

Revision of the Canadian species of *Amauromyza* Hendel (Diptera: Agromyzidae)

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Abstract—The Canadian fauna of the genus *Amauromyza* Hendel (Diptera: Agromyzidae) is revised and contains 11 species: *Amauromyza abnormalis* (Malloch), *A. angulicornis* Zlobin, *A. flavifrons* (Meigen), *A. karli* (Hendel), *A. luteiceps* (Hendel), *A. nevadensis* Spencer, *A. pleuralis* (Malloch), *A. riparia* Sehgal, *A. scleritica* Spencer, *A. shepherdiae* Sehgal, and *A. subinfumata* (Malloch). Among these, three species (*A. luteiceps*, *A. nevadensis*, and *A. scleritica*) are here newly recorded in Canada and *A. angulicornis* newly recorded in the United States of America. Other species are significantly more widespread in Canada than previously recorded. All species are redescribed and a new identification key to Canadian species is provided.

Résumé—La faune canadienne du genre *Amauromyza* Hendel (Diptera: Agromyzidae) est révisée et contient 11 espèces : *Amauromyza abnormalis* (Malloch), *A. angulicornis* Zlobin, *A. flavifrons* (Meigen), *A. karli* (Hendel), *A. luteiceps* (Hendel), *A. nevadensis* Spencer, *A. pleuralis* (Malloch), *A. riparia* Sehgal, *A. scleritica* Spencer, *A. shepherdiae* Sehgal et *A. subinfumata* (Malloch). Parmi celles-ci, trois espèces (*A. luteiceps*, *A. nevadensis* et *A. scleritica*) sont répertoriées pour la première fois au Canada et *A. angulicornis* est nouvellement répertoriée aux États-Unis. D'autres espèces se retrouvent beaucoup plus réparties à travers le Canada qu'elles ne l'étaient à l'origine. Toutes les espèces sont décrites à nouveau et une nouvelle clé d'identification des espèces canadiennes est donnée.

Introduction

Amauromyza Hendel was originally erected as a subgenus of *Dizygomyza* Hendel to accommodate a few black European species with black halteres (Hendel 1931a). The subgenus was later raised to full generic rank by Nowakowski (1962) and this decision was followed by subsequent authors who confirmed the homogeneity of the group based on male genitalic characters (Spencer 1971b). *Amauromyza* has now a worldwide distribution and consists of 60 species (Table 1). Externally, this genus is highly variable, with colour varying from completely black with partially or completely black halteres (similar to some species of *Nemorimyza* Frey) to species that are partially to largely yellow with white or yellow halteres (similar to species of *Calycomyza* Hendel or *Phytoliriomyza* Hendel). The orbital setulae are usually present and either reclinate or inclinate, but sometimes partially

proclinate (as in *Amauromyza scleritica* Spencer) or absent (as in *Amauromyza pleuralis* (Malloch)). The costa usually extends to vein M_{1+2} but only to R_{4+5} in two European species: *Amauromyza fraxini* (Beiger) (previously in *Aulagromyza* Enderlein) and *Amauromyza madrilena* Spencer. The presutural dorsocentral bristle is usually present. Correct identification to genus is possible only by using a combination of external (see “Diagnosis”) and genitalic characters (mainly the broadly rounded hypandrium and the large bowl-shaped base of the ejaculatory apodeme). Identification of Canadian species of *Amauromyza* is also difficult because the most recent key (Spencer 1969b) contained only three species: *A. abnormalis* (Malloch), *A. karli* (Hendel), and *A. subinfumata* (Malloch). Two other species, *A. flavifrons* (Meigen) and *A. pleuralis* were included in the genus *Trilobomyza* Hendel, later treated as a subgenus of *Amauromyza* (Spencer 1971b) and synonymised with subgenus *Cephalomyza*

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Table 1. Checklist of world species of *Amauromyza* with biogeographic regions.

Species	Geographical region
<i>A. (Ceph.) abnormalis</i> (Malloch)	Nearctic
<i>A. acuta</i> Sasakawa (subgenus unassigned)	Palaeartic
<i>A. (Ceph.) albidohalterata</i> (Malloch)	Nearctic
<i>A. (A.) aliena</i> (Malloch)	Oriental
<i>A. (Ceph.) angulicornis</i> Zlobin	Nearctic
<i>A. (Ceph.) anomala</i> Spencer	Nearctic
<i>A. (Ceph.) auriceps</i> (Melander)	Nearctic
<i>A. (A.) balcanica</i> Hendel	Palaeartic
<i>A. (Ceph.) belamcandae</i> Sasakawa	Palaeartic
<i>A. (Ceph.) bifida</i> Sasakawa	Palaeartic
<i>A. (Ceph.) boliviensis</i> Sasakawa	Neotropical
<i>A. caliginosa</i> Spencer (subgenus unassigned)	Australasian
<i>A. (A.) carlinae</i> (Hering)	Palaeartic
<i>A. (Ceph.) chamaebalani</i> (Hering)	Palaeartic
<i>A. (Ceph.) chenopodivora</i> Spencer	Palaeartic
<i>A. (A.) clinopodii</i> Sasakawa	Palaeartic
<i>A. (Ceph.) confodata</i> Spencer	Nearctic
<i>A. (Ceph.) crucifera</i> Sasakawa	Oriental
<i>A. (A.) elaeagni</i> (Rohdendorf-Holmanová)	Palaeartic
<i>A. (Ceph.) elsinorensis</i> Spencer	Nearctic
<i>A. (Ceph.) flavida</i> Spencer	Palaeartic, Oriental
<i>A. (Ceph.) flavifrons</i> (Meigen)	Holarctic
<i>A. (Ceph.) fraxini</i> (Beiger)	Palaeartic
<i>A. (Ceph.) gyrans</i> (Fallén)	Palaeartic
<i>A. indecisa</i> (Malloch) (subgenus unassigned)	Nearctic
<i>A. (Ceph.) insularis</i> Spencer	Nearctic
<i>A. (Ceph.) karli</i> (Hendel)	Holarctic
<i>A. (Ceph.) knowltoni</i> Spencer	Nearctic
<i>A. (Ceph.) labiatarum</i> (Hendel)	Palaeartic
<i>A. (A.) lamii</i> Kaltenbach	Palaeartic
<i>A. (A.) leonuri</i> Spencer	Palaeartic
<i>A. (Ceph.) lucens</i> Spencer	Nearctic
<i>A. (Ceph.) luteiceps</i> (Hendel)	Holarctic
<i>A. (Ceph.) madrilena</i> Spencer	Palaeartic
<i>A. (A.) maltensis</i> Cerny	Palaeartic
<i>A. (Ceph.) mihalyii</i> Spencer	Palaeartic
<i>A. (Ceph.) monfalconensis</i> (Strobl)	Palaeartic
<i>A. (A.) morionella</i> (Zetterstedt)	Palaeartic
<i>A. (Ceph.) nevadensis</i> Spencer	Nearctic
<i>A. (Ceph.) nipponensis</i> Sasakawa	Palaeartic
<i>A. (A.) nigripennis</i> Sasakawa	Palaeartic
<i>A. (A.) obscura</i> (Rohdendorf-Holmanová)	Palaeartic
<i>A. (A.) papuensis</i> Spencer	Australasian
<i>A. (A.) plectranthi</i> Sasakawa	Palaeartic

Table 1. Continued

Species	Geographical region
<i>A. (Catal.) pleuralis</i> (Malloch)	Nearctic
<i>A. (A.) queenslandica</i> Spencer	Australasian
<i>A. (A.) rameli</i> Cerny	Palaeartic
<i>A. (Ceph.) riparia</i> Sehgal	Nearctic
<i>A. (Ceph.) remus</i> Spencer	Nearctic
<i>A. (Ceph.) romulus</i> Spencer	Nearctic
<i>A. (Ceph.) schusteri</i> Spencer	Nearctic
<i>A. (Ceph.) shepherdiae</i> Sehgal	Nearctic
<i>A. (Ceph.) scleritica</i> Spencer	Nearctic
<i>A. (Ceph.) strobli</i> (Hendel)	Palaeartic
<i>A. (Ceph.) subinfumata</i> (Malloch)	Nearctic
<i>A. triseta</i> (Spencer) (subgenus unassigned)	Afrotropical
<i>A. (Ceph.) verbasci</i> (Bouché)	Palaeartic
<i>A. (Ceph.) volans</i> Singh & Ipe	Oriental
<i>A. (Ceph) sp. (Colo.)</i> (Spencer and Steyskal 1986)	Nearctic
<i>A. (Ceph.) sp. (Cuba)</i> (Spencer and Stegmaier 1973)	Neotropical

Note: *A. (Annimyzella) maculosa* (Malloch), *A. (Annimyzella) fuscibasis* (Malloch), and *A. (Annimyzella) ranchograndensis* Spencer were transferred to the genus *Nemorimyza* and *Amauromyza (Annimyzella) lathyroides* Spencer was transferred to the genus *Liriomyza* (Zlobin 1996); *A. (Ceph.) soozii* Zlobin is a synonym of *A. (Ceph.) chamaebalani* (Hering) (Spencer and Martinez 1987).

Hendel by Spencer and Steyskal (1986). New species descriptions, nomenclatural changes, and a new concept of the genus supported by genitalic characters have raised the number of Canadian *Amauromyza* species to 11: *A. abnormalis*, *A. angulicornis* Zlobin, *A. flavifrons*, *A. karli*, *A. luteiceps* (Hendel), *A. nevadensis* Spencer, *A. riparia* Sehgal, *A. scleritica* Spencer, *A. shepherdiae* Sehgal, *A. subinfumata*, *A. pleuralis*. Among these, *A. nevadensis* and *A. scleritica* previously known from the United States of America and *A. luteiceps* previously known from the Palaeartic region are here newly recorded in Canada.

There has been uncertainty in the past on the limit and validity of some subgenera of *Amauromyza*. The subgenera *Amauromyza*, *Catalpomyza* Spencer, and *Cephalomyza* remain valid but further investigation is needed (Zlobin 1996). Most Canadian species belong to *Cephalomyza* (recognised by the spiny membrane

associated with the distiphallus), except *A. pleuralis*, which is in the monotypic subgenus *Catalpomyza*.

Host plants are known for 26 species of *Amauromyza*. Among these, 23 species (excluding *Amauromyza morionella novakii* [Strobl 1902], a synonym of *A. morionella* [according to Spencer 1966]) are listed in Benavent-Corai *et al.* (2005). Additions to that list include *Amauromyza (A.) aliena* (Malloch) on *Callicarpa formosana* Rolfe (Lamiaceae) (Spencer 1986); *Amauromyza (A.) clinopodii* Sasakawa on *Clinopodium chinense grandiflorum* (Maximovicz) (Lamiaceae) (Sasakawa and Matsumura 1998); and an undescribed species *Amauromyza (Ceph.)* sp. (Cuba) reared from *Commelina erecta* Linnaeus (Commelinaceae) (Spencer and Stegmaier 1973; Spencer 1990). Species with known natural history are either linear-blotch miners or internal stem-borers. In Canada, the host plants have been confirmed for only four species of *Amauromyza* and belong to the families Elaeagnaceae, Amaranthaceae, Caryophyllaceae, and Bignoniaceae.

Materials and methods

This study is based on specimens housed in the Biodiversity Institute of Ontario, Guelph, Ontario, Canada (BIOUG); the Canadian National Collection of Insects, Arachnids & Nematodes, Ottawa, Ontario, Canada (CNC); the University of Guelph Insect Collection, Guelph, Ontario, Canada (DEBU); Lyman Entomological Museum, McGill University, Ste-Anne-de-Bellevue, Québec, Canada (LEM); the Museum of Zoology, Lund University, Sweden (MZLU); the Royal British Columbia Museum, Victoria, British Columbia, Canada (RBCM); and the Spencer Museum, University of British Columbia, Vancouver, British Columbia, Canada (UBCZ). Morphological terminology follows Cumming and Wood (2009) except that orbital and frontal setae are referred to ors and ori, respectively. The clypeus is \cap -shaped and the thickness refers to the width of the sclerite between the outer and inner margins. Abbreviations are as follows: dc: dorsocentral bristles (numbered starting posteriorly); ors: orbital setae; ori: frontal setae. Distribution of species is based on published data and on specimens examined. Asterisks in distribution lists indicate new locality records.

Taxonomic treatment

Amauromyza Hendel

Redia Lioy (1864): 1313. Preoccupied by *Redia* Filippi, 1837 (Trematoda). Type species: *Agromyza gyrans* Fallén (1823), by subsequent designation of Coquillett (1910: 599). Synonymy Frick (1952: 394) (as *Calycomyza*). Synonymy Spencer and Martinez (1987: 256) (as *Amauromyza*).

Amauromyza Hendel (1931a: 59) (as subgenus of *Dizygomyza*). Type species: *Agromyza lamii* Kaltenbach (1858), by original designation.

Phytobia (Amauromyza): Frick (1952: 393).

Amauromyza: Nowakowski (1962: 97); Spencer (1969b: 157); Spencer (1971a: 252); Spencer (1971b: 158); Spencer (1976: 156); Spencer (1981: 141); Spencer and Steyskal (1986: 78); Zlobin (1996: 271).

Irenomyia Nowakowski (1960: 421). Type species: *Xeniomyza obscura* Rohdendorf-Holmanová (1959), by monotypy. Synonymy Spencer and Martinez (1987: 256).

Melanophytobia Hering (1960: 127) (as subgenus of *Phytobia*). Type species: *Phytobia chamaebalani* Hering (1960), by monotypy. Synonymy Spencer and Martinez (1987: 256).

Campanulomyza Nowakowski (1962: 97). Type species: *A. gyrans* Fallén (1823), by monotypy. Synonymy Spencer (1976: 156).

Trilobomyza Hendel (1931b: 71) (as subgenus of *Dizygomyza*). Type species: *Agromyza flavifrons* Meigen (1830), by original designation. Synonymy Spencer and Steyskal (1986: 273).

Diagnosis

Canadian species of *Amauromyza* can be differentiated from other genera of Agromyzidae (subfamily Phytomyzinae) by a combination of characters including: orbital setulae erect, reclinate, or inclinate; vein M_{1+2} closer to wing tip than R_{4+5} ; wing with costa extending to apex of M_{1+2} ; foretibial and midtibial bristles absent; calypter fringe usually brown or black (yellow in *A. pleuralis*); halter usually black or partially darkened (completely yellow in *A. flavifrons*, *A. karli*, *A. luteiceps*, and *A. pleuralis*); anepisternum usually completely dark (except in *A. pleuralis*). Genitalic characters include: sperm pump of ejaculatory apodeme with characteristic bowl-shaped base; broad and largely rounded hypandrium; subepandrial sclerites broadly separated from each

other; surstylus absent; pregonite without long inner process connecting it to anterior margin of aedeagal hood (Zlobin 1996). Members of the subgenus

Cephalomyza are characterised by having the distiphallus ending in paired sclerites, which are surrounded by a spinulose membrane (Spencer 1981).

Key to Canadian species of *Amauromyza*

1. Legs yellow; bristles on head, thorax, and legs very pale; anepisternum yellow; two well-developed dc; head completely yellow including antenna and palpus (frons and antenna at most dusted with grey); frons only moderately projecting and parafacial narrow (Fig. 7); male forecoxa with a strong, white, flattened inner bristle (Fig. 24); phallus pale and membranous (Figs. 47, 48), apparently without spinulose membrane *Amauromyza (Catalpomyza) pleuralis* (Malloch)
- Legs brown, at most femora yellow on distal third; all bristles dark brown; anepisternum dark; at least three well-developed dc; male forecoxa without strong, white, flattened inner bristle; phallus usually well sclerotised and partly surrounded by spinulose membrane 2
2. Head, including antenna and palpus, yellow (upper orbit may be darker). 3
- At least antenna and/or palpus brown 4
3. Legs mostly brown with femora only narrowly yellow at apex (Fig. 4); epistoma conspicuously broad and projecting towards antennae (Fig. 15); phallus as in Figures 37–38; distiphallus with one tuft of setae present on side of each sclerite, most easily observed in ventral view (Fig. 38, arrow) *Amauromyza karli* (Hendel)
- Femora yellow on distal third; epistoma not as broad (Fig. 16); phallus as in Figures 41–42; distiphallus without tufts of setae. *Amauromyza luteiceps* (Hendel)
4. Head bright yellow except for darker antenna and palpus (Figs. 3, 9) 5
- Head mostly dark brown, at most frons and gena partially yellowish brown 6
5. Arista 0.3–0.4 mm long (at least 3.5 times length of first flagellomere); frons and parafacial at most weakly projecting, gena narrow, less than 0.2 times maximum eye height (Fig. 3); oviscape normal, approximately 1/3 length of abdomen in dorsal view; phallus as in Figures 34–35 *Amauromyza flavifrons* (Meigen)
- Arista 0.16–0.20 mm long (not more than twice length of first flagellomere); frons and parafacial strongly projecting, gena deep, over 0.3 times maximum eye height; oviscape long (Fig. 56), at least 1/2 length of abdomen in dorsal view; phallus as in Figures 53–54 *Amauromyza scleritica* Spencer
6. Knob of halter almost completely dark brown, at most white at suture; arista 0.35–0.40 mm long (at least 3.5 times length of first flagellomere); frons strongly projecting and parafacial broad (Fig. 1); epistoma large (Fig. 12); head and body completely brown, frons and gena sometimes paler, orange brown or yellowish brown; two ors and three ori; gena very deep, strongly extended at rear; 3 + 1 well-developed dc; phallus as in Figures 25–26, 27 *Amauromyza abnormalis* (Malloch)
- Not exactly as above. 7
7. First flagellomere slightly angulate and gena deepest at midpoint (Fig. 2); orbital plate widening at level of ors (Fig. 23); four orbital bristles; clypeus sunken deep inside mouth margin; phallus as in Figures 30–32 *Amauromyza angulicornis* Zlobin
- First flagellomere rounded; gena deepest at rear; orbital plate parallel sided or very slightly widening at level of ors; clypeus in line with ventral margin of gena (in lateral view) or only slightly sunken; number of orbital bristles variable; phallus not as above 8
8. Epistoma well developed and projecting anteriorly towards antennae (Fig. 17); phallus as in Figures 44–45 *Amauromyza nevadensis*
- Epistoma absent or weakly developed (Fig. 19, 22); phallus not as above 9
9. Arista 0.18–0.20 mm long; three inclinate ori and two reclinate ors; mesonotum distinctly pale grey; phallus as in Figures 50–51 *Amauromyza riparia* Sehgal
- Arista 0.22–0.27 mm long; number of orbital bristles variable; mesonotum darker, brown or black; phallus not as above 10
10. Four orbital bristles (two inclinate ori, two reclinate ors), lower ors closer to ori than to posterior ors; arista 0.25–0.27 mm long; phallus as in Figures 57–59 *Amauromyza shepherdiae* Sehgal
- Five orbital bristles (three inclinate ori, two reclinate ors), lower ors equidistant between posterior ori and posterior ors; arista shorter, 0.22–0.24 mm long; phallus as in Figures 61–62. *Amauromyza subinfumata* (Malloch)

***Amauomyza (Cephalomyza)*
abnormalis (Malloch)**

(Figs. 1, 12, 25–28)

Agromyza abnormalis Malloch, 1913: 320.

Dizygomyza (Amauomyza) abnormalis: Hendel (1931a: 59). (misidentification = *Amauomyza chenopodivora* Spencer).

Phytobia (Amauomyza) abnormalis: Frick (1952: 393; 1959: 378).

Amauomyza abnormalis: Spencer (1969b: 158; 1990: 65).

Amauomyza (Cephalomyza) abnormalis: Spencer (1981: 148); Spencer and Steyskal (1986: 80).

Specimens examined: **CANADA: British Columbia:** Robson, 13.vi.1952, H.R. Foxlee (1 ♀: CNC). **Manitoba:** Brandon, 6.viii.1958, J.G. Chillcott (2 ♀: CNC); same except 10.viii.1958 (1 ♀: CNC); 5 mi. N. Minnedosa, 8.vii.1958, R.L. Hurley (1 ♀: CNC); Winnipeg, St. Charles Rifle Range (49°54.6'N, 97°20.5'W), Malaise trap at poplar forest/tallgrass prairie edge 3–10.vii.1998, Pollock & Roughley (1 ♀: LEM). **Ontario:** Chatham, 29.viii.1928, A.B. Baird (1 ♀: CNC); Essex Co., East Sister I. Prov. Nat. Res., 41°49'N, 82°51'W, 30.vii.2003, dry pond bed, yellow pans, S.A. Marshall (9 ♂: DEBU); same except cormorant colony (4 ♂: DEBU); Essex Co., East Sister I. Prov. Nat. Res., 41°49'N, 82°51'W, 30.vii.2003, sweeping, S.A. Marshall, debu00238339 (1 ♂: DEBU); Essex Co., Middle I., 41°41'N, 82°41'W, yell. pans in mud, 11.vi.2003, S.A. Marshall (8 ♂: DEBU); except yellow pans, 4.vii.2003, Marshall, Paiero & Cheung (3 ♂: DEBU); Lambton Co., Port Franks, Watson Property near L-lake, 19.viii.1996, J. Skevington (1 ♂: DEBU); Ottawa, 11.vii.1957, J.E.H. Martin (1 ♀: CNC); Ottawa, Damp second-growth *Acer-Betula* wood, 5.vii.1994, J.R. Vockeroth (1 ♂: CNC); Marmora, 10.vi.1952, J.R. Vockeroth (1 ♂: CNC). **Québec:** Abbotsford, 19.vi.1937, G. Shewell (1 ♂: CNC). **UNITED STATES OF AMERICA: Arizona:** Patagonia, 13.vi.1992, Sonoita Creek Pres. Malaise, Grass/Nettle meadow, JS and AG (2 ♂: DEBU); Santa Cruz Co. Patagonia (31.53'N, 110.77'W), Malaise trap, 28.v.1995, B. Brown & E. Wilk (4 ♂: LEM); same except 15.vii.1995 (1 ♂; 2 ♀: LEM); same except 23.vii.1995 (3 ♂: LEM); same except

13.viii.1995 (1 ♀: LEM); same except (31.58'N, 110.77'W), Malaise trap, 01.vii.1995 (1 ♂: LEM). **New Mexico:** Grant Co. 14 mi. N. Silver City, Cherry Ck Cmpgrd (32°54.8'N, 108°13.6'W), 7400', Malaise trap, 14–16.viii.2007, J.E. O'Hara (2 ♂: LEM); Roosevelt Co. Portales 4000', 23–26.viii.1993, O'Hara & Jorgensen, Malaise (1 ♂: LEM).

Redescription. Frons width (including orbital plates) 0.27–0.40 mm; usually three inclinate ori (sometimes four) and two reclinate ors (upper ors sometimes directed slightly outwards); orbital setulae short, erect, or reclinate; frons strongly projecting in profile and parafacial broad, forming distinct ring below eye (Fig. 1); gena deep, at midpoint approximately 0.30 times maximum eye height, gena much deeper at rear (Fig. 1); first flagellomere rounded; arista normal, approximately 0.35–0.40 mm long (at least 3.5 times length of first flagellomere); clypeus shiny or subshiny, medium thickness; epistoma broad (Fig. 12). 3 + 1 well-developed dc; acr in approximately five rows. Wing length 1.85–2.20 mm (♂) and 2.20–2.70 mm (♀) (up to 3.20 mm according to Spencer 1969b); last section of CuA₁ approximately 2.0–2.3 times penultimate.

Colour. Head usually completely brown, sometimes frons and gena paler, orange brown or yellowish brown; face, orbit, and parafacial sometimes contrastingly darker (black); clypeus black; epistoma pale brown or beige; thorax, abdomen, and legs completely brown; halter mostly brown except white at suture (narrowly or more extensively, sometimes leaving only a black spot apically); calypter pale brown, margin and fringe dark brown.

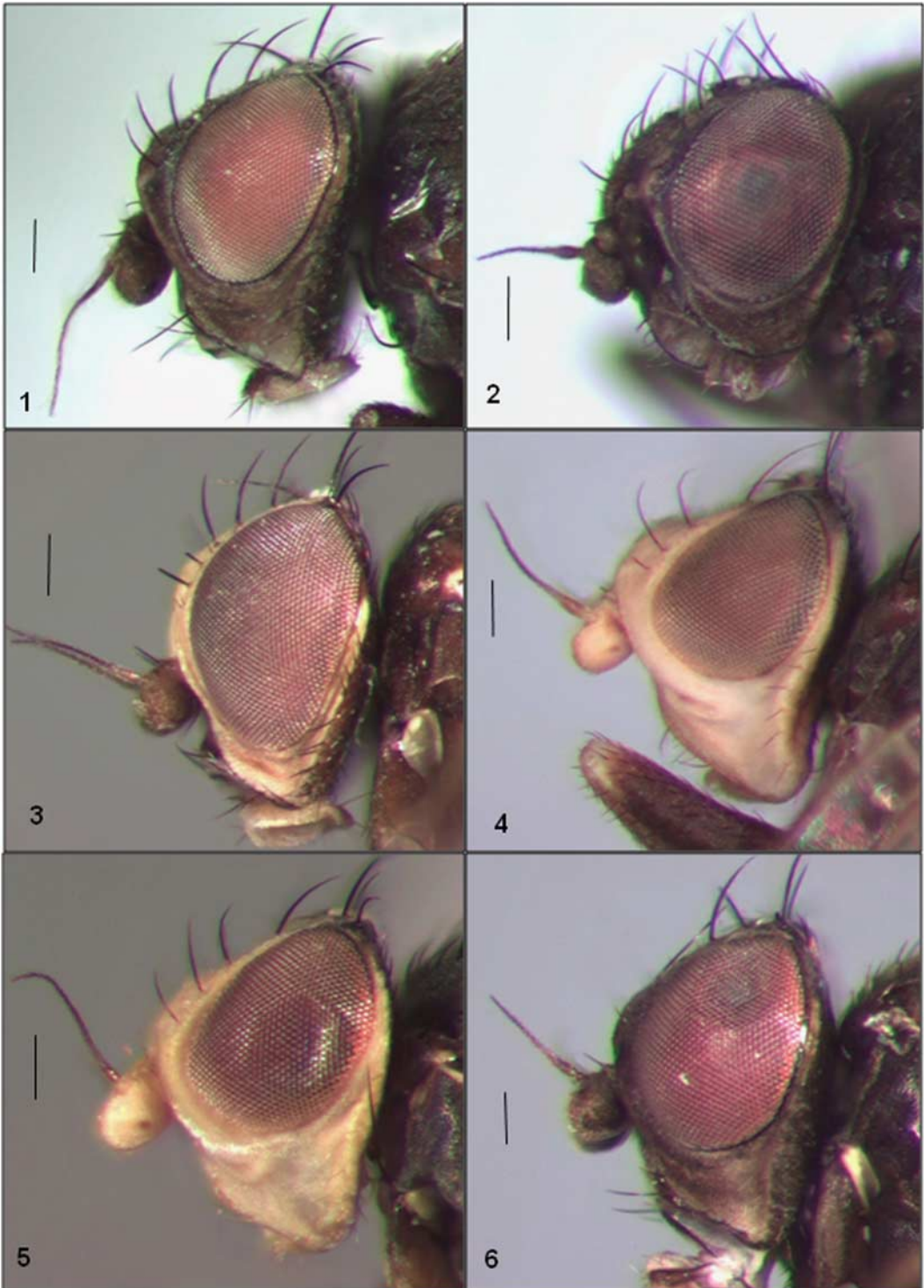
Genitalia: Phallus with distinct shape in lateral view (Figs. 25, 27); membrane of distiphallus large, covered with numerous small spines; ejaculatory apodeme with broad blade and large bowl-shaped base (Fig. 28).

Geographic distribution: Canada (BC*, MB*, ON, QC); United States (various states from CA to DC); Mexico (Bautista-Martinez *et al.* 1997).

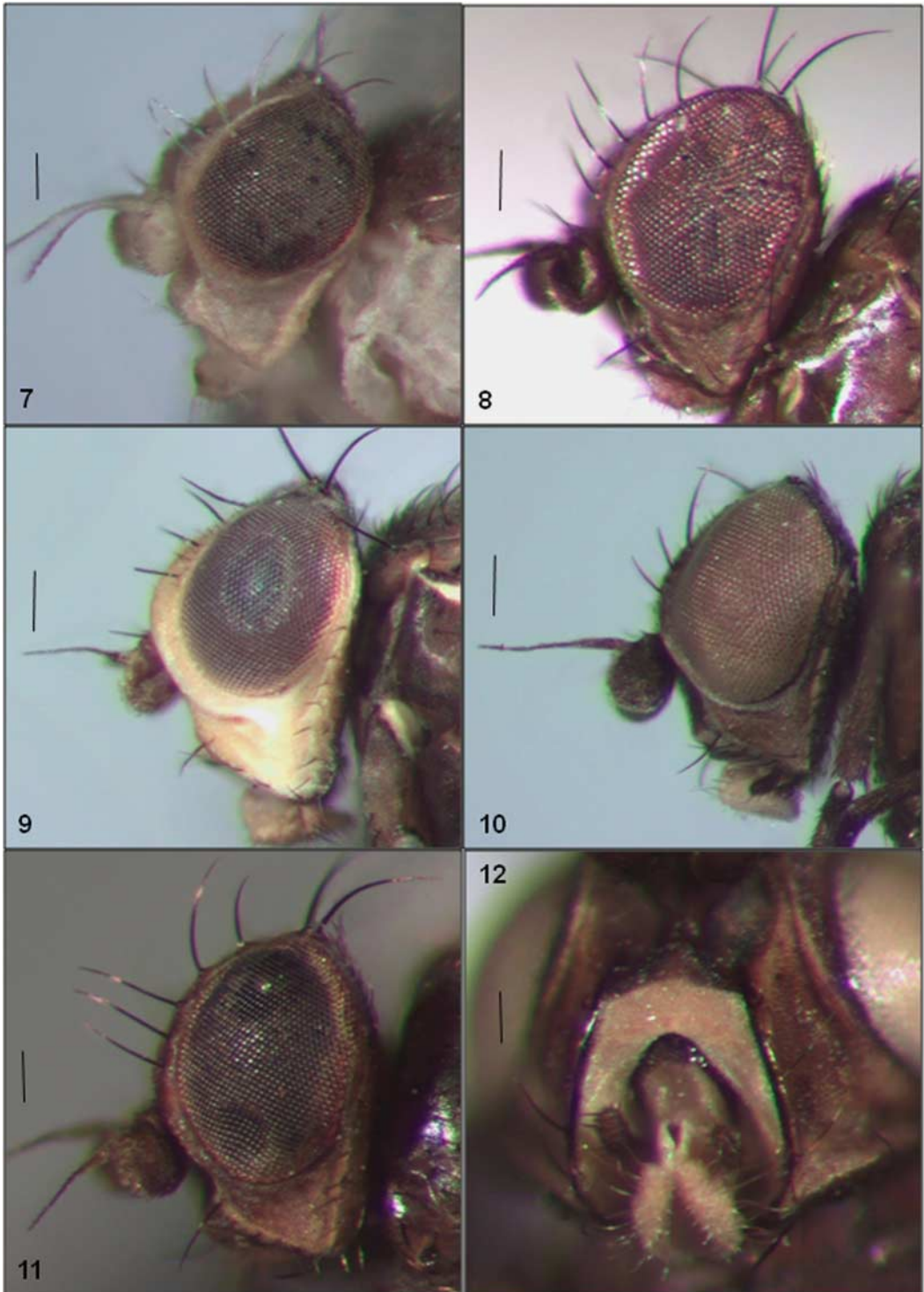
Host plant and natural history: Larva develops and pupates in stems of *Amaranthus* spp., (Amaranthaceae) (Spencer 1990).

Comments: Spencer (1981: 150) mentioned that the male specimen from Québec may represent a different species than the male from

Figs. 1–6. Head, lateral: (1) *Amauomyza abnormalis* (Malloch), (2) *Amauomyza angulicornis* Zlobin, (3) *Amauomyza flavifrons* (Meigen), (4) *Amauomyza karli* (Hendel), (5) *Amauomyza luteiceps* (Hendel), (6) *Amauomyza nevadensis* Spencer, (lower ors and lower ori missing). Scale bars = 0.1 mm.



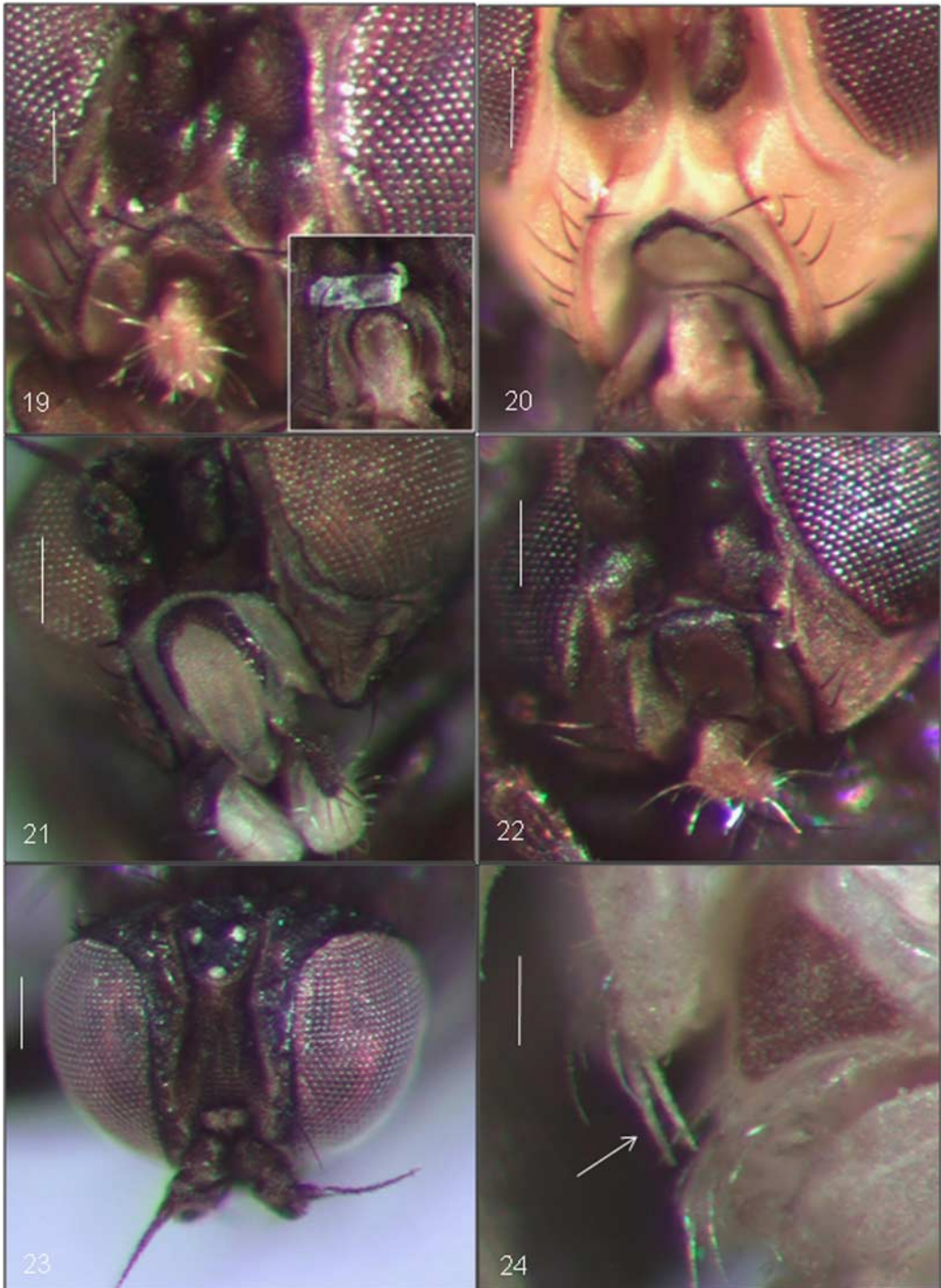
Figs. 7–12. Head, lateral: (7) *Amauomyza pleuralis* (Malloch), (8) *Amauomyza riparia* Sehgal (holotype), (9) *Amauomyza scleritica* Spencer, (10) *Amauomyza shepherdiae* Sehgal (upper ors missing), (11) *Amauomyza subinfumata* (Malloch). Clypeus (12) *Amauomyza abnormalis* (Malloch). Scale bars = 0.1 mm.



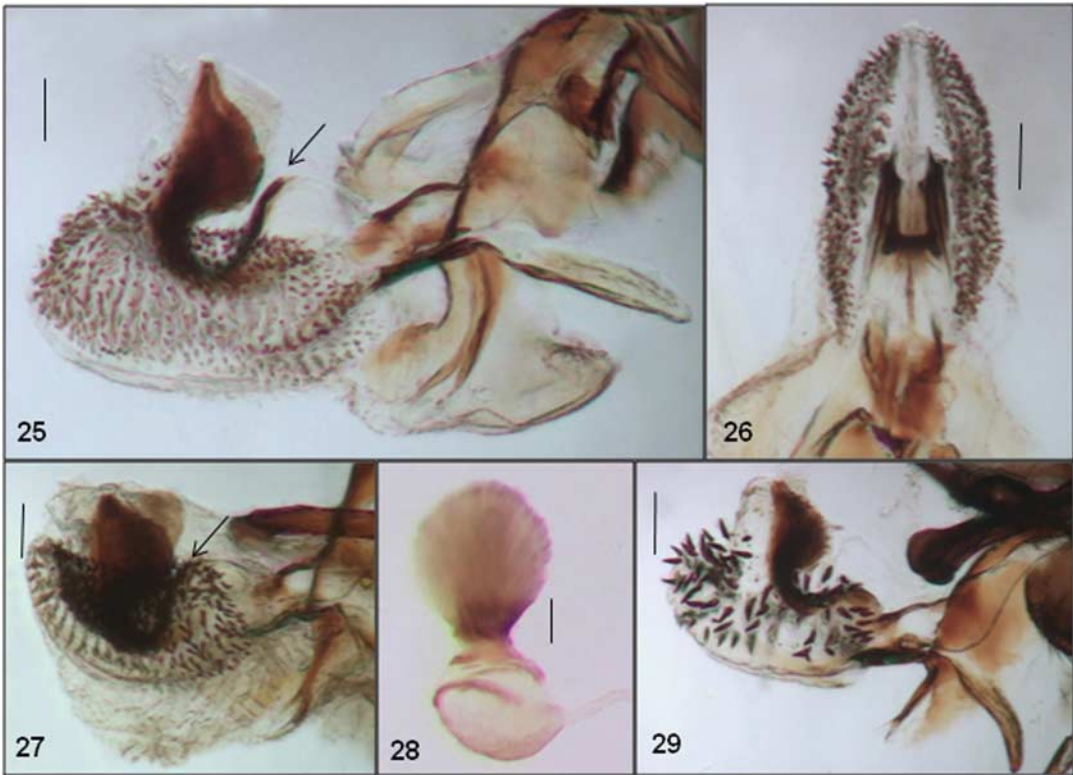
Figs. 13–18. Clypeus: (13) *Amauromyza angulicornis* Zlobin (female), inset: variation (male), (14) *Amauromyza flavifrons* (Meigen), inset: variation, (15) *Amauromyza karli* (Hendel), (16) *Amauromyza luteiceps* (Hendel) (male), inset: variation (female), (17) *Amauromyza nevadensis* Spencer, (18) *Amauromyza pleuralis* (Malloch). Scale bars = 0.1 mm.



Figs. 19–24. Clypeus: (19) *Amauromyza riparia* Sehgal (holotype), inset (paratype), (20) *Amauromyza scleritica* Spencer, (21) *Amauromyza shepherdiae* Sehgal, (22) *Amauromyza subinfumata* (Malloch). Head dorsal view: (23) *Amauromyza angulicornis* Zlobin. forecoxa (arrow – medial bristle). (24) *Amauromyza pleuralis* (Malloch) (male). Scale bars = 0.1 mm.



Figs. 25–29. *Amauromyza abnormalis* (Malloch): (25) phallus lateral, ON, (26) phallus ventral, ON, (27) phallus lateral, NM, (28) ejaculatory apodeme, ON. *Amauromyza chenopodivora* Spencer: (29) phallus lateral, Sweden. Scale bars = 0.05 mm.



California (both illustrated in Spencer (1981) and Spencer and Steyskal (1986)). Examination of the Québec specimen (QC: Abbotsford, CNC) confirmed that it is *A. abnormalis* and that the phallus is not as illustrated in Spencer (1969b, 1981) but is most similar to specimens examined from New Mexico (Fig. 27). Although this species had been considered Holarctic (Hendel 1931a; Papp 1984), records of *A. abnormalis* in the Palearctic are not valid (Spencer 1976); they represent *A. chenopodivora* Spencer (Spencer 1971b), a similar species restricted to the Palearctic region. Specimens of *A. chenopodivora* examined from Sweden (3 ♀; 3 ♂: MZLU) are slightly larger: 2.10–2.40 (♂) and 2.75–2.90 mm (♀) than *A. abnormalis* and the last section of CuA_1 is smaller, usually less than twice (approximately 1.85) the length of the penultimate section. The shape of the distiphallus (Fig. 29) is slightly different, especially in lacking the narrow basal extension that curves

upwards in *A. abnormalis* (arrow, Figs. 25, 27). The spines on the membrane of the distiphallus of *A. chenopodivora* are larger and less numerous (Fig. 29) than in *A. abnormalis* (Figs. 25, 27).

***Amauromyza* (*Cephalomyza*) *angulicornis* Zlobin**

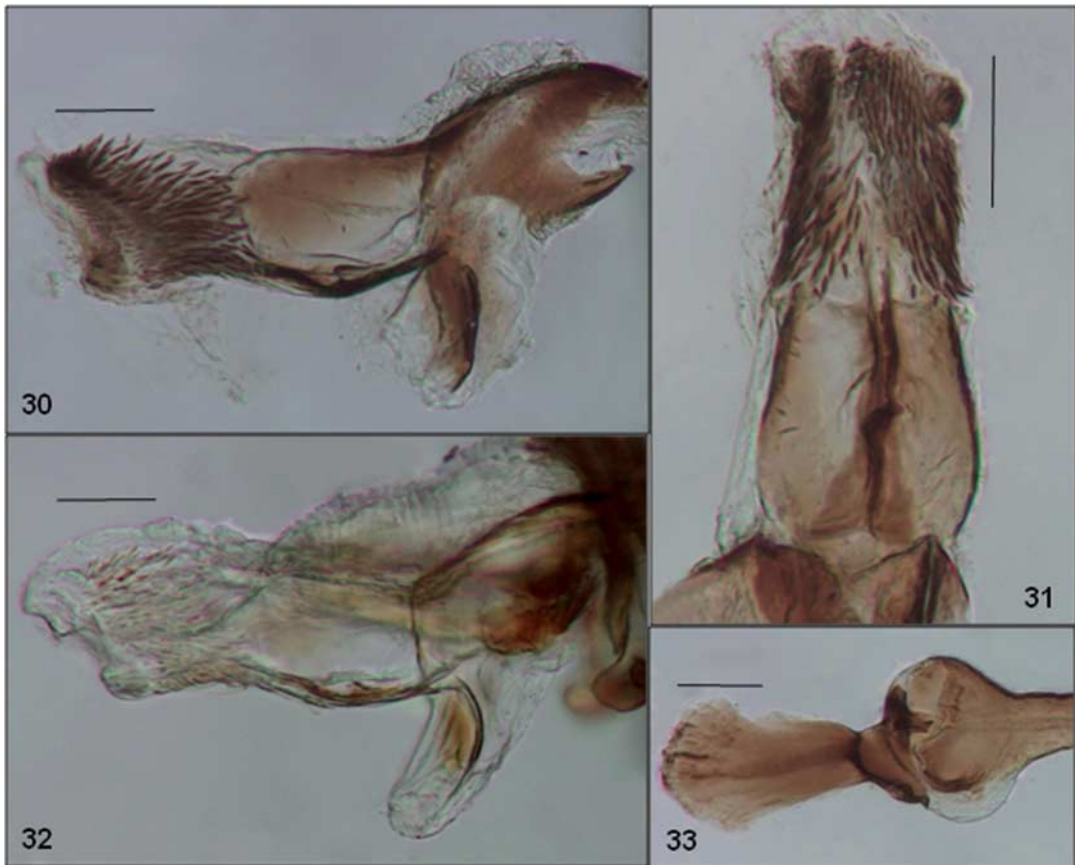
(Figs. 2, 13, 23, 30–33)

Amauromyza (*Cephalomyza*) *angulicornis* Zlobin, 1997: 88.

Type specimen examined: Holotype ♂. **CANADA: British Columbia:** Manning Park, 1700 m, 27.vi.1984, leg. R. Danielsson (MZLU) (head missing).

Other specimens examined: **UNITED STATES OF AMERICA: Wyoming:** Sheridan Co., Twin Buttes, (44.8060°, –107.5401°), 2441 m, sweep alpine meadow, 03.vii.2010, T.A. Wheeler (1 ♀: LEM); same except: Big Horn NF, Tongue

Figs. 30–33. *Amauromyza angulicornis* Zlobin: (30) phallus lateral, BC (holotype), (31) phallus ventral, BC (holotype), (32) phallus lateral, WY, (33) ejaculatory apodeme, BC (holotype). Scale bars = 0.05 mm.



Creek (44.8062°, -107.5399°), 2460 m, sweep alpine meadow, 02.vii.2010, A. MacLeod (1 ♂: LEM).

Redescription. Frons width (including orbital plates) 0.18–0.20 mm; orbital plates widening at level of ors (Fig. 23); four orbital bristles, including possibly three ori and one ors (as mentioned by Zlobin 1997) or two ori and two ors (division and orientation of ori and ors not clear); orbital setulae slightly reclinate; frons slightly projecting in profile, parafacial weakly developed, forming only narrow ring below eye; gena deepest at midpoint; approximately 0.26–0.30 times maximum eye height; first flagellomere slightly angulate at upper corner (Fig. 2); arista short, 0.18 mm (approximately twice length of first flagellomere); clypeus medium-thick, rounded; width 0.6 mm (arrow, Fig. 13); clypeus sunken deep inside mouth margin; epistoma well developed

(female, Fig. 13) or absent (male, inset Fig. 13). At least 4 + 1 dc (possibly more, but weakly developed); acr in approximately 5–6 irregular rows in holotype, 3–4 rows in other specimens. Wing length 1.4–1.6 mm in males, 1.5 mm in female; last section of CuA₁ approximately 2.6–2.8 times penultimate.

Colour. Head completely dark brown, except gena slightly paler brown; thorax, abdomen and legs all brown; calypter, margin and fringe brown; halter with pale brown stalk, knob mostly white or yellow, but narrowly pale brown at base.

Genitalia: Spinulose membrane of phallus well defined (Figs. 30–32); distiphallus short, membranous, about same length as mesophallus and extending slightly beyond spinulose membrane (most clearly visible in Fig. 32); mesophallus with well sclerotised ridge ventrally; ejaculatory apodeme with narrow blade and moderately large cone-shaped base (Fig. 33).

Geographic distribution: Western Nearctic (BC; WY*).

Host plant and natural history: Unknown.

Comments: This species was previously known only from the holotype, which has lost its head subsequent to the original description. Two additional specimens were identified in this study. The species is easily distinguished by its slightly angulate first flagellomere, short arista, and gena deepest in the centre.

***Amauromyza (Cephalomyza) flavifrons* (Meigen)**

(Figs. 3, 14, 34–36)

Agromyza flavifrons Meigen, 1830: 184.

Dizygomyza (Trilobomyza) flavifrons: Hendl (1931b: 71).

Trilobomyza flavifrons: Spencer (1969b: 160).

Amauromyza (Trilobomyza) flavifrons: Spencer (1971b: 159); Spencer (1976: 162); Spencer (1987: 877).

Amauromyza (Cephalomyza) flavifrons: Spencer and Steyskal (1986: 85, 275).

Specimens examined: **BELGIUM:** Welle, Wellemeersen Nature Reserve (50°54'N, 04°02'E), sweep 06.vii.2000, S.E. Brooks (1 ♀: LEM). **CANADA: British Columbia:** Penticton, West Bench, 11.vii.1986, R.A. Cannings, ENT991-13881 (1 ♀: RBCM); Point Grey, Vancouver, 20.v.1973 (2 ♀: CNC); same except, 22.vii.1973, J.R. Vockeroth (3 ♂; 4 ♀: CNC); same except 12.ix.1972 (2 ♀: CNC); West Bench, Penticton, 4.vi.1983, S.G. Cannings (1 ♂: UBCZ). **Ontario:** Algoma Distr., Tenby Bay, Lakeshore, Malaise, 30.vii.1992, J.E. Swann, debu00305901 (1 ♀: DEBU); same except 12.vii.1992, debu00298010 (1 ♀: DEBU); same except 13.viii.1992, debu00302367 (1 ♀: DEBU); Algoma Distr., Hilton Beach, 46°15'N, 83°53'W, 23.viii.1992, edge of hardwood forest & field, Malaise, J.E. Swann, debu00297245 (1 ♀: DEBU); same except 5.vii.1992, debu00297180 (1 ♂: DEBU); Cambridge, 27.viii.1979, K. Barber (1 ♀: DEBU); same except 20.viii.1979 (1 ♀: DEBU); Cherry Valley, Pr. Edward Co., 14.viii.1968, J.R. Vockeroth (1 ♂: CNC); Essex Co., Point Pelee Natl. Pk., Visitor Centre, Malaise & pans, O. Lonsdale, 5–26.ix.2000, debu01007104 (1 ♀: DEBU);

Figs. 34–36. *Amauromyza flavifrons* (Meigen): (34) phallus lateral, ON, (35) phallus ventral, ON, (36) ejaculatory apodeme, ON. Scale bars = 0.05 mm.



same except 26.ix-10.x.2000, debu01006835 (1 ♀: DEBU); same except 10–18.x.2000, debu01006739 (1 ♀: DEBU); same except 18.x-19.xi.2000, debu01006439 (1 ♀: DEBU); Forks of the Credit River, 5.vi.1981, J. Cairns (1 ♂: DEBU); Grey Co., Hepworth, Grey Sauble Authority Forests sweep of mature pine, 27.viii.1993, D.C. Caloren (2 ♂: DEBU); Guelph, 27.vii.1977, P. R. Heels (1 ♀: DEBU); Guelph, 22.vii.1978, B. Menard (1 ♀: DEBU); Guelph Dow backyard, veg sweep, 18.vii.1996, J.M. Dow (1 ♀: DEBU); Halton Co., Milton, 16 mile Crk. & 4th line sweep, 9.vi.2001, S. Paiero, debu00172584 (1 ♀: DEBU); Hilton Twp. Tenby Bay, Malaise at edge of lake & poplar forest, 26.vi.1992, J.E. Swann (1 ♀: DEBU); Lambton Co., Port Franks Watson Property near L-lake, 15–17.vii.1996, Malaise traps, J. Skevington (1 ♀: DEBU); Orleans, Chapel Hill, 28.v.1990, J.R. Vockeroth (1 ♀: CNC); Ottawa, Damp second-growth *Acer-Betula* wood, 27.vi.1989, J.R. Vockeroth (1 ♀: CNC); same except, 27.vi.1993 (1 ♂: CNC); same except, 10.vii.1989 (1 ♀: CNC); same except, 12.vii.1989 (1 ♀: CNC); same except, 15.vii.1989 (1 ♀: CNC); same except, 12.vii.1990 (1 ♂; 1 ♀: CNC); same except, 13.vii.1989 (1 ♀: CNC); same except, 18.vii.1989 (1 ♀: CNC); same except, 26.vii.1989 (1 ♀: CNC); same except, 18.viii.1989 (1 ♀: CNC); same except, 28.viii.1989 (1 ♂: CNC); same except, 10.ix.1989 (1 ♀: CNC); Owen Sound, 12.viii.1975, J.M. Cumming (1 ♀: DEBU); Pt. Pelee, 7.vii.1980, D.L. Krailo (1 ♂; 2 ♀: CNC); same except, 9.vii.1980, S. Beierl (1 ♂; 1 ♀: CNC); Stittsville, 19.viii.1968, J.R. Vockeroth (1 ♂: CNC); Thornhill, 30.v.1964 (1 ♂: CNC); Wellington Co., Fergus, Malaise, 21.v.1992, Marshall & Cannings (1 ♀: RBCM); Wellington Co., Guelph, Stone Rd. E. 2.ix.1992, Malaise, R.A. Cannings (1 ♀: RBCM); Weston, 22.vii.1978, W. Ralley (1 ♂: DEBU). **Québec:** Gaspé, Haldimand (48°47'N, 64°22'W), sweep path in forest, 18.viii.2001, H. Varady-Szabo (1 ♂: LEM); Mont St. Hilaire (45°32'N, 73°09'W), sweep vegetation at parking lot, 25.v.2001, T.A. Wheeler (2 ♀: LEM); Mont St. Hilaire Reserve, Rocky trail, sweep trail in forest, 19.vi.2007, Lyman students (1 ♀: LEM); Pointe Fortune Conservation Area (45°34'N, 74°23'W), 7.vii.1999, S.E. Brooks (1 ♀: LEM); Ste-Anne-de-Bellevue, Stonecroft Pond (45°25.8'N, 73°56.4'W), Malaise

near pond, 24.v.1998, S.E. Brooks (1 ♀: LEM). **UNITED STATES OF AMERICA:** **Michigan:** Marquette Co. ne/se T51N-R28W S 14, Emgd: 21.iii.2002, Surv: R.J. Priest. Reared EX *Silene pratensis*, Recv 24.ix.2001, LOT: RJP 1242.5 (1 ♂: LEM); same except, Emgd 8.iii.2002, LOT: RJP 1242.2 (1 ♀: LEM); same except, Emgd 19.iii.2003, Recv 23.ix.2002, LOT: RJP 1353.10 (1 ♀: LEM); same except, Emgd 22.iii.2002, LOT: RJP 1242.17 (1 ♀: LEM). **Oregon:** Marion Co., 1–5 rest area, 4.5 km NW Jefferson (44°44.41'N, 123°03.30'W), 60 m, 21.vi.2008, C. Borkent (1 ♀: LEM). **Vermont:** So. Randolph, Hwy 14, 27.vi.1980, B.V. Peterson (1 ♀: CNC). **Washington:** Mt. Baker, ne slope 900 m, 27.v.1973, J.R. Vockeroth (2 ♂: CNC).

Redescription. Frons width 0.25–0.33 mm; three inclinate ori and two reclinate ors, sometimes two or four ori on one side only; orbital setulae mostly inclinate or reclinate; frons not or very slightly projecting anterodorsally; gena at midpoint approximately 0.16–0.19 times maximum eye height, gena slightly deeper at rear (Fig. 3); first flagellomere rounded, with patch of short white setae apically; arista normal, length 0.30–0.40 mm (at least 3.5 times length of first flagellomere); clypeus thick with upper margin rounded; epistoma variable, moderately broad (Fig. 14), or weakly developed (Fig. 14, inset), upper margin rounded, not projecting anteriorly towards antennae. 3 + 1 well-developed dc; acr in approximately five rows. Wing length 1.8–2.0 mm in males and 2.00–2.25 mm in females (up to 2.7 mm according to Spencer 1969b); cell dm small: last section of CuA₁ approximately 2.3–3.0 times length of penultimate.

Colour. Frons and orbit yellow with vertical bristles on dark background; antenna, face, and palpus usually brown, but antenna sometimes paler to almost completely yellow; gena yellow (pale brown in one specimen); clypeus dark brown; epistoma white; thorax, abdomen, and legs brown (rarely rusty orange), foreknee faintly yellow; halter completely yellow; calypter and fringe brown.

Genitalia: Distiphallus consisting of one pair of well-sclerotised, black processes with spinulose membrane small and restricted to apex (Figs. 34, 35); ejaculatory apodeme large, with small bowl-shaped base (Fig. 36).

Geographic distribution: Eastern (ON, QC*) and Western (BC*) Canada; United States (DE,

MI*, OH, OR*, PA, VT*, WA*, WI); Palearctic (Spencer 1976).

Host plant and natural history: Larva forms a white blotch mine on many genera of Amaranthaceae and Caryophyllaceae (Spencer 1990). Mines were illustrated in Spencer (1976) and Spencer and Steyskal (1986).

Comments: This species was previously excluded from the subgenus *Cephalomyza* based in part on the apparent lack of spinules around the distiphallus (Spencer 1976). Although the spinulose membrane is not as developed in this species as in other species in the subgenus, it is still present apically, and the species was transferred to *Cephalomyza* by Spencer and Steyskal (1986). This species was previously known from the northeastern Nearctic region. Its presence in

Oregon, Washington, and British Columbia represents a considerable range extension.

***Amauromyza (Cephalomyza) karli*
(Hendel)**

(Figs. 4, 15, 37–40)

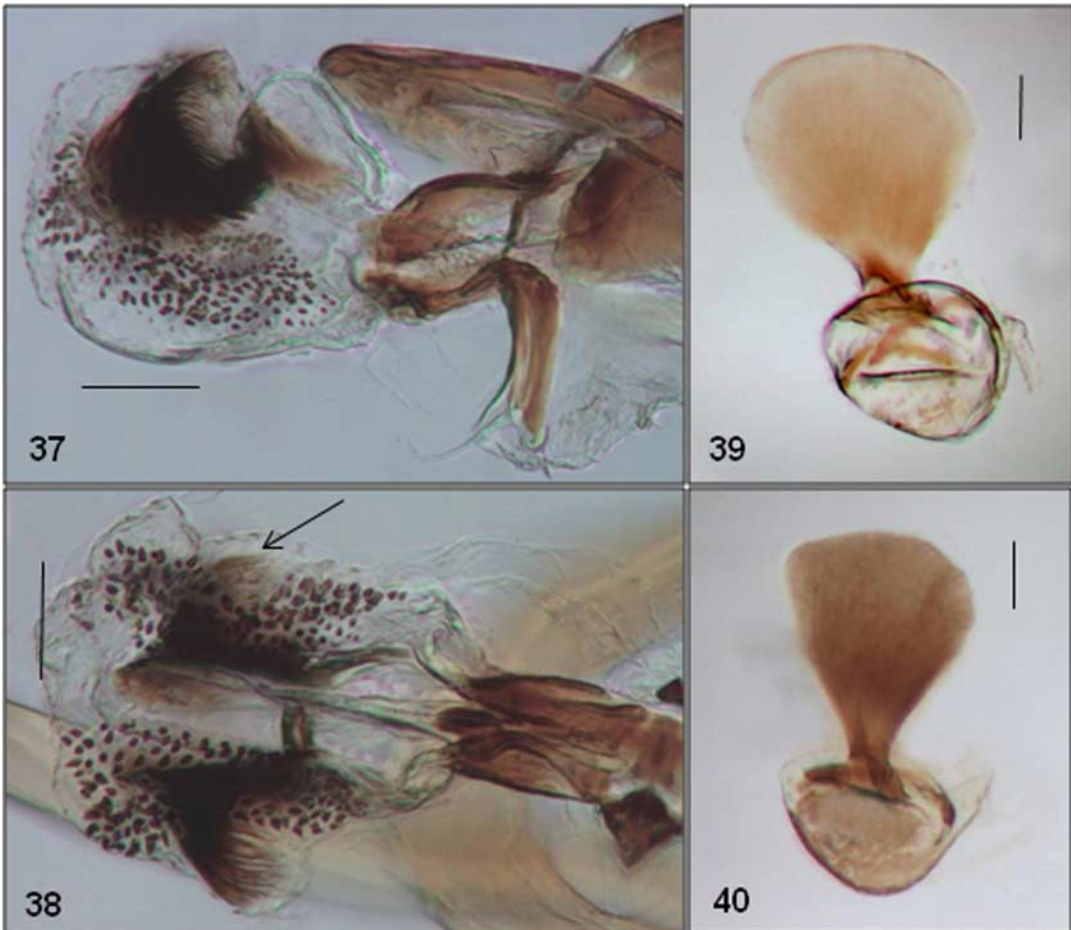
Dizygomyza Karli Hendel, 1927: 253.

Dizygomyza (Cephalomyza) Karli: Hendel (1931a: 34).

Amauromyza (Cephalomyza) karli: Spencer (1969b: 158; 1977: 242).

Specimens examined: CANADA: Alberta: Red Deer River, NW Dinosaur Prov. Pk. (50°50.5'N, 111°36.5'W), 06–09.vii.1997, J.E. O'Hara. Malaise trap (2 ♂; 4 ♀: LEM); S of

Figs. 37–40. *Amauromyza karli* (Hendel): (37) phallus lateral, ON, (38) phallus ventral, ON, (39) ejaculatory apodeme, ON, (40) ejaculatory apodeme, AB. Scale bars = 0.05 mm.



Onefour (49°00.7'N, 110°26.6'W), Malaise trap, 14–16.vii.1997, J.E. O'Hara (1 ♂: LEM). **Manitoba:** Aweme, Criddle farm (49°42'N, 99°36'W), sweep prairie N of house, 13.vi.1999, S. Boucher (1 ♀: LEM); near LaSalle, La Barrière Pk., sweep vegetation near river 15.vi.1999, S. Boucher (1 ♀: LEM); Winnipeg, Beaudry Prov. Pk. (49°51.5'N, 97°28.6'W), sweep disturbed meadow near Assiniboine River, 18.vi.1999, T.A. Wheeler (1 ♀: LEM). **Ontario:** Algonquin Prov. Pk., Arowhon Rd., Simm's Pit, 45°34'19"N, 78°42'41"W, yellow pans, 15–16.viii.2002, M. Buck, debu00225814 (1 ♂: DEBU); Elora, 11.viii.1971, G.A. Surgeoner (1 ♀: DEBU); Erin, 25.vii.1979, J. Ernst (1 ♀: DEBU); Manitoulin Island, 10 km W Gore Bay (45°53'N, 82°34'W), Malaise trap in grassland alvar, 21.viii.1996, P. Bouchard (1 ♀: LEM); Metcalfe, 4.viii.1991, B.E. Cooper (1 ♂: CNC); Oxford Co., Black Creek Swamp, near Drumbo, 20.vi.1993, J. Skevington, Black Ash wetland, sweep over body of roadkill snapping turtle (1 ♀: DEBU); Stonecliffe, Driftwood Prov. Pk., 2.ix.–5.x.79, S. Peck, Malaise, open pine plant, sand & heath (1 ♀: DEBU); Thunder Bay Distr., Neys Prov. Pk., Dune Trail, 48°46'52N, 86°36'53W, Malaise, 7–19.vii.2002, M. Buck, debu00215484 (1 ♂: DEBU). **Québec:** Chemin-du-Lac Bog (47°45'36.8"N, 69°31'35.5"W), pan trap, restored site, 21–26.vii.2006, A.G. Taillefer (1 ♂: LEM); Johnville Bog and Forest Park (45°20.7'N, 71°44.5'W), Malaise trap, 23–28.vi.2005, J. Savage & J. Kuchta (1 ♂: LEM); Ste-Anne-de-Bellevue, Stoneycroft Pond (45°25.8'N, 73°56.4'W), Malaise trap, 26.v.–01.vi.1999, S.E. Brooks (1 ♂; 3 ♀: LEM); St.-Charles Bog (46°45'48.0"N, 70°59'34.4"W), pan trap, abandoned site, 14–22.vi.2006, A.G. Taillefer (2 ♀: LEM); same except 7–14.vii.2006 (1 ♀: LEM); same except, Malaise trap, 7–9.vii.2006 (1 ♀: LEM); same except (46°44'52.1"N, 70°59'42.0"W), pan trap, restored site, 29.vi.–7.vii.2006 (1 ♀: LEM).

Redescription. Frons width 0.25–0.30 mm; three inclinate ori and one reclinate ors (one specimen with extra bristle on one side); orbital setulae inconspicuous, short and pale, mostly erect; frons strongly projecting in profile and parafacial broad, forming distinct ring below eye; gena very deep (Fig. 4), at midpoint approximately 0.35–0.45 times maximum eye height, gena strongly extended at rear; first flagellomere rounded or slightly

elongated; arista normal, length 0.36–0.40 mm (at least 3 times length of first flagellomere); clypeus thin with upper margin triangular; epistoma conspicuously broad and projecting anteriorly towards antennae (Fig. 15). Normally 3 + 1 dc, but sometimes 3 + 2 or 4 + 2; acr in two to four irregular rows. Wing length 1.7–2.0 mm in males and 2.0–2.5 mm in females; last section of Cu_{A1} approximately 1.8–2.3 times penultimate.

Colour. Head almost completely yellow, including antenna, face, epistoma, and palpus; at most upper orbit brown, sometimes just below ors; vertical bristles on dark background, but inner vertical sometimes at margin of yellow; clypeus brown; thorax and abdomen brown; legs mostly brown with femora narrowly yellow (about 0.1 times length of femora), tibiae sometimes narrowly yellow adjoining femora, and forecoxa sometimes yellow apically; halter yellow; calypter pale yellow or slightly darker, margin and fringe pale brown.

Genitalia: Distiphallus well sclerotised with spinulose membrane well defined; distiphallus with one tuft of setae present on side of each sclerite, most easily observed in ventral view (arrow, Fig. 38); ejaculatory apodeme with blade uniformly large (Fig. 39) or narrow basally and gradually expanding (Fig. 40).

Geographic distribution: Canada (AB*, MB*, ON, QC*); Palearctic (Spencer 1969b, 1977).

Host plant and natural history: Unknown.

Comments: This Palearctic species was first recorded in Canada by Spencer (1969b) and was restricted to Ontario. Many new Canadian localities are here recorded and the species is now widespread. *Amauomyza karli* is similar to *A. luteiceps*, a Palearctic species newly recorded in Canada (see below).

Amauomyza (Cephalomyza) luteiceps (Hendel)

(Figs. 5, 16, 41–43)

Dizygomyza luteiceps Hendel, 1920: 133.

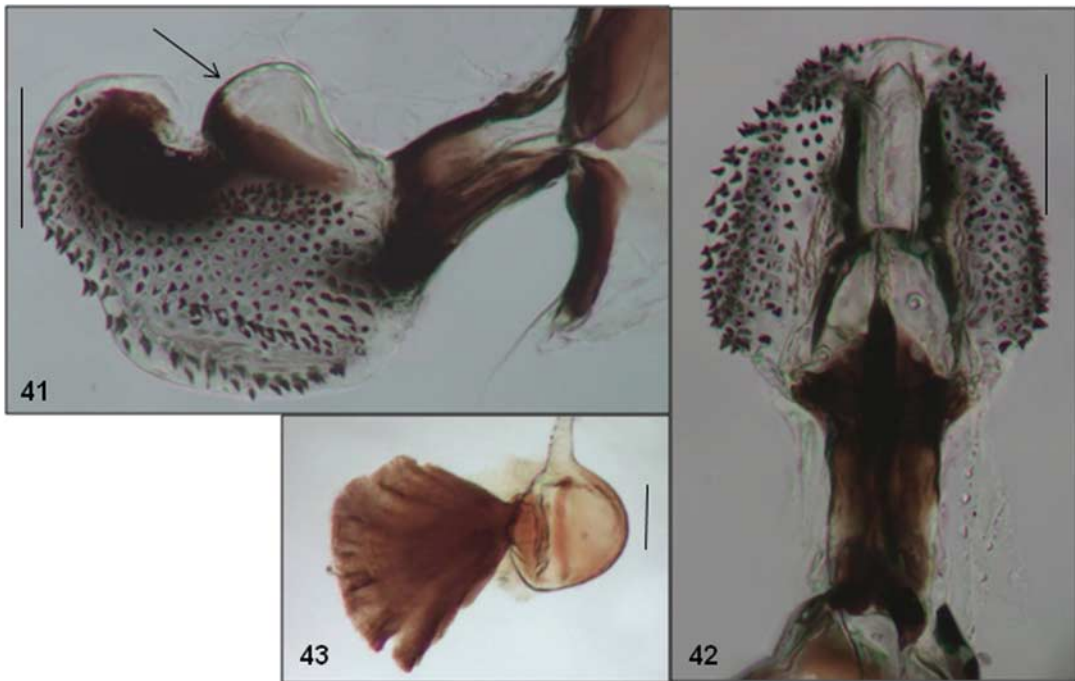
Dizygomyza (Cephalomyza) luteiceps: Hendel (1931a: 34).

Dizygomyza hendeli de Meijere (1924: 138).
Synonymy Hendel (1931a: 34).

Amauomyza luteiceps: Spencer (1969a: 13).

Amauomyza (Cephalomyza) luteiceps: Spencer (1976: 160).

Figs. 41–43. *Amauromyza luteiceps* (Hendel): (41) phallus lateral, NB, (42) phallus ventral, NB, (43) ejaculatory apodeme, NB. Scale bars = 0.05 mm.



Specimens examined: **CANADA:** **New Brunswick:** St. Andrews, 8.vii.1978, S.A. Marshall (1 ♂: DEBU). **Nova Scotia:** Crescent Beach (44°13.8'N, 64°23.2'W), sweep dune vegetation, 24.vii.2002, J. Forrest & T. Wheeler (1 ♂: LEM). **Québec:** Gaspé, Rivière aux Renard, sweep in marsh, 12.viii.2001, H. Varady-Szabo (1 ♀: LEM).

Redescription. Externally similar to *A. karli*, except clypeus with upper margin not triangular but rather rounded or straight (Fig. 16); epistoma not as broad and not always projecting anteriorly towards antennae (Fig. 16, inset).

Colour. As described for *A. karli*, except legs more extensively yellow: all femora yellow for about 1/3 of length, tibiae narrowly yellow adjoining femora, and forecoxa yellow apically.

Genitalia: Phallus similar to *A. karli*, except without tufts of setae on distiphallus (Fig. 42) (compare with Fig. 38: *A. karli*), and with sclerite of distiphallus having a sharp projection, visible in lateral view (arrow, Fig. 41); ejaculatory apodeme gradually expanding and with moderately large bowl-shaped base (Fig. 43).

Geographic distribution: Eastern Canada* (NB, NS, QC); Palearctic (Spencer 1969a, 1976).

Host plant and natural history: In Europe this species is a stem borer in *Atriplex* (Amaranthaceae) (Spencer 1990). Although the host plant is unconfirmed in Canada, specimens were collected near ocean dunes and marshes, which suggests that species of *Atriplex* may also be the host plant in North America.

Comments: This Palearctic species is newly recorded in Canada. It is similar to *A. karli*, but is easily distinguishable externally by the more extensively yellow femora.

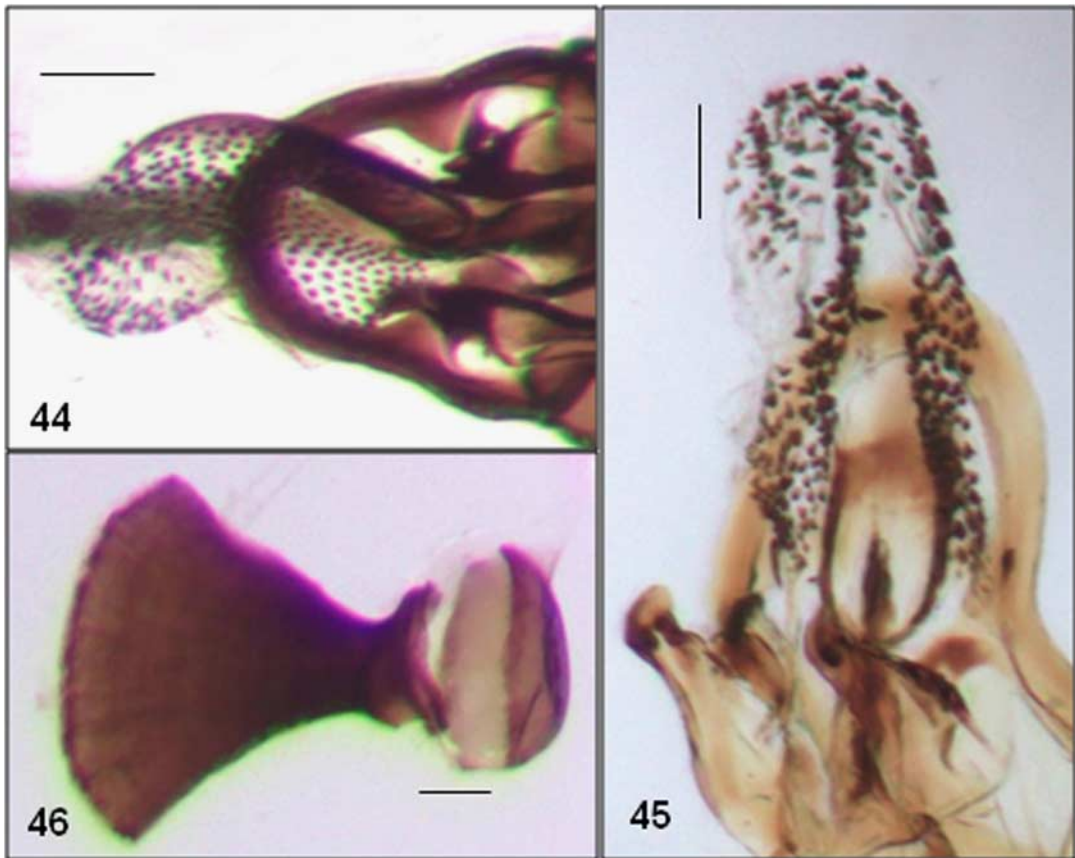
***Amauromyza* (*Cephalomyza*) *nevadensis* Spencer**

(Figs. 6, 17, 44–46)

Amauromyza nevadensis Spencer, 1981: 155; Spencer and Steyskal (1986: 81).

Specimen examined: **CANADA:** **Alberta:** Waterton Lakes NP, Red Rock Parkway,

Figs. 44–46. *Amauromyza nevadensis* Spencer: (44) phallus lateral, (45) phallus ventral, (46) ejaculatory apodeme. Scale bars = 0.05 mm.



(49.0996°, -113.9061°), 1390 m, sweep meadow, 08.vii.2010, T.A. Wheeler (1 ♂: LEM).

Redescription. Frons width (including orbital plates) 0.28 mm; apparently two inclinate ori and two ors (Spencer 1981 mentioned normal arrangement probably three ori and two ors, but number of ori may vary from two to four), lower ors somewhat inclinate and reclinate and upper ors directed posteriorly and outwards; orbital setulae inclinate or erect; frons moderately projecting in profile and parafacial well developed, forming distinct ring below eye; gena at midpoint 0.31 times maximum eye height; gena deepest at rear (Fig. 6); arista short, approximately 0.23 mm long (2.5 times length of first flagellomere), clypeus medium-thick, with upper margin straight; epistoma well developed, broad, and projecting towards antennae (Fig. 17). Apparently 4 + 2 well-developed dc (but number of dc irregular,

sometimes 4 + 3 or 3 + 2 [Spencer and Steyskal 1986]); acr in approximately three to four irregular rows. Wing length 1.9 mm (up to 2.1 mm according to Spencer and Steyskal 1986); last section of CuA_1 approximately 1.4 times penultimate (up to 2 times according to Spencer and Steyskal 1986).

Colour. Head mostly brown: frons and gena paler brown (both slightly yellowish brown posteriorly), orbit black, antenna dark brown. Mesonotum dark brown, subshiny; pleurites brown, legs all brown; calypter greyish black, margin and fringe brown; halter with knob mostly pure white, stalk and base of knob brown.

Genitalia: Apex of distiphallus elongate and curving ventrally in lateral view (Fig. 44); spinulose membrane of phallus well defined, looping ventrally below distiphallus in lateral view (Fig. 44); ejaculatory apodeme moderately large with small bowl-shaped base (Fig. 46).

Geographic distribution: Western Nearctic (AB*; CA).

Host plant and natural history: Unknown.

Comments: This species has the phallus most similar to *A. scleritica* (see below). Both species were described from the same locality in California (Spencer 1981) and are here newly recorded in Canada from the same locality in Alberta.

***Amauromyza (Catalpomyza) pleuralis* (Malloch)**

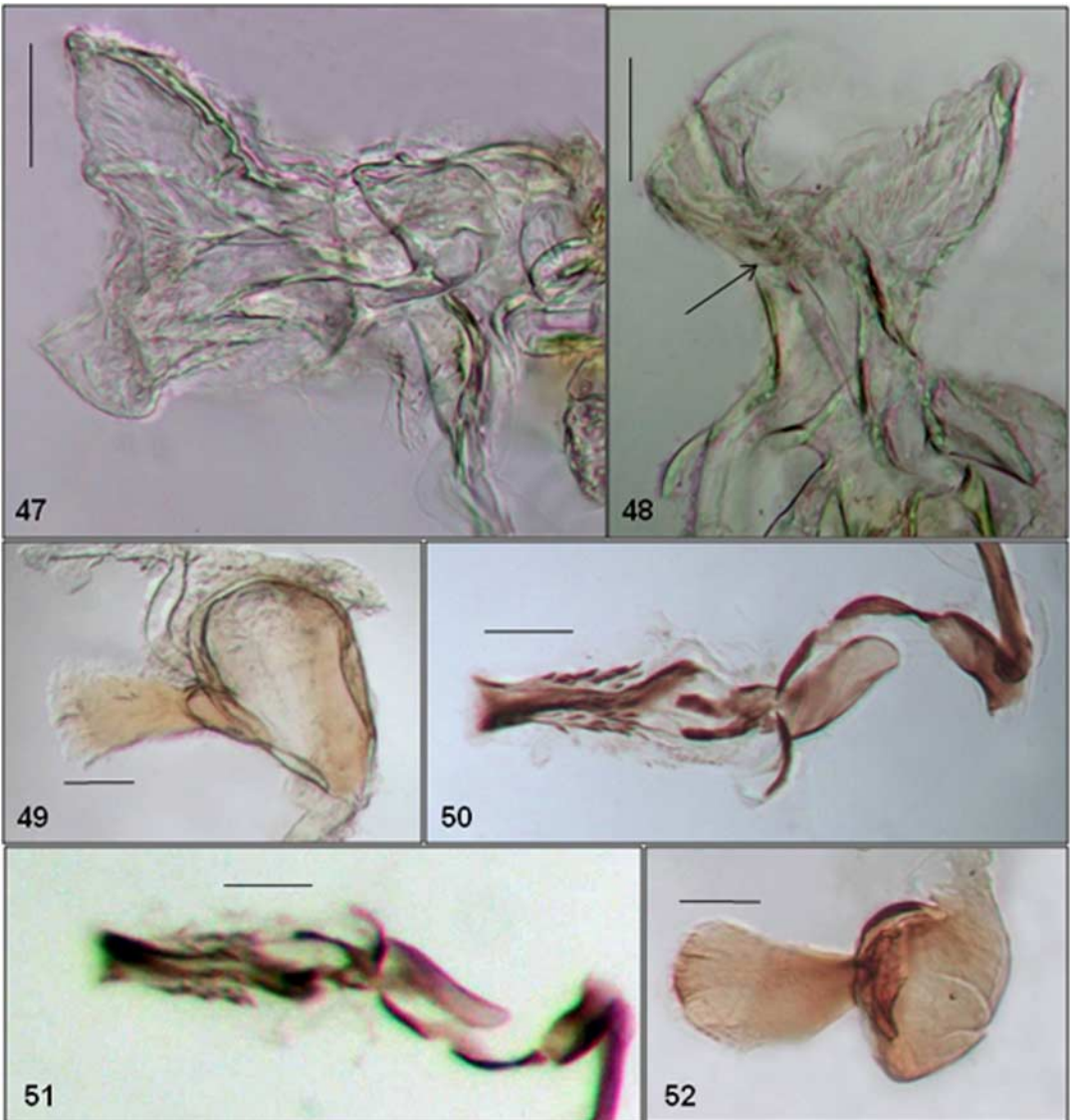
(Figs. 7, 18, 24, 47–49)

Agromyza pleuralis Malloch, 1914: 311.

Phytobia (Trilobomyza) pleuralis: Frick (1953: 71; 1959: 393).

Trilobomyza pleuralis: Spencer (1969b: 161).

Figs. 47–52. *Amauromyza pleuralis* (Malloch): (47) phallus lateral, (48) phallus ventral, (49) ejaculatory apodeme. *Amauromyza riparia* Sehgal: (50) phallus lateral (holotype, permanent mount), (51) phallus lateroventral (holotype, permanent mount), (52) ejaculatory apodeme (paratype, permanent mount). Scale bars = 0.05 mm.



Amauromyza (Catalpomyza) pleuralis: Spencer (1977: 242); Spencer and Steyskal (1986: 83); Spencer (1990: 218).

Specimens examined: CANADA: Ontario: St. Williams, Lake Erie, 21.ii.1962, *Catalpa* sp. (2 ♂: CNC); same except, 28.ii.1964 (1 ♂; 2 ♀: CNC).

Redescription. Frons width 0.25–0.28 mm; three inclinate ori and one reclinate ors; orbital setulae absent; frons moderately projecting and parafacial weakly to moderately developed (Fig. 7); gena at midpoint approximately 0.36 times maximum eye height, gena slightly deeper at rear; first flagellomere rounded; arista normal, length 0.35 mm (3 times length of first flagellomere); clypeus thin with upper margin rounded; no epistoma. Apparently 2 + 0 dc, additional dc present but about same size as acrostichals, these in approximately five rows. Male forecoxa with strong, white, flattened inner bristle (Fig. 24). Wing length 1.75–1.85 mm in males and 2.25 mm in females; last section of CuA₁ approximately 1.3–1.5 times length of penultimate.

Colour. Frons, orbit and antenna yellow, sometimes dusted with grey; both vertical bristles on dark background; face and palpus yellow or partly grey; gena yellow; clypeus yellow; mesonotum grey or brown; pleura completely yellow except katepisternum, meron and katatergite brown; bristles on head, thorax and abdomen pale yellow (one female specimen with slightly darker bristles); legs completely yellow; halter yellow; calypter pale yellow, margin pale brown, fringe yellow or brown.

Genitalia: Distiphallus pale, membranous (Figs. 47–49), cup-shaped with a row of setulae near anterior margin (only visible at high magnification – at least 200×) and without distinct spinulose membrane; ejaculatory apodeme small and narrow with wide bowl-shaped base (Fig. 49); hypandrium broadly rounded with small apodeme at apex.

Geographic distribution: Eastern Canada (ON); eastern United States (IL, OH).

Host plant and natural history: Larva forms a small linear-blotch mine on various species of *Catalpa* (Bignoniaceae). Illustrations of the mine are in Spencer and Steyskal (1986).

Comments: The overall pale body colour and pale bristles of this species are atypical of the genus *Amauromyza* but more commonly found

among species of *Phytoliriomyza*. The enlarged base of the ejaculatory apodeme and low and broad hypandrium are typical of *Amauromyza*. Its isolated position in a monotypic subgenus will need further investigation. Although not easily visible in the male specimens examined, there may be a remnant of a spinular membrane on the distiphallus (Fig. 48, arrow), a characteristic that would justify its transfer into the subgenus *Cephalomyza*. An external defining character for this species is the presence of a strong, white, flattened medial bristle on the forecoxa in males (Tschirnhaus 1991). Spencer (1969b) recorded this species from Turkey Point, Québec but that locality is, in fact, in Ontario.

***Amauromyza (Cephalomyza) riparia* Sehgal**

(Figs. 8, 19, 50–52)

Amauromyza riparia Sehgal, 1971: 326.

Type specimens examined: Holotype: CANADA: Alberta: Edmonton, river bank near University of Alberta campus, 18.v.1969, V.K. Sehgal (1 ♂: CNC [#12066]); Paratype, same except, 14.v.1969 (1 ♂: CNC [#12066]).

Other specimens examined: CANADA: New Brunswick: Fredericton, 23.v.1958, on *A. piceae* infested bf, N.R. Brown (1 ♀: CNC); **Québec:** Bolton Pass, Knowlton, 800', 5.vi.1963, J.R. Vockeroth (1 ♀: CNC); Old Chelsea, 15.v.1989, J.R. Vockeroth (1 ♀: CNC).

Redescription. Frons width, 0.23 mm; three inclinate ori and two reclinate ors, upper ors directed outwards; orbital setulae reclinate; frons slightly to moderately projecting, parafacial forming narrow ring below eye; gena at midpoint approximately 0.24–0.27 times maximum eye height, gena deepest at rear (Fig. 8); first flagellomere rounded, arista short, 0.18–0.20 mm (less than twice length of first flagellomere), slightly enlarged at base; clypeus medium-thick (slightly narrower in paratype than in holotype) (Fig. 19), with upper margin rounded; epistoma absent; Usually at least 4 + 1 or 4 + 2 dc, decreasing in size anteriorly, but presutural definitely longer than acrostichals (Sehgal 1971 mentioned only three strong dc); acr in approximately five rows. Wing length 1.5–1.7 mm

in males, up to 2.2 mm in females. Last section of CuA_1 approximately 1.7 times length of penultimate.

Colour. Head (including antenna, face, and palpus) mostly brown; frons slightly paler yellowish brown above, blackish below; orbit mat, slightly darker than frons; mesonotum mat, pale grey; scutellum also grey except for paler yellow vertical line centrally; legs brown; halter apparently brown or at most dirty white (not “distinctly whitish or paler” as described by Sehgal 1971); calypter and fringe brown.

Genitalia: Distiphallus narrow, elongated, and in lateral view, curving dorsally at an obtuse angle in basal third (Fig. 50); spinulose membrane closely appressed to distiphallus; ejaculatory apodeme slightly expanded on one side and with enlarged bowl-shaped base (Fig. 52).

Geographic distribution: Western Canada (AB); eastern Canada (NB*, QC*).

Host plant and natural history: The host plant is unknown. This species appears to be active in late spring.

Comments: This species was previously known only from the male types from Alberta.

Three additional female specimens from Québec and New Brunswick agree externally with the characteristics of this species.

***Amauromyza (Cephalomyza) scleritica* Spencer**

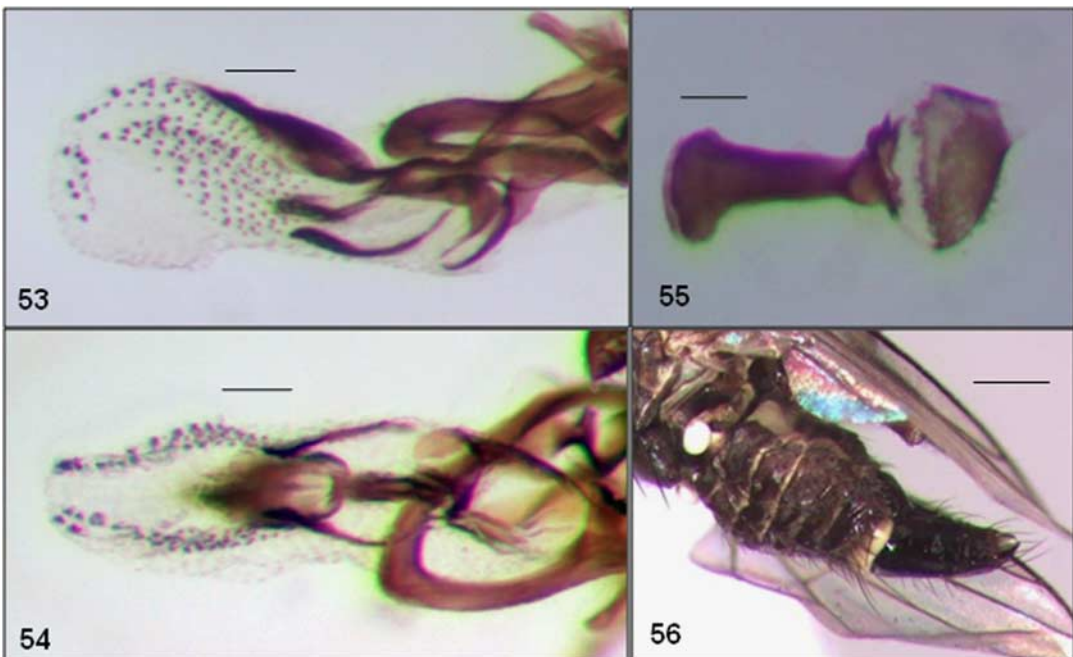
(Figs. 9, 20, 53–56)

Amauromyza (Cephalomyza) scleritica Spencer, 1981: 160; Spencer and Steyskal (1986: 84).

Specimens examined: CANADA: Alberta: Waterton Lakes NP, Red Rock Parkway (49.0996°N, –113.9061°W), 1390 m, sweep meadow, 08.vii.2010, T.A. Wheeler (1 ♂; 1 ♀: LEM). **UNITED STATES OF AMERICA: California:** Truckee, 6000' Tahoe Co., 14.vii.1961, B.H. Poole (1 ♀: CNC).

Redescription. Frons width 0.22–0.30 mm; four orbital bristles; orientation and division between ori and ors not clear, normal arrangement probably three inclinate ori and one reclinate ors (California female specimen with extra upper ors on both sides); orbital setulae inclinate,

Figs. 53–56. *Amauromyza scleritica* Spencer: (53) phallus lateral, (54) phallus ventral, (55) ejaculatory apodeme, (56) abdomen female, with long oviscape. Scale bars = 0.05 mm, except Figure 56 = 0.2 mm.



some slightly proclinate; frons strongly projecting in profile and parafacial broad (Fig. 9); gena very deep, at midpoint approximately 0.30–0.38 times maximum eye height, gena strongly extended at rear; first flagellomere rounded, with patch of white setae apically; arista short, 0.16–0.20 mm (not more than twice length of first flagellomere); clypeus narrow with upper margin rounded; epistoma broad and projecting anteriorly towards antennae (Fig. 20). Mesonotum with 4 + 2 dc, decreasing in size anteriorly; acr in approximately three to four rows. Wing length 1.4 mm in male and 2.0 mm in females; last section of CuA₁ approximately 1.4–1.7 times length of penultimate (see “Comments”). Female with long oviscape, approximately half length of abdomen in dorsal view (Fig. 56).

Colour. Frons, gena and most of orbit yellow; upper orbit brown (above and sometimes at level of upper ors); both vertical bristles on dark background; antenna and palpus brown; face yellowish brown; clypeus black; epistoma pale yellow; mesonotum dark greyish brown, scutellum sometimes slightly paler brown; pleura brown except for notopleuron sometimes paler, yellow or yellowish brown; legs completely brown (at most foreknee faintly yellow in one specimen); halter with knob mostly yellow (partially pale brown basally) and stalk brown; calypter and fringe brown. Female abdomen with apex narrowly yellow (Fig. 56).

Genitalia: Phallus somewhat similar to *A. nevadensis*, but conspicuously enlarged basally and narrowing apically for only a short distance, not curving ventrally (Fig. 53); ejaculatory apodeme narrow with large bowl-shaped base (Fig. 55).

Geographic distribution: Western Nearctic (AB*, CA).

Host plant and natural history: Unknown.

Comments: This species was previously known only from California (Spencer 1981). The specimens examined differ from Spencer’s description by having a shorter wing (1.4 mm in male compared with 1.75–1.90 mm in Spencer’s description) and a larger discal cell: last section of CuA₁ 1.4–1.7 times the length of penultimate (compared with almost twice the length of penultimate in Spencer’s description).

***Amauromyza (Cephalomyza) shepherdiae* Sehgal**

(Figs. 10, 21, 57–60)

Amauromyza shepherdiae Sehgal, 1971: 327; Spencer (1990: 141).

Type specimen examined: Holotype ♂: **CANADA: Alberta:** Edmonton, University of Alberta campus, 5.vii.1968, from leaf mines on *Shepherdia canadensis* (L.), emerged 25.v.1969, V.K. Sehgal (CNC) (head missing).

Other specimens examined: CANADA: Manitoba: 4 km SE Churchill, Dene Village, (58.734°, –994.112°), Malaise trap, 14.vii.2008, A. Thielman (5 ♂: BIOUG).

Redescription. Frons width 0.22–0.23 mm; frons not projecting in front of eye in profile; normally two inclinate ori (one specimen with three ori on one side) and two reclinate ors, lower ors closer to posterior ori than to upper ors (may appear as three ori and one ors when bristles are lacking); orbital setulae sparse (about 9–10), erect or reclinate; gena at midpoint, approximately 0.20–0.23 times maximum eye height; first flagellomere rounded apically; arista moderately short, 0.25–0.27 mm (approximately 3 times length of first flagellomere); clypeus medium thickness with upper margin rounded (Fig. 21). Epistoma weakly developed or absent (Fig. 21). 3 + 2 dc present (presutural dc smaller); acr in approximately four to five irregular rows. Wing length 1.50–1.75 mm (male); last section of CuA₁ approximately 2.20–2.75 times penultimate.

Colour. Frons, gena and face dark brown, orbit and ocellar triangle weakly shiny black, antenna black (Sehgal 1971). Mesonotum and scutellum dark brown, subshiny; pleura brown, legs all brown; calypter, margin and fringe brown; halter with knob mostly white, stalk and base of knob brown.

Genitalia: Distiphallus mostly of uniform width in lateral view, with spinulose membrane small and restricted to distiphallus area (Figs. 57–58); distiphallus flaring apically in ventral view (Fig. 59); ejaculatory apodeme with small blade and large base (Fig. 60).

Geographic distribution: Western Canada (AB, MB*).

Host plant and natural history: This species forms blotch mines (Sehgal 1971: Fig. 46) on leaves of *S. canadensis* (L.) Nuttall (Elaeagnaceae).

Figs. 57–60. *Amauromyza shepherdiae* Sehgal, (57) phallus lateral (holotype, permanent mount), (58) phallus lateral, MB, (59) phallus ventral (also visible, postgonites and hypandrium), MB, (60) ejaculatory apodeme, MB. Scale bars = 0.05 mm.



Comments: This species was previously known from a single damaged male from Alberta. This small dark species is most similar to *A. riparia* and *A. subinfumata* and can only be distinguished by the number of orbital bristles (four in *A. shepherdia*, five in the other two species) and by the male genitalia.

***Amauromyza* (*Cephalomyza*)
subinfumata (Malloch)**

(Figs. 11, 22, 61–63)

Agromyza infumata Malloch, 1915a: 15.

Agromyza subinfumata (Malloch 1915b: 108).

Replacement name for *A. infumata* Malloch, preoccupied by *A. infumata* (Czerny and Strobl 1909).

Phytobia (*Praspedomyza*) *subinfumata*: Frick (1953: 71; 1959: 395).

Amauromyza subinfumata: Spencer (1969b: 159).

Amauromyza (*Cephalomyza*) *subinfumata*: Spencer and Steyskal (1986: 81).

Specimens examined: **CANADA: Alberta:** Elkwater, 10.vi.1956, O. Peck (1 ♂: CNC). **Manitoba:** NE Glenboro, Spruce Woods Prov. Pk., Spirit Sands Trail, spruce forest open dune transition area, 8.vii.1992, T.A. Wheeler (1 ♀: LEM). **New Brunswick:** Chamcook, 30.vi.1965, G.E. Shewell (1 ♀: CNC). **Ontario:** Manotick, 22–29.v.1952 (1 ♂: CNC); Mer Bleue, Ottawa, 14.vi.1972, H.J. Teskey (1 ♂: CNC). **Québec:** Eardley, 14.v.1959, J.R. Vockeroth (1 ♀: CNC); Lac St.François Nat. Wildl. Area, Chemin Fraser (45°02.4'N, 74°28.03'W), Malaise trap beside sedge meadow, 18–26.v.1999, S.E. Brooks (2 ♂: LEM); Lanoraie Bog (45°59'N, 73°17'W), Malaise trap, 02.vi.1987, Sanborne, Genier & Hargreave (1 ♂: LEM); Roundtop Mt., Sutton, 1300', 5.vi.1963, J.R. Vockeroth (1 ♀: CNC).

Redescription. Frons width 0.23–0.28 mm; three inclinate ori and two reclinate ors; orbital setulae erect or reclinate; frons and parafacial not projecting, or only slightly projecting (Fig. 11); gena at midpoint usually 0.13–0.22 (AB and MB

Figs. 61–63. *Amauromyza subinfumata* (Malloch): (61) phallus lateral, QC, (62) phallus ventral, QC, (63) ejaculatory apodeme (showing size relative to phallus). Scale bars = 0.05 mm, except Figure 63 = 0.1 mm.



specimens: 0.24–0.30) times maximum eye height, gena deepest at rear (Fig. 10); first flagellomere rounded, arista short, 0.22–0.24 mm (about 2.2–3.0 times length of first flagellomere); clypeus thick with upper margin rounded; epistoma absent or weakly developed (Fig. 21); mesonotum with 3 + 1 strong dc (one female with 4 + 2 dc, anterior presutural smaller); acr in approximately four to five rows. Wing length usually between 1.7–1.9 mm in both males and females (up to 2.2 mm in Spencer (1969b)); last section of CuA_1 approximately 1.8–2.5 times penultimate.

Colour. Head (including antenna, face, and palpus) mostly brown, except frons and gena sometimes slightly paler yellowish brown (gena especially paler in AB and MB specimens); frons sometimes paler posteriorly and black anteriorly (as in *A. riparia*); orbit well differentiated, usually slightly darker than frons; mesonotum dark brown or blackish grey, mat or weakly subshining; scutellum brown, sometimes

slightly paler centrally; legs all brown; halter with stalk and most of knob pale brown, somewhat infuscated, knob dirty white apically; calypter and fringe brown.

Genitalia: Phallus with characteristic shape (Figs. 61–62), somewhat V-shaped in lateral view but with dorsal sclerite asymmetrical, slightly longer and upcurved (Fig. 61); spinulose membrane small, restricted to distiphallus area; ejaculatory apodeme with very large blade and enlarged bowl-shaped base (Fig. 63).

Geographic distribution: Widespread in Canada (AB*, MB*, NB*, ON, QC); eastern United States (IL).

Host plant: Unknown.

Comments: This species was previously considered eastern Nearctic, restricted to Ontario, Québec, and Illinois. The Alberta specimen is a considerable extension of the known range. One specimen from BC not listed above (8 km E Sicamous, 1.vi.1992, A. Borkent, 1 ♀: CNC) agrees mostly with *A. subinfumata*, except

for a slightly deeper gena (as in AB specimen), slightly more developed epistoma, a paler brown, subshiny mesonotum, wing length 2.1 mm, and a paler, ochreous calypter and fringe. It may represent a new species but further material would be needed to confirm the status of this specimen.

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