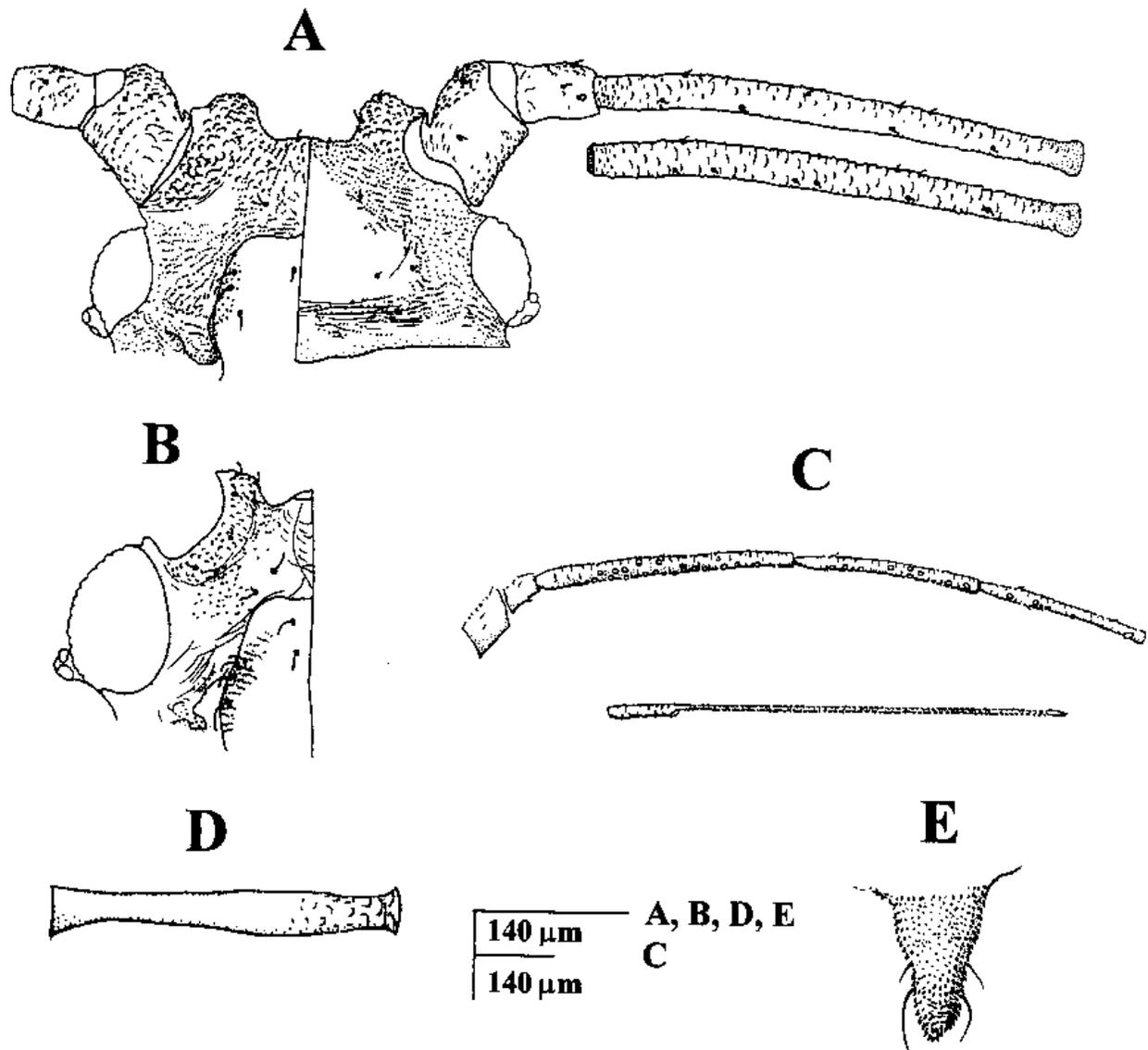


Fig. 6. *Hyalomyzus jussiaeae* Smith. A. Aptera dorsum of head and 1st 2 antennal segments, right side, with dorsal and ventral surface of antennal segment III; ventral surface of head and 1st 2 antennal segments, left side. B. Ventral surface of head of alata. C. Antenna of alata. D. Cornicle of aptera. E. Cauda of aptera.

were not able to determine any differences between the 2 species in this character.

The alatae of *H. jussiaeae* are most similar to *H. eriobotryae*, *H. collinsoniae*, *H. orphonophlebos*, and *H. pocsinus*. Among all these species it is easily recognized by the distinct, wide band of spinules on the head ventrally between the head and the mouthparts (Fig. 6B). The apterae are more difficult to separate, but those of *H. jussiaeae* usually can be recognized by their relatively narrow, heavily scabrous cornicles, scabrous base of the tibiae, and the normally relatively long ultimate rostral segment. In addition, the ventral protuberance of the antennal tubercles is usually more heavily scabrous in *H. jussiaeae* than in the other species. See also the "Discussion" section for *H. eriobotryae* and *H. orphonophlebos*.

**Material Examined.** Honduras: Paleto, 19-VII-61, on *Jussiaea*, E. Melendez, (2 ap.) USNM; La Lima Cortez,

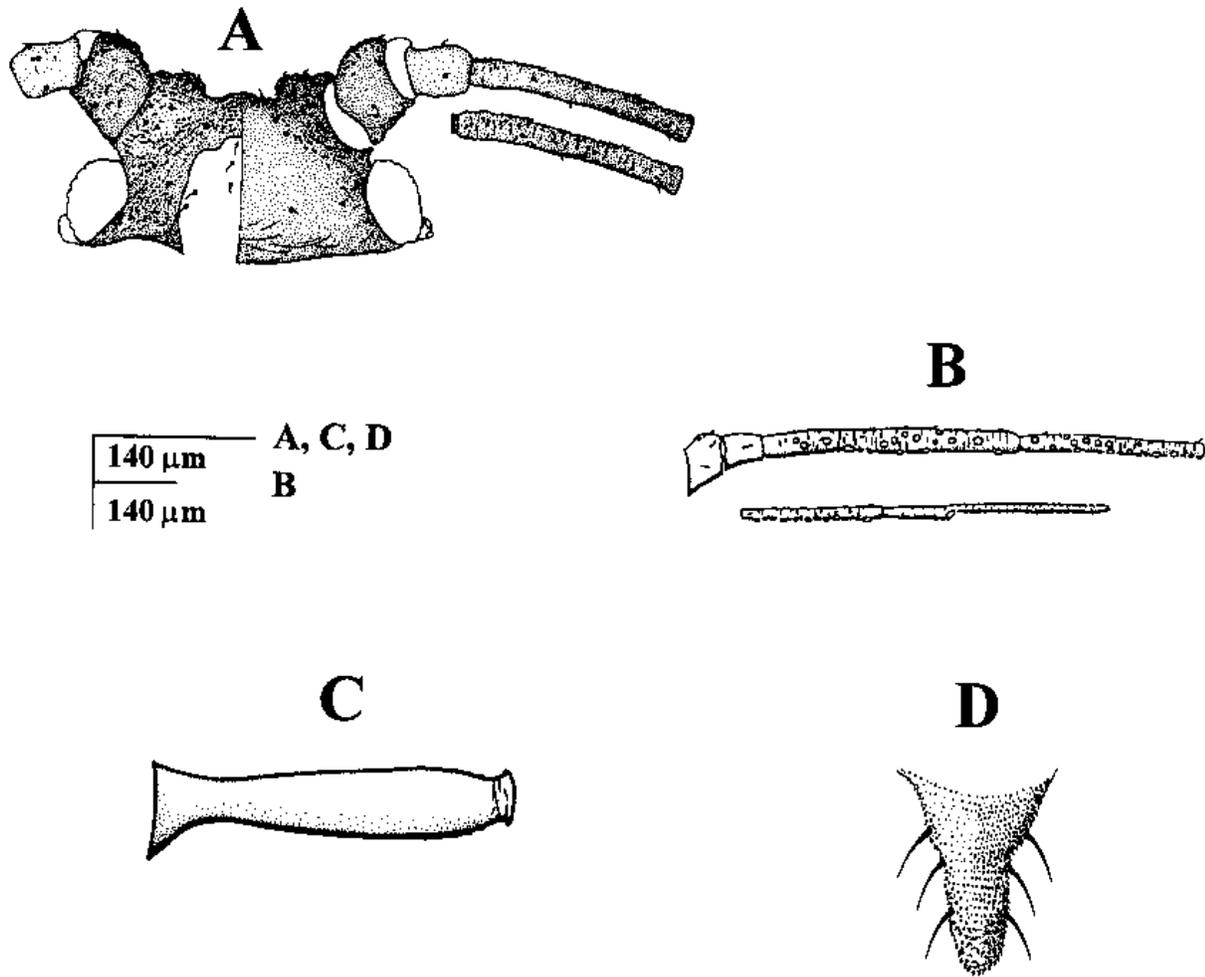
28-II-62, on *Jussiaea suffruticosa* [= *Ludwigia suffruticosa*], Melendez, (1 ap., 1 al., 1 imm.) USNM.

U.S.A.: District of Columbia: U.S. National Arboretum, 31-X-97, on *Crataegus viridis*, Miller & Jensen, (2 ov., 2 al., 1 al. ♂ on 5 sl.) USNM.

Florida: Gainesville, Agr. Exp. Sta., 30-III-42, on *Crataegus vicana*, A. N. Tissot, (1 al.) USNM; 12-IV-28, on Loquat, *Eriobotrya japonica*, (1 al. ♂) USNM; Otter Creek, 2-IV-36, on *Drosera capillaris*, E. West & A. N. Tissot, (1 ap., 11 al., on 12 sl.) USNM, FSCA, NCSU; Quincy, 10-XI-48, on traps, Chamberlain, (1 al.) USNM; 15-XI-48, Chamberlain, (2 al. ♂) USNM; Dade Co., Kendall, 30-VIII-96, from suction trap, D. Chalot, (1 al.) FSCA.

Georgia: Richmond Hill, 2-XII-43, on *Malus* or *Crataegus*, Mayer, (1 ov., 3 al., 1 imm.) USNM.

Maryland: Patuxent River, Queen Anne's Bridge, 9-X-97, on *Crataegus*, A. Jensen, (3 al.) USNM.



140  $\mu$ m A, C, D  
140  $\mu$ m B

Fig. 7. *Hyalomyzus mitchellensis* Smith. A. Apterous dorsum of head and 1st 2 antennal segments, right side, with dorsal and ventral surface of antennal segment III; ventral surface of head and 1st 2 antennal segments, left side. B. Antenna of alata. C. Cornicle of aptera. D. Cauda of aptera.

Mississippi: Hattiesburg, 21-III-33, haw, J. P. Kislanko, (3 ap., 3 al., 6 imm.) USNM; 26-IV-33, hawthorn, J. P. Kislanko, (6 ap., 5 imm.) USNM; 30-IV-34, on *Jussiaea decurrens* [= *Ludwigia decurrens*], J. P. Kislanko, (3 ap., 3 al., 1 imm. on 7 sl.) USNM; Forrest Co., Brooklyn, 21-IV-34, on *Jussiaea decurrens* [= *Ludwigia decurrens*], J. P. Kislanko, (2 ap., 1 al.) MSEM; Laurel, 7-XI-32, on *Crataegus* sp., J. P. Kislanko, (1 al.) MSEM; Saucier, 29-XI-32, on *Crataegus* sp., J. P. Kislanko, (1 al., 5 imm.) MSEM.

Puerto Rico: El Yunque, 26-VII-54, on *Jussiaea angustifolia* [= *Ludwigia octovalvis* ssp. *octovalvis*], Perez-Smith, (2 ap. paratypes, 2 imm. paratypes) NCSU; 9-III-55, C. F. S., (2 ap. paratypes, 1 al. paratype, 2 imm. paratypes on 2 sl.) NCSU; 1-IV-67, S. S. P., (16 ap., 5 al., 12 imm. on 6 sl.) NCSU; Maricao Forest, km. 219, 11-III-55, on *Jussiaea angustifolia* [= *Ludwigia octovalvis* ssp. *octovalvis*], C. F. S., (15 ap. paratypes, 1 al. paratype, 1 al. holotype, 2 imm. paratypes on 7 sl.) NCSU, USNM; Naranquito-Barranquitas Rd., 30-IV-60, on *Jussiaea angustifolia* [= *Ludwigia octovalvis* ssp. *octovalvis*], S-M, (19 ap., 6 imm. on 6 sl.) BMNH, NCSU; Dona Juana-Jayuya Rd., 26-IV-60, on *Jussiaea*

*angustifolia* [= *Ludwigia octovalvis* ssp. *octovalvis*], S. M., (15 ap., 6 imm. on 4 sl.) NCSU; Utuado-Adjuntas Rd., 11-III-69, on *Jussiaea angustifolia* [= *Ludwigia octovalvis* ssp. *octovalvis*], S. S. M. Sil., (28 ap., 1 al., 12 imm. on 7 sl.) USNM; Drocovis, 7-IV-67, on *Jussiaea angustifolia* [= *Ludwigia octovalvis* ssp. *octovalvis*], S. S. P., (17 ap., 6 imm. on 3 sl.) FSCA, NCSU; Cayay Salinas Rd., 26-III-59, on *Jussiaea angustifolia* [= *Ludwigia octovalvis* ssp. *octovalvis*], Martorell, (2 ap. paratypes, 2 al. paratypes, 5 imm. paratypes on 3 sl.) FSCA, NCSU; El Yunque, East Peak Rd., 7-III-69, on *Jussiaea angustifolia* [= *Ludwigia octovalvis* ssp. *octovalvis*], S. S. M. W., (14 ap., 1 al., 7 imm. on 4 sl.) FSCA, NCSU.

*Hyalomyzus mitchellensis* Smith  
(Fig. 7)

*Hyalomyzus mitchellensis* Smith, 1982:325-329.

Type Material. Alata holotype (at the 8 o'clock position not "6 o'clock" mentioned by Smith [1982]) with left label "MT. MITCHELL, NC 19 JUNE 1979 C F SMITH C K SMITH"; right label "79-4 *Hypericum mitchellianum* Holotype" (USNM). In addition, we

have examined 228 other paratypes (BMNH, FSCA, NCSU, USNM); other type material at CNCI (Smith 1982) not seen.

**Field Features.** Apteræ, pale to dark green with conspicuous black cornicles (Smith 1982) or light amber to orange (USNM slide data); alatae, light amber to orange (USNM slide data).

**Recognition Characters.** Apteræ: Body length 1.10–1.60; width through eyes, 0.30–0.38. Antennae shorter than body; venter of segment II smooth; III, 0.14–0.29 long; IV, 0.07–0.25 long; V, 0.10–0.27 long; base of VI, 0.07–0.15 long; terminal process, 0.13–0.27 long. Anterior setae on dorsum of head capsule short, less than half basal width of antennal segment III; dorsal spinulation of head capsule present anteriorly and along margins, smooth in middle posteriorly. Venter of head capsule adjacent to eyes spinulose; ventral tubercles absent laterad to base of rostrum. Rostrum extending beyond hind coxae; rostral segment III almost always with 2 pairs of setae; ultimate segment 0.06–0.08 long, without accessory setae and shorter than hind tarsal segment II. Dorsal base of hind tibiae smooth or slightly wrinkled, hind tibia 0.43–0.76 long; hind tarsus II 0.07–0.10 long. Abdomen with distinct irregular polygon-like structures over whole dorsum; spinal tubercles on abdominal tergite VII absent; abdominal tergite VIII with 3–4 setae, setae much shorter than basal width of antennal segment III. Cornicles slightly scabrous, 0.25–0.34 long, swollen on apical half. Cauda 0.10–0.18 long, triangular, with slight medial and preapical constriction, usually with 4 lateral setae and reduced apical spinulation with blank spaces dorsally.

Alata: Body length 1.16–1.47; width through eyes, 0.33–0.38. Antennae shorter than body; III, 0.41–0.49 long, with 19–38 secondary sensoria distributed around the entire circumference of segment; IV, 0.26–0.32 long, with 13–28 secondary sensoria; V, 0.20–0.29 long, with 3–16 secondary sensoria; base of VI, 0.11–0.15 long; terminal process, 0.22–0.30 long. Head setae and spinulation similar to aptera. Rostral length and setae similar to aptera, ultimate segment 0.06–0.08 long with 0 accessory setae; mandible with spinulose or scabrous ornamentation laterally. Mesosternum with rows of minute spinules; hind tibia 0.72–0.90 long; hind tarsus II 0.09–0.10 long. Wing veins without testaceous highlighting. Abdominal tergum without patches or bands, surface sculpturing similar to aptera, abdominal tergite VIII with 3–4 setae; lateral abdominal tubercles absent. Cornicles 0.24–0.31 long, similar to aptera. Cauda 0.10–0.15 long, similar to aptera with 4–6 lateral setae.

**Discussion.** *Hyalomyzus mitchellensis* is monoecious holocyclic on *Hypericum* and produces apterous males (Smith 1982).

Although *H. mitchellensis* represents a valid species, characters used in Smith's (1982) keys to apteræ and alatae are based in part on misidentifications. The listing of *Hypericum* sp. as a host plant for *H. sensoriatum* is based upon designated plesiotype material of *H. sensoriatum* (Nielsson and Habeck 1971). Examination of this material revealed that it was actually *H. mitchellensis*. These specimens do exhibit the "sclerotic

spots" that Smith used in his key although these spots are very light. Additionally, the use of pigmentation of the antennal segments and cornicles is not helpful for distinguishing included species. This character is too variable, probably due in part to the different procedures of specimen preparation. The use of secondary sensoria in the key to alatae is another concern. The numbers of secondary sensoria for *H. sensoriatum* apparently come directly from Mason (1940). Since the description of *H. sensoriatum* is actually based on a mixed collection of *H. eriobotryae* and *H. sensoriatum*, this character is also problematic. See also *Discussion* section of *H. sensoriatum*.

**Material Examined.** U.S.A.: North Carolina (all North Carolina specimens are paratypes except the holotype): Mt. Mitchell, 10-XI-67, on *Hypericum mitchellianum*, C. F. Smith, (2 ap., 2 imm.) USNM; 12-V-69, S. R., (2 fund., 4 ap., 1 imm. on 5 sl.) USNM; 11-VI-69, C. F. Smith & M. G. Robertson, (18 ap., 15 imm. on 9 sl.) NCSU; 12-VIII-76, M. Cermeli & C. F. Smith, (26 ap., 7 imm. on 9 sl.) USNM, NCSU; 9-IX-63, C. F. Smith & C. K. Smith, (1 ap.) NCSU; 20-IX-76, (14 ap. on 4 sl.) NCSU; 12-VIII-78 (12 ap. on 2 sl.) NCSU; 12-X-78, (3 ap., 5 ov., 1 imm. on 2 sl.) NCSU; 19-VI-79, (1 ap. holotype, 18 ap., 9 al., on 10 sl., plus 10 slides of blackened gum-based mounts) BMNH, USNM, NCSU, FSCA; Mt. Mitchell, Camp Alice Trail, 11-VI-76, on *Hypericum mitchellianum*, C. F. S., (47 ap., 15 imm. on 8 sl.) USNM, NCSU; Mt. Mitchell, Camp Alice, 9-X-68, on *Hypericum mitchellianum*, C. F. Smith & M. G. Robertson, (4 ap., 1 imm.) NCSU; Mt. Mitchell, 6-X-68, on moss, etc. (Burllese funnel), C. F. Smith & M. G. Robertson, (5 ap., 1 imm. on 2 sl.) NCSU; Mt. Mitchell, Camp Alice Trail, 15-X-68, on moss, C. F. Smith, (1 ov.) NCSU; Mt. Mitchell, Camp Alice Rd., 11-X-67, on *Hypericum mitchellianum*, C. F. Smith, (5 ov., 8 ap. ♂, 9 imm. on 3 sl.) NCSU.

Pennsylvania: Cook's Forest, 28-VI-58, on *Hypericum* sp., J. O. Pepper, (3 ap., 3 al.) USNM. State College, Poe Paddy Park, 13-VII-58, on *Hypericum* sp., J. O. Pepper, (6 ap., 6 al. on 2 sl.) USNM, NCSU; 3-VI-62 (5 ap., 2 al., 8 imm. on 3 sl.) NCSU; Black Moshannon Park, 30-VI-62, on *Hypericum* sp., J. O. Pepper, (6 ap., 6 al., 2 imm. on 2 sl.) BMNH, FSCA; Parker Dam, 18-VIII-62, on *Aster* (tall, white), J. O. Pepper, (1 ap., 11 al. on 4 sl.) NCSU; State College, Black Moshannon Dam, 21-VI-63, on *Hypericum* sp., J. O. Pepper, (24 al. on 6 sl.) NCSU.

#### *Hyalomyzus monardae* (Davis)

(Fig. 8)

*Phorodon scrophulariae* Thomas, 1879: 72.

*Phorodon monardae* Williams, (1910) 1911: 173 [89] (nomen nudum).

*Rhopalosiphum monardae* Williams (nomen nudum), Davis, 1911: 288 [36].

*Myzus monardae* (Williams), Hottes and Frison, 1931: 339.

*Myzus scrophulariae* (Thomas), Hottes and Frison, 1931: 343.

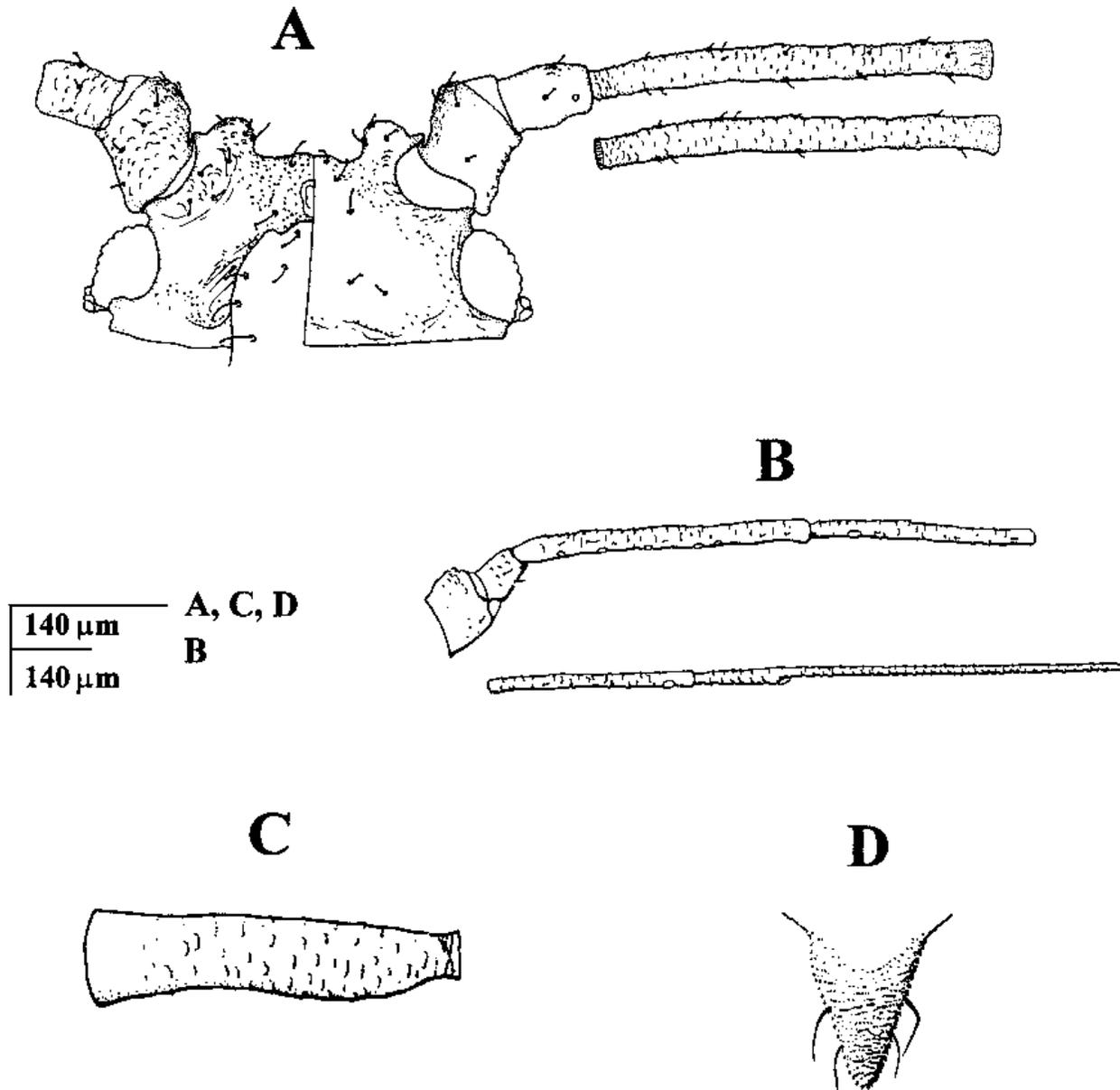


Fig. 8. *Hyalomyzus monardae* (Davis). A. Apterous dorsum of head and 1st 2 antennal segments, right side, with dorsal and ventral surface of antennal segment III; ventral surface of head and 1st 2 antennal segments, left side. B. Antenna of alata. C. Cornicle of aptera. D. Cauda of aptera.

*Hyalomyzus monardae* (Davis), Eastop & Hille Ris Lambers, 1976: 219.

*Hyalomyzus scrophulariae* (Thomas), Remaudière, G., and M. Remaudière, 1997: 100.

**Type Material.** Holotype of *H. monardae* not seen, "single winged female on the type slide" deposited in the University of Nebraska collection (Davis 1911). Mason's (1940) description of *H. monardae* was based upon "paratypes" in the USNM (see Nebraska section in *Material Examined*); however, Davis (1911) did not designate paratypes in his original description. Three slides with the same collection date as that recorded by Davis (1911) are present in the USNM collection (see Nebraska section in *Material Examined*). One slide is labeled "co-type" on the collection label and the other 2 slides have wrappers labeled "Paratype." A

lectotype of *P. scrophulariae* Thomas (not seen) is deposited in the INHS (Eastop and Voegtlin 1990). More recently, a decision was made by the International Commission on Zoological Nomenclature to suppress the name *scrophulariae* and conserve *monardae* as a recognized and appropriate name (Anonymous 1995), following the request submitted by Voegtlin (1994).

**Field Features.** Apterous yellowish brown with brownish tibiae and cornicles and pale cauda; alata with dark head and thorax, yellowish brown abdomen, dusky antennae beyond base of III, tibiae and cornicles slightly dusky, pale cauda, and slightly smoky wing veins (Palmer 1952).

**Recognition Characters.** Apterous: Body length 0.95–1.49; width through eyes, 0.30–0.38. Antennae sub-

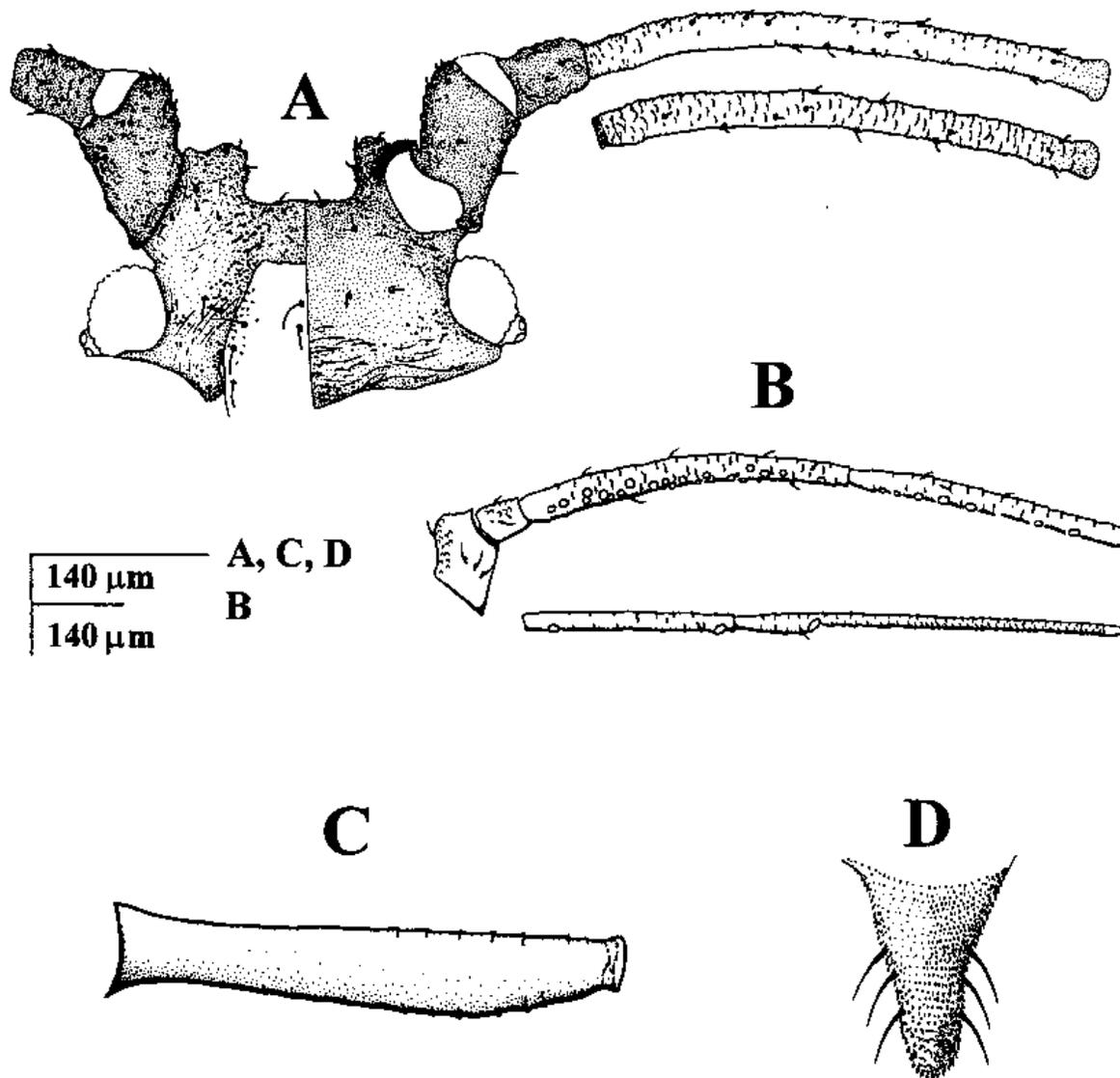


Fig. 9. *Hyalomyzus orphnophlebos* n. sp. A. Aptera dorsum of head and 1st 2 antennal segments, right side, with dorsal and ventral surface of antennal segment III; ventral surface of head and 1st 2 antennal segments, left side. B. Antenna of alata. C. Cornicle of aptera. D. Cauda of aptera.

**Recognition Characters.** Aptera: Body length 1.62–1.74; width through eyes, 0.38–0.41. Antennae longer than body; venter of segment II bumpy; III, 0.44–0.49 long; IV, 0.32–0.41 long; V, 0.28–0.33 long; base of VI, 0.12–0.13 long; terminal process, 0.58–0.74 long. Anterior setae on dorsum of head capsule long, more than half basal width of antennal segment III; dorsal spinulation of head capsule present anteriorly and along margins, smooth in middle posteriorly. Venter of head capsule adjacent to eyes spinulose; ventral tubercles present laterad to base of rostrum. Rostrum extending to hind coxae; rostral segment III with >2 pairs of setae; ultimate segment 0.13–0.15 long, with 6 or more accessory setae and longer than hind tarsal segment II. Dorsal base of hind tibiae smooth or slightly wrinkled, hind tibia 1.04–1.31 long; hind tarsus II 0.07–0.08 long. Abdomen with distinct irregular polygon-like structures over whole dorsum; spinal tubercles on abdominal tergite VII usually present; setae of abdominal

tergite VIII subequal to basal width of antennal segment III. Cornicles slightly scabrous, 0.37–0.43 long, swollen on apical half. Cauda 0.15–0.17 long, elongate, triangular, occasionally with slight medial and preapical constriction, usually with 3 pairs of lateral setae and reduced apical spinulation with blank spaces dorsally.

Alata: Body length 1.45–2.17; width through eyes, 0.35–0.44. Antennae longer than body; III, 0.47–0.59 long, with 37–50 secondary sensoria restricted to approximately half the circumference of the segment; IV, 0.40–0.46 long, with 10–17 secondary sensoria; V, 0.30–0.39 long, with 0–4 secondary sensoria; base of VI, 0.11–0.13 long; terminal process, 0.56–0.84 long. Head setae and spinulation similar to aptera. Rostral length and setae similar to aptera, ultimate segment 0.14–0.15 long; lateral mandibular ornamentation spinulose or scabrous. Mesosternum with rows of minute spinules; hind tibia 1.20–1.48 long; hind tarsus II 0.07–0.08 long. Abdominal tergum without patches

or bands, surface sculpturing similar to aptera except less distinct; lateral abdominal tubercles present in at least some specimens. Cornicles slightly scabrous, 0.34–0.43 long, similar to aptera. Cauda 0.17–0.21 long, similar to aptera.

**Discussion.** The life cycle of *H. orphnophlebos* is not fully known. Apparently, this species is heteroecious, with May Haw (*Crataegus aestivalis* (Walt.) Torr. & Gray) and stoneroot (*Collinsonia serotina* Walt.) serving as hosts.

This species is described from 4 collections by J. P. Kislanko in Mississippi. These collections were made by Kislanko in the same areas as other collections of *H. jussiaeae* and *H. collinsoniae*, indicating that *H. orphnophlebos* is not a geographical variant of 1 of these 2. Also, the collection of aphids with the unique characters of this species on 2 different hosts tells us that those unique characters are not a result of host plant influences. Thus, it seems clear that a distinct species is involved.

*Hyalomyzus orphnophlebos* is unique among the *Hyalomyzus* for having 3 or more pairs of setae on rostral segment III, a more setose ultimate rostral segment, sensoria restricted to 1 side of antennal segment III in the alata, and for extremely dark and bordered wing veins.

**Material Examined.** U.S.A: Mississippi: Hattiesburg, 29-III-34, on May Haw, J. P. Kislanko, (1 ap. paratype, 2 al. paratypes) USNM; New Augusta, 17-IX-36, on stoneroot [= *Collinsonia serotina*], J. P. Kislanko, (3 ap. paratype, 1 al. holotype, 1 al. paratype) USNM. Forrest Co., Fruitland Park, J.P.K. lot #892, 4-X-35, on *Micheliella anisata* [= *Collinsonia serotina*] – stoneroot, J. P. Kislanko, (16 ap., 4 al., 14 imm. on 11 sl.) BMNH, CNCL, MSEM, USNM; Forrest Co., Hattiesburg, J.P.K. lot #629, 29-III-34, on May Haw, J. P. Kislanko, (13 al. on 8 sl.) BMNH, MSEM, USNM; Perry Co., New Augusta, J.P.K. lot #894, 11-X-35, on *Micheliella anisata* [= *Collinsonia serotina*] – stoneroot, J. P. Kislanko, (10 ap., 6 al., 4 imm. on 2 sl.) MSEM.

**Specific Epithet.** The name *orphnophlebos*, from the Greek orphnos, meaning “dark or dusky” and phlebos, meaning “vein,” refers to the distinct dark veins of the forewings.

*Hyalomyzus pocosinus* Stuetzel, Jensen and Miller,  
n. sp.  
(Fig. 10)

**Type Material.** Alata holotype is hereby designated with left label “Maryland, USA Beltsville ex *Hypericum virginicum* roots growing on grass hillocks 20 v 1998 G. Miller & Jensen, coll.”; right label “*Hyalomyzus pocosinus* Stuetzel, Jensen, & Miller” (USNM). All specimens listed in the *Material Examined* section are paratypes except for the holotype.

**Field Features** Color is red; in life, the tip of the cauda is covered in a light fluffy wax.

**Recognition Characters.** Apterous: Body length 1.01–1.64; width through eyes, 0.31–0.41. Antennae longer than body; venter of segment II bumpy; III, 0.27–0.46 long; IV, 0.20–0.34 long; V, 0.20–0.30 long; base of VI,

0.10–0.14 long; terminal process, 0.34–0.43 long. Anterior setae on dorsum of head capsule less than half basal width of antennal segment III short; dorsal spinulation of head capsule present throughout. Venter of head capsule spinulose throughout, occasionally with a small smooth area near the base of the antennal tubercle; ventral tubercles present laterad to base of rostrum, although not pronounced. Rostrum extending past the hind coxae; rostral segment III with 2 pairs of setae; ultimate segment 0.10–0.15 long, with 2 accessory setae and longer than hind tarsal segment II. Dorsal base of hind tibiae smooth, hind tibia 0.50–0.91 long; hind tarsus II 0.07–0.10 long. Abdomen with distinct irregular polygon-like structures over whole dorsum and 2 rows of irregular dorsolateral sclerites; spinal tubercles on abdominal tergite VII usually present; setae of abdominal tergite VIII approximately ½ basal width of antennal segment III. Cornicles scabrous, 0.28–0.40 long, swollen on apical half. Cauda 0.09–0.14 long, elongate, triangular, with slight medial constriction, usually with 2 pairs of lateral setae and reduced apical spinulation with blank spaces dorsally.

**Alata:** Body length 1.30–1.66; width through eyes, 0.36–0.40. Antennae longer than body; III, 0.43–0.52 long, with 22–34 secondary sensoria distributed around the entire circumference of the segment; IV, 0.29–0.39 long, with 10–21 secondary sensoria; V, 0.23–0.32 long, with 5–10 secondary sensoria; base of VI, 0.11–0.15 long; terminal process, 0.40–0.54 long. Spinulation not as pronounced as in aptera, head setae similar. Rostral length and setae similar to aptera, ultimate segment 0.12–0.13 long; lateral mandibular ornamentation spinulose or scabrous. Mesosternum with rows of minute spinules; hind tibia 0.77–0.95 long; hind tarsus II 0.08–0.09 long. Abdominal tergum with lateral patches, surface sculpturing similar to aptera except less distinct; lateral abdominal tubercles usually present. Cornicles slightly scabrous, 0.30–0.36 long, similar to aptera. Cauda 0.10–0.13 long, similar to aptera.

**Ovipara:** Similar to aptera, but differs as follows: body length 1.55–1.97; width through eyes, 0.40–0.44. Antennae sorter or subequal to body; III, 0.38–0.45 long; IV, 0.31–0.36 long; V, 0.25–0.31 long; base of VI, 0.12–0.14 long; terminal process, 0.37–0.44 long. Ultimate segment 0.13–0.14 long. Hind tibia 0.70–0.81 long with numerous pseudosensoria; hind tarsus II 0.09–0.10 long. Cornicles 0.37–0.43 long. Cauda 0.13–0.15 long, with 2–3 pairs of lateral setae.

**Apterous male:** Similar to aptera, but differs as follows: body length 1.23–1.31; width through eyes, 0.37–0.40. Antennae longer or subequal to body; III, 0.33–0.36 long, with 14–20 secondary sensoria; IV, 0.25–0.29 long, with 8–15 secondary sensoria; V, 0.20–0.24 long, with 5–7 secondary sensoria; base of VI, 0.10–0.12 long; terminal process, 0.35–0.45 long. Ultimate segment 0.11–0.12 long. Hind tibia 0.68–0.72 long; hind tarsus II 0.08–0.09 long. Aedeagus and a pair of setose claspers present. Cornicles 0.31–0.33 long. Cauda 0.08–0.11 long, with 2 pairs of lateral setae.

**Discussion.** *Hyalomyzus pocosinus* is monoecious holocyclic, with apterous males, on the Virginia marsh St. John's Wort, *Triadenum virginicum* (L.) Raf. (Clu-

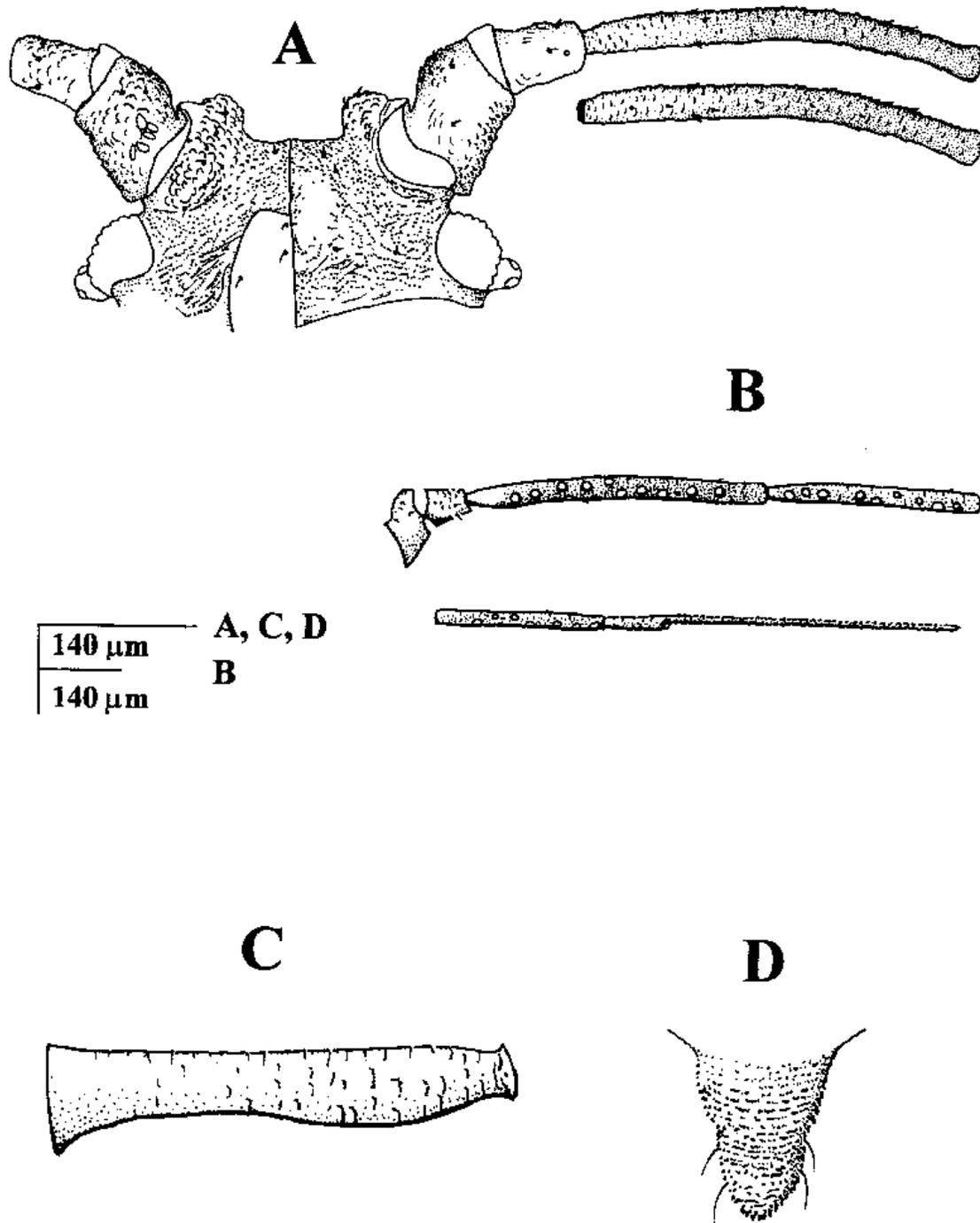


Fig. 10. *Hyalomyzus pocosinus* n. sp. A. Aptera dorsum of head and 1st 2 antennal segments, right side, with dorsal and ventral surface of antennal segment III; ventral surface of head and 1st 2 antennal segments, left side. B. Antenna of alata. C. Cornicle of aptera. D. Cauda of aptera.

siaceae). This aphid is currently known only from a series of specimens collected in a pocosin in Beltsville, MD, (Fig. 11). This species occurs on the lower stem and rootlets of *T. virginicum*. *Hyalomyzus pocosinus* apparently requires a very specialized habitat. It was only collected from hillocks or very small hummocks of  $\approx 1$ –2 feet in diameter that were either surrounded by water or found above very wet ground. These hummocks (Fig. 12) were usually comprised of a dense growth of an unidentified grass and 1 to several

plants of the *T. virginicum*. Although *T. virginicum* was commonly found throughout the Beltsville pocosin and the plant was widely sampled for aphids, collection of *H. pocosinus* was restricted to only the small hummocks. On 1 occasion, the aphid was collected on the upper stems of partially submerged plants. However, this collection was made after a period of heavy rain and the collection site was under more water than was usually found in that locality. Additionally, a glade in western Maryland was also surveyed for the pres-



Fig. 11. The pocosin habitat of *Hyalomyzus pocosinus* n. sp.

ence of *H. pocosinus*. While *T. virginicum* was not identified in this glade, other Clusiaceae (*Hypericum* spp.) were abundant. Examination of these plants did not yield specimens of *H. pocosinus*.

This species is unique among the *Hyalomyzus* because the aptera, and to a lesser degree the alata, has the entire surface of the dorsum of the head spinulate; the rostrum is long, extending past the meta-coxa; abdominal tergite VIII usually has only 2 setae while other *Hyalomyzus* spp. usually have 3 or more; and the hind wing in alata has only a single transverse vein while most other species of *Hyalomyzus* have 2 transverse veins.

**Material Examined.** U.S.A.: Maryland: Beltsville, 17-X-97, 20-X-97, on *Hypericum virginicum* [= *Triadenum virginicum*], A. Jensen & G. Miller, (30 ov., 3 ap. ♂, 4 imm. on 13 sl.) CNCI, BMNH, MNHN (Museum National D'Histoire Naturelle) USNM; 24-V-97, X-27-1997, on *Hypericum virginicum* [= *Triadenum virginicum*], A. Jensen, (4 ov., 1 ap. ♂, 1 imm. on 3 sl.) USNM; 8-V-98, on *Hypericum virginicum* [= *Triadenum virginicum*], G. Miller & A. Jensen, (2 ap., 1 al. on 3 sl.) USNM; 15-V-98, on *Hypericum virginicum* [= *Triadenum virginicum*], G. Miller & A. Jensen, (4 ap., 4 al. on 4 sl.) USNM; 20-V-98, on *Hypericum virginicum* [= *Triadenum virginicum*], G. Miller & A. Jensen, (9 ap., 2 alata/aptera intermediate, 12 al. on 14 sl.)

BMNH, CNCI, MNHN, USNM; 22-V-98, on *Hypericum virginicum* [= *Triadenum virginicum*], A. Jensen, (9 ap., 16 al., 4 imm. on 9 sl.) USNM.

**Specific Epithet.** The name *pocosinus*, from pocosin or the Algonquian (Delaware) *pakwesin*, meaning "shallow place," refers to the boggy or swampy habitat of this aphid.

*Hyalomyzus sensoriatus* (Mason)  
(Fig. 13)

*Myzus sensoriatus* Mason, 1940: 19.

*Hyalomyzus sensoriatus* (Mason); Richards 1958: 172. (tentative assignment).

*Ovatus* (*Hyalomyzus*) *sensoriatus* (Mason); Quednau 1966: 426.

*Hyalomyzus sensoriatus* (Mason); Nielsson and Habeck 1971: 885-886.

**Type Material.** Alata lectotype with left label "12186 *Rhopalosiphum sensoriata* Mason on *Crataegus crus-galli* Chain Bridge D.C. 14 May 1906 Type"; right label "HYALOMYZUS *sensoriatus* (Mason) Lectotype designated by R.J.N. Det. R. J. Nielsson remounted 1970 by RJN" (USNM). In addition, we have examined a single paralectotype (USNM). All material examined is in poor condition.

**Field Features.** Undetermined. Pergande's field notes included color descriptions of the collected aphids; however, since the original collection of *H. sensoriatus* also had some *H. eriobotryae*, it is impossible to associate these notes with the proper species. For further comments on the Pergande collection of *H. sensoriatus* and *H. eriobotryae*, see *Discussion* below.

**Recognition Characters.** Aptera not seen. The following characters represent those deduced after examination of a single ovipara, alatae, and nymphs. Antennal segment II bumpy ventrally; terminal process <3 times the base. Anterior setae on dorsum of head capsule short, less than half basal width of antennal segment III. Venter of head capsule adjacent to eyes spinulose; ventral tubercles present laterad to base of rostrum. Rostral segment III with 2 pairs of setae; ultimate segment longer than hind tarsal segment II and with 0-2 (usually 2) or rarely 4 accessory setae. Dorsal base of hind tibiae smooth or slightly wrinkled. Cornicles swollen on apical half. Cauda with reduced apical spinulation with blank spaces dorsally.

**Alatae:** Body length 1.52-1.70; width through eyes, 0.32-0.39. Antennae shorter than body; III, 0.38-0.46 long, with 22-57 sensoria distributed around the entire circumference of the segment; IV, 0.19-0.26 long, with 10-26 sensoria; V, 0.15-0.18 long with 5-16 sensoria; base of VI, 0.11-0.14 long; terminal process 0.16-0.20 long. Venter of head capsule adjacent to eyes spinulose; ventral tubercles present laterad to base of rostrum; dorsal head spinulation absent. Rostral segment III with 2 pairs of setae; ultimate segment 0.10-0.11 long with 2 accessory setae. Lateral mandibular ornamentation smooth. Mesosternum with rows of minute spinules; hind tibia 0.78-0.88 long; hind tarsus II 0.07-0.08 long. Wing veins with fuscous highlighting. Abdominal tergum without patches or bands, sur-



Fig. 12. A grassy hummock on which the host of *Hyalomyzus pocosinus* n. sp., *Triadenum virginicum*, is growing.

face sculpturing absent, abdominal tergite VIII with 2–3 setae; lateral abdominal tubercles present. Cornicles 0.25–0.29 long, swollen on apical half. Cauda 0.09–0.11 long, elongate, triangular with a constriction approximately  $\frac{2}{3}$  of the length and remaining  $\frac{1}{3}$  nearly parallel-sided, with 4 lateral setae and reduced apical spinulation with blank spaces dorsally.

**Discussion.** *Hyalomyzus sensoriatus* is known from the original collection on *Crataegus crus-galli*, from *Crataegus viridis*, and alatae and alate males from *Lycopus americanus* in New York. These findings suggests that this aphid may be heteroecious, but additional work will be needed to confirm this possibility.

Mason's (1940) original description of *H. sensoriatus* is actually based on a mixed collection of *H. eriobotryae* and *H. sensoriatus*. Nielsson and Habeck (1971) designated a lectotype and paratype from the original series. However, in their redescription of *H. sensoriatus*, they also designated a morphotype and plesiotypes. These specimens were all collected on *Hypericum* and were determined by us to be *H. mitchellensis*. The discovery of an ovipara and the unique characters of this and the alatae indicate that *H. sensoriatus* is a valid species. It can be distinguished by the short terminal process and numerous secondary sensoria on the antennae. Based on the appearance of the ovipara, it may also lack dorsal head spinules in the aptera, in a similar fashion to *H. triangulatus*. The validity of this species is further supported by 2 alatoid nymphs from the original collection series. These specimens also have a shortened terminal process and the numerous antennal sensoria of the developing adult are visible

through the cuticle on the last instar. Other alatoid nymphs were present in the collection series, however, that were *H. eriobotryae*. These specimens also exhibited numerous secondary sensoria visible through the cuticle of the last instar, but the terminal process was long. See also "Discussion" section of *H. mitchellensis*.

**Material Examined.** U.S.A.: District of Columbia, Chain Bridge, 14-V-06, on *Crataegus crus-galli*, T. Pergande, (1 al. lectotype, 1 al. paralectotype, 2 imm. on 4 sl.) USNM.

Maryland: Sandy Spring, 3-XI-97, on *Crataegus viridis* in nursery, found on branches and trunk, G. Miller & A. Jensen, (1 ov.) USNM.

New York: Long Island, Greenport, 22-IX-57, on *Lycopus americana*, R.L., (5 al., 4 al. ♂, 3 imm. on 3 sl.) NCSU.

#### *Hyalomyzus triangulatus* Voegtlin (Fig. 14)

*Hyalomyzus triangulatus* Voegtlin, 1984: 563–569.

**Type Material.** Aptera holotype on "slide 82-216-4, progeny of specimen taken on *Hypericum prolificum*, 4 km SE of Eddyville, Pope Co., IL, 10-XI-1982, David Voegtlin" (Voegtlin 1984) deposited at the Illinois Natural History Survey was not seen. Type material was deposited at the BMNH, INHS, USNM and CNCI (Voegtlin 1984). We have examined 32 paratypes (BMNH, INHS, USNM) and they are listed in the *Material Examined* section.

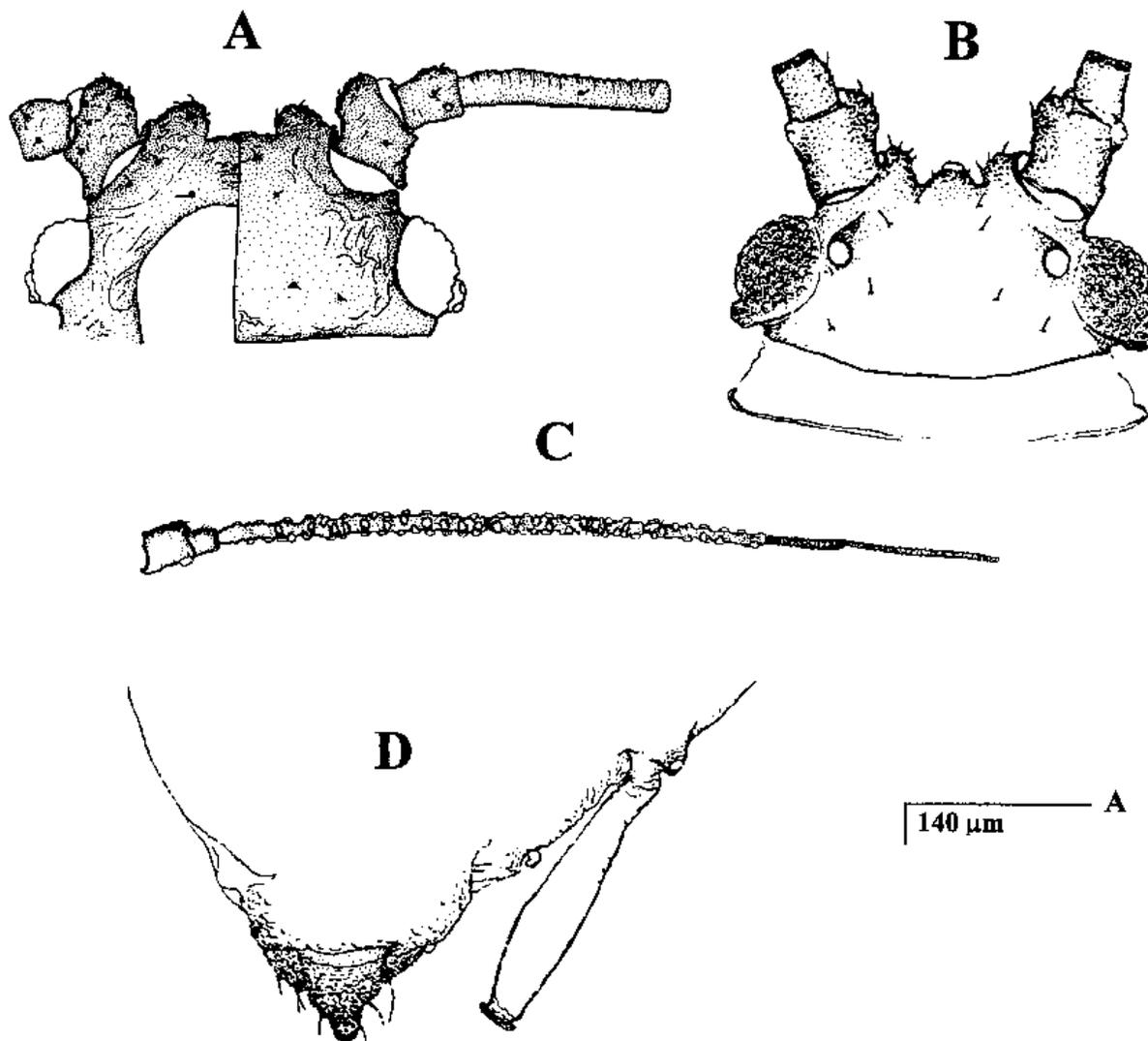


Fig. 13. *Hyalomyzus sensoriatus* (Mason). A. Ovipara dorsum of head and 1st 3 antennal segments, right side; ventral surface of head and 1st 2 antennal segments, left side. B. Dorsum of head of alata (from Mason 1940). C. Antenna of alata (from Mason 1940). D. Posterior of abdomen of alata (from Mason 1940).

**Field Features.** Aptera, pale yellow to green yellow in spring and early summer, fall specimens darker yellow-green abdomen and yellow head and thorax with pale yellow appendages (Voegtlin 1984); alatae, yellow to greenish yellow, darker green areas include head, pterothorax and antennae beyond base of segment III. Antennal I, II and base of III greenish yellow. Cornicles darkening distad, cauda deeper yellow than abdomen. Femora with basal  $\frac{1}{2}$  pale, distal  $\frac{1}{2}$  of femora, all tibiae and tarsi evenly dark green (Voegtlin 1984). The Maryland specimens did not have wax on the cauda.

**Recognition Characters.** Aptera: Body length 1.10–1.76; width through eyes, 0.26–0.29. Antennae 5 or 6-segmented, shorter than body; venter of segment II smooth; 5-segmented antennae: III, 0.13–0.23 long; IV, 0.08–0.13 long; base of V, 0.08–0.11; terminal process, 0.07–0.10 long; 6-segmented antennae: III, 0.11–0.13 long; IV, 0.09–0.12 long; V, 0.10–0.12 long; base of VI, 0.09–0.10 long; terminal process, 0.09–0.10 long. An-

terior setae on dorsum of head capsule short, less than half basal width of antennal segment III; dorsum of head without spinulation. Venter of head capsule adjacent to eyes smooth; ventral tubercles absent laterad to base of rostrum. Rostrum extending beyond mesocoxae; rostral segment III with 2 pairs of setae; ultimate segment 0.06–0.07 long, without accessory setae and shorter than hind tarsal segment II. Dorsal base of hind tibiae smooth or slightly wrinkled, hind tibia 0.31–0.51 long; hind tarsus II 0.08–0.11 long. Abdomen with maze-like sculpturing; spinal tubercles on abdominal tergite VII absent; abdominal tergite VIII with 2–4 setae, setae much shorter than basal width of antennal segment III. Cornicles scabrous, 0.27–0.42 long, swollen on apical half. Cauda 0.96–0.14 long, triangular, usually with 4 lateral setae and reduced apical spinulation with blank spaces dorsally.

Alatae: Body length 1.12–1.61; width through eyes, 0.36–0.34. Antennae shorter than body; III, 0.24–0.30 long, with 11–19 secondary sensoria distributed

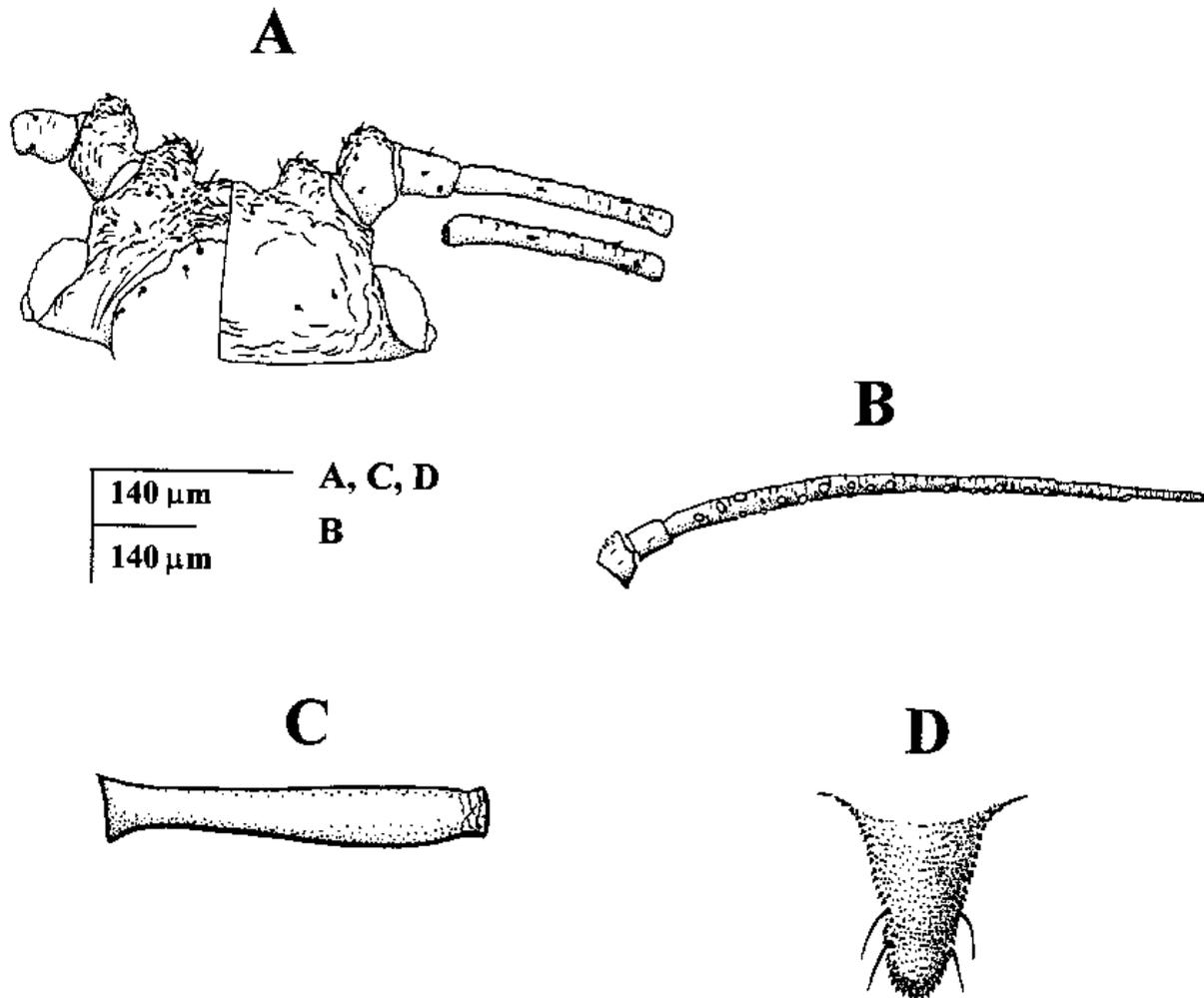


Fig. 14. *Hyalomyzus triangulatus* Voegtlin. A. Apterous dorsum of head and 1st 2 antennal segments, right side, with dorsal and ventral surface of antennal segment III; ventral surface of head and 1st 2 antennal segments, left side. B. Antenna of alata. C. Cornicle of aptera. D. Cauda of aptera.

around the entire circumference of segment; IV, 0.15–0.18 long, with 6–10 secondary sensoria; V, 0.12–0.16 long, with 3–6 secondary sensoria; base of VI, 0.08–0.12 long; terminal process, 0.07–0.12 long. Head setae and spinulation similar to aptera. Rostral length and setae similar to aptera, ultimate segment 0.54–0.64 long without accessory setae; mandible smooth laterally. Mesosternum with rows of minute spinules; hind tibia 0.49–0.65 long; hind tarsus II 0.09–0.11 long. Wing veins with slight testaceous highlighting. Abdominal tergum without patches or bands, surface sculpturing similar to aptera except less pronounced, abdominal tergite VIII with 4 setae; lateral abdominal tubercles absent. Cornicles 0.21–0.30 long, similar to aptera. Cauda 0.11–0.14 long, similar to aptera.

**Discussion.** Voegtlin (1984) thoroughly described this species, including all adult morphs and the life cycle. It is monoecious holocyclic on *Hypericum prolificum* and *Hypericum densiflorum*, with apterous males. It is known only from Illinois and Maryland.

Among all *Hyalomyzus* species, this 1 is unique in having extremely short, often 5-segmented antennae,

with the terminal process of segment VI about equally as long as the base of the segment. The cornicles of this species usually extend beyond the tip of the cauda, another unique feature. On *Hypericum densiflorum* it is very cryptic, feeding very closely appressed to the leaf surface, with its legs tucked close to the body.

**Material Examined.** U.S.A. Illinois: Pope Co., Eddyville, 3-V-80, 14-V-80, 16-V-82, 12-X-82, 10-XI-82, 20-XII-82, on *Hypericum prolificum*, D. Voegtlin, (1 al. ♂, 6 ov., 11 ap., 5 al., 3 fund., 3 imm. on 14 sl.) BMNH, INHS, USNM; reared in lab from 80 to 14, 25-V-80, on *Hypericum prolificum*, D. Voegtlin, (1 ap., 1 al. on 2 sl.) INHS; 20-XII-82, on *Hypericum prolificum*, D. Voegtlin, (1 ov.) INHS.

Maryland: Garrett Co., The Glades, TNC property, 29-VI-98, on *Hypericum densiflorum*, Miller & Jensen, (4 ap., 1 imm. on 4 sl.) USNM.

### Conclusions

Although several works on the North American *Hyalomyzus* have been published, the monophyly of

the genus or relationships among its species have never been analyzed cladistically. The results of our phylogenetic analyses may not be robust, but we believe *Hyalomyzus* still represents a valid genus. The exact relationship of *H. monardae* with other species of *Hyalomyzus* is unresolved, but we believe it should be considered a *Hyalomyzus* until further research dictates otherwise. Within the current study, we synonymize 1 species (*H. tissoti* = *H. jussiaeae*) and increase the number of North American species of *Hyalomyzus* with the description of *H. orphnophlebos* and *H. pocosinus*.

Several of the *Hyalomyzus* species are of economic interest. Included are those species of *Hyalomyzus* feeding on *Crataegus*, especially those plants used as ornamental specimens. Since hawthorns are ornamental trees and shrubs that exhibit attractive spring flowers, fall foliage, and red fruit in the winter, they are prized for landscape plantings. Heavy feeding damage could reduce the esthetic value of the plant, or worse, reduce its vigor. Replacement value for some of these plants may be high. Also of potential economic importance are those species of *Hyalomyzus* feeding on St. John's Wort (*Hypericum* spp.). The interest in St. John's Wort is currently related to its potential as an alternative treatment for depression, and its possible anti-cancer and anti-viral properties (Lee 1998). Additionally, a pigment found in the plant's leaves and flowers, hypericin, was found effective in pest control (Lee 1998). This is especially interesting in light of the fact that some species of *Hyalomyzus* are monoecious on *Hypericum*. Of interest is what defensive characteristics these aphids have developed in their association with the plant.

### Acknowledgments

We thank Sonja Scheffer and Michael E. Schauff of the U.S. Department of Agriculture, Systematic Entomology Laboratory, David J. Voegtlin of the Illinois Natural History Survey, and 2 anonymous reviewers for their helpful suggestion and critiques on this manuscript. We also appreciate Paul A. Brown, BMNH; Lewis L. Deitz, NCSU; Susan E. Halbert, FSCA; K. C. Kim, PSFM; Eric Maw, CNCI; and David J. Voegtlin, INHS for their cooperation in obtaining additional specimens for this study. Special thanks and appreciation is extended to Terence L. Schiefer, MSEM, for assistance in locating J. P. Kislanko's aphid specimens as well as copies of his field notes.

### References Cited

- Anonymous. 1995. *Rhopalosiphum monardae* Davis, 1911 (currently *Hyalomyzus monardae*; Insecta, Homoptera): specific name conserved. (Opinion 1818). Bull. Zool. Nom. 52: 281.
- Anonymous. 1998a. Integrated Taxonomic Information System [web page] [http://www.itis.usda.gov/plantproj/itis/itis\\_query.html](http://www.itis.usda.gov/plantproj/itis/itis_query.html) [accessed 18 February 1999].
- Anonymous. 1998b. The PLANTS National Database [web page] <http://plants.usda.gov/plants/index.html> [accessed 18 February 1999].
- Basu, R. C., M. R. Ghosh, and D. N. Raychaudhuri. 1976. Studies on the aphids (Homoptera: Aphididae) from eastern India XXXIV. Two new genera, three new subgenera, one new species and some new records from north east India. Entomon 1: 59-66.
- Bhattacharya, D. K. 1994. Notes on the genus *Hyalomyzus* Richards (Homoptera: Aphididae) with description of a new species from India. Oriental Insects 28: 199-203.
- Bremer, K. 1994. Branch support and tree stability. Cladistics 10: 295-304.
- Davis, J. J. 1911. Williams' "The Aphididae of Nebraska"; a critical review. University Studies of the University of Nebraska 11: 253-291 [pagination also 1-39].
- Eastop, V. F. 1966. A taxonomic study of Australian Aphidoidea (Homoptera). Austral. J. Zool. 14: 399-592.
- Eastop, V. F., and D. Hille Ris Lambers. 1976. Survey of the World's Aphids. Dr. W. Junk, b.v., The Hague.
- Eastop, V. F., and D. J. Voegtlin. 1990. Taxonomic notes on some North American aphids. Proc. Entomol. Soc. Wash. 92: 115-119.
- Hille Ris Lambers, D. 1973. Notes on some Oriental aphids, with descriptions of a new genus and four new species (Homoptera: Aphididae). Oriental Insects 7: 239-258.
- Hottes, F. C., and T. H. Frison. 1931. The plant lice, or Aphididae, of Illinois. Bull. Ill. Nat. Hist. Surv. 19: 121-447.
- Jensen, A. S. 1997. Redefinition of the aphid genus *Sitobion* Mordvilko (Homoptera: Aphididae) based on cladistic analyses, with emphasis on North American species. Syst. Entomol. 22: 333-344.
- Lee, J. 1998. Harvesting drugs from medicinal plants. Agric. Res. 46: 18-20.
- Maddison, W. P., and D. R. Maddison. 1992. MacClade: Analysis of Phylogeny and Character Evolution, version 3.0. Sinauer, Sunderland, MA.
- Mason, F. W. 1940. A revision of the North American aphids of the genus *Myzus*. U.S. Dep. Agr. Misc. Publ. 371: 1-30.
- Nielsson, R. J., and D. H. Habeck. 1971. The genus *Hyalomyzus* (Homoptera: Aphididae), with the description of a new species. Ann. Entomol. Soc. Am. 64: 883-887.
- Palmer, M. A. 1952. Aphids of the Rocky Mountains Region. Thomas Say Foundation 5: 1-452.
- Pepper, J. O. 1950. Six new aphids from Pennsylvania. Fla. Entomol. 33: 3-15.
- Pepper, J. O. 1965. A list of the Pennsylvania Aphididae and their host plants. Trans. Am. Entomol. Soc. 91: 181-231.
- Quednau, F. W. 1966. A list of aphids from Quebec with descriptions of two new species (Homoptera: Aphidoidea). Can. Entomol. 98: 415-430.
- Remaudière, G., and M. Remaudière. 1997. Catalogue of the world's Aphididae Homoptera Aphidoidea. Institut national de la Recherche Agronomique, Paris.
- Richards, W. R. 1958. A new aphid genus (Homoptera: Aphididae). Fla. Entomol. 41: 169-172.
- Smith, C. F. 1960. New species of Aphidae: Homoptera from Puerto Rico. J. Agr. Univ. Puerto Rico 44: 157-162.
- Smith, C. F. 1982. A key to the species in *Hyalomyzus* (Homoptera: Aphididae) in North America, with the description of a new species. Proc. Entomol. Soc. Wash. 84: 325-331.
- Swofford, D. L. 1993. PAUP: phylogenetic analysis using parsimony, version 3.1.1. Computer program distributed by the Illinois Natural History Survey, Champaign, IL.
- Thomas, C. 1879. Noxious and beneficial insects of the state of Illinois. Eighth Report of the State Entomologist 1-212.
- Tissot, A. N. 1935. A new *Myzus* from Florida. Fla. Entomol. 18: 49-52.

- Voegtlin, D. J. 1984. A new species of *Hyalomyzus* (Homoptera: Aphididae) from *Hypericum prolificum* in Illinois. Proc. Entomol. Soc. Wash. 86: 563-571.
- Voegtlin, D. J. 1994. *Rhopalosiphum monardae* Davis, 1911 (currently *Hyalomyzus monardae*; Insecta, Homoptera): proposed conservation of the specific name. (Case 2890): Bull. Zool. Nom. 51: 118-120.
- Williams, T. A. 1910. 1911. The Aphididae of Nebraska. University Studies of the University of Nebraska 10: 85-175 [also 1-91].

*Received for publication 1 December 1998; accepted 17 March 1999.*

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